Update

16th Congress of the World Energy Council

Following the theme 'Energy for our Common World—What Will the Future Ask of Us?,' the World Energy Council (WEC) held its 16th Congress in Tokyo, October 8-13, 1995, with some 5000 participants. The WEC, formed in 1924, is a non-governmental, non-sectoral, and non-commercial organization that draws its membership from 100 countries, which together consume over 90% of the world's energy. The WEC's objective is to promote sustainable supply and use of energy for peaceful purposes for the greatest benefit of all. The WEC convenes a Congress every three years and conducts a continuing program of studies, including surveys of energy resources, preparation of energy data profiles for each member country, and forecasts of energy supply and demand.

The main body of the program dealt with these four main themes: 1) energy in its relationship to economic development; 2) sustainable supply for the future; 3) more efficient use of energy; and 4) improved protection of the environment. The Congress took place in 13 sessions at which 245 papers from 90 countries, including nine from Canada, were presented.

The Congress commenced with four keynote addresses on the principal themes. Major addresses were also presented by energy experts from Britain, France, Japan, US, and Zambia dealing with managing energy systems for the 21st century and the geopolitics of energy in a world in transition. There were also two special addresses presenting views on the climate change question and on total energy industry quality control.

Topics of the Round Table discussions, which are an important feature of WEC Congresses, ranged from 'Balancing government regulation and market forces' to 'Asia/Pacific energy development;' and from 'Financing energy development' and 'Transport and the environment' to 'Energy and environmental development—a retrospective from 2100.' The collected summaries of papers prepared for the Working Group and Round Table Sessions have been published in both hard-copy and CD-ROM format.

The continuing achievements of the WEC since the last meeting in 1992 were reviewed in eight Working Group Sessions. These topics included: economic instruments and economic goals; privatization of the electricity supply industry; energy transition in central and eastern Europe; and global energy perspectives to 2050.

One notable paper presented to the environmental sessions dealt with acid precipitation, which is caused by the combustion of fossil fuels and by industries such as non-ferrous smelting and refining. A study conducted for the World Energy Council by the International Institute for Applied Systems

Analysis (IIASA) using the RAINS Model estimated acidic deposition in Asia arising from the anticipated increases in the combustion of coal in China. The study forecasts high levels throughout China and in neighbouring Korea and Japan peaking at more than 10 grams of sulphur per m^2 per year (equivalent to 300 kg SO_4/Ha/yr). This level of precipitation is some 15 times the Canadian target of 20 kg SO_4/Ha/yr set in the 1980s and would be enough to seriously affect agricultural production in China and its neighbours and exacerbate health problems.

For the first time, young professionals in the energy field had their own Youth Energy Symposium sessions to discuss energy issues of international importance. Some 123 participants attended these sessions, sponsored by 39 WEC Member Committees (including three from Canada), and co-sponsored by the Energy Council of Canada, the Canadian Electrical Association, Canadian Gas Association, and the Canadian Nuclear Association.

Conclusions and Recommendations were presented in the final session of the Congress. These included a warning against complacency to the effect that the 'breathing space' afforded during the last two decades by the absence of global energy crises should not lull governments or business into a false sense of security. Action postponed will become opportunity lost, and early measures are needed to ensure sustainability. Two challenges remain on which little progress had been made since the previous Congress in Madrid in 1992: to make an immediate and determined response to the plight of over two billion people in developing countries who have no electricity or access to any commercial form of energy; and to achieve sustainable, environmentally-friendly energy development in a world of rapidly growing population as an important component of providing an acceptable quality of life.

The Conclusions to the Congress stressed an answer to the question 'What will the future ask of us?' in that the requisite policy, business and end-consumer decision-making must start now. Major financial, social, and environmental problems arising from future energy requirements must be faced, particularly because the size and shape of energy demand will in future be determined not by the industrialized world but by Asia, Latin America, and some African countries as well. By 2010, the developed nations' share of world energy consumption will have fallen below 50% for the first time.

A number of post-Congress tours were conducted to various utilities, research centres, and industrial operations in Japan.

The next World Energy Congress will be held in Houston, Texas, on September 13-18, 1998, with the theme 'Energy and Technology: Sustaining World Development into the Next Millennium.' The 18th Canadian Energy Forum will be held in Charlottetown, PEI, for the first time, May 26-28, 1996, and will deal with 'Regulation Issues in the Canadian Energy Industry.'

Copies of the Conclusions and Recommendations of the 16th Congress of the World Energy Council, three reference publications (*International Energy Data–1995, Survey of Energy Resources–7th Edition*, and *Performance of Thermal Generating Plant–Monograph 1995*), and other information concerning supporting documents and papers may be obtained from the Energy Council of Canada, 400–30 Colonnade, Nepean, Ontario K2E 7J6 (Fax: (613) 952-6470). (From: R.B. Toombs)

IAEE Seminar on World Outlook for Energy

The Ottawa Chapter of the International Association for Energy Economics (IAEE) held a Seminar on September 22, 1995. It was based upon the current version of the World Energy Outlook (WEO), which was released earlier in 1995 by the International Energy Agency (IEA), on the occasion of the visit to Ottawa of Seán O'Dell, Chief Economist and Director of the Office of Economics, Statistics and Information Systems of the Agency. Mr. O'Dell noted the WEO study provided a forecast to 2010 which was built around two main cases: a Capacity Constraints Case (Case I) and an Energy Savings Case (Case II). Case I leads to an upward price trend for oil reaching $US 28/bbl by 2010, thereby checking growth in energy demand. (Such a price increase would provide a strong incentive for the development of the oil sands in Canada.) Case II foresees the real oil price remaining at $US18/bbl with energy savings being achieved through improved energy efficiency, that is, reduction in demand over and above historical trends. These Cases are compared to a Base Case determined from low prices and extrapolated trends where energy demand rises 50% above the 1992 level by 2010. By compari-

son, in Case I, the energy demand rises 44% by 2010 and in Case II, 33% above the 1992 level. In Case I, world oil supply rises from the 1994 level of 68.3 million bbls per day (Mbd) to 95.2 Mbd, with OPEC supplying 49% of the total. In Case II, the supply rises to 92.0 Mbd., of which 53.6% comes from OPEC. In these projections to 2010, 90% of global energy supply comes from the fossil fuels. In Case I, non-OECD countries are the source of over half the CO_2 emissions in 2010 with China accounting for over 40% of this fraction. Carbon taxes are not considered by the IEA as effective in controlling carbon dioxide emissions since a levy of some $300/tonne would be needed.

The meeting then continued with comments from a three-member panel. Mr. Jim Hughes, of Imperial Oil, noted that his company agrees in general with the IEA forecast. He further stated that oil remains the predominant energy source to 2010, though natural gas is the fastest growing energy source. The growth in non-OPEC sources of oil is due to advances in technology and effective cost cutting. The natural gas supply outlook in Canada is favourable and will sustain export levels. The oil supply, on the other hand, is more price sensitive with the future becoming more dependent upon supplies from heavy oil and oil sands.

Mike McCracken of Informetrica Limited noted important behavioral issues that affect energy use. He referred to the effect of privatization, which reduces the influence of public policy, and changes in work habits to say a 4-day week with a growing shift to telecommuting. He speculated about the future of the automobile in China's future and noted that a temporary decline in emissions in recessionary periods does not constitute a solution to environmental concerns.

Ralph Torrie, of Torrie, Smith and Associates, strongly criticized the WEO forecast claiming it was mute on environmental issues. In his view, the potential for reduction in energy demand was badly underestimated in the study — greater savings are possible through greater efficiency in the use of energy and through technological innovation. Specifically, he claimed the report failed to address the global warming issue seriously. He believes macro-economic tools are inadequate for such analyses.

In the subsequent general discussion, Mr. O'Dell noted that the WEO studies constitute only a portion of the IEA program, and that much effort is given to environmental issues, renewable technologies, etc. All panel participants agreed that a large number of factors, in addition to macroeconomic analysis techniques, need to be considered in energy forecasting. There was a plea for early clarification of future emissions requirements so more realistic planning may be conducted by industry. Generally, the WEO forecast was well received by the meeting with the view that it was a valuable contribution to the energy scene. (From: R.B. Toombs)

IEA Conference on Greenhouse Gases

The IEA Greenhouse Gas R&D Programme, based at Cheltenham in England, organized a second conference on the mitigation options available to deal with greenhouse gases. The Programme, in which 16 countries and industrial organizations participate, is Chaired by Dr. Kelly V. Thambimuthu of Natural Resources Canada. Canada has been an active member of this group since its inception.

The conference, which was held in London on August 22-25, 1995, followed the interest expressed at the first meeting in this series held in Oxford in 1993. It was attended by over 250 delegates from 39 countries, and included the presentation of over 128 papers and 40 poster reports, with seven contributions coming from Canada.

The conference was organized to cover the following subject areas: international dimensions of the greenhouse gas problem; advanced technologies; CO_2 capture; CO_2 storage in oceans or underground in aquifers including use in the enhanced recovery of oil and gas; methane and nitrous oxide emissions; biomass options; full fuel and life cycle studies; and options for the utilization of captured CO_2. This relatively new field is rapidly maturing. Costs and problems are now known with much better accuracy than just a few years ago. Of special interest is the rapid progress in the field of CO_2 capture from power stations which had been identified previously as one of the major cost barriers. Storage seems entirely feasible in aquifers and in fact the first actual project of this kind will be underway in Norway in 1996 at the Sleipner Off-Shore Platform, where one million tonnes of captured CO_2 per year will be injected into the Utsira aquifer. A co-operative project was suggested at this meeting to study this activity as it unfolds. Storage in the sea is also possible but environmental ob-

jections are to be expected. Several biomass options, especially tree planting, seem possible between nations on a Joint Venture basis. New Zealand seems attracted to this possibility. Progress on the re-circulation of CO_2 to allow the combustion of fuels in oxygen, thereby reducing the capture problem significantly, seem, however, to be disappointingly slow, especially for gas turbines.

There is no doubt now that CO_2 may be captured from power stations and possibly other industrial processes and that satisfactory methods of storage can be devised. It is still too early to say, however, whether the capture and sequestering of CO_2 will prove a significant option for the future if emissions of this gas must be controlled.

Because of the continuing negotiations under the United Nations Framework Convention on Climate Change, a paper from Brazil (R. Schaeffer and A. Leal de Sá) was of special interest. An estimate was prepared of the quantity of carbon embodied in Brazilian imports and exports and it was shown an increasing fraction of the domestic emissions of CO_2 was due to the energy intensive nature of that country's non-energy exports as compared to its non-energy imports. Accordingly, these authors believe Brazil is underwriting reduced emissions in other countries who are in effect buying energy in the form of energy-intensive non-energy commodities. It may be that both Australia and Canada among the developed 'Annex I' countries are also in this position.

This conference has been held in alternate years to the International Conference on CO_2 Removal (ICCDR). ICCDR-1 was held in Amsterdam in 1992, ICCDR-2 was held in Kyoto, Japan, in 1994, and ICCDR-3 will be held at MIT in Cambridge, Massachusetts, September 9-11, 1996. Proceedings of the IEA London meeting were published in a special issue of the UK journal *Energy Conversion and Management* (as has been the practice for previous meetings in both series) in early 1996. The IEA Greenhouse Gas R&D Programme has a Home Page on the World-Wide Web at http:/www.ieagreen.org.uk/

CO_2 Research Initiative Workshop

A CO_2 Research Initiative Workshop was held in Edmonton, December 7-8, 1995, under the auspices of the Alberta Chamber of Resources and the National Task Force on Oil Sands Strategies. The object of the meeting was to review the research options relevant to Alberta for controlling CO_2 emissions in the fossil fuel industry. Subjects surveyed included enhanced oil and gas recovery; markets for CO_2; biofixation in food, fibre and fuel; process changes in the utility and oil sands industries; and emerging R&D possibilities. The options were then considered in a series of working sessions. Among the options considered were combustion in oxygen in a utility environment and using CO_2 to displace methane from coal seams. Information on this Workshop may be obtained from the Alberta Chamber of Mines, 10235–101st Street, Edmonton, Alberta T5J 3G1 (Fax: (403) 425-4623).

New Reports and Books

Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC)—the main body advising governments at the international level in the continuing negotiations related to the Framework Convention on Climate Change agreed to at the 1992 Rio de Janeiro earth summit—released its second assessment synthesis report in Rome, December 11-15, 1995. In the Summary, the IPCC report states categorically that the growing body of data and analysis now suggests that the warming of the past century, and especially the last few years, is unlikely to be entirely due to natural causes. The conclusion is stated in this way: 'The balance of evidence, from changes in global mean surface temperatures and from changes in geographical, seasonal and vertical patterns of atmospheric temperature, suggests a discernible human influence on global climate.' This is the first time such a direct connection between fossil fuel emissions and climate change has been drawn by this group, in which Canada actively participates. The report goes on to say 'uncertainties remain which are relevant to judgement of what constitutes dangerous anthropogenic interference with the climate system, and what needs to be done to prevent such interference. The literature indicates, however, that significant no regrets opportunities are available in most countries and that the risk of aggregate net damage due to climate change, consider-

ation of risk aversion, and the precautionary approach, provide rationales for actions beyond no regrets.'

In Canada, the summer of 1995 was the third warmest in a century, although it was notably colder in the central regions of the country in the fall months. On a world basis, this year proved to be the warmest yet since the collection of reliable records began 140 years ago. There were also some indications that erratic and/or extreme patterns in the weather are increasing.

In the US, despite the election in 1994 of a Congress not notably sensitive to environmental issues, the Clinton Administration has been considering more aggressive measures to meet its commitment of reducing emissions of greenhouse gases to 1990 levels by the year 2000. These steps are important since the US is the largest absolute, per capita and cumulative emitter of CO_2. It is almost certain Canada will not meet the same target, but the government, nonetheless, has decided on a policy of voluntary compliance measures.

The *Summary Report* of the IPCC is available from the Department of the Environment.

International Energy Opportunities—The Canadian Advantage

This succinct, 12 page report, published by the Energy Council of Canada in 1995, summarizes the initiatives which the Council's Task Force on International Opportunities intends to pursue to enhance Canada's presence in the growing international market for energy equipment and services. The report opens with a brief review of the Canadian energy situation and then proceeds with sections on the international environment, current international initiatives, market entry considerations, downside risks and precautions, sources of assistance, the financing of international opportunities, an assessment of international competition, and the development of consortia. It concludes by noting the unsatisfied demand for energy in developing countries is massive, and the political climate is increasingly receptive to investment from the private sector. While Canada has not, in the past, been as aggressive as other countries in this field, this country has a well-deserved reputation for technical and managerial know-how in almost all sectors of the energy industry and should be able to increase its share of the market.

Copies of this useful report may be obtained from the Energy Council of Canada, 400–30 Colonnade, Nepean, Ontario K2E 7J6 (Fax: (613) 952-6470).

Newsletter of the IAEE

The Summer 1995 *Newsletter* of the IAEE contains edited versions of several recent presentations of general interest, including: 'Policy Implications of the World Energy Outlook' by Rilwanu Lukman, Secretary-General of OPEC; 'The Oil Industry in the 21st Century, Challenges and Opportunities' by Dr. Subroto, former Secretary-General of OPEC; 'Energy Challenges of the 21st Century: Where are We Going and How Do We Get There?' by John P. Ferriter, Deputy Executive Director, International Energy Agency; 'The European Energy Charter Treaty' by Clive Jones, Secretary-General of the Energy Charter Conference; 'Scenarios for Non-OPEC Oil Production through the Year 2010' by Herman T. Franssen, Economic Consultant to HE The Minister of Petroleum and Minerals, Sultanate of Oman; and 'Oil and Gas Reserve Values in the USA' by M.A. Adelman and G.C. Watkins of MIT and Charles River Associates respectively.

Copies of this newsletter may be obtained from the IAEE at 28790 Chagrin Boulevard, Suite 210, Cleveland, Ohio 44122 (Fax: (216) 464-2737).

Prospects for Energy Technology in the Netherlands

This report in two volumes from the Netherlands Energy Research Foundation (ECN), subtitled *Evaluation of the Cost-Effectiveness of Energy Technologies under a Range of Long-Term Future Conditions*, dated August, 1995, was prepared to aid in the selection of priorities for energy R&D activities on a national basis. Authored by J.R. Ybema, P. Lako, D.J. Gielen, R.J. Oosterheert, and T. Kram, the report uses four scenarios to rank a host of energy technologies of interest. There are two base scenarios extending to 2040 at high and low energy prices respectively, in which a uniform discount rate of 5% per year is employed. In addition, for high energy prices, technology and sector-specific discount rates of 5%, 12% and 20% per year are used. The same specific rates are also repeated for low energy prices. Altogether a total of 60 scenario cases were calculated. In general, the MARKAL linear programming model was used to calculate minimum cost options, although the limitations of this approach were recognized. The report included the capture and sequestering of CO_2 as an option, and has interesting sections on the steel

industry.

Volume 2 may be of wide interest internationally with its tables of characterization data covering about 200 energy technologies on both the demand and the supply side. In the results, the technologies were classified into three categories: 1) those that play a vital role in at least one of the sets of cases with CO_2 emission reduction targets of 20% or more; 2) those that play a role in the majority of cases with more ambitious CO_2 reduction targets, and 3) a group of technologies that seem less relevant to the future energy system of the Netherlands.

Copies of these two volumes, catalogued as Reports No. ECN-C-95-002 and -039 (in English), may be obtained from the Netherlands Energy Research Foundation (ECN) at P.O. Box 1, 1755 ZG Petten, The Netherlands (Fax: +31 2246 44 80). The ECN has also established a home page on the World-Wide Web which may be reached at the following URL: http://www.ecn.nl/

Interdepartmental Program of Energy Research and Development

The Office of Energy Research and Development of Natural Resources Canada (NRCan) has released its 75-page report on *Public Good and Wealth Generation Benefits* prepared to evaluate the ongoing value to Canada of activities supported by the Interdepartmental Program of Energy Research and Development (PERD) to determine their overall benefits. Notable among the conclusions is that the investment, through this agency, of $142 million levered $378 million ($2.65 for every $1 of PERD expenditure) in R&D investments from its partners for a 83% industrial partnership. The document also provides a convenient guide to PERD projects classified according to the PERD system.

The report, classified as OERD 95-04 and dated September 26, 1995, may be obtained from OERD at NRCan, 14th floor, 580 Booth Street, Ottawa, Ontario K1A 0E4 (Fax: (613) 995-6146).

The Emerging International Regime for Climate Change

The Royal Institute of International Affairs has published a book entitled *The Emerging International Regime for Climate Change* which summarizes a workshop held by the Institute in June of 1995 to examine the outcome of the Berlin Conference of the Parties (COP) to the Framework Convention on Climate Change. At the COP, held in Berlin in March/April of 1995, the existing emission goals were confirmed as inadequate and the industrialized countries committed themselves to negotiate new obligations. Edited by Michael Grubb, Head of the Energy and Environment Programme, and Dean Anderson, this book may be obtained in North America from The Brookings Institution, 1775 Massachusetts Avenue NW, Washington, DC 20036 (Fax: (202) 797-6004).

Reformulated Gasoline: Lessons from America

The Oxford Institute for Energy Studies has published a 82-paged paper (ISBN 0-948061-87-1) dealing with the experience with the introduction of reformulated gasoline to reduce emissions in the US. This American program has been the most ambitious example of fuel quality regulation to date. Other recent papers from the Institute include: *Indonesia: The Political Economy of Energy* by Philip Barnes (ISBN 0-19-730016-2); *Nigeria: The Political Economy of Oil* by Sarah Ahmad Khan (ISBN 0-19-730014-6); *Ownership and Performance in Electric Utilities—The International Evidence on Privatization and Efficiency* by Michael G. Pollit (ISBN 0-19-730015-4); and *The Effects of Vertical Integration on Oil Company Performance* by Fernando Barrera-Rey (ISBN 0-948061-90-1). Copies of these papers may be obtained from the Institute at 57 Woodstock Road, Oxford, England 0X2 6FA (Fax: +44 (01865) 310527).

A New State of the Environment Report

Environment Canada released another in its series of State of the Environment (SOE) Reports numbered 95-1, dealing with *The State of Canada's Climate: Monitoring Variability and Change*. This document of 52 pages, illustrated with many tables and graphs, includes sections on climate change in Canada, temperature, precipitation, and clouds. A further chapter puts the extensive data in perspective, noting that the most distinctive feature of climate change in Canada over the past century has been widespread but irregular warming. There has been a statistically significant increase in average annual temperature of 1.0° C over the period 1895-1992, or about twice the estimated warming for the globe as a whole over a similar period. Seasonally, the greatest warming in Canada as a whole, and in most regions, has occurred during winter and spring, whereas the least warming has occurred in the fall. Day and night temperatures have also warmed at different rates.

Copies of this report and further information may be obtained from Atmospheric Environment Service, Environment Canada, 4905 Dufferin Street, Downsview, Ontario M3H 5T4 (Fax: (416) 739-4882).

Natural Gas Market Assessment Report from the National Energy Board

On December 18, 1995, The National Energy Board released the latest in its series of Natural Gas Assessment (NGMA) reports entitled *Price Convergence in North American Natural Gas Markets* prepared as part of the Board's Market-Based Procedure of natural gas export regulation. In 1995, Canadian gas production reached 5.6 TCF (preliminary data), with exports also reaching a new record of 2.7 TCF.

This NGMA report is directed toward a statistical analysis of price links between various natural gas producing basins in North America since the deregulation of natural gas markets in the mid-1980s. By assessing the strength of the price links between basins, conclusions may be drawn on whether natural gas is priced in a single continental market or whether pricing takes place in segmented regional markets. The Board's analysis suggests three broad conclusions: 1) there has been an increasing degree of integration among North American natural gas markets since price deregulation and the introduction of open access; 2) there is, however, somewhat of a pricing split between eastern and western gas markets; and, 3) the pricing of Alberta gas is more strongly linked with western US natural gas markets than with eastern markets. Thus, despite the general trend towards greater continental market integration, it would not be accurate at this point to claim there is a single North American natural gas market in which the 'law of one price' prevails.

This 46 page report (including Appendices and References) contains much useful statistical information on price changes over the past decade or so. The methodology employed relies heavily upon the Kalman filter originally developed in the field of mechanical engineering to remove signal noise from data which varies with time. Copies of this report in English or French, catalogued as No. NE22-53/1995E or F (ISBN 0-662-24004-9), may be obtained from the National Energy Board, 311 Sixth Avenue SW, Calgary, Alberta T2P 3H2 (Fax: (403) 292-5503).

On December 13, 1995, the National Energy Board 'Export and Import Reporting Regulations' were promulgated in Part II of the *Canada Gazette*. On January 13, 1996, amendments to the National Energy Board's Part VI Regulations were re-published in Part I of the *Gazette*. In the latter case, the major new amendments to the Regulations are in the area of information concerning gas supply. In general, these new regulations streamline the reporting requirements for persons exporting oil, gas or electricity or importing gas under the authority of a licence, order or permit issued by the Board. Copies of the new Regulations may be obtained from the above address.

Short Notes

• On August 16, 1995, the Hon. Anne McLellan, Minister of Natural Resources Canada (NRCan) and Mr. Mike P. Lipkewich, Chairman of The Coal Association of Canada (CAC), signed a Memorandum of Understanding on global climate change. The agreement commits the CAC to work with NRCan to develop and promote the Voluntary Climate Change Challenge and Registry Program aimed at preparing action plans that will result in limitations of greenhouse gas emissions. A similar agreement was reached with the Canadian Gas Association (CGA) on September 20, 1995. The CAC and the CGA join the Canadian Association of Petroleum Producers, the Canadian Electrical Association, and the Canadian Energy Pipeline Association who entered into similar agreements earlier in 1995. The Minister also honoured six mining companies for their contribution to energy conservation by presenting them with Industrial Energy Innovator Awards. A progress report on this program listing the cooperating companies and organizations was released on November 20, 1995 under the title *Voluntary Challenge and Registry* and is available from Natural Resources Canada, 580 Booth Street, Ottawa, Ontario K1A 0E4 (Fax: (613) 947-6799).

• The ocean wave floating power plant 'Osprey' was launched into the Clyde River near Glasgow in August, 1995. Built at a quoted cost of £1.9 million, this first large-scale sea power unit of some 8000 tonnes has a capacity of 2 MW to be generated in turbines by the expansion of air compressed by the action of the waves. It is also fitted-out to carry wind turbines of 1.5 MW capacity. This first unit was financed by a number of sources, including the Joule

program of the European Union, but without participation from the British government which declined support on the grounds that the capital investment in wave power devices is likely always to be excessive. Unfortunately the nine ballast tanks were found to be ruptured after launching and the necessary repairs will cause some delay in the trials—if not their cancellation.

• Argentina and the United Kingdom have reached an agreement to share revenue from the prospective off-shore region surrounding the Falkland Islands. The effect of this agreement is to encourage exploration for oil in what is one of the few remaining untested basins in the world. Some geologists believe sufficient oil will be found to eventually rival the North Sea in production.

• A new study by the National Oceanic and Atmospheric Administration (NOAH) of the US has found that about half of the CO_2 emitted by the combustion of fossil fuels is absorbed by plants in the Northern hemisphere, showing that plants play a role about equal to the oceans to which most of the absorption had previously been attributed. Scientists working in Brazil have found the first proof that undisturbed tropical rain forests soak up large quantities of CO_2: about one tonne of CO_2/year for each hectare of forest. (Source: *New York Times*)

• The National Energy Board, following a serious break in a natural gas pipeline on the TransCanada Pipelines Limited system in Manitoba earlier this year, has announced the terms of reference for an inquiry into the stress corrosion cracking of steel, to be undertaken under Section 15 (1) of the Board's Act because of the apparent increased incidence of this type of failure of the nation's pipelines. There was a break in one oil line of the IPL System in November. The inquiry will be conducted by a panel of three Board members—K.W. Vollman, A. Côté-Verhaaf, and R. Illing—who will have the powers of subpoena and the taking of evidence under oath as outlined in the Act. The Board has invited public participation, and requested those interested to register by October 12, 1995, and to file submissions by December 31, 1995. Copies of the *Direction on Procedures* and the *Preliminary List of Issues* may be obtained from the Board at 311– Sixth Avenue S.W., Calgary, Alberta (Fax: (403) 292-5503).

• The ATHENA prototype software is the result of a three-year research program coordinated by Forintek Canada Corp., a national, non-profit, wood products research institute with facilities in Quebec City and Vancouver, developed to help designers, builders, policymakers, and consumers make better environmental choices of construction materials. Based upon the concept of life-cycle analysis, the software can estimate the environmental consequences entailed in the production, transportation, use, and disposal of materials or structural assemblies used in construction. The development of this software was supported by Natural Resources Canada as a contribution to energy conservation and to better use of forest products.

• On October 2, 1995, the Ukrainian Prime Minister, Yevhen Marchuk, took advantage of the occasion of the visit of Saskatchewan Premier Roy Romanow to ask Canada for assistance in getting the G-7 countries to provide financing to help that country meet its commitment to close the Chernobyl nuclear plant by 2000. At that time, Ukraine stated it needed $US 4 billion to close the plant, the site of the world's worst nuclear accident, to ensure the future of its 6,000 employees, and to make up for the 5% of the country's electricity still generated there. Rather than build a gas-fired combined-cycle plant at the site as was originally envisioned, the proposal is now to complete other unfinished nuclear reactors in parallel with a modernization of Ukraine's energy sector. Some G-7 country's, notably France, are reluctant to provide this assistance, which includes a nuclear reprocessing plant. The country must still rely upon Russia for enrichment and reprocessing services although the Ukraine possesses resources of uranium. In the meantime, pressurized water reactors of the Russian design VVER (440 MWe) have been restarted in Armenia and Bulgaria due to power shortages despite protests by the International Atomic Energy Agency who consider these reactors unsafe. The Armenian reactor is located in an earthquake zone. Russia has also announced assistance to Cuba to complete an already started VVER reactor in four years. This reactor is expected to supply 15% of the island's electrical requirement. (The cost to Russia is put at $US 349 million and to Cuba $US 208 million.) However, on December 20, 1995, the Deputy Prime Minister and then Minister of the Environment, Sheila Copps, and the Ukrainian Minister for Environmental Protection and Nuclear Safety, Y.I. Kostenko, signed a G-7/Ukraine Memorandum of Understanding (MOU) related to the closure of the Chernobyl nuclear power

plant. This is the first agreement ever to be signed by the Chairing Government on behalf of all G-7 member countries. The MOU requires the Ukraine to take all necessary measures for the decommissioning of the Chernobyl Nuclear Power Plant in the shortest, practically achievable time. The MOU goes on to state that 'Ukraine and the G-7 countries will work with financial institutions as well as foreign and domestic investors to prepare loan-financed projects based upon least-cost planning principles for completion of Khmelnitsky II and Rovno IV nuclear reactors, for thermal and hydro plant rehabilitation and pumped storage projects, and for energy efficiency projects in accordance with Ukraine's energy sector strategy.' The financial resources to be provided by the international community for this activity are projected to total $US 2.3 billion, of which $US 498 million are in the form of committed grants and the remaining $US 1.8 billion will be in the form of loans from Euratom and other sources.

• Ballard Power Systems Inc. of North Vancouver announced on September 11, 1995, that the Chicago Transit Authority will place three buses into service by 1996 powered by hydrogen fuel cells of their manufacture. Chicago will thus become the first city to use buses powered this way in its public transit system. These cells, rated at 275 horsepower (205 kW), will be fitted into bodies built by New Flyer Industries. The initial program will cost $US 8 million, with two more buses to be added when additional funding is secured.

On October 3, 1995, the company announced that a fuel cell has achieved the power density (power per weight and volume) required for use in cars. This fuel cell was developed by Ballard under a joint program with Daimler-Benz of Germany. The cell is capable of producing 1000 Watts/litre and 700 Watts/kg (28 kW/ft^3), which exceeds the company's previous goal of 25 kW/ft^3 for cars and is the highest power density ever achieved in proton exchange membrane fuel cells. This success is considered a major step towards the development of workable zero-emission vehicles.

In February 1996, the company announced that its US subsiduary, Ballard Power Corporation, had received a $8.1 million contract from Georgetown University to develop a 100kW fuel cell based upon methanol, with the object of powering a small bus. The overall project is supported by the US Department of Transportation.

• The Ford Motor Company has become the first to build cars with factory-fitted natural gas fuel systems in Crown Victoria cars on the assembly line at their St. Thomas, Ontario, plant. Until now, such installations have been retro-fitted to existing vehicles.

• The Canadian Council of Ministers of the Environment (CCME) met in Whitehorse, Yukon Territory, on October 24-25, 1995. Ministers unanimously agreed to work toward national standards for cleaner fuels for cars. Several interesting reports prepared under the general heading, 'Environmental and Health Benefits of Cleaner Vehicles and Fuels,' were considered. They dealt with various aspects of this question including: Air Quality Modeling; Selected Concentration-Response Functions for Human Health Effects; Economic Evidence of Monetary Valuation of Human Health Effects; Cost Effectiveness of Various Vehicles and Fuels Options; and Cost of Upgrading Canadian Transportation Fuels. Copies of these and other relevant reports may be obtained from the CCME Secretariat, 326 Broadway, Suite 400, Winnipeg, Manitoba R3C 0S5 (Fax: (204) 948-2125).

• California regulators are studying a system that could quietly monitor every car's compliance with Federal emissions rules. Beginning with 1996 models, all new cars sold in the US are required to be equipped with a computerized device that warns drivers when the emissions control system is malfunctioning. The California Air Resources Board is considering whether to require installation of a radio transmission device that would allow officials to automatically monitor the car's emissions equipment as it was driven along the highway. The installation of such transponders is also being considered in connection with automatic highway toll systems in a number of countries. In the meantime, British Columbia, faced with a major problem in the Vancouver region, has announced the adoption of California car emissions standards. By 2001, all new vehicles sold in BC should produce 70% less emissions than today's new cars. (Source: *New York Times*)

• An interesting review article on windpower by Jay Jayadev has appeared in the November 1995 issue of the journal *Spectrum* published by the IEEE (Vol. 32, No. 11). The article provides past and projected costs of wind-generated electricity and projected additions to wind energy capacity in a number of developing countries.

• PetroCanada has announced progress in its plans to develop

the Terra Nova oil field off the southern coast of Newfoundland. A floating production platform will be used to produce the 63.6 million m^3 (400 million bbls) of reserves at a rate of 15,900 m^3 (100,000 bbls) per day starting in 2001. The project, which is estimated to cost $2 billion, will be raised by the consortium which also includes Mobil Oil Canada Ltd, Husky Oil Ltd., Murphy Oil Co. Ltd. and Mosbacher Operating Ltd. The Hibernia field in the same region is set to begin production in 1997 at 17,500 (110,000 bbls) m^3/day from a fixed platform.

• In December 1995, Alberta announced a new taxation regime to encourage the development of the oil sands. The federal government also made tax changes in its February 1996 budget to encourage the industry.

• The $US 6.2 billion experimental Japanese fast-breeder nuclear reactor Monju experienced a serious leak of three tonnes of sodium coolant on December 8, 1995, and may be shut down indefinitely unless the cause of the accident can be corrected. The official in charge of investigating a possible cover-up in the worst nuclear incident in Japan to date has committed suicide apparently because he was distressed by the evidence he had unearthed. (Source: *New York Times*)

• The Los Alamos National Laboratory is studying the reaction of CO_2 and magnesium oxide in the minerals serpentine and olivine. The reaction is exothermic and the resulting magnesium carbonate is stable with the result the CO_2 may be sequestered in the mineral indefinitely.

• The Motor Vehicle Manufacturers Association signed a cooperative agreement with Natural Resources Canada on November 1995 to develop a comprehensive strategy to contribute to limitations on the emissions of greenhouse gases. The strategy will include finding ways to help drivers realize the benefits of fuel savings, improving the on-road fuel efficiency of vehicles, encouraging consumers to consider fuel efficiency when purchasing vehicles, and promoting technological progress in the fuel efficiency of new vehicles.

• Some useful Uniform Resource Locators (URLs) in the Energy Field: IEA Greenhouse Gas R&D Programme: http://www.ieagreen.org.uk/; IEA Energy Technology Data Exchange: http://etde.org:80/html/etde/home.html; Risø National Laboratory in Denmark: http://www.risoe.dk/; Carnegie Mellon University Climate Change: http:// miami.epp.cmu.edu:80/global_change/; Global Analysis Task Force: http://pyramid.unh.edu/csrc/gaim; Intergovernmental Panel on Climate Change: http: //usgcrp.gov:80/ipcc/; Greenpeace: http://www.greenpeace.org:80/greenpeace.html; Friends of the Earth: http://foe.co.uk:80/

• General Motors announced on January 4, 1996, that it would market a two-seat, battery-based electric car to be known as the EV1 in Arizona and California beginning in the fall of 1996. This car, which will cost in the mid-$US 30,000 range, will travel about 150 km between recharges at a top speed of 130 km/hr. A battery pick-up truck is also planned with an auxiliary engine. Both vehicles are intended to help meet the severe air quality problems of the region, though California has recently relaxed its goal for the introduction of zero-emissions cars. Originally, the Air Resouces Board of that State aimed to have 2% of the vehicles sold in 1998 meet this performance target and 5% by 2001, but this requirement has now been withdrawn. Nevertheless, the target of 10% to this standard by 2003 remains in place.

A technical difference is emerging over the preferred technique for re-charging electric vehicles. General Motors favours an inductive device for making the connection while Chrysler and Ford favour conductive systems. It is claimed that the inductive-type charger is safer because there is no exposed metal and that this method can be more easily automated. The disadvantage is greater complexity and cost.

• A paper appearing in the January 1996 issue, Vol. 99, No.1, p.-30, of *Technology Review* entitled, 'The Electric Car Unplugged' by Richard de Neufville and other authors based at MIT is critical of legislative measures designed to encourage the use of vehicles powered in this way. In the same issue of this journal, there is an interesting account of the development of sodium light bulbs excited by microwaves and used in conjunction with light pipes (page 15).

• According to the article by William Sweet in the January 1996 issue of the *IEEE Spectrum* (page 23), 1995 will be the first year that orders for combined-cycle power plants around the world will exceed those for conventional steam practice. Also noteworthy in 1995 was the introduction of the General Electric 'H' class gas turbine, which is the first to break the 60% HHV efficiency barrier.

• British Energy, the holding company formed to control the most modern reactors of Nuclear Electric and Scottish Nuclear in preparation for privatization expected later this year, has an-

nounced it will not proceed with either the planned Sizewell C or Hinkley C reactors on the grounds of uncertainty in electrical demand and the low price of natural gas. Most observors believe that this decision marks the end of an era in the history of the nuclear industry in the UK. Expansion of the industry continues in Asia, however, and in 1995, French companies sold two reactors to China for expansion of the Daya Bay project to supply electricity in southern Guandong Province.

• In one of its first major decisions, the new World Trade Organization has found that the Clean Air Act in the US discriminates against foreign oil companies and so has directed a change in these rules. This issue is important since in the latest US Department of Energy *Annual Energy Outlook*, imports of clean oil products are expected to double from their present level to 254,000 m^3 (1.6 M bbls) per day by 2015 due partly to a decline in US refining capacity. The WTO has been criticized by some political leaders as exemplifying external interference with US laws.

• In a paper by David Vaughan and C.S.M. Doake of the British Antarctic Survey, published in January in the UK Journal *Nature*, it is claimed that rising temperatures on the Antarctic peninsula have loosened large sheets of ice over the past 50 years. Such melting is likely associated with global warming and has raised concerns over rising sea levels.

• A proposal to install a power plant of 150 MWe capacity using oil shale as fuel is being studied in Israel. A US firm, MidAtlantic Energy Group of Pittsburgh, is investigating this possibility under an arrangement negotiated with Israel Electric Corporation with the object of exploiting the large resources of shale occurring in the Negev region of the country. Similar oil shale resources are known nearby in Jordan.

• An established US inventor of good reputation is reporting an electrolytic system that produces more energy than supplied to it. Though reminiscent of the results attributed to the 'cold fusion' experiments of a few years ago, there are important differences in the setup used. Fine beads are coated with layers of three metals which are then placed in an electrolytic saline cell using ordinary (not heavy) water. According to television reports (ABC Network Morning Program, February 7, 1996), these results have been duplicated by some other scientists and a few well-known companies have expressed interest.

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*