Energy Studies Review Vol. 12, No. 1, 2003 pp.95-115

Canadian Energy Up-Date

John Walsh

Climate Change Plan for Canada

The Climate Change Action Plan for Canada was tabled in the House of Commons by the Minister of the Environment, the Hon. David Anderson, on 21 November 2002 in advance of Parliamentary deliberations on the ratification of the Kyoto Protocol which began 25 November 2002. The aim was to outline how Canada can meet its greenhouse gas reduction target under the Protocol which was formally ratified on 17 December 2002. The Plan addressed objections to the earlier document released on 24 October 2002 and responded to concerns of industry. Its authors claim 'This Plan strikes the balance needed to enable our economy to flourish even as we reduce our greenhouse gas emissions' and 'This Plan proposes both short-term action and a longer-term perspective.'

The report of 55 pages is divided into the following sections: (1) Climate Change and the United Nations Kyoto Protocol; (2) Canada's Approach to Climate Change; (3) Meeting our Target and Innovating for the Longer Term; (4) Canadians, Communities and Governments: Each Doing Our Part; (5) Improving Our Understanding of Climate Change and Preparing to Adapt; (6) Accountability; and (7) Conclusion. There is also an Annex of 10 pages titled 'Analysis and Modeling of Cost Impacts' that is mainly a synopsis of the modeling reports issued earlier.

The overall approach outlined in the Plan reflects the principles suggested by provincial and territorial governments in their 28 October 2002 statement. These may be summarized as: (1) a made-in-Canada

John Walsh is an independent energy advisor in Ottawa. Update, in continuous preparation for future issues of the "Energy Studies Review", may be found on the web at: www.pages.ca.inter.net/~jhwalsh/update.html John Walsh may be reached at jhwalsh@ca.inter.net

approach based upon collaboration, partnerships and respect for jurisdiction; (2) no region bearing an unreasonable burden; (3) taking a step-by-step approach that is transparent and evergreen; (4) minimizing mitigation costs while maximizing benefits; (5) promoting innovation; and (6) limiting uncertainties and risks. It does not, however, include a guarantee by the federal government to `incorporate appropriate federally-funded mitigation of the adverse impacts of climate change initiatives,' or recognize that benefits from assets such as forests and agricultural sinks accrue to the Province and Territory that owns the assets, nor did it guarantee that `no Province or Territory bears the financial risk of federal climate change commitments.' A number of changes were also made after extensive consultations with the major industry sectors, particularly those would be covered under the domestic emissions trading system.

To achieve this goal, five key instruments are proposed: (1) emissions reductions targets for large industrial emitters established through covenants with a regulatory or financial backstop, including flexibility for these emitters through emissions trading and access to domestic offsets and international permits; (2) A Partnership Fund that will cost-share emissions reductions; (3) Strategic Infrastructure Investments in innovative climate change proposals such as urban transit projects, intermodal transportation facilities and a CO_2 pipeline as noted in the Alberta plan; (4) A Coordinated Innovation Strategy linking the various supporting funding sources; and (5) Targeted Measures including information, incentives, regulations and tax measures.

The Plan identifies action requirements in five broad areas: transportation, housing and commercial/institutional buildings, large industrial emitters, small and medium-sized enterprises, and the international market. The Plan goes on to detail specific proposals in each of these areas in three steps summarizing (1) actions now underway, (2) new actions in this Plan and (3) the remainder to be addressed in detail later.

Copies of the Climate Change Action Plan for Canada (ISBN 0-662-33172-9) may be downloaded in .pdf form from the Web at www.climatechange.gc.ca.

UK Energy White Paper:
Our Energy Future – Creating a Low Carbon Economy

The Secretary of State for Trade and Industry of the Government of the U.K. released an Energy White Paper subtitled Our Energy Future – Creating a Low Carbon Economy on 24 February 2003. In Section One, an Overview is followed by Chapter 1 which deals with `Cleaner, smarter

energy;' Section Two, with four chapters, covers the low carbon economy including a succinct review of the current status of climate research; Section Three, with three chapters, deals with `Reliable, competitive and affordable supplies;' and Section Four, with one chapter, considers `Delivery through partnership.' There are two Annexes, one an extensive glossary, and the other, unusual in this class of publication, a long list of references complete with Web links where available. In the Foreword signed by the Prime Minister, it states: `This white paper is a milestone in energy policy. It is based on the four pillars of the environment, energy reliability, affordable energy for the poorest, and competitive markets for our businesses, industries and households.' Its recommendations are in marked contrast to the energy policy now been deliberated in the U.S. Congress.

The paper is organized around three challenges. First, it stresses the need for action to reduce emissions of greenhouse gases, particularly carbon dioxide, in this way:`We therefore accept the Royal Commission of Environmental Pollution's recommendation that the UK should put itself on a path towards a reduction in carbon dioxide emissions by some 60% from current levels about 2050' - a goal much beyond Canadian efforts to comply with the Kyoto Protocol. Second, there is the need to deal with the decline in the production of the indigenous supplies of oil, gas, nuclear and coal. The U.K. expects to become a net importer of natural gas about 2006 (with Norway the main prospective supplier), and of oil by about 2010 (with Russia and the Middle Eastern countries the main source). Much of the country's economic supplies of coal will be exhausted in another ten years. The report states: `By 2020 we could be dependent on imported energy for three quarters of our total primary energy needs' and `Of the world's leading industrial nations only two – Canada and the UK - are net energy exporters. The others have all achieved economic growth as energy importers.' It then proceeds to review issues related to gaining access to imported energy. The third challenge is set out as the need to update much of the UK's energy infrastructure over the next two decades and this is regarded as an opportunity to develop the renewable energy and conservation industries.

The four goals of the new energy policy are summarized as (1) to `put ourselves on a path to cut the UK's carbon dioxide emissions; (2) to maintain the reliability of energy supplies; (3) to promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and improve our productivity; and (4) to ensure that every home is adequately and affordably heated.' The main means selected to meet these goals are increasing the efficiency with which energy is consumed, implementing a carbon dioxide emissions trading scheme, and

deploying a much-strengthened renewable energy option. A target is set for renewables to supply 10% of the electrical supply by 2010 increasing to 20% in 2020. Market mechanisms are to play a major role in all the options. It is interesting that no major place was suggested for nuclear power. Unusual among the many individual projects noted in the paper is the development of mobile regenerators to support the use of gas turbines in transportation applications.

Copies of the Energy White Paper (142 pages) may be downloaded from at www.dti.gov.uk/energy/whitepaper/ourenergy future.pdf.

Activities of the Energy Council of Canada

The Energy Council of Canada has released two new position papers. Let's Take a Broader Look at Climate Change considers that Canada needs to articulate and follow a strategy that identifies an appropriate national development path, takes into account the current continental and global economic and environmental situations; and builds on our strengths as a nation. It includes an annex that tabulates the significant progress some member companies have made in the reduction in greenhouse gas emissions in the last few years. Ongoing Innovation in Energy Essential for Canada prepared by A.J. Birchenough and J.G. Hollins, notes that a successful innovation strategy for Canada will assure for the medium and long terms the balanced energy budgets required to deliver the goods and services that Canadians need in a socially and environmentally responsible manner by fostering a community of researchers, engineers, and government and business leaders who are committed to the full cycle of innovation and understand the complementary roles of government and business, who are willing to invest in innovation for the long term, who make intelligent, informed and disciplined choices and stick with them, and who connect effectively to international partners and consortia at all stages of the innovation cycle.

The Council has also prepared a CD-ROM which includes the main presentations at the 2002 National Energy Forum held 22-24 September 2002 in Kelowna, B.C. which was attended by some 75 delegates. Two papers of note were the presentation by Robert W. Gale of GF Energy LLC of Washington, D.C., who provided an overview of today's energy decision-making priorities, and that by Reid Morden, who discussed the safety and security issue.

The next National Energy Forum will be held in Quebec City 7-9 September 2003. The next World Energy Congress will be held 5-9 September 2004 in Sydney, Australia. The 2007 Congress will be held in Rome. Copies of the two Position Papers and the CD-ROM for the 2002

Energy Forum may be obtained from the Energy Council of Canada, 807 – 350 Sparks Street, Ottawa, Ontario, K1R 7S8 (E-Mail: epc@energy.ca; Fax 613-952-6470; Web: www.energy.ca)

New Reports

New Books

Richard Heinberg of the New College of California has written The Party's Over: Oil, War and the Fate of Industrial Societies, a book produced in B.C. by New Society Publishers in 2003 (ISBN: 0-86571-482-7, 274 pages). This book gives a good account of energy history from the prospective of one who believes a crisis in oil supply is imminent. It is well balanced for one of this genre and, unusually, provides background material on the main players on each side of this growing controversy.

Dr. C.J. Campbell has published The Essence of Oil and Gas Depletion, a compendium of separate pieces prepared in recent years in the petroleum depletion field. (Multi-Science Publishing Company; Web: Sciencem@hotmail.com)

National Energy Board Documents

The National Energy Board has released a draft version of Canada's Energy Future – Scenarios for Supply and Demand to 2025 prepared as a coherent framework for the public consultations held prior to the publication of the final report scheduled for May of 2003. One-day public meetings were held in Toronto (28 January), Montreal (29 January), St. John's (31 January), Halifax (3 February), Calgary (6 February), Vancouver (7 February), and Calgary again (11 February). Written comments were also invited by the Board.

This report relies upon the scenario approach. Most of the text revolves around two visions of the future termed Supply Push which includes 'Fortress North America' aspects (characterized by low action on environment and low pace of technical change) and Techno-Vert (characterized by high action on environment and high pace of technical change). The reporting is divided into five main sections: 1.0 Scenario Process and Framework; 2.0 Scenario Overviews; 3.0 Macroeconomic Assumptions; 4.1 Total Canadian Energy Demand; 4.2 Canadian Residential Sector Energy Demand; 4.3 Canadian Commercial Sector Energy Demand; 4.4 Canadian Industrial Sector Energy Demand; 4.5 Canadian Transportation Sector Energy Demand; 4.6 Non-Energy Use of Hydrocarbons; 5.1 Electricity Supply; 5.2 Crude Oil and NGLs; and 5.3 Natural Gas Supply. A set of specific issues or questions appear at the end

of each section which address the main uncertainties that have been identified to guide for those making comments.

Many graphs and tables are included in the text. In the case of natural gas, it is apparent that the Board believes the peak in the production of conventional natural gas from the Western Canada Sedimentary Basin will occur soon. In both scenarios, the peak of conventional supply occurs before 2010 and probably about 2007. As far as non-conventional gas production is concerned, a substantial and growing contribution from Coal Bed Methane is assumed. The overall peak in gas supply from all sources (including eastern and northern regions, B.C. offshore, CBM, and imported LNG) is reached about 2010 for the Supply Push Case and increases slowly from 2010 through the end of the study period in 2025 for the Techno-Vert Case.

This document of 58 pages may be downloaded in .pdf form from the Board's Web Site at www.neb-one.gc.ca or copies or may be obtained by mail from the National Energy Board, 444 Seventh Avenue SW, Calgary Alberta, T2P 0X8. Further information is available from Karen Morton at kmorton@neb-one.gc.ca or by toll-free telephone at 1-800-899-1265.

The National Energy Board issued Canadian Electricity: Exports and Imports, the most recent in its series of Energy Market Assessments, in January of 2003 (ISBN 0-662-33417-5). The previous EMA dealing with electricity appeared in May of 2001. To deal with the pronounced regional aspects of this question, the report provides analyses on a provincial basis and includes many figures and graphs. Most of the issues impinging on the electricity trade of interest to both consumers and the generating industry are discussed, including the associated revenue and pricing.

Canada has historically been a net exporter of electricity to the U.S. Although there is substantial variation among the provinces, these exports have typically accounted for 7-9% of domestic generation. This report appears after a period of rapid change in the structure of the industry as a result of the trend to deregulation. Its main finding is that the restructured electricity market has not resulted in increased exports. The report concludes with a series of observations on the future for exports and imports, including the recent adherence to the Kyoto Protocol, trends in export and import prices, implications for consumers, and the role of the emerging Regional Transmission Organizations and Standard Market Design Initiatives.

The National Energy Board published another in its series of energy market assessment reports entitled Short-term Natural Gas Deliverability from the Western Canada Sedimentary Basin in December 2002. In its conclusions the Board states that 'despite drilling a record number of gas wells in 2001 and the start-up of the highly productive Ladyfill project,

increases in natural gas deliverability have been lower than projected' in previous reports. The Board now believes that gas deliverability from the WCSB by the end of 2004 will fall some four per cent below the year-end 2001 production rate. Presently, to offset declines from existing wells, production from one year's new connections must amount to about twenty per cent of current production.

Copies of these reports may be obtained from the NEB at 444 Seventh Avenue S.W., Calgary, Alberta, T2P 0X8, Fax: (403) 292-5576, Web: www.neb-one.gc.ca)

Frequently Asked Questions about the Science of Climate Change

The Meteorological Service of Canada has prepared Frequently Asked Questions about the Science of Climate Change authored by Henry G. Hengeveld, Elizabeth Bush and Patti Edwards. It provides concise answers to the usual questions provided under the following headings: General Overview: What is Climate Change?; Human Influences on the Atmosphere; Detecting and Attributing Climate Change; Predicting Climate; Global Impacts of Climate Change; Canadian Impacts of Climate Change; and Scientific Credibility and Human Response. Copies of this document of 35 pages (catalogued as ISBN 0-662-33349-7) are available without charge in English or French from the Meteorological Service of Canada, 4905 Dufferin Street, Downsview, Ontario M3H 5T4, or may be downloaded from the Web at www.msc-smc.ec.gc.ca/saib/.

National Academy of Sciences Review of Research into Climate Change

A committee formed by the U.S. National Academy of Sciences conducted a review of the Climate Change Science Program in that country entitled Planning Climate and Global Change Research: A Review of the Draft U.S. Climate Change Science Program Strategic Plan which was released on 25 February 2003. The existing plan was deemed inadequate in that it 'lacks a clear guiding vision and does not sufficiently meet the needs of the decision-makers who must deal with climate change. ' This report is important because when the U.S. rejected ratification of the Kyoto Protocol, it decided to place more emphasis on research into the climate change field instead. The review is available on the Web at www.nas.edu.

'Renewables Information 2002' from the International Energy Agency

The International Energy Agency has published 'Renewables Information 2002' the first of what is intended as an annual statistical series dealing with renewable energy output in OECD countries. The

Agency states that the new publication `provides a comprehensive range of statistics and focuses on electricity and heat production, supply and final consumption, as well as installed capacity of renewables and waste sources in the thirty member countries' which together supply about 24% of the global renewables supply. The dispersion of these sources, especially off-grid production, introduces problems in transparency in the measurement of these energy sources and as a first step, the report `defines, clarifies and classifies renewables and wastes energy statistics.' For this reason, the first issue is to be considered a work in progress and the Agency wishes to attract the widest possible review to help address the problem of providing reliable information in this growing field of importance.

Copies of `Renewables Information 2002' (ISBN 92-64-09952-2) may be downloaded in .pdf form without charge from the Agency at www.iea.org (E-Mail: books@iea.org).

`Greenhouse Issues' Newsletter of the IEA Greenhouse Gas R&D Programme

`Greenhouse Issues' for November 2002 published by the IEA Greenhouse Gas R&D Programme contains an overview of the Sixth International Conference on Greenhouse Gas Control Technologies (GHGT-6) held in Kyoto, Japan, the previous October. Dr. Kelly Thambimuthu of Natural Resources Canada serves as international chairman of this International Energy Agency activity. Topics covered included geological storage, ocean storage, capture technologies, energy modeling, economics, biomass, renewable energy, land use and sinks, and fuel cells. A separate article entitled Zero Emission Technologies: A Key Strategic Option for Climate Change Mitigation by Pierre-Philippe and Philippe Mathieu is also included (Web: www.ulg.ac.be/genienuc). The Proceedings of this Conference were published by Elsevier Science in the Spring of 2003. The next meeting in this series, GHGH-7, will be held in Vancouver, B.C. in September of 2004.

Copies of `Greenhouse Issues' may be obtained from the IEA Greenhouse Gas R&D Programme, Stoke Orchard, Cheltenham, Glos., United Kingdom, GL52 7RZ. (Fax: +44 (0) 1242 680758, Web: www.ieagreen.org.uk)

Newsletter of the International Association for Energy Economics

The IAEE Newsletter for the First Quarter of 2003 contained a review entitled Energy Security: Is the Past Prologue? of the evolution of U.S. policy on this subject since 1965 by Leonard L. Coburn of the U.S. Department of Energy. Other papers included: Mexico's Energy Scene by Pablo Mulás and Gerardo Bazan; The Canadian-U.S. Energy Relationship:

Issues and Challenges – A Canadian Perspective by André Plourde of the University of Alberta; Global Cooperation for Hydrocarbon Technology by Paul Tempest of the Windsor Energy Group in the U.K.; Increased Concentration in the Norwegian Electricity Market: Is the Market Sufficiently Open, or Can a Dominant Norwegian Power Company Raise Rates? by Tor Arnt Johnsen of the Norwegian Water Resources and Energy Directorate; Challenge and Opportunity for a Sustainable Future for Korea by Hoesung Lee, a former president of the IAEE; Prospects of Energy Development in Taiwan Under a Changing Economic Structure by Rong-I Wu of the Taiwan Institute of Economic Research; and Mythologizing Iraq's Oil by G. Hassantash of the Iranian Association for Energy Economics.

The IAEE Newsletter for the Fourth Quarter of 2002 included an assessment of Energy Privatisation in the United Kingdom by Lord Nigel Lawson who was Minister during the period his policy was introduced. Other papers included: The North Sea in a Global Context: A BP View by Tony Hayward of that company; A New Perspective on Energy Security by Robert Priddle, then Executive Director of the International Energy Agency; Electricity Restructuring: Is Ontario Getting it Right? by John Grant of the Ontario Independent Electricity Market Operator; Australia on Top by Tony Owen of the University of South Wales; The Swedish Electricity Market: Current Issues by Lars Bergman of the Stockholm School of Economics; and Natural Gas Use in the Mexican Power Generation Sector: Political, Market and Regulatory Issues by Alberto Elizalde Baltierra of the University of Paris.

Copies of the Newsletter may be obtained from the IAEE at 28790 Chagrin Boulevard, Suite 350, Cleveland Ohio, 44122. (Fax: (216) 464-2737; E-Mail: IAEE@IAEE.org)

IEEE 'Spectrum' for January 2003

The January 2003 issue of the IEEE publication 'Spectrum' (Vol. 40, No. 1) contains a number of articles of interest in the energy field. Kennedy Maize writes on Opening Up Energy Trading which provides a succinct review of the situation in this field; Mark Ingebretsen and William Sweet on Emission Permission, an article reviewing the present status of carbon dioxide trading; and Willie D. Jones on Hybrid Vehicles to the Rescue in which he deals with the prospects for this promising automotive power train. Additional references are provided as background for these articles on the Web at www.spectrum.ieee.org.

Short Notes

- Canada became the 100th country to ratify the Kyoto Protocol on 17 December 2002. The instrument for ratification was signed by the Prime Minister on 16 December 2002 after approval by Parliament and the Senate on 10 December 2002 and 12 December 2002 respectively. The expected adherence of Russia is awaited to bring the agreement into force. Australia and the U.S. will not ratify.

- Claude Mantil, formerly head of the Institut Français du Pétrole, succeeded Robert Priddle as the Executive Director of the International Energy Agency in February of 2003. The IEA Committee on Energy Research and Technology now distributes the OPEN Energy Technology Bulletin to subscribers on the Web without charge. (Web: www.iea.org)

- Professor William D. Nordhaus of Yale University has written Economic Consequences of a War with Iraq which includes a comprehensive section dealing with the effects to be expected on the world oil market. www.nthposition.com/politics_nordhaus1.html and /politics_nordhaus2.html.)

- Two U.S. cities - Oakland, California and Boulder, Colorado - have joined a lawsuit brought jointly by the Friends of the Earth and the Greenpeace organizations against the Export-Import Bank and the Overseas Private Investment Corporation contending that these organizations have provided $US 32 billion in financing and insurance to a number of fossil fuel projects around the world without assessing the contribution these developments have made to global warming. This early litigation is thought to be a forerunner of the greenhouse gas emission lawsuits to be expected in the future.

- An archive of Monthly Newsletters of the Association for the Study of Peak Oil (ASPO) may now be found at www.asponews.org in several file formats together with other supporting material. This Web Site is maintained by the MetaFoundation of Vancouver. Dr. R.W. Bentley of Reading University, a member of the Association, has established a Web Site devoted to a comprehensive review of oil and gas depletion and its implications at www.oildepletion.org. The Oil Depletion Analysis Centre (ODAC) is now at 140 Fortess Road, London, NW5 2HP (Web: www.odac-info.org, E-Mail: odac@btconnect.com). Another member, Professor Kjell Alekett of Uppsala University,

Sweden, has also established a Web Site on oil depletion at www.peakoil.net.

- The International Energy Agency (IEA) Greenhouse R&D Programme has mounted a new web site at www.co2sequestration.info which provides an information data base listing 84 carbon dioxide sequestration.activities around the world. In the capture field, 11 demonstration and 20 R&D projects are listed; for geological storage, 9 demonstration projects and 34 R&D projects; and for ocean storage, 10 R&D projects.

- A new Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) has been formed in Australia with support from that country's government. Details of the research program may be found at www.crc.gov.au.

- The International Test Centre for Carbon Dioxide Capture was opened 3 March 2003 on the campus of the University of Regina where the smaller scale research will be carried out. A demonstration-scale facility is located at the Boundary Dam generating facility of SaskPower near Estevan. The Government of Canada also announced a $5 million contribution to the International Energy Agency Weyburn Carbon Dioxide Monitoring Project. The object is to follow the fate of this greenhouse gas in enhanced recovery operations undertaken to extend the life of this mature oil field. The CO_2 is captured from a coal-to-synthetic natural gas plant in North Dakota and pipelined to the site. Fourteen million tonnes of carbon dioxide are expected to be stored over the life of this project. The monitoring project will be managed and coordinated from the Petroleum Research Centre at the Regina Research Park of the university. Papers presented at a recent meeting of the Intergovernmental Panel on Climate Change in Regina devoted to capture and sequestering will serve as the background for a major report on this subject to be prepared by the IPCC. Details may be found on the Web at www.climatepolicy.info/ipcc.

- The U.S. Department of Energy has mounted a Web Site devoted to information on carbon sequestration in that country which included activities in this field around the world at carbonsequestration.us.

- The Laboratory for Energy and the Environment at the Massachusetts Institute of Technology has established a web site to provide information on carbon sequestration. (Web: sequestration.mit.edu.)

- The 28 March 2003 issue of 'Science' (Vol. 299) contains two papers of interest in the field of climate change. R.B. Alley and 10 other authors including W.D. Nordhaus in Abrupt Climate Change, a review with 74 cited references, call attention to the large, abrupt, and widespread changes in climate that have had major impacts in the past. They recommend more research directed towards understanding this problem, improving monitoring systems, and taking actions aimed at enhancing the adaptability and resilience of ecosystems and economies. In Climate Sensitivity and the Need for Energy Without CO_2 Emission, Ken Caldeira, A.K. Jain and Martin I. Hoffert point out that while the sensitivity of global mean temperature to increasing atmospheric CO_2 is not known well, there will be a need for a massive transition to CO_2 emission-free energy technologies over the full range of this uncertainty. (Web: www.sciencemag.org)

- The U.S. Department of Energy has announced it will support one half the cost of a $1 billion venture to build a coal to electricity and hydrogen plant with virtual total elimination of emissions (including most of the carbon dioxide) to be known as FutureGen. A consortium will be organized to manage the project which calls for the design and construction of a 275 MWe facility over the next five years with a period of test operation foreseen for a further five years. It is envisioned that this facility will be a test bed for the demonstration of new technologies in this field.

- The Canadian Clean Power Coalition (CCPC) has been formed by ATCO Power, EPCOR, Luscar Ltd., Nova Scotia Power Inc., Ontario Power Generation, SaskPower, and TransAlta Corporation. The governments of Alberta and Saskatchewan, the Electric Power Research Institute (US), and the International Energy Agency's Greenhouse Gas R&D Programme and Clean Coal Centre serve as partners. The CCPC members operate 90% of Canadian capacity for coal-fired generation which accounts for 20-25% of the nation's electrical supply. With support from Natural Resources Canada of $1.66 million, the first phase of the research activities will be to determine which of the three following possibilities is the most cost-effective in capturing carbon dioxide and other pollutants: oxyfuel combustion; chemical separation from stack gases; or gasification-based technologies. It is the intention to retrofit an existing coal-burning power plant to capture at least 50% of this gas by 2007, with the ultimate aim of developing a new prototype facility to capture up to 90% by 2010.

- The U.K. journal 'Nature' for 02 January 2003 (Vol 421, No.69) contains reports by two groups who searched for a climate change fingerprint in studies of the overall patterns of a wide range of plants and animals. In the first paper, Parmesan and Yoher present a meta-analysis of studies of more than 1,700 species, and find that there have been significant range shifts averaging 6.1 km per decade towards the poles, and that spring has advanced by 2.3 days per decade. The authors claim with 'very high confidence' that this means that climate change is already affecting living systems. In the second paper, Root et al. also detect a temperature-related fingerprint in species from insects to mammals, and grasses to trees. The changes are most marked at high latitudes and high altitudes, where the largest changes are predicted. (Web: www.nature.com)

- The Atlas of Canada now includes maps related to climate change which may be found on the Web at atlas.gc.ca. These deal with the sites of the main electrical generating facilities, climate change scenarios, potential impacts, stress to the atmosphere, societal response, future impacts, and includes animation.

- A paper by Martin I. Hoffert and fifteen other authors including two from McGill University, Christopher Green and H. Douglas Lightfoot, entitled Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet, was published in the 1 November 2002 issue of the U.S. journal 'Science' (Vol. 298 p.981-987). This paper with 86 reference citations explored the technological options for dealing with climate change in the longer term The authors dispute the statement of the Intergovernmental Panel on Climate Change (IPCC) made in 2001 that 'known technological options could achieve a broad range of atmospheric carbon dioxide stabilization levels ... over the next one hundred years or more.' These authors conclude instead 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.'
  (Web: www.sciencemag.org)

- Stanford University will host a major project in the field of energy and climate change which could cost as much as $225 million over a decade. Among the companies supporting this major effort that will focus on carbon sequestration and the substitution of hydrogen for the direct use of the fossil fuels are ExxonMobil, General Electric and Schlumberger.

- EnCana Corporation of Calgary announced a delay in its $1.3 billion project to develop the Deep Panuke gas field off the coast of Nova Scotia on 14 February 2003 due to disappointing exploration results. The reserve of natural gas at the Sable Island field off the coast of Nova Scotia has been significantly reduced by its operators. This reduction is not expected to affect the present production from the project but will shorten its life.

- PetroCanada reported the completion of its MacKay River in-situ project in the oil sands of Alberta with the first production in November of 2002. Output from this Steam-Assisted Gravity Drainage Project is expected to reach design capacity of some 30,000 barrels per day later in 2003. The project was completed within the budget of $274 million and was on schedule. Steam will be supplied later this year from a new co-generation installation of 165 MWe capacity. Operating costs are anticipated to be $2.25/barrel plus the cost of one mcf of natural gas. A second installation of this type at Meadow Creek located 75 km south of Fort McMurray and planned as a joint venture with another company, will have a capacity of 80,000 barrels per day. Suncor Energy Inc. has announced a further expansion of its 'Firebag' in-situ project before the first phase was completed as part of a major continuing program of investment in the oil sands.

- Trans-Northern Pipelines Inc., an oil products line serving the Montreal-Toronto corridor, has applied to the National Energy Board to both increase capacity and to reverse flow direction to east-to-west on the section between Farran's Point and Toronto. Originally built to move products from Montreal refineries to Eastern Ontario, the flow on the western section of the line had been changed to west-to-east at the time of the energy problems of the 1970s. Line 9 of the Enbridge system, which was built at that time to move western crude from Sarnia to Montreal, has already been reversed since 1999.

- The U.S. Senate voted against opening the Arctic National Wildlife Refuge in north-eastern Alaska to oil drilling on 19 March but this action must be reconciled with a later opposite vote in the House of Representatives.

- An article in 'Technology Review' for March 2003 (Vol 106 No.3) entitled Recharging the Power Grid by Peter Fairley describes the progress being made in the development of large flow cell batteries to meet peak power needs. Currently water-based pumped storage

methods provide only about 90 gigawatts of power around the world or about three percent of global generating capacity but this option is unlikely to increase greatly as the most favourable sites are either already developed or are off-limits for a variety of reasons, chiefly local opposition. There is also growing opposition to large-scale transmission lines so battery storage near load centres are becoming a more attractive option to meet demand in peak periods. Such techniques may also help the introduction of fluctuating renewable sources of electricity such as those based upon wind and solar generation. The largest such system entering service in the U.S. uses a flow battery based upon sodium bromide and sodium polysulphide streams, but VRB Power Systems of Vancouver offers a flow system based upon a redox reaction using vanadium compounds. McKenzie Bay Resources is planning a vanadium mine and related facilities aimed at meeting the emerging battery market at a cost of $360 million, including the development of a new extraction process. The deposit at Lac Doré in Northern Québec is said to be the second largest known of this metal.

- The Spheral Solar company of Cambridge, Ontario, will begin the manufacture of a flexible solar panel in 2004. Waste silicon from the chip-making industry is converted into 1mm spheres and then doped. The spheres are then mounted between two layers of aluminum prior to encasing in plastic. The flexible product may be mounted over a wide variety of shapes and has a solar conversion efficiency of about 11%.

- Solar Hydrogen Energy Corporation of Saskatoon has announced it will receive $200,000 from the CANMET arm of Natural Resources Canada towards the $450,000 cost of a project to advance its Thermocatalytic Hydrogen Production Process aimed at producing this gas from water by applying solar energy using a proprietary catalyst developed by the company

- BP (formerly British Petroleum) has closed its California facility for making thin film photovoltaics which manufactured solar collectors based upon amorphous silicon/cadmium telluride. Conversion efficiencies were only in the 5-7% range. The National Renewable Energy Laboratory in the U.S. is continuing its efforts to perfect this technology.

- Tidal currents will be the source of energy for a submerged turbine of Norwegian design to enter service in the northern region of that country

later this year. This first small installation has a capacity of 300 KW. A British Company, Marine Current Turbines, plans to test another tidal turbine system which sticks above the water level to facilitate maintenance in southern England in 2003. A 20 MW conventional tidal power installation has drawn energy from the very high tides of the Bay of Fundy in Nova Scotia since 1984 but there no current plans to expand generation in this way in Canada. The largest tidal power plant has operated in northern France since the 1960s across the La Rance river with a capacity of 240 MWe.

- Scientists at the Lawrence Berkeley National Laboratory in California have developed a semiconductor called indium gallium nitride (InGaN) that raises the maximum possible conversion of sunlight to electrical energy from 30 to 50%. It has been found possible to vary the ratio of indium to gallium in different layers to increase the range of bandwidth to match the solar spectrum perfectly.

- Researchers at the Pennsylvania State University are developing a refrigerator that uses the properties of ultrasound as the cooling mechanism. The object is to reduce the emissions of greenhouse gases from refrigeration equipment.

- Saga University of Japan has devised a system to produce both electricity and drinking water from seawater using an ammonia cycle. The large temperature difference between surface and deepwater characteristic of the Pacific (as much as 24 degrees C) provides the driving force. The system is attractive to small island nations such as the Republic of Palau which is considering the first installation. Over the years there have been several efforts to generate electricity from this temperature difference following Georges Claude's original experiments in Cuba before World War II, but this is the first effort to combine generation with desalination in recent years.

- The first commercial scale facility to convert animal wastes into diesel fuel and a fuel gas is in the start-up phase in Springfield, Missouri. Operated by Renewable Environmental Resources, a joint venture of ConAgra and the process developer, Changing World Technology, the conversion is based upon thermal depolymerization in which wastes in the form of a slurry derived from a large turkey raising operation are treated at elevated temperature and pressure. It is planned to produce 115,000 tons of oil per year from a feed of about 200 tons per day. The

Environmental Protection Agency has contributed $US5 million to the $US15 million project.

- Ensyn Technologies Inc. of Ottawa has announced support of $3.4 million from the Government of Ontario towards the construction of a facility to convert wood and other biomass to fuel and chemicals located in Renfrew, Ontario. The first stage will be capable of processing 60 tonnes of dry feedstock per day in a flash pyrolysis process developed in Canada to produce a bio-oil from which higher value chemicals may be extracted. The residual will serve as a fuel for the generation of electricity. This facility is expected to begin operations within 12 months at a total cost estimated at $9 million.

- Starting in the 2004 model year, The Honda Motor Company will offer a version of its Civic model equipped with an engine tuned for only for natural gas and equipped with a continuously variable transmission to allow full advantage to be taken of this fuel's properties to obtain a reduction in greenhouse gas emissions of some 20%. The FuelMaker Corporation of Toronto, in which Honda holds a 20% equity stake, will offer a re-charging system to allow the compressed gas tanks to be refilled at home from the domestic natural gas supply. The fuelling range is given as 300 km in the city and 420 km on the highway.

Electric Vehicles and Hydrogen

- The Minister of Industry, the Hon. Alan Rock released the Canadian Fuel Cell Commercialization Roadmap on 15 April 2003. This document identifies the critical factors for industry to bring this emerging technology to market and provides strategic planning tools for industry, academia and governments. The Roadmap focuses on the following four key areas: stimulating market demand; improving product quality while reducing costs; gaining access to capital for growth; and creating a support infrastructure. Located in Vancouver at the National Research Council Innovation Centre, Fuel Cells Canada is a non-profit national industry association which is the primary focal point for industry and research institutions interested in the fuel cell field. (Web: www.fuelcellscanada.ca)

- In his State of the Union address to Congress on 28 January 2003, President Bush announced a $US 1.2 billion program called the Freedom Fuel Initiative to advance hydrogen-powered fuel cell vehicles. Freedom Fuel will invest $US 720 million in new funding

over the next five years to develop the technologies and infrastructure needed to produce, store, and distribute hydrogen for use in fuel cells mainly for vehicles but also for the generation of electricity. Combined with the allied FreedomCAR (Cooperative Automotive Research) Initiative, previously announced in 2002 and undertaken to develop technologies needed for the mass production of hydrogen fuel cell vehicles, a total of $US 1.7 billion will be budgeted over five years. Freedom Fuel has the objective to make fuel cell cars cost-competitive with conventional gasoline-powered vehicles by 2010, and to advance the methods of producing hydrogen from renewable resources, nuclear energy, and coal. It is not clear what effect this announcement which may be found on the Web at www.energy.gov will have on Canadian efforts in the field. In November of 2002, the U.S. Department of Energy had released its U.S. National Hydrogen Energy Roadmap which was based upon a Workshop held the previous April and attended by some 220 technical experts and industry practitioners who are specifically identified, including several Canadians. The purpose of the workshop was to identify the strategic goals, barriers, and key activities required to evaluate the costs and benefits of a hydrogen energy economy. The Roadmap contained chapters titled Systems Integration, Production, Delivery, Storage, Conversion, and Applications. After reviewing the current technological position in each subject area, specific requirements are then identified for the next phase of development. This report of 49 pages may be downloaded in .pdf form at ww.eren.doe.gov/hydrogen.

- The General Hydrogen Company of Vancouver, formed by Dr. Geoffrey Ballard with the participation of a number of companies including Air Products, BHP Billiton, British Energy, CAMECO, and General Motors, and with support from Natural Resources Canada and the National Research Council, may be found on the Web at home.generalhydrogen.com.

- Shelley Minteer and colleagues at St. Louis University have developed a fuel cell which operates on ethanol with the aid of enzymes. The first application is aimed at portable computers. Other companies will soon be offering methanol (a poison which affects the optic nerve) as a fuel for cells for this application.

- A Canadian company, Powertech Lab Inc. of Vancouver, a wholly-owned subsidiary of B.C. Hydro, will be working with six automakers – Daimler-Chrysler, Hyundai Motor, Ford, Toyoto, Nissan and

Peugeot-Citroen – together with the Kokandrum Company of Japan to standardize specifications for tanks and other components of high-pressure fuel systems for use in hydrogen-powered vehicles by 2005. (Web: www.powertech.bc.ca)

- The Honda Company will use an ultracapacitor in tandem with a hydrogen fuel cell supplied by Ballard Power of Burnaby, BC., in the first car to be supplied to the U.S. market powered only by this power source of 78 kW. Some 30 such vehicles will be leased in the coming year in the U.S. and Japan.

- The Government of Canada through the Canadian Transportation Fuel Cell Alliance is contributing $620,000 to two projects of the Hydrogenics Corporation, a designer and manufacturer of fuel-cell systems in Mississauga, Ontario, a company in which General Motors Corporation has an interest, whose total cost will be about $1.61 million. One involves a reforming installation in which hydrogen produced from natural gas is fed to a 50 KW stationary fuel cell and the second, the demonstration of electrolysis technology in a mobile hydrogen fuelling station.

- The Federal Government will provide $3 million for a test of a fuel-cell powered bus in Winnipeg. The bus, to be supplied by New Flyer Industries of that city, will be equipped with a hybrid-electric hydrogen-fuel cell developed by Hydrogenics Corporation. This will be the first bus equipped with ultracapacitors to recover regenerative braking energy.

- An article in 'Technology Review' December 2002/January2003 Issue (Vol. 105 No. 10) provides a short description of the efforts of General Motors in the field of hydrogen fuel cell technology which the company calls Hydronomy. A new common platform is being developed for vehicles on which different models could be mounted. It is envisioned that cars so equipped could supply electrical energy to the grid during the 90% of the time they are parked. The company will also offer fuel cells for stationary power applications. An animation of the operation of a hybrid gasoline-electric car may also be found at the 'Technology Review' Site: www.technologyreview.com/visualize. The company has also announced it is developing a robust diesel hybrid truck with continuous variable transmission for military purposes based upon its Silverado model. The U.S. army expects a savings of 20% over conventional diesels and a reduction in emissions. The battery will

use the nickel-metal hydride system. It will be equipped with a 5-kilowatt proton exchange membrane fuel cell developed by its alliance partner, Hydrogenics Corporation of Mississauga, Ontario. (http://gm.com/company/gmability /environment/road_to_future) The company is discontinuing production of its all-electric vehicle EV1 of which a little over one thousand were built for service in California.

- General Motors Corporation also intends to introduce five vehicle models with at least some degree of hydrid power operation by 2007. The Ford Motor Company has already announced a hydrid version of its Escape sport utility vehicle to be introduced in 2004 and DaimlerChrysler will market a hybrid version of its Dodge Ram pickup truck for the same model year.

- The Toyoto Company has announced its intention to produce 300,000 hybrid vehicles annually around the world by 2007. A Lexus Sports Utility Vehicle will be among the models offered with this new technology, but it is not clear whether the Canadian line assembling this SUV will produce the hybrid version. Press reports indicate it is the intention of Toyota, the world's second largest auto maker, to switch to all gasoline-electric hybrid power plants by 2012. Only by expanding production can the company overcome the present $US 3000 disadvantage in manufacturing costs over conventional engines. Toyota believes that hydrid vehicles can meet both emission and climate change objectives.

- Azure Dynamics of Vancouver has announced an agreement with Purolator Courier Ltd. of Missassauga, Ontario, to investigate the application of hybrid electric powertrains to the latter company's 3,000 trucks.

- A Vancouver company, Railpower Technologies Corporation, has developed prototype hybrid switcher locomotives based upon lead batteries and diesel power to reduce emissions.
(www.railpower.com/greengoat.php)

- A prototype underground hydrogen-fuel cell propelled locomotive has been developed for mining applications by the CANMET branch of Natural Resources Canada in co-operation with a number of mining companies.

Energy Studies Review Vol. 12, No. 1, 2003 pp 115-117

Energy in a Competitive Market: Essays in Honour of Colin Robinson

Various Authors

Editor: LESTER C. HUNT; Published by Edward Elgar, 2003; 233 pages; ISBN: 1-84064-789-1

This book contains eleven papers presented at a conference organized by the Surrey Energy Economics Centre during summer 2000 in honour of energy economist Colin Robinson. Those papers cover several topics related to energy economics, spanning from the economics of oil field developments at the micro level to cross-country comparisons of environmental Kuznets curves at the macro level. Although this is allegedly meant to reflect "Colin's involvement with the whole spectrum of energy economics" (p. xvi), it is difficult to define a typical reader for such a wide array of topics.

Nevertheless, for those interested in the regulation of natural monopoly segments of energy markets, the book gathers a series of four excellent papers on yardstick competition and comparative performance measures. Catherine Waddams Price (Yardstick competition and comparative performance measures in practice) reviews experience with performance measures in UK, Norway and Netherlands. Thomas Weyman-Jones (Yardstick competition and efficiency benchmarking in electricity distribution) presents the theoretical foundations of yardstick competition and describes methods for measuring comparative performance. After assessing the relative advantages of one of these methods, data envelopment analysis (DEA), he exposes it clearly and thoroughly. Massimo Fillipini and Jörg Wild (The Swiss electricity industry and the regulation of distribution prices) estimate an average cost function for the Swiss electricity distribution utilities in order to predict the implications of yardstick competition for this sector. Finally, David Hawdon (Efficiency and performance in the gas industry) uses DEA to assess the performance of the gas industry in 33 countries. Although the papers have been written independently, together they present an overall picture of advantages and difficulties associated with yardstick competition, both at the theoretical and empirical levels. These papers are very instructive and give a common theme for this part of the book.

Although the other papers are of good quality and very interesting per se, they do not exhibit such coherence. Two papers look at the past and recent history of energy market regulation in UK. Eileen Marshall (Electricity and gas regulation in Great Britain: the end of an era) describes and comments the evolution of gas and electricity regulation from the liberalization in the 1980s to the likely consequences of the Utilities Act 2000. Mike Parket (UK coal in competitive energy markets) argues that it is hard to disentangle the influence of politics and economics, on the one hand, and the impacts of market liberalization, on the other hand, in the fate of the UK coal industry. Two papers deal with the operations of the oil industry. Paul Stevens (Economists and the oil industry: facts versus analysis, the case of vertical integration) argues that there are two types of vertical integration in the oil industry, (traditional) operational vertical integration and financial vertical integration, and by failing to recognize this, economists ignore important aspects of the functioning of the oil industry. Two papers concern the economics of the environment. Peter Pearson and Roger Fouquet (Long-run carbon dioxide emissions and environmental Kuznets curves: different pathways to development) present empirical evidence on the relationship between economic development and emissions. Bridget Rosewell and Lawrence Smith (UK emissions targets: modelling incentive mechanisms) find that a performance credit should be used in order to incite firms to participate in the voluntary UK Emissions Trading Scheme. Finally, in a methodological paper, Lester Hunt, Guy Judge and Yasushi Ninomiya (Modelling underlying demand trends) develops econometric methods allowing, among other things, to distinguish between "normal 'price effects' (as measured by the price elasticity of demand) and the 'endogenous technical progress' effect" (p. 142) that is induced by sustained price rises.

Despite the wide spectrum of subjects, a general "impression" comes up from the reading of the whole book: even if papers refer to so-called competitive energy markets, regulations which are contemplated and discussed seem ever more involved and complex. Although there is probably no need to convince an economist that the natural monopoly segments of energy industries must stay regulated and that their regulation must be refined, some propositions in the book can be more easily assimilated to an era of planning rather than one of liberalization. The best illustration of this is the paper of Kemp and Stephen on field cluster development. The two authors show that, because of economies of infrastructure cost sharing and of risk sharing, "joint development of a group of oil fields could be viable where individual projects remain unattractive" (p. 102). Then, observing that "[t]o obtain the benefits of shared infrastructure costs and risk sharing it is necessary to devise a

scheme to execute the sharing among licensees in the various fields" (p. 133),[1] they compare seven possible schemes for sharing common costs. At this stage, one wonders whether the recognition of the initial problem and its analysis should not be left to market participants rather than to economists. Likewise, chapters on the economics of the environment are more naturally assimilated to a need for regulation than to a liberalization trend. We then ask to ourselves whether these essays in honour of Colin Robinson do not paradoxically confirm its sayings: "there is still far too ready a tendency to seek out apparent market failures and then to propose government remedial assumption that it will make matters better than worse".[2] In fact, it would have been very interesting to have Colin Robinson comment the papers and, where appropriate (as, for instance in the yardstick competition papers), to get his opinion on whether or not proposed analysis and regulation do carry the risk of ill-devised government interventions. More generally, Robinson's comments could have given perspective and unity to the book. But since this is probably asking too much of a collection of conference papers (and, of Collin Robinson), an easy, if unsatisfactory, alternative would have been to title the book "Energy markets in the wake of regulatory reforms".

To conclude, this book contains interesting papers on energy markets and has certainly its place in university libraries. It should probably not stand on any personal bookshelf, however, as I do not know anyone who has such a wide range of interest in energy economics.

Michel Roland
Department of Economics
Université Laval

[1] To be exact, however, except for some tax modifications, the schemes proposed could be implemented by the industry itself and do not necessarily call for government interventions. Yet, the propositions look like coming from a central planning body.

[2] Robinson, Colin, "Energy Economists and Economic Liberalism", *Energy Journal,* 21 (2000), p. 8.

Energy Studies Review Vol. 12, No. 1, 2003 pp 118-121

Policy Instruments For Environmental and Natural Resource Management.

By THOMAS STERNER.

Published: Nov 2002; RFF Press; ISBN: 1-891853-12-0

In Policy Instruments for Environmental and Natural Resource Management, Thomas Sterner outlines environmental natural resource policy both in theory and in practice, with an emphasis on the latter. The author uses the experiences of a number of developed and developing countries to illustrate how and why policies are selected and implemented and how well they perform in different countries. The book is not intended as an environmental economics textbook but rather as a reference for people of different backgrounds interested in the choice between the policy instruments available for environmental protection and natural resource management. As a reference for those involved in environmental policy, it is both interesting and informative.

The book is comprised of 7 parts. Part I outlines the economic causes of environmental degradation and the misuse of natural resources. The traditional causes of environmental problems, such as economic growth and market failure, are discussed, as are the complications presented by asymmetric information and public goods. The section also includes a chapter dedicated to models of natural resource management. The discussion of the evolution of property rights is particularly interesting and is not often found in texts on environmental management.

Part II provides a theoretical review of policy instruments with a chapter dedicated to each of direct regulation, tradable permits, taxes, subsidies/deposit-refund systems, legal instruments, and national planning. The discussion in the main text is kept informal with formal mathematical notes provided in separate boxes. I found mathematical notes too brief to provide an appropriate understanding of concepts such as the revelation principle. As well, given the purpose of the book, they could likely have been replaced with references to more technical treatments of the subject.

In Part III, the author turns to the factors that are, or ought to be, taken into account when selecting a policy instrument. He relies on both economic theory and practical institutional arguments. First, the efficiency of various instruments in the face of heterogeneous abatement costs, heterogeneous damage costs, and the incentives for technological advancement under different instruments is discussed. The effect of uncertainty about abatement and damage costs, as well as asymmetric information regarding the polluter and her behavior on instrument choice is then outlined. The remainder of the section discusses a number of factors involved in instrument choice, including the ability of different instruments to reduce the pollution intensity of production and the level of production, the possibility of a double dividend from environmental taxation, the distribution of costs between polluters and society, and the role of rights allocation. The author also provides an interesting discussion of the politics of instrument selection, which highlights the fact that the political feasibility and enforceability of instruments must be taken into account when evaluating environmental policies. International environmental issues and the need for international agreements are briefly discussed, as is the linking of trade and environmental problems. In light of the attention being paid to international environmental agreements and the complexities involved in the regulation of transboundary and global pollution abatement, a more detailed discussion might have been warranted.

The next three sections of the book are each dedicated to the regulation of specific industries or environmental problem and each section ends with a discussion of the lessons learned. Part IV presents a discussion of environmental regulation of road transportation. The author briefly outlines the numerous types of environmental damage caused by road transportation, including climate change (global), acidification (regional), congestion, noise, and air pollution (local) as well as how location and vehicle characteristics affect the environmental damage. The chapters that follow discuss various types of road policies: the pricing of road transportation and the possibility of moving from a simple system of tolls to a more complex pricing scheme, taxation and regulation used to increase fuel efficiency, a fuel consumption tax, emissions standards, as well as fuel quality standards, vehicle standards and urban planning used to address local environmental problems. The phaseout of lead in gasoline in both developed and developing countries is discussed at length. The suggestion is that integrated urban pollution programs may be the most effective and practical approach to the myriad of environmental problems facing the megacities in developing countries.

Part V outlines policies used to combat industrial pollution. The author first discusses the experience of industrial pollution control in developed countries, focusing on the experiences of a number of European countries and the United States in regulating sulfur dioxide, nitrogen oxides, and trichloroethylene. His discussion provides a comparison of environmental taxation, standards (performance and design), tradable permits, refunded emissions payments, and prohibition are discussed and compared. The author also discusses the use of liability law, information provision and voluntary agreements in the US. Finally, international experience with protecting the ozone layer and mitigating climate change are mentioned. The next chapter discusses a number of successful attempts at environmental regulation in developing countries, highlighting the opportunities that exist in the developing world. The author outlines the success of environmental funds and fines in Eastern European countries as well as environmental funds and fees in China. The use of environmental charges in Columbia, voluntary participation in reducing pollution from brick kilns in Mexico, and electricity tariffs in Mexico and Zambia are outlined. The use of a labeling scheme in Indonesia where regulations were likely to be unsuccessful given the power of industrial owners is particularly interesting. This chapter makes it clear that policy instruments used in developed countries are not often practical in developing countries, but that informal instruments can be effective for environmental management.

Part VI of the book focuses on the management of natural resources and ecosystems. The author discusses policies used to reduce the usage of scarce water supplies including water management, tariffs, and water pricing. Examples from Middle Eastern economies, Chile, South Africa and Botswana are provided. Experiences with waste management in both developed (the US and Sweden) and developing countries are outlined. The author then provides an overview of the state of world fisheries and different ways fisheries are managed. A detailed discussion of individual transferable quotas including the experiences of Iceland, New Zealand, Chile, the US, and Canada is provided. The next chapter outlines key issues in agriculture, including the environmental threat of agricultural runoff and soil erosion. As well, the role of property rights in agriculture, risk in sharecropping and the use of taxes to reduce agricultural pollution in Malaysia are discussed. The use of subsidies, taxes, regulations, government concessions, and certification to manage forest resources is discussed, as is the role of carbon offsets to help mitigate climate change. Finally, the management of wildlife in Zimbabwe and the management of marine ecosystems in Tanzania, Zanzibar, and Mexico are examined as examples of ecosystem management. This section illustrates that the

management of different resources require different policy instruments, with tradable quotas being used to manage fisheries, pricing to manage water and common property management to manage ecosystems.

The book concludes with a chapter discussing policy issues and potential solutions. It is argued that actual policy selection is complicated because the most important factors to consider differ across environmental issues and the process is political with many parties lobbying in favor of their position. The author points out that flexibility may be of primary importance in light of the complexities and uncertainties involved in environmental management.

In the preface the author states that the book is not an encyclopedia or textbook of environmental and resource economics. However, the book does provide an informative discussion of the causes of and possible solutions to a number of environmental problems. As well, the author presents a balanced discussion of policy instruments, highlighting both the economic efficiency of instruments and their practicality and political feasibility in developing and developed countries. Although not suitable as a pure environmental economics text, in addition to the audiences recommended by the author, the book would be very useful as a text in a senior policy class for students of environmental studies or resource management, who are likely to find jobs in environmental governance.

Heather Eckert
University of Alberta

Energy Studies Review Vol. 12., No. 1 2003 pp 122-124

ENERGY REVOLUTION: POLICIES FOR A SUSTAINABLE FUTURE

By HOWARD GELLER

Washington, DC: Island Press, 2003. 289 pages. ISBN: 1559639652, Paper back, Alk.

Chris Flavin, the president of Worldwatch Institute writes about this book: "In Energy Revolution, one of the world's leading energy policy experts shows once again why he is so respected around the globe. Howard Geller provides ... a clear road map to the proven policies that will make a post-petroleum economy possible."

And he looks absolutely right in his claim. Dr. Geller could have been the only person to write this comprehensive, detailed and insightful guide to understanding the biggest global challenge of today: the quest for a sustainable energy future.

Dr. Howard Geller is currently the Director of the Southwest Energy Efficiency Project (SWEEP), a public interest venture he founded in 2001. He is the former Executive Director of the American Council for an Energy-Efficient Economy (ACEEE). He established ACEEE's Washington, D.C. office in 1981, stepping down as Executive Director in February, 2001. Dr. Geller received his PhD in Energy Policy from the University of Sao Paulo in Brazil. He also holds a Masters degree in Mechanical Engineering from Princeton University.

Dr. Geller has advised and conducted energy efficiency studies for utilities, governmental organizations, and international agencies. He is author or co-author of three other books: Efficient Electricity Use: A Development Strategy for Brazil; Energy Efficiency in Buildings: Progress and Promise; and Energy Efficiency: A New Agenda.

The book starts with an introduction to energy and its importance in our lives. The current energy trends and their implications such as high costs, global warming, local and regional air pollution, global warming, security risks, resource depletion and inequity, have been examined. The author concludes that "a sustainable energy future is possible through much

greater energy efficiency and much greater reliance on renewable energy sources compared to current energy patterns and trends." The following chapter discusses in detail the barriers to greater energy efficiency and renewable energy use.

The next two chapters discuss policy options and market transformation. Policy initiatives comprising research and development, financing, pricing, regulations, capacity building, etc. have been described. The examples for market transformations for energy efficiency and different renewable energy technologies have been taken from experiences in China, United States, Brazil, Netherlands, India, Denmark and United Kingdom.

The following chapter gives an insight into past US energy policies and future scenarios. The author implies that the US contributes a disproportionate share of global problems caused by conventional energy use because with only 4.6 percent of the world's population, it uses 26 percent of all energy consumed worldwide and 30 percent of all electricity. He then compares a business-as-usual scenario with a sustainable energy approach and suggests measures for the promotion of clean energy technologies; the resulting economic and environmental impact has been shown to be very positive.

The demand of energy in developing world is growing rapidly. So in the next chapter, the author chooses Brazil as an example from the developing countries and discusses its energy policy objectives, and puts forward proposals to enhance energy efficiency and renewable energy use in this country.

On a global scale, international policies are needed to promote efforts for a sustainable energy future. The role of international institutions is very important in this regard and is discussed next. The efforts of International Energy Agency have been described, one of them being its Climate Technology Initiative which is assisting developing countries with the adoption of environmentally sound energy technologies and practices. The World Bank approved $1.2 billion in loans between 1994 and 1998 for sustainable energy development. Global Environmental facility has provided funding to many developing countries such as Argentina, Brazil, China and India, under bilateral agreements for implementation of renewable energy technologies. The United Nations agencies such as UNDP and UNEP are also contributing to such efforts. The author provides an introduction to the global environmental treaties like United Nations Framework Convention on Climate Change adopted by 150 nations at 1992 Earth Summit, and the Kyoto Protocol of 1997. The flexibility mechanisms of Kyoto Protocol namely Joint Implementation and Clean Development Mechanism have been described and the

implications of US non-ratification and withdrawal are depicted. As part of enhancing international technology and policy cooperation, the author suggests that an International Energy Efficiency and Renewable Energy Agency should be created to support and strengthen energy efficiency and renewable energy efforts in both industrialized and developing countries.

The last chapter provides policy lessons from past, progress to date and future prospects. The author presents his own Global Clean Energy Scenario, illustrating how energy supply and demand could unfold during this century if a strong and steady commitment is made to greater energy efficiency and expanded renewable energy use. The challenges posed by the rapid increase in transportation vehicles and population growth are discussed along with possible solutions. The chapter ends with a conclusion outlining the process of a clean energy transition. An extensive list of references and a useful index mark the end of the book.

The main beauty of this book is the collection of latest information. The information has been arranged in a format with widespread relevance and appeal. Non technical language is used throughout. The recommended audience of this book comprises students, educators, policy makers, environmentalists and politicians. Apart from that, this book possesses great value to anyone who wishes to be informed on sustainable energy policies and future scenarios.

Umar Karim Mirza Ph. D.
Pakistan Institute of Engineering and Applied Sciences
Pakistan.

THE ENERGY JOURNAL

Subscription Form

The Energy Journal is published by the Energy Economics Education Foundation, the educational affiliate of the International Association for Energy Economics. It is the Association's premier international journal published four times a year. The journal is refereed and encompasses a broad spectrum of energy economics topics such as:

Alternative Transportation Fuels	Energy Finance
Conservation of Energy	International Energy Issues
Economic Energy Modeling	OPEC Topics
Energy Demands and Usage	Markets for Crude Oil
Electricity and Coal	Natural Gas Topics
Energy & Economic Development	Nuclear Power Issues
Energy Management	Petroleum Topics
Energy Policy and Issues	Renewable Energy Issues
Environmental Issues & Concerns	Fuel Taxation
Greenhouse Effect & Change	Developing World Energy Issues
Electricity Deregulation	Market Power Issues

This professional journal carries a variety of other topics as well. Also included are topics of timely interest, research papers and reports, book reviews, government reports on energy policy and prospects and advertisements of interest to readers. This is one publication that every library should have. Subscriptions are $200 in the U.S. and Canada and $225.00 for all other countries.

Name:_____
Position:_____
Company:_____
Address:_____
Address:_____
Postal Code:/Country:_____
Phone Number:_____ Fax Number:_____

___ $200.00 (US & Canada)
___ $225.00 (Foreign)

___ MasterCard ___ Visa Exp Date: _____

Card No:_____
Name on Card:_____
Signature:_____

Payment must be made by credit card, wire transfer or check (in U.S. funds drawn on a U.S. Bank)

Send this form to: International Association for Energy Economics, The Energy Journal Subscription Department, 28790 Chagrin Blvd., Ste. 350, Cleveland, OH 44122, USA. Phone: 216-464-5365. Fax: 216-464-2737. E-mail: iaee@iaee.org URL: www.iaee.org