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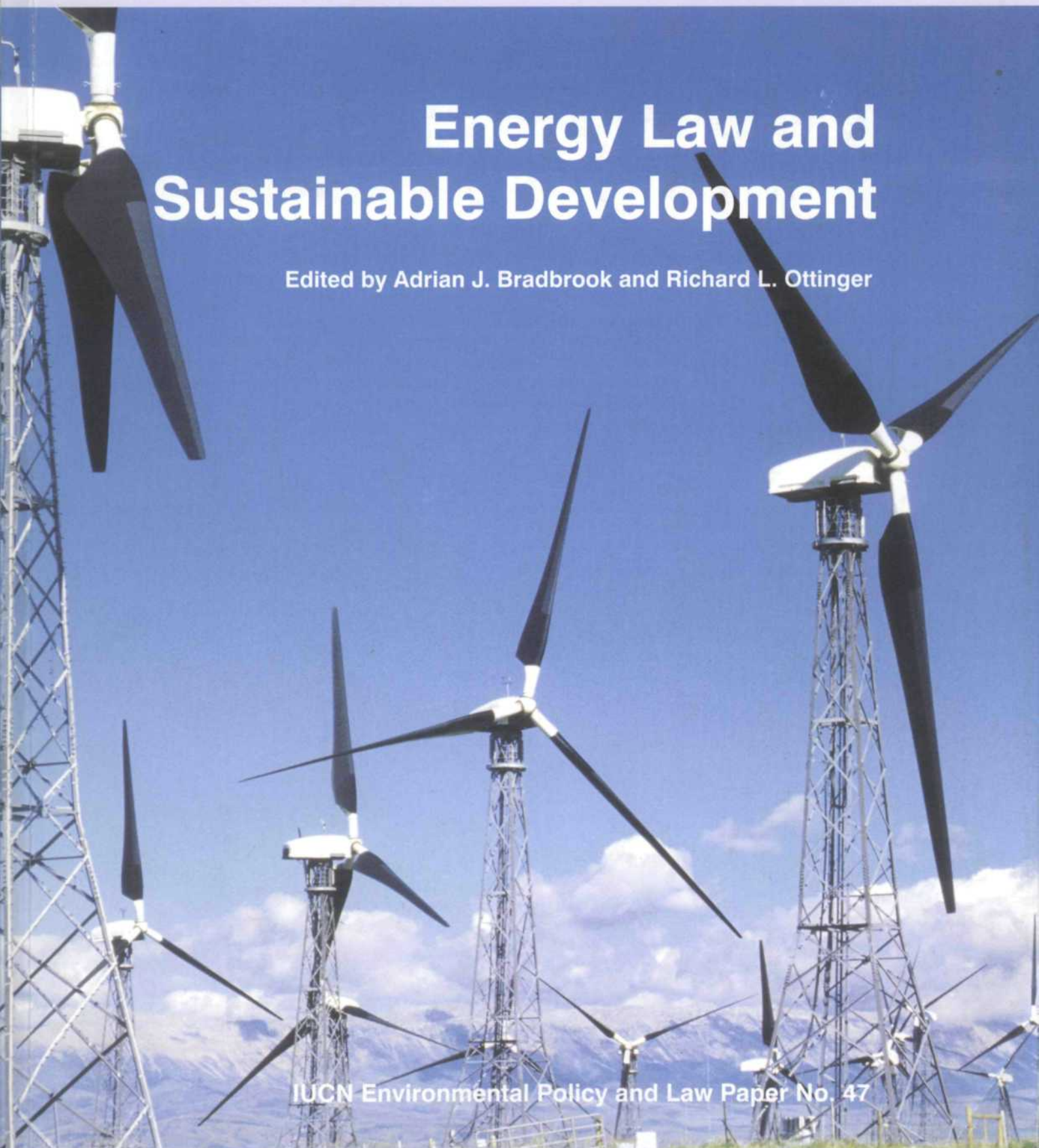
Energy Law and Sustainable Development

Edited by Adrian J. Bradbrook and Richard L. Ottinger



IUCN Environmental Policy and Law Paper No. 47

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The World Conservation Union

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Foreword

The World Summit on Sustainable Development (WSSD) recommends that nations undertake the reform of their energy regimes.[1] This is a matter of great urgency, since most national systems for generating electrical energy, or otherwise consuming fossil fuels, are the primary sources of greenhouse gases contributing to climate change. Forthcoming debates about how most effectively to implement the Kyoto Protocol[2] will lend urgency to these WSSD recommendations. The expert authors of this book provide us with important guidance on how nations may respond to the WSSD's recommendations on a worldwide basis.

Given the fundamental challenges posed by the reports of the Intergovernmental Panel on Climate Change (IPCC),[3] nations inevitably will find themselves undertaking a far more fundamental assessment of their energy regimes than has ever been the case. The recommendations of the WSSD carry implications which extend well beyond even the scope of the essays provided in the chapters of this book. By way of this foreword, one may speculate on some of these implications.

One principal analytic tool of ecosystem management is measuring the flow of energy through living and inanimate systems. Since climate change functions within Earth's biosphere, energy flow measurement should be assessed at this level, as well as within individual ecosystems. Solar energy fuels life in the biosphere, and is recycled over centuries in fossil fuels and over decades in trees. The process of photo-synthesis channels solar energy into resources that sustain all life on earth. These natural laws are only dimly perceived, however, by the utilitarian human laws that govern how short-term energy is supplied to our human economy.

As contemporary energy law has developed over the past century in each nation, it has rarely had occasion to integrate such ecological assessment into its fundamental norms or legal framework. The challenge of the coming generations is to accomplish this integration. Without integration of energy law and environmental law, human society cannot meet the goals for sustainable development envisioned at the 1992 UN Conference on Environment and Development in Rio de Janeiro. Reformation of energy laws will be an essential element of the transition to attain sustainability within national and global economies.

Energy law has developed through a disjointed body of statutes and treaties. Energy law is most often considered to be merely a variant of public administrative law. However, rather than being a refined and integrated legal field of law, the laws of this sector are characterized by a lack of basic principles or integrative systems. Its costs are underwritten by application of public finance laws. It has evolved incrementally over time, in an essentially instrumental manner, reactive to perceived needs to find sources of energy to consume. Energy law facilitates the development of whatever energy system is possible in light of available technology. Its short-term goal is always to supply electricity or such other basic fuels as each society requires.

Energy law's emphasis has been on ensuring an adequate supply of energy, rather than providing energy systems with an emphasis on maximizing efficiency, respecting ecology or ensuring equity in use among all users.[4] As a result, energy law has developed without much regard for the negative environmental impacts of energy generation. Prices for energy services for decades have ignored environmental externalities, and most often disregarded whether the poor can access such services. Most nations have been obliged to compensate for these shortcomings by enacting statutes, and negotiating several treaties,[5] to cope with the economic

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1 Plan of Implementation for the United Nations World Summit on Sustainable Development, adopted September 4, 2002, Johannesburg, South Africa.

2 The Kyoto Protocol to the UN Framework Convention on Climate Change is available at <www.unfccc.int>

3 Reports of the International Panel on Climate Change are available at < www.ipcc.ch>

4 This paper does not focus on the property law regime for the ownership of natural resources, such as fugacious fuels like oil and gas or hard minerals such as coal or uranium, or the property regimes providing access to land sites or water bodies. Property rights often are a basic element of the costs determinative of which energy sources are developed to provide energy. Rather, energy law is here discussed as the framework of public policies and administrative law that governs the extraction or generation, provision and distribution of energy to users. Energy law extends from customary practices, such as an individual's conduct like a charcoal dealer in a developing nation, to the corporate enterprises generating electricity, whether owned by the State, or in a parastatial form, or privately owned. Both private companies and government-owned properties, in both capitalist or socialist states, produce the same sort of issues as discussed here, and the administrative rules in both types of economies, or in mixed economies, appear to suffer comparable dysfunctions. Environmental law readdresses these dysfunctions alike in whatever economic setting is involved.

5 *See*, e.g., the 1979 Geneva Convention on Long-Range Transboundary Air Pollution, and its Protocols. 1302 U.N.T.S. 217, 18 I.L.M. 1442.

"externalities" generated by the energy sector. Principal among the environmental externalities are the following: air pollution including "acid rain," waste water pollution, significant solid and hazardous waste products from mining or combustion of coal or use of enriched uranium, disregard for the reclamation of mined lands and their ecosystems, discharge of waste heat from cooling systems into aquatic ecosystems, loss of habitat and soil salting in the wake of hydroelectric dam development, and impacts associated with constructing high tension electric power lines or natural gas pipelines.

Environmental laws currently only partially, and imperfectly, regulate these impacts of the energy sector. The continuing accumulation of such problems bodes ill for how energy law will handle the new challenges that the energy sector faces as it contemplates reduction of carbon dioxide emissions required under the Kyoto Protocol, or the improved application of the environmental impact assessment to energy sector projects, as is required by national environmental impact assessment (EIA) laws[6] or the 1998 Århus Convention on Public Access to Information, Participation in Decision-making and Access to Environmental Justice.[7] Because practically every nation has favoured systems that supply energy exclusively through economic sector preferences, energy law today only superficially addresses how energy suppliers could better take economic, social or ecological responsibility for the adverse effects of their processes and services. In most places, since the utility services that supply energy are a near monopoly, those societies that decide to require energy suppliers to consider social or environmental issues have chosen to establish regulatory systems[8] to ensure that the pricing of energy is balanced between (a) generating fees sufficient to pay for the investment in building and operating the energy systems, (b) providing a "reasonable" profit to the governmental, parastatial, or private enterprises that build and operate the energy systems, and (c) ensuring that the public can afford to pay the fees and showing that the fees appear fair to the users.

Historically, the regulatory systems established to meet these energy objectives have operated as a distinct and relatively independent sector of government and the economy.[9] For instance, regulations often establish exclusive service areas with enough customers to permit the enterprise generating and transmitting electricity to recover its costs associated with supplying electricity, and make a reasonable profit. Little attention has been devoted to how the energy sector relates to the broader environmental context in which it is embedded. Hydroelectric systems, and their dams, have been obliged to consider alternative uses of rivers and lakes, because these resources serve navigation and fishing interests also. For instance, during the Progressive era in the United States of America, Congress enacted Section 10 of the Federal Power Act of 1920[10] requiring that the federal regulatory agency[11] balance the competing demands of water before it could decide whether or not to authorize a new hydroelectric power facility which might interfere with other water uses. This has been held to require a study of alternative sources of energy that might obviate the need for the proposed hydroelectric facility.[12] Out of specific licensing proceedings in the USA,[13] for instance, experience was gained that helped Congress to enact a generic administrative procedure for weighing these sorts of

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6 Principle 17 of the Rio Declaration on Environment and Development provides that "Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority." UN Doc. A/CONF. 151/26, 31 I.L.M. 874 (1992). For the oldest application of EIA, see the environmental impact assessment in the USA required under the National Environmental Policy Act (NEPA), 42 U.S.C. 4321, *et seq.*, and its regulations at 40 C.F.R. Part 1500. The European Union has required that its members enact legislation for EIA since 1985: Council Directive 85/337 of June 27, 1985, on the Assessment of the Effects of Certain Public and Private Projects on the Environment. *Official Journal* 1.175 (July 5, 1985): "Member States shall adopt all measures necessary to ensure that, before consent is given, projects likely to have significant effects on the environment by virtue, *inter alia*, of their nature, size or location are made subject to an assessment with regard to their effects." (Article 2.1).

7 *See* the Århus Convention, which incorporates EIA.

8 *See*, e.g., the Public Service Commission of the State of New York, Public Services Law.

9 In this regard, the energy regulatory regimes share some of the same dysfunctional relationships to the social and environmental foundations for sustainable development that characterize the debate over the liberalized trade sector and the environment sector. For proposals to bridge this gap see generally Daniel C. Esty and Maria H. Ivanova, "Revitalizing International Environmental Governance: A Function-Driven Approach," in Esty and Ivanova, *Global Environmental Governance Options and Opportunities* (New Haven, Conn., Yale School of Environmental Science and Forestry, 2002) pp. 193–4, available at <www.yale.edu/environment/publications>

10 Federal Power Act, 16 U.S.C. 791–828c.

11 Initially this was the Federal Power Commission, which was reconstituted during the presidency of Jimmy Carter to be the Federal Energy Regulatory Commission (FERC).

12 *Scenic Hudson Preservation Conference* v. *Federal Power Commission*, 354 F. 2d.608 (2d Cir. 1965), *cert. den.* 384 U.S. 941 (966). More recently, IUCN, the World Bank and others, participated in the preparation of the report of the World Commission on Dams, which outlines the competing factors and need for better environmental impact assessment and public participation in the development of new hydroelectric facilities around the world.

13 *Ibidum.* The *Scenic Hudson* case highlighted the need to take a hard look at alternatives.

alternatives. In consequence Congress enacted the National Environmental Policy Act of 1969, which first established environmental impact assessment procedures.[14]

Environmental impact assessment is now widely used by many nations to determine what sort of new energy systems should be licensed. Unfortunately, far too often the EIA process is treated as a routine exercise, without requiring a thorough study of environmental effects or a valid consultation with potentially affected stakeholders.[15] Even where EIA is well established in national law, EIA is not yet used to measure the ways to avoid greenhouse gas emissions, or to sequester any carbon dioxide that may be emitted. EIA procedures also are rarely, if ever, applied to existing energy development regimes, such as the refining, distribution and use of petrol.[16]

Indeed, so effective are society's vested economic interests in the use of petroleum as a preferred energy source that the nations producing oil and gas prevented any sustainable use energy recommendations from being included in the action plan adopted at the UN Conference on Environment and Development in 1992 in Rio de Janeiro. Rio's Earth Summit recommended that EIA "shall" be used in national environmental decision-making,[17] but EIA was not mentioned in the action plan adopted at the Rio Earth Summit, known as Agenda 21.[18] The only references in Agenda 21 were to the need to use energy sources more efficiently and environmentally in the context of the transportation sector.[19]

This does not mean that Agenda 21 was irrelevant to energy and climate issues. It also had a chapter on "safe and environmentally sound management of radioactive wastes,"[20] recognising that this one fuel cycle had long-term and dangerous consequences for human health and the environment. In addition, a number of the chapters of Agenda 21 implicitly address an energy law agenda. For instance, between the 1972 United Nations Conference on the Human Environment in Stockholm and the 1992 UN Conference on Environment and Development in Rio de Janeiro, environmental law had emerged as the fastest growing field of law at both national and international levels (it still is today). The success that environmental regulation has had in abating pollution and enhancing environmental quality throughout States such as Singapore, the UK, the USA, Canada, Australia, or The Netherlands stands in stark relief against the acute and still growing threats to public health from air, soil, and water pollution in urban centres such as Bangkok, New Delhi, Mexico City, or Beijing. To combat the environmental degradation trends, Agenda 21 called for rapid development of further environmental law.[21]

Experience with environmental laws illustrates how appropriate legal systems can foster progressively wider uses of clean energy and transportation systems. Case studies of these experiences are the best evidence that the practical measures needed to implement the Kyoto Protocol of the UN Framework Convention on Climate Change have in fact been field tested and are ready to be employed to stabilize greenhouse gas emissions. For instance, air pollution control legislation commonly establishes health standards, monitors where those standards have not been attained, and then requires concrete and measurable steps to curb air emissions. Conversion to clean fuels and rigorous use of energy efficiency technology readily emerges as a

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14 NEPA is at 42 U.S.C. 4321.

15 *See*, e.g. *Shehla Zia and Others* v. *WAPDA*, PLD 1994, SC 693 (1994), in which the Pakistan Supreme Court ordered high-tension electric lines not placed over congested urban residential areas without undertaking health impact assessments first. Programmatic EIAs were used to assess potential exploitation of coal resources in the northern plains of the USA or to determine whether to permit oil and gas exploration in the outer continental shelf of the USA during the energy crisis of the 1970s; see for instance, *Sierra Club v. Morton*, 510 F. 2d 813 (5th Circuit 1975). The use of EIA by international organizations such as the World Bank, has been timid and of limited value in ensuring sustainable environment decisions.

16 The EU EIA Directive includes petro-refming in the list, but most NEPA FERC decisions relate to pipelines and power line routes, or state EIA procedures relate to supply routes, and not to extraction or refining by facilities owned by the private enterprises. In developing nations, the *Shehla Zia* decision, *supra ibidum*, is a rare exception to the trends that EIA is not often performed for energy infrastructure development.

17 Principle 17, Rio Declaration on Environment and Development (1992).

18 *See*, N. A. Robinson (Ed.), *Agenda 21: Earth's Action Plan* (Dobbs Ferry, N.Y., Oceana Publications, 1993) [cited herein as *Agenda 21*].

19 Agenda 21, Para. 7.5 recommended "promoting sustainable energy and transport systems in human settlements," and in Paras 7.46 to 7.52 elaborated on this recommendation, noting that "[t]ransport accounts for about 30% of commercial energy consumption and for about 60 per cent of total global consumption of liquid petroleum. In developing countries, rapid motorization and insufficient investments in urban-transport planning, traffic management and infrastructure, are creating increasing problems in terms of accidents and injury, health, noise, congestion and loss of productivity similar to those occurring in many developed countries. All of these problems have a severe impact on urban populations, particularly the low-income and no-income groups." Para 7.48.

20 Agenda 21, Chapter 22.

21 Agenda 21, Chapter 8.

cost-saving and immediately available means to comply with the strict air pollution laws. Laws requiring the public disclosure of all air emissions, and the media coverage of those emissions, have further stimulated companies and governmental authorities alike to seek to cut emissions, rather than receive the censure of the public.

In addition to air pollution issues, environmental impact assessments (EIAs) feature in environmental laws and are now a mature legal system established in all regions. EIA techniques have been used to promote the study of alternative means for supplying energy and meeting transportation needs. Since the legal framework for EIA is in place, EIA can and should be more conscientiously used for requiring the study of clean energy options. The retarding factor in EIA is often the lack of government will to use it toward these ends, coupled with the failure to permit public oversight or enforcement of the EIA process in many States. The success of public participation in the implementation of the National Environmental Policy Act (NEPA) in the USA demonstrates the value of such oversight in promoting sound energy practices. Agenda 21 was silent on how to implement EIA, but implicit in Principle 17 of the Rio Declaration on Environment and Development is that EIA's examination of "alternatives" to proposed government actions must entail examining alternative means to promote energy efficiency and avoid exacerbating green house gas emissions.

Many experts in energy and environmental law recognised that these energy recommendations implicit in Agenda 21 would not by themselves be strong enough to reverse current unsustainable patterns of energy use. The UN Development Programme, with commendable support from Sweden, and the UN World Energy Council and the UN Department of Economic and Social Affairs in the UN Secretariat, undertook preparation of the World Energy Assessment.[22] Released in September of 2000, this comprehensive report assessed the fuel cycles used to generate energy supplied, and their competing values and problems. UNDP Administrator, Mark Malloch Brown, called the report "a real landmark. It combined a clear and cogent assessment of the current world energy situation with a detailed analysis of the implications for the poor and the environment. It shows how and why the pursuit of economic growth and environmental protection can be mutually reinforcing goals rather than conflicting ones. And it provides a wide range of provocative but feasible recommendations on how to address these overarching problems."[23] The World Energy Assessment became one of the major contributions to the deliberations of the 9th Session of the UN Commission on Sustainable Development, which examined the role of energy in sustainability. Ironically, the UNDP discontinued its work to promote an understanding of the World Energy Assessment in the same year that the World Summit on Sustainable Development convened in Johannesburg.

In the same time-frame, members of the International Union for Conservation of Nature and Natural Resources (IUCN), including the Pace University Center for Environmental Legal Studies through its Energy Project,[24] brought the same issues to the governing assembly of IUCN. At the first World Conservation Congress in Montreal in 1994, IUCN members mandated the Union's Commission on Environmental Law (CEL) to examine how energy laws could be adapted to ensure environmental protection and advance sustainable development.[25] It was clear to IUCN's Commission on Environmental Law that the objectives of the 1992 United Nations Framework Convention on Climate Change[26] could not be achieved without building the sustainability policies adopted at the UN Conference on Environment and Development (UNCED)[27] in 1992 into the energy laws of each nations. Since 1994, the IUCN CEL Climate and Energy Law Specialist Group has assiduously researched and defined an agenda for the new generation of energy laws, and provided expert advice for the 9th Session of the UN Commission on Sustainable Development in its deliberations in New York.

Largely because Agenda 21 contains no explicit chapter on energy, the UN Commission on Sustainable Development devoted its 9th Session in 2002 to an examination of the role that energy plays in sustainable

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22 *World Energy Assessment,* (New York, UNDP) 2000.

23 Statement by Mark Malloch Brown at the luncheon marking the launch of the World Energy Assessment, New York, September 20, 2000 (UNDP).

24 The Pace Energy Project prepared the leading academic study on the unintended environmental harm produced by established energy systems, see R. Ottinger, *et al., The Environmental Costs of Electricity* (Dobbs Ferry, New York, Oceana Publications, 1990).

25 IUCN 1st World Conservation Congress, Resolution 1.41 (Montreal, Canada); this mandate was renewed at the 2nd World Conservation Congress in Amman, Jordan, in the year 2000, through Res. 2.17.

26 UNFCCC, 1771 UNTS 107 (1992).

27 Rio Declaration on Environment and Development, UN Doc.A/CONF. 15126 (1992), and Agenda 21, UN Doc.A/CONF.26 (volumes I—III) (1992), reprinted with annotations in N. A. Robinson, *Agenda 21: Earth 's Action Plan* (Dobbs Ferry, New York, Oceana Publications, 1993).

development. As an Observer in the UN General Assembly, IUCN has a right and duty to participate in such meetings to provide its expertise to its State Members and other UN Members. Consequently, the IUCN CEL Climate and Energy Law Specialist Group was invited to participate in a one-week experts' consultation at the UN headquarters in New York in early 1999, and subsequently in the CSD's deliberations.[28] Many of the positions that the IUCN Specialist Group advanced had earlier been presented to the "Millennium Conference on Energy, Environment and Clean Mobility," in Geneva, Switzerland, in January of 2000. IUCN's Director General, Dr Marietta Koch-Weser, presented the keynote address to that Conference, setting out the fundamental link between the fields of energy and nature conservation. This Conference was also a significant input for the 9th Session of the Commission on Sustainable Development.

In late 2000, IUCN (through its Climate and Energy Law Specialist Group) and the International Council of Scientific Unions (ICSU) presented a joint paper to the Commission on Sustainable Development in a dialogue that had been scheduled to explore ideas of achieving equitable access to cleaner energy, exploring choices for producing, distributing and consuming energy, and developing public-private partnerships to achieve sustainable energy for transport, and transport planning choices.[29] IUCN's Climate and Energy Law Specialist Group participated, by invitation, in an inter-sessional Energy Expert Group meeting (26 February–2 March 2001) convened before the 9th Session of the Commission on Sustainable Development, to explore alternative energy paths to enhance sustainable development.[30]

The recommendations of the 9th CSD provided the foundation for the decisions taken in the Preparatory Committee for the World Summit on Sustainable Development, and ultimately reflected in the WSSD's Johannesburg Plan of Implementation (adopted 4 September 2002). While details are not set forth in the Plan of Implementation, as discussed below, many of the most salient issues are elaborated in this book. The chapters that follow here elaborated the energy recommendations of the Johannesburg Plan of Implementation. This book focuses on the issues that will necessarily constitute the agenda for the reform of energy law systems worldwide.

Perhaps the greatest political events made in Johannesburg at the time of the WSSD were the decisions by Canada and the Russian Federation to ratify the Kyoto Protocol. Canada subsequently took its decision to ratify, and the Russia action can be anticipated. These ratifications will be sufficient to bring the Kyoto Protocol into force, but the practical fate of the Kyoto Protocol depends on how it will be implemented. Ratifications alone do not, of course, implement the Protocol; the legal frameworks for implementation remain to be put in place in each nation. The challenge will be to integrate environmental and energy law into a synthesis that furthers sustainable energy generation and use.

The significance of the challenge to reform energy policy and law transcends the event of the World Summit on Sustainable Development in 2002. Climate change constitutes one of Earth's most fundamental challenges, and will be so for the next few decades. The economic costs of internalizing what are now energy externalities will require a basic reordering of the global economy and each nation's economy. Many nations have come to recognise that they need to undertake significant reductions in greenhouse gas emissions if the objectives of the Kyoto Protocol are to be realized. Even where national leaders are unwilling to reach these conclusions, as in the USA currently under President George W. Bush, local authorities and other political subdivisions have taken decisive action, as in California's initiative to require measurable cutbacks on motor vehicle greenhouse gas emissions as a condition for their sale in California. The growing consensus of nations in support of advancing recommendations for energy law reform provide the basis for moving from study to implementation of the recommendations.

The delegates to the Preparatory Committee of the WSSD built on this growing body of recommendations and the decisions of the 9th Session of the UN Commission on Sustainable Development. Although no agreement could be reached on binding, or even merely recommended timetables and targets for abating existing greenhouse gas emissions or for averting new emissions, it is nonetheless significant that the Johannesburg Plan of Implementation does set forth the energy recommendations that were missing from Rio's Agenda 21. Energy policy is now a core part of the agenda for sustainable development.

On 4 September 2002, the WSSD agreed that sustainable development requires a refocusing of energy. First, in the Johannesburg Declaration on Sustainable Development the delegates included access to energy as

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28 Professor Richard L. Ottinger (USA), Prof. David Hodas (USA), and Ambassador Ben Mudho (Kenya) comprised the team present for the meetings.

29 IUCN-ICSU CSD-9 Dialogue Paper (November 2000).

30 *See* http:/www.un.org/esa/sustdev/csd9/csd9_2001.htm

a basic requirement for human dignity,[31] and also noted "the global environment continues to suffer.... The adverse effects of climate change are already evident."[32] In this political declaration, the nations at the WSSD committed themselves "to the Johannesburg Plan of Implementation and to expedite the achievement of the time-bound, socio-economic and environmental targets contained therein."[33]

The final core provisions of the Johannesburg Plan of Implementation were negotiated and agreed upon in paragraph 8 of the text adopted on 4 September 2002. The nations agree to take joint actions "to improve access to reliable and affordable energy services.. .sufficient to facilitate the.. .goal of halving the proportion of people in poverty by 2015."[34] The nations expressly recognise that provision of access to energy is basic to providing other basic services, such as power to pump and supply clean, potable water. In order to meet this ambitious target, the nations agreed on eight priority recommendations:

1) "I*mprove access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services and resources."* Doing so entails giving priority attention to rural electrification and decentralized energy systems. In places such as much of Africa, where most communities are not part of any centralized national power grid, local systems for generating electricity will need to be established. Such efforts will require accelerated research into hydrogen fuel cell technology, and wider use of wind and solar power, or where appropriate small head hydroelectric power in mountain areas. To accomplish such results, nations must engage in "intensifying regional and international cooperation in support of national efforts, including through capacity-building, [and] financial and technological assistance."[35]

2) "*Improve access to modern biomass technologies.*" This recognises that opportunities exist to use what is now agricultural or silvicultural waste as an energy asset. Biomass is to be considered for commercial operation, and use in rural areas.[36]

3) "*Support the transition to the cleaner use of liquid and gaseous fossil fuels, where considered more environmentally sound, socially acceptable and cost-effective.*"[37] Whether any fossil fuels can be used without exacerbating greenhouse gas emissions and the attendant climate change, is a troubling question. Since fossil fuels are going to be used for some decades to come, however, social engineering to limit the growth in their use is essential. Previous investments in fossil fuel energy systems will tend to retard use of any such innovative legal and economic measures; incentives will be needed to effect this transition. The Johannesburg Plan of Implementation is silent on this aspect.

4) "*Develop national energy policies and regulatory frameworks that will help to create the necessary economic, social and institutional conditions in the energy sector*"[38] *in order to meet the goals in the first recommendation.* Emphasis is given to doing so in rural, peri-urban and urban areas. This recommendation expressly recognises the need for reforms in energy law, such as those that the IUCN Legal Specialist Group is studying and designing. These recommendations invite more detailed analysis of what sort of regulatory frameworks are needed for licensing energy systems, for economic incentives and disincentives to promote sustainable systems, and for procedures for impact assessment and public participation in energy/environmental decision-making. Above all, before any effective regulatory reforms can be fashioned, there is a need to re-assess the fundamental principles and policy that should guide sustainable energy policy. These principles need to be incorporated into national energy statutes and regulations.

5) *"Enhance international and regional cooperation " to meet the above ends, again "with special*

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31 Paragraph 18 of the Johannesburg Declaration on Sustainable Development, UN Doc. A/CONF. 1999/L.6/Rev. 3 (4 September 2002), states that: "We welcome the Johannesburg Summit focus on the individuality of human dignity and are resolved through decisions on targets, timetables and partnerships to speedily increase access to basic requirements such as clean water, sanitation, energy, health care, food security and the protection of biodiversity...."

32 Paragraph 13 of the Johannesburg Declaration on Sustainable Development, *Ibidum,* states that: "The global environment continues to suffer. Loss of biodiversity continues, fish stocks continue to be depleted, desertification claims more and more fertile land, the adverse effects of climate change are already evident, natural disasters are more frequent and more devastating and developing countries more vulnerable, and air, water and marine pollution continue to rob millions of a decent life."

33 Para. 36 of the Johannesburg Declaration on Sustainable Development, *Ibidum.*

34 The Johannesburg Plan of Implementation, UN Doc A/CONF. 199/ 20 (4 September 2002), advanced unedited text at Para. 8.

35 Id., Para. 8(a).

36 Id., Para. 8(b).

37 Id., Para 8(c).

38 Id., Para. 8(d).

attention to rural and isolated areas."[39] This will require improvements in international environmental governance systems, which was a priority for the WSSD in its preparation, but one about which no consensus could be realized at Johannesburg. Part X of the Johannesburg Plan of Implementation urged the nations to make the existing systems of multilateral cooperation work more effectively; however, in the energy sector, there is an absence of institutional systems to undertake the cooperation called for here. This is another weakness in the recommendations that will need to be addressed.

8) "*Assist and facilitate on an accelerated basis...the access of the poor to energy systems as set forth in recommendation one above*." This re-iterates the relationship of energy to poverty alleviation. With over 80% of the people of Africa, for instance, having no access to electricity, it is imperative that sustainable development give priority to deploying decentralized renewable energy systems, and develop and deploy hydrogen fuel cell systems to generate electricity in remote places.

Two elements will be required to realize these eight recommendations. *First*, basic principles, which have been pioneered in the context of environmental law, will need to be applied consistently to the realm of energy law, and with greater effectiveness. These include the principles set forth in the UN World Charter for Nature,[40] in the 1992 Declaration of Rio de Janeiro on Environment and Development, and in the earlier Stockholm Declaration on the Human Environment of 1972. These principles are implemented in many nations' laws, in the Directives of the European Union, and the several multilateral environmental agreements. This is a basic question of ethics, as the Johannesburg Plan of Implementation states.[41] Nonetheless, those who develop the utilitarian and short-term economic objectives of the energy sector have largely ignored these principles. Ignoring these principles is no longer sustainable. Energy law must be grounded on the reuse and recycling of energy, waste avoidance and robust use of procedures for environmental impact assessment and public participation. Assurance of basic electricity and other fuel needs for the poor must be a priority.

Second, guided by principle, financial and technological resources should be deployed to put on line, where geographic conditions permit, renewable energy systems (solar, wind, hydro-electric) and to refine and deploy hydrogen fuel cell technologies for motor vehicle design in transport systems and for supply of electricity on a decentralized, rural basis.

It may be that the Conference of the Parties of the UN Framework Convention on Climate Change can advance – as a priority – the development of basic principles to guide the next generation of energy laws. It may be that the Conference of the Parties of the UN Convention on Biological Diversity can develop the standards for effective sequestration of carbon dioxide through photosynthesis. It may be that the Second Committee of the UN General Assembly, and the UN Commission on Sustainable Development, can identify consensus policies that will unite the two sectors of biology and energy. If global ecosystem management has any meaning, it needs to be in the measurement of energy flows, and this endeavour must include the intellectual energy flow of ideas and action across sectors and between these several global forums for decision-making. International cooperation will be essential.

Ultimately, however, energy law reform is the quintessential national issue. Parliaments around the world need to address how to reshape national energy laws. In the period after Stockholm, "capacity building" in legislation was focused on the developing nations. In the period after Johannesburg's WSSD, the comparable effort must be devoted to working in each of the capitals of the world to build a new framework for sustainable energy law. In such a mission, IUCN and its Commission on Environmental Law are well positioned to assist national legislators as they consider their options to revise energy laws. Ultimately, reshaping energy law will be a common challenge met by each human community within Earth's biosphere.

Nicholas A. Robinson

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39 *Id.*, Para. 8(f); on the issue of failing to agree on enhancements to the international environmental governance, see Nicholas A. Robinson, "Befogged Vision: International Environmental Governance a Decade after Rio," *William and Mary Law & Policy Review* (forthcoming; an article delivered at a Symposium in May 2002, William & Mary Law School, Williamsburg, Virginia).

40 UNGA Res. 37/7(1982).

41 Paragraph 5 bis: "We acknowledge the importance of ethics for sustainable development, and therefore we emphasize the need to consider ethics in the implementation of Agenda 21."

Preface

The IUCN Environmental Law programme (ELP) welcomes the publication of this pioneering work. It reinforces the relevance of the outstanding work being done by members of the IUCN CEL Climate and Energy Law Specialist Group. Furthermore, it demonstrates in a very tangible way how members of this volunteer network of over 800 environmental law specialists from all over the world are contributing to meeting the challenge of:

> *"Laying the strongest possible legal foundation at the international, regional and national levels for environmental conservation in the context of sustainable development. "*
>
> *IUCN ELP Mission*

This book was produced through the collaboration of distinguished CEL members and staff of the Environmental Law Centre (ELC), who work together to deliver an integrated global environmental law programme. It draws on the insights of a unique mix of leading experts in the field of energy and climate change. The ELC is proud to be associated with this work, and with good reason. This new publication comprises the most recent ideas on a topic of ever increasing evolution and importance.

Energy has recently emerged at the forefront of sustainable development. The United Nations Development Programme's World Energy Assessment (2000) linked energy and most of the ills of modern society in both developed and developing countries. The World Summit on Sustainable Development (WSSD) selected energy as one of its five major agenda issues, devising a Plan of Implementation emphasising the role of energy in eradicating poverty. That same plan calls for the establishment of policy and regulatory frameworks to promote the development and dissemination of alternative energy technologies. This ground-breaking publication should serve as an invaluable tool to facilitate this task.

Energy law, as an integral component of environmental law and overall environmental strategy, is a relatively new concept, which underlines the importance and relevance of this publication. Climate change has not only been the precursor behind this association but also the driving force behind bringing down political barriers which have prevented the overhaul of energy legislation worldwide. At present, Parties to the Kyoto Protocol to the UNFCCC are individually and collectively drafting and amending energy laws in order to meet their obligations under the Protocol.

The purpose of this publication is to facilitate the understanding of the relationship between energy law and sustainable development. In doing so, the IUCN Environmental Law Programme hopes that the information will be used by all stakeholders in the energy debate to further the use of clean renewable sources of energy.

John Scanlon
Head, IUCN Environmental Law Programme
Director, IUCN Environmental Law Centre

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Message

I commend the IUCN Environmental Law Programme for publishing this extremely insightful handbook. It is interesting and timely in many respects.

It squarely addresses the nexus among development, energy security and climate change. Energy as an engine for development is at the heart of many development strategies, as was most recently confirmed by the World Summit on Sustainable Development. If one takes the objective of the United Nations Framework Convention on Climate Change seriously, the world should be heading towards a carbon constrained energy economy. This publication clearly indicates that we aren't there yet!

The book attempts to link the legal instruments developed at the "environment side" to an energy regime where economic motives dominate and differ across nations, depending on their natural resource endowments, i.e., whether they are blessed with renewable or non-renewable resources. The legal instruments (like environmental impact assessment at the project or policy level) seem to be largely developed through environmental legislation. As such, the title of the book is somewhat misleading: there is not much – at least reported on in this book – in terms of energy law that would contribute to sustainable development. The key is to be found in applying environmental legislation and soft law in the energy sector. This publication certainly supports the pursuit of further integration and the need for mainstreaming climate change concerns in development and energy legislation and policies. As such the recent introduction of climate change legislation at the international and national level, which is at the crossroads of environmental and economic legislation, is certainly a step forward.

It is also interesting to note that the emphasis in the book is more on policies and policy instruments than on legislation in the narrow sense. This seems to confirm a trend of policies moving away from the use of command and control rooted in strict legislation.

In the climate change area the possible (economic) win-wins in terms of more climate friendly energy options combined with less dependence on energy imports, with associated economic benefits, are met with increased attention. The implementation of the Kyoto Protocol will undoubtedly shed further light on evolving practices, which will need careful analysis. The market-based instruments like international emissions trading and the project-based Clean Development Mechanism (CDM) are unprecedented in international agreements. If they go hand in hand with the abolition of environmentally harmful subsidies, major strides can be made towards an environmentally sustainable energy future.

Joke Waller-Hunter
Executive Secretary
United Nations Framework Convention on Climate Change

Acknowledgements

Energy issues currently are very much at the focus of international environmental and development deliberations. We have come a long way from the Rio UN Conference on Environment and Development (UNCED) of 1992 and its Agenda 21 that barely mentioned energy's relationship to development at all. Ten years later in the 2002 Johannesburg UN World Summit on Sustainable Development (WSSD), energy was central to the world's development considerations.

This remarkable shift in focus in just a decade was caused by many factors. High on the list were the findings of the world scientific community in the Intergovernmental Panel on Climate Change (IPCC) that expanded human use of fossil fuels since the Industrial Revolution threatens changes in climate that endanger the future of all living things on earth, from agriculture to oceans to biodiversity represented by ecosystem and human and other animal survivability – all this on top of the already known serious environmental and health consequences of highly toxic fossil fuel emissions of sulphuric and nitric acids, small soot particles, mercury and lead leading to air and water pollution and acid rain, and contributing to environmental destruction and animal/human diseases and early death. Terrorism and threatened war against Iraq also contributed importantly.

This book addresses these problems of unsustainability of today's predominant forms of energy production and use. It points the way to a more sustainable future and the legal means for achieving it. In this respect, the book breaks new ground as unlike most past publications in the energy law field the focus is not predominantly on the economic development of fossil fuel resources.

The book chapters are written by leading experts in their fields from around the world. The issues are well scoped in a Foreword by Professor Nicholas A. Robinson, Legal Adviser to 1UCN and Chair of its Commission on Environmental Law. The relationship of development and energy is vividly described by Professor José Goldemberg of Brazil, the editor-in-chief of the UNDP-WEC-UNDESA World Energy Assessment, while the relationship between energy and biodiversity is considered by Jeff McNeely of IUCN. Sustainable development in the petroleum sector is covered by Professor Jacqueline Lang Weaver of Houston Law School. Renewable energy and energy efficiency are described by Dean Emeritus Richard Ottinger and Energy Project Director Fred Zalcman of the Pace University School of Law, with wind promotion highlighted with a Denmark case study by Dr Rikke Munk Hansen, formerly with the Danish government, now with the UN Economic and Social Commission for Asia and the Pacific (UNESCAP). Achim Steiner and Larry Haas of IUCN cover hydroelectric energy and the report of the World Commission on Dams. The contribution of international law to achieving sustainable energy for development is discussed by Professor Adrian Bradbrook of the University of Adelaide Law School and Dr Ralph Wahnschafft of UNESCAP, while the role of international agencies in the energy sector is covered by the eminent Dr Thomas Wälde of the University of Dundee, United Kingdom. Market issues are discussed from the Green Power standpoint by Dr Alexandra Wawryk of the University of Adelaide and from the standpoint of the relationship between market liberalization and sustainability by Professor Barry Barton of the University of Waikato in New Zealand.

Thus many viewpoints and perspectives are offered on the legal issues of promoting sustainable energy for development in a book that hopefully will be valuable to all those working in the field.

We would like to thank Nick Robinson for his constant support and encouragement in bringing this project to fruition. We also wish to extend our thanks to John Scanlon, Head of the IUCN Environmental Law Programme for his support, and to Maria Socorro Manguiat, Stephane Levy and Ann DeVoy of the IUCN Environmental Law Centre and the members of the IUCN Publications Services Unit for their editorial and administrative work on this book.

Adrian J. Bradbrook and Richard L. Ottinger, editors
January 2003

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Barry Barton is an Associate Professor at the University of Waikato, in Hamilton, New Zealand. He studied at the University of Auckland and the University of British Columbia, and was a research associate in the Canadian Institute of Resources Law. In 1991, he joined the academic staff of the new School of Law at Waikato. His research field is natural resources law, including environmental law and energy law, particularly focusing on mining, water, and electricity. He is the New Zealand member of the Academic Advisory Group of the Section of Energy and Natural Resources Law of the International Bar Association and a director of the Environmental Defence Society.

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José Goldemberg, a physicist by training, is Full Professor and former Rector of the University of Sao Paulo. He has served as Secretary of State for Science and Technology of Brazil. He has published widely in the energy field, and was the Chief Editor of the World Energy Assessment, sponsored jointly by the United Nations Development Programme, the United Nations Department of Economic and Social Affairs and the World Energy Council.

Lawrence J. M. Haas holds degrees in Civil Engineering and Environmental Studies from Canada. After managing energy and environment projects in Canada with Federal and Provincial government departments, for the past 20 years he has worked internationally leading inter-disciplinary teams working with government, non-government and private sector organizations in several countries in Asia and Africa. Since the early 1990s, much of this work involved advising governments on ways to redefine regulatory and institutional frameworks to build participation and transparency into the selection of infrastructure projects, and to introduce new financing approaches. Mr Haas was Team Leader in the Secretariat of the World Commission on Dams (WCD). Presently he is an independent consultant based in the United Kingdom engaged in various follow-up activities to the WCD, and climate change adaptation work in water and energy resource development.

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the relationship between people and wildlife in Southeast Asia, agriculture, economics, biodiversity, climate change, and protected areas. His latest book, co-authored with Sara Scherr, is *Ecoagriculture: Strategies to Feed the World and Save Wild Biodiversity* (2003).

Richard L. Ottinger is Dean Emeritus and Professor of Law at Pace Law School in White Plains, New York, where he taught environmental law and was Dean from 1994–1999. He is a member of the IUCN Commission on Environmental Law and Chair of its Climate and Energy Working Group. He served for 16 years in the US Congress, chairing the House Subcommittee on Energy, Conservation and Power. He was a founding staff member of the US Peace Corps and was an Associate in the New York law firm of Clearly, Gottlieb, Friendly & Hamilton. He is a graduate of Harvard Law School and Cornell University.

Achim Steiner is the Director General of IUCN. He has degrees from the Universities of Oxford and London. He also studied at the German Development Institute in Berlin and the Harvard Business School. Previously, as Secretary General of the World Commission on Dams, he brought together the public sector, civil society and the private sector in a global policy process on dams and development. Prior to that, he worked as Chief Technical Adviser with GTZ and the Mekong River Commission and was Senior Policy Adviser to IUCN's Global Policy Unit. His professional career also includes extended field assignments in Southern Africa and South Asia. Achim Steiner is a member of the UN Secretary General's Advisory Council for the Global Compact, the Environmental Advisory Council of the European Bank for Reconstruction and Development, the Bureau of China Council for International Cooperation on Environment and Development, and the International Advisory Committee of Global Environmental Action.

Thomas Wälde (Dr iur (Frankfurt); LL.M. (Harvard)) holds the Jean Monnet Chair for EU Economics and Energy Law, and is Head of the CEPMLP International Business Transactions programme, University of Dundee, UK. From 1980 to 1990 he was the principal UN adviser on international investment, natural resources and energy. Professor Wälde is now an internationally leading scholar (and government and corporate adviser) in the field of international economic and investment law, regulatory reform and commercial/investment negotiations. He has published widely on energy law. He is editor of the leading international journals in international economic and energy/natural resources law; chief adviser on several EU legislative reform projects; consultant to major international energy/resource companies, international and national agencies (World Bank, EU, IEA, APEC, OPEC, GTZ); and acts as an arbitrator and mediator in energy law issues. He was voted in 2000 Euromoney Survey as the internationally leading practitioner in oil-gas-energy law. He is the Principal of Thomas Wälde & Associates.

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Fred Zalcman, the Executive Director of the Pace Energy Project, has been lead counsel for New York's environmental community in a variety of proceedings before the New York Public Service Commission. Mr Zalcman has been the team leader on a number of consensus-building activities among environmental NGOs on restructuring policy and among insurance companies on benefits of sustainable energy investments. Most recently, Mr Zalcman has focused his efforts on removing economic and environmental regulatory barriers to the development of emerging clean distributed generation technologies. He teaches energy and natural resource law at Pace Law School and has significant experience in energy and environmental matters, both as an attorney and as a policy analyst. Prior to joining Pace in 1994, he was head of the Strategic Planning Section of the Illinois Department of Energy and Natural Resources.

Development and energy

José Goldemberg

This Paper presents an analysis that shows clearly that energy has a determinant influence on the quality of life, particularly in the early stages of development, in which the vast majority of the world's people, particularly women and children, find themselves today. The Paper also emphasises the importance of the efficiency of energy use and renewable energy resources in influencing the relationship between energy and development.

1 Introduction

While energy is a physical entity well understood and quantitatively defined, the concept of development is less well defined and there are different perceptions about its meaning. The World Bank measures development by the gross national product (GNP) and nations are classified in categories according to their GNP "per capita."[1]

This "monetization" of the concept of development is not well understood, nor accepted by many, particularly in developing countries, where income "per capita" varies dramatically between the poor and the rich. This is not the case in the OECD countries where there is a large middle class and variations in income are not very large.

What the poor in the developing countries aspire to – and they represent 70% of the world's population – is a "better life" meaning jobs, food, health services, housing (rural or urban), education, transportation, running water, sewage communication services, security of supply and good environment. These things are usually measured in industrialized countries by monetary transactions but not necessarily so in many others. Climate, abundant and easily available natural resources can lead to a "better life" without great monetary expenses. In some countries cultural values are such that some items are less desirable than in others. In others the political system privileges some solutions over others that cost much less. This is why to compare stages of development only by GDP "per capita" can be quite misleading.

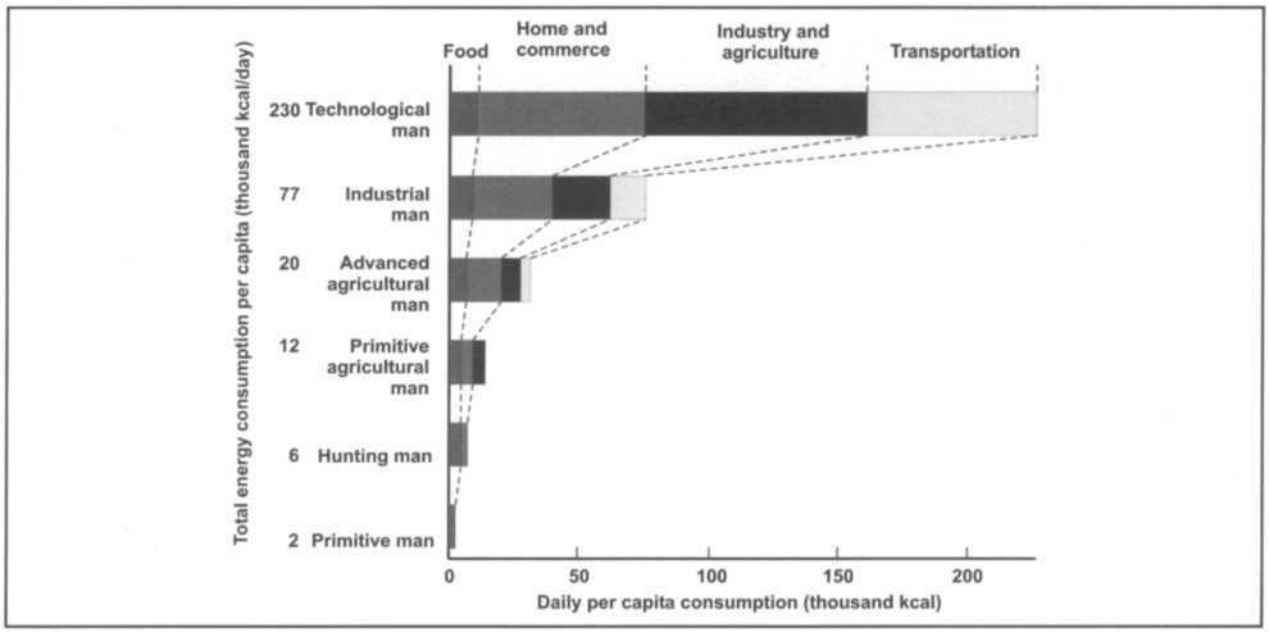
Energy in its various forms (mechanical, chemical, electrical, heat, electromagnetic radiation) is essential for all aspirations listed above and thus energy is closely linked to a range of social issues. The relationship is a two-way street: the quality and quantity of energy services, and how they are achieved, have an effect on social issues as well.

The stages of development of man from primitive man (one million years ago) to today's technological man can be roughly correlated with energy consumption as indicated in Fig. 1, which shows daily consumption of energy per capita for six stages in human development.

- *Primitive man* (East Africa about 1 million years ago), without the use of fire, had only the energy of the food he ate (2,000 kcal/day).
- *Hunting man* (Europe about 100,000 years ago) had more food and also burned wood for heating and cooking.
- *Primitive agricultural man* (Fertile Crescent in 5000BC) was growing crops and used animal energy.
- *Advanced agricultural man* (Northeast Europe in 1400AD) had coal for heating, water power, wind power and animal transport.
- *Industrial man* (in the United Kingdom in 1875) had the steam engine.
- *Technological man* (in the United States in 1970) consumed 230,000 kcal/day.

[1] High income: US$9,266 or more; middle income: US$756–9,265; low income: US$755 or less (dollars of 1999).

Fig. 1 Stages of development and energy consumption

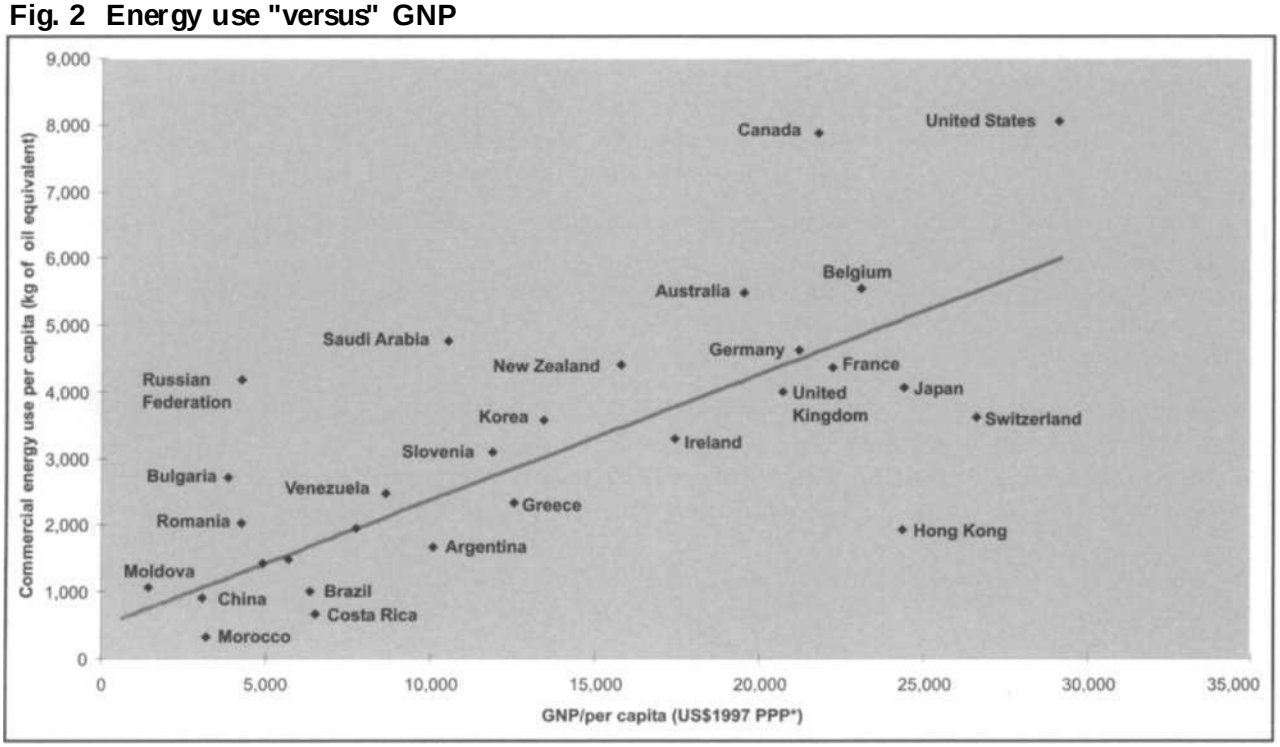


Source: Cook, E., *Man. Energy, Society*, W. H. Freeman and Co, San Francisco, US (1976).

Starting with the very low energy consumption of 2000 kcal per day, which characterized primitive man, energy consumption grew, in one million years, to 230,000 kcal per day. This enormous growth of per capita energy consumption was only made possible by:

- Increased use of coal as a source of heat and power in the 19th century;
- Use of internal combustion engines which led to the massive use of petroleum and its derivatives; and
- Electricity generated initially in hydroelectric sites and afterwards in thermoelectric plants.

Fig. 2 Energy use "versus" GNP



*purchasing power parity
Source: World Development Indicators, World Bank, 1999.

Income "per capita" has also grown and one is thus tempted to find out if there is a clear correlation between energy consumption/capita and GDP/capita. Fig. 2 shows data for a number of countries.

A linear relationship between energy consumption/capita and GDP/capita could be expected since higher income means more appliances, automobiles, larger homes, more travel and many other activities but empirical evidence shows that is not the case. Clearly there are many countries that do not fit into a linear relationship.

Moreover some countries with the same GNP/capita can have very different energy consumption "per capita" which is the case for example for Russia, China and Morocco. Their GNP/capita is approximately the same but energy consumption in Russia is 4 times higher than in China and 15 times higher than Morocco.

2 The importance of non-commercial energy

One problem with Fig. 2, as far as the developing countries are concerned, is that the horizontal axis considers only "commercial energy" which is the fraction of total energy consumption that can be quantified since by definition it involves monetary transactions. In reality, in many areas non-commercial energy sources such as dung, agricultural residues and fuelwood are used. In some countries it represents a large percentage of total consumption particularly for the poor. Table 1 shows the importance of non-commercial energy in a number of countries.

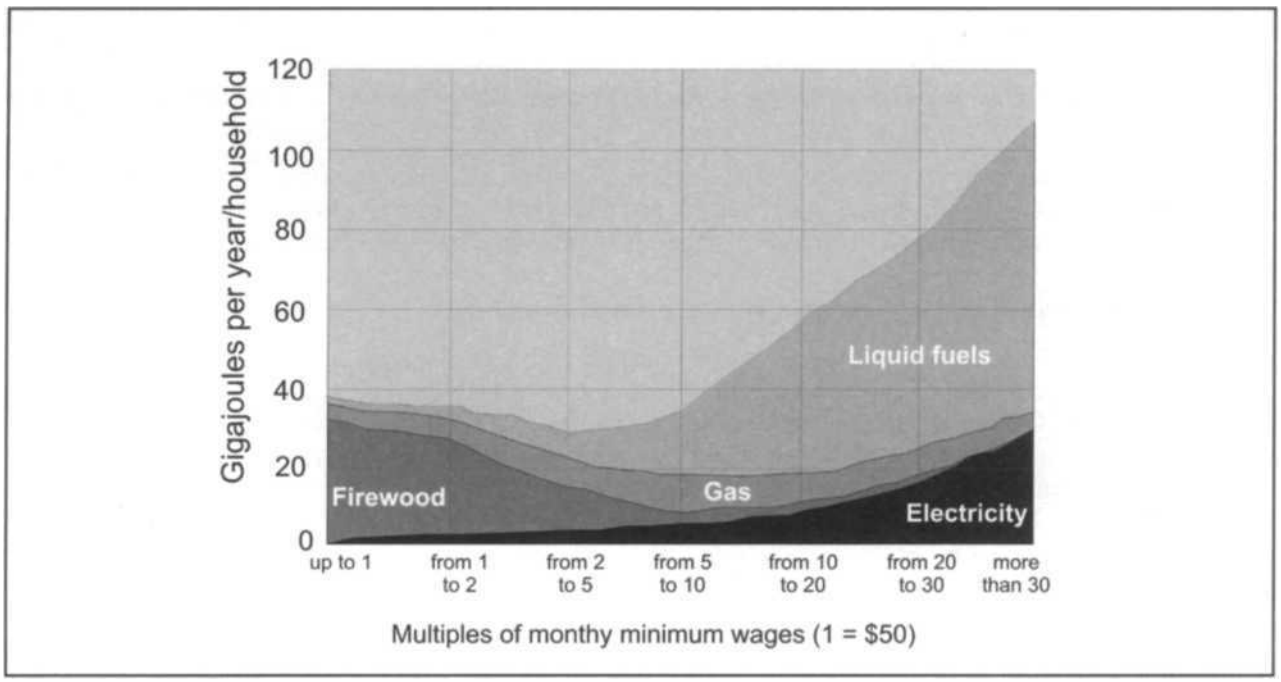
Table 1. Non-commercial energy in Africa

Country	1973	1985
Uganda	83%	92%
Malawi	87%	94%
Guinea-Bissau	72%	67%
Gambia	89%	78%
Guinea	69%	72%
Burundi	97%	95%
Mali	90%	88%
Burkina Faso	96%	92%

Source: World Resources, World Resources Institute 1998.

The importance of non-commercial energy is also clearly exemplified by the data in Fig. 3 which shows the average energy demand by income segment in Brazil. For low-income household firewood (usually a non-commercial energy source) is the dominant fuel. At higher income firewood is replaced by commercial fuels and electricity which offer much greater convenience, energy efficiency and cleanliness. In most of Africa and India dung and agricultural residues are used in lieu of firewood.

Fig. 3 Average energy demand by income segment in Brazil, 1998

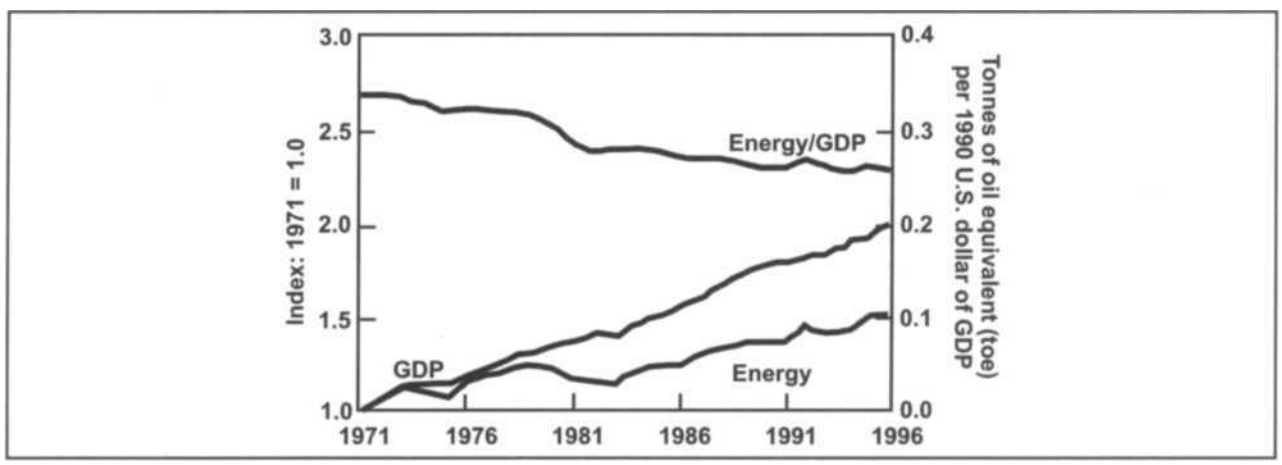


Source: Almeida, E. and Oliveira, A. "Brazilian Life Style and Energy Consumption" in *Energy Demand, Life Style changes and Technology Development,* World Energy Council, London, 1995.

3 The energy intensity

Another reason for the lack of a linear relationship between energy and GDP per capita is that the amount of additional energy required to provide energy services depends on the efficiencies with which the energy is produced, delivered, and used. Energy intensity (the ratio of energy demand to GDP) often depends on a country's stage of development. In OECD countries, which enjoy abundant energy services, growth in energy demand is less tightly linked to economic productivity than it was in the past (Fig. 4).

Fig. 4 GDP and primary energy consumption in OECD countries, 1971–96



Source: Energy Balances of OECD Countries, IEA (International Energy Agency) Paris, 1999.

The evolution of the energy intensity (I =*E*/GDP) over time reflects the combined effects of structural changes in the economy – built into the GDP – and changes in the mix of energy sources and the efficiency of energy use – built into the primary energy consumed *E*.

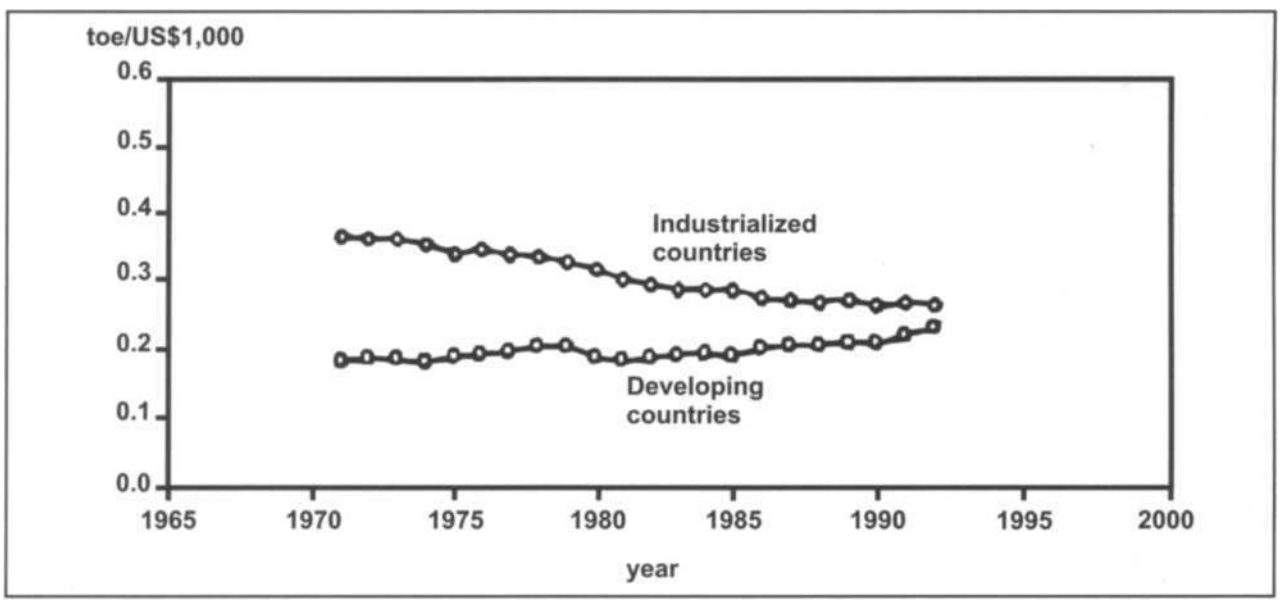
Although admittedly a very rough indicator, energy intensity has some attractive features: while *E* and GDP per capita vary by more than one order of magnitude between developing and developed countries,

energy intensity does not change by more than a factor of two. This is due in part to the common characteristic of the energy systems of industrialized and developing countries in the "modern" sector of the economy, and in part to the fact that in industrialized countries energy-intensive activities, such as jet travel, are increasingly offsetting efficiency gains in basic industries.

Energy intensity (considering only commercial energy sources) declined in OECD countries in the period 1971–1991 at a rate of roughly 1.4% per year. The main reasons for that movement were efficiency improvements, structural change and fuel substitution. However, in the developing countries the pattern has been more varied.

A recent study indicates that the energy intensity in the period 1971–1992 of developing and industrialized countries is converging to a common pattern of energy use. For each country, energy intensity was obtained as the ratio of commercial energy use to GDP converted in terms of purchasing power parity (PPP). The path of energy intensity of a country was given by the yearly sequence of energy intensity data over the period 1971–1994. The same procedure was followed to have the energy intensity paths for a set of 18 industrialized countries and for one of 23 developing countries. The energy intensity data for each of these subsets were given by the ratio of total commercial energy use to total PPP-converted GDP for each group of countries at each year of the period 1971–1994 (Fig. 5).

Fig. 5 Energy Use/GDP-PPP (in 1992 US$)

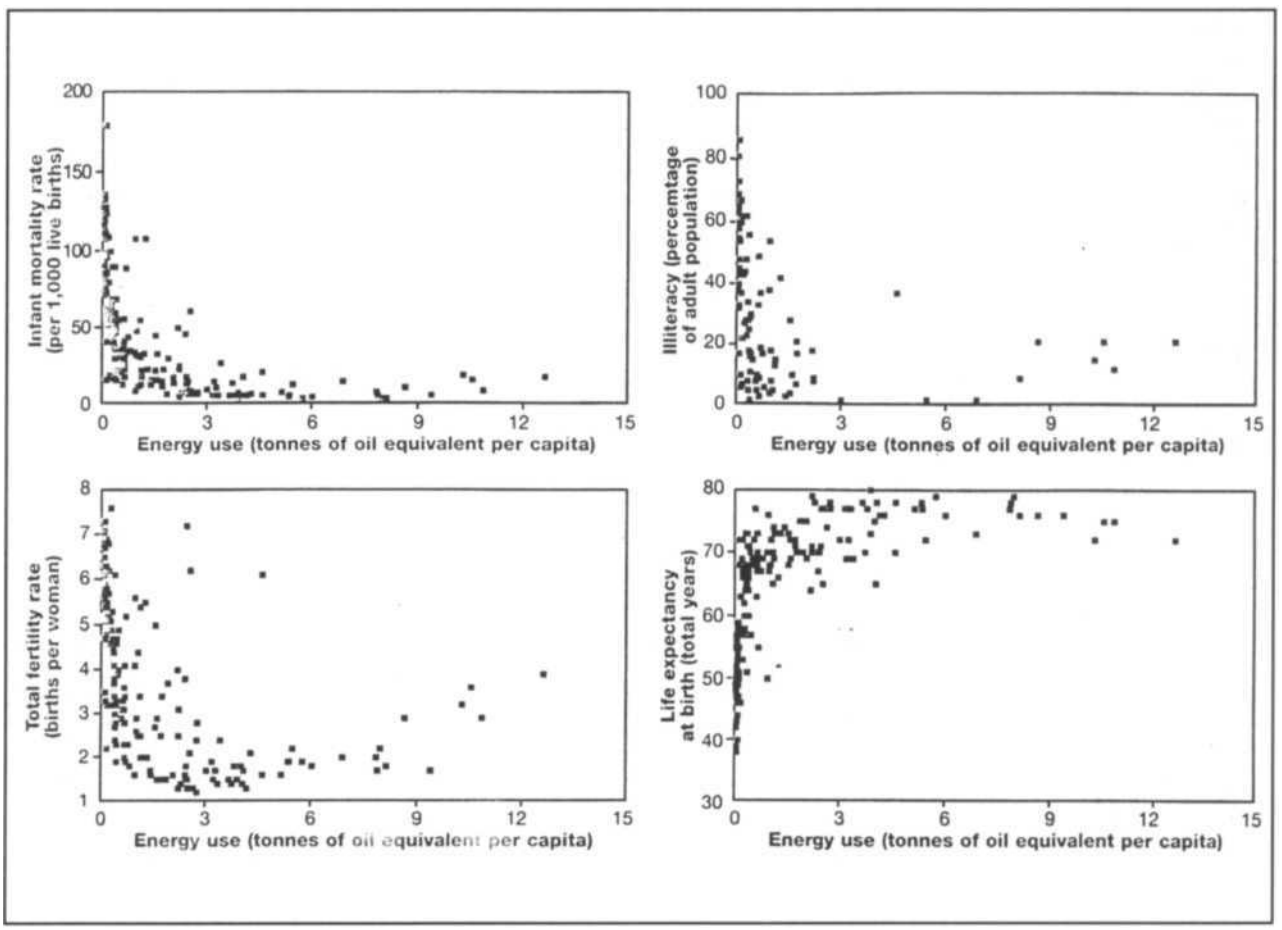


Source: Mielnik, O. and Goldemberg, J. "Converging to a common pattern of energy use in developing and industrialized countries" *Energy Policy* 28. pp.503-8, 2000.

4 The human development index

Since a clear correlation between energy and income is difficult to establish one is tempted to look for other correlations between energy consumption and social indicators such as infant mortality, illiteracy and fertility (Fig. 6).

Fig. 6 Commercial energy use and infant mortality, illiteracy, life expectancy, and fertility in industrialized and developing countries



Source: World Energy Assessment, UNDP, DESA and WEC – Editor: Goldemberg, J., 2000.

It is clear from such figures that energy use has great impacts on major social issues which does not necessarily mean a causal relationship between the parameters represented but a strong covariance.

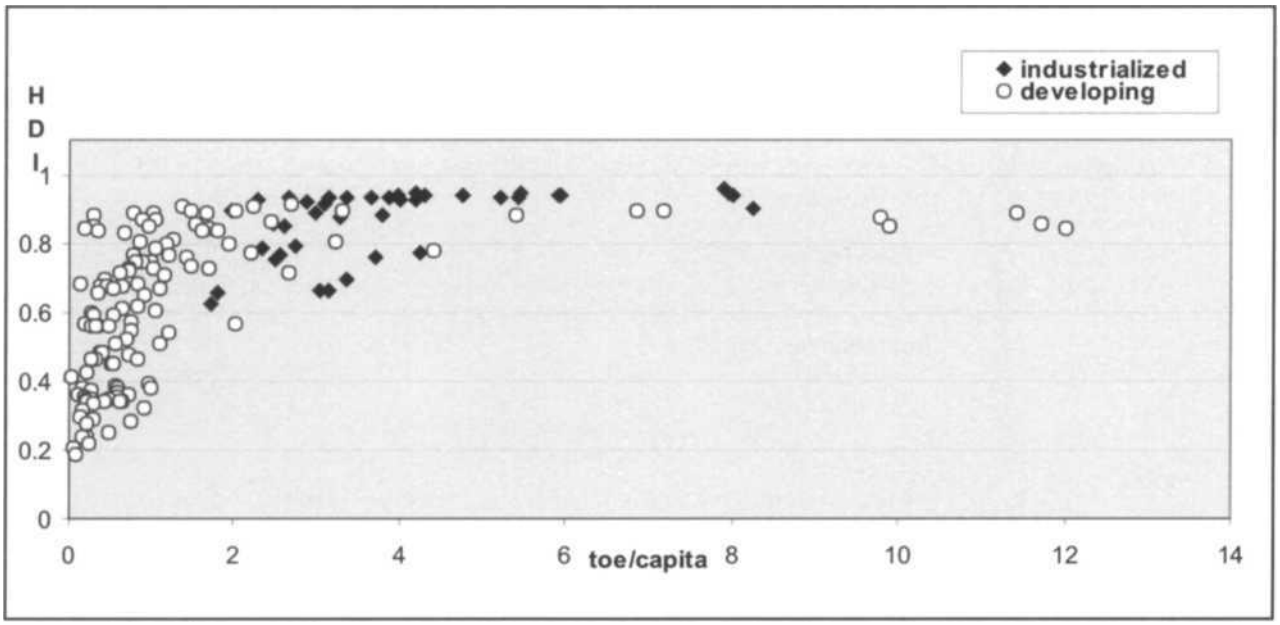
Such behaviour encouraged analysts to invent an indicator that would include not only GDP/capita but take into account longevity and literacy.

The Human Development Index (HDI) developed by UNDP is one way of measuring how well countries are meeting, not just the economic, but also the social needs of their people, that is, their quality of life. The HDI is calculated on the basis of a simple average of longevity, knowledge, and standard of living:

- longevity – measured by life expectancy;
- knowledge – measured by a combination of adult literacy (two-thirds weight) and mean years of schooling (one-third weight); and
- standard of living – measured by purchasing power, based on real GDP per capita adjusted for the local cost of living (PPP).

The HDI measures performance by expressing a value between 0 (poorest performance) and 1 (ideal performance). Fig. 7 shows HDI as a function of commercial energy consumption for a large number of countries.

Fig. 7 HDI and energy use – 40 industrialized and 121 developing countries (in toe/capita)



Sources: World Bank (*1999 World Development Indicators)* for energy data; UNDP (*Human Development Report 1998*).

Table 2 lists the characteristics of a few countries, their HDI value and HDI rank.

Table 2. HDI for a few countries

Country	Life expectancy at birth (years)	Adult literacy rate (% age 15 and above)	GDP per capita (PPP US$)	HDI	HDI rank
Russia	66.1	99.5	7.473	0.775	55
Brazil	67.5	84.9	7,037	0.75	69
Sri Lanka	71.9	91.4	3,279	0.735	81
China	70.2	83.5	3,617	0.718	87
Morocco	67.2	48.0	3.419	0.596	112
India	62.9	56.5	2,248	0.571	115

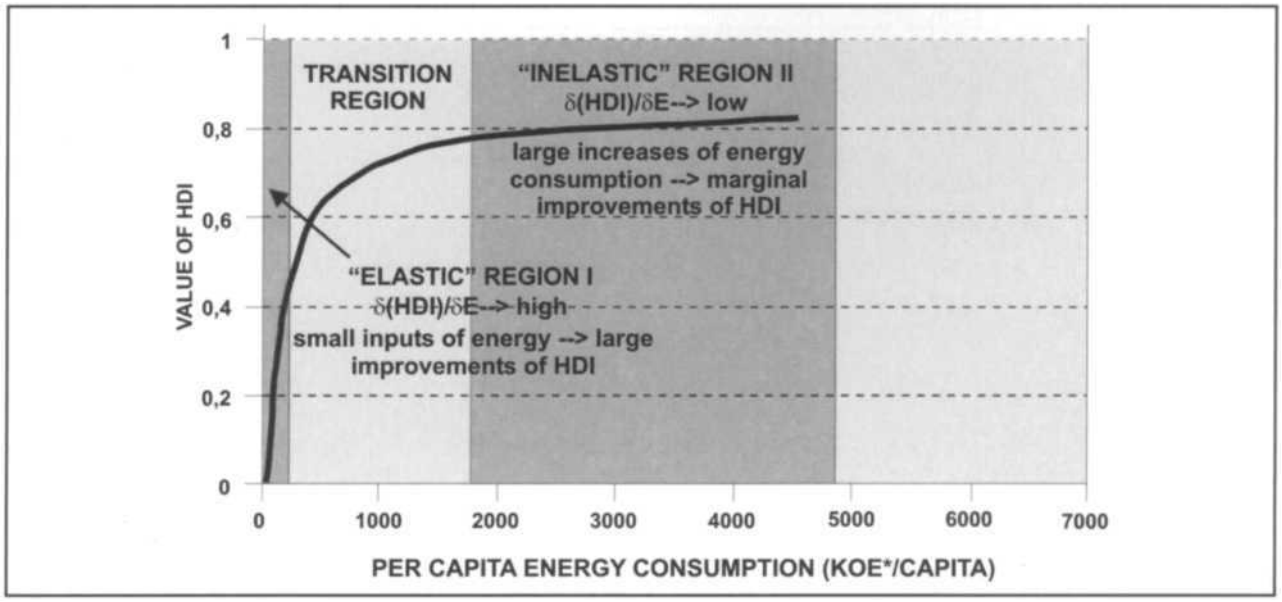
Source: Human Development Report, UNDP, 2001.

An analysis of this table indicates how important are other factors, besides GDP/capita, in determining the HDI rank of different countries. Just to give some examples Russia and Brazil have approximately the same GDP/capita but adult literacy in Russia (99.5%) is much higher than in Brazil (84.9%) which puts the former in rank 55 against 69 for Brazil. Sri Lanka and China have a GDP/capita approximately the same as Morocco but the life expectancy and adult literacy of the former are much higher which give Sri Lanka rank 81, China 87 and Morocco 112.

It is apparent from Fig. 7 that, for an energy consumption above one ton of oil equivalent (toe)/capita per year, the value of HDI is higher than 0.8 and essentially constant for all countries. One toe/capita/year seems, therefore, the minimum energy needed to guarantee an acceptable level of living as measured by the HDI, despite many variations of consumption patterns and lifestyles across countries.

The relationship between HDI and energy has several important implications. The relationship can be considered to consist of *two regions* (Fig. 8).

Fig. 8 "Elastic" and "inelastic" regions of HDI vs energy consumption



**Kilograms of oil equivalent*
Source: Reddy, A. K. N. "Energy Technologies and Policies for Rural Development" in *Energy for Sustainable Development,* 1IIEE and UNDP. Editors: Johansson, T. B. and Goldemberg, J., 2002.

This figure shows that in region I – the "elastic region " – the slope *d* (HDI)/*d* (E) of the HDI vs E curve is high. In region II – the "inelastic region" – the slope *d* (HDI)/*d* (E) of the HDI vs E curve is low; even *large* inputs of energy (large improvements of energy services) result only in *marginal* improvements in HDI, i.e., the HDI-energy (benefit-cost) ratio is very low. In the "elastic" region I, enhanced energy services lead *directly* to the improvement.

Thus the implication of the "elastic" and "inelastic" regions is that in the elastic region increased energy services guarantee direct improvement of HDI, whereas improvement of HDI via income depends on what the income is used for.

5 Generation of jobs in energy production

There are estimates of the number of direct jobs generated in the production of energy from a variety of sources. We collected some of these estimates in Table 3.

These numbers were obtained from a variety of sources and include jobs involved in operating the generating stations excluding the jobs involved in producing and commissioning the equipment.

What is striking in the table is the very large number of jobs generated by the truly decentralized options which are photovoltaics and ethanol from sugarcane.

Photovoltaics energy is usually generated (and used) in small modules of 100 watts and the generation of 1 TWh would require typically 10 million modules to be installed and maintained.

Ethanol from sugarcane in Brazil involves agricultural production over approximately four million hectares plus the industrial production in sugar-alcohol distilleries which explains the large number of generated direct jobs.

There are also some rough estimates of the number of jobs generated by energy conservation. A study in Sacramento, California shows that saving enough energy to avoid 100 megawatts worth of power plant capacity creates 39 jobs, compared with the 15–20 jobs required to operate the same amount of capacity at a modern coal or gas-fired power plant.[2]

[2] Quoted in M. Renner, "Working for the Environment: a Growing Source of Jobs." WorldWatch Paper 152 (Sept. 2000) Worldwatch Institute.

Table 3. Direct jobs in energy production

Sector	Jobs (person-years) Terawatt-hour
Petroleum[1]	260
Offshore oil[1]	265
Natural gas[1]	250
Coal[1]	370
Nuclear[1]	75
Wood energy[2]	1000
Hydro[2]	250
Minihydro[3]	120
Wind[3]	918
Photovoltaics[3]	7,600
Ethanol (from sugarcane)	4,000

Sources: 1. G. Grassi "Potential Employment Impacts of Bioenergy Activity on Employment" *Proceedings of the 9th European Bioenergy Conference Vol. I,* pp. 419–23, P. Chattier *et ah,* (eds.) Elsevier, Oxford (1996).

2. L. C. Carvalho and A. Szwarc "Understanding the Impact of Externalities, Case Studies" Brazil International Development Seminar on Fuel Ethanol December 14, 2001 Washington DC.

3. Perez, E. M. *Energias Renovables, Sustentabilidad y Creadon de Enpleo: Una Economia Impulssionada por el Sol,* 2001.

6 Conclusions

The analysis presented shows clearly that energy has a determinant influence on the HDI, particularly in the early stages of development, in which the vast majority of the world's people, particularly women and children find themselves. It also shows that the influence of per capita energy consumption on the HDI begins to decline somewhere between 1,000 and 3,000 kilograms of oil equivalent (koe) per inhabitant. Thereafter, even with a tripling in energy consumption, the HDI does not increase. Thus from approximately 1,000 koe per capita, the strong positive covariance of energy consumption with HDI starts to diminish.

More generally what we have shown is that what one understands by development including the generation of jobs depends on a number of factors and GNP/capita is not the only determinant. Furthermore, although an essential ingredient of development, energy is more important for low rather than high incomes.

Energy, climate change and sustainable development

David R. Hodas

Climate change from global warming is a sustainable development problem because rapid climate change will adversely effect all major ecosystems that support human beings and all major economic activities that promote human welfare. Use of fossil fuels, such as coal, oil and natural gas, increases atmospheric concentrations of greenhouse gases, which in turn warm the world and change climate systems. Scientific research has discerned a human fingerprint on the global warming the world has experienced since the Industrial Revolution. An international legal regime is nearly in place to allow the global use of market-based mechanisms to reduce global emissions of greenhouse gases and to increase sinks (storage of greenhouse gases). These mechanisms will promote sustainable development by allowing economic development that is significantly more energy efficient that at present. The major obstacle to adoption of this legal regime and to the institution of the market-based approach is the US refusal to participate.

1 Introduction

Beginning with the discovery of fire, the history of the improvement of human welfare is the story of the human ability to harness energy. Yet there is increasingly compelling evidence that the current rate of consumption of fossil fuels, e.g., coal, oil, natural gas (methane) – sources of energy derived from natural processes of decay and compression of once living plants and animals[1] – while improving the quality of life, is causing a significant warming of the temperature at the surface of the earth, which itself is causing a significant and potentially disastrous change in the planet's climate. If sustainable development is to be achieved, humanity's need for energy will have to accommodate the fact that the earth's atmosphere cannot absorb unlimited amounts of the by-products of fossil fuel consumption without creating problematic climate changes. This chapter will outline the scientific understanding of the relationship between human activity and climate change and the range of consequences climate change will impose on human society and the world's ecosystems, and will describe emerging efforts to create an international law regime to regulate the emission of the harmful GHG products of energy consumption.

The essence of the global warming problem is that the current rate of burning fossil fuels releases into the atmosphere with relative suddenness[2] the carbon the earth removed from the atmosphere over millions of years and stored underground as the remains of ancient plants and animals that have been buried under conditions of enormous pressure over such long periods that the carbon comprising their structures is converted into coal, oil, or natural gas.[3] The beneficial effects of the efficiency gained by exploiting the earth's storehouses of fossil fuel have been dramatic:

> "Simply harnessing oxen, for example, multiplied the power available to a human being by a factor of 10. The invention of the vertical water wheel increased productivity by a factor of 6; the

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1 Coal, petroleum and natural gas (methane or CH_4) are commonly referred to as fossil fuels because they are made by the same geological process as fossils – sedimentary pressure over millions of years. Methane, although located in large underground deposits generally associated with oil and coal, can also be naturally created over short time-frames by bacteria acting on organic material such as garbage in dumps, bacteria in the stomachs of ruminants such as cows, and other anaerobic decomposition of organic matter such as in rice paddies, swamps, and even mulch piles. However, the gigantic underground pools of natural gas were created over millions of years in geological formations that trapped the methane.

2 For instance, the USA annually burns about a billion short tons of coal, or about 2030 Tg CO_2 Eq., to make electricity, about 2390 Tg CO_2 Eq. of petroleum for transportation, heating, and industry, and 1200 Tg CO_2 Eq of natural gas. US EPA, *Inventory of US Greenhouse gases and Sinks: 1990–2000* (2002) 2–3 to 2–4, Figure 2–2. *Tg CO_2 Eq.* (teragrams – trillion grams – carbon dioxide equivalent) is the international standard established by the Intergovernmental Panel on Climate Change (IPCC) for reporting fossil fuel use and greenhouse gas emissions. *Id.* at 1–10, 21. *See also* IPCC, Revised 1996 *IPCC Guidelines for National Greenhouse Gas Inventories,* IPCC/UNEP/OECD/IEA (1997).

3 Humans also consume other carbon-based sources of energy, especially wood. Large portions of developing countries rely on wood for fuel, either directly, or after converted into charcoal. In those regions, so much wood is used so inefficiently as fuel that demand for wood far exceeds the rate that forests can be regenerated. However, compared to fossil fuels, forest can be regrown in a relatively short time (decades to a century for forests compared to tens of millions of years for fossil fuels). United Nations Development Programme, *World Energy Assessment: Energy and the Challenge of Sustainability* (2000) 65–68, 370 (hereinafter *World Energy Assessment).*

> steam engine increased it by another order of magnitude. The use of motor vehicles greatly reduced journey times and expanded human ability to transport goods to markets.
>
> Today the ready availability of plentiful, affordable energy allows many people to enjoy unprecedented comfort, mobility, and productivity. In industrialized countries, people use more than 100 times as much energy, on a per capita basis, as humans did before they learned to exploit the energy potential of fire."[4]

Today, the world each year burns about 3.4 billion tons of oil, 4.5 billion tons of coal (2.22 billion tons of oil equivalent), natural gas in an amount equivalent to 2.02 billion tons of oil; and wood and other forms of traditional biomass at a rate equivalent to 0.9 billion tons of oil; taken all together, the burning of these forms of collected, mostly ancient, sources of energy accounts for more than 89% of all human energy use[5] and releases about 6.3 ± 0.4 billion tons of carbon dioxide into the atmosphere annually;[6] carbon dioxide "is the dominant human-influenced greenhouse gas" and accounts for about 60% of the atmosphere's increased heat trapping over the past 150 years.[7]

Although this consumption of our energy capital (fossil fuels) has allowed society to prosper,[8] burning fossil fuels is not a harmless, cost-free activity.[9] Some of the pollutants created by burning fossil fuels are inherently harmful and impose external costs on society.[10] Other emissions, such as carbon dioxide (CO_2), are inherently benign.[11] In the atmosphere, CO_2, together with water vapour,[12] methane,[13] nitrous oxide[14]

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4 *World Energy Assessment* 3.

5 *World Energy Assessment,* Table 1, p6 and 34–35. Large hydro supplies about 2.2%, renewables (wind, geothermal, small hydroelectric dams, photovoltaic, modern biomass, etc), supplies about 2.2%, and the remaining major source of energy is from nuclear power plants, which supply about 6.5% of our primary energy consumption.

6 *IPCC Climate Change 2001: The Scientific Basis,* (J. Houghton *et al,* eds., Cambridge University Press, 2001) Table 2 at 39.

7 *Id.*

8 From a business perspective this consumption of capital is problematic, particularly if we do not invest adequate portions of the wealth generated by this capital consumption in the development of replacement technologies for the future. In terms of sustainable development, wealth should be the result of living off the income earned from the investment of capital (human or natural) so that past and present consumption of capital does not prejudice future generations.

9 Nor is burning wood or charcoal harmless. The indoor pollution from using wood for heating and cooking and the increasing shortage of locally available wood increases poverty and diminishes public health: *World Energy Assessment 69.*

10 Sulphur in fossil fuels, when burned, is emitted as SO2 (sulphur dioxide), which causes adverse respiratory effects and can be converted into acidic compounds that fall to the earth as acid precipitation. High temperature combustion results in the creation of nitrogen oxides (NOx), which can be noxious in their own right, and when combined with volatile organic compounds, humidity, and sunlight can result in ground level (tropospheric) ozone (Oz), the major component of smog, with its adverse health effects. Burning fossil fuels can also release soot and fine particulates, which pose a health risk to people with asthma, and which can carry heavy metals, SO_2, mercury and carcinogens into human lungs. These pollutants also have adverse effects on the health and viability of ecosystems worldwide.

Each of these pollutants has a different mechanism, range and scale of action. For instance, some pollutants, such as mercury and other heavy metals, are directly toxic and long lasting. Other pollutants, such as tropospheric ozone and acid precipitation, result from the interaction of fossil fuel emissions with other atmospheric influences and chemicals to produce adverse regional effects, which may last only hours, days or months until the emissions or atmospheric conditions abate. *See, Id.* at 63–85, 63–85, and R. Ottinger *et al., Environmental Costs of Electricity* (Oceana Pub. 1989) and *World Energy Assessment* 63–85.

11 The carbon cycle and CO_2 are central components in the web of life. In very simplistic terms, CO_2 is released when we metabolize our food to obtain the energy to live. Green plants use CO_2 in photosynthesis to create, carbohydrates, cellulose and other woody or fibrous structures and release oxygen, which animals and plants use to convert food into energy. Some of the carbon is absorbed by the oceans, and some is stored in soil. The remainder, about half of the original emissions, remains in the atmosphere for up to 200 years. The carbon cycle, in its rich complexity, is described in I. Prentice, *et al.. The Carbon Cycle and Atmospheric Carbon Dioxide, IPCC Climate Change 2001: The Scientific Basis,* (J. Houghton *et al.*, eds., Cambridge University Press, 2001) 185–213.

12 Water vapour is the largest natural contributor to the greenhouse effect, but the amount of water vapour in the atmosphere is not directly affected by anthropogenic emissions of water vapour. However, human activity can increase atmospheric water vapour concentration indirectly by the emission of other greenhouse gases, such as carbon dioxide, that warm the atmosphere, thereby increasing the rate of evaporation; this increased evaporation increases water vapour, which further accelerates global warming: *World Energy Assessment* 86.

13 Methane (CH_4), the major component of natural gas, is anthropogenically released into the atmosphere from coal mining, leaking natural gas pipelines, ruminant livestock such as cows, rice paddies, and solid waste facilities.

14 Nitrous oxide, N_2O, is produced both naturally in soil and water, and by human activity in agriculture, energy industrial and waste management activities. According to US EPA, "agricultural soil management accounted for 70% of US N_2O emissions" in 2000 and "[f]rom 1990 to 2000, emissions from this source increased 11% as fertilizer consumption, manure production, and crop production rose." N_2O is also produced when fuels are burned at high temperatures, in the manufacture of adipic and nitric acid, and in the context of management of human and animal wastes. N_2O accounts for 6.1% of US emissions. Globally, "the atmospheric concentration of nitrous oxide has increased by 16% since 1750, from a pre-industrial value of about 270 ppb to 314 ppb in 1998, a concentration that has not been exceeded during the last thousand years. US EPA, *Inventory of US Greenhouse Gas Emissions and Sinks: 1990–2000* (2002) ES 21–22, 1–5.

and other trace gases,[15] have the ability to trap heat in the atmosphere. For over a century scientists have known that the gases that trap infrared radiation (heat) in the atmosphere make life on earth possible. Although without these greenhouse gases, the earth would be a frigid rock, much like the moon or Mars, with excessive amounts of heat-trapping gases in the atmosphere, the earth would be an inferno, like Venus. The greater the concentration of greenhouse gases in the atmosphere, the more heat is trapped, and the warmer the earth becomes.[16]

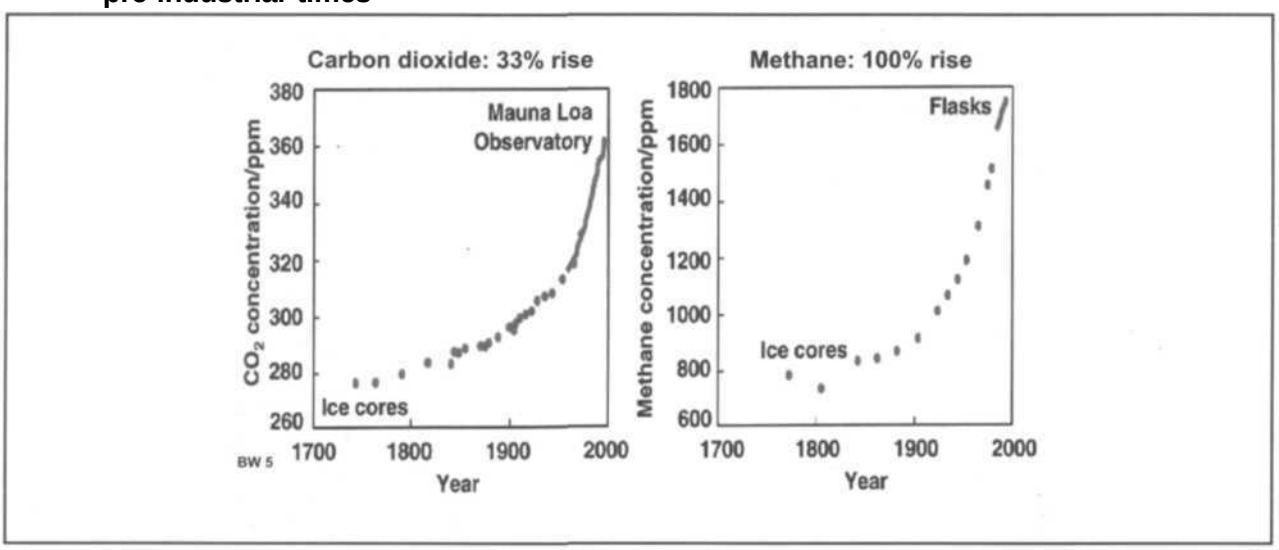
The rate at which society consumes fossil fuels far outstrips the time it took for fossil fuels to be created. Over the last century or two, by burning fossil fuels, we have released carbon into the atmosphere that had been slowly removed by nature over tens to hundreds of millions of years.[17] The atmosphere (with its abundant oxygen) we thrive in today was created by that process of removing carbon from the atmosphere.[18] While the presence of greenhouse gases in the atmosphere is necessary, the rapid increase in their concentration since the Industrial Revolution will change global climate, and if the rate and amplitude of change is too great, catastrophic consequences may ensue.

Analysis of the climate change problem requires consideration of several threshold questions: Are atmospheric GHG concentrations increasing? If so, what portion of the increase is from human activities? If human activity is the principal force behind these increases, what level of increase will cause "dangerous...interference with the climate system?"

2 Atmospheric concentrations of GHGs are increasing

Over the past 50 years, scientists in Hawaii have been recording the atmospheric concentrations of both carbon dioxide and methane. Those records, combined with measurements of the concentration of those gases in bubbles trapped in cores of ancient ice demonstrate that since the beginning of the Industrial Revolution the

Fig. 1 Concentrations of carbon dioxide and methane have risen greatly since pre-industrial times



Source: IPCC Climate Change 2001: The Scientific Basis.

[15] Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hcxafluoride (SF_6). HFCs are non-ozone depleting chemicals that are used as a replacement for stratospheric ozone depicting chemicals know as halocarbons (CFCs, HCFCs, methyl chloroform, carbon tetrachloride, bromine halons, methyl bromine and hydrobromofluorocarbons) that are regulated under the Montreal Protocol on Substances that Deplete the Stratospheric Ozone Layer and its Amendments. *See* 26 *1LM* 1550 (1987), UNEP/Oz.L.Pro.2/3 (Annexes I, II, III), and 32 *1LM* 874 (1993). PFCs and SF_6 are emitted by aluminium smelting, semiconductor manufacturing, electric power transmission and magnesium casting. Taken together HFCs, PFCs, and SF_6. are trace gases that only contribute a very small portion of global wanning; however, these powerful greenhouse gases have extremely long lifetimes in the atmosphere and are being emitted in growing quantities. *Id.* 1–5 to 1–6.

[16] *1PCC Climate Change 2001: The Scientific Basis.* (J. T. Houghton *et al.*, eds., Cambridge University Press, 2001) 87–90.

[17] Since 1950, the nations of the world have emitted some 720 billion tons of carbon dioxide, of this amount the USA has contributed 186 billion tons and Europe 265. World Resources Institute, Earth Trends: The Environmental Information Portal, available at http://earthtrends.wri.org/datatables (visited 4 November, 2002).

[18] *1PCC Climate Change 2001: The Scientific Basis.* (J Houghton *et al.*, eds., Cambridge University Press, 2001) 201.

atmospheric concentrations of greenhouse gases and other industrial emissions have increased dramatically.[19] Fig. 1 illustrates this remarkable trend.

Fig. 1 shows that the atmospheric concentration of CO_2 has increased by 31 % from the stable pre-industrial level (around 1750) of about 280ppm to 367ppm in 1999. This present CO_2 concentration has not been exceeded during the past 420,000 years and likely not during the past 20 million years. Moreover, the current rate of increase is unprecedented during at least the past 20,000 years.[20] IPCC also reports that about ¾ of the anthropogenic emissions of CO_2 during the past 20 years are from fossil fuel burning; the rest is predominately due to land-use changes, especially deforestation. As a result, during the past 20 years, CO_2 concentration has increased on average about 1.5 parts per million (ppm). Currently the ocean and land together remove about half of the annual anthropogenic CO_2 emissions from the atmosphere.[21]

Atmospheric methane (CH_4) concentration has increased since 1750 by about 151 %, from about 690 ppb to about 1,750 ppb, and continues to increase at an annual rate of about 7 ppb. As with CO_2 these increases are greater than anything experienced in the past 420,000 years. The primary anthropogenic sources of methane emissions are the use of fossil fuels, cattle, rice agriculture and landfills; carbon monoxide (CO) emissions from use of fossil fuels also contribute to methane concentrations.[22]

The third major greenhouse gas, nitrous oxide (N_2O), also has dramatically increased in the atmosphere over the last century. From a stable concentration of about 270 ppb from 1000 to around 1800, it has risen to about 310 ppb by 2000. These data are summarised:[23]

	CO_2	CH_4	N_2O
Pre-industrial atmospheric concentration (ppm)	278	0.7	0.27
Atmospheric concentration (1998) (ppm)	365	1.745	0.314
Rate of concentration change (1990–1999) (ppm/year)	1.5	0.007	0.0008
Atmospheric Lifetime (years)	5–200[a]	12[b]	114[b]

[a] No single lifetime can be defined for CO_2 because of the different rates of uptake by different removal processes.
[b] These lifetimes take into account the indirect effect of the gas on its own residence time.

In terms of radiative forcing[24] since the year 1000, that is, how much additional heat these increased GHGs are trapping now as compared the year with 1000, CO_2 has increased 150%, CH_4 about 50%, and N_20 about 14%. Virtually all of the increased radiative forcing has occurred since 1900, primarily as a result of carbon dioxide emissions. The rate of increase of forcing accelerates in response to the rate of increase of GHG concentrations. See Fig. 2.

19 The data is based both on ice core and other data from Antarctica and Greenland, and on direct samples of the atmosphere since the 1950s. These greenhouse gases are both rapidly and thoroughly mixed around the earth after they are emitted, so measurements of concentrations at remote locations are representative of global concentrations. *IPCC Climate Change 2001: The Scientific Basis* 6.

20 *IPCC Climate Change 2001: The Scientific Basis,* (J. Houghton *et al.*, eds., Cambridge University Press, 2001) 185.

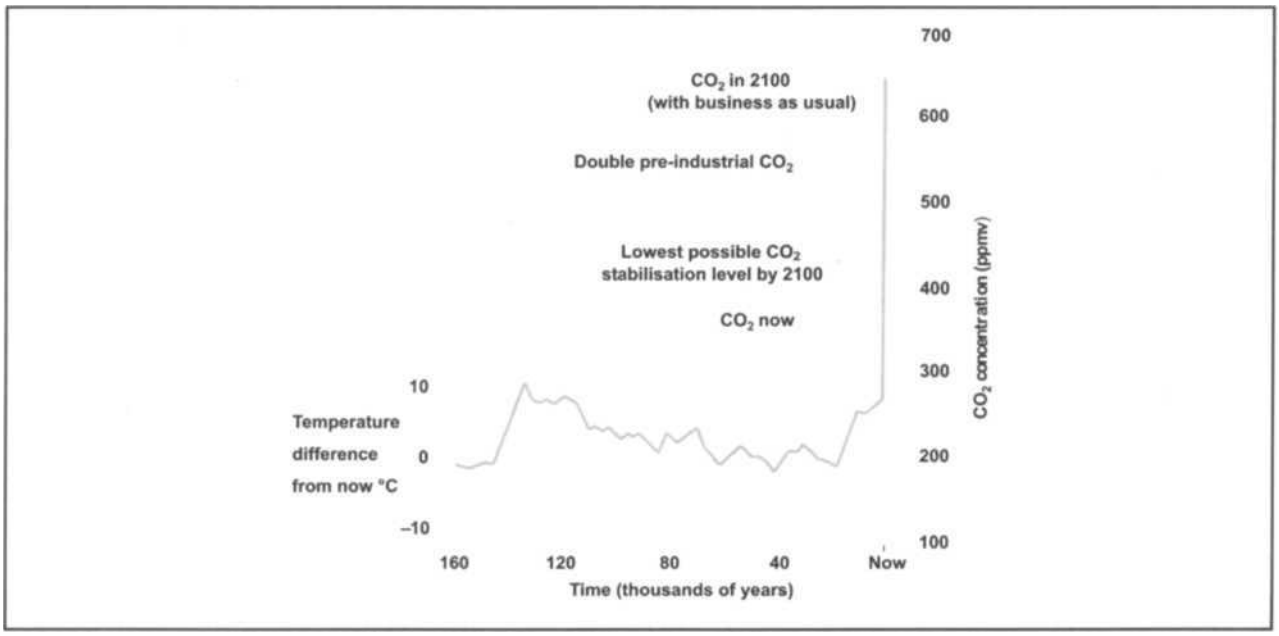
21 *Id.* at 7.

22 *Id.* at 6.

23 *Source:* IPCC (2001) at 38 and EPA Inventory (2002).

24 This heat trapping capacity is generally expressed in terms of "radiative forcing," which measures "the influence a factor has in altering the balance of incoming and outgoing energy in the Earth-atmosphere system, and is an index of the importance of the factor as a potential climate change reaction." Radiative forcing is calculated in terms of watts of solar energy per m^2. A positive forcing, such as that produced by increasing concentrations of greenhouse gases, such as carbon dioxide, methane and nitrous oxide, tends to warm the earth's surface. A negative forcing, which can arise from an increase in aerosols such as sulphur dioxide that reflect light from the sun back out into space, or soot or carbon black that block sunlight, tends to cool the earth. IPCC (Science) at 90–91, 353.

Fig. 2 The last 160,000 years (from ice cores) and the next 100 years



Source: IPCC

Once a greenhouse gas is emitted, it rapidly mixes with the atmosphere and immediately begins trapping infrared radiation (heat) and will continue to do so for as long as it remains in the atmosphere.[25] It is irrelevant, in terms of global radiative forcing effects, where that gas was emitted or who emitted it. All that is relevant for global wanning is how much heat that particular type of greenhouse gas can trap (i.e., how much radiative forcing a given amount of GHG will contribute) and how long the gas will remain in the atmosphere contributing its radiative forcing effect. It is therefore possible to develop a common frame of reference to evaluate the comparable effects of emitting different greenhouse gases, as well as the comparable benefits of reducing emissions or removing the gas from the atmosphere (or, in the IPCC nomenclature, creating a sink).[26]

To enable comparisons between gases and policy choices, and to allow credits and trading in GHG emissions reductions and sink enhancements, the IPCC has rated each greenhouse gas's "global warming potential" (GWP),[27] with CO, being set at 1 on the scale. Thus, CO_2 has a GWP of 1, for the next 20, 100, and 500 years. Methane, which remains in the atmosphere about 8.4 years before breaking down into CO_2 and water has a GWP of 62 for 20 years, 23 for 100 years and 7 for 500 years. By comparison, N_2O, which has an atmospheric lifetime of about 120 years, has a GWP of 275 for 20 years, 296 for 100 years and 156 for 500 years.[28]

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25 *See* Table 1 for the atmospheric lifetimes of these GHGs.

26 IPCC defines *sink* as "any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas or aerosol from the atmosphere." IPCC (Science) at 791. When the ocean or a tree absorbs carbon dioxide it acts as a sink, or a reservoir. If a sink's activity could be enhanced, then it may be able to absorb more carbon dioxide, or absorb carbon dioxide at a greater rate, thereby reducing carbon dioxide in the atmosphere. However, if a sink capacity to absorb carbon dioxide were to diminish, as might happen as a forest matures or oceans reach their saturation level and slow down their absorption of carbon dioxide, then less carbon dioxide would be removed from the atmosphere annually, and concentrations would increase faster than at present for the same level of emissions. For details on sinks *see* 1. Prentice *et al., The Carbon Cycle and Atmospheric Carbon Dioxide*, IPCC (Science) 185-224, and J. Samiento and N. Gruber, Sinks for Anthropogenic Carbon, *Physics Today* (August 2002) available at http://www.aip.org/pt/vol-55/iss-8/current.html

27 The IPCC defines *global warming potential* as "an index, describing the radiative characteristics of well mixed greenhouse gases, that represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing infrared radiation. This index approximates the time-integrated warming effect of a unit mass of a given greenhouse gas in today's atmosphere, relative to that of carbon dioxide." IPCC (Science) App. 1, 791.

28 *Id.* at 47, 244, 388.

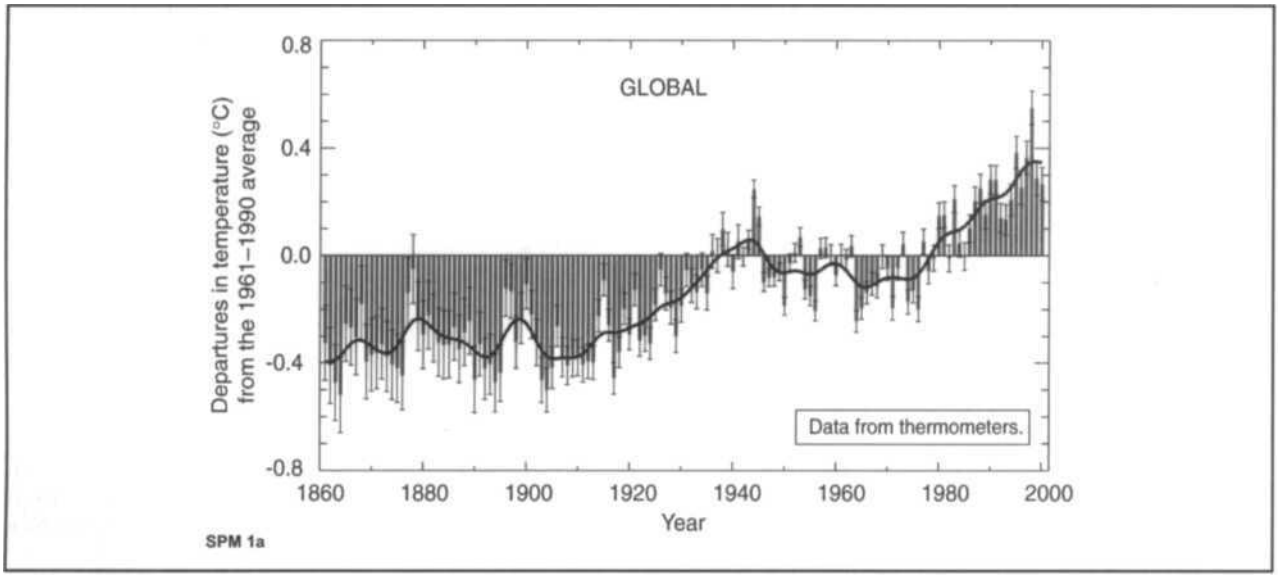
Table 1. Direct Global Warming Potentials (mass based) relative to carbon dioxide

Greenhouse gas	Lifetime (years)	Global Warming Potential – 20 years	Global Warming Potential– 100 years	Global Warming Potential – 500 years
Carbon dioxide (CO_2)	5–200	1	1	1
Methane (CR_4)	12*	62	23	7
Nitrous oxide (N_2O)	114*	275	296	156

*Lifetime estimates for CH_4 and N_2O are *adjustment times* that include feedback effects of the GHG emission on its atmospheric lifetime
Source: (IPCC 2001) 388.

In contrast to the major GHGs, which can remain in the atmosphere for up to two centuries, several other short-lived emissions are also emitted into the atmosphere. Sulphate aerosols, produced from chemical reactions in the atmosphere with the gaseous precursors, primarily sulphur dioxide (SO_2) from burning coal and oil containing sulphur, have grown enormously over the last hundred years from their pre-industrial levels.[29] Sulphates tend to create haze that reflect light and reduce visibility. In this sense they reduce radiation reaching the earth and contribute, indirectly, a small cooling effect. However, sulphates have a short residence time in the atmosphere, and tend to be concentrated regionally instead of being well mixed throughout the atmosphere. With the implementation of the acid precipitation programme in the USA under the 1990 Amendments to the Clean Air Act and sulphur dioxide emission reductions in other coal burning regions of the world, sulphate concentrations have dropped, and will continue to decline. Ironically, to the extent past sulphur emissions have offset the radiative forcing from the major GHGs, the cooling effect from these short-lived aerosols will rapidly disappear as pollution control programmes are implemented. The radiative forcing effects of other aerosols, referred to informally as soot, have also been evaluated by the IPCC: carbon black, organic carbon from burning fossil fuels and mineral dust aerosols. Because some of the aerosols cool and some warm the effect of sulphates, carbon black and organic carbon aerosols on future climate will vary depending on the impact of pollution laws that regulate these short-lived pollutants. Overall the IPCC estimates the effects "to be substantially smaller … than that of CO_2."[30]

Fig. 3 Variations of the Earth's surface temperature for the past 140 years



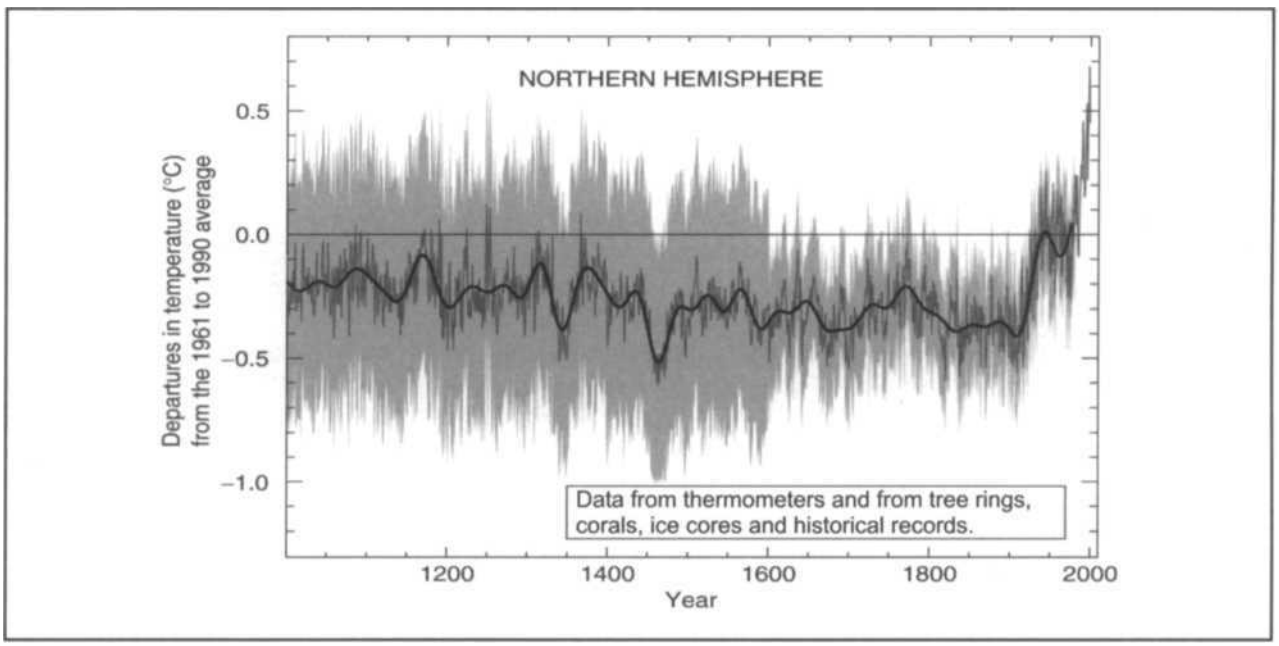
Source: IPCC (2001).

[29] Greenland ice cores reveal that with the exception of short-lived spikes (which are statistically insignificant within the context of "a robust running median") due to major volcanic eruptions, there was a long period of stable levels of sulphates prior to about 1900. which quadrupled by the late 1990s. Levels reached their peak between 1991 and 1993, as a result of the Mt. Pinatubo eruption. *Id.* at 36, 307, 351.
[30] *Id.* at 351–2.

3 Is the earth warming?

A large and rapidly growing storehouse of data collectively paints a "picture of a warming world."[31] This picture is best seen with the aid of a few graphic depictions of the data. Fig. 3 depicts changes in global temperature from 1860 to 2000, based on accumulated data from thermometer readings around the world. As can be seen, over the last 140 years the surface temperature of the earth has increased by about 0.6° C plus or minus 0.2° C.[32] Combining the 140 year thermometer data with proxy data that represents temperature, such as tree rings, coral reefs, ice cores and historical records, scientists have been able to depict temperature changes for the northern hemisphere over the last 1000 years (see Fig. 4). Mindful of the uncertainties associated with reconstructing temperature from these proxies, the IPCC is confident that the 20th century has been the warmest century over the last 1000 years, and that the 1990s was the warmest decade, with 1998 being the warmest year over the past 100 years in the northern hemisphere.

Fig. 4 Variations of the Earth's surface temperature for the past 1,000 years



Source: IPCC (Science) 2001. based on Fig. 2.20.

The IPCC reports that evidence of warming is now widespread and striking:

- Global average surface temperature has increased 0.6° ±0.2°C since the late 19th century. See Fig. 3.
- Global ocean heat content has increased significantly since the late 1950s.
- It is likely that the rate and duration of the warming in the 20th century is larger than any time during the last 1,000 years. The 1990s are likely to have been the warmest decade of the millennium in the Northern Hemisphere, and 1998 is likely to have been the warmest year.
- Annual land precipitation continue[s] to increase in the middle and high latitudes of the Northern Hemisphere (very likely to be 000.5 to 1%/decade), except over East Asia.... It is likely that total atmospheric water vapour has increased several percent per decade over many regions of the Northern Hemisphere... Changes in total cloud amounts over Northern Hemisphere mid- and high-continental regions indicate a likely increase in cloud cover of about 2% since the beginning of the 20th century, which has been shown to be positively correlated with decreases in the diurnal temperature range.

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31 *Id.* at 2.

32 This estimate represents a 95% confidence level given data uncertainties such as random instrument error, ocean surface temperature data, adjustments for urban heat island effects, and ocean data gaps.

- Diurnal temperature range is decreasing very widely, but not everywhere.
- Satellite data show that there are very likely to have been decreases of about 10% in the extent of snow cover since the late 1960s. There is a highly significant correlation between increases in Northern Hemisphere land temperatures and the decreases. There is now ample evidence to support a major retreat of alpine and continental glaciers in response to 20th century warming. ... Over the past 100 to 150 years, ground-based observations show that there is very likely to have been a reduction of about two weeks in the annual duration of lake and river ice in the mid- to high latitudes.
- A retreat of sea-ice extent in the Arctic spring and summer of 10 to 15% since the 1950s is consistent with an increase in spring temperatures and, to a lesser extent, summer temperatures in the high latitudes.
- There likely has been an approximately 40% decline in Arctic sea-ice thickness in late summer to early fall between... 1958 and the mid 1990s.
- Based on tide gauge data, the rate of global mean sea level rise during the 20th century is in the range 1.0 to 2.0 mm/yr.
- The behavior of ENSO (El Niño – Southern Oscillation) has been unusual since the mid-1970s compared with the previous 100 years, with warm phase [El Niño] episodes being relatively more frequent, persistent, and intense than the opposite cool phase.
- In regions where total precipitation has increased, it is very likely that there have been even more pronounced increases in heavy precipitation events. The converse is also true.
- Taken together, these trends illustrate a collective picture of a warming world.[33]

Other evidence of warming keeps appearing. The year 2001 was the second hottest year on record, nine of the ten warmest years since 1860 have occurred since 1990, global temperatures are now rising three times as fast as they were in 1900, and the year 2001 will be the 23rd consecutive year with the global mean surface temperature above the 1961–1990 average.[34] Warmer weather in Alaska has allowed beetle growth rates to soar, so that vast stretches of Alaska spruce forest have been destroyed.[35] Arctic permafrost is retreating as warming is increasing. Tropical mosquitoes are moving to higher latitudes. Worldwide precipitation has increased over the last century as warmer air simultaneously increases evaporation from the earth's sources of water and also enhances the air's capacity to hold moisture. 100 year extreme weather events, and the catastrophic costs associated with them, are no longer the rarity that by definition they should be, such as the simultaneous 100 year drought in the eastern United States and the August flooding in Europe (the worst in 150 years) during the summer of 2002.[36]

The detection of climate changes, large and small, appears to be consistent with the notion of increased heat being trapped in the atmosphere. However, climate changes can result from many factors natural variation and cycles, as well as changes in atmosphere's ability to trap heat, both natural and human caused. Thus, the next question is whether the observed warming and related climate changes are associated with increased anthropogenic emissions of greenhouse gases, or with some other (human or natural) climate influence.

4 Is global warming the result of human activity?

It is established that GHG concentrations in the atmosphere have increased dramatically, and that a variety of significant climate change phenomena have been observed that are consistent with warming of the atmosphere. However, if this warming were primarily due to natural causes, such as climate cycles of hundreds of thousands of years, changes in the sun's intensity from sun spot cycles, or natural emissions of greenhouse gases, then there is little human society can do to alter the climate trends that are afoot. On the other hand, if the increases of GHGs are primarily anthropogenic, and if the warming is due primarily to these increases, then today's societies, by changing emission patterns, can reduce the damage that rapid climate change will inflict on present and future generations.

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33 *Id.* at 26–34.

34 World Meteorological Organization, *WMO Statement on the Status of the Global Climate in 2001* (2001) available at http://www.wmo.ch/web/Press/Press670.html

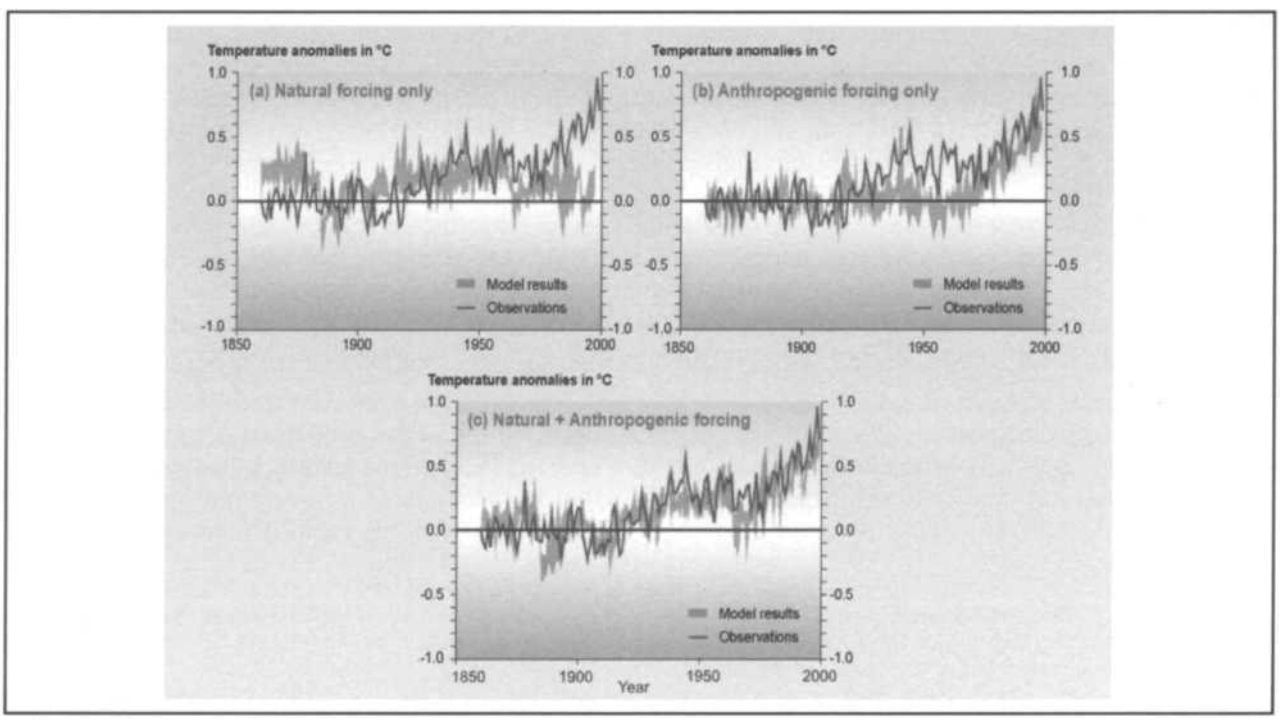
35 IPCC, *Climate Change 2001: Impacts, Adaptations, and Vulnerability* (2001) (IPCC (Impacts 2001)) 824–826.

36 UN Environment Programme, *2002: Natural Disasters Set to Cost Over $70 Billion* (Oct 29, 2002) available at www.enn.com/extras/; *see also,* WMO, *WMO Statement on the Status of the Global Climate in 2001* (2001) available at http://www.wmo.ch/web/Press/Press670.html (reporting on record floods and other natural weather related disasters in 2001).

To tease out whether the observed global warming is driven by natural cycles or by society's release of GHGs, the scientific community has turned to computer models of the climate under various conditions. Over the past decade both the models and the computers that run them have become increasingly sophisticated and capable. Over 30 different models are being continually run and improved at about 15 different public and private scientific centres around the world.[37] These models, when coupled,[38] "provide credible simulations of both the present annual mean climate and the climatological cycle over broad continental scales for most variables of interest for climate change."[39] Not only are the models assessed for how accurately they render present climate, but they are also evaluated as to how accurately they can reconstruct the climate over the past century, and for selected times in the distant past (palcoclimates). The models' improvements in accuracy and detail have been dramatic. In 1996, the IPCC noted that "current atmospheric models generally provide a realistic portrayal of the phase and amplitude of the seasonal march of the large-scale distribution of temperature, pressure and circulation. ... [C]urrent models are now able to simulate many aspects of the observed climate with a useful level of skill...at large space scales (e.g., hemispheric or continental); at regional scales skill is lower."[40] By 2001, the IPCC's confidence in the models' ability "to project future climates [has been] increased by the ability of several models to reproduce the warming trend in the 20th century surface air temperature when driven by radiative forcing due to increasing greenhouse gases and sulphate aerosols."[41] Moreover, "climate models now have some skill in simulating changes in climate since 1850," and "all atmospheric models are able to simulate several large-scale features of the Holocene climate [about 6,000 years ago]."[42]

The IPCC has compared three different coupled model scenarios with actual temperature data since 1850.[43] First, the IPCC compared actual temperatures with those predicted if it were assumed that all of the radiative forcing were due to solar and volcanic forcing only. Then, the coupled model simulated the climate using "anthropogenic forcing including well mixed greenhouse gases, changes in stratospheric and troposphcric

Fig. 5 Comparison between models and observations of temperature rise since the year 1860



Source: IPCC (2001).

37 *Id*, at 478.

38 The IPCC term, *coupled models* or *coupled atmosphere-ocean general circulation models*, refers to "the most complex climate models ... involving coupling comprehensive three-dimensional atmospheric general circulation models, with ocean general circulation models, with sea-ice models, and with models of land-surface processes." IPCC at 48–49, 475.

39 *Id.* at 473.

40 *Id.* at 474.

41 *Id.* at 473. For an extensive evaluation of the climate models, with detailed technical references, see IPCC Ch. 8, 472–523.

42 *Id.* at 496.

43 IPCC (Science) at 58.

ozone and the direct and indirect effects of sulphate aerosols." Finally, the models compared actual temperature results with those predicted if the models assumed that the earth was influenced by both natural and human radiative forcings. The results, shown in Fig. 5, demonstrate that the combined predicted temperature effects of human and natural sources of GHGs most closely fit with the actual global temperature over the last 150 years.[44] To the IPCC, and all other scientists examining this data, this last graph is the metaphoric human fingerprint on global warming: "[I]n the light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations."[45]

With the benefit of computer modelling, the international scientific community could by 1995 conclude that, "the balance of evidence suggests a discernible human influence [from greenhouse gas emissions] on global climate."[46] Six years later scientific understanding had improved to the point that the IPCC Third Assessment Report not only confirmed that "emissions of greenhouse gases and aerosols due to human activities continue to alter the atmosphere in ways that are expected to affect the climate," but also definitively concluded "there is new and stronger evidence that most of the wanning observed over the last 50 years is attributable to human activities."[47]

Based on close scrutiny of the data of increasing temperatures and upon climate data for the past 1,000 years, scientists agree that the warming over the past 100 years is very unusual and unlikely to be due primarily to natural causes; neither solar flares and storms nor volcanic activity explain the warming during the last 50 years.[48] Moreover, "it is very likely (90–99% chance) that the 20th century warming has contributed significantly to the observed sea level rise, through thermal expansion of sea water and widespread loss of land ice."[49]

5 How much will the earth warm and what will be the consequences of that warming?

Unfortunately, there are large uncertainties in predicting regional effects of climate change, which depend on understanding how regional ecosystems will react to climate changes, and on whether climate changes will be linear or erratically variable. It appears that the amount and rate of global warming is generally dependent on the rate at which society emits GHGs into the atmosphere: the higher the concentration of GHGs when GHGs concentrations eventually stabilize in the atmosphere, the greater the warming. The IPCC has projected warming over the next century using various emission scenarios, ranging from so-called business as usual, with carbon dioxide rising by the year 2100 to 970 ppm (250% above the 280 ppm concentration in 1750), to an aggressive international regime which might result by 2100 in a concentration of 540 ppm (90% above the concentration in 1750).[50] The computer models predict that "the globally averaged surface temperature is projected to increase by 1.4 to 5.8°C from 1990 to 2100"[51] (see Figs. 6–9 and Table 2). However, if the oceans, which currently absorb about 50% of our annual emissions, become saturated catastrophic warming could result.[52]

The warming projections vary by scenario. The IPCC modelled four different scenarios, each based on its own "storyline." Scenario Al assumes a "future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies."[53] Scenario A2 envisions "a very heterogeneous world" which has regionally oriented economic

44 IPCC (Science) 728. The IPCC also found that natural forcing alone was unlikely to account for the warming, but "anthropogenic greenhouse gases are likely to have made a significant and substantial contribution to the warming observed over the second half of the 20th century, possibly larger than the observed warming."

45 IPCC (Science) 60, 728 ("Results from optimal fingerprint methods indicate a discernible human influence on climate in temperature observations at the surface and aloft and over a range of applications.")

46 *Intergovernmental Panel on Climate Change, 1995: The Science of Climate Change* (J. Houghton *et al.*, eds., Cambridge University Press, 1995) 3–5.

47 IPCC, *Climate Change 2001: The Scientific Basis,* (J. Houghton et al, eds., Cambridge University Press, 2001) 5.

48 *Id.* at 10.

49 *Id.*

50 IPCC (Science) 63. IPCC also factored in uncertainties about land and ocean feedback loops by causing scenario to actually range from a low of 490 ppm (75% above 1750 levels) to 1260 (350% above 1750 levels).

51 IPCC (Science) 69.

52 *See*, National Academy of Sciences, Committee on Abrupt Climate Change, *Abrupt Climate Change: Inevitable Surprises* (National Academy Press 2002); IPCC (Science) 444–5, 536.

53 IPCC (Science) 63, 532. Al is subdivided into three groups: A1FI (fossil intensive), A1T (non-fossil energy source), and A1B (balanced across all energy sources and end use technologies).

Fig. 6 Projected temperatures during the 21st century are significantly higher than at any time during the last 1,000 years

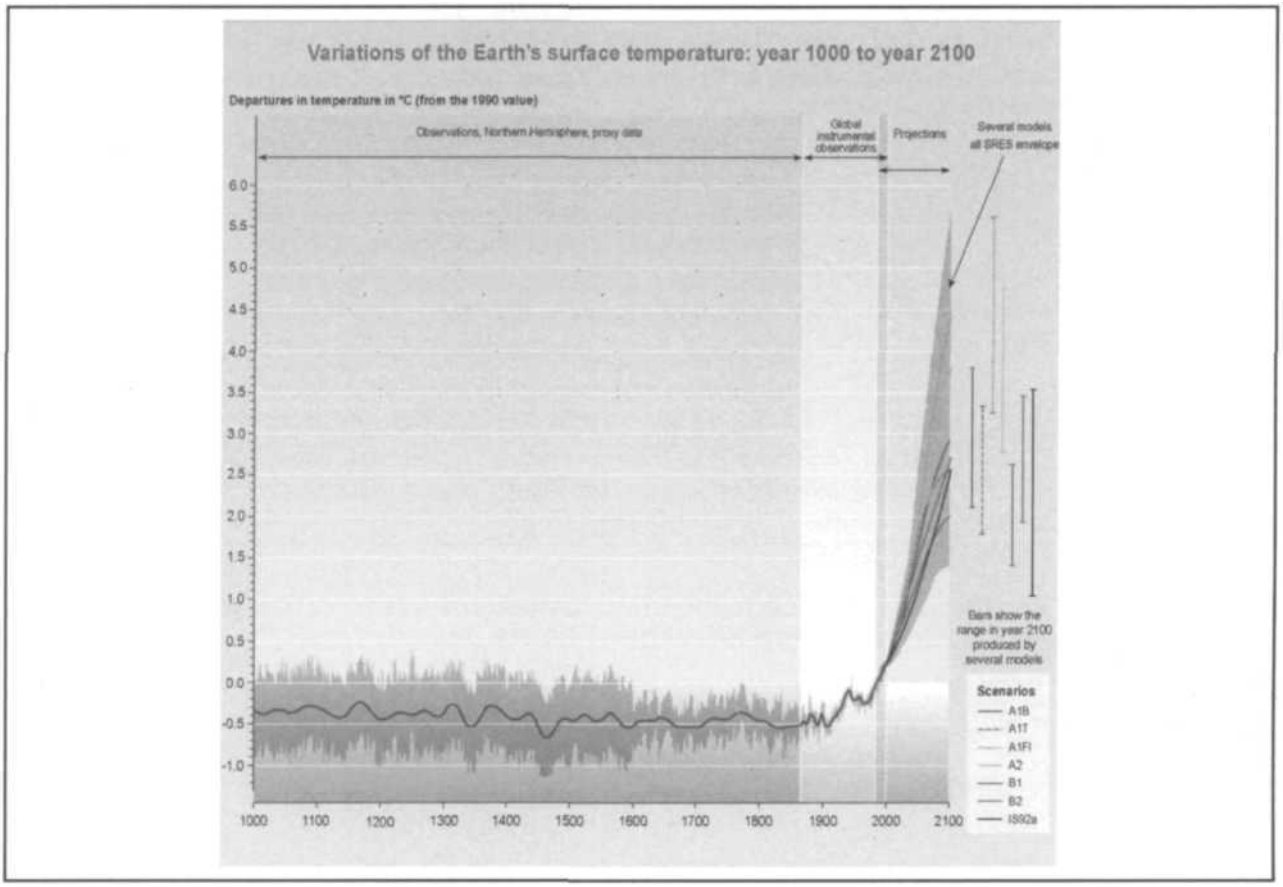


Fig. 7 Projected concentrations of CO_2 during the 21st century are two to four times the pre-industrial level

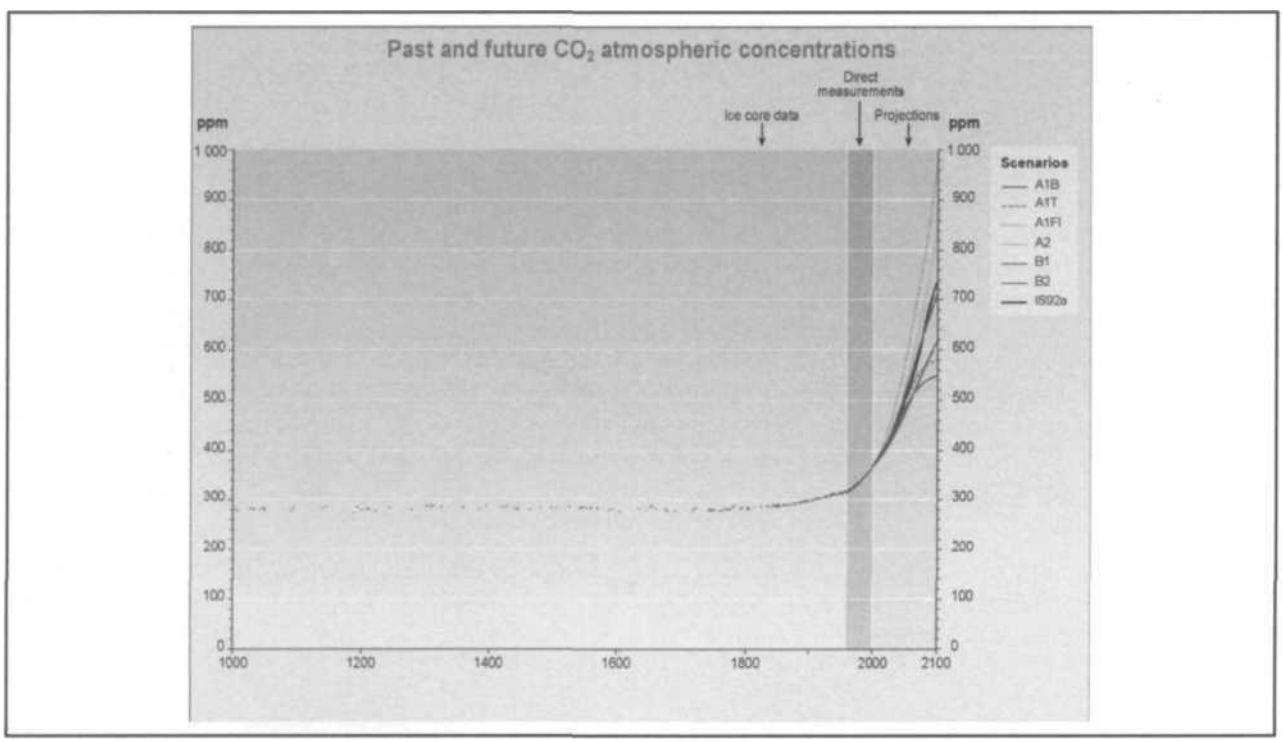


Fig. 8 Constant emissions of CO_2 do not lead to stabilization of atmospheric concentrations

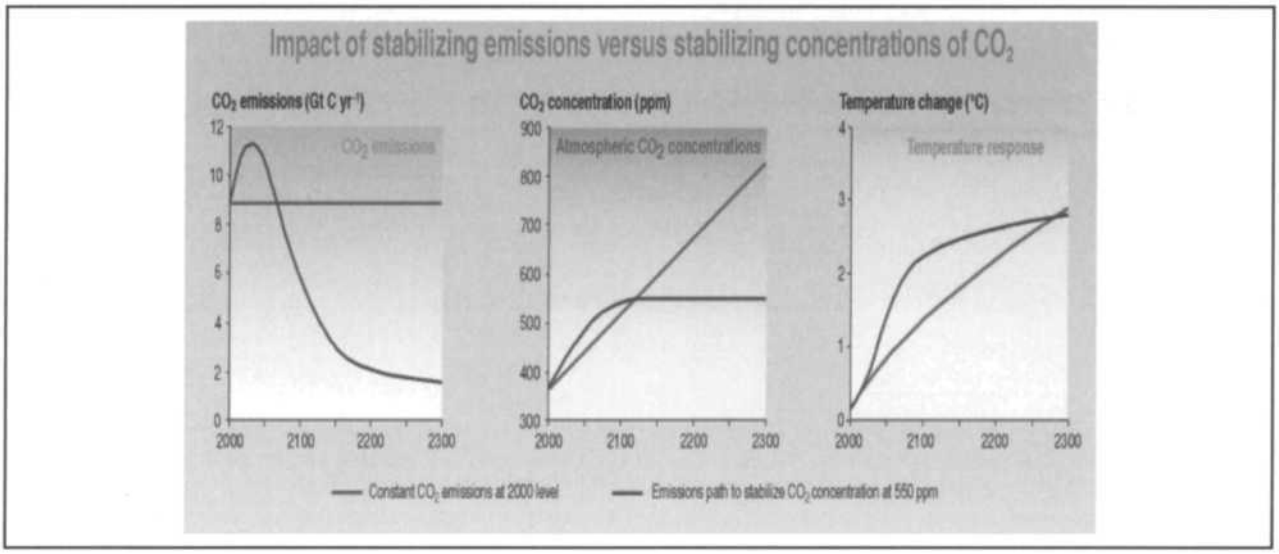
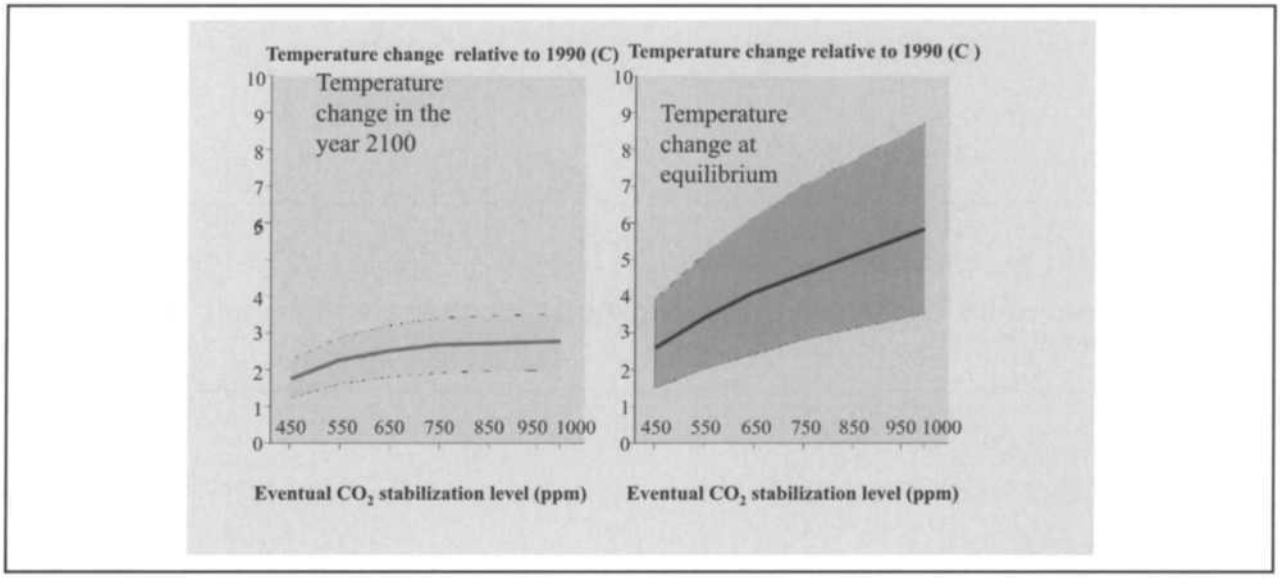


Fig. 9 There is a wide band of uncertainty in the amount of warming that would result from any stabilized concentration of greenhouse gases



growth and continuously increasing population. Scenario B2 assumes a world similar to A1, "but with rapid change in economic structures toward a service and information economy, with reductions in material intensity and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives." Finally, B2 assumes a world similar to A2, but with a lower rate of increasing population and less rapid and more diverse technological change; B2 focuses on local and regional responses to environmental protection and equity. A1FI (fossil intensive) results in the most wanning by the year 2100 (about 3.5 to 6.7°C) while A1T (non-fossil) warms less (about 1.7 to 3.3°C).[54] Thus, by choosing a development scenario, the world will be choosing a wanning track, with all the impacts associated with that amount of warming.

The IPCC also ran warming projections based on the assumption that climate was stabilized at 450, 650 or l,000ppm of carbon dioxide. At 450 ppm, the earth would warm about 1.7°C by 2100 (and peak at 2°C by about 2300); in contrast, at 1,000 ppm the earth would heat up about 2.8°C by 2100 (and by 2300 it would rise

54 IPCC (Science) 64–5, 554–7.

to about 4.7°C and would continue rising for at least another century thereafter).[55] To stabilize at 450 ppm would require anthropogenic emissions to drop below 1990 global levels within the next few decades; 650 ppm requires reaching sub-1990 levels within a century, and 1,000 ppm requires sub-1990 levels in about two centuries. Each level would require steady decreases in GHG emissions thereafter.[56]

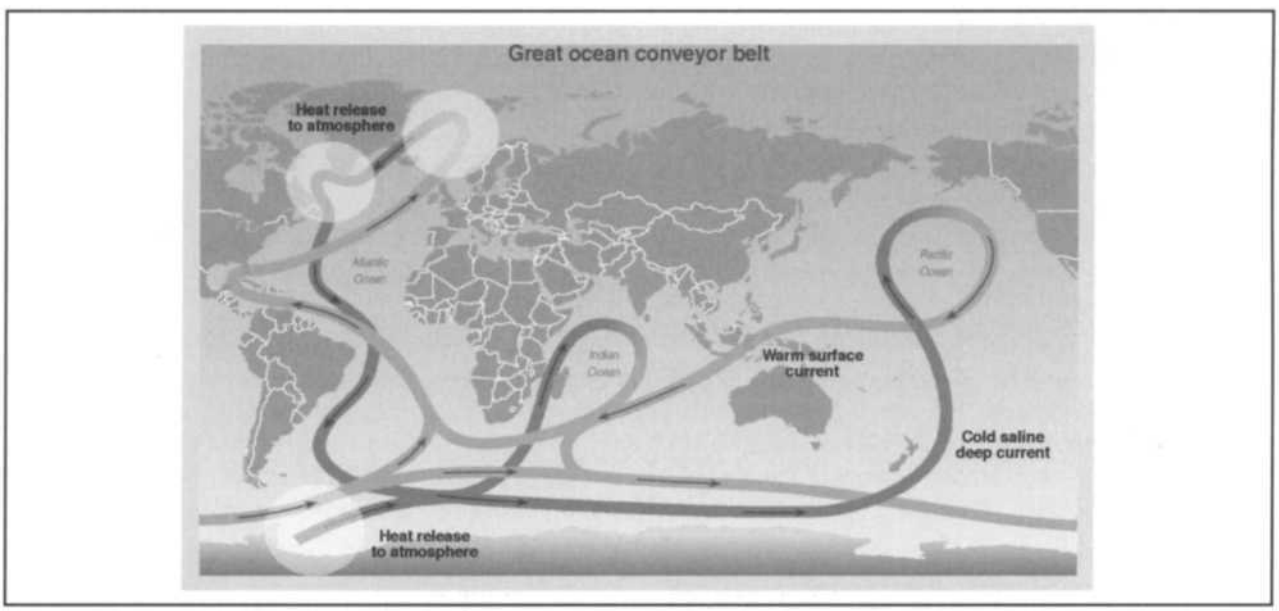
Table 2 Stabilization of atmospheric concentrations of CO_2 will require emissions reductions globally

Stabilization level (ppm)	Date for global emissions to peak	Date for global emissions to fall below current levels
450	2005–2015	2000–2040
550	2020–2030	2030–2100
650	2030–2045	2055–2145
750	2050–2060	2080–2180
1000	2065–2090	2135–2270

These dates are associated with CO_2 stabilization alone stabilization of CO_2 equivalent concentrations need to occur even earlier because of the contribution of the non-CO_2 greenhouse gases.

The adverse consequences of the climate change driven by this warming could be dramatic, depending on the sensitivity, adaptability and vulnerability of ecosystems as well as the magnitude and the rate of climate

Fig. 10 The thermohaline circulation could be disrupted by climate change



change affecting the systems. The IPCC predicts that, on average, evaporation, water vapour and precipitation will increase, although some regions of the world will be wetter and some drier.[57] Thermal expansion of the oceans and melting of ice and permafrost will cause global mean sea levels to rise between 13 and 94cm by 2100. Sea level rise will inundate coastal areas, harming many highly populated and fertile regions of the world, such as the Nile Delta, Bangladesh, and the Gulf of Mexico coast of the US, disrupting fisheries, agriculture, ecosystems and human settlements. As temperature warms, many forests will shrink. Temperature changes will have variable effects on the production of food around the world. Arctic ice is already more than a metre thinner than it was several decades ago, and the thinning will continue.[58]

55 IPCC (Science) 76.
56 IPCC (Science) 75.
57 IPCC (Science) 71.
58 According to UNEP this trend is confirmed by data going back to 1693 which shows the shifting of the date when winter ice begins to break up on the Tornio River, Finland to earlier in the year. http://www.grida.no/climate/vital/31.htm

With respect to extreme weather, it is:

- very likely that most land areas will experience:
  - higher maximum temperatures and more hot days
  - higher minimum temperatures and fewer cold days and frosts
  - increased days with high heat indexes (a measure of heat and humidity effects on people)
  - more intense precipitation events;
- likely that most areas will experience increased summer continental drying and risk of drought;
- likely that some areas will experience:
  - increased tropical storm wind intensity;
  - increased tropical storm mean and peak precipitation intensities.[59]

Global warming could also result in nonlinear responses or what the IPCC terms *large-scale singularities*, in which a series of feedback loops trigger major regional or global impacts. For example warming and freshwater melting from Greenland could shut down the Northern Hemisphere Thermohaline Circulation (the Gulf Stream), which warms the northern Atlantic Ocean and Western Europe.[60] IPCC models also predict that global ocean circulation will also weaken and possibly collapse as a result of the warming.[61] Weaker global ocean circulation could significantly reduce the ocean's ability to absorb carbon dioxide, cause a shutdown of ocean circulation in the North Atlantic, Labrador and Greenland Seas, and could shut down the formation of Antarctic bottom water. The impact on marine ecosystems and fisheries could be severe because the shutdown would lead to a stagnant deep ocean, reducing deepwater oxygen levels and carbon uptake, would severely reduce the warmth that Europe now enjoys, and could cause dramatic changes in global wind and weather patterns. The IPCC concerns are sobering:

> "Neither the probability and timing of a major ocean circulation change nor its impacts can be predicted with confidence yet, but such an event presents a plausible, non-negligible risk. The change would be largely irreversible on a time scale of centuries, the onset could be relatively sudden, and the damage potential could be very high."[62]

Other large-scale singularities the IPCC has evaluated are the disintegration of the West Antarctic Ice Sheet, which could raise the sea level 4–6m (the irreversible process of disintegration could begin in the 21st century); runaway warming if the oceans and biosphere became less able to absorb carbon dioxide or if vast gas hydrate reservoirs were released; major intensification of continental monsoons; even El Niño becoming a permanent condition; major die-back of forests, and major "destabilization of international order by environmental refugees and emergence of conflict as a result of multiple climate change impacts."[63]

Human health will be adversely affected[64] as summer heat puts more stress on fragile members of society and as warming expands the range (both latitude and altitude) of many disease carrying vectors, such as dengue fever and malaria. Hotter days and heat waves will increase mortality and morbidity in the elderly, weak and sick in urban areas, damage crops, and place heat stress on livestock. Fewer cold days and frost will benefit those who suffer from cold weather, but will also extend the range and seasons of pests and diseases.

Ecosystems will be adversely affected.[65] Lack of frost can adversely affect some trees that need a frost for their seeds to grow. Increased precipitation can lead to floods, land slides and mud slides; more intense winds in tropical storms will increase their potential to inflict great human and property loss. Plant and animal species will become endangered and extinct. Rangeland wildfires and forest fires may increase. Heat sensitive crops will wither. Small island nations may be flooded or even disappear under rising seas. Irrigation and drinking water systems will be threatened; saltwater will intrude into coastal aquifers, freshwater wetlands may become brackish or saline, and coral bleaching will continue, especially at the Great Barrier Reef.

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59 IPCC (Science) 72.
60 National Academy of Sciences, Committee on Abrupt Climate Change, Abrupt Climate Change: *Inevitable Surprises* 108–117.
61 IPCC (Science) 562–3.
62 IPCC (Impacts) 950–951.
63 IPCC (Impacts) 949–950.
64 IPCC (Impacts) 12, 451–78, 570.
65 IPCC (Impacts) 7–17, 28–61.

6 The international legal response

In response to the evidence that greenhouse gas concentrations are increasing and threaten to change the earth's climate, the UN Framework Convention on Climate Change was created to:

> [a]chieve...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner.[66]

7 The international treaty framework

On May 29, 1992, at Rio, the leaders of all the nations of the world, being both "concerned that human activities...enhance the natural greenhouse effect and that this will result...in additional warming of the earth's surface and atmosphere and may adversely affect natural ecosystems and humankind" and "determined to protect the climate system for present and future generations," signed the UN Framework Convention on Climate Change (FCCC) to stabilize "greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system;" the FCCC entered into force on 29 May 1994.[67] When the treaty was negotiated and signed, the science of global warming was less certain, and the fear of possible significant economic consequences of creating new, binding legal obligations confined international consensus to recognition that a global threat existed, that more research and information was needed, and that only general, substantive goals could be declared. Thus, instead of committing to binding targets for GHG emissions or atmospheric concentrations, the industrial nations agreed to "tak[e] the lead in modifying long-term trends in anthropogenic emissions" by taking steps to reduce GHGs "with the aim of returning... to their 1990 levels of ...anthropogenic emissions of carbon dioxide and other greenhouse gases" by the year 2000.[68] In response to the FCCC's principle of "common but differentiated responsibilities," the industrialized nations (designated as Annex 1 countries) agreed to take the lead in reducing emissions, assist in technology transfer, and follow the "additionality" concept with respect to developing nations.[69]

The FCCC, being a framework convention, envisioned the need for protocols to establish future targets, timetables, commitments and rules, and so set up the procedural mechanisms for a continuing international effort to address climate change.[70] In particular, the Conference of the Parties (COP) was created as the institutional entity that would conduct future negotiations at regular meetings; the efforts of the COP and FCCC would be supported by a secretariat, headquartered in Geneva, and other subsidiary bodies assigned particular topics by the COP.[71]

Parallel to the FCCC and COP process, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC) to review, assess and report on the current state of knowledge concerning climate change issues.[72] The IPCC is divided into three working groups. Working Group I's mandate was to prepare a "comprehensive and up-to-date scientific assessment of past, present and future climate change" that will be "the standard scientific reference for all those concerned with climate change and its consequences" from scientists to policy-makers in government and industry.[73] Working Group II's report is a comprehensive analysis of the

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66 UN Framework Convention on Climate Change, Act 2 (concluded at Rio de Janeiro, May 29, 1992, entered into force, March 21, 1994), 31 I.L.M. 849(1992).

67 UN Framework Convention on Climate Change, 1771 UNTS 108, *reprinted in* 31 I.L.M. 849 (1992)), Art. 2.

68 *Id., Art.* 4, ¶ 2(a) and (b).

69 *Id.,* Art. 4, ¶ 3 ("Additionality" is expressed as an obligation of the industrialized world to "provide new and additional financial resources" to developing countries to meet their "full incremental costs of implementing" measures under the FCCC.)

70 *Id.,* Art. 12–18.

71 The Secretariat internet web site is http://www.fccc.int

72 The WMO and the UNEP established the IPCC in 1988. It is open to all member nations of the UNEP and WMO. The IPCC is "to assess the scientific, technical and socio-economic information relevant for the understanding of the risk of human-induced climate change. It does not carry out research nor does it monitor climate related data or other relevant parameters. It bases its assessment mainly on peer reviewed and published scientific/technical literature." The IPCC web site is http://www.ipcc.ch

73 IPCC, Working Group I, *Climate Change 2001: The Scientific Basis.* (J. Houghton *et al.,* eds., Cambridge University Press, 2001) (cover page). In addition to the hard copy version published by Cambridge University Press, the reports are also available in pdf on the IPCC website at http: www.ipcc.ch.pub

potential consequences of, and adaptation responses to, climate change.[74] Working Group III's report is a scientific, technical and economic assessment of climate change mitigation options.[75] Each report also contains a definitive Summary for Policymakers, which were each fully reviewed and approved by IPCC member governments.[76] The most recent IPCC report, commonly referred it as its Third Assessment Report, was issued in 2001.

The COP, at its first meeting (COP-1 in 1995), concluded that the FCCC's non-binding approach was not going to achieve GHG reductions, and began years of intense negotiations that led to the drafting of the Kyoto Protocol to the FCCC, at COP-3 in Kyoto in 1997.[78] The key element of the Kyoto Protocol was the creation of binding national targets for Annex 1 nations (developed countries and countries in transition to a market economy) to reduce their overall emissions of greenhouse gases at least 5% below 1990 levels[79] by 2008–2012, the first commitment period.[80] To achieve total reduction of 5%, each Annex 1 nation agreed to reduce its own "aggregate anthropogenic carbon dioxide equivalent emissions of greenhouse gases listed in Annex A,"[81] a schedule of GHG reductions indexed to achieving a GHG emissions levels some 6–8% below that country's level in 1990.[82] These emission reductions could be achieved directly or by earning credits for verifiably creating carbon sinks that remove and store carbon from the atmosphere.[83] Each nation, or the European Union as a group, would be allowed to develop its own mix of implementation policies, which could range from command and control to market-based options or taxes, so long as the target was met within the commitment period 2008–2012. However, to promote economic efficiency, the Kyoto Protocol, at the insistence of the USA, established a variety of flexible, international, market-based mechanisms to promote reductions: emissions trading,[84] joint implementation of GHG emission reductions between Annex 1 nations,[85] and a Clean Development Mechanism, which would allow Annex 1 nations to invest in a fund that would finance emission reduction projects in developing nations and receive a credit for the certified emission reductions accruing from the project.[86]

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74 IPCC, Working Group II, *Climate Change 2001: Impacts, Adaptations and Vulnerabilities* (J. McCarthy *et al.*, eds., Cambridge University Press 2001).

75 IPCC, Working Group III, *Climate Change 2001: Mitigation* (B. Metz *et al.*, eds., Cambridge University Press 2001).

76 The Working Group I (Science) Summary for Policymakers was prepared by 122 lead authors, 515 contributing authors, 21 review editors, and 420 expert reviewers, and was formally accepted by the 99 IPCC member countries at the 8th session of Working Group I in Shanghai January 17–20, 2001. Working Group II's (Adaptation) Summary for Policymakers was "approved in detail at the 6th Session of IPCC Working Group II in Geneva, February 13–16, 2001. The Working Group III (Mitigation) Summary for Policymakers was approved in detail at the 6th Session of IPCC Working Group III in Accra, Ghana, 28 February–3 March, 2001.

77 In July 2002, the IPCC agreed to start the process of preparing its fourth assessment, which it plans to release in 2007.

78 As of 16 October, 2002, 96 nations have ratified the Protocol, and the ratifications represent 37.4% of Annex 1 1990 emissions of carbon dioxide. Thus, the Kyoto Protocol will enter into force when Annex 1 nations representing an additional 17.6% of 1990 emissions ratify. This could happen, even if the USA (36.1 %) does not ratify, if Russia (17.4%) and any country or combination of Annex 1 nations accounting for 0.2% such as Canada (3.3%), Poland (3.0%), Australia (2.1%), Switzerland (0.3%), New Zealand (0.2%) ratify the Kyoto Protocol. The status of the Kyoto Protocol can be checked at http://unfccc.int/resource/kpthcrmo.html

79 Unfortunately, the goal of the Kyoto Protocol is only to return the industrial world's emissions to about 8% below the 1990 level by 2008–2012 which will only modestly slow the rate of *increase* of GHG concentration in the atmosphere, and will still result in significant additional global warming.

80 Kyoto Protocol to the United Nations Framework Convention on Climate Change, UN Doc. FCCC/CP/1997/7/ADD.2, *reprinted in* 37 *ILM* 22 (1998) (signed Dec. 10, 1997) Art. 3.

81 The Kyoto GHGs are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), pcrfluorocarbons (PFCs), and sulphur hexafluoride (SF_6). Compliance flexibility was also promoted by the adoptions of a "comprehension" approach to all GHGs of concern. Each GHG's "global warming potential," as determined scientifically by the IPCC, would be scaled to CO_2 as 1, so that all GHG reductions could be calculated and expressed in the common currency of tons of CO_2 equivalent. *Id.*, Art. 5, ¶ 3.

82 Annex B targets, as a percentage of 1990 emissions, are: Australia 108, Austria 92, Belgium 92, Bulgaria 92, Canada 94, Croatia 95, Czech Republic 92, Denmark 92, Estonia 92, European Community 92, Finland 92, France 92, Germany 92, Greece 92, Hungary 94, Iceland 110, Ireland 92, Italy 92, Japan 94, Latvia 92, Liechtenstein 92, Lithuania 92, Luxembourg 92, Monaco 92, Netherlands 92, New Zealand 100, Norway 101, Poland 94, Portugal 92, Romania 92 and the Russian Federation 100.

83 *Id.*, Art. 3, ¶ 3.

84 *Id., Art.* 6.

85 *Id.*, Art. 4. *Joint implementation (JI)* refers to "a market based implementation mechanism defined in Article 6 of the Kyoto Protocol, allowing Annex I countries or companies to implement projects jointly that limit or reduce emissions, or enhance sinks, and share the emission reduction units. JI activity is also permitted in Article 4.2(a) of the UN FCCC." IPCC (Mitigation 2001) 715. The FCCC also established a pilot phase for *activities jointly implemented* for projects among developed countries (and their companies) and between developed and developing nations (and their companies). At present, these activities do not receive any emission reduction credits, but may in the future, but are encouraged as first steps in creating a market in tradablc permits for GHG emission reductions and sink enhancements. *Id.* at 427–29, 708.

86 *Id.*, Art. 12. The Kyoto Protocol also expects Annex 1 nations to "provide new and additional financial resources" to institutions such as the Global Environment Facility to fund the developing countries' cost of implementation of their FCCC obligations, and to cover the incremental costs of technology transferred to developing countries to reduce GHG emissions. Art. 11.

It was left to future COP meetings to establish the specific rules for how emission reductions and carbon sinks will be measured and verified, how the various flexible mechanisms will actually work, and how each country's compliance with its duties will be verified and enforced. The Kyoto Protocol will enter into force when ratified by 55 parties to the FCCC, including a sufficient number of Annex 1 nations to account for 55% of total 1990 carbon dioxide emissions.[87] As of May 2003, 108 parties including Annex I parties accounting for 43.9% of 1990 emissions have ratified the Kyoto Protocol, which leaves only six more Annex I countries: USA (36.1%), Russian Federation (17.4%), Australia (2.1%), Switzerland (0.3%), Monaco (0.0%), and Lichtenstein (0.0%).[88]

The Kyoto Protocol created binding targets and envisioned flexible, market-based implementation. But the operating rules and definitions needed to measure, validate and verify the reduction credits were the subject of contentious and frustrating negotiations that dragged on for years, through many COPs and an almost unending series of international meetings. While progress was modest, emissions were steadily increasing. Ironically, when President George W. Bush rejected the Kyoto Protocol in March 2001,[89] the withdrawal by the USA, the world's greatest GHG emitter, seemed to galvanize the rest of the world. In July 2001, major political and policy issues were resolved at the Bonn COP meeting (the Bonn Agreements), which allowed the Marrakesh COP in November 2001 to craft the detailed rules for emissions trading and control measures (the Marrakesh Accords).[91]

8 The Bonn Agreements and Marrakesh Accords

The Bonn Agreements and Marrakesh Accords comprise hundreds of pages of language that attempt to resolve, first at a political level in the Bonn Agreements, and then at the detailed rule level in the Marrakesh Accords, most of the many contentious issues at stake in the overall climate change negotiations. Generally speaking they establish the operational guidelines for creating a transparent market in credible emission reductions. The Accords address so-called flexibility mechanisms, sinks (also referred to under the awkward title of "Land Use, Land Use Change and Forestry"), monitoring, reporting, review, compliance and enforcement, and funding for developing countries.

The key provisions of the Marrakesh Accords concern the establishment of concrete rules and guidelines to support a market-based approach to GHG emission reductions and sink enhancements.[92] To do this, the Accords create a trading vehicle in the form of the "emission reduction unit," (ERU) which is equal to one ton of carbon dioxide equivalent (calculated using IPCC global warming potentials and can be used to meet emission reduction targets).[93] A supervisory committee of ten members of the Parties to the Kyoto Protocol or independent entities accredited by the supervisory committee must verify all ERUs generated by GHG reduction projects. To participate in a project and be allowed to earn and trade ERUs, a nation must be a Party to the Kyoto Protocol and have in place a national system of GHG emission measurements that meet IPCC best practice guidelines. Projects must first be approved, after undergoing review in a transparent process, that includes establishing baselines for measurement. Once implemented, projects must also be verified by a certified independent entity. The same process must be followed for credits under the Clean Development Mechanism and other flexible mechanisms under Kyoto. All credits will be issued and transferred by the

87 *Id.*, Art. 25. If, and when, the Kyoto Protocol enters into force, the COP will serve as the meeting of the parties to the Protocol, except that nations that have not ratified the Protocol will not be able to vote when the COP acts as the meeting of the Parties to the Protocol. Art. 13.

88 http://unfccc.int/resourcc/kpthermo_if.html (visited May 9, 2003) "President Putin has said that Russia intends to ratify the Kyoto Protocol, which would push the emissions to 61.3% and cause the Kyoto Protocol to enter into effect as international law. However, Russia has not yet ratified."

89 The USA, under the Bush Administration, has refused to adhere to its proposed Kyoto reductions. Instead it proposes to slightly increase the efficiency of the US economy so that the emissions per dollar of GDP are reduced by about 1 % per year. However, this rate of efficiency occurs naturally in the economy, so the "new" idea is actually a "business as usual" proposal that will only lead to increased levels of GHG emissions.

90 *See*, Bonn Agreements for the Implementation of the Buenos Aires Plan of Action, UN Doc. FCCC/CP/2001/L.7 (2001). COP-4, Buenos Aires 1998, could not reach any substantive agreements on operational details to implement Kyoto, as a default it issued the Buenos Aires Plan of Action, which identified the issues on which rules were needed to implement Kyoto, and self-imposed a deadline of COP-6 for reaching agreement.

91 The Marrakesh Accords, UN Doc. FCCC/CP/2001/13/Add.1-4 (2002).

92 For analysis of the Marrakesh Accords, *see* M. Vespa, Climate Change 2001: Kyoto at Bonn and Marrakesh, 29 *Ecology L.Q.* 395 (2002) D. Wirth, The Sixth Session (Part Two) and Seventh Session of the Conference of the Parties to the Framework Convention on Climate Change, *American J. ofInternational Law* (July 2002).

93 Marrakesh Accords, Add 2 Annex. Related tradable units were also created: "certified emission reduction," and "removal unit" (allowing trading in sink enhancement).

supervisory committee, which will be compensated for its administrative expenses by receiving a share of the project credits. Strong compliance and enforcement provisions were also agreed included in the Accords. It appears that the Accords create all the necessary elements for a global market in GHG emission reduction credits and sink enhancements. Such a system, if implemented could unleash an enormous demand for renewable energy technology and energy efficient supply-side and demand-side technology. Taken together, the texts from the FCCC to the Marrakesh Accords comprise an emerging international legal structure to control GHG emissions. Ultimately, each nation will be responsible for its own reductions. To do that, they will need to adopt some combination of policies described in this book to improve energy efficiency, to shift from fossil fuels to renewable sources of energy (See, e.g., the chapter by Richard L. Ottinger *et al., Legal Measures To Promote Renewable and Energy Efficiency Resources),* and to enhance carbon dioxide sinks. Even with ambitious efforts, GHG concentrations will rise, the earth will warm and society will face expensive imperatives to adapt to the consequences of climate change.

9 Prospects for the new legal regime

President Bush's opposition to Kyoto has been firm since March 2001, although over time his reasons have transmogrified. At first, President Bush questioned the IPCC scientific assessment that global warming was a serious imminent problem and so he asked the US National Academy of Science to evaluate the IPCC Third Assessment Report. Instead of rejecting the IPCC findings, the National Academy of Science "generally agree[d] with the assessment of human caused climate change presented by the IPCC Working Group 1.. .scientific report"[94] and concluded:

> "GHGs are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperature and subsurface temperatures to rise. Temperatures are, in fact, rising. The changes observed over the last several decades are likely mostly due to human activities, but we cannot rule out that some significant part of these changes are also a reflection of natural variability. Human-induced warming and associated sea level rises are expected to continue through the 21st century".

Faced with scientific consensus on the seriousness of human induced climate change, Bush's opposition to the Kyoto Protocol shifted to concern that compliance would hurt the US economy and that the Kyoto Protocol does not require developing nations to reduce emissions. Bush's worry is that to reduce USA to 7% below its 1990 levels, its current emissions will have to be lowered by about 25–30%, because its emissions have steadily increased since 1990. Instead of reducing GHG emissions over the next ten years, the Bush administration now proposes to reduce the carbon intensity (not total GHG emissions) of the economy by 18%, even though the economy will, based on historic and present investment patterns, become 17.5% more efficient over the next decade through the unremarkable, ongoing process of capital replacement.[95] However, following the Bush administration's strategy will result (based on the Bush administration's own projections) in the USA in ten years emitting 30% more GHGs per year than it was in 1990; in contrast, the industrialized nations meeting their Kyoto Protocol targets will reduce emissions by about 3% from 1990 levels.[96]

The Bush administration's second objection to the Kyoto Protocol is that it does not mandate targets and timetables for developing countries. Yet, because the USA has the largest historic total of GHG emissions, accounting for the largest share of the past emissions, and is the world's largest emitter of GHG in total quantity and among the highest in per capita GHG emissions,[97] the USA, along with all the industrial nations, bound itself in the FCCC to "tak[e] the lead in modifying long-term trends in anthropogenic emissions." The Kyoto Protocol is only a small first step. In fact, the US share of Kyoto reductions is less than its proportionate share of 1990 emissions. More substantial reductions will need to be established for post 2012 commitment periods, when the obligations of developing countries will most likely engage. By taking the lead, the industrialized countries will assuage some of the developing world's present resistance to reducing GHG

94 Committee on the Science of Climate Change, National Research Council, Climate Change Science: An Analysis of Some Key Questions 1 (2001).

95 *See* S. Eizenstat, F. Loy and D. Sandalow, *President Bush 's Disappointing Climate Proposal,* (2002), and John Podesta, *Do the Math: Under the White House Global Warming Plan, Carbon Dioxide (CO2) Pollution Would Continue Increasing at Same Rate as Past Decade Accounting Tricks Hide Growing Damage Behind Veil of Progress,* (2002).

96 S. Eizenstat, F. Loy and D. Sandalow, *President Bush 's Disappointing Climate Proposal,* (2002).

97 *World Energy Assessment* 94 .

emissions growth on the grounds that the problem created by the industrialized world is being unfairly imposed on the developing nations.[98]

The FCCC obligates all parties (including developing nations) to adopt GHG emission programmes and to address GHG emissions within their energy, transportation, industry, agriculture, forest and waste management sectors,[99] and some developing countries, such as China and India, are voluntarily beginning to address climate change. It is well understood by all nations that the greenhouse gas problem cannot be successfully addressed without all nations participating, and that all developing nations will be phased into the legal regime, but on a timetable that reflects their common, but differentiated, obligations.

Perhaps thwarted by the Marrakesh Accords (and the possibly imminent entry of the Kyoto Protocol into force) in its argument that the USA should not be bearing the burden of reducing GHG emissions without participation of developing nations, the Bush administration announced at COP-8 a new spin on the Kyoto Protocol. The USA first opposed the Kyoto Protocol because developing nations refused firm GHG targets and timetables. But at COP-8, the USA agreed with the developing countries' view. According to Paula Dobriansky, US Under Secretary of State for Global Affairs, "[the US] does not see targets and timetables as realistic for developing countries."[100] Therefore, the circular reasoning goes, the USA cannot ratify the Kyoto Protocol because developing countries should not be subject to any hard commitments. This led the USA to announce in Delhi its new approach to global warming: adaptation is as essential to climate change as is prevention, and the key to environmental progress is economic growth. In other words: learn to live with it, the USA can and so should you.[101]

In rejecting Kyoto, Bonn and Marrakesh, the USA is obstructing the emergence of market-based mechanisms that could be financially beneficial to all participants, that would motivate the industrial nations to develop new technology, and that would provide the incentives and open the channels for the flow of investment for energy efficient and renewable technology to developing countries. Without this leadership, China, India and other developing nations will use traditional coal-based and oil technologies to develop. If they do that and approach per capita emission rates anywhere near those of the industrial world, global GHG emissions will soar out of control, and any hope of sustainable development will be lost. The USA will also be excluding itself from these new market opportunities because both the Kyoto Protocol and the Marrakesh Accords exclude non-Parties from participation.

98 India's Prime Minister, Atal Bihari Vajpayee, at COP-8 in Delhi on 31 October, 2002, addressed the differences between developed and developing countries over how to approach global warming. His speech, which expressed the views (even resentments) of developing nations, argued that poor nations should not be expected to spend money preventing global warming because they bear little responsibility for global warming and emit fewer GHGs than developed nations, but suffer more from natural disasters, such as floods and droughts, attributable to global warming. Moreover, poorer nations are already challenged in trying to meeting critical social needs such as health care and education, and so have little money to invest in reducing GHG emissions. A. Waldman, At Climate Meeting, Unlikely Ally for Have-Nots, *New York Times*, 1 Nov., 2002, at A8.

99 FCCC, Art. 4, ¶1 (b), and (c).

100 *Id.*

101 *Id.*

Energy and biodiversity: Understanding complex relationships

Jeffrey A. McNeely

People concerned about energy issues seldom give adequate attention to biodiversity, and those concerned with biodiversity give inadequate consideration to the implications of energy policy for their issues. However, virtually all of the factors leading to the loss of biodiversity are intimately linked to the development and use of energy by people. This chapter discusses the biological impacts of hydroelectric energy, nuclear energy, fossil fuel energy, biomass energy, and other more innovative approaches to providing the energy needs of modern society. Some of these impacts are direct, such as pollution from combustion or flooding of habitat to make a hydroelectric dam. Other impacts are indirect; for example, the leading cause of species extinction is the spread of invasive alien species, a spread that is greatly facilitated through global trade that is made possible through cheap and easily-available energy for transport. By far the most profound indirect impact of energy development on biodiversity is through climate change driven especially by the carbon dioxide released from burning fossil fuels. Groups of species that are likely to be particularly damaged by climate change include those that already are rare or threatened, migratory species, polar communities, peripheral populations, genetically impoverished species, specialized species, and montane and alpine communities. The loss of biodiversity through climate change can also have profound implications for human welfare; climate change has been a major force in the collapse of historical civilizations. To deal with the linked problems of climate change and biodiversity, greater collaboration is required in the implementation of the respective international conventions. For example, the implementation of the Kyoto Protocol should give far greater attention to its impacts on biodiversity, and consider adding the possibility of investments in conservation of old-growth forest in developing countries. The paper concludes with five suggestions for better addressing the linked risks of climate change and biodiversity loss through energy policy.

1 Introduction

Humans have dominated the planet for centuries, but their impacts have been accelerating since the energy-driven industrial revolution began to spread around the world. Between a third and a half of the land surface has now been transformed by human action; the carbon dioxide concentration in the atmosphere has increased by nearly 30%; more atmospheric nitrogen is now fixed by humanity than by all natural terrestrial sources combined; more than half of all accessible surface fresh water is put to use by humanity; and about one-quarter of the bird species on Earth have been driven to extinction.[1] [2] [3] Some scientists have even gone so far as to consider humans to be the world's greatest evolutionary force.[4]

The dominance of our species over others is due above all to our ability to capture energy. Some non-human species are able to utilize energy from hydrothermal vents, or take advantage of wind currents to migrate or reproduce. But most species depend primarily on solar power, especially as mediated through the process of photosynthesis; and humans now appropriate 10–55% of terrestrial photosynthesis products,[5] thereby depriving other species of this energy. One of the factors that make humans unique is their ability to generate energy from a wide variety of additional sources. In fact, it seems quite possible that the harnessing of energy in the form of fire was one of the driving factors in the evolution of modern *homo sapiens.*[6] [7]

Burning biomass fuel was the main external form of energy for humans for thousands of years; but as populations and levels of consumption increased, forests were cleared, biodiversity was lost, resource conflicts increased, and new sources of energy were sought. For example, as 16th-century Britain ran out of wood, it turned to coal, which started a chain of events that led to the Industrial Revolution two centuries

1 S. Rojstaczer, S. Sterling and N. Moore. "Human Appropriation of Photosynthesis Products" (2001) 294 *Science* 2549.
2 IUCN, *Red List of Threatened Species* (2002).
3 P. Vitousek, H. Mooney, J. Lubchenco and J. Melillo, "Human Domination of Earth's Ecosystems" (1997) 277 *Science* 494.
4 S. Palumbi, "Humans as the world's greatest evolutionary force" (2001) 239 *Science* 1786.
5 S. Rojstaczer, S. Sterling and N. Moore, note 1 above.
6 W. Hough, *Fire as an Agent in Human Culture*, Smithsonian Institution, Washington D.C.
7 T. Vale (ed.), *Fire, Native Peoples, and the Natural Landscape* (2002).

later.[8] Coal soon showed its limitations, leading to the form of energy that supports our global economy, namely oil. This convenient and flexible fuel has played a key role in the remarkable expansion in human population over the past 100 years, increasing from about 1.6 billion in 1900 to about 6 billion in 2000 while energy consumption increased 16-fold over the same time.[9] This rapid expansion of the energy-driven human "footprint" on the environment has also involved profound influences on biodiversity.[10] [11] [12] This chapter examines some of the key issues of the relationship between human uses of energy and the conservation of biodiversity, with a particular focus on the impacts on biodiversity of climate change driven by the use of fossil fuels to generate energy.

2 Impacts of energy development on biodiversity

Throughout most of human history, our welfare was directly linked to the planet's biological diversity, which the Convention on Biological Diversity (CBD) defines as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems". The tangible biotic components of ecosystems are biological resources, such as genes, rice plants, or elephants, which have actual or potential use or value for humanity.[13]

But with industrialization and global trade, our species has become proportionately less directly dependent on biodiversity, though of course our dependence remains absolute in the sense that all of our food comes from biological resources. That said, the impressive material gains for humans over the past century have often come at the expense of the other species with whom people share the planet. The diversity of these species is considerable, with some 1.4 million species having been formally described, and another 10–20 million species still awaiting discovery by science.[14] But the planet's biodiversity is seriously threatened; the latest figures from the authoritative IUCN Red List indicate that nearly 24% of all species of mammals, 12% of birds, and at least 14% of plants are threatened with extinction.[15] The general consensus among biologists indicates that if present trends continue, at least 25% of the world's species could become extinct, or be reduced to tiny remnants, by the middle of this century. Many more species are losing a considerable part of their genetic variation, making them increasingly vulnerable to pests, diseases, and climate change. The causes of the decline of species and their genetic diversity are multiple and complex, including transformation of natural habitats into agricultural lands, excessive harvesting of particular species of economic value, the effects of invasive alien species, the impacts of various environmental pollutants, and changes in climate. These are all closely related to increasing uses of energy by people.

The basic point is that the convenient availability of energy enables humans to significantly over-exploit biodiversity. For example, the rapid expansion of road systems, enabled by cheap energy to provide transport, opens up even the most remote areas to various kinds of biodiversity exploitation, ranging from logging to hunting. Using petrol-driven chainsaws, just a few villagers can clear-cut an extensive area of forest in only a few months, and industrial loggers can clear vast areas. Ships can harvest tons of fish in a matter of days, tractors enable a single farmer to plough hundreds of hectares, and the products of combustion pollute air, soil, and water. These human impacts, along with many others that could be listed, enable the species that can co-exist with humans to prosper at the expense of many others.

Impacts on biodiversity of energy mobilized for human interests can be direct (for example, wildlife habitat lost by forests converted to fields or firewood, or flooding due to dam construction) or indirect (such as broad-scale habitat change brought about by climate change) or a combination of direct and indirect influences. Different kinds of energy can lead to different impacts on biodiversity. Some of the major ones are discussed below.

8 J. Nef, "An early energy crisis and its consequences" (1977) 237(5) *Scientific American* 140.
9 J. McNeill, *Something New Under the Sun: An Environmental History of the 20th Century* (2000).
10 M. Wackernagel and W. Rees, *Our Ecological Footprint: Reducing Human Impact on the Earth* (1996).
L. Guruswamy, D. Lakshman and J. McNeely (eds.), *Protection of Global Biodiversity: Converging Strategies* (1998).
12 E. Wilson, *The Future of Life* (2002).
13 L. Glowka *et al.*, *A Guide to the Convention on Biological Diversity* (1994).
14 E. Wilson, *The Diversity of Life* (1992).
15 IUCN, *Red List of Threatened Species* (2002).

2.2 Hydroelectric energy

Some 45,000 dams over 15m high have been built worldwide in the past century, especially to provide hydroelectricity; about six per cent of the world's energy and 25% of its electricity is now generated by dams, including over 90% of total national electricity in 24 countries. Hydroelectricity has the substantial advantage that it can be developed on all sizes of rivers and streams, with micro-hydroelectric plants appropriate for providing energy at the village level, especially in mountainous areas that otherwise have few energy alternatives. Hydroelectricity is a relatively clean source of energy, but the generation of hydroelectricity has had profound influences on biodiversity. Virtually all of the major rivers on the planet have been dammed, greatly altering river flows, flooding natural habitats, and changing the seasonal flooding that brings nutrients to productive agricultural soils. Dams have slowed water velocity in river systems, converting high-energy rivers to chains of connected reservoirs, which in turn changes patterns of sediment and nutrient transport, blocks fish migration, creates new migratory pathways for alien species, alters the composition of riparian habitat, and contributes to changes in coastal ecosystems. An extensive survey carried out for the World Commission on Dams[16] found that large dams have led to:

- the loss of forests and wildlife habitat, the loss of species populations, and the degradation of upstream catchment areas due to inundation of the reservoir area;
- emissions of greenhouse gases from reservoirs due to the rotting of vegetation and carbon inflows from the basin;
- the loss of aquatic biodiversity, upstream and downstream fisheries, and the services of downstream floodplains, wetlands, and riverine estuarine and adjacent marine ecosystems; and
- the creation of productive fringing wetland ecosystems with fish and waterfowl habitat opportunities in some reservoirs.

Thus the impacts of hydroelectric dams on biodiversity are somewhat mixed, but on balance are more negative than positive. While it is not possible to mitigate many of the impacts of building reservoirs on terrestrial and aquatic ecosystems, closer and earlier cooperation between the dam design team, ecologists, and affected people can lead to more effective mitigation. Managing the flow, including flood releases from dams, can reduce the impacts of changed stream flow regimes on aquatic, floodplain, and coastal ecosystems downstream. Finally, legislative or policy measures can help ensure that particular river segments or basins are maintained intact, thus conserving biodiversity and ecosystem functions. But these measures do not reverse the negative impacts of hydroelectric development on biodiversity; they simply make socially-acceptable trade-offs.

2.3 Nuclear energy

Nuclear energy, which produces about five per cent of the world's energy and approximately 80% of the electricity in France and Belgium, has the advantage of being relatively clean, producing relatively small amounts of greenhouse gases, and having relatively modest impacts on biodiversity. On the other hand, the risks of nuclear energy have led to strong opposition in many countries, based primarily on the problems of dealing with radioactive waste, the hazards of uranium mining, and the implications of accidents at nuclear power plants. Such concerns were well illustrated by the 1986 accident at the nuclear power plant in Chernobyl (Ukraine), which sent radioactive dust high into the upper atmosphere with fallout estimated at equal to 40 Hiroshimas and the displacement of 135,000 people from a 1,000km area. In some areas of the former Soviet Union, consumption of forest berries, fungi, and fish, which contribute significantly to the radiation exposure of local people, will need to be restricted for at least a further 50 years. The contamination of foodstuffs by the Chernobyl fallout is still being felt elsewhere in Europe, with restrictions on certain products in the UK extended for a further 10 to 15 years, more than 100 times longer than originally expected.[17]

Ironically, this was not an unqualified disaster for biodiversity, as Chernobyl has now become the world's first radioactive nature reserve. The site's rodent population was severely reduced by the blast, and of the handful of survivors, the first several generations included almost no males. But by the third or fourth generation, the species adapted and the reserve is now teeming with rodents and their predators. The wolves

16 World Commission on Dams, *Dams and Development: A New Framework for Decision-Making* (2000).
17 J. Smith *et al.*, "Chernobyl's Legacy in Food and Water" (2000) 405 *Nature* 141.

are smaller than those in the surrounding lands and their internal organs are radioactive, but 200 wolves are now living in the nature reserve, which also has begun to support populations of reindeer, lynx, and European bison, species that previously were not found in the region. While the impact on humans was strongly negative, the wildlife is adapting and even thriving on the site of one of the 20th century's worst environmental disasters.

Because of the potential risks posed by nuclear energy, some nuclear plants are surrounded by protected areas. For example, the Hanford Site occupies 145,000ha in south-eastern Washington State; in addition to containing several reactors and plants for producing nuclear materials, it also contains several protected areas and sites of long-term research.[18] The Hanford Site provides an important sanctuary for plant and animal populations that have disappeared from surrounding areas following decades of intensive agriculture. It also serves as a refuge for migratory waterfowl and fish, as the site also contains one of the last wild stretches of the Columbia River. Thus the overall development of nuclear energy can have some benefits for biodiversity, if the development is planned appropriately. Whether the net result is a benefit for biodiversity or a hazard remains to be seen.

Nuclear energy also carries with it the substantial risk of the proliferation of nuclear weapons, which may overwhelm other considerations.

2.4 Biomass energy

Biomass currently provides about 12% of the world's energy, including about 35% of energy requirements in developing countries. The most common form of biomass is solid fuel in the form of wood, charcoal, forestry and crop residues, and agro-industrial and municipal wastes. Biomass can also yield liquid fuels such as ethanol, methanol, and vegetable oils, as well as biogas formed by anaerobic respiration of biomass digesters, particularly common in China and India.[19]

Biomass energy has been highly touted as a productive and renewable source of energy. But on more sober reflection, biomass loses much of its attraction. It is relatively inefficient in generating energy (as compared to, for example, solar thermal electricity generation) and the land used for generating biomass energy is also needed to grow food crops or meet other human needs; further, biomass energy does nothing to address the fundamental problem of carbon dioxide accumulation in the atmosphere, and can have negative impacts on biodiversity. Biomass combustion also leads to significant pollution, including more than 100 chemical pollutants released into the atmosphere.[20] Burning crop residues as a fuel also has negative impacts on biodiversity through removing essential nutrients from the land, reducing soil organic matter and the water-holding capacity of the soil.

The economic benefits of biomass energy are maximized when biomass is able to be harvested close to where it is being used, making it popular among rural people. It appears that about three tons per hectare of dry woody biomass can be harvested each year from a forest with small amounts of nutrient fertilizer inputs, while grass may be able to produce as much as five tons per hectare per year.[21] To meet the energy needs of a city of 100,000 people using biomass harvested sustainably from a forest would require about 220,000ha of forest, about the same area as currently used to produce food, housing, industry, and roads for the same number of people. Intensively managing a plantation for biomass may require additional inputs of fossil fuel for machinery, fertilizers, and pesticides, thereby potentially leading to negative impacts on biodiversity. Worse, the replacement of natural forests by monocultural biomass forests increases soil erosion and water runoff, as well as a loss of biodiversity.

On the other hand, if biodiversity objectives are incorporated into the design of a biomass project, the negative impacts could be significantly reduced.

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18 R. Gray and W. Rickard, "The Protected Area of Hanford as a Refugium for Native Plants and Animals" (1989) 16(3) *Environmental Conservation* 251.

19 R. Hill, P. O'Keith and C. Snape, *The Future of Energy Use* (1995).

20 D. Pimentel *et al.*, "Renewable energy: economics and environmental issues" (1994) 44 *BioScience* 536.

21 *Id.*

2.5 Fossil fuel energy: Oil, gas, and coal

Fossil fuels – petroleum, coal, and natural gas – provide about 77% of world energy supply.[22] The exploration, exploitation, and transport of fossil fuels have had profound direct and indirect impacts on biodiversity. The pollution produced from generating energy from fossil fuels has numerous negative impacts on biodiversity, with an annual loss of commercial timber in Europe amounting to US$30 billion, and damage to forests in southern China amounting to US$14 billion per year. Losses from air pollution on agriculture is also substantial, amounting to $4.7 billion in Germany, $2.7 billion in Poland, and $1.5 billion in Sweden.[23] The direct impact of oil spills on aquatic and marine ecosystems are widely reported in the popular press. The most infamous case is the Exxon Valdez, which ran aground on 24 March 1989, spilling 42 million cubic metres of crude oil into Alaska's Prince William Sound. The subsequent liability agreement included a US$900 million civil settlement fund that is designed to restore and conserve the natural resources of the Sound.[24]

Indirect impacts come through the development of oil fields in remote areas that are valuable for conserving biodiversity, including through clearing of land for agriculture or to construct infrastructure, increasing demands on water resources, generation of wastes and other pollution, commercial logging, extraction of non-timber forest products, increased hunting and fishing, and expanded trade in bushmeat and other biological resources. Perhaps worse, the large numbers of people attracted by the energy development are likely to be even more dependent on natural resource extraction once the energy operation has ceased. The impact of burning fossil fuels on climate are discussed later in this chapter.

The impacts of fossil fuels on biodiversity are a function of supply. The best estimate for total petroleum supply is around 2.1 trillion barrels, with peak production being reached in 2003–2006,[25] followed by rapidly increasing prices and slowing levels of consumption that ironically may lead to the involuntary meeting of Kyoto Protocol targets. Supplies of coal, oil shales, and natural gas are far greater, but these sources of energy are not nearly as convenient as oil, and the transition from using oil as fuel to using oil as a petrochemical feedstock is unlikely to be a smooth one. The implications for biodiversity are uncertain.

2.6 Minor forms of energy production

Several other forms of energy are being developed and are beginning to provide important contributions to at least local energy supplies. *Windpower* is one of the most rapidly growing sources of energy, with substantial investments in Denmark, the UK, and the USA. Wind farms may be co-managed for biodiversity objectives if the human impact can be minimized. But the rotating blades can result in mortality for migratory and resident birds. Appropriate site selection is therefore important.

Photovoltaic cells are also growing in significance, and are being used in many desert areas that otherwise would not be economic to reach with modern energy generation techniques. The size of units is highly flexible, and can be incorporated into the design of houses, farm buildings, factories, and so forth. But major photovoltaic farms would require substantial land, and such land use would not necessarily be appropriate for collateral benefits for biodiversity; solar farms may compete for land with agriculture, forestry, and protected areas. While emissions of carbon dioxide and other pollutants are negligible, the production process may involve production of substantial pollutants through use of toxic chemicals in their manufacture.[26]

Tidal power plants, which harness the rise and fall of the tides, have been developed in France, Canada, China, Russia, the USA, and elsewhere. Development of tidal power depends on appropriate geological conditions where the facilities can be installed economically. Impacts on biodiversity include the disruption of migratory patterns of fish, reduction in feeding areas for waterfowl, disruption of traditional flows of suspended sediments, and various other changes at the ecosystem level. These impacts on biodiversity arise because the conditions that make an estuary ideal for generating power, namely the periodic rise and fall of the tides, also make it a rich feeding area for birds. Invertebrates may be affected by changes in levels of salinity and silt deposition, and by the build up of chemical pollutants in estuarine sediments.[27]

Geothermal energy is very dependent on appropriate geological conditions, usually linked to volcanism. Lardarello (Italy), the Geysers (California), and Wairakei (New Zealand) are among the prominent

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22 J. Holdren, "Population and the Energy Problem" (1991) 12(3) *Population and Environment* 231.
23 N. Myers and J. Kent, *Perverse Subsidies: How Tax Dollars Can Undercut the Environment and Economy* (2001).
24 J. Kaiser, "Stemming the Tide of Invading Species" (1999) 285 *Science* 1836.
25 K. Deffeyes, *Hubbert's Peak: The Impending World Oil Shortage* (2001).
26 D. Pimentel *et al*, "Renewable energy: economics and environmental issues" (1994) 44 *BioScience* 536.
27 R. Milne, "Tidal Power Ruffles Feathers," *New Scientist*, 26 May 1988: 38–39.

geothermal production sites, and the Geysers provides about half the electricity needed by San Francisco. Many of the sites where geothermal energy might be developed are also important for conserving biodiversity. An example is the geothermal development in Kahaualea in a heavily-forested site adjacent to Hawaii Volcanoes National Park, which is also a World Heritage site recognised under the 1974 World Heritage Convention. The site encompasses over 10,000ha of high quality *Ohia* forest that provides essential habitat for several species of endangered endemic birds. As a result of the controversy engendered by the proposed development, the State of Hawaii passed the Geothermal Subzone Act (1983-Act 296) which was designed to provide a strong technical basis for decision-making regarding geothermal development. While the final outcome of geothermal development in Hawaii remains embroiled in controversy, the impacts on biodiversity certainly have been clarified.[28]

2.7 High-tech energy generation

Some advanced technology approaches to generating energy that is free of carbon emissions have been proposed, including terrestrial solar and wind energy, solar power satellites, nuclear fusion, fission-fusion hybrids, and fossil fuels from which carbon has been sequestered. Other technologies could contribute to climate stabilization, such as improvements in efficiency, production of hydrogen, superconducting global electric grids, and geoengineering. Unfortunately, all of these approaches still have severe deficiencies that limit their ability to contribute to global programmes to slow climate change. Hoffart *et al*.[29] conclude that a broad range of intensive research and development is urgently needed to produce technological options that can allow both climate stabilization and economic development. This research and development needs to take biodiversity concerns into consideration.

One problem with the high-tech approach is that it is unlikely to be much help to the two billion or so people who still lack access to affordable modern energy. Instead, new forms of sustainable development will require energy that is economically viable, need-oriented, self-reliant, and environmentally sound.[30]

Another possibility is to develop new approaches to resource recovery, replacing waste disposal with reclamation that both reduces pollution and saves energy. This reorientation could also contribute to a more general shift toward greater cooperation among organizations dealing with the environment,[31] and thus at least indirectly support conservation of biodiversity.

3 An indirect impact: How energy contributes to biological homogenization

One critical element in the economic globalization that characterizes the modern world is the movement of organisms from one part of the world to another through trade, transport, and tourism, all utterly dependent on cheap and convenient energy. Many of these movements of organisms into new ecosystems where they are alien (also called non-native, non-indigenous or exotic) are generally beneficial to people. Agriculture, forestry, the horticultural industry, and many industrial consumers of raw materials today depend on species that are native to distant parts of the world. The lives of people everywhere have been enriched by their access to a greater share of the world's biological diversity, and expanding global trade is providing additional opportunities for further such enrichment. But many other species have very mixed impacts, benefiting some individuals or interest groups while disadvantaging others. And in a few cases, especially disease organisms and pests of forests or agricultural crops, the alien species is clearly detrimental to all, or nearly so. The latter groups are "invasive alien species" (IAS), that subset of alien species whose establishment and spread threatens ecosystems, habitats, or species with economic or environmental harm.[32]

Considerable evidence indicates a recent rapid growth in the number and impact of IAS.[33] Trade and economic development lead to more IAS; countries that are more effectively tied into the global trading system tend to have more IAS, being positively linked to the development of terrestrial transport networks,

28 L. Hannah, "Rainforests and Geothermal Energy in Hawaii: Environmental Concerns Expose Flawed State Planning Process" (1990) 17(3) *Environmental Conservation* 239.

29 M. Hoffart *et al.*, "Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet" (2002) 298 *Science* 981.

30 J. Goldemberg *et ah*, "Energy for the New Millennium" (2001) 30(6) *Ambio* 330.

31 R. Iranpour *et al.*, "Environmental Engineering: Energy Value of Replacing Waste Disposal with Resource Recovery" (1999) 285 *Science* 706.

32 J. McNeely *et al.*, (eds), *A Global Strategy on Invasive Alien Species* (2001).

33 H. Mooney, A. Harold and R. Hobbs (eds.), *Invasive Species in a Changing World* (2000).

migration rates, number of tourists visiting the country, and trade in commodities.[34] The general global picture shows tremendous mixing of species, with a clear trend toward homogenization as cosmopolitan species replace local endemics. The future is certain to bring considerable additional species mixing as an inevitable consequence of growing global trade. This mixing will result in some species becoming more abundant and many others declining in numbers (or even becoming extinct). Species diversity in some locations may actually increase, but because IAS are the major factor in species extinction over the past 400 years,[35] the overall effect will likely be a global loss of biodiversity at species and genetic levels.

While the biological dimensions of IAS are fundamental, more effective responses to the problems they pose must be linked to the energy and trade agendas. For example, cities tend to be the focal points of the global economy and the entry points for many invasives, as well as major consumers of energy (urban-dwellers may consume 10 times more energy per capita than rural people[36]). Many invasive species are most prolific in urban and urban-fringe environments where long histories of human disturbance have created many opportunities for invasion. Settlement patterns also involve transportation links, and the distribution of many invasives seem to follow transportation corridors. Thus human settlement patterns, too, are part of the energy-biodiversity-invasive species issue.

To address the problem of IAS, over 40 international conventions, agreements, and guidelines have been enacted and many more are being prepared.[37] But current economic orthodoxy argues that global trade is fostered through removing regulations that may constrain such trade, such as measures that may restrict the introduction of a potentially invasive alien species. These contradictions help to underline the conflict of interests between global trade and the control of IAS, and the challenges to current management measures and legal frameworks.

Governments have also expressed their concerns about the problem of IAS through the Convention on Biological Diversity, which calls on the Parties to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats, or species" (Article 8h). But the expanding impact of IAS on both global economies and the environment implies that these international instruments have been insufficient to prevent and combat IAS effectively, suggesting the need for additional measures, such as a protocol under the CBD.

At the national level, those opposed to eradicating IAS on ethical grounds often are prepared to argue their case in court, where litigation can be effective. This challenge calls for a legal framework that clearly recognises the need to eradicate IAS when they threaten the greater public good, and education for judges to ensure that they understand the issues before them. While energy is the key factor that facilitates the international trade that in turn facilitates species invasions, national and even local legislation also needs to recognise such elements as trade, ethical concerns, human health, cultural considerations, and even international obligations.

4 Energy, climate change and biodiversity

Climate is the most complex manifestation of human-induced global change, and potentially has the greatest impact on biodiversity. Large-scale extinctions have occurred as a result of past major climatic changes, and it appears very likely that global warming and associated disturbance events, particularly when coupled with human population growth and accelerating rates of resource use, will bring further losses in biological diversity. The Intergovernmental Panel on Climate Change (IPCC) has been established by governments to provide the current scientific consensus on climate change. In its Second Assessment Report, IPCC projects that the Earth's mean temperature will increase by between 1.4–5.8°C by 2100, a rate faster than any observed during the past 10,000 years, with an accompanying sea level rise of 15–95cm over the same timeframe.[38] [39] A doubling of CO_2 concentration over present levels, due especially to by-products of energy production, is expected to occur by 2050 unless drastic actions are taken to mitigate greenhouse gas emissions. Even if greenhouse gas concentration is stabilized at 1990 levels, as called for under the Kyoto Protocol, global surface temperature will continue to rise for several decades and sea level will rise for many centuries. These

34 S. Dalmazzone, "Economic Factors Affecting Vulnerability to Biological Invasions," in C. Perrings, M. Williamson and S. Dalmazzone (eds), *The Economics of Biological Invasions* (2000), 17–30.

35 B. Groombridge and M. Jenkins, *Global Biodiversity: Earth 's Living Resources in the 21s' Century* (2000).

36 H. Girardet, *The Gaia Atlas of Cities* (1992).

37 C. Shine, N. Williams and F. Burhenne-Guilmin, *Legal and Institutional Frameworks on Alien Invasive Species: A contribution to the Global Invasive Species programme Global Strategy Document* (2000).

38 J. Houghton *et al.*, (eds), *Climate Change 2001: Scientific Basis* (2001).

39 J. McCarthy *et al.*, (eds), *Climate Change 2001: Impacts, Adaptation, and Vulnerability* (2001).

changes could bring increased frequency and destructiveness of hurricanes; more protracted droughts, longer and hotter heatwaves, and more severe rainy periods; and significant reduction in the area of the great polar ice sheets. The risks of such changes led governments to negotiate the Framework Convention on Climate Change (FCCC), signed at the Earth Summit in 1992.

Major changes in global vegetation cover – a key indicator of biodiversity – are expected to occur in response to global climate change, primarily as a result of changing temperature and precipitation. Hotter temperature and more rain may result in the expansion of boreal forests, but overall forest area is expected to shrink, with grasslands and deserts increasing in extent. Desert and other areas of sparse vegetation may expand at the expense of grasslands, shrublands, and prairies, while shrubby vegetation may spread into areas of sparse vegetative cover in other areas. These predicted changes could have profound influences on biodiversity, both positive and negative, as the habitat of forest-dwelling species and grassland-dwelling species expand or contract. The impacts of climate change on desertification are also likely to be profound, with biodiversity significantly affected.

In forest ecosystems, rainfall and seasonality as well as temperature may be influential, particularly if they cause major changes in fruit or seed production. Further, the responses of forests to climate change may depend as much on the indirect effects of climate and vegetation on soil properties.[40] [41] The ability of animal and plant species to shift their ranges in response to climate change also depends on dispersal mechanisms. Significant changes in temperature could occur during the lifetime of some long-lived tree species; trees that disperse light, wind-blown seeds or drop seeds carried by animals may be able to disperse more easily than others.[42] On the other hand, tree species dependent on animals for pollination or seed dispersal may be affected by the changing ranges of animal species.

A growing body of research has examined the possible effects of climate change on individual species and biotic communities. This research suggests that biological communities will adapt in complex and unpredictable ways as the geographical distributions of species are altered individually rather than in community units.[43] Further, because species are interrelated, any advantage falling to a given species in a closed system will affect other species in ways that are not always predictable. The rate of species invasions and extinctions is likely to accelerate further, bringing about complex changes in species compositions and interactions. Thus, rather than causing a simple poleward or uphill shifting of ecosystems with all of their inhabitants intact, climate changes will serve to reorganize biological communities in unforeseeable ways.

5 Energy, climate and biodiversity: Some challenges

5.1 Overcoming our ignorance

Losing biodiversity is no trivial matter, and climate change poses a significant challenge to the planet's biodiversity. Changes in the abundance of species – especially those that influence water and nutrient dynamics, trophic interactions, or disturbance regimes – affect the structure and functioning of ecosystems. Diversity is also functionally important, both because it increases the probability of including species that have strong ecosystem effects and because it can increase the efficiency of resource use. Species that serve similar functions in ecosystems may be sensitive to different environmental factors, thus contributing to the stability of ecosystem processes, whereas differences in sensitivity among functionally different species may make ecosystems more vulnerable to change. Thus changes in climate that affect species composition and diversity are likely to profoundly alter the functioning of the biosphere and change the flow of benefits to humans from such functioning.[44] However, our understanding of such relationships is very incomplete and many surprises may be in store.

The complexity of the issues and the momentous implications for society call for close collaboration between ecologists studying biodiversity, meteorologists studying climate, and policy-makers seeking to guide investments, regulations, and incentives. But such collaboration faces several challenges. Climate modellers typically use grid squares that are 500 x 500km, while ecologists tend to use much smaller field plots, often of less than one hectare and sometimes as small as a laboratory bench; such scale incompatibilities

40 J. Pastor and W. Post, "Response of Northern Forest to CO2-Induced Climate Change" (1988) 334 *Nature* 55.
41 S. Schneider and T. Root, *Wildlife Responses to Climate Change: North American Case Studies* (2002).
42 R. Peters and T. Lovejoy, *Global Warming and Biological Diversity* (1992).
43 J. Cohn, "Gauging the Biological Impacts of the Greenhouse Effect" (1989) 39(3) *BioScience* 142.
44 F. Chapin *et al.*, "Biotic Control over the Functioning of Ecosystems" (1997) 277 *Science* 500.

make it difficult for climate modellers to incorporate experimental results of ecologists, and for ecologists to apply broad climate trends to their particular site. Further, considerable uncertainties and risks surround predictions of the implications of ecological changes. Policy options advocated may involve substantial investments that can have significant social, political, and economic consequences. Developing more reliable predictive power could help society mitigate potential negative impacts and facilitate the adaptations of ecosystems to global changes, thereby minimizing plausible damages and maximizing potential opportunities. The ideal would be multi-scale interconnections among disciplines studying the biotic and abiotic effects of climate change, involving continuous cycling between large- and small-scale studies. Such cooperation would offer improved understanding of the behaviour of complex environmental systems and allow more reliable forecast capabilities for analysing the ecological, social, and economic consequences of global climate change.[45]

Baseline data are also needed on the status and trends of numerous species across all taxa as a basis for determining how climate change is affecting ecosystems; such data are also essential for deciding priorities and practical strategies for conservation. The key is to put policy-making on a firmer factual basis, thereby helping to ensure that the limited resources available for environmental protection are spent most effectively. Perhaps more important, such research could also indicate how various kinds of subsidies may be leading to actions that are contrary to both conserving biodiversity and addressing climate change.[46]

5.2 Understanding impacts on people of changes in climate and biodiversity

While the ecological effects of climate change on biological diversity could well be traumatic, they will only amplify the impacts that are already being imposed on natural systems by humans. As human populations and levels of consumption of natural resources (including energy) continue to rise, so too will the impacts of humans on natural systems. Major changes in the ecological-economic-political-social feedback system can reasonably be expected to follow major changes in climate, thereby precipitating major changes in human civilization.

This is nothing new. Climatic variation has had dramatic impacts on human societies of the past, often being implicated in the fall of ancient civilizations.[47] Modern society, for all its technological marvels, is not immune to climatic impact. In fact, it may well be that our highly specialized society, dependent as it is on a very wide range of resources, energy, alliances, transport, and so forth, is more vulnerable to change than are local communities that control most of the main inputs to their lives. Considerable social consternation could be generated when projected shifts affect agricultural production, particularly since the cause was economic activities (i.e. CO_2 production) that directed differential costs and benefits to various groups. In essence, greenhouse gas-induced environmental changes create an issue of "redistributive justice."[48] The social instability that is likely to follow from such social consternation means that we must generate very robust systems of resource management, able to survive the major social changes which may well arise.

The biological changes brought about by climate change will certainly affect people directly. Changing climates that change the distribution of rainfall will also change the kinds of land use that are possible in various parts of the world, for example turning agricultural land into land more appropriate for grazing, shifting the wheat belt further north, changing the places where irrigated rice can be grown, and so forth. Such fundamental changes in food production historically have led to fundamental changes in societies, including through the impacts of famines, war, and social upheaval.[49] While history is not an infallible predictor of the future, the social impacts of climate change are so far-reaching that they must be brought more forcefully to the attention of policy-makers.

Global warming could also lead to the spread of infectious diseases such as cholera, malaria, and yellow fever. *Anopheles* mosquitoes which carry malaria are limited to areas with average temperatures of 16°C, but with global warming, the range of these mosquitoes could be dramatically extended northward.[50] Further,

45 T. Root and S. Schneider, "Ecology and Climate: Research Strategies and Implications" (1995) 269 *Science* 334.
46 N. Myers and J. Kent, *Perverse Subsidies: How Tax Dollars Can Undercut the Environment and Economy* (2001).
47 R. Bryson, "Civilization and Rapid Climatic Change" (1988) 15(1) *Environmental Conservation* 7.
48 S. Schneider, "The Greenhouse Effect: Science and Policy" (1989) 243 *Science* 771.
49 B. Fagan, *Floods, Famines, and Emperors: El Niño and the Fate of Civilizations* (1995).
50 P. Martin and M. Lefebvre, "Malaria and Climate: Sensitivity of Malaria Potential Transmission to Climate" (1995) 24(4) *Ambio* 200.

warmer temperatures accelerate the lifecycles of disease-carrying insects, encouraging them to feed more often and therefore infecting significantly more people in warmer weather.

Extremes in climate help create conditions that can lead to outbreaks in infectious disease. For example, an epidemic of pneumonic plague in India in 1994 was at least partly due to hot, dry conditions which enabled disease-carrying fleas to thrive. And the 1993 outbreak of hantavirus in the south-western United States appears to have been caused at least partly by extreme climatic events over the previous six years which produced an abundance of the foods that disease-carrying rodents prefer; but the drought, accompanied by federally-funded predator-control programmemes, had killed off many of the normal, but slower-breeding, predators of the rodents – again showing how unbalanced ecosystems can have profound, and unpredictable, effects on humans.

Perhaps the biggest challenge is that problems of biodiversity and climate change lie in the deeply-ingrained everyday behaviour of people, especially in their patterns of consumption of fossil-fuel energy. It is an open question whether even complete knowledge about the causes and future impacts of climate change would lead to significant changes in human consumption of energy in time to avert the predicted changes. And even if people fundamentally changed their behaviour today, the effects on climate, and thus on biodiversity, would still continue for several decades into the future.

6 Using international law to respond to the challenges

. International cooperation is needed to address the linked problems of energy production, climate change and biodiversity, and the Rio Conventions offer a useful mechanism for doing so. The CBD should be seen as a major instrument for implementing the FCCC, as it has several elements directly relevant to addressing the problems of climate change. For example, Article 6 calls on Parties to integrate the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes, and policies. This clearly would include any plans, programmes, and policies dealing with climate change.

Article 7 deals with identification and monitoring. Its sub-Article (c) calls for Parties "to identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques." Since climate change has a significant ecological effect, it clearly falls under this Article.

Several CBD Articles are relevant to the mitigation of the impacts of climate change or adaptation to climate change. Article 8(a) calls for the establishment of a system of protected areas, while Article 8(b) calls for Parties to develop guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity. Such guidelines could reasonably be expected to address the implications of climate change, calling for establishing a protected area estate that both covers the major ecosystem types of each country, as well as creating corridors between protected areas that will facilitate the movement of species with changing climate.

Similarly, promoting the protection of ecosystems, natural habitats, and the maintenance of viable populations of species in natural surroundings (8d) will clearly help facilitate responses to climate change. And Article 8(1) calls for Parties to regulate or manage the processes and categories of activities that are having a significant adverse effect on biological diversity, as determined under Article 7(c).

Article 20 calls for Contracting Parties to take into consideration the special conditions facing developing country Parties, in particular small island states (which have high levels of endemic species, many invasive alien species, and high vulnerability to rising sea levels). It also calls for consideration to be given to developing countries that are most environmentally vulnerable, such as those with arid and semi-arid zones, coastal and mountainous areas. These are countries likely to be particularly affected by climate change, as well as biodiversity loss.

The FCCC can also be seen as an important means of implementing the CBD. It defines "adverse effects of climate change" as changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed eco-systems or on the operation of socio-economic systems or on human health and welfare. Thus it has an inherent interest in the issues being addressed by the CBD.

The objective of the FCCC calls for ensuring that the anthropogenic effects on the climate are reduced to a level that will allow ecosystems to adapt naturally to climate change, and such adaptation will depend on maintaining biodiversity.

Under the FCCC, Parties are called upon to take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects, again implying an important role for the CBD.

Article 4 contains the major commitments agreed by Parties. Several of these are directly relevant to the CBD. Examples include:

- 1(a): Develop national inventories of removals by sinks of all greenhouse gases (which clearly would include forests and other habitats contained within protected areas);
- 1 (b): Mitigate climate change by removals by sinks and measures to facilitate adequate adaptation to climate change (for example, through corridors linking protected areas);
- 1(d): Conserve and enhance sinks and reservoirs of all greenhouse gases, including through forests and oceans as well as other terrestrial, coastal and marine ecosystems;
- 1(e): Adapt to the impacts of climate change through integrated coastal zone management plans, plans for water resources and agriculture, and plans for the protection and rehabilitation of areas affected by drought, desertification, and floods (suggesting a close link with CBD's Article 6);
- 1(f): Take climate change considerations into account in social, economic, and environmental policies and actions;
- 8: Give particular attention to small island countries, countries with low-lying coastal areas, countries with arid and semi-arid areas, forested areas, and areas liable to forest decay; countries with areas liable to drought and desertification; countries with areas with fragile ecosystems, including mountainous ecosystems; and land-locked and transit countries. (These clearly cover virtually all developing countries).

It is apparent, therefore, that the CBD and the FCCC are mutually reinforcing, and that measures taken to implement one can, and should, help implement the other. On the other hand, such mutual reinforcement is not automatic, and indeed some of the measures called for under the Kyoto Protocol to capture carbon dioxide and convert it into living biomass have the potential to lead to continued loss of biological diversity. For example, under the Clean Development Mechanism (CDM), habitats rich in biodiversity may be cleared in order to plant large plantations of just a few fast-growing species that would capture large amounts of carbon dioxide from the air.

As discussed above, invasive alien species can be a very significant ecological problem, so it is essential that carbon sequestration measures carried out under the Kyoto Protocol give preference to native species, and that native grasslands and wetlands not be converted to industrial-scale carbon plantations. Many other management practices could maximize carbon sequestration while contributing to loss of biodiversity, degradation of forest, and an overall diminished quality of the environment. Such inappropriate management practices can include the manipulation of natural or established fire regimes, excessive application of chemical fertilizers and pesticides, thinning that reduces the diversity of forest species, and other intensive forestry practices that lead to the simplification of forest structure.[51] Appropriate environmental impact assessments that include careful consideration of biodiversity issues can help to ensure that carbon sequestration projects designed to implement the Kyoto Protocol also contribute to the objectives of the CBD. This may require, in some cases, changing the legislative framework at the national level.

6.1 Measures to return carbon to vegetation

Under the Kyoto Protocol, industrialized countries may partly offset their domestic carbon dioxide emissions through measures such as afforestation, reforestation, revegetation, and so forth. Developing countries are eligible to implement only afforestation and reforestation projects under the Clean Development Mechanism (CDM). Regrettably, the Kyoto Protocol neglects to include the most appropriate form of carbon storage, namely the conservation of old-growth forests. In most forest ecosystems, most carbon is stored in wood, litter, or partially decomposed organic matter, so replacing unmanaged old-growth forest by young Kyoto stands will lead to massive carbon losses to the atmosphere by replacing a large pool with a minute pool for regrowth and by reducing the flux into a permanent pool of soil organic matter.[52] Protecting existing tropical forests will also maintain historical land surface conditions such as the hydrological cycle, the distribution of latent and sensible heat, cloud cover, and other factors that moderate climate and weather. It would also

51 B. Orlando *et al., Carbon, Forest, and People: Towards the Integrated Management of Carbon Sequestration, the Environment and Sustainable Livelihoods* (2002).

52 E-D Schulze, C. Wirth and M. Heimann, "Managing Forests after Kyoto" (2000) 289 *Science* 2058.

reduce greenhouse gas emissions by keeping the carbon in living trees rather than converting it into wood that may be burned or otherwise enter the atmosphere. Conserving existing tropical forests will produce secondary and tertiary benefits for both climate stability and biodiversity, justifying investments in conserving standing forests as an eligible activity under the Kyoto Protocol.

Table 1. Potential biodiversity impacts of possible types of forest carbon projects

Forest project type	Approach	Use of carbon payments	Impacts on biodiversity
Large-scale industrial pulp or timber plantations	Establish plantations of fast-growing trees for industrial use in deforested and degraded areas	To cover up-front costs of developing new industry	Minimal benefits, especially in monospecific plantations
Agroforestry, community forest plantations	Increase tree-growing and forest cover on farms or associated non-farmed lands to supply tree products or ecosystem services	To provide technical and marketing assistance; pay farmers for carbon benefits produced; increase local organizational capacity to manage and implement carbon contracts	Moderate, requires specific measures to encourage diversity of wild and domestic species
Forest rehabilitation and regeneration	Rehabilitate and regenerate severely degraded natural forests on community land or farms, to supply products and ecosystem services; once regenerated, develop sustainable forest management system with local communities	To provide training, local organization and planning; pay costs of forest protection and management; compensate users excluded from harvesting the regenerating forest	Potentially significant benefits for forest biodiversity, mostly as a side-effect
Strictly protected forest areas	Remove potential threats of deforestation, and manage area so as to minimize human impacts	To compensate sources of deforestation threats; pay costs of forest protection; develop local income sources, outside protected forest, to reduce leakage	Significant benefits; often best approach for conserving wild biodiversity
Multiple-use community forestry within protected forest	Remove potential threats of deforestation and develop sustainable forest management system with local communities (timber, NTFPs, hunting, ecotourism) within protected forest	To compensate sources of deforestation threat; develop local technical and business capacity for managing protected forest	Significant potential benefits, especially when biodiversity management is an explicit project objective

Modified after Smith and Scherr, 2002.[53]

That said, active regeneration of native tree species on land that historically was forest-covered would seem to be the best opportunity for both sequestering carbon and conserving biological diversity under the CDM's current rules. More than a dozen such carbon sequestration forestry projects are now underway in the US, Norway, Brazil, Malaysia, Uganda, Bolivia, Russia and Australia, amounting to over 5 million ha of forest lands. Table 1 contains a list of possible types of forest carbon projects along with the potential impacts on biodiversity.

Carbon emission trading markets established under the Kyoto Protocol are providing new perspectives on how ecosystem services might be part of the economic framework for conserving healthy ecosystems. They have the significant advantage of enabling low-income forest-dwelling people to benefit economically from the effective management of their forest resources, reversing the historical trend that has tended to relegate these forest dwellers to the margins of the economy. However, this opportunity is not automatic; on the

[53] J. Smith and S. Scherr, *Forest Carbon and Local Livelihoods: Assessment of Opportunities and Policy Recommendations*, CIFOR Occasional Paper No. 37 (2002).

contrary, it will require serious commitment to providing benefits to the forest-dwelling people. While the Kyoto Protocol by itself is unlikely to have a significant impact on climate change, at least in the short term, it can provide significant capital flows from energy producers into economically impoverished forest regions, and help to conserve biological diversity while enhancing the capacity of society to adapt to changing conditions.

As one example from Bolivia, the Noel Kempff Mercado Climate Action Project includes eliminating logging and eliminating conversion of forest to agricultural land. It provides alternative economic opportunities for the affected communities, assimilates some areas into the national park, controls fires, includes local communities in park management, and discourages migration by providing key infrastructure for the local population. Some have worried that the prospect of carbon credits for avoiding emissions, such as prevention of planned deforestation, could perversely act as an incentive for accelerating deforestation activities before the conservation measures come into force. Bolivia has responded that deforestation is due primarily to socio-economic reasons and most people involved in deforestation are not aware of the Kyoto Protocol or carbon credits. Greenpeace contends that the Kyoto Protocol is not necessarily the most suitable context for addressing in-depth forest management issues; this point is well taken, but on the other hand, governments should ensure that the Kyoto Protocol does not contribute to worsening these forest management challenges, and instead contributes as best it can to their solution.

7 Conclusions

Policy-makers need better systems for anticipating the impacts of energy generation and use on biodiversity, especially through climate change. They need to be well aware of the threats to security that might be triggered by climate-driven environmental disruptions. While ensuring that mitigation efforts do not inadvertently lead to loss of biodiversity, they should focus efforts on identifying mechanisms for adapting to changes, as these will often include measures to conserve biodiversity.

Species and communities are already being affected in many ways from the direct and indirect impacts of climate change. Populations located near the edge of a species' range, narrowly endemic species, and endangered species that exist only in protected areas or other extremely limited habitats are especially vulnerable to global vegetation shifts. Species that are already threatened by direct exploitation and habitat loss and degradation are likely to be particularly susceptible to new threats. Coastal communities may be inundated as sea levels rise, while altitudinal shifts brought about by increased temperatures would reduce or even eliminate the ranges of montane and alpine species, many of which are already relictual, having been isolated by past climate changes.

The overriding influences on biodiversity over the next few decades are likely to remain energy-mediated land use changes and related human impacts such as invasive alien species and pollution. The challenge posed by energy development and associated climate change needs to be addressed through thorough risk assessments. What are the appropriate responses? Here are five suggestions:

- Establish high-level joint implementation units for the Conventions on Climate Change and Biodiversity as a means of incorporating climate change considerations into biodiversity strategies and action plans, and building biodiversity concerns into planned responses to climate change.
- Ensure that all energy development projects, including alternative forms of energy, are preceded by detailed environmental impact assessments that thoroughly address potential impacts on climate change and biodiversity.
- Ensure that any carbon sequestration measures are consistent with biodiversity conservation objectives; and include forest conservation measures by developing countries as eligible for payments under the Kyoto Protocol's Clean Development Mechanism.
- Support a greatly increased research effort on linkages among energy, biodiversity, and climate change, including collaboration among several disciplines to understand better how the functions of ecosystems respond to climate change, and create national programmes for inventory and monitoring, as a basis for assessing status, trends, and impacts of climate change and biodiversity.
- Greatly expand the scale of areas being managed for the objectives of the Convention on Biological Diversity, using a bioregional or large ecosystem approach covering millions of hectares (often crossing international boundaries) that will enhance adaptability to changing climates.

One final thought: our current patterns of energy use are driving forces that are causing environmental degradation, including both biodiversity loss and impacts on climate change. These involve market and policy failures such as subsidies, under-valuation of biological resources, failure to internalize environmental costs

into prices, failure to appreciate global values at the local level, and so forth. Action to address these market and policy failures can facilitate implementation of both the CBD and the FCCC, and ensure that modern society can continue to develop without further losses of biodiversity.

Sustainable development in the petroleum sector

Jacqueline Lang Weaver[1]

This Paper defines and discusses sustainable development in the oil and gas extraction sector as a "triple bottom line" of economic progress, environmental progress, and social progress. Many large multinational companies (MNCs) in the petroleum sector view these societal goals as congruent with their corporate goals of profitability, environmental mitigation and high labour standards in health, safety, and worker training. After reviewing the unique roles of oil and gas in the world economy and the principles of conservation and prevention of externalities applicable to the production of oil and gas, the Paper evaluates the four mechanisms which can be used to bring sustainable development to the petroleum sector: (1) international law; (2) the national laws of host countries; (3) the private law embodied in the petroleum contract negotiated between the MNC and host governments in developing countries, including the use of industry codes of conduct; and (4) litigation. This analysis concludes that the third mechanism is the one most often used today, particularly in developing countries or failed states, and gives specific examples of sustainable development in practice in the oil sector. A brief section looks at the implications of taxes and subsidies on the supply and demand for oil and gas. The Paper concludes that the principles of sustainable development in the extractive sector of the oil industry today are most evidenced by complex, multi-stakeholder contracts between MNCs, host country governments, local communities, NGOs and sometimes international financing agencies. This project-oriented, semi-voluntary approach can be further promoted by use of the Clean Development Mechanism under the Kyoto Protocol.

1 Introduction and scope of this paper

1.1 The triple bottom line vs. the petro curse

Sustainable development has entered the lexicon of the oil and gas industry's annual reports, trade literature, conference meetings and business councils, much as it swept through the environmental policy and economic development literature and communities over the last two decades. This full sweep reflects both the painful legacy of pollution and poverty too often left by the extractive industries in developing countries in the past and a beam of light pointing to a brighter future. This chapter will focus on the environmental issues facing the oil and gas industry and the question of achieving sustainability in this sector of the worldwide economy.

Many oil companies, and certainly much of their industry literature, have embraced the concept of sustainable development. Many in the industry have adopted the Brundtland Commission's definition of sustainable development as meeting "the needs of the present without compromising the ability of future generations to meet their own needs," and then translated it into a "triple bottom line" of accountability that meshes their business strategy with the three legs of the sustainable development tripod – economic progress, environmental progress and social progress. The triple bottom line, or "TBL" congruence can be summarised as follows:[2]

1. Corporate economic growth, as measured in terms of revenues, earnings, and shareholder return, is the analogue of a nation's economic growth, based on the taxes, royalties, profit-sharing revenues, employment effects and technology transfers that private investment in the oil and gas sector bring to a nation. Access to domestic oil and gas resources can also reduce oil imports which require scarce foreign currency reserves.
2. Corporate environmental stewardship, as measured in terms of increased energy efficiency, pollution reductions, and mitigation projects, becomes the analogue of a nation's environmental goals for cleaner air, water and land, and for the preservation of areas of unique ecological value.

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1 A. A. White Professor of Law, University of Houston Law Center. The author especially thanks the University of Houston Law Foundation for a research grant in support of this chapter; Al Boulos for his thoughtful review of this work; and Dr Usha Shah for her research help.

2 Adapted from Conoco Sustainable Growth Report, p.7 (June 2002). *See generally*, M. Whittaker, "Emerging 'triple bottom line' model for industry weights environmental, economic, and social considerations," *Oil & Gas J.* 23 (20 Dec, 1999).

3. Corporate social progress, measured in terms of community outreach, human rights, labour standards, respecting diversity in the workplace and preventing conflicts, have their parallel in many United Nations resolutions and in the social goals of many nations, including those struggling to create participatory democracies. In addition, a nation's revenues from domestic oil and gas production can be spent on social infrastructure projects that reduce income inequality and provide affordable, clean energy to underserved populations whose only energy sources are firewood, dried dung and canisters of kerosene.

This triple bottom line is mirrored in the definition of sustainable development used by the United Nations Development Programme and the World Energy Council in their World Energy Assessment as "energy produced and used in ways that support human development over the long term, in all its *social, economic, and environmental* dimensions."[3] Bringing affordable, modern energy resources, especially gas, liquid fuels, electricity and more efficient end-use technologies for cooking, heat and light to the two billion people on earth who live in desperate poverty is a large part of the definition. Clean, modern energy sources can reduce deforestation and lung-related illnesses prevalent in wood-burning communities.

The triple bottom line is of special import to the multinational companies (MNCs) and state-owned energy companies that currently dominate the production of oil and gas globally. Juxtaposed against the triple bottom line approach to resource development is evidence of the "petro curse." Too many developing nations became poorer, not wealthier, as MNCs and state-owned enterprises extracted their natural resources to supply overseas markets with the necessities and consumer luxuries of modern life. In the formerly Communist nations, multiple five-year plans of increased energy production fueled the military-industrial complex, but left local communities and regions with enormous environmental degradation from the extraction and combustion of energy with virtually no pollution controls. Even the high oil prices in the 1970s led to unsustainable growth patterns and social upheaval as oil-exporting nations pledged their petroleum resources as collateral and became saddled with huge debts to international institutions when oil prices later fell. Oil revenues in "failed states" have fueled years of civil conflicts between competing war lords, devastating subsistence farmers and nomads caught in the turmoil. Kleptocrats and cronies of military dictators treated petroleum revenues as their personal sources of treasure and hid billions of dollars of their nations' wealth in private bank accounts abroad. Inequality in income distribution, a potent source of social discontent, often widened, both internally and between the developed and developing nations.

Between 1960 and 1993, the average rate of growth in per capita Gross Domestic Product (GDP) for 85 developing countries was much lower in the resource-rich countries, including the oil exporters, than in the resource-poor countries.[4] Far from fuelling economic growth, oil and gas extraction seemed linked to a "petro curse" of stagnation, inflation, pollution, debt, corruption and income inequality. A large body of economic development literature has examined the reasons for this correlation, often finding that it is due to deliberate, misguided national objectives and, more fundamentally, to the lack of democratic institutions, the rule of law, and cultural attitudes toward work, education, gender equality, meritocracy and technological innovation, rather than being a fatal consequence that must inevitably accompany resource extraction.[5]

Thus the hope persists that a nation can turn its oil and gas bounty into a positive force by following a path of sustainable development. Some statistics show the allure of continuing this quest. A World Bank study of land use in the Peruvian rainforest calculated that the present value of harvesting its hardwood was $ 1000 per hectare, but that the present value of a mix of fruit, latex and selective timber harvesting was $6820. What is a hectare of Peruvian rainforest worth if it overlies a large oil or gas field? One can posit a 50 million barrel oil field which will cause 100ha of necessary forest destruction to develop. The project will also result in an additional 2,000ha of destruction from squatters and loggers who gain access to new roads. The oil is worth about $1 billion (at $20 per barrel). Assuming the host country will receive at least 25% of these revenues in

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3 *The World Energy Assessment: Energy and the Challenge of Sustainability*, p. 3 (2000, UNDP). This comprehensive energy policy for global sustainability was produced by the UN Development Programme, the UN Department of Economic and Social Affairs, and the World Energy Council, a coalition of industry, government, academic and NGO members with expertise in energy and environmental matters.

4 R. Auty and R. Mikesell, *Sustainable Development in Mineral Economies* at 86–87 (Clarendon Press, Oxford 1998). *See also,* T. Karl, *The Paradox of Plenty: Oil Booms and Petro States* (Univ. of California Press 1997).

5 *See generally,* D. Landes, *The Wealth and Poverty of Nations* (W.W. Norton & Co. 1998); W. Ascher, *Why Governments Waste Resources: Policy Failures in Developing Countries* (Johns Hopkins Univ. Press 1999). Failure to account for these institutional and cultural barriers to sustainable growth patterns often explains why the "overnight" adoption of Western-style models of market-oriented laws has been unsuccessful in achieving rapid reform of state economies. *See, e.g.,* B. Black and A. Tarassova, "Institutional Reform in Transition: A Case Study of Russia," Stanford Law School, John N. Olin programme in Law and Economics, Research Paper 238 (2002).

taxes, royalties and local purchases, this amounts to about $120,000 per hectare for all 2,100 destroyed hectares and $2.5 million per hectare for the project's necessary destruction. If the project can be designed with strong environmental safeguards and if the nation's revenues are used for health, education and infrastructure, including the provision of clean and affordable energy to its citizens, both in the local community and nationally, the case for development is a strong one. History might place low odds on this prospect. Can a commitment to sustainable development by private investors or governments change the odds?

1.2 Scope of this chapter

Because other chapters in this book address Energy and Climate Change directly, this chapter will more narrowly focus on the unique characteristics of oil and gas as energy sources and on the prospects for sustainable development in the production of oil and gas versus its combustion and end use. It is primarily the extraction phase of oil and gas that has caused concerns about the petro curse in developing countries in the past. This chapter does address some of the issues in building oil and gas pipelines, but it does not discuss the environmental impacts of tankers or refineries. Tanker spills, while spectacular and sometimes devastating to impacted ecosystems, are relatively rare, and should become even less common as double-hulled tankers and additional safety devices increase in use. Most marine pollution from oil products comes from fuel users, not from producers or shippers.[6] Refineries and tanker terminals, so often located in coastal bays and estuaries or along rivers, certainly have environmental impacts worthy of discussion, but their impacts are similar to power plants, chemical plants or any other large-scale enterprise located near bodies of water.

After addressing sustainable development in the particular context of petroleum extraction, this chapter briefly discusses three other important issues related more generally to sustainable development in the petroleum sector: (1) the implications of the Kyoto protocol on global climate change; (2) the effect of subsidies on energy use and production; and (3) the use of pricing and taxing mechanisms to mitigate the externalities of fuel use. Externalities are the economist's term for impacts or costs, such as pollution-induced damage or illness, imposed on one group in society by another's acts.

1.3 Factors unique to natural gas

Methane, or CH_4, is the principle ingredient of natural gas, and it is nature's most pervasive hydrocarbon. Cows belch it and swamps bubble with it. Mix organic waste with water in an airtight tank, add anaerobic bacteria, and the microbes will digest the waste and produce methane.

Natural gas plays a unique role in discussions of sustainable development. It is often produced with oil, and the two fossil fuels earn the opprobrium of those for whom sustainable development means greater reliance on renewables, such as wind and solar and biomass. Methane is a potent greenhouse gas (GHG). Each unit of methane released into the atmosphere has about 20 times the heat-trapping potency of a unit of CO_2. However, the carbon content per BTU of gas is only 55% of that for coal and 70% of that for oil, so its use as a substitute for the other fossil fuels significantly reduces CO_2 emissions. Natural gas is by far the cleanest burning of the three major fossil fuels. It is virtually free of sulphur and toxic metals such as mercury. For these reasons, gas plays a unique role in the debate over sustainable energy production and use. If nations shift from coal to gas to generate electricity in power plants, emissions of CO_2 and of sulphur and nitrogen oxides are reduced substantially. England took this path many years ago and eliminated the killer fogs that once smothered London. China sees this shift as a major tool for reducing the heavy pollution levels that enshroud some of its major cities and rural areas. Already, China has achieved a dramatic slowing in its emissions of CO_2. Its annual output of CO_2 actually declined by 17% while its GDP grew by 36% during the mid-1990s.[7] During these years, China ended coal subsidies, shifted to market pricing for fuels, curbed coal combustion and encouraged energy efficiency. In the United States, natural gas usage in power plants has soared. About 80% of all new power plants planned in the USA in the next 10–15 years are projected to use gas turbines to produce electricity.

6 Almost 85% of gasoline and oil spills in North American ocean waters derive from land-based runoff and emissions from small boats and jet skis. About 8% comes from tankers and 3% from exploration and production. Worldwide, about 70% of marine pollution comes from fuel users rather than from production or shipping. National Research Council (of the National Academy of Sciences), "Oil in the Sea III: Inputs, Fates, and Effects" (prepublication version from National Academy Press available at http://www.nap.edu/books

7 E. Eckholm, "China Said to Sharply Reduce Emissions of Carbon Dioxide," *N. Y. Times*, 15 June, 2001 at A1.

Natural gas power plants have other advantages. Both small- and large-scale gas power plants are equally feasible. The smaller scale plants can be built relatively cheaply and quickly compared to nuclear and coal plants, and they can be turned on and off quickly. Companies have used gas turbine plants for years as sources of "peaking" power for times of high electricity demand. The mechanics are simple: gas is burned in the functional equivalent of an airplane's jet engine which turns the wheels of an electric generator. In addition, the latest generation of advanced Combined Cycle Gas Turbines (CCGTs) now has efficiency rates of 58%. These plants include both a gas turbine and a steam turbine that uses the excess heat thrown off by the gas turbine to create steam which turns a second generator. Such plants are able to produce energy efficiencies higher than competing technologies using other fuel sources. A new "H System" turbine developed by a public-private research and development effort between the Department of Energy (DOE) and GE can operate at a 60% efficiency rate, a breakthrough touted as the equivalent of running the four-minute mile. This increased efficiency could translate into savings of $30–40 million over the lifetime of a plant, in addition to reducing pollution from less fuel use.

A study by the Environmental Law Institute analysed the benefits and costs of reducing by 50% the use of coal in electricity generation in the USA by the year 2010, using natural gas turbines and a small increase in wind power and other sources as substitutes for coal. The transition would lower pollution levels dramatically: SO_2 emissions would fall by 50%, NOx by 40%, mercury by 60%, and CO_2 by 25%. The price of electricity would rise about six-tenths of a cent per kilowatt hour above the business-as-usual scenario. The total health benefits of the emissions reductions would offset the increased cost of electricity. Moreover, an integrated approach to pollution would prevent costly investments in end-of-stack controls on single pollutants from older coal-fired plants.[8]

Natural gas-powered vehicles, especially buses and corporate fleets of vans and trucks using compressed natural gas, are already in use and are much safer and more reliable than those of a decade ago. These vehicles produce significantly less air pollution than gasoline-powered cars. Extensive research is also underway in the development of fuel cells powered by natural gas. Fuel cells are electrochemical devices which create electric current by combining oxygen and hydrogen ions without the need for a mechanical generator. Cars powered by fuel cells produce mainly water as a waste product.

Because natural gas is such a "golden" fuel compared to oil and coal under current technology, its projected price is the key variable determining the degree to which energy users will shift away from alternative fuels into natural gas in a competitive market. For example, in its environmental impact statement on the restructuring of wholesale electricity markets in the USA, the Federal Energy Regulatory Commission (FERC) projected that competitive conditions would favour gas over coal, and therefore the move to competitive markets in electricity would have beneficial rather than adverse effects. However, the Environmental Protection Agency (EPA) disagreed with FERC's conclusion, projecting instead that competition would result in increased generation at older, high-polluting, coal-fired power plants which had often been exempted (or "grandfathered") from Clean Air Act requirements. These plants have a low, depreciated cost basis and use relatively low-cost coal, against which the new gas turbine plants cannot compete, especially if environmental regulations do not force the older plants to install additional pollution controlequipment.[9]

Because the relative price of gas versus coal is so important in measuring pollution externalities of future energy use, and the demand for gas is projected to increase steadily, a large number of studies have looked at the adequacy of natural gas supplies over the next half-century, and even beyond. Conservatively, most experts agree that at present rates of use and current technology we have enough natural gas to last at least a half century in the USA. The Environmental Law Institute surveyed government and industry gas supply forecasts to assess the US ability to switch from coal to gas.[10] Official estimates of recoverable gas reserves based on current prices and little technological growth total 1,331 trillion cubic feet (TCF), or about 60 years of supply. However, technical progress measured by the historical trend adds another 100 years to future gas supplies. If technology instead advances at the rapid rate of the last decade, then it will unlock enormous gas resources currently considered economically unrecoverable in coal bed methane (300 TCF), tight sands (6,600 TCF), deep gas deposits (3,200 TCF), and geopressurized aquifers (5,700 TCF). The *World Energy*

8 Environmental Law Institute, *Cleaner Power: The Benefits and Costs of Moving from Coal Generation to Modern Power Technologies*, ELI Research Report (May 2001).

9 F. Bosselman, J. Rossi and J. Weaver, *Energy, Economics and the Environment* 901–05 (Foundation Press 2000).

10 Environmental Law Institute Research Report, "How Abundant? Assessing the Estimates of Natural Gas Supply" available at www.eli.org/bookstore/rrgas99. If coal-fired electric generation in the USA were to be reduced by 50% by 2010, natural gas demand would increase 25%. ELI, *Cleaner Power*, *supra* note 8.

Assessment also agrees that the resource base for both oil and gas is large enough to last comfortably for another half-century at least, with prices not much different from today's.[11]

The potential gas stored in methane hydrates could add an astounding 200,000 TCF of gas to the resource base. A methane hydrate is a cage-like lattice of ice in which molecules of methane are trapped. Hydrates have been found underneath permafrost and in ocean beds. Geologists now estimate that the amount of methane trapped inside hydrates is about twice the amount of carbon held in all fossil fuels on the planet. While hydrates produce relatively small amounts of CO_2 and particulates (and no sulphur) when burned, uncontrolled releases of methane from the hydrate's cage into the atmosphere could result in a massive injection of greenhouse gases. Much research is required to determine if methane can be captured from hydrates with minimal venting into the atmosphere.

Thus, it appears that gas can be used as an energy source for centuries, depending on technology and price. The Environmental Law Institute study concluded that if the price of gas drops significantly below $2 per thousand cubic feet (MCF), supplies will fall below even the official reserve estimate of 1,331 TCF. On the other hand, a price of $4 per MCF would trigger major new supplies around the world, and would allow liquefied natural gas (LNG) from large foreign reserves to enter many markets in the USA and abroad. LNG is natural gas which is cooled to minus 160 degrees Centigrade and compressed so that it can be stored and shipped in LNG tankers. Once delivered, it is returned to its natural state as a gas and can be fed into any existing network of gas pipelines. For comparison, the price of natural gas as of 26 May, 2002 is $3.35 per MCF. Even at this price, many energy companies are making major investments in LNG tankers and terminals to bring gas from developing countries to markets in Japan and the USA.

The $4 price would also make large Alaskan gas reserves, now trapped in the Prudhoe Bay oil field, marketable via a gas pipeline to the lower 48. One energy company has identified 1,200 "stranded gas" fields around the world, largely fields which have no pipeline access to transport the gas. With an adequate gas price, long-distance pipelines, often crossing several national borders, are feasible to bring this gas to market.

Many of the major energy companies have launched large research and development projects, including pilot plants, aimed at converting gas to liquid in so-called "GTL" plants. Such plants combine methane with carbon monoxide and hydrogen to form middle distillates that can be refined into methanol, gasoline, diesel fuel or other chemical feedstocks. The conversion makes the now-liquid "gas" transportable to markets via pipelines, tankers, railcars or trucks. If Alaskan gas were converted to synthetic oil, then the Trans Alaskan Oil Pipeline System could be used for another 25 years rather than building a separate gas pipeline. Synthetic gasoline and diesel fuels derived from natural gas burn much more cleanly than the current products based on crude oil.

In summary, estimates of both the supply of and demand for natural gas have been increasing. The price of natural gas will be a key determinant, perhaps the key determinant (absent additional government regulation of greenhouse gases and pollution from coal and oil combustion) of the shift to cleaner burning fuels, including the fuel required in hydrogen fuel cells. Many of the new technologies, especially methane hydrates and coalbed methane, have environmental externalities which must be addressed. The cost of these environmental control measures will also affect the supply and demand equation for natural gas. Of course, long-term predictions of the price of any fuel must be treated warily, given that the consensus forecast made in the 1970s by almost every major industry and government association projected the price of oil in the year 2000 to be $70 per barrel (versus the actual price of about $30). Nonetheless, it appears that supplies of natural gas will be adequate to meet increased demand in the next several decades, and probably for the next half-century at a price not much greater than $3 per MCF. Importantly, the higher the price of natural gas, the more competitive become coal and renewables.

1.4 Factors unique to crude oil

Crude oil has a unique role in world energy: the transportation sectors of all nations' economies are almost 100% dependent on products refined from crude oil, and this dependence is at the heart of global geopolitical factors that transcend mere economics. The price of crude oil is subject to the vagaries of geopolitics, as the world learned during the 1973 Arab oil embargo of western nations. The use of oil as a weapon against the West was a watershed event which transformed the international energy industry. The oil price shocks of 1973 and 1978 caused profound dislocations to importing nations, as prices of crude oil climbed from

11 *World Energy Assessment, supra* note 3 at 148.

$3/barrel to almost $40/barrel. In the USA, unemployment rose from 4.7% in the fall of 1973 to over 8.5% by the end of 1974. Inflation jumped from an annual rate of 6.1% to 11.4% over the same period, resulting in a new vocabulary word, stagflation. The balance of payments deficits of poorer oil-importing countries ballooned. Oil has also been used as an environmental weapon. During the Persian Gulf War of 1990-91, Saddam Hussein invaded Kuwait and set fire to almost all of Kuwait's 1,000 prolific wells, creating an environmental inferno of fireballs, sulphurous clouds, soot, greasy black rain and oil-coated coasts and soils.

The oil shocks of 1973 and 1978 had two enormous effects on oil markets. First, higher prices led producers to discover many more sources of oil in many different countries around the globe, from the North Sea to Africa, so importing nations could diversify their sources of supply. Secondly, consumers reacted to the price increases by conserving energy in unprecedented amounts. Although it took a few years, by 1981, a combination of fuel switching (to coal, nuclear and gas) and technological improvements in energy efficiency led to a third "oil shock" – the shock of seeing prices plunge in early 1981. By 1985, the USA was 25% more energy efficient and 32% more oil efficient than it had been in 1973. By 1983, oil consumption in the entire noncommunist world was about six million barrels less than daily consumption had been at its peak in 1979.[12] The collapse of world oil prices in 1981 then sent the economies of many oil-exporting nations (and of many producing states like Texas) into a tailspin, causing social distress in these regions.

International crude oil markets are still subject to manipulation by the large exporting countries. In December 1998, world oil prices had fallen to $10/barrel, a near-historic low (if adjusted to constant dollars) because of weakened demand due to the Asian financial crisis. OPEC export revenues had fallen by 35% in just one year, to the lowest point since 1972. In March 1999, OPEC ministers, joined by non-OPEC producing countries like Mexico, Norway and Russia that also faced steep budgetary losses, agreed to reduce output. By July 1999, prices had risen to almost $20/barrel. By March 2000, the price of a barrel of crude oil reached more than $30 and soaring gasoline prices had become a serious political issue in many importing countries.[13]

More recently, the events of September 11 illustrate starkly the Faustian bargain of crude oil dependency. Some Middle Eastern countries are led by rulers hostile to Western culture and power. Oil can finance terrorism and buy weapons of mass destruction to attack perceived enemies. Few Middle Eastern nations are democracies. Even the rulers of moderate or "friendly" oil-rich nations are constrained by the need to appease radical extremists in their own countries. Both Europe and the United States have sought to diversify their sources of oil imports to reduce the geopolitical risk of oil embargoes, but despite discoveries of oil in many new areas around the world, the continued global dependence on crude oil from the vast Mideast reserves is a fact of life in every projection of future energy supply and demand over the next few decades. [14]

To guard against future embargoes, the United States has created strategic petroleum reserves that store crude oil underground in large salt dome caverns for use in an emergency. Europe has also taken measures to stockpile crude oil. The cost of maintaining these stockpiles and of keeping a military presence to defend friendly oil exporting countries can validly be recognised as an externality unique to crude oil use.

While some pessimists in the industry forecast that the "big rollover," i.e., the predicted date when existing oil production and new discoveries can no longer replenish the world's reserves as quickly as they are depleted, will occur as early as 2010, the consensus view today is that oil reserves, like gas reserves, will remain plentiful for several more decades.

1.5 Renewables versus oil and gas

The relative price of renewable energy sources (wind, solar, geothermal, hydropower and biomass) compared to oil and gas is also a key determinant of the shift in use between these two fuel groups. Indeed, were oil and gas prices to rise due to increasing scarcity, markets for renewables (but also for coal and nuclear) would become more profitable to exploit without the need for government subsidies or other policy interventions. A Resources for the Future study of the performance of renewables in penetrating the market for electricity generation in the United States over the last 30 years shows that renewables have performed quite well in meeting expectations and policy goals of reduced costs. However, the costs of generating electricity using fossil fuels fell relatively more (due to the deregulation of natural gas prices, technological change reducing the costs of finding and producing oil and gas, more diverse and competitive world oil markets, dramatic cost

12 Bossclman *et al.*, *supra* note 9 at 1098.
13 *Id.* at 1100–01.
14 Energy Information Administration, *International Energy Outlook 2002* at 38–39 (US Department of Energy 2002). In 2000, two-thirds of the crude oil trade to industrialized countries came from Persian Gulf exports.

reductions for rail transportation of coal, and the rise of competitive wholesale generators under the Energy Policy Act of 1992). Thus, while renewable technologies have performed well on an absolute scale, their relative growth in penetrating electric markets has been quite small. In addition, environmental laws and technological change have improved the environmental performance of newly constructed fossil fuel plants quite dramatically over the last 30 years, reducing the relative advantage of renewables in this sphere as well. Thus, the study concludes: "The ultimate impacts of these changes in the regulation, technology and market structure of fossil fuels have been mostly favourable for electricity consumers; they have also been frustratingly disappointing for the fate of renewable technologies."[15]

2 Petroleum conservation and the externalities of extraction

2.1 Petroleum conservation as sustainable development

Petroleum occurs in both liquid and gaseous states underground, depending largely on the temperature and pressure at which it is found. It is a chemically complex substance composed of carbon and hydrogen with trace amounts of oxygen, nitrogen and sulphur. Oil and gas are sometimes found together in a reservoir, with a lighter gas "cap" sitting on top of the heavier oil stratum. Some fields produce only natural gas which is comprised largely of methane (CH_4), a colourless and odourless gas; other fields produce mostly oil, although some gas production inevitably accompanies oil production. If no market or pipeline connection exists for the gas which is brought up with the oil, it is either flared or reinjected into the reservoir.

Before the 1950s, vast quantities of unwanted gas (trillions and trillions of cubic feet) were vented or flared into the atmosphere as a waste byproduct of oil production in the United States. Today, flaring is rare. Natural gas is far too valuable as a fuel source, state conservation commissions have largely prohibited the practice, and a network of pipelines exists to bring the gas to market. However, large-scale flaring still occurs in some countries, *e.g.*, Nigeria, Brazil and Siberia, where oil production began without requirements for gas reinjection and where inadequate domestic infrastructure and markets exist to use the gas. Astronauts report that the gas flaring in Siberia outrivals Paris as the "greatest light show" on the Eurasian continent.[16] As noted above, natural gas may be compressed into LNG or converted to a synthetic liquid petroleum if quantities are sufficient and the price is right. Nigeria is currently promoting LNG projects to help reduce its gas flaring, which it hopes to eliminate by 2005.

Oil and gas reservoirs can be inefficiently produced if certain conservation principles, founded on petroleum engineering science, are not followed. Most oil reservoirs have a maximum efficient rate of recovery, or MER, which, if exceeded, will result in leaving a significant quantity of oil locked in the underground reservoir. Controlled production rates which conserve the pressure of any natural gas drive or water drive pushing oil towards well bores are essential in order to maximize the percentage of oil that can be recovered. In the early development of the oil industry in the United States, uncontrolled, competitive drilling and production resulted in "boom to bust" cycles in which 95% of the oil in the field was left in the reservoir. Good engineering techniques can assure that 30–85% of the oil in a field is recovered.[17]

For the first half of the 20th century, "sustainable development" of oil and gas meant adopting the laws and regulations necessary to prevent the underground waste of oil and gas through well spacing and permitting requirements, prorationing controls, no-flare orders, and pooling and unitization statutes that prevented competitive drilling and production. In the United States where oil and gas can be owned by private landowners, these regulations are largely the jurisdiction of conservation commissions in each of the producing states (and of the Department of Interior for federal offshore leasing). In most of the rest of the world, oil and gas are owned by the sovereign government which can either grant concessions to private investors to develop the resource or develop itself through a national oil company. By granting large blocks of

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15 J. McVeigh, D. Burtraw, J. Darmstadter, and K. Palmer, "Winner, Loser, or Innocent Victim? Has Renewable Energy Performed as Expected?," Resources for the Future Discussion Paper 99–28 at iii (1999), available at the Resources for the Future website, www.rff.org. This study only discussed generation costs. Solar and wind power also incur dispatching costs and require backup power to assure reliable electricity supplies.

16 R. Gavigan, "Siberia's Environment: A Challenge to Traditional Thinking," 8 *Georgetown Int'l Envtl L. Rev.* 333, 336(1996). The Russian oil fields flared 16 billion cubic metres of gas every year from 1976–96. Acid rain from SO_2 produced by gas flares in the Tyumen region destroyed 1,500 square miles of forests. One out of every ten barrels of oil produced in Russia was lost to spills or leaks.

17 *See generally*, S. McDonald, Petroleum Conservation in the United States: An Economic Analysis (Resources for the Future, Johns Hopkins University Press 1971); J. Weaver, Unitization of Oil and Gas Fields in Texas, Ch. 2 (Resources for the Future 1986).

land in concession agreements, the government reduces the potential for competitive, wasteful overdrilling and production that so plagued the early development of oil and gas in the United States on small tracts. Nonetheless, the host government should have a legal mechanism in place to assure that the parties withdrawing oil and gas are following petroleum engineering principles for sound conservation. Unfortunately, evidence suggests that both host governments and their concessionaires have sometimes preferred immediate cash flows from rapid production, resulting in suboptimal recovery rates. This is wasteful development.

In more recent decades, this body of conservation law has used more sophisticated analysis of optimal patterns of depleting non-renewable resources such as oil and gas, for purposes of sustainable development. The first involves integrating the depletion of natural resources into national income accounting by deducting the value of the resources produced and used from measures of a nation's Gross Domestic Product (GDP). Without such an accounting, a nation which is rapidly depleting its finite source of a mineral may experience high rates of economic growth, but this growth is not sustainable (correspondingly, as technology advances and new reserves are proved up, the stock of natural resources capital increases). The second advance in "green" accounting further deducts damage to the environment from the measure of Gross Domestic Product. For example, a 1995 study by the Japanese Economic Planning Agency concluded that air and water pollution and ecosystem damage cost the Japanese economy $ 100 billion or two per cent of Gross Domestic Product in 1990.[18]

Some resource-dependent states and nations have adopted trust funds which place a certain percentage of the royalties and tax revenues from resource extraction into a fund reserved for future use. When the resource is depleted, the fund will continue to generate interest payments which can provide services to those citizens who can no longer benefit from the resource-generated rents enjoyed by earlier citizens. These trust funds can be useful devices to assure intergenerational equity, but they reduce the investment funds currently available for social infrastructure and economic diversification. In nations with pressing immediate needs to solve problems of social equity, poverty and health, such trust funds may seem a luxury. Nonetheless, all resource-extracting nations should engage in long-term planning for the day when their resources run out. At a minimum, sustainable development requires that such nations save and invest in social capital at a rate which replaces the natural resource capital being depleted.[19]

2.2 Overview of externalities

The externalities of oil and gas production and use occur at all levels – local, regional, national and international. The local and regional impacts are primarily related to the physical facilities involved in the production and development of oil and gas fields in the host country. The national and international impacts are related primarily to the long distance transportation of oil and gas and its products and to the air emissions generated from their use in the consuming countries. Many excellent books and articles describe the physical processes and externalities involved in the development of oil and gas fields and the best practices used to mitigate disturbances.[20] In particular, the International Union for Conservation of Nature and Natural Resources (IUCN) has worked with the petroleum industry through the E&P Forum to produce environmental guidelines for oil and gas exploration and production in sensitive ecosystems such as Arctic onshore regions and coastal mangrove areas.[21] This section of the chapter will briefly survey the major impacts of each stage of development. The following section then discusses mitigation measures at each stage, followed by some examples of measures used in sensitive ecosystems. Both sections rely largely on the IUCN/E&P Forum Guidelines.

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18 D. Cole, "Accounting for Sustainable Development," 8 *Fordham Envtl L. J.* 123 , 131 (1996). *See generally,* R. Solow, *An Almost Practical Step toward Sustainability* (1992). Economists have also developed models for optimal levels of pollution. *See generally,* B. Field and M. Field, *Environmental Economics: An Introduction,* Ch. 5 (3d ed. McGraw Hill 2002).

19 Auty and Mikesell, *supra* note 4 at 47–80.

20 *See, e.g.,* F. Jahn, M. Cook and M. Graham, *Hydrocarbon Exploration and Production* (Elsevier 1998); Celia Campbell-Mohn, Ch. 15 "Petroleum," in *Environmental Law from Resources to Recovery* (Environmental Law Inst. 1993); S. Patin, *Environmental Impact of the Offshore Oil and Gas Industry* (1999 Ecomonitor Pub.).

21 *Oil and Gas Exploration and Production in Arctic and Subarctic Onshore Regions: Guidelines for Environmental Protection* (1993, IUCN); *Oil and Gas Exploration and Production in Mangrove Areas: Guidelines for Environmental Protection* (1993, IUCN). The E&P Forum is an international association of oil companies and petroleum industry organizations formed in 1974 to represent its members at the International Maritime Organisation and other United Nations agencies and governmental bodies. Another professional trade association, the International Association of Geophysical Contractors, has also produced environmental guidelines for worldwide geophysical operations (exploration only, not production), with special addenda devoted to desert, rainforest, wetland, mountainous and marine operations.

2.3 Exploration

Exploration is the process of gathering information about the hydrocarbon potential of porous rocks that may lie thousands of feet, indeed several miles, beneath the land surface. It is the least environmentally intrusive phase of oil and gas development, but it nonetheless has external impacts. The initial phase of the search for geological basins that may hold such rock often relies on airborne surveys or satellite imaging maps. For example, magnetometers on aircraft can measure changes in the earth's magnetic field caused by variations in the magnetic properties of rock. Land disturbance is minimal, although low-flying planes may affect wildlife. Some countries prohibit low-level flights. In this event, remote-sensing satellite images or on-the-ground surveys using gravity meters to measure differences in rock densities or electromagnetic methods are the only options. Such surveys have little impact on the surface beyond that required for foot traffic and temporary localized surface impacts at measurement points. These survey methods are used in rugged terrain where the more capital-intensive seismic surveys described below are infeasible. Even though the "rock knocking," foot-travelling geologist has virtually no impact on the surface, his presence may be perceived as a harbinger of industry and pollution to come. Some groups, like Greenpeace, seek to block exploration at its earliest stage in order to prevent subsequent activity.

Seismic surveys use acoustic waves generated at the surface to penetrate the earth's crust and reflect back from subsurface rock intervals. The signals are recorded and analysed, often with the help of supercomputers, for patterns which reveal structures most likely to contain hydrocarbon resources. The acoustic source is produced in three ways: using surface detonations, shot-hole detonations, or Vibroseis trucks which produce vibrations rather than using explosive charges. Small, highly sensitive geophones are laid in survey lines on the surface to receive the reflected signals from the energy waves sent through the earth. The signals are then set to a nearby truck with recording equipment.

Surface detonations use small explosive charges set on wooden stakes a few feet above the ground. This method is often used in remote areas, with helicopters transporting workers and equipment along the survey line so that little impact occurs on the land. However, the noise can be heard for considerable distances, depending on surface terrain, and can have significant impacts on wildlife and on people.

Shot-hole operations use small explosive charges set at the bottom of a hole drilled anywhere from 10–200 feet deep and about four inches in diameter. Usually only a dull thud is heard on the surface. However, this operation requires a drilling crew, motorized vehicles, a shot-hole plugging crew, a detonation crew, and a reclamation and clean-up crew.

The Vibroseis method uses trucks equipped with a vibrator pad which is pressed against the earth and vibrated to generate energy waves. Usually four or five trucks will move together in a convoy and coordinate the vibrating intervals. The pad leaves little impression on the land surface, but the trucks are large and heavy and may impact the surface of the land, especially by leaving tyre ruts on sensitive soils. The trucks require flat surfaces and cannot be used in rough terrain.

Helicopters may be used to transport equipment into inaccessible areas or areas of great ecosystem value. Heliportable operations use smaller drilling equipment designed to separate and reassemble easily on site, followed by traditional shot-hole methods.

In the past decade, major technological change has significantly affected the seismic industry. Super-computers can now convert seismic data into three dimensional colour images of underground strata rather than the black, linear squiggles of "2D" seismic. However, 3D seismic demands much more data gathering in the field. Instead of running lines only in horizontal rows, 3D seismic demands intersecting lines – a chequered effect on the surface rather than a mere striped effect. If Vibroseis trucks are used, the surface impacts of these closely spaced lines and rows are doubled. 3D seismic is considerably more expensive than 2D seismic at both the data gathering and data processing stages, but 3D analysis is often so much more accurate that it can save millions of dollars by decreasing the risks of drilling even one dry hole. The fewer dry holes, the less environmental impact at the drilling stage.[22]

[22] 3D seismic has dramatically increased the success rate of drilling an exploratory well from about 20%–50%, reducing finding costs by 40%. D. Bohi, Changing Productivity in US Petroleum Exploration and Development at 45–50, Resources for the Future Discussion Paper 98–38 (June 1998).

2.4 Exploratory drilling

There is still only one sure-fire method of determining whether oil and gas actually do lie beneath the surface, and that is to drill an exploratory well. Such a well is far different from the shallow shot-holes drilled during seismic operations. It is drilled using a rig capable of drilling a seven to eight inch hole many thousands of feet into the earth where the potential reservoir has been mapped. Rigs may be brought in by land, water or air. Once on site, the rig and a self-contained support camp are assembled. The rig modules include a derrick, power generators, fuel and water tanks, and equipment to handle drilling mud and cementing. A one-hole drilling rig will require about two acres (5,000–20,000m^2) and a nearby support camp will occupy 1,000m^2.

Drilling operations are conducted around-the-clock and generally take one or two months. Testing the rocks and fluids brought up by the exploratory well takes about another month. If the tests are positive for continued activity, the drilling rig will be dismantled and moved to another site where additional exploratory wells will be drilled. The results from these wells will undergo appraisal to determine the size and nature of the reservoir, its commercial potential, how many development wells will be required and whether further seismic work is necessary. To minimize surface disturbance, the additional exploratory wells may be drilled from a surface location site adjacent to the existing well, but then deviate directionally underground to reach out to other parts of the reservoir. Directional drilling is another major technological advance in the industry in recent decades.

2.5 Development and production

A large reservoir will require drilling many more development wells to produce all of the oil and gas in it. Multiple production wells can be drilled from one pad and one wellbore may be used for multiple completions into different producing strata, thus reducing infrastructure cost and surface disturbance. Many of the production platforms offshore hold the surface wellheads for nine wells which spread out radially underneath the sea floor. A central production facility will gather and separate the produced fluids (gas, oil and water). If the field produces large quantities of natural gas, field processing plants will often process the gas to condense its heavier components into liquid hydrocarbons separated from the resulting "dry" gas. Once gathered, separated and field processed, transportation options must be assessed. Usually oil and gas pipelines are the most efficient transportation, although oil can also be transported by truck or barge. The crude oil and gas will be shipped to terminal facilities for domestic or export markets. Crude oil may be loaded onto large tankers for voyages of thousands of miles to distant markets. Natural gas may be liquefied at terminal facilities and loaded on to LNG (liquefied natural gas) tankers. Otherwise, natural gas markets are limited to areas which can be served by pipeline transmission.

At some point, reservoirs lose their ability to recover oil through primary recovery which uses natural underground pressure differentials to push the oil toward the well bores. Then, if it is commercially viable, operators will use secondary or tertiary recovery methods to increase rates of recovery. Such processes use injected water or gas (sometimes carbon dioxide) to repressure the reservoir and push oil toward producing well bores. Such processes often involve significant additional surface facilities for the injection wells and machinery.

Coalbedmethane

A relatively new method of producing natural gas from coal seams has developed into a growth industry in parts of the United States. This coalbed methane (CBM) is one of the hottest plays in the Powder River Basin of Wyoming and Montana. CBM is produced as plant matter, CO_2 and water are transformed into peat, lignite, and then higher quality coal grades. This coalifieation process produces large volumes of methane which is stored in porous coal in three states: as free gas, as gas dissolved in the water in coal, and as gas "adsorbed" on the surface of coal, i.e., held to the surface by weak forces. Because of the large surface area of coal pores, much methane is adsorbed. When coal mining reduces the pressure on the coalbed, the gas in the coal formation is released. CBM may also be found in thin reservoirs adjacent to the coal seam and in fractures within the coal where methane has accumulated. Historically, coal miners considered CBM a nuisance and a hazard because it caused explosions and deaths of workers.

In the early 1980s, new research and technology and substantial federal tax credits led to the growth of the CBM industry.[23] To release CBM from the coal, pressure in the underground coal seam must be reduced. This is done by removing water from the coalbed. The dewatering process requires drilling a well and pumping large amounts of water from the ground through relatively shallow wells (350–1,200 feet). Dewatering an average CBM well in Wyoming pumps up 21,000 gallons of water per day. The Bush/Cheney energy strategy projects 51,000 new CBM wells drilled in this area by 2010. The dewatering process can result in lowering the water table of local aquifers and in land subsidence. Dewatering can also pollute surface waters because of the dissolved salts and sodium in the produced water, unless the water is reinjected into disposal aquifers or contained in surface reservoirs (which have their own environmental problems). The disposal cost of wastewater from CBM production is 38 times greater than the costs from a conventional gas well.[24] In the arid west, aquifer recharge is unlikely to occur for hundreds of years. While dewatering ratios and the salinity of produced water from CBM wells can vary significantly in different geographic areas, the externalities of CBM production in some Western states have led to a boomlet in local moratoria on well permitting by town officials.

Released methane can also migrate away from wellbores and vent into the atmosphere through natural fractures, endangering residential communities (methane is colourless and odourless), and contributing to greenhouse gas emissions. Coal seams may also spontaneously combust after dewatering. Thus, this fast-growing segment of the industry appears to have greater externalities than traditional oil and gas production. Coal reserves are plentiful in many parts of the world. If CBM production develops abroad without strong environmental controls, methane releases and dewatering pose serious threats to the environment.

2.6 Abandonment, decommissioning and reclamation

After the economic limit of oil and gas recovery is reached, the field will be abandoned. The surface equipment and base camps must be removed and the site restored and reclaimed. The abandoned wells must be properly plugged to secure against leaks, especially into nearby groundwater aquifers. These costs can be significant onshore. Offshore, the cost of dismantling platforms is formidable, even if the lower part of the structure is left in place in a manner that does not interfere with safe shipping.

2.7 Environmental impacts: Overview

The surface acreage impacts of oil and gas activities are summarized as follows:[25]

Seismic exploration	1.6 acres per mile.
Well site	2.7 acres per site (flat terrain)
Well site	5.8 acres per site (40% slope)
Access road	2.3 acres per mile (flat terrain)
Access road	8.7 acre per mile (40% slope)
Power line	2.4 acres per mile
Pipeline	2.4 acres per mile
Compressor station/ gas plant/water disposal plant	5 acres per plant

Clearly, oil and gas activities affect the environment to a lesser or greater degree, depending on the stage and size of the field. Exploration and development activities use generated sources of power, involve

23 The tax credit for CBM reached 90 cents per million BTU in 1992, at a time when the price of natural gas was often below $2 per million BTU. T. Ahlbrandt, "Adequacy of Energy Resources for the Future," 16 *Natural Resources & Env't* 220, 221 (ABA Section for Environment, Energy and Resources, Spring 2002). Little CBM production has occurred in nearby Canada which has no tax credit.

24 *Id.* at 220.

25 G. Marsh, The Environmental Realities of Petroleum Exploration, Ch. 28, at 348, in R. Steinmetz (ed.), *The Business of Petroleum Exploration* (1993 American Ass'n of Petroleum Geologists).

transportation and infrastructure development, and, if successful, produce large amounts of oil, gas and produced water. A shot-hole seismic crew alone typically consists of about 50 people. Production and development will require more workers and bigger base camps with attendant sewage and waste control issues. At one time, Maxus Energy Corporation had 3,000 project employees working in the rainforest of Block 16 in the Ecuadorian Amazon.[26]

A summary listing of the major types of environmental impacts that should be addressed and mitigated follows:

Effects on the natural environment. These include impacts on air quality from flaring, venting, or purging gases; from combustion processes such as diesel engines and gas turbines; from dust dispersal due to road traffic; and from fugitive gas losses. Emissions from oil and gas operations may include carbon dioxide, carbon monoxide, methane (natural gas itself), volatile organic carbons, nitrogen oxides, and halons (used largely in fire suppression equipment). Emissions of sulphur dioxide and toxic hydrogen sulphide may also occur if the hydrocarbon deposits contain sulphur.

Hydrological impacts on groundwater and surface waters include possible contamination from produced water (briny water brought up with the oil and gas), drilling and well treatment fluids, process and drainage water, and sewage and domestic wastes. Excavation and infill for roads and infrastructure sites can alter existing watercourses and drainage patterns with marked effects on vegetation and wildlife. Accidental oil spills and leaks may result in substantial damage to natural resources.

Soil compaction and erosion can dramatically reshape the land and affect its scenic and visual beauty if not controlled. Vegetation can be lost or altered by construction activity for access roads, drilling and production sites, and pipelines, as well as by contamination from discharges. When habitat is disturbed, wildlife is affected. Feeding, nesting, breeding, migration routes, and predator protection patterns may be altered. Changes in the distribution of certain species may significantly impact the livelihoods of indigenous peoples. Biological diversity may be lost where care is not taken to evaluate the vulnerability of individual species to development activity.

Effects on the human environment. The socio-economic and environmental effects of oil and gas activity on local communities, especially indigenous peoples, can be profound. Even the arrival of a single seismic crew can have a significant impact on a small village or tribe living in remote regions of rainforests, steppes or desert. Oil and gas activity can affect customary land use patterns, fishing, hunting, trapping, and the cultural heritage of the tribe. It can bring an influx of in-migration along newly built access routes to the area by persons seeking jobs or access to land for their own use. Exposure to western diseases can result in many deaths. While local programmes to improve the health and educational levels of indigenous peoples will often accompany oil and gas activity, the cultural shock of rapid changes in social structures, practices and beliefs must be considered and planned for.

The visual impacts of oil and gas activity may also negatively affect the recreational and tourism values of certain areas, although providing access to such areas may also have positive benefits to tourism. Noise from helicopters and other activities may disturb the migratory birds or other animals that tourists seek to view.

3 Controlling externalities of oil and gas development

3.1 General mitigation measures

Much can be done to minimize the environmental impacts of oil and gas development, but this requires careful management attention, professional staff, training and monitoring. This section of the chapter gives an overview of the major requirements of a good environmental management system.

Project planning begins by preparing an environmental profile, conducted before acquiring any rights to the land or minerals. The profile is an initial review of the environmental, social and cultural "lay of the land," based largely on desk-top study. The profile will assist the planning and control of exploration work and provide background for consultations with external bodies. It also provides a review of applicable regulations and land-use patterns in the area of interest.

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26 M. Forrest, Ecuador Oriente Basin Block 16: Exploration and Development, 1986–98, at 380, in G. Kronman, D. Fclio and T. O'Connor (eds.), *International Oil and Gas Ventures: A Business Perspective* (2000 American Ass'n of Petroleum Geologists).

After evaluating the information in the profile, the company should undertake a programme of both formal and informal public consultations. Statutes often require formal meetings with centralized ministries which may not be located near the area of interest and which may not have the same priorities as the people who live near the proposed area of activity. Informal consultation with the local communities that will be most affected by oil and gas activity should also be initiated to build good will and an understanding of local values and local ecological knowledge. Public participation by legislative representatives, local interest groups, NGOs, local businesses and the media should be encouraged.

After acquiring an exploration concession, a preliminary Environmental Impact Assessment (EIA) should be prepared before beginning any seismic work that will have more than short-term and reversible impacts. The preliminary EIA studies the issues described in the profile in more detail by gathering site-specific data and surveys on cultural, ecological and land use issues and also identifies additional issues of sensitivity and ways in which impacts can be mitigated. It is prepared in consultation with the appropriate authorities and organizations, environmental specialists and the local community and general public. The objective of the EIA is to scope issues and assess whether and when a full Environmental Impact Statement (EIS) should be prepared.

An EIS should be prepared for any project that has the potential to affect significantly the human and natural environment. The EIS process is an iterative one, evolving and expanding as project feasibility studies and detailed specifications move from one stage of activity to the next. In sum, the EIS will provide a comprehensive and detailed analysis of the proposed project in all of its stages. It will describe the dynamics of the existing environment, the regulatory regime governing the project, the proposed project and alternative proposals. It will then identify the significant potential impacts of the planned development and its alternatives and recommend the best practical measures to mitigate adverse impacts and enhance environmental benefits. The EIS will assess and evaluate the unavoidable impacts of development, describe the environmental management plan, including contingency planning for spills and blowouts, and propose and describe monitoring programmes for all stages of activity, including decommissioning, reclamation and restoration of the site. The EIS must comply with all statutory requirements.

Once the project is underway, environmental monitoring through a system of routine checks and tests should be done to verify the effectiveness of control measures and identify any unforeseen environmental effects. The feedback from monitoring may result in new information and call for new measures and solutions to be adopted in response. Environmental training and regularly scheduled refresher courses and briefings must assure that all personnel are able to apply the environmental operating procedures correctly, and should include training on socio-cultural awareness and interactions with the local community's values and activities.

Environmental auditing provides a systematic evaluation of environmental and management performance, using metrics to examine and verify this performance. Environmental audits are usually conducted internally, but periodic reviews by external, independent auditors are increasingly being used to assure NGO communities, financing sources and shareholders that the company's contractual or legal obligations are really being translated into practice. All employees and contractors should know the company's environmental plans, targets, and performance indicators and should be trained to accomplish them.

3.2 The Arctic

This summary overview can hardly do justice to the detailed scientific, technical, and anthropological and cultural knowledge and studies that must accompany a well-planned project in environmentally sensitive areas. The IUCN/E&P Forum Guidelines for exploring and producing in the Arctic or in mangrove swamps give some idea of the planning and training that must occur.

In the Arctic, a layer of permanently frozen subsoil, called permafrost, is overlaid by an active layer of soil that thaws in the summer, forming a complex pattern of drainage and vegetation. Melting ground ice causes land subsidence, called thermokarst. Numerous shallow lakes form by melting permafrost. Tundra vegetation grows very slowly, so habitat is difficult to restore. Lichens, the base of the tundra food chain, are very sensitive to air pollution. Disturbing the top, active layer of the soil can lead to thermokarst and erosion. Arctic birds have very short nesting seasons, so any disturbance which interrupts the incubation process may have serious effects. Similarly, caribou migrate to particular areas to calve, and disturbances at this time may lead to increased mortality. Indigenous groups in the Arctic often have subsistence livelihoods and cultures

dependent on certain plants and animals; industrial activity in the midst of their traditional patterns of resource use may cause considerable impact on the groups.

Because of these factors, exploration and production activity in the Arctic is usually done in winter when snow covers the ground protecting the underlying tundra, and when few birds and animals are active. Onshore seismic surveys usually use the shot-hole technique, avoiding the use of Vibroseis trucks. When the crew encounters frozen streams with steep banks, mechanical equipment may be used to move snow and reduce the gradient, always assuring that thick snow cover remains wherever a vehicle is to pass. Little rehabilitation is usually required after seismic activities. Temporary base camps for seismic surveys usually consist of sled-mounted trailers, which are moved daily to keep pace with the recording operation. In fact, the flat Arctic tundra has been described as "[p]erhaps the only onshore environment where a geophysical crew can pass with virtually no lasting evidence of its passage... Even here, though, while flying over the land in the summer, the careful observer can detect faint traces of a previous winter's passage of the large-tyred rollogon vehicles."[27]

To stabilize the terrain during exploratory drilling operations, two options exist. The first is a winter-only option and consists of constructing an ice pad by packing snow or flooding the area with water to form an ice base which distributes the weight of the drilling equipment. Because the ice pad will melt in the spring thaw, drilling must be able to be completed during the winter season. The second all-season option is to construct an elevated pad of gravel or rock with insulation material, matting and an impermeable liner. The pad must be thick enough to distribute the weight of the equipment and avoid heat transfer to the permafrost. The borrow sites from which the gravel or rock are taken must be carefully selected to minimize environmental disturbances. The drilling operations generally use closed systems which recycle drilling muds and reinject reservoir and wellbore fluids downhole.

With field development and production, additional year-round facilities are required: a larger base camp, centralized processing facilities and pipelines, helipads, airstrips or roads. Again, careful environmental management can minimize much environmental impact. Wells can be clustered and drilled directionally to reduce surface use. Pipelines must be either buried or raised to minimize interference with wildlife and maintain the thermal integrity of the permafrost. All produced water will generally be reinjected. If natural gas accompanies oil production and there is no local use or market for it, it must be either flared or reinjected into the producing reservoir. Many more specific methods of handling wastes are outlined in the Guidelines.

3.3 Mangroves and marine environments

Environmental protection may be more difficult to implement in tropical coastal areas, dense rainforests, and hilly terrain than on the frigid Arctic plains. In these warmer climates, clearing trees for seismic crews, drill sites and pipeline rights of way can cause serious soil erosion. Many different tropical ecosystems exist requiring special expertise. For example, the marine clay soils which often exist in mangrove areas have the potential to generate acid sulphates when exposed to the air from dredging or digging activity. Exposure releases sulphuric acid. The impact of acid drainage on fisheries, irrigation and other activities can be very severe. Dredging in coastal areas can alter intertidal hydrology over a large area with serious effects on plants and animals. Even small spills spread quickly in the watery terrain. Seismic lines can be deviated only to a certain extent to bypass large trees or species habitat, so it is more difficult to explore without having some impact on the environment. Drilling will generally require barges and dredging, although small rigs can be heli-ported in and roads can be built atop pilings, allowing transport of a land rig. All such activity leaves greater marks on the land than the Arctic's ice roads and bridges.

About 25% of the world's petroleum is produced from offshore areas. In offshore waters, sound waves are generated by air guns that shoot compressed air impulses through the water every 20–60 seconds (replacing the use of explosives which often caused mass mortality of fish populations).[28] The impulses can create quite loud seismic waves. During two to three weeks of an average geophysical exploration, a ship will tow a train of strings, cables, seismic generators, and hydrophones. The train is often several kilometres long. A survey of 100km will send five to eight million seismic impulses through the water. Obviously, the survey train can seriously interfere with commercial fishing nets. Unfortunately, the biological effects of high-energy waves of seismic signals on marine organisms have not been well studied. Some studies have found very damaging

27 Marsh, *supra* note 25 at 347.
28 The information in this paragraph is from Patin, *supra* note 20 at 60–63.

effects to fish populations and to fish larvae in particular, ranging from disorientation, haemorrhage, paralysis and death. Other studies have shown high startle responses of fish, with a quick return to behavioural patterns.

Seismic surveys can be timed to avoid some of these biological effects. For example, in the North Sea, seismic surveys are not allowed from July through September in areas where herring spawn. Surveys are also timed to avoid conflicts with animal migration patterns, such as the annual passage of bowhead whales through the Beaufort Sea. However, the effects of seismic surveys on marine mammals and fish clearly require more research.

3.4 Lands unsuitable

While a good environmental plan, well-monitored, implemented and enforced, can do much to assure a clean operation, some areas of the world have understandably been considered as unsuitable for oil and gas development. Oil and gas activity does leave marks on the land. As one veteran explorationist laments: "Our activities are not without some cost to the environment. It appears, however, that exploration has probably suffered more from environmental concerns than the environment has suffered from exploration." The punishment suffered has been the one "from which it [exploration] cannot recover: denial of access to the land.[29]

The United States has used many levers to put millions of acres of land off limits to the oil and gas industry. Federal land withdrawal acts include: the National Wilderness Preservation Act of 1964; the Wild and Scenic Rivers Act of 1968; the Marine Protection and Sanctuaries Act of 1972; the Federal Land Management and Policy Act of 1976; the National Forest Management Act of 1976; and the Alaskan Native Interest Lands and Conservation Act of 1980. In addition, the Secretary of the Interior can withdraw federal lands from use through public land orders, the Congress can do likewise using the appropriations process or by directly creating more preservation areas, as can the President by Executive Orders and proclamations. Congress and the President have been especially active in imposing moratoria on leasing OCS lands which adjoin politically powerful states on the east and west coasts. The Endangered Species Act and the Clean Air Act may also close off lands which are critical habitat or which are in or near nonattainment areas. All in all, the United States has an active political process at the local, state and national levels and many legal mechanisms for declaring certain lands unsuitable for oil and gas activity.

In other parts of the world, these mechanisms may be lacking. The federal government of a country may initiate the process of granting oil and gas concessions without a careful analysis of the land's potential as a bioreserve for endangered species, a hunting ground for indigenous tribes, or even for its eco-tourism potential. Oil companies who then seek to develop in these areas may well find themselves in the eye of a public relations storm despite their commitment to environmentally protective systems. Conoco, for example, withdrew from further development of a block of land in the Ecuadorian rainforest after encountering widespread international criticism for operating on a tract which included part of Yasuni National Park and which was located near indigenous communities. Ultimately, however, this withdrawal did not prevent oil and gas development. Another company, Maxus Energy (subsequently acquired by YPF, the privatized Argentinian national oil company which was then acquired by Repsol, a Spanish company), stepped in as operator and developed the project under an Environmental Management Plan which had many of the elements discussed above.

The example illustrates the fundamental reality that sovereign nations have the right to exploit their resources as they see fit, as long as their decisions do not impose externalities on other nations. International protest campaigns by NGOs rarely focus on the host country's sovereign right to choose development – a right that is undeniable, at least in countries with functioning democracies. Rather, the protests usually work by focusing on the MNC's reputation. While a particular MNC may withdraw, a country that wants development will usually find a competitor to take its place. NGOs will also often attempt to use the host country's legal system to prevent development, but laws may not exist to prevent activity in areas that many members of the international environmental community consider unsuitable. As discussed below, to date, there is little international "hard law" that imposes sustainable development on sovereign nations. Yet, perhaps surprisingly, more land is being protected for preservation around the globe. The United Nations Environment Programme reports that protected reserves worldwide have grown from 1.07 million square miles in 1970 to 4.7 million in 2000, with much of this increase occurring before the Convention on Biological Diversity

[29] Marsh, *supra* note 25 at 350.

became effective in 1993.[30] Some of the increase reflects the successful efforts of private conservation groups, such as the Nature Conservancy.

4 Mechanisms to bring sustainable development to the oil sector

Four mechanisms can be used to control the externalities of oil and gas development and either encourage or force principles of sustainable development in this sector: (1) international law; (2) national laws; (3) private law based on contractual obligations in concession agreements or on industry codes of conduct; and (4) litigation. This section of the chapter will discuss each mechanism in turn.

4.1 International law

Sources of international law are often characterized as "hard law" or "soft law." Hard law consists of binding international commitments such as treaties in force, decisions of international courts, and clear customary international law principles. Custom is defined as the general practice of sovereign states. For example, the law of the sea was derived almost entirely from custom before becoming codified in the 1958 and 1972 conventions on the Law of the Sea. Custom is international "common law."

Soft law sources are nonbinding legal instruments that declare principles and aspirational goals or set voluntary standards. UN General Assembly resolutions and declarations of international institutions and conferences fall into this category. However, as states conform their general practices to a resolution's principles, the resolution may become authoritative evidence of international law. A United Nations resolution which is adopted unanimously or by a large majority which includes the major powers, and which is relied upon by states, can thus become "hard law".[31]

As yet, there is little hard law on sustainable development, although there is a large and growing body of soft law. The principles of sustainable development enunciated in the Rio Declaration of 1972 and Agenda 21 are still considered to be soft law. Other sources of soft law of sustainable development include guidelines and standards of international organizations, such as the United Nations Environmental Programme (UNEP) Guidelines on environmental assessment, the International Maritime Organization Guidelines on removal of offshore structures, and directives issued by the World Bank requiring EIAs for offshore oil and gas projects and measures to reduce environmental harm. Some sources are more detailed than others, and some are more stringent than others. For example, the World Bank's EIA requirement does not have a "no action" alternative. An increasing body of international technical standards, such as ISO 14000, may also be counted as soft law. Industry guidelines adopted by industry trade associations have proliferated as soft law, such as the joint IUCN/E&P Forum guidelines discussed in section 3 above, and many others like the International Chamber of Commerce's Business Charter for Sustainable Development.

The Rio Earth Summit was the first major UN-sponsored global conference with strong business participation, led by the International Chamber of Commerce and the newly created Business Council for Sustainable Development. The recommendations of Agenda 21 and of the United Nations World Charter for Nature provide a useful consensus blueprint of the norms implicit in sustainable development, but they ultimately depend on the will of national governments to enact implementing legislation. Some nations have ratified multilateral treaties that invoke principles of sustainable development which the ratifying nations are then obligated to reflect in national laws, such as the Convention on Biological Diversity adopted at Rio in 1992, the Ramsar Convention on Wetlands of International Importance, and the Convention on International Trade in Endangered Species. Other international treaties set out certain principles of sustainable development, such as the 1992 Framework Convention on Climate Change, but unless they are supplemented by protocols (such as the Kyoto Protocol) adopted by the ratifying nations, effective implementation of these principles is lacking.

Several "hard law" treaties, such as the 1972 London Anti-Dumping Convention, the 1973/1978 MARPOL Convention, and the 1982 Law of the Sea Convention are designed to protect the marine environment from pollution, reflecting the international interest in the oceans as a shared resource essential to navigability and commerce. While of great importance, most oil pollution originates on land where most of the facilities and

[30] United Nations Environment Programme (UNEP), *Global Environmental Outlook 3: Past, Present and Future Perspectives,* Ch. 2 on " State of the Environment and Policy Retrospective: 1972–2002" at 124., available at www.unep.org/GEO/geo3.

[31] J. Hickey, Jr., "International Law," in *Energy Law and Policy for the 21st Century* at 4–18 (Rocky Mountain Mineral Law Foundation 2000).

almost all of the use occur. Little hard international law applies to the onshore industry. Regional international agreements, such as the 1994 Energy Charter Treaty (between Europe, Russia, Japan and Australia) and Environmental Law Directives of the European Community contain some mandatory environmental provisions affecting oil and gas operations. Still, the hard law of ecosystem protection and pollution control must ultimately be found at the national rather than international level.[32] At this level, soft international law clashes with the nearly inviolate hard wall of a nation's sovereignty over the use and development of its own natural resources.[33]

4.2 National laws of the host country

Multinational energy companies travel the globe to find and produce petroleum deposits. The host country may be a developing nation with relatively little environmental law on its books.[34] Even if such laws exist in a host nation's constitution or statutes, the country often has inadequate enforcement mechanisms and regulatory personnel to implement the laws. Sometimes, oil and gas reserves exist in "failed states," which have virtually no functioning government, and are plagued by civil wars, guerrilla fighting, massive corruption and lack of any social infrastructure. Many developing countries granted near-monopoly control of their oil and gas resources to a state-owned company. These national oil companies often have had a far greater interest in providing revenues to the federal treasury than with environmental protection or local economic development.[35]

The national laws regulating the oil and gas industry can be broadly categorized into three approaches.[36] The first is represented by the US and UK approach: a plethora of detailed, command-and-control statutes of considerable breadth and depth. The environmental framework generally regulates all industry broadly. There is relatively little unified legislation specifically designed for the oil and gas industry. The result is a complicated and sometimes confusing welter of laws, administered by many different agencies which sprang up incrementally over the years, sometimes in response to particular events such as the Exxon Valdez oil spill.[37] Developing nations may understandably decline to follow this pattern of detailed, but complex and uncoordinated, legislation.

A second model recently developed in some nations, particularly in South America, is to adopt environmental statutes that apply only to their petroleum sector. For example, Peru's petroleum law has 17 titles, 60 articles, and many appendices with technical standards for discharges and emissions for all stages of petroleum operations. China adopted offshore petroleum regulations in 1982 which cover most environmental aspects of upstream operations, although no parallel onshore regulations have been enacted.[38] Indeed, one MNC was taken by surprise at the stringency of some of China's offshore discharge requirements, and had to do expensive retrofitting of on-platform water treatment devices.[39] While this legislative approach appears to be spreading, it is still limited globally.[40]

In the past two decades, many developing nations have adopted some type of command-and-control environmental regulation. The requirement of an Environmental Impact Assessment, the most effective form

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32 *See generally*, Z. Gao, Environmental Regulation of the Oil and Gas Industry, Discussion Paper DP 16, University of Dundee Centre for Energy, Petroleum and Mineral Law and Policy (1997). J. Dernbach, "Sustainable Development as a Framework for National Governance," 49 *Case W. Reserve L. Rev.* 1 (1998). Operators have been surprised, however, to find international hard law applying to them. The United States, Mexico and Canada have signed the Migratory Bird Treaty which protects birds on their long migration north in the winter. Birds that land in the oilfield pits of West Texas operators to rest and drink, often died after contact with the oily water. Federal wildlife officials started arresting operators for violating the treaty, which had become federal law. In response, the state conservation commission passed a rule requiring nets on oilfield pits.

33 *See, e.g., A.* Tarlock, "Exclusive Sovereignty Versus Sustainable Development of a Shared Resource: The Dilemma of Latin American Rainforest Management," 32 *Texas Int'l L. J.* 37 (1997).

34 In general, environmental awareness was lacking in all countries, both developed and undeveloped, for most of the first half of the twentieth century. Environmental law only began as a field of law in the early 1970s and sustainable development did not become a mainstay of environmental law until the 1980s.

35 *See,* Gavigan's description of the Russian petroleum industry *supra* note 16. *See also* A. Lieders, "A New Chapter in Brazil's Oil Industry: Opening the Market While Protecting the Environment," 13 *Georgetown Int'l Envtl L. Rev* 781 (2001) for the sad environmental record of Petrobras, Brazil's national oil company.

36 Gao, Discussion Paper *supra* note 32.

37 Until this spill occurred, virtually no national laws dealt with oil pollution in the USA. The Oil Pollution Act was passed in 1990 to fill this gap.

38 Gao, Discussion Paper, *supra* note 32 at 48–49.

39 J. Murphy and S. Williams, "International Environmental Issues and Strategies," at 333, in Kronman *et al., supra* note 26.

40 Gao, Discussion Paper, *supra* note 32 at 50.

of precautionary measure when accompanied by mitigation measures, has become nearly universal. Laws requiring environmental insurance, performance bonds, environmental audits, oil spill response capability, and decommissioning and abandonment funds are becoming more common around the globe. MNCs can anticipate that the enforcement devices used in many developed nations, such as suspension or cancellation of licences, fines and criminal penalties, and environmental charges and taxes will spread to the developing nations. Indeed, foreign plaintiffs are already using the courts of the MNC's home nation to pursue litigation for environmental damages and human rights abuses committed by the MNC in the host country. Some of the impetus driving industry associations and MNCs to create private codes of conduct stems from an effort to avoid harsh and unreasonable laws that might otherwise be enacted. This is the third approach to national regulation of the petroleum industry: contracting for environmental protection.

4.3 Private law: Environmental obligations in the petroleum contract and industry codes of conduct

Petroleum contracts

Typically, host governments enter into petroleum agreements with private MNCs because the latter have the capital, technology and expertise that many countries lack. These agreements differ radically from the early concessions granted to the major oil companies in the early 1900s in the Mideast. These first concessions granted vast tracts with little or no obligation on the part of the company to develop the resource and no opportunity for the host government to participate in development decisions. Today, host nations avail themselves of an array of mechanisms and legal arrangements to govern their relations with the private investors who seek to develop their petroleum deposits. National oil companies and governments now take about 80% of the profits from oil and gas production, leaving 20% for the private MNCs.[41]

Some countries rigidly prescribe the form of the agreement between the host country and the oil company, such as the United States does in granting leases on its public lands. Others authorize a state commission or a national oil company to negotiate and execute individualized agreements with foreign oil companies. A number of countries use a hybrid approach that allows for some flexibility within statutory constraints designed to assure public policy objectives. This third system delegates authority to a specific agency to establish the procedures and minimum standards required to transfer development rights to MNCs. In the absence of a body of well-developed domestic environmental law, the individual contracts awarded to winning investors are the dominant vehicle for assuring environmental protection or sustainable development objectives.

Selection of a contractor or licensee can be vested entirely in the discretion of the host government, or it can be done through a form of auction or open competition. In the latter, the government announces the terms for a licence in a certain geographic area and each applicant makes an offer based on the announced criteria. If adequate competition exists, an auction will force rival bidders to offer the best financial terms to the host government in terms of royalties, taxes, or a share of profits from the development. Environmental standards can be made a part of the fixed, non-negotiable terms in the bidding process.

The host government can also choose from an array of contractual models in common use today. The first is the concession or licence which grants exclusive development rights to the licensee, but with extensive provisions governing work commitments. Revenues to the state accrue through royalties, taxes and bonus payments. The second is a production sharing contract whereby the host country grants a private company the right to develop an area in exchange for the opportunity to recover its costs and a specific profit share from any production obtained under the contract. The company takes the risk that production revenues will cover costs. The state usually maintains control over the property by creating a state-owned oil company which enters into the production sharing contract with the foreign company. The state receives revenues as a share of the "profit oil" remaining after part of the oil, the "cost oil", is used to reimburse the contractor for expenses.

The third type of contract is the joint venture or participation agreement whereby the state oil company (or government) and the MNC form a new entity to develop the oil and gas reserves. A management committee of representatives from both parent entities operates the joint venture. Many licence concessions and production sharing agreements give the host government the option of electing to participate as a partner in the enterprise. The final type of agreement is a service contract, under which the MNC simply agrees to provide certain

41 In 1970, the governments' share of profits was only 50%. Bosselman *et al., supra* note 9 at 1103.

services or technical assistance to the host country or its national oil company in return for a fixed fee or a share of production. Many countries have promulgated model forms of their preferred type of agreement.

Of these four forms, joint ventures offer host governments the most opportunity to acquire the advanced expertise, knowledge and training from the MNCs by working in partnership with them. This transfer of skills and technology can then be used by the state oil company to move into joint ventures in transportation, refining and marketing, and to exploit opportunities for oil and gas development in joint ventures with other companies outside of their own borders. Indeed, the poor performance of Pemex, Mexico's national oil company, has been linked to Mexico's long history of isolation from joint participation with profit-driven MNCs.[42]

Many state oil companies today operate abroad, including in the United States. A good number of these entities were privatized in the 1990s. Privatization was accomplished in several ways: by selling company stock to private investors; by selling the company's assets; by downsizing and reorganizing into subsidiaries, some of which are sold and some retained; and by milder methods, such as entering into service contracts with private firms that provided the skills and technology necessary for efficient development. The privatization trend resulted from the low oil prices of the 1980s and 1990s which exposed the inefficiency and bloated bureaucracies of many state-run operations. Many states could no longer provide the capital needed to invest in their own oil and gas resources. Private lenders were wary of investing in wasteful operations run by state monopolies. Too often, host nations had promoted deliberate policy initiatives aimed at capturing revenues for the central treasury and redistributing wealth in ways which left state oil companies with billions of dollars of debt.[43]

As might be expected, the petroleum concessions negotiated in the first part of the 20th century were either devoid of environmental provisions, or contained only the brief phrase that all petroleum operations be conducted in "workmanlike manner with reasonable precautions."[44] But even after the 1970s when the new contractual arrangements described above supplanted the old, one-sided concessions, environmental provisions received little attention. A survey of petroleum agreements in more than 100 developing countries done in the early 1990s revealed a contractual pattern of generally referencing a broad principle of environmental protection, with no substantive or systematic requirements imposed.[45] For example, Thailand negotiated 12 rounds of concessions agreements between 1971 and 1989, and all failed to even mention environmental protection. A revision to its model contract in 1989 added an obligation that the concessionaire secure "appropriate" insurance coverage in the event of damages. Indonesia's model and individual production sharing contracts require that the contractor "prevent extensive pollution of the sea or rivers." Brazil's original risk service contract of 1976 contained no environmental obligations and subsequent revisions simply required the contractor to clean up damages caused by spills or leaks. Needless to say, such contracts lack a commitment to environmental protection, much less to sustainable development. Zhiguo Gao, the author of this survey summed up: "[I]nternational petroleum agreements are the product of a single-minded pursuit of narrow commercial interests. They are not designed for sustainable development but rather are aimed at rapid exploitation. . . ."[46] He attributes this pursuit to the developing nations' preference for export earnings and tax revenues, aided by the MNCs' similar interest in cash flow recovery. Host nations appear unwilling to trade tougher environmental standards for additional revenues, especially when the nation is a joint participant that must share any additional environmental costs before recovering its profit share.

Gao's survey results from 1992 must be updated for the passage of another decade. On paper, some petroleum agreements continue to neglect environmental issues. For example, Nigeria's Model Production Sharing Contract of 1995 has only one environmental clause, which requires that all insurance policies be based on good international practice. Nonetheless, there is strong evidence that environmental considerations do, in fact, play a significant role in recent negotiating processes between MNCs and host nations. A survey of executives of many major MNCs that operate in developing countries concluded the following:[47] First, different countries do have different levels of environmental awareness, laws and politics, and developing

42 E. Smith and J. Dzienkowsky, "A Fifty-Year Perspective on World Petroleum Arrangements," 24 *Texas Int'l L. J.* 13 (1989).

43 Ascher, *supra* note 5 (providing many case studies of deliberate governmental decisions in developing countries that wasted resources on a grand scale).

44 Z. Gao, "International Petroleum Exploration and Exploitation Agreements: A Comprehensive Environmental Appraisal," 12 J *Energy & Natural Resources L* 240 (1994). The environmental aspects of oil and gas development in the United States in the first half of the century were virtually unregulated also, permanently scarring many areas of Texas and other producing states.

45 *Id.* at 249.

46 *Id.* at 248.

47 Murphy and Williams, *supra* note 39 at 329–37.

nations may accept less stringent environmental standards in exchange for more revenues. Second, a comprehensive environmental plan is "needed to play" in the bidding for petroleum contracts with host governments, but it is not always "needed to win." Additional monies or accelerated drilling programmes are sometimes more attractive to the host nation than the best-prepared or most stringent environmental plan. Nonetheless, a well-prepared environmental plan is still essential and can sometimes give the petroleum negotiator an edge. This survey gives examples of environmental plans that provided a winning margin to successful bidders: pilot studies of remediation of contaminated, pre-existing sites; heli-ported small rig drilling in rainforests; and reforestation of sites using indigenous cuttings versus reseeding or nursery plant. Strong, pro-active environmental health and safety staffs can also create a competitive "edge," especially when they are a mix of local and foreign experts working in an interdisciplinary team with ample opportunities for training. The survey warns that underestimating environmental costs in bids can ultimately be a short-sighted and costly strategy.

Codes of conduct

In the absence of "hard" international law, national statutes, or contractual provisions for environmental protection in oil and gas development, many industry trade associations have devoted substantial time and effort in writing codes of conduct applicable internationally to their particular industry. These codes are a type of international "soft" law which may fill some of the gaps in the other regulatory mechanisms discussed above. Indeed, so many international codes dealing with environmental and sustainable development issues have now been developed that some companies and countries are suffering "code fatigue" in attempting to track and compare all the codes.

In addition, individual MNCs have developed their own codes of conduct, particularly in the oil and gas sector. As Professor Baram explains: "[C]ompanies have used codes to address those aspects of business where corporate managers have enjoyed considerable discretion in making decisions, and where the decision outcomes have harmed the firm's morale, reputation, productivity, or profitability."[48] Many of the major oil companies' websites now have a section on sustainable development, describing their commitment to its principles and giving examples of projects that meet their guidelines. Shell, for one, accepted the 1997 challenge of an NGO, Sustain Ability, to be judged as the leading multinational in economic, environmental and social responsibility and invited Sustain Ability to help them achieve this goal. In these private codes, the companies generally pledge to follow principles of sustainable development in all of their worldwide operations.[49]

The question is, of course, whether such codes are mainly public relations gimmicks or whether they will be implemented in a manner which substantively affects the way that the MNC does business, particularly in developing countries. Put differently, the issue is whether private actors can be better resource stewards than host governments. Professor Baram concludes that "[t]rade associations in particular are capable of weaving a global system of private codes that could be superior in many respects to public sector efforts, which have proven to be cumbersome and inefficient."[50] His article discusses various strategies to extend the reach of private codes in the developing world, such as integrating and harmonizing codes into a quasi-regulatory international system which uses registration, progress reports, evaluations and public access to monitor the performance of companies. An international agency, such as the United Nations Environment Programme (UNEP) would enforce the codes with sanctions such as de-registration and adverse publicity ("naming and shaming") directed against companies that fail to make progress.

Professor Baram's recommendations have been adopted by UNEP and SustainAbility. In 1999, these two organizations issued the first annual "Oil Sector Report" which examines how 50 leading oil companies do environmental and social accounting, as a catalyst for developing a "best practices" reporting framework that

48 M. Baram, "Multinational Corporations, Private Codes, and Technology Transfer for Sustainable Development," 24 *Environmental Law* 33, 43 (1994).

49 The global reach of the MNC codes today is in marked contrast to a 1991 study that found that none of the 98 MNC codes reviewed promised uniform practices and technologies in both developed and developing nations. Some firms in 1991 were striving for "functional equivalence" in their operations abroad and many managers felt that there should be comparable procedures and protections in place on all their operations worldwide. *Id.* at 54.

One global standard, ISO 14000, is widely used as an international standard for environmental management, audits, labeling and life-cycle analysis. *See generally,* P, Stenzel, "Can the ISO 14000 Series Environmental Management Standards Provide a Viable Alternative to Government Regulation?" 37 *Am. Bus. L. J.* 237 (2000).

50 Baram, *supra* note 48 at 57.

will become part of a permanent Global Reporting Initiative.[51] Of these 50 companies, 34 published some type of Corporate Environmental Report. The Oil Sector Report had three major findings; (1) smaller companies (especially exploration and production-only companies), state-owned companies, and joint venture-based consortia of companies have poorer environmental reporting standards than the large multi-nationals; (2) most company reports do not measure actual impacts such as disturbances to land or biodiversity; and (3) many of the companies do not use third-party verification which would raise the level of public trust in the companies' voluntary reports. The overall conclusion was that, as of 1999, the environmental reporting done by the oil sector did not allow a reader to make genuine assessments or comparisons of a company's true environmental performance. However, the oil sector was well-positioned to work towards a set of best practices in environmental reporting.

The criticism of industry codes of conduct is that they "legitimize norms defined by special interests" and legalize "environmental self-regulation."[52] Judith Kimerling, whose earlier work documented in stark terms the bleak record of oil companies developing in the rainforest during the 1970s and 1980s,[53] returned to Ecuador recently to assess the code of conduct used by Occidental, the largest US-based producer of crude oil in Latin America, in its rainforest operations. Occidental's code is implemented through its petroleum contract with Ecuador which adopts Occidental's corporate Environmental Management Plan (EMP) as a legal standard. The EMP was to abide by "international standards" and "best practices." Kimerling found that government officials and local communities did not know what these phrases meant in terms of actual standards which were to be used. Nor did they know what alternative standards might exist as a "best practice."[54] Occidental originally appears to have adopted a "policy of equivalence" using the same level of protection required in the USA, unless Ecuadorian standards are stricter. This policy was changed in 1995 to a "worldwide standard of care," but Occidental has not made public the standards which it uses to meet this contractual commitment. Kimerling also found that the company had not adequately disclosed or remedied an oil-related spill which occurred on a tribal hunting ground; and that the local community most directly affected by the petroleum activity had not been given a copy of the Environmental Management Plan.

Kimerling concludes that private environmental obligations in petroleum contracts require additional safeguards. First, they must clearly identify the standards being used and the source of these standards. Second, they must require compliance with these standards, and measure actual environmental performance against these standards. Third, they must have credible monitoring and review protocols that can ultimately be implemented by nationals, including public outreach and training programmes for government officials, local community members and NGOs. And, fourth, the findings of external experts and auditors must be accurately recorded and reported to the public.

Kimerling's critical views about the need for external auditors of private activity are echoed by other long-term observers and experts on international petroleum contracts. Professor Thomas Wälde notes that companies often oppose independent environmental audits on the grounds that they might reveal internal information which should not be released to competitors. Wälde argues instead that companies should view external environmental audits like financial audits carried out by independent accounting firms.[55] Many large accounting firms now have environmental services groups or "Sustainability Advisory Services" which conduct field audits of their clients' environmental performance.[56]

While internal audits are a useful management tool, external audits from independent, internationally recognised environmental consultants or NGOs will increasingly be a condition of financing arrangements

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51 The Oil Sector Report is available at www.sustainability.co.uk. Additional information on the Global Reporting Initiative is available at www.globalreporting.org. The GRI complements the Global Compact, a United Nations project setting principles for corporate conduct in human rights, labour standards, and the environment, at www.unglobalcompact.org

52 J. Kimerling, "International Standards in Ecuador's Amazon Oil Fields: the Privatization of Environmental Law," 26 *Colum. J. Envtl L.* 289(2001).

53 J. Kimerling, *Amazon Crude* (NRDC 1991); J. Kimerling, "Disregarding Environmental Law: Petroleum Development in Protected Natural Areas and Indigenous Homelands in the Ecuadorian Amazon," 14 *Hastings Int'l & Comp. L. Rev.* 849 (1991). After 25 years of oil and gas production , Ecuador had amassed a foreign debt of $12.4 billion; more than 19 billion gallons of produced water had been dumped into waters and soils without treatment; unlined oilfield waste pits dot the Oriente area; and 30 major oil spills had polluted many acres of once-pristine rainforest. *See also*, J. Kane, *Savages* (Vintage Books 1996) (describing life with the Huaorani tribe in a rainforest being developed for oil).

54 E.g., the US EPA imposes zero discharge limits as the best available technology for produced water and drilling wastes in the Gulf Coast, but Occidental's plan did not specify if this was the standard being used.

55 T. Wälde, "Environmental Policies Towards Mining in Developing Countries," *10 J Energy & Nat. Resources L.* 327, 348 (1992).

56 Both Shell and BP use external auditors from firms like KPMG, Price Waterhouse and Ernst & Young and report value from these services. The Oil Sector Report, *supra* note 51 at 12.

and tax and other incentives. A "green certificate" issued by external environmental consultants will become an important tool used to assess the performance of MNCs.[57] The benefits – economic, environmental and social – of securing the early participation of knowledgeable NGOs are aptly illustrated in a recent case study of World Bank financing in 1994 and 1996 of a small international oil company's pipeline though a Guatemalan national park. Instead of following the route of an existing road, the pipeline opened a new right-of-way into the park which already faced intense pressures from illegal logging and slash-and-burn colonizing. While the company obeyed all applicable laws, the case study shows real gaps in the World Bank's implementation of its own policies for public participation and environmental protection.[58]

4.4 Litigation

Weak or corrupt judicial systems in some developing countries prevent national environmental laws or private contractual obligations from being litigated fairly in the host nation. Citizens who suffer environmental damages or injury cannot recover adequate compensation from spills or explosions through the courts of failed states. Nor can they seek to vindicate government seizures of their land or human rights abuses related to petroleum development. For these reasons, native citizens of the host, developing country have increasingly sought to litigate their rights in foreign courts, particularly in the United States. MNCs are often joint venturers with the state-owned oil agencies of repressive regimes, giving them complicit status in the brutal acts of the regime. For example, plaintiffs in Nigeria and in Myanmar (formerly Burma) have brought suit in US courts against Shell Oil and Unocal, respectively. The complaints seek to hold the MNCs responsible for the acts of torture, forced labour, murder and expropriation carried out by the notorious security forces of the national oil company with which the MNC is often required to form a joint venture under the country's concession laws.[59]

Foreign plaintiffs generally must hurdle the doctrine of *forum non conveniens* in order to bring suit in foreign courts. *Forum non conveniens* is a judicially created doctrine designed to prevent plaintiffs from harassing defendants by filing suit in an inconvenient forum, even though personal jurisdiction and subject matter jurisdiction exist in that forum. One important factor in determining whether the suit can proceed is whether the plaintiff has a fair and adequate forum in the foreign country.

The doctrine's international application has been the subject of much commentary. Supporters of the doctrine's usefulness in dismissing claims and sending plaintiffs back to their home courts typically cite Lord Denning: "As a moth is drawn to the light, so is a litigant drawn to the United States. If he can only get his case into their courts, he stands to win a fortune."[60] The United States judicial system offers many advantages to a foreign plaintiff: skilled public interest attorneys who will work for contingency fees; no liability for defendants' attorney costs; the world's most extensive pretrial discovery; strict liability laws; the award of damages for many more types of harms, including punitive damages; and the right to a jury.

On the other hand, critics of dismissals on the grounds *of forum non conveniens* often quote Justice Doggett's concurring opinion that the doctrine is used to shield alleged wrongdoers: "The refusal of a Texas corporation to confront a Texas judge and jury is to be labeled "inconvenient" when what is really involved is not convenience but connivance to avoid corporate accountability."[61] In his opinion, Justice Doggett cited a senior vice president of Monsanto who acknowledged that "[t]he realization at corporate headquarters that

57 Wälde, *supra* note 55 at 348.

58 I. Bowles *et al.*, "The Environmental Impacts of International Finance Corporation Lending and Proposals for Reform: A Case Study of Conservation and Oil Development in the Guatemalan Peten," 29 *Envtl L.* 103 (1999).

59 In *Doe I. Unocal Corp.,* 110 F. Supp. 2d 1294 (CD. Cal. 2000), the court held that Unocal could not be held liable for the Myanmar government's use of forced labour because the company showed that it could not exercise control over the government's decision to commit the acts of slavery. The evidence showed that Unocal knew that forced labour was being used and that the joint venture benefited from this practice, but this was insufficient to establish liability under the Alien Torts Claim Act. The documentary evidence presented in the case offers a devastating picture of what it is like to be a joint venturer with one of the world's most repressive regimes. In *Ken Wiwa v Royal Dutch Shell Pet. Co.,* 226 F.3d 88 (2d Cir. 2000), the court upheld US jurisdiction over a claim alleging that Shell had provided money, weapons and support to the Nigerian military which committed murder and torture against local Nigerian communities protesting the environmental degradation of their lands.

60 As cited in *Smith Kline & French Lab. Ltd. v Bloch* [1983] 1 W.L.R. 730, 733 (C.A. 1982). Sec generally, R. Weintraub, "International Litigation and *Forum Non Conveniens"* 29 *Texas Int* 7 *L. J.* 321 (1994).

61 *Dow Chemical Co. v. Castro Alfaro,* 786 S.W.2d 674, 688 (Tex. 1990). In this case, Costa Rican farmworkers sued Dow and Shell Oil Company in a Texas court for personal injuries allegedly sustained as a result of exposure to a pesticide (DBCP) made by the companies in Texas plants. The EPA had banned the pesticide's use in the United States, but Dow and Shell had allegedly shipped the pesticide to Costa Rica for use in the banana plantations there. The globalization of world markets and the interconnectedness of the world's ecological systems have also been given as reasons for considering the doctrine of *forum non conveniens* as obsolete.

liability for any [industrial] disaster would be decided in the US courts, more than pressure from Third World governments, has forced companies to tighten safety procedures, upgrade plants, supervise maintenance more closely and educate workers and communities."[62]

Dismissal of a suit by a US court under the doctrine is usually outcome determinative. One study has shown that fewer than four per cent of cases dismissed ever reached trial.[63] Whatever the merits of the doctrine as a legal passport to foreign courts in a particular case, litigation to remedy past wrongs and harms is no substitute for preventing the harms and abuses from arising in the first place. Increasingly, MNCs are seeking the help of NGOs like Amnesty International and other human rights advocates to establish appropriate guidelines for working in failed states. In 2000, several major oil and mining companies, prompted by the US and British governments, joined Amnesty International in drafting a Human Rights Charter as a code of conduct governing their relationship with national security forces of host countries. Energy companies have not failed to note that NGO groups target MNCs in the resource extractive industries and maintain many websites visited regularly by the news media.

5 Sustainable development in practice

5.1 In the exploration and production (E&P) sector of developed nations

In industrialized nations, sustainable development today is largely a matter of controlling the externalities of fossil fuel combustion. The externalities of the petroleum extraction stage are already highly regulated. However, even here, surprising gaps can be found as policy-makers and regulators seek to protect the jobs and revenue streams created by their domestic industries. The United States, in particular, has a domestic industry highly dependent on high-cost, marginal wells. Of the 550,000 producing wells in the USA in 1998, some 419,000, or 76%, produce an average of two barrels per well per day. An astounding number of additional wells, about 343,000 are idle, *i.e.*, they are not producing at all. Of these 343,000, only about half are idle with state approval. Another 34% lack state approval, but the operator is known and some degree of financial security exists to plug the well. This still leaves about 57,000 orphan wells – idle wells which have no known operator or an insolvent operator, and which have not been properly plugged and abandoned under state conservation laws. Except for discharges to navigable waters and the use of underground injection wells, oil and gas exploration and production (E&P) activities in the USA are mostly regulated at the state level, not under uniform federal standards.

In response to the low oil prices of the 1990s, the legislatures of many US states enacted incentive programmes to keep marginal wells in operation, such as exemptions from state severance taxes. In Texas, the legislature also extended the period of time to plug a nonproducing well from 90 days to one year, and allowed unlimited extensions of the plugging requirement with the payment of a small fee. The liberal extensions were granted without requiring an annual test to show that the well did not pose a pollution threat. The result was predictable: a steady increase in the number of unplugged and orphan wells which would require plugging at state expense. By the year 2000, the number of Texas wells not in compliance with the plugging rules had grown from 21,000 wells in 1992 to 25,672 in 1999. History predicted that the majority of these 25,672 wells would be orphaned to the state. The Texas Programme had become a government bailout programme for delinquent operators – an economic and environmental nightmare of non-sustainable development. The 2000 legislative session strengthened bonding requirements on operators and also increased industry fees and charges to the state to pay for oilfield clean-up costs.[64]

Almost all of the producing states in the United States are members of the Interstate Oil and Gas Compact Commission, or IOGCC. In 2000, this Commission completed its own blueprint for a national energy policy for the United States.[65] Two recommendations made to the federal government bear noting: first, the federal government should establish the true costs to the American public of imported oil, including the military expense of defending friendly Mideastern oil exporters such as Kuwait and Saudi Arabia against aggression, as we did in Desert Storm in 1990–91. Second, the costs of imported oil should also reflect the environmental

62 *Id.* at 687, note 10.
63 D. Robertson, "*Forum Non Conveniens* in America and England: 'A Rather Fantastic Fiction'," 103 *L.Q. Rev.* 398, 409 (1987).
64 J. Weaver, "The Federal Government as a Useful Enemy: Perspectives on the Bush Energy/Environmental Agenda from the Texas Oilfields," 19 *Pace Envtl L. Rev.* 1 29–30(2001).
65 Interstate Oil and Gas Compact Comm'n, *A Dependent Nation: How Federal Oil and Gas Policy Is Eroding America's Energy Independence* (2000).

pollution that occurs in foreign countries with lax regulation. The IOGCC report states that, unless all nations adopt the environmental standards applied to the US industry, the domestic industry is severely handicapped by the unevenness of the global playing field. The IOGCC does not call for a lessening of US standards; rather it asserts that the domestic industry's dedication to clean operations has earned it the right to greater access to public lands such as the Arctic National Wildlife Refuge.

Great Britain's zeal for enforcing pollution controls on North Sea producers has also been questioned because the same ministry that promotes oil and gas development regulates its environmental impacts.[66] The Oil Sector Report issued by UNEP and Sustainability also notes that voluntary environmental disclosure is less common among companies operating only in the exploration and production sector. These E&P companies lack a retail gasoline brand, and so are out of the public eye and do not feel the same public pressure as the integrated companies who have faced consumer boycotts over their practices. Also, many US-based companies voluntarily disclose only what is already required to be reported under the federal Toxic Release Inventory (TRI). The TRI does not require data on releases from E&P activity.[67] Thus, it is difficult to assess corporate performance in this sector, even in developed nations. Nonetheless, there is little question that developed nations' environmental regulations at home have been far stricter than the requirements imposed by developing nations for most of the past century.

5.2 In the Amazon Rainforests: the Shell Camisea and ARCO Villano projects

Large oil and gas fields underlie the rainforests and offshore areas of several countries of South and Central America, including Peru, Ecuador, Colombia and Brazil. Shell, ARCO (now merged with BPAmoco), Conoco, Occidental and other MNCs have licences to operate in these areas, often in partnership with national oil companies. Undoubtedly stung by the severe public condemnation of past practices, some of these companies are making serious efforts at sustainable development.

The Camisea Project in Peru

Shell, in particular, has pledged a policy of openness and public participation in its practices. When it drilled exploratory wells in the Camisea area of Peru, it maintained an extensive website which broadcast briefing papers, photos, anthropologist's reports, environmental assessment reports, and speeches and contracts with the indigenous groups in the drilling area. The briefing papers unflinchingly documented mishaps and problems, such as a cement spill near a creek, the need for greater erosion control at two well sites, and the anxiety of a local community over the criteria for awarding scholarships for higher education studies.[68] Shell pledged a standard of "sustainable development" in its Camisea agreements, defined as "improv[ing] the quality of life while ensuring that renewable resources remain vibrant to benefit future generations and nonrenewable resources are used wisely and efficiently with the benefit of future generations in mind."

Shell's greatest challenge was developing mechanisms to work with the indigenous groups. It hired environmental consultants to identify the stakeholders and NGO groups and involved them in meetings and workshops. As a result of these early consultations, Shell voluntarily modified the boundary of its concession to exclude a small area that intruded into a national park. Shell then undertook a "world class" environmental impact assessment. The Smithsonian Institute was invited to do an independent survey of the area to establish its biodiversity and to monitor any effects of the project. Shell undertook a study of the local population's health through the Royal Tropical Institute of Amsterdam and key Peruvian health agencies. It also studied the socio-economic base of the region. It agreed with Red Ambiental Peruana (RAP), an NGO network of 35 organizations, to perform independent monitoring work. In addition the government performed quarterly audits of performance, which Shell requested be made public. Feedback from all of these studies and communication with all the stakeholders led to constant, iterative changes in the design of the project, a process called "adaptive management."

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66 Gao, Discussion Paper 16, *supra* note 32 at 44–45.

67 Oil Sector Report, *supra* note 51 at 20.

68 Shell Prospecting and Development Peru maintained the Camisea website for several years at www.camisea.com, but the website was eliminated after Shell withdrew from the development stage of the Camisea project, having drilled three successful exploratory wells. The materials cited in this section are in the author's files. Shell withdrew, first, because of guerilla violence and then because it could not secure a long-term contract for the gas at a guaranteed price. Camisea is now being developed by a consortium led by Pluspetrol, an Argentine company. Producing and marketing the gas will require building a 700km pipeline through the steeply forested terrain to Lima, Peru.

To minimize effects on the indigenous people, Shell developed a health passport of required inoculations for all workers going to Camisea. Anyone with signs of the flu or contagious illness could not travel to the project. Shell workers were restricted to project site areas. Only a few people called Community Liaison Officers met regularly with the native communities. Local native people were hired as guides or for field work, so that no settlers or outside workers would come up the river to look for work. This focus on health is due to the fact that a large number of Nahua Indians had died in 1984 from the spread of a western disease, seemingly contacted from loggers. Shell's Community Relations Guidelines, a code of conduct for all project workers at Camisea, were written by an independent anthropologist.

The Peruvian Hydrocarbon Law gives licensees the right of eminent domain to acquire surface access to acreage necessary for development. Shell promised in its Camisea agreement that its operation would involve the participation of the local indigenous people and that "net benefits" would accrue to them through contractual agreements for surface use, rather than using condemnation. The Land Use Transfer Agreement between Shell and the Shivankoreni Native Community appeared in full on the Camisea website. In summary, the contract provided that Shell, the Transferee, "has assumed a public commitment to carry out the Camisea Project – Block 75 – in a sustainable manner, based on good operating practices, the fulfillment of the highest industry standards, and with a net benefit for the region with the dynamic participation and the cooperation of the surrounding communities to the area of the project." Shell agreed to "rigorously" fulfil the technical, safety and environmental protection standards in the EIA to prevent, minimize or eliminate negative impacts. Payment is a schedule of physical goods (such as medications, school supplies, water tanks, a community hall, sewing machines, machetes and shovels, mosquito netting, a solar-powered refrigerator to store medicines and vaccines, and modules for 100 laying hens) to be used as infrastructure for health, education, communication, water supply and the social well-being of the community (rather than as benefits to any one individual). In addition, Shell promised to finance the training of members of the Shivankoreni so that they would be able to operate and maintain the physical infrastructure and acquire a sense of autonomy with respect to their own development.

The land use agreement could be nullified by the natives if Shell or its workers exceeded the limits of the acreage granted, failed to deliver the promised goods or programmes, injured any member of the native group either "physically or morally," or failed to adhere to the stipulations of the environmental management plan for ecological protection. Shell invited SustainAbility, an independent NGO, to monitor the project's health, safety and environmental performance and make its report available to the public.

Two groups continued to oppose Shell's (and any other company's) drilling in the Amazon – the Rainforest Action Network (RAN) and Project Underground. Shell's public website dialogue stated that RAN failed to acknowledge the support which Shell had from the local indigenous communities and the desire of these communities to make social and educational progress and to have an influential voice of their own. Mercedes Manriquez, legal advisor of CONAP (the Confederation of Amazonian Nationalities of Peru) spoke directly to the problem of achieving indigenous participation in the Camisea development. She documented the difficulties that native communities had in understanding Shell's EIA and responding to it. But she also documented the problems that ensued when outside NGOs desiring to orient the communities as to the best way to face Shell ended up confusing the native viewpoint and limiting the joint initiatives that the natives wanted to establish. Manriquez concludes:

> "The native communities need the interaction of national and international NGOs that identify with the indigenous cause, but will not impose upon our decisions, and will act in response to our needs. They must also be in agreement with the same principles of respect, consultation and participation that in support of us they demand from the State and the Oil Companies. Our options, priorities and the course of our destiny are decisions for us to make. We also have the right to make mistakes and learn from our errors".[69]

The ARCO Villano Project

Industry journals also report on the advanced technology being used in rainforests. For example, ARCO's Villano project in Ecuador's installed the "small footprint" drillsite model now used in Alaska's North Slope

[69] M. Manriquez, "Indigenous Participation in the Current Development Process of the Camisea Project," Camisea website document in author's files. For many thoughtful perspectives on both the positive and negative roles that environmental NGOs play in developing countries, *see* the symposium issue of 13 *Colorado J. Int'l Envtl L. & Policy*, No. 1 (Winter 2002), titled "A Cartography of Governance: Exploring the Province of Environmental NGOs."

and offshore.[70] No roads access the area. All equipment was brought in by helicopter. The drill site is about 6.2 acres, and multiple wells extend from it. Produced water is reinjected. Production is remotely controlled from a central processing facility located 24 miles from the site next to an existing road in an area already disturbed by human intervention. Electricity is generated here and cabled to the drill site.

The greatest challenge was transporting the oil out of a roadless area with minimal impact. The usual pipeline right of way (ROW) is 45 to 90 feet wide, and pipe is laid in trenches using heavy equipment. ARCO determined that its 12-inch flow line to the central processing facility would not be buried because this caused erosion and damage to mature tree roots. Instead, it looked to densely populated countries in Europe and Japan for solutions. While looking for an overhead monorail system for the pipeline, ARCO found a small, walking tractor-excavator used in the Alps on slopes of up to 45 degrees. ARCO modified the machines with special attachments and cleared a ROW in the rainforest with a maximum width of 12 feet. It adapted a cogwheel-based monorack system used to transport harvest loads in vineyards and orchards on hilly slopes. The "invisible pipeline" now snakes through a "green tunnel" in the jungle. Because so few large trees were disturbed, the jungle canopy above the pipeline remains unbroken. A footpath of small logs follows the pipeline through the rainforest. Six small construction campsites remain with helipads to serve the six shutoff control valves, topped by solar power panels to power the valve.

ARCO encountered two significant non-technical problems. The first was that some indigenous groups demanded (unsuccessfully) that the company build a road to Block 10, delaying the project by five months. The second is that the infant mortality and health of the indigenous population around Block 10 improved so dramatically from health services provided to them that the growing population created environmental problems. The native people cut timber in a circular pattern around their living area to sell in local markets. With more children to feed, they cut more trees. The natives' desire for a road to bring more timber to market is strongly opposed by the environmental NGOs who work in the area.

5.3 The Chad/Cameroon project

The $3.5 billion Chad/Cameroon (CC) pipeline project in West Central Africa is another example of the new sustainable development paradigm in action. Unlike the Camisea project, however, the CC pipeline involved the World Bank as a significant actor. The CC project is a 660-mile (1,070km) pipeline bringing oil from landlocked Chad (the fifth poorest country in the world) to a marine terminal on the coast of Cameroon. A consortium of affiliates of ExxonMobil (as project operator), Petronas (the Malaysian national oil company) and Chevron are the private investors in the project. Both governments of Chad and Cameroon wanted to participate as equity holders in the project, but required World Bank loans to fund their percentage, amounting to about three per cent of project costs. Both states are pre-industrialized societies whose leaders have an ignoble past of corruption and human rights abuses, including torture of political opponents. Enormous pressure from human rights and environmental NGOs was exerted against both ExxonMobil and the World Bank to prevent project approval unless effective safeguards were created to prevent oil money from being used to further corrupt undemocratic governments, including the purchase of weapons to use in civil wars against the local populations. In the process, writes *Fortune* magazine, Exxon has been forced to take on the role of "multinational as missionary," serving as "development agency, human-rights promoter, de facto local government, and even (don't laugh) environmental watchdog."[71]

The doleful record of oil development in surrounding African countries well illustrates the "petro curse." In Nigeria, to the west of Chad, per capita income has dropped 23% since 1975, despite $300 billion earned from oil. Billions of dollars have fled the country into the bank accounts of kleptocratic dictators while local communities suffered environmental devastation. To the east and south of Chad, oil has fueled ruinous civil wars between competing warlords in Angola and the Sudan. Yet, the pipeline project could bring Chad more than $2 billion over 25 years, dollars which, if well spent, could do much to improve the health and welfare of Chad.

Shell declined to participate in the CC project. ExxonMobil, fearful that Chad would become a Nigeria, sought assistance from the World Bank to act as a "moral buffer" and to help coordinate the participation of NGOs in project assessment. With its own reputation now at stake, the World Bank negotiated a Revenue

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[70] Bob Williams, "ARCO's Villano Project: Improvised Solutions in Ecuador's Rainforest," *Oil & Gas J.* Aug. 2, 1999 at 19. *See also*, www.arco.com?init/villano for photos.

[71] J. Useem, "Exxon's African Adventure," Fortune, at 102, 15 April, 2002. Information on this project is available at the ExxonMobil website, www.essochad.com, and at the World Bank website, www.worldbank.org/afr/ccproj/project/pro_document.htm

Management Plan with Chad's President Deby and with the Chad parliament, that 10% of all oil revenues would be held in trust for future generations, 80% would be earmarked for health, education and rural development, and 5% would go to communities around the oil fields as detailed in the Regional Development Plan. Spending will be supervised by a nine-person board that includes four NGO representatives, and the World Bank assisted Chad in implementing a system of financial controls over the revenues. Public consultation on the project began in 1993 and ultimately included about 900 village level meetings; 145 meetings with about 250 in-country and international NGOs; 165 consultation visits to Pygmy settlements in Cameroon; and one-on-one consultations with households in Chad that will be forced to resettle.

The Environmental Management Plan (EMP) for the project consists of 19 volumes of documentation describing the environmental assessments and environmental management standards and commitments of the project sponsors. The plans include site-specific mitigation actions and instructions for every kilometre along the pipeline. The pipeline will be buried to avoid risks of vandalism and sabotage that have plagued above-ground pipelines. In Cameroon, three specific country-level plans were developed: an Offsite Environmental Enhancement Programme for the creation of two biodiversity reserves, the Induced Access Management Plan and the Indigenous Peoples Plan. Pipeline routes were adjusted based on biological and anthropological studies.

The project's progress is available for the world to monitor via quarterly reports on the website of essochad.com. The reports chronicle noncompliance events, such as spills of sewage or hazardous materials, working outside approved areas, inadequate equipment use (such as lack of drip pans), workers eating bush meat, and traffic accidents. The Fourth Quarter 2001 Report states that about 85% of the Project's workers are host country citizens and that more than two-thirds of the Chad and Cameroon workers hold skilled or semi-skilled jobs. Specialists are training nationals to become environmental monitors and technicians. One project enhancement was added: a high-speed fibre optic line cable is being laid in the pipeline trench to link Chad electronically to the rest of the world.

Still, the project is not without controversy. The signing bonus of $25 million received by the government of Chad was not included in the Revenue Management Plan. After hearing rumours that some of this money was not going to development projects, the World Bank investigated and found that the government had spent $4.5 million on military weapons. The Bank exercised its leverage to deny debt relief to Chad if the government did not use the Revenue Management Plan for all revenues. The Chad government complied and adopted a budgetary amendment allocating all remaining bonus funds to priority expenditures under the Oversight Committee.

Moreover, the Netherlands Committee of the IUCN reviewed the project using a team of experts and concluded that the World Bank gave inadequate attention to the possibility of major oil spills, especially from sabotage, and to the lack of a functioning legal system that would compensate those injured by spills and compensate for destruction of natural resources. Judicial independence and court procedures are lacking in the two host countries with past records of violence and human rights abuses. Capacity building of institutional competence in the rule of law has proven to be a long-term and difficult proposition. The IUCN report also found that the national laws of Chad and Cameroon on liability for environmental damages are inadequate, and little international environmental law exists to fill the gap.[72] The IUCN study called for establishment of an independent, transparent and external monitoring structure as an integral part of the project's legal framework.

In response to the misuse of the $4.5 million, the World Bank in February 2001 announced the creation of a six-person International Advisory Group to act as a watchdog over the CC project, guarding against misuse of public money in the project and monitoring the fulfilment of the developers' promises of environmental protection and social benefits.[73]

Finally, disillusionment among the villages has already set in. The influx of workers has resulted in soaring food and housing prices, and some of the promised benefits in terms of schools and microcredit initiatives have been slow to start.[74] Moreover, the demands of western NGOs often conflict with the desires of villagers

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72 S. Bronkhurst (ed.), *Liability for Environmental Damage and the World Bank's Chad-Cameroon Oil and Pipeline Project,* Annex II p.115 (Netherlands IUCN Symposium 2000).

73 The six members include a former Senegalese Prime Minister; a former Canadian deputy minister of the environment; a US professor of African studies; a former Norwegian minister of development and human rights; the president of Senegal's forum of African Voluntary Development Organizations; and a Dutch agricultural specialist.

74 Useem, *supra* note 71.

who want roads to pass through their villages and rainforests to be cleared for farming. Unlike Shell's Camisea project which was limited to exploratory drilling, the success of the Chad/Cameroon project will be measured over a much longer term. The real test of the project will come when the oil starts flowing in 2003 and beyond. Will the project actually deliver net benefits to the citizens of Chad and Cameroon over its lifetime?[75]

5.4 Summary of sustainable development in practice

The "triple bottom line" efforts of Shell, ARCO and other MNCs deserve respect for their technical innovations, careful environmental planning, social infrastructure benefits, and training of nationals. This new approach to oil and gas development is far removed from the destructive practices often used before sustainable development became an industry pledge. These past practices have left a legacy of pollution in many parts of the world, and the existing petroleum infrastructure in many countries (often built by or with state oil companies or governments) will cause environmental problems for years to come. For example, in May 1999, heavy rains triggered a landslide which wiped out 13 feet of Perupetro's 530-mile pipeline, sending thousands of barrels of oil gushing into the rainforest. In January 2000, 250,000 gallons of oil spilled into the bay waters off Rio de Janeiro from a ruptured pipeline operated by the state-owned Petroleo Brasileiro, blackening miles of shoreline.

Petroleum operations will never be without some cost to the environment. Ironically perhaps, it appears that the best chance of getting high environmental standards applied in the oil and gas sectors of many countries is to involve large MNCs in the projects. They can bring a level of expertise, capital and training that state oil companies and smaller-sized companies do not command.[76] The worry is that these large MNCs have such strong bargaining power vis-à-vis developing nations that they can threaten to withdraw if the nations insist on standards other than those offered by the MNC. The nation may also prefer to trade higher revenues for lower environmental standards as is its sovereign right. Smaller projects by smaller companies may not be as vigilantly monitored by international institutions or responsible NGOs, who learn about them too late to affect significant decisions. Even in those developing countries which have adopted sound petroleum laws and judicial systems, local regulatory officials will require training to build the expertise for effective monitoring and enforcement of the laws and contractual provisions for environmental protection. Until then, external monitoring by credible, experienced NGOs, international institutions, or non-industry experts is probably the only way to assure the global community that sustainable development is an "on the ground" reality, project by project.

6 Implications of kyoto for the oil and gas sector

As discussed in the first section of this chapter, the shift away from the use of fossil fuels is made difficult by their current availability and relatively low prices. Yet combustion of these fuels is the major contributor to greenhouse gas emissions which scientific consensus has linked to global warming. While other sections of this chapter have discussed sustainable development in the petroleum extraction phase, this section briefly surveys three other aspects of sustainable development in the oil and gas sector: (1) using the Clean Development Mechanism proposed in the Kyoto Protocol to achieve "triple bottom line" results through the activities of MNCs in developing countries; (2) removing subsidies and tax credits for fossil fuels; and (3) pricing or taxing pollution externalities.

6.1 Implications of the Kyoto Protocol: The US Position

It is clear now that the United States will not ratify the Kyoto Protocol. Thus, the United States will not be bound to fixed targets of reduced greenhouse gas (GHG) emissions. However, if, as expected, Russia ratifies the Protocol, it will become effective among the signatory parties even without the participation of the United States, the world's largest energy consumer and producer.

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75 For an overview of other industry efforts at sustainable development in local communities, *see* D. Asmus, "Industry Perspectives on Benefits Sharing and Distribution in the Upstream Petroleum Industry," presented at the World Petroleum Congress, Rio de Janeiro, Sept. 2002.

76 Maxus Energy, the successor to Conoco on a concession in Ecuador, had great difficulty operating the project; its merger with larger, more experienced companies was important to the overall success of the project. Forrest, *supra* note 26.

In lieu of ratification, federal efforts to reduce CO_2 in the USA will rely mainly on voluntary programmes and research and development funding.[77] The USA will probably adopt stricter air pollution standards on power plant emissions of sulphur oxides, nitrogen oxides and mercury, but not CO_2. Overall, the USA is projected to continue its long-term trend of becoming more energy-efficient, with the net result that emissions of GHG will decrease per unit of Gross Domestic Product, but will continue to increase in absolute terms as the economy expands.

The US perspective on Kyoto has been aptly summarised by Professor Pring as "schizophrenic."[78] Estimates of the cost of US compliance with Kyoto's target of reducing GHG emissions to seven per cent of 1990 levels range from a modest $14–26 per ton of carbon reduction (with little impact on the economy) to $300 per ton (with large job losses and sharp hikes in gasoline and electric bills), illuminating the huge gap between the economic pessimists and the technology optimists. The large difference also reflects different assumptions in the effectiveness of international trading mechanisms.

The negative position of the US Congress and the Bush administration towards climate change obligations is also attributed to the strong influence of the domestic energy and car industry lobby and the Global Climate Coalition, an organization of trade associations and companies in the energy, transportation, mining and utility sectors. Countering these industry forces are many environmental NGOs, such as Environmental Defense and the Natural Resources Defense Council (NRDC), that promote the market-based flexible trading mechanisms in Kyoto and that seek to work cooperatively with industry. Their campaigns and the work of the Pew Center's Climate Change Project have been quite successful in encouraging defections from the Global Climate Coalition, notably by major, European-based oil companies such as BP and Shell. Both of these companies broke ranks with the oil industry in 1998 and pledged to voluntarily reduce GHG emissions by ten per cent below 1990 levels by the year 2010.[79] Ford, DaimlerChrysler, GM, Texaco, and Southern Company (the largest utility in the US) then also defected from the Coalition. Several other businesses such as IBM and DuPont announced that they would reduce GHG emissions, sometimes by dramatic amounts, and many companies joined business councils that support energy efficiency, sustainability, and pro-active solutions to GCC. Even the Edison Electric Institute, an association of US investor-owned utilities, admitted support for an early start to the Clean Development Mechanism so that its members could start earning emission reduction credits.

6.2 Using the Clean Development Mechanism (CDM)

Many US companies, with strong support from Environmental Defense, the NRDC and environmental think tanks, have sought legislation for "early action credits" so that voluntary reductions made now can be used to satisfy any federal obligations imposed at a later date. Coal-fired power plants, the most polluting entities in the US, are especially interested in flexible trading mechanisms, both within the USA and internationally, which would allow them to buy credits to pollute from entities who can reduce GHG emissions relatively inexpensively compared to the power plants' domestic alternatives of fuel-switching or end-of-pipe controls. However, no such bill has yet been enacted.

The Kyoto Protocol offers several emissions trading mechanisms. One (called Emissions Trading or ET) allows developed nations to purchase unused portions of another nation's emission quota. Two other programmes, Joint Implementation (JI) and the Clean Development Mechanism (CDM), are project-based and allow developed countries to receive GHG credits by implementing actual GHG offset projects in or by providing other technology transfers to another country. The JI programme works between developed (Annex I) nations, and the CDM works between developed and developing nations. The Clinton administration's optimism that the USA could meet its Kyoto targets at modest cost to the domestic economy is premised on being able to meet 75–85% of the nation's obligations through purchasing credits from other nations or doing

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77 Since 1992, the US Government has promoted a number of voluntary GHG reduction programmes, such as the Coalbed Methane Outreach Programme to encourage the capture of CBM as a fuel source instead of venting it, but there is considerable doubt about the effectiveness of these programmes. R. Pring, on "The United States Perspective," Chapter 10, at p.210, in P. Cameron and D. Zillman (eds.), *Kyoto: From Principles to Practice* (Kluwer Law Int'l 2001). The book's other chapters document the strong efforts being made by many other countries, especially in Europe, to implement the Kyoto Protocol.

78 Pring, *supra* note 77.

79 *See*, A. Kolk and D. Levy, "Winds of Change: Corporate Strategy, Climate Change and Oil Multinationals, 19 *European Management J.* 501 (2001) (analysing the different drivers of US-based Exxon Mobil and the European MNCs). Shell and BP are both members of the Partnership for Climate Action (PCA). Their efforts at GHG reductions are reported in Partnership for Climate Action, Common Elements Among Advanced Greenhouse Gas Management Programmes, Discussion Paper, Mar. 2002.

offset projects abroad. The European Union and many environmentalists oppose this strategy because it allows the USA to buy its way out of any real commitment to reduce energy consumption, increase innovation at home, and alter nonsustainable life styles in the long term.[80]

Still, there is considerable support in the USA for JI and CDM. The USA has participated in a number of JI/CDM pilot projects approved by the Conference of the Parties in 1995 to provide a baseline of experience for evaluating these mechanisms. By 1999, US initiatives totaled 32 approved projects in 14 countries of Africa, Asia, Europe and Latin America. Of these, 17 directly reduced GHG emissions by investing in wind, geothermal, hydroelectric, biomass waste-to-energy, and solar projects, switching from coal to natural gas, capturing methane gas, and increasing residential energy efficiency. The other 15 indirectly reduced GHG emissions by sequestering emissions though forest conservation and land use projects. The private developers of these projects estimated they would reduce CO_2 emissions by 200 million metric tons of carbon equivalent and 1.3 such tons of methane.[81] However, the General Accounting Office could not verify these claimed benefits because standard methods for evaluating the reductions had not been developed. In order for CDM and JI projects to provide real benefits, not just "hot air," major issues of baseline measures, verification, and monitoring need to be resolved.[82]

The relationship between the CDM in the Kyoto Protocol and sustainable development in the oil and gas extraction sector is readily perceived. The CDM can be used to promote the shift from coal to gas, to eliminate gas flaring, to increase energy efficiency and pollution control, and to promote bioreserves as mitigation projects and carbon sinks in developing countries. In countries like India and China, domestic coal reserves will often be a cheaper source of fuel for power plants than natural gas. Using CDM, the additional cost of natural gas can earn emissions reduction credits for the project investor from a developed country. These credits can then be sold or traded as an offset to the additional expense. Similarly, certified emissions credits can be earned by investing in higher cost, but higher efficiency Combined Cycle Gas Turbines or gas-fired distributed generation units that can be placed in highly polluted urban areas or scaled to the needs of smaller populations in rural areas where stranded gas fields might exist. These opportunities may be less costly than renewables and may be available in areas that have no potential for wind, solar, geothermal or biomass supplies. Reductions in gas flaring in oil fields in Brazil and Nigeria, over and above those required by contract or national laws, can earn credits for the MNCs operating the fields, making such investments profitable.[83] Similarly, certified emission reductions can result from sequestering methane or CO_2 in depleted natural gas reservoirs, a technology and activity for which existing oil and gas operators would have ready expertise.[84] CDM credits could also be earned by investing in the host country's shift to compressed natural gas vehicles, thereby helping to create a market for gas in the host country.

The use of CDM by MNCs in their foreign operations has the benefit of involving the nationals of the host country. As discussed in Section 4, host countries often participate as equity investors in the joint venture or licensing agreement. As participants, they will bear the additional costs of the CDM project, but will also earn a share of the emission reduction credits. In the process of developing the CDM project, host nationals will acquire training and technology skills that are important to assuring the country's self-development, including skills in monitoring projects for environmental compliance. The 2002 Johannesburg Summit on Sustainable Development endorsed what summit-speak calls "Type 2 Partnerships" between governments, industry and civil society (including NGOs and private foundations) that promote both economic growth and environmental benefits through stakeholder consultation and collaboration.[85]

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80 *E.g.,* the US could meet its Kyoto targets largely by purchasing offsets from Russia whose economy collapsed so drastically in the 1990s that its GHG emissions fell well below its targeted allowance.

81 The US Climate Action Report – 2002, the Third National Communication of the United States under the UN Framework Convention on Climate Change, is now available at www.cpa.gov/globalwarming/publications/car/index.html as an update to the 1997 Climate Action Report. Federal policies are summarised at pp. 52–61; state, private sector and NGO initiatives arc collected at pp. 61–63, and Appendix B contains fuller descriptions of all the projects. Nothing in this 2002 report alters Prof. Pring's analysis. By 2002, the US had accepted 52 JI/CDM pilot projects in 26 countries. International projects and funding for technical transfers are detailed in the 2002 report at pp.113–136 and App. C.

82 R. Stewart, J. Connaughton and L. Foxhall, "Designing an International Greenhouse Gas Emissions Trading System," 15 *Nat. Resources & Env't* 160 (Winter 2001) (ABA Section on Energy, Environment & Resources); United Nations, *The Clean Development Mechanism: Building Public-Private Partnerships under the Kyoto Protocol* (Richard Stewart, lead author, 2000) (UNCTAD/GDS/GFSB/Misc. 7/Rev. 1).

83 *E.g.,* The Nigerian National Petroleum Company appears not to have the funds to provide its share of joint venture costs to reduce gas flaring in Nigeria to zero by 2004. If Shell, its partner, provided these additional funds, Shell could earn emission credits. Alternatively, any developed nation or other private investor could provide the funds and earn the credits.

84 S. Stevens and J. Gale, "Geologic CO_2 Sequestration," *Oil & Gas J.* 40 (May 14, 2000).

85 For an example, see The Global Gas Flaring Reduction Initiative Report on Consultations with Stakeholders, available at www.ifc.org/ogc/global_gas

6.3 Removing subsidies

Economists, environmentalists and business leaders all agree that subsidies can distort consumption and production patterns, leading to over-production and over-consumption of the favoured fuel. In a competitive market, subsidies are inherently self-defeating. Subsidies temporarily increase the profitability of producing; firms expand output or new firms enter the market, and supply increases; costs rise and prices fall, and ultimately, the industry's profit level returns to normal.

Two types of subsidies distort energy markets. The first keeps prices artificially low to consumers. For example, one study reports that energy resources are sold at an average of 20% below cost in eight countries: China, India, Indonesia, Iran, Kazakhstan, Russia, South Africa and Venezuela. If these subsidies were removed, primary energy consumption is projected to decrease by 14% and carbon dioxide emissions by 17%, and each nation's gross domestic product (GDP) could grow by one per cent due to improvements in economic efficiency and technology. Additional economic benefits would accrue if these countries received credits for their CO_2 reductions under some sort of global trading scheme.[86] However, in developing countries, such subsidies are often difficult to remove without political turmoil. When the World Bank conditioned a loan for co-financing of new oil exploration in Ecuador on the government's increasing the price of gasoline in its domestic market, street riots ensued with some deaths.

Unlike "life-line" rates which price electricity at low rates for very small users, subsidies to all consumers benefit the rich as well as the poor, and often do not benefit at all the very poorest members of a society who have no access to any fuel source other than wood or dung or other local biomass. Subsidies do not let the market price reflect the real price to society of producing or importing the fuel source. The subsidy is often paid by the government, adding to its budget deficits and subtracting from funds which could be used for other infrastructure needs in health and education or clean water. Alternatively, the national oil company or electricity provider must bear the cost of the subsidy, and cannot then acquire capital to reinvest in modern technology or efficient practices, including environmental controls. The answer is to use the general tax and welfare system rather than energy subsidies to redistribute income and services to alleviate poverty, but even in wealthy nations, subsidies are notoriously difficult to end.

The second type of subsidy grants tax advantages to producers to expand production of a particular type of energy. For example, the boom in coalbed methane production and in deep gas drilling in the USA was fuelled by federal tax credits. Another mechanism used to spur additional drilling in deep waters offshore is royalty relief– lowering the royalty payments due the federal government on production from expensive, deepwater platforms. These and many other mechanisms, such as accelerated depreciation or expensing of drilling costs, favour oil and gas drilling over other sectors of the economy.

It is difficult to get an accurate measure of the extent to which eliminating subsidies to fossil fuels can reduce energy production and use, and thus greenhouse emissions. Because the USA is the largest emitter of greenhouse gases and because fossil fuels account for about 90% of these emissions, a number of studies have attempted to measure the effect of subsidies on GHG emissions in the USA alone. A careful comparison of ten of these studies by Koplow and Dernbach shows large disparities in subsidy definitions and valuation.[87] For example, some studies define subsidies as direct transfers targeted to energy producers or consumers, while others also look at indirect subsidies, such as subsidised lending to rural electric cooperatives and loan guarantees. The authors then list the conclusions of the studies projecting the impact of fossil fuel subsidy reform on greenhouse gases, both in the US and globally. In general, there are two consistent trends. First, all of the reports project some reductions in emissions, varying from less than one per cent to the 6–8% range, with the largest reductions occurring in the transition economies that have most directly subsidized the price of energy to consumers. Second, a general consensus emerges that reforms will lead to increased efficiency and little or no change in economic welfare at the national level. Thus, subsidy reform can probably play a role

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86 International Energy Agency, World Energy Outlook: 1999 Insights, November 1999, as reported at www.weathervane.rtf/negtable/energy_subsidies

87 D. Koplow and J. Dernbach, "Federal Fossil Fuel Subsidies and Greenhouse Gas Emissions," in 26 *Annual Review ofEnergy and Environment* 361–89 (2001). Some studies account for the subsidy effect of programmes in related sectors that disproportionately benefit the energy sector, like inland waterway transportation and ports, capital subsidies, or the cost of maintaining a military presence in the Persian Gulf or the domestic Strategic Petroleum Reserve. Some studies include externalities of fossil fuel use on environmental quality, health and congestion. Similarly, the manner in which the studies offset subsidies with "netting' effects, such as the effects of excise taxes on fuels, varies widely. Also, some studies include coal, not just oil and gas as a fossil fuel.

in progressing toward a more sustainable energy future, although a significant part of the effect is often due to a removal of subsidies from coal rather than oil and gas.[88]

6.4 Pricing and taxing externalities

To encourage the shift from coal and oil to natural gas or renewables, legislation can require the use of environmental adders to the price of each energy source. Because coal and oil are not as clean burning as gas, such adders would lower the price of gas relative to dirtier fuels, thus encouraging the use of gas. Renewables, while not without certain externalities of their own, would also be encouraged by low adders relative to fossil fuels. Increasing the stringency of pollution controls on coal and oil would have a similar effect by raising the relative costs of combusting them. Environmental adders on all three of the fossil fuels would encourage renewables, and would also promote nuclear energy unless it is assigned adders for its distinctly different environmental impacts.

The simplest mechanism for accounting for environmental externalities of fossil fuel use in the context of global climate change is to institute a carbon tax which automatically accounts for inter-fuel differences in carbon intensity. Such a tax has the added advantage of raising the price of fossil fuels overall, thus encouraging conservation by end users. The tax can then be returned to consumers to spend as they like, or it can be used to fund education, health, parks, mass transit, research and development, renewables, or other social priorities. Many economists advocate a broad shift in taxation, reducing taxes on labour and capital investment and increasing taxes on consumption, particularly energy consumption. An increasing number of European nations have adopted energy or carbon taxes. Such a tax is a political impossibility in the United States at this time.

7 Summary and conclusions

As shown above, the principles of sustainable development in the extractive sector of the oil industry have been most evidenced through the development of complex, multi-stakeholder contracts between MNCs, host country governments, NGOs, local communities, and sometimes the World Bank or other international financing associations on a project by project basis. It will be increasingly difficult for MNCs and governments to negotiate licensing or joint venture projects without engaging in this type of multi-party negotiation. Several drivers explain this project-oriented, semi-voluntary approach to sustainable development. First, oil and gas extraction often takes place in developing countries which have no domestic environmental law or effective compliance mechanisms. The internal development of such laws and regulatory agencies is a long-term proposition that cannot solve today's problems. Second, MNCs prefer to operate under private codes of conduct and contractual provisions that can be tailored to a particular project and that may stave off harsher national laws (which may also ultimately be less effective). The MNCs often see their high standards in health, safety and the environment as a competitive advantage in the bidding process. Third, the host country readily perceives the advantage of the transfer of technical expertise to its nationals as they participate in the project as joint venturers. The agreement often expressly provides for technology transfer and training, separate and apart from any commitments to provide schools or health care.

Unease with this approach to sustainable development derives from its privatization of environmental standards in the hands of economically and politically powerful MNCs whose superior expertise is both their greatest asset and the very source of the discomfort. The unease is shared by many of the companies themselves who view a nation's legal and institutional infrastructure and the use and distribution of the nation's petroleum wealth as matters for government. However, as Sir Geoffrey Chandler, a former executive with Royal Dutch Shell has written, in failed states or states with weak institutions, the assertion that private investment in resource development will lead inevitably to improved living conditions for affected communities or the populace at large is demonstrably untrue, leaving MNCs with "challenges of particular difficulty." He continues:

> "Companies must not usurp or take on the role of governments, whatever the nature of the regime. But with increasing scrutiny of the impact of oil not just on a country's revenues, but on its social, cultural and economic fabric and its political stability, it must be questionable whether

[88] The Bush/Cheney national energy plan and the current House and Senate energy bills are a step backwards from the standpoint of sustainable development because they grant billions of dollars in new subsidies and incentives to energy production, including a loan guarantee that operates as a floor price on natural gas transported by pipeline from Alaska.

> companies can stand wholly aside from issues in whose origins their own technical success has played a fundamental role. . . . The company's very presence is a factor in the situation".[89]

This "debate on development" has led to the recognition of the need for partnerships involving governments, intergovernmental organizations, NGOs, private foundations, and private investors in the oil sector.[90] If responsible NGOs and other external expert groups are included as stakeholders in the project planning and monitoring (and if an international financing agency with real expertise is similarly involved), the project becomes "public-ized" in many respects.[91] To many in the petroleum industry, this approach to sustainable development is simply an extension of their primary quest for shareholder value. By reducing political risk, sustainable development practices create a "social licence to do business" that enhances investment stability and long-term shareholder wealth.

A second source of unease with the contractual approach to sustainable development is that smaller private investors or state oil companies without expertise in or a commitment to sustainable development practices, will operate smaller projects without the public scrutiny accorded larger MNCs and without any applicable national or international law that can avoid the mistakes of the past. The attitude of some companies and governments is that they are capable of bargaining with each other and adhering to standards of sustainable development without the involvement of NGOs or other external groups. Because it is increasingly difficult in the globalized world of the internet, international NGOs, and satellite photography for actions in any part of the world to escape the public eye, both governments and companies are likely to adhere to higher standards than those of the past, even without multi-party stakeholder involvement.

International development agencies can supplement project-based training with technical assistance in building administrative agencies and judicial institutions which further rules of fair play. Passage of national laws applicable to the petroleum sector and complemented by licensing conditions tailored to a project may be a more feasible approach to national law-making than enacting comprehensive, command-and-control environmental laws for all industry. A national law which requires tripartite negotiations between private investors, the energy ministry and an environmental ministry with veto power over the project as leverage, could promote the goal of sustainable development even if the country has not enacted much environmental regulation (at least in countries where corruption and bribery are minimal). Environmental consultants, some from NGOs representing the local community, should serve as independent experts on behalf of the environmental ministry and local communities in the project approval process.

Early consultation with all stakeholders during the approval process and the use of external monitors and auditors after the project is underway will do much to assure that sustainable development occurs, even though it is driven largely through a process of private contract law. Ultimately, whether the strictest environmental standards of developed nations will apply to all petroleum activity in a developing country will depend largely on the host country's balancing of its own triple bottom line of economic, environmental and social progress.

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89 Sir G. Chandler, "The Responsibilities of Oil Companies," at p. 14, in A. Eide, H. Bergesen and P. Goyer (eds.), *Human Rights and the Oil Industry* (Intersentia 2000).

90 *Id.* at 16.

91 "Tri-sector partnering" among government, industry and civil society (including NGOs) is promoted by companies in the petroleum industry who are members of Business Partners for Development. Its website is www.bpdweb.org

Legal measures to promote renewable and energy efficiency resources[1]

Richard L. Ottinger and Fred Zalcman

1 Introduction

Virtually all the experts who have addressed the energy aspects of sustainable development have concluded that renewable energy and efficiency resources should play a major role. Yet, in both developed and developing countries, these resources, while their use is growing rapidly, have not reached anywhere near their technical and economic potential as found in numerous studies throughout the world.

Energy efficiency measures are often the most economic means available to improve delivery of energy services. They usually can be installed with a very short investment payback and frequently can yield substantial savings for the end user. They are particularly applicable to areas that already have electrification. But for the two billion people in rural areas without access to electricity, efficiency measures create a unique opportunity for capturing their advantages from the outset of electrification. And this head start is invariably far more economical than retrofits introduced after electrification and end use equipment has already been purchased and installed.[2]

Renewable resources vary widely in their technical and economic characteristics. Some renewable resources like wind, geothermal, modern biomass and small hydroelectric energy plants are in fairly wide application in developed countries, can be economic, and offer large environmental advantages. They are applicable either for grid use or for stand-alone energy in rural communities. Some, like photovoltaics, are still too expensive for many electric grid applications, but are very viable for niche applications everywhere, such as for switching equipment upgrades. For poor and remote communities not yet served by electricity, photovoltaics are highly economic, particularly to provide power for lighting, refrigeration, irrigation and communications. Hydrogen fuel cells have great technical and economic potential and much work is being done by governments and the private sector to hasten their economic feasibility. Hydrogen is generally accepted as the fuel of the future. Other renewable resources with significant potential like wave and tidal energy, and deep hot rock geothermal are, for most applications, not yet economically viable or technically perfected and require additional research and development or subsidy.

There are a host of economic, social and legal barriers that account for the failure of renewable and efficiency energy resources to reach their potential. Legislation can remove these barriers, get the price signals right, and provide various measures for promotion of these resources.

Nuclear energy is excluded from this analysis as a development option because of its high capital and operating costs, high technical requirements for operation and maintenance, and its unresolved problems of proliferation and waste disposal. After the events of September 11,2001, an over-riding problem is their great vulnerability to terrorist attack, particularly on the control rooms and spent fuel pools that are located outside the containment vessels. Nuclear energy is, at any rate, not renewable unless reprocessing of spent fuel is utilized, an even more prohibitively expensive and technologically challenging option for developing countries. For all countries, reprocessing is a technology which is particularly vulnerable to proliferation because of its plutonium production, unenforceable according to the International Atomic Energy Agency.

Trash to energy is excluded because it is so highly polluting and because recycling options are so much cleaner and usually more economical.

Special problems must be addressed for most developing country areas that already have electrification because their electricity is so highly subsidized that it is often unprofitable to install renewable energy or efficiency measures. The resulting inability to finance proper maintenance and repair of power equipment and transmission and distribution lines results in highly unreliable power. The subsidization also deprives the utilities of sufficient revenues to permit adequate maintenance and repair, resulting in frequent brownouts and blackouts.

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[1] The authors wish to acknowledge and thank Rebecca Williams, Pace Law School student intern, for her valuable research assistance.

[2] World Energy Assessment, http://www/undp.org/seed/eap/activities/wea/

Special problems of the poor rural areas of developing countries also must be separately addressed. Their primary source of energy is wood burned for household cooking and home heating, a dreadful source of health-damaging pollution. Modern biomass stoves and LPG can help resolve these problems until electrification can be provided.

For all developing countries (and many developed countries), education of the public and training of government officials, utility personnel and private sector business managers, engineers and operational people are essentials that governments can promote or provide. Removal of barriers to import of equipment and materials and creation of effective capital markets and financial instrument regulations are vital. An infrastructure must be created for the handling of projects, making financing applications, financial accounting and controls and management.

This chapter explores renewable energy and efficiency resource options from the standpoint of the legal mechanisms that can be used to promote them. Most of the mechanisms rely either on legislation or executive actions. The experiences of developed countries are relevant because they tend to set patterns used by developing countries and developing countries generally rely on the industrialized countries for the relevant technologies and expertise necessary for their introduction. Options explored include legislated market mechanisms such as subsidy removal for unsustainable resources (thus permitting renewables to be more competitive), mandated use of life cycle costing and inclusion of externalities in energy procurements; emissions trading and credits; government standards and regulations; government procurement and incentives; electric and gas utility regulations; government financed research and development; international loan and grant programmes and other innovative financing arrangements for developing countries; and use of the Kyoto Protocol mechanisms.

With an adequate framework of legislative and executive measures to promote efficiency and renewable measures, they can be competitive and can make a significant contribution to sustainable development.

2 Energy efficiency measures

Energy efficiency measures in the manufacturing, transmission and end use of electricity replace the need for fossil fuel resources and virtually always produce a net economic benefit, which is often substantial. The need for energy efficiency is illustrated by the fact that 71% of all primary energy is wasted in the process of producing heat, light, and cooling other energy services.[3] Employing energy efficiency technologies can reduce the amount of this waste that will in turn reduce costs.

2.1 Appliance efficiency

Furnaces, boilers, air conditioners, heat pumps, refrigerators, water heaters, clothes washers and dryers, ranges and dishwashers account for 85% of energy consumption in the residential sector. 65% of energy in the commercial sector is used for heating, cooling, lighting, water heating, refrigeration and office equipment. In the industrial sector, lighting equipment and electric motors account for more than 75% of electricity consumption.[4] The tasks desired from these appliances can be furnished by much more efficient appliances that use a fraction of the electricity used by less efficient, more popular models. The more efficient appliances can also provide substantial savings to companies, consumers and society.[5]

2.2 Lighting

In countries that have grid electricity, replacement of incandescent light bulbs with compact fluorescent bulbs, which last ten times longer and use one-quarter as much electricity, achieves great savings to the consumer and to society. Task lighting, reflectors and use of daylight also result in significant savings at low or no cost. In many countries, utilities invest in lighting efficiency measures for residential and business customers, sometimes repayable out of the savings from the conversion. Many countries have started to

3 A 1997 study estimated that aggressive adoption of energy efficiency measures could result in net gains of nearly 800,000 jobs in the USA by 2010. A. Lovins and L. Lovins, *Making Sense and Making Money*, Rocky Mountain Institute (13 November, 1997) at 1.

4 H. Geller *et al.*, *Approaching the Kyoto Targets: Five Key Strategies for the United States*, American Council for an Energy-Efficient Economy (Washington, DC, August 1998).

5 Advanced refrigerators alone can save over 90% of the energy used by standard models today, thus not only reducing carbon dioxide emissions but also eliminating climate and ozone disrupting CFCs from insulation and refrigerants. Lovins, *supra* note 3, at 7.

produce compact fluorescent light bulbs for domestic use and for export, creating new business, revenue and job opportunities. Conversion of incandescent street lighting to sodium vapour or other efficient alternatives also creates considerable savings to municipal taxpayers and to the environment, and produces much improved lighting.[6]

2.3 Insulation

Many of the new buildings in developing countries are entirely without insulation, resulting in the waste of much of the fuel (usually fossil), which is used to heat and cool them. Most of the older buildings in developed countries also lack insulation. The buildings can be retrofitted with insulation at a payback of just a year or two of the retrofit costs.

2.4 Urban heat islands

One-sixth of the electricity consumed in the USA goes to cool buildings, at an annual cost of $40 billion. In urban areas, the lack of shade for buildings and dark-coloured roofs and roads create what is known as "urban heat islands" which consume large amounts of air conditioning energy. Many tropical countries plant deciduous trees on the south side of buildings and paint the buildings in light colors. These measures are low cost/no cost means of achieving substantial savings in the energy used for air conditioning in hot climates. For example, building owners in Haifa and Tel Aviv are required to whitewash their roofs each spring.[7]

The use of light-coloured aggregates in highway and road construction materials can also achieve substantial energy savings. The direct savings in air conditioning of the buildings treated are supplemented by an indirect saving from the lowering of temperature in surrounding buildings.[8]

2.5 Drinking water purification

The recent development of ultraviolet (UV) water purification, if widely adopted, could save the vastly greater energy consumed by existing water filtration and chlorination plants in industrialized societies or the use of fossil fuel or wood to boil water for purification in developing countries. Attendant advantages are that UV processes use no chemicals, impart no taste or odour to water, have no risks of overdose, do not require *pressurized water and cost less than the alternatives.*[9]

Approximately 1 billion people worldwide use cooking stoves to boil their drinking water. This process is reliable, but it demands labour, imposes high economic, environmental and human health costs and is ultimately susceptible to limited fuel availability.

UV treatment uses approximately 6,000 times less energy than boiling over a biomass cooking stove.[10] UV technology is a rapid disinfection process that acts at the DNA level without heating the water, and thus offers great energy and cost savings potential.

2.6 Recycling

The recycling of household waste products saves consumers and municipal taxpayers the costs and pollution of waste incineration. The recycled waste is often convertible into useful products, thereby creating revenues and jobs.

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6 J. Goldemberg and W. Reid (eds.), *Issues & Options; The Clean Development Mechanism,* UNDP (New York 1998).

7 H. Akabari, A. Rosenfeld and H. Taha, *Summer Heat Islands, Urban Trees and White Surfaces,* Proceedings of American Society of Heating, Refrigerating and Air Conditioning Engineers, Atlanta, GA (February 1990); also, Lawrence Berkeley National Laboratory Report LBL-28308, Berkeley, CA (1990); A. Rosenfeld, J. Romm and H. Akbari, Painting the Town White – and Green, *Technology Review* (Boston, MA February/March 1997).

8 E. Mills, Fuel-based Light: Large CO_2 Source, *International Association for Energy-Efficient Lighting Newsletter,* Issue No. 23, vol. 8 (February, 1999), at 4.

9 A. Gadgil, D. Green and A. Rosenfeld, *Energy-Efficient Drinking Water Disinfection for Greenhouse Gas Mitigation,* 1998 ACEEE Summer Study, Energy Efficiency in a Competitive Environment, vol. 5, p. 131, American Council for an Energy Efficient Economy, Washington, DC (1998).

10 M. Suozzo and J. Thorne, *Market Transformation Initiatives: Making Progress,* American Council for an Energy-Efficient Economy (Washington, DC, May 1999) at 37.

In the industrial and commercial sectors, the recycling of wastes is also economically and environmentally advantageous. For example, the USA throws away enough aluminium to rebuild the country's commercial aircraft fleet every three months, even though recycling aluminium takes 95% less energy than manufacturing it. Interface, the world's largest carpet-tile maker, estimates it cuts its materials flow by about tenfold by leasing floor-covering services instead of selling carpet and by remanufacturing old carpet. Land and coalmine gas recovery turns heat trapping and hazardous methane emissions into a voluble fuel that also displaces fossil-fuelled power plants.[11]

2.7 Transmission and power plant efficiency

In many developing countries, the transmission and distribution systems are inadequate, causing large losses of the power generated and also resulting in frequent blackouts or brownouts that are very costly to businesses. Even in developed countries, these systems are often neglected, resulting in outages at times of system stress. Upgrading inadequate transmission or distribution systems should be a high priority in these cases. Usually, these costs are borne by the utility company and paid for in the electricity charges, but in many developing countries the electricity charges are inadequate to cover these costs.

Distributed resources such as energy efficiency measures, fuel cells and photovoltaics are often economic alternatives to expansion or upgrades of transmission and distribution systems. Because of their proximity to customer loads, distributed systems can offer improved reliability, as well as emission reductions. Distributed resources also avoid the line losses resulting from the transmission of power from the central station power plant to the load centre; typical transmission losses account for about 10% of central plant generated power.[12]

2.8 Industrial efficiency

Electric motors consume more than half of the electricity in the USA and almost 70% of manufacturing sector electricity.[13] Replacement of standard electric motors with smaller variable speed drive motors (as with the gear shift in a vehicle), and matching the motor output to the load produces large electricity and pollution savings and economic benefits.

The biggest industrial energy savings frequently occur in improving the efficiency of industrial processes themselves, e.g. using continuous casting of steel and utilizing waste products for electricity and heat generation, as is often done in paper, lumber and plywood manufacturing in the United States. The US chemical industry saved nearly half its energy per unit of product from 1973–1990 by plugging steam leaks, installing insulation and recovering lost heat.[14] These kinds of improvements can usually be financed through commercial loans repayable from the savings achieved. Some US utilities offer industrial efficiency audits, provide technical assistance and participate in the financing of efficiency improvements.

The industrial sector in the US accounted for about 36 quads of primary energy use in 1997, which was 39% of US energy consumption, with manufacturing dominated by six sectors (petroleum refining, chemicals, primary metals, paper and pulp products, food products, and stone, clay and glass products). There is a great potential for cost-effective improvement. For example, an in-depth analysis of 49 specific energy efficiency technologies for the iron and steel industry in 1999 found a total cost-effective energy savings potential of 18%.[15]

2.9 Combined heat and power (cogeneration)

Utilization of the waste heat from electricity generation for industrial or district heating purposes converts as much as 90% of fuel input into useful energy, compared to 30–35% for a conventional power plant, thus saving significant amounts of fuel, pollution and expense.[16] Conversely, some manufacturing facilities that produce substantial high temperature fluid or steam wastes have used this waste heat for electricity

11 Lovins, *supra* note 3, at 7.
12 *Environment and Energy Newsline,* 7 December, 1999.
13 Suozzo, *supra* note 10.
14 Lovins, *supra* note 3, at 6. Better catalysts with matching heat to temperature needs can save 70% of the remainder with a two-year payback.
15 H. Geller, S. Bernow and W. Dougherty, *Meeting America's Kyoto Protocol Target: Policies and Impacts,* American Council for an Energy Efficient Economy (Washington, DC 1999), at 12 and 13.
16 Lovins, *supra* note 3, at 7.

production. Roughly 52GW of combined heat and power (CHP) was installed in the USA as of 1998, providing about 9% of total electricity production. Europe is far ahead of the USA in CHP installation, exceeding 30% in the Scandinavian countries, and widely being used in the climate strategies of the UK, Denmark, Sweden, the Netherlands and Germany.[17]

There is enormous potential to expand the use of CHP. For example, the chemicals industry uses only about 30% of its CHP potential and has used only 10% of useable sites. A CHP plant in Stockholm has a net overall efficiency of 86% compared to an average efficiency of just 36% for non-CHP plants in the European Union.[18] It has been estimated that legislative and regulatory action could result in an additional 50GW of installed CHP by 2010 and 144GW by 2020 in the USA, with a net savings that pays back the first cost in four to five years on average.

Developing countries with agro-industries such as rice, wood, sugar and palm oil production can especially benefit from the use of co-generation because they can utilize the residues, which are normally thrown out and convert them into energy, thereby reducing waste, saving money and generating electricity. For example, there are over 169 sugar mills in Southeast Asia, each utilizing the bagasse generated as residue for heat and power generation. These mills produce 30 million tons of bagasse each year, which equals the energy equivalent of 5.6 million tons of oil equivalent.[19]

A rather successful partnership between the European Commission and the Association of Southeast Asian Nations (ASEAN) encourages and implements co-generation technologies. The programme, EC-ASEAN COGEN, sets up demonstration plants and implements proven technologies for generating heat and power from agro-industrial residues in the ASEAN region. So far, over US $ 100 million of clean and energy efficient equipment has been installed.

All US conventional power plants together convert only one-third of their fuel into electricity, thus wasting two-thirds as waste heat, which is equivalent to the total energy use of Japan. The Trigen Corporation's cogeneration installation increases system efficiency 2.8 times, harnessing 90–91% of the fuel's energy content, providing electricity costing only 0.5–2 cents/kWh. Selling waste heat from industrial processes to others within affordable distances could cost-effectively save about 45% of Japanese industrial energy and 30% of US industrial energy, or 11% of US total energy.[20]

However, a variety of barriers including hostile utility policies, onerous environmental permitting requirements, lack of regulatory recognition of CHP benefits and unfavourable tax treatment limit CHP growth in the US and elsewhere.

2.10 District heating

District heating involves the use of a single heating generator to warm and cool multiple buildings in a community. Considerable energy can be saved in defined or newly planned communities by using district heating instead of less efficient heating units for each building or each dwelling unit in the community. District heating is widely used in Europe, particularly in the Scandinavian countries. Beijing, China has installed a district heating system, which reduces coal usage by 30–40%.[21]

District heating has a number of advantages over systems that serve an individual user, including increased energy efficiency, reduced energy consumption, and can be used with almost any type of fuel. For example, the town of Campeni, Romania used to rely on fuel oil to run its district heating system. Wood residues were dumped into the local rivers, so the town, in order to reduce pollution and utilize the wood waste instead of the more costly fuel oil, changed the system. Now Campeni's district heating system is fuelled entirely from wood waste. Not only does the system reduce heat production costs by 40%, but it also has an efficiency of 83%.[22]

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17 Geller *et al., supra* note 4, at 26.

18 I. Smith, C. Nillsson and D. Adams, *Greenhouse Gases – Perspectives on Coal,* IEAPER/12/IEA Coal Research (London 1994); Geller *et al, supra* note 4, at 25–29.

19 M. Pennington, The Power of Green, *Economic Bulletin,* January, 1997 at 16.

20 Lovins, *supra* note 3, at 7.

21 Wei Ke, *Honeywell Heats City Efficiently,* available at http://www.pnl.gov/china/honeywll.htm

22 Wood Waste Heating Improves Environment and Saves Money in Campeni, Romania, available at http://www.orgve.dk/inforse-europe/ro-wood.html

2.11 Transportation efficiencies

Cars and light trucks currently account for 56% of transportation energy use. The efficiency of combustion engine vehicles can be greatly improved through using lighter weight materials and smaller vehicles, reducing wind resistance, improving tyre performance and improving the combustion efficiency of engines.[23]

New vehicle propulsion systems are being adopted and designed which can greatly reduce or avoid altogether the use of fossil fuels, namely: electric vehicles with regenerative braking systems; electric/hybrid vehicles that combine electric motors with small, more efficient internal combustion engines; fuel cell-driven vehicles utilizing hydrogen as their fuel; and vehicles propelled by propane gas or ethanol. Toyota and Honda are now mass-producing hybrid cars in Japan and have introduced the cars into the US market. These electric hybrid vehicles have 50–75% improved fuel efficiency over conventional vehicles. Plants for the manufacture of cellulosic ethanol for use as a vehicle fuel or additive are being constructed in a number of US states including Louisiana, California and New York.[24] In 1984, Argentina established a compressed natural gas vehicle programme, which has resulted in the use of 450,000 compressed natural gas vehicles.[25]

Many of these new transportation technologies are now being used around the world, particularly in buses and for automobile fleets. The use of natural gas buses has been adopted for Flanders and Brussels in Belgium, Denmark, France and Hungary (which is replacing its old diesel engines with new compressed natural gas for all its buses in Budapest). Brazil has pioneered in growing energy crops for conversion to ethanol as a vehicle fuel. Brazil initially subsidized the manufacture of ethanol-adapted vehicles (the subsidies have since been eliminated). This programme has significantly reduced automobile-derived pollution.[26] By 1987, the programme cut Brazil's petroleum imports in half, saving over $10 billion.[27]

Other significant measures to reduce transportation energy use include: land use planning to avoid urban/suburban sprawl that requires the use of vehicles for access to essential services;[28] promotion of mass transportation facilities that are much more energy efficient than vehicles; promotion of car pooling; payment for employee use of mass transportation; van transport to work; HOV (High Occupancy Vehicle) lanes restricted to multi-passenger occupied vehicles on highways; elimination of free parking and imposition of parking fees at business and institutions; encouraging the use of telecommunications to reduce physical travel; and promotion of pedestrian and bicycle paths, bicycle parking facilities, and urban bicycle lanes.[29]

2.12 Conclusion

Energy efficiency measures almost always result in savings to the producer, the consumer and society. They are usually inexpensive compared to new power construction and are capable of being financed out of the savings achieved. For developing countries, the initial installation of energy efficient products and processes enables them to leapfrog into the use of superior technologies, thus avoiding the experience of most developed countries in having to convert inefficient products or processes to efficient ones, incurring a double cost and, while the inefficient products are in use, incurring electricity and environmental costs arising from their use.

3 Renewable energy alternatives

Renewable energy resources hold great promise for meeting the energy and development needs of countries throughout the world, but in particular for developing countries, where in many areas a commitment has not been made to fossil fuel dominance.

23 Smith, *supra* note 18, at 17.
24 Geller *et al.*, *supra* note 4, at 11.
25 J. Goldemberg and W. Reid (eds.), *Promoting Development While Limiting Greenhouse Gas Emissions: Trends & Baselines*, UNDP (1999) at 19.
26 H. Geller *et al*, *Update on Brazil's National Electricity Conservation Program (PROCEL)*, American Council for an Energy-Efficient Economy (Washington, DC June 1999).
27 The Brazilian Energy System, available at http://www.mct.gov.br/clima/ingles/comunic_old/tdown02.htm Moyra Ashford, *Tanked Up on Sugar*, New Internationalist, Issue 195 (May 1989), available at http://www.oneworld.org/ni/issuel95/sugar.htm
28 France, Germany and the United Kingdom have provisions requiring consideration of traffic-minimization measures in their land use planning. See http://www.iea.org/pubs/newslett/eneeff/intro.htm
29 Victoria Transportation Policy Institute, available at http://www.vtpi.org/tdm/

Renewables include a multitude of technologies, both proven and emerging. For instance, electricity can be produced from the light of the sun via photovoltaic cells in decentralized applications or for the production of central station power in vast arrays; from the heat of the sun, again for localized tasks like providing homes with hot water or space heating, or providing central station power using fields of parabolic collectors focused on a fixed hot water source; solar ponds; from the power of the wind; from the heat below the earth through various geothermal applications; from the power of ocean tides and waves; from the temperature variations between ocean surfaces and depths; from hydropower installations; from agricultural wastes through bio-methanation; and from biomass crops grown for energy use or from crop waste cellulose that can be gasified for heat, electric and transportation applications.

Of these technologies, only photovoltaics, wind, biomass, geothermal and hydroelectric resources are proven and widely being applied.

Use of renewable resources has grown markedly in the past decade. Many countries have significant renewable installations and programmes. For example, India is a world leader in use of renewable energy. It has pioneered renewable energy applications research through its internationally renowned Tata Energy Research Institute. India is one of the only countries in the world to have created a cabinet-level department for promotion of renewable energy technology, the Ministry of Non-Conventional Energy Sources (MNES). Technology support centres have been created in India's universities to promote renewable technology support to manufacturers and to certify the quality of technology procured by the government. India has also embarked on manufacturing itself a number of renewable technologies. India also created as far back as 1987 a Renewable Energy Development Agency (IREDA) to fund renewable energy projects.[30]

The results of these efforts in India have been remarkable. India as of April 2000 had cumulative installations of 3.02 million family-size biogas plants; 32 million modern cooking stoves, including 485 thousand solar cookers; half a million solar hot water systems; 57 megawatts of photovoltaic installations including 3,371 water pumps, 1,920 kilowatts of electric power systems, 40,000 community and street lighting units, 100,000 home electric systems and 250,000 home and community lighting systems; 34.36 megawatts of biomass gasifier electric systems; 222 megawatts of bagasse cogeneration units; 1,167 megawatts of wind farms; and 217 megawatts of mini and micro hydroelectric generating units.[31]

Major increases in these installations were achieved since the creation of MNES in 1993. This increased penetration of renewables is largely attributable to the conversion of a technology-oriented subsidy programme to one that focuses on fostering of markets through indirect subsidies, fiscal and financial incentives such as low interest loans, financing packages, 100% depreciation allowance for equipment during the first year, waiver of excise duties for renewable technologies and their components, exception from central and state sales taxes to meet the end-use needs of the communities such as for lighting, communications, pumping and industrial uses. MNES now is organized into sectoral groups of rural energy, urban/industrial energy and power generation (rather than by technology). Quality control, maintenance of systems and personnel training also have contributed to these successes.[32] It should be noted, however, that India still gets the preponderance of its energy from coal and large hydroelectric projects. Other countries also have extensive renewable energy programmes. Indonesia has a goal of providing 1 million solar homes and already has delivered 200,000 systems towards this goal. Installment purchases contributed to this success, with the assistance of World Bank and GEF loans.[33]

In Europe, Finland accesses about 30% of its electricity from renewable resources, the majority of which comes from biomass.[34] Germany and the other Scandinavian countries also have significant renewable energy programmes.

Renewable resources are very attractive for developing countries where some two billion people have no access to electricity. In 1990, 66% of the rural population had no access to electricity.[35] Ninety per cent of the entire African population does not have electricity.[36] In these rural areas, renewable resources often are far cheaper than traditional resources that have expensive transmission and distribution requirements on top of

30 Overview of Renewables in India, available at http://www.teriin.org/renew/overview.htm
31 Present Status of Renewables in India, available at http://www.teriin.org/renew/estpot.htm
32 Overview of Renewables in India, available at http://www.teriin.org/renewable.overview.htm
33 Y. P. Abbi, *Thermal Power Generation Key Issues in India,* TERI Newswire 7(19), (October 2001), available at http://www.teriin.org/features/artl45.htm
34 Finland Renewable Energy Technologies, available at http://www.tradeport.org/ts/countries/finland/isa/isar0005.htrnl
35 Food and Agriculture Organization of the United Nations, *Solar Energy: Power for Rural Development,* available at http://www.fao.org/NEWS/2000/001003-e.htm
36 K. Jechoutek, *Empowering the Future: The Dawn of a New Energy Service Industry*, World Bank, 6th Annual Symposium on Global Responsibility, April 2000.

heavy capital costs for generating equipment. The most advantageous and widely used renewable resources for energy in developing countries today are wind, photovoltaic, biomass and hydroelectric resources.

3.1 Wind energy

Wind energy for electricity production today is a mature, competitive and virtually pollution-free technology widely used in many areas of the world. Wind is also still used to some extent for pumping water. Wind electric systems have experienced some siting problems due to aesthetic concerns, and some early wind farms had problems with killing raptor birds that fly into the blades, though this problem has been minimized with more modern machines and their careful placement.

Internationally, the use of wind energy for electricity was pioneered by Denmark, which is currently generating 15% of its electricity via wind energy.[37] The basic support mechanism for wind energy in Denmark is a partial redemption of the Danish carbon dioxide tax levied on all electricity regardless of its origin. There are 4,800 wind turbines in Denmark, more than 80% owned by wind energy co-operatives or by individual farmers. One hundred thousand families either own shares in wind co-operatives or own their own wind turbines.[38] Denmark exports windmills to 35 countries and more than 50% of all the devices manufactured in the world come from Denmark.[39] Germany today is the leader in wind energy installations and the UK also has extensive wind applications. Both are large wind machine manufacturers and exporters.[40] The potential exists for developing countries also to manufacture and market their own wind machines.

3.2 Solar energy

Solar energy presents great development advantages in developing countries, particularly since most of them are in the Sun Belt. Solar photovoltaic energy is uniquely useful in rural areas unserved by electric grids, to provide basic services such as refrigeration, irrigation, communications and lighting. It also provides great opportunities for local manufacture and jobs. For example, China today is promoting widespread use of photovoltaic energy and is manufacturing photovoltaic cells for export.[41] Solar thermal energy is particularly suited to the large demand for heat in the domestic, agricultural, industrial and commercial sectors of the economy. It is applied successfully to water heating, industrial process heating, drying, refrigeration and air conditioning, cooking, water desalination and purification (through use of solar ponds), pumping and power generation.[42]

Solar energy often is far more efficient than existing energy uses. For lighting, a photovoltaic compact fluorescent light system is 100 times more efficient than kerosene, used in the rural areas of many developing countries to provide night lighting.[43] Photovoltaic systems also avoid the pollution problems of standard fossil-fueled power plants.

3.3 Hydroelectricity

Hydroelectricity is the largest renewable resource in use today, but mostly utilizing large dams. Large hydroelectric dams flood large areas of land and thus create environmental problems and problems of displacement of people and/or agriculture. The dammed water also creates carbon dioxide and methane (another greenhouse gas) emissions from decaying vegetation. Adding power to existing dams, however, does not create these problems. The placement of generating equipment at existing dams has great worldwide potential and no environmental consequences. Run of the river hydro systems are technologically more complex but pose minimal environmental consequences, especially when compared to large-scale dams. Lastly, small dams can reduce the environmental harms of hydroelectric power production.[44]

37 Interactive News Forum, *Eco-Economy Offers Alternative to Oil, says Author*, WASHINGTON, DC, US, June 12,2001, available at http://www.solaraccess.com/news/story.jsp?storyid=1213

38 *See* Danish Wind Turbines: An Industrial Success Story, http://www.windpower.dk/articles/success.htm

39 *Denmark Moves Ahead in Wind Power*, New York Times, International Section (October 9, 1999).

40 J. Goldemberg *et al.*, (eds.), UNDP, *World Energy Assessment* (2001) at 231, 427.

41 China Energy Group, available at http://eetd.lbl.gov/EA/partnership/China/refpubs.html

42 Solar Thermal Technologies in India, available at http://www.teriin.org/renew/tech/solth/about.htm

43 F. Lundberg, PV Lighting, *International Association for Energy-Efficient Lighting (IAEEL) Newsletter*, February, 1996, available at http://www.iaeel.org/IAEEL/NEWSL/1996/tval996/LiRen_a_2_96.html

44 Energy Efficiency and Renewable Energy Network (ERENA Hydropower: Frequently Asked Questions, US Department of Energy, available at http://www.eren.doe.gov/state_energy/technology_faqs.cfm?techid=7

3.4 Biomass

Utilization of biomass is a very attractive energy resource, particularly for developing countries since biomass uses local feedstocks and labour. Crop wastes, cellulosic biomass and crops raised to provide energy feedstocks on otherwise barren lands are good energy sources for industry, electricity production, home heating and cooking if used in efficient modern stoves or gasified. Brazil has successfully pioneered in growing energy crops of sugar to produce ethanol for use in vehicles, thus halving its oil imports.[45]

Biogas projects that capture methane gas from garbage are becoming more widespread. Decaying garbage produces methane, which can be used as a fuel to generate electricity. A project in China is underway to set up the country's first landfill gas recovery project. The landfills in China generally consist of open pits on the outskirts of the cities or in the river valleys. China has recognised the need to improve these waste sites not only to generate electricity, but to also reduce disease and pollution.[46]

Biogas generated from cattle and pig manure can also be used to generate electricity.[47] Even wastewater treatment plants can capture methane gas and use it to generate heat and power.[48]

3.5 Biodiesel

Although the name suggests it comes from a fossil fuel, biodiesel is a completely natural, renewable fuel. Biodiesel is vegetable oil based, and can be made from common plants like soybeans, corn, rice and sunflowers. Using biodiesel has several advantages: it reduces tail-pipe emissions; it is non-flammable; biodegradable; and can be used in conventional diesel engines without any modifications.[49]

In Hawaii, biodiesel is produced entirely from recycled cooking oil. Pacific Biodiesel, Inc. opened a processing plant, and it became cheaper for trucks to deliver used restaurant oil to the plant then to landfill it.[50]

3.6 Fuel cells

Hydrogen is the most promising alternative fuel for the future. It currently is produced from natural gas in a process less polluting than oil or coal-fired power plants. With improved and more economic technology, hydrogen can be produced from photovoltaic or wind-powered electrolysis, separating hydrogen from water, and from some seawater algae.[51] Hydrogen combustion is virtually pollution free, recombining hydrogen and oxygen to release water. Hydrogen is economically transportable in pipelines. The principal challenge for its widespread adoption is to bring down the cost of both hydrogen production and fuel cells. Also, an infrastructure must be constructed to transport the hydrogen, although existing natural gas pipelines can be used if treated.

Fuel cells can be used in a variety of ways, from transportation to stationary sources. In the transportation industry, several different companies have developed and are looking to market fuel cell vehicles within the next few years. Already big names in the industry such as Toyota and Honda are developing not only fuel cell cars, but also mini-vans, sports utility vehicles and even scooters. Fuel cells are already being used in Europe, the US and Canada for mass transit. Demonstration projects using fuel cell buses are being planned for use in Mexico, Brazil, India, China and Egypt.[52]

Stationary applications of fuel cells are being developed for a variety of uses. Many fuel cell generators have been installed throughout the world in offices, hospitals and hotels.[53]

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45 The Brazilian Energy System, available at http://www.mct.gov.br/clima/ingles/comunic_old/tdownO2.htm

46 Promoting Methane Recovery and Utilization from Mixed Municipal Waste in China, available at http://www.gefweb.org/Outreach/outreach-PUblications/Project_factsheet/China-prom-9-cc-undp-eng.pdf

47 Energy Efficiency and Renewable Energy Network (EREN), *Methane (Biogas) From Anaerobic Digesters*, US Department of Energy, available at http://www.eren.doe.gov/consumerinfo/refbriefs/ab5.html

48 Turning Wastewater to Energy in Industry and Municipalities, available at http://www.wifocusonenergy.com/renewable/wastewat.pdf

49 Pacific Biodiesel, the Fuel, available at http://www.biodiesel.com/biodiesel_fuel.htm#FUEL

50 Pacific Biodiesel, available at http://www.biodiesel.com

51 Melis *et al.*, Sustained Photobiological Hydrogen Gas Production upon Reversible Inactivation of Oxygen Evolution in the Green *Alga Chlamydomonas reinhardtii*, *Plant Physiology*, Vol. 122, January 2000, at 127–135.

52 Commercialization of Fuel Cell Buses: Potential Roles For the GEF, (April 2000) available at http://www.undp.org/gef/fuel-cell/doc/proceed.pdf

53 Fuel Cells 2000, available at http://www.fuelcells.org/fcapps.htm

One of the largest US bank credit card processors, The First National Bank of Omaha, converted to fuel cell power because power disruptions from conventional sources caused it to lose important data. Fuel cells are 99.9999% reliable.[54]

Although fuel cells offer a clean alternative to fossil fuels, cost is a major barrier. More research must be done in order to make the systems commercially competitive with other energy sources. For example, the most widely marketed stationary fuel cells cost about $4,500 per kilowatt, but a diesel generator costs $800 to $1,500 per kilowatt, and a natural gas turbine can be even less.[55]

4 Renewable energy and energy efficiency barriers

The main constraints to the more widespread use of energy efficiency technologies and renewable resources are:

1. Lack of information by the public (and even many government, commercial and industrial energy officials), about the availability, costs and benefits of renewable energy and energy efficiency technologies;
2. Lack of knowledge by project initiators and managers of the energy and related social needs of rural communities, adaptation of projects to meet these needs, and involvement of the communities in the design of projects. This may be the most significant barrier. If projects fail to meet the local needs for which they are intended, such failures can impede renewable energy applications for decades. Developing country residents can ill afford unsuccessful experiments;
3. Failure to get the prices right when comparing energy efficiency and renewable energy to traditional energy options – particularly the heavy subsidization of traditional energy resources and the failure to value resources on a life-cycle basis taking into account externality costs to society;
4. Preference for known fossil resources over newer renewable resources and energy efficiency technologies by government, commercial and industrial officials responsible for making energy decisions and by banking and other financing officials;
5. Huge well-financed sales forces for traditional energy sources and frequently a financial stake by energy decision-makers in these sources;
6. Lack of knowledge and personnel trained in financing mechanisms available to support renewable energy and energy efficiency projects;
7. The need for research and development (R&D) to improve renewable energy and energy efficiency technologies and to lower initial costs; and
8. Regulatory pricing structures which encourage the maximization of throughput and load growth as the utility's most profitable strategy; tariff barriers such as exorbitant standby rates; and interconnection difficulties.

While these barriers are common to both renewable energy and energy efficiency, renewable energy options face additional barriers. These include: import duties on renewable equipment and other barriers to foreign investment generally and as related to renewable energy resources; lack of personnel trained in the installation, operation and maintenance of renewable energy equipment; paucity of sales forces for renewable energy resources and lack of financial and political clout to promote them effectively.

5 Legal mechanisms for renewable energy and energy efficiency implementation

Many mechanisms have been successfully used around the world for realizing renewable energy and energy efficiency solutions by both the public and private sectors and in both developed and developing countries and their municipalities. The mechanisms discussed include education, economic and market mechanisms,

54 http://www.enn.com/news/enn-stories/1999/06/063099/fcell_4056.asp "First National Bank of Omaha, Neb., elected to use a fuel cell system from Sure Power Corporation of Danbury, Conn., to run its computer system that processes millions of dollars in transactions every day. The system produces reliable power 99.9999 percent of the time. All told, US businesses lose about $29 billion a year from computer failures due to power outages."

55 Fuel Cell Technology, available at http://www2.fossil.energy.gov/coal_power/fuelcells/

government programmes, utility regulatory requirements and programmes, standards and government-encouraged voluntary programmes. These measures are by no means mutually exclusive, and in many cases more than one mechanism has been applied. They are categorized here according to their predominant characteristic.

5.1 Education and training

Education is vital to inform the public, energy decision-makers, NGOs and the private sector about the available renewable energy options, their application and their costs and benefits. Such knowledge also is essential to build the political support necessary for enactment of appropriate legislative measures to promote energy efficiency and renewable resource use. Education of the public really should start at the primary and secondary school levels and continue as a part of professional and technical training for those whose jobs will involve energy related-decisions.

Education is particularly important for architects, engineers, builders, commercial enterprise managers, trades people, and government officials at all levels, to inform them of available economic renewable energy technologies and applications, and also of the requirements of laws that have been adopted to promote energy efficiency and renewable resources and of the costs and benefits of the measures they can take either voluntarily or pursuant to legal requirements.[56] It is important that retail sales staff, contractor installers and maintenance/service personnel understand the benefits of renewable technologies and that they can personally benefit from promoting these products to end users.

It is essential that technical staff be trained and available in sufficient quality and quantity to maintain and operate all energy efficiency and renewable energy systems installed. Failure to perform this function can discourage rather than promote renewable energy projects. Often the staff of equipment providers can provide some or all of this requisite training; but there must be rigorous government supervision of maintenance and operation training and performance of the systems where done by the private sector.

Much of the necessary education must be conducted or contracted by governments. They must create a legislative framework for this educational effort and appropriate or seek grants for the necessary funding. They also should provide funding for staff mailings, conducting workshops and conferences, and doing media education work.

As commercial enterprises learn of the economic advantages of energy efficiency and renewable energy measures that can be profitable for them, they also will participate in the educational efforts. NGOs advocating for clean energy measures can perform an important part of the educational effort; many international, national and local NGOs have created Internet sites and list services to inform advocates and the public of renewable energy and efficiency resource opportunities, advantages and costs. And political leaders can play an important educational role as well.

Labelling programmes

One effective educational measure has been adoption by countries and municipalities of energy efficiency product labelling requirements. Labelling is an inexpensive educational tool. The US, many of its states and cities, and many other countries and their municipalities have adopted such labelling requirements, which give energy consumption and cost-saving information about appliances such as refrigerators, electric stoves, clothes washers and dryers, computers and other appliances, essential for customers to make an informed choice.[57] Appliance labelling has often been an effective precursor for the adoption of efficiency standards.

The US, Canada and the European Union have endorsement labelling programmes for energy efficiency that are operated by both the government and non-governmental organizations. Mexico's labelling

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56 The usual means of compensating architects and engineers worldwide, as a percentage of building and equipment costs, has the perverse incentive of discouraging least cost solutions. It has been estimated that this incentive design has led the USA to misallocate about $1 trillion in air conditioning equipment and the energy needed to operate it than had the buildings been optimally designed to produce the same or better comfort at least cost. Lovins, *supra* note 3, at 18.

57 The ENERGY STAR® labelling programme was estimated to have saved about .22 quads of primary energy per year from 1993–1998. Geller *et al. supra*, note 4 at 3,4. In Japan and Canada mandatory efficiency labelling is reinforced by a compliance policy assuring accuracy of the information on the labels. Most Australian states also have adopted mandatory energy efficiency labelling. *See* http://www.iea.org/pubs/newslett/eneeff/intro.htm

programme is modelled after this type of scheme.[58] Germany's "Blue Angel" programme has been in existence since 1977 and is used on a wide range of products, from recycled paper to computers.[59] Thailand, through its Electrical Generating Authority (EGAT), operates voluntary labelling programmes for refrigerators and air conditioners. The governments of the Philippines and Korea have established mandatory comparison labelling. Brazil has a comparison labelling programme for refrigerators and air conditioners, and is considering adding lamp ballasts, cover lamps and motors to its labelling programme.[60] A new programme sponsored by the Danish Electricity Savings Trust organized a group of large institutional buyers, including housing companies and local governments, to jointly procure at a very favourable bulk-purchase price up to 10,000 energy-efficient refrigerators that qualify for the top European Union efficiency label rating.

New buildings can also be the subject of energy efficiency labelling requirements, as is required through building certification programmes in Denmark and Canada.[61] The USA and some other countries have miles per gallon labelling requirements for vehicles sold.

Ratings

Ratings of companies on the greenness of their products also can be an effective educational tool. For example, the US major environmental organizations, together with consumer and industry participants and the NGO Center for Resource Solutions, have established a "Green-E" clean electricity certification programme. This programme permits display of the Green-E logo if power providers meet very rigorous "green" conditions: 50% plus renewables; for the remaining 50%, non-renewables with low emissions; full disclosure of electricity sources; no nuclear power generation; one year after deregulation, at least five per cent new renewables, increasing five per cent per year until 25% is reached. Also required is a commitment to biannual reviews of truth in advertising; and annual independent audits of renewable offerings. The rating is designed to inform electricity consumers of assured superior green power offerings.

With the advent of electric utility deregulation in the USA, a Power Scorecard also has been developed to rate the environmental quality of products offered in the competitive utility retail market, permitting informed consumer choice.[62] The Power Scorecard has been adopted in the states of Pennsylvania and California, and there are plans to deploy it in Texas, New Jersey and Connecticut.[63]

Awards

Many governments and private organizations have established award programmes to recognise companies, private organizations and products that accomplish outstanding energy efficiency or renewable achievements. There are also a number of government information programmes. For example, the Federal Trade Commission in the USA has issued "Energy Guide" labels and the EPA has its ENERGY STAR® programme. NGOs like the American Council for an Energy-Efficient Economy have issued guides to the most efficient home appliances.[64]

5.2 Assessment and adaptation to local needs

No aspect of renewable energy and energy efficiency promotion is more important than assessment of local needs, adaptation of projects to meet those needs and inclusion of local communities in design of projects. While these requisites may seem obvious, they are far too often overlooked. Too often well meaning international and national agencies, equipment suppliers, and project investors and promoters are ignorant about community needs, customs and cultures. They ignore local input to the peril not only of their projects but also of the successful promotion of renewable resources and efficiency throughout the country or even the region affected.[65]

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58 J. Duffy, *Energy Labeling, Standards and Building Codes: A Global Survey and Assessment for Developing Countries* (International Institute for Energy Conservation 1996), at 3.

59 Scenarios for a Clean Energy Future, Interlaboratory Working Group on Energy-Efficient and Clean Energy Technologies, November, 2000.

60 Duffy, *supra* note 58, at 9.

61 Scenarios for a Clean Energy Future, Interlaboratory Working Group on Energy-Efficient and Clean Energy Technologies, November, 2000.

62 Pace Energy Project, Pace Law School (White Plains, NY 1999).

63 Pace Energy Project, Pace Law School (1999), available at http://www.powerscorecard.org

64 Geller *et al., supra,* note 4 at 7.

65 TATA Energy Research Institute, available at http://www.teriin.org

Clean energy can be an important instrument of advancing economic and social development in communities, but only if the projects are knowledgeably designed and carefully planned with full local input and cooperation. Particularly in poor rural areas, the costs of renewable energy and energy efficiency projects will absorb a significant part of the small incomes of participants. They cannot afford unsuccessful projects that may not only fail to meet their development objectives, but also leave them destitute.

The governments promoting renewable energy projects should institute absolute requirements to assess local needs and obtain participation by local communities in the design of projects. All project designers, architects, engineers, suppliers, technical operation and maintenance personnel, educators, trainers, project funders, government officials, NGOs and others having a say in design and execution of renewable energy and energy efficiency projects must be required to participate in such local assessment and participation efforts, and they also should undergo training to prepare them adequately to meet these needs.

Assessment of resources

A move towards locating the best and most lucrative locations for investors is the Solar and Wind Energy Survey Assessment (SWERA) project created by the United Nations Environment Programme (UNEP). This project is designed to pinpoint the best locations for solar and wind energy in 13 developing nations. Those working on the project are convinced that the project will prove that the potential for wind and solar projects in these countries is far greater than currently assumed. The goal of the project is to eliminate the uncertainty associated with investing in these types of projects by measuring the size and intensity of the solar and wind resource in various locations, thereby allowing investors to choose the optimum site for development. Although the costs of renewable resources are declining, it is hoped that SWERA will bring down the costs evenmore.[66]

The first phase of the SWERA will concentrate on Kenya, Ethiopia, Ghana, Bangladesh, Brazil, China, Cuba, El Salvador, Guatemala, Honduras, Nepal, Nicaragua and Sri Lanka. Once the first phase is complete, investors considering building wind and solar power projects in these nations will be able to use SWERA to determine the optimum location. SWERA will be accessible over the Internet through a Geographical Information System. International collaboration between various organizations such as the TATA Energy Research Institute and the US National Renewable Energy Laboratory are helping to make the project a success.

5.3 Environmental impact assessments/statements

One of the most effective measures for requiring that the environmental consequences of projects are exposed to the public is the environmental impact assessment or statement. In the United States, such assessments are required for all major "federal actions significantly affecting the quality of the human environment" by the National Environmental Policy Act of 1969.[67] The statements must detail the environmental impacts of any proposed action, any unavoidable adverse environmental effects, alternatives to the proposed action, short vs. long term effects and any irreversible commitments of resources. Assessments that do not conform to the Act can be challenged in court, a measure that has been very effective in assuring that the consequences of proposed actions be considered before they are implemented.

More than 175 countries have enacted their own environmental impact legislation and assessments have been required in a number of international environmental treaties such as Article 206 of the UN Convention on the Law of the Sea.[68] The World Bank and other multilateral banks require such assessments under their administrativeprocedures.[69]

Unfortunately in the US environmental impact statements have not been required for most actions by the Federal Energy Regulatory Agency and for state energy policy determinations.

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66 United Nations Environment Programme, *International Effort to Pin Point Some ofthe World's Best Solar and Wind Power Sites Gets Underway*, GRID-Arendal News, December 18, 2001, available at http://www.grida.no/inf/news/news01/news117.htm

67 42 U.S.C.A §§4321–4379 (1969), particularly §4332(C).

68 The United Nations Convention on the Law of the Sea, 21 I.L.M. 1261(1982).

69 N. Robinson, *Environmental Law Systems for Sustainable Energy,* Proceedings of the CleanEnergy2000 Conference, Geneva, Switzerland (24–28 January, 2000).'

5.4 Market mechanisms

Removal of fossil fuel subsidies

Legislation to repeal and remove subsidies for production and use of fossil fuels is the most direct legal measure to promote clean energy. Subsidy removal not only is a costless measure, but by definition, it is a certain revenue-enhancing one. In many countries fossil fuel subsidies amount to tens of billions of dollars.[70] Global annual energy subsidies were estimated at about $250–300 billion in the mid-1990s, and that doesn't count the huge US subsidies required to secure the supply of oil imports that has been estimated to produce a true oil cost of over $100 per barrel.[71] Revenues saved from subsidy removal can be used to promote clean energy alternatives internally.

The problem in achieving subsidy removal is political: recipients of subsidies get addicted to them and feel they cannot survive without them. These recipients also tend to be rich, powerful and influential. But these subsidies both encourage increased use of fossil fuels and discourage the use of clean alternatives by making them less economically competitive.

Fossil fuel subsidies are usually granted by governments under the pretext of protecting domestic jobs, promoting use of domestic resources and protecting the poor from high energy prices. In fact, subsidies are enacted under pressure from the wealthiest elements of society to increase their profits. In most developing countries, the poor do not even have electricity or automobiles and thus receive virtually no benefit from the subsidies. In many countries, fossil fuels are imported at great cost, displacing the ability to invest in basic needs such as education, health care and the environment. In those countries that have domestic fossil resources, more beneficial use can be made of the subsidy funds to retrain and place workers and acquire clean energy resources, which also can be domestically produced.

Developing countries like China are eliminating coal subsidies, downsizing coal production, and creating major renewable energy industries that can supply domestic needs and export renewable facilities and equipment worldwide. China's actions are particularly remarkable. Between 1990 and 1997, annual fossil fuel subsidies in China fell from $24.5 billion to $10 billion. Coal subsidy rates fell from 61% in 1984 to 37% in 1990 to 29% in 1995, and further since then. Petroleum subsidies fell from 55% in 1990 to 2% in 1995.[72] Over 40,000 coal mines were closed between 1999 and 2000, with more expected to be shut down in the next couple of years.[73]

Poland has decreased its fossil fuel subsidies by $3 billion per year. These reductions led to an overall 30% decrease in the amount of coal used between 1987 and 1994. Since 1990, Russia has lowered fuel subsidies by more than 50%. The United Kingdom decreased coal subsidies from $7 billion in 1989 to zero in 1995. This has led to an increase in the use of North Sea natural gas by 62% while polluting emissions have fallen consistently during the five-year period between 1990 and 1995.[74]

On the other hand, there are countries that are not making comparable strides in reducing incentives and subsidies for energy sources contributing to greenhouse gas emissions. For instance, the United States still doles out as much as $14 billion a year in fossil fuel supports[75] and the current Administration energy proposals call for billions of dollars in additional subsidies to the oil, coal and gas industries. Germany is still requiring its electric utilities to purchase domestic coal, and has increased the amount of money funding subsidies by more than 50%. Canada's tax incentives amount to $6 billion per year. France and Japan, while reducing the amount of money available for fossil fuel supports, are still providing substantial incentives for the use of coal, $722 million and $149/ton.[76]

The political difficulties of eliminating subsidies and the transition problems for local economies in fossil-producing countries can not be minimized. Nevertheless, countries such as Brazil, China, the Czech

70 N. Meyers and J. Kent, *Perverse Subsidies: How Tax Dollars can Undercut the Environment and the Economy* (Island Press, London, 2001) at 76.

71 Lovins, *supra* note 3, at 19; A. Reddy *et al., Energy After Rio: Prospects and Challenges*, United Nations Development Programme (New York 1997).

72 United States Energy Information Administration, *China: Environmental Issues*, October 1999, available at http://www.grida.no/inf/news/news01/news117.htm

73 Coal Portal, China, available at http://www.coalportal.com/members/documents/Exporters-f/China-f.html

74 C. Flavin and M. Dunn, *Rising Sun, Gathering Winds: Policies to Stabilize the Climate and Strengthen Economies*, WorldWatch Paper No. 138, Worldwatch Institute (Washington, DC, November, 1997) at 26.

75 Meyers *et al., supra*, note 70, at 85.

76 Flavin and Dunn, *supra* note 74, at 27.

Republic, India, the Netherlands, Poland, the United Kingdom and Russia have reduced or eliminated fossil subsidies successfully.

Externalities

A legislative or regulatory requirement for consideration of externality costs can materially promote clean energy use. When the costs of fossil fuel use are compared to the costs of clean energy resources, the costs to society from fossil fuel emissions are generally ignored, thus effectively placing a zero value on these costs. Numerous studies have now shown that these external costs are substantial, especially with respect to the increased incidence of human health problems and early mortality.[77] Some of these studies calculate that the externality costs of burning coal for electricity can be greater than the generation costs.[78] No accurate assessment can be made of the comparative costs of clean energy without inclusion of externality costs.

Use of life-cycle costs (as opposed to up-front capital costs)

The costs of introducing clean energy resources often entail substantial first cost investments, but the savings over the life of these resources make them cheaper than fossil fuel alternatives over time. This phenomenon is particularly evident with efficiency measures and with solar, hydroelectric and wind energy resources where the equipment acquisition cost can be considerable. However, the total absence of fuel costs and very low maintenance costs result in them being much more economical compared to fossil fuels over their anticipated useful life. The costs of fossil fuels should always be compared to efficiency and renewable resource costs on a life-cycle basis. Legislative or regulatory requirements for the utilization of life cycle costing are feasible andcostless.[79]

Removing investment and import restrictions

In many developing countries there are high duties on import of equipment, including equipment required for renewable energy.[80] Such duties must be eliminated if renewable energy use is to be promoted. Many restrictions also exist on investment of foreign capital that need to be removed to create a climate encouraging investment.

Pollutiontaxes

Taxing pollutants or polluting fuels can be an effective way of promoting energy and emission reductions in the marketplace.[81] Such taxes make the polluters pay the externality costs of the damages to society from their pollution. They raise the price of emissions-intensive goods or processes and lower profits for fossil fuel use, thus allowing market forces to encourage adoption of renewable resources and energy efficiency technologies.

Pollution taxes have been imposed in Brazil, Denmark, Finland, Italy, Latvia, Lithuania, Sweden and the United Kingdom (which funds its Renewable Purchase Obligation subsidies with electricity taxes). Sweden instituted environmental taxes in 1991 and included NOx emissions in 1992.[82]

Pollution taxes are politically difficult since inevitably some energy-intensive industries and jobs are affected. However, if the pollution taxes are offset by reductions in other business taxes, they can produce a net economic benefit.[83] The political difficulty is illustrated by the fact that in a number of the countries that

77 For example, it has been estimated that just the health cost of air emissions in Cairo may exceed $1 billion a year. M. Bernstein *et al., Developing Countries and Global Change: Electric Power Options for Growth,* Pew Center on Global Climate Change (Arlington, Virginia, June 1999).

78 R. Ottinger *et al.,* (eds.), *Environmental Costs of Electricity,* Oceana Publications, Inc. (New York 1991).

79 G8 Taskforce on Renewable Energy, Final Report, (July 2001) available at http://www.renewabletaskforce.org/report.asp

80 M. Philips and B. Browne, *Accelerating PV Markets in Developing Countries,* available at http://www.repp.org/articles/pv/7/7/html

81 The potential of carbon taxes as a funding mechanism is enormous. A carbon tax of just $1 per ton on fossil fuel use in OECD countries at 1990 emission levels would yield annual revenues of $4.3 billion. Two years of such a tax would support the solar technology R&D needs of the world over the next 20 years. Such a tax in the US would increase energy prices less than 0.3% or less than $6 per capita per year. WEC, 1994., http://www.worldenergy.org/wec-geis/publications/open.plx?file=archives/tech_papers/other_tech_papers/WECco2rpt97app.htm

82 A Database of Environmental Taxes and Charges, Sweden 2000, available at http://europa.eu.int/comm/environment/enveco/env_database/sweden2000.htm

83 S. Bernow *et al., Carbon Taxes with Tax Reduction in New York State,* Tellus Institute (Boston, Massachusetts, February 1997).

have legislated such taxes, major industries have been exempted to avoid competitive disadvantage to domestic production.[84] Taxing pollutants or polluting fuels can be an effective way of promoting emission reductions in the marketplace. Such taxes make the polluters pay the externality costs of the damages to society from their pollution. They raise the price of emissions-intensive goods and lower profits for fossil fuel use, thus allowing market forces to reduce emissions.

Technology and tax incentives

While long-term subsidization of any fuel, technology or product distorts the market and is therefore theoretically undesirable, temporary subsidies and tax exemptions to bring new technologies into the marketplace can be effective, useful, and often essential to accelerate their market acceptance. Also, where fossil fuel subsidies persist, non-fossil fuel subsidies are justifiable to level the playing field for them.

A good example of effective use of such temporary incentives is found in Denmark's introduction of wind power. From the start of its wind power programme in 1976 through 1996, the Danish Government spent $75 million on wind turbine R&D. The Government provided subsidies for up to 30% of the investment costs of a turbine in 1980, which was reduced to 15% in 1984 and repealed in 1989 as the market accepted the new technology. The Government now requires Danish power companies to pay 85% of the retail electricity price of wind energy, paid for by rebates of carbon taxes on fossil fuels. Consumers now pay less for wind power than for power from coal. As a result of this programme, Denmark now has over half of the world sales of wind turbines. Its turbine production now provides about 60% of new wind turbines installed throughout the world, produces revenues of nearly $1 billion a year and has provided over 16,000 jobs. Today, 100,000 Danish families own wind turbines or shares in wind cooperatives.[85]

The Poland Efficient Lighting Project, financed by the GEF and administrated by the International Finance Corporation established a 3-year programme to subsidize compact fluorescent lamp sales. At the end of the programme in 1997 some 1.6 million lamps had been installed and 97% of the buyers indicated an intent to buy these efficient lights again.[86]

Germany has had great success with its Electricity Feed Law (EFL) subsidizing the purchase of renewable resources. EFL requires utilities to pay 90% of the retail residential price for electricity produced by wind, solar, hydropower and biomass resources. For wind resources, the law also provides subsidies based on electricity output or capital costs. By the end of 1997, Germany had an installed wind capacity of 2,081 MW, the highest in the world. EFL also stimulated a 450% increase in photovoltaic installations from 1991 to 1997, with a 37% drop in prices. German companies such as Siemens now lead the world in PV sales. Germany has begun a "100,000 Roofs" PV programme, with low interest loans to be issued by private banks, which promises to be the largest single PV subsidy programme in the world.[87]

Argentina, in order to encourage the use of biodiesel fuel, has exempted biodiesel from the fuel transfer tax for ten years. The government hopes that this tax exemption as well as other incentives will foster development in the biodiesel industry.[88]

Singapore created a Green Vehicle Program to promote electric, hybrid and natural gas vehicles. The programme gives those who purchase such vehicles tax breaks to lessen the price difference between conventional vehicles and clean vehicles. Buyers of electric vehicles will receive a rebate of 20% of the vehicle's market value and buyers of hybrid vehicles will be given a rebate of 10%.[89]

Tradable renewable energy certificates

Renewable energy is generally produced on site at the customer's energy facility or sold into the wholesale market by large scale renewable energy projects. Often times the high front end costs of renewables discourages their adoption. Tradable Renewable Energy Certificates (TRECs) are a way to promote the use of renewable energy by marketing the environmental benefits of green power separately from the energy itself. The certificates assure the purchaser (customer) that they are getting a commitment from the seller (power

84 Goldemberg *et al.*, (eds.), *supra* note 6, at 424.
85 C. Moore and J. Ihle, *Renewable Energy Policy Outside the United States*, Renewable Energy Policy Project Issue Brief No. 14 (Washington, DC, October 1999).
86 Poland Efficiency Lighting Project (PELP), available at http://www.ifc.org/enviro/EPU/EEfficiency/PELP/pelp.htm
87 Moore and Ihle, *supra* note 85, at 10.
88 *Argentine Government Grants Biodiesel Tax Exemptions*, Center for Sustainable Economy, Vol. 20, No. 8, November 20, 2001.
89 *Singapore Grants Tax Rebates to Green Vehicles*, Center for Sustainable Economy, Vol. 20, No. 5, October 31, 2001.

marketer) that the electricity (usually in the form of a kWh) they are buying has renewable attributes (representing the air, land, and other benefits or avoided impacts associated with renewable energy). These attributes can be bought and sold together, separately, or combined at the point of sale by a power marketer.[90]

TRECs have two roles; the first is that of a tracking and verification mechanism. In the US, TRECs are generally used in conjunction with Renewable Portfolio Standards, which are standards that require electric utilities to purchase a certain percentage of their power from renewable resources.[91] The second role is to market TRECs in geographic locations where renewable energy is not available, thereby allowing those who wish to purchase renewable energy to do so indirectly. Generally, TRECs involve a combination of government, NGO and private participation.[92]

There are several advantages to TRECs that make them attractive to customers and utilities alike. TRECs can cross geographic or regional boundaries that actual kWh cannot cross. Producers can recover their costs. There is no competition with fossil fuels. TRECs also allow the producer to sell renewables in a wholesale market at a competitive level.[93]

The United States has recently begun to use TRECs, due mostly to the electric industry restructuring. New York and California are selling renewable energy certificates to those interested, and a few organizations such as the US Bonneville Environmental Foundation in Oregon are utilizing TRECs.[94]

The use of TRECs in Europe is more widespread than in the USA, Italy, Austria, Denmark and Belgium have TRECs in place, and the Netherlands, the United Kingdom and Sweden are considering implementing TREC systems pending legislative approval. The Renewable Energy Certificate System (RECS) is a voluntary, extra-governmental group of over fifty power companies from Norway, Sweden, Italy, Belgium, Denmark, the United Kingdom and the Netherlands. This self-financed group has begun trading this year, and hopes to develop the market and to implement an international TREC system. Under the RECS system, power is traded and consumed locally under common tariffs, and the environmental value is reflected in the certificates. The value of the certificates is determined by market forces.[95]

A project designed to increase the capacity for TRECs in Europe is the European Renewable Electricity Certificate Trading Project (RECerT), a web-based renewable certificate trade simulation. Each member of the European Commission will play out the simulation as an exercise to educate and demonstrate to public and private players that international trade is possible. It is hoped that the simulation will help solve some of the problems associated with TRECs such as the legal implications.[96]

Vehicleincentives

Since the most polluting and inefficient vehicles tend to be older models, legislation creating an incentive to replace existing vehicles with new less polluting models could be very effective. Such incentives have been proposed but not adopted in the US Congress. "Feebates" have been suggested charging a fee on inefficient vehicles which would pay for granting a rebate for the purchase of more efficient models, best calibrated to the difference in efficiency between the old vehicle, which would be required to be scrapped, and the newer one purchased with the rebate. Unfortunately, there were no programmes identified to retire older vehicles. There also are no international measures to prevent the sale of inefficient retired vehicles by industrialized countries to developing countries, a major problem for the latter.

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90 *Summary Report on Tradable Renewable Certificates (TRC): The Potential and the Pitfalls,* The Center for Resource Solutions, available at http://www.resource-solutions.org/CRSprograms/trec/FinalSummary.pdf

91 For example, TRCs are used in Texas as a way of complying with the state's renewable portfolio standard (which requires a certain proportion of electricity sold by each supplier in the state to come from a renewable source). A computer system keeps track of TRCs generated and sold. *See*, http://www.rapmaine.org/gpnews8.htm

92 The Center for Research Solutions, *supra,* note 90.

93 J. Pepper, *Renewable Certificates for Photovoltaics: A Model to Build Upon,* Renewable Energy Technology Project, Pace Energy Project (September 7, 2001).

94 *Summary Report on Tradable Renewable Certificates (TRC): The Potential and the Pitfalls, supra,* note 90.

95 Trends in Renewable Energies, Issue #161 (week of 18–22 December).

96 *Summary Report on Tradable Renewable Certificates (TRC): The Potential and the Pitfalls, supra,* note 90.

5.4 Standards and regulations

Standards

Standards for pollution, and for building, appliance and vehicle efficiency can be very effective in promoting renewable and efficiency measures.

Politically, standards can ordinarily be set only where technological and economic feasibility have been demonstrated and where the businesses affected can be persuaded to agree to the level of control. They therefore generally represent minimum rather than maximum feasible achievements. Information programmes, labels and incentives are needed to persuade manufacturers and vendors to go beyond the standards. Also, many products involve rapid technological change so that standards can become quickly obsolete. Regular updating of the standards is therefore required.

Standards also must be set with care as to their applicability. For example, it makes sense to require installation of compact fluorescent lamps only where usage is reasonably high; they may be uneconomic where lamps are only used a few hours a day. Also, it is difficult to use standards for new technologies that are still relatively unproven and costly, in which case information, incentive and R&D programmes may be more appropriate. Lastly, standards are ineffective if not enforced, so regular reporting, inspections and enforcement mechanisms must be included, as well as training of the personnel who will be involved with their application.

Renewable portfolio standards

A direct way of promoting renewable energy resources is to adopt Renewable Portfolio Standards. Such standards have been adopted in the USA and in other countries. These standards require electric utilities to purchase a certain percentage of their power from renewable resources. As of mid-1999, nine US states (Arizona, Connecticut, California, Maine, Massachusetts, Nevada, New Jersey, Texas and Wisconsin) had adopted some form of renewable portfolio standard utility requirement. Going even further, Massachusetts and Connecticut regulatory commissions have required a Generation Portfolio Standard requiring each distribution company to offer a mix of generation sources that will meet federal and state air pollution standards.[97] If such standards were to be widely adopted, they would allow mass production of renewable energy generation equipment, substantially reducing their costs, thus making them more competitive against fossil fuels.

The United Kingdom has enacted the Non-Fossil Fuel Obligation (NFFO), a concept similar to the US's renewable portfolio standard. After the UK's deregulation of its electric utility industry in 1989, it created Regional Electricity Companies (RECs), which in 1992 were required to purchase 1,500MW of non-fossil generated power by the year 2000 in a series of auctions. These auctions were so successful that 3,271 MW of non-fossil power has been purchased at the auctions, far in excess of the 1,500MW requirement. The programme's 15-year contracts with five-year repayment grace periods permit reasonable financing of projects. The auction device has driven renewable prices down to about 4.3 cents/kWh (very close to the electricity pool price of 4.2 cents). On the other hand, the intense competition arising from the auction process has favored large, deep-pocket companies and has discouraged small investors, independent developers and the domestic renewable energy manufacturing industry. Subsidies to pay the RECs for excess costs of non-fossil resources are paid from a tax on all electricity.[98] In 2000, the Parliament adopted the Utilities Act, which replaces the NFFO with the Renewables Obligation.[99] The Renewables Obligation requires all electricity suppliers, beginning January 2002, to obtain specific but increasing proportions of electricity from eligible renewables. The goal of the programme is to generate 10% of all the UK's electricity from renewables (compared with the 2.8% generated in 2000).[100]

Italy, Austria, Argentina, Denmark, Belgium and Germany also have adopted utility renewable requirements. The Netherlands mandates renewable purchases where utilities purchase excess power to cover avoided fuel and capacity costs. Denmark, in addition to pollution taxes and incentives for renewables purchases, has adopted a renewable portfolio standard under which a target for renewables is set legislatively

97 Geller *et al.*, *supra* note 4, at 8.
98 Moore and Ihle, *supra* note 85, at 12–15.
99 Utilities Act 2000 (UK), 2000 Chapter 27.
100 Eligible renewables are defined by the Utilities Act 2000 to include all energy sources other than fossil fuels or nuclear fuel. *Renewable Energy,* Parliament Office of Science and Technology, Postnote, October 2001, Number 164.

and utilities are required to meet these targets. The utilities may either develop renewable resources themselves or purchase credits from other renewable generators. The extra costs of renewable purchases are paid by all of the utility's customers. Japan adopted "Project Sunshine" under which the government subsidizes photovoltaic purchases by utilities to meet a 10,000 roofs goal, and in 1997 enacted a new energy law establishing a goal to provide 3.1% of primary energy from renewable resources by 2010 (vs. 2.1% in 1996). While there is no purchase requirement, the government's requests to suppliers are the effective equivalent of a required standard under the Japanese system.[101]

Pollution standards

Standards for air polluting emissions from power plants and from vehicles can be very effective in promoting renewable energy resources. Power plant standards are usually adopted for emissions of sulphur dioxide, nitrogen oxides, particulates and sometimes mercury and carbon dioxide. These standards, by making it more expensive to use fossil fuels, encourage the use of cleaner alternatives such as renewable and efficiency measures. Of course, pollution standards also reduce the health, mortality and environmental effects of air pollutants, so there is a double dividend. The costs in terms of more expensive electricity have been slight.

The United States (through its Clean Air Act[102]), as well as Japan and several European countries have adopted such standards. Brazil and Indonesia have air quality standards similar to those of the USA. China and India, unlike the US, have standards that vary in regions where living conditions differ. For example, the limits set for heavily polluted areas in China are three times as high as the limits set for natural conservation areas.[103]

Emission standards for vehicles are now in effect in virtually all developed countries as well as several developing countries. Brazil, Chile, Mexico, the Republic of Korea and Thailand have all adopted vehicle emission standards due to air pollution caused by increased vehicular traffic that has resulted from increased economic development.[104]

Building codes and standards

Most countries have adopted standards for construction of new buildings. Many have now included energy requirements in these building standards. All the International Energy Agency countries have energy requirements as a part of their building codes and many recently are strengthening them. For example, France is adopting more stringent thermal regulations for new residential and commercial buildings with the aim of improving energy efficiency by 25%.[105] Building energy standards usually require all new residential, commercial and industrial construction to be built to a minimum energy efficiency level that is cost-effective and technically feasible. In the USA,"good practice" residential energy codes, as defined by the 1992 Model Energy Code (now known as the International Energy Conservation Code),[106] have been adopted by 32 states, and "good practice" commercial energy codes, as defined by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE 90.1-1989) model standard, have been adopted by 29 states.[107] The Energy Policy Act of 1992 (EPAct)[108] requires all US states to adopt this commercial building code standard and to consider upgrading their residential codes to meet or exceed the 1992 Model Code, but this legislative requirement has not been well enforced. Experience in the US has shown that building codes can reduce space conditioning energy use in new buildings by 25% or more.[109]

The efficiency of existing buildings, which account for approximately two-thirds of the energy used in the buildings sector, can also be substantially increased through cost-effective retrofits.

> "For example, an evaluation of the US national weatherization assistance program found that retrofits of low-income housing carried out during 1990–96 typically reduced natural gas consumption for space heating by 34%. Also, retrofits of 15 office buildings as a part of EPA's ENERGY STAR® Showcase Buildings partnership reduced energy consumption by 30 per cent

101 Moore and Ihle, *supra* note 85, at 4.
102 42 U.S.C.A. §§7401–7671.
103 L. Wijetilleke and S. Karunaratne, *Air Quality Management: Considerations for Developing Countries* (World Bank 1995).
104 A. Faiz *et al., Air Pollution From Motor Vehicles: Standards and Technologies for Controlling Emissions* (World Bank 1996).
105 International Energy Agency, available at http://www.iea.org/pubs/newslett/eneef/intro.htm
106 *Status of State Energy Codes*, Building Codes Assistance Project, Washington, DC (1999).
107 Geller *et al., supra* note 4, at 5.
108 Pub. L. 102-486, Title VII (October 24, 1992), 106 Stat. 2776.
109 Geller *et al., supra* note 4, at 5.

> on average. The technologies that can be used to upgrade efficiency include adding insulation to walls and attics, replacing older windows with energy efficient windows,[110] sealing leaky heating and cooling air ducts, sealing air leaks in the building envelope, upgrading heating and cooling systems, replacing inefficient lighting, and installing control systems."

Ordinances requiring retrofits of existing buildings have been adopted in US cities such as San Francisco, California, Minneapolis, Minnesota, and Burlington, Vermont.[111] Energy audits of buildings have also been adopted in various jurisdictions, for example in Luxembourg on a voluntary basis.[112] One measure worth pursuing is a law, adopted in some US states, requiring that homes or commercial buildings be inspected at the time of resale, with a retrofit requirement for buildings that are found not to be up to standard.

Many developing countries have yet to adopt building codes. However, as these countries begin to raise their standard of living, building electricity use will increase. Adopting such standards now will help to reduce the growth of energy consumption in the future. Eleven developing countries have used ASHRAE standards to develop their own building codes, including China, Hong Kong, Malaysia, Pakistan, the Philippines, Singapore, South Korea and Thailand. Jamaica has a system based upon voluntary guidelines, but provides mandatory standards in limited regions or for specific building types.[113]

Appliance efficiency standards

Legislated standards for appliance efficiency are particularly needed because most appliances are bought, not by bill payers, but by landlords, home builders and public housing authorities which have no economic interest in saving energy in selecting them; quite to the contrary, they are more likely to select appliances which have the lowest first cost regardless of energy consumption. While incentives and appliance labelling for energy efficiency (which is required in the US and many other countries) can be helpful in exceeding standards, only standards can assure that at least the most inefficient models will be removed from the market.[114]

Residential and commercial buildings currently account for 36.5% of national energy use in the USA, mostly consumed by heating and cooling equipment and electric appliances. Approximately 85% of residential energy is consumed in furnaces, boilers, air conditioners, heat pumps, refrigerators, water heaters, clothes washers and dryers, ranges and dishwashers. Sixty-five percent of commercial energy consumption occurs in heating, cooling, lighting, water heating, refrigeration, and office equipment. In industry, lighting equipment and electric motors account for more than 75% of electricity consumption. The US has adopted a broad range of appliance efficiency standards starting in 1987, on fluorescent ballasts in 1988, and on a variety of commercial and industrial equipment in 1992. It is estimated that the US standards cumulatively will reduce electricity use in the USA by 2.7% in 2000 and 6% by 2015.[115]

The European Commission also developed efficiency targets to reduce standby power consumption for TVs and VCRs. In implementing these targets, the Swiss Federal Office of Energy, pursuant to a Swiss statute, provided that if the industry fails to meet the target values by a specified date, it would set mandatory minimum efficiency standards for these appliances; it also provides for mandatory labelling of these products and a stiff reporting requirement. The results reported for 1994 to 1996 show that TV and VCR sales for models with standby power of 5 Watts or less increased from 36% to 44%, while appliances using more than 10 Watts in standby power dropped from 19% to 8%.[116]

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110 Efficient windows can insulate fourfold better and let in six times as much daylight but a tenth of the unwanted heat than conventional unglazed windows, while at the same time cutting air conditioning energy needs fourfold. This saves about enough money to pay for the extra costs of the windows. The retrofit, saving of three-quarters of the energy, then costs essentially the same as a routine renovation that saves nothing. Lovins, *supra* note 3, at 6.
Geller *et al.*, *supra* note 4.

112 International Energy Agency, available at http://www.iea.org/pubs/newslett/eneeff/intro.htm

113 Duffy, *supra* note 58.

114 There are several reasons that the marketplace cannot and does not by itself attract the sale of the most efficient appliances. Lack of knowledge is a major factor, particularly in the residential sector. In the commercial and industrial sectors, purchasing decisions are often made by purchasing or maintenance staff who have little knowledge about or interest in the efficiency of the equipment they order. They tend to purchase the equipment that is lowest first cost, regardless of the cost of the energy used by the equipment, and they are judged by their superiors accordingly. Even were they to purchase efficient equipment, the savings would not accrue to their departments. Furthermore, efficient equipment is often not stocked sufficiently by suppliers because of inadequate demand, thus requiring special orders and long lead times for delivery of the equipment. Developers and landlords have little interest in buying efficient equipment where they do not pay the energy bills. These are substantial barriers to the introduction of efficient equipment in the marketplace and a principal reason for the need for appliance efficiency standards. Incentives can be used to go beyond the standards. Lovins, *supra* note 2, at 5,6.

115 Geller *et al.*, *supra* note 3, at 5.

116 Lovins, *supra* note 3, at 16.

China, Korea, the Philippines and Taiwan have all developed mandatory minimum efficiency standards for household appliances. India has voluntary efficiency standards for refrigerators. Mexico is the only country in Latin America with mandatory minimum efficiency standards, which are similar to those in the USA.[117] Brazil, through its National Electricity Conservation Programme (PROCEL), has worked with manufacturers to develop and commercialize energy efficient appliances. While the standards in Brazil are voluntary, they have been effective in encouraging manufacturers to improve energy efficiency in refrigerators. The Tunisian Energy Conservation Agency (AME) has established national energy efficiency standards for refrigerators and air conditioners. In addition, AME has worked with local manufacturers of appliances to increase local production of energy efficient appliances.[118]

Over time, these standards result in considerable economic savings for consumers and society. While the first cost of the efficient appliances often is slightly more than inefficient models, the economic savings over the life of the appliance can be very significant and the savings to society from reduction of energy demand also are great, resulting in decreased use of polluting fossil fuels and thus promoting cleaner energy. In developing countries there may be a need to provide for initial assistance to enable the purchaser to pay for the higher first cost of the efficient appliances.

Vehicle efficiency standards

Legislation setting standards on the vehicle miles per gallon for all vehicles sold can also reduce pollution. The US Congress enacted Corporate Average Fuel Economy (CAFE) standards during the energy crisis in 1975, and Canada adopted a similar Motor Vehicle Fuel Efficiency Program with voluntary standards.[119] The US CAFE standards provide that the passenger automobiles produced by each manufacturer must average a prescribed miles per gallon, with a lesser standard for light trucks. As a result, the average miles per gallon of the US passenger automobile fleet increased from 17 mpg in the 1970s to a high of 25.9 mpg in 1988.[120]

However, with the recent introduction of highly popular larger "sports utility vehicles," which unfortunately were classified as light trucks, and the increased use of light trucks for passenger use, the average mpg in the US has been reduced to 23.8 mpg today. Congress has resisted strengthening the standards and turned down a proposal for a modest gasoline tax increase at the beginning of the Clinton Administration.[121] In December 1999, however, the Administration was successful in reaching an agreement with the automobile manufacturers and the oil industry to apply stricter standards for sports utility vehicles and light trucks together with a mandate for production of gasoline with a lower sulphur content.[122]

In other countries, similar programmes have been adopted in the form of negotiated agreements between governments and the auto industry. Australia, for example, entered an agreement to reduce national average fuel consumption for new cars and required the use of a mandatory fuel efficiency label. The German auto industry is committed to a 25% improvement in the efficiency of cars built and sold between 1990 and 2005. Italy and Japan have similar programmes. In Switzerland, a voluntary programme was enacted calling for a 15% reduction in fuel consumption between 1996 and 2001, with the authority to adopt mandatory regulations if this target is not reached.[123]

Other vehicle measures adopted include multiple-occupancy vehicle lanes on highways and car-pooling incentives including company-provided vanpools, elimination of free parking by business establishments and parking fees. These measures have been adopted in a good number of US states.[124] France and Italy have even gone so far as to limit city parking to alternate days for odd and even licence numbers and create "No Car Days."[125]

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117 Duffy, *supra* note 58, at 25.

118 K. Millock, *Analysis of Energy Efficiency Standards*, Stockholm Environment Institute, Vol. 7, No. 2, August 1994.

119 42 U.S.C. §§ 6231 *et seq*.; re Canada, *see* http://www.iea.org/pubs/newslett/eneeff/intro.htm

120 Geller *et al.*, *supra* note 4, at 9.

121 Greenhouse gas standards for motor fuels also have been proposed, similar to the renewable portfolio standards for electricity generation, at a 5% emissions reduction in 2010, increasing 1% per year to a 15% reduction by 2020, supplemented by expanded R&D and market creation programmes and financial incentives to stimulate the production of low-carbon fuels such as cellulosic ethanol and biomass- or solar-based hydrogen. See Geller, *supra* note 15, at 10, 11.

122 "Clinton Allays Criticism on New Pollution Rules," *New York Times*, December 22, 1999, page 1.

123 International Energy Agency, available at http://www.iea.org/pubs/newslett/eneeff/intro.htm

124 A 1997 US legal innovation permitted employers to cash out employee parking spaces, charging fair market value for each space and paying each employee a commuter allowance of equal after tax value, typically reducing demand for parking spaces which often cost $10,000–30,000 each. Singapore charges drivers automatically registered toll fees designed to make them pay the social costs of driving and invests the proceeds in public transit and coordinated land use, with the result that it is virtually congestion-free. Lovins, *supra* note 3, at 16.

125 International Energy Agency, available at http://www.iea.org/pubs/newslett/eneeff/intro.htm

Enforcement of standards

Effective enforcement is critical to the success of any standards programme. Theoretically, the governments adopting the standards should enforce them, and any standards programme, to be effective, should incorporate substantial resources for training, inspection and enforcement. In practice, however, governments and their regulatory agencies often come to identify with the industries or companies that they regulate. Also, political pressures often prevent effective government enforcement. Citizen enforcement, adopted in the US in the Clean Air Act[126] and other environmental statutes has been found to be a most effective enforcement mechanism. NGOs in the US are able to hold regulators' feet to the fire very effectively by filing suit to enforce standards, with the award of attorney's fees for such litigation; the very presence of citizen suit provisions enables the NGOs to influence government enforcement policies.

6 Government procurement of renewable energy and energy efficiency

All governments are major energy users. Legislation or regulation to require purchase by federal, state and/or municipal governments of clean energy products and processes can do much to promote renewable and efficiency measures. Government procurement of green products also creates tremendous "market pull". By harnessing the purchasing power of government agencies, policy makers can help bring down their prices and set an example of the feasibility of their use for the private sector.

In the US, the government is the world's largest single buyer of energy-using products, accounting for over $10 billion of such purchases each year.[127] The US Government, through legislation and executive orders, has required that all US federal agencies must use 30% less energy per square foot in their buildings in 1999 than they consumed in 1985 and 35% less in 2010. In implementing these requirements, the Federal Energy Management Program requires the use of energy efficient lights and appliances in all its buildings and has adopted strict energy efficiency requirements for the construction of its buildings.[128] All federal agencies are required to purchase only products that qualify for the ENERGY STAR® label, or, where there is no label, are among the 25% most efficient products on the market. Renewable resources must be acquired wherever cost effective.

The US Government also is including energy efficiency specifications in its contracting guide specifications used for construction and renovation projects. For example, by adopting efficiency criteria, the US Navy in just one year (1998) saved an estimated $1.2 million per year in reduced electricity use by installing 500,000 efficient (T-8) fluorescent lamps, 200,000 electronic ballasts and 20,000 light-emitting diode (LED) exit signs.[129] And, as a part of a massive renovation programme, the Department of Defense recently installed photovoltaic panels on the Pentagon.[130]

The US government green procurement has saved government agencies, and thus taxpayers, hundreds of millions of dollars in energy costs, and benefited citizens at large through reduced levels of pollution. Government procurement programmes involve payment of a premium up front, but result in very substantial long-term savings. Governments can also require the purchase for their vehicle fleets of clean and efficient vehicles. Many municipalities in the US are now purchasing electric and natural gas turbine buses. The City of Los Angeles, California has purchased a fleet of electric cars for municipal use and has installed recharging stations for the public throughout the city.[131]

Other countries have been very aggressive about reducing energy consumption by investing in public transportation, building efficiency measures, planting trees and installing solar collectors. For example:

126 42 U.S.C.A. §§7401–7671.

127 A. McCane and J. Harris, *Changing Government Purchasing Practices: Promoting Energy Efficiency on a Budget,* Proceedings of the ACEEE Summer Study (Asilomar, California, Summer, 1996).

128 Executive Orders 13123 and 12902, *See,* http://www.nara.gov/fedreg/eo.html

129 *See* http://www.epa.gov/appdstar/purchasing; http://www.eren.doe.gov./femp/prcurement. An example of a state government agency efficiency success story: The Environmental Services Department (ESD) of San Diego decreased its energy consumption by 70% when energy efficient measures were implemented in its office building. The 73,000sq.ft. building received a new high-efficiency heating, ventilation, and air conditioning (HVAC) system; high-efficiency window films; fluorescent lamps and fixtures; and daylight and occupancy sensors. These improvements helped the building surpass California's Title 24 building code by more than 50%. Actual savings for ESD have been approximately $80,000 per year ($1.10/square foot). The building went from operating at 21–22kWh/square foot to 7–8kWh/square foot. J. Romm, *Cool Companies* (Island Press, Washington, DC 1999).

130 FEMP Focus, US Department of Energy (September/October 1999).

131 *See* http://www5.oadwp.com/services/electran/vehicles.htm

Australia utilizes best practices in government procurement through performance contracting; Finland has adopted a target to reduce heating energy and electricity consumption in its government operations; Ireland has a programme to reduce energy consumption in all state buildings; and the United Kingdom has a five-year programme for reducing energy in government facilities. Canada, through a Federal Building Initiative, has been successful in achieving energy savings by contracting with energy service companies (ESCOs).[132]

Government procurement actions to stimulate development of improved energy-efficient technology can also include the conduct of competitions to produce equipment with superior energy savings. A successful example was the US government's "Golden Carrot" Super-Efficient Refrigerator Program under which a consortium of government, utilities and NGOs organized a competition to award a total of $30 million to the manufacturer offering the best new refrigerator that exceeded prevailing efficiency standards by at least 30%. The goal was met and many participating utilities also offered additional consumer rebates for it.[133] Sweden has a similar, very ingenious programme under which purchasing offices issue requests for proposals guaranteeing to buy a large number of devices at specified prices if they meet technical standards for energy efficiency and customer savings.[134]

6.1 Aggregation of procurements

Governments also can aggregate procurements to make production of energy superior equipment economic for manufacturers. Technology procurement for energy-efficient products, pioneered in Sweden, subsequently has been used in the US, The Netherlands and Finland. Sweden's initial effort recruited housing cooperatives for a 1992 procurement creating a market for super-efficient windows that have reduced energy losses by half compared to the standard triple-glazed windows.[135] In 1995, the New York Power Authority and the New York City Housing Authority created a technology procurement project for new refrigerators that used 30% less electricity than those then on the market. And the International Energy Agency has sponsored a number of technology procurement projects for electric motors, heat-pump dryers, LED traffic signals and digital multifunction office copiers.[136]

7 Industry-government partnerships

Many industries recently have undertaken major programmes to promote efficiency measures and renewable energy use, often in partnership with sponsoring governments on a shared funding basis. Some of these efforts are in anticipation of Kyoto Protocol requirements and credits. Large international companies such as Dupont, Shell Oil, BP and others have instituted such programmes. All the major US and Japanese automobile manufacturers have aggressive programmes to develop hydrogen fuel cell-powered automobiles in collaboration with their governments.

The US Government has relied heavily on partnerships with industrial companies to achieve utilization of both energy efficiency and renewable technologies. For example, the US Government has initiated an ENERGY STAR® programme that gives technical assistance and recognition to companies that market very efficient equipment and renewables. The programme saved US businesses and consumers more than $5 billion in 2000.[137]

Canada started a Voluntary Challenge and Registry (VCR) programme as a part of its National Action Program on Climate Change in 1995, which became an independent private/public partnership in 1997. Its purpose is to spur voluntary actions to promote use of efficiency and renewable resources to address climate change and publicize them. Two-thirds of its funding is from the private sector, the rest from the federal and provincial governments. In its first three years, Canada's VCR programme registered about 700 companies and organizations.[138]

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132 International Energy Agency, available at http://www.iea.org/pubs/newslett/eneeff/intro.htm

133 M. Ledbetter *et al., US Energy-Efficient Technology Procurement Projects: Evaluation and Lessons Learned,* Pacific Northwest National Laboratory Report PNNL-12118 (Richland, Washington, February 1999).

134 Lovins, *supra* note 3, at 17.

135 *High Performance Windows Halve Energy Losses,* Centre for the Analysis and Dissemination of Demonstrated Technologies (CADDET), available at http://www.etis.net/caddet/eetb_eut/R327.pdf

136 Lovins, *supra* note 3, at 17; H Wrestling, Co-operative Procurement: Market Acceptance for Innovative Energy Efficient Technologies, NUTEK Report B-1996-3 (Stockholm, 1996).

137 *See* EPA 2000 Annual Report, available at http://www.epa.gov/ocfo/finstatement/2000ar/2000ar.htm#2000ar

138 International Energy Agency, available at http://www.iea.org/pubs/newslett/eneeff/intro.htm

Market transformation programmes[139] are often aimed at overcoming the "Catch 22" problem of suppliers' reluctance to stock renewable energy and energy efficiency equipment in the face of insufficient or uncertain consumer demand. This stock problem was solved ingeniously for energy efficiency equipment by B.C. Hydro of Canada, which paid a small, temporary subsidy to suppliers to stock only efficient models. In three years, the market share of premium-efficiency motors soared from 3% to 60%, and the subsidy was phased out. Similarly, PG&E in California paid refrigerator distributors a small bonus for each efficient model stocked, but nothing for inefficient models, which quickly vanished from the shops. PG&E found that the vendor subsidy improved refrigerator efficiencies faster, at less than a third the cost of giving rebates to end users.[140] The same incentives could be adopted for renewable resources.

8 Technology transfer and research and development

8.1 Research and development

Government-sponsored research, development and demonstration (RD&D) projects have dramatically reduced the cost and increased the performance of renewable resources. The US Department of Energy technology laboratories have done pioneering studies and effective research on energy efficiency and renewable technologies. For example, R&D has fostered the development of compact fluorescent light bulbs, which last 10 times longer and use about one quarter of the electricity of incandescent bulbs.[141]

Another example of the results of recent relevant R&D successes is the development of combined cycle natural gas power plants with double the efficiency and one-fourth the carbon intensity of coal-fired power plants.[142] These plants are being widely adopted around the world in countries with natural gas resources. Other relevant R&D successes include the development of variable speed drive electric motors that produce the same work for less than half the electricity use as conventional motors and efficient wind machines that have drastically cut their costs.[143] Much successful R&D has been done in the area of building efficiency, with the development of better insulation materials, double or triple-glazed windows designed to utilize the sun's heat or protect from it, and many other innovations.[144]

Unfortunately, with the advent of increased global commercial competition and increasing privatization around the world, corporations have significantly decreased their long term R&D expenditures. Utility spending on efficiency R&D also has drastically declined, by 33% from 1993 to 1996, from $708 million to 476 million.[145] As a result, if the benefits of new technology are to be achieved, governments will have to conduct the requisite R&D themselves or legislate the funding of R&D efforts; they could also mandate that a percentage of sales be devoted by private entities to R&D or enter into partnerships with private companies to develop technologies that will reduce greenhouse gas emissions.

8.2 Demonstration programmes

In the US, the government has established several demonstration programmes in which grants are given to specific industries to develop ways to increase energy efficiency, reduce industry's costs and promote clean production. Industries compete for the grants and the chance to develop the technologies and market them.[146]

Sweden used a competition among suppliers to encourage manufacturers to improve the efficiency of a wide variety of home appliances. The improved performance of the winning model of a refrigerator-freezer was remarkable, using more than 30% less electricity than the most efficient model then on the market. There

139 Market transformation programmes are designed to produce permanent changes in markets for energy efficient equipment. Unlike traditional utility rebate programmes, which offer a range of financial incentives to the end user, market transformation programmes often focus on "upstream" market participants such as manufacturers, architects and builders, vendors, and retailers.

140 Geller *et al, supra* note 4, at 13.

141 US Department of Energy, *Compact Fluorescent Lamps*, Consumer Energy Information: EREC Reference Briefs, available at http://www.eren.doe.gov/consumerinfo/refbriefs/ef2.html

142 Lovins, *supra* note 3, at 8.

143 US Department of Energy, *Compact Fluorescent Lamps*, Consumer Energy Information: EREC Reference Briefs, available at http://www.eren.doe.gov/consumerinfo/refbriefs/ef2.html

144 Interlaboratory Working Group, *Scenarios of US Carbon Reductions: Potential Impacts of Energy-Efficient and Low-Carbon Technologies by 2010 and Beyond* (1997), available at http://eetd.lbl.gov/51ab/

145 J. Eto *et al.*, Ratepayer-Funded Energy-Efficiency Programs in a Restructured Electricity Industry: Issues and Options for Regulators and Legislators, American Council for an Energy-efficient Economy (Washington, DC, May 1998).

146 Scenarios for a Clean Energy Future, Interlaboratory Working Group on Energy-Efficient and Clean Energy Technologies, November, 2000.

have been similar successful competitions run by the US Department of Energy under its "Golden Carrot" programme.

World-wide, industries have developed similar types of competitions as a way to encourage research and development. The World Solar Challenge, first held in 1987, is a four day event in which those within the automotive industry from around the world gather to race the solar vehicles they have developed. In 1999, forty-three teams from fourteen countries competed in Australia.[147]

8.3 Technology transfer

For the developing countries, technology transfer is a critical factor in enabling them to take advantage of energy efficiency and renewable technologies used in industrialized countries. Technical assistance and education of key energy players is essential to success. There are many such efforts being conducted around the world sponsored by governments and international agencies.[148]

Improved technology offers great potential for developing countries to leapfrog to cleaner energy solutions. They can adopt the cleaner technologies from the start, avoiding the economic and pollution costs of using less efficient technologies and then having to replace them, as has been done in the industrialized countries.

One particularly successful effort has been the establishment of Energy Outreach Centers in the formerly planned economies of Eastern Europe and in China, a project overseen by the US Department of Energy's Pacific Northwest National Laboratory. Start-up funding was provided by the US Environmental Protection Agency and Department of Energy, the World Wildlife Fund, the Charles Steward Mott Foundation and the John D. and Catherine T. MacArthur Foundation, and uniquely, each of the centres has been successful in becoming self-sustaining after the initial project funding ended. Some 250 local and international companies now participate in their projects. The centres partner with suppliers of modern renewable and energy efficient equipment and services and in-country collaborators. Six centres were established as not-for-profit, non-governmental independent entities in Poland, the Czech Republic, Russia, Bulgaria, China and Ukraine. In the nine years since the first centre was established they have achieved remarkable results in reforming local laws to promote energy efficiency and renewables and effectuate technology transfers.[149]

A few examples of successes: The Russian Center helped develop the first regional level code for energy building construction incorporating energy efficiency and renewables. The Czech Center helped draft a national energy policy and legislation for energy labelling and standards provisions. The Polish Center developed a programme for utility energy efficiency and renewable investments. The Beijing Center provided expertise in instituting Integrated Resource Planning for a major utility. The centres have focused on policy reform, private sector assistance for joint energy technology and service ventures, demonstration and training, and public education and information dissemination.

Other programmes such as China's CFC-free Energy-Efficient Refrigerator Project have shown great promise. The project began in 1989 in order to develop an energy-efficient CFC-free refrigerator. The final model, completed in 1996, demonstrated a 40% reduction in energy use.[150] The Global Environment Facility Project Development Funding then funded studies with several manufacturers for large-scale production and distribution of the new refrigerator. The United Nations Development Fund provided a $1 million technical assistance grant. The programme thus leapfrogs to modern efficient refrigerator technology, providing China with a major industrial opportunity with attendant jobs, consumer savings and power load reductions.

The Philippine Technology Transfer for Energy Management programme provided energy audits, technical assistance and below market loans to more than 120 companies for adoption of energy-saving technologies. This programme was funded by $4.6 million from the US Agency for International Development in 1985. The centerpiece was a Demonstration Loan Fund to demonstrate efficiency technologies and practices not widely used in the Philippines. Nearly 1,100 participants from the public and

147 World Solar Challenge, available at http://www.wsc.org.au/About/history.solar

148 J. Goldemberg *et al.*, (eds.), *supra* note 40.

149 W. Chandler *et al*, *Energy Efficiency Centers in Six Countries: A Review*, Battelle Pacific Northwest Laboratories, PNNL 13073 (Washington, DC, November 1999).

150 A. Fine *et al*, *Sino-US CFC-Free Super Efficient Refrigerator Project Progress Report: Prototype Development and Testing*, US Environmental Protection Agency, Washington, D.C. (October 1997), available at http://eetd.lbl.gov/EA/partnership/China/refpubs.html

private sectors attended 25 seminars that were conducted nationwide under the programme. Sixteen projects completed had an average internal rate of return of 41%, with very significant cost savings.[151]

9 Recycling programmes

Many countries today have laws providing for the recycling of their waste paper, glass and metal products. For example, in Denmark, half of all waste is recycled and 80% of new paper is made from used paper.[152] Almost every city in the US has established a recycling programme for paper, glass, plastic and metal wastes, with either kerb-side pickup or establishment of a central recycling municipal facility. Many business and institutions not required by law to do so recycle their waste products on a voluntary basis. In the industrial and commercial sectors, the recycling of wastes is almost always economically and environmentally advantageous.[153]

10 Utility programmes and regulatory requirements

10.1 Utility incentive programmes

Utilities in many US states have been required by regulatory commissions to undertake integrated resource planning (IRP), including energy efficiency "demand-side management" (DSM) and renewable resources. The utilities are required to provide incentives to their customers to purchase energy efficient lighting and appliances and to provide free or low cost energy audits to residential, commercial and industrial customers to help them identify efficiency opportunities.

These utility incentives were very effective in a regulated environment, but with the prospect of deregulation, the utilities have been allowed to cut back on these incentive programmes for fear that their costs would make the utilities uncompetitive[154] with those without incentive requirements (even though efficiency investments were made profitable for the utilities by the regulators[155] and efficiency investments save energy at a cost far less than new power plant construction). In the US, utility spending on energy-efficiency programmes has declined from about $1.4 billion in 1992 to about $1.2 billion in 1996, with continuing declines to date and projected, despite the fact that only a handful of states have passed restructuring legislation.[156]

Other countries have been more aggressive in their utility regulation to promote efficiency. In Brazil, for example, a federal utility regulatory agency in July 1998, required all distribution utilities to spend at least 1% of their revenues on energy efficiency improvements, with at least one quarter of this amount (about $50 million per year) to be spent on end-use efficiency projects.[157] Utilities in Australia, Austria, Belgium, Canada, Germany and Ireland also have IRP and DSM requirements.[158] Ontario Hydro of Canada placed its primary emphasis on end-use efficiency and distribution planning to displace building transmission and generating capacity. Its first three experimental programmes cut its investment needs by up to 90%, saving it $600 million.[159]

Application of utility incentives to rental apartment buildings can be a problem. The tenants have no incentive to install measures that will benefit the landlord and the landlord has little incentive to invest in measures that primarily will benefit the tenants. Some state utility regulators have addressed this problem by giving larger incentives to the landlords. To induce tenant cooperation, it is important that apartments be individually metered for electricity and gas consumption. Brazil has an extensive metering programme run by PROCEL, a national electricity conservation programme, and its national utility.[160]

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151 P. Rumsey and T. Flanigan, *Asian Energy Efficiency Success Stories,* International Institute for Energy Conservation (Washington, DC 1995).

152 *Denmark Moves Ahead in Wind Power,* New York Times, International Section (October 9, 1999).

153 Lovins, *supra* note 3, at 7. *See also* section 2.6 above on page 81.

154 In some states, utilities have been relieved of their "obligation to serve" and consequently no longer own or build new generation. This development has led some to question the appropriateness of requiring utilities to evaluate or fund customer energy efficiency measures.

155 These states simply decoupled utility profits from sales, letting utilities keep as extra profit part of the savings from energy efficiency measures they financed. Lovins, *supra* note 3, at 15.

156 Eto *et al., supra* note 145.

157 Geller *et al, supra* note 15.

158 International Energy Agency, available at http://www.iea.org/pubs/newslett/eneeff/intro.htm

159 Lovins, *supra* note 3, at 15.

160 Geller *et al., supra* note 15, at 1.

10.2 Systems benefit charges

In the USA, in states that have deregulated their utility generation, environmental advocates have been quite successful in getting utility regulators or legislators to impose a "systems benefit charge" on the distribution utility, which remains a regulated monopoly, to fund efficiency, renewable and other public benefit investments; the revenues from these charges often are placed in independently administered public benefit funds. As of June 2001, nineteen states have adopted utility system benefit charges and benefit funds.[161] A national public benefits trust fund of 0.2 cents/kWh (which would cost the typical residential customer only about $1 per month) has been introduced in the US Congress.[162]

These SBC funds are designed to preserve funding for programmes that would not be adequately supported by market participants in a competitive electric industry. Programmes vary from state to state, but typically include energy efficiency, renewable energy, low income affordability, and research and development. The fund is structured to be "non-bypassable," meaning that all who connect to and benefit from the grid must contribute a fair share to the fund. Moreover, the fund is designed to be "competitively neutral," meaning that the fund is levied on the monopoly service of the electric industry (distribution), and does not impact the industry functions that are more amenable to competition.

For example, in August 1996 the Rhode Island legislature and regulatory commission authorized electric distribution companies to levy a charge of at least 2.3 mills (0.23 cents)per kWh for energy efficiency and renewables; about $17 million per year of the funds raised were to be spent by utilities on efficiency and renewable projects to be selected by collaboratives of all utility stakeholders. Oregon takes 3% of its electric revenues to establish a public benefit fund, $70 million in 1998, $10 million of which was dedicated entirely to low-income customer payment programmes. Montana has adopted a 2.4% charge of retail sales between 1999 and 2003 for energy conservation, renewable resource projects and low-income energy assistance. Gas utilities are to contribute 0.42% of the utility's annual revenue for low-income energy bill assistance.[163] The California legislature adopted a charge on the distribution utilities which brought about $1.8 billion in funding between 1998 and 2001 for energy efficiency, renewable resources and related R&D, with programme administrators to be selected competitively by the regulatory commission.[164]

Similarly, other countries have established a variety of public benefit arrangements to fill the gap for energy efficiency funding after deregulation. The United Kingdom established an Energy Savings Trust as a private limited company, funded by a small charge on distribution services, to promote energy efficiency for small customers. Norway adopted a small transmission tax earmarked for energy efficiency information, and it created and funded independent regional conservation centres to provide energy efficiency services. New Zealand set up an Energy Saver Fund as a part of its restructuring legislation to support residential programmes funded by an $18 million appropriation for an initial three-year period.

Brazil also has established a public benefits fund by levying a small nonbypassable wires/pipes charge on all sales of electricity or gas. This system also is used in California.[165]

10.3 Utility purchases

A number of US utilities have acquired renewable resources for their own use. For example, the Pacific Gas and Electric Company (PG&E) uses 1,100PV systems to produce a combined total of 44kW of energy, the majority of which provides power for gas flow computers, automated gas meters, and water level sensors. Technology improvements have reduced PV generation costs from $1.50/kWh in 1980 to a range of $.30–$.40/kWh today. Utilities benefit by using PV systems that are often the most cost-effective solution for specialized applications because of their reliability, modularity, low maintenance, and independence from

[161] M. Sami Khawaja *et al., System Benefits Charge: Economic Impacts and Implications*, The Electricity Journal, Volume 14, No. 5 (June 2001). State restructuring funds are being used to finance energy R&D, energy efficiency programmes, renewable energy programmes and low income programmes. For a good discussion of these state programmes, *See* M. Kushler, *An Updated Status Report of Public Benefit Programs In an Evolving Electricity Utility Industry*, American Council for an Energy-Efficient Economy (Washington, DC, September 1998). And for a good discussion of the policy considerations involved in establishing such funds. *See*, Eto *et al., supra* note 145.

[162] Geller *et al., supra* note 4, at 7.

[163] M. Khawaja *et al, System Benefits Charge: Economic Impacts and Implications*, The Electricity Journal, Volume 14, No. 5 (June 2001).

[164] Eto *et al., supra* note 145.

[165] *Powerful Partnerships: The Federal Role in International Cooperation on Energy Innovation*, Panel on International Cooperation in Energy Research, Development, Demonstration and Development (June 1999) at 3–23.

transmission and distribution systems. The systems have successfully powered small off-grid loads and have been installed on transmission towers and switching stations in place of transformers to handle small loads.[166]

10.4 Green marketing

A number of US energy service companies offer an option to customers to purchase a package of green generation products at a slight premium in cost. Pennsylvania, one of the first states to restructure its electric industry, boasts several energy service companies offering consumers electricity supply products comprised in whole or in significant part of renewable energy sources.[167] Other countries such as the Netherlands and Australia have created a green pricing programme permitting consumers to purchase renewables at a small premium.[168]

A particularly ingenious and promising *"Green Power for a Green LA"* programme was commenced in June of 1999 by the Los Angeles, California municipal utility. It commits to customers that choose a 6% rate increase (about $3 per month on average) to use the entire rate increase proceeds to invest in new renewable generation sources, combined with a commitment to install free energy efficiency measures for subscribers, assuring that participating customer bills will, as a result, experience a net decrease – a strong incentive for participation. The utility president, David Freeman, one of the world's clean energy pioneers, has thus found a way to finance new renewable resources in a way which demonstrably will be at no cost to the customers, creating a unique win-win financing arrangement. The Green LA is now the largest of its kind in the nation with over 90,000 participants.[169]

10.5 ESCOs

Energy Service Companies (ESCOs) provide comprehensive energy efficiency or energy reduction services to customers that own or operate facilities (industrial, commercial, institutional and governmental).[170] Energy efficiency and cost reduction is achieved by making process and infrastructure improvements, installing new technologies and providing alternative forms of energy (including renewables).[171] The ESCO can provide a number of services such as analysis, obtaining or arranging for financing, construction, project management and maintenance, monitoring, and training. Generally ESCOs are private entities, but they can also be created by a utility. ESCOs typically use their own capital for identifying and developing projects, but they use financing to construct the project.[172]

In the US, the success of ESCOs has been limited to niche markets for large customers.[173] It is estimated that the size of the ESCO market in Europe is $25 billion USD.[174] The development of ESCOs in developing countries has been encouraging. Thailand, Brazil and the Czech Republic have several ESCOs each.[175]

10.6 Disclosure

A number of states have required disclosure by their utilities of their emissions and the sources of their power generation. Information required typically includes the reporting of generation sources, fuel mix, fuel emissions, kWh price, price volatility, and contract terms. Market studies and polls consistently show that consumers want clean energy resources. In competitive retail markets, this disclosure requirement enables consumers to make informed decisions about the environmental consequences of their choice among suppliers. Disclosure requirements have been imposed by a number of US states.

166 *Profiles in Renewable Energy: Case Studies of Successful Utility-Sector Projects* (visited 15 October, 1999) available at http://www.nrel.gov/documents/profiles.html

167 These products are described at http://www.powerscorecard.org

168 Moore and Ihle, *supra* note 85, at 4.

169 Los Angeles Daily News, *L.A. leads way in developing true "Green Power"* (June 2, 1999).

170 World Energy Efficiency Association, *Briefing Paper on Energy Services Companies* (1999), available at http://www.weca.org/ESCO/ESCO%20bulletin.pdf

171 D. Witcher, Jr, *The Experience of the US ESCO Industry in the International Market* (2002), available at http://ksgnotesl.harvard.edu/BCSIA/ETIP.nsf/www/pcast-junior

172 World Energy Efficiency Association, *Briefing Paper on Energy Services Companies* (1999), available at http://www.weea.org/ESCO/ESCO%20bulletin.pdf

173 Eto *et al.*, *supra* note 145.

174 World Energy Efficiency Association, *supra* note 172.

175 D. Witcher, Jr, *supra* note 171.

11 Internal financing mechanisms

The financing of the renewable energy measures is of course vital to their achievement. While many of the measures undertaken are cost-effective in the long run, the initial capital investments needed for their accomplishment can be very great. A review of the methods that have been used to fund energy efficiency and renewable improvements is therefore an important consideration.

As indicated previously, there are a number of financial resources that can be generated internally by any government such as subsidy removal, pollution taxes, government and utility financing. The largest of these in most countries is removal of fossil fuel subsidies. Many energy efficiency measures achieve such large savings over time as to provide very substantial revenue resources. Taxes on pollutants and fossil fuels have been used in many countries to help finance renewable energy measures. Emission trading rights have been utilized to lower the costs of pollution reduction measures. Governments have used general tax revenues to support efficiency and renewable programmes and R&D for new technologies. They also have initiated programmes to require purchase of renewable for their own use. And they have required their electric utilities to do integrated resource planning that includes efficiency and renewable resources and to assist customers in acquiring them.

11.1 Utility financing

As mentioned earlier, many utilities in the US historically were required by state regulatory commissions to assist in the financing of energy efficiency and renewable resources for their customers. These programmes were usually in the form of rebates for energy efficient equipment and renewable resource production. Governments also have initiated programmes to require utility purchases of energy efficient appliances, lighting and buildings for their own use. They also have required their electric utilities to do integrated resource planning that includes DSM and renewable resources and to assist customers in acquiring them.[176]

In many instances, clean energy measures can be funded internally by electricity charges. Thus, Japan's 10,000 Roofs successful solar PV programme was funded by electricity surcharges to pay one-third the installation costs of household PV systems, with utilities purchasing any excess power at retail electricity prices.[177] Most generation, transmission and distribution efficiency improvements are financed by electricity charges.

Often utilities maintain programmes of rebates, customer loans and grants to encourage the purchase of energy-efficient equipment and renewable resources. Sometimes these incentives are most effectively given to the manufacturer rather than the end-user. Consumer incentives have the advantage of educating the end-user, putting the sponsor in direct contact with consumers and giving the sponsor recognition for promotion of efficient products. Manufacturer incentives can reduce paperwork and administrative costs and assist with transformation of the market by lowering the price of efficient projects and making them more widely accepted.

An example of a successful manufacturer incentive (involving both government and utility financing) is the Poland Efficient Lighting Project, initiated to increase the use and acceptance of compact fluorescent light bulbs (CFLs) in order to reduce evening peak load demand in areas with insufficient distribution capacity. The Project included an incentive to manufacturers reducing wholesale CFL prices by $2 per CFL. The Project resulted in the sale of over 1.2 million CFLs over a two-year period and installations of 2–9 CFLs per household in target neighbourhoods, resulting in a 15% peak demand reduction. The programme also was highly cost- effective for the utility compared with adding new generation, saving an average of 50% over five years and 20% over ten years.[178]

In 1985, Brazil established a national electricity conservation programme known as PROCEL, housed at the national electricity utility. PROCEL funds energy efficiency projects carried out by state and local utilities, state agencies, private companies, universities and research institutes. The programme's energy efficiency measures are estimated to have saved about 5.3 TWh/year in 1998, equivalent to 1.8% of Brazil's electricity use, and another 1.4 TWh due to power plant improvements. The programme avoided about 1,560MW of new capacity, saving about $3.1 billion of avoided investments in new power plants and transmission and distribution facilities, with investments of only $260 million. In addition, a number of new

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176 The Regulatory Assistance Project, Integrated Resource Planning For State Utility Regulators (June 1994).

177 Moore and Ihle, *supra* note 85.

178 M. Ledbetter *et al., IFC/GEF Poland Efficient Lighting Project: Demand-side Management Pilot Final Report,* Battelle Pacific Northwest National Laboratory Report #PNWD-244 (Richland, Washington, 1998).

technologies are now manufactured in Brazil, including demand limiters, lighting controls, electronic ballasts for fluorescent lamps and solar hot water heaters.[179]

Since its restructuring in 1996, the Brazilian Government created a system of partnerships between the public sector and local and foreign private sectors.[180] Brazil created several laws, based upon Article 175 of the Federal Constitution, to enable the State to delegate the provision of public services to third parties.[181] Under this scheme, the third party, or concessionaire, invests his own money in the name of the State, and receives payment for the collection of rates.[182] The law requires the concessionaires to pay a compulsory contribution. Part of the money received goes into a Reversion Global Reserve Fund (RGR Fund), which is maintained by Electrobrás, the federal holding company that coordinates and supervises the expansion and operation of the generation, transmission and distribution systems. The RGR Fund was created in order to improve and expand rural electrification, energy efficiency, and programmes for low income communities.[183]

With the advent of deregulation in the US, direct utility financing has been replaced in many jurisdictions with non-by-passable "systems benefit charges" placed on the distribution utility (that remains a monopoly) to fund public benefit programmes including efficiency and renewable energy measures. The funds collected are usually placed in an independently administered trust fund which makes grants and loans for energy efficiency and renewable projects, low income programmes, etc. Increasingly, standard offers are being used by these funds as a payment per unit of energy saved or standard contracts are proffered in order to reduce transaction costs.[184]

11.2 Government financing measures

The Netherlands permits accelerated depreciation of renewable energy. It also has tax deductions for renewable investments of between 40% and 52% of the costs, subsidized loans for green projects at 1–2% below prevailing rates, a programme that authorizes the use of a "green label" for renewable generation, and a temporary experimental programme providing green mortgages that permit the borrower of houses costing $188,000 or less who installs renewable equipment to get a loan of up to $35,000 for ten years at a rate roughly 20% below market prices (roughly 4% instead of 5%).[185]

In New Zealand, an Energy Saver Fund was established and funded by an $18 million 3-year appropriation, as part of restructuring legislation to support residential energy-efficiency programmes. Like UK's auctions for renewables, the New Zealand law calls for bids for efficiency programmes to determine Fund access.[186]

In a number of countries, support for renewable projects also is available from national and local agencies. One example is India, where the Federal Ministry for Non-Conventional Energy Sources (MNES), through the Indian Renewable Energy Development Agency (IREDA) supports renewable energy projects.[187] IREDA provides funding for renewable energy projects and is financed through the government of India as well as international institutions.[188] The government of India also promotes renewable energy technologies through demonstration projects. For example, in order to create awareness and investment opportunities, State Governments within India have established demonstration wind farms. Nine States have established projects in 25 different locations. The MNES provides 60% of the full cost of the projects, and the rest of the funding is provided by the individual state government.[189]

Hydropower and biomass represent the largest percent of renewable energy sources in Brazil. In 1999,87% of the electricity generated was from hydropower.[190] Brazil also generates much of its electricity from biomass, due largely to an ethanol fuel production programme started in 1975 from sugar cane crops grown specifically for fuel use, presently occupying 2.7 million hectares of land and employing about 350

179 Ledbetter, *supra* note 178, at 9, 10.
180 R. Ferreira da Silva *et al., Concessions in Brazil,* National Law Center for Inter-American Free Trade (1996), available at http://www.natlaw.com/brazil/topical/cm/spbrcm/spbrcm3.htm
181 Article 175, Brazilian Federal Constitution.
182 Ferreira da Silva *et al., supra* note 180.
183 Financing Renewable Energy in Brazil, available at http://www.mct.gov.br/clima/ingles/comunic old/renov07.htm
184 Eto *et al., supra* note 145, at 19.
185 Moore and Ihle, *supra* note 85, at 16,17.
186 Eto *et al., supra* note 145.
187 M. Mendis, *Financing Renewable Energy Projects Constraints and Opportunities,* Alternative Energy Development, Inc., Silver Spring, MD (July 1998).
188 Overview of the Renewable Energy Sector, TATA Research Institute, available at http://www.teriin.org/renew/overview.htm
189 Ministry of Non-Conventional Energy Sources (MNES) Annual Report 1999–2000, available at http://mnes.nic.in/frame.htm?adminsetup.htm
190 Energy Information Administration, Brazil Country Analysis, June 2001, available at http://www.eia.doe.gov/cabs/brazil2.html

distilleries. Ethanol currently provides over 40% of the fuel consumed by cars and light trucks.[191] It is estimated to have saved Brazil over $40 billion in oil imports, excluding the costs of the programme. Ethanol was heavily subsidized by the government until 1998 when it was deregulated and taxes from gasoline sales were substituted to subsidize its costs. To get the programme started, the state-owned oil company guaranteed ethanol purchases on a cost plus basis and tax incentives were provided for the purchase of neat ethanol-using vehicles. The ethanol production supports about 700,000 rural jobs.[192]

The US Department of Energy has joined with top finance firms to create the International Performance Measurement and Verification Protocol. Like FHA mortgage rules, the Protocol standardizes streams of energy savings in buildings so that they can be aggregated and secured. The Protocol as of November 1997 had been adopted by more than 20 countries including Brazil, China, India, Mexico, Russia, Ukraine and the USA. The Protocol has been successful in stimulating a market in which loans to finance energy savings can be originated and projects can be affordably financed without use of internal capital or competition with other internal investment needs.[193]

11.3 Commercial loans

Renewable projects such as biomass combustion/cogeneration, geothermal, hydropower and wind farms are considered to be mature, low risk and commercially ready technologies that have a reasonably established cost basis, and thus should be able to access commercial lenders. However, renewable projects require longer-term debt financing, making them harder to finance. They also have difficulty establishing project cash flow because their revenues are not secured by enforceable fuel supply or power purchase contracts. Also, it is difficult to get non-recourse financing because many of the suppliers are new and do not have extensive financial performance records.[194]

Nevertheless, commercial banks often do make loans to finance energy efficiency and renewable installations where the projects produce sufficient net revenues to justify commercial financing.

11.4 Aggregated loans

One way to overcome the problems with small size of loans needed to finance distributed resources is to aggregate the loans in various ways; examples follow:

Instalment loans. An innovative credit arrangement to overcome small loan problems has been adopted by several countries, by making loans to credit-worthy institutions like local utilities. The utilities then set up revolving funds to manage instalment loans to individual and small business on relatively attractive terms. Such arrangements have been adopted in Indonesia for its Solar Home Systems Project, in India for a solar photovoltaic programme, in Kenya for its wood stove upgrading programme and for off-grid photovoltaic systems, and in Bangladesh, the Dominican Republic and Honduras.[195]

Micro utilities. Another innovative mechanism is financing service providers through renewable energy micro utilities that sell energy services, thus permitting financing to be aggregated to the service provider. The end-user is required to make payments based on the level of energy services received. This approach has been successfully demonstrated in the Dominican Republic and is now being implemented in a 10,000 solar home system programme by a rural electric cooperative in Bolivia. Mortgage financing, allowing homeowners to incorporate the costs of installing renewable systems into the overall costs of their homes through mortgages is being tested in a rural housing/electrification programme in South Africa.[196]

Grameen Bank. *A* particularly fascinating development is the creation of micro lending organizations in some of the poorest countries for their most impoverished populations. Thus, Grameen Bank ("village bank" in Bengali) in Bangladesh has started a lending programme for people earning on average less than $1 a day. Today, Grameen is established in over 40,000 villages in Bangladesh, lending to approximately 2.4 million borrowers.[197] Established in 1986, it reached its first $1 billion cumulative loans in 1995. It took only two

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191 Andrade *et al., Biomass Energy Use in Latin America: Focus on Brazil,* International Energy Agency, March 1998, available at http://www.iea.org/pubs/proc/files/bioend/

192 Geller *et al., supra* note 24, at 9.

193 Lovins, *supra* note 3, at 11, 12.

194 Lovins, *supra* note 3.

195 Lovins, *supra* note 3, at 44.

196 Lovins, *supra* note 3.

197 The Grameen Bank, available at http://www.grameen-info.org/bank/index.html

more years to reach $2 billion. The repayment rate hovers between 95 and 100%.[198] In a typical year, 5% of Grameen borrowers, representing 125,000 families, rise above the poverty level. The Grameen model has now been applied in 40 countries. In all, about 22 million poor people around the world now have access to small loans. Grameen has now established more than two dozen enterprises, often in partnership with other entrepreneurs. One such enterprise is Grameen Skakti (Energy), which has been helping to install solar energy systemsintovillagehouseholds.[199]

11.5 Leasing programmes

Leasing of equipment is an innovative approach to overcoming the financing problems for small renewable and energy efficient systems and to make them affordable. For example, the French government and France's largest utility developed the largest leasing programme for CFLs on the island of Guadeloupe, seeking to reduce evening peak electricity demand. The leasing programme's incentive was a coupon allowing customers to lease CFLs at no initial cost, the lease payments being identical to the electric bill savings. Thirty-four percent of all households redeemed the coupons for an average of 7.8CFLs each. This success stimulated an identical programme for Martinique, which resulted in distribution of 345,000CFLs in just a few months. The two programmes resulted in 7MW of peak demand savings on each island and 29–33GWh of annual electricity savings. Also, in the Dominican Republic, the US company Soluz operates a photovoltaic leasing programme.[200]

Several companies also have innovated with the leasing of services rather than of the equipment. The Carrier Corporation in the USA has a programme to lease "comfort services;" the Schindler elevator company leases vertical transportation services; and Dow leases solvent services. Service leasing improves not only energy efficiency, but also incentives; the more efficient Carrier's air conditioning systems become, the greater its profits and the better service it provides at lower cost to more customers. Service leasing aligns the provider's incentive with the customer's needs.[201]

11.6 Vendor financing

Sometimes equipment suppliers will not only construct, install and operate systems, but also offer equipment financing, sometimes on favourable financing terms. A vendor may be the manufacturer, the wholesaler or retail distributor or a contractor. The vendor is motivated to offer financing in order to sell the more efficient equipment. The vendor often becomes the aggregator of capital demand for individual installations and may provide maintenance or warranty support, particularly with equipment leases, to assure the equipment remains in good working order.[202]

11.7 Performance contracting

Performance contracting has been widely used to finance energy efficiency projects in the USA and Europe. The customer contracts with an Energy Service Company (ESCO) to provide the desired energy efficiency improvements, its financing, and often other related services like operations and maintenance. The customer makes payments to the ESCO from savings achieved by the efficiency measures or equipment installed.[203] To date, ESCOs have not been very successful in the US, however, filling only niche efficiency applications for large industrial, commercial and institutional customers.[204] Adequate long-term financing for ESCO operations is critical, since the ESCO must put up initial capital that may not be paid off from savings for several years. ESCO financing is particularly important to establish ESCOs in developing countries.

198 Credit Delivery System, The Grameen Bank: available at http://www.grameen-info.org/bank/cds.html

199 M. Yunus, The Grameen Bank A small experiment begun in Bangladesh has turned into a major new concept in eradicating poverty, *Scientific American* (November, 1999) at pp.114–119. *See also* T. Friedman, Social Safety Net, *N.Y. Times*, Foreign Affairs column (November 3, 1999).

200 Results Center [ND], *Electricite' de France B Operation LBC*, Executive Summary, Results Center Profile # 119; *see* http://solstice.crest.Org/efficiency/irt/l 19.htm

201 Lovins, *supra* note 3, at 19.

202 Lovins, *supra* note 3.

203 World Energy Efficiency Association, *Briefing Paper on Energy Services Companies* (1999), available at http://www.weea.org/ESCO/ESCO%20bulletin.pdf

204 Eto *et al.*, *supra* note 145.

12 External financing mechanisms

In the past few years, the international lending organizations: the World Bank, regional development banks, the International Financing Corporation (IFC), the UN Development Programme (UNDP) and the Global Environment Facility (GEF) have started major programmes of financing energy efficiency and renewable projects in developing countries. They must do more, but their resources will never be sufficient to meet developing country requirements. The capital requirements of electric power growth in developing countries (projected at 5% to 7.5% per year) have been estimated to be between $1.4 to $4 trillion over the next two decades. Unfortunately, the World Bank currently lends less than $4 billion per year to the energy sector, while commercial lending stands at about $16 billion per year (as of 1991).[205] It is clear that both private and public internal sources will be required if the need is to be met.

The World Bank and its sister international lending institutions, which had for many years made wasteful investments in highly capital-intensive energy inefficient technologies, have changed direction and are now making major funding available for energy efficiency and renewable technologies. For example, the World Bank has established the Asia Alternative Energy Unit (ASTAE) to develop only renewable and energy efficiency projects; ASTAE has helped the Bank to lend over $500 million for renewable projects in the Asia region. The World Bank also financed a Renewable Energy Small Power Project in Indonesia, a component of which funds medium-scale/isolated grid systems there. A World Bank Market Transformation Initiative loan of $5 million fosters a photovoltaic industry in Kenya that is selling over 20,000 systems annually with a 300kW capacity, and has already sold over 80,000 systems providing electricity for some 250,000 rural dwellers.[206]

Recent examples in other international financing institutions: the International Finance Corporation has recently launched a $100 million Renewable Energy and Energy Efficiency Fund. And the Asian Development Bank approved a $100 million loan to the Indian Renewable Energy Development Agency for biomass cogeneration projects in India. The GEF donated $10 million to Argentina to assist Argentinean cooperatives in the removal of barriers to installation of windpower and solar photovoltaic development, including subsidies for equipment investment and technical assistance and studies.[207]

A problem that these international lending facilities have had to overcome is administering small loans because of the small size of many efficiency and renewable projects. They have started to assist in the creation of local and regional lending institutions to manage the smaller loans on their behalf.

13 Kyoto Protocol mechanisms

Article 12 of the Kyoto Protocol provides for three market-based mechanisms for encouraging industrial countries and companies to invest in greenhouse gas emission reduction measures in developing countries. These measures are Emissions Trading, Joint Implementation and the Clean Development Mechanism (CDM) all of which can include investment in renewable and energy efficiency technologies. By participating in these measures that generate greenhouse gas reductions in a developing country, an industrialized country or its companies can earn carbon emission reduction credits to meet the country's Kyoto Protocol obligations. Some companies have made such investments already in anticipation of the adoption of rules for utilization of these mechanisms under the Protocol and national credit legislation.

These trading measures offer great promise of providing the means by which developing countries can acquire the resources needed by them to cover the up front costs of renewable energy technologies to promote sustained carbon dioxide emission reductions. These measures can help developing countries acquire the necessary capital, information and training to permit them to participate fully in global warming solutions through the use of renewable, energy efficiency and other clean energy resources that also are advantageous for development.

After the seventh session of the Conference of the Parties in Marrakech, Morocco (COP-7), several important key issues were resolved. Emissions units under all three mechanisms will be treated equally, allowing for a more liquid market in emissions units. A Removal Unit (RMU) was created to represent the credits generated in developed countries. RMU's can be used only to meet a party's emission target in the

[205] M. Levine *et al, Report to the US Working Group on Global Energy Efficiency, Energy Efficiency, Developing Nations and Eastern Europe,* Lawrence Berkeley National Laboratory (1991) at p. 37.
[206] *Ibid.*
[207] Mendis, *supra* note 187.

commitment period in which they are generated. Also, a compliance regime was created to set consequences for failing to meet an emissions target, but the issue of whether the consequences are legally binding was deferred until the next session of the COP.

13.1 Joint Implementation

Joint Implementation allows developed countries to implement projects that reduce greenhouse gas emissions by sources, or enhance removal through "sinks" in territories of countries in transition. The resulting credit can be used against the developed country's own emission targets. Developing countries can participate on a voluntary basis. The actual transfer of the credits under Joint Implementation will not begin until 2008.

Canada, Australia, Japan, Norway and Germany have very active Joint Implementation programmes that include support for renewable programmes.[208] The countries in transition in Central and Eastern Europe are hosts to a total of 68 Joint Implementation projects. For example, the Czech Republic has three registered Joint Implementation projects covering forestry rehabilitation, coal-to-gas conversion and upgrading of a cement factory.[209] Several developing countries are also participating on a voluntary basis. Costa Rica has an extensive pilot Joint Implementation programme, with several renewable energy projects planned, and four forestry projects and water treatment projects being implemented. Similar Joint Implementation projects have been approved in Mexico (including lighting and forestry carbon sequestration projects); Honduras (a solar electrification programme, lighting and biomass project); Bolivia (solar electrification); Ecuador (forest conservation); and Belize (forest conservation).[210] Indonesia has four Joint Implementation projects, one with Tokyo Electric Power for renewable rural electrification and others for efficient logging, recycling of paper sludge and solid waste and installing an improved cooling system for cement clinker production.[211] The Business Council for Sustainable Development (Latin America) has been active in these endeavours.

13.2 Clean Development Mechanism (CDM)

The Clean Development Mechanism is the most promising means for developing countries to acquire the resources and expertise necessary to promote renewable and other clean energy resources. The purpose of the CDM is to assist developing countries in achieving sustainable development and in contributing to the ultimate goal of the Convention. Under the CDM, developing countries benefit from greenhouse gas reduction projects while developed countries can receive certified emission reductions in order to achieve compliance for their own reduction commitments. Unilateral CDM is now allowed under COP-7, which enables developing countries to undertake a CDM project without a developed country partner, enabling the developing country to market the resulting emission credits themselves. In order for certified emissions reduction credits to flow from the project, the project must meet certain criteria and rules that are currently being negotiated. The projects must also be approved by the CDM Executive Board.

13.3 Emission trading

An interesting innovation in the Protocol is for the establishment of international carbon emission trading. The provision is based on the US experience in reducing the costs of sulphurdioxide and NOx emissions by establishment of emission trading rights. Polluters may accumulate trading rights by reducing their emissions below adopted standards and then sell these rights to other polluters for whom pollution reduction is more expensive. International emission trading would provide another incentive for developed countries and their businesses to invest in renewable energy projects in developing countries.

14 US foundation programmes

A number of charitable foundations in the USA have funded renewable energy efforts. For example, the MacArthur, Pew and Rockefeller Foundations joined together to create a new Energy Foundation about eight

208 Mendis, *supra* note 187.

209 E. Petkova and K. Baumert, *Making Joint Implementation Work: Lessons From Central and Eastern Europe*, World Resources Institute, Climate Notes (November 2000), available at http://www.wri.org/cdm/ji_note.pdf

210 Activities Implemented Jointly Under the Pilot Phase, United Nations Framework on Climate Change, FCCC/SB/1999/5, October 14, 1999, available at http://www.unfccc.de. *See also* Joint Implementation Project Summary, available at http://www.igc.org/wri/climate/ccji-t01.html

211 CDM Opportunities in Indonesia, September 2001, available at http://www.teriin.org/climate/cdm-indo.pdf

years ago. The Energy Foundation funds programmes throughout the US promoting energy efficiency and renewables in electricity and vehicle efficiency improvements. Recently, it joined with the Packard Foundation to promote clean energy systems in China.[212]

15 Conclusions

There are abundant examples, only a few of which have been identified here, in both developed and developing countries, of successful adoption of cost-effective measures to ameliorate pollution emissions in their electric utility and vehicle sectors, while aiding their economies. A wide variety of legislative and voluntary programmes have been undertaken and the legal and financial mechanisms for doing so also are many and varied. It is possible to meet the world's energy, development and environmental needs. This achievement can even be done on a basis of long term profitability; indeed energy efficiency savings are so compelling that they should be undertaken just to save money, regardless of whether the scientific community is right about the risks of global warming. But achieving these goals will take determined action and political will among all the governments and international institutions of the world.

212 The Energy Foundation, available at http://www.ef.org/

Legislative measures for promotion of renewable energy: Wind energy development in Denmark as a case study

Rikke Munk Hansen[1]

This Paper seeks to contribute towards overcoming barriers to the utilization of renewable energy resources and development of renewable energy technologies by providing information on, and analysis of policy and legal support structures for the increased utilization of renewable energy, using the promotion of wind energy in Denmark during the past two decades as a case study.

The Paper places wind energy development in the broader context of concerns and objectives governing Danish energy policy, describing driving forces behind political decisions to diversify energy supply, increase energy self-sufficiency and abate negative environmental impacts of energy production and consumption. The analysis of wind energy promotion focuses on incentives put in place through action plans and regulations and the measures taken to secure extensive user involvement and public support for wind energy.

Linkages between regulations and actual rate of wind power capacity increase, including the sensitivity of renewable energy development to changes in regulations, are analysed. The analysis is drawn upon to reflect on prospects for replication of policies and legislation in other technologies, locations and economic situations.

1 Preface

Energy development is attracting wide attention because of its importance for economic and social development and its linkages to environmental issues. Wide availability and attached environmental benefits place renewable energy resources in the focus of attention. In spite of this, utilization of renewable energy resources and development of renewable energy technologies progress rather slowly. Reports, analyses and meetings repeatedly point out barriers to renewable energy development – barriers faced by governments, utilities, non-governmental organizations, the private sector and local communities. Barriers are normally categorized as financial, technical, institutional, and policy or information related and discussions on overcoming barriers concentrate on financial assistance, increased private sector involvement and political support to create a level playing field for alternative energy resources and technologies.

The Paper seeks to contribute towards overcoming barriers to the increased utilization of renewable energy, by providing information on, and analysis of policy and legal support structures using the promotion of wind energy in Denmark during the past two decades as a case study. In this period, Denmark experienced an impressive growth in wind energy utilization. By 2000, wind turbines generated 13% of the country's electricity supply compared with close to nothing in 1980. Along with this development, a new industry has been created, producing around half of the wind turbines on the world market. Today, wind turbines are so competitive that electricity from wind turbines is the cheapest way of reducing CO_2 emissions from power production.

The Paper places wind energy development in the broader context of concerns and objectives governing Danish energy policy. It describes how the oil crises of the seventies, increased focus on environmental issues during the eighties and internationalization in the nineties became driving forces behind political decisions to diversify energy supply, increase energy self-sufficiency and abate negative environmental impacts of energy production and consumption. The analysis of wind energy promotion focuses on incentives put in place through action plans and regulations and the measures taken to secure extensive user involvement and public support for wind energy.

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[1] I would like to extend a note of thanks to former colleagues in the Danish Energy Agency, who have been most helpful in providing background information for the article, and to current colleagues for their valuable inputs. All monetary values expressed in this Paper are in Danish Kroner unless otherwise stated (1 Euro = 7.4DKK as at August 2002).

The introductory section provides a brief overview of Danish energy supply and demand and developments from the eighties to now. This is followed by an analysis of energy policy development with particular focus on policies to promote renewable energy. Section 3 contains detailed information on developments in the wind energy sector followed by a separate section on legislative means for the promotion of wind energy. Selected regulations in unofficial translation have been placed in Annex I.

The final section contains an analysis of the coherence between the described policies and regulations on the one hand and the actual rate of wind power development on the other. This leads to a discussion of the sensitivity of wind energy development to changes in regulations or expected changes. Prospects for replication of policies and legislation to other technologies, locations and economic situations are also discussed in the concluding section.

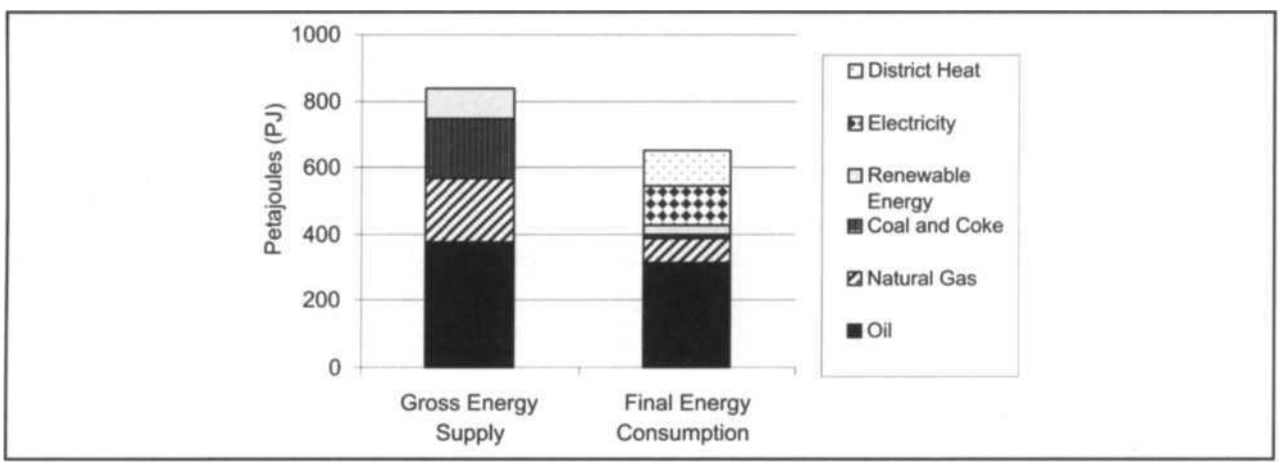
Annex II contains a historic overview of highlights pertaining to Danish wind energy development.

2 Energy supply and demand[2]

Denmark is a small, relatively densely populated developed country with 5.3 million inhabitants. The country is part of the European Union and is situated in Northern Europe, bordering Germany to the south. It has good to average wind resources and a long coastline, including numerous islands. The country has extensive foreign trade – export and import of energy include electricity exchange with Norway, Sweden and Germany, import of coal and export of oil and natural gas.

Energy supply consists of oil (45%), natural gas (23%), coal (21%) and renewable energy (11%). Most of the coal and a large part of the natural gas are used for power and district heat production. The bulk of the country's final energy consumption thus consists of oil, mainly for transportation, natural gas and district heating, mainly for space heating, and electricity (see Fig. 1).

Fig. 1 Gross energy supply and final energy consumption, 2000



During the late seventies and early eighties, oil and natural gas reserves were discovered in the Danish part of the North Sea. Commercial exploration of these resources was initiated in the eighties, and in 1998 Denmark became a net exporter of energy (see Fig. 2). Resources in the North Sea are however limited and known reserves will be exhausted by 2016 with current levels of production. Besides the reserves in the North Sea, the country has no known fossil fuel resources.

2.1 Energy demand and supply trends, 1980–2001

The oil shocks in 1973 and 1979 led the country together with most other European countries to explore options for diversifying the energy supply. Oil dependency in particular attracted attention, and the energy

[2] The Energy Statistics published by the Danish Energy Agency is the source of all data used for graphics in this section. 2001 data are provisional. Data on energy supply and consumption have been adjusted for variations in temperatures and net exports of electricity.

Fig. 2 Energy production and gross energy supply, 1980–2001

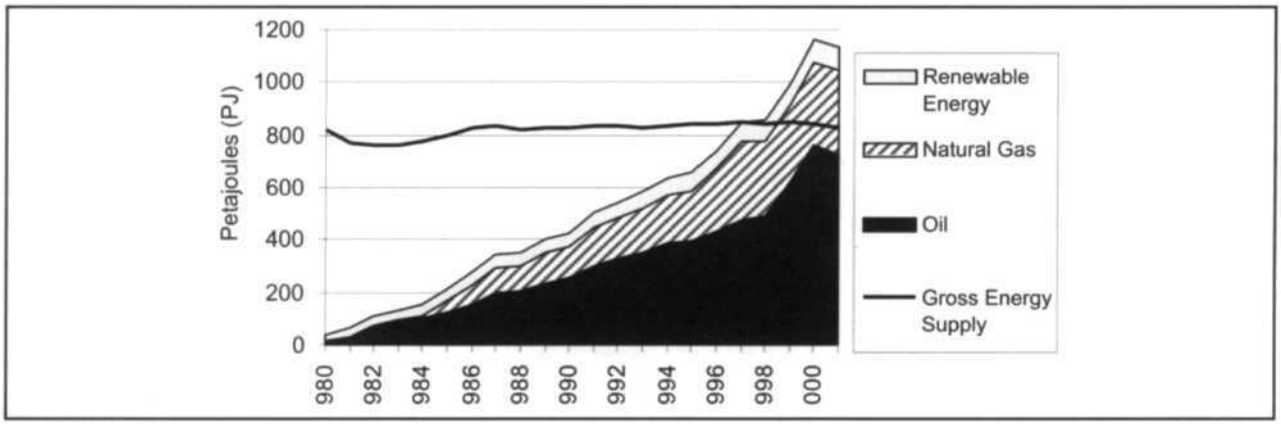
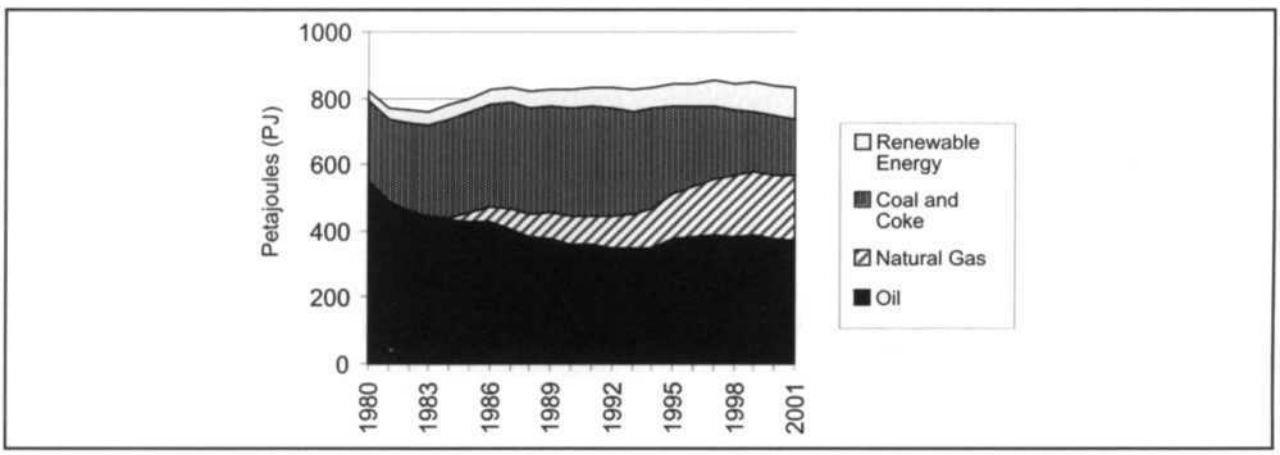


Fig. 3 Gross energy supply, 1980–2001



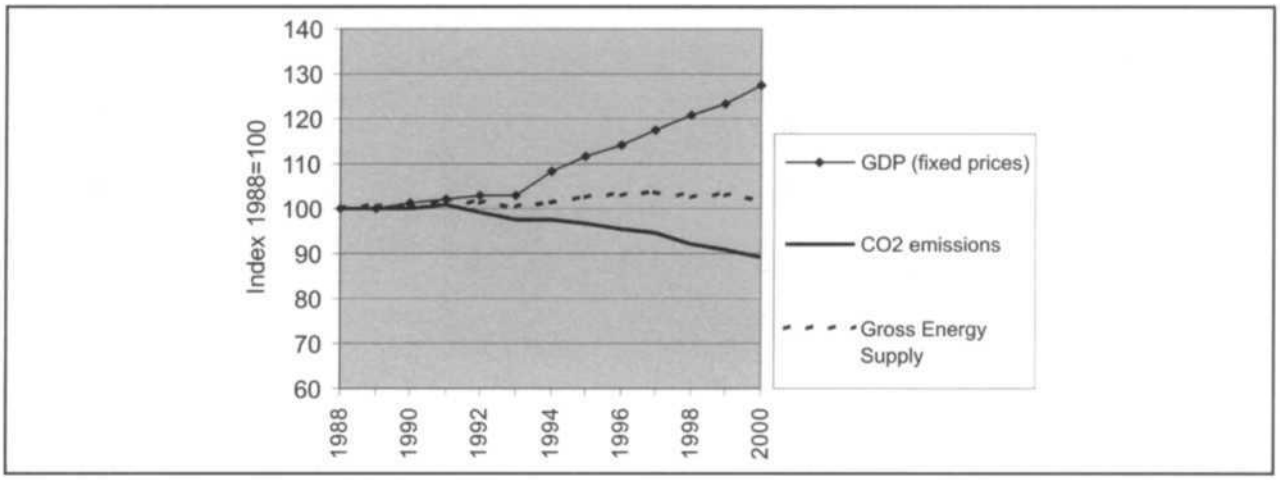
mix has since undergone massive changes (see Fig. 3). Electricity and heat production have undergone the largest changes: first, oil was substituted by coal, later environmental concerns and the discovery of natural gas led to increased utilization of natural gas, biomass, waste and wind for the generation of electricity or Combined Heat and Power (CHP).

Denmark has one of the lowest energy intensity economies in the world, a fact explained by low energy intensity production and high efficiency of energy utilization. Most production sectors are high-technology industries with relatively low energy requirements, and efforts have been made to introduce energy savings and increase energy efficiency in households and industry. The household sector, with large energy requirements for heating, has lowered energy consumption substantially resulting in an increase in energy efficiency for space heating by 25% during 20 years.

In spite of high levels of energy efficiency and relatively low energy demand per production unit, the CO_2 intensity of the economy is one of the highest in the world. This is mainly due to the large amount of coal used for electricity and district heat production, and steadily increasing oil consumption for transportation. Successful efforts have been made to change the energy mix for power and heat production away from coal and towards natural gas and renewables, but as yet no interventions have been successful in changing the growing demand for gasoline. Transportation in 2000 accounted for 27% of total CO_2 emissions against 20% in 1988. Also, even though most electric power is generated at highly efficient CHP plants, most CHP capacity is coal-based.

Energy savings, an increase in energy efficiency and changes in fuel mix have resulted in an almost unchanged level of gross energy supply and a falling trend in CO_2 emissions during a period of time with steady economic growth (see Fig. 4).

Fig. 4 CO_2 emissions, GDP and gross energy supply, 1988–2000



3 Danish energy policy[3]

The energy sector naturally attracted serious attention from policy-makers after the oil crises. Energy was recognised as an area with a need for dedicated policies and programmes. With the establishment of the Energy Agency in 1976, energy matters were gathered under the same administrative unit, and in 1979, the Ministry of Energy was established. During the following 20 years, energy policies and plans gradually became more comprehensive and coherent, and more strategic approaches were adopted to put the plans into action through legislation, other regulations or agreements among major players.

3.1 Drivers for policy development

Supply security

When the first oil crisis struck in October 1973, Denmark was in an extremely vulnerable situation. With power generation, industrial production, domestic heating and transportation primarily based on oil products, imported oil made up 92% of gross energy supply. In June 1979, the second oil crisis hit and found the country almost as vulnerable. According to OECD, Denmark was the country the hardest hit by the oil restrictions following the price shocks.

Energy was high on the political and public agenda in the years of the oil crises. Various measures were taken to curb the impacts of the rising oil prices, including car-free Sundays, energy saving regulations and the introduction of taxes on oil and electricity. For a while, electricity and gasoline consumption as well as room temperatures in public buildings were regulated.

Discussions took place on options for developing solar, nuclear, wind, wave and geothermal power. Experimental renewable energy plants were built and the first renewable energy programmes were initiated. Efforts to exploit the newly found oil resources in the North Sea were speeded up, and by 1980 it became clear that the North Sea held sufficient reserves to supply the country with oil for 20 years or more. By 1984 natural gas production began in the North Sea.

Economic development

Realising that the oil shocks were primarily due to the economic impacts of the drastic increases in the price of oil, attention was directed towards economic aspects of energy supply. The goals for energy development shifted towards providing an efficient energy sector with reduced reliance on imported fuels and greater fuel diversification. Renewable energy played a natural role achieving such goals, and renewable energy installations became eligible for investment subsidy. From 1983, by a parliamentary decision, electricity from

[3] It may be helpful to refer to the overview of highlights of wind power development placed in Annex III while reading this section.

renewable energy was subsidized per unit by an amount similar to the electricity tax (at that time approximately 0.15DKK/kWh).

Environment

Environmental concerns entered the public debate after the work of the Brundtland Commission in 1987 and resulted in concerted efforts to promote utilization of renewable energy resources. Specific targets were introduced on renewable energy penetration in energy supply and on reduction of emissions from energy consumption.

In 1994, as a result of the growing importance of environmental issues in energy planning, the Ministry of Energy was abolished and its portfolio moved to the Ministry of Environment and Energy. One of the first outcomes of this transfer was the preparation and publication of an integrated review on new initiatives for the promotion of renewable energy, focusing in particular on solar, wind and biomass.

Globalization

In recent years, international development has become an increasingly important driver for national energy development. Intensive trade on the Nordic Electricity Exchange (NordPool) has influenced electricity pricing, and global discussions on climate change have resulted in legally binding national commitments. Existing national commitments on CO_2 reductions were in 1998 supplemented by yet more ambitious targets in the EU commitments to the Kyoto Protocol. Other EU decisions have limited freedom of action for energy policy-making at the national level.

Publicinvolvement

Stakeholders outside the political system have played major roles in energy policy development. This is not surprising considering the Danish tradition of public involvement in political decisions. Cooperatives are an integral part of the country's democratic and economical development and locally based organizations have historically been a major driving force for many political decisions. The tradition for organization provides advantages for the political system as well as for the civil society: almost no matter the issue, an organization acting as the mouthpiece for the stakeholders in question exists (and if not, one will soon emerge).

Massive public involvement in energy issues began with disputes about nuclear power in the early seventies. The Organization for Information on Nuclear Power (OOA) was established in 1974. Concerns spread to large parts of the population with large demonstrations in 1976 and surveys showing almost 60% against nuclear power development at a time when nuclear development was part of official Danish energy policy. The public played a role in raising awareness among politicians of alternatives for energy development; e.g. a group of researchers developed the "Alternative Energy Plan 1983" suggesting decentralized CHP, wind energy and energy savings as viable alternatives to nuclear power. The massive protests led Parliament to postpone a decision on nuclear power, until it finally reached an agreement in 1985 to abolish nuclear power in public energy planning.

Since the early public involvement in the nuclear power issue, various stakeholders have been involved at different levels in energy sector development – from involvement of the general public in information campaigns for general awareness raising to participation of associations in discussions and negotiations on strategies and implementation plans. Major stakeholders such as utilities, municipalities and academia have been widely represented in governmental councils and committees to review developments, analyse options for development and advise the Government accordingly.

3.2 Energy planning

Since 1976, the Minister of Energy has been obliged by law to provide an annual review of developments in the energy sector to the Parliament. The review must include assessments of energy demand and supply options, plans and targets for adequate utilization of various energy sources as well as results of programmes for the support of energy research and development (R&D). The Energy Agency has, since its establishment, been obliged to monitor Danish and international developments in energy production, supply, consumption and R&D.

However, neither a systematic approach to energy planning nor a framework for managing plans and their implementation was in place initially. Such mechanisms were developed gradually with the introduction of energy policy reviews and strategy papers and later through more comprehensive and well-researched energy development plans.

Energy plans and strategies

The Ministry for Energy, immediately after the first oil crisis in 1973, sent out a statement on targets and means in Danish energy supply, focusing on long-term planning of the energy sector to decrease vulnerability during future critical times. There was a need to move away from one-string supply based on imported oil, and the plan focused on fuel diversification in a broad sense, including fossil fuels, nuclear energy as well as renewables.

The first energy plan "Danish Energy Policy 1976" was in essence very similar to the statement from the ministry a few years earlier, focusing on decreased vulnerability in case of supply disruptions. The goal was to safeguard Denmark during international energy crises. The strategy for achieving the goal was to intensify, improve and co-ordinate research and development of alternative energy resources and to curb energy consumption growth. Alternative energy resources included renewables and nuclear power.

"Danish Energy Policy 1976" was followed by legislation to support the strategies laid out in the plan. The Energy Research Programme was initiated, and in 1977 the first law on subsidies for energy saving measures was put in place.

Table 1. Overview of existing targets for energy development

Targel	Description and origin
Renewable energy	Share of renewable energy in gross energy consumption to increase by 1% per annum towards 2030 ("Energy 21"). According to various scenarios, this increase will imply that renewable energy meets 35% of gross energy demand by 2030.
Green electricity	At least 30% of electricity consumption to be produced from renewable energy by 2005 ("Energy 2000").
Energy intensity	Energy intensity to be reduced by 20% from 1994 to 2005 ("Energy 21").
Transportation	CO_2 emissions from transportation to be stabilized in 2010 compared with 2000, corresponding to a reduction of 12.2 million tons (agreement from June 2001). Transport sector emissions to be reduced by 25% by 2030 compared with 1990 ("Energy 21").
CO_2	CO_2 emissions from energy consumption to be reduced by 20% in 2005 compared with 1988 levels. ("Energy 2000").
Kyoto	By the EU distribution of commitments to fulfil the Kyoto protocol Denmark is committed to reduce total emissions (six greenhouse gases) by 21 % on average from 2008–2012 compared with 1990 levels.
NOx	Denmark is within the framework of UN-ECE committed to reduce total NOx emissions by 55% by 2010 compared to 1990 levels. 99% of NOx emissions stem from fuel combustion.
SO_2	Denmark is within the framework of UN-ECE committed to reduce SO_2 emissions by 70% in 2010 compared to 1990 levels. 95%–99% of SO_2 emissions derive from fuel combustion.
Final energy consumption	The following energy saving targets to be met by 2005: Households: 8 PJ; Public Service: 2 PJ; Trade and Service: 3 PJ; Production: 2 PJ (agreement by majority in Parliament, May 2001). The savings correspond to 2.3% of final energy consumption in 2000.

Sources: "Energy Statistics 2000," the Danish Energy Agency, 2001, and "Energy 21."

In November 1981, the second energy plan "Energy 81" was presented to Parliament. The plan focused on the economic aspects of energy supply, supply security and energy efficiency. It was followed by increased support for renewable energy, introducing a 30% investment subsidy. "Energy Planning 1986" followed the

strategies from the previous plan, focusing on continued implementation of decentralized district heating planning.

In 1990, "Energy 2000 – plan of action for sustainable development" was presented to Parliament, the title and to some extent the content influenced by the global discussions on sustainable development. For the first time, goals were quantified and translated into specific targets for development: 15% decrease in energy consumption and 20% decrease in CO_2 emissions by 2005, measured against 1988 levels. The plan was followed by legislation on energy savings, energy taxes and electricity production subsidies for renewable energy. A political decision was taken to shift income-based taxation towards taxation based on environmental impacts of consumption. Taxing emissions was part of this decision, and a CO_2 tax was introduced in 1992.

"Energy 21" was presented to parliament in 1996, followed by intense discussions and broad support to maintain the CO_2 targets from Energy 2000 and to include a long-term perspective (2030) in the plan. An additional target was set to increase the share of renewable energy in total supply by 1% per annum. Realising the difficulties in meeting the CO_2 commitments, the government in 1997 introduced a ban on new coal-based capacity in the electricity supply.

The energy plans and a number of across-the-board agreements reached in Parliament subsequent to the presentation of the plans have resulted in a number of politically binding targets. Table 1 provides an overview up to the end of 2001.

3.3 Moving into a strategic planning and management regime

Energy plans or strategy papers have been developed at intervals of five to ten years since the establishment of the Danish Energy Agency, and energy policy reviews have been provided to the Parliament on a regular basis. Placing all energy issues under one administrative unit has supported the development of dedicated and comprehensive policies for the energy sector. More important however seems to be the impact of external and internal drivers for development – drivers, which forced political action to move towards fuel diversification, energy efficiency and environmentally benign energy production. The visions that have governed Danish energy policy seem to stem mainly from the pressure of these driving forces.

The energy plans have undergone a remarkable development from discussion papers with relative loose justifications into comprehensive, well-researched plans comprising vision, goals, targets as well as strategies and action programmes to reach the targets. A major shift came with the preparation for "Energy 21." Ambitious efforts were put into developing the plan, including the first technical analysis of future scenarios for energy supply and demand. The "business-as-usual" and the "maximum" scenario, encompassing extensive promotion of renewable energy and energy sector decentralization, constituted the two opposite poles in the analysis. The analysis was published as a discussion paper "Denmark's Energy Futures" and used to develop "Energy 21". This preparatory work made "Energy 21" one of the best-documented policy papers in the world. The fact that most targets from "Energy 21" are still maintained today must to a large extent be attributed to these efforts. Not only the analyses but also the scenarios developed with the plan constitute a scientifically justifiable basis for estimating impacts of political decisions. This makes it difficult to suggest radical changes if overall visions and targets are to be maintained.

To implement plans and policies properly, a monitoring system that provides necessary information for adjustments of targets and programmes must also be in place. Energy production and consumption is followed closely by the Energy Agency, and consistent data are available from 1976 onwards. Basic statistical work constitutes the absolute minimum for a real monitoring system, not only for developing the plans themselves. The Danish political system traditionally establishes a wealth of governmental committees and councils to advise the Government, and the energy sector is no exception to the rule. To mention a few, the Steering Committee for Renewable Energy was established in 1982, the Council on Renewable Energy was established in 1990, and the Council on Energy and Environment was established in 1996 to advise government on environment-related aspects of energy development. Such a system provides, if not completely independent views, then at least critical inquiries to the Government, which can be very useful in the monitoring process.

A structured approach to monitoring and evaluation of Danish energy plans was initiated by a review of "Energy 2000" in 1993. The review was discussed at a stakeholder conference and included detailed recommendations on adjustments. The outcome of the stakeholder consultation was published as the "Energy 2000 follow-up – a responsible and future-oriented energy policy." A dedicated review of renewable energy

initiatives and options for further action was presented in 1995. The same approach with stakeholder conferences and detailed analytical work by government-established committees has been used for discussions and reviews of "Energy 21."

The long-term scenarios of "Denmark's Energy Futures" introduced a scientific background for detailed assessments of actions needed to be taken in order to reach long-term targets. Apart from the above-mentioned advantages for consistency and justification of energy policies, this also added a dimension to energy policy reviews and therefore to monitoring of plans. Not only could the reviews give an overview of latest developments, but could also estimate to what degree these developments would influence long-term targets.

The result of these developments has been relatively consistent policies and regulations, and a planning system that demands scientific justifications for policy changes.

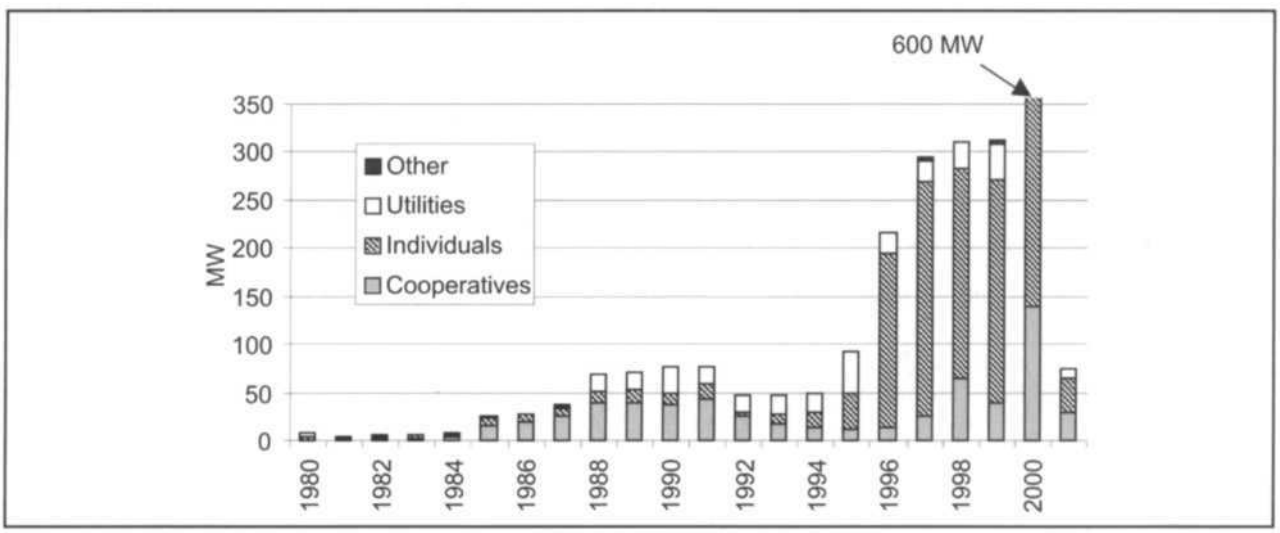
4 Wind power development

Wind power received consistent political support throughout a period of 20 years. The energy plans presented by the government included wind power development as part of the strategies to achieve goals of increased self-sufficiency, diversification of the fuel mix and mitigation of environmental impacts. So even though the goals of energy development changed, wind power remained part of the development strategies.[4] Vulnerability to price fluctuations, environmental degradation and supply disturbances have thus had positive impacts on the political status and attention given to wind power development.

A target of 10% wind power in the electricity supply corresponding to 1,500 megawatts (MW) by 2005 was maintained, and as the developments overtook the target, it was adjusted to 16% by 2003. More than 2,400MW of wind capacity was installed by 2001. In Energy 21, the long-term target was set to 40–50% wind in the electricity supply by 2030, this target mainly to be met by installation of 4,000MW off-shore wind power.

Political support alone cannot explain the development, and political commitments to support wind power development were made in interaction with a number of other stakeholders playing significant roles in the development. The consistency of the support however constituted a trustworthy climate for wind power investors, which for a long time was unique in the world.

Fig. 5 Annually installed wind turbine capacity, 1980–2001



Source: Data from 1980-1998: Wind Power in Denmark. Danish Energy Agency, 1999. Data from 1999. 2000 and 2001: Energi- og Miljødata (EMD), 4th quarter 2001.

4 A historic overview of energy plans as well as regulations put in place pursuant to the plans can be found in Annex III.

4.1 Grass roots

Grass roots convinced of the future of the technology played a large role in promoting wind power in Denmark. Efforts were made throughout the seventies and early eighties to convince politicians, utilities and others of the potential for wind power development. Technical assessments of options for wind energy development and plans for large-scale wind power development were parts of activities carried out by engineers, consulting companies and research institutions before policy-makers became aware of the opportunities. A few institutions and communities even erected their own turbines, the best known of these being the Tvind turbine at the Tvind Folke School from 1978, at that time the world's largest wind turbine (900kW). In 1975, the Academy of Technical Sciences stated that the country should focus on wind energy in pursuit of a more independent energy supply. More established parts of society, including industrial associations, were sceptical, believing that large-scale penetration of wind technologies in energy supply was unrealistic.

The public maintained a high level of involvement during the next 20 years in discussions and negotiations but primarily as turbine owners (cf. the section on Roles of Utilities, Wind Turbine Manufacturers and Wind Turbine Owners and Fig. 7).

4.2 Research and development

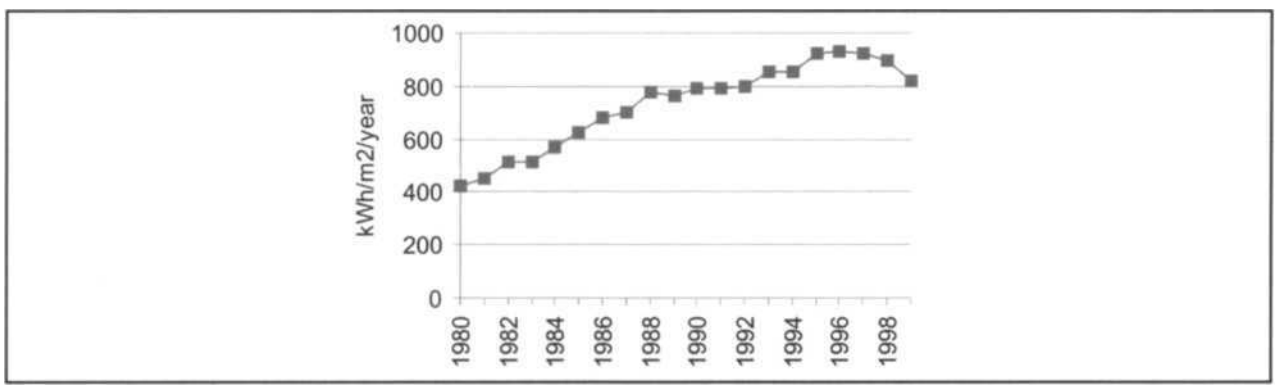
Publicly financed research and development (R&D) began in 1976 with the introduction of the Energy Research Programme (ERP). ERP supported wind energy research projects, one outcome of the programme being the establishment of the Rise Test Station for Wind Turbines in 1978 – Risø later led the way for type approval and international standardization of wind turbines and is acknowledged worldwide today. ERP encouraged partnerships and co-financing, and most projects had several partners from research institutions, private companies, utilities and others.

The Renewable Energy Development Programme (REDP) started financing wind-related R&D by 1982. The aim of REDP was to promote the development of wind industries and technologies.

The New Energy Technologies Programme (NETP, 1980–1990) was put in place to support the commercialization of new energy technologies. The company Danish Wind Technology Ltd – an R&D company with the objectives of technical development of wind turbines – was established in 1981 through NETP with the Ministry of Energy initially a major shareholder. The Ministry sold out its last share by 1985. Another programme, Individual Energy Projects, supported a number of pilot wind farms from 1982 to 1989.

The R&D support has been directed towards basic research rather than actual turbine or component development. Around 100 million US$ was spent by the Government from 1976 to 1995 on wind energy-related R&D.[5] Although the level of support is comparable to other countries with R&D programmes for wind energy, a major characteristic of the Danish support is that it has been remarkably stable. This is partly due to academia, such as Rise and the Danish Institute of Technology, and governmental councils that provided continuous advice on revisions of R&D programmes and warned about the dangers for the wind turbine industry if R&D was discontinued.

Fig. 6 Wind turbine productivity, 1980–1999



Source: Wind Power Note, Danish Wind Turbine Manufacturers Association, July 2000. Figures are based on random samples from turbines installed in each year.

5 Quoting OECD/IEA statistics.

4.3 Roles of utilities, wind turbine manufacturers and wind turbine owners

The established part of the energy sector became increasingly involved in wind power as the technology matured. The electricity utilities began to look into technological challenges linked to integrating the unstable production patterns of wind turbines into the overall load. This has been and still is a major concern of the utilities. By 2002, the grid in the western part of the country has an average of 20% of its load coming from wind turbines, and occasionally wind power accounts for up to 50% of power generation.

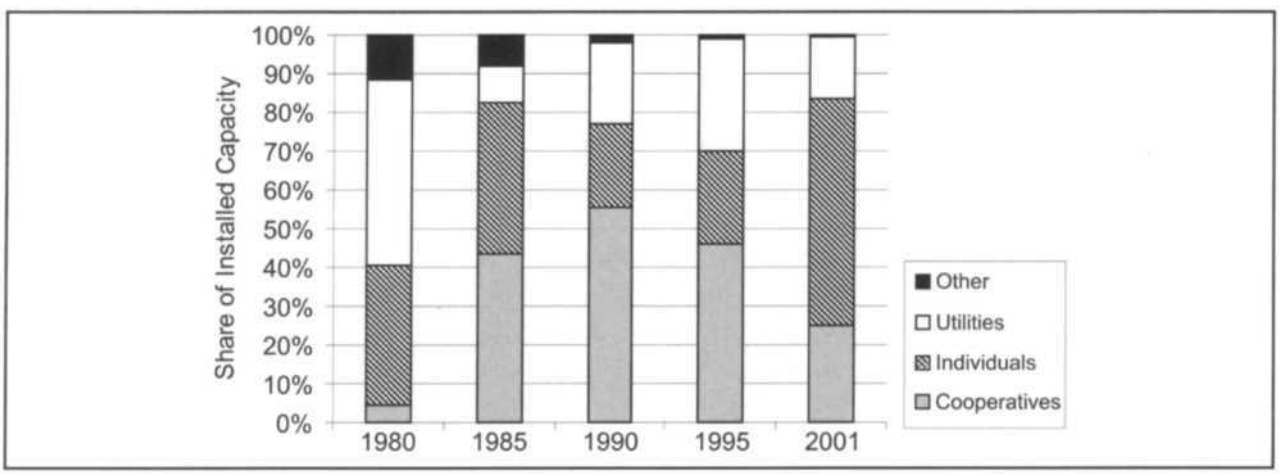
In 1982 the utilities announced their support of building 20–25 large (0,5–1 MW) wind turbines before 1987. The minister and the utilities in 1985 made an agreement on 100MW additional wind capacity to be built by the utilities. In 1987, Europe's largest wind turbine farm (five turbines each of 750kW) was inaugurated by one of the main power producers. In 1996, a new agreement was made obligating the utilities to install an additional 200MW of wind power capacity before end 1999.

In 1984, the first agreement between the Wind Power Associations and the Danish Electricity Utilities on pricing for grid-connected wind power was reached, the utilities agreeing to pay 85% of the average consumer tariff for wind power delivered to the grid.

The public was highly involved in the wind development, as the bulk of wind capacity was owned by cooperatives or individuals (see Fig. 7). In 1978, the Wind Turbine Owners' Association was established, organizing the cooperatives and individual owners as well as a number of people with general interest in wind energy development. The Association has since played a major role in negotiations with utilities and the Government on power purchase arrangements and grid-connection of privately owned wind turbines. By providing information on renewable energy policies and the manufacturing industry the Association has enhanced transparency and competition in the wind turbine market.

The wind turbine industry became organized into the Danish Wind Turbine Manufacturers' Association in 1981. The Association is also today a major player in policy discussions as well as technical developments and standardization efforts. The manufacturing of wind turbines became increasingly commercialized and developed from almost nothing in 1983 into dominating the world market by 1996. Danish turbine manufacturers had a turnover of 12.5 billionDKK. in 1999 and employed more people than the electricity generation, transmission and distribution companies combined. From primarily supplying the domestic market, the industry in 1999 only sold 17% of its turbines in Denmark. Developments on international markets were supported from 1990 by the Act on Guarantees to the Wind Turbine Manufacturers' Guarantee Association, which provided state guarantees of up to 750 millionDKK. to companies taking the financial risk of Danish wind turbine projects abroad.

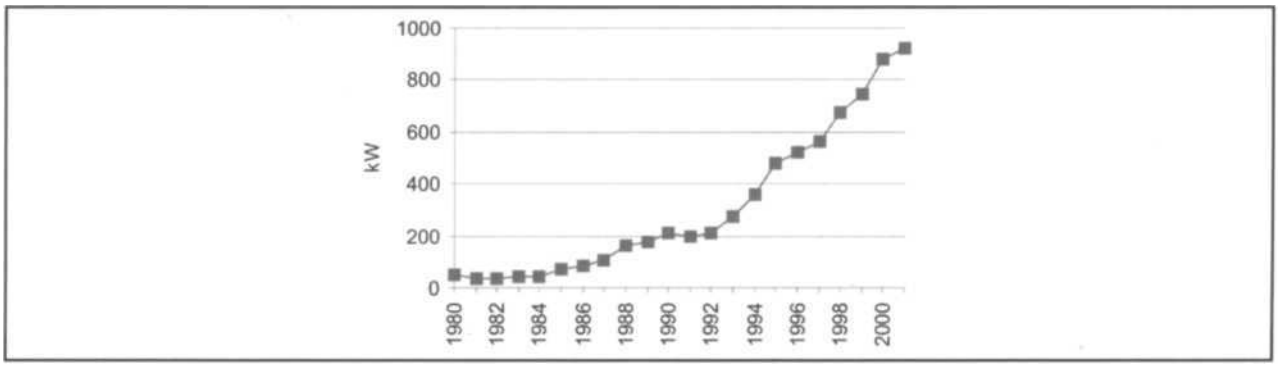
Fig. 7 Wind turbine ownership



Source: Wind Power in Denmark. Danish Energy Agency, 1999. Data for 2001 from Encrgi- og Miljødata (EMD), 4th quarter 2001. Decommissioned turbines – around 43MW from 1980 to 2001 – are not considered.

Intensive R&D by industry, utilities and research institutions has resulted in reduced prices and larger and more efficient turbines (see Fig. 6). The average size of a wind turbine installed in Denmark in 2001 was 922kW compared with 70kW in 1985 and 479kW in 1995 (see Fig. 8). The price of wind-generated electricity has been reduced from an average of 1.2DKK/kWh in 1981 to 0,3DKK/kWh in 1997.

Fig. 8 Average installed wind turbine size, 1980–2001



Source: Data from 1980-1998: Wind Power in Denmark, Danish Energy Agency, 1999. Data from 1999, 2000 and 2001: Energi- og Miljødata (EMD), 4th quarter 2001.

4.4 Off-shore development

With the ambitious targets for wind power development, it was obvious that the bulk of developments in the long run had to take place off-shore. Part of the public R&D was therefore since the early nineties channelled into off-shore developments. Several investigations of off-shore wind resources were conducted, resulting in a complete resource mapping of all Danish waters.

It was decided by the administration (the Danish Energy Agency) to carry out detailed investigations and put regulations in place before large-scale off-shore development was allowed. Most applications for permission to build off-shore wind power plants were therefore initially refused. By 1999, only two small demonstration wind farms of 5MW each had been built (Tunø Knob, 1995, Vindeby, 1991). Both were built by utilities and permission was granted based on existing regulations. A governmental committee was appointed in 1992 to advise on regulations for off-shore wind power. After careful public hearings, planning regulations were developed around 1997, obligating the Danish Energy Agency to hear all parties and carry out environmental impact assessments (EIAs) of off-shore wind power sites and projects. A main reason for this careful approach has probably been the disputes that occurred in relation to on-shore wind power development over land and environmental issues.

In 1997, the utilities together with the Danish Energy Agency and the Natural Forest and Nature Agency developed an action programme for off-shore wind energy development. The programme identified eight areas with a total theoretical wind capacity of 28,000MW and recommended that 150MW demonstration projects be built on each of these selected sites. An agreement to build 750MW (5 times 150MW) off-shore wind power from 2001–2008 was reached between the government and the utilities. Two of the sites are now being developed (Horn's Rev (2002) and Rødsand (2003), a total of 300MW) by two Danish power companies. A smaller site Middelgrunden of 40MW was erected just outside the harbour of Copenhagen in 2001.

The Electricity Supply Act from May 1999 put in place the first detailed regulations for commercialized off-shore developments. It was stated that the right to develop off-shore belongs to the Danish Government, that tender procedures will be developed and followed for each specific area identified by the Government for development, and that Environmental Impact Assessments are required for each project.

Recently, the Government has withdrawn an Executive Order to the power companies on further expansion of off-shore wind power capacity. The withdrawal has been justified by the fact that Denmark is already ahead of its targets for wind power development. Nevertheless, the withdrawal constitutes a remarkable shift in Government priorities, as there has previously been a will to adjust targets upward if moving faster than planned. Other parts of the action programme to achieve the targets of "Energy 21" are not proceeding according to plan – in particular, goals for the transport sector seem to be difficult to meet (and have indeed already been adjusted downwards). Adjustments to allow wind energy to meet a larger share of the renewable energy or CO_2 reduction targets than originally planned could be appropriate and even become necessary, but long-term perspective and commitments to meet the goals of the energy sector seem to be given lower priority than before.

Wind turbine manufacturers have raised concern about the shift in government policies. Off-shore development is seen as a new window of opportunity for the manufacturers, but to grasp it they need the advantage the industry previously had of using the home market as a testing ground for new innovations. It is feared that this home market advantage may be lost with the unclear political outlook.

5 Legislative means to promote wind power

The previous section describes a rapid wind energy development resulting in maturing markets and technologies, which in turn lead to larger and more efficient turbines. Regulating the development to ensure fairness, avoid disputes and ensure a consistent demand were crucial prerequisites for sufficient wind power development to meet the targets set for long-term energy sector development. This section provides an overview of legislation put in place to regulate wind power development and secure the demand for wind turbine capacity and electricity.

Wind power development has been governed by three major acts: The Act on Utilization of Renewable Energy Sources, the Act on Subsidy for Electricity Production and the Electricity Supply Act. Danish Law lay *down detailed instructions and information on each Act in Executive Orders. In the following,* "*regulation*" refers to the Act in question including Executive Orders put in place pursuant to the Act.

5.1 The act on utilization of renewable energy sources

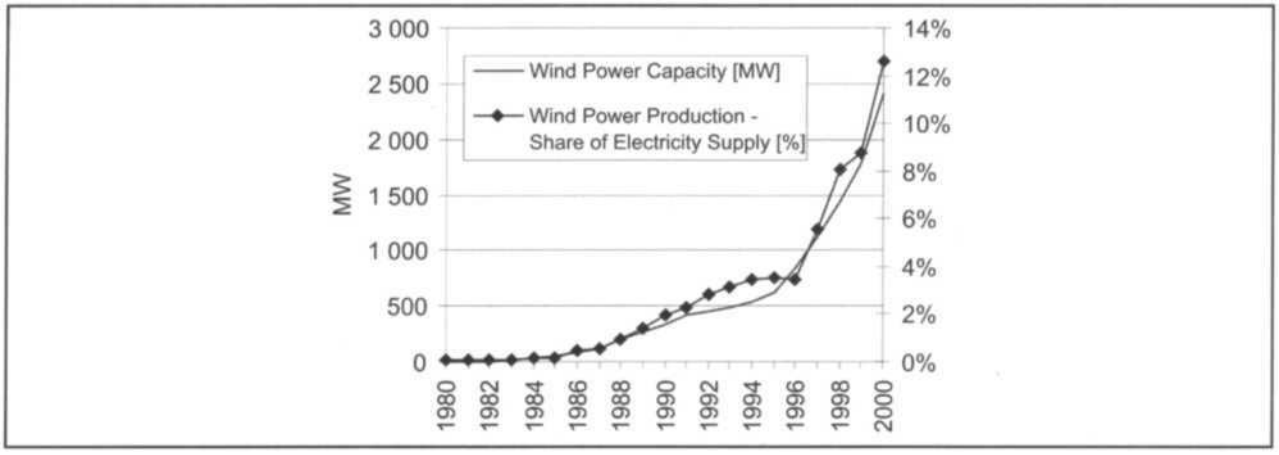
The Act on Utilization of Renewable Energy Sources contained from the start a provision for subsidizing a number of renewable energy installations for supplying buildings with electricity or heat and also for subsidizing test stations for renewable energy. 120.2 millionDKK was reserved for these subsidies in the fiscal year 1981. A maximum of 20% of installation costs with a maximum of 1 millionDKK could be supported per installation. In 1982, the ceiling for subsidy was raised to 30% of installation costs.

A detailed regulation for implementing the Act was put in place in 1988. It laid out in detail which installations could be subsidized and how applications should be made. Wind turbines received special attention and specific demands were made on the placement and the size of wind turbines in relation to the owner's place of living and electricity consumption. In short, the owner of a turbine must live in the municipality where the turbine is erected and could own shares in wind turbine capacity corresponding to a maximum of his or her own consumption of electricity plus 35%. The subsidy was fixed at 15% for wind turbines and only new turbines could receive subsidy. Extracts of the regulation are placed in Annex II (Executive Order No. 1 of 4 January 1988).

In 1989, the installation subsidy for wind turbines was abolished, and wind turbine owners were supported only through production subsidies and agreements with utilities on feed-in tariffs.

In 1990, the Minister was authorized to regulate wind turbine connection, installation, placement and approval schemes.

Fig. 9 Wind power's share of electricity supply, 1980–2000



Source: Energy Statistics 2000, Danish Energy Agency, 2001. Figures include only grid-connected wind turbines.

The Act was revised again in 1992, including specific requirements for grid connection of wind turbines and power purchase arrangements. It was decided that wind turbine owners cover costs of connecting the wind turbine to the low-voltage grid (10-20 kV) and that the local electricity supply company cover other connection costs and necessary enhancements of the existing grid. Also, it was determined that wind owners should receive a fixed feed-in tariff per unit delivered to the grid equalling 85% of the local electricity supply company's sales price to other consumers. A similar power purchase scheme had actually been in place since 1984 by agreement between utilities and the wind turbine associations but by now the Minister of Energy became authorized to lay down rules, including tariffs, for purchase of wind power electricity. An extract of the regulation is placed in Annex II (Notice of the Act on Utilization of Renewable Energy Resources, No. 837 of 7 October 1992).

Following disputes on placement of wind turbines and resistance by some municipalities to allotting sites, it was specified that approval of wind turbine sites be made by the municipality councils in accordance with the National Planning Act, and that the installation be made in accordance with official approval procedures. Advance planning with public hearings at municipality level was introduced, which helped acceptance of subsequent placement of turbines and general acceptance of the technology.

Rules on owner's residence and own electricity consumption were lessened, so that owners were allowed to live in the neighbouring municipality and install turbines covering up to own consumption plus 50%. The rule on own consumption was abolished for owners installing the turbine on their own property (typically farmers).

The establishment of a countrywide wind register was included in the Act in 1997.

Following the revisions of the Electricity Supply Act, the production subsidy of 0.27DKK per kWh and the extra 0.10DKK CO_2 tax exemption were moved from the Act on Subsidies for Electricity Production (see below) and placed under this Act in 1999. Although the value of the subsidy was unchanged, it was now administered as a price surcharge. This meant in practice that the added price for wind turbine electricity became a direct burden for the electricity supply companies and therefore an increase in consumer costs for electricity. The result was that excess costs of renewables were internalized into the electricity price.

In 2001, regulations on purchase of wind-generated electricity were placed under the Electricity Supply Act.

5.2 The act on subsidies for electricity production

The Act on Subsidies for Electricity Production came into force in 1992. It introduced a production subsidy of 0.27DKK per kWh for wind turbine generated electricity. It was specified in 1993 that privately owned wind turbines were eligible for the 0.27DKK subsidy whereas utility owned wind turbines only received 0.10DKK per unit, equivalent to reimbursement of the newly introduced CO_2 tax. Subsidies were to be paid through reductions in each turbine owner's electricity bill; utilities were to receive the subsidies through reductions in their annual tax accounting.

These subsidies for wind generated electricity remained unchanged with only minor adjustments in accounting procedures and obligations to provide information until 1999, when the subsidies when abolished and changed to a price surcharge for wind power generated electricity to be paid for by increases in consumer prices. After this, purchase of electricity from wind turbines was administered through the Act on Utilization of Renewable Energy.

5.3 The Electricity Supply Act

The Electricity Supply Act of 1976 was in force almost unchanged for 20 years until major revisions were made in the late nineties.

The Act laid out the ground rules for a tightly controlled electricity sector, where only licensed companies were allowed to produce, transmit and distribute electricity through the public grids. Distribution companies were obliged to justify their consumer tariffs to an Electricity Price Committee through financial statements on their activities, costs of salaries, fuel and administration. The Electricity Price Committee comprised of representatives from government, utilities and municipalities. All information was available to the public. The Minister of Energy was authorized to use supply security justifications to oblige electricity supply companies to include specific energy types in their supply and take measures to improve the energy efficiency

of supply. The Act focused on the supply obligations of the electricity distribution companies and had no mention of the companies' power purchase obligations.

The Act was refined during the late eighties and early nineties. Major changes included the introduction in 1989 of obligations for the supply companies to purchase power from IPP's if generated as local CHP or from renewables. Power from wind turbines was however excluded from this regulation as it was already regulated in detail through the Act on Utilization of Renewable Energy Sources.

In 1994, obligatory integrated resource planning and demand supply measures were introduced for electricity producers and distributors, respectively. Also in 1994, environmentally sound development of the electricity supply was included in the main objectives of the Act. The Minister could now use environmental developments as justifications for imposing obligations on utilities to taking measures pertaining to fuel use, energy efficiency and renewable energy development.

In 1996, an EU directive on an EU internal market for electricity was adopted and countries were asked to put their respective legislation in line with the directive. A major overhaul of the whole sector followed. The revision of the Electricity Act in 1996 took the first step towards introducing a more competitive electricity market while at the same time providing for prioritization of renewables and other forms of environmentally friendly energy in the electricity supply. By this revision, all consumers became obliged to purchase electricity from prioritized plants, in practise meaning that costs for RE were distributed equally among all consumers. The Act only came into force in 1998 awaiting approval from EU.

An agreement was reached by Parliament in 1999 on the introduction of CO_2 quotas and renewable energy certificates (RE-certificates) to ensure demand for renewable energy electricity in a competitive market. The agreement was put into legislation later that year as the new Electricity Supply Act. The Act followed by outlining the previous changes made in 1996, the main objectives being to lay down a legislative framework for the simultaneous fulfilment of environmental objectives, consumer protection and introduction of increased competition. The Act introduced RE-certificates but also included regulations for a transition period.

Extracts of the Electricity Act from 1999 in unofficial translation are placed in Annex II. The extracts contain chapters on consumer and electricity supplier obligations and on the RE-certificate market.

Latest developments

The Electricity Act of 1999 implementing the electricity reform agreement came into force in 2001 after EU approval of the proposed mechanisms for simultaneously introducing competition and prioritization of environmentally benign electricity. The sections dealing with wind power development however entered into force already in 1999 resulting in the described adjustments in the Act on Utilization of Renewable Energy Sources and the Act on Subsidies for Electricity Production.

A parliamentary hearing in 2001 concluded that the RE-certificate scheme from the Electricity Act was impracticable and as a result the scheme has not been implemented. Until a decision is made, detailed transitional regulations on power purchase rates and excess price surcharges for wind power, as laid out in a number of Executive Orders, are in force:

Until an existing (i.e. commissioned before 1 January 2000) privately owned wind turbine is ten years old, the cost of electricity is set at 0.43DKK/kWh. An additional surcharge of 0.17DKK is received for a certain number of full-load hours (the larger the turbine, the lower the ration of full-load hours). Subsequently, the electricity is settled at the market price plus the value of the RE-certificate.

Electricity from turbines commissioned after 1 January 2000 and grid-connected before end 2002 is set at 0.33DKK/kWh for 22,000 full-load hours plus the value of the RE-certificate. Subsequently, the cost of the electricity is set at the market price plus the value of the RE-certificate. Electricity from turbines grid-connected from 2003 onwards will be set at the market price plus the value of the RE-certificate.

Until a RE-certificate market is in place, a unit surcharge of 0.10DKK is granted instead.

Privately owned off-shore wind turbines and non-grid connected turbines on land are so far granted a fixed feed in tariff of 0.33DKK/kWh plus a surcharge of 0.27DKK/kWh.

Turbines owned by electricity production or supply companies are governed by a different set of regulations. Depending on the age of the turbine, the date and the financing scheme for their installation, the price varies from strictly market based prices to guaranteed feed-in tariffs, price surcharge and RE-certificates.

5.4 Replacement of wind turbines

The rapid development of wind turbine technology has led to a need for replacement of turbines from previous generations of technology. Already in 1994 a replacement programme for old turbines was introduced. Due to insufficient economical incentives, the programme was not successful. Over the years though, some turbines have been replaced by utilities outside government-financed programmes.

In 2001, a new programme for replacement of old wind turbines was introduced. An owner who replaces an old wind turbine is granted an additional surcharge of 0.17DKK/kWh for 12,000 full-load hours for the new wind turbine. The new turbine must be grid-connected after 1 April 2001 and before 1 January 2004, and the capacity of the old turbine must be maximum 150kW. The surcharge will be given only for a proportion of the capacity of the new turbine corresponding to two-three times the installed capacity of the decommissioned turbine.

The same regulation from 2001 also states that existing wind turbines pursuant with the Electricity Supply **Act** will not be guaranteed fixed feed-in tariffs or price surcharges after 10 years of operation.

The replacement programme thus contains a mix of positive and negative incentives and seems so **far** to have been a success.

6 Summary and conclusion

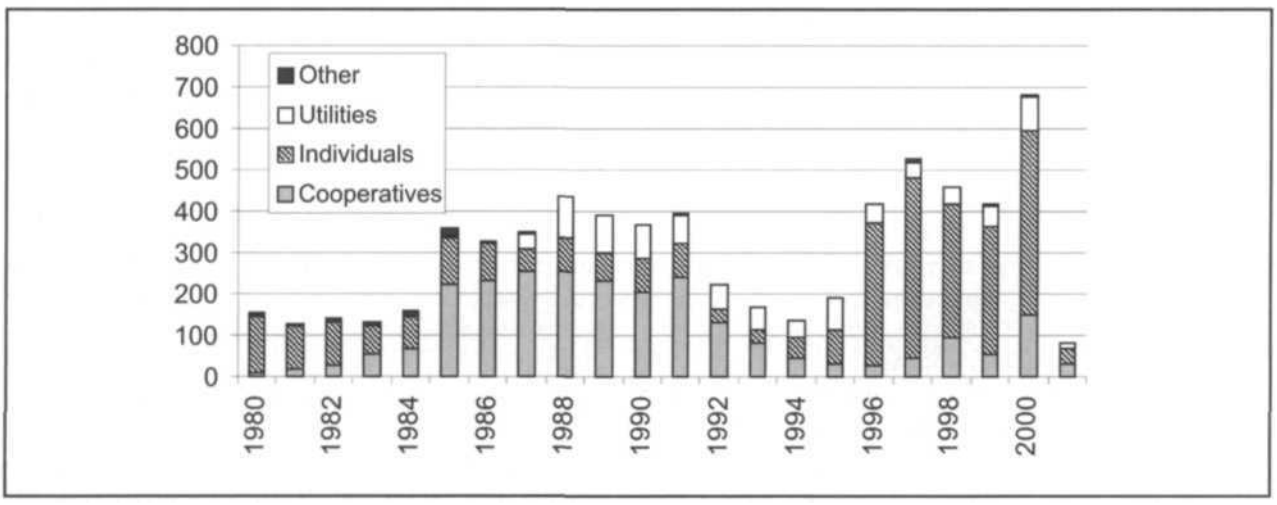
The development of wind power seems to prove that with proper support structures in place it is possible to overcome barriers facing renewable energy development. But would similar measures be successful in other countries and for other technologies? Below, the information provided on legislation and policies is compared with the annual development in number of turbines and capacity installed. The analysis is then drawn upon to reflect on options for replication.

6.1 Linkages between regulations and wind power development

Wind power was supported through a combination of power purchase agreements with electricity utilities, subsidies to IPPs, incentives for user involvement by ownership, and research and development for technological development.

Installation of wind power capacity by power utilities was governed by individual agreements between the Government and the utilities and was as such not directly linked to incentives put in place for individuals, cooperatives and companies to invest in wind turbines (cf. the section on wind power development). This part of the development has therefore been excluded from the following analysis.

Fig. 10 Number of wind turbines installed annually from 1980–2001



Source: Data from 1980-1998: Wind Power in Denmark, Danish Energy Agency, 1999. Data from 1999, 2000 and 2001: Energi- og Miljødata (EMD), 4th quarter 2001.

The installation subsidies from 1979 and 1981 created the first push in demand for wind turbines. A small wind turbine manufacturing industry existed at that time, but very few turbines had been installed since the end of World War II. R&D programmes, basic research, data collection and resource assessments, which had been initiated a few years prior to the introduction of installation subsidies, assisted in preparing manufacturers to meeting a growing demand.

Around 120 turbines were installed annually from 1980 to 1984; most of them purchased by individuals. In 1984, the power purchase agreement with the utilities together with the introduction of production subsidies boosted the demand for turbines and for additional capacity. More than twice as many turbines were installed in 1985 compared with 1984, and the average capacity increased by 54%. The certainty of power purchase arrangements encouraged grid-connection, and more individually owned wind turbines (typically household turbines) were connected to the grid. The development also supported organization of wind turbine owners in cooperatives where the turbine(s) were normally connected to the grid rather than directly to the place of consumption.

The introduction of ownership rules (limitations in size and placement of turbine related to the electricity consumption and place of living of the owner) together with a decrease in installation subsidy from 1988 resulted in a decrease in the number of annually installed turbines. An exemption to the electricity consumption ceiling for turbines of up to 150kW installed on own property however increased the demand from individuals who wanted to install a turbine on their own land. Limitations to the placement of turbines constituted an incentive to install larger turbines. The average capacity of a turbine installed in 1988 was remarkably close to 150kW, 44% larger than in 1987. *The* abolition of the installation subsidy from *August* 1989 had minor negative impacts on the development in 1989 and 1990 after which the development picked up at previous rates. This implies correct timing of the removal of the installation subsidy.

By the early nineties, the placement of wind turbines had become a bottleneck for development because of lack of available sites and protests from municipalities and people living in close proximity of the turbines. A fixed production subsidy was introduced in 1992, replacing the former arrangement of reimbursement of the electricity tax. As the electricity tax at that time was around 0.33DKK and the subsidy was 0.27DKK this was a subsidy decrease. Difficulties with placement of turbines together with the decrease in production subsidy resulted in a contraction of the development with only half as much capacity installed in 1992 as in 1991. Planning procedures put in place at municipality levels with obligations for the municipalities to identify suitable sites, and softening of the ownership rules were measures taken to make development pick up again.

The adjustments from 1992 had a positive impact on individuals' inclination to invest in turbines and install them on their own property (typically farmers – the 150kW ceiling mentioned above was abolished). The following four years saw a steady increase in installation of turbines by individuals and a continued decline in turbines purchased by cooperatives.

Uncertainty about regulations for the anticipated RE-certificate market, which was part of the electricity reform in 1999, caused concern among turbine owners, turbine industry and potential investors. Transitional settlement rules for wind turbines commissioned before 1 January 2000 were part of the electricity reform agreement, but until April 2001 no regulation was in place for wind turbines commissioned at later dates. The market reacted as expected with almost no turbines being installed in 2001 (Fig. 10).

Partly because of new regulation but mainly because of exhaustion of available sites on land, the bulk of new capacity is expected to be installed off-shore. Most future on-land activities will probably be the replacement of old turbines.

6.2 Options for replication

Through a combination of R&D support, investment and production subsidies, involvement and close collaboration among stakeholders, the power generation mix was successfully changed and a new renewable energy technology and industry was developed. Main characteristics of surrounding policies, stakeholders and cooperation modalities include:

1. *Consistent political support.* An analysis of development of a certain technology tends to focus on legislation, as above. Legislation, however, does not develop in a vacuum. A requirement for legislation to enter into force and thereafter being enforced and maintained is a solid basis of politically binding agreements, preferably entered into by most parties in Parliament, including parties presently outside the Government. Such across-the-board agreements have been a major reason for consistent energy policies and could be achieved in any reasonably stable political system.

As earlier mentioned, the strategic approach to energy planning also greatly helped the consistency of policies and regulations. This approach was however not in place from the beginning but developed over a number of years. The consistent political support of wind energy thus to some extent can be contributed to a lucky mix of different drivers for energy development, which all pointed in the direction of increased renewable energy penetration in the energy supply.

Drivers for shifting investments, policies and funding towards renewable energy are in short supply all over the world. The inertia of current financial structures geared towards large investments, unfair pricing systems that favour fossil fuels and inadequate internalization of environmental costs in energy pricing are just some of the parameters that pull in opposite directions. A shift in funding priorities at international levels towards renewables could constitute such a driver for developing countries. Minimum thresholds for renewable energy share of projects under export credit schemes and internationally acknowledged approval schemes for renewable energy projects could constitute drivers for a change of direction for private investments.

At the country level, the adoption of a strategic approach to energy sector development is a powerful tool to direct investments towards achieving goals and targets. Also such an approach supports a pro-active approach to donor support, enabling governments to justify the types and nature of funds requested.

2. *Few changes in rules and regulations.* Past and in particular recent developments made patent the sensitivity to changes or even anticipated policy changes of areas depending on government subsidies. Introduction of subsidies and fixed feed-in tariffs had an immediate impact on the market, and uncertainties about the functioning of RE-certificate markets led to a rush to install turbines before old rules expired. The delay in agreeing on transitional rules brought the market to a halt in 2001. Investors only act in markets with high degrees of predictability. In many countries, markets mainly financed through subsidies and therefore extremely vulnerable to political decisions, are the least predictable of all. This again underlines the importance of across-the-board agreements at a high political level together with committing stakeholders to contribute to the development as tools and prerequisites for abating such uncertainty.

   In the case of Danish wind power development, some legislation only streamlined and maintained already established procedures. Other legislation, for example, the planning obligations of municipalities and the sharing of costs for grid connections between utilities and turbine owners, was put in place to regulate a development where confusion or disputes had occurred. For a new technology such ad hoc approaches and adjustments may be unavoidable, but it should not be replicated. The approach taken for off-shore development seems to be better thought out from the beginning. In all cases, close monitoring of developments is an absolute necessity to enable policy-makers to time and implement appropriate adjustments.

3. *Public involvement by ownership, research and participation in advisory bodies.* Most renewable energy systems are tailored to decentralized supply systems, and spreading the ownership widely among consumers seems to have abated or at least delayed disputes on placement in the landscape of these very visible energy plants. Spreading ownership however also introduces great sensitivity towards adjustments in regulations on settlement prices as it has immediate impact on the owners' private economy. Sharing the ownership of the plants among a group of consumers in arrangements similar to the cooperatives alleviates the impact somewhat.

   Translating this experience to rural communities – often the target areas for renewable energy development – local ownership of a decentralized energy supply should be encouraged. If possible, ownership as well as maintenance responsibilities should be dispersed widely among villagers.

4. *A new technology developed simultaneously with increased demand; yet few technical problems with the renewable energy plants.* The early introduction of approval schemes together with close collaboration among research institutions and manufacturers resulted in early introduction of quality control measures by manufacturers, and rather quick approval of new innovations by approval authorities. This supported fast technology development while maintaining high quality. Collaboration and standardization should be encouraged whether a new technology is being developed or an existing is being introduced and adapted to local conditions.

   In many situations, importing a well-proven technology would be preferred over local development of a new technology. This may prove a technology barrier overcome, but benefits of locally available expertise

for local adaptation and maintenance should not be neglected. Also in the long run, the existence of a local industry can influence public opinion of the technology and exercise important pressure on politicians for the long-term support of the renewable energy technology.

5. *High degree of transparency and networking.* Networking among stakeholders and the availability of all necessary information for investors, industry, politicians and others are important prerequisites for successful policy implementation: availability of impartial information from independent institutions on rules, regulations and technology enables investors to make well-informed decisions, and ensures competition among manufacturers. Widespread ownership creates high levels of awareness and knowledge in civil society. A growing renewable energy industry constitutes an economic incentive for politicians to continue the support and can also silence critics considering RE development too expensive or undesirable for other reasons.

Networking, collaboration and involvement to the degree experienced in the Danish case may be relatively easy in a small country with a high level of education and tradition of consumer organizations. In other places this may not be feasible, but efforts should be taken to inform and involve at least major players in the process. As an example, the Danish utilities were major stakeholders in wind energy development by being the purchaser of wind electricity as well as wind turbine installers. The concerns of the utilities about the integration of wind power into the overall load were at first not taken seriously, leading to a low level of enthusiasm on the part of utilities for participating in the development. This resulted in less support than could be expected from a major player with useful knowledge and experience, which could have been drawn upon more advantageously than was the case.

Other kinds of renewable energy technologies received similar support by the Danish Government but never succeeded to the same extent as did wind energy. The success of wind energy must therefore also be contributed to an industry and an electricity supply, which showed themselves equal to the task, appropriate wind resources, a successful collaboration between research institutions, industry and the Government, and last but not least a lucky timing of interventions and other measures, enabling the Danish wind industry to become the world leader in developing and refining the technology.

Annex I – Selected Legislation in Translation

Executive Order No. 1of4 January 1988

Extracts pertaining to requirements for wind turbine owners' residence and electricity consumption.

Chapter 3

Conditions for notification of commitment to subsidize

4. Commitment to subsidize can only be notified if the plant is type or system approved and conditions in the approval scheme have been met.

5. Commitment to subsidize can only be notified if a written estimate or offer for the installation is available. If applying for investment subsidy for electricity generating plants, the estimate or offer must indicate the investment contribution.

(2) If building permission is required by the municipality, commitment to subsidize can only be notified if a final building permission is available.

5a. It is a requirement for subsidy for wind power plants that the owner resides in the municipality where the wind power plant is installed or within 10km from the turbine.

(2) If the wind power plant is owned by a number of individuals, (1) applies to all owners. If a company owns the wind power plant, any shareholder of the company is regarded as an owner of the wind power plant.

(3) The applicant must document meeting the requirements of (1) and (2).

5b. It is a requirement for subsidy for wind power plants that the annual electricity production does not exceed the expected annual electricity consumption of the owner by more than 35%. The owner's expected annual electricity consumption is estimated either at 6,000kWh per residence or as the actual expected consumption at the residence plus any industrial consumption in the municipality or within 10km from the wind power plant. Electricity consumption cannot prior to the application have been used as justification for state subsidy for a wind power plant.

(2) If the wind power plant is owned by a number of individuals, (1) applies to all owners. If a company owns the wind power plant, any shareholder of the company is regarded as an owner of the wind power plant.

(3) (1)does not apply to a wind power plant with an installed capacity of up to 150kW established at a property, which is owned and occupied by the owner of the plant or from where the owner exercises his or her primary business. From January 1 1986, subsidies can only be granted to one such plant for each property.

(4) In special cases, the Energy Agency can waive (2).

(5) If application is justified by an estimated annual electricity consumption larger than 6,000kWh, cf. (1), a statement from the electricity supply company/ies in question regarding every owner's expected annual electricity consumption must be included in the application. Also, a statement– e.g. from the manufacturer or electricity supply company in question – on the expected annual electricity production of the wind turbine must be included in the application.

5c. The residence requirements of section 5a do not apply to owners of property on small islands if the wind power plant is established on the island. For such properties, subsidy can only be granted to owners if the annual electricity consumption requirements of section 5b are met by the respective owner's total electricity consumption on the island.

6. Installation must not be initiated until written commitment of subsidy has been received.

(2) Installation is considered to be initiated when physical work on the property has begun. In cases of doubt the Energy Agency determines when an installation has been initiated.

7. Subsidy can only be granted if the installation is undertaken by a VAT registered construction company.

(2) Subsidy for purchase of the plant and construction materials can only be granted if it is documented that the plant and the materials are purchased and used by the VAT registered company(ies) undertaking the installation.

(3) Subsidy cannot be granted for work undertaken by a company or the owner of a company on the property of the company or the owner of the company.

(4) Subsidy cannot be granted to plants or materials supplied or manufactured by a company or owner of a company and utilized on the property of the company or the owner of the company.

Notice of the Act on Utilization of Renewable Energy Resources, No. 837 of 7 October 1992

Extracts pertaining to installation and grid-connection of wind turbines and settlement price for wind power.

Chapter 2

10a. The Minister of Energy can lay down rules governing the construction, production, installation and operation of wind power plants.

(2) The Minister of Energy can lay down rules governing off-shore wind power plants and their grid connections.

10b. The Minister of Energy can lay down rules governing the erection and grid-connection of wind power plants.

(2) Costs pertaining to the connection of the wind power plant to the 10–20kV grid fall on the owner of a wind power plant.

(3) Costs for extension of the 10–20kV grid or enhancement of an existing grid, which are made necessary by the connection of a wind power plant to the grid, fall on the electricity supply company.

(4) The Minister of Energy can lay down detailed rules governing the payment of costs for grid-connection of wind power plants by (2) and (3).

10c. Electricity supplied by wind power plants to the grid is settled with 85% of the tariff paid by households (calculated without taxes, dues and subsidies) in the electricity supply area where the wind turbine plant is placed.

(2) The Minister of Energy can lay down detailed rules governing the settlement price for electricity supplied by wind power plants to the grid by (1).

10d. The Electricity Price Committee established pursuant to the Electricity Supply Act must be notified on prices and conditions concerning grid-connection of wind power plants.

The Electricity Supply Bill[6]

Bill no. ***234*** *Folketinget (Danish Parliament) 1998-99. Adopted by Folketinget on 28 May 1999 with amendments. Now* ***Act no. 375 of 2 June 1999.***

Extracts from the Bill on power purchase obligations, environmentally benign electricity production and RE-certificates.

Part 1
Introductory provisions

1. The objective of the Act is to ensure that the electricity supply of the country is organised and implemented in accordance with consideration for security of supply, the national economy, the environment and consumer protection. Within the terms of this objective, the Act is to ensure consumers access to inexpensive electricity and continue to provide them with influence on the administration of the assets of the electricity sector.

(2) In accordance with the purposes mentioned in (1), the Act is to promote in particular sustainable energy application, including by energy savings and the use of CHP, renewable and environmentally benign energy sources, while also ensuring efficient use of financial resources and creating competition in markets for production of and trade in electricity.

...

Part 2

The position of electricity consumers

...

8. Every electricity consumer in Denmark must purchase a relative share of the electricity which the grid companies and the system responsible companies are obliged to purchase pursuant to Part 9 of the Act or rules or decisions pursuant to the Act. For electricity, the price must be paid that follows from the Act or from provisions laid down pursuant to the Act.

(2) By agreement with the grid company, electricity consumers can free themselves of their purchase obligation according to (1) upon a payment that must be reasonable vis-à-vis the other consumers.

(3) Every electricity consumer in Denmark must acquire RE certificates in accordance with the rules in Part 9 from the point in time laid down by the Minister for Environment and Energy pursuant to section 61.

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6 The full text of the Bill with official notes are available in English at: http://www.ens.dk/graphics/publikationer/laws/bill_234.pdf

(4) Every electricity consumer in Denmark must also meet a relative share of the necessary costs of the collective supply companies in implementing the public service obligations as these have been ordered in accordance with this Act or rules or decisions pursuant to the Act, cf. section 9.

...

Prioritised sale of environmentally benign electricity production

57. In order to promote environmentally benign energy production, grid companies and system responsible companies are obliged to purchase electricity from 1) small-scale, including industrial, CHP production plants and electricity from electricity production plants that produce RE electricity or utilise waste as fuel at a payment that results from sections 58 and 59, and 2) other CHP plants designated to supply district heating to the extent that the electricity cannot be sold at prices that cover the necessary costs of the electricity production in question.

(2) Following submission to the committee specified in section 3, the Minister for Environment and Energy can lay down rules or make a decision concerning the content and scope of the commitments specified in (1) to purchase electricity, including the time duration of the purchase obligation and calculation of the settlement price pursuant to (1), no. 2.

(3) Following submission to the committee specified in section 3, the Minister for Environment and Energy can lay down rules that electricity production from utility-owned plants or plants constructed by these companies shall not be covered by the purchase obligation in (1).

Settlement rules for prioritised electricity

58. Electricity from plants as specified in section 57 (1) no 1, shall be purchased at a price that corresponds to the costs of producing and transporting electricity, including fuel and operational costs etc. and long-term plant costs. When the long-term plant costs are being fixed, the objectives specified in section 1 shall be considered. RE electricity, including RE electricity produced by CHP plants, shall be settled in accordance with rules issued in pursuance of section 59, cf., however, (3).

(2) The Minister for Environment and Energy can lay down specific rules as to the plants that shall be covered by the provisions in (1) and about calculation of the settlement price pursuant to (1).

(3) Following submission to the committee specified in section 3, the Minister for Environment and Energy can lay down special settlement rules for electricity, including RE electricity that is produced at utility-owned plants or plants constructed by these companies.

59. Following submission to the committees specified in section 3, the Minister for Environment and Energy shall lay down rules for settlement of RE electricity, including that different settlement prices can be utilised for different technologies. The Minister for Environment and Energy shall also lay down rules that, over and above the settlement price, a surcharge of a maximum of DKK 0.27 per kWh for RE electricity shall be paid should RE certificates not be issued for this electricity pursuant to section 60. The Minister for Environment and Energy shall lay down rules concerning the production plants for which the surcharge shall be paid and rules concerning the duration of the settlement rules and the surcharge.

(2) Electricity from wind turbines which the RE Fund is to take over pursuant to section 66 shall be settled at a price that corresponds to the costs incurred by the RE Fund in the take-over specified in section 66. The Minister for Environment and Energy may lay down more specific rules for the calculation of the settlement price.

(3) Following submission to the committee specified in section 3, the Minister for Environment and Energy can lay down special settlement rules for RE electricity produced at plants constructed as a consequence of orders issued pursuant to section 13 of the hitherto valid Electricity Supply Act.

RE certificates

60. Producers of RE electricity shall receive certificates for the amount of RE electricity they have produced. The certificates are to be called "RE Certificates" and are tradable.

(2) The Minister for Environment and Energy is to lay down rules about which producers are to be covered by the provision in (1) with respect to issue and distribution of and trade in RE Certificates from a point in time decided by the Minister.

61. From a point in time decided by the Minister, every consumer of electricity in Denmark will be obliged to acquire RE certificates. Following submission to the committee specified in section 3, each year the Minister for Environment and Energy is to determine the minimum number of RE certificates every consumer of electricity shall acquire. The purchase obligation shall be uniformly fixed for all electricity consumers as an obligation to acquire a certain number of RE certificates in relation to electricity consumption.

(2) The Minister for Environment and Energy is to reduce the purchase obligation pursuant to (1) in cases where it proves impossible to fulfil.

62. The system-responsible companies are responsible for undertaking the purchase obligation pursuant to section 61 on behalf of their customers.

(2) Consumers with a different supplier than the supply-committed enterprise may themselves attend to their purchase obligation or request the supply-committed enterprise in the supply area in question to purchase RE certificates on their behalf.

(3) The Minister for Environment and Energy is to lay down rules with regard to when and how the fulfilment of the purchase obligation is to be documented.

63. In case of failure to fulfil the purchase obligation pursuant to section 61, DKK 0.27 shall be paid for each kWh for which the party obliged, pursuant to section 62, should have purchased certificates. The sum shall be paid to the Treasury.

(2) The Minister for Environment and Energy can lay down rules concerning payment and collection of the sum specified in (1), including that the sum shall be charged by the collective electricity supply companies. There is right of distraint for the sum.

The RE Fund

64. With the objective of buying up RE certificates pursuant to the rules in section 65 and taking over wind turbines pursuant to the rules in section 66, a Fund is to be set up called "The RE Fund". The Minister for Environment and Energy can lay down rules to the effect that the Fund shall also promote RE electricity in other ways. The Fund is to be administered by the Minister for Environment and Energy.

(2) The State is to grant an annual sum of money over the Finance Act to the RE Fund for the purposes specified in (1). Amounts not utilised in one year shall be transferred to the next year.

(3) The Minister for Environment and Energy is to lay down rules about the establishment of the RE Fund, including rules concerning the executive management of the RE Fund and applications of the financial means of the Fund.

(4) The costs of administering the RE Fund are to be met from the financial means of the Fund.

65. Should the total number of RE certificates that are to be purchased in Denmark pursuant to the purchase obligation in section 61 not have been sold by a point in time specified pursuant to section 62 (3), the RE Fund is to buy up the number of RE certificates that are necessary for fulfiling the purchase obligation on the national level. The RE certificates are to be bought up for a minimum of DKK 0.10 and a maximum of DKK 0.27 per kWh.

66. Owners of wind turbines who can document that they will be unable to pay off outstanding loans in a wind turbine due to changed surcharges on wind turbine electricity fixed pursuant to section 59 (1), can request the RE Fund to take over the wind turbine and the obligation to pay off the loans outstanding. This provision shall also be applied to loans obtained by wind turbine owners who own part of a wind turbine.

(2) (1) shall solely be applied concerning loans obtained before the Bill was presented to finance the purchase of a wind turbine. (1) shall not be applied in the case of utility-owned wind turbines.

(3) The Minister for Environment and Energy can lay down specific rules concerning the application of (1), including rules with regard to the latest date at which the request should be submitted and concerning the scope and application of the scheme.

(4) The RE Fund can dismantle, sell or operate wind turbines that are taken over pursuant to (1).

(5) Electricity from wind turbines that the RE Fund has taken over pursuant to (1) shall be charged in accordance with the rules in section 59 (2). Funds which originate in the dismantling, sale or operation of wind turbines taken over by the RE Fund pursuant to (1) shall accrue to the Treasury.

Connection etc. of environmentally benign electricity and CHP production plants

67. When the plants specified in section 57 (1) no. 1 are connected to the electricity supply grid, the owner of the plant shall only pay the cost that would have been incurred in being connected to the 10–20kV grid, irrespective of whether, on objective criteria, the grid company selects another connection point. Other costs, including costs for grid boosting and grid expansion, shall be met by the grid company.

(2) Owners of plants as specified in section 57 (1), no 1, who wish to supply electricity at a higher voltage level than 10–20kV shall themselves meet the costs involved in being connected to a correspondingly higher voltage level. Other costs, including costs for grid boosting and grid expansion, shall be met by the grid company.

(3) The provisions in (1) and (2) shall not apply to wind turbines.

68. The Minister for Environment and Energy can lay down rules with respect to the construction and connection of wind turbines to the electricity grid, including rules concerning the distribution of costs involved in grid connection and being connected to the electricity grid. The Minister for Environment and Energy can lay down rules regarding the construction, installation, design and operation of wind turbines and rules about accreditation of certificates and testing with respect to these matters.

(2) The Minister for Environment and Energy can lay down rules to the effect that the collective electricity supply companies administer rules laid down pursuant to (1) and section 59 and make decisions about matters that are regulated pursuant to these provisions.

(3) The Minister for Environment and Energy is to supervise that the rules laid down pursuant to (1) are complied with. The Minister for Environment and Energy may order that matters that are in contravention of rules or decisions pursuant to (1) and (2) shall be put right immediately or within a time-limit.

(4) The Minister for Environment and Energy can lay down charges for requests for grid connection in accordance with rules laid down pursuant to (1) and for supervision, registration and control of wind turbines and wind-turbine owners in connection with the establishment of a nation-wide register of wind turbines and wind-turbine owners. There is right of distraint for these fixed charges.

The Report of the World Commission on Dams: Some implications for energy law

Achim Steiner and Lawrence J. M. Haas[1]

This Paper describes the genesis and outcome of the World Commission on Dams (WCD), an innovative process in global public policy-making, one that addresses conflicting viewpoints that have made large dams a flash point in the nexus of environment, water and energy development and social justice. The Commission 's final Report, "Dams and Development: A New Framework for Decision-Making," was derived from an intensive dialogue process that engaged key constituencies in the dams debate. It offers a practical and principled way to move beyond controversy toward consensus on ways to achieve more equitable and sustainable provision of water and energy services. From many perspectives there is urgency in doing so, such as growing water stress, chronic and deepening poverty in rural and urban areas in many parts of the world, as reflected in the lack of access to water and energy services, and the wider effects of growing competition for water resources among human and ecological systems.

In keeping with the energy law theme, this Paper considers broadly defined legal implications of the Commission 's work and its recommendations, and what may he required to turn policy to practice. It identifies some of the enabling laws and legal instruments the Commission explicitly and implicitly asks governments to deploy to help them respond to the dams controversy and achieve wider consensus on sustainable water and energy development. These provisions would support comprehensive options assessment and a "rights-and-risks" approach to pursue negotiated outcomes on development decisions, and otherwise underpin the priorities and policy principles the Commission has offered to achieve sustainable outcomes. This Paper also shows some of the responses to the final WCD Report by key constituencies, received after it was launched in November 2000, and it refers to activities underway at local, national and regional levels to act on the recommendations, or otherwise draw on the Report to inform national policy debates and project-level decision-making processes.

1 Introduction

Among the international Commissions reporting so far this millennium on water and energy development issues, the World Commission on Dams (WCD) through its report, "Dams and Development: A New Framework for Decision-Making," has issued perhaps the clearest and most comprehensive call to action for the legal fraternity and law-making constituencies in this field. The WCD report refers to itself as a milestone in the evolution of dams as a development option. Observers have characterized the multi-stakeholder processes that gave birth to the Commission, and around which it deliberated and produced its recommendations, as a watershed in global governance – one that also serves as a model for other resource development fields.

As agreed from the outset, the Commission dissolved itself when it submitted its final report to the international community in London in November 2000. Through its findings and recommendations the Commission explicitly called for inclusion of a number of key principles in the growing body of national legislation, laws and regulatory frameworks for water and energy development, and for these to be reflected in international approaches. It felt the framework and principles that it offered would not only go a long way to respond to the controversy over large dams, as one option for water management and energy supply, but would markedly improve decision-making processes and outcomes. Moreover, such steps would help to lower the risks faced by all stakeholders, and ultimately improve access to financing for initiatives that emerged from consultation and negotiation processes.

The Commission's work applies not only to new initiatives, but also to new ways of managing the world's existing 45,000 large dams and their associated service delivery infrastructure. Here the Commission emphasised the scope to address "remaining problems", to use the Chinese vernacular, that have led to many of today's controversies over large dams; and perhaps most important, to realize opportunities for high-return investments to optimize the social, environmental and economic performance of existing infrastructure.

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1 With valuable contributions from John Scanlon and Maria Socorro Manguiat of the Environmental Law Centre in Bonn, Germany.

This essay draws directly from the WCD report and knowledge base and analysis of the responses to it. Here energy law is viewed in its broadest sense. That is, the body of policies, legislation and legal and regulatory frameworks that circumscribe water and energy development, as well as more specific legal instruments and tools such as contracts and agreements. Strategic and project-level decision-making processes also provide different entry points to apply laws that influence or enable new decision processes and outcomes.

The Commission proposed five core values and a "rights-and-risks" approach, with supporting strategic priorities and guidelines to better integrate these perspectives in decision-making on water and energy development. The rights-and-risks approach is particularly helpful as an integrating mechanism for project-level decision-making. It enables effective negotiation initially on the decision whether to proceed with a particular project, and if approved, to support further negotiation at key decision-points through the project life cycle, particularly where rights may be significantly transformed or affected. It offers a way to include all legitimate stakeholders in negotiating development choices and agreements, including voluntary and involuntary risk takers and marginalized voices, and goes to the core of many issues in the dams controversy.

At the other end of the spectrum, strategic decisions define the rules that promote sustainable use of water and energy resources, and how these rules are applied. This includes questions critical in the dams debate such as what options are actually on the table to achieve sustainable development, and how they get there, how options are subsequently considered and weighed, and whether a "level playing field" exists for options, or in fact, whether policy or regulatory measures to correct for non-market factors are to be invoked. In this respect, an important theme in the WCD Report was to engage stakeholders in comprehensive options assessment processes at a strategic level, before embarking on project-level approval processes.

2 The genesis of the WCD, the process and its outcome

The debate on large dams is at the intersection of many debates over the impacts of globalization, human rights, equity and sustainable development. The proposal for an independent Commission on large dams was born as a response to this controversy, in a multi-stakeholder process involving representatives of civil society, the private sector, governmental, non-governmental and multilateral organizations. There was a powerful convergence of interest from all sides in the debate to move beyond stalemate, which not only delayed or threatened investment in large dams, but also was affecting alternative investments to meet priority needs. The World Bank and IUCN – The World Conservation Union brokered this agreement in a meeting in Gland, Switzerland in 1997. Based on that outcome, the Commission began work in 1998 under the Chairmanship of Professor Kader Asmal, then South Africa's Minister of Water Affairs and Forestry and later the Minister of Education.

The Commission's two mandated tasks were:

- to review the development effectiveness of large dams and assess alternatives for water resources and energy development; and
- to develop internationally acceptable criteria, guidelines and standards, where appropriate, for the planning, design, appraisal, construction, operation, monitoring and decommissioning of dams.

On the first agenda, the Commission's unanimous agreement was that dams have made an important and significant contribution to human development, and the benefits derived from them have been considerable. In too many cases an unacceptable and often unnecessary price has been paid to secure those benefits. More specifically:

- lack of equity in the distribution of benefits has called into question the value of many dams in meeting water and energy development needs when compared with the alternatives;
- by bringing to the table all those whose rights are involved and who bear the risks associated with different options for water and energy resources development, the conditions for a positive resolution of competing interests and conflicts are created; and
- negotiating outcomes will greatly improve the development effectiveness of water and energy projects by eliminating unfavourable projects at an early stage, and by offering as a choice, only those options that key stakeholders agree represent the best ones to meet the needs in question.

The five core values the Commission applied to inform its understanding of the issues were equity, efficiency, participatory decision-making, sustainability and accountability. It proposed a generic framework for decision-making based on recognising the rights and assessing the risks of all interested parties. This

framework was elaborated in seven strategic priorities for gaining public acceptance, comprehensively assessing options, addressing existing dams, sustaining rivers and livelihoods, recognising entitlements and securing benefits, ensuring compliance, and sharing rivers across boundaries; supported by practical criteria and guidelines.

The Commission felt this framework could be applied in all governance settings. It would require more work upfront for dialogue processes, and to put in place the enabling mechanisms for negotiation, but would ultimately serve to reduce risks, reduce overall cost and time, and deliver more equitable outcomes. It would help to integrate social, environmental, economic and technical dimensions in decision-making, add value to recent thinking on development, and add flesh to participatory planning principles advocated in the past decade, particularly starting with the Brundtland Commission on Sustainable Development (1987).

Moreover, by documenting the sources of controversy, and pointing to an alternative framework that avoided sources of controversy, the Commission offered no verdict, but an understanding and analysis of "what was broken and needs to be fixed or adapted". It did not prescribe a development model or outcome, but proposed a framework for effective and transparent decision-making. And it did not prejudge whether a dam should be built, but instead offered criteria to enable societies to identify preferred options themselves. Most important, it did not pre-empt whole societies from making an informed choice which is their sovereign and human right, but offered a principled way forward to address the issues, and how the international community may support that endeavour.[2]

3 The changing context the WCD addressed

The changing development context and trends in water and energy resource provided the rationale for the Commission's call to action. But certainly, the WCD's own work was not without precedent or peers. It worked on common ground with a number of other integrating global initiatives to address the challenges in water, energy, environment and sustainable development for the new millennium. These included processes around the World Water Forum (WWF) and Global Water Partnership (GWP), the UNEP-WEC World Energy Assessment Report (WEA-2000), and the Intergovernmental Panel on Climate Change (IPCC) supporting the United Nations Framework Convention for Climate Change (UNFCCC). Though the WCD had a more specific mandate, the same influences that are shaping governance and development thinking today informed each process.

3.1 The changing governance and development context

A number of overall trends in governance have significantly altered the context for decision-making on large dams and alternatives over the past twenty-five years. In fact part of the Commission's challenge was to offer ways to better translate these changes to new decision-making processes on dams. The first is the dramatic number of transitions from authoritarian to democratic rule. The democratizing trend has in turn been deeply interconnected with the spread of human rights norms and the proliferation and strengthening of civil society organizations, both domestically within countries and internationally. A further trend involves the globalization of development issues, and in particular, the increased prominence of market-oriented economic models and institutional processes for environmental protection and conservation.

Within this, there is a detectable shift in the way public interest is defined from one which placed a premium on strict technical or economic interests, to one which places much more weight on the rights and interests of people and communities affected by development activities, with a focus on equity in the spread of costs and benefits from development, including the concept of inter-generational equity in dealing with resource use. This applies to consumptive uses of water, as well as finite energy resources. It fundamentally shifts the basic perspective on management of resources from a more technical and economic optimization exercise to emphasise human development and sustainability, and puts management of the resource to optimize social needs and welfare, as a foremost criteria.

At the same time, roles and responsibilities among the public and private sectors and civil society are changing. This is not to say that the role of governments has become less important; simply that its role is changing in character in most governance settings. The role of civil society organizations has, by contrast,

[2] The WCD report and its knowledge base consisting of all the regional consultations, submissions, thematic papers, case studies, presentations and constituency reactions to the interim and final report are available at http://www.dams.org and on the website of the UNEP sponsored follow-up initiative that is discussed later in this essay at http://www.unep-dams.org

expanded and their legitimacy in representing and defending interests, in participating in decision-making on development, and in monitoring compliance is increasing, although not unchallenged. The private sector has also considerably expanded its role, undertaking service provision and other functions that were once – and not long ago – the exclusive remit of government.

The recent emphasis on good governance is shifting to insistence on transparent and participatory decision-making, which requires that the range of stakeholders not only be consulted but be empowered to negotiate in processes taking key decisions affecting them. Within this, the concepts of legitimacy and accountability are becoming pillars of the new order, and decisions that have not been taken in a context that guarantees their legitimacy are increasingly being challenged. Legitimacy is being evaluated on the grounds of transparency and openness, and participation. And stakeholders are developing ways to hold decision-makers and developers accountable for the fulfilment of their undertakings.

There is also a growing body of international instruments relating to human rights, as well as institutions to oversee their further development and application. While little of this may be binding and enforceable, there is a growing sense that development activities will be increasingly open to question and challenge if they infringe on these rights in a substantial and systematic way. International instruments will also continue to inform the development of national laws, and mechanisms for oversight of human rights are growing steadily stronger and more influential, both at national and international levels. These strengthen the arguments in favour of greater transparency, participation in decision-making and accountability for compliance.

Similarly the notion of the right to development is beginning to develop a normative framework for specifying responsibilities in applying the human rights approach to development. In the future, it is unlikely that approaches based on a narrow assessment of costs and benefits of specific actions will be tolerated if they do not adequately take into account the real impact of those actions on the rights and welfare of all those affected.

3.2 Sustainable management of fresh water resources

Global trends in water demand and supply reinforced what follows from analysis of governance and development trends – that is in spite of difficulties, negotiated outcomes offer the only practical way forward, and basis for improved development outcomes.

The WCD knowledge base shows the dramatic impact of water withdrawals from the world's lakes, rivers and ground aquifers, and how the growing water stresses impact on interdependent human and natural systems. By 2025, there will be approximately 6.5 times as many people as today, or 3.5 billion people living in water stressed countries. At present 2 billion people lack adequate, safe drinking water supply and sanitation. The unfolding scenario for water use in many parts of the world is one of increasing concern about access, equity and the response to growing needs. This will increasingly affect relations:

- within and between nations;
- between rural and urban populations;
- between upstream and downstream interests;
- between agricultural, industrial and domestic sectors; and
- between human needs and the requirements of a healthy environment and functional ecosystems.

Moreover, the evidence is compelling that climate change will bring additional pressure to the world's hydrological systems, watersheds, river basins and wetlands, increasing the uncertainty and scale of the challenge.

In face of this evidence, the Commission's view was that real strategic decisions are not about dams as such, but about wider options for water, energy and sustainable development. The challenge was not to mobilize so as to compete successfully, but to cooperate in reconciling competing needs and adapt successfully to changing circumstances. It is to find ways of sharing water resources equitably and sustainably. Ways that meet the needs of all people, as well as those of the environment and economic development. The Commission recognised that these needs are all intertwined.

3.3 Sustainable development of energy (electricity) systems

Fortunately, the global energy resource outlook is not as acute as that for fresh water, particularly for electricity generation. The WEA (2000) suggested that while individual countries have different energy resource endowments, there is no shortage of renewable energy or conventional fossil resources, or conversion options at all scales, to meet future electrical needs well into this century. The immediate concerns relate more to closing the equity gap, where close to one-third of humanity live with no access to electricity services, and to expand electrical services in developing countries to support growth and modernization, leaving aside the question of how those services are provided. A second pressing issue, related to sustainability, is how to address the causal linkage between present patterns of energy resource conversion and use, and climate change, given that power generation directly accounts for up to 30% of human generated GHG emissions, mostly from coal plant.

The WCD knowledge base showed that the power sector in virtually all countries is undergoing structural change, more rapidly so than the water sector. The motivations vary. But apart from allowing new forms of ownership and financing, the regulatory reforms facilitate market entry of renewable and more efficient conventional technologies, formation of decentralized or distributed electrical systems, and introduction of consumer-oriented energy services. Where enabling conditions are present in rural areas (e.g. political will and financial capacity), advances include the adoption of new decentralized, stand-alone systems such as solar units that "leapfrog" conventional approaches to service provision. At the other end of the spectrum, the regulatory reform processes in the power sector coupled with political changes are redefining energy security, less in national terms, and more in regional terms. This evidence is in the dramatic increase in the number of agreements for interconnection of regional power grids, regional power pool arrangements and gas and oil pipelines crossing national boundaries to supporting power generation in neighbouring countries.

Especially in Europe, the concern over global warming of conventional thermal generation has translated into a new impetus for regulation to promote renewable and non-conventional power generation options, and systems where the consumer "can choose" the generation source at some cost premium. EU governments have established "minimum resource portfolios" with tariff, tax and other subsidy equalization or levelling measures to achieve new targets for renewable generation in the supply mix. They, for instance, now require that a minimum of ten per cent of total electrical generation be from renewable energy sources by 2010. It is anticipated that such targets would be increased as climate change mitigation and adaptation strategies are finalized. This trend is not restricted to developed economies. China and India are moving toward setting renewable energy generation targets, though how the hydropower option is treated in the renewable equation varies from country to country, and is a source of ongoing debate at international levels.

It is also clear that many aspects of the regulatory reforms remain controversial, especially the ownership issues and tariff-related equity impacts. Certainly without adequate institutional safeguards such as transparent regulation and credible rules, divestiture or the opening up of power markets to private investors may contribute to market failure by increasing rent-seeking and introducing new opportunities for corruption, the recent concerns about power trading in California not withstanding.

3.4 Applying the rights-and-risks framework to seek negotiated outcomes

Few disagree that large dams fundamentally alter rivers and transform resources, frequently reallocating benefits and entitlements from local riparian users to new groups of beneficiaries at the regional or national level. In the Commission's view, issues of equity, governance, justice and power to decide entitlements were at the heart of the dams debate, and negotiated approaches serve best to reconcile the competing needs and entitlements. The Commission felt that a rights-and-risks approach provided an effective framework to determine who has a legitimate place in consultation on overall water and energy policy, what issues need to be on the agenda, and what legitimate groups need to be at the negotiation table on specific projects.

The rights-and-risks approach empowers decision-making processes based on the pursuit of negotiated outcomes, conducted in an open and transparent manner and inclusive of all legitimate actors involved in the issue. While this will present greater demands at early stages, it leads to greater clarity and legitimacy for subsequent steps in project-level decision-making and implementation and reduces the risks faced by all stakeholders. It shifts the basic perspective on management of resources to place more emphasis on human development dimensions.

The Commission did not have to look far to identify principles on rights. They are the same principles that emerge from the global debates on human rights, development and sustainability. And as mentioned, the emergence of a globally accepted framework of norms rests on the adoption of the Universal Declaration of Human Rights and later resolutions including the Declaration on the Right to Development adopted by the UN General Assembly in 1986, and the Rio Principles agreed in 1992.

In practice these have to be translated to the context. For upstream and downstream riverine communities affected by dams, there are a "bundle of rights" that potentially may come into play. These range from customary and traditional rights of ownership, tenancy, resources access, and livelihood benefit that may uncodified, to other more formal rights encoded in legislation. Rights may also belong to the individual, household or family, a traditional user or neighbourhood group, or to a community or public body, or other defined social entity such as indigenous people. At the other end of the spectrum are the rights of those who may be recipients, or the main beneficiaries from a resource transformation occurring elsewhere, and include their right of access to water and energy services essential to their right to develop, welfare, and livelihood.

The second element in the rights-and-risk approach, the assessment of risk (including rights at risk), adds an important dimension to understanding to what extent an intervention may impact on people's rights in a significant or systematic way. Traditional practice has been to restrict the definition of risk to that of the larger national economy in terms of avoided cost, or nationally defined water or energy security, or to the corporate investor or developer, in terms of loan repayment and expected returns on equity. In contrast, the WCD's Global Review showed that risks faced by a far larger group of stakeholders in dam projects were not addressed. Often these groups had risks imposed on them *involuntarily* and managed by others, including risks that directly affect their livelihoods, quality of life and culture. Typically, these involuntary risk-bearers have little or no say in overall water and energy policy, in the choice of specific projects to meet their needs, or in subsequent project design and implementation, thus denying them a stake in the decision-making process commensurate with their exposure to risk.

In the Commission's view *voluntary* risk-takers have the capacity to define the level and type of risk they wish to take and explicitly to define its boundaries. Involuntary risk bearers must engage with risk takers in a transparent process to negotiate equitable outcomes, in ways appropriate to the governance context. What the Commission proposed was that governments have a responsibility to establish the enabling framework for good faith negotiations to take place. To be effective this framework would include procedures for more effective mediation, and adjudication either through political or judiciary means, in the case of intractable disputes. Governments nonetheless retained ultimate responsibility for all processes, decisions and their sovereignty.

3.5 Using the planning and project cycle

What the Commission identified was five generic decision points in the strategic planning and project cycle where an appropriate group of stakeholders should be involved, such as identified with the rights-and-risks approach.

The decision-points at the strategic level were:

1. needs assessment – validating the needs for water and energy services; and
2. selecting alternatives – identifying the preferred development plan consisting of a mix of complementary options from among the full range of development options.

And where a dam emerges from this process, three further critical decision points are:

3. project preparation – verifying that agreements among stakeholders are in place before tendering construction contracts;
4. project implementation – confirming compliance with agreements before commissioning; and
5. project operation – adapting to changing contexts.

The five stages and associated decision points need to be interpreted within the overall planning and regulatory contexts of individual countries such as for government and privately licensed projects. And to some extent strategic and project-level planning activities are interactive. The steps also illustrate points of entry to apply different legal instruments and tools, and how comprehensive options assessment can be lifted out of project-level debates to strategic decision-making levels.

4 Some of the legal implications arising from the WCD Report

4.1 Strategic Priorities

The Commission suggested, and in fact urged governments to review their national policies, regulations and institutional frameworks in light of the WCD Report, using multi-stakeholder processes. And while different States are at different stages in developing legal and regulatory systems and institutional capacity, much of the work in translating new policy to legal and regulatory instruments would be accomplished with local legal knowledge, capacity and expertise. There are areas where it may also be advantageous for national legal entities to draw on international law centres and networks, such as the IUCN Environmental Law Centre in Bonn and the IUCN Commission on Environmental Law, a network of over 820 lawyers in more than 130 countries.

Following are three of the Commission's seven strategic priorities and possible implications for policy and legal provisions. A discussion of possible entry points for legal measures to act on the remaining four strategic priorities is then provided.

Strategic Priority 5. Recognising entitlements and sharing benefits

Key Message

Joint negotiations with adversely affected people result in mutually agreed and legally enforceable mitigation and development provisions. These provisions recognise entitlements that improve livelihoods and quality of life, and affected people are beneficiaries of the project. Successful mitigation, resettlement and development are fundamental commitments and responsibilities of the State and the developer. They bear the onus to satisfy all affected people that moving from their current context and resources will improve their livelihoods. Accountability of responsible parties to agreed mitigation, resettlement and development provisions is ensured through legal means, such as contracts, and through accessible legal recourse at national and international level.

Effective implementation of this strategic priority depends on applying these policy principles:

- Recognition of rights and assessment of risks is the basis for identification and inclusion of adversely affected stakeholders in joint negotiations on mitigation, resettlement and development related decision-making.
- Impact assessment includes all people in the reservoir, upstream, downstream and in catchment areas whose properties, livelihoods and non-material resources are affected. It also includes those affected by dam-related infrastructure such as canals, transmission lines and resettlement developments.
- All recognised adversely affected people negotiate mutually agreed, formal and legally enforceable mitigation, resettlement and development entitlements.
- Adversely affected people are recognised as first among the beneficiaries of the project. Mutually agreed and legally protected benefit sharing mechanisms are negotiated to ensure implementation

Among the possible arrangements national policy-makers and the legal fraternity may use to improve the recognition of entitlements and sharing of benefits, depending on whether these provisions are currently embodied in existing laws and statutes, include steps to:

- consolidate and clarify ambiguous laws and regulations on traditional, customary and formal entitlements and rights to be considered in negotiations;
- introduce formal requirements for negotiation on projects, and clarifying procedures and mechanisms to determine effective stakeholder involvement;
- clarify roles, authorities and responsibilities of governments, licensing agencies, regulators and developers (public or private) in such negotiations;
- introduce support mechanisms for the poorest and most vulnerable stakeholders, such as funded access to independent legal advice;
- clarify policies and procedures for either political resolution, or arbitration and legal recourse for dispute settlement; and

- develop models for contracts and agreements among stakeholders such as for benefit sharing, new entitlements, and for resettlement and compensation agreements.

The rights-and-risks framework offers a useful starting point for a number of these tasks. The WCD knowledge base showed there are surprisingly few mechanisms for benefit sharing in widespread use today, despite the fact that models exist for different governance settings, especially for hydropower projects that generate a revenue stream. The WCD knowledge base also shows many instances of benefit sharing for projects with limited revenue streams such as irrigation and flood control projects. These are typically livelihood entitlement approaches that arise from negotiation, and that go well beyond one-time cash compensation for lost and property assets. These include new entitlements to replace those entitlements lost, provide access to services generated by the dam to its host community, and ongoing financing of local enterprise development to enhance long-term welfare and livelihoods.

Strategic Priority 6. Ensuring compliance

Key Message

Ensuring public trust and confidence requires that governments, developers, regulators and operators meet all commitments made for the planning, implementation and operation of dams. Compliance with applicable regulations, criteria and guidelines, and project-specific negotiated agreements is secured at all critical stages in project planning and implementation. A set of mutually reinforcing incentives and mechanisms is required for social, environmental and technical measures. These should involve an appropriate mix of regulatory and non-regulatory measures, incorporating incentives and sanctions. Regulatory and compliance frameworks use incentives and sanctions to ensure effectiveness where flexibility is needed to accommodate changing circumstances.

Effective implementation of this strategic priority depends on applying these policy principles:

- A clear, consistent and common set of criteria and guidelines to ensure compliance is adopted by sponsoring, contracting and financing institutions and compliance is subject to independent and transparent review.
- A compliance plan is prepared for each project prior to commencement, spelling out how compliance will be achieved with relevant criteria and guidelines and specifying binding arrangements for project-specific technical, economic, social and environmental commitments.
- Costs for establishing compliance mechanisms and related institutional capacity, and their effective application, are built into the project budget.
- Corrupt practices are avoided through enforcement of legislation, voluntary integrity pacts, debarment and other instruments.
- Incentives that reward project proponents for abiding by criteria and guidelines are developed.

Governments and other stakeholders need to be satisfied that once agreements are reached, all parties can monitor and ensure compliance with obligations throughout the life of a project. Indeed the Commission felt that past conflicts over dams arose all too frequently from the failure to fulfil voluntary and other commitments that were made, to observe statutory regulations and abide by internal guidelines. Compliance mechanisms largely exist for construction, engineering and equipment performance aspects of dams. The concern here is to extend compliance provisions to cover environmental and social performance, reflecting agreements reached in this regard. This is consistent with a shift toward optimizing the performance of infrastructure away from strict technical and economic criteria to enhance human development returns.

Among the possible measures to ensure effective compliance that should be in place to improve compliance when a decision is taken to proceed with a new dam, or to significantly alter an existing dam, include steps to:

- introduce requirements for compliance plans in regulations and licences for new projects that complement existing requirements such as for resettlement and environmental mitigation and management plans, and when relicensing existing facilities;
- clarify roles, authorities and responsibilities of governments, licensing agencies, regulators and developers (public or private) and affected stakeholders in developing compliance plans, monitoring and compliance, and to provide accessible means to address and remedy non-compliance;

- define incentives and sanction measures (rewards and penalties) to include in project agreements and sub-agreements among stakeholders, appropriate to different circumstances; and
- provide model compliance plans and monitoring indicators for stakeholders to be consulted on, or agree to as appropriate.

Legally-based sanctions for non-compliance would apply to projects, private concessions and licences to quasi-public entities. The WCD Report suggested that environmental performance bonds supported by financial guarantees are a possible mechanism, where there is some experience in mining and the construction industries. Bonuses and other incentive mechanisms have also been used for different purposes. Different instruments may be required for public entities building and operating dams, or where a government ministry or agency is responsible separately for resettlement, environmental mitigation and compensation components of a project. Forming an independent panel for compliance review is one measure that may be implemented quickly for these circumstances. Trust funds that hold and manage funds set aside for a particular purpose (such as resettlement or environmental measures) with transparent disbursement is another possible measure. Other longer-term steps being advocated are standards and certification approaches, working with recognised international standards groups such as the International Standards Organization, of which many governments arc members.

Strategic Priority 7. Sharing rivers for peace, development and security

key message

Storage and diversion of water on transboundary rivers has been a source of considerable tension between countries and within countries. Dams are specific interventions for diverting water that require constructive cooperation. Use and management of resources increasingly becomes the subject of agreement between States that promotes mutual self-interest for regional cooperation and peaceful collaboration. There is a shift in focus to sharing rivers and water and the benefits deriving from them. States are innovative in defining the extent of issues that form the scope of negotiations and do not restrict themselves to seeking allocation of a finite resource.

Effective implementation of this strategic priority depends on applying these policy principles:

- National water policies make specific provision for basin agreements in shared river basins. Agreements are negotiated on the basis of good faith among riparian States. They are based on principles of equitable and reasonable utilisation, no significant harm, prior information and the Commission's strategic priorities.
- Riparian States go beyond looking at water as a finite commodity to be divided, and embrace an approach that equitably allocates not the water, but the benefits that can be derived from it. Where appropriate, negotiations include benefits outside the river basin and other sectors of mutual interest.
- Dams on shared rivers are not built in cases where riparian States raise an objection that is upheld by an independent panel. Intractable disputes between countries are resolved through various means of dispute resolution including, in the last instance, the International Court of Justice.
- For the development of projects on rivers shared between political units within countries, the necessary legislative provision is made at national and sub-national levels to embody the Commission's strategic priorities of 'gaining public acceptance' 'recognising entitlements' and 'sustaining rivers and livelihoods.'
- Where a government agency plans or facilitates the construction of a dam on a shared river in contravention of the principle of good faith negotiations between riparians, external financing bodies withdraw their support for projects and programmes promoted by that agency.

The need to pursue negotiated outcomes is perhaps most visibly demonstrated in the case of States sharing rivers. There are 216 international river basins worldwide, most do not have agreements covering water allocation, certainly there are few agreements covering shared, beneficial use of ground water aquifers.

As shown in the WCD knowledge base, negotiation of agreements between riparian States has proceeded on a case-by-case basis without an overarching globally binding legal instrument. With the intensifying scarcity of water, pressures will grow for mechanisms to resolve disputes between riparian states. Broad international consensus has been reached on some overarching principles such as embodied in the 1966 Helsinki Rules on Use of Water in International Rivers, as well as more recent agreements such as the Petersburg Declaration, which saw water as a catalyst for cooperation and Dublin Water Principles (1992), and the Ministerial Declaration and Bonn Recommendations for Action from the International Conference on

Freshwater (2001). But in the absence of effective international agreements, other measures need to be invoked.

An approach the WCD offered was for riparian states to constructively widen the considerations for negotiated outcomes on sharing rivers to a broader framework of cooperation. This would shift the primary focus from one of negotiation about how to allocate finite water quantities, to negotiation of sharing benefits that derive from the use of water in a wider development context, inclusive of other synergies such as in wider terms of trade. This approach may help avoid water disputes from becoming polarized and entrenching negotiating positions. Other avenues include support for integrated basin management, including river basin organizations and regulatory bodies and enforcement agencies. Many countries internally, and international financing agencies almost without exception, now embrace the principle of integrated river basin management (such as the European Union Directive 2000/60/EC establishing a framework for Community action in the field of water policy). Legal and regulatory reforms within countries, such as arrangements to share resources among provinces or states within countries, build toward and help improve the enabling environment for eventual international agreements. This also offers an integrating framework and entry point for many cross-cutting laws including those concerned with water allocation and conservation, water quality, and ecosystem restoration and protection.

4.2 Some implications for legal mechanisms and tools for the remaining four strategic priorities

The following highlight issues where policy and legal mechanisms may need to be introduced, or strengthened, to better achieve the underlying aims of the four remaining strategic priorities of the WCD, namely: gaining public acceptance, comprehensively assessing options, addressing existing dams, and sustaining rivers and livelihoods. The Commission recognised that the approach and timeframe to revise policies and put supporting tools in place is country and context specific.

Gaining public acceptance

Laws that provide better more open access to information is one central and comparatively easy measure to gain public acceptance and confidence. This is not only for stakeholders directly involved in project-related negotiation, but also for the wider stakeholder constituencies. Enabling laws are also needed to ensure that information such as environmental impact assessment reports on new project proposals and monitoring reports on the performance of existing projects are more accessible and understandable to the public. Although regional in scope, the adoption of the Aarhus Convention is of global significance in setting a regional framework for gaining more open access to information.

Comprehensive options assessment

A feature that the Commission proposed that was new or not widespread practice was an assessment of all of the options of interest to stakeholders, and to move options assessment processes "upstream" to strategic planning level. In some cases, assessments and limited debates on options are now carried out within, or prompted by, project approval processes for specific dams. Revisions to planning and regulatory systems to accommodate this may not be difficult, but may be gradual. Beyond this step, laws and regulations will need regular assessment and possible revision to ensure a level playing field for all options. This will take into account, for example, direct and hidden subsidies, or at minimum, make these explicit in decision-making processes. This also provides scope to identify laws and regulatory provisions to accelerate the adoption of options, or more sustainable practices where appropriate. Such measures not only apply to supply options, but also to demand measures to encourage longer-term structural efficiency in water or electricity demand.

Addressing existing dams

What the Commission called for that was new, or not widespread practice, was to ensure that improvements in existing dams are part of comprehensive options assessment (i.e. improving social, environment, technical and economic performance), and secondly, to involve stakeholders in adaptive management of existing dams, particularly where changes in the operation would significantly affect upstream or downstream communities and ecosystem services. It also recommended a review of policies and legislation to address unresolved claims and disputes that were unforeseen or unintended outcomes of existing dams. An important step in this

direction is to ensure that all dams have licences that stipulate roles, responsibilities and entitlements of all stakeholders in how the dam is managed and operated.

Sustaining rivers and livelihoods

Many countries have developed new policies and laws relatively recently to address a range of environment protection and restoration concerns related to rivers, watersheds, wetlands and aquatic ecosystems, that directly and indirectly concern dams. At present, 177 countries have accepted, approved, or acceded to the Biodiversity Convention and 122 to the Ramsar Convention on Wetlands. The WCD report calls for the better integration of these measures in dam-related decision-making, and in option assessment processes to ensure the full range of options for sustainable management of water resources are debated. What the Commission called for that was new, or not in widespread practice, was the consideration of policies on intact rivers and environmental flows, where there are numerous models and precedents to draw upon.

5 Responses and follow-up to the WCD Report

While reaction to the Dams and Development Report when it was issued in November 2000 was largely positive, there was no unanimous endorsement of all its aspects by all constituencies. In some instances there were different responses even from international and national committees of the same organizations. Some – notably, on both sides of the debate – felt the weight of some findings unbalanced against their respective positions, or that recommendations could have gone further, or went too far. Yet the overwhelming consensus was that, despite their remaining differences in perspectives, the Report provided a solid reference point for all parties to move forward, both individually and collectively.

5.1 Initial responses after the WCD Report was launched in November 2000

As an immediate response, a number of governments, NGOs, civil society representatives, development agencies, professional associations and engineering companies engaged in the WCD process issued statements, indicating that the philosophy of the Report and its specific recommendations would be reflected in their policies and practices.

NGOs and civil society groups collectively called for full and complete adoption of the WCD Report by all governments as a starting point, but especially by the multilateral financing agencies, bilateral agencies and Export Credit Agencies (ECAs). A coalition of a number of peoples' movements and NGOs also called for a moratorium on dams until a time-bounded programme to implement the Report's major recommendations were agreed. Many industry groups and professional associations welcomed the Report unconditionally. Other key groups such as the International Commission on Irrigation and Drainage (ICID), International Commission on Large Dams (ICOLD) and International Hydropower Association (IHA), while noting basic agreement on the strategic priorities and principles, indicated concerns about what they felt was a negative tone of the review of past performance of dams. They also felt the Report's criteria and guidelines, while based on best practices, could make it too difficult to construct any new dams, and thus could be interpreted as anti-dam, or even anti-development. The World Bank and Asian Development Bank immediately welcomed the Report, but the World Bank also said that the critical test for it would be whether its country members represented by the major borrowers accepted the Commission's recommendations.

Reactions after the WCD held a series of regional launches to present the report to governments and constituencies in the debate, indicated substantive agreement emerging across the spectrum of interests on some of the following points:

- that the linkage between water, dams and wider development challenges was correctly identified in the Report, and that an increasing number of countries are facing an urgent need to proceed with investments;
- that countries should review their national policies, legislation and large projects in the context of the WCD Report;
- that multilateral and bilateral financing agencies should review their policies in the context of the WCD Report;
- that core values and strategic priorities the Commission offered were appropriate for these reviews;
- that a fair and realistic assessment of all options is needed early in the planning process;

- that sector and river basin studies are needed to get a broadly acceptable portfolio of projects;
- that there should be a greater focus on refurbishment and optimizing technical, economic and environmental performance of existing dams and other assets;
- that guarantees for the social and environmental mitigation work are needed and compliance plans are needed which clearly specify responsibilities; and
- on the need to continue the dialogue among the constituencies so as not to miss the window of opportunity presented by the WCD process and its momentum.

A number of developing countries responded to the Report at the regional launches in different capitals, or in a direct response to the WCD Chairman, or through the outreach work of the World Bank and ADB canvassing their Members' reactions. Some, but certainly not all, agreed with many aspects of the Report, especially the core values, strategic priorities and policy principles. Many expressed strong concerns about the practicality of the detailed guidelines, amidst concerns that the WCD Report, if adopted in total by international financing agencies, would lead to greater conditionality. Moreover, because they had not directly authored or negotiated key aspects of the Report, many developing government representatives wanted time to consider its implications more fully, using multi-stakeholder processes in some cases.

The majority view of members of the WCD Forum at its final meeting in February 2001 was that an information clearinghouse function was needed to support the national dialogues spawned by the Report, and build on the unprecedented interest in the Report, while negotiations proceed at the international level on the next steps.

5.2 Two years after the release of the final WCD report

In response to the WCD Forum request, the United Nations Environment programme (UNEP) agreed to host the Dams and Development Project (DDP). Building on the dialogue of the WCD and the WCD's core values and strategic priorities, the aim of this two-year programme is to promote a dialogue on improving decision-making, planning and management of dams and their alternatives based on the WCD core values and strategic priorities. For this, UNEP has constituted a 14 member Steering Committee, a support Secretariat, and a Dams and Development Forum of 90 representatives from different constituencies, 50 who were formerly WCD Forum members. UNEP also sees the DDP and the broad representation of the Steering Committee as a model for more substantive national processes to follow in digesting and taking action on the Report. The first Forum meeting was held in Nairobi in June 2002.

A number of organizations actively participating in the DDP will channel further responses to the WCD Report and how it may be applied in different countries and at international levels through the DDP platform for dialogue. Others countries and organizations have already taken steps to assess how to integrate the WCD report in their own activities, or have launched complementary initiatives to achieve this. A sampling of these is noted as follows. This is not comprehensive, but rather to indicate the nature of the follow-up.

Activities at the national level

Separate to the WCD launch meetings in different capitals, over 22 national governments have arranged or have participated in activities ranging from multi-stakeholder seminars and workshops to national forums to gather responses to the Report and decide further practical steps. A few countries have moved ahead with more substantive, multi-stakeholder reviews of their policies and programmes, and many more are likely using the report as a reference in ongoing programmes. For instance, the South African government is using the WCD Report to scrutinise their national policies and procedures on dams with open stakeholder processes. The Government of Pakistan has initiated a one-year process with donor support to consult with stakeholders in all provinces and territories, and have a national debate to help generate recommendations for policy reforms by the Government through enhancing understanding of the WCD Report, combined with national issues.

Most OECD country members indicate that they had already, or will take steps to implement WCD recommendations in their development assistance programmes, and reflect them in the export credit agency policies. They have indicated they will continue to take similar positions as Board Members of multilateral agencies and would explore further mechanisms to harmonize policies among bilateral programmes on these matters. For example, the USA Senate Committee on Appropriations in its report in 2001 urged the World Bank to continue to engage with the full range of interested parties in the implementation of the WCD's

report, and to integrate these guidelines to the fullest extent practicable into the Bank's relevant operational policies and directives, including those relating to resettlement, environmental assessment, and water and energy policies.

Multilateral Development Banks

After its initial internal review and canvassing of borrowing Country reactions, the World Bank launched its own initiative under a Dams Planning and Management Action Plan. The stated aim of the initiative is to improve the quality of its operations by building on the core values and strategic priorities of the WCD report. This includes a series of initiatives to identify best practice, such as on stakeholder involvement, benefit sharing and comprehensive options assessment. The World Bank is also participating on the DDP steering committee. Similarly, the Asian Development Bank after sponsoring regional dialogue among its Members on the report, including a workshop with delegations from 15 member countries including China, India, Pakistan, Nepal, Indonesia, Thailand, the Philippines and Malaysia, indicated that it will determine the extent to which the Report's recommendations may necessitate changes in its existing procedures. Agencies including the African Development Bank, the Inter American Development Bank and the European Bank for Reconstruction and Development indicated similar intentions to apply the WCD principles in their lending policies.

International development organizations and conventions

UNEP is hosting the DDP and will be a primary vehicle to bring the WCD report directly into inter-governmental discussion forums. IUCN – The World Conservation Union, apart from resolutions to respond to the recommendations of the WCD report passed at the World Conservation Congress and subsequent resolutions of the IUCN Council, is participating on the DDP Steering committee and has established a programme of work to respond to the WCD report. Other international development organizations working with the WCD report include the OECD-DAC Environmental Development Committee and the OECD Export Credit Agency Working Party, who indicate they will incorporate reviews made of the WCD recommendations in their efforts to harmonize guidelines and ECA activities. The members of the Convention on Biological Diversity and the Ramsar Convention on Wetlands are similarly conducting assessments on how the Report can be integrated in the Convention's activities.

Private sector and professional associations

Private sector groups including equipment manufacturers and consulting firms are represented on the DDP Forum and DDP Steering Committee. The Hydro Equipment Association (HEA) has been formed to represent the hydro equipment industry in the follow-up dialogue and actions with other stakeholders resulting from the WCD Report. IHA has subsequently joined the Steering Group of the DDP. While ICOLD and ICID remain cautious about engaging directly in the DDP process, subsequent to the WCD report, ICOLD established an ad-hoc Committee on dams to "Implement the ICOLD Position Paper on Dams and Environment" and extend it to Governance of Dam Projects, including ethical points of view. ICID has formed a new task force for "Promoting Appropriate Decision-Making Procedures for New Dams, particularly for Irrigation, Drainage and Flood Management".

Civil Society and NGO Community

NGOs and advocacy groups have been actively disseminating the WCD report to their constituencies and have brought the Report into national policy dialogue processes and project-specific consultations in different countries. For example, the International Rivers Network has published a Citizens Guide to the WCD. Key civil society and NGO groups are actively involved in the DDP follow-up process participating on the DDU Forum and Steering Committee, and specifically have been monitoring the responses of the key donor agencies, the development banks and companies to the Report. They have for instance increased pressure on the World Bank and OECD country ECAs for the adoption of the Report. Other NGO groups have been helping to sponsor national or regional dialogue on the WCD report inviting governments and all constituencies.

6 From policy to practice

The WCD report is certainly not the last word on large dams, or on how the issues raised in the dams debate should be tackled. It derives its significance from the rapidly changing context into which the Commission's recommendations are offered, at a time when sustainable water resources management concerns are rapidly moving to the top of the global development agenda, as is most evident from the United Nations Millennium Declaration and the outcomes from the World Summit on Sustainable Development, and the Johannesburg Political Declaration and Plan of Implementation. The WCD's own legitimacy in offering a way forward was that it engaged the entire spectrum of participants in the dams debate, and at all levels, in an open process. It offered itself as a model for what can be achieved at the national level. Certainly after two years of intense study, dialogue and reflection, the Commission felt its rationale and framework offered scope for progress on this issue that no single perspective on its own may offer. In their 'Call to Action' the Commission declared that the WCD report itself was not a blueprint. They encouraged all parties to use it as "a starting point for discussions, debates, internal reviews and reassessment of existing procedures". As the Commission hoped, stakeholders have moved on with the dams debate, largely informed by, and in large measure with constant reference to the Commission's work. The acknowledged task now is to move from policy to practice. And in this respect the legal fraternity in countries and working at the international level will have a significant role to play.

The contribution of international law to achieving global sustainable energy production and consumption

Adrian J. Bradbrook and Ralph D. Wahnschafft[1]

In the context of sustainable development, energy has recently achieved prominence at the World Summit on Sustainable Development, held in Johannesburg in September 2002. The Plan of Implementation agreed to at this Summit represents the first substantive international agreement that charts a way forward towards reducing energy consumption in developed countries and ensuring that all humankind has access to modern energy services. This instrument may be viewed as the first step towards a global energy policy. Further work and international instruments will be required to ensure concrete action. Against the background of this evolving area of international law, the authors reflect on the possibilities for achieving a global consensus on sustainable energy production and consumption. The authors advance proposals for a non-binding universal Statement of Principles for a Global Consensus on Sustainable Energy Production and Consumption, which could become the core for developing "soft international law" on energy sector development and international cooperation in energy.

1 introduction

Over the past 50 years, the intergovernmental consultation process under the umbrella and the framework of the United Nations, its General Assembly, and its various subsidiary organs and Commissions has produced a large number of international conventions and protocols under which nations have committed themselves to agreed principles of international law and global standards. Whilst Conventions and Protocols form the core of binding international law, the world community has always recognised the value of achieving consensus in the formulation of non-binding principles and universal policy guidelines though which policy issues of international concern can be addressed.[2]

Growing recognition of the need to achieve an ecologically more sustainable socio-economic development has clearly marked the international development debate throughout the past decade.[3] In the same context, the need to urgently address energy-environment related issues and to work towards a sustainable energy future for all humankind has been widely recognised.[4] In spite of the increased global concerns for greater environmental protection and greater integration of environmental concerns into energy sector and economic decision-making, and in spite of a considerable potential for international consensus on global policy guidelines in this field, no universal "code of conduct," "guideline," "action plan" or other form of "soft law" has yet been established.[5]

This chapter seeks to remedy this omission and propose draft guidelines on sustainable energy production and consumption applicable to both developed and developing countries.

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1 An earlier version of this paper was published by the authors in (2001) 19 *J. Energy and Natural Resources L.* 143.

2 The use of such principles and guidelines has its origin in 1948 in the Universal Declaration of Human Rights (UNGA Res 217A (III); UN Doc A/810), probably the best-known and most frequently cited soft law document.

3 The importance of sustainable development was brought to international prominence in 1987 by the report of the World Commission on Environment and Development (the Brundtland Commission), created by the UN General Assembly in 1983: *See, Our Common Future,* OUP, 1987.

4 For example, in November 2000 the UN ESCAP organized in Bali, Indonesia, the Asia-Pacific NGO Symposium on Regional Perspectives and Initiatives for Achieving a "Sustainable Energy Future for All." The authors of this article were invited participants.

5 For a discussion of the role of "soft law," *see* C. Chinkin, "The Challenge of Soft Law: Development and Change in International Law" (1989) 38 *Int & Comp LQ* 850; P Dupuy, "Soft Law and the International Law of the Environment" (1991) 12 *Michigan J. Int.* 215.

2 The terms of the proposed Statement of Principles

The possible terms of a Statement of Principles, as drafted by the authors, are set out in full in the final section of this article. Readers should refer to this text when considering the discussion of the terms in this section of the article.

While the majority of the terms of the proposed Statement of Principles contain novel ideas developed by the authors, some of the articles have been influenced by other soft law documents, in particular Agenda 21[6] and the Non-Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all Types of Forests.[7] The adoption of ideas from analogous documents, where appropriate, is considered sensible from a political standpoint in light of the anticipated difficulty in achieving the necessary international consensus to secure the adoption of the proposed Statement of Principles by the majority of nations. Where a particular clause or framework has been successfully negotiated in other parallel contexts, it would seem more likely to be regarded by the international community as acceptable in this context in comparison with other possible solutions.

A number of the minor provisions of the proposed Statement of Principles are self-explanatory and require no comment. The discussion in the remainder of this article will explain the meaning and significance of the important provisions.

2.1 Preamble

There is no consistency as to the length of preambles in modern international legal instruments. The goal should be to ensure that the context and background of the issue to be addressed by the document is adequately explained.

The proposed preamble seeks to make the following points:

- There should be universal access by the world population to clean and affordable energy resources. This is considered important in light of the fact that approximately two billion people in the world today (approximately one-third of the entire world population) are without access to electricity.[8] In areas without electricity supplies, people are obliged to rely on burning wood and animal manure for their energy requirements, which is unsustainable and causes severe health problems due to indoor air pollution.[9]
- Energy is a key component in the drive towards sustainable development.
- The needs of future generations must be taken into account in determining energy policy. This is consistent with the newly-emerging principles of international environmental law.[10]
- The current heavy reliance on fossil fuels for energy production is unsustainable in the long term.
- The principle of common but differentiated responsibility[11] dictates that different energy solutions will be required in respect of developed and developing countries. As the current unsustainable energy production and consumption patterns were created initially by the developed countries, it is appropriate that the lead in introducing reforms and changes leading to sustainable energy patterns should be introduced and financed by the developed countries. This is consistent with other modern international environmental law instruments, where developed countries have taken primary responsibility for change.[12]

6 A/Conf 151/26. Sec N. A. Robinson (ed), *Agenda 21: Earth 's Action Plan*, Oceana Press, 1993.

7 (1992)31 *ILM* 881.

8 United Nations Development Programme, United Nations Department of Economic and Social Affairs and World Energy Council, *World Energy Assessment: Energy and the Challenge ofSustainability,* United Nations, New York, 2000, at 44.

9 *Id,* at 68.

10 *See generally,* E. Brown Weiss, *In Fairness to Future Generations: International Law, Common Patrimony and Intergenerational Equity,* Dobbs Ferry, NY, 1988; E. Brown Weiss, "Our Rights and Obligations to Future Generations for the Environment" (1990) 84 *American J. Int. L.* 198; L. Gündling, "Our Responsibility to Future Generations" (1990) 84 *American J. Int. L.* 207. This principle was first recognised in Principle 2 of the Stockholm Declaration on the Human Environment (1972) 1 1 *ILM* 1416. It is also referred to in Principle 3 of the Rio Declaration on Environment and Development ((1992) 31 *ILM* 874), article 4 of the UNESCO Convention for the Protection of the World Cultural and Natural Heritage ((1972) 11 *ILM* 1358) and in a number of UN General Assembly Resolutions (for example, Protection of Global Climate for Present and Future Generations of Mankind, G. A. Res 43/53, 6 December 1988, UN Doc A/Res/43/53, 27 January 1989.

11 Proclaimed in principle 7 of the Rio Declaration on Environment and Development (1992) 31 *ILM* 874.

12 *See,* for example, the United Nations Framework Convention on Climate Change (1992) 31 *ILM* 849 and its associated Kyoto Protocol (1998) 37 *ILM* 22.

2.2 Objectives

Articles 1–3 contain a wide range of objectives of the Statement of Principles. The major features of these are as follows:

- Sustainability in the energy context is not inconsistent with the right of each State to promote economic development. However, it is the responsibility of each State to ensure that such development is not inconsistent with environmental objectives and reduces possible adverse impacts on human health to an absolute minimum.
- Energy security is a valid concern when considering sustainable energy policies.[13] This dictates a need for the international community to promote energy efficiency and to shift from fossil fuels to other energy resources. The past heavy reliance on oil and gas has caused international instability and tension and has led to armed conflict. For example, the current international dispute involving the People's Republic of China, Viet Nam and the Philippines over sovereignty in the Spratly Islands in the South China Sea appears to concern the ownership of the suspected energy reserves in the seas surrounding the islands and to have little (if any) relevance to the sovereignty of the islands themselves.[14]
- The development of appropriate national energy laws and regulations, as well as energy policies, is an important element in the promotion of sustainable energy production and consumption. The exact form that such measures might take is considered in more detail below.[15]
- The need for additional financial assistance to developing countries to adopt sustainable energy policies together with technology transfer. This factor has been reiterated in all major environmental conventions in recent years.[16]
- The need to reduce wastage of fossil fuels based on past energy production and consumption practices. While still plentiful, coal, oil and gas reserves are finite and will eventually be exhausted. Reduction in wastage will allow additional time for the world to develop adequate alternative renewable energy resources.
- The promotion of energy efficiency and renewable energy resources represents the best sustainable path for the world to take.
- When assessing the economic viability of alternative energy paths, consideration must be given to external environmental costs. The present system of energy accounting largely ignores such issues and makes traditional fossil fuel-based energy policies appear to be artificially cheap. For example, when comparing the economics of road and rail transport for the transport of goods, no allowance is traditionally made for costs such as road damage caused by heavy vehicles, damage to health caused by poor air quality in cities as a result of vehicle exhaust, or public hospital costs resulting from vehicle accidents. Similar comparisons can be made in the context of the costs of alternative forms of electricity generation.[17]

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13 On the importance of national energy security, particularly for developed countries, *see,* for example, R. Belgrave, C. K. Ebinger and H. Okino (eds), *Energy Security to 2000,* 1987; G. C. Georgiou, "US Energy Security and Policy Options for the 1990s" (1993) 21 *Energy Policy* 831; C L Orman, "The National Energy Strategy – An Illusive Quest for Energy Security" (1992) 13 *Energy L.J.* 251.

14 *See* D. Ong, "The Spratlys Dispute Over Marine Resources: Time for a New Approach?" (1994) 12 *Oil and Gas Law and Taxation Rev* 352; D. Ong, "Joint Development of the Spratly Islands' Marine Resources: Legal Problems and Prospects for Solutions" (1993) 11 *Oil and Gas Law and Taxation Rev.* 158; G. M. Valero, "Spratly Archipelago Dispute: Is the Question of Sovereignty Still Relevant?" (1994) 18 *Marine Policy* 314; L. G. Cordner, "The Spratly Islands and the Law of the Sea" (1994) 25 *Ocean Development and International Law* 61.

15 *See* notes 48–9 below, and accompanying text.

16 *See, for example, articles 11–12 of the United Nations Framework Convention on Climate Change ((1992) 31 ILM 849); article 11 of the Kyoto Protocol to the Framework Convention on Climate Change ((1998) 37 ILM 22); article 10–10A of the Montreal Protocol on Substances that Deplete the Ozone Layer ((1987) 26 ILM 1541).*

17 *See* the seminal work by Pace University Center for Environmental Legal Studies, *Environmental Costs of Electricity,* Oceana Publications Inc, New York, 1990.

2.3 Common principles

The two proposed common principles articles attempt to deal with the difficult balance between respecting each State's sovereignty with the need to control transboundary environmental damage. In *Trail Smelter*[18] an Arbitration Tribunal awarded damages to the United States in respect of air pollution damage caused by a Canadian smelter and required Canada to take appropriate control measures to ensure the cessation of the harm. The Tribunal stated that no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another.[19] Article 4 seeks to incorporate this decision within the energy context and to expand the principle so as to include all forms of environmental damage resulting from energy production and consumption. It is consistent in its wording with Principle 21 of the 1972 Stockholm Declaration on the Human Environment[20] and Principle 2 of the Rio Declaration on Environment and Development[21] which are regarded as reflecting customary international law.[22] Article 5 goes somewhat further by seeking to ensure that all State energy policies are consistent with sustainable development. This is outside the scope of Principle 21, but would be within the newly-emerging customary right to a decent environment.[23]

In light of the difficulties caused to the development of international environmental law by sovereignty, it may be questioned whether it is a sensible idea to refer to sovereignty at all in the Statement of Principles. The argument could be made that the right of sovereignty is backward-looking and is inconsistent with the aim and purpose of the Statement of Principles. There appear to be three answers to this possible objection. First, to be effective the Statement of Principles will need to be adopted by the maximum possible number of States. The references to sovereignty in articles 4 and 5 may reassure reluctant and hesitating States, which fear a loss of sovereignty, to become signatories. Secondly, there seems little advantage in trying to disguise the current state of environmental law by omitting references to sovereignty. Thirdly, the inclusion of references to sovereignty would reduce the likelihood of arguments arising that the Statement of Principles is inconsistent with sovereignty and reduce the credibility of such arguments.

2.4 Efficiency in energy supply systems

The need to improve the energy efficiency of energy supply systems and to reduce the use of fossil fuels in energy production is a key issue in achieving energy sustainability. Traditional coal-fired power plants are notoriously inefficient and as a consequence are major sources of transboundary air pollution. One major problem is acid rain.[24] The problem varies in gravity around the world, depending on geography and climatic conditions, and the sulphur content of the coal consumed. The problem has become of acute concern in the eastern part of North America where Canadian forests have suffered as a consequence of airborne sulphur from power stations in the Mid-West of the United States which burn high sulphur-content locally produced coal. East Asia also suffers from the use of high-sulphur coal in China.[25] Perhaps the greatest problem is global warming. By far the greatest problem in the global warming issue is the increasing release of carbon into the atmosphere, the bulk of which results from coal-fired power stations, although the use of oil and gas also makes a significant contribution.[26] Approximately two-thirds of the global warming problem is caused

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18 (1939)33 AJIL 182 and (1941) 35 AJIL 684; 1931-1941 3 UN RIAA 1905.

19 (1941)35 AJIL 684 at 716.

20 Principle 21 reads: "States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction".

21 This provision repeats the terms of Principle 21 of the Stockholm Declaration, except that the phrase "and developmental" is added after the phrase "pursuant to their own environmental."

22 *See,* for example, L. Sohn, "The Stockholm Declaration on the Human Environment" (1973) 14 *Harvard Int. L. J.* 423.

23 *See* H. Hohmann, *Precautionary Legal Duties and Principles of Modern International Environmental Law,* Graham & Trotman, London, 1994, 191–203.

24 For a general discussion of the problem of acid rain, *see,* C. C. Park, *Acid Rain: Rhetoric and Reality,* Methuen, London, 1987; H. Dowlatabadi and W. Harrington, "Policies for and Mitigation of Acid Rain; A Critique of Evaluation Techniques" (1989) 17 *Energy Policy* 116; D. P. Adams and W. P. Page, *Acid Deposition. Environmental, Economic and Policy Issues,* Plenum Press, New York, 1985. For a discussion of the legal problems associated with acid rain, *see,* for example, J. L. Regens and R. W. Rycroft, "Options for Financing Acid Rain Controls" (1986) 26 *Natural Resources J.* 519.

25 A. J. Bradbrook, "Energy Use and Atmospheric Protection" (1996) 3 *Australasian J. Natural Resources L. and Policy* 25 at 28–29.

26 *Id,* 30.

by energy use and production.[27] Other problems attributable in part to energy supply systems include local air pollution in cities and ozone depletion.

While coal is the major pollutant amongst traditional energy supply systems, lesser but still significant problems caused by oil and gas-fired plant exist. The other pollutant is nuclear energy. While this does not produce the problems referred to above, and in particular causes no atmospheric carbon emissions, the accidental release of radiation resulting from an accident at a nuclear power plant can cause catastrophic transboundary environmental harm, as evidenced in 1986 at Chernobyl.

The Statement of Principles seeks to reduce these sources of transboundary environmental harm by a variety of different stratagems. Foremost amongst these is the use of a variety of different forms of renewable energy technologies as alternative supply-side options. Many of the options contained in article 6 are self-explanatory. The list seeks to be as broad as possible to take account of the differing availability of the various resources in different countries and regions of the world. For example, solar energy is best suited to equatorial and sub-equatorial regions, while wind energy tends to predominate in high latitudes. Wind energy would include not only traditional land-based wind farms, but also newly-emerging off-shore wind turbines.[28] A variety of different solar energy technologies exist, and all are supported by article 6. These include direct heat applications, photovoltaic conversion and solar thermal power stations.[29] Small-scale hydropower schemes, which are based on run-of-the-river technology requiring no dams, is encouraged, but not the traditional large-scale applications. Although hydropower is clean and non-polluting, large-scale applications have resulted in massive social and environmental disruption as a result of the physical displacement of native peoples and the drowning of fertile and productive land.

Article 7, which supports and promotes the use of energy efficiency, is another important key towards achieving a sustainable energy future. This is designed to emphasise the importance of energy efficiency in maximizing energy efficiency in energy production, and not only in energy consumption, where it has received most emphasis in the past. The draft article refers to the need to achieve the full benefit of energy efficiency throughout the energy cycle. "Energy cycle" should be understood to mean the entire energy chain, including activities related to prospecting for, exploration, production, conversion, storage, transport, distribution and consumption of the various forms of energy, and the treatment and disposal of wastes, as well as the decommissioning, cessation or closure of these activities, minimizing harmful environmental impacts.[30]

A particularly pervasive form of energy waste is transmission losses arising from electricity transmission cables. Depending on the distances that electricity is required to be transmitted, losses of up to ten per cent are not uncommon. While some transmission losses are inevitable, technology has advanced to the extent that they can be substantially reduced. While this matter would be included within the general wording of article 7, it was thought appropriate in light of the importance currently attached by the world community to extending electricity grid systems into remote areas in developing countries[31] to highlight the need for energy conservation in this respect by the inclusion of a special provision, article 8.

Articles 9 and 10 refer to the vexed and controversial issues of the privatization of the energy supply industries and the future use and expansion of nuclear energy. Most developed countries have either undertaken or are in the process of undertaking structural reforms promoting privatization of the electricity and natural gas industries.[32] Such reforms are justified by the increased efficiencies that private participation has promised. While privatization can produce useful economic savings in the production of energy supplies,

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27 The exact figure may vary from country to country depending on its energy mix. *See* e.g. *Green Paper on Sustainable Energy Policy for Australia,* AGPS, Canberra, 1996, at 20; R. J. Fowler, "International Policy Responses to the Greenhouse Effect and their Implications for Energy Policy in Australia", in D. J. Swaine (ed), *Greenhouse and Energy,* 1990, at 462; D. A. Lashof and D. Tirpak, *Policy Options for Stabilising Global Climate,* US Environmental Protection Agency, Washington, DC, 1990.

28 *See, K. C. Tong, "Technical and Economic Aspects of a Floating Offshore Wind Farm" (1998) 74 J Wind Engineering and Industrial Aerodynamics* 399; A. J. Bradbrook and A. S. Wawryk, "The Legal Regime Governing the Establishment of Offshore Wind Turbines in Australia" (2001) 18 *Environmental and Planning Law Journal* 30.

29 For a discussion of the different solar technologies, see World Energy Council, *New Renewable Energy Resources,* Kogan Page, London, 1994; A. J. Bradbrook, *Solar Energy and the Law,* Law Book Co., Sydney, 1984, ch 1; S. F. Kraemer, *Solar Law,* Shepards Inc, Colorado Springs, 1978, ch 3.

30 This definition is taken from article 19(3)(a) of the Energy Charter Treaty ((1995) 34 *ILM* 360) and article 2(4) of its related Protocol on Energy Efficiency and Related Environmental Aspects ((1995) 34 *ILM* 446).

31 World Energy Assessment, note 8 above, at 381.

32 *See,* for example, A. R. Lucas, "Impact of Privatisation and Deregulation of Energy Industries on Canadian Environmental Law and Policy" (1996) *14 J. Energy and Natural Resources L.* 68; G. Kühne, "Incremental Regulatory Reform and Antitrust Law in the Energy Sector" (1996) 14 *J. Energy and Natural Resources L.* 76; U. Hammer, "Reorganisation of the Norwegian Electricity Market" (1996) 14./. *Energy and Natural Resources L.* 95.

the danger exists that the public interest will be sacrificed in the name of increasing corporate profits. The public interests that need protecting are many and varied, including, for example, the need to ensure the preservation of a minimum level of supplies to needy people. The public interest also embraces the advancement of energy efficiency and renewable energy supplies. Unfettered, the drive towards profit maximization may well lead private electricity companies to abandon the use of renewable energy technologies and increase the use of traditional, fossil fuel technologies on the ground of cost-competitiveness. Similarly, as corporate profits will only be generated by the sale of energy, energy conservation and efficiency runs counter to the private interests of companies. The answer is to ensure that provisions are included in national electricity and gas legislation requiring privatized companies to ensure a minimum use of renewable energy for electricity generation and to adopt specified measures in support of energy efficiency.[33] As such legislation could take a variety of possible forms, it would be inappropriate for the Statement of Principles to specify the exact form that it should take. It would be sufficient for the Statement merely to require appropriate measures to be taken in this regard. The wording of the proposed article 9 has been drafted accordingly.

In light of current polarized opinions as to the future of nuclear energy, it would be impossible to achieve world consensus for the inclusion of a clause in the Statement of Principles recommending either the expansion of the industry or its eventual abolition. While nuclear energy is being enthusiastically promoted in some countries (France, Belgium and Japan), it is being phased out in others (Germany, Sweden and Switzerland). Opinions differ fundamentally as to whether the risk of future accidental large-scale releases of radiation is real, whether there is yet a satisfactory solution to the disposal of nuclear wastes, and whether the use of nuclear energy for peaceful purposes can be separated from its possible military application. While past incidents culminating in 1987 in Chernobyl have placed a break on the expansion of nuclear energy in some countries, the passage of time since that accident and the emergence of global warming as a major international environmental issue have led to a reconsideration in other countries. The latter issue is potentially very significant as the nuclear energy cycle avoids atmospheric carbon emissions.[34] The wording of article 10 of the Statement of Principles is designed to achieve a compromise between the two factions by not prohibiting the future use and expansion of nuclear energy, but making such use and expansion conditional upon a satisfactory resolution of the problems of nuclear waste disposal and the accidental release of radiation.

2.5 Efficiency in energy consumption

It is in the field of energy consumption that energy efficiency can make its most effective contribution in the short to medium term. Energy efficiency measures can be adopted in all sectors of the economy, including industry, transport, domestic appliances and buildings. This is recognised by the wording of article 11, which encourages appropriate State action in respect of each of these sectors. Articles 12–17 seek to expand on the type of measures considered appropriate.

Articles 12 and 13 refer to energy efficiency measures to curb industrial energy consumption. Article 12 does not impose actual measures on States, but rather leaves it to their discretion to determine the appropriateness of possible alternative measures. A wide body of literature exists on the various alternative measures.[35] Article 13 seeks to supplement such legislative responses by the use of regular energy and environmental auditing of resource use in industry and by the use of trained energy managers.[36]

Article 14 refers to energy efficiency in home and office appliances and promotes the use of energy efficiency standards and energy labelling programmes.[37] Such standards and programmes already exist in

33 *See, e.g., Electricity Act 1989 (UK), ss 32–33.*

34 Nuclear energy is not entirely free of carbon emissions as significant carbon emissions result from the construction of nuclear plant.

35 *See,* for example, A. Bradbrook, "Energy Conservation Legislation for Industry" (1992) 10 *J. Energy and Natural Resources L.* 145.

36 *Id,* at 153–155.

37 *See* A. J. Bradbrook, "The Development of Energy Efficiency Laws for Domestic Appliances" (1990) 12 *Adelaide L. Rev.* 306; W. H. Lawrence and J. H. Minan, "The Use and Implementation of Solar Energy Equipment Standards" (1982) 3 *Solar Law Reporter* 781; California Energy Commission, *California's Appliance Efficiency Standards: An Historical Review, Analysis and Recommendations,* Report P400-83-020, 1983.

many industrialized countries.[38] The problem caused by electricity consumption in the stand-by use of electricity for office and home equipment has increased to such an extent in recent years that it is thought necessary to make special mention of the need for remedial measures.

The need to improve the fuel efficiency of motor vehicles is referred to in article 15.[39] This issue is particular significant in light of the fact that little fuel switching to renewable energy resources has occurred in this sector,[40] and that the sector is still overwhelmingly reliant on oil. The article promotes the use of fuel efficiency standards, labelling for fuel efficiency and the mandatory inclusion of fuel efficiency information in model-specific vehicle advertising.

Energy efficiency in the building sector is addressed in articles 16 and 17.[41] The Statement of Principles favours the adoption of a combination of measures for all categories of buildings, the most important being minimum insulation standards, energy rating schemes, building energy audits and training schemes for professional personnel.

A major difficulty is in securing agreement on the most appropriate measuring system for energy consumption. Without such a system, no comparative records could be kept. Energy intensity is used by the various articles in the Statement of Principles as the appropriate measure. This can be defined as the level of energy needed per unit of output. While energy intensity has never been employed in the past in any international agreement, it is commonly employed by energy specialists as an accurate measure of testing comparative energy efficiency levels.[42] The essence of energy intensity is that any given manufactured item requires a certain amount of energy to produce. The country that produces the given item using the smallest level of energy will have the lowest energy intensity (and vice versa). The aim is to record the lowest measure of energy intensity possible.

Energy intensity is not the only possible measuring system for energy consumption. If energy intensity were considered to be too complex, it would be possible to adopt a system of percentage reduction of either total energy consumption or fossil fuel consumption. The use of either of these alternatives would involve only minor changes to the wording of the Statement of Principles.

2.6 Energy pricing

The pricing of energy is crucial in shaping the world's energy future. The past and continued predominant use of fossil fuels for both energy production and consumption in all sectors of the economy is a reflection of the fact that fossil fuels have been priced more cheaply than possible alternatives. In addition, the relative affordability of traditional petroleum supplies has fuelled the exponential use of petroleum for private motor vehicles since the end of the Second World War.

Under existing pricing policies it is unrealistic to expect widespread adoption worldwide of sustainable energy futures. A reshaping of energy pricing policies is a vital precursor to increasing the use of energy

38 See, for example, United States: Energy Policy and Conservation Act 1975, Pub L 94–163, 89 Stats 871; Australia: Electricity (Energy Labelling of Electrical Appliances) Regulation 1995, made pursuant to Electricity Act 1945 (New South Wales), s 37(2); Electricity (Electrical Articles) Regulation 1994, made pursuant to the Electricity Act 1994 (Queensland), s 266; Electrical Products Regulations 1990, made pursuant to the Electrical Products Act 1988 (South Australia), s 8.

39 *See* Office of Technology Assessment, *Improving Automobile Fuel Economy: New Standards, New Approaches,* US Government Printing Office, Report OTA-E-504, 1991; A. J. Bradbrook, "Alternative Legal Measures to Improve the Fuel Efficiency of Motor Vehicles", in Economic and Social Commission for Asia and the Pacific, *Energy Efficiency: Compendium of Energy Conservation Legislation in Countries of the Asia and Pacific Region,* United Nations, New York, 1999, at 105ff; A. J. Bradbrook and A. S. Wawryk, "Legislative Implementation of Financial Mechanisms to Improve Motor Vehicle Fuel Efficiency" (1998) 22 *Melbourne U. L Rev.* 537.

40 In some countries, ethanol and methanol have acquired a significant market share. The most spectacular success is Brazil, where 70% of all motor vehicles now rely on ethanol rather than petrol. For a discussion of the situation in Brazil, *see* J. Goldemberg, T. B. Johansson, A. K. N. Reddy and R. H. Williams, *Energy for a Sustainable World,* Wiley Eastern Ltd, New Delhi, 1988, at 239ff; A. de Oliveira, "Reassessing the Brazilian Alcohol programmememememe" (1991) 19 *Energy Policy* 47. See *generally,* A. J. Bradbrook and A. S. Wawryk, "Energy, Sustainable Development and Motor Fuels: Legal Barriers to the Use of Ethanol" (1999) 16 *Environmental and Planning L. J. 196.*

41 *See* A. J. Bradbrook, *Energy Conservation Legislation for Building Design and Construction,* Canadian Institute of Resources Law, Calgary, 1992; G. P. Thompson, *Building to Save Energy: Legal and Regulatory Approaches,* Ballinger Publishing Co, Cambridge, Mass., 1980.

42 For a general discussion of energy intensity, *see* H. Khatib, "Energy Intensity: A New Look" (1995) 23 *Energy Policy* 727; W. H. Golove and L. J. Schipper, "Restraining Carbon Emissions: Measuring Energy Use and Efficiency in the USA" (1997) 25 *Energy Policy* 803.

efficiency measures and renewable energy technologies and to preserving the existing stocks of fossil fuels for future generations.

The Statement of Principles contains three measures on energy pricing in articles 18 and 19. First, environmental costs and benefits should be incorporated into energy pricing mechanisms. The traditional failure to do so in the past has resulted in the price of fossil fuels being kept artificially low. The adoption of environmental effects into fossil fuel prices would have a dramatic effect. It would mean, for example, that the cost of road freight would have to be increased to take account, *inter alia*, of increased damage to the highways caused by trucks, the increased health costs posed by vehicle exhaust emissions and the increased hospital costs resulting from road accidents. Such increased prices might well result in the transfer of most road freight to rail, a much more efficient and environmentally-friendly alternative. It would also mean that energy utilities using coal as the principal source of fuel for electricity generation would have to adjust their prices upwards to take account of the environmental problems caused by coal combustion, including global warming, acid rain, the health and safety effects of coal mining and local air pollution degradation.[43]

Secondly, article 19 recommends the gradual adjustment of energy prices upwards in order to enhance sustainable energy production and consumption. This is particularly important in the major developed countries, which are collectively responsible for the majority of the world's fossil fuel consumption. Some European nations have already taken the first steps in this regard. An illustration of this is Germany, which has introduced an ecological tax on petroleum whereby the price is increased by annual increments of approximately three euro cents over the rate of inflation over a period of years.

Thirdly, article 19 calls for existing price subsidies in favour of conventional energy technologies to be phased out. Such subsidies exist in nearly all developed countries, although their details and operation differ. They are not designed to deter the development of energy efficiency and renewable energy technologies, but incidentally have this effect. One useful illustration is the adverse effect that cheap, off-peak electricity tariffs have had on the market for solar hot water systems. The introduction of such preferential tariffs were designed with the laudable goal of promoting energy efficiency in electricity generation and to avoid the need for electricity utilities to construct new electricity generating stations for peak supply periods, but have had the effect of pricing solar energy for water heating out of the market. Solar energy systems have a high initial capital cost which is gradually recouped by savings made in electricity supply charges. With cheap, off-peak tariffs for water heating the time taken for purchasers of solar systems to recoup their initial capital outlay (the "pay-back period") has increased to such an extent that the systems are no longer economically justifiable in many countries.

2.7 Mitigation of environmental impacts

Although the environmental impacts of energy production are referred to in the Statement of Principles in other contexts, the issue is regarded as sufficiently important to justify separate treatment in the document. The relevant articles are 20, 21 and 22.

Article 20 draws the link between forest preservation and energy policies. The provision reflects the increased importance attached to forest management and preservation since the Rio Conference on Environment and Development in 1992 and the adoption in that year of the Statement of Forestry Principles.[44] Much forest damage in the past has resulted from energy production, particularly from coal-fired power plants. The proposed article requires all pollutants from energy production which are capable of harming forest ecosystems to be strictly controlled by all levels of government.

Article 21 makes the general statement that governments must ensure that the possible adverse environmental consequences must always be taken into account prior to adopting any policies, programmes and plans in support of energy production by the use of fossil fuels. This is followed by a proposed practical means of implementing this requirement contained in article 22. This article focuses on environmental impact assessment (EIA) as a tool for controlling pollution from fossil-fuel fired power plants. The majority of developed nations have already adopted EIA procedures for all significant land developments, although the effectiveness of their procedures and their applicability in the energy context varies from state to state depending on the terms of the national legislation. EIA is generally regarded by environmental lawyers as one

43 *See* Pace University Center for Environmental Legal Studies, *Environmental Costs of Electricity*, Oceana Publications Inc, New York, 1990.

44 *See* note 7 above, and accompanying text.

of the major methods of preventing and controlling actual and potential environmentally-harmful developments. The Statement of Principles proposes that all activities involving the use of energy by the use of non-renewable energy resources which are likely to have an adverse effect on the environment be evaluated before approval. Such evaluation must be effective and transparent.

2.8 Consumer information and environmental education

Sustainable energy development involves the introduction of a wide range of consumer products incorporating renewable energy and energy efficiency technologies. Consumer education and consumer confidence is essential to the widespread introduction of these new consumer products.[45]

This has been highlighted in the past by both the United Nations and international consumer organizations. In 1999, the United Nations General Assembly amended its Guidelines for Consumer Protection so as to include sustainable consumption, based on a recommendation of the 3rd session of the Commission for Sustainable Development.[46] The new Guidelines state that the promotion of sustainable consumption is one of the principal objectives of consumer protection (cl I(h)), and that the promotion of sustainable consumption should be one of the features of a strong consumer protection policy which all governments are urged to develop and maintain (cl II.3(g)). Energy is specifically included as an area of consumer concern. This same theme was adopted by the Asia-Pacific NGO Forum on Effective Consumer Information for Sustainable Energy Use, held in May 1999 in Seoul, Republic of Korea, and organized jointly by the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and the Citizens' Alliance for Consumer Protection of Korea. This Forum consisted of representatives of the leading consumer organizations of the majority of countries of the Asia-Pacific region. The Forum published a document entitled *Conclusions and Recommendations for Future Action by Consumer Organisations to Promote Sustainable Development and Sustainable Energy Use.*[47] Recommendation 6 states that:

> "A comprehensive system of legislation designed to protect consumer interests is essential. Consumers investing in renewable energy devices and energy efficiency equipment deserve particular protection from misleading information."

The Statement of Principles builds on this theme in articles 23–25. Article 23 states that greater public awareness and understanding of the environmental impacts of energy production and consumption is an essential prerequisite to more environmentally conscious consumption patterns. Article 24 supports the development of consumer information programmes as to energy consumption, including product energy labelling for comparative energy efficiency and independent product testing. Education is seen as the key element in article 25 both for the purposes of influencing consumer choice and indirectly for influencing electricity producers and product manufacturers. The article states that education is required as to sustainable energy consumption, and that emphasis should be given to targeting children as future consumers.

2.9 Policies and strategies for implementation

The Statement of Principles recognises in article 26 that the achievement of a sustainable energy future will depend on a combination of policy initiatives rather than on one large measure. The article adopts the conventional wisdom that the combination of measures must consist of three separate types of measures: regulations, financial stimulatory measures and educational reforms.[48] Regulations, sometimes referred to disparagingly by economists as "command and control measures," ensure that minimum levels of reforms are achieved. This type of reform includes such measures as energy efficiency standards for appliances,

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45 *See* J. H. Minan and W. H. Lawrence, "Product Standards and Solar Energy," in J. H. Minan and W. H. Lawrence (eds), *Legal Aspects of Solar Energy*, Lexington Books, Massachusetts, 1981, at 153ff; W. H. Lawrence and J. H. Minan, "The Role of Warranties and Product Standards in Solar Energy Development" (1981) 34 *Vanderbilt L. Rev.* 537; A. J. Bradbrook, "Eco-Labelling: Lessons from the Energy Sector" (1996) 18 *Adelaide L. Rev.* 35.

46 The original ECOSOC Guidelines for Consumer Protection were drafted in 1985 and adopted by General Assembly Resolution 39/248 of 9 April 1985. The Commission on Sustainable Development recommendations are contained in document E/1992/31, chap I, para 45, sec E. The revised Guidelines for Consumer Protection were adopted in ECOSOC Resolution 1999/7 of 26 July 1999.

47 *See* A. J. Bradbrook, "The Development of a Regulatory Framework on Consumer Protection and Consumer Information for Sustainable Energy Use" (2000) 5 *Asia Pacific Journal of Environmental Law* 239.

48 On this issue, *see* A. J. Bradbrook, "Energy Law as an Academic Discipline" (1996) 14 *J. Energy and Natural Resources L.* 190 at 214–215.

maximum fuel consumption laws for motor vehicles and the compulsory purchase by electricity supply companies of specified minimum levels of supply from renewable energy sources. Such laws typically penalize non-performance by fines. The weakness of such measures is that they only ensure compliance by companies with the minimum standards specified in the legislation and give no incentives to companies to exceed these standards. This is the role of financial stimulatory measures. Such measures may consist of investment allowances, income tax or company tax deductions for investment costs, and special grants or tax concessions for expenditure on research and investment. The combination of regulations and stimulatory measures has been referred to as the "carrot and stick" approach to reform, with regulations (the stick) being supplemented by financial incentives (the carrot).[49] This would appear to be the ideal combination.

Educational measures promoting the importance of sustainable energy development are often overlooked, but are fundamental for building the public understanding and support for the type of reforms that will be necessary to take us away from the fossil fuel era into a future built on renewable energy technologies. The measures required will be at all levels, ranging from energy education at school through to new professional courses offered at tertiary institutions and to general educational courses for the general public at continuing education centres. An important element in the educational process is the provision of information on energy consumption. Hence some reforms that have already been made (for example, the provision of energy consumption labels on motor vehicles and domestic appliances) relate primarily to the educational goal and show that progress has already been made. There is a link between regulation and education, as sometimes the purpose of a mandatory law is not to punish the individual for breaching the law but rather to educate them as to the correct course of action. The real purpose of the labelling legislation is not to punish companies for breaching the law but rather to ensure that the public is educated and persuaded to change its behaviour. Outside the energy sector there are many examples of this. Examples include laws requiring the mandatory wearing of seatbelts in cars and crash helmets for motor cycles, and laws requiring a compulsory health warning to be displayed on tobacco products.[50]

Articles 27–33 support the general policy enunciated in article 26 in a variety of different ways with a number of specific proposals. Article 28 makes the important point that action will be required by all levels of government to address the sustainable energy question. While some reforms will be the responsibility of national governments (for example, taxation reforms and fiscal incentives to manufacturers), others may devolve to local or state governments. An illustration of the latter would be legislation designed to protect solar access to solar collector panels.[51] The division of legislative responsibility will depend on the constitution of each country.

Articles 31 and 33 are particularly significant for the future of sustainable energy development. Article 31 states that scientific and technological research in relation to sustainable energy production and consumption should be strengthened. This recognises that there has been a very significant shortage of research funds available in the majority of countries in recent years to conduct research into sustainable energy technologies. This is presumably because governments have failed to recognise the importance of this area of research for future development. In addition to the increased provision of direct research grants in this area by governments to industries and universities, the article could best be satisfied by the introduction of significant taxation incentives for private investment in sustainable energy research and development. The cost to consolidated revenue would be minimal in comparison with the boost that such a measure would give to sustainable energy technologies.

Article 33 seeks to prohibit developed countries from exporting old, polluting technologies into developing countries. This form of dumping already occurs in many parts of the world. One illustration is the sale by Japan to many countries of the Asia-Pacific region of motor vehicles over a certain age which are no longer allowed to be registered in Japan under national legislation. Dumping of outmoded energy-consuming equipment merely shifts the source of pollution from the exporting to the importing nation and fails to address the need for energy efficiency on a world-wide basis. Such a measure also condemns developing countries to suffer major health and other environmental problems caused by the use of polluting technologies.

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49 *Id,* at 215.

50 *See eg, Canada: Tobacco Products Control Act, Stats Can 1988, c 20; New Zealand: Smoke-Free Environments Act 1990 (NZ); Hong Kong, China: Smoking (Public Health) Ordinance 1982.*

51 For a discussion of solar access legislation, *see A.* J. Bradbrook, *Solar Energy and the Law,* Law Book Co, Sydney, 1984; M. M. Eisenstadt, "Access to Solar Energy: The Problem and its Current Status" (1982) 22 *Natural Resources J.* 21; J .W. Gergacz, "Legal Aspects of Solar Energy: Statutory Approaches for Access to Sunlight" (1982) 10 *Boston College Environmental Affairs L. Rev.* 1.

The key to the introduction of reforms in favour of sustainable energy technologies is the availability of government revenue. Article 30 seeks to address this issue by providing for the creation of specific national funds for this purpose created from revenues produced from direct or indirect forms of energy consumption taxation. While such an energy consumption tax would doubtless prove unpopular in the short term, there are many examples of the use of taxes or levies to fund environmentally-worthwhile national or local projects.[52]

2.10 International cooperation

The proposed articles on international cooperation, articles 34–40, contain a variety of measures designed to ensure that all States, particularly developing countries, participate in and derive benefit from the drive towards the introduction of sustainable energy technologies. Without such participation, the wealth gap between developed and developing countries will in future only get worse as the world comes to rely increasingly on energy efficiency measures and renewable energy sources.

Many of the proposed measures are self-evident and require no commentary. Perhaps the most important provisions are articles 38, 39 and 40. Consistently with other modern international environmental law agreements, article 38 seeks from developed countries the provision of new and additional financial resources to be made available to developing countries. The specified purpose in article 39 is to enable developing countries to introduce sustainable energy production and consumption policies. This is linked to article 40, which asks developed countries to provide access to and transfer of environmentally sound technologies and corresponding know-how on favourable terms, including on concessional and favourable terms. In light of the existing wealth imbalance between developed and developing countries and the problem of external indebtedness of the majority of developing countries, it is quite unrealistic to expect developing countries to be able to finance unaided the development and implementation of sustainable energy technologies or to develop the necessary know-how and scientific and technical expertise.

Article 39 is noteworthy in that it makes the link between energy and climate change. As noted above, energy production and consumption is the major source of atmospheric carbon emissions and the leading cause of global warming.[53] If the three flexibility mechanisms prescribed in the Kyoto Protocol to the United Nations Framework Convention on Climate Change (the Clean Development Mechanism, Joint Implementation and Emissions Trading) are to play an effective role in reducing carbon emissions, it will be vital that such mechanisms include new sustainable energy projects.

3 Conclusion

A sustainable energy future has long been recognised as one of the essential elements in the drive towards sustainable development. Specific mention in international documents as to the importance of energy for sustainable development go back at least as far as the Brundtland report in 1987. While progress in developing internationally-agreed sustainable energy policies since then has been slow, the recently-concluded World Summit on Sustainable Development Plan of Implementation gives new hope to the development of international law in this area in the future. In contrast to Agenda 21, where the relevant part of the report, chapter 9, makes scant reference to energy, the new Plan of Implementation sees energy as an integral part of world poverty eradication and the changing of unsustainable consumption and production patterns.

As the first major international soft law instrument to recognise and address energy production and consumption as part of sustainable development, the Plan of Implementation is inevitably vague and general in relation to the concrete actions proposed. The authors believe that the next stage forward will be the development of a non-binding statement of energy principles. This should form the basis of a further international conference and negotiations. The adoption of such a statement was eventually accepted at the 1992 UNCED conference as the most appropriate policy in respect of forest management, an area of similar difficulty in achieving consensus. The proposed statement of energy principles expounded in this article is designed as the basis for negotiation of a future international agreement. While many may regard a statement of energy principles as too weak to be effective and would consequently prefer the negotiation of a new Convention on Energy or a new Energy Protocol to the United Nations Framework Convention on Climate Change, it is submitted that such a binding treaty would as a practical matter be impossible to achieve in the short to medium term. This would need to be left to a third stage of international law development.

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52 In Australia, for example, *see* Water Management Act 2000 (NSW) and Emergency Services Funding Act 1998 (SA).

53 *See* World Energy Assessment, note 8 above, at 86–95.

Annex
Non-legally binding statement of principles for a global consensus on sustainable energy production and consumption

Preamble

(a) Access to clean and affordable energy is a precondition for all social and economic development. These Guidelines endeavour to lay out a universally acceptable framework for national policies and international cooperation in pursuit of the sustainable development objectives laid out in Agenda 21. Adherence to these guidelines is expected to facilitate the achievement of "a sustainable energy future for all".

(b) Energy resources should be sustainably managed to meet the social, economic and ecological needs of present and future generations. The currently prevailing patterns of energy production and consumption are predominantly based on finite fossil fuel reserves and are therefore not sustainable in a longer-term perspective. Growing environmental concerns also call for a stringent review of energy policies.

(c) Unsustainable patterns of energy production and consumption threaten to harm the global environment. Industrialized countries should take the lead in achieving sustainable energy production and consumption patterns; developing countries should seek to achieve sustainable energy production and consumption patterns in their development process, having due regard to the principle of common but differentiated responsibilities. The special situation and needs of developing countries in this regard should be fully taken into account.

(d) States should strive to promote an international economic climate conducive to the continued and environmentally sound development of sustainable energy production and consumption in all countries.

Objectives

1. The guiding objective of these principles is to allow for economic development to occur in all States with the minimum possible adverse impact to human health and the environment and to preserve the existing reserves of fossil fuels for the benefit of future generations.

2. The objectives of this Statement of Principles are as follows:

(a) To act as a framework for a world energy strategy aimed at concerted international, national and regional programmes for harmonious and sustainable economic and social development;

(b) To encourage States to cooperate and, as appropriate, assist each other in developing and implementing policies, laws and regulations designed to promote sustainable energy production and consumption;

(c) To promote energy efficiency policies consistent with sustainable development;

(d) To create framework conditions which induce energy producers and consumers to use energy as economically, efficiently and environmentally soundly as possible, particularly through the organization of energy efficient markets and a fuller reflection of environmental costs and benefits;

(e) To advance the sustainable energy policies agreed to in Chapter 9 of Agenda 21 relating to the protection of the atmosphere;

(f) To encourage and facilitate programmes for fuel switching from high carbon to low carbon sources of energy and for the substitution of fossil fuels by environmentally benign sustainable energy technologies;

(g) To ensure financial and technological assistance for developing countries to adopt sustainable energy production and consumption policies; and

(h) To preserve dwindling global reserves of fossil fuels from further unnecessary waste due to past unsustainable patterns of energy production and consumption.

3. Energy conservation and energy efficiency are important features of energy security, and their promotion can enhance the prospects of economic development and world peace.

Common principles

4. States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own energy resources pursuant to their own environmental policies, but have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

5. States have the sovereign and inalienable right to utilize, manage and develop their existing energy resources in accordance with their development needs and level of socio-economic development, but subject to policies consistent with sustainable development.

Efficiency in energy supply systems

6. States should promote the greater use of renewable sources of energy and energy efficiency as far as possible throughout all sectors of the economy. Renewable sources of energy include, amongst others, the following: (a) biomass fuel (including crop residues, wood mill wastes, forest residues, municipal solid wastes and ethanol); (b) solar energy (in all its applications); (c) wind energy; (d) geothermal energy; (e) tidal and wave energy; (f) salt gradient energy; (g) ocean thermal energy conversion; and (h) small-scale hydropower (of capacity of ten megawatts or less).

7. States should strive to achieve the full benefit of energy efficiency throughout the energy cycle. To this end they should, to the best of their competence, formulate and implement energy efficiency policies and cooperative or coordinated actions based on cost-effectiveness and economic efficiency, taking due account of environmental aspects.

8. In the maintenance and development of supply-side energy systems, conversion and transmission losses need to be minimized to the extent technically possibly and economically feasible.

9. The facilitation or increase of private sector participation can be an important option for the development of the energy supply infrastructures, in particular in developing countries. Where this occurs, legislative measures must be taken to ensure that the use of energy efficiency measures and renewable energy technologies is enhanced.

10. The future use and expansion of nuclear energy should only proceed if the problems of the disposal of nuclear wastes and the environmental risks associated with the accidental release of radiation are adequately addressed.

Efficiency in energy consumption

11. States should formulate, implement, publish and regularly update national programmes containing measures to reduce energy intensity. These programmes concern all sectors of the economy, including, *inter alia,* industry, transport, commercial, institutional and residential buildings.

12. In most industrialized and new industrializing countries, industry accounts for the largest share in final energy end use. At national level appropriate measures should be considered with a view to raising the energy efficiency of industrial production, in particular in those sectors and industrial establishments which are characterized by energy intensities significantly above world average.

13. Measures to promote periodic, regular energy and environmental auditing of resource use in industry are useful for enhancing productivity. However, adequate training of designated energy managers is a further important factor in advancing energy conservation programmes in industry.

14. In consultation with manufacturers and consumer organizations, States should seek to promote higher levels of energy efficiency in electrical home and office appliances. The introduction of minimum

energy efficiency standards and energy labelling programmes for enhanced consumer information can be cost-effective tools for energy efficiency promotion. Measures aimed at reducing electricity leakage and stand-by losses will be significant for the long-term development trend in energy use.

15. Increasing the fuel efficiency of automobiles is another effective policy measure for reducing harmful atmospheric emissions. The introduction of fuel efficiency standards and fuel efficiency labelling, and the mandatory inclusion of fuel efficiency information in model-specific vehicle advertising are among the policy options through which vehicle fuel efficiency can be improved.

16. In many of the developed and the rapidly developing economies, commercial and institutional buildings account for a growing share in energy consumption, in particular electricity consumption. Building codes and standards requiring improved building insulation can be effective tools to reduce energy consumption. The introduction of pre-construction permits, building energy audits and training of professional personnel are among the most effective optional measures for energy efficiency promotion. In addition, the promotion of bio-climatic building designs and maximum use of daylight have also proven effective measures in both developed and developing countries.

17. Mandatory building codes or energy rating schemes for residential buildings have shown to be an important energy-saving measure, in particular in countries with cold climates. In developing countries such schemes are less relevant and less applicable.

Energy pricing

18. The incorporation of environmental costs and benefits into market forces and mechanisms, in order to achieve sustainable energy production and consumption, should be encouraged.

19. States should seek to enhance sustainable energy production and consumption by adjusting energy prices upwards to reflect the real cost of energy supply and to enable energy efficiency projects to compete financially on a level playing field with other technologies. Existing subsidies in favour of conventional energy technologies distort the market and discourage energy efficiency initiatives. Such subsidies should be phased out.

Mitigation of environmental impacts

20. Pollutants from energy production and consumption, particularly airborne pollutants, including those responsible for acidic deposition, that are harmful to the health of forest ecosystems at the local, national, regional and global levels, should be strictly controlled.

21. States should take appropriate measures to ensure that before they adopt policies, programmes and plans relating to energy production by the use of non-renewable energy resources that are likely to have a significant adverse effect on the environment, the environmental consequences of such actions are duly taken into account.

22. (a) States should establish or strengthen national environmental impact assessment procedures to ensure that all activities involving the production of energy by the use of non-renewable energy resources which are likely to have a significant adverse effect on the environment are evaluated before approval.

(b) States should designate appropriate national authorities to ensure that environmental impact assessments are effective and conducted under procedures accessible to concerned States, international organizations, persons and non-governmental organizations.

(c) States should conduct periodic reviews both to determine whether activities approved by them are carried out in compliance with the conditions set out in the approval and to evaluate the effectiveness of the proposed mitigation measures.

Consumer information and environmental education

23. Greater public awareness and understanding of the environmental impacts of energy production and consumption is an essential precondition to achieving more environmentally conscious patterns of consumption.

24. Consumers should be entitled to full information on visible and invisible product qualities, including comparative energy efficiency. Independent product testing, publication of comparative market surveys and other measures such as energy or environmental labelling are important elements in consumer information programmes.

25. The task of supporting and expanding consumer education and awareness programmes in the field of sustainable energy consumption, especially targeting children as future consumers, is of vital importance. States should recognise that education is the key to influencing electricity producers and consumers to adopt sustainable energy policies.

Policies and strategies for implementation

26. Sustainable energy production and consumption can most effectively be promoted by a combination of policy initiatives and financing. State initiatives may take the form of regulation, financial stimulation or educational measures.

27. States should strive to implement national energy management and energy conservation laws. Such laws should provide basic mandates for institutional development or for national advisory services, improved energy efficiency in power generation and transmission, minimum energy efficiency standards for motor vehicles, industrial equipment, domestic appliances and buildings, and improved market transparency resulting from energy labels or other measures designed to enhance public or investor awareness for the benefit of energy efficiency investments.

28. Recognising that the responsibility for sustainable energy production and consumption is in many States allocated among federal/national, state/provincial and local levels of government, each State, in accordance with its constitution and/or national legislation, should pursue these principles at the appropriate level of government.

29. States should promote and provide opportunities for the participation of all interested parties, including local communities and indigenous people, women, industries, labour and non-governmental organizations, in the development, implementation and planning of national sustainable energy policies.

30. States should establish, consolidate or expand national energy efficiency promotion or energy conservation funds, based on domestic revenues from direct or indirect forms of energy consumption taxation used for the purpose of providing financial incentives for energy efficiency investments.

31. Scientific and technological research in relation to sustainable energy production and consumption should be strengthened.

32. Institutional capabilities in education, training, science, technology, economics, law, architecture and social aspects of energy production and consumption are essential to the development of sustainable energy production and consumption policies and should be strengthened.

33. States should control the importation of old, polluting energy technologies into developing countries.

International cooperation

34. The implementation of national policies and programmes aimed at sustainable energy production and consumption, particularly in developing countries, should be supported by international financial and technical cooperation, including through the private sector, where appropriate.

35. International institutional arrangements, building on those organizations and mechanisms already in existence, as appropriate, should facilitate international cooperation in the field of sustainable energy production and consumption.

36. International exchange of information on research into sustainable energy production and consumption should be enhanced and broadened, as appropriate, making full use of education and training institutions, including those in the private sector.

37. States should promote international awareness and information exchange on their relevant energy efficiency and renewable energy programmes and standards and on the implementation of those programmes and standards.

38. New and additional financial resources should be provided to developing countries to enable them to introduce sustainable energy production and consumption policies. The efforts of developing countries to implement policies consistent with sustainable energy production and consumption should be supported by the international community, taking into account the importance of redressing external indebtedness. In this respect, special attention should also be given to the countries undergoing the process of transition to market economies.

39. States should endeavour to support the development of sustainable energy production and consumption in developing countries by the use of the flexibility mechanisms (the Clean Development Mechanism, Joint Implementation and Emissions Trading) prescribed in the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

40. In order to enable, in particular, developing countries to adopt sustainable energy production and consumption policies, the access to and transfer of environmentally sound technologies and corresponding know-how on favourable terms, including on concessional and preferential terms, as mutually agreed, in accordance with the relevant provisions of Agenda 21, should be promoted, facilitated and financed, as appropriate.

The role of selected international agencies in the formation of international energy law and policy towards sustainable development

Thomas W. Wälde[1]

This Paper examines the development, role and operation of the major international agencies responsible for the development of energy law and policy, namely OPEC, 1EA, Energy Charter Conference and Secretariat, IAEA, United Nations and its agencies, OECD Nuclear Energy Agency, and the European Union. Particular emphasis is placed on the role and effectiveness of each organization in promoting sustainable development. As a former UN civil servant, the writer is in a unique position to evaluate where weaknesses exist. He offers his own views as to the type of reforms, both political, economic and legal, which will be necessary to promote sustainable development to its maximum potential.

1 Introduction

The concept of sustainable development now dominates the natural resources, energy and environmental discourse with its accommodating notion of developing in the present while not compromising the future. However, sustainable development suffers from an imbalance: rhetoric overwhelms action; affirmation of moral values overwhelms implementation; having good intentions prevails over getting good results. Results can only be achieved if the "game" is properly understood: the context of the action, including the economic, social and cultural elements of the relevant environment; the concepts, usually culturally formed in some relationship with the – often historical and now obsolete – economic and technical context; the role, parameters of action, interests, and dominant perception of the main players.

While sustainable development can perhaps be described as the ideological input, activities such as technical and financial assistance and work with rules (formulating, implementing, revising) are the output of international agencies. This output is one of the factors which determines if, how and to what extent and in what shape and form sustainable development leaves the realm of morality and ideology and enters the realm of socio-economic and organizational reality. Very little practical research seems to have been done on how international agencies participate in the emergence of rule systems in the field of energy. This Paper is meant to sketch out observations on the role of selected key international agencies in the field of energy law (policies and regulation). The outcome of the Paper should help to understand, somewhat better than before, how sustainable development can be achieved more effectively through the activities of international agencies in the energy sector. The emphasis in this Paper is not only on the formal mandates – popular in the examination of international organizations by public international lawyers, but also and perhaps with greater emphasis on the "real-life" operations and strategies pursued by such agencies. The first is easy to do – all that is necessary is to look at constitutional documentation and periodic official reports; the latter is much more difficult and can not be done without involving considerable speculation, value-judgement and the uncertainties of looking behind the veil of officialdom and of trying to uncover the difference between what the agency says it is about and it does – the pretence – and what it "really" is about and does. Since this effort is more ambitious and backed-up by much less objective information and documentation, it is necessarily more ambiguous and leaves much more space for protestation.

International organizations play a central role in the emergence of international energy law. They represent a response to the globalisation of the regulatory challenges. As national regulation loses its grip, international agencies emerge to mirror the global scope of action of relevant actors – multinational companies, banks, non-state actors, criminal groups, but also the global scope of problems – transboundary environmental impact, need to create more level playing fields for competition in global trade, development and

[1] This Paper is a preliminary result of a more comprehensive project dealing with international energy law and policy. The author has received comments on all the international agencies from former or present staff of these agencies; their contribution is gratefully acknowledged, but needs to remain confidential. Helpful comments were also received from Dr Desta (CEPMLP/Dundee) and Dr Al-Hajji, Iowa. Another preliminary part of the project – on "International Energy Law: An Introduction to Modern Concepts, Context, Policy and Players" – was recently published in the Schneider and Theobald (eds), *Handbuch zum Recht der Energiewirtschaft*, 2002.

administration of a system of global legal disciplines to ensure the wealth-creating machine of the global economy can function properly, including its social safeguard. One could qualify the role of international agencies in this sense as "collaborative international regulation;" it is rare that governments yield all or even a substantial portion of their regulatory jurisdiction to international agencies, except where inevitable, and even then with safeguards. The much more homogeneous and integrated European Union's relation with its member states – and the well-known British reluctance to yield sovereignty – is a good example.

International agencies in this area are therefore more a prototype of true international regulation; they help its member states to regulate better by providing model guidelines, collective and better regulatory intelligence and a forum of dialogue and collegiality.[2] As we shall see, they are primarily intergovernmental collegial networks. This, in turn, helps national regulation to be more aligned with each other. National administrations usually establish formal and informal channels for collaboration as part of their participation in international agency activities (conferences, workshops, elaboration of model codes).

There is an explicit, visible role of international agencies in the regulatory process – servicing the negotiation and administration of treaties, formal elaboration of standards and guidelines and, though rarely, direct regulatory power. Elaborating technical standards, usually in collaboration with experts in governments, companies and industry associations, is a latent, but key, direct regulatory role.[3] Such standards may be directly binding, but in most cases they have an indirect legal effect: as standards of due diligence for defining civil responsibility, by explicit incorporation into contracts or by reference in national or international (e.g. GATT/WTO-based) law. They also work by providing national governments – and domestic experts and social forces – with a ready-made set of usually well-researched, tested and often elsewhere applied rules. These possess the political and technical legitimacy pertaining to "authoritative" international standards. Standards by the IMO for offshore pollution and dumping, by the IAEA for nuclear safety of facilities and transport, by the OECD on good conduct by multinational companies, by the World Bank on environmental assessment of lending projects, by UNCITRAL on infrastructure concession contracts, by the UN on environmental considerations in mining or by non-governmental organizations such as the Institute of Petroleum or the American Petroleum Institute on safety and environmental best practices of oil and gas operations are in many ways the most significant rules applicable in the respective industries. Their "legal" nature is often not immediately apparent; the fact that they are usually not produced by lawyers, but by engineers should not blind the analyst from their significance.

But international organizations also have an implicit, informal and less visible role: serving as a forum for discussion, an actor (often with some autonomy and independent dynamics) with agenda-setting power, international agencies also provide legitimacy and a benchmark for national regulatory action. There is a feedback process between the national level, the NGO and business level, the authoritative media (foremost the Financial Times) and the international level. Innovations and new concepts jump from the domestic level to the international agency level. They are here processed, refined and negotiated into a more universally accepted format. They then leapfrog by way of an agency endorsement to the level of national regulation.[4] At times, international agencies acquire true international regulatory competencies. The EU is the best example. The new EU energy law emerging out of the 1996/98 electricity and gas directives and its current amendment proposals illustrates the balance between true EU Commission powers and national regulatory powers to be exercised within the EU energy law framework. The more technical the subject and the more homogeneous the membership, the more it is likely that international agencies obtain true and direct regulatory powers, often exercised jointly with national enforcement authorities. IMO, WIPO and other specialised agencies illustrate this angle. Here, there are superior technical and efficiency reasons for transferring direct regulatory powers, and less "sovereignty" reasons related to more politicised issues for keeping such power at home.

International agencies serve as vehicles for transnational coalitions[5] to impose or influence by persuasion of national regulation, usually to counter the stronger influence of domestic pressure groups (protectionist

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2 J. Wciler, "The Rule of Lawyers and the Ethos of Diplomats – Reflections on the Internal and External Legitimacy of WTO Dispute Settlement" (2001) 35 *J. World Trade* 191.

3 *See* forthcoming article by A. Wawryk, 20 *JENRL* (2002), on international environmental standards in the oil industry: Improving the Operations of Transnational Oil Companies in Emerging Economies.

4 I have explained this process in the international petroleum law field, in N. Beredjick, T. Wälde, *Petroleum Investment Policies in Developing Countries* (1987).

5 E.g. national ministry, international business associations and international agency officials and their expert networks or, with a similar structure, national environment agencies, international NGOs and the environmental agency network. On the competition of such transnational constituencies, see T. Wälde, "Sustainable Development and the 1994 Energy Charter Treaty: between Pseudo-Action and the Management of Environmental Investment Risk", in F. Weiss *et al.*, (eds), *International Economic Law with a Human Face* (1998), at 223–271.

business or labour lobbies, ideological pressure groups).[6] The agency, with its experts, funds and machinery for consultancy work, meetings and publications, serves as forum for the elaboration of common rules by such specialized communities. The national representatives then return to their domestic regulatory process with the added legitimacy and technical and informational underpinning gained in the international agency process. The international agency, so to speak, is the nest to which and from where "birds of the same feather" fly into their domestic political and regulatory context. This leads to another non-conventional observation.

One generally ignored quality of international agencies is their scapegoat role for domestic politics. There is nothing more convenient than putting the blame and political responsibility for necessary action which is strongly contested by vociferous interest groups, on international agencies and international obligations. The EU is the perfect example of national civil servants negotiating a regulatory agenda with the EU Commission staff. National politicians then blame an external and therefore intrinsically unpopular organization for the result they have all designed jointly. The current politicization of the most visible international agencies (World Bank, IMF, WTO, OECD) resulting in agitation by the inchoate and disparate forces of the anti-globalization movements is a consequence of governments re-directing protest to faceless international agencies. In fact, national governments often encourage and later sympathetically take up such protest, to the extent it serves their interest in gaining legitimacy and public opinion support. In consequence, such international agencies have to engage in a political, not only technical dialogue with non-governmental forces. This is likely to lead to a further weakening of nation states and to more "real" power and legitimacy than the currently only apparent power of international organizations. The anti-globalization onslaught on the "pretend" power of international agencies may therefore result in the end in real power. International agencies are therefore in the midst of globalization: proto-regulators of the global economy, they become the target of the anti-globalization protest. They will in turn become politicized actors in global media campaigns, rather than just acting as the "servants" deriving funds, power and legitimacy from the members of the "nation states club."

The primary and traditional function of international agencies is to provide the secretariat services for conferences out of which emerge regulatory instruments such as multilateral treaties. The WTO services the GATT-related treaties (and subsidiary instruments such as protocols and understandings), the Energy Charter Secretariat, the protocols and decisions of the Energy Charter Conference and IMO for various offshore pollution and dumping protocols. International agencies always proclaim that they are mere "servants" of the governments meeting in conference. This is an essential element of the official self-presentation. They will use such defence in particular when attacked by outside forces (press, NGOs) for disliked treaties, treaty administration and their mandate-based activities. This is formally correct: intergovernmental organizations consist of a "secretariat" providing faceless "clerical" services to their governmental masters: preparing studies, conferences services, support of negotiations, reports on implementation. Formal decision powers, treaty-making and the making of subsidiary law under treaties rests as a rule with the conferences or governing bodies composed of government representatives – economic ministry delegates in the case of the OECD, finance ministry delegates in the case of the World Bank (here acting through the World Bank executive directors), environmental ministry delegates in UNEP and so on.

This view of the role of the organization is usually described in the charters and other legislative documents setting up the organization. But such defensive escape into anonymity, while formally correct, also intentionally ignores the reality. An international organization, while professing to be only the servant of its governmental masters, develops within a short while a life, interests, external constituencies and an organizational dynamic of its own. Pure formal descriptions focusing on founding instruments and organizational self-representation are therefore unable to capture the reality of an international agency and its role in the evolution of energy law. International agencies foremost develop a corporate self-interest in perpetuating themselves, even when their original purpose has evaporated. Since they are usually not set up with explicit "sunset" clauses, i.e. a finite end, like a task force, they will continue to exist even when the original purpose no longer exists nor requires the organization's continued existence. International agencies will therefore work hard at pretending that the original purposes still exist and are valid – and justify the considerable expense, usually by membership fees, to maintain them. They will in addition adapt to respond to issues they see as suitable for their survival. The fact that international agencies leap like lemmings, usually all together,

6 An excellent analysis of the bargaining dynamics: R. Putnam, "Diplomacy and Domestic Politics: The logic of Two-Level Games" (1988) 42 *International Organization* 427.

after the most recent fad,[7] reflects this survival instinct. A study of the self-justifications of agencies would lead to the identification of a "life cycle" of fashionable terms, with innovation, reluctance, gradual acceptance, enthusiastic pursuit, widespread use, and finally obsolescence and quiet disappearance.

But agencies dispose of a potent arsenal of instruments for self-perpetuation. They do not rely on the cyclical appearance and fade-out of lead paradigms, but rather exploit this cycle for their own benefit. They have resources to buy-in the support of external constituencies, usually in some sort of patronage: consultancy assignments for people linked to diplomats on their governing boards, senior executive roles for former diplomats or their friends and allies. The fact that senior officers of an agency usually and predominantly are not recruited by an open and transparent international recruitment process, but by the secondment of staff from ministries and in particular their governing boards indicates this symbiosis between the agency and the national ministries associated with it. This transnational alliance then persuades comparatively under-informed governments of the need to continue to pay for them. They have significant power to set the agenda of meetings since their staff will become more expert, with more time and resources (e.g. consultancies) than available to most government delegates. There are always informal linkages between secretariat staff and delegates with ambition and a purpose. Many organizational actions spring out of such informal alliances.[8]

International agencies will develop constituencies – in more euphemistic language "stakeholders", e.g. environmental ministry delegates, academic experts, consultants, environmental NGOs which will support its continuous existence – and the need to fund them. Since few if any agencies are subject to an independent assessment to gauge the continuing need for them, they are very hard to eradicate once established. Most informed assessment is partisan and a non-partisan assessment is usually un-informed since without access and resources for an in-depth assessment. To develop a proper understanding of the role of international agencies is therefore quite difficult, if not impossible. One can understand why most of the international law literature does little more than regurgitate statutory instruments and corporate propaganda rather than at least attempting an independent examination with the aim of at least coming closer to an image of reality.

The work of international agencies is closely related to the functioning of efficient regional and global energy markets. Only the market mechanism can unleash the human forces of innovation and efficiency. The market mechanism has, if left to its own devices, shortcomings – externalities, public goods, excessive volatility. The task of regulation, and therefore, for regional and global markets, of the proto-regulatory functions of international agencies, is to deal with these deficiencies, i.e. to strengthen the effective functioning of international energy markets, internalise externalities, take care of truly "public goods" and smooth out – to the extent feasible – excessive volatility. There is an ever-present risk of over-regulation: "state failure" is the other side of market failure. Over-regulation imposes excessive transaction costs, prevents innovation and thus damages the capacity of society to both create economic and technological resources to deal with the challenges of sustainable development. In international organizations, the risk of preferring state-led solutions is greater than in a national regulator: the international agency is twice removed from democratic legitimization, almost fully removed from the pressure of competitive markets and interacts mainly with like-minded constituencies – i.e. governmental delegates, NGOs and agency-selected experts with a natural pro-agency and usually pro-regulatory bias. This inherent weakness of international organizations is to some extent mitigated by the reduced effectiveness of their action, in particularly of the mainly "talk-shop" organizations.

In the remainder of this Paper, we will review relevant international agencies, with comments on their role and function. Due to space constraints, only the international agencies of most significance for energy will be discussed.

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7 I have worked in and with international economic organisations since 1996. I have observed a continued "product cycle" of "lead concepts": basic needs, transfer of technology, self-reliance, the role of women in development, institutional reform, good governance, eradication of poverty have succeeded themselves as the lead paradigm in a usually 5–7 year period, with some lead concepts (e.g. basic needs) now returning under a different label ("eradication of poverty"). The risk for sustainable development is that it might suffer the in-built obsolescence of a lead paradigm. There is a regular sequence of "concept cycle" phases: disregard of minority criticism, gradual acceptance, acquisition of the pole position by the development community, widespread "mantra"-likc use and repetition resulting in increasingly voiding of substantive content; criticism of inherent contradictions and hypocrisy, gradual fade-out from general use and finally deposition into the "old ideas" archive.

8 As a UN civil servant, I regularly drafted the resolutions to give us work and a mandate for funding together with sympathetic delegates with an institutional or personal interest in the follow-up activities. That seems to be the rule throughout the international agency world.

2 Organization of Petroleum Exporting Countries (OPEC)

If one tries to deal with truly "international" energy law, OPEC is the international organization with the greatest impact on the oil sector, but also with influence on energy and energy-related environmental questions, and not only on production and trade, but also on investment. OPEC countries currently control about 75% of the world's oil reserves and 40% of oil production. What is more, most of low-cost oil is produced by OPEC countries. This means that a prolonged slump in prices will tend to enhance these market shares.[9] High-cost producers also tend to deplete their reserves much more rapidly. This means that the lower the price, the greater the subsequent enhancement of future OPEC's market share.

The suppression of the existence of OPEC that one finds in Western international law literature reflects a Euro- or US-centric perspective. OPEC is an actor that does not fit well into a traditional perspective given that it has been seen, since the 1970s, as at least co-responsible for high oil prices, nor into the modern "green" perspective since it pushes, naturally, for hydrocarbon consumption. The fact that a high oil price has as much of an energy-efficiency impact as most other measures undertaken by Western governments does not help – it is a high oil price imposed by the interest of producing countries and not, as the EU large gasoline excise taxes, for, at least ostensibly, environmental reasons. It also does not fit into the mind-set of Western NGOs: OPEC does not conform with the dominant view of developing countries as victims and passive beneficiaries in need of high-minded Western support and guidance, but it is rather an independent actor outside Western control. It is also barely, if at all, the object of NGO attention or exposed to NGO pressure. NGOs play virtually no role in the political systems of almost all OPEC countries.

In the 1970s, OPEC was viewed with great hostility (including US calls for "resource wars") as it seemed to set up a dependence of Western countries on a group of developing countries – which is counter to the situation seen as normal. OPEC still carries the image of the 1970s with Sheiks swimming in petrodollars. But, apart from Qatar, UAE and Kuwait, OPEC countries are much closer in their socio-economic make-up to developing countries. It was also seen in Western countries, particularly in the US, as threatening the high standard of living, which is largely based on comparatively high per capita hydrocarbon consumption. OPEC, I suggest, is currently the one global force which keeps the US and European petroleum production, its industry and its companies, alive and in healthy profit. This fact is counter-intuitive and counter to the standard reference to the "OPEC cartel". It facilitates worldwide adaptation of companies' production to demand, thus smoothing destabilizing price cycles; it also makes addition of new capacity, with its de-stabilizing influence on the normal price cycle of this commodity, more difficult by restricting access to acreage for new oil development.[10] In other words, it carries out the functions of the corporate petroleum cartels – then supported by their governments – of the past. In addition, by working against a fall of prices to their marginal cost, OPEC's effects are the equivalent of adding the ideal climate-change tax on hydrocarbon consumption. Restriction of investment in OPEC countries – basically for production likely to exceed the present and perhaps expected future quota – has an effect of supply restriction, again something that environmental groups opposed to oil have called for. Multinational companies and environmental groups are thus the silent partners of OPEC, though still quite unconscious of this and mostly trapped in the frame of mind of the 1970s. The only divisive issue of substance at this time is, as is normal, the division of spoils. The main cost of OPEC falls on consumers. Though, arguably, its pricing strategy – well beyond marginal production cost – also means greater security of supply as otherwise uneconomic reserves, as a rule outside OPEC countries, have been developed. Without OPEC, the only reserves worth developing would be those low-cost reserves, mainly in a very few countries in the Middle East.

OPEC was founded in the 1960s through a Venezuelan-Saudi initiative to reduce dependence on the international oil companies.[11] At the root of OPEC's formation were pricing disputes with the companies and US import restrictions. The main objective was to establish a common front vis-à-vis the oil companies with respect to several fiscal issues ("expensing royalties" in lieu of crediting them against tax; calculation of the proper reference price for oil taxes and royalties). Its objectives evolved in the 1960s in response to US government and oil company action moving gradually from a focus on tax matters to oil pricing. First, a developing country producers' association to develop links, information and discussion, it supported the efforts of major producing countries in the 1960s and 1970s (Iran, Gulf countries, Venezuela) to take over foreign-owned operations and set prices. OPEC Resolution XVI.90 of 1968 formulates a common agenda and

9 Low oil prices will also tend to increase the efficiency in high-cost areas (e.g. North Sea). Significant results in terms of lowering production cost have been achieved, e.g. by the UK CRINE initiative. This incentive for efficiency is not present in the Middle Eastern low-cost producers. But the difference between, say, North Sea and Saudi production cost is still very large.

10 B. Mommer, *Global Oil and the Nation State*, 2002, develops this as an implicit function of OPEC since the 1970s.

11 P. Stevens, *Oil and Gas Dictionary* (1988), 138–140; L. Lugo, *The Amazing Story of OPEC* (1997).

the legal position of producing countries.[12] This crucial, now quite dated, resolution also expresses explicitly the otherwise implicit OPEC policies restricting acreage access by the international oil companies; the principle is still alive in the Middle East, but has been disregarded in Indonesia, Venezuela and Nigeria. In terms of impact on international law, that was perhaps the period of the major impact: OPEC's position was fully aligned with the then prevailing "Third World" claim for a "New International Economic Order" with "Permanent Sovereignty over Natural Resources" and exclusive jurisdiction over foreign investment, including the right to nationalize. OPEC's then success fed directly into the formulation of the NIEO-resolutions of the UN General Assembly, and those in turn provided and amplified legitimacy to OPEC actions – without much attention paid to the fact that the increase of the oil prices then affected developing countries most.[13]

Similarly, much of the Western strong and instinctive opposition to the NIEO concept was based on the fear of being at the mercy of the oil producers grouped in OPEC, a fear that, with the NIEO being buried, energy of more plentiful and supply of more diversified, is hard to appreciate in times of oversupply and low prices. This fear, naturally, recurs in times of tight supply and high prices, and in particular if there are concerns over politically (or now religiously) motivated supply disruptions. In the 1970s, US academics and international relations specialists openly suggested the legitimacy of a "resource war" to secure oil supplies from recalcitrant suppliers. No account was taken of the much higher energy consumption per capita in Western countries, in particular the US. It was a kind of sacrosanct right to energy supplies from wherever energy resources were located then prevailed.

With most of the upstream oil and gas reserves and production in the hands of producing countries' state enterprises by 1980, OPEC became the forum for dialogue, and sometimes collective action, by its members. While the very early days of OPEC focused on royalty/tax questions, by the 1970s the focus was price setting. This was later replaced by the use of production quota for each country. The intention then was that through the change of the production quota in response to market conditions, prices within desired price bands could be achieved. With oil revenues dramatically increased after 1973 and again 1981, it set up the OPEC Special Fund for development aid.

OPEC was seen as a threatening "cartel" in the 1970s when it tried to set prices, but it is not clear if market conditions and actions by the major producing countries (in particular Saudi Arabia) or OPEC as a common voice of the producing countries were the real cause. The view of OPEC has largely mirrored the ups and downs of oil prices: a threatening cartel in the 1970s and early 1980s, it became a "paper tiger" and mere facade for Saudi policies after the oil price declines in 1985 and again in 1998.[14] When quota discipline did seem to stick again in 2000, to the US it was again viewed as an illegal cartel. OPEC did move closer to the image of a conventional cartel in the 1980s when it set production quotas for its members. These failed to a large extent due to lack of discipline, but the severe collapse of oil prices in 1985 and again in 1998 seems to have persuaded its members (and significant non-members such as Russia, Oman, Norway, Mexico and the US oil industry) that there is mutual overall benefit in the quite normal market logic to reduce production and capacity in a low-demand, low-price context, and increase it in a high-demand and high-price context. As of 2002, OPEC seems to have managed to respond, even if not perfectly and to all theoreticians' recipes, to oil price volatility by a corresponding adjustment of the OPEC member's quota.

OPEC is an international organization headquartered in Vienna with a staff of about 120 (with 25 senior professionals from member countries). The secretariat does not, unlike other international agencies, seem to have developed a major autonomous role. It is engaged in research, monitoring of market trends and technical preparation of the meetings of ministers. Attempts to acquire a larger role of its own seem to be regularly rebuffed by its members. The IEA, for example, born as a reaction to the formation of OPEC, has a much larger, much more serious and even more autonomous role and outreach. It has built up a reputation for high-level competence which is probably due to the autonomy given by its members and the emphasis on professional competence. An important part of OPEC's mandate is presenting OPEC's view to the public, and in particular developing informed response to the criticism of OPEC mainly in Western countries – a function of bundling the expertise in and for OPEC countries and providing an "OPEC view" to the world. But even so it seems that the major countries (in particular Saudi Arabia, able to rely on ARAMCO, the world's largest oil company) do not fully trust the OPEC secretariat, either with respect to sharing intelligence with it or using its

12 H. Zakaryia, quoted in: T. Wälde, "Revision of Transnational Investment Agreements" (1978) 10 *Lawyer of the Americas* 265.
13 T. Wälde, "Requiem for the New International Economic Order," in G. Hafner and G. Loibl (eds), *Festschrift fuer Ignaz Seidl-Hohenveldern* (1998); for this reason, the OPEC Fund for international development was set up.
14 V. Stagliano, "The Ghost of OPEC in Energy Security Policy," *Resources for the Future*, Spring 1995, No. 119, 6–9.

work, but operate their own oil market intelligence machinery. The use of OPEC by its member states is quite limited. Perhaps given the great differences among them (with nothing uniting them other than oil- dependence), OPEC member states seem to use OPEC much less for jointly building strategic expertise and negotiating capacity and for developing a professional network for intelligence, standard-setting and policy formulation than, for example, the much more homogeneous industrialized countries grouped in the IEA. The studies which are, at present, being carried out by the World Bank on petroleum revenue management, or work on petroleum law, contracts, taxation, safety regulation, environmental protection would constitute the natural mandate for an organization of oil producers. But member states seem to have preferred to limit their solidarity to the essential core – production and pricing policies, rather than build up OPEC as a common producing countries research, think-tank and standard-setting organization – as is the function of international agencies such as the OECD, IEA or NEA. It seems that the organization, including its system of decision-making, its mandate, its staffing and budget level are much in need of modernization to adapt to post-2000 globalization. This is a world that is very different from the confrontation with the "Seven Sisters" in 1959 which was at the root of OPEC's foundation. OPEC – or better its member states – would benefit from carrying systematic benchmarking of the structure, organization, recruitment and funding mechanisms in place in organisations such as the IEA.

The Secretary-General (mainly three years) as well as the post of Chair of the board of governors (one year, on alphabetic rotation) are filled in relatively short-term rotation. The principal organ is the Ministerial Conference; management is under the authority of the board of governors. Special issues (in particular monitoring of the oil price and production quotas) is handled by specialized ministerial committees. The Economic Commission reviews reports and is responsible for technical recommendations for the ministerial council. Its budget (1995) was about US$15 million. From all accounts, the organization seems to have little influence on the oil policy *per se.* There are little evidence that the secretariat brokers compromise in the typically very fractious dialogue. It is also hampered by the fact that more significant secretariat positions can only be filled by nationals from OPEC member states. Since OPEC has, in comparison to for example the IEA, a much smaller number of member states, this is one constraint (there are others) for its staff work. The pool of qualified professionals is therefore much smaller; as often in international agencies, member state influences play a large role in recruitment. Member state control over OPEC activities (including recruitment) reportedly goes much further than in other international organizations. This may be due, *inter alia*, to the small number of member states and the sensitivity of oil production to those states, but also to the prevailing culture of caution in the most influential member states. The fact that OPEC members are – apart from being major oil producers – much less culturally homogeneous than, say, the OECD and IEA, that may also be a hindrance to the full development of the inherent potential of OPEC's secretariat. It seems that OPEC does not grant to its staff the status of independent civil servants. While this principle is not always taken seriously in practice in other international organizations, it does help to establish a professional culture. Long-term, contractually tenured, international civil servants tend to develop an "esprit de corps" and identify rather with the organisation than their country of origin. Civil servants, on the other hand, which are appointed on relatively short- and fixed-term contracts on the recommendation of their sponsoring home governments, will naturally have their prime loyalty to the home government.

In spite of such constraints, OPEC has developed considerable expertise in the operation of petroleum markets, perhaps largely through links with the very large state oil companies in its member countries. It regularly publishes the OPEC Bulletin, the OPEC Review and the Monthly Oil Market Report; these bring together know-how, with the focus very much on authors from its member states. OPEC, as an international organization, constitutes, provides and services a forum for discussion and determination of concerted action by the member states. Such action consists, in the main, as of 2002, of production quotas per member State plus their adjustment in response to oil prices. Currently, OPEC pursues a policy of increasing production levels when prices over a period exceed a specified price band and lowering production levels when prices decline below the specified price band.[15]

OPEC's current role in the evolution of international energy law is marked by two key issues. First, the organisation was founded on producing countries' natural interest to increase and stabilise revenue, i.e. its "mineral rent" from its control over oil and gas resources. That is still its *raison d'etre.* But there are tensions between short-term maximisation through price versus long-term strategies centred on market-share for OPEC oil and gas as against non-OPEC competitors and non-hydrocarbon alternatives. Here, there is a

15 *See* Farewell open letter by the then outgoing Secretary General Ali Rodriguez Araque, available from the OPEC website.

conflict between Western, in particular EU governments' high excise taxes and OPEC policy.[16] High excise taxes – up to four times or more the price of gasoline (e.g. UK) – have an environmental justification. They internalize external costs to the environment and by road traffic. But they are also a convenient cover for a large tax income to compensate for the more visible lowering of income tax rates. The OPEC-consuming country conflict is not about a higher price for petroleum-based energy, but rather about who gets most of it. The EU and the US have tried to deflect political blame for high gasoline prices on to OPEC. They have, however, not been ready to accept the OPEC interest in stabilized oil prices and a "fair" OPEC share of the mineral rent on a formal negotiating agenda. Second, OPEC is naturally disinclined to view favourably the curreny Western, especially EU government policy to use heavy pressure to move away from hydrocarbons in favour of renewable energy sources as this would devalue its reserves. But such policies could go hand in hand with a price- and production-based supply restriction.

Both sides however, producer and consumer states, have some commonalities: there is an interest in all states with substantial petroleum production (US, UK, non-OPEC producers) and exports to oil producers not to have the oil price decline as dramatically as it did in 1985 and 1998; the consequences are a deterioration of the position of high-cost, non-OPEC production as well as non-conventional energy, reduction of trade with OPEC countries due to their then abruptly collapsing purchasing power, disruptions in the world financial system, greater economic volatility and greater emission of greenhouse gases due to cheaper petroleum.[17] Volatile oil prices – the benchmark for all energy pricing – will undermine the economic viability of much of the current drives towards non-hydrocarbon, energy-efficient, and renewables-based energy scenario. Both groups may also have an interest in capping petroleum prices as this would lead to both inflation (a problem for consuming countries) and an accelerated substitution of petroleum (a problem for OPEC countries). In theory, there is accordingly a possible deal between consumers and producers to stabilise oil prices in an acceptable range, to reduce volatility of little interest to anyone but oil traders and include some sort of monetary coordination to make oil prices responsive to high-growth and recession situations. Such a negotiating agenda might also contain quid-pro-quos in the area of free access of oil and oil-based products to EU and US markets and some principles on sharing mineral rent (i.e. between consumer excise taxes and producer royalties).

Climate change itself is not a mid-term threat to OPEC countries if production (based on investment) is kept in balance with demand. The OPEC policy of implicitly keeping controls on investment and explicitly on production is quite compatible with the more extreme anti-hydrocarbon positions taken by NGOs such as Greenpeace: exiting from hydrocarbons by restricting supply. OPEC policy can be interpreted not only as a price stabilisation (increase) policy, but also as a conservation policy, in the sense of Art. XX of GATT. But current Western thinking is not favourable to the use of regulatory instruments (trade, investment and pricing rules) to smooth pricing volatility. The history of the largely failed commodity stabilization instruments of the 1970s and 1980s does not encourage new tinkering with similar instruments. Country-based income stabilization is another matter. In a volatile industry, it makes sense to skim off surplus in rich years and add to invested funds to add income in lean years. Many if not all OPEC and Western producing countries have developed different types of oil income funds (Alaska, Norway, Kuwait, Abu Dhabi, Venezuela). These are now proposed or established for new developing country producers.[18] In essence, income is stored away and made more difficult to access except in cases of emergency or severe budget pressures due to historically low oil prices. Such income stabilization may not make oil prices less volatile, but would make low price periods easier to suffer.

These are issues for an agenda of discussions between OPEC and the producer countries (with the IEA and the EU as the main interlocutors). Such a dialogue has been attempted in the 1980s and in a low-profile way again more recently.[19] But no prospect for more than consultation and information-exchange has emerged so far. While OPEC is currently the major international petroleum organization, it is neither a major influence in prospective negotiations with consumer states on oil price stabilization as yet, nor, apart from a critical role and observer role, in the Kyoto-based climate change negotiations. Perhaps, there is less of a role here for

16 OPEC estimates that the G7 nations in 1996 obtained oil tax incomes totalling US$270 billion, while OPEC petroleum export revenues were US$160 billion.

17 A. Alhajji, "What Have We Learnt from the Experience of Low Oil Prices," *OPEC Review,* Sept 2001, 193.

18 Norway, Alaska, Alberta, Kuwait, Oman, Venezuela, Colombia, Azerbaijan, Chad, Iran, UAE. Charles McPhcrson, of the World Bank, has written in 2001 a paper on Petroleum Revenue Management in Developing Countries: see http://www.worldbank.org/html/fpd/mining/news/conference/taxation/McPherson.pdf. The World Bank is engaged in a project on the use of oil revenues.

19 Saudi Arabia called in 2000 for the establishment of a permanent secretariat for the International Energy Forum. A Forum secretariat is now being established in Riyadh following a producer-consumer meeting in 2002 in Osaka.

formal international law, than for quiet diplomacy in significant bilateral relations (e.g. US – Saudi Arabia) impacting on national policies towards oil and gas. The Western world has largely tried to suppress the existence of OPEC psychologically or destroy it. US external energy policy since September 2001 is, at least implicitly, again attempting to free itself from its overwhelming and inevitable dependency on oil supplies from Saudi Arabia. Its newly emerging strategies – entente with Russia, building up the Kazakh producers, accelerated expansion in West Africa and attempt to distance Nigeria, Indonesia and Venezuela from OPEC, prospect of a regime-change in Iraq towards a more US friendly regime – follow the now 30-year-old tradition of anti-OPEC policies. I suggest that a policy of active and formal engagement with OPEC might be more fruitful. The lack of such an active engagement may be because both OPEC and the IEA, as organizations representing major producers and consumers, are in themselves weak, secretariat-like services without the ability to identify and strike major international deals.

The role of OPEC is also likely to come under scrutiny from WTO law; several OPEC members are now in the process of accession. GATT/WTO obligations do not apply to OPEC which is not a WTO member, but to its member states. Production quotas such as the ones currently used are "export quotas" under Art. XI of the GATT.[20] One justification may be under Art. XT (2(b) – measures "necessary for international marketing of commodities"; the next defence could be found in Art. XX and XXI of the GATT. The question is justifiability under Art. XX, mainly (g) – conservation of exhaustible natural resources or (h) – pursuance of obligations under any intergovernmental commodity agreement which conforms to criteria submitted to the WTO parties and not disapproved by them. Acceptance as a legitimate measure under an international commodity agreement might be one way, but it is unlikely that governments – without a comprehensive deal being struck with OPEC – would approve such arrangements at present. OPEC quotas are intended primarily to maintain and increase price levels. Do they have a conservation function? It is at present not a primary rationale for these measures, but it can be seen as a secondary justification. Conservation is certainly the effect of a higher price and government-induced limitation on production. But the condition is that such conservation measures must be equally applicable to domestic production. That this is done currently is questionable, but needs more in-depth investigation. OPEC countries would also rely on the national security exception (Art. XXI of the GATT); acceptance of this is far from certain, but the concept has been interpreted by major trading countries (US, EU) very widely. The dependency of OPEC countries on oil production, not comparable to the role of oil in other countries, would be an argument. GATT does not include any formal reference to "permanent sovereignty over natural resources" (GA Res. 1801 of 1962) or "energy sovereignty" (Art. 18 ECT). But this principle could be seen as controlling or at least influencing the interpretation of the national security and conservation exceptions (Art. XX of the GATT), either directly as customary international law or indirectly as a result of GATT interpretation for maximum compatibility with customary international law. Accession negotiations and conditions could carve out an exception for participation in OPEC export quota schemes.[21] However, accession to the WTO is now subject to increasingly restrictive conditions – getting into the club early means having to live with less such constraints. The WTO in 1948 may have been primarily about access to manufacturing goods, with little interest in energy security. But this has changed for the influential blocks in the WTO. There is and will be more and more of an effort to extract concessions favouring US and EU energy security concerns from the resource-owning countries requesting membership. For example, in the case of Russia the dual energy price (i.e. higher export price, lower domestic prices for both energy exports and pipeline tariffs) is currently a stumbling block (as is the prohibition on TRIMs). Nevertheless, the legal instruments for a "deal" are available – but it needs political will and some creativity to identify the contours of a deal that improves the situation of both sides.

Possible future membership of the OPEC countries in the Energy Charter Treaty[22] would raise the same questions as raised for the WTO as the ECT provides for non-GATT members' application of GATT provisions with some qualifications. Different from the GATT, however, the ECT, in Art. 18, explicitly recognises "Energy Sovereignty" and "the optimisation of (resource) recovery and the rate at which they may be depleted or otherwise exploited" (Art. 18(3)). Arguably, ECT membership therefore poses less problems for OPEC countries than the GATT (though the GATT/WTO includes several OPEC members and others in accession discussions, while the ECT does not). There may, however, be soft-law disciplines under the ECT

20 Very early GATT reports leave no doubt that export restrictions used to avoid price competition among exporters and maintain export prices are covered by Art. XI, GATT.

21 UAE, Nigeria, Qatar, Venezuela, Indonesia and Kuwait are WTO members; Algeria and Saudi Arabia are in accession negotiations; Iran and Libya's applications for accession are explicitly being blocked by the US; Iraq is not a member nor involved in accession discussions.

22 (1995) 34 *ILM* 360.

for "export taxes" on oil[23] and under Art. 6 (competition law) as well as Art. 5 (prohibition on TRIMs). Some of these issues could be solved through "Understandings" negotiated by countries requesting accession (or, in the case of Russia, before ratification). Such understandings could include a limitation or long transition process for the TRIMs obligation (Art. 5), a recognition of OPEC production control (limiting any argument about the competition law article 5), an understanding that the ECT does not affect issues that are controversial between the EU and energy exporters (e.g. Russia, Algeria) such as destination clauses and initial access to new infrastructure such as pipelines.

To sum up: OPEC, as an international organization and forum which facilitates coordination among the major oil and gas producing countries, is now increasingly pulled into the institutional structure of the global economy. There will have to be a give-and-take on both sides to conclude such integration successfully. Unlike the more hostile 1970s, OPEC currently fulfils invisible but important functions for both domestic producers and international oil companies by being the organization most keen to – and most capable of– stabilizing prices by helping producers to manage production. Whether this ability – which was not evident in the 1980s and 1990s – is maintained or, as happens with most cartels, will fade again, is outside our ability to forecast. Sustainable development requires greater application of energy efficiency, minimisation of emissions that are harmful for the global (and localized) climate and possibly restrictions on the supply, and use, of hydrocarbons. Such policies, eagerly pursued by NGOs and the EU, for example, are unlikely to succeed if proper account is not taken of OPEC, the major international agency of the major oil producing countries. This analysis suggests that there may be more compatibility that meets the eye or which is intuitively implicit in the conventional reference to the "OPEC cartel". We suggest that an overall deal is possible, but requires a more active and creative effort at identifying communities of interest and much stronger leadership in pursuing and negotiating them on both sides. An arrangement could require some concessions by OPEC in terms of managing the oil price as a contribution to a stabilizing world monetary policy (e.g. lower prices in a recession; higher in a boom). It would require better guarantees of security of supply to concerned parties (e.g. US, EU, China). Oil prices could also be linked to import prices for the producing countries. In exchange, there could be some examination of the very high excise taxes on gasoline and some other developed country policies affecting the producer states. A higher price for oil together with a discipline on supply could be in the interest of both the OPEC countries, the environmentalist community and consumer countries long-term interest in a stable and secure oil supply. An unfettered global oil market is probably not in the interest of anybody – contrary to recurrent allegations in particular in the US. An unfettered oil market without political influence never existed. It would drive down oil prices to very low levels, close down most non-OPEC production (including in the US), counter current Kyoto and energy efficiency objectives, discourage development of renewable energy and would very likely result in extreme swings in oil prices.

3 International Energy Agency (IEA)

The IEA in Paris is the Western response to OPEC, though to mention explicitly this reverse-mirror role seems to be taboo. It is the main international organization dealing with energy, though its mandate, membership and operations are very limited – essentially it is an intergovernmental energy policy institute for Western countries which also manages an emergency sharing system. Its importance also derives from the fact that there is no global intergovernmental energy agency. Quite likely, the division between the Western (IEA) and producer country world (OPEC) is the reason that there has not been enough political interest and effort to create a World Energy Agency (WEA). Existing international agencies with an energy mandate (UN, UNCTAD, UNEP, UNIDO, World Bank) would also see their turf threatened if a World Energy Agency were to be created and would seek to take on such mandates.

The IEA was founded in 1974 on a suggestion by Henry Kissinger made in 1973, i.e. at the height of the first oil crisis, sudden increase in oil prices and take-over of foreign-owned oil production by the producing countries. OPEC, whose existence was disregarded in the 1960s, came to be seen as the main instigator and a powerful cartel threatening western countries' – in particular the USA's – oil supply. The IEA was, and is, explicitly limited to western, that is most OECD countries.[24] South Korea, Hungary and the Czech Republic

[23] Art. 29(4): states shall "endeavour" not to increase export levies.

[24] Members, at present, include the EU countries (plus Hungary and Czech Republic), Turkey, the US, Japan, Canada, Australia, New Zealand and South Korea. The EU participates, but is not a member (though it could accede). Norway is member of the 1EA, but not of the emergency system, based on a special agreement with the IEA.

have recently joined the IEA.[25] The IEA was not meant to be or become a universal energy organization. As with the EU (*infra*), there have been intermittent calls for a UN Energy Organization, most recently to be attached or within UNIDO, but these have so far come to nothing. The IEA's basic purpose was to develop a system of collective energy security mirroring the collective producer power embodied in OPEC, then at the height of its power. Such collective energy security operates through the continuing emergency sharing system administered by the IEA. This system was never put into operation, though that may have been close at the time of the first Gulf war in 1991.[26] The most significant supply disruptions in the EU came about not because of OPEC and Middle Eastern conflict, but because of resistance to another round in gasoline tax increases by the British and other EU governments in October 2000.

The IEA's *raison d'etre* has therefore diversified away from its earlier focus – Western solidarity in the face of OPEC-faced threats, towards energy-focused research and market intelligence, i.e. the type of work that is also well carried out by academic institutions, consultancy and investment firms. The IEA advantage or difference is that it is publicly and internationally funded, and therefore with much more historical continuity, financial stability and less dependence on markets, clients and national budgeting processes than private or nationally based public energy research institutes. While still in charge of the OECD countries' energy sharing mechanism, it now fulfils a function of centralized research and intelligence quite similar to the role of national energy institutes or the pooled research and intelligence function of international business associations. Focused on something that is still seen as strategic, and insulated from the questioning of national agencies of that type by its character as an international organization, it may have to justify its continuing usefulness by defining more closely the "public good" it delivers and its distinctive comparative cost and quality advantage over private, more market-driven organizations.

The International Energy Programme of 1992 is the treaty constituting the IEA.[27] Membership is limited to OECD countries, but there is no automatic membership of OECD countries. Accession therefore requires a double hurdle – to the OECD and then to the IEA. The close-to-membership association agreement with Norway might, though, be a relatively simple way of proto-membership for non-IEA countries (if this was considered desirable). An IEA path towards a universal energy agency is therefore in all likelihood blocked; given the common economic and political orientation, one could advocate a link-up with the Energy Charter Conference, if the US were to join (see *infra)*, but a full merger seems not to be on the cards as long as Russia and the other former Soviet countries are not OECD members. The IEA is open to membership by the European Community (Art. 72 of the IEP), but this has not happened as yet. The EU Commission participates in all meetings without voting rights. There seems to be a low-profile competition with the EU Commission. Decision-making by its governing board is mainly by majority voting, not by consensus as in the OECD. This should make the Agency able to act more rapidly, theoretically, in view of energy disruptions, which was the intention of a voting arrangement different from the OECD. Votes are weighted by pro-rata oil consumption highlighting the economic weight and role in emergency sharing.

The IEA is in a complex relationship with the OECD as an "autonomous agency" with its own Executive Director, its own budget (though formally integrated into the OECD budget) and governance process, with some integration into and use of OECD administrative services.[28] Funding is by membership contribution based on the OECD scale, plus voluntary, project-related contributions. The IEA has a separate division on "non-member countries" which is used for an energy policy dialogue, economic studies and joint research projects. A modest "global energy window" is thus open to the IEA via its "non-member" activities and structures. Unlike other national or international agencies (e.g. World Bank, UN, UNIDO, UNCTAD, IMF, IMO), the IEA seems not to have provided technical assistance (policy advice; legislative, tax and institutional reform; training; assessment of energy projects and programmes; privatization; investment promotion) in member or non-member countries. Given that the IEA has a large core of expertise, a comparative edge in its specialty field and an energy policy link with all the IEA and many non-IEA countries, that is regrettable. Energy assistance, when provided by other agencies (including the EU Commission) is never the central focus of expertise and interest and therefore often provided with rather uneven know-how. Member states must have preferred energy policy assistance to come through their bilateral aid agencies, perhaps with the idea of

25 There have been discussions with Mexico (which originally applied for membership). But in the meantime Mexico has withdrawn its application: J. Abramowski, "Mexican Energy Laws," (1995) 13 *JENRL* 29.

26 At the time of writing this paper, a second Gulf war looked likely. The IEA is again preparing plans to ready its emergency sharing system.

27 Its character as a proper international treaty independent from the OECD seems to have been questioned in bureaucratic turf battles with the OECD, but is strongly defended by the IEA.

28 The IEA is much more autonomous than the "Nuclear Agency," a part of the OECD proper.

gaining a competitive advantage for their own energy industries and consulting firms rather than providing regular programme funding for technical assistance to the IEA. Also, the IEA may have intentionally avoided vigorously seeking voluntary contributions which would have placed it in competition with most other international agencies. The rough-and-ready tumble of international aid competition does usually not sit easily with well-funded international organizations staffed by Western civil servants on secondment. The dual character – rarefied and rare emergency sharing here, intergovernmental research institute there – may also not sit easily with the competitive vigour required to develop a sizeable role in policy advice.

The traditional core of the IEA is its emergency oil sharing programme – now better described with the wider term "emergency response measures". It consists, first, of measures by member states to reduce demand and to maintain oil stocks at 90 days of net imports. If emergency situations for the whole IEA group occur (two levels of group shortage: a 7% and a 12% shortfall, to be determined by the IEA Executive Director), a rationing plan is triggered which also requires surplus countries to provide for imports into deficit countries. IEA-based oil companies may have to be directed by member states to re-order supplies. There is a regular coordination mechanism between the IEA and such oil companies. The trigger is an actual shortage – rather than a sudden price explosion, so that the mechanism is rather akin to a war-time international rationing plan than a market intervention mechanism. The distinction between the two is sometimes questioned. Price spikes can both indicate and cause a disruption of physical supplies and market intervention can help to manage scarcity situations. The US, for example, has been more interventionist in deploying their strategic reserve in high-price situations, e.g. in 2000/2001. With two more recent governing board decisions in 1984 and 1995, the flexibility of the IEA and the member states to respond in a coordinated fashion to pre- emergency situations was increased, basically by a consultation procedure leading to the use ("draw-down") of the oil stocks. None of these mechanisms has ever been activated, though the beginning of the Gulf war in 1991 led to calls to start at least with some use of oil stocks to calm markets. The relation of the IEA mechanisms to market developments (which can cause shortages as well) is not very clear. Presumably, the current concept is that action to reduce prices is not justified, but only to deal with significant physical shortages. But when market developments lead to physical shortages, the very presence of the IEA mechanisms and in more severe cases their activation should have an effect on the market. Responsiveness to the oil markets (both physical and forward plus paper-based) and management of physical shortages can therefore not be completely divorced from each other. The IEA members have been moving away from primary reliance on sharing. It has now become, in essence, a measure of last resort. The primary emphasis is on coordinated measures involving the timely draw-down of strategic stocks, supplemented by demand restraint, oil production and fuel-switching measures.[29] A new EU Communication[30] suggests: "As regards the IEA, the basic elements of the 1974 Treaty are no longer applied. Other provisions have been put in place, but these require the unanimity of the 26 participating countries. The mechanisms have become obsolete in as much as they provide for joint action only if there is a physical disruption of oil supply. There is no legal framework for the coordination of action in the event of a threat of a physical disruption which would increase oil prices beyond what is reasonable." The EU report furthermore highlights the absence of gas in the IEA emergency sharing system – in spite of gas having much greater significance than in the 1970s and the risks requiring consent from IEA member countries in a completely different situation than the EU.

Otherwise, and in view of the largely dormant character of the emergency programme, the IEA has become very much a collective study organisation for its members. There is regular reporting to enhance the transparency of oil markets; in-depth review of country energy policies – with recommendations, preparation of "outlooks" which provide national (and commercial) actors with some idea about the future of energy demand and supply and a formulation of "shared goals" which at present comprise liberalization of markets and environmental issues. The IEA is unlikely to take a position on implementation of the Kyoto Protocol to the UN Framework Convention on Climate Change as long as there is a strong divergence between the US (and most of its companies) and the EU (and its companies). Different from other more visible international agencies (e.g. the OECD with its failed effort to negotiate a multilateral agreement on investment; the WTO, World Bank and IMF with their exposure to the anti-globalization movement(s)), the IEA has so far escaped most public attention. This relative immunity, though, is also likely to make it less aware of non-governmental views and demands and less able to engage in a dialogue with them. Finally, the IEA provides an institutional vehicle for research in energy technology through, so far, over 40 collaboration agreements that it sponsors, including with non-member countries. There should be potential here to engage not only scientific and technological, but also more applied and policy-oriented technical assistance.

29 A comment from Mr Craig Bamberger, until 2001 the Legal Counsel of the IEA.
30 "Internal Energy Market: Commission Proposes Strengthening Security of Oil and Gas Supplies," 11 September 2002, at 4.

The IEA is in a curious situation. A child of the oil agitation of the 1970s, it may find itself in search of justification for its existence. With the realisation that the oil exporting states are much more dependent on export than the importing states, the fact that the emergency programme has so far never been activated, can be more easily explained. With oil itself declining in the energy mix – substituted in part by gas, and now, under the signs of Kyoto change, the new push towards renewable energy resources, its oil-focus risks obsolescence. Energy security is now no longer exclusively a matter of oil supply, but also of gas, coal, uranium and electricity supply. Energy security for the IEA member countries, in particular the EU, means a favourable investment situation in producing countries, favourable legal and institutional conditions for transport and transit of energy resources – and electricity – and physical infrastructure (plus a regulatory framework maximising its use) such as pipelines, interconnectors and storage facilities. While the IEA has dealt with such issues in various studies, it has no operational, or policy advisory role. Also, its character as a strictly Western, OECD-type of organisation may be in question as globalisation and the forces now triggered call rather for universal organisations, with an ability to conduct a global dialogue with all relevant stakeholders, conduct globally focused research and prepare globally relevant policy studies corresponding in coverage with the globalisation of energy markets. This has been brought home starkly to the OECD when it tried to negotiate (in its club atmosphere) a multilateral investment code that was mainly relevant and intended to be ultimately applied to non-OECD countries.[31]

There does seem to be a need for a truly universal energy agency, as energy continues to be the mainstay of the global economy. One way would be to maintain the emergency sharing system of oil, but to expand the organisation's focus on all energy sources, expand membership (perhaps in associate form) to all countries wishing to join and put more emphasis on developing energy-related technical assistance. The IEA's non-member countries and its research contract areas would seem to provide a nucleus for such expansion. One might envisage an IEA consisting of two components – an emergency-sharing, OECD-based side and a universal, all-energy-based side. This could be developed gradually, and might emerge over time anyway, but it would also make sense to consider amending the IEA Agreement to provide for formal associate membership to non-OECD countries. In terms of influence on international energy law, the IEA's contribution has been mainly the emergency-sharing system as a free-standing element. IEA studies – generally of high quality, often prepared by seconded government and industry staff – will have an influence on policy-making by accentuating policy shifts (as presently towards liberalisation and environmental mechanisms), but there is little direct influence on national energy law reform – as, for example, through bilateral or World Bank and UN technical assistance – nor has the IEA so far played a visible role in the evolving WTO-, NAFTA- or EU-based trade law of energy nor in the many environmental treaties, protocols and guidelines now emerging.

With or without the IEA, my policy recommendation is for a truly global World Energy Agency (WEA). The energy industries are coalescing into a truly globalized industry. This means there is a need for the research institute-type of work of the IEA, the market stabilizing influence of OPEC and the proto-regulatory work of the OECD, but involving, on an equal level, all stakeholders, both governments, companies (for example in the way they are involved in the ILO procedures), other international agencies (IEA, OPEC, OECD, WB, UN agencies) and non-state actors such as industry, professional associations and NGOs. As the EU Commission recently noted, energy in developing countries is "an orphan without a parent international organisation."[32] There is currently no push for such an organization and nobody with the authority of Henry Kissinger to advocate its establishment. Most other agencies involved in energy would be jealous for turf and competitive reasons. But the interesting challenge to create such a new international energy organization would be to identify an organizational design that does justice to the much greater role of non-state actors (companies, associations and NGOs). A modern WEA would embody and institutionalize the modern ways of stakeholder consultation now being designed and employed.[33] The EU Commission has raised in a quite oblique way the need for a WEA. It might be a comparatively well placed international organization to promote it, in particular since it has probably the best ability to speak with every significant stakeholder, including OPEC and the OPEC countries, Russia, the increasingly significant Asian consumers (India, China), the US and "civil society." Much of the current mandate, activities and staff of the IEA, the ECT Secretariat (*infra*), the energy activities of the World Bank and the UN, but also a part of the research and

31 D. Henderson, *The MAI Affair: A Story and its Lessons* (1999); P. Sauve, "Scaling Back Ambitions on Investment Rule-Making at the WTO" (2001) 2 *J. World Investment* 529.

32 EU Com, 17.7.2002 at 5, *supra*.

33 E.g. the Global Mining Initiative which led to the MMSD project (www.iied.org), a global stakeholder consultation process funded, in this case, by the industry.

dialogue activities of OPEC, could be consolidated into the proposed WEA. Such modernization of the international institutional set-up for energy policy would evidently have to strengthen, both in content, linkages and name, the incorporation of sustainable development.

4 Energy Charter Conference and Secretariat

The Energy Charter Conference, served by its Secretariat, is the most recent addition to specialized, energy-focused international organizations. It is based on the Energy Charter Treaty[34] (with a headquarters agreement with Belgium), and has the formal status of an international organization. The Secretariat services the negotiations for secondary and follow-up instruments (protocols) and supports treaty implementation. The ECT is an energy-focused treaty with all European countries, the states of the former USSR, plus Australia and Japan as members.[35] The treaty deals mainly with investment protection (in the style of modern bilateral investment treaties) and with trade (adopting WTO rules for energy trade between states where at least one is not a WTO member (that is now mainly Russia, Ukraine and the Asian countries of the former USSR). The ECT also deals with transit in a novel way.

The main activities of the Conference/Secretariat are at this time the elaboration of a transit protocol providing more specifics to the more general Art. 7 of ECT. A supplementary treaty to provide legally binding and specific rules for access for foreign investors ("pre-investment") was supposed to be negotiated when the ECT was signed in 1994. Negotiations took place between 1995–1998. Their final conclusion depends on the resolution of a number of outstanding political issues. The political interest in the supplementary treaty seems to have expired. There was also resistance, reportedly mainly from France and the EU. The interest in expanding investment arbitration (available under Art. 26 of the ECT) may also have waned as the full potential of investment arbitration, in particular under the NAFTA, has become clear.

The trade part of the Treaty is losing significance, as most East European countries are about to join the WTO. It is, for example, still relevant for the issue of energy import restrictions now being imposed by EU countries (in particular Germany and Austria) on nuclear-based electricity to the extent such restrictions would affect non-WTO members (e.g. Russia or Ukraine).

The ECT – different from the quite similar in content MAI (Multilateral Agreement on Investment) *(supra)* – has not been politically very visible. As a result, the treaty – and the ECT organisation – have been spared NGO onslaught. As in the IEA case, that has also compelled them less than the large international organisation to engage in a dialogue with non-governmental voices. The ECT's future lies mainly in securing its current membership through ratification by Russia (which seems possible), extending its membership to other Asian and Mediterranean countries, and serving at least as a model for regional energy relations in Asia (APEC), Latin America and Africa. The strength of the treaty and the justification for a permanent secretariat will also depend on the respect for the treaty's investment protection, and here mainly in the higher-risk former USSR countries. But the secretariat's role in getting such respect is limited, though the Secretary-General has a role under Art. 7 in particular for appointing a conciliator with provisional decision-making powers in case of transit disputes.

The staff of the ECT is quite small (under 30) and it has at this time no substantial budget for extra-curricular activities, e.g. studies and country reports like the IEA or technical assistance like the UN and World Bank. EU technical assistance has, though, at times supported ECT implementation projects. The Energy Charter Secretariat sits not too comfortably between the EU Commission (both are located in Brussels) and the IEA in Paris. Formally, the EU Commission has no particular role in the EC Secretariat; the EC is one of the 52 members. But politically and financially the EU in its entirety is the main sponsor of the ECT. The absence of the US reinforces this role.

The ECT is one of several privileged dialogue facilities between Europe and the former Soviet Union, though for East European countries the ECT will decline in significance as accession to the EU, and thereby full adoption of the energy "acquis communautaire", has acquired priority. But for the EU and the Commission in particular, it does not seem clear whether they wish to use the ECT machinery, or its internal instruments for creating a legal and institutional framework facilitating trade and investment with its major energy partners. Several EC initiatives – e.g. the Inogate energy transit project – seem to overlap, duplicate or

34 (1995) 34 *ILM* 360.

35 US and Canada have signed the 1991 precursor European Energy Charter, but not the 1994 Energy Charter Treaty. China and Saudi Arabia have acquired observer status; several Mediterranean countries are considering the possibility of accession.

compete with the ECT transit protocol effort. Similarly, instruments of EU external energy policy – such as association, partnership and cooperation agreements and the Lome/now Cotonou agreements – could substitute for work through the ECT.

In terms of influencing non-OECD countries – transition and developing economies – towards market-economy models for organizing the energy sector, the EC Secretariat/Conference overlaps with much larger organizations such as the EU, the World Bank and the non-member activities of the IEA. If the US were part of the ECT, one could argue for much more collaboration, up to merger, between the EC Secretariat/ Conference and the IEA. If, on the other hand, Russia were to formally ratify the ECT and other countries were to accede, the ECT could become either a major channel of EU dialogue with energy producers around the world (including OPEC countries) or, alternatively, a jointly "owned" and therefore more equal organisation for regulating their economic relationship, rather than the more one-sided reliance on EC agreements.

The ECT and its organization's contribution to international energy law is currently mainly through the service of the ECT, one of the very few multilateral treaties exclusively devoted to energy, and thus a key element of international energy law. By supporting negotiations for an energy transit protocol, the Energy Charter organization is also directly involved in the emergence of new, and very relevant international energy law. As energy markets integrate regionally and globally, the role of transport, transit and inter-connectors becomes much more important than it was in a period when most energy industries were segregated into national areas.

5 International Atomic Energy Agency (IAEA)

The IAEA is the one universal agency dealing with the peaceful use of nuclear energy. It has played a vital role in international nuclear security, and a minor, if at all, role in the development and application of nuclear power.[36] It was established by treaty, effective in 1957 – one of the few instances of a successful East-West collaboration during the Cold War.[37] Seated in Vienna, with a staff of over 2,000, a budget of over US$300 million[38] and the usual set-up (general conference, board of governors and headed by a Director-General), it is not much known outside the specialized nuclear community and has, as yet, not been exposed to the anti-nuclear movement in any significant way.[39] As a universal organization (related to the UN as such, but not a specialised UN agency in the narrow sense), it is used by Western countries for purposes of controlling nuclear risk in the developing, and now former Communist countries, but it has to co-exist (with some underlying competitiveness) with the specialized nuclear agencies of the OECD countries (OECD Nuclear Agency, *infra)* and EURATOM, the EU's special nuclear agency.[40]

The IAEA original mandate included *inter alia:*

- Research on the peaceful use of nuclear energy including scientific and technical information exchange and training;
- The safeguards system to ensure nuclear materials are not diverted to military purposes; and
- Setting of safety standards.

Over the years, the main functions have been standard-setting and the safeguards system. Its main task now is to safeguard the use of nuclear materials and facilities in member countries under the Non-Proliferation Treaty (Art. III deals with IAEA verification), but also in non-NPT countries (e.g. India, Pakistan and Israel,

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36 I am grateful for comments to Dr Norbert Pelzer, Goettingen; Dr Nathalie Horbach, Amsterdam; Prof. William Walker, St Andrews; and Ms J. Macdonald, British Energy.

37 An excellent survey of the history of its conception is: N. Pelzer, in R. Wolfrum (ed), *UN: Law, Politics and Practice,* London 1995; N. Horbach, "The International Atomic Energy Agency", in *International Encyclopaedia of Laws,* Intergovernmental Organisations, Suppl.3 (October 1998).

38 The IAEA has over the last 15 years been relatively starved for cash, part of the general policy of Western countries to curtail funding to the universal international agencies. This has, arguably, not been a very wise policy as the IAEA's core functions – nuclear safety, controls over trade in nuclear materials and disciplines on non-proliferation have become, even before 9/11/2001, more acute than ever, both in the context of the collapse of the ex-USSR nuclear industries, acquisition of nuclear power (for peace and for war) by developing countries and the threat of nuclear terrorism. It is assumed that the Al-Qaeda attack on New York in 2001 will reverse that trend.

39 This is arguably so because the security functions of the Agency, setting of security standards, control on nuclear materials trade and non-proliferation have been largely supported by the anti-nuclear movement. The IAEA has also never taken a strong position in favour of establishing more nuclear power capacity.

40 The EURATOM treaty, essentially governing nuclear materials transfers within and into the EU, was concluded in 1957.

although most of their facilities are kept outside the reach of IAEA safeguards).[41] The nuclear powers emerging in the Cold War encouraged non-nuclear powers into the IAEA and NPT treaty system. Based on special bilateral agreements with the state, the IAEA carries out monitoring of facilities to ensure safety – in terms of operational standards, but also in terms of non-proliferation. The non-proliferation issue has become relevant not only in relation to states (as the Iraqi efforts to build secretly a nuclear arms industry),[42] but also in relation to illegal trade in nuclear materials and weapons from state to state and possibly to terrorist groups. With, in 2002, the security threat by terrorists to nuclear installations seen in a much more acute light, many of the future high-priority IAEA activities are likely to focus on nuclear security, both with respect to defence against attacks on nuclear installations and with respect to terrorist threats to build and use small-scale nuclear explosives against civilian targets.[43]

Apart from non-proliferation (which has now a significance for "rogue states" and smaller states keen on nuclear weaponry i.e. not countries that are too big for international pressuring such as China, India), the IAEA is to develop and help apply technical standards and guidelines for nuclear plant safety, waste disposal and decommissioning of nuclear plants. The IAEA has here, like most specialized agencies, no direct regulatory powers, but has a major, if not the most dominant influence on regulation by national agencies with direct regulatory powers. For those, in particular from smaller countries, it would be inefficient to replicate the amount of effort in information-gathering, consultation and best-practices definition that goes into IAEA standard setting. In a material, though not formal, way the IAEA therefore acts as a global nuclear regulatory agency. The standard-setting activities are the most relevant for nuclear operators. Standard-setting is preceded by extensive information-gathering, including the "International Nuclear Information System" (INIS) for scientific literature. Reactor safety protection and radiation protection are implemented through "Operational Safety Review Teams" assessing specific nuclear power plants; the "Operational Safety Indicators Programme" providing for plant-specific safety indicator and the "Incident Reporting System" which reports on incidents in nuclear power plans.

Standard-setting includes protection norms and guidelines, including Regulations for the Safe Transport of Radioactive Materials; this forms the basis of all international transport conventions and national implementing legislation. The IAEA also develops Nuclear Safety Standards to standardize technical standards for establishment and operation of nuclear reactors. There is also a Code of Practice on the International Transboundary Movement of Radioactive Waste (1990). The IAEA safety series sets out what is assumed to be best practice. It is very influential with competent national authorities. The Nuclear Safety Programme sets down international minimum standards for nuclear power plants. They are not directly legally binding, but can become binding through reference, voluntary acceptance or incorporation in IAEA technical assistance agreements or accession to the 1994 IAEA nuclear safety convention.[44]

The safeguarding activities is the third major, and currently very relevant, function. The IAEA carries out a large number of inspections of individual nuclear facilities and materials (over 2,000 usually per annum, depending on budgetary constraints). Several treaties (non-proliferation of 1968; Tlatelolco for Latin America; Rarotonga of 1985 for the South Pacific) oblige member states to submit to IAEA inspections. Bilateral safeguards agreement – now with most states – govern the details of the safeguarding inspections. It is hard to deny in these situations that the IAEA has acquired not only material, but also formal regulatory powers in such situations by delegation via treaty. Following the revelations of Iraqi efforts to build an atom bomb, the safeguards system was enhanced. Under the Additional Protocol (INFCIRC/540) to the NPD safeguards agreement (INFCIRC/153), the IAEA acquired greater and more immediate access to sites in NPT countries; state parties were obliged to disclose more information about their nuclear activities and installations. Ratification, though, has been relatively slow, much due to the US government's depreciation of multilateral arms control. With nuclear terrorism now threatening the US, this is likely to change. As other developing countries embark on major nuclear power programmes (e.g. Iran, China, Pakistan), they will be encouraged to accede to the Additional Protocol as a sign of good-will and to avoid "blacklisting" and other forms of sanctions. The IAEA has also an important role in nuclear trade control. Under the Nuclear Suppliers Guidelines, to which nearly all supplier countries subscribe, nuclear materials exported must be placed under permanent IAEA safeguards.

41 Note the International Atomic Energy Agency: draft model protocol to strengthen and improve the effectiveness and efficiency for the IAEA safeguards system, in (1997) 36 *ILM* 1232.
42 *See* UN Security Council Resolution 687 (1991); for reports of the Special Commission on Iraq: www.iaea.org
43 N. Horbach, O. Brown and T. Borre, "Terrorism and Nuclear Damage Coverage" (2002) 20 *JENRL* 231.
44 (1994) 33 *ILM* 151.

The IAEA provides technical assistance in matters of nuclear safety (out of voluntary contributions), but it is here in some competition with other agencies, e.g. the EBRD's programme on nuclear safety in Eastern Europe or the OECD/NEA.[45] EBRD is only involved in the Ukraine (Chernbyl Shelter Fund), Lithuania (Ignalina NPP closure), Bulgaria (Kozloduy upgrade/closure) and Russia (Rovno Unit 4 and Khmelnitsky Unit 2) under its Nuclear Safety Account. OECD/NEA is only involved in some advisory activities on emergency testing, technical aspects of power plants and a project in Russia.[46]

The IAEA is an institution born out of both the enthusiasm for peaceful uses of nuclear energy, and the anxiety about nuclear war (and later accidents of nuclear power plants) which prevailed in the Cold War; in fact, it represents one of the few results of positive collaboration between the two rivalling camps at this time. It has now to adapt itself to a post-Cold War world. Its use for the technical aspects of discipline against rogue states, nuclear newcomers and would-be states and finally nuclear terrorism is a contemporary function with a future. Similarly, by providing technical expertise on safety standards and decommissioning, it responds to the post-Chernobyl fears and to the still persisting, at least in central and northern Europe, opposition to nuclear power which probably dates from the Cold War. It has not attracted much attention from anti-nuclear groups. This is partly because such groups will regard the IAEA as vital to any future disarmament and disbanding of nuclear power project. The IAEA seems so far not to have been much involved in the debate, mainly in Europe, about nuclear power, with both the traditional hostility from the "green" movement, but also the fact that maintenance, in fact expansion, may be indispensable for the objective of at least coming close to the Kyoto targets for CO emissions without lasting damage to Western countries' prosperity.[47] It also seems to have been largely kept out of regulatory and institutional reform for nuclear power plants in the transition countries, where the EU (in particular through accession arrangements) and EBRD have taken the lead. Should the nuclear option re-emerge, perhaps, through technological innovation with better solutions in particular for waste disposal and in light of the climate-change implications, then the IAEA might acquire a more important role to ensure that nuclear power is safely handled in countries with a weak economic, and thereby institutional and technical competence for managing the high risk. My view is that taking Kyoto seriously implies an expansion of nuclear power at least until the possibly quite remote time when renewable energy can substitute both for current coal and hydrocarbon-based electricity production.[48]

The IAEA has been a significant contributor to international nuclear law, in particular in the area of non-proliferation and safety of materials and installations, both by administering relevant treaties, servicing the negotiation of new multilateral treaties and protocols and the design of periodically reformed technical standards.[49] The IAEA was also the moving force in creating the Vienna Convention on Civil Liability,[50] but also the Brussels Convention on the Liability of Operators of Nuclear Ships, the Convention on Civil Liability for Maritime Carriage of Nuclear Materials, the Convention on Physical Protection of Nuclear Materials, the Convention on Early Notification of Nuclear Accidents, the Convention on Assistance in Case of Nuclear Accidents and the revised Vienna Convention on Civil Liability for Nuclear Damage. The Vienna Convention served as a model for the subsequently negotiated Paris Convention. Other agreements sponsored by the IAEA relate to radioactive waste, nuclear safety, radiation, emergency planning, safeguards and the nuclear liability agreements mentioned (with some involvement of the OECD/NEA) in the Paris and Brussels nuclear liability conventions.

There are other initiatives, such as a Fissile Material Cutoff Treaty, which have not got off the ground yet. The unilateralism of the US government has meant a halt or delay in many IAEA initiatives – at least before the 9/11/2001 attack on the US. It seems rather to have been pushed and used by Western countries when appropriate than exercising initiative and leadership in its areas. Perhaps, with more nuclear power capacity installed in developing countries, it may gradually acquire a larger role in the specific nuclear issues of

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45 N. Horbach, "Assistance Programmes of the IAEA to the CEEC/NIS" (1999) 17 *JENRL* 211; also, *Contemporary Developments in Nuclear Energy Law: Harmonising Legislation in CEEC/NIS* (1999), 439–468.

46 The TASPLAV project, concerning a Russian experimental facility where the reactor core material can be melted.

47 More detail: T. Waelde, *EU Energy Law*, 2003 (forthcoming) (chapter on energy and environment). *Also*, OECD Nuclear Energy Agency, *Nuclear Power and the Kyoto Protocol* (2002).

48 The contradiction between an environmental policy in favour of climate-change mitigation and the inherited and long-standing tradition of the environmental movement (with its origin in the 1950s anti-nuclear movement) of opposition to nuclear power is as yet mentally suppressed and will need to become open and exposed to rational debate. For comparative data on the effect of the various forms of energy production on climate change: OECD/NEA 2002, *supra.*

49 The IAEA also publishes regularly, in its "Legal Series," updated information and analysis on nuclear law. The Nuclear Law Bulletin, on the other hand, is published by OECD/NEA.

50 N. Horbach, Liability versus responsibility under international law, defending strict state responsibility for transboundary damage, Doctoral thesis, Leiden, 1996.

developing and transition countries. The potential of nuclear power to help achieve Kyoto targets, the safety of nuclear installations in countries with weak governance and the measures needed to counter the existing much more acute threat of nuclear terrorism seem to be the main future items on the IAEA agenda.

6 United Nations

The UN system consists of the UN proper with its various departments and other units and specialised agencies. Some of those, like the World Bank or IMO, are for practical purposes completely independent. Our survey can not do justice to the panoply of activities by the UN system, its main and secondary organs and many secretariat groups and specialized agencies. What follows is therefore rather a selection with comments than a systematic survey.

6.1 Climate Change Secretariat

For the energy industries, in particular the oil and gas industry, the one UN activity with most relevance is the UN Framework Convention on Climate Change with its secretariat in Bonn.[51] The fate of the Kyoto Protocol is not clear, with its specified caps on CO_2 and other relevant greenhouse gas emissions for industrialized (including post-Soviet) countries, unspecific good-will obligations on developing countries, introduction of emission trading and other emission reduction measures (CDM and JI) and absence of the US, the largest CO_2 emitter. But the negotiations held by the COP ("Conference of the Parties") towards implementing the Kyoto Protocol are likely to put pressure on governments, in particular within the EU and the EU accession countries, to favour renewable (and possibly later nuclear) electricity generation and reduce coal, and possibly later oil and then gas-based power generation and consumption in transportation. With US absence, there will also be a trade issue to the extent that implementation of the Kyoto mechanisms is likely to develop intra-corporate, national and international trade in emission rights, but also financing of joint implementation and the clean development mechanism (CDM);[52] it is hard to see how US companies, operating outside the Kyoto membership, can be full beneficiaries of the emerging trade in emission rights and equipment/services for climate-change management with a tension between free trade under the WTO agreements and restricted trade among the Kyoto member states.[53]

6.2 Compensation Commission

The political arm of the UN has had an involvement in oil and gas affairs through the UN Compensation Commission, instituted after the Gulf War to administer Iraqi liability for war damage, in particular large environmental and other damage to the oil production facilities in Kuwait[54] by Security Council resolutions 687 and 705 (1991) and 986 (1995). The UNCC was created in 1991 as a subsidiary organ of the UN Security Council. Its mandate is to process claims and pay compensation for losses and damage suffered as a direct result of Iraq's unlawful invasion and occupation of Kuwait. A specified percentage of the revenue – currently 25% – from authorised Iraqi oil exports is earmarked for the compensation of damages resulting directly from the invasion of Kuwait by Iraq. Such damages are to include, according to the Security Council resolution, commercial losses, "environmental damage" and depletion of natural resources.[55]

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51 www.unfcc.org; J. Mitchell, *The New Economy of Oil* (2000), 222.

52 T. Wälde, "Contractual Architecture for the Kyoto Protocol," (1999) 8 *RECIEL* 168 (with I. Worika, M. Brown and S. Vinogradov).

53 B. Müller, "The Kyoto Mechanisms Linking Technology to Ratification," (2002) 36 *J. World Trade* 57. One needs to examine here the implications of Art. XXI (g) GATT and analogies to the role of regional economic integration organizations and the non-inclusion of international organizations in the WTO membership and obligation system.

54 R. Lillich (ed), *The United Nations Compensation Commission* (reviewed in (1996) 90 *AJIL* 532); a bibliography is published on: http://www.unog.ch/uncc/publicat.htm (1996); UN Compensation Commission, "Text of Well Blowout Claim" (1997) 36 *ILM* 1343.

55 There is no doubt that Iraq by far exceeded the right of extraction of a belligerent occupant. It seems to have carried out a large-scale destruction of the Kuwaiti oil industry installations: UN Compensation Commission, Governing Council, Doc S/AC.26/2001/16 of 22 June 2001, in particularly p. 65 re Kuwait (also contains an overview of the mandate, process and procedures of the UNCC. The issue is, if the belligerent occupant, with the right of usufruct, can continue to extract the "normal" amount of (technically depletable) hydrocarbon (or water) resources.

The UNCC is in form and name not a tribunal, but an administrative process set up to expedite claims.[56] One needs to bear in mind that the Commission received over 2.3 million claims. Practical and expedient justice was therefore the primary aim – different from the US-Iran Claims Tribunal(*supra*) where claims are still being litigated in depth. Most claims have been settled by 2002.[57] There have been decisions awarding very large amounts to Kuwait for damage to its oil installations, for oil extracted and environmental damage caused by oil spills. These have been subject to criticism of over-valuation, an issue that may be more problematic in view of the legal and financial resources available to Iraq to put its own position effectively. In practice, however, two things have transpired that, in the opinion of many, may vitiate this concern. First, at the Panels' direction, the Commission staff has taken an aggressive role in verifying the claims. As a result, the Commission sought and received significant budget increases to permit the legal and valuation staff to conduct thorough investigations of the circumstances of many of the commercial and environmental claims. Some claimants objected that the process was more intrusive than they would have experienced under most normal adversarial processes. Budget figures and the success rates for category E claims bear this out. Second, Iraq has had far more access than the Commission's designers anticipated. Iraq receives all claims submitted to the El (oil sector) Panel and is permitted to make its own submissions. In the larger claims, the El Panel has also held oral proceedings and has permitted Iraq to appear through counsel and argue the issues raised for decision. One should bear in mind that the panels only issue reports and recommendations – the final decision (not always the same) is made by the Governing Council. Reportedly, various governments, including Russia and France, used experts to review the El (oil-related) awards. On the other hand, participants of the process – inside and outside the UNCC – have also communicated to me that the Governing Council's decisions were intensely political, with only marginal adjustment of the procedures to afford to Iraq more than a mere formal opportunity to argue against in particular the valuations proposed by the UNCC's consultants.

The UN Compensation Commission practice should lead to international precedent for valuation of damage to the oil industry and oil-related environmental damages. The activity of the UNCC in the field of oil industry-related liabilities would merit deeper examination.[58] It is in my view regrettable that the impact of this significant precedent is somewhat weakened by the absence of full "due process" to the de facto defendant Iraq. The panels of the UNCC have reportedly, in response of such criticism,[59] made considerable efforts to stretch the existing rules to provide as much of a hearing to Iraq as possible.[60] Future litigants will cite them as examples of legitimate ways to address problems such as valuation of oil and gas losses. This is particularly so as there is not much direct precedent.

6.3 United Nations Development Programme

The UN Development Programme is the UN's main development funding programme, fed by voluntary contributions. While the main funding is allocated to each country according to a population/poverty factor and spent according to national priorities, UNDP also runs several energy-related programmes relating to small-scale energy development, development of renewable energies (mainly through the Global Environment Facility, GEF, jointly with the World Bank) and implementation of the Montreal Protocol by assisting developing countries to eliminate activities that contribute towards depletion of the ozone layer.[61] It is difficult to discern any appreciable effect on energy law in these activities; there will be occasional funding by UNDP – if it fits into country priorities – of technical assistance for legislative reform in the oil and gas or energy sector.[62]

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56 *See* the explicit statement on the UNCC website on "claims processing": "The Commission is thus neither a court nor a tribunal with an elaborate adversarial process. Rather, the Commission was created as a claim resolution facility that could make determinations on a large number of claims in a reasonable time. As such, the Commission operates more in an administrative manner than in a litigation format. The Commission's claims processing procedures were prescribed by the Security Council and were further elaborated by the Governing Council..."

57 For detailed reference to the various UN SC resolutions, the various claims types and claims processing methods: www.unog.ch/uncc/clmsproc.htm

58 Mr Loftis is planning to write a comment for the JENRL (2003).

59 I have raised such criticism at the 1999 Geneva Global Arbitration, not to everybody's satisfaction.

60 Communication by Mr Loftis, former legal staff of the UNCC.

61 Website: www.undp.org; H. Sahlmann/Blank, UNDP, in R. Wolfrum (ed), *UN: Law Policies and Practice* Vol. 2 (1995), 1287.

62 I was responsible, from 1981 to 1991, as UN interregional adviser on mineral, petroleum and investment law, for providing direct assistance in legislative reform, institutional strengthening and investment negotiations funded directly by the then UN regular programme, but also fund-raising and managing advisory projects through UNDP. From all accounts, this advisory assistance as a focused, coordinated and high-profile specialised "business unit" has largely disappeared, though it is still sporadically carried out by *ad hoc* projects by UN/ESA, UNDP, UNIDO and UNCTAD. For an overview of general energy projects undertaken by UNDP, *see* http://www.undp.org/seed/energy/unise/appendix.html

The UN/UNDP in technical and financial assistance in the energy sector is, apart from the inevitable special attention for Kyoto and Montreal Protocol issues (renewable energy; ozone layer), not in any particular way focused on energy and certainly not on energy law. The significant developments in the energy industry over the last decade – privatisation, liberalisation and post-privatisation economic regulation – seem to have passed the UN system almost un-noticed. This is probably because the World Bank (for transition economies in some competition with EBRD) has taken leadership and "ownership" of these issues, but also because the UN system has had trouble modernizing its internal culture, outlook (and staff), all bogged down like old generals in the philosophy of the NIEO, with little substantial contact with industry, banks or modern market-oriented thinking. Multilateral development funding has also been declining, and UNDP projects have shifted from the "harder" topics of energy to the topics which are more fashionable in the UN discourse, that is poverty eradication, human rights, women and sustainable development. In competition with the World Bank, the UN system has not been able to capitalise on its competitive advantage – greater sympathy for and trust by developing countries and (somewhat) greater independence from the US – to develop concepts that are both in tune with the modernization of formerly state-oriented economies and less ideological than the philosophies which the Western-dominated institutions – World Bank, EBRD and OECD – have imposed with rigour and purity, but also with less realism, practicality and critical judgement – on developing and post-soviet countries in the 1990s. It is both easy to speculate on the UN's role in the energy sector and difficult to prove anything, since there is no independent assessment. Like all other international agencies, information and competence for critical assessment are divorced and self-assessment generally amounts to a mixture of propaganda and paraphrase of formal remits and in my view mostly fallacious if not even sometimes fraudulent reports on own successes.[63] From the accounts available, the UN activity appears diluted, ad hoc, not subject to systematic independent assessment in terms of cost-effectiveness and with little, if any, lasting impact. This may be due partly to the organization's mode of operation and heavy bureaucratic processes, but also due to the fact – relevant for any provider of technical assistance – that aid may not be the most effective method to upgrade economic and energy competencies in countries which are seriously underdeveloped, in institutional, structural, governance and cultural terms. Aid, to put it directly, in principle does not work where there is no absorptive capacity and culture.

6.4 United Nations Environment Programme

The UN Environment Programme in Nairobi is mandated to develop a global approach to environmental issues of sustainable development. As all UN organizations, it organizes training workshops for disseminating state-of-the-art know-how to developing countries, conferences to identify key issues and develop policy recommendations and technical assistance to help developing countries to adopt modern policies. There is some focus on incorporating environmental considerations into energy planning. More of interest for international energy law is UNEP's work providing administrative support – including for the negotiation of subsequent protocols – to international treaties – such as the Vienna Convention for the Protection of the Ozone Layer and its 1987 Montreal Protocol, the Basel Convention on hazardous waste transport and the UNFCCC. These, while not directly "energy law", have at times a tangential impact on, in particular, the oil industry.

UNEP, though, has never been fully accepted as the lead agency on global environmental challenges and the global community's policy response. As part of the UN system, it suffers from the lack of political and technical credibility throughout Western countries and international companies; major activities in its field are carried out by the Global Environment Facility rather than UNEP or the UNFCCC secretariat in Bonn. The "greening" of the World Bank under its president Wolfensohn has simultaneously reduced the need of Western countries for a UN institution in the environment field. Different from some of the accepted specialized agencies – seen as in practical terms fully independent and professionally very competent – UNEP has not achieved such status. It is rather covered by the negative view from which most of the standard UN activities suffer – conferences, constant organizational restructuring and the making of ever more pious resolutions. A significant contribution to energy law – though not international or national environmental

63 A. Seck, Oil and Gas Finance in the former Soviet Union, PhD thesis, CEPMLP/Dundee, 1995/96 has demonstrated in a particular case – claims for investment activation through agency funding – how most of the success claims, if properly assessed, turn out to be misleading. I had to compile from about 1985–1990 annual success claims for UN technical assistance in energy/resources. These turned out in the end to be mainly claims about causing large-scale investment when our activity was merely a marginal companion added on to some bigger project for which we then claimed creatorship. I am therefore convinced that most self-assessment in international agencies is generally misleading, and sometimes fraudulent.

law[64] – has, so far, been absent. That may differ, though, if UNEP's current efforts to promote guidelines on best practices with respect to environmental disclosure in the oil industry develop. Here, UNEP has stepped into the middle of non-conventional international energy law evolution by authoritative international and internal corporate guidelines.

In summary, energy is not treated well in the UN system. Its political appeal has been overshadowed by the great popularity of environmental and now human rights activities which offer the chance to develop mutual benefits for both NGOs and the UN system to help each other to more political legitimacy. Energy is not only one of the most significant nuts-and-bolts issues of economic development, inter-country trade, but also a core element of sustainable development and climate change. With energy, after liberalisation and privatization, developing from a mostly mere country issue to a great opportunity for mutual benefits from transnational trade, developing countries seem to gain less from this potential as their institutional framework and inter-country politics are in most cases discouraging energy trade.[65]

There is a case for a specialised UN agency dealing with energy matters, both in terms of monitoring world developments, linking with other issues (environment, transport, nuclear, shipping, climate change), developing policy proposals for a global negotiating agenda (where really needed), relating with industry and providing technical assistance in technical, institutional and regulatory areas. Such an agency would only work satisfactorily if it were not part of the UN system as such, but rather a professionally competent specialized agency. It should be organized with considerable input from both industry and competent NGOs and professional associations, i.e. rather in the way the IMO, IAEA, IEA and WTO are set up than a general UN department with its inevitable slack and wastage.

7 OECD Nuclear Energy Agency (NEA)

The NEA is a specialised agency integrated (much more closely than the IEA) into the OECD, though with some internal operational autonomy and directly under the Nuclear Energy Steering Committee, a sub-committee of the OECD Council. The 28 Members comprise the OECD countries, with some exceptions (Poland, New Zealand); they account for 85% of the world's installed nuclear energy capacity. Its main functions relate to research, data collection and the information exchange relating to the peaceful use of nuclear power, in particular safety of operations, transport of nuclear materials, workers' protection and waste management. In the past, the NEA managed nuclear operations directly. It works in the areas of nuclear safety and regulation; nuclear energy development; radioactive waste management; radiological protection and public health, nuclear law and liability, nuclear science and data collection related to the nuclear industry.

The NEA also has a proto-regulatory role by preparing decisions of the OECD to its member states in the area of operational safety of nuclear plants, severe nuclear accidents and radioactive waste disposal. Its own guidelines and standards are recommendatory, i.e. not legally binding. It works here through the Committee on Nuclear Regulatory Activities, the Committee on the Safety of Nuclear Installations and the Radioactive Waste Management Committee; these bring together the national nuclear authorities. Different from the IAEA, it does not carry out safeguard inspections. Its relations are mainly with the nuclear authorities in member countries. As in all other international agencies, there is a connection between its primary network function and the identification of "best practices" arising out of the technical dialogue and regulatory comparison. The NEA also functions as a channel to transpose radiation protection norms developed by the International Commission on Radiological Protection into OECD decisions. A process of revision of the 1990s radiological protection recommendations is currently under way. There has been, in 1998, an evaluation of the NEA. The principal recommendations have been to incorporate sustainable development into its conceptual framework; to integrate better with the broader energy-policy perspectives of the IEA and to develop a better collaboration with the IAEA based on complementarity and through an agreement and to accept new members, in particular with major nuclear operations, but also to avoid duplication, in particular in the area of technical assistance. It is not certain that the inherent organizational logic and self-interest of the NEA will allow such cooperative strategies to be implemented – inter-agency cooperation is usually recommended by external advisers that agencies only pay lip-service to it; the reality is usually inter-agency competition for interesting projects, funding, public profile and organizational mandates, with often large-scale duplication.[66]

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64 Note the references to the legal support and advisory activities in UNEP in its 2000 Annual Report.

65 T. Wälde, "Access to Energy Networks: A Precondition for Cross-border Energy and Energy Services Trade", CEPMLP internet journal and (with A. Gunst) now published in (2002) 36 *J. World Trade* 191.

66 On inter-agency relations (with a primary international law perspective), *see* C. Tietje, "Global Governance and Inter-Agency Co-operation in International Economic Law" (2002) 36 J. *World Trade* 501.

One of the NEA functions is to develop and disseminate information on nuclear law. The objective is greater harmonisation. It has carried out technical assistance on nuclear law reform (including nuclear liability in case of accidents) in Eastern Europe and Asia, usually in collaboration with the EU and the IAEA. It publishes the – authoritative – Nuclear Law Bulletin and has compiled several analytical/comparative studies on nuclear law in its member countries and Eastern Europe.[67] It also runs a professional training programme on nuclear law with the University of Montpellier. Finally, the NEA services the Paris Convention on third-party liability in the field of nuclear energy and the Brussels Convention complementing it.[68] The NEA also collaborates with non-member countries (particularly in the former Soviet Union) in the area of nuclear law.

Different from the IAEA (which has real regulatory powers), or the EU (which has real money for technical assistance), one should consider the NEA again rather in the club-model of the OECD: a forum for exchange and therefore dissemination and improvement of best nuclear regulatory practices. From the anti-nuclear perspective, the NEA is not necessarily an adversary: its emphasis on nuclear safety – including its work on decommissioning of nuclear plants – fits as well with an anti-nuclear perspective. There is no record that "civil society" so far has included the NEA in its group of top evil forces driving globalisation – such as the World Bank, the IMF and the WTO. NEA has in the past not taken much of a position in the debate over the continued justification of nuclear power. But with its most recent study on the link between greenhouse gases, climate change and nuclear power,[69] it has identified in detail the contribution that nuclear power makes – and can make – to achieving the Kyoto targets. It demonstrates that nuclear power is responsible for virtually zero CO_2 emissions – quite different from the large to very large CO_2 emissions from coal, oil and gas consumption in power plants. Given the current debate about nuclear power – with opposition from traditionally anti-nuclear NGOs, and support based on its pro-Kyoto impact, one should expect the NEA to continue to be a significant, if not vital function, in the very specialised field of nuclear law and regulation. It is somewhat squeezed between the globally oriented IAEA – which will now be mobilized to counter the terrorist threat to nuclear installations, and the politically and financially much more weighty EU Commission. But the NEA should provide a currently very desirable bridge for nuclear dialogue between the EU (and its accession countries) on the one hand and the US/North America and the Asian-Pacific regions on the other. Non-state actors opposed to nuclear energy are not represented in the NEA committees which therefore function largely as expert groups dominated by governmental and industry expertise. A "neutral" or "objective" view can therefore not be expected – but rather an informed partisan position in the debate on nuclear power.

8 European Union (EU)

The EU is not an international agency, but a persona under international law that is situated between a supranational organization and a federation of states.[70] The "energy law" it produces is therefore both part of international energy law and the internal, domestic energy law of both the Union and, through direct effect and implementation by national law, of the member states.[71] The EU has, among all international organisations, been the most active producer of energy law over the last 15 years, primarily in the design and implementation of its target, an integrated energy market. This development is now in full motion, including implementation in member states, but far from completion. The EU is also a most interesting case to watch: its energy law is a pilot exercise for creating integrated energy markets in other regions (e.g. North America; South America and the Americas; Asia-APEC; around Russia). It is also the dominant model in spheres of intensified economic cooperation of the EU (accession countries; Eastern Europe, CIS; Mediterranean) where there is now a legal obligation and a de facto pressure to adapt the single market instruments. Finally, the energy integration methods and experience of the EU provide an example of energy (and wider economic) integration in the global economy. It is the world's laboratory for ways to create integration benefit out of opening up national, hitherto largely segregated markets for cross-border investment and trade, for

67 *See* the contributions by Horbach, Brands and Reyners (focusing on NEA cooperation) in N. Horbach, *Contemporary Developments in Nuclear Law* (1999).

68 The text of the conventions is available at: http://www.nea.fr/html/law/legcom.html. The NEA Steering Committee may recommend the exclusion of nuclear installations or materials from the operation of the Paris Convention.

69 http://www.nea.fr/html/ndd/reports/2002/nea3808.html

70 Each of the European Communities, EC, EURATOM and ESC (expiring in 2002) has its own legal personality. The "European Union" combines the European Communities plus, established by the Treaty of EU ("Amsterdam Treaty"), the foreign and security policy, justice and home affairs "pillars." The Council can authorise the Presidency to negotiate agreements with third parties binding the EU. The EU's formal legal status is therefore as with many EU matters unclear, perhaps one could qualify it as a "partial and budding international legal person."

71 In detail: T. Wälde, *EU Energy Law and Policy* (2003); M. Roggenkamp *et al.*, *EU Energy Law* (2001).

identification of the obstacles which have been overcome – and which have not yet been overcome, including the current – cultural, institutional and political – limits to integration and for the new challenges, in particular environment and climate change, and ways how to deal with them. The EU is therefore at this time the most relevant precedent case, not necessarily for instant copying, but for identifying challenges, issues, policy instruments and their likely impact (including resistance to them). The importance of the EU as the global economy's laboratory for modern, post-privatisation energy law as an instrument of economic and environmental regulation in emerging integrated energy markets cannot be over-estimated.

In terms of organizational structure, the European Commission is both the conventional secretariat servicing the Treaties (Treaty of Rome and Amsterdam, Euratom and ECSC), but also an independent actor with co-legislation, regulatory and enforcement powers. In terms of political weight, it is the driver of integration policies, setting the agenda, organizing the process of information, consultation and coalition building. Energy competence is located mainly in DG TREN (ex-DG XVII, single energy market, Synergie), but energy-related competencies are also exercised by DG Competition, DG Environment and the directorates – in particular DG Relex (ex-DG I) handling international assistance and foreign affairs (e.g. the TACIS and Phare Programmes). The Council represents the member states and the intergovernmental facet of the EU.

The European Court of Justice (ECJ) is the most influential and active international court. It has been instrumental in developing key notions of EU law going beyond the intergovernmental character of international treaties and developing the EC/EU into something between a supranational organization and a federal state, mainly through the concepts of supremacy and direct effect of EU law, and by a mostly integration-oriented and rather policy- than letter-based interpretation of EU law. It has, though, been reticent to decide on matters which would require a large-scale industrial restructuring and establishment of a regulatory system as in the 1997 case on various EU member states' energy import/export monopoly.[72] In these cases, the Court has observed "regulatory restraint" and rather waited for the negotiations for new energy directives led by the Commission to achieve their result.

The European Parliament has been acquiring greater powers in the legislative process and some influence over the Commission; its weakness, like the European Commission, is that it has quite limited political acceptance and legitimacy as a truly European society prevailing over nation states has as yet not developed.[73] On the other hand, it is not correct to argue that the European institutions have no democratic legitimacy, but are just appointed bureaucracies. Like in any nation state in the EU, legitimacy is based on institutional procedures whereby the decision by voters is mediated and channelled through elected representatives; the appointment of the President of the Commission and thereby the Commissioners rely on both the properly elected EU Parliament and properly elected national governments. It is just that societies in Europe are, culturally, linguistically and emotionally still primarily (though no longer exclusively) national societies rather than integral elements of an overarching "European society." The formal flow of democratic legitimacy from the national "bottom" to the EU institutions exists reasonably well, but its mediation above the national level does not yet instil the confidence and political acceptance as is the case with national institutions. This analysis is significant for understanding the dynamics of the EU institutions since they will often be more motivated than national governments mainly acting through and with political parties to seek additional public acceptance through pursuing involvement of important social forces (professional and industry associations and NGOs) and bend often too easily to prevailing (and usually fickle) public moods.

The new EU energy law can not be compared to conventional international public law which deals now mainly with, firstly, division of proprietary and regulatory jurisdiction, and secondly, with the existing quite general, unspecific and indirect impact of many, often not yet ratified international conventions, on the energy industry. EU energy law has a quite different goal: it is aimed primarily at restructuring the institutional and legal foundation of national energy industries so that a truly EU-wide energy industry can gradually emerge, while at the same time introducing on the Community- and member-state level a more level playing field with respect to environmental regulation and initiatives towards reducing greenhouse gas emissions. It is part of the global paradigm of privatization and liberalization. This entails dismantling of existing monopolies and barriers to cross-border trade, providing the legal basis for competitive markets and finally nudging the industries towards real competition. It is the legal form of a proactive, rather than reactive, industrial restructuring in the EU energy industries.

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72 *Commission v. France et al*, (1997) ECR I, 5699, 5879, 5815 and 5865.
73 J. Weiler, "The Transformation of Europe" (1991) 100 *Yale L.J.* 2403.

EU energy law consists primarily of the EU treaty and its key general provisions (Art. 28–31; 49, 50; 81, 82, 86 and 87) for freedom of movement and controls on anti-competitive conduct as applied specifically to energy situations on one hand, and, on the other, on a series of directives, chief among them are the 1996 Electricity and the 1998 Gas Directives. There is no separate chapter or policy in the EU Treaty on energy (though it has often been advocated),[74] but only some references (Arts. 3 (u), 154, 174 to natural resources and environment, 175) of only marginal significance. Since energy is one of the most strategic industries, one can both argue that an energy chapter is desirable, but also that energy is automatically covered and included as a key component in any reference to industry, commercial and economic affairs. The energy directives are being implemented by the member states (and by the East European accession states based on "Europe agreements"), with perhaps still a too large diversity. Primary law could have been used to dismantle the export and import monopolies and provide third-party non-discriminatory access to the "essential facilities" of electricity and gas transport, storage and distributions systems owned mainly through monopoly, but there was not enough political will and power in the Commission; too much resistance from member states and the energy monopolies and no green light from the European Court of Justice.[75]

Supported by the leverage of the theoretical applicability of the articles of the EU Treaty, large industrial consumers and economic liberal opinion, the Commission exercised considerable, and successful leadership in developing an agenda which combined the – commonly accepted – single market imperative with – much more controversial – liberalization of national energy industries. The key issue in all of the debates and in the final directive (and subsequent implementation process) was, first, the lifting of energy trade monopolies (national as in France or regional as in the German case) and, second, an obligation of the owners of natural monopolies (transport, storage and distribution) to provide non-discriminatory access at reasonable conditions to competitors. This process is as yet not completed. The practical implementation is proving difficult until the economic interest of the owners of these natural monopolies is no longer to support their own energy business, but rather the maximisation of their transport business ("ownership unbundling"). This stage is not yet reached. The approach of the directives is to provide for gradually diminished thresholds of "eligibility" for access rights, such eligibility being defined as to reach targets for relative market openings over time. Current initiatives aim at facilitating cross-border trade by preventing prohibitive transport tariffs and by creating mechanisms for coordination of electricity dispatch over connected systems.

These liberalization initiatives have been accompanied by now emerging measures for compliance with the EU's Kyoto targets for greenhouse gas emissions by promotion of energy efficiency and renewable energy sources (RES). These will in turn require compatibility with the EU's rules on state aids (which are responsive to renewable energy and other truly environmental goals), transparent and non-discriminatory procurement and EU-wide trade. Other significant measures have been the obligation of state – and private – energy utilities and oil and gas licensees to procure in a transparent and non-discriminatory way, i.e. to abstain from formal or informal protectionism ("Utilities directive"), a duty on member states to issue oil and gas exploration and development licences in a similar transparent and non-discriminatory way, i.e. exclude preference for domestic companies or companies with a desired domestic procurement record ("Licensing Directive").

The EU, however, does not only produce "internal" energy law, but it also participates actively, though in a still inchoate form, in "general" international energy law.[76] The gradually coalescing "federal" character, with its tension between necessary, unitary negotiating and deal-making competence towards the outside world and the maintenance of such elements of national sovereignty by member states makes the EU a particularly awkward, indecisive and contradictory international actor.[77] It is now recognised, based on several authoritative ECJ decisions that the EU has exclusive competence in trade matters, e.g. WTO negotiations, but only

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74 C. Egenhofer and G. Goy, "Europaeische Energiepolitik vor der Regierungskonferenz 1996/97," *in Viertelsjahreshefte fuer Wirtschaftsforschung*,Vol. 65, 368 (1996).

75 In its October 1997 judgement on export/import monopolies, the ECJ essentially told the Commission it had to restructure the existing regime by negotiated and agreed upon specific directives, and not by ad hoc actions focusing on specific issues in the much more complex sequence of energy operations endorsed by the Court. The Court in essence declined political responsibility for such restructuring and mandated the Commission to seek a negotiated – and thereby accepted and easier to implement – solution. *Commission v. France et al.*, Case C157-160/94.

76 For more detail, see forthcoming chapter on "International Dimension of EU Energy Law," in T. Wälde, *EU Energy Law and Policy*, 2003.

77 Comment by R. Holbrooke, "Some advice from a friend: time to shape up," Financial Times; Apr 17, 2001.

"mixed" competence in "investment matters" (e.g. GATS, TRIPS, ECT, MAI).[78] There is no explicit competence for the EC to enter into treaties relating to energy matters in the EC Treaty, so that trade, investment and other powers are relied upon, and usually in the form of joint EC/member states accession. The result is that the EU is very slow and inflexible to react and is therefore at a disadvantage in international negotiations where decisiveness and clarity are required.[79] The EU is very dependent on import of primary energy sources, in particular oil (apart from the UK), gas (apart from Netherlands, Denmark and UK).[80] This important dependence, coupled with the fact that most energy sources are in volatile regions close to the EU (Russia, Central Asia, Caucasus, Algeria and other Mediterranean countries; Middle East/Gulf countries, Angola and Nigeria), with political insecurity in these countries spilling over to the EU in terms of security of supply, but also domestic political disruptions (terrorism; volatile situation of ethnic minorities from these countries; unwilling, but inevitable implication of the EU in the US/Israel-Arab conflict). But a unitary and focused EU action is here impeded by numerous special interests by its member states: UK and French relation with its former colonies, German sensitivity to anything endangering peaceful relations with its Eastern neighbours, Norwegian special status as non-EU member, but more or less subject to EU energy law via the EEA agreement (and a major, and stable oil and gas supplier), UK's "special relationship" with the US and French "special" competitiveness in political and cultural affairs with the US. EU actions are also influenced by the opaque relationship with the US. The EU needs the US as senior partner, in particular for security measures where the EU can usually not act decisively nor employ effective security forces, but there is also an underlying tension, both out of economic competition, some resentment (in particular France) at US hegemony and much greater linkage of the EU to various countries and social, political and religious forces in its greater neighbourhood.

The most visible success of the EU is the Energy Charter Treaty; here, the EU has managed its probably most visible tangible success in being essential in moving a 52-countries plus EC investment, trade and transit treaty to legal effectiveness and implementation.[81] The ECT is not legally "owned" by the EU, but the EU is its major financial and political sponsor. The treaty's transit article 7 is now being developed into a specific energy transit protocol which reflects the EU's interest in facilitating diversified supply of energy (oil, gas and perhaps electricity) in particular from the oil and gas prospective countries now making up the former Soviet Union.[82] The Treaty, though, has not been followed, as was the original negotiating mandate, by a "supplementary agreement" dealing with access for investors and privatisation (though a full-text draft exists). The Treaty is now of increasing interest to countries outside its original sphere (East-West Europe); for OPEC countries, it would be a multilateral treaty where they would not have to face US obstruction.

Other noted instruments have been the "Europe agreements" with the East European accession states; these oblige the accession states to transpose EU law (including energy law and the new directives) within a time span into their national system.[83] There is a focus on developing "trans-European energy networks" (i.e. pipelines, transmission grids, interconnectors) and other current priorities of the EU in the energy sector: promotion of renewable energy, compliance with Kyoto obligations and nuclear safety of the problematic safety standards of nuclear reactors in Eastern Europe. The accession countries are under considerable pressure – as weaker, EU-entry seeking parties – to adopt the EU "acquis communautaire", i.e. the current state of EU energy law. On the other hand, while they will be pressured to adopt this "acquis" in the making of which they have had no influence, they are not likely to benefit from the liberalization of the EU if powerful domestic interests of domestic member states are affected. There is, for example, considerable reluctance – and search for legitimate reasons, mainly based on environmental pretext – to provide for free energy imports into the EU from Eastern Europe. But this is the nature of the relative bargaining power – seekers to join a club have to accept its rules, without being certain that their presence is universally welcome.

As regional and global energy markets develop, competition law becomes more relevant and no longer exempt for these industries. Access to essential facilities, prohibition of long-term sales contracts with exclusivity features and an anti-competitive effect are the main issues. While there is a EU-US agreement on

78 Opinion 2/92 of 1995 – relying on Art. 133 (ex 113) and, before signature of the WTO agreement, Opinion 1/94, also relying on Art. 133 (ex 113); for a thoughtful and interesting comment: W. Shan, "Towards a Common EC Policy on Investment Issues" (2001)2 *J.W.I.* 603.

79 Holbrooke and Peel, *Financial Times*, 17 April, 2001. The Holbrooke criticism is only partly justified. As something between a federal state and a supranational organization, such slowness is unavoidable.

80 EU Commission, Green Paper on Security of Supply, November 2000; J. Stern, *EU Security of Supply and Gas* (2001).

81 T. Wälde (ed), *The Energy Charter Treaty* (1996); C. Bamberger, J. Linehan and T. Waelde, "Energy Charter Treaty in 2000: in a New Phase" (2000) 18 *JENRL* 331.

82 www.encharter.org; R. Liesen, "Transit under the Energy Charter Treaty" (1999) 17 *JENRL* 59.

83 EU Commission "Enlargement and International Relations," www.europa.eu.int/comm/enrgy_transport_2_en.html

administrative collaboration in competition law, there is so far no truly international competition law – with some exception based on the non-discrimination and competition good-will clause in the Energy Charter Treaty.[84] But the way competition law is now applied to energy issues is by extraterritorial application of either US or EU (or US and EU) competition law to events and situations which may take place outside the EU/US territory, but which have a substantial impact within them.[85] *Faute de mieux,* extraterritorial regulation by major economies will be the only way to exercise some control over anti-competitive practices in the energy industry. EU competition law, naturally, is applied within the EU, but also through the EEA agreement, in particular now directed at Norwegian practices.[86] The EU's major energy suppliers – Norway, Algeria, Russia – are now challenged by EU competition law: destination clauses (i.e. clauses which forbid the further sale of supplied gas) and other exclusive features of long-term contracts are questionable under EU competition law, but they may be necessary, at least in an initial phase, to provide a solid foundation for long-term investment in expensive infrastructure (mainly pipelines and related facilities). The rules of third-party access – existing under Art. 82 of the Treaty and the two energy directives (96 and 98) can cause difficulties to the commercial viability of new infrastructure being established, with financing based on long-term contracts with a predictable cash flow. A compromise is here necessary, and apparently in the offering. The approach to solve these problems is not conceptually difficult. In essence, projects require for an initial period greater leeway from EU competition law which can gradually expand its scope as the investment is made and recouped. But it requires, as usual in the EU, complex intra-departmental political bargaining for which the Commission seems famously slow. The EU-Russia energy dialogue ("Prodi-Putin dialogue"), while so far apparently largely without substantive result,[87] will have to include a EU-Russia deal where the extraterritorial impact of EU competition law on long-term gas supply contracts is pushed back, EU-backed financing for energy infrastructure (pipelines, interconnectors) either directly provided or at least legally and institutionally facilitated; the Russian contribution has to be ratification of the Energy Charter Treaty, collaboration with its transit protocol. For the EU, the proper strategy for its energy security concerns is to develop a firm, high-level and legally well-anchored institutional structure with all of its major suppliers – and this includes both OPEC countries, Russia and the Caspian countries. The chief condition for success of such deals is that the Commission should speak with a coordinated voice and that promises made are deliverable by the organization.

A significant influence by the EU on energy law, in particular in transition countries, is exercised through the Tacis (former USSR), Phare (Eastern Europe) and Synergie (energy-focused) development assistance programmes.[88] These programmes have funded, throughout the 1990s, advisory assistance on policy, legislative and institutional reform in the energy sector in virtually all transition countries. They have been most effective in the accession countries, both for reasons of greater cultural receptivity and the added pressure of accession requirements formulated in the Europe agreements. In the CIS-states these projects have helped to secure ratification of the ECT (but not by Russia as yet) and have had otherwise a more mixed result. No independent assessment is available, though there are doubts about the most effective method of organising such assistance and the ease of persuading governments to undertake energy policy reform desired by the EU. At times, there have also been overlaps, such as the EU Commission's support for the Energy Charter Treaty's emerging new transit protocol, but also, through different units, for a pipeline agreement proposed by the EU FNOGATE project. EU financial assistance in the energy sector is probably the largest programme around in terms of grant money, but not the leading one in terms of reputation for expertise, focus and efficiency.[89]

The major direction of current EU involvement in international energy law is through the Kyoto process (*supra*). The EU has become the main promoter and sponsor of the Kyoto Protocol setting targets on greenhouse emissions, and this role has increased with the exit of the US. It is not dissimilar from the way the

84 T. Wälde and P. Wouters, "State Responsibility in a Liberalised World Economy. State, Privileged and Subnational Authorities under the 1994 Energy Charter Treaty, An Analysis of Articles 22 and 23" (1996) 27 *Neth Ybk Int lL* 143.

85 M. Broberg, "The European Commission's Extraterritorial Powers in Merger Control, Gencor v. Commission" (2000) 49 *1CLQ* 172.

86 D. Buchan, "Norway rebuts Brussels charge of fixing gas contracts," Financial Times September 11, 2001.

87 www.europa.eu.int/comm/energy_transport/en/lpi en3.html review the discussions for a "EU-Russia partnership". It mainly identifies possible commonalities of interest (omitting existing conflicts of interest) and issues, but does not yet identify what the contours of a negotiating package ("deal") could be.

88 111 T. Wälde , *EU Energy Law and Policy* (2003), ch. 8 (forthcoming); information from the EU websites: http://www.europa.eu.int/comm/energy_transport/en/enlarg_2_en.html

89 My own experience, which is affirmed by most other consulting firms, is that bilateral agencies are much more efficient, less politicized, less transaction-cost generating than EU services – and this includes, from a very practical point, also a reputation for proper payment procedures.

Energy Charter Treaty has moved to completion, with the EU pushing and the US exiting. The strong position taken in the Kyoto-process reflects the EU's comparatively greater domestic interest in environmental matters than the US. One of the reasons is that, first, the European Parliament has a sizeable representation of "green party" members and that the EU Commission, as an international agency searching for making up for its low level of political legitimacy, is more responsive to pressures from environmental NGOs. Parallel to Kyoto, the EU has also been promoting tighter measures against marine pollution, mainly by using port state leverage *(supra*), influencing the OSPAR convention committee towards full prohibition of off-shore decommissioning of oil platforms, participating in all relevant international conventions with an at least tangential impact on energy industry operations, issuing a number of directives mandating environmental impact assessment for power plants and developing systems of eco-labelling measuring, *inter alia*, energy efficiency of appliances.[90]

8.1 EURATOM

EURATOM,[91] a separate treaty, but fully integrated into the Community institutions and managed by the Commission, was the EC's early response to the need to develop and monitor safety systems for nuclear energy materials. It was originally premised on the 1950s enthusiasm for the "peaceful use of nuclear energy," fears over security of supply of oil and a supply-sharing system for uranium. None of these factors present at the origin of EURATOM is present today – except to some extent the security of supply aspect. EURATOM's original objectives were frozen during the early decades by conflicts with France which wanted to see EURATOM deployed to develop an exclusively European (i.e. not US-linked, and largely French-influenced) nuclear industry.

Nuclear industry is in the EU (in particularly outside France and the Southern member states) an embattled industry. Austria has closed down its nuclear industry; Sweden and Germany are engaged in a slow process towards closing and decommissioning. The future of these processes can, however, not be predicted with any certainty as the enthusiasm for the Kyoto Protocol and the opposition to nuclear industry are difficult to square. If nuclear industry is on the wane, then the future task of EURATOM will be decommissioning and safe storage of used nuclear materials. If nuclear industry re-emerges, then safety rules, rehabilitation of East European nuclear power plants and management of nuclear waste will be priorities. The new threat from terrorism will also pervade European nuclear law. There will be a tightening of rules of nuclear safety (installations, materials). The implication of a successful or almost successful terrorist attack on a European nuclear installation are hard to predict; the consequence could be an acceleration of the trend towards closure – or a much greater investment in security.

EURATOM develops safety norms, supports research, cooperates closely with industry, scientists and other international organisations (in particular the IAEA and OECD/NEA) and can invest in projects including the right to raise loans for that purpose. Nuclear research constitutes one of the major components of Commission-funded research.[92] EURATOM produces through the Community institutions directives, regulations and administrative decisions. It is given the right to own nuclear materials within the EU. It runs a system of safeguarding for nuclear materials (excepting those for defence purposes) within the EU. Like its sister organizations (IAEA, OECD/NEA), EURATOM has managed to keep largely out of the limelight of public opposition to nuclear. Its specialized, technical character, its generally endorsed focus on nuclear safety and its absence from public debate over nuclear energy should have helped. That may have helped the nuclear activities of the European Commission to have a more comfortable life, but it is not certain that retreat from challenge and debate has served either these organizations nor the issue of nuclear energy. As organizations with special knowledge of nuclear industry, and most extensive networks, the EURATOM service of the Commission (as the IAEA and OECD/NEA) should have developed a position to be able to make informed arguments about nuclear energy and highlight in the public eye both the risks, but also the particularly newly emerging benefits in terms of climate change. At present, the Commission's nuclear services have taken a more active role in the debate on nuclear industry: they stress the climate change/Kyoto target and security of supply advantages of nuclear energy; they currently propose a much deeper engagement

90 T. Wälde , *EU Energy Law and Policy* (2003) (forthcoming), environmental chapter.

91 H. Donndorf, "Nuclear Treaties, Euratom and Beyond," in *IBA/SERL Proceedings of its 1996 Prague conference;* http://europa.eu.int/comm/energy/nuclear/index_en.html

92 The current nuclear-related EU Commission research budget is over 1.2 billion Euro from 2002–2006; loans available to fund rehabilitation of East European nuclear reactors should exceed two billion Euro.

with the safety-wise problematic nuclear reactors in Eastern Europe and improved safety standards and safeguard procedures.

Its function of safeguarding nuclear materials will only increase as international terrorism develops increasing sophistication and will inevitably try *to utilise* nuclear materials. Here, though, the main risk of leakage of nuclear materials, equipment and expertise is likely to be in countries with run-down nuclear establishments and weak systems of governance. The EURATOM service of the Commission as well as the IAEA and OECD/NEA are likely to gain more prominence as they will have to serve as international instruments to deny access to nuclear power to terrorist organizations.[93]

In summary, the EU is currently, in spite of its many and deep institutional weaknesses, the one supranational organization with the most visible impact on national energy laws (mainly in accession, transition and many developing countries), the main laboratory for economic regulation of cross-border energy trade and investment under the current paradigm of environment-friendly post-privatisation liberalization, but also the main sponsor of major international energy initiatives, mainly the Kyoto Protocol and the Energy Charter Treaty. International energy law can no longer be seriously studied without understanding both the internal and external dimension of EU energy policy. It is likely to progress at a tortoise pace pushed away from conventional energy (coal, oil and gas) by the new emphasis on renewable energy sources, but on the other hand still, and for all the foreseeable future, dependent on strategic oil and gas imports from highly insecure producing countries. It has not yet been able to grapple with its major energy dilemma: a large part of the EU's energy demands is covered by nuclear energy. Nuclear electricity is currently and for the foreseeable future, together with large hydropower, the only substantial energy source which is not responsible for greenhouse gas emissions. The EU's 2000 Security of Supply Green Paper and subsequent reports make this clear, but simultaneously there is no political leeway for the EU to strongly promote maintenance, and expansion of nuclear power until the green movements in the EU have made a choice between their traditional opposition to nuclear energy, based on the risk of accidents and disposal of nuclear waste, on the one hand and the indubitable fact that nuclear energy is among the currently relevant energy sources the most Kyoto-friendly one. Should the re-orientation of subsidy and support lead to a true upsurge of non-nuclear renewable energies, then this dilemma might fade, but if it does not, then there seems to be no choice about either embracing, vigorously and expansively, nuclear again or forgetting about control of greenhouse gases.

9 Conclusions

All international agencies have at their core a "cross-border network" function: they bring "colleagues" together, typically from a ministry with a similar regulatory and operational task. There is a secretariat which acts to organize the network, its – typically very formalized – gatherings and provide permanent expertise (mainly of a comparative nature). This function is not often perceived so clearly, but it may be the vital function of the organization. The network now increasingly includes, often relegated to a lesser rank in communication priority, non-state actors: non-government, commercial, professional organizations and consultants. If the agency does not have direct regulatory powers (they rarely do), the "network" nevertheless exercises considerable influence over national and international energy law: it identifies best (or at least prevailing and current) practices. These provide a persuasive and practical blueprint for national regulation. Experiences are discussed, models taken home or brought to the "club" meetings. Copying other people's work and working off legal precedent has always constituted the practical core of the legal profession.

The much more formal and directly "legal" focus of international agencies work revolves around their respective treaties. The secretariats service the treaties, the governmental delegates negotiate (with low-profile secretariat influence) such treaties and then "implement" them at home. It is only in the EU, a hybrid between an international organization and a federated country, that the international authorities (Commission, Council, Court) have some direct regulatory powers.

Different from human beings who grow largely along the lines of a genetic programme, international organisations mutate: they come with a fixed mandate, the organizational constitution which seems at the beginning to be written in stone. But all agencies here surveyed have developed quite differently; some parts of their original mandate have become obsolete and dead text, others have been developed and new mandates have been effectively acquired, often based on bold re-interpretations of the original terms of reference. The OECD and its predecessor started out to manage the Marshal Fund; it is now the major intergovernmental

93 *See* forthcoming article by N. Horbach/Brown in (2002) 20 *JENRL* 231.

policy think-tank on any subject that moves governments. The World Bank started off as a financing agency for reconstruction in Europe after WWII – it sees itself now as the "premier development institution." The IAEA started off to encourage nuclear power, it is now mainly an institution to develop and enforce disciplines relating to nuclear risk, by accident, mismanagement or terrorism. What they lack is a natural death. It is very hard to make an obsolete international agency disappear; it – its leaders, staff, clients and constituency – will cling to life, sometimes with (self-) deception over its continued usefulness, often with a desperate attempt to latch on the currently fashionable paradigm so that criticism against the agency can be presented as criticism of the current high-ground moral values. International agencies seem to adapt more easily in form and substance. They re-baptise readily what they have always done and will continue to do in the fashions of the day – they are much better at re-designing their public relations than what they do and how they do it. Probably every organisation examined is in some way or other seriously out of date, mainly with respect to its internal structure and organisation. They should all be modernised – in my view towards more professional competence, but also inclusion of non-state actors in their formal decision processes. Their funding – almost exclusively by government contribution (e.g. national taxes) – is also in need of review. More dependence on the value of services rendered in a more competitive situation would make them more modern, responsive and efficient. Some of them – e.g. OPEC or the IEA – were borne out of a particular crisis which no longer exists in this form; here, adaptation has been particularly difficult and modernization particularly pressing. But as intergovernmental organizations they are mainly controlled by diplomats, themselves removed from elections, politics, competition and markets so that the need for modernization is delayed by a double wall of insulation.

There is a considerable difference between two types of international agencies: the general ones (primarily the UN, also to some extent the OECD) are mainly "talking-shops". They do not have a very specific and certainly very little or no regulatory or operational focus, but they serve to accommodate the public concerns and themes of the day, to process them into organisational language of some (though in reality much less than is claimed) authority. This is an important function as they conduct a public dialogue, albeit in very stilted form, about "global politics." The weaker the nation state, and the greater pressure for public participation, now expressed on the international level mainly by the NGOs, the more is there a need for a "parliament" in the original sense, i.e. a "talking-shop". Not surprisingly, general international agencies have found it least problematic to accommodate the pressure of NGOs for involvement. Both actors look for legitimacy – and reciprocal recognition of legitimacy helps both. They operate politically in symbiosis. The problematic legitimacy of both is less of a problem as the operational impact is minimal – even international treaties emerging are typically neither legally effective (because not ratified) nor, even if ratified, specific enough to make a difference.

Very much in contrast to the more discursive and symbolically acting international organisations arc technically specialised and focused agencies. Here, specific regulation emerges, either sometimes directly when delegating such powers to an international agency seems inevitable, or in the form of standards and guidelines which are then used by national authorities by reference, incorporation or copying. These are the agencies which have most influence on the specific content of international energy law. Their advantage is a professional network and culture, great competence through specialisation and direct significance in their field of play. On the other hand, such agencies typically are "captive," i.e. they operate for the benefit and through the participation of specific industries. They will only very grudgingly open up to challenges brought from the outside into their well fortified citadels. "Civil society" has left these agencies largely in peace and focused on the "talk-shop" and the most prominent agencies – the Globalisation Triad of World Bank, IMF and WTO. In practical terms of influencing the rules for the global energy economy, this strategy is wrong. It is mainly in the specialised agencies that specific and effective rules are made. This rule-preparation or rule-making activity cannot be influenced much by scoring significant rhetorical successes in UN forums.

My conclusion is that both the international agencies and the manifold actors within "civil society" need to open up to each other, in a professional way. There is a good reason for "civil society" to be present in the talk-shop forums. But there is also the temptation that NGOs and such agencies continuously run like lemmings into the same, regularly changing fashionable direction, scoring successes that do not count. I suggest that there is a good reason for the specialised, and practically influential, international organisations to open up, not just formally, and not only by being more transparent, but by effectively allowing formal representation of non-state actors on their governing boards. Multinational companies now have sometimes representatives from public-interest organisations and academia on their boards. Intergovernmental organisations are a child of the club of nation states. Such adjustment to a world where governments do not play exclusively and where many non-state actors are now significant actors is difficult for international organisations and their nation-state governors. Even if non-state actors now compete with governmental actors on

the global scene, it is difficult for the places where governments still call the tune, to yield a part of their formal power. But I suggest this is nothing but to accommodate to the changing reality of global society. How to do it is much more difficult. NGOs, for example, are mainly self-appointed, with weak governance, transparency and accountability. Commercial companies, their associations and professional groupings, on the other hand, are better structured and in a formal sense more easily identifiable. In principle, international organisations should gradually co-opt those who represent power – commercial , financial , political and public-opinion – into their governing structures. Similarly, treaty negotiations should, as the OECD debacle with the MAI has shown,[94] incorporate in a much more active sense those who have power and a voice in the field. There are inchoate precedents: the ILO tripartite system of decision-making (itself child of the 1950s corporatist world-view), the meek OECD, BIAC and TUAC (largely it seems lunch opportunities for retired functionaries). But these need to be developed, experimented with and at the end formalised. There is no reason why those with a powerful voice — Greenpeace, Shell, the ICC or the International Bar Association — should not be able to be part of the directorium of international organisations and part of the treaty negotiators whose consensus is necessary. From "civil society" this would require a sea-change in attitude: from a merely critical, destructive and political-campaigning attitude to a position where constructive alternatives have to be designed, bargained for and where positive responsibility and accountability for results (not just for criticism) has to be accepted.

International agencies now fulfil a vital role for the proper functioning of the global economy – as designed in the Bretton Woods discussions in 1944. They help to provide rules, institutions and stability to facilitate the transnational commercial and financial transactions. All criticisms of them by "civil society" have not shown any constructive alternative. But they are also now held accountable for the ills of the world – the defects of globalisation. There is very much the need for clearly identified scapegoats here at play. Most of the ills of the world existed before international agencies emerged. Poverty is nothing new. But in response to these accusations – and in some cases because this is their original or newly acquired mandate (e.g. the World Bank), such international organizations now take "economic development" as their prime task. I doubt that the underlying philosophy of much of the "development industry" has ever been properly reflected on and debated. In essence, the idea that by development aid one can help "underdeveloped" countries become "developed countries" (using the periodically changing catch-words ruling the agency rhetoric for a time), assumes that it is practical and possible to fundamentally change the nature of a society by well-thought out and largely funded external intervention. I suggest there is very little evidence that such global social engineering actually can work. Countries which have developed rapidly tend to have a cultural, institutional and geographical make-up that favours prosperity. Countries which have maximised foreign aid (e.g. Tanzania) have often not developed at all. Aid, providing investment capital (and then later loan forgiveness) seems overall to have little correlation with development, and certainly much less than both the agency and "civil society" rhetoric (including rock singers' intervention) loudly proclaims. The aid industry naturally advocates the usefulness of aid – would they not? My impression – after three decades of work with development aid practically and intellectually – suggests that there is an organic combination of culture, law, institutions, geographical condition, political system – which decides at the end over who becomes prosperous and who not.[95] Agencies which acquire for themselves both a role in facilitating transactions in the global economy plus the task of "eradicating poverty" set themselves, in my view, an impossible – though possibly well-funded task. At best, an agency can help on the margins to support what is already developing and to help to create framework conditions in the global economy that help those who are able to help themselves. The rest is rather a global welfare task.

This scepticism towards global social engineering also informs my view on international law-making. I suggest it is much more preferable to let rules develop organically and spontaneously out of the social and commercial intercourse of the commercial operators – and use legislation rather to codify for greater clarity's purposes rules that already exist than to use rule-making to "change the world" in a voluntaristic way. Voluntaristic law-making tends not to work. If it goes against the grain of what the main actors expect, want, already practise and accept, it will remain law on the books, but not law in action.[96] "Directing" economic actors against their will only promises failure – facilitating their action, on the other hand, is the only way to

94 E. Graham, *Fighting The Wrong Enemy: Antiglobal Activists and Multinational Enterprises* (2000).

95 Relying on W. Easterly, op. cit.; also Francis Fukuyama Trust, *The Social Virtues and the Creation of Prosperity* (1995); M. Olson, *Power and Prosperity* (2000); J. Sachs, "Nature, nurture and growth", Economist, June 14, 1997, 22–24; D. Landes, *The Wealth and Poverty ofNations* (1998).

96 I have developed this approach in more depth: T. Wälde , "Non-Conventional on Effectiveness" (1999) 4 *Austrian Review of International & European Law* 164.

effectiveness. The international scene is dominated currently so much by rhetoric, by pretend-rules and pretend-actions instead of an appreciation of what it takes to help and nudge change gradually along.[97]

Finally, this survey of the role of international agencies with a focus on energy law and policy has also persuaded me that we are in the middle of a process of formalizing power relationships over weakly governed, underdeveloped countries which is reminiscent of (though certainly not identical with) the colonialism of the 19th century. Then, the power of the state, the wealth of the investors and the values of the missionary movements propelled European states to control a large part of the world. Today, the formal trappings of statehood and sovereignty are everywhere. But "soft" and "structural" power is exercised by the rich societies through their NGOs – reborn 19th century missionaries, through their multinational companies, through their – controlled and funded – international agencies and through the legal, financial, educational and cultural tools of exercising influence and co-opting elites – rather than outright formal ownership as in the past. The treaties and their subsidiary tools now being used to impose "good governance" on less civilised societies tend all to be formal at face value, but asymmetric in substance and actual practice. They are all directed towards telling underdeveloped countries and their governments what to do – but rarely, in practice, do they target the rich countries.

I am surprised that these phenomena are not perceived more generally – so either I am wrong, or too much chained to analogies in the past, or I see something that is as yet taking shape before it can be more scientifically interpreted. Institutionalized systems of power are not *per se* evil. They are a societal method to regularize, institutionalize and even discipline the exercise of brute power and therefore they form part of civilization. Camouflaging such exercise of power in noble concepts may serve a purpose, and perhaps sometimes a good one. But should it not be the scientist's responsibility to call a spade a spade and see the naked emperor under his imagined clothes?

97 "Sustainable Development and the 1994 Energy Charter Treaty: Between Pseudo-Action and the Management of Environmental Investment Risk," in Friedl Weiss *et al.*, (eds), *International Economic Law with a Human Face* (1998), 223–271.

Green pricing and green power marketing: Demand-side mechanisms for promoting "green power" in deregulated electricity markets

Alexandra S. Wawryk

A number of mechanisms have been proposed and/or adopted to promote the supply of electricity from renewable energy sources or "green power" in competitive electricity markets. This chapter explores two "demand-side" mechanisms — green pricing schemes and green power marketing schemes — which aim to increase the uptake of green power through increasing consumer demand for green power products. This chapter describes the main features of green pricing and green power marketing schemes that have been adopted in deregulated electricity markets, summarises their strengths and limitations, and addresses the appropriate role of the law in this area, including minimum legislative requirements for the successful operation of these schemes.

1 Introduction

The production and use of electricity generated by fossil fuels is one of the most environmentally damaging human activities on this planet. It is generally acknowledged that increasing the share of electricity generated by renewable energy is vital for reducing the environmental impacts of electricity generated by fossil fuels and achieving sustainable development. Protection of the environment is a key reason for the introduction of government policies encouraging the development of renewable energy through mechanisms such as tax and other financial incentives and the mandatory purchasing by electric utilities of electricity generated from renewable energy sources in developed countries since the 1970s.

More recently, the deregulation and/or privatization of energy markets in many countries, including the United States, United Kingdom, Canada, Australia, various European countries and the countries of Latin America, has led to concerns about the future of renewable energy resources in the generation of electricity. As utilities in competitive electricity markets become more efficient, reduce costs and charge lower electricity prices, it is feared that renewable energy sources, which are generally higher-cost options for producing electricity, will find it increasingly difficult to penetrate electric power markets.

While proponents of renewable energy have pressed for government support of renewable energy to continue in competitive electricity markets, the suitability of applying policies for promoting renewables in regulated electricity markets to deregulated markets has been questioned.[1] As a result, governments have turned their attention to the most appropriate methods for promoting the supply of electricity from renewable energy sources or "green power" in competitive electricity markets. A number of mechanisms have been proposed and/or adopted, including both "supply-side" and "demand-side" mechanisms.

"Supply-side" mechanisms target the producers or generators of green power. The most popular type of supply-side mechanism is the renewable portfolio standard operating in conjunction with tradeable green certificates, whereby electricity wholesalers and/or retailers meet government requirements to acquire a certain amount or percentage of their electricity from green power by generating or purchasing green power, or by purchasing green certificates issued by renewable energy generators. In contrast, "demand-side" mechanisms aim to increase the uptake of green power through increasing consumer demand for green power products. The demand-side mechanisms that have been most enthusiastically adopted by electricity companies are green pricing schemes and green power marketing schemes, and it is these mechanisms that are the subject of this chapter.

The structure of this chapter is as follows. Part 2 defines the key terms and concepts of green power, green pricing and green power marketing. Part 3 describes the main features of green pricing and green power marketing mechanisms adopted in various jurisdictions that have deregulated their electricity industries,

[1] Energy Information Administration, *Challenges of Electric Power Restructuring for Fuel Suppliers*, September 1998, http://www.eia.doe.gov

namely California in the United States, Alberta in Canada, and Australia, and the key legislation relating to these schemes. Part 4 summarises the strengths and limitations of green pricing and green power marketing schemes, while Part 5 addresses the role of the law and sets out minimum legislative requirements for the successful operation of these schemes.

2 Green power, green pricing and green power marketing

2.1 Green power

Green power is "electricity generated from renewable energy sources, that mitigates climate change by producing few or no greenhouse gas emissions."[2] While there is no standard classification of the "renewable energy sources" that are green power sources, the generation of electricity is generally required to have a minimal impact on: local and regional air quality; water quality; watersheds, river systems and fisheries; flora and fauna; geophysical features; noise; visual aesthetics; and any additional build-up of hazardous or toxic waste. Some definitions of green power require specific environmental performance criteria such as pollutant emission limits to be met before the electricity product is certified as "green power," for example the revised Canadian Environmental Choice Program guidelines, but others do not.

Examples of specific technologies and resources that are generally classified as green power sources include: solar energy (photovoltaics and thermal electric generators); wind energy; small hydroelectric facilities, such as run-of-the-river hydro facilities; biomass; geothermal heat and power; wave and freestream tidal power stations and water velocity turbines; and other technologies that use media such as hydrogen, compressed air or fuel cells to control, store and/or convert renewable energy sources.

The production of power from large-scale hydroelectric power plants and nuclear plants is not considered to be green power, as these energy sources create significant environmental problems elsewhere in the ecosystem. Power produced from fossil fuels is generally not considered to be green power, although "superefficient" technologies such as fuel cells, which can be seen as clean power sources, have been classified as a source of green power. Electricity sourced from natural gas cogeneration is not classified as green power.

2.2 Green pricing

Green pricing is an optional utility service that enables customers to support a greater level of utility investment in renewable energy technologies. Under green pricing programmemes, consumers voluntarily choose to pay a premium above the "normal" price for electricity, which is used by their supplier toward the additional costs of investing in renewable energy technologies. As of January 2002, more than 64 utilities in the US had developed or announced intentions to develop green pricing programmes, with customer participation in the programmes resulting in an installation of nearly 220MW of new renewable resources and plans for installing another 110MW.[3] Green pricing is also available in the deregulated electricity industries in the UK, the province of Alberta in Canada, and in Australia.

There is no definitive classification of the existing types of green pricing programmes. Wiser, Bolinger and Holt identify four general types of programme, which differ in the ability of customers to substitute an amount of green power for a utility's standard resource mix.[4] The first of these are *contribution programmes* or *renewable energy contribution funds*, under which customers contribute to a utility-managed fund for renewable project development, but do not receive any part of their electricity directly as green power. The second type is an *energy tariff*, where the electricity supplier charges a ¢/kWh premium based on a specific amount of energy delivered to the grid. These may be sold in energy blocks (eg 100kWh of wind energy) or as a percentage of customer use (eg 50% renewable energy).

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2 M. Raynolds and A. Pape, *The Pembina Institute Green Power Guidelines for Canada*, Pembina Institute for Appropriate Development, July 2000, at 4.

3 L. Bird and B. Swezey, "Estimates of Renewable Energy Developed to Serve Green Power Markets", National Renewable Energy Laboratory, January 2002, http://www.eren.doe.gov/greenpower/new_gp_cap.s.html

4 R. Wiser, M. Bolingerand E. Holt, *Customer Choice and Green Power Marketing: A Critical Review and Analysis ofExperience to Date*, Prepared for the ACEE Summer Study on Energy Efficiency in Buildings, August 2000, www.eren.doe.gov, at 5.367–5.368.

The third type of green pricing scheme is a *capacity tariff*, whereby utilities fund the development of a specific amount of installed renewable capacity by charging consumers a premium based on the number of capacity blocks they wish to reserve. This type of scheme has also been described as a "tailored renewable energy project," where a utility identifies a particular renewables project for which it solicits contributions and, after receiving a minimum number of subscriptions, the utility builds the project with the subscribers receiving energy from the new facility.[5] Fourth, *finance* programmes involve the payment of monthly payments by consumers to lease or finance and install customer-sited photovoltaic systems.

While there are a number of different green pricing schemes, an essential and common element of all these programmes is the existence of non-mandatory and/or legislative certification or eco-labelling schemes to protect electricity consumers from fraudulent suppliers who offer electricity that is described as "green" but which is in fact sourced from fossil fuels. As will be seen in Part III, consumer protection mechanisms are a vital part of green pricing schemes in all countries.

2.3 Green power marketing

Green power marketing is the sale of green power directly to customers in competitive markets with multiple suppliers and service offerings. Green power marketing enables electricity suppliers in competitive markets to differentiate their service, as retail customers can choose their electricity supplier and therefore switch to suppliers that make green power available directly to them. As of June 2002, retail customers in the US could purchase competitively marketed green power in the District of Columbia, Illinois, Maryland, New Jersey, New York and Pennsylvania, Texas and Virginia.

3 Examples of green pricing and green power marketing schemes by country

3.1 United States – California Case Study

One of the key elements of reforming the electricity industry in the United States has been the introduction of competition into the retail sector of the electricity industry. As of August 2002, 25 States and the District of Columbia had passed laws or regulatory orders to implement retail competition. Of these 25 States, six States have experienced a delay in the restructuring process, while in September 2001 California suspended its laws allowing consumers direct retail access following the energy crisis in that State. Twenty-six States are not undertaking restructuring activities.[6]

Because green pricing and green marketing programmes operate at the retail level, State governments are responsible for promoting the consumption of green power through these schemes. In States where electricity markets have been deregulated, governments and electricity suppliers have generally embraced green pricing and green power marketing schemes as a low-cost mechanism for promoting renewable energy. There is also evidence that consumers are supporting green pricing and green power marketing programmes in the US. As of January 2002, across the United States, 650MW of new renewable capacity had been installed to meet demand for green power, of which 220MW was installed to meet utility green pricing programmes and 430MW to meet demand for green power under competitive green power marketing schemes. Plans to install a further 440MW were either under way or had been formally announced, of which 110MW is to be installed to meet utility green pricing programmes and 330MW is planned for installation under competitive green power marketing schemes.[7]

As it is beyond the scope of this paper to compare the laws for the promotion of green power that have been adopted in all the States that have deregulated their electricity markets, I will examine the laws of California to provide an example of the legislation that has been introduced. California has been the leader in both electricity industry restructuring and also, historically, in the implementation of policies promoting renewable energy. In 1996, prior to deregulation of the state's electricity industry, California produced by far the largest share of non-utility renewable energy generation in the US, accounting for 23% of all US

5 B. Swezey, "Utility Green Pricing programmes: Market Evolution or Devolution?", *Solar Today*, January/February 1997 at 22.
6 Energy Information Administration, *Status of State Electricity Industry Restructuring Activity as of August 2002*, http://www.eia.doe.gov/cneaf/electricity/chg_str/regmap.html
7 Bird and Swezey, as above note 3.

non-utility renewable electricity produced in 1996, followed by New York with 5.1%.[8] Also, although green power marketing in California has collapsed since the summer of 2000, largely because of structural problems relating to electricity deregulation, some legislation enacted to deal with specific aspects of green power marketing and green pricing, such as consumer protection laws, provide useful examples of legislative approaches to green power.

On September 23 1996, the Governor of California signed Assembly Bill 1890 into law, thereby establishing a four-year transition period to make the State's electricity industry competitive. On March 31 1998, California became the first US State to open its retail electricity market to competition. Multiple electricity suppliers, including privately owned utilities, cooperatively owned utilities, state publicly owned utilities and independent power producers, provide multiple service offerings.

After the implementation of retail competition, customers of the utilities switched to alternative suppliers marketing green energy. As of August 2000, a total of 23 companies had registered with the California Energy Commission as renewable electric service providers. Swezey and Bird report that after two years of competition, 2.2% of all eligible utility customers had actually switched electricity suppliers, comprising 1.8% of the utilities' residential customers, 4.1% of commercial customers and about 20% of industrial customers. Of the 160,000 residential customers that changed suppliers, "virtually all" received green power.[9] The green power products offered by the marketers varied. Some companies offered multiple products containing anywhere between 50–100% of "eligible" renewable energy content (as defined in s383.5 of the Public Utilities Code), as well as power from large hydro and natural gas. In 1998, the price premium charged by green power marketers ranged from 1.1¢/kWh to 2.5¢7kWh, although in 1999 state credits of 1.0¢/kWh reduced the price to consumers.[10]

Following the electricity shortage in the summer of 2000 and spiralling electricity prices, green power marketing collapsed in California, forcing residential consumers to switch back to utilities as their service providers. As 5% of the state's peak electricity load is under direct access contracts, mainly with industrial customers, in September 2001 the California Public Utilities Commission suspended direct retail access as a means of alleviating the electricity shortage. Green power marketers will continue to provide green power to their customers under contracts made prior to September 2001, until the contracts expire.[11]

Although direct access to green power retailers has been suspended, electricity consumers are able to purchase green power through the green pricing programmes offered by utilities. As of July 2002, seven public utilities offered green pricing programmes to their customers, sourcing electricity from various renewable energy facilities including geothermal, biomass, wind, landfill gas, small hydro and rooftop photovoltaic installations, and charging price premiums ranging from 1¢/kWh to 3.0¢/kWh.[12]

The Californian government has instituted financial and legal mechanisms to support green power. First, the Consumer Credit Account, created by the government in 1997, is a financial mechanism by which the Californian government supports green power marketing.[13] It contains $75.6 million to be used for customer rebates for the purchase of electricity produced by renewable energy (Public Utilities Code s383.5(e)(l)). Eligible consumers of electricity automatically receive a credit of up to 1.0¢/kWh on their electricity bill for renewable electricity consumed. To be eligible for the credit, consumers must have switched from the utilities California Edison, Pacific Gas and Electric Company, San Diego Gas and Electric, or the Bear Valley Electric Company to a renewable energy provider that has been registered by the California Energy Commission (CEC). The renewable energy must be produced in California and not be utility-owned. Customers switching to registered providers receive the electric service from the utility, but the payments spent on electricity supported the energy sources of the customer's choice.

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8 Energy Information Administration, as above note 1, at 70–72.

9 B. Swezey and L. Bird, *Green Power Marketing in the United States: A Status Report* (National Renewable Energy Laboratory, Colorado, 5th ed, August 2000), http://www.nrel.gov/analysis/emaa/brief_5.html, at 9.

10 As above.
California Public Utilities Commission, *Interim Order Suspending Direct Access,* D0109060, September 20, 2001, as modified by D0110036, October 10, 2001; and *Opinion Rejecting an Earlier Date Than Sept. 20, 2001, for the Suspension of Direct Access, and Implementing the Suspension, as adopted In D.01-09-060, as Modified by D.01-10-036,* D0203055, March 21, 2002. CPUC internet site, "Official Documents", http://www.cpuc.ca.gov/static/official+docs/index.htm

12 The Green Power Network, "Summary of Green Power programmes", United States Department of Energy http://www.eren.doe/greenpower/summary.shtml, July 2002.

13 Assembly Bill 1890 of September 1996 amended the Public Utilities Code to establish a $540m public benefits fund for renewable energy technologies, to be collected over four years. Senate Bill 90 of 1997 provides administrative guidelines for the fund. The programme has since been extended through to 1 January 2012 (SB 1194 and AB 995).

Second, in order to minimize the possibility of fraudulent claims by green marketers and other electricity suppliers regarding the supply of green power, in September 1997 the Californian legislature enacted Senate Bill 1305 to amend the Public Utilities Code to require retail suppliers of electricity to disclose the sources of generation to customers. Section 398.4 of the Public Utilities Code requires every retail supplier that makes an offering to sell electricity that is consumed in California to disclose its electricity sources to potential end-use consumers in all product-specific written promotional materials distributed to customers by printed or electronic means, excepting advertisements and notices in general circulation media. Electric service providers must also provide quarterly disclosure statements to their end-use customers who have purchased electricity (s398.4(c)).

The legislation distinguishes between "net system power," the source of which may not be traceable to individual generating facilities, as it is supplied to consumers from the power exchange or power pool, and "specific purchases," which refer to purchases of electricity that are traceable by an "auditable contract trail" to specific generation plants. Under the legislation, electric service providers must claim their electricity source to be either net system power or specific purchases. Section 398.4(g) requires electric service providers to disclose their net system power and specific purchases to end-use customers, expressed as a percentage of annual sales. For each of these two categories, electric service providers must further disclose, as a percentage of annual sales, the electricity that is derived from the following sources: coal, large hydroelectric, natural gas, nuclear and eligible renewables. The information concerning renewables must be further classified into the percentage of annual sales derived from biomass and waste, geothermal, small hydroelectric, solar and wind power (s398.4(h)). Retail suppliers must also disclose their projected specific purchases for the current year (s398.5(a)). For renewables, this may be expressed as the total eligible renewables and not broken down into subcategories.

Section 398.3 requires generators that report meter data to a system operator to report quarterly to the system operator on the amount of electricity generated in kWh, the fuel type(s) and fuel consumption by fuel by month. The System operator will make the information available to the CEC. Generators that do not report to system operators but claim specific purchases must report this information directly to the CEC. The legislation also requires retail suppliers that disclose specific purchases to annually report the following information to the CEC: the kWh purchased, by generator and fuel type during the previous calendar year, consistent with the meter data, including losses, reported to the system operator; the kWh sold at retail for each electricity offering; and, for each electricity offering, the disclosures made to consumers pursuant to s398.4 (s398.5). The information obtained by the Energy Commission is used to verify information disclosed to consumers and to calculate net system power.

SB 1305 required the CEC to specify guidelines for the format and means of disclosure to consumers under the Public Utilities Code. The Energy Commission has developed a Power Content Label as the mechanism for disclosure. The Label lists the different energy sources that can be used to generate electricity; shows the retail supplier's expected percentage of annual electricity sales derived from each energy source; and compares this with the power mix from the power exchange.

In addition to the legislative requirements, in November 1997 a non-profit organisation called the Centre for Resource Solutions established a voluntary certification procedure in California, called the Green-*e* Renewable Electricity Certification programme. Various criteria must be fulfilled in order for an electric service provider to use the trademarked Green-^{e} logo.[14] First, the electricity product offered by the supplier must meet various criteria, including the following: at least 50% of the electricity supply for the product must be generated from renewable energy resources (solar, hydro, wind, biomass and geothermal); the fossil fuel portion, if any, of the product must have equal or lower air emissions than an equivalent amount of system power; and one year after deregulation of a states' electricity industry, the product must contain at least 5% "new" renewable electricity, a percentage which increases each year until 25% of the product content is from new renewable sources.

Second, companies must undertake certain activities to obtain Green-*e* certification. Companies participating in the programme must: sign an application including a six-page contract containing a Code of Conduct and a legal affidavit on the resource mix of the electricity product for which certification is sought; provide all potential customers with a one-page summary of the contract information using a standardized Green-*e* format; provide a disclosure statement to potential customers listing the resources from which the

[14] Center for Resource Solutions, "Introduction to Green-e", "Information for Power Providers" and "Certification Requirements", http://www.green-e.org

green power is generated, using a standardized Green-*e* label; and provide customers with an annual disclosure of the fuel mix used in the past year to generate the electricity purchased by the customer.

Companies must also undergo, at their own expense, annual third party verification of contracts, meter data, billing statements and any other records necessary to substantiate the electricity mix and air emission content required for certification. Finally, companies must agree to abide by the Green-*e* Code of Conduct, which contains general ethical guidelines that must be obeyed by the company. Companies undergo a biannual review by CRS staff to ensure they are abiding by the Code of Conduct. Members that do not adhere to the Code lose the right to use the logo for 18 months on any of their products.

3.2 Alberta, Canada

Under Canada's constitution, electricity is primarily within the jurisdiction of the provinces, with the bulk of generation, transmission, and distribution provided by a few dominant utilities. While several provinces are now beginning to deregulate their electricity sectors, Alberta has been the leader in electricity industry restructuring in Canada. The deregulation and privatization of Alberta's electricity industry has occurred pursuant to the *Electric Utilities Act* of 1995 and the *Electric Utilities Amendment Act* of 1998. On January 1 2001, Alberta became the first Canadian province to open its retail electricity market to competition and allow consumers to choose their electricity supplier.

Retailers in Alberta began offering green power packages to consumers in the year 2000. Of those companies providing retail services, EPCOR (retail affiliate of the City of Edmonton) and ENMAX Corporation (retail affiliate of the City of Calgary) are leaders in the provision of green power products to electricity consumers. The two main green power offerings are ENMAX's product "Greenmax" and EPCOR's product "Eco-Packs."[15]

ENMAX began offering Greenmax in 1998. The primary source of green energy supplied under Greenmax is wind energy, purchased from wind energy supplier Vision Quest Windelectric Inc. Residential consumers may choose a monthly premium of $5, $10 or $15 to purchase electricity produced from wind energy. A customer with average monthly energy consumption paying $15 per month would receive about 42% of their power from wind energy. In November 2000, after energy from an initial two wind turbines had become fully subscribed, Enmax contracted with Vision Quest to install two more wind turbines. In May 2000 Enmax contracted with Vision Quest to install sixteen 660kW wind turbines by October 2001.

EPCOR began offering its EcoPack in July 1999. Renewable sources include biomass, run-of-the-river hydro, solar photovoltaics and wind energy. Customers can choose to purchase 10%, 20%, 50% or 100% of their power from renewable sources. Price premiums range from an extra C$5 per month for the 10% option, to C$40 (approximately US$26.00) per month for the 100% option (or approximately US$3.20 to US$26.00, based on an exchange rate of C$1=US$0.641891). Based on an average use of 550 kWh per month, this translates to a premium of about C9c7kWh (US5.7¢/kWh) per month under the 10% option, and C7??/kWh (US4.4¢/kWh) per month under the 100% option.

In Alberta, green pricing premiums serve two uses. First, the premium ensures that electricity produced from renewable sources is purchased and dispatched to the Alberta Power Pool. Second, in Canada, the premiums also buy green power customers greenhouse gas "emission reduction credits" (ERCs). When green power customers demand electricity from renewable energy sources, this displaces electricity produced from fossil fuels, thereby reducing air pollution. ERCs, which are measured in terms of kilograms or tonnes of carbon dioxide equivalent, are used by consumers of electricity to offset their own carbon dioxide emissions from industrial plants, automobiles and household use. In Canada, ERCs are reported in annual updates to the Voluntary Challenge Registry, which forms part of the country's national strategy for reducing greenhouse gases.

Green power schemes in Alberta are monitored by the Federal Ministry, Environment Canada. Environment Canada's Environmental Choice^{M} Program (ECP), established in 1988, is a national eco-labelling programme for a range of products and services. The ECP has provided a certification process for distributors and generators of electricity, with the official symbol of certification known as the EcoLogo , since 1996. Certification is based on compliance with environmental criteria established by Environment

[15] Information on ENMAX's Greenmax product and EPCOR's EcoPack offering is available from the companies' websites http://www.enmax.com, and http://www.epcor-group.com

Canada. To obtain certification, companies must submit to independent third party verification of the company's compliance with the established environmental criteria. Auditing and verification for the scheme is conducted by TerraChoice Environmental Services Inc, an environmental programme and consulting services firm.

With respect to electricity products, the ECP certifies "alternative source electricity distribution and generation".[16] As regards alternative source electricity generation, the ECP has established general certification criteria that apply to all relevant renewable energy facilities (solar, wind, hydro, biomass, biogas and geothermal technologies) as well as environmental criteria specific to generation from each particular renewable energy type. The general criteria are:

- the facility must be operating, reliable, non-temporary and practical;
- during project planning and development, appropriate consultation with communities and stakeholders must have occurred, and prior or conflicting land use, biodiversity losses and scenic, recreational and cultural values must have been addressed;
- no adverse impacts can be created for any species recognised as endangered or threatened;
- supplementary non-renewable fuels must not be used in more than 2% of the fuel heat input required for generation; and
- sales levels of ECP-certified electricity must not exceed production/supply levels.

The technology-specific criteria for generation obviously vary between technologies, but include, for example, the proper disposal or recycling of cadmium wastes for solar energy producers, the protection of birds for wind energy producers, and maximum levels of air emissions for producers of energy from biomass.

Certification for alternative source electricity distribution requires the following conditions to be met: only components of a multi-sourced power product that fully satisfy all pertinent ECP criteria for generators can be identified as ECP-certified; sales levels of ECP-certified electricity must not exceed production/supply levels; and a criteria statement must appear with the EcoLogo. As of August 2002, 31 companies generating electricity and five companies providing electricity distribution services in Canada were listed on the ECP internet site as offering certified products. In Alberta, both ENMAX's Greenmax product and EPCOR's "Eco-Packs" are certified as alternative source electricity distribution products under the ECP scheme, with their energy suppliers such as Vision Quest Windelectric Inc. being certified generators under the scheme.

Additional protection against fraudulent suppliers is supplied by legislation. The *Electricity Marketing Regulation* (AR 109/2000), made under the Fair Trading Act 1999, requires retailers who offer electricity services to home, farm and smaller industrial and commercial consumers to hold a "marketing of electricity business licence" in order to engage in the marketing of electricity. As well as licensing requirements for electricity marketers, the Regulations: lay down duties with respect to documentation; set out requirements with respect to the terms of contracts between retailers and consumers; set out requirements for the provision of disclosure statements to consumers that must be signed before the consumer enters a contract; and contain a code of conduct for retailers. While the Regulations do not contain any provisions specifically aimed at preventing fraud with respect to the provision of green power, the code of conduct for retailers in Reg 13 covers this type of behaviour. Some parts of the code that may be relevant to misrepresentations about green power supply include the following provisions of Reg 13(2):

> (b) a marketer must not abuse the trust of a consumer or exploit any fear or lack of experience or knowledge of a consumer; ...
>
> (d) a marketer must not make any representation or statement or give any answer or take any measure that is not true or is likely to mislead a consumer; ...
>
> (g) a marketer must ensure that all descriptions and promises made in promotional material are in accordance with actual conditions, situations and circumstances existing at the time the description or promise is made;
>
> (h) a marketer must ensure that all data the marketer refers to is properly established and reliable and supports any claim for which the data is cited; ...

[16] Environment Canada Environmental Choice Program, "Browse a Product Category – Alternative Source Electricity and Generation", http://www.environmentalchoice.com/index_rnain.cfm

(k) a marketer must not make any representation that savings, price benefits or advantages exist if they do not exist or if there is no evidence to substantiate the representation.

Regulation 13(3) provides that the code is breached if the breach occurs "in the course of inducing a person to enter into a marketing contract, even though the marketing contract is not entered into or is not completed". A contravention of s 13 is an offence for the purpose of s 162 of the Fair Trading Act (Reg 15). Section 164 of the FTA sets out the penalty for convention of an offence, which is: a fine of not more than $100,000, or three times the amount obtained by the defendant as a result of the offence, whichever is greater; or imprisonment for not more than two years; or both.

Unlike California, there is no legislative provision that makes specific provision for the supply of information regarding renewable energy sources to consumers. The *Electric Utilities Act* s.31.992(2)(a) provides that after 31 December 2000, retailers must maintain records and accounts relating to customers of the retailer respecting the provision of electricity services. Under Reg 16(2)(a) of the *Roles, Relationship and Responsibilities Regulation* (AR 86/2000) the duty to maintain records and accounts extends to billing. Although Reg 4 of the *Billing Regulation* (AR 290/99) sets out certain specified information that must be included in an account, this does not include separate details about the green pricing or green marketing programmes.

However, Reg 16(4) of the *Roles, Relationship and Responsibilities Regulation* (AR 86/2000) states that retailers must provide: (a) to the Minister, or (b) to the person holding the office of Executive Director of the Electricity Branch of the Department of Resource Development or a successor office, the information requested by that individual. In practice, this means that all retailers must register with Alberta Energy to enable Alberta Energy to monitor the development of the market and ensure that retailer information is posted on a "Customer Choice" internet site (http://www.customerchoice.gov.ab.ca/) which provides consumers with information about the electricity industry and retail suppliers.

3.3 Australia

In Australia, regulation of the retail sector of the electricity industry in each state is within the jurisdiction of the state governments, who have been keen to adopt green power policies to stimulate the growth of the renewable energy industry. Green pricing programmes are available in all the Australian States and Territories, although the price premiums for green pricing programmes and the renewables mix differ between states and companies. In South Australia, the electricity retailer AGL offers a green power product called "AGL Green Energy." As of 20 August 2002, the product was based on biomass (89.7%), wind (6.8%) and solar (3.5%), and price premiums were: 0.55¢/kWh for 10% Green Energy; 1.1¢/kWh for 25% Green Energy; 2.2¢/kWh for 50% Green Energy; and 4.4¢/kWh for 100% Green Energy.[17]

There is evidence that Australian consumers are supporting green pricing programmes. As of 30 June 2002, there were 16 retailers offering accredited products to 96% of all Australian residents, and about 67,000 customers had signed up to a green power product.[18] Total green power sales increased from 290,355 MWh in 1999/2000 to 454,505MWh in 2000/2001. Over the period 2000–2001, 72% of energy sold under the Green Power programme came from newly constructed generators.[19]

A major contribution toward the success of green power schemes by the governments of South Australia, New South Wales, Victoria, Queensland and the ACT has been the establishment and operation of a joint accreditation programme, called the National Green Power Accreditation Program, which sets standards for green power and audits electricity retailers to ensure they are purchasing sufficient quantities of Green Power. In May 2000, the NSW Sustainable Energy Development Authority was appointed as the central programme manager of the accreditation programme and the Green Power Accreditation Steering Group was officially established.

For a company to sell an accredited Green Power product, they must satisfy a number of requirements outlined in the Green Power Guarantee. The accreditation programme uses a "government approved" green

[17] AGL, "Green Energy", http://www.agl.com.au/AGL/Your+Home/SA/Green+energy/default.htm (no date).

[18] *National Green Power Accreditation Program, Quarterly Status Report – June 2002* http://www.greenpower.com.au/go/download/1016407966, (no date), at 4.

[19] Sustainable Energy Development Authority, *National Green Power Audit* (March 2002), http://www.greenpower.com.au/go/download/1016407966, at 2,5 and 2,7.

logo to certify that a retailer's Green Power product has met these requirements. To use the logo, an electricity company must:[20]

- use energy sources that are based primarily on an a renewable energy resource and that result in greenhouse gas emissions reduction and net environmental benefit;
- source 60% of their green power from new renewable generators, defined as generators commissioned after 1 January 1997–a percentage which will increase to 70% in 2001 and 80% in 2002;
- submit monthly, quarterly and annual reports to ensure that sufficient approved renewable energy is purchased to meet customer needs;
- place revenue from selling green power into a separate account which is independently audited;
- use Green Power account funds for the purchase of energy from renewable sources; and
- purchase Green Power themselves for their own electricity needs.

Regular reporting by energy suppliers allows SEDA to verify the compliance of Green Power products with the accreditation criteria. The monthly reports contain information on new, lost and current Green Power customers. Quarterly status reports provide a description of each Green Power product and customer numbers. Green energy purchases are given according to the type of renewable resource used, for both new and existing generators. The annual audit reports are technical and financial statements, which have been independently audited and then verified by SEDA. These provide detailed yearly summaries of Green Power product purchases, sales, customer numbers and newly installed renewable generators.

Unlike California, in Australia there is no legislation addressing fraudulent claims by green power marketers, nor are there any legislative requirements regarding the disclosure of information regarding the electricity source mix to consumers. Similarly to Alberta, each Australian state in the National Electricity Market has a retail code that regulates the sale and marketing of electricity to consumers but does not specifically address green power. However, the consumer protection provisions of the *Trade Practices Act (Cth)* 1974 will apply to contracts between electricity corporations and consumers. The Act provides remedies for misleading and deceptive conduct that will apply to representations made by green power marketers or utilities to consumers in order to obtain contracts for the supply of green power.

In South Australia, where AGL is the only retailer of green power products, the Industry Regulator has published a special Guideline regarding green power and consumer protection and information.[21] The Guideline, which applies only to the sale of green power products to consumers who cannot choose their retailer, requires AGL to accredit its green power products under the national accreditation programme (s3.1.1.2) and to set a fair and reasonable price for green power (s3.1.2.2). It also: prohibits misleading and deceptive conduct, requiring AGL to ensure all representations are factually correct and to comply with the *Trade Practices Act* and other consumer protection legislation (s3.1.3.2); and lays down requirements for billing practices (s3.2.1.3), complaints and dispute resolution (s3.2.1.4) and compliance reporting to the Industry Regulator (s3.3.1). The Guideline will remain in force until full retail competition is introduced in 2003.

4 Strengths and limitations of green pricing and green power marketing schemes

Green pricing programmes and green power marketing schemes are market-based mechanisms that are used to increase demand by consumers for electricity produced from renewable energy sources. These programmes are voluntary and depend upon the willingness of consumers to pay a price premium for the supply of green power to them directly or the investment by a utility in developing renewable energy technologies. As market-based mechanisms, green pricing programmes offer a number of benefits but are also subject to a number of limitations.

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20 Sustainable Energy Authority Victoria, "National Accreditation", (no date), http://www.seav.gov.au/greenpower/accred.htm

21 South Australian Industry Regulator, *Consumer Information and Protection: Green Power*, Electricity Industry Guideline No. 7, November 2000, made under the *Independent Industry Regulator Act* 1999 (SA).

4.1 Green pricing

The advantages of green pricing programmes are that the schemes: enhance information and customer choice with a minimum of regulation; allow suppliers to encourage renewables development at no competitive cost to themselves or to customers uninterested in renewables; and provide a mechanism for promoting renewable energy that enhances individual freedom and economic efficiency.[22] Another benefit is that the schemes are not dependent on government support, in particular financial support, for their success.

Despite these benefits, green pricing programmes are subject to a number of criticisms. First, green pricing schemes do not correct the market failure associated with the use of fossil fuels and do not allocate the cost of providing green power, a public good, across society. The costs of pollution associated with the production of electricity from fossil fuels are not taken into account in the pricing of electricity, thus the low electricity prices that render renewables uncompetitive in a competitive market do not reflect the true environmental cost of using fossil fuels. In economic terms, the marginal private cost to electricity companies of generating electricity from fossil fuels does not reflect the marginal social cost of electricity production. There is an externality or market failure associated with the production of electricity from fossil fuels. In contrast, the supply of electricity from renewable energy sources is a public good. Critics of green pricing schemes argue that as green power provides a public benefit to society, all electricity consumers should pay for green power. By asking a subset of consumers to fund a public good though voluntary contributions, green pricing transfers the costs for environmental benefits from the general public to a select group and enables utilities to avoid responsibility for environmental costs and perpetuate the market failure associated with the use of fossil fuels.[23]

Other critics argue that while green pricing schemes have a useful role to play in supplementing supply-side mechanisms, they should not be relied upon as the sole method of promoting green power. The main reason for this is the problem of free riding. Because green pricing programmes are voluntary, consumers have the incentive to buy the cheapest electricity available while hoping that others will buy more expensive green power.[24] It has also been argued that utilities with a large existing base of non-renewables energy sources, such as coal and nuclear power, may fear that future sales of their electricity will be undermined by green pricing initiatives, and have no incentive to offer successful green pricing programmes.[25] For these reasons, green pricing schemes alone are generally regarded as insufficient to ensure that green power will comprise an adequate proportion of total electricity generated in a deregulated market.

Finally, green pricing schemes have been criticised as promoting the perception that renewables are uneconomic at a time when many renewables are approaching, or have already achieved, cost-effectiveness.

4.2 Green power marketing

From the perspective of green power marketers and generators, experience to date in California, Pennsylvania, New Jersey and Massachusetts indicates that green power marketing has proven to be a successful method of differentiating generation supplies. However, the percentage of residential customers who have switched suppliers is, on average, only about 1%. Studies of the electricity markets in California, Pennsylvania, New Jersey and Massachusetts have identified a number of barriers to the success of green power marketing.

First, the cost of attracting and signing up new customers, particularly smaller customers, has been prohibitive for some green marketers. Demand for green power must be created through intensive marketing and by educating customers about the availability and benefits of green pricing schemes, which is a very costly undertaking. As the costs of acquiring new customers are raised, the profitability and attractiveness of the market are reduced. Wiser *et al.* have found that high start-up and customer acquisition costs in the early days of the California market "overwhelmed" profit margins from power sales, forcing some marketers to abandon the residential market.[26]

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22 F. Sissine, "Renewable Energy and Electricity Restructuring," National Council for Science and the Environment, Congressional Research Service Issue Brief for Congress, RS 20270, 20 July 1999, http://cnie.org/NLE/CRSreports/energy/eng-56.cfm

23 R. Wiser, S. Pickle and C. Goldman, "Renewable Energy Policy and Electricity Restructuring" (1998) 26 *Energy Policy* 465 at 466.

24 R. Fouquet, "The United Kingdom Demand for Renewable Electricity in a Liberalised Market" (1998) 26 *Energy Policy* 281 at 284.

25 Swezey, as above note 5 at 23.

26 Wiser, Bolinger and Holt, as above note 4.

Second, the size of the "default service price" in deregulated markets is a key component to the success of green marketing schemes. The default service price is the price at which customers who do not switch suppliers or into new contracts will be supplied power after deregulation. Through a comparison of the markets in California, Pennsylvania, New Jersey and Massachusetts, market researchers have found that the single most important factor affecting the success of green power markets is the default service price relative to the wholesale market price, as the difference between the two determines the ability of suppliers to earn profit margins and/or offer consumers discounts from current rates. A low default service price relative to the wholesale market price leaves green marketers little opportunity to earn profit margins and/or offer price savings to consumers, thereby providing little incentive either for marketers to enter the market and offer supply choices, or for consumers to spend time comparing electricity offers and switch suppliers.

The emergence of a successful market for green power depends on the existence of either a high default service price (eg Pennsylvania) relative to the wholesale market price or, where there is a low default service price, the introduction of a sizeable subsidy for green power customers, for example in California, where the consumer credit offsets a low default service price.[27] Even the existence of the consumer credit was unable to save green power marketers in California in the face of severe electricity shortages, when extremely high wholesale power prices, combined with retail electricity price caps of 6.5¢/kWh (operating retrospectively from 1 June 2000, to 31 December 2003) meant that green power marketers could not earn sufficient profit margins to survive.[28]

Third, false claims by green marketers in early markets have deterred some consumers from switching suppliers. In New England, during two retail competition pilot programmes, green power producers made false claims about the "greenness" of their products.[29] The success of green pricing schemes and green power marketing relies on the provision of good quality green power products. As it is not possible for consumers themselves to ensure the veracity of claims made by suppliers about their green power products, consumer protection mechanisms such as disclosure and certification requirements play a crucial role in establishing successful markets for green power.

Despite the need for consumer protection mechanisms, these mechanisms may raise costs for green marketers and deter entry into the market. Reed and Houston cite the example of US green marketer GreenMountain.com who, with a sizeable presence in Pennsylvania, refused to enter the New Jersey market until the state amended or abolished the rule requiring a customer's signature to be affixed to any agreement to switch generation suppliers (the "wet signature" rule). GreenMountain.com, which targets residential and smaller commercial customers, has relied heavily on telephone and internet recruitment. The requirement that customer must ultimately mail or fax an agreement with a signature affixed was seen as a significant barrier to entry.[30]

Fourth, the requirement that green power be sourced from new as opposed to existing facilities may deter marketers from entering the market. Using pre-existing renewables capacity rather than new capacity limits the uptake of new renewables, and most certification programmes require a certain percentage of green power to be sourced from new renewables. However, when green power markets are in their infancy, marketers do not have captive customer bases while they procure new sources of renewables. In new markets, it is less risky for green power marketers to use existing renewable resources as these are usually cheaper and contract terms are more favourable. In those areas without an established existing renewables sector, green marketers, who must procure more new generation in the early stages of the market when demand and consumer confidence are not yet established, face higher risk levels. Some marketers may not be willing to take the risk in the early stages of the market.

Fifth, the utilities can act in a manner that impedes competition. For example, in California, the utilities made it more difficult for green power marketers to operate competitively by: making it impossible for green power marketers to offer products such as consolidated billing; refusing to allow customers to choose their green power provider at the time of first contact with the utility after deregulation; failing to explain adequately or accurately about how utility and green pricing worked to consumers; and, in the case of San

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27 G. Reed and A. Houston, "Status of the US Market for Green Power," Prepared for the ACEE Summer Study on Energy Efficiency in Buildings, August 2000, http://www.nrel.gov/analysis/emaa/brief_5.pdf

28 Retail price caps were introduced by AB 265 of 7 September 2000 (Stats. 2000, ch. 328).

29 Wiser, Bolinger and Holt, as above note 4.

30 Reed and Houston, as above note 27 at 5.282.

Diego Gas and Electric, imposing price caps during the electricity crisis for all customers except those who had switched to a green power provider.[31]

5 The role of the law

Market research in the US shows that while a majority of electricity consumers has expressed a willingness to pay higher prices for renewable energy, this has not yet translated into a large-scale change in consumer behaviour. The majority of consumers only purchase green products when they are competitively priced and where there is no reduction in quality or convenience. This, combined with problems such as free riding, has resulted in electricity from renewables purchased under these schemes forming only a small percentage of all electricity purchased. Thus "while a niche market for green power clearly exists ... full reliance on the green power market to meet national renewable energy objectives would be premature: traditional forms of public policy support will continue to be needed for the commercialization and maturation of the renewables industries."[32]

The limitations of green pricing and green power marketing schemes are recognised in most developed countries, where these voluntary schemes operate concurrently with mandatory supply-side mechanisms such as renewable portfolio standards. These include the Mandatory Renewable Energy Target in Australia and the Renewables Obligation in the UK, while the US federal government is considering the introduction of a renewable portfolio standard to replace the mandatory purchasing provisions of the Public Utilities Regulatory Policies Act 1978. An exception is Alberta, where there is no renewable energy portfolio scheme operating at the provincial or federal level. It is the policy of the Albertan government to encourage renewable power in the electricity market through open, non-discriminatory access to the Power Pool of Alberta and consumer support of voluntary green power schemes. The provincial government has explicitly stated that the success of renewable energy projects "depends on how much value consumers put on supporting green power" and "not on a regulatory hearing or a government decision."[33]

Green pricing and green power marketing schemes provide a useful but small contribution to the uptake of renewable energy, and should operate in conjunction with mandatory supply side mechanisms. Given that mandatory supply-side mechanisms are introduced, green pricing and green power marketing schemes as demand-side mechanisms should remain voluntary, thereby taking advantage of the existing benefits of the schemes, and a relatively light-handed approach towards the regulation of these schemes is appropriate. The role of the government and law should be that of providing a "level playing field" in the deregulated electricity market for renewables producers, and providing education, information and protection to consumers. In particular, governments through legislation should address the following issues:

- In order to support green power marketing, governments should address the level of the default service price relative to the wholesale price. Upon deregulation of the electricity industry, the default service price is usually set out in the legislation restructuring the industry. Governments must ensure that the default service price is sufficiently high relative to the wholesale price so that consumers are encouraged to switch between suppliers. Alternatively, if the default service price is relatively low with respect to the wholesale price, a financial incentive to consumers that will encourage switching between suppliers should be offered, as in California.
- Governments should play a role in educating the population about the environmental harm caused by electricity generated from fossil fuels, and the environmental benefits of green power. Government participation in the provision of education will reduce the costs to green power marketers and utilities offering green pricing schemes, enhancing the profitability and attractiveness of the market.
- Governments also have a crucial role to play in consumer protection. False claims from some green marketers about the "greenness" of their product damages the credibility of the entire market for green energy. It is absolutely crucial that mechanisms are established to minimize the possibility of fraudulent claims by green marketers and other electricity suppliers regarding the supply of green

31 Center for Resource Solutions, *Ten Factors That Affected California 's Retail Green Power Market,* (no date), http://www.green-e.org/pdf/topten.pdf

32 Reed and Houston, as above note 27 at 5.377.

33 Alberta Resource Development, *Power of Competition: A Guide to Alberta 's New Competitive Electric Industry Structure,* (March 2000).

power. The case studies of California, Alberta and Australia demonstrated a number of ways in which consumer protection mechanism may be implemented.

Alberta relies on the voluntary certification scheme administered by the Canadian Environmental Choice Program for quality guarantee, with no government-administered scheme laying down specific requirements for disclosure of information to consumers about the content of green power products. However, the government has enacted the Electricity Marketing Regulations, which specifically prohibit fraudulent behaviour by electricity marketers. In Australia, the state governments have established a joint accreditation scheme for green power, administered by SEDA. While retail codes regulate the sale of electricity to consumers, there are no specific legislative disclosure requirements regarding green power such as those in California. The general consumer protection laws contained in the *Trade Practices Act* govern fraudulent behaviour by green power marketers.

California has the most comprehensive mix of legislative and voluntary mechanisms for consumer protection. Legislation makes it mandatory for retail suppliers and electric service providers to disclose information to end-use customers through the Power Content Label, the eco-labelling scheme that is administered by the government through the California Energy Commission. Legislation also makes it mandatory for certain generators and retail suppliers to report to the CEC to enable the Commission to verify that information provided to electricity consumers is correct. The voluntary Green-*e* accreditation scheme run by the Center for Resource Solutions, a non-profit organization, provides a further guarantee for consumers.

Laws containing mandatory disclosure and reporting requirements modelled on the California eco-labelling system, combined with laws specifically prohibiting fraudulent behaviour by electricity marketers and laying down penalties for fraudulent claims, such as the provisions of the Albertan Electricity Regulations, should be enacted to provide a comprehensive system for consumer protection. Voluntary accreditation schemes such as that run by the Canadian Environmental Choice programme^{M}, which provide for independent third party monitoring and auditing of facilities, and set out stringent requirements for electricity to be classed as "green" power, will also benefit consumers, but should exist as voluntary schemes in addition to government regulation.

These recommendations are made on the assumption that green pricing and green power marketing schemes will operate in conjunction with mandatory supply-side mechanisms such as a renewables portfolio standard. Where a mandatory renewables portfolio standard is in place, all electricity suppliers will be contributing to the supply of green power, either by paying directly for extra generation from renewable energy sources or by trading in green certificates. However, in the case of countries that do not establish supply-side mechanisms but rely solely on green pricing and green power marketing to encourage renewable energy, such as Alberta, then I further suggest that offering green pricing programmes should be compulsory for all utilities. Utilities with a large existing base of non-renewables energy sources may fear that future sales of their electricity will be undermined by green pricing initiatives, and have no incentive to offer genuine programmes. In this situation, utilities must be forced to offer some green power product to electricity consumers, or stated support for renewable energy will be only illusory.

Does electricity market liberalization contribute to energy sustainability?

Barry Barton

Many countries have adopted a market approach to the reform of their electricity industries. Do such changes contribute to energy efficiency and conservation, and the uptake of renewable energy? The inherent characteristics of a market approach are compared with a political or regulatory approach. The role of subsidies is considered. So too is the legal design ofenergy market institutions, and the manner in which the details of market design can affect energy sustainability, such as in demand-side management. The Paper concludes that, while the record is mixed, a market approach can make a contribution to energy sustainability.

1 Introduction

Many countries have adopted a market approach to the reform of their electricity industries. Whether such changes help or hinder energy sustainability is debatable. Do they contribute to energy efficiency and conservation, and the uptake of renewable energy? This Paper examines the inherent characteristics of a market approach in comparison with a political or regulatory approach, for example in relation to energy pricing and investment. The role of subsidies is considered. It examines the legal design of energy market institutions and the manner in which the details of market design can affect energy sustainability, such as in demand-side management. It appraises policy instruments grafted onto a market strategy in order to improve energy sustainability. It concludes that, while the record is mixed, a market approach can make a contribution to energy sustainability.

2 Energy sustainability

Three elements can be identified in energy sustainability. Energy efficiency concerns the productivity we obtain from the primary energy we consume. Although in technical terms some energy is always wasted when it is converted from one form to another, or put to use, the amount can be reduced. Improvements in energy efficiency mean that the amount of economic output or satisfaction of human needs per unit of energy can be increased. Some countries like Japan have made dramatic improvements in the measure of gross domestic product obtained per unit of energy consumed. The second element, energy conservation, is the reduction of energy use, for example in eliminating unnecessary heating. The third element is renewable energy sources, replacing or avoiding dependence on fossil fuels.

Policies of energy sustainability have several justifications. There is the simple economic cost of investments in generation and capacity. At times supply has not been able to keep up with demand, and the need to avoid waste has been very evident. Energy security has been another reason to restrain demand and avoid dependence on fossil fuels, whether due to depletion of resources or due to political problems. In recent years more attention has turned to the environmental consequences of energy production and use. Air pollution has long been understood to be a significant adverse effect of the use of fossil fuels, especially coal, but it continues to be a severe problem in many regions. Other environmental consequences are pollution and thermal degradation of water, visual impact of generation and transmission facilities, and nuclear hazards. At a fundamental level, energy sustainability has a vital role in reducing the adverse effects of human activities on global climate. Energy use is the main source of anthropogenic carbon dioxide emissions, in the use of petroleum, natural gas and coal. The reason why energy sustainability measures are so important is that there is no practical way to mitigate carbon dioxide emissions; they cannot be filtered out of the fumes or treated technically like other products of combustion. The amount of carbon dioxide emitted is tied firmly to the amount of fossil fuel energy used.

Energy sustainability faces barriers of various kinds. Its uptake is strongly affected by the availability and price of traditional fuels, which in turn are affected by the extent to which external environmental costs are externalized. Traditionally the price of oil, gas and coal has not reflected pollution or climate change costs. Other barriers are the cost of capital investment and information. The special characteristics of renewable energy sources can also be a barrier; wind and solar, in particular, provide an intermittent supply of electricity

that may or may not match demand. Renewables also have their own environmental burdens to carry. Biofuels can cause significant pollution; wind farms attract criticism for damaging amenity and affecting birdlife habitat; hydro dams affect rivers and lakes, and large ones affect whole regions. This Paper is particularly concerned with barriers of a legal and institutional kind.

Governments have a role in reducing these barriers. The Energy Charter Treaty is one international instrument that recognises this role, and calls on ratifying parties, in non-binding language, to improve energy efficiency and develop and use renewable energy sources.[1] An associated Protocol addresses energy efficiency specifically. Another protocol for energy efficiency and renewable energy, it can be argued, should be made under the United Nations Framework Convention on Climate Change, because of the role of energy use in the emission of climate change gases.[2]

3 Characteristics of the traditional electricity industry

It is convenient to start with the legal structures for the traditional electricity industry, where electricity and its delivery are assumed to be inevitably intertwined and provided by the one large monopoly organization. Large centralized organizations suit the generation technologies that have prevailed, at least up until the 1990s, because ever-greater economies of scale could be obtained from large generation stations.[3] There are two main legal forms for the electricity industry under such circumstances. The first is as a government agency. Generation and transmission are in the hands of a department or ministry under the direct control of a politically-accountable minister, or in the hands of a board or state-owned enterprises substantially controlled by the minister. Distribution and sales may be part of that department or entity's work, but commonly they are administered by local councils or boards on a non-profit basis. The department has a legal monopoly and can (and often does) refuse to allow anyone else to build power stations. The local distribution and sales councils have a like legal monopoly. They have a corresponding duty to supply all paying customers. Prices are set by regulation and so subject to direct political control. Price increases sometimes take place in the safer parts of the electoral cycle. Pricing often involves cross-subsidy to reduce the electricity prices for homeowners, who are after all voters. Investment decisions, in new power stations or new transmission lines, are government decisions. Staying ahead of demand is one of the main factors that a government will take into account, and it assumes that to be a necessity without comparing costs and benefits in any rigid way; it is a given that the government must provide electricity. But is by no means the only purpose that governments pursue in electricity development projects. They see them as valuable means of job creation, which provide employment in construction and in coalmining, which contribute (in the case of hydro projects) to flood control and irrigation, and which act as vehicles for generalized regional development including roads and other infrastructure. This has been the dominant model in many parts of Europe, Canada, Australia, New Zealand, and developing countries.

Decisions about prices and investments are all made within the one integrated entity. Decisions about what fuel to purchase, what plant to run, and what capital works projects to invest in are taken in view of the wellbeing of the enterprise as a whole. There is no competition in any real sense between different sections of the enterprise. Accounting procedures are often different from in the private sector, focussing more on controlling the expenditure of taxpayers' money, and less on capital and the rate of return on capital. Political control also extends to decisions about fuel type and about renewables and energy efficiency. In some cases, however, political control is weak and the enterprise achieves high levels of autonomy. (Ontario Hydro from the 1920s to the 1990s is a leading example.) System operation and security is all dealt with as the enterprise's business.

The second main structure for a traditional electricity industry is privately-owned company subject to strict regulation. This pattern is found in Europe and is common in the United States. The companies are "investor-owned utilities," in business to make a profit. However their profitability is subject to the oversight of a public utility board or like regulatory agency that has jurisdiction over prices and investment decisions. In exchange for the loss of control that this implies, each company obtains a franchise or legal monopoly for the supply of electricity in a particular territory, and the security of a reasonable income for the investors who

1 Energy Charter Treaty, art 19, (1995) 34 *ILM* 360. Under it was made the Energy Charter Protoeol on Energy Efficiency and Related Environmental Aspects 34 *ILM* 446, whereby the parties committed themselves to establish energy efficiency policies and appropriate regulatory frameworks.

2 A. J. Bradbrook, "The Development of a Protocol on Energy Efficiency and Renewable Energy to the United Nations Framework Convention on Climate Change" (2001) 5 *NZJEL* 55.

3 S. Hunt and G. Shuttleworth, *Competition and Choice in Electricity* (Chichester: John Wiley, 1996) at 1.

hold its stocks and bonds. The public utility board regulates to control the prices that the monopoly company can charge, but to allow it to make a reasonable rate of return on its assets.[4] This requires an elaborate analysis of what investments can properly be included in the allowed asset base, before decisions on the rate of return and then the tariff for different classes of customer. Capital investment projects like new power stations require the board to grant a certificate of convenience and necessity. The legislation that gives the board its jurisdiction may direct the board to take energy efficiency into account as it performs its functions. Power companies operating under this kind of regulation are like government departments in many respects, e.g. monopoly, integration and close political direction. They are in a symbiotic relationship with their public utility boards, in a regulatory compact. They share with government departments a predilection for capital works, because when prices and profits are controlled, the only way for the company to grow is by increasing the amount of the capital invested.

Whether investor-owned or publicly-owned, the traditional form of the industry has been the dominant paradigm for a century, and for good reason.[5] The vertically-integrated organization allows the development of large-scale transmission systems, and enables the introduction of larger and larger generation stations to take advantage of the economies of scale that have prevailed at least until recently. The total monopoly of the vertically-integrated entity makes it simple to maintain subsidies for social purposes or for the benefit of different fuel industries.

4 Energy sustainability characteristics of a traditional system

What are the energy sustainability characteristics of these traditional forms of the electricity industry? First, they are designed to supply electricity in order to satisfy demand. Electricity is perceived as a public service, required for the nation's development and for the improvement of the lives of its factory workers, farmers and householders. In the heyday of electrification in the 1920s and 1930s, electricity was the very essence of progress, and access to it was necessary for modern citizenship. Our dependence on electricity has only grown since; few of us in the developed world would know how to run our homes or offices, let alone our farms and factories, without a reliable supply. In many countries, demand has grown steadily and at a faster rate than the population.[6] The traditional model of the industry is therefore geared to supplying more electricity, come what may. It is all the more focussed on supply when electricity prices are kept deliberately low, as they are in many developing countries for the purposes of modernization, economic growth, and social equity.[7] The consequences are that consumption is encouraged, although the consequences must fall on the state because the lower prices will discourage private investment in generation.

Second, in relation to investment decisions, there is a long record of governments forging ahead with energy schemes heedless of both environmental and economic risks. Hydro electric development is especially prone to grandiose proposals. Kellow has documented examples in Canada, the United States, Australia and New Zealand where governments have insisted on proceeding with projects without taking the environmental impact into account, and without considering closely the need for the electricity to be generated.[8] In New Zealand, the government in the late 1970s and early 1980s embraced the "Think Big" strategy of energy and natural resource development, putting both financial and environmental prudence to one side. The response, in the reforms later in the 1980s, brought together fiscal conservatives and environmentalists in an unusual alliance.[9] The influence of government on investment decisions need not always be as bad as this, indeed one would hope that at least occasionally it would be a positive influence. However in a market system the government influence will generally need to be overt, through legal interventions.

Thirdly, monopoly and integration favour large enterprises, large centralized power plants, and shut out new enterprises which may have new ideas and new technologies to contribute. Kellow draws out the point that traditional electricity departments are concerned above all with meeting demand, and therefore with development, expansion and building new capacity. They tend to be dominated by an engineering ethos.

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4 *See*, S. Breyer, *Regulation and its Reform*, Cambridge, Mass: Harvard Univ Press, 1982.
5 Hunt and Shuttleworth, *supra* note 3 at 31-38.
6 Energy Information Administration, Per Capita (Person) Total Primary Energy Consumption, All Countries, 1980–000, http://www.eia.doe.gov/pub/international/iealf/tableelc.xls
7 F. P. Sioshansi, "Sobering Realities of Liberalizing Electricity Markets" *International Association for Energy Economics (IAEE) Newsletter*, 3rd Quarter 2002, at 24.
8 A. Kellow, *Transforming Power: The Politics of Electricity Planning* (Cambridge: Cambridge University Press, 1996).
9 B. J. Barton, "From Public Service to Market Commodity: Electricity and Gas Law in New Zealand" (1998) 16 *JERL* 351.

Where circumstances change, for example where demand drops because of economic recession, they find alternative rationales for their projects; Kellow called it "reverse adaptation."

5 Subsidies in the traditional system

The last energy sustainability characteristic of traditional systems is that governments often maintain subsidies that work against sustainability. Some are general subsidies of production and consumption, in the form of reduced electricity prices, for purposes such as assisting agricultural irrigation, maintaining regional employment or maintaining adequate supplies of energy to the poor.[10] Other subsidies or quotas help particular fuels such as coal. A leading example was Germany's "kohlepfennig," a levy on the electricity industry to support the domestic coal industry. It was not removed until 1995, and even then it was replaced with direct state aid to the coal industry.[11] But subsidies distort price signals and fail to reflect the true economic costs of supply. They lead to inefficient levels of production. They exacerbate the negative externalities associated with energy supply in the form of environmental damage.

Other subsidies, however, have sought to inject energy efficiency measures into traditional electricity industries. Demand-side management, discussed shortly, is one. A leading example from the United States is the Public Utilities Regulatory Policies Act of 1978 (PURPA), which promoted co-generation and small renewable power production.[12] It did so by requiring electric utilities to buy power production from such "qualifying facilities" at favourable prices, generally the avoided cost of new capacity. PURPA led to major advances in the construction of energy-efficient electricity capacity. It also showed that it was possible for non-utility generators to connect to the grid and sell electricity and that economies of scale no longer dictated that generation be a monopoly. However it led to excesses. No account was taken of the costs in relation to the benefits of purchasing from qualifying facilities. Regulators often over-estimated avoided costs by a wide margin, especially at a time when oil prices were peaking. From 1984 new procedures lowered the avoided-cost payments and put competitive pressure on suppliers of new generation capacity. As a policy instrument PURPA was not viable, but it showed the way towards new possibilities in the way that the industry worked.

The legal regime for the traditional electricity industry makes it relatively easy to look after such social and economic objectives. A government department responsible for electricity can simply be directed by its minister to build this kind of power station and not that. It can be told to put more money into renewable energy or research and development. It can be told to alter its price tariff to encourage energy efficiency, to discourage high levels of use, or to assist low-income customers. Investor-owned utilities can be given similar directions through legislation or through orders of the public utility board. Either way, integrated monopoly utilities can simply pass the extra costs on to their customers, and (in the case of government departments) to the government in the form of lower or non-existent return on investment. However it is often difficult to tell the size of the subsidy.

6 Characteristics of a market approach

Many countries have taken a market approach to reform their electricity industries. While the pattern varies, the market approach involves the removal of monopoly rights to allow new companies to enter the field, and the removal of regulation of tariffs and capital spending, so that pricing and investment decisions are made in response to market supply and demand.[13] State-owned enterprises are sometimes privatized. The industry is generally restructured by dividing integrated enterprises into smaller ones in order to improve competition, and to separate potentially competitive functions like generation from usually monopolistic ones like transmission and distribution. The underlying assumption is that the command-and-control relationships within a single firm can be replaced with contractual relationships between separate firms, and that the competition benefits outweigh the transaction costs.[14] A market approach became possible when new technology such as co-generation and combined-cycle gas technology reduced the economies of scale of large

10 K. Schneider and M. Saunders, "Removing Energy Subsidies in Developing and Transition Economies" *IAEE Newsletter,* 1st quarter 2001, at 17.

11 E. D. Cross, *Electricity Regulation in the European Union* (Chichester: Wiley, 1996) at 132.

12 T. J. Brennan *et al., A Shock to the System: Restructuring America's Electricity Industry* (Washington DC: Resources for the Future, 1996) at 28; Hunt and Shuttleworth, *supra* note 3 at 4, 45.

13 Hunt and Shuttleworth, *supra* note 3.

14 P. I. Joskow and R. Schmalensee, *Markets for Power: An Analysis ofElectric Utility Deregulation* (Cambridge Mass: MIT Press, 1983).

organizations. Improved information and communication technology also played a role in making markets possible, in managing complex system co-ordination, auctions to find spot prices every half-hour, and subsequent financial reconciliations.

An electricity industry that takes the form of a competitive market sees a number of generator companies offering electricity for sale in a wholesale market.[15] The electricity may be sold directly to large industrial users, or to retailers who then sell it on to individual businesses and households. For the transfer of energy from power stations to consumers, the generator and retailer companies enter into agreements with the owners of the high-tension transmission system and the local distribution networks. The retailers will sometimes be the same companies who own the local distribution networks, or they may be the generator companies themselves, or third parties. In order to facilitate these different sales and agreements, the industry establishes institutions for an electricity market and for system operation. The workings of the market allow supply and demand to be determined regularly, usually resulting in a spot price for every half-hour or hour during the day. Because spot prices will go up and down, companies may make hedge contracts and other financial arrangements in order to reduce the risks they face.

Motives for opening electricity supply to market forces have varied. Competition and choice are argued to result in greater efficiency, better use of existing plant, better investment decisions, lower energy prices, higher economic productivity and increased domestic and international competitiveness.[16] Traditional price-setting mechanisms are thought to insulate utilities from the consequences of their actions. Sometimes the incumbent utility has become inefficient and needs new incentives, but other incumbents want to be freed from constraints. Governments sometimes wanted to avoid further investment and investment risk themselves and get the private sector involved. Privatization policies have brought forward questions of markets and regulation where previously none had existed. Policies of small government, deregulation and elimination of bureaucracy have played a part. The introduction of full competition will often be accompanied by scrutiny of subsidies that produce inefficiencies. Users have sought market choice – the freedom to choose from among competing suppliers. Alternative energy advocates have wanted to break the monopolies of traditional integrated utilities in order to have access to grids and customers.

The main benefit that is envisaged from market liberalization is the efficiency that market forces bring. Companies in competition are under pressure to keep their prices down and to offer a more attractive service to customers. On the other hand, prices will reflect the value of electricity and the inputs required to make it and bring it to the customer, that is, the fuel cost, the cost of required pollution abatement measures, the cost of capital to build power stations, the cost of transmission and of the distribution lines. Consumers in search of electricity will have to pay the market price in competition with other consumers; the price of electricity will reflect its scarcity. When electricity is more scarce, for example during a drought in a hydro-dependent country, the price will rise. When prices are sufficiently high, companies will consider investing in further generation and transmission capacity. On the other hand, investing too early is penalized. There are a number of points of contrast, therefore, with the traditional system; the pressure of competition, price signals flowing through the system and reflecting scarcity and value, and the lack of government involvement in key industry decisions.

7 Experience with market systems

The market approach is no longer a new idea, and we are gathering experience of how it works. Britain, Scandinavia, Germany, Australia and New Zealand saw some of the earliest markets emerge.[17] North America has seen some liberalization but it is not evenly spread.[18] There is a new realization that it is not easy to restructure the electricity industry and throw it open to market forces.[19] Power markets are much more complex than many policy-makers had realized. Electricity cannot be treated as merely another commodity; it

15 For a discussion of different models, *see* Hunt and Shuttleworth, *supra* note 3. Also D. Sharma "Australian Electricity Reform: A Regulatory Quagmire" *IAEE Newsletter*, 2nd quarter 2002 p. 22; Barton (1998), *supra* note 9; J. Surrey (ed) *The British Electricity Experiment* (London: Earthscan, 1996); A. Pickering, "Contracting for Electricity Supply" [1998] *AMPLA Ybk* 245.

16 Hunt and Shuttleworth, *supra* note 3 at 11; Sharma, *supra* note 15.

17 *See generally,* R. J. Gilbert and E. P. Kahn (eds.), *International Comparison of Electricity Regulation* (Cambridge: Cambridge University Press, 1996); M. M. Roggenkamp, A. R0nne, C. Redgwell and I. del Guayo, *Energy Law in Europe* (Oxford: Oxford University Press, 2001); Surrey, *supra* note 15, Barton (1998), *supra* note 9; B. J. Barton, "Risk and Promise in Energy Market Liberalization: Consumer Choice in Buying Electricity" (1999) 64 *Applied Energy* 275–288.

18 M. Bailey and C. Eaton, "An Update on American Electricity Markets: Still Coming together at the Seams?" *IAEE Newsletter*, 1st quarter 2002, at 14.

19 Sioshansi *supra* note 7 (2002); Sharma, *supra* note 15.

is more fundamental to the economy than most things, it is still a public service in the eyes of many citizens, not a mere article in commerce, and it cannot be stored. Benefits such as higher operating efficiencies and lower retail prices do not automatically flow from the introduction of competition, and where they do occur they do not necessarily accrue to expected beneficiaries like small consumers. (In England and Wales the benefits seemed to go to investors, not customers.) Newly liberalized markets do not automatically self-regulate. Competition is hard to produce, it takes a great deal of regulatory effort. Mere removal of legal monopolies and restructuring to break integrated companies up into pieces will not suffice. Markets, paradoxically, need constant and diligent monitoring and a powerful independent regulator. The role of regulators, and their workload, has usually increased following the introduction of competition in many jurisdictions. New Zealand is a clear example of the failure of competition to spark after restructuring.[20] Measures in 1998 and 2001 have reintroduced active management (although relying considerably on self-regulation) in order to foster the competition that the restructuring up to 1995 could not produce.

Along with this more mature understanding has come caution. The benefits of liberalization have flowed less freely than many had hoped. In California, liberalization was a fiasco, for a number of reasons; the deregulation of prices applied only to the wholesale level, so when wholesale prices climbed, retailers were stuck in the middle and went bankrupt.[21] Supply was already tight because there had been next to no building of generation or transmission for years, but customers were not exposed to the high prices that should have resulted. In spite of the scarcity of capacity, the power exchange bought energy only, not capacity. The legal and institutional regime for the market was too complicated; a dozen or more agencies had a hand in running it. A number of other USA states sheered away from plans to open up markets, but Pennsylvania-Jersey-Maryland shines as an example of successful liberalization.

Britain's Pool was the pioneer of large deregulated electricity markets. Over the years since its inception in 1989 a number of difficulties emerged. It was centralized and its rule-making procedures lacked flexibility. Its pricing mechanisms failed to reflect falling costs and increased wholesale competition. The New Electricity Trading Arrangements (NETA) replaced the Pool in March 2001.[22] The new system provides for a balancing and settlement mechanism to be operated by the National Grid Company to provide system security, but it plays a less central role than the Pool played. Only about two per cent of the electricity produced now goes through the balancing mechanism, the rest that is in wholesale trade is sold in bilateral trades or through voluntary power exchanges. The NETA system is being extended to Scotland.[23] When NETA came into operation, critics argued that it would be a major barrier to the deployment of renewables.[24] It put particularly heavy penalties on generators that need to buy electricity at the last minute for balancing purposes. Gas and coal-fired plants could run part-loaded, under full capacity, and ramp up at the last minute to avoid penalties, but renewables could not do the same. Wind power is particularly vulnerable to a system which puts a premium on predictability. There is some evidence that part-loading of thermal power stations has increased under NETA, and carbon emissions from the electricity sector have risen, but it is not easy to say how much is due to NETA and how much is due to the use of coal in place of gas, the price of which has risen substantially.[25] Wholesale prices have fallen by 40% since 1998, although much of the fall is attributable to low fuel prices and over capacity rather than to the trading arrangements. Combined heat and power producers however have suffered from this fall in wholesale prices at the time that gas prices have risen.

8 Energy sustainability characteristics of a market system

Because the whole orientation of a market system is different from the traditional system, with its monopoly and emphasis on construction, it is capable of bringing considerable benefits in energy sustainability. The first benefit that we may identify is the accurate pricing of energy. Energy sustainability requires the accurate pricing of energy, free of subsidies and incentives to over-consume, so that consumption patterns are affected by the real costs of production. Users have to pay the true costs of energy resources. Competing companies will attempt to sell electricity at a lower price than the others, but they will not sell for less than what it costs

20 Barton (1998), *supra* note 9.
21 F P. Sioshansi, "California's Electricity Crisis Continues" *IAEE Newsletter*, First Quarter 2001, at 10.
22 See http://www.ofgem.gov.uk/neta/index_neta.htm
23 It will be the British Electricity Trading and Transmission Arrangements (BETTA), an acronym deplorably calculated to release a spate of weak puns.
24 United Kingdom Parliament, House of Commons Environmental Audit Committee, Fifth Report of Session 2001–02, *A Sustainable Energy Strategy? Renewables and the PIU Review*, 22 July 2002, http://www.parliament.the-stationery-office.co.uk/pa/cm200102/cmselect/cmenvaud/582/, (UK. Select Committee, 2002) para. 68.
25 UK Select Committee, 2002, para 79.

them to produce it. Their investment decisions will be governed by these market prices. This can be very different from the pricing and investment policies of a government agency, that may have only a hazy idea of the costs of its inputs, and may be more concerned with the place of electricity projects and prices in general economic management. Under a market system, prices will rise if they have been set artificially low. That will not be congenial politically, but it may be necessary for energy efficiency and desirable levels of investment in alternative energy technologies. However, a market system may send pricing and investment signals that are relatively short-term in their outlook. Long-term investments, such as in research and development for alternative technologies, may be given less significance, especially where fuel is readily available.

A market system where price signals are transmitted without distortion puts more focus on the price of inputs. The price of different fuels cannot be hidden, and companies either reflect the price of fuels in their sales prices, or go broke. In a more opaque system, such as an integrated government department, there may be routine cross-subsidy between fuel types and very loose linkage of fuel costs with sales prices. There may not even be the information available about the cost-effectiveness of different fuels. A competitive company is more likely to have that information on hand and use it quickly to maximize its net returns.

Inputs include environmental inputs; the environmental burdens that different kinds of generation impose on the environment – air pollution, climate change gases, water pollution, the adverse effects of gas production or coal mining, their transport, and waste disposal, whether fly ash or nuclear waste. In economic terms, these environmental burdens are called externalities. All too frequently they are imposed on the public at large or on assets not within the market system, such as clean air, clean water and the global climate. If there is no disincentive for imposing those negative externalities, whether by regulation or by some form of pricing, then they can be expected to continue. One of the benefits of a market system is that if imposed, those disincentives or prices will naturally flow back through the system to consumers, and affect their decisions about the use of energy. In contrast, in a traditional system, it will require a further decision to raise prices to reflect the environmental price being paid.

A further characteristic of a market system is that government has less influence in investment decisions. We noted above the problem of governments committing themselves to dramatic development programmes, abetted by a construction ethos in the department or agency. Companies in a market system are not invulnerable to government influence, but they are working with their shareholders' money rather than taxpayers' money. The market imposes a financial discipline of its own. Where government does exercise influence in a market system, it will generally need to do so overtly, through legal regulation or direction.

Compared with an integrated one-company industry, a market system is decentralized, made up of smaller companies which may differ in their strengths and philosophies. There is a greater opportunity for innovative technologies to be tried out and for new business models to be adopted. Companies in competitive markets are more likely to be dominated by an ethos of pursuing market share and increasing efficiency of production than an ethos of construction. On the other hand they may be less likely to engage in long-term research and development.

9 Subsidies in a market system

The subsidies common in traditional systems were described above. They often produce poor results for energy sustainability, in increasing demand artificially or favouring fuels such as coal. Subsidies are often removed or re-arranged when a market system is approached, mainly because they can no longer be implemented by ministerial or regulatory directives to the monopoly power company. Where the subsidies have reduced the price of electricity to consumers, price rises will accompany the introduction of a market system – which makes restructuring politically unpopular in such cases. But with the reduction of energy consumption that can be expected will occur a reduction in pollution and greenhouse gas emissions, although the size of the reductions is open to debate.[26] The removal of different subsidies on different fuels can lead to fuel substitution, which is positive if it leads to cleaner fuels, although it can result in the old fuels being diverted to the export market.

[26] Schneider and Saunders, *supra* note 10, predict smaller reductions than International Energy Agency, *Looking at Energy Subsidies: Getting the Prices Right*, World Energy Outlook Insights Series (Paris: OECD, 1999).

10 Designing electricity markets to encourage energy sustainability: elasticity of demand

In its early growth years the electricity industry was driven by the assumption that demand would only ever increase, and that it had to build more and more capacity to supply it. The assumption was based in experience, of course, in a new industry. When prices were set by regulation or by board order, they were fixed for months or years, and users of electricity had no incentive to reduce demand when supply was low. The price did not change no matter what the scarcity and no matter what their behaviour. But the electricity sector is mature now. Where there is an electricity market, the real difference is the effect of price. Scarcity of supply, because of low generation capacity, constrained transmission, or low hydro lakes, means that prices will rise. The chief point is that if that price signal is passed on to users then they are likely to respond by cutting back their levels of consumption. If there is any elasticity of demand, then the quantity of electricity responds to a change in price. This has major implications for energy conservation. As Sioshansi puts it:[27]

> One of the enormously positive lessons of restructured markets is that there is a new recognition of the significance of *elasticity* of demand. There is now a much better understanding that customer demand can – and should – play a more active role in balancing supply and demand in real time. Markets provide the incentives – through market price volatility – to influence demand when and where it is cost-effective to do so.

Consumers can take steps to avoid using electricity in response to price signals, for example in peak periods, so promoting energy efficiency and reducing environmental impacts.

Price signals do not always contribute to energy efficiency so readily. Demand for electricity is often not as elastic as it is for other commodities; a bank or a hospital cannot stop using electricity because the price has risen. Households might switch to wood stoves for heating, but they are likely to keep buying it for their lighting and television no matter what the price. Another factor is the presence in the power bills of end users of fixed lines charges that do not reflect the scarcity of energy. The fixed lines charges are not paid to the generator but to the owners of the high-tension transmission grid and local distribution network. For small consumers, that is often about half of the final power bill. It reduces the strength of the energy price signal, and reduces the cost of wasting power. It is worse if the allocation of costs between lines and energy is skewed to keep lines charges higher and energy charges lower. Small retail consumers will generally not be as responsive as larger industrial and commercial consumers. For reasons such as these, price elasticity of demand is thought to have decreased in recent years in American states that have restructured their retail markets.[28] The record of markets on elasticity is therefore not as clear as it should be. However, price elasticity seems to increase with consumer experience in participation in a market system.

11 Demand-side participation

Demand-side participation is the conservation activity that consumers of electricity can carry out in order to avoid using electricity. At its simplest, it involves reducing load – turning things off– but it can have more sophisticated forms. Industrial and commercial users can engage in load shifting – rescheduling energy-intensive processes to different days or different times of day. Water heating, space heating, air conditioning, and water pumping can be rescheduled in this way, to reduce load in the heaviest use times of the day or week. Other industries have less flexibility; for example an aluminium smelter, one of the largest individual consumers of electricity, runs continuously, and can only shut down a potline at great expense. Prolonged water shortage in a hydro system could justify such a decision. The demand-side also participates where consumers turn to their backup power systems, e.g. diesel generators, to reduce consumption from the grid. (Fortunately from an environmental point of view that is a less common response than reducing use.) In a household, demand-side participation may include the installation of energy-efficient water heating and space heating, better insulation and more efficient appliances. It may also appear in changes in the use of electricity through the day, putting off laundry until after the peak demand period has passed. It may also involve fuel-switching, such as installing a wood stove for space heating. Demand-side participation yields environmental benefits in reducing emissions and the need for the construction of new power plants and transmission lines. It also yields benefits in system reliability (especially during emergency conditions), market efficiency,

[27] Sioshansi (2002), *supra* note 7 at 32, footnote omitted.
[28] Peak Load Management Alliance, *Demand Response: Principles for Regulatory Guidance* (Jupiter, Florida: 2002), www.peaklma.com

risk management (reducing exposure to price spikes), customer choice in managing their power use, mitigation of the market power of generator companies, and – of course – lower costs.[29]

The traditional legal framework for the electricity industry gave few incentives for demand-side participation except for the overall price, and that was often a poor reflection of the true cost of energy supply. Prices did not vary to reflect the increased scarcity of energy during peak periods. Prices were average cost prices, where new higher-cost sources were averaged in with the lower-cost sources, hiding the higher marginal cost of those sources and discouraging conservation. However, in the 1980s, American public utilities began to offer substantial demand-side management programmes at the instance of their regulatory agencies, in order to encourage customers to reduce their electricity consumption.[30] The programmes would reduce the need to build expensive and contentious new power stations, and were in fact a cheaper investment for the utility than those power stations. The programmes offered free energy audits and subsidized purchase of energy-efficient appliances. Larger users could be offered tariffs that allowed supply to be interrupted at peak periods. When demand-side management programmes engaged in such peak-load pricing, in an attempt to impose the full marginal cost of supplying electricity in a peak period, they contributed to the movement towards market liberalization.

At first blush, a competitive system should allow consumers to participate actively in the market, demand participating equally with supply, and should give consumers incentives to manage their demand. (Because neither supply nor demand is managed centrally, the older term "demand-side management" has given place to "demand-side participation" or "demand response".) The consumer participates by selling callable demand reductions to the power supplier or some other party. Large consumers can participate in wholesale markets on their own account, and small ones can participate indirectly because their retailer suppliers have an incentive to offer them tariffs that encourage demand response. However these theoretical possibilities have met with frustration in practice. In the USA, the Peak Load Management Association identifies the difficulties in retail markets as "lack of information, lack of incentives, lack of enabling technologies, lack of functional wholesale market, lack of customer choice."[31] Progress under the demand-side management programmes of the 1980s has fallen back, because the programmes were not readily reconcilable with an open-market system. In wholesale markets, jurisdictional fragmentation is a problem. So is the presence of price caps imposed by regulators to prevent price spikes; the caps reduce the incentives on participants to protect themselves against them with demand response programmes. Regulators seem to require particularly clear proof of the benefits of demand response programmes. In England and Wales, even large users could only participate indirectly in the Power Pool. NETA, which replaced it, was intended to improve the situation, but it has not led to much growth in demand-side participation.[32] There is some in providing fast reserves and standing reserves as contracted balancing services to National Grid Company, the system operator. It has been argued that the complexity of the new arrangements is a deterrent.[33] In New Zealand even large consumers have difficulty with the price and complexity of monitoring wholesale market price information, and do not see the benefits of participation coming through to them.

Ways around these obstacles are emerging so that demand-side participation can occur in competitive markets. The Peak Load Management Alliance identifies a number of actions that regulators can take to stimulate greater use of economic demand response resources.[34] Markets can be designed to foster participation by customers of all types and sizes. Demand response participants should be on an equal footing with generator companies – rare in current market governance arrangements. Demand response has historically been an afterthought. Restrictions on consumer use of backup generation should be re-examined, and price caps should be phased out. In Australia, the Independent Pricing and Regulatory Tribunal of New South Wales has made recommendations to pursue the same objective, finding again that a major obstacle is the traditional supply-oriented culture that pays little more than lip service to demand response.[35]

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29 Peak Load Management Alliance, *supra* note 28, para. 2.0.

30 S. F. Bertschi, "Integrated Resource Planning and Demandside Management in Electric Utility Regulation: Public Utility Panacea or a Waste of Energy?" (1994) 43 Emory L. J. 815; Brennan, *supra* note 12 at 122.

31 Peak Load Management Alliance, *supra* note 28, para. 4.2.

32 Office of Gas and Electricity Markets, *The Review of the First Year of NETA: A Review Document* (July 2002) (Ofgem 2002), at 114.

33 R. Lane, "The England and Wales Mid-Course Correction – Is it Working?" International Bar Association Section on Energy and Resources Law Conference, Edinburgh, April 2002.

34 Peak Load Management Alliance, *supra* note 28, para. 7.0–8.0.

35 Independent Pricing and Regulatory Tribunal, *Inquiry into the Role of Demand Management and Other Options in the Provision of Energy Services: Final Report*, (Sydney, NSW: The Tribunal, October 2002, Review Report No. Rev02-2), www.ipart.gov.nsw.au

Alongside these regulatory solutions is the innovative possibility of voluntary techniques of demand response. Electricity retailers can engage with their customers as active trading partners without having to involve them in the wholesale market. "Customers indicate their specific action plans based on market conditions. The economic benefits to the customer show up either in cash or as credits on their future electric bill. Interval metering and verification of electrical loads round out the balance of the process."[36] The retailer can use a website to post prices in the time windows for which it seeks demand reductions, and customers can state their offers in reply. This voluntary system can work whether or not electricity is subject to full market competition. It gives consumers an opportunity to learn how to modify their demand in interaction with constraints upon supply. Emergencies such as power shortages at different times in California and in New Zealand have stimulated voluntary measures. The challenge is to make them more common in ordinary circumstances. In this and more generally, we see that competitive electricity markets present significant problems for demand-side participation, but it is worth reminding ourselves how much the traditional electricity industry structure limited any such participation. As new problems emerge when markets are liberalized, so do new solutions.

12 Real-time pricing

Demand-side management in an open market for electricity raises the question of the point in time when prices are fixed. The usual way that electricity markets work to determine prices is after each trading period – half an hour in many countries, one hour in North America. This is "ex-post" pricing. It is usual because electricity markets working with an auction bidding system "discover" prices from the bids and indications made for each such trading period by buyers and sellers. From this supply and demand information, the spot price can be determined from the highest price of supply required to meet the demand. Market operators are at pains to deny that they decide the prices, let alone fix them. The consequence, however, is that they cannot discover the price until the period is over. This normal practice of ex-post pricing has implications for the demand side, that is, the decisions of electricity users, and in turn for energy efficiency and conservation. It prevents users from knowing the actual price they are paying in time to make load management decisions that would in turn affect price through reduced demand.

Ex-ante pricing is technically difficult to calculate. It requires the market to run the auction interactions right down to the last minute before the half-hour trading period begins. In contrast ex-post pricing takes what happened in the auction interactions and the period itself, and runs it through the market software to determine the price. Real-time pricing seems to be viable as an alternative to produce more accurate and timely information. The New Zealand Electricity Market has proposed a rule change to allow a trial of real-time pricing in late October 2002.[37] It will allow production of six five-minute ex-post indicator prices in each half-hour trading period directly after the completion of each five-minute period, and production of an indicative final price on completion of each half-hour period that is a time-weighted average. If it is successful, it will allow users to know the actual price they are paying in time to make load management decisions that will in turn affect price.

13 Volatility of the market

Prices go up and down in all open electricity markets; that is their whole point, after all. But the volatility of spot market prices can be higher in some markets than others, and that can affect alternative energy suppliers. Market rules have a significant effect on volatility. In England and Wales, the Pool spot market was very volatile because the great majority of power was traded on long-term contracts. Volatility threatens all traders, and discourages use of the spot market. It is beyond the variability that ordinary hedging instruments can manage. It is particularly serious for small generators, because they have less ability to manage risk, and it is particularly serious for emerging wind generator companies. Because of the nature of wind energy, it cannot be guaranteed round the clock; if the wind is not blowing, then there will be no production. A wind company which has made supply commitments will have to make up its supply from the spot market, and in a volatile market they may have to pay exorbitant prices. If it cannot offer dependable supply, then it will have to sell at a discount. NETA in England and Wales have reduced volatility through the balancing mechanism; price volatility as reflected in balancing mechanism prices has declined from around £70/MWh at the start of NETA to £17 a year later.[38]

36 "Introducing the Demand Exchange" www.dcmx.com
37 NZEM Update, July 2002.
38 Ofgem 2002, *supra* note 32 at 4.

14 Small companies

Energy efficiency and alternative energy are often brought to the market by small operators. Market arrangements can vary in the expense they impose on participants, especially on small ones. Prudential requirements, for example, are required for purchasers, to ensure that the pool or market institution will be able to collect payment, often in the form of a letter of credit from a bank. But if too much is required, it can be especially burdensome for small retail companies. NETA in England and Wales has imposed new costs in new computer systems and trading desks, in credit cover and estimating demand. However, small generators, mainly renewables, are producing as much energy as they were before NETA.[39] This was good news because after the first two months of NETA they had reported a 44% reduction in output. Prices being obtained by such generators are comparable with other generators, or higher where they attract government subsidies. A change to NETA balancing rules to reduce gate closure from three and a half hours to one hour gives market participants more time to balance their positions and reduce the risk of charges for being out of balance. This helps wind generators with their difficulty in predicting their output. Consolidation services are seen as desirable to improve the negotiating position of small generators and to reduce their costs. The lack of work on them has been criticised.[40]

15 Governance and regulation

The rules of an electricity market affect these matters of demand-side participation, real-time pricing, volatility, and the place of small companies. We need therefore to consider how the rules are made in electricity market institutions. Barker, Tenenbaum and Woolf[41] identify four categories of power exchange governance in use internationally:

(i) A Multi-Class Stakeholder Board. A club or representative model in which different classes of participants (generators, buyers, marketers, etc) are represented and given a fair voice.

(ii) A Non-Stakeholder Board of Independent Directors. Members elect board members who have no financial interest in any of the market participants, but who are chosen for their professional experience to act independently. Hybrid boards have some such independent directors and some stakeholder representatives.

(iii) A Single-Class Board. All decisions are controlled by one class, e.g. generators or incumbent vertically-integrated utilities.

(iv) A Single For-Profit Corporation Not Affiliated with Market Participants.

Single-class boards are likely to be dominated by generators, and even multi-class stakeholder boards are likely to suffer the same fate. Generators, left to their own devices, are unlikely to promote demand-side management unless there are incentives to do so. They are more likely to pursue extra sales and market share instead. Energy sustainability therefore depends in important measure on governance, and the extent to which generator-dominated market structures can be steered to promote demand-side management and real-time pricing in particular.

In New Zealand, the government insisted that the governance system change, not least for energy sustainability reasons.[42] The New Zealand Electricity Market had been governed under what started as a multi-class stakeholder model, to use Barker, Tenenbaum and Woolf s parlance, but which became dominated by generators as independent retailers disappeared from the industry, making it more of a single-class board. The government was concerned that the Market may have lost its focus on efficiency, on the functions of parties other than generators, and on social policy issues such as equity and sustainability. It required the industry to change to a non-stakeholder board of independent directors, and for the board to bring under its control the work of the Metering and Reconciliation Information Agreement and the Multilateral Agreement on Common Quality Standards as well as that of the NZEM. The new Electricity Governance Board (EGB) must adopt and implement Guiding Principles laid down by the government, including explicit requirements for energy efficiency and environmental objectives. Rules set by the EGB must be consistent with

39 Ofgem 2002, *supra* note 32 at 5.

40 UK Select Committee (2002), *supra* note 25, para. 73.

41 J. Barker Jr, B. Tenenbaum and F. Woolf, "Regulation of Power Pools and System Operators: An International Comparison" (1997) 18 *Energy L. J.* 261.

42 Ministry of Economic Development, *Power Package: Government Decisions on Electricity Industry Reform* (Wellington: The Ministry, 3 Oct 2000, <http://www.med.govt.nz/ers/electric/package2000/index.html>).

government policies on climate change and energy efficiency. The government has taken statutory powers by amendments to the Electricity Act 1992 to impose such a board, or to impose requirements on an industry board, but it has refrained from doing so, and instead it has allowed industry to reform its self-governing mechanisms to comply with the government's policy. The EGB is to include membership with expertise in energy efficiency and renewables, and its performance is to be monitored as to energy sustainability by the Parliamentary Commissioner for the Environment.

This pressure has caused the New Zealand Electricity Market to act on real-time pricing, even though it has had the matter under consideration from its inception. As well as the measures described above, the government required the EGB to ensure that its rules promote demand-side participation, facilitate demand-side bidding and set up a real time market so that the demand side can see and respond to actual prices immediately they change.

NETA in the United Kingdom shows how policies of encouraging renewables can be adversely affected by ostensibly technical market affairs such as gate closure, the price of imbalance from predicted output, and the relative expense of participation in the market for small companies. On governance's positive side, NETA allows rule changes to be made to improve conditions, whereas the previous arrangements made rule changes very difficult to obtain, especially if the established generators were opposed. Regulatory arrangements have come under attack in the UK, for failing to keep the regulator Ofgem and the Department of Trade and Industry to formal duties to promote sustainable development.[43]

16 Policy instruments grafted on to a market system: subsidies and social policy

A market system does not accommodate social objectives like sustainability as easily as the traditional system, where a minister or utility board can, as we have seen, simply direct the power monopoly to build this kind of power station or that, or to alter its price tariff one way or another, with the costs being passed on to consumers or government. The experience of environmental and advocacy groups has been that in a competitive market nobody will look after such social concerns.[44] Where there were mechanisms to look after them under the old system, market liberalization has tended to dismantle them as part of deregulation.

Should they be re-introduced? One widely-held view is that they should not; the invisible hand of the market should be allowed to look after such matters, and that it is an error to intervene in markets. Certainly, market forces can deliver on some such social concerns in the energy sustainability area, as we have seen. But it does not follow that all necessary progress on energy sustainability can be delivered that way. Rather, we must use alternative measures if the market will not deliver. Legislation and regulatory activity is eminently justified to pursue social justice or environmental sustainability, and the free operation of market forces must be subordinate to those objectives.[45] Environmentally benign technologies require long-term investment and bankable contracts to cover their development. Left alone, liberalized energy markets do not readily support such long-term contracts, because they are oriented to shorter investment horizons. Some sustainability policy measures therefore represent compulsory long-term investments in new technologies.[46]

If indeed policy measures are to be introduced to promote sustainability, we cannot assume that the old mechanisms will work in the new competitive market. Legislative or regulatory mechanisms must be attuned to the facts of market competition, and must change market behaviour, but must not introduce unwanted distortions and side effects into the working of the market. We need also to be aware of the importance of market design, market governance, and contractual arrangements as well as conventional regulation. On the positive side, where measures for sustainability are introduced into an electricity market system, their costs and benefits can be measured better than under a traditional system. This is because pricing under the traditional system is opaque and often masks the true costs and benefits of the non-market measure.

43 UK Select Committee (2002), *supra* note 25, paras. 71, 82.
44 Sioshansi (2002), *supra* note 7 at 24–5.
45 Generally on this theme, *see* C. Sunstein, *After the Rights Revolution: Reconceiving the Regulatory State* (Cambridge: Harvard University Press, 1990); C. Sunstein, *Free Markets and Social Justice* (New York: Oxford University Press, 1997).
46 UK Select Committee (2002), *supra* note 25, para. 76.

17 Small interventions in a market system

New Zealand saw a number of small interventions or adjustments of a market system introduced in 2001 for energy sustainability purposes.[47] It was decided to require retailers to offer at least one tariff to domestic consumers with a fixed charge of no more than 10% of the bill of the average domestic consumer (8,000kWh a year). Renewable energy was given a boost by allowing distribution companies to employ it if they want to get back into electricity generation, from which they were banned by the Electricity Industry Reform Act 1998. Those companies were also given some latitude (up to 2% of a network's load or 5MW, whichever is greater) to own generation if it is embedded or distributed generation connected to the local network rather than the national grid, thereby reducing transmission demand and line losses. Possible misuse of hydro resources also received attention. A mechanism ensures that hydro generation companies will have to provide more information about the amount of water they spill from hydroelectric storage dams without using it to generate electricity. This will disclose whether they are "gaming" the market and withholding hydro generation in order to lift market prices, but causing unnecessary hydro spill and increased consumption of natural gas.

Similar interventions or adjustments of a market system for energy sustainability purposes are administered in the United Kingdom, by the regulator, the Office of Gas and Electricity Markets (Ofgem). The first is the energy efficiency commitment which requires all major gas and electricity suppliers to improve the energy efficiency of customers' homes with better insulation, better plant and equipment. Collectively it will entail expenditure of approximately £500 million over three years, with a view to saving 62TWh over the next three years. It is targeted particularly at disadvantaged customers. The second, the climate change levy exemption for renewables, exempts renewable electricity from the levy payable on sales to the business and public sectors. It therefore helps renewable producers to keep their prices competitive. The third element, the renewables obligation, is described below in relation to green certificates. The British government's target is for ten per cent of electricity sales to come from renewables by 2010, subject to the costs being acceptable to the consumer, and for 10,000MW combined heat and power (CHP) capacity by then.[48]

18 Green certificates

Green certificates are receiving a great deal of attention in Europe as an alternative to old systems for subsidizing renewable energy.[49] The attention has been stimulated by a European Union Directive promoting electricity produced from renewable energy sources.[50] The Directive requires member states to set national indicative targets for the consumption of renewable electricity, and to establish a system of certification of renewable energy electricity. In a green certificate scheme, green certificates are issued to the generator of renewable environmentally-friendly electricity (let us say green electricity) for every megawatt-hour of energy it produces. The demand for certificates can be structured in different ways. Certificates can be voluntary, so that holding them is a marketing advantage that allows an electricity retailer company to put itself forward as environmentally friendly. Firms buying from the retailer can in turn advertise that their inputs are environmentally friendly as to energy. In many schemes, however, certificates will be compulsory. Consumers must hold certificates to cover a quota or legislated percentage of their consumption in each accounting period. (Domestic consumers can be covered through their retailer.) This is envisaged in Denmark. In Italy an alternative is envisaged, that a purchase obligation is imposed on the production side.[51] In the compulsory schemes, the quota or purchase obligation is necessarily imposed as a matter of public law.

The green certificates are tradeable, so that a market in them forms. Consumers of electricity (or others on whom a purchase obligation is imposed) purchase enough certificates to cover a percentage of their electricity

47 Ministry of Economic Development (2000), *supra*. Powers were taken by amendment of the Electricity Act 1992, but the policies are mostly being implemented by industry institutions in liaison with government. For background see Parliamentary Commissioner for the Environment, *Getting More for Less: A Review of Progress on Energy Efficiency and Renewable Energy Initiatives in New Zealand* (Wellington, 2000); D. Caygill, S. Wakefield and S. Kelly, *Ministerial Inquiry into the Electricity Industry* (Wellington: 12 June 2000). Discussed by B. J. Barton, "Governance in the Electricity Industry" [2000] *NZLJ* 300; B. J. Barton, "Responsive Regulation in the Electricity Industry" [2000] *NZLJ* 347.

48 *Government Response to Ofgem 's Reports "The New Electricity Trading Arrangements – Review of the First Three Months " and "Report to the DTI on the Review of the Initial Impact of NETA on Smaller Generators " of 31 August 2001* (London: Dept of Trade and Industry, 1 November 2001).

49 S. Grenaa Jensen, "Green Certificates and Emission Permits in the Context of a Liberalised Electricity Market" *IAEE Newsletter*, 1st quarter 2002, p.24; B–O. Gram Mortensen, "Green Certificates in a Danish and EU Context", unpublished staff seminar, University of Waikato, Hamilton New Zealand, 2002.

50 Directive 2001/77/EC, 27 September 2001.

51 Grenaa Jensen, *supra* note 49.

consumption. There are two markets, one for the physical supply of electricity, and another for green certificates. Green certificates represent a splitting off of the benefits of ownership of renewable energy production from the physical supply of energy. They get around the fact that one cannot tell which part of a supply of electrical energy is from a green source and which is not. The renewable energy producer therefore adds the revenue from the sale of certificates to that from the sale of electricity, and can trade profitably when otherwise it could not. Green certificates therefore assist the uptake of renewables. The electricity market continues separately, and continues to impose market incentives and discipline on all participants, on purchasers, conventional producers and renewable producers alike.

In the United Kingdom, green certificates take the form of "renewable obligation certificates." Statutory power has been taken for a scheme which began in April 2002 and obliges electricity sellers to obtain at least three per cent of their electricity from renewable generators in 2002–2003, a figure which will rise to 10.4% in 2010–2011.[52] Renewables generators apply to the regulator (the Office of Gas and Electricity Markets) for accreditation, and are issued one renewable obligation certificate per megawatt hour (MWh) generated. The certificates can be sold along with the electricity generated, or separately. Electricity sellers can meet their obligation to buy three per cent renewable by buying certificates, or by paying a buy-out price of £30/MWh for the shortfall. Biomass is eligible, but not incineration of mixed waste, and the eligibility of large hydro and co-firing with fossil fuels is restricted.

In Denmark, legislation to establish green certificates (or Renewable Energy Certificates) has been enacted, but is not yet in force. It is uncertain whether changing government policy will see it come into force. However there is strong interest from other countries in northern Europe, notably Sweden and the Netherlands. There are significant difficulties to be solved in introducing such a new system. Establishing a market for certificates will be no easier than establishing one for electricity. The size of the market could be a difficulty, if it is too small to sustain liquidity and active trading. Transaction costs will need to be contained. Stranded costs will need to be dealt with. Cross-border trade will be complicated, even in the European Union, where one country may still be on an old subsidy system and the other on a new green certificate system. Scope and definitional questions need to be answered, for example, are new large-scale hydro dams included as green energy?

The emerging shape of the green certificate scheme indicates that its incentive system can be kept separate from the electricity market itself.[53] That may be the best arrangement for all such energy sustainability systems. In other cases the separation may involve clear arrangements for the proper pricing of inputs, so that externalities are captured, internalized and properly reflected in the generator's costs. The price of thermal generation, for example, should reflect the price that society, or more properly the international community, considers should be paid for the effect of carbon dioxide on the global commons of the atmosphere. Carbon credits are likely to evolve into an international market that is separate from the electricity market.[54] In Denmark, the system of tradeable CO_2 emissions permits is expected to co-exist not only with the electricity market but also with the green certificates market.[55] Arguably, at least, the price of hydro generation should include a figure for the value of the water, although putting a price on it is difficult. The same goes for geothermal generation, recognizing that in some cases a geothermal system is not infinitely renewable. The great contribution that an electricity market can make is to ensure that those costs are passed through promptly and accurately to consumers. A traditional system masks these costs.

19 Conclusion

While the record is mixed, a market approach in electricity can make a contribution to energy sustainability. A market system's pressure for financial efficiency can often further energy efficiency and conservation. It prevents many of the perversities that seem to be inevitable in the traditional system, such as a tendency towards capital development, a resistance to new players and new technology, failure to connect costs with prices, and failure to signal explicitly the value of energy resources. The introduction of markets is generally accompanied by the removal of non-sustainable subsidies such as subsidies for the coal industry or for cheap

52 Renewables Obligation Order 2002 (2002 No. 914) made under the Electricity Act 1989 as amended by the Utilities Act 2000. The renewable obligation replaces the non-fossil fuel obligation which was introduced with the reforms of the UK electricity sector in 1988.

53 They could be merged; the system operator or market rules could give priority in dispatch to verified issuers of green certificates, ensuring that they can run whenever they are able. But there seems to be greater risk of unpredictable market distortion.

54 P. D. Cameron and D. Zillman (eds.) *Kyoto: From Principles to Practice* (The Hague: Kluwer Law International, 2001)

55 Grenaa Jensen, *supra* note 49.

electricity for farmers. However market systems are not simple, and their design can include hurdles, preferences and subsidies, whether intended or unintended. They call for careful scrutiny to ensure that they are really providing opportunities for the non-conventional technologies, for the renewables, for the small-sized enterprises, and for the new entrants.

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