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# Update

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## Federal *Green Plan* Announced

Following a public consultation process unprecedented in its scale, the Government announced its long-awaited *Green Plan* on December 11, 1990. Three billion dollars of new expenditures are to be made available over five years for the more than 100 purposes identified in the 174-paged document released by the then Minister of the Environment, the Hon. Robert de Cotret, though this funding was reduced somewhat in the Budget of February 26, 1991. The *Green Plan* provides a framework for the specific proposals to be announced over the coming years. Copies of this document are available from the Communications Branch of the Department of the Environment, Ottawa, Ontario, K1A 0H3.

Concerns over energy take a central place in planning Canada's environmental future. As far as greenhouse gases are concerned, the immediate goal remains as already announced: namely, to stabilize national emissions of carbon dioxide and other active gases at 1990 levels by the year 2000. The document makes clear that it may prove necessary to restrict these emissions to even

lower levels, but any such further action should await the outcome of international negotiations now beginning preparatory to the UN Conference on Environment and Development to be held in Brazil in 1992. Even this relatively modest target may be difficult to meet since, under 'business-as-usual' conditions, emissions would be expected to increase some 17% over the coming decade primarily as a result of economic growth, according to studies conducted by the Department of Energy, Mines, and Resources.

Since no aggressive economic levers (such as a carbon tax) are now included in the plan, the measures to be introduced first are those that make economic sense in their own right, such as encouraging higher energy efficiency and greater tree planting, or those that serve multiple policy objectives, such as eliminating the use of chlorofluorocarbons (CFCs). The document does, however, promise a discussion paper on relevant economic instruments which will be released during 1992.

In addition to measures announced under the *Green Plan*, the Minister of Energy, Mines and Resources will table a National Energy Efficiency and Alternative Energy Act which will deal specifically with such things as the regulation of minimum efficiency

standards for energy-using equipment, the labelling of products to convey information on energy use, improved dissemination of relevant information, and the collection and interpretation of statistics on energy use. Minimum energy efficiency standards will be developed for appliances and equipment; 'Energide' labelling for home appliances will be enhanced, and the 1983 Measures for Energy Conservation in New Buildings will be updated and regionalized. This will include the enhancement of technologies for producing better windows, lighting, and heating/cooling systems. A further round of fuel efficiency targets for new vehicles will be set. As far as industry is concerned, a National Advisory Council will be established to promote industry/government cooperation and to establish energy efficiency targets for each of Canada's industrial sectors.

Measures will also be introduced to limit greenhouse gas emissions by promoting alternative energy forms, especially the accelerated development and market penetration of alternative transportation fuels such as natural gas, increased availability of alternative fuel vehicles, encouragement of ethanol and methanol as vehicle fuels and fuel feedstocks, and support for such new

sources as hydrogen. Renewable energy sources such as passive, active, and photovoltaic solar energy options will be studied in cooperation with utilities and other industry partners. There will also be increased research, development and demonstration of advanced energy systems such as combined-cycle systems for the generation of electricity, cogeneration processes, and district energy systems.

The tone of the text of the *Green Plan* is generally pessimistic, suggesting that the efficiency measures that could be implemented at no net cost to the economy will prove insufficient in the longer run, although the present recession will aid in meeting the immediate targets. It is clear, however, that the government is not prepared to further burden the economy with the high costs of more extensive reductions in greenhouse gases until concerted international action is agreed upon.

To meet long-term objectives, absolute national upper limits on the emissions of both carbon dioxide and sulphur dioxide are being proposed. Such limits (which do not increase with the units of energy used) will have major effects on the economy in the longer run. The energy basis of the Canadian economy will have to undergo a major transformation in the coming years, and in the view of many, the sooner this change occurs the lower the ultimate cost will be.

## US National Energy Strategy Released

On February 20, 1991, President George Bush and Admiral James Watkins, the US Secretary of Energy, released a new National Energy Strategy which has been in preparation for the past several years. Perhaps due to the recent crisis in the Middle East, which was then at its peak, this document has not received the attention that might have been expected despite an unprecedented 18 months of public consultations. It was ironic that the report was overshadowed by what many considered an oil war.

The report itself is surprisingly short at 217 pages of main text (including a good Executive Summary) together with 3 Appendices. After a short prologue asking the rhetorical question—Why Energy Matters?—the first section deals with increasing energy and economic efficiency in electrical generation and use, and then proceeds to examine energy use in the residential, commercial, industrial, and transportation sectors. The second section concentrates on energy security by considering separately the situations in oil, natural gas, coal, nuclear power, renewable energy, fusion, and enhanced research and development. The final sections are devoted to improving environmental quality and, in the most novel feature of the document, to fortifying the foundations for the energy future through fundamental science and engineering research, improved technology transfer, and education.

The document may be described as a balanced or moderated market-oriented approach to

energy policy. The text goes to great lengths to justify the rather limited interventions occasionally recommended for the energy economy. In the main, the focus is on removing obstacles to increasing the supply of energy from conventional domestic sources, and on eliminating barriers to improving the efficiency of the use of energy in general, all the while encouraging emerging renewable sources. It is clear that the old target of achieving energy 'independence' has long been abandoned. Even with the application of the recommended policies, imports will continue to provide almost half of America's oil for the next decade and beyond.

Electricity is expected to grow steadily in importance, and within this sector a major continuing role is predicted for nuclear energy. The report leaves no doubt that the new passive reactor designs are expected to lead to a reborn nuclear industry; the deployment of this advanced class of fission reactors is to be facilitated by streamlining the licensing procedures involved. In the technical forecasts, it is something of a surprise to see the emphasis on fusion, which is expected to begin to play a role in the next century.

In the field of coal, the only energy supply of which the US is a net exporter, the cost goal for liquefaction processes is as low as \$30 per barrel, which is thought to be achievable at the test-facility level in as little as 5 to 10 years. If so, the availability of liquified coal should, in principle at least, cap the international price of oil, since coal resources, both in the US and throughout the world, are large.

The central role of research and development in resolving the many dilemmas in the energy field is well recognized and considerable attention is given to

such problems as commercializing the results of research, the value of industry-government collaboration including international cooperation, and the ever-vexing question of the management of intellectual property in these activities. The targets of the recently-enacted Clean Air Act are incorporated into the document (President Bush and Prime Minister Mulroney signed the US-Canada Clean Air Accord March 13, 1991), but the over-arching problem of carbon dioxide emissions and the greenhouse effect is not faced directly. Nowhere is there a specific target to limit emissions as there is in Canada (see *Green Plan* above). Instead, there are oblique references to the large costs involved.

The new strategy has not been well received in many quarters. The main criticisms centre on the lack of emphasis on conservation and efficiency measures. Though the report recognizes the central problem of supplying a liquid fuel for transportation purposes, there are no rigorous regulations recommended to increase automotive fuel standards, and it explicitly dismisses a large increase in the gasoline tax (to, say, Canadian levels) on the grounds that the burden would fall disproportionately upon the poor. Clearly, the authors of the report do not expect as much savings will be made through conservation as the most active exponents of this course of action believe. Others have criticized the strategy as 'quaint' especially in view of what is happening at present in Ontario. While this may be unfair, the document does have the tone of one that might have been written in Canada ten years ago. It also shows the effect of obvious compromises made both within the Department of Energy and

throughout the US governmental apparatus in general. There are well-founded reports that substantial changes had to be made in the material on conservation and efficiency at the behest of the White House staff and the Office of Management and Budget.

How the strategy will fare in Congress is another question. Modifications are to be expected, especially as a result of recent events in the Middle East, which again have raised the issue of oil supply security. Moreover, there is an inconsistency on the question of imported oil. The document fully supports an open market for oil and the futures trading system which determines its price, but it also notes that sharp changes in the price of oil do more harm to the economy than gradual price increases. Perhaps there is an implied criticism by the authors that the US was too slow to release oil from the Strategic Petroleum Reserve during the recent Middle East crisis. Few doubt the price would not have risen as far or the effects been so disruptive if there had been a more aggressive intervention in these markets.

From this writer's vantage point, outside the US, some parts of the new energy policy unfortunately leave the impression of a 'busybody' at work. Other countries are urged to increase their oil and gas production by investing in more modern technology (while conforming to American ideas on the control of intellectual property rights), but there is insufficient reference to whether these investments will bring net benefits to these countries. In relation to natural gas, the document refers to the 'North American resource base' and an 'integrated North American gas market,' despite the remaining authority of the National Energy Board Act to

act on behalf of distinctly Canadian interests.

There is also a major inconsistency in the section on natural gas. Ample gas is said to be available from North American sources for the next 40 years at well-head prices of not more than US \$3 per Mcf (presumably 1991 dollars). US consumption is expected to rise by one trillion cubic feet (Tcf) above today's levels, and by 2010, imports will comprise about 14% of the augmented total. If all projected imports, 2.8 Tcf per year, were to come from Canada, it is very doubtful that supplies of that magnitude could be supported at the projected price. Gas from Arctic sources and LNG supplied from other countries by tanker would likely be even more expensive. In addition, Canadian domestic demand will surely increase if, for instance, serious efforts are needed to reduce CO<sub>2</sub> emissions and if generating stations in Ontario have to be supplied with gas in the wake of that province's nuclear moratorium. On this and other matters, the text of the energy policy document reflects an innocent, unconscious imperialism.

Copies of the US National Energy Strategy can be obtained from the National Technical Information Service, US Department of Commerce, 5285 Port Royal Road, Springfield, Virginia, 22161, and from the Superintendent of Documents, Washington, D.C. 20402, Stock # 061-00-00754-7 (\$US 16).

## Major Expansion of TransCanada Pipelines

Three important decisions by regulatory bodies in November 1990 will allow TransCanada Pipelines Limited (TCPL) to begin construction on a major expansion of their gas transmission facilities. The expansion, which will markedly increase the company's ability to deliver Alberta gas to expanding markets, is predicated on increased sales of 3.0 million m<sup>3</sup>/day to central Canada by November 1991, and 20.6 million m<sup>3</sup>/day to the eastern US by November 1992.

On November 6th, the National Energy Board (NEB) issued its Reason for Decision on the controversial toll design methodology and economic feasibility approach to be applied to the pipeline expansion. The NEB decided that all facilities approved for the program will be rolled into the company's overall rate base for toll purposes. Among reasons for its decision, the NEB found that it is the aggregate demand of all shippers that gives rise to the need for additional pipeline capacity. Some producers had objected to this procedure on the grounds that wellhead netbacks would be lower than under some other regimes, while many consumers in central Canada objected to paying more for gas transportation to cover the costs of new facilities which are primarily designed to serve export markets.

Also in November, the Federal Regulatory Commission (FERC) of the US Department of Energy approved the main application for construction of the Iroquois

Pipeline Transmission System, in which TCPL has a 29% interest (reduced from the original 49% to meet the requirements of the US Public Utilities Holding Act). This new gas line is to extend 595 km from a point on the border near Iroquois, Ontario, to Long Island, New York. The line, of 735 mm (30 inches nominal), diameter telescoping down to 588 mm (24 inches nominal), will serve north-eastern gas markets en route, including several cogeneration facilities. Authorities in the State of New York have also given their approval.

Upon completion, the Iroquois line will carry the energy equivalent of about 30 million barrels of oil per year to a region heavily dependent on imported fuel. The possibility offered by the new gas pipeline for more substitution of gas for oil at a time of uncertainty in oil markets is thought by many to have been a factor in the FERC and the New York State approval process.

On November 15, 1990, the NEB gave partial approval for 1592 km of pipeline, 21 new compressor units, and two compressor stations by 1991/1992. The total cost of the proposed facilities is estimated to be \$2.6 billion. IPSCO of Regina, Saskatchewan, and Stelco Inc. of Hamilton, Ontario, will supply pipe for installation in Canada, while the latter company has been awarded a \$US 91 million contract to supply 435 km of pipe for the Iroquois project. The very large scale of this expansion means this activity must be considered yet another Canadian megaproject along with Hibernia, the Lloydminster upgrader, and the Vancouver Island gas project. Export earnings generated through this pipeline are projected to add about one billion dollars to the Canadian economy

annually.

Plans are now being made to expand the shipment of natural gas to California and other western US markets. The California Public Utilities Commission has approved a 1,448 km line proposed by Pacific Gas and Electric Company through its Pacific Gas Transmission subsidiary which would run from British Columbia through Idaho, Washington, and Oregon en route. Construction on this line is scheduled to start in early 1992 and end in late 1993, should final approval be received from FERC as expected. The chief competitor for this application is the proposed Altamount Pipeline, which would deliver Canadian gas to Wyoming for transit to California.

Finally, TCPL suffered a setback on March 18, 1991, when the NEB took the unusual step of denying another proposed pipeline (known as the Gananoque Extension) into New York State without giving reasons. This line would have branched from the main system east of Kingston, Ontario, 25.2 kilometres to a point on the international border near Wolfe Island on the St Lawrence River at the western end of the Thousand Islands tourist region. The purpose of this line was to export natural gas to the Niagara Mohawk Power Corporation in New York State. There was vociferous local opposition to the line. The official reason for rejecting the proposal was to be released in May of 1991. The NEB stated it was always reluctant to release a decision without also releasing its reasons, but held that there were exceptional reasons in this case because of the contractual problems now faced by the purchaser of the gas. This is the first time that a proposed pipeline to export gas to the US has been denied in this way.

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## AECL Sells a Second Nuclear Reactor to Korea

On December 27, 1990 the Minister of Energy, Mines and Resources, the Hon. Jake Epp, announced that a 700 MWe reactor will be built next to the existing CANDU unit at Wolsung, Korea. It will cost some \$1.5 billion and is expected to be in service in 1997. A substantial part of the work will be carried out in Canada. This is the first export order received by Atomic Energy Canada Ltd. (AECL) in nearly a decade. Korea has a total of nine reactors in service.

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## Regular Reports of the Petroleum Monitoring Agency

The Petroleum Monitoring Agency (PMA) was first established in the aftermath of the second 'oil shock' on August 1, 1980 by Order-in-Council under the Inquiries Act, and was later continued by the Energy Monitoring Act of 1983. The purpose of the PMA is to provide objective non-political assessment of petroleum industry performance and financial condition twice per year, publishing data that would have credibility both inside and outside government. The aim is to provide a factual foundation for both public and private sector decision-making. The Agency neither draws conclusions nor makes policy recommendations.

The PMA's semiannual reports are based on responses to questionnaires from all but the small-

est oil and gas companies, with information coming from more than 100 organizations. This information includes data on production, profits, flow of funds, capital expenditure, dividend payments, and ownership and control. Through data sharing agreements with Statistics Canada, information is also provided on research and development expenditures, international flow of funds, and company debt. Its small staff of 18 people is knowledgeable in energy economics and is in frequent contact with the industry. The PMA reports are valuable to anyone wishing to follow economic and corporate developments in the industry and are especially useful at times of rapidly fluctuating oil prices.

Canadian ownership and control in the petroleum industry appear to be slowly falling. The average rate of return on equity in the industry for the first half of 1990 was only 4.1% as compared to 8.3% for all the other (non-financial) industries (although the rate was probably much better in the latter part of the year when oil prices were higher). These low rates of return are at odds with the public perception of the industry as one with high profits. (These reports are available from the Communications Branch of the Department of Energy, Mines and Resources, 580 Booth Street, Ottawa, Ontario, K1A 0E4.)

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## Remarkable Drop in Demand for Electricity in Ontario

Ontario Hydro has reported that consumption of electricity in 1990 was 2.9% less than in 1989. In contrast, from 1982 to 1989, electrical demand grew steadily at an annual rate between 4 and 5%. Though the situation in 1990 was clouded by major industrial disputes in the steel and paper industries, and by a record cold spell in December 1989 which had driven demand in the previous year to new heights, there is little doubt that much of the drop was due to the severity of the recession in Ontario.

Despite the drop in consumption, the province was a net importer of electricity during this period due to difficulties at some nuclear generating facilities and limitations on fossil-fuel stations imposed to reduce acid gas emissions. Much of this imported energy was generated in the US from coal, which had the indirect effect of increasing acid rain in the province due to carriage by the wind.

Nationally, Canadian net electrical exports to the US reached a peak of 44,823 gigawatt-hours (GWh) in 1987, dropped to 26,876 GWh in 1988 primarily due to low rainfall, and then fell sharply to 9,715 GWh in 1989. In 1990, based upon preliminary statistics, net electrical exports fell to only 951 GWh primarily because of the difficulties in Ontario and continuing dry conditions in those provinces with hydraulic installations. Canada's only deficits in its electricity trade to date were small and occurred in 1967 and 1968.

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## Agreement to Increase the Efficiency of Energy Use in Federal Facilities in Ontario

On March 7, 1991, a Letter of Cooperation was signed between the Federal government and Ontario Hydro with the object of improving energy efficiency in the approximately 14,000 federal facilities throughout Ontario. According to this agreement, Ontario Hydro will conduct 'Power Savers' efficiency audits of at least 1,300 of these facilities each year throughout the province for the next five years. This agreement was based on a successful pilot program launched in October 1990, which involved energy audits of more than 60 facilities mainly in the Ottawa region. The estimated savings in power demand of the full program would be a minimum of 85 megawatts, with a saving amounting to between \$25 and 50 million annually.

Typically in these programs about 100 different types of energy efficiency improvements are considered. These may be grouped into the following categories:

- heating, ventilation and air-conditioning modifications accounting for about 53% of the potential savings;
- energy efficient lighting (31%);
- energy efficient motors (11%); and,
- building shell improvements (5%).

This agreement should be considered one more example of the changing role of utilities in the energy system, from strictly being suppliers to those providing an energy service.

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## First Export of Power under new Canadian Electricity Policy

On January 31, 1991 the National Energy Board (NEB) announced it had issued permits to the New Brunswick Electric Power Commission (NB Power) for the export of electricity to a number of utilities in New England.

The applied-for non-interruptible exports, which would terminate in 1994, would be generated in large part from NB Power's Point Lepreau nuclear plant (although it was subsequently announced that this unit will be temporarily closed for re-tubing), with the remainder coming from thermal generation fuelled by oil and coal. The proposed interruptible exports, which would extend to 2000 or 2002, would be produced entirely by thermal generation. The major thermal plants involved initially would be the Dalhousie plant in the north of the province and the Courtney Bay and Coleson Cove plants near Saint John in the south. New coal-fired generating stations will be installed at Belledune in 1993 and Grand Lake in 1994, and a third unit, as yet uncommitted for construction, is planned for 1997.

The importance of these permits, which allow the continuation of a pattern begun many years ago of electrical exports from the province to its New England neighbours, is that they are the first dealing with major export proposals to be processed in accordance with the new Canadian Electricity Policy. The NEB Act, which was amended on June 1, 1990 to implement this policy, al-

lows the export of electricity to be authorized by permit without the requirement for a public hearing unless the Board recommends that the Governor-in-Council designate the application for licensing, which would necessitate a public hearing.

The advantage of the new procedure is that it is speedier and less costly. It will no doubt encourage the export of electricity from Canada. The procedure has been criticized by environmental groups and others who believe that it will, in this case, lead to increased emissions of sulphur and carbon dioxides. In the longer run, there may also be encouragement to NB Power to expand both fossil and nuclear capability over and beyond purely local needs without an opportunity for public interest groups to have, in their view at least, an adequate voice in the NEB's decision-making process.

From the viewpoint of NB Power, increased exports have the advantage of stabilizing their operation through improved ties to the large New England network, and allowing a relatively small utility to install generating equipment at a larger and more efficient scale than might otherwise be feasible. To the extent generating efficiency is increased by this practice, unit emissions are reduced.

In this decision, the NEB also decided that the wheeling of US-generated electricity through New Brunswick to other US markets need not be subject to the Board's current export regulation, though it will continue to monitor such transactions. This is another example of the liberalization of the electricity trade between the US and Canada coming into force in the new policy.

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## Vermont Plans Action on the Energy Front

In addition to programs initiated by the US Department of Energy, which released its National Energy Strategy on February 20, 1991, many States are taking independent action on energy matters. California has always been a leader in formulating distinctive policies, primarily because of its problems with air pollution. On January 4, 1991, Vermont announced a blueprint for dealing with global warming, acid rain, and dependence upon foreign fuels. The essence of the plan is to tax energy use and earmark the money to pay for new equipment that will operate more efficiently. Specifically, the proposal is aimed at reducing global warming gases (chiefly carbon dioxide) by 12%, fossil fuels consumption by 29% per person, and the pollutants in acid rain by 17% by the turn of the century.

About \$21.5 million (US) will be raised each year in new fees and taxes, with projected savings of \$236 million per year through increased efficiency. The measures include low-cost loans to homeowners and businesses, financial incentives for consumers to buy more efficient cars, and lowering the speed limit back to 55 miles per hour from 65. The plan would be paid for with a 3-cent-a-gallon tax on gasoline and diesel fuel, as well as taxes on non-renewable fuels that are now unregulated, such as heating oil and propane. It will be interesting to see how much of this blueprint is actually adopted in the years ahead.

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## Aggressive Response by Atomic Energy Control Board to Greenpeace Criticism

In July 1990, the environmental organization Greenpeace distributed a 16-page document, entitled *Canada's Radiation Scandal*, to a wide audience through the media, claiming that "Canada's radiation limits are among the worst in the developed world." In a response unprecedented in its directness for a governmental body, the Atomic Energy Control Board (AECB) replied in a document entitled *Canada's Radiation Scandal?* (December 1990). In it, the Greenpeace document is disputed on a point-by-point basis, using such expressions as: "nonsense," "ludicrous," "exaggeration," "false," "inaccurate," "incomplete," "misleading," "unscientific nonsense," "unreasonable," "not true," "puzzling," "deceitful," "dishonest," "senseless," "absurd," "inflammatory," "outrageous," "inaccurate," and just plain "wrong." The AECB apparently believes Canada's radiation standards are adequate and that they compare favourably with those in other advanced countries. Its response does not, however, deal with the Executive Summary of the Greenpeace report on the grounds it was a "polemic!" (Copies of the response numbered INFO-0362 may be obtained from the Atomic Energy Control Board, P.O. Box 1046, Ottawa, Ontario, K1P 5S9.)

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## New EMR Laboratory Being Established in Varennes, Quebec

In late 1988, the Department of Energy, Mines and Resources announced that its research arm, the Canada Centre for Mineral and Energy Technology (CANMET), would establish an Energy Diversification Laboratory (EDRL) in the south-shore district of Montreal in suburban Varennes. The Laboratory will concentrate on advancing non-conventional technologies, especially those related to increasing energy efficiency and developing alternative sources of supply. This effort will be coordinated with the government's *Green Plan* to reduce the environmental impact of many present energy activities.

The EDRL will be housed in a new 2,700 square meter facility to cost about \$8 million. By mid-1992 the laboratory will be staffed by 25 full-time employees and about 10 guest researchers from both industry and the universities. About 75% of the research will be conducted in-house, with the rest contracted. Activities of the private sector in this field are intended to be an integral component of the operation and periodic requests for proposals will be issued to solicit such participation.

Research efforts will concentrate on three main areas. In Renewable Energy and Hybrid Systems there will be a heavy emphasis on solar energy, particularly on the development of cost-effective and high-performance photovoltaic (PV) systems. Hybrid systems linking PV technology and batteries with other generation methods will be important ele-

ments. This work will include system assessment and monitoring, with the objective of commercializing competitive applications in the near- and medium-term future.

The second research area is devoted to Natural Gas Technology, where the emphasis will be on making the best use of this important domestic energy source which burns more cleanly and with less carbon emissions than the other fossil fuels. The research efforts will focus on improving the means of converting natural gas into other useful fuels. Conversion to hydrocarbons using plasma and microwave technology as well as electrochemical processes will be studied, again in close co-operation with the industry.

The third research area will be devoted to Energy Management Technologies in the fields of energy upgrading and storage. Advanced heat-pump technologies, capable of utilizing low-grade thermal energy, will be assessed. Specific projects will include the development of thermally-driven chillers for application to mechanical and chemical heat pumps, air conditioning, refrigeration, and cogeneration. In the realm of energy storage, the efforts will concentrate on thermal, chemical, and electrochemical technologies, such as those that permit load-leveling and the use of intermittent energy sources.

An important objective of the new laboratory is to transfer useful technologies to industry, and careful attention is being given to the most effective way of disseminating this information. As part of this activity, EDRL will manage Canada's involvement in the International Energy Agency's (IEA) dedicated technology transfer program, known as CADDET,

thus making efforts around the world available to Canadians.

With its close proximity to the Institut de Recherche en Electricité du Québec (IREQ) laboratory of Hydro-Québec, Institut National de la Recherche Scientifique (INRS), and other industrial groups nearby, a new and important addition has been made to the research community of the south-shore region of Montreal.

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## **New Executive Director at CANWEC**

Dr. E.P. Cockshutt has been appointed the new Executive Director of the Canadian Member Committee for the World Energy Council (CANWEC), succeeding Dr. C.H. Smith, who will now be coordinating preparations for the 150th anniversary of the Geological Survey of Canada, one of the most enduring institutions on the Canadian scene.

Dr. Cockshutt, a mechanical engineer, retired from the National Research Council in September of 1990 after a 37-year career in research and research management. He joined NRC to conduct research on gas turbine technology and later spearheaded the Council's work on energy research. Under his leadership the Division of Energy led Canadian research and development in renewable energy (solar, wind, and bioenergy), and was also involved with other energy forms from fuel cells to fusion.

CANWEC acts as the coordinating body for Canadian activities in the World Energy Council, a major non-governmental organization on the energy scene. It

organizes the Canadian Energy Forums, the next of which will be held October 28-29, 1991 in Halifax, and the national contribution to the 15th World Energy Congress, to be held in Madrid in September 20-25, 1992.

The theme of the next World Energy Congress is 'Energy and Life' and the four segments of the program are: Energy and the Environment; Energy and the Economy; Energy and Development; and Energy Cooperation. Prospective authors should advise the CANWEC office of their interest. (Suite 305, 130 Albert Street, Ottawa, K1H 5P5).

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## **North American Carmakers Co-Operate to Improve Batteries for Electric Vehicles**

The major North American carmakers have formed a consortium (the United States Advanced Battery Consortium) to find an efficient way to boost the range of electric cars. The emphasis of the work is not on developing a new car, but on improving the performance of battery systems which might be used in electric vehicles. This effort is one more indication of the seriousness that manufacturers are showing with respect to the stringency of the new California air-quality laws.

While co-operative research efforts are unusual in the US because of antitrust implications, there have been precedents for arrangements of this type, as in the already on-going cooperative program to study the use of plastics in cars and trucks.

Preliminary results for the new battery program are expected within three years. Such developments are also important to Canada because of growing air quality problems in some regions (Southern Ontario, Quebec, and the lower mainland region of BC) and because of the well-developed electrical supply system here.

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## Two Recent Publications On Global Warming

The Canadian Council of Ministers of the Environment (CCME) have now distributed their 'National Action Strategy on Global Warming,' dated November, 1990. The strategy will be considered during their further meetings in 1991. This short report (45 pages plus appendices) sets out possible positions for both the Federal and Provincial governments on this question, and includes an excellent summary of the present state of international negotiations. It is an invaluable guide to non-specialists in this area who may wish an easy-to-use reference. Comments are also invited. Copies may be obtained without charge from the CCME, 3rd Floor, Building 30, 139 Tuxedo Avenue, Winnipeg, Manitoba, R3N 0H6.

The first issue of *The Energy Journal* (published by the International Association of Energy Economics) for 1991 has been devoted exclusively to global warming. A total of 10 papers cover a wide range of economic opinion on this question of steadily growing importance, including one from Canada entitled 'Cutting CO<sub>2</sub> Emissions: the Effects of Alterna-

tive Policy Approaches' by John Whalley (University of Western Ontario) and Randall Wigle (Wilfrid Laurier University).

The volume includes a further paper by Alan S. Manne and Richard G. Richels ('Global CO<sub>2</sub> Emission Reductions — the Impacts of Rising Energy Costs'), which extends the now well-known work of these authors. In the paper by William D. Nordhaus (Yale University), it is surprising to read that no allowance is made for efficiency gains, which most 'conservationists' believe are possible at no, or even negative, costs, although the author does concede some savings are possible at first at little additional cost to the economy. Prof. Nordhaus believes vast geo-engineering options should be studied carefully, such as adding particles to the upper atmosphere to reflect energy away from the earth, or adding iron at favoured locations in the ocean to accelerate the absorption of carbon dioxide by the oceans. The cost of these rather extreme measures is claimed to be 'far less than many perennial favourites like reforestation or fuel switching or energy conservation.' William D. Hogan and Dale W. Jorgenson (both of Harvard University) in 'Productivity Trends and the Cost of Reducing CO<sub>2</sub> Emissions' make the point that a major component may have been omitted in previous estimates of the cost of controlling these emissions due to the fall in the rate of productivity growth likely to be caused by these measures. According to these authors, over the longer run, 'this otherwise ignored productivity effect could be the largest component of a complete cost analysis.'

This volume should be consulted by all specialists in the global warming problem.

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