Update

Framework Convention on Climate Change

The Framework Convention on Climate Change (FCCC) was negotiated at the Earth Summit held in Rio de Janeiro in June of 1992 with the objective of stabilizing the concentrations of greenhouse gases at a level that will prevent dangerous anthropogenic interference with the earth's climate. The agreement, to which Canada adheres, requires signatories to develop inventories of emissions; to formulate national programs to mitigate climate change; to promote and transfer technologies; and to cooperate in research. Annex 1 Countries (OECD countries and eastern Europe) have also agreed to adopt national policies, take measures leading to the mitigation of climate change, limit their emissions of greenhouse gases, and protect and enhance their greenhouse sinks and reservoirs. Annex 1 countries have also set an objective to return, individually or jointly, CO_2 and other greenhouse gases to their 1990 levels by the year 2000.

In the first Conference of the Parties (COP1) held in Berlin in the Spring of 1995, it was agreed that these commitments were inadequate to meet the ultimate goal of the FCCC and that the meeting of COP2, scheduled for Geneva July 8-19, 1996, will be an important step in the extension of the commitments already made with the object the negotiation of a Protocol or other legal instrument to be signed in 1997. Preparations are now in progress to advance the analytical studies still outstanding, to examine possible policies and measures, and to explore limitation and reduction objectives for the post-2000 period.

To further these international negotiations, a series of consultations have been held with the leading Canadian stakeholders concerned with this subject. There are now two consultative groups: the National Air Issues Coordinating Committee and the Non-Government Advisory Group on International Climate Change. The latter smaller group focuses on international matters arising in the on-going climate change negotiations. Canada participates in the Ad hoc Group on the Berlin Mandate (AGBM) as well as its two subsidiary bodies: the Subsidiary Body on Implementation (SBI); and the Subsidiary Body on Scientific and Technological Advice (SBSTA). A report is available on the March meetings of these groups held in Geneva in preparation for COP2. Notable in this documentation is a reference to a Dutch study suggesting that average global warming should be held to no more than 0.1°C per decade for ecological reasons. This finding suggests that policies aimed at only stabilization of emissions will prove inadequate. Copies of some papers presented to Workshop Sessions are also available including a useful contribution by M.J. Grubb, Head of the Energy and Environmental Programme of the

Royal Institute of International Affairs, entitled 'On the Differentiation of Quantified Emission Limitation and Reduction Objectives for Annex 1 Countries.' At the request of the FCCC, the International Energy Agency (IEA) is now preparing 11 studies in selected energy fields to explore possible actions aimed at lower emissions.

A Workshop on Climate Strategies in Climate Change Negotiations was held in Toronto on January 16-17, 1996, to gather stakeholder views from industry, environmental groups, and Federal and Provincial governments to provide input to help guide the formulation of the Canadian position. The meeting reviewed the principles to be followed in the negotiations, and went on to consider possible policies and measures, quantified emission limitation and reduction objectives, the engagement of developing countries (including the related opportunities for Canadian industry in Activities Implemented Jointly), and a number of innovative ideas. A limited number of copies of the report of this meeting prepared by the facilitator Price Waterhouse are available from Mr. John Drexhage, Global Air Issues Branch, Environmental Protection Service, Environment Canada, Ottawa, Ontario, K1A 0H3 (Fax: (819) 994-0549).

Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization and the United Nations Environment Programme in 1988 to: (i) assess available scientific information on climate change, (ii) assess the environmental and socioeconomic impacts of climate change, and (iii) formulate response strategies. The IPCC First Assessment Report was completed in August 1990 and provided the basic background information for the subsequent negotiation of the United Nations Framework Convention on Climate Change in 1992. Special reports were published in 1992 and 1994 and the *Second Assessment Report* (SAR) was agreed at a session in Rome in December 1995. Cambridge University Press will publish the three volumes of the *SAR* in mid-1996 with the following titles: 'Climate Change 1995 – The Science of Climate Change Contribution of Working Group I' to the *SAR* editors J.J. Houghton, L.G. Meiro Filho, B.O. Callander, N. Harris, A. Kattenberg and K. Maskell; 'Climate Change 1995 – Impacts, Adaptations and Mitigation of Climate Change Contribution of Working Group II' to the *SAR* editors R.T. Watson, M.C. Zinyowera and R.H. Moss; and 'Climate Change 1995 – Economic and Social Dimensions of Climate Change Contribution of Working Group III' to the *SAR* editors James P. Bruce, Hoesung Lee and Erik F. Haites.

Each of the three volumes of the *SAR* consists of a 'Summary for Policymakers' together with individual chapters written by lead authors. Each of these chapters was drafted by a writing team of between three and 20 experts in the field including at least one expert from a developing country. There were some 700 lead authors. After the comments of the over 1,000 experts involved in the review process were addressed, there was further review by the participating governments and other organizations. The extensive peer and governmental review process is critical to assuring member states that the underlying material is technically sound. The individual chapters were accepted by the IPCC but they remain the responsibility of the lead authors. Each Summary for Policymakers was approved unanimously, word-by-word, by the representatives of over 100 governments. It was an extremely challenging task to achieve consensus on a text that is consistent with the technical content of the individual chapters and yet was also acceptable to virtually every country in the world.

The December 1995 meeting of the IPCC also approved, again word-by-word, the IPCC *Second Assessment Synthesis of Scientific-Technical Information Relevant to Interpreting Article 2 of the UN Framework Convention on Climate Change*, copies of which will soon be available from the IPCC Secretariat in Geneva. This article expresses the ultimate objective of the Convention as:

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

The policy judgment as to what constitutes "'dangerous interference" and how quickly concentrations of these gases should be stabilized is now the subject of continuing deliberations in the FCCC Conference of the Parties. It is clear, however, that stabilizing the concentrations in the atmosphere in much less than a century would be difficult and that

regardless of the concentration level chosen for CO_2, the principal greenhouse gas, annual emissions will ultimately need to be reduced well below current levels. In the coming year, the IPCC will prepare a series of reports to aid these negotiations by compiling and interpreting information from the *SAR* and including the assessment of more recent research on particular topics. Workshops will also be organized to deal with topics where additional research is needed.

Many Canadians have played a prominent role in the IPCC *SAR*. In Working Group I, dealing with the Science of Climate Change, the following were Lead Authors: G. Boer (Canadian Centre for Climate Modeling and Analysis); K. Denman (Institute of Ocean Sciences); G. McBean (Atmospheric Environment Service); and A. Weaver (University of Victoria).

The following were Contributors to Working Group I: S. Calvet (University of British Columbia); B. Findlay (Environment Canada); G. Flato (Canadian Centre for Climate Modelling and Analysis); I. Fung (University of Victoria); D. Gullet and W. Hogg (both of Environment Canada); S. Lambert, University of Victoria); R. Laprise (University of Québec at Montréal); T. Lewis (Pacific Geoscience Centre); L. Malone (Environment Canada); N. McFarlane (Canadian Climate Centre); E. Mekis (Environment Canada); T. Pederson (University of British Columbia); M. Pena (Institute of Ocean Sciences); T. Platt (Bedford Institute of Oceanography); K. Wang (Pacific Geoscience Centre); and F. Zwiers (Canadian Climate Centre).

The following were Lead Authors in Working Group II dealing with Impacts, Adaptations and Mitigation of Climate Change: J. Dumanski; T.D. Prowse; H.A. Reiger; H-H Rogner; R.B. Stewart, H. Tiessen; and M-K Woo. The following were Contributors to this Working Group: S. Arnott; M. Brklacich; R.D. Brown; C.A. Campbell; R.L. Desjardin; P.N. Duinker; E.G. Gregorich; P.J. Hall; R.Hecky; A.G. Lewkowicz; C. Monreal; D.F.W. Pollard; N. Roulet; W. Skinner; B.J. Stocks; C. Tarnocai; A.E. Taylor; D. Waltner-Toews; D. Welch; and E. Wheaton.

For Working Group III dealing with Economic and Social Dimensions of Climate Change: J.P. Bruce of the Canadian Climate Change Program Board served as Co-Chair and E.F. Haites (Margaree Consultants), M. Jaccard (Simon Fraser University) and J.B. Robinson (University of British Columbia) served as Lead Authors. (section above from Erik F. Haites)

The World Energy Council released a critique of the *SAR* entitled *Climate Change 1995* in March of 1996 which was the subject of a press release in London June 5, 1996. Copies of the WEC commentary, designated as 'Report No. 5,' are available from the Energy Council of Canada, 30 Colonnade Road, Nepean, Ontario, K2E 7J6 (Fax: (613) 952-6470).

New Reports

Greenhouse Issues Newsletter

The *Greenhouse Issues Newsletter* (No. 22 January 1966 - ISSN 0967 2710), circulated by the IEA Greenhouse Gas R&D Programme, features a lead article dealing with the Natuna gas field in Indonesian waters in the South China Sea. This field, with about 1,270 billion m^3 of recoverable hydrocarbon reserves, is one of the largest in the world but 71% of the gas is CO_2. Pertamina, the national oil company of Indonesia, in partnership with an affiliate of Exxon Corporation, plan to start production of liquefied natural gas (LNG) for export markets in about eight years time. It is planned to sequester the separated CO_2 in two large underground aquifers occurring in large carbonate formations. This is the largest sequestering project planned to date and will follow a somewhat similar Norwegian project at the Sleipner Off-Shore Platform in the North Sea scheduled to begin operation in 1996.

The March Issue (No. 23) of the *Newsletter* provides a number of useful Uniform Resource Locators (URLs) for organizations with Home Pages on the World Wide Web active in the global clilmate change field. Three are listed below: The Global Environment Facility of the World Bank: http://www. worldbank. org/html/gef/; Carbon Dioxide Information Analysis Centre (CDIAC): http://ww~eosdis .Ornl.gov/daacpages/cdiac.html; and Global Climate Change Information Programme (GCCIP): http://www.doc.mmu.ac.uk/aric/gcciphm.html

The *Newsletter* is available without charge from the IEA Greenhouse R&D Programme, CRE Group Ltd., Stoke Orchard, Cheltenham, Gloucester, UK GL52 4RZ. (Fax: +44 (0) 1242 680758; E-Mail – andrea@ieagreen.demon.co.uk). The Web Site URL is: http://www.ieagreen .org.uk/

Newsletter of the International Association for Energy Economics (IAEE)

The Winter 1996 *Newsletter* of the IAEE contains an extended review of the regular London Conference sponsored jointly by the Royal Institute of International Affairs, the British Institute of Energy Economics and the IAEE with the subject of the December 4-5, 1995, meeting The Changing Politics of International Energy Investment. The summary of this meeting, prepared by David Jones, is a valuable contribution to this field. Other articles of interest in the *Newsletter* include: a summary of a presentation by Peter Pearson to the IAEE 18th International Conference held in Washington in July 1995, and entitled 'Electric Power, Emissions and Economic Development;' notes from the Belarus Workshop of October 4-6, 1995; 'Energy-The Key to Ecologically Sustainable Development' by Bruno Fritsch; 'The IEA Gas Security Study' by Bjorn P. Saga; 'Privatization of the Hungarian Energy Industry' by Tamas Jaszay Jr. and Eniko Kiss; and 'An Analysis of OPEC/Non-OPEC Cooperation' by William R. Edwards.

Copies of the *Newsletter* may be obtained from the IAEE at 28790 Chagrin Boulevard, Suite 210, Cleveland, Ohio, US 44122. (Fax: (216) 464-2737; E-Mail: IAEE@IAEE.org). The Web Site URL is: http://www.IAEE.org)

Science and Technology for the New Century

On March 11, 1996, the Federal Government released its strategy for *Science and Technology for the New Century* following an extensive consultation period. Three related goals were set out for 'building a strong, forward-looking, dynamic Canadian innovation system: (1) sustainable job creation and economic growth; (2) improved quality of life; and (3) advancement of knowledge.' The report deals with the changes in emphasis needed in both funding and management to meet these objectives in an age of absolute spending reductions. It notes that according to the World Economic Forum's 1995 review of 48 countries, Canada ranks only 18th in science and technology and that national productivity increased only 0.3% per year from 1974 to 1993, much lower than the 2% a year achieved in the earlier decades of the 1950s and 60s. This fall is attributed to an 'innovation gap.'

Despite its importance to Canada, there is little reference to the energy field although the priorities of the Department of Natural Resources are stated as the sustainable development of natural resources and the international competitiveness of associated industrial sectors. The report notes that 'science and technology are key to achieving sustainable development' and that the four federal departments concerned with natural resources are 'jointly implementing a framework for sustainable development' in the science and technology field.

Copies of the strategy papers, published in four separate reports catalogued as ISBN 0-662-62160-3, 0-662-62066-6, 0-662-62300-2, and 0-662-62301-0 together with other related supporting documents, may be obtained from Distribution Services, Industry Canada, Ottawa, Ontario, K1A 0H5 (Fax: (613) 954-6436).

A 'Special Edition' of the *R&D Bulletin*, issued by Public Works and Government Services Canada (PWGSC) in April, 1996, provides a synopsis of the main points of the new policy announcement together with an explanation of the role of the Unsolicited Proposals Brokerage Service (UPBS). This Service helps obtain financial support of innovative research and development projects in the public sector through partnerships with the private sector and government departments and agencies at the federal, provincial and municipal levels. The UPBS is managed and administered by PWGSC but is organized as a joint initiative of that Department and Industry Canada. Normally, the *R&D Bulletin* is available only on line at the following URL: http://www.pwgsc.gc.ca, but copies of this special addition can be obtained from PWGSC, Ottawa, Ontario, K1A 0S5.

Annual Report of the National Energy Board for 1995

The Minister of Natural Resources, the Hon. A. Anne McLellan, released the *Annual Report* of the National Energy Board on April 16, 1996. Virtually every category of energy production reached a new high in 1995 with the exception of nuclear generation of electricity which was down 10.3%. Total Canadian energy exports increased 10% on the year, but electrical exports decreased by 10% to 40.5 terrawatt hours. The value of gas, oil and electricity exports together was estimated at $16.9 billion as compared to $16.3 billion in 1994.

Total oil production was estimated to increase to 313,300 m^3 (1,971,000 bbls) per day. Exports exceeded imports by 73,900 m^3 (465,000 bbls) per day, an in-

crease of 27% in the net export position when estimated this way. Crude oil exports were up 6.3% at 167,000 m^3 (1,052,100 bbls) per day

Natural gas production reached a new high at 149.6 billion m^3 (5.28 tcf), up 5.2%. Gas exports were up 10% to 79.3 billion m^3 (2.80 tcf). Exports again exceeded domestic sales as has been the pattern since 1992.

Primary energy consumption reached a new high of 10.734 EJ, but was up only 1.7% on the year.

The Board reported on the first negotiated toll settlements for Interprovincial Pipe Line Inc. and other major pipelines also filed multi-year negotiated settlements that were later approved in 1996. In August of 1995, the Board commenced a wide-ranging public inquiry on the occurrence of Stress Corrosion Cracking on Canadian oil and gas pipelines which phenomenon has been responsible for a number of failures in recent years. Joint panel environmental assessments were instituted for the proposed Express Pipeline Project and a joint panel was established to review the proposed Sable Island Gas Project off the Nova Scotia coast to fulfill the requirements of the Canadian Environmental Assessment Act. The Board also reported that its total budget declined to $30.9 million in the 1994-9 period: approximately 85% of these costs are now recovered from the regulated industry.

The Board held a hearing on July 22, 1996, for a further expansion of the natural gas transmission facilities of TransCanada PipeLines Limited. The company proposes to add approximately 61.8 km (38.6 miles) of pipeline, three 28.3 MW compressor units, and a 2.2 MW compressor unit to its existing system in Saskatchewan, Manitoba, and Ontario. With construction to be completed by November of 1997, these new facilities will provide incremental gas service totalling about 3.6 million m^3 (126.3 million ft^3) per day for both domestic and export markets. The cost is estimated at $ 263.6 million.

Copies of the *Annual Report* and a separate convenient list of tabular appendices may be obtained from the Board at 311 - Sixth Avenue S.W., Calgary, Alberta T2P 3H2 (Fax: (403) 299-5503. This report is also available on the Bulletin Board at (403) 299-2751 (Communication Settings: full duplex N-8-1)

The Canadian Environmental Assessment Agency

The Canadian Environmental Assessment Act came into force in January, 1995. With the passage of this Act, the federal assessment process has a statutory basis thus reducing legal uncertainties and the need for court interpretations. Sustainable development was established as the fundamental objective of the process. At the same time, increased opportunity for public input was provided for all types of environmental assessments. The Act provides comprehensive definitions of key terms to facilitate the process.

A convenient series of five Fact Sheets has now been prepared explaining various aspects of the Act. These may be obtained from the Canadian Environmental Assessment Agency 200 Sacré-Coeur Blvd., Hull, Québec K1A 0H3 (Fax: (819) 953-2891).

Short Notes

• There are press reports indicating consideration is being given to merging the nuclear activities of the federal Crown Corporation Atomic Energy of Canada Ltd. (AECL) and the provincial Crown Corporation Ontario Hydro. Such a merged operation would have assets in the range of $30 billion and so would be one of the most important organizations in the world involved in producing and marketing nuclear energy. This possibility is one of the options being examined by a committee chaired by former federal energy minister Donald Macdonald formed to review the future of Ontario Hydro. Although the prospects for nuclear energy seem poor in North America in the immediate future, expansion programs are in progress in mainly Pacific Rim countries. The market for the supply of uranium has been tightening recently as evidenced by price increases, and Canada remains the largest exporter of this nuclear fuel.

• AECL and Ontario Hydro are continuing their study undertaken in cooperation with the US Department of Energy to fuel two reactors at the Bruce 'A' Generating Station with plutonium now surplus to military requirements. The study envisages processing 50 tonnes of plutonium over 25 years starting around 2002. Two to 3% of plutonium in oxide form of both US and Russian origin would be combined with conventional uranium oxide fuel in a mixed oxide termed 'MOX.' The results of this study are expected in late 1996. Though opposed by some anti-nuclear groups on the grounds that plutonium is dangerous to transport and handle, the result would be a depleted

oxide no longer suitable for bomb-making. The Canadian and Russian Prime Ministers approved a document furthering cooperation in this field on April 18,1996, prior to the G-7 Meeting of Heads of State in Moscow April 19-20, 1996 where a Trilateral Testing Agreement was signed with the US. Russsia signed a number of international conventions on nuclear safety and security aimed at reducing the chances of nuclear material falling into the hands of terrorists. The intention to close the Chernobyl reactors by 2000 was also confirmed, but no new funds were evidently provided to the Ukraine over what has already been committed.

An environmental assessment panel established to review the concept of management and disposal of nuclear wastes proposed by AECL began hearings on March 11, 1996, in Toronto. The format for the Phase I public hearings was interesting in that one topic in a range of broad societal issues was examined each day by an invited speaker prior to roundtable discussions among registered participants and others attending the sessions.

The first two weeks of the Phase II hearings were also held in Toronto from June 10-14 and 17-21, 1996, and will consist of technical sessions focusing on the long-term safety (the post-closure period) of the AECL concept of geological disposal from scientific and engineering viewpoints. An extra two days, from June 27-28, has been added to the Phase II hearings to address the environmental, health, and social impact issues specific to the pre-closure period of the proposed disposal facility. All sessions in Phase II will consist of detailed presentations by the proponent on each topic followed by questions and answers. The topics cover the range from technical aspects of site characterization and site availability to socio-economics impacts of a disposal facility.

AECL has spent 15 years and $450 million to devise a radioactive waste management system in which spent nuclear fuel is encased in titanium, then sealed in a crypt of clay, cement and rock located 500 to 1,000 metres below the surface of the Canadian shield. The vault is designed to hold the fuel without supervision up to 10,000 years, but may be reopened to allow fuel to be retrieved if need be. The Federal Government has recently announced budget cuts at AECL that may curtail this program. It was also announced that the AECL labs would no longer conduct research outside of the nuclear energy field, perhaps in preparation for a merger with the nuclear facilities of Ontario Hydro.

In May of 1996, AECL also issued a report prepared at the request of the Environmental Assessment Panel to respond in writing to issues regarding long-term safety that had been raised from the review of the previously submitted *Environmental Impact Statement*. This 133-page volume provides a convenient reference to frequently asked questions in this field, while the two separate appendices present an extensive and cross-linked list of references. Copies, catalogued as AECL-11602-VI, COG-96-237-VI, are available from the Canadian Environmental Assessment Agency, 200 Sacré-Coeur Blvd., Hull, Québec, K1A 0H3 (Fax: (819) 994-1469: Internet—Kerryg @fox.nstn.ca).

• The Prime Minister participated in the inauguration of the first CANDU reactor to enter service of the five originally planned at Cernavoda on the Danube River in Romania on April 17, 1996. This reactor of the CANDU-6 type, which was financed by the Export Development Corporation, has a generating capacity of 705 MWe and is expected to provide 8 or 9% of that country's electrical requirements. Originally scheduled for completion in 1985, it was scheduled to reach capacity in June. The second reactor at this site is about 30% complete. This reactor is similar to the unit operated by New Brunswick Power at Point Lepreau where about 100 Romanians have been trained in preparation for the start-up. There are no plans at present to complete the other three partly constructed reactors at this site.

• A long article on the status of the unfinished nuclear plant of Russian design at Juraguá on Cuba's south coast appeared in the *New York Times* on February 25, 1996. Construction of this 675 MWe pressurized water reactor of the updated VVER-440 (now classed as Type V-318) design was suspended three and a half years ago but an agreement has been reached between Russia and Cuba to finish this reactor at a cost of $US 750 million (in addition to the $1 billion already spent) although it appears a foreign partner is required to complete the financial arrangements. Although the overall design is similar to plants operating in Finland and Hungary, many of the safety and design changes being incorporated are prototypes that have not been tested in other reactors in Eastern Europe. It is now planned to use western-designed controls and instruments. The US government is concerned about the safety of a reactor located some 320 km from its territory but the US Department of

Energy has not included Cuba in its $180 million nuclear safety program it has established with Russia and former Soviet Block states in Eastern Europe at 59 Russian-designed reactors.

• The US and Brazil have initialed an agreement that opens the way for Brazil to purchase nuclear technology from US companies now that that country has signaled its intention to abide by the safeguards of the International Atomic Energy Agency.

• The Environment Policy Committee of the OECD marked its 25th Anniversary on February 19-20, 1996, with its fifth meeting at the Ministerial level, and the first since 1991. In their communiqué, the OECD Ministers dealt with several matters of interest to the energy field. Referring to the *Second Assessment Report* adopted by the Intergovernmental Panel on Climate Change in December, 1995, Ministers 'underlined the importance of strengthening the commitments in the UN Framework Convention on Climate Change, and of strengthening their cooperation to elaborate policies and measures, as well as setting quantified limitations and reductions to be reached within specified timeframes beyond the year 2000, which could contribute to limiting and reducing greenhouse gas emissions.' In this regard, they recognized 'the need to integrate the concepts of environmental cost-internalization and sustainability into national energy policies.' The Ministers also expressed their deep concern over the continuing depletion of the ozone layer. The Canadian Minister of the Environment, the Hon. Sergio Marchi, particularly welcomed the Declaration on lead reduction, stating that the voluntary action plan by the lead producing industry 'could serve as a model for government-industry co-operation on future risk reduction activities.' The UN Commission on Sustainable Development, set up to monitor progress since the 'Earth Summit' in Rio de Janeiro in 1992, ended two weeks of meetings on May 3, 1996. Though many success stories were reported, it appears that concern over unemployment and other economic problems was making it progressively difficult to make environmental impact a major factor in economic policy-making. The Commission did, however, for the first time, bring the world's oceans and their resources under the scrutiny of UN environmental bodies.

• In a paper published in the February, 1996, issue of the International *Journal of Radiation Biology*, Denis L. Henshaw and his colleagues at the University of Bristol in England reported the attraction of radon daughter nuclei in normal domestic room air to everyday sources of power frequency electromagnetic fields. These radioactive particles not only collected around the power lines but oscillated under the action of the magnetic field. Although theoretically predicted in the past, this concentration was actually measured in this paper. In the words of these authors, these "observations may have implications for the apparent enigma that there is no persuasive evidence to show that power frequency electromagnetic fields can influence any of the accepted stages in carcinogenesis. On the contrary, the observations show that EM-fields can concentrate in their vicinity a cocktail of radon daughter nuclei, a known carcinogen, and presumably other potentially harmful agents." The significance of these findings is, however, unclear. The view of the National Radiological Protection Board of the UK is that the fields produced by electric wires may actually reduce overall human exposure to radon. This is because the wires are, in effect, attracting radon away from the air breathed in most situations. This discovery is intriguing and will no doubt prove controversial.

In the April 1996 issue of *Technology Review* (Vol.99, No.3, p.24), Jon Palfreman in an article entitled 'Apocalyse Not' reviews the evidence for an association between magnetic fields arising from power lines and adverse health effects and concludes (as did the American Physical Union last year) that nothing has been proved. No reference was made, however, to this most recent study by Henshaw and his colleagues. Moreover, a recent study of the long-term health of Air Canada pilots found that, although the pilots were healthier than the population at large, they suffered higher incidence of some cancers. The cause is attributed to either increased exposure to radiation at higher altitudes or to electromagnetic fields. The long-awaited US Environmental Protection Agency study on this subject is expected possibly this year.

• At the meetings of the American Association for the Advancement of Science held in Baltimore in February 1996, William Rees, Director of the School of Community and Regional Planning at the University of British Columbia, extended his studies of the "ecological footprint" required for cities to remain sustainable. In the case of Vancouver, he estimates the footprint to be about 180 times the size of the city. This approach leads Prof. Rees to believe that there is little hope of increasing standards in the Third World to those of North America

because there is simply not enough land available. Nevertheless, according to a recent study *Urban Agriculture: Food, Jobs and Sustainable Cities,* published by the United Nations Development Program, there is a marked tendency for agricultural production to increase within the boundaries of third world cities. Since the quality of this food may be compromised by worsening air pollution in several cases, guidelines for growing food in urban centers have been published by the World Health Organization and other groups that seem to have been effective in protecting health.

• Environment Canada has found that 18% of the 2,300 cars tested in 11 cities in four provinces in the summer of 1995 showed signs of tampering with pollution-control equipment. Fully 23% of the cars tested did not pass standard pollution tests and 11% were rated as gross emitters. Currently, only British Columbia, which experiences serious air pollution problems in the Lower Mainland region of the province, has mandatory pollution control measures: cars must pass an annual check at the time of licence renewal. The BC government is presently considering measures to encourage the removal of older, high-emitting cars from the roads. The Federal Minister of the Environment, the Hon. Sergio Marchi, has announced his support of national standards to curb such pollution but seems reluctant to impose restrictions as tight as those proposed by the BC government. He has also re-introduced Bill C-29 into Parliament to ban the gasoline additive MMT. Opposed by the oil industry on the grounds of adding to refining costs—estimated by the industry at $80 million per year—this Bill is supported by the automotive industry because it is believed this additive damages vehicle anti-pollution control equipment. Some provinces, notably Alberta, are supporting the oil industry in this dispute.

• There have been recent reports of serious air pollution in the Paris region attributed in part to the high usage of diesel vehicles in the French capital.

• A link has been found between global warming and acid rain precipitation, which, together, are making lakes and rivers more vulnerable to damage from ultraviolet (UV) rays. The change in the chemistry of lakes and rivers from these two causes has led to increasing effects on marine organisms including fish. The warmer and more acidic water contains less of the carbon which normally protects against this form of radiation.

• The 88 large reservoirs built around the world since the early 1950s, mainly for irrigation purposes, but also for hydroelectric energy, have caused a minute but measurable effect on the rate of spin of the earth according to Dr. Benjamin Fong Chao of the Goddard Flight Center of the US NASA. These reservoirs, which contain the bulk of the world's impounded water, have increased the proportion of water held at mid-latitudes. (from *The New York Times* of March 3, 1996.)

• Studies in England indicate that women (the study was limited to women) that use gas stoves are about twice as likely to suffer asthma-like symptoms such as breathlessness and wheezing than those that use electric appliances. It is suspected that NO_2 in the combustion products of gas stoves is responsible for this effect.

• At a presentation to the Royal Society in the UK in February 1996, Sir John Houghton, Professor of Atmospheric Physics at Oxford University (who also serves as Chairman of the Intergovernmental Panel on Climate Change) was pessimistic about the effects of global warming. He stated that Southern China, Bangladesh, and Egypt face the prospect of land losses due to sea level rise. He warned further that water supplies throughout the world would be severely affected. Food supplies might not be affected by global warming as "some regions may be able to grow more, others less, but the distribution of production will change because of changing water availability. The regions likely to be adversely affected are those in developing countries in the sub-tropics with rapidly growing populations. There may be a large number of environmental refugees." (from *The Guardian Weekly* for the week ending February 25, 1996.)

• The Hon. Anne McLellan, Minister of Natural Resources and Julia Carabias, Secretary of the Environment of Mexico, agreed on March 27, 1996, during the Minister's visit to that country, to work together to facilitate the development of climate change and joint implementation projects in the energy and natural resources sectors. The objective of both parties is to contribute to the international effort to gain knowledge and experience through the pilot phase of the Joint Implementation activity that was launched in Berlin in 1995 at the first meeting of the Conference of the Parties to the Framework Convention on Climate Change.

• In its publication *Electricity Supply and Demand 1995-2004,* the North American Electric Reliability Council reports that coal will continue to be the most important energy source for the

generation of electricity in the US. In 1995, coal supplied 57% of the electricity generated from facilities constituting 41% of the total installed capacity. In 2004, coal is expected to provide 55.8% of the total electricity generated from 37.5% of the total installed capacity. Coal consumption for this purpose is expected to rise from 751.6 million tonnes (Mt) in 1995 to 837.8 Mt in 2004.

• As recently as 1950, 33.8% of US homes were heated with coal, though by 1991 this proportion had fallen to a minuscule 0.3%. It comes as a surprise therefore that eight million tonnes of anthracite were mined in Pennsylvania in 1995, about double the amount in 1992, and the largest production since 1970. Most of this coal is being used to heat houses and small businesses. This coal is now delivered in clean plastic bags with the attraction of lower heating costs.

• In a presentation to the Ottawa Section of the Petroleum Society on February 14, 1996, Kirk Osadetz and Peter Hannigan of the Geological Survey of Canada reviewed progress in the evaluation of Canada's petroleum resource base in the light of recent advances in interpretation. In general, it may be said that the immediate outlook for further discoveries is favourable, including regions in eastern Canada, particularly the western Newfoundland near- and off-shore, where a discovery was reported in 1995 on the Port-au-Port Peninsula. A comprehensive report on this work, which will be the first such major revision of the assessment of the nation's petroleum potential since 1983, is scheduled for publication in 1997.

• The Talisman Energy Company spudded a new well on February 24, 1996 in Offshore Block EL 1008 on property controlled by Vinland Petroleum Inc. near the Port-au-Port Peninsula on the west coast of Newfoundland, but the results were disappointing. Hunt Oil of Texas and its partner, PanCanadian Petroleum Limited (controlled by Canadian Pacific), will drill a third well of their series in the off-shore waters of this region in 1996.

In March 1996, large areas of the eastern off-shore were opened for bidding. Effective January 1, 1996, PanCanadian acquired LASMO Nova Scotia Limited, which holds a 50% interest in the only producing offshore oil field at present which is located southeast of Halifax. In 1995, production from this facility, which began in 1992, averaged 3500 m^3 (22,000 bbls) per day of light crude. The Sable Offshore Energy Project, a consortium of companies developing plans to produce about 11.33 million m^3 (400 million ft^3) per day of natural gas from the six main fields already discovered near Sable Island off the Nova Scotia Coast, was awarded an exploration licence in 1995. This gas would be marketed in eastern Canada and the northeastern US. If this project proceeds, the consortium estimates that about $2 billion in capital would be required for offshore development, gathering systems, and onshore processing facilities during its expected 25-year life.

• Petro-Canada and its partners expect to file a development plan application for the Terra Nova oil field during the spring of 1996. This field is located off the south coast of Newfoundland, 35 km southeast of the Hibernia field, which is now being readied for production. The Canada-Newfoundland Offshore Petroleum Board estimates that this field contains about 64 million m^3 (400 million bbls) of recoverable, light sweet crude. This field could be producing 16,000 m^3 (100,000 bbls) per day in as little as four years from the decision to proceed. It is proposed to use a floating production system requiring an investment of about $2 billion. Production is now expected to begin from the Hibernia field in late 1997. When the full output of some 19,900 to 20,700 m^3 (125,000 to 130,000) bbls per day is reached at the turn of the century, it is expected some 10% of Canada's oil supply will come from this source.

• IPL Energy Inc., operators of Interprovincial Pipeline Inc., the world's longest oil pipeline system, having completed an expansion in capacity of 27,000 m^3 (170,000 bbls) per day in 1994, is now installing facilities for a further expansion of 19,000 (120,000 bbls) per day to enter service in 1996. The company has submitted an application to the National Energy Board for a further expansion costing $540 million that would increase capacity by 19,000 m^3 (120,000 bbls) per day in Canada and by 27,000 m^3 (170,000 bbls) per day in the US. The company has also reached an agreement with the Canadian Association of Petroleum Producers and five of Canada's largest refining companies which outlines the potential timing and other terms for the reversal of the Sarnia-to-Montreal crude oil link. Under the terms of this agreement, the producers and refiners will formally support the company's planned application to the National Energy Board to reverse direction of this pipeline so as to carry imported and possibly some eastern offshore oil to refining centres in Ontario. On March 15, 1996, the National Energy Board, after the third line break on the IPL

pipeline in the past nine months and the fourth since 1989, has directed the company to reduce the operating pressure and to pressure test certain sections of its system. Stress corrosion cracking is suspected on some of the older sections of the line. In response, the company has filed a pipeline integrity plan with the Board.

• Imperial Oil reports continued progress in its expansion plans for bitumen recovered from the large Cold Lake field in northeastern Alberta. Gross bitumen production from underground steam recovery operations reached 14,900 m^3 (94,000 bbls) per day in 1995, up about 7% on the year. The field is stated to contain proved and probable reserves of about 159 million m^3 (one billion bbls) of bitumen. Production will continue to increase until the current $240-million investment program is completed at the end of 1997.

• Syncrude Canada has announced that its target of a record production of 11.7 million m^3 (73.5 million bbls) was reached in 1995. It was also stated that the costs were well under Cdn $\$88/m^3$ ($14/bbl) which was also a new low.

• An agreement was reached on May 20, 1996, between the United Nations and Iraq to permit that embargoed country to export some 111,000 m^3 (700,000 bbls) per day on world markets. Security Council Resolution 986 would permit the sale of oil worth $US one billion every 90 days for six months. It is expected to be extended. About 50% of the proceeds from this sale will provide food and medicines for the main areas of the country, 30% will be directed toward war reparations to both Kuwait and others affected, 15% will go for food and medicine for the semi-autonomous Kurdish areas in the northern regions, and 5% will be directed to cover the costs of related United Nations operations. Iraq is to provide a plan for implementing the agreement which must be approved by the UN.

The quantity of oil to be added to the market is a little less than 1% of current world production and somewhat less than the normal growth in world oil consumption over the corresponding time period. There was little immediate reaction on world oil trading markets, presumably because the agreement took so long to negotiate it had already been discounted, but prices had begun to fall by the time of the OPEC meeting in June of 1996. Oil prices had increased in the spring of 1996 in part because suppliers minimized their inventories in expectation of a price drop when the settlement was finally reached. The companies experienced somewhat greater demand than expected due to colder weather and some other factors during a period when demand is usually slack. The result was a tight supply situation for some products. In February, Russia signed an agreement with Iraq—reported to be worth $10 billion—to assist in the re-equipping of its oil and power industries. In 1995, Iraqi oil production was reported as 86,650 m^3 (545,000 bbls) per day.

• There is an interesting account of the difficulties in operating tankers in the north in the Spring Issue of *the Imperial Oil Review* (Vol.80, No.420) in an article entitled 'By Tanker to Resolute' dealing with a voyage from Halifax to this northern centre for aviation.

• There are now calls in the US to repeal the 15.2 ¢ per litre (4.3¢ per US gallon) tax on motor fuels in the wake of increases at the pump in the spring of 1995, although most experts expected these prices to subside in the summer months. It was announced that 1.9 million m^3 (12 million bbls) will be released from the Strategic Petroleum Reserve. The fact is that Americans are consuming more motor fuel than expected. They are driving greater distances using a greater proportion of vans and sports utility vehicles (which now account for about 40% of new light duty vehicles sold) so that average fuel efficiency of the fleet is decreasing. Furthermore, speed limits have been increased in many States. Up to now, however, the cost of fuel per unit of distance traveled has remained about constant in real terms since the real cost of motor fuel has been falling.

In 1973, the light duty vehicles travelled about 8,629 km (5,350 miles) per person, but by 1994 this figure had reached 12,742 km (7,900 miles). Actual miles per gallon were 13.11 (17.94 litres/ 100 km) in 1973, and increased to 20.22 mpg (11.63 litres/ 100 km) in 1985 due to rising prices and mandated efficiency improvements. By 1994, this figure had fallen to 19.31 mpg (12.18 litres /100 km). Americans bought 1.24 million m^3 (7.79 million bbls) of gasoline per day in 1995 as compared to 1.04 million m^3 (6.54 million) per day in 1974.

• In Bremen, in December of 1995, the German Post Service started a two-year test of a zinc-air battery system in six of its delivery trucks (to be eventually increased to 64 vehicles) using a zinc cell mounted in replaceable cassettes. In essence, the electrical energy is generated in a fuel cell based upon the conversion of zinc metal to its oxide, which has the advantage of a high specific energy of more than 200 Wh/kg. The spent zinc may be regener-

ated in a central electrolytic facility. This system was developed by Electric Fuel Corporation which has headquarters in New York and research and manufacturing facilities in Jerusalem.

In France, PSA Peugeot Citroèn has begun selling an electric vehicle called the '106 Electric.' The company plans to produce 6,000 units this year. This vehicle uses a nickel-cadmium battery that is leased for FF 501.66 (about US $100) per month under a rental system called Battery Service, which was established by the car company, the battery manufacturer SAFT, a finance company, and Electricité de France. (from IEEE *Spectrum* March, 1996)

In the US, General Motors will be offering its battery vehicle, the EV1, in Southern California and Arizona in a few months time. The price is believed to be in the US$35,000 range. It will come equipped for charging at 110 volts, but a 220-volt system will also be available at extra cost.

The Honda company has announced it will be marketing an electric vehicle in California in early 1997 powered by nickel hydride batteries, which are expected to extend the range of operation to about 202 km (125 miles) between re-charges.

The Daimler-Benz company of Germany unveiled a working prototype van in May of 1996 powered by a hydrogen-based fuel cell developed by Ballard Power Systems of North Vancouver, BC. The van, called the Necar II and based on the company's new V-Class vehicle, is capable of carrying six people, has a range of 250 km (155 miles) between refuelings, and can reach 110 km/hour. The company announced its intention to evaluate the possibility of fueling this type of vehicle with methanol which would entail installing an onboard reformer to produce the necessary hydrogen.

• An American company has devised a combination starter/ generator for cars which, it claims, would permit idling engines to provide emergency power supplies. A typical car might have a capacity of about 4 kW. Such a system may be attractive in regions prone to power failures, such as in the developing world.

• Natural Resources Canada is preparing a fact sheet on operating, maintaining and troubleshooting Heat Recovery Ventilators such as those installed in homes built to the R-2000 insulation standard. For copies contact NRCan at Fax: (613) 943-1590.

• The lead article in the April 1996 issue of the *Atlantic Monthly* (Vol.277, No.4) surveys the implications of cuts in expenditure for federally-supported energy research and development in the US. In 'Mideast Oil Forever?,' Joseph J. Romm and Charles B. Curtis of the US Department of Energy note progress in a number on energy technologies, especially renewables, including the production of ethanol from cellulose for use as a fuel for vehicles. The publication of this article coincided with an unexpected increase in the price of oil which added to its impact. These authors believe that if there is no support for the imposition of economic instruments of one kind or another (carbon taxes, for example), or regulations to improve the efficiency with which energy is consumed, the only option left is the encouragement of new, benign technologies. They conclude "only a misbegotten ideology could conceive a blunder of such potentially historic proportions."

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