Update

Post-Kyoto Canadian Action on Climate Change

After difficult negotiations at Kyoto in December 1997, protocol was agreed to that set different reduction targets for the world's 38 richest nations in 2010 expressed in terms of the base line emissions of six greenhouse gases in 1990. Overall these nations have committed to a reduction of 5.2%. Canada adopted 6% reduction target; the US 7%; the European Union 8% though Australia (up 8%), Iceland (up 10%) and Norway will be allowed to increase their emissions due to special circumstances in each of these latter countries. It is intended to achieve further reductions after 2010.

A compromise was reached with the developing nations concerning an emissions trading system but no formal targets were set for these countries now responsible for a growing share of world emissions. The Joint Implementation of mitigation projects among developed nations and between developed and developing nations would be encouraged. The Protocol must now be ratified by the respective signatories though approval by the US Senate is doubtful.

A new Climate Change Secretariat was established following the meeting, headed by Mr. David Oulton, formerly Assistant Deputy Minister at Agriculture and Foods Canada, and previously a senior official with Natural Resources Canada. This secretariat will report to a committee of Deputy Ministers chaired jointly by Environment Canada and Natural -Resources Canada, which, in turn, will be responsible to the Cabinet Committee on the Economic Union, Chaired by the Hon. Ralph Goodale, Minister of Natural Resources. Important functions of this new group are organizing joint efforts with the provinces and industry, and to develop Canada's first emissions trading scheme. Dr. D.L.P. Strange was appointed manager of the Climate Change Action Fund and also serves as Science and Technology Advisor.

The allocation of $60 million over three years already provided in the past Budget was announced on December 15, 1997. These funds were targeted towards four programs aimed at increasing energy efficiency primarily in structures and for the encouragement of the renewable energy technologies. The Commercial Building Incentive Program was granted $10 million per year to encourage building owners to incorporate energy-efficient technologies and practices in designs for new commercial and institutional buildings.

Starting April 1, 1998, $3 million dollars will be provided each year to expand the Energy Innovators Program to allow more organizations to participate in projects aimed at reducing energy operating costs and greenhouse gas emissions. Another $3 million per year has been allocated to the EnerGuide for Houses program to encourage Canadians to improve the energy performance of their houses. The Renewable Energy Deployment Initiative (REDI) will receive $12 million over

three years to promote renewable energy systems for space heating and water heating and cooling. Businesses and corporations will be eligible for a contribution of 25% towards the purchase and installation cost of a qualifying system up to a maximum of $50,000.

An Office of Energy Efficiency (OEE) has also been established within Natural Resources Canada to (a) deliver the 16 existing energy efficiency programs, including regulations under the Energy Efficiency Act; (b) administer new budget measures totalling $48 million over three years; (c) table an annual report of the state of energy efficiency in Canada and organize an annual conference on energy efficiency; and (d) develop new measures to increase the impact and reach of NRCan's energy efficiency programs and activities, such as expanded regulations and labelling, and new marketing and information programs. The OEE maintains an Energy Efficiency Home Page at http://eebdee.NRCan.gc.ca.

It will be very difficult to achieve the ambitious targets that have been announced both political and technical viewpoints, particularly as emissions are still increasing. Because of gains in economic growth and population in the intervening period, Canada needs, in effect, to reduce its emissions about 21% below what they would have been otherwise in 2010, a formidable task. Much will depend upon the cooperation of industry and individual Canadians. To provide further public information the following Web Sites have also been established: Environment Canada's Green Lane at http://www.ec.gc.ca/climate/index.html; Natural Resources Canada's Global Climate Change Site at http://www.nrcan.gc.ca/gcc/cc-e.htm; and a site providing information on this subject across the government as a whole at Government of Canada Climate Change Site at http://Canada.gc.ca /cc/change.html/.

The fourth meeting of the Conference of the Parties will be held in Buenos Aires, Argentina, November 2-13, 1998.

New Energy Competition Act in Ontario

On June 9, 1998, the Ontario Government introduced the first reading of the Energy Competition Act into the Ontario Legislature signaling the end of the monopoly held by Ontario Hydro for the 92 years since its establishment in 1906. The plan is to split the utility into two corporations: the Ontario Electricity Generation Corporation, to run all of Ontario Hydro's power plants; and the Ontario Electric Services Corporation, to operate the grid, which will now be open to all suppliers. The services company would also compete for customers.

A third unit, the non-profit Independent Market Operator (IMO), would provide the mechanism for all competitors to supply the Ontario power grid. The IMO would have a market surveillance panel as well to restrict price fixing and other uncompetitive practices. In addition, the many municipal-level distributors throughout the Province would also be commercialized and required to compete for retail customers.

Most of the legislation will not take effect until 2000. The Bill allows for environmental controls with the existing Ontario Electricity Board (OEB) being able to require all suppliers to disclose emission levels including, those outside the province. Customers will therefore have the opportunity to buy energy from suppliers they perceive as benign even at a higher price. The new proposals were generally well received by both industry and environmental organizations.

With the current, relatively high level of economic growth, it may be expected that electricity demand will rise. This incremental demand will likely be met by the consumption of natural gas to generate energy, complicating a situation where the future status of several nuclear reactors is in doubt. The viability of the use of natural gas option depends critically on the future trend for natural gas prices, which are currently at the low end of the expected range. There have been press reports of several proposed large-scale co-generation and combined-cycle plants based on natural gas.

Many issues remain to be resolved, including the vexing problem of stranded assets arising largely from the nuclear program. Some observers expect some $20 billion will have to be absorbed by the Province's Treasury. Also, an open market system usually implies a trend to marginal cost pricing and it is unclear what the future marginal cost will be from natural-gas combined-cycle power plants installed in an era when greenhouse gases must be controlled.

Norsk Hydro Studies Power Plant Incorporating the Capture of CO_2

Norsk Hydro, the Norwegian energy, chemical and metals company, announced at a press conference on April 23, 1998, that it is considering building two major combined-cycle power installations based upon natural gas and incorporating the capture of carbon dioxide. In this proposal, natural gas would be reformed with steam, possibly autogenously by adding air, and the carbon dioxide separated in the normal way after shifting the reformed gases with more steam. The hydrogen resulting would then fuel a gas turbine operated in combined-cycle mode. The captured carbon dioxide would be used for Enhanced Oil Recovery (EOR) in the offshore Grane field and thus sequestered.

Two power plants, planned for the West Coast of the country in Rogaland and Hordaland, would have the capacity to produce 10-12 TWh per year, corresponding to about 10% of Norway's present annual generation. The only significant emission would be NO_X, which may now be controlled closely in modern gas turbine installations.

The Grane field, which is estimated to contain 191 million m^3 (1,200 million bbls) of heavy oil, lies about 180 km offshore in the Norwegian sector of the North Sea. The EOR proposal would require 4 to 5 million tonnes of carbon dioxide each year for 15 years. Preliminary estimates place the cost of this undertaking in the range of $US 1.1-1.3 billion, including the pipelines to deliver the carbon dioxide to the oil field. This interesting alternative, which results in the production of essentially emission-free electricity from natural gas and at the same time increases oil production, is the subject of a major feasibility study by the company. The natural gas would otherwise be subject to a carbon tax in Norway. (Abstracted from *Greenhouse Issues*, Number 36, May 1998.)

National Forum on Climate Change

Twenty-five Members of the Order of Canada, all non-climate specialists, participated in the sessions of the National Forum on Climate Change organized by The National Round Table on the Environment and the Economy (NRTEE) that began on February 16-17, 1998, and continued in Ottawa throughout the Spring. These distinguished Canadians, who were drawn from across the country and had no special interests to represent, were invited to hear presentations from a number of experts on the current state of the climate change field as an aid in reaching their own conclusions as to what should be done. The meeting was convened by Dr. Stuart Smith, Chair of the NRTEE and was Co-chaired by Elizabeth May of the Sierra Club and Dee Parkinson-Marcoux, formerly President of Gulf Heavy Oil of Gulf Canada Resources and currently President and CEO of Ensyn Energy in Calgary. The delegates were welcomed by the Hon. Christine Stewart, Minister of the Environment, and the Hon. Ralph Goodale, Minister of Natural Resources. In the late afternoon of the first day, they were also welcomed by the Prime Minister, the Rt. Hon. Jean Chrétien, who expressed pleasure at recent polling results that suggested fairly wide acceptance among the public of the recent commitments made by Canada at the December 1997 Third Conference of the Parties to the United Nations Framework Convention on Climate Change held in Kyoto, Japan. It is expected that these sessions will lead to a declaration concerning what other Canadians need to know about climate change from a group of respected and disinterested citizens.

Minister Stewart noted the events leading up to the Kyoto Meeting where Canada committed itself in formal terms to "reduce combined CO_2, CH_4 and N_2O emissions by 6% below 1990 levels and combined HFC, PFC and SF_6 emissions by 6% below 1995 levels between 2008 and 2012." Minister Goodale stated the policy of the government in terms of a number of principles including fairness in the sense that no one region or sector would be called upon to bear more that its share of the burden in meeting this stringent objective.

The first presentation was given by Dr. James P. Bruce, himself an Officer of the Order of Canada, who was responsible for the Canadian Climate Change Centre of Environment Canada and has now retired as Co-Chair of Working Group 3 of the Intergovernmental Panel on Climate Change (IPCC). Dr. Bruce reviewed the evolution of concern on climate matters from the last century to the present time, explaining in some detail how the IPCC arrived at its main conclusion that, although some uncertainties remain in the General Circulation Models regarding the

interpretation of variations of solar influx, the treatment of aerosols, and cloud cover, anthropogenic activities cause climatic change.

Dr. Gordon A. McBean of Environment Canada provided detailed information on the events leading up to and during the negotiation of the Kyoto Protocol. Roger B. Street, also of that Department, dealt with impacts of climate change since, whether the Kyoto Protocol limits are achieved or not, the world is committed to a measure of climate change already.

Questions about water are expected to be the major issue though many other aspects were covered in the 1997 *Canada Country Study*.

On the second day, Doug Miller, President of Environics International Ltd., reported on public attitudes to the protection of the environment and to the question of climate change in particular. He gave reasons to believe there would be increased public attention to this field in the coming years. Allan Howatson, Senior Research Associate of the Conference Board of Canada explained the purposes and limits of economic models and reported that a Climate Change Economic Analysis Forum had been established between his organization and the Canadian Energy Research Institute (CERI) of Calgary. Professor Mark Jaccard of Simon Fraser University explained the problem of meeting the Kyoto objective regionally in Canada and the merits of using economic instruments such as personal credit cards for energy consumption. Thomas d'Aquino, President and Chief Executive Officer of the Business Council on National Issues, criticized both the Kyoto Target and the process that led to it, stressing the possible damage to Canada's competitive position on world markets.

The Second Session was held on March 9-10, 1998. One day was devoted to Impacts on the Canadian Economy and Society. Presenters included: Carl Sonnen, President of Informetrica of Ottawa, who created some controversy by placing the cost of complying with the Kyoto target as $100 billion over 15 years with the burden falling as much on consumers as producers; Liseanne Forand, Director-General of the Canadian Council of Ministers of the Environment who elaborated the process to be followed by the two levels of government; Michael Cloghesy of the Centre Patronal de l'Environnement du Québec who stressed the need to rely on voluntary actions as much as possible; David Hallman, Coordinator of the Climate Change Program of the World Council of Churches who spoke on the moral dimension of this problem; R. Hornung, Director of the Climate Change Program of the Pembina Institute who noted the need to add "learning by doing" to the studies; David Manning, President of the Canadian Association of Petroleum Producers, who stated that Canadians want a joint cooperative approach to the problem; Dick Martin, Secretary-Treasurer of the Canadian Labour Congress, who called attention to the large number of one-industry towns in Canada and the need to help displaced workers; Mark Nantais of the Canadian Vehicle Manufacturer's Association, who reported that the considerable improvement in vehicle fuel economy of the past decades has been offset by the increasing number of vehicles and the greater distances now driven; Jeff Passmore, Executive Vice President, Renewable Energy, Iogen Corporation who discussed the importance of renewable energy in meeting the goals; and Sherri Torjman, Vice-President of the Caledon Institute of Social Policy, who spoke on the social dimensions and the effect on the poor.

The second day was devoted to Approaches to Compliance. The presenters were Louise Comeau, then Director of Energy and Atmosphere of the Sierra Club of Canada, who discussed the transformations needed in society, including the problem of overcoming the greater 'first' cost of most conservation measures as compared to their more favourable 'second' cost; Ian Burton, Scientist Emeritus of Environment Canada, who dealt with the problems and opportunities inherent in adaptation measures; Reid Morton, then President of Atomic Energy of Canada Ltd. mentioned the importance of nuclear power in dealing with this problem, especially in Asian countries, but also noted that the Canadian nuclear program had saved one billion tonnes of carbon dioxide emissions from its inception; George Weyerhauser Jr., President, Weyerhauser Canada Ltd. and also Chair of the Canadian Pulp and Paper Association Task Force on Climate Climate Change, who described the importance of biomass; and Carl Sonnen, making a second appearance, who touched on the unresolved problems in emissions trading, the recycling of energy taxes, and the importance of engaging legislators at all levels of government.

On April 5, 1998, the Members heard three speakers on the subject of climate modelling, and three others who dealt with community action on climate change. Prof. Richard S. Lindzen of MIT, well known as a skeptic on the subject of global climate change,

denied that there was a consensus in the scientific community. He complained of misrepresentation and oversimplification in the IPCC Report.

Prof. Danny Harvey of the University of Toronto strongly defended the idea that there was a consensus and stated that there was only a small minority of scientists who might be classed in the 'anti' group.

Dr. Ian Rutherford of the University of Victoria outlined the principles of the main models used and their limitations. The three speakers of the Community Action Group: Lois Corbett; Dan Leckie; and John Hachey, all dealt with the actions already taken and planned at the local level to cope with climate change.

The Members of the Order of Canada met on April 6-7 to draft their public statement. Although a few Members expressed doubts as to the interpretation of the science and the reliability of the models employed, all agreed in effect to the Precautionary Principle. The final Declaration was released on June 3, 1998, and called for urgent action by government, industry and individuals to reduce greenhouse gas emissions.

Local environmental efforts by ordinary citizens were considered important and the Members recommended that the government establish a National Atmospheric Fund modeled after the successful fund in Toronto that invests in energy-efficient and greenhouse gas reduction projects. A Summary of the Proceedings and the Declaration may be obtained from the National Round Table at 344 Slater St., Suite 200, Ottawa, Ontario, K1R 7Y3 (fax: (613) 992-7385).

Notes on Electric Vehicles

Although attention has focused on the hydrogen fuel cell to power vehicles, work has continued around the world on methanol-based homogeneous fuel cells notably at the University of California. Next year, the first such cell should reach commercial application, albeit at the micro scale, to replace batteries in cell phones, laptop computers and other such portable electronic equipment. Four such small cells will be linked together to provide about 50 times more energy than the standard batteries now in use. These will require periodic recharging with methanol and have an expected service life of about ten years. Two well-known figures in the US auto industry, Lee Iacocca (formerly with Chrysler Corporation) and Robert Sempel (formerly with GM) have joined forces with Stanford Ovshinsky, Chairman of Energy Conversion Devices, Inc., a developer of new battery technologies, to explore the production of electric two- and three-wheeled bicycles and other light vehicles. Mazda Motor Corporation of Japan announced on 8 April 1998 it will join a new alliance with Ford Motor Company, Daimler-Benz, and Ballard Power Systems of Burnaby, BC, to apply the latter's fuel cell technology for motor vehicles. Mazda is 33.4% owned by Ford and has developed a fuel-cell vehicle of its own, the Demio FCEV, using its own technology. The three companies together plan to invest about $700 million in this project. The German Postal Service plans to stop funding its experiment with vehicles propelled by zinc-air batteries. This was a cooperative project involving Daimler-Benz and Electric Fuel Corporation of Israel. Chrysler Corporation has announced it intends to produce battery-powered vans at its plant in Windsor, Ontario, starting in the Fall of 1998. The Toyoto Company has announced it will start sales of its Prius gasoline/battery hybrid car in the US by the end of 2000. This vehicle, first introduced in Japan at the Kyoto Conference in the Fall of 1997, reduces carbon dioxide emissions about one half and other emissions about 90%. The Honda Motor Company will offer electric-vehicle leases to consumers in New York in July of 1998. The EV Plus vehicle, which has been available in California since 1997, is equipped with a nickel-metal hydride battery to extend range. It is recharged by conventional conductive methods. The Bombardier Company has received notice of approval from the US National Highway Safety Administration which recognized its lead-acid battery-powered Neighbourhood Vehicle as in a new class. This electric vehicle, manufactured near Sherbrooke, Québec, will be restricted to low speed driving situations. It is marketed primarily to retirement communities in the US south.

Automotive Energy Use

The European Automobile Manufacturers Association has offered to raise the average fuel economy of new cars sold in Europe to 6 litres/100 km of gasoline within ten years as compared to the 7.13 litres/100 km at present. In the US, current regulations require an average fuel economy of 8.55 litres/100 km for cars and 11.36

litres/100 km for the light trucks category which includes sports utility vehicles and minivans.

Two US manufacturers — Ford and General Motors — are members of the European Association who have taken a different position in the US although General Motors has given some support to a modest increase in gasoline taxes in exchange for the repeal of mileage regulations in the latter country.

A new study by the US Environmental Protection Agency (EPA) made available in April 1998 indicates it will be difficult to meet existing Federal standards for ozone and other air pollutants without imposing further restrictions on emissions from cars. This is due to the steady growth in the number and distance each travels, and because of the continuing popularity of sports utility vehicles which operate under looser standards than conventional passenger cars. Under present US legislation, the EPA is to issue proposed standards at the end of 1998 and a final rule by the end of 1999 preparatory for their introduction in 2004.

The panel established by Federal and Provincial Ministers of the Environment has formulated three options for the control of sulphur levels in gasoline for the consideration of the public and later the two levels of government.

Option One is to do nothing until the United States sets its national standard. Canadian sulphur contents average about 360 parts per million (ppm) in gasoline with the level in Ontario currently around 553 ppm, one of the highest sulphur levels in the developed world.

Option 2 would set the standard at 150 ppm (about four times the current California requirement of 40 ppm).

In Option 3, the limit would be a stringent 30 ppm. Option 2 would have a start-up cost of $697 million and annual operating costs of $89 million. Savings were estimated at $5.4 billion over 20 years, with fewer deaths and many avoided health cases with respiratory and asthma symptoms. This option would lead to increased gasoline prices of about 0.5¢/litre at the pump.

Option 3 would require $1.8 billion in capital requirement with an annual operating cost of $119 million. Savings in health costs for this case are estimated at $7.2 billion over 20 years with correspondingly fewer people affected by these diseases.

Public input was invited until May 6, 1998, after which the final recommendations were presented to Environment Canada.

On February 2, 1998, President Clinton proposed a $US 3,000-4,000 tax credit for buyers of costly energy efficient cars with low emissions in his Budget submission to Congress.

The Nissan Company of Japan has announced it will increase its production of continuously variable transmissions (CVTs) with the object of decreasing carbon dioxide emissions some 20% by increasing fuel efficiency in the vehicles so equipped. The Renault Company of France will increase its production of natural gas- and LPG-fueled vehicles primarily to meet new air pollution standards. The Mitsubishi Motors Company of Japan has announced it will produce a gasoline direct- injection (GDI) engine that meets California's Ultra Low Vehicle Emission standards. The engine will probably be used first in a new sports utility vehicle to be introduced in 1999. Isuzu Motors Ltd. of Japan has announced it has begun selling a sports utility vehicle equipped with a direct-injection diesel engine. It is anticipated carbon dioxide emissions will be reduced 50% as compared to conventional gasoline engines and that nitrogen oxide emissions will be 35% less that with regular diesel engines. The new engine adds $US 722 to the cost of the vehicle.

The Canadian Vehicle Manufacturers Association has announced that low-emission cars, sport utility vehicles and light trucks will be sold in Canada by the 2001 model year. This action is in step with the introduction of vehicles under the National Low Emission Vehicle Program (NLEV) in the US that promises a reduction of about one-half in most of the common pollutants. Cooperation with the oil refining industry is required to produce fuels of the required standards, particularly those low in sulphur.

The Volvo Company has announced that its S80 model to be available in the Spring of 1999 will be equipped with a radiator coated with a catalytic compound developed by Engelhard Corporation of Iselin, New Jersey, to reduce ground-level ozone levels. The PremAir catalyst system works by converting some 75% of the ozone contained in the ambient air through which the car passes to regular oxygen. The extra cost is reported to be about $US 50. In effect, individual buyers are being given the opportunity to spend a little more for their cars to help produce cleaner air.

Some Useful Web Sites

The Home Energy Saver of Lawrence Berkeley Laboratory provides the means of quickly com-

puting a home's energy use on line at http://eande.lbl.gov/HES.

The Activities Implemented Jointly Program of the World Bank may be reached at http://www-esd.worldbank.org/cc/gci.html.

The US Environmental Protection Agency maintains an EnviroFacts Warehouse at http://www.epa.gov/emviro/index_java.html.

Information on World Oil Resources may be found at http://www.halcyon.com/duncanrc.

Information on carbon dioxide emissions may be obtained from the Carbon Dioxide Information Analysis Center of Oak Ridge National Laboratory at http://cdiac.esd.ornl .gov/

The Federal Panel on Energy R&D (PERD) has established a site at http://www.nrcan.gc.ca/es/new/oerd.htm.

The US Department of Energy has posted its current National Energy Strategy at http://www.hr.doe.gov/nes/cnes.html. Information on its Office of Fossil Energy may be reached at http://www.fe.doe.gov and its new Clean Coal Technology Web Site is at http://www.lanl.gov/ projects/cctc/.

New Reports

Work in Energy Analysis at Lawrence Berkeley National Laboratory

The Environmental Energy Technologies Division of the Lawrence Berkeley National Laboratory, operated by the University of California for the US Department of Energy, has issued a report on 'Current Work in Energy Analysis.' The current efforts of the Energy Analysis Department with its staff of about 100 is reported under the following headings: Global Environment, including a section on co-operation with China, India and some other countries: Policy dealing with Voluntary Government Programs; Energy Efficiency Standards for lighting and appliances; Electricity Markets and Policy; and Mitigation of Heat Islands. Other sections deal with buildings and industrial and transportation energy analysis and policy. Short notes are included on a wide range of activities in this field with sections on the steel and pulp and paper industries of interest to Canada.

Many of the initiatives to improve the energy efficiency of US government installations that were announced by President Clinton in July 1998 can be traced to the work of this laboratory.

This group, along with Oak Ridge National Laboratory, led the five-laboratory study entitled *Scenarios of US Carbon Reductions: Potential Impacts of Energy Technologies by 2010 and Beyond* (1997), which played a role in setting the US position for the Kyoto Conference in December of that year. This important 51-page report, catalogued as LBNL-41073 and dated March, may be downloaded at http://eetd.lbl.gov/EE.html. It is distributed by the National Technical Information Service of the US Department of Commerce, 5285 Port Royal Road, Springfield, Virginia, US 22161.

Report on Nuclear Fuel Waste Management and Disposal Concept

In 1978, the governments of Canada and Ontario directed Atomic Energy of Canada Limited (AECL) to develop the concept of deep geological disposal of nuclear fuel wastes. It was subsequently announced that the disposal site selection would not begin until there had been a full federal public hearing and approval of the concept by the two governments.

In September of 1988, the Minister of the (then) Department of Energy, Mines and Resources, under the federal Environmental Assessment and Review Process Guidelines Order, referred the concept, along with a broad range of nuclear fuel waste management issues, for public review. On October 4, 1989, the federal Minister of the Environment appointed the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel to conduct this review and related hearings. The Panel was chaired by Blair Seaborne, a former Deputy Minister of the Environment. The review procedure took nearly a decade and cost about $7 million.

The report of the Panel, which was released on March 13, 1998, under the title *Nuclear Fuel Waste Management and Disposal Concept* and runs to 83 pages, is organized with the following headings: Executive Summary; Outline of the Review Process; The Natural of the Problem; The AECL Concept; Criteria for Safety and Acceptability; Safety and Acceptability of the AECL Concept; Future Steps; and Matters Outside the Mandate. The 17 appendices provide a wide range of useful background material. The dimensions of the problem may be stated in this way: Canada has 22 nuclear reactors that produce about 85,000 spent fuel bundles a year. This waste is now stored temporarily in specially designed pools of water and in concrete canisters. More than 1.3 million spent fuel bundles have now accumulated, and there will

be about 3.6 million bundles to store in another 35 years.

The Panel concluded that the proposal developed by AECL since 1978 for geological disposal 500 to 1,000 metres deep in plutonic rocks was technically sound but would not be supported by the public at large. In this sense, the Panel has in effect transferred the problem back to the government. It did recommend, however, that a Nuclear Fuel Waste Management Agency (NFWMA) be established as soon as possible at arm's length from both the utilities and AECL, and that the proposed new agency should conduct broad public consultations in the development of its plans.

The Nuclear Fuel Waste Management and Disposal Concept Report dated February 1998 and catalogued as ISBN 0-662-26470-3, may be obtained on the Web at http://www.ceaa.gc.ca or from the Canadian Environmental Assessment Agency, 200 Sacré-Coeur Boulevard, Hull, Québec, K1A 0H3 (Fax: (819) 997-4931).

Special Report on Oil in Scientific American

Four papers have appeared under the rubric Preventing the Next Oil Crunch in the March 1998 issue of the *Scientific American* Vol. 278 No.3, Colin J. Campbell and Jean Laherrère in 'The End of Cheap Oil' take the position the decline in world production of oil from conventional sources will begin before 2010 when about one-half the original endowment will have been consumed. These findings are based upon the performance history of 40,000 oil wells in 18,000 fields in 65 oil-producing countries. In their view, world oil reserves have been overstated and only about 150 giga barrels (GB) remain to be discovered. Furthermore, these authors believe the world is now finding only about 6 GB of conventional oil a year at present, whereas annual consumption has now passed the 24 GB mark. Cumulative production to the end of 1997 is 807 GB, with reserves stated as 850 GB: the original endowment was thus about 1,800 GB. The consequence, in their view, is that the world will have to turn to more expensive heavy oils, oil sands, and other non-conventional sources and substitutes in the near future. Further information as well as the availability of the book by C.J. Campbell, entitled *The Coming Oil Crisis*, may be found at the Web Site of the Geneva firm of Petroconsultants, at http://www.petroconsultants.com/.

Richard L. George of Suncor Energy, Fort McMurray, provided a short history and overview of the oil sands mining industry of Alberta in 'Mining for Oil.' His company, with partners, is also currently investigating the mining of oil shales of Australia. These non-conventional sources, along with the heavy oils of Venezuela and some other countries, provide a major supply option for the future.

Roger N. Anderson, Director of Petroleum Technology Research at Columbia University in Oil Production in the 21st Century, reviewed recent innovations in underground imaging, steerable drilling, and deepwater oil production that are leading to significant additional production around the world.

Safaa A. Fouda, of the CANMET research arm of Natural Resources Canada, in 'Liquid Fuels from Natural Gas' reviewed the increasing progress in this field. Natural gas is more plentiful than oil and significant quantities are sometimes found at stranded locations where local markets are too small. Converting natural gas to the more readily transportable liquid fuels of very low sulphur content is thus an important option. This practice is already the basis of the important methanol industry and operating facilities convert natural gas directly to petroleum products in South Africa (other facilities have run in the past in New Zealand via methanol as an intermediate and presently in Malaysia).

Recent Publications by the IAEE

The Winter 1998 *Newsletter* of the International Association for Energy Economics contains another paper in the series *World Oil Supply* organized by Peter Davies of British Petroleum plc. The paper by Suhail A. Khan, entitled 'APERTURA — The Opening of Venezuelan Petroleum Sector: New Investment Opportunities' describes the changes in progress in that country's fossil fuel oil industry. Other papers of interest include: 'China Petroleum — A Sense of History in the Making' by Paul Tempest; 'It's Time to Lift Trade Barriers with China: Participating in China's Nuclear Program is in the Best Interest of the United States' by Bob Ebel; 'Energy in Central and Eastern Europe: Progress and Challenges' by Guy Caruso and Erich Unterwurzacher; 'An Outlook on the Supply of Oil' by Ferdinand E. Banks; 'Oil Depletion in Islamic Fundamentalist Economic Thinking: The Future Trend?' by Mamdouh G. Salameh; and '1998 — The Restructuring Process Unfolds' by Fereidoon P. Sioshansi, which deals with the restructuring of the electrical industry beginning in California and other States.

The Volume 19, Number 1, 1998, issue of the *Energy Journal*

of the IAEE is dedicated to 'The Potential for Use of Modern Asset Pricing Methods for Upstream Petroleum Project Evaluation' as an alternative to the discounted cash-flow (DCF) financial analysis techniques now widely used. Many believe the DCF approach applied in the oil-producing industry: (1) underestimates the relative value of long-term reserves; (2) is biased toward building too much productive capacity, which leads to inefficiencies once decline sets in; (3) undervalues future costs so that, for example, there is a bias against using higher-quality equipment to lower maintenance costs; (4) does not have the ability to evaluate unique risk profiles presented by similar projects subject to different fiscal regimes; and (5) does not value the flexibility inherent, for example, in the phased development of a potential megaproject when contrasted with the economics of scale offered by a single- phase, large-scale approach.

The application of Modern Asset Pricing (MAP) to the financial analysis of energy projects was proposed by David G. Laughton (now at the Faculty of Business and School of Mining and Petroleum Engineering at the University of Alberta) and Henry Jacoby (MIT) in 1992 to overcome some of these disadvantages. This special issue, after 'Introductory and Concluding Remarks' by David G. Laughton, includes four papers: 'Implications of Output Price Risk and Operating Leverage for the Evaluation of Petroleum Development Projects' by Gordon Salahor; 'On the Use of Modern Asset Pricing for Comparing Alternative Royalty Systems for Petroleum Development Projects' by Paul Bradley; 'The Management of Flexibility in the Upstream Petroleum Industry' by David G. Laughton; and 'Alternative Models of Uncertain Commodity Prices for Use with Modern Asset Pricing Methods' by Malcom Baker, Scott Mayfield and John Parsons. A paper titled 'Valuing Management Flexibility: A Basis to Compare the Standard DCF and MAP Valuation Frameworks' by M. Samis and R. Poulin, as applied to the mining industry, appeared in the *CIM Bulletin*, Vol. 91 No. 1019 (April) 1998.

Volume 19, Number 2, of the *Energy Journal* (April, 1998) contains the 'Proceedings' of The Lennart Lundberg International Symposium on Global Power Generation in the 21st Century held in Stockholm in October 1997. These papers give a broader perspective of the changes in this industry than is usual. Contributors include Marian Radetzki on 'The Critical Choices'; Nathan Rosenberg on 'The Role of Electricity in Industrial Development'; Paul L. Joskow on 'Electrical Sectors in Transition'; Ulf Hansen on 'Technological Options for Power Generation'; Kenichi Matsui on 'Global Demand for Power Generation, Input Choices and Supply Security;' Thomas C. Schelling on 'The Environmental Challenges of Power Generation;' notes by Denny Ellerman on 'The Seemingly Indefinite Extension of Power Plant Lives;' Bo Källstrand on 'Information Technology and Efficiency of Deregulated Electricity;' and comments by F. Ailleret, D. Jefferies, J. Blom, T. Gerholm and D. Finon.

The IAEE *Newsletter* for the Second Quarter of 1998 focuses on the implications of the Kyoto Protocol agreed in November of 1997. The papers include 'The Kyoto Protocol and its Implications for Energy' by Richard Baron and Lee Solsbery of the staff of the International Energy Agency; 'The Fruits from Kyoto for the Sustainable Energy Business' by Paul E. Metz; 'The Clean Development Mechanisms: Some Developing County Perspectives' by R.K. Pachauri; and a report by David Jones on a conference convened by The Royal Institute of International Affairs on the subject 'Climate after Kyoto: Implications for Energy' held in London February 5-6, 1998. Other papers of interest include reports on the activities of the Italian Association of Energy Economists and on Finnish energy policy; and papers by Perry Sioshansi entitled 'New Shape of Things: From Regional Utilities to National Energy Companies,' and Edgardo Curcio on 'The Energy Sector: Towards New Scenarios/Dimensions.'

The IAEE also published a Special Issue of the *Energy Journal* in early 1998, with nine papers devoted to the subject of 'Distributed Resources: Towards a New Paradigm of the Electricity Business,' a subject of increasing interest to those who follow the rapid developments in the electricity field.

Statistics Canada Econnections Electronic Report

In February 1998, Statistics Canada released a CD-ROM entitled *Econnections 1997* that offers summary indicators that track progress toward sustainable development and which contains detailed environmental and economic information focusing on the connection between the environment and the economy. These indicators are grouped under the following themes: natural resource stocks; use of land resources, consumption of materials and energy; waste production; and expenditures for environmental protection. Three green-

house gases—carbon dioxide, methane, and nitrous oxide—are combined into a single indicator of emissions per $1,000 of household income. In the near future, another CD-ROM, entitled *Databases for Environmental Analysis*, will be available. These may be obtained from Statistics Canada, Ottawa, Ontario, K1A 0T6 (e-mail: order@statcan.ca).

Note on Climate Change by Sir Robert May

On the occasion of a presentation entitled 'Science and the Climate Change Agenda Post-Kyoto' to the National Research Council in Ottawa on April 28, 1998, Sir Robert May, Chief Science Adviser to the UK Government, tabled a 'Note on Climate Change,' which sets out his personal views on this subject of increasing importance, including possible effects on ocean currents. Dated September 1997, this 'Note' of just 12 pages, presumably based upon a high-level internal briefing document, is a model of both completeness and succinctness in the way it covers this subject with its many uncertainties. A few copies are in the possession of J.H. Walsh (e-mail: dwalsh@magi.com). Sir Robert stressed the long-term nature of this problem in his remarks to the NRC audience and viewed the Kyoto Protocol, signed by the Minister of the Environment, the Hon. Christine Stewart, on behalf of Canada on April 29, 1998, as an encouraging first step. He also referred to the growing acceptance of the need for action among several senior British companies, some of whom anticipate commercial opportunities in dealing with this problem, and for more involvement of the public at large. For the latter reason, the government of the UK is preparing to launch a £1.7 million publicity campaign in the near future to reach as many people as possible.

New Publications from the Oxford Institute for Energy Studies

The Oxford Institute for Energy Studies has published the following new reports: 'The Oil Price Crisis of 1998' by Robert Mabro; 'The New Governance of Venezuelan Oil' by Bernard Mommer; 'Why Carbon Dioxide Emissions Differ in China, Korea and Japan' by Hyun-Sik Chung; 'Is More Information Always Better? The Effect of Information on the Validity of Contingent Valuation' by Benito Müller; 'A Comparison of the US and European Auto/Oil Programmes' by Sarah Legge; 'The Petrobras Monopoly and the Regulation of Oil Prices in Brazil' by Fabio Brandio; and 'Financial Risks and Rewards in LNG Projects: Qatar, Oman and Yemen' by Ulrich Bartsch. Copies of these papers may be obtained from the Institute at 57 Woodstock Road, Oxford OX2 6FA UK (fax: (44) 1865 310527).

Annual Report of the NEB

The *Annual Report* of the National Energy Board was tabled in Parliament by the Hon. Ralph Goodale, Minister of Natural Resources, on May 6, 1998. The Board reports that crude oil production set a record of 328,000 m^3 (2.1 million bbls) per day in 1997, surpassing the 1996 record. Most of the increase came from the greater production of heavy crude and bitumen though the production of the lighter grades remained stable. Crude oil exports increased to 188,200 m^3 (1.19 million bbls) per day. Natural gas production was about at 1996 levels, while exports reached 82.3 billion m^3 (2.91 trillion ft^3) in 1997, up 2% from 1996. Natural gas, petroleum and electricity exports generated $24 billion in gross export revenue, or $12 billion on a net basis illustrating the importance of Canada as a major energy trading nation.

The *Report*, in addition to the usual review of the major regulatory activities, provides an overview of energy consumption, production, exports and imports over the last five years. It also notes some of the highlights of 1997, including: the start of production from the Hibernia oil field off Newfoundland; approval of the Sable Island Gas project to develop natural gas fields off the coast of Nova Scotia, and the related pipelines to carry this gas to markets in the US through New Brunswick; and the approval of the reversal of Interprovincial Pipe Lines Inc.'s Line 9 to allow imported oil to flow from Montreal to Sarnia (see following note).

Separately, the Board has also announced its intention to make a decision of declaration of 'significant discovery,' in accordance with the Canadian Petroleum Resources Act, with respect to an application from Imperial Oil Resources Limited regarding the South Nipterk structure in the Beaufort Sea. This action is based upon the results of an exploration well drilled in 1998 by the company's predecessor, Esso Resources Limited. Subsequently, there may be a declaration of 'commercial discovery,' which enables the interest holder to apply to the responsible minister for a Production Licence that conveys title to the produced oil and gas. Copies of the *Annual Report* may be downloaded from the National Energy Board's web site at http://www.neb.gc.ca. Copies of

the *Report on the Application for Significant Discovery* may be obtained from the Publications Office at 444 - Seventh Avenue SW, Calgary, Alberta, T2P 0X8 (fax: (403) 292-5503).

Report *of the Commissioner of the Environment and Sustainable Development*

Brian Emmett, the Commissioner of the Environment and Sustainable Development released his report on May 26, 1998. The Commissioner reports directly to Parliament from the Office of the Auditor General of Canada and is thus independent of the government. Volume 1 of the *Report* (bilingual) is subtitled 'Commissioner's Observations — 1998' (Foreword and Main Points); Vol.2 consists of Chapter 2 subtitled 'Greening the Government of Canada — Strategies for Sustainable Development;' Vol.3 'Global Challenges (encompassing Chapter 2 'Working Globally — Canada's International Environmental Commitments;' Chapter 3 'Responding to Climate Change — Time to Rethink Canada's Implementation Strategy;' and Chapter 4, 'Canada 's Biodiversity Clock is Ticking'); and Vol. 4 subtitled 'Managing for Sustainable Development' (encompassing Chapter 5 'Expanding Horizons — A Strategic Approach to Sustainable Development;' Chapter 6 'Environmental Assessment — A Critical Tool for Sustainable Development;' Chapter 7: 'Counting the Environment In;' and Chapter 8 'Performance Measurement for Sustainable Development Strategies'). The major issues raised concerned Canada's ability to meet its targets for the reduction of greenhouse gases agreed upon in the Kyoto Protocol negotiated in December 1997, and the increasing threat to the diversity of species.

The *Report* is of special interest to those concerned with the management of environmental problems and the implementation of activities for sustainable development. The Commissioner believes the Federal Government is failing to meet its policy commitments because it is paying too little attention to the management side of the sustainable development equation. Nevertheless, innovative steps have been taken to deal with this government-wide problem. Amendments to the Auditor General Act require all the departments of government to prepare strategies to turn the concept of sustainable development into concrete action through their policies, programs and day-to-day operations. These individual strategies may be found on the above web site. It is progress on this aspect that is the principal focus of the report. The two main weaknesses found to date are: 1) that almost all departments have failed to establish clear and measurable targets, and 2) many of the strategies devised to date appear to represent less a commitment to change in order to promote sustainable development than a restatement of the status quo.

The individual auditors involved were identified in each of the chapters and may be contacted on specific points. The report also notes progress in this field in some major companies and certain other countries and is thus of value to those concerned with development of sustainable development in other organizations.

Copies of this report may be obtained in either official language from the Office of the Auditor General of Canada, 240 Sparks Street, Ottawa, Ontario K1A 0G6 (fax: (613) 941-8286; e-mail: green-report@oag-bvg.gc.ca; web site: http://www.oag-bvg.gc.ca).

Extreme Weather and Climate Change

Environment Canada released a further report in its Climate Change Digest Series *entitled Extreme Weather and Climate Change* by David Francis and Henry Hengeveld in July 1998. This document, catalogued as ISBN 0-662-26849-0 and published in bilingual format (31 pages in English, including bibliography), was prepared to address the frequently asked question as to whether perceived changes in weather behaviour in recent years are linked to climate change. This report deals carefully with this issue under the following headings: 'Is Extreme Weather Becoming More Common?;' 'Natural Variability; Greenhouse Warming and Weather Extremes;' 'Implications of an Increase in Weather Extremes;' 'Responses;' and 'Drawing Conclusions.' Separate short box sections deal with 'What is Extreme Weather;' 'El Niños and Climate Change;' 'Flooding in Canada;' 'The 1998 Ice Storm;' and the 'Possibility of Surprises.' The conclusions are cautious suggesting a firm answer may still be another decade or so away, but it is evident that these authors believe the link will emerge. This report is useful in that it provides detailed documentation concerning this unresolved possibility in a Canadian context.

Environment Canada has also released another issue of the *Carbon Dioxide Climate Report* dated Spring 1998 (Issue 98-1 with 41 pages). Over 700 references are listed for 1996 and are discussed under the following headings: 'Changes in Atmospheric Concentrations;' 'Radiative Forcing;'

'Climate Modelling;' 'Climate Trends;' 'Impacts of Carbon Dioxide Increase;' and 'Policy Response.' Copies of both reports may be obtained from the Canadian Climate Centre of the Atmospheric Environment Service, Environment Canada, 4905 Dufferin Street, Downsview, Ontario, M3H 5T4 (tel: (416) 739-4382 or 739-4432).

Special Issue of Energy Policy

The April 1998 (Vol. 26, No. 5) issue of the British Journal *Energy Policy* was devoted to Climate Strategy for the US : `Bottom-Up' Analysis of Carbon Dioxide Reduction Cost and Benefit. Seven papers dealt with various aspects of this subject notably 'The Energy Efficiency Paradox – Bureaucratization and Organizational Barriers to Profitable Energy-Savings Investments' by Stephen J. DeCanio of the Department of Economics at the University of California, Santa Barbara. Prof. DeCanio argues existing economic models do not explain the actions of organizations in this field adequately and that there is a need for improved and more comprehensive theories of investment behaviour.

Short Notes

• A US Federal Appeals Court has struck down legislation passed by New York State in 1993 that would have required at least 2% of the vehicles sold to meet zero-emission standards beginning with the 1998 model year. California has delayed this requirement, which apparently still stands in that State, until 2003.

• The World Energy Council has appointed Mr. Gerald Doucet its new Secretary- General succeeding the late Ian Lindsay at its Headquarters in London. Mr. Doucet, previously President and CEO of the Canadian Gas Association, is the first Canadian to hold this post. This year, the 17th World Energy Congress, scheduled every three years, was held in Houston, Texas, September 13-18, 1998. The Canadian Pavilion at this event was hosted by Dr. E.P. Cockshutt (E-Mail: cockshut @netcom.ca).

• Suncor Energy, operator of a large oil sands plant in Alberta that it plans to expand, has made the first international emissions trading arrangement since the signing of the Kyoto Protocol of December 1997. In its agreement with Niagara Mohawk Power Company of Syracuse, New York, Suncor will purchase the rights to emit 100,000 tonnes of greenhouse gases, at first with an option to purchase rights over a decade totaling 10 million tonnes at a cost of $10 million. Niagara Mohawk has already sold credits for 2.5 million tonnes of carbon dioxide emissions to Arizona Public Service Company. Suncor stated that its emissions will decline 32% between 1990 and 2000 per unit of production, but with the planned increase of 64% in total output, emissions will increase by 12% over the same period.

• On January 15, 1998, the Canada-Newfoundland Offshore Board approved the development plan for the Terra Nova oil field subject to a number of conditions including relocating some of the engineering work to this province. Located 350 kms southwest of St. John's, this field is expected to produce about 63.6 million m^3 (400 million bbls) of light sweet crude using a floating production system.

Petro-Canada leads the six-company consortium formed to exploit this field, which was discovered in 1984. An agreement to proceed was announced with the Province of Newfoundland on February 17, 1998, despite current low prices for oil. The nearby Whiterose field may also be developed. In the spring of 1998 there were reports in the press suggesting other substantial discoveries had been made.

• The National Energy Board held the first round of public consultations preparatory for its report on Canadian Energy Supply and Demand 1998-2025 to be released in 1999. The assumptions and issues to be addressed in the ensuing analysis were considered in a series of informal workshops held in Calgary, Halifax, Montreal, Ottawa, Toronto and Vancouver during April 1998. The second round of consultations are scheduled for the late Fall of 1998 to hear comments on the preliminary results of this study of supply and demand, one of a series issued by the Board over the years. The National Energy Board has mounted a preparatory consultation package on its Website at http:// www.neb.gc. ca. The Consultation Package is also available in hard copy form from Kelly Bordian, Project Manager of the Supply and Demand Project for the Board at 444 Seventh Avenue S.W., Calgary, Alberta T2P 0X8 (Fax: (403) 292-5503). The Package contains sections on the modelling framework, macro economic assumptions, energy price assumptions, energy demand, electricity and coal, oil resources and supply costs, gas resources and supply costs, renewable fuels, environmental considerations, proposed major cases, and the format of results. It is interesting that one of the tables indicates some 68% of ultimate recoverable resources of conven-

tional light oil from the Western Canada Sedimentary Basin has already been produced. The NEB will present its results within the format of two broad cases: one centred on High Technology Supply and the other on High Technology Demand, but there will be number of scenarios evaluated within this framework. The final Report and its appendices are expected to be mounted at the Web Site in June of 1999.

• The Norwegian Company Statoil, the operators of the first major carbon dioxide sequestration scheme at the Sleipner West off-shore natural gas field, have agreed to the formation of an international program to monitor the performance of this pioneering facility. The Greenhouse Gas R & D Programme of the International Energy Agency will work with Statoil to establish and manage this activity. The aim is to confirm that storage of carbon dioxide in an aquifer is a safe and reliable mitigation option and to supply data to validate reservoir simulation models for planning future such facilities.

• A noteworthy article entitled 'Projecting Crude Oil Prices' by Walter Seducks has appeared in the February 1998 issue of *CHEMTECH* (Vol. 28, No. 2) published by the American Chemical Society.

• Imperial Oil Limited reports net production from its heavy oil operations at Cold Lake, Alberta, averaged 17,170 m^3 (108,000 bbls) a day in 1997 up more than 45% from 1996 reflecting completion of Phases 9 and 10 of the steady expansion at this large field. The company has applied to increase production by a further 4,800 m^3 (30,000 bbls) a day but this stage may be delayed due to the current low price of oil.

• IPL Energy Inc. reports that the reversal of its 76 cm. (30") diameter Line 9 which extends 834 km (517 mi.) between Sarnia and Montreal will be completed in the second half of 1998. The National Energy Board approved the facilities for this project on December 18, 1997 which involves the investment of about $90 million by the company. Four refiners are expected to import oil though Portland, Maine, using existing pipeline facilities to Montreal and then through the reversed Line 9 to Ontario. The capacity is expected to increase from 25,400 cubic metres (160,000 bbls) per day initially to 38,200 m^3 (240,000 bbls) per day in 1999.

• Petro-Canada reported it expects its 20% share in the Hibernia field off Newfoundland, which began production late last year to average between 1,900 and 2,385 m^3 (12,000 and 15,000 bbls) of oil per day in 1998 and 4,293 (27,000 bbls) per day in 1999. One well alone at the Hibernia platform is producing 6,360-7,150 m^3 (40,000-45,000 bbls) a day of light crude, which is almost twice that of any other well in Canada's oil history. The company also noted progress in the preparations for the development of the nearby Terra Nova field, and accelerated exploration activities in the same waters.

• A short article by Robert F. Service in the US journal *Science* Vol. 280 (April 24) 1998, p. 525 describes the recent progress made by Catalytica Advanced Technologies of Mountain View, California, in the direct oxidation of methane (natural gas) to methanol. A modified platinum catalyst has been found that permits the conversion of 70% of the feed methane to the intermediate product methyl bisulphate. This intermediate may be transformed in turn to methanol. The successful development of such a process would help the exploitation of 'stranded' gas resources in many parts of the world if it proved more economic than the present energy-intensive reforming route.

• TransAlta Corporation reports it expects to exceed its voluntary goal of returning to the atmosphere its net contribution of greenhouse gases to 1990 levels in the year 2000 despite its heavy reliance on coal for the generation of electricity. It is reducing emissions by increasing efficiency in generation and through offset projects that reduce or permanently store greenhouse gases. One project encourages farmers in Saskatchewan to alter farming practices to retain carbon in the soil. This project will result in emissions to the atmosphere of at least 11 million tonnes of carbon dioxide over its 12-to-15 year life span.

• There is an interesting article on the reconstructed Mitte power plant in Berlin in the March 1998 issue of IEEE journal *Spectrum* (Vol. 35 No. 3). This plant, which began service in September of 1997, supplies a large area of the rebuilt city with electricity, district heating and air conditioning. Each of the two gas turbines has an electrical capacity of 139 MW and the steam turbine is rated at 108 MW(e). The thermal capacity is 373 MW which may be augmented by natural gas-fired boilers. Though such installations exist in a number of cities around the world, the new Berlin facility, according to the authors of the article, "represents a milestone in efforts to integrate the most advanced energy planning with the best approaches in contemporary urban design."

• Three agreements in the international Climate Technology Initiative were signed at the Conference of the Parties to the UN Framework Convention on Climate Change, held in Kyoto in

December of 1997, which involve ten countries and five international organizations. Canada and the US will lead the geological sequestration project which has a budget of about $US four million over five years. The initial activity concentrates on assessing the feasibility of sequestering carbon dioxide in deep unmineable coal seams so displacing the methane associated with the coal. A single test well is planned in Alberta with the Alberta Research Council serving as the Operating Agent. Other projects are contemplated including sequestration in deep saline aquifers, depleted oil and gas reservoirs, and in other locations.

The Board of Management of the CTI met in Paris in February 1998 and agreed a new structure for this initiative. There will be three broad areas of activity: capacity building; technology assessment, analysis, and strategy; and research and development. Working Groups will be established for each field replacing the existing Task Forces.

The Working Group on Capacity Building aims to enhance national capacities to diffuse climate-friendly technology and practices; The Working Group on Technology Assessment will seek to assess and analyze technology needs and ultimately to develop a strategy for accelerated diffusion of technology; and the Working Group on R and D will concentrate on projects with high potential impact. It is intended to collaborate with existing bilateral and multilateral agreements.

The Climate Technology Initiative has its Web Site at http://www.climatetech.org.

• Jorge Sarmiento and his colleagues at Princeton University reported in the 22 May 1998 issue of the British Journal *Nature* that higher global temperatures may hinder the ability of the oceans to absorb carbon dioxide from the atmosphere, its ultimate destination. If so, this effect would amplify the greenhouse gas problem though it is possible marine life might change to increase absorption in compensation.

• The Carbon Dioxide Information Analysis Center at the Oak Ridge National Laboratory has extended and updated its database of emissions from fossil-fuel combustion and cement production with historical emissions for each year on a global basis through to 1995.

• Costa Rica is to set aside 530,000 ha (1.25 million acres) of forests as a carbon sink. Credits will be sold to other countries to aid in meeting their targets for the reduction of greenhouse gases. These credits will be certified by a well-known independent inspection organization.

• According to *The New York Times* of March 1, 1998, Americans spend about $US 3.5 billion each year to power their electronic devices such as TVs and VCRs. Some one billion dollars of this sum is spent to power equipment not in use but in standby mode. Such standby power losses amount to about 5% of the average electric bill, and, according to the Environmental Protection Agency, are equivalent to the output of six average-size power plants.

• The UN World Meteorological Organization confirmed in January 1998 that 1997 was the warmest year on record due in part to the strong continuing El Niño phenomenon in the Pacific Ocean. The estimated average surface temperature worldwide in 1997 was 0.44°C higher than the 1961-90 average of 16.5°C. Preliminary results indicate the first half of 1998 was the warmest ever in some countries including Canada.

• In a paper published in the 23 April 1998 issue of the British journal *Nature*, Professor Michael Mann and his colleagues at the University of Massachusetts have reconstructed the world's average temperature back to 1400. Their findings reveal that 1990, 1995 and 1997 were the warmest years during that long period. When land and ocean temperatures were combined, 1997 and 1995 were about one-half degree C above the average for the 20th Century. These authors ascribe these warmer temperatures to evidence of the greenhouse effect.

• At the urging of the State of New York, the Long Island Lighting Company announced it would stop selling pollution credits earned by cleaning its own smokestacks to utilities in the Midwest and South. This action was taken because the prevailing wind direction causes the pollutants released in those regions to return over the State. Although the marketplace established for the trading of sulphur emissions in the US has generally been found effective in reducing the costs of reducing pollution and is being considered as a model for dealing with the trading of carbon dioxide emissions among nations, it may not help those immediately downwind.

• In a report issued May 12, 1998, the Ontario Medical Association ascribed 1,800 deaths per year in Southern Ontario to poor air quality. The Association claims the evidence is now 'incontrovertible' and calls for decreases in the allowable sulphur content of gasoline and other remedial measures to reduce emissions from power stations. The air quality is worse in Windsor due to its proximity to the US, the source of about half the aver-

age air pollution in eastern Canada.

• On March 9, 1998, the governments of Newfoundland and Québec announced an understanding for the further development of the hydroelectric power potential of Labrador. It is planned to increase the capacity of the existing Churchill Falls development by the installation of two more turbines with the water supply augmented by diversions of rivers in Québec, and for new generating facilities at Gull Island on the Lower Churchill and Muskrat Rivers for a total additional capacity of 2.2 GW. New transmission lines will be built in two directions: to the west to Québec transmission system and to the southeast to the Island of Newfoundland. To reach the latter market, an under underwater crossing of the Strait of Belle Isle will be required for the distance of some 25 km.

The overall cost of the project is placed in the range $10-12 billion and financing will be difficult for the smaller province. It is clear Newfoundland anticipates some help from the Federal government perhaps in exchange for organizing greenhouse gas credits from fossil fuel producers.

The Innu of Labrador have protested this new project and disrupted the announcement ceremonies.

• Atomic Energy of Canada Ltd., leader of a consortium to continue work on the second CANDU reactor at Cernavoda in Romania, reports it has arranged $200 million in interim financing to allow this project to proceed. A further long-term arrangement to complete the financing of this reactor is expected within the nine-month term of the present agreement.

Update *is prepared by John Walsh, Ottawa, Canada. He can be contacted at (613) 745-6279, or by visiting his Web site at http:// infoweb.magi.com/~dwalsh/jhw .html*