Update

International Conference on Activities Implemented Jointly

An International Conference on Activities Implemented Jointly organized by the IEA Greenhouse Gas R&D Programme was held in Vancouver May 26-29, 1997, with support from the governments of Canada, Japan, Norway and the US; the Canadian Electricity Association; Alberta Energy; and the Canadian International Development Agency. Activities Implemented Jointly (AIJ) has been formally adopted into the text of the UN Framework Convention on Climate Change (FCCC) to describe a wide range of possible arrangements usually between interests in two or more countries undertaken to reduce or sequester greenhouse gas emissions to the benefit of all parties. Costs of controlling carbon dioxide emissions are not the same in all countries. The object of AIJ is to provide the means and especially the technology for those countries, usually in the developing world, where such measures may be implemented at less cost than in nations already advanced in the field. Therefore countries with a lower marginal cost of abatement can implement projects jointly with countries whose costs are higher. Both technology, including expertise and funding, may be transferred. The method of tallying the credits for the reduction between the countries concerned is under negotiation as, at present, only the pilot phase has been agreed upon. It is anticipated that the outstanding issues of baselines, additionality, monitoring and institutional arrangements for AIJ will be addressed at the Third Conference to the Parties of the FCCC to be held in Kyoto December 1-10, 1997.

The Vancouver meeting was opened by the Hon. John Fraser, Canadian Ambassador for the Environment who outlined Canada's policy on climate change. The meeting focused on the technologies appropriate for such projects with contributions from those who have had practical experience in this emerging field. Forty-one projects have already received approval. The papers on the program ranged from forest management in Latin America to tea-drying in Sri Lanka; from improvements in energy efficiency in India to applications for solar power in Crete; from the use of carbon dioxide for enhanced oil recovery in China to improved cooking and lighting in Africa. There were 120 presentations at the Conference, which was attended by 220 delegates from 41 countries.

There is little doubt of the growing importance of this field and it is expected there will be more projects undertaken after the COP3 Conference in December. Although many will be en-

tirely within the private sector, the World Bank is developing a carbon offset mutual fund which may be of great importance to the developing countries, since some in this grouping have expressed concerns with the sharing of benefits in an equitable way.

The *Proceedings* will be published later this year by the IEA Greenhouse Gas R&D Programme, Stoke Orchard, Cheltenham, Gloucestershire, GL52 4RZ, UK (Fax: +44 (0) 1242 680758; E-Mail: mail@ieagreen.demon.co.uk). (From Dr. Kelly Thambimuthu of CANMET who is currently International Chairman of the IEA Greenhouse Gas R&D Programme.)

Renewable Energy Conference in Ottawa

Canada's largest Renewable Energy Conference was held in Ottawa April 14-15, 1997, with the major emphasis placed on Releasing Canada's Stranded Opportunities. A trade show was held concurrently with this meeting with many exhibits from the Canadian renewable energy industry featuring small hydro, wind energy, wave power, energy efficiency, and other such technologies including the solar car Quest which has competed in major events for this class of vehicle. Some 350 delegates attended the Conference, the theme of which was the contribution that energy from renewable sources can make to reducing the emissions of greenhouse gases.

One full session was devoted to the global climate change question. One informed observer, Douglas Russell of Global Change Strategies International, Inc., took the view Canada was falling behind in the current negotiations. He expected that little progress would be made until after the then-impending June 1997 federal election in view of the internal difficulties in reaching a national consensus. As late as the following mid-October there was still no publicly-announced Canadian position.

The impending deregulation of the electrical industry poses some opportunities, as well as problems, for the renewable energy industry. Deregulation of generation allowing for the participation of Independent Power Producers makes it possible for individuals to express a preference for benign energy for which some may be willing to pay a premium. Polls taken in New England and other places, including some anecdotal information from the developers of wind farms in Alberta suggest that many will exercise this option when it is available, but that it is quite unlikely that corporations would make the same choice. The experience to date in California suggest deregulation has to be done very carefully to avoid harming the existing renewable power industry. A careful period of transition is required in which some fraction of the market is protected for the renewable industry in some form or other.

Information on presentations and other aspects of the 1997 Renewable Energy Conference may be obtained from Passmore Associates International, 600–255 Albert Street, Ottawa, Ontario, K1P 6A9 (Fax: (613) 233-9527).

New Reports

Spring Issue of the Carbon Dioxide Climate Report

The Spring 1997 issue of the *Carbon Dioxide Climate Report* (Issue 97-1) provides a comprehensive review of developments relevant to the science of climate change for 1994-95. The 885 literature citations are particularly useful. Following an introduction, the subject matter is divided into six sections providing a succinct summary of progress into various aspects of this increasingly important field.

The section on Changes in Atmospheric Composition considers carbon dioxide, methane, nitrous oxide, ozone and its precursors, halogenated gases, and aerosols. The section on Radiative Forcing considers greenhouse gases global warming potentials, tropospheric aerosols, stratospheric aerosols, and solar forcing. The section on Climate Modelling considers model development and validation, climate model processes, and results from climate model simulations. The section on Historical and Current Climate Trends considers glacial/interglacial climates, the holocene period, the last millennium, and the past century. The one on Impacts of Increased Carbon Dioxide Concentration and Climate Change deals with carbon dioxide fertilization, climate change impacts research methodologies, natural ecosystems, agriculture, storms, disasters, cryosphere and social infrastructure. The final section, on Policy Response: Reducing the Risks of Climate Change, focuses on carbon sequestration, adaptation and research, and science communication.

The *Carbon Dioxide Climate Report* is issued periodically by Environment Canada and may be obtained by contacting the Canadian Climate Centre, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, M3H 5T4 (Tel: (416) 739-4432).

Report of the National Energy Board for 1996

The 1996 *Report* of the National Energy Board was released on April 28, 1997. The Chairman, Mr. Roland Priddle, is now in the last year of his 12 years of distinguished service in this post. The *Report*, as usual, reviews all the main activities of the Board for the year. Highlights included approval of a multi-year negotiated settlement on rates between TransCanada Pipelines Ltd. and its shippers; an extensive inquiry into Stress Corrosion Cracking on Canadian oil and gas lines, after which the NEB adopted 27 recommendations to promote public safety; approval of the Express Pipeline, the first new oil pipeline out of Western Canada in 45 years; and the negotiation of an agreement with federal and provincial parties for a joint public review of the proposed Sable Gas Projects in offshore Nova Scotia, which was approved on October 27, 1997.

Crude oil production set a new record of 318 thousand cubic metres (2 million barrels) per day in 1996 surpassing the previous record set in 1973. Heavy oil production has increased some 45% in the last five years while light crude production levels have been maintained, an outstanding achievement by the industry. Canada remains a net exporter of oil, and this trend is expected to increase slowly over the next decade. Natural gas production and exports also reached record levels in 1996 of 158.2 billion cubic metres (5.6 trillion cubic feet) and 80.7 billion cubic metres (2.85 trillion cubic feet) respectively. Natural gas, petroleum and electricity exports generated almost $24 billion in gross export revenue or almost $15 billion on a net basis.

The National Energy Board announced a re-organization on May 5, 1997. It will now carry out its responsibilities through five main divisions: Applications, Operations, Frontier Areas, Commodities, and Information Management.

On July 25, 1997, the NEB released another Natural Gas Market Assessment report entitled *Producer's Response to Changing Market Conditions* (ISBN 0-662-25760-X – 42 pages plus a Glossary and four Appendices). This study consists of six chapters with the following titles: Introduction; Review of Market Conditions; Producers' Response to Changing Market Conditions/ Shifting Patterns of Gas Supply; Trends in Gas Well Connection and Production; Additions to Reserves and Productive Capacity; and Key Observations. The text and the appendices contain many valuable figures and tables. The report begins with a review of the changing market conditions for natural gas and then focuses on three aspects of the producer's response to these changes: (1) the levels and characteristics of gas-directed activity and responsiveness to market signals; (2) changes in the underlying characteristics of gas supply, such as well productivity and production decline profiles; and (3) the effectiveness of drilling activity in finding new reserves and adding productive capacity. It concludes that the industry has been adept at adapting to a more competitive market place. The report also indicates that 'there is an increasing reliance on the drilling and connection of new wells with less reliance on older wells. In 1995, only 38% of new well connections were in pools greater that 20 years old, compared to 61% in 1985. The overall decline rate of Alberta's producing wells is increasing with each passing year and stands at 18.1% in 1995. This trend to steeper declines will likely continue, at least over the next two to three year period. This means that an increasing volume of additional deliverability must be connected, primarily through new wells, to account for production decline, plus any increase in demand. It is estimated from 3,500 to 4,000 wells will have to be drilled and connected annually in the Western Canada Sedimentary Basin, over the 1997 to 1998 period, to meet this requirement.'

The current year will be busy for the Board with a number of pipeline extensions proposed. One notable proposal is the application for the reversal of Line 9 of Interprovincial Pipe Line Inc., which will allow crude oil to be pumped the 832 km (517 miles) from Montreal to Sarnia. This line was originally built with government assistance to make western Canada's crude oil available to Montreal area refineries at the time of the oil crises of the 1970s. It was subsequently mothballed and then reopened for reduced service from west to east. Following extensive industry consultations on the future supply of oil to Ontario, four refining companies: Imperial Oil; Petro-Canada; Shell Canada Limited; and NOVA Chemicals (Canada) Ltd., have committed themselves to using

the line with its flow reversed. After this $89 million project is completed, the capacity will be 25,400 cubic metres (160,000 barrels) per day at the projected in-service date of April 1, 1998, rising to 38,200 cubic metres (240,000 barrels) per day in later years. Oil will be supplied through the existing Portland/Montreal pipeline. Presumably some of the oil to be produced from the new fields, to enter production from the eastern offshore later in 1997, could reach markets in this way. Applications have also been filed with the Board by Gaz Metropolitain, Inc and Trans Québec & Maritimes Pipeline (TQM) to extend the natural gas pipeline system some 213 km in Quebec to the New Hampshire border together with associated electric-powered compressor stations to augment gas supply to New England through a connection to the Portland Natural Gas Transmission system. This $270 million project is expected to be in service by November 1, 1998. The initial gas flow will be 4.3 million cubic metres (152.2 million cubic feet) per day to the US and 1.7 million cubic metres (60.0 million cubic feet) per day to the markets to the Eastern Townships of Québec which will increase to 5.9 million cubic metres (210.0 million cubic feet) per day and 2.1 million cubic metres (75.0 million cubic feet) per day to the two markets respectively in the second year. Some gas now moves in the reverse direction in pipelines originally built during World War II to import crude oil to Montreal through the port of Portland, Maine.

TQM have also filed an application with the Board for a 310 km (192 mile) extension of its system from Saint-Nicolas, Qué, (on the south shore of the St. Lawrence near Québec City) to the border of New Brunswick. This line of 610 mm (24 inch) pipe is proposed as part of a system to move gas from the Sable Island fields off Nova Scotia to markets in Québec.

TransCanada PipeLines filed an application May 13, 1997, for the construction of Nexus, a major two-year project to expand the capacity of the company's system to more than 283 million cubic metres (10 billion cubic feet) per day at a cost estimated at $2.6 billion. The first phase of the project for construction in 1998 involves 371 km (231 miles) of pipeline looping and related facilities with an estimated cost of $1.1 billion. High pressure pipe would be used on this, the largest single expansion planned to date, together with other facilities on the main pipeline extending from Empress, Alberta, through the US Midwest and then the length of the Windsor-Montreal corridor.

The Alliance Pipeline Ltd. has applied to the Board to build about 1,565 km (970 miles) of mainline and related facilities from Gordondale, Alberta, to the US border in Saskatchewan, where it would link with the Alliance Pipeline LP. It would extend approximately another 1,430 km (890 miles) to a terminal in Chicago. Most of the line would be 914 mm (36 inches) in diameter and would be capable of delivering 37.5 million cubic metres (1.325 billion cubic feet) of natural gas per day on a firm basis when completed in late 1999.

Copies of the NEB 1996 *Annual Report* (ISBN 0-662-25573-9), the *Natural Gas Market Assessment Report Producers' Response to Changing Market Conditions 1992-1996*, and other Board documents may be downloaded from the Board at the following URL (http://www.neb.gc.ca) or may be obtained by writing to the Board at 311 Sixth Avenue SW, Calgary, Alberta, T2P 3H2 (Fax: (403) 292-5503).

Report on Natural Gas Potential in Canada

The Canadian Gas Potential Committee, an independent group of senior geoscience professionals from the petroleum industry and government, released a report *Natural Gas Potential in Canada* in May 1997. The study concludes there is about 6.7 trillion cubic metres or Tcm (237 Tcf) of discovered gas in place and 5.86 Tcm (207 Tcf) of potential gas in place in the Western Canada Sedimentary Basin. Of the existing and potential gas in place, approximately 5.33 Tcm (188 Tcf) is deemed marketable. In total, 47% of the conventional gas resources in the Basin are undiscovered. The report contains maps which indicate in the opinion of the authors where the undiscovered potential is located and figures showing the sizes of the undiscovered pools in each exploration play. When the more expensive unconventional gas resources are considered, such as coalbed methane, tight gas reservoirs and shale gas, the Committee believes there is an estimated 16.15 Tcm (570 Tcf) of discovered and undiscovered natural gas in Canada.

It is clear Canada is well endowed with natural gas with 1996 production at 158.6 billion cubic metres (5.6 Tcf). The supply curve is likely to be gently rising and smoothly continuous over time.

Copies of this report may be obtained, for $215, from the Canadian Gas Potential Commit-

tee, PO Box 20032, RPO Bow Valley Square, Calgary, Alberta, T2P 4H3 (Fax: (403) 781-5598).

A Pragmatic Response to Climate Change

Mr. Robert A. Reinstein of Reinstein and Associates International has made available his report *A Pragmatic Response to Climate Change*. This document of 100 pages plus annexes dealing with the Berlin Mandate and OECD Country Carbon Dioxide Profiles together with extensive Endnotes is a useful reference for those interested in the current negotiations under the United Nations Framework Convention on Climate Change. The chapters have the following headings: Background and International Process; Target Proposals; Initial Proposals for Negotiated Commitments; The Negotiation and Review Process; Participation of Developing Countries; and finally Conclusions. Mr. Reinstein also offers reasonable views on how to proceed in this difficult process.

Copies of this report may be obtained from Reinstein and Associates International, 10316 Rockville Pike, #302 Rockville, Md. 20852 USA (Fax: (301) 571-5038). This organization also has offices in Brussels and Helsinki.

Short Notes

• Following the election in June 1997, The Hon. Ralph E. Goodale is now the Minister of Natural Resources Canada succeeding the Hon. Anne McLellan who became Minister of Justice. Energy Council of Canada has announced that Dr. John G. Hollins, presently with Environment Canada, will succeed Dr. E.P. Cockshutt as Executive Director as of January 1, 1998. Dr. Hollins, long active in the affairs of the Council, coordinated the 10th Anniversary Observances of the Montreal Protocol on Ozone Layer Depletion held in that city on September 9-16, 1997.

Michael R. MacLeod has been appointed Energy Analyst on the staff of the Council.

• The Spring 1997 *Newsletter* of the International Association for Energy Economics (IAEE) contains a number of edited versions of papers presented at the 20th IAEE International Conference held January 22-24, 1997, in New Delhi, India. John P. Ferriter dealt with Globalization: Challenges and Opportunities in Shaping a Common Future; Shekhar Datta presented An Industry Perspective on the Indian Energy Situation; A. Bhattacharyya spoke on Bridging the Energy Gap in Asia: Experience of Strategic Alliances/Joint Ventures in India; R.K. Pachauri also spoke on Globalization: Challenges and Opportunities in Shaping a Common Future; Stephen Karekezi with Responding to International Energy-Related Challenges: The Case of the African Energy Policy Research Network; and Katsuo Seiki on Technology Transfer and National Capacity Enhancement. Other summarized papers of interest include: West European Gas Supply/Demand Balance by Morten Frisch; A Perspective on Russian Oil by Isabel Gorst; and The Quest for Middle East Oil: The United States Versus China by Mamdouh G. Salameh. Copies of the Newsletter may be obtained from the IAEE at 28790 Chagrin Boulevard, Suite 210, Cleveland, Ohio, 44122.

• Negotiations in preparation for the Conference of the Parties to the Framework Convention on Climate Change to be held in Kyoto December 1-12, 1997, continue. The Sixth Session of the Adhoc Group on the Berlin Mandate (AGBM-6) met in Bonn, the new location of the Secretariat, March 3-7, 1997. There are many outstanding issues to be resolved such as timetables and targets, and measures and compensation. It is clear it will prove difficult to arrive at acceptable proposals for Quantified Emission Limitation and Reduction Objectives (Quelros) in time to permit the signing of the planned Protocol. The US continues to emphasize flexible measures, such as emissions trading and borrowing emissions from future budget periods, etc., with a flat-rate target. There are some indications, however, that some form of differentiated reduction target might also prove acceptable.

On October 22, 1997, President Clinton announced his policy for the coming negotiations in Kyoto in December. The US delegation was instructed to seek: 1) binding and realistic agreements to limit emissions at their 1990 level in the 2008-2012 period with further reductions to come in later years; 2) a flexible agreement involving Activities Implemented Jointly with developing countries and an international emissions trading system; 3) active participation from the developing countries.

As far as US domestic activities are concerned, there will be: 1) a one billion dollar program over five years in the form of tax cuts and R&D projects for targeted industries; 2) credits for improvements in energy efficiency; 3) establishment of a market system for reducing emissions along the lines of the present sulphur trading system;

4) increased efforts to reduce emissions from government facilities; 5) encouragement of competition in the electrical industry through further deregulation; and 6) some specific measures to encourage reductions in identified industrial sectors of importance.

The announced policy relies heavily upon market mechanisms and the encouragement of new technology but some measures would also be introduced to help displaced workers.

Actual inventories and projections of emissions from the parties included in Annex 1 of the United Nations Framework Convention on Climate Change may be found at the following Web Site: http://www.unfccc.de/.

• The World Meteorological Organization has reported that 1996 was the eighth warmest year on record. Equally worrying are indications of an increasing number of extreme weather events around the world. The changing weather patterns are broadly consistent with predictions by the General Circulation Models for the world's climate.

• Australian researchers have reported a statistically-significant association between electromagnetic fields of the kind emitted by digital mobile phones and cancer in mice genetically-altered to be susceptible to lymphoma, a cancer of the immune system. This work was carried out by Dr. Michael Repacholi and colleagues at the Royal Adelaide Hospital and published in the American journal *Radiation Research*. The implications of this result for humans is unclear at present. The World Health Organization, located in Geneva, has embarked upon a five-year international project on the health effects of electromagnetic fields. In July of 1997, researchers at the National Cancer Institute in the US reported in the New England Journal of Medicine finding no evidence that magnetic field levels in the home increased the risk of childhood leukemia. This comprehensive study will be augmented later this year with similar reports based upon work conducted in Canada and the UK.

• Electric Vehicles: On April 14, 1997, it was announced that the Daimler-Benz company of Germany had acquired a 25 % share in Ballard Power Systems Inc. of Burnaby, BC for $450 million. It is expected that vehicles based upon the fuel cell under development by the Canadian company will be in production by 2006. Subsidiary companies will be formed as a consequence of this agreement to market this benign technology for car, truck and bus use. Daimler-Benz announced in May 1997 that it intended to sell a fuel cell-powered bus with production to begin shortly after 2000. German companies are also developing robot arms to refuel vehicles with liquid hydrogen automatically. On April 21, 1997, the Hon. Anne McLellan, the former Minister of Natural Resources, announced an $8-million program with Ford Motor Company of Canada to integrate the fuel cell being developed by Ballard Power Systems of Burnaby, BC, with that company's concept car being designed under the US Partnership for a New Generation of Vehicles (PNGV). The object of this program is a car with three times the fuel efficiency but with the same safety and affordability as current vehicles.

General Motors has announced its electric vehicle, the EV1, now offered for lease in California, Arizona, and soon Florida, will be equipped with a second generation nickel metal-hydride battery to replace the present conventional lead-based batteries. The range will be extended from 110 to 240 km. The new batteries are presently five times as costly as the ones they will replace. In May 1997, the price was reduced 25% because of disappointing demand, and the company will support the construction of an additional 50 charging stations in the marketing area.

A nickel metal-hydride battery was used in a converted production model Geo Metro by Solectria Corporation to set a new record of 402 km (249 miles) between recharges in the American Tour de Sol race organized by the Northeast Sustainable Energy Association in May of 1997. The battery was manufactured by Ovonic Battery Company, a joint venture between Energy Conversion Devices of Troy, Michigan, and General Motors Corporation. This car is priced at $US 88,895 as compared to $US 33,995 for the version with conventional lead acid batteries. The average distance travelled between recharging rose to 271 km (168 miles) from 227 km (141 miles) in the race last year.

Nissan Motor Company of Japan announced in May 1997 it is developing a gasoline engine-based hybrid electric car. Among its advantages is a 50% reduction in carbon dioxide emissions. The battery is of the lithium ion type which was developed in conjuction with Sony Corporation.

Researchers from the Jet Propulsion Laboratory of the California Institute of Technology and the University of Southern California have developed what they term a direct methanol liquid-feed fuel cell which converts a methanol-water mix-

ture directly into electricity with no preliminary reforming stage. A polymer proton exchange membrane, coated with a platinum-ruthenium catalyst, is used (from the *IEEE Spectrum* June 1997).

The United States Advanced Battery Consortium, composed of the three major car manufacturers and the US Department of Energy, have awarded a third contract of $34 million to a research grouping involving Hydro-Québec, the 3M Company of Minnesota and Argonne National Laboratory, Chicago, for further work on a lithium polymer battery intended for electric vehicles. So far the contracts awarded to this research consortium have totalled $117 million. The current phase involves the assembly and delivery of full-sized battery packs in 1998 to allow road testing. In March of 1997, the utility had previously announced an $8.3 million expansion of the facilities where the batteries will be made. The object is a battery for EVs having improved power, range and cost. Separately, Hydro-Québec is developing an EV with motors on each wheel hub.

• The Ford Motor Company has announced its intention to increase the production of flexible-fueled cars and light trucks. About 250,000 of these vehicles will be built by the company in the next three of or four years that can run on gasoline, ethanol or combinations of these two fuels. This decision is widely believed to help the company meet its obligations on fuel standards even though not many may actually be fuelled with ethanol because of the limited number of supply stations at present and because of the greater cost of this alcohol to the vehicle owner even after subsidy.

• Three companies have reported improvements to the classical Fischer-Tropsch (F-T) conversion of synthesis gas to middle distillates (kerosene and diesel fuel). Following the first appreciable use in Germany during World War II to convert coal to oil, the technique was modified and has been used by SASOL in South Africa for 40 years where three plants now produce about 15,900 cubic metres (100,000 barrels) a day from coal and 400 cubic metres (2,500 barrels) per day from natural gas from an isolated offshore field. The question is: What to do with 'stranded' natural gas which has only limited local markets and where no long-distance pipeline connections are available? Such gas may be marketed as Liquefied Natural Gas (LNG) by tanker, converted to methanol and also shipped by tanker, or consumed locally in energy-intensive applications such as by generating electricity for the production of aluminum or reducing gases to convert iron ore to metallic iron. An improved F-T process offers a large-scale option for conversion of gas to oil products, usually middle distillates, which may be shipped economically by tanker. The production of such products had the advantage of by-passing the capital-intensive refinery stage and, because the sulphur content of the natural gas must be reduced to very low levels to protect process catalysts, the products themselves are very low in this environmentally-sensitive element. Exxon Corporation has also developed improvements to the process and is considering a facility in Qatar, where there are very large resources of gas to produce 15,900 cubic metres (100,000 barrels) a day. SASOL is considering a plant to produce 3,180 cubic metres (20,000) barrels a day at the same location. A small US company, Syntroleum Corporation, is offering a smaller-scale version of an improved F-T process as well. The Shell group of companies has followed a somewhat different technical route in a small facility in Malaysia. In Canada, significant resources of stranded natural gas exist in the Arctic and, depending upon the success of current exploratory efforts, possibly in Newfoundland.

• Now that the Sun group of companies is offering natural gas directly to consumers following the further deregulation of the energy industry, the company is now known as Suncor Energy Inc. The company announced in June of 1997 that it planned a facility to produce oil from the Stuart oil shale deposits in Australia in a joint venture with two other companies.

• Amoco Canada, with Petro-Canada and Norsk Hydro as partners, will begin in June 1997 to drill an exploratory well at West Bonne Bay in the Jeanne d'Arc Basin off the south coast of Newfoundland about 40 km from the Hibernia field. Geologists believe as much as 48 million cubic metres (300 million barrels) of oil may be found.

• It was announced in June 1997 that BHP Co. Ltd. of Australia through its subsidiary BHP Minerals Canada will join Shell Canada to develop the previously announced $1- billion oil sands mining project in the Athabasca region of northern Alberta. This project, now at the pre-feasibility stage, is expected to produce between 19,000 and 24,000 cubic metres (120,000 and 150,000 barrels) per day starting in 2002.

• Mobil Oil Canada has announced it is studying the con-

struction of a new plant to produce 15,900 cubic metres (100,000 barrels) per day from the Alberta oil sands.

• Nova Scotia Power Corporation has announced it will consume about 13% of the gas to be produced from the off-shore Sable Island fields. This project, led by Mobil Oil Canada, is now in the regulatory review phase by the National Energy Board and other agencies working together. This gas will replace imported heavy oil now combusted in some of the company's thermal power plants.

• It was announced in June 1997 that a group of 36 parties under the leadership of PanCanadian Petroleum Ltd. will spend $1.1 billion to apply an enhanced recovery technique using carbon dioxide to the Weyburn field in Saskatchewan starting in mid-1998. Ninety-five million cubic feet (2.7 million cubic metres) of this gas per day will be imported from the Dakota Gasification Company in Beulah, North Dakota, where lignite is converted into synthetic natural gas. The carbon dioxide, which is now released to the atmosphere, will be transported to Weyburn in a dedicated, 370 km pipeline to be built at a cost of $100 million. To the extent that the carbon dioxide remains in the ground after the miscible flooding operation is completed, there is a reduction in greenhouse gas emissions. Oil production is expected to increase some 1590 cubic metres (10,000 barrels) per day to 4770 cubic metres (30,000 barrels) per day by 2008 and the life of the field, originally discovered in 1954, is expected to be extended for another 25 years. Appropriate tax régimes have been under negotiation for some time. This project may serve as a model for future activities in the Western Canada Sedimentary Basin as existing reservoirs mature. Additional carbon dioxide could be obtained from thermal power plants and hydrogen plants in the region. Definite information concerning the contribution of such projects to the reduction in net emissions in carbon dioxide to the atmosphere will be another important contribution of this new venture.

•Both British Petroleum and the Shell Group of companies have recently indicated that renewable sources of energy will become more important because of the problem of Global Climate Change. Mr. John Browne, the Group Chief Executive of BP, stated in a speech presented at Stanford University in May of 1997 'it would be unwise and potentially dangerous to ignore the mounting concern' and that 'it falls to us to begin to take precautionary action now.' He went on to say his company would be more active in the field of solar power with its sales of this technology expected to reach the $US 1 billion per year in the next decade. The text of this important policy statement by the head of a major oil company may be found at the company's Web Site at http://www.bp.com in the 'What's New' section. Shell for its part indicated that renewable energy sources—wind, biomass and solar energy—would grow to 5% of the global energy market by 2020, a faster expansion than was achieved by oil a century ago. The views of the two European oil giants contrast with statements from most other oil companies on the importance of dealing with Global Climate Change.

• On August 12, 1997, following the recommendations of a report by the Nuclear Performance Advisory Group commissioned by Ontario Hydro, it was announced seven nuclear reactors at the Pickering and Bruce Nuclear Generating Stations will be shut down for extensive modifications. The cost of the repairs, safety upgrades and reliance on more expensive fossil fuel-based generation in the meantime will lead to additional expenditures of some $5-8 billion. Excessive corrosion is the main technical problem, but the report was critical of the management of the utility. As a result, the President and Chief Operating Officer, Allan Kupcis, resigned. It is not clear whether all the reactors to be shut down will be restored to service. Emissions of carbon dioxde will, no doubt, increase as a consequence of this decision.

• Another CANDU nuclear reactor will be purchased by Romania. The first unit began service in 1996.

• The US Congress is considering a Clean Energy Science Initiative with an expenditure of $US 250 million over two years in the solar and other renewable energy fields. This amount would be an increase of over 11% of the sums authorized for work in these fields at the scientific level for the current fiscal year.

• Web Sites of Interest in the Energy Field: The 1997 issue of British Petroleum *Statistical Review of World Energy*, containing data for the year 1996, may be found at http://www.bp.com/bpstats. The Carbon Dioxide Information Analysis Center, located at Oak Ridge National Laboratory in the US, may be located at http://cdiac.esd.ornl.gov/. The US Environmental Protection Agency Global Warming Site may be found at http://www.epa.gov/globalwarming/home.htm. Papers on clean cars,

and clean fuels for the 21st Century, may be found at http://www.fia.com/homepage/fia.htm. Over 500 titles covering 20 years of activities by the Canadian Environmental Assessment Agency may be found at http://www.ceaa.gc.ca.

Correction to 'Report on Canada's Energy Outlook 1996-2020' in Vol. 8, No.1 of *Energy Studies Review*

A corrected version of this note appears below. The previous version was based upon a preliminary issue of the *Outlook*.

The Department of Natural Resources released its update of *Canada's Energy Outlook 1996-2020* in April 1997, though it was first discussed at the time of the regular meeting of Environment and Energy Ministers December 11-12, 1996. A number of copies were circulated in advance to those interested in the energy field for the purpose of consultation. The *Outlook* is prepared to develop views within a consistent framework, identify pressure points and to undertake policy analysis. The energy projections are the government's official reference case and, as such, are used for the review of Canada's progress under the National Action Program for Climate Change (NAPCC). The most important change in the two-year period since the last *Outlook* was released in 1994 is a drop in the estimate of greenhouse gas emissions expected in 2000 to an 8.2% increase from 1990 in comparison with the estimate of a 13% increase between those years prepared in 1994 for the NAPCC. The oil price scenario used in the economic calculations employs somewhat lower prices than those used previously: 1995 $US 20 in the 1996 *Outlook* throughout the period from 2000 to 2020. Spot market prices were somewhat higher in December of 1996. As in previous *Outlooks*, there is much detailed information including estimates of energy demand by sector and projected supply/demand balances for the principal energy sources. Net oil exports are expected to continue to increase until 2000 and then decline gradually thereafter. The assumptions used in the econometric calculations are clearly set out. It is apparent the authors anticipate no major surprises before 2020.

Copies of *Canada's Energy Outlook 1996-2020* (ISBN 0-662-25618-2) are available from the Communications Sector, Department of Natural Resources, 580 Booth Street, Ottawa, Ontario, K1A 0E4.

The Update *section in preparation for future issues may be previewed at John Walsh's web site at http://infoweb.magi.com/~dwalsh/jhw.html. He can be contacted at (613) 745-6279.*