Science and Public Policy, volume 15, number 1, pages 35-42, Beech Tree Publishing, 10 Watford Close, Guildford, Surrey GU1 2EP, England.

Governmental organization

Energy R&D policy in Canada

Yves Gingras and Jacques Rivard

CREST
centre de recherche en
évaluation sociale des technologies

As a result of the energy crisis of 1973, Canada formed an Interdepartmental Panel on Energy R&D in January 1974 to coordinate federal activities. With the objectives of diversification and self-sufficiency, the Panel would distribute funds to bring about a greater equilibrium in energy R&D. Initially this had the effect of reducing the share taken by nuclear energy but the budget cuts of 1984/5 reversed this trend. On a provincial level the situation is more difficult because each province relies on its own resources, such as oil sands in Alberta.

The Panel has suffered from trying to coordinate the activities of a number of autonomous departments: being entrenched in the governmental structure it has also been more susceptible to financial cuts.

Yves Gingras and Jacques Rivard are at the Department of Sociology and Centre for Research on the Development of Industry and Technology, CREDIT, University of Quebec at Montreal, PO Box 8888, Succursale 'A', Montreal, Quebec, Canada, H3C 3P8.

BEFORE THE OIL CRISIS of October 1973, few countries had an energy R&D policy. Most did not even have an energy policy. Energy research and development was, of course, going on in industry as well as in governmental laboratories but there was little conscious attempt to take stock of and to coordinate overall activities.

Governments usually think through institutions and the energy crisis prompted, around the world, the creation of organizations that could handle energy R&D policy matters. In 1974, the government of United States, created an Energy Research and Development Administration with a mandate to define and coordinate the national efforts in this domain.[1] In the same year, Great Britain created new organizations like the Energy Technology Support Unit and the Advisory Council on Energy Conservation.[2]

In Canada, an Interdepartmental Panel on Energy R&D was formed in January 1974 to coordinate activities at the federal level. At the end of 1974, the International Energy Agency (IEA) was created as an autonomous body within OECD (Organization for Economic Cooperation and Development) to facilitate international collaboration among member countries in the management of perceived energy shortages. Among the many committees created to monitor the energy situation was one specially devoted to energy R&D.[3]

Other countries reacted more slowly to the energy crisis. In Australia, for example, a National Energy Research and Development and Demonstration Council was created only in 1978.[4]

When these institutions were created, there was little accurate information on the level of investment in energy R&D, which is an essential tool for the definition and implementation of any science and technology policy. In 1975, IEA published a first compilation of energy R&D statistics that could serve to compare levels of activities in the member countries.[5] The quality of the information was, however, not very high given that many countries were still working out their definition of energy R&D and collecting information scattered in many different departments and agencies.

In Canada, for instance, a complete list of projects on energy R&D in federal government departments and agencies was produced only in 1976.[6] Before that, nobody knew exactly what was

 0302-3427/88/010035-8 US$03.00

happening. Institution building and statistics gathering were thus the first steps toward a rational political intervention in energy R&D.

Coordination of energy R&D

Set up in January 1974, the Task Force on Energy R&D was chaired by the Deputy Minister of Energy Mines and Resources and composed of deputy ministers or senior officers from 17 departments and governmental agencies having responsibilities or interest in energy matters. Its objectives were to review federal energy R&D activities, define a coordinated programme and advise the government on the allocation of funds.[7]

Tabled a year later, the report of the Task Force led to the creation of a coordination structure composed of an Interdepartmental Panel on Energy Research and Development (hereafter referred to as the Panel), assisted by an Office of Energy Research and Development (OERD), which plays the role of the secretariat to the Panel.

Regrouping senior representatives of science and technology branches of all the federal government ministries and central agencies involved in energy R&D, the Panel acts as a central policy and planning committee responsible for coordinating the program of federal energy R&D and for recommending allocation of resources within the different sectors of energy.[8] The coordination activities also include collaboration with provinces and with foreign countries through the international programs administered by the IEA.

The government provides the Panel with its own annual budget which is distributed according to priorities set up in relation to the Energy Policy defined by the federal government. The ministries and agencies involved are in charge of implementing those aspects of energy R&D which relate to their domain. Though the most important federal institutions in these matters are the Ministry of Energy Mines and Resources, Atomic Energy of Canada Ltd and the National Research Council, the Panel also includes other departments affected by energy resources like Transport, Public Works, Agriculture, Fisheries & Oceans, Indian & Northern Affairs, Health & Welfare and National Defense.

Because of the many departments involved in energy, Canada rejected the option of a central agency like the American ERDA and adopted a lighter structure designed to assure a coordination of efforts between the activities of the departments. This seemed to be an appropriate choice because, in addition to being divided between many departments, energy R&D is also divided between different provinces which have the control of their natural resources. An interdepartmental panel could discuss with provincial authorities to define joint projects and avoid duplication and loss of money.

In contrast to the Australian National Energy Research, Development and Demonstration Council which regroups members of government, universities and industry, the Panel is a strictly governmental structure. This lack of representation from the industry at the level of definition and planning of policy was noted by the IEA in its 1978 report and it was suggested that industry should be associated in some way.[9] Though not officially present on the Panel, industries, as well as provincial governments, are nonetheless consulted through "formal and informal routes by scientists, R&D managers, Panel members and officers of OERD".[10]

Though the report of the Task Force served as a starting point for the definition of a national programme of Energy R&D, there was another important document produced at the time by the Science Council of Canada. Created in 1966 as an advisory body on science policy, the Council produced many documents on sectorial aspects of science and technology policy. From this science policy angle, a committee on national resources was set up as early as September 1971 to study those aspects of science policy connected with the production, distribution, conservation and end use of energy resources.

The committee, composed of five members from government departments and agencies, five from industry and two from universities, issued its report on *Canada's Energy Opportunities* in March 1975 suggesting an expansion of energy R&D activities in the sectors of conservation, conversion and more efficient use of energy.[11] Four years later, the Committee published another report recommending 11 demonstration programs ranging from oil and gas production in ice-congested water to nuclear, biomass and solar energy.[12]

Though there are obvious links with science policy and thus with the activities of the Science Council and the Ministry of State for Science and Technology (MOSST), the official responsibility for developing an energy R&D policy lay with the Ministry of Energy Mines and Resources, for energy R&D is only a means to attain objectives defined by the energy policy.

With rich and diversified energy sources, Canada has frequently taken stock of its energy situation and produced at least nine studies related to energy policy between 1944 and 1985, but energy R&D was not an important preoccupation before 1973.[13] In the summer of that year, the federal government published *An Energy Policy for Canada: Phase 1* which, as one commentator put it, "can be read as the last document of the sixties."[14] The document still took for granted the necessity of high level energy consumption and thus recommended more efforts on the development of nuclear energy and research on synthetic oil.[15]

However, the report became obsolete a few months later with the oil crisis, so that the definition of an energy R&D policy adequate to the new situation only came with the report of the Task Force in 1975. According to this document, a composite goal for a national energy R&D program should be "to develop the scientific and technical capability to achieve self-reliance in energy with

In 1975, the Task Force set the goal of developing scientific and technical capability to achieve self-reliance in energy with minimum environmental, social or economic costs

Table 1. Energy R&D expenditures in Canada (millions, current dollars)

	Federal (% administered by PERD)*	Provinces	Sub total federal/ provinces	Industry**	Total
1974	105.3 (0.0)	35.6	140.9	n.d.	-
1975	109.4 (1.0)	34.9	144.3	n.d.	-
1976	111.3 (9.0)	41.6	152.9	n.d.	-
1977	127.1 (16.4)	69.4	196.7	113	309.7
1978	150.4 (22.3)	92.2	242.6	161.1	403.7
1979	157.1 (23.7)	101.1	258.2	186.6	444.8
1980	204.6 (19.2)	103	307.6	259.7	567.3
1981	251.0 (31.0)	107	358.0	402.6	760.6
1982	345.1 (35.6)	67.1	412.2	404	816.2
1983	403.1 (40.3)	85.3	488.4	347	835.4
1984	407.5 (41.8)	110.5	518	362	880
1985	396.8 (28.8)	95.9	492.7	n.d.	-
1986	352.4 (27.0)	115.1	467.5	n.d.	-

Notes: *PERD: Panel on Energy Research and Development
**to obviate double counting, the amount for industry includes only self-funded activities. Government funded activities are excluded.

Sources: EMR, OERD, *An Inventory of Energy Research and Development Supported by the Government of Canada,* 1978-1980, Report ER 80-6e, October 1980.
EMR, OERD, *Committee on Energy Research and Development National Energy R&D program reviews information on Government Energy R&D Budgets.* 1981, 1982, 1983, 1984, 1985, 1986.
EMR, OERD, *Estimated Energy R&D Funding by the Governments of the Provinces and Territories in 1976-77, 1977-78, 1978-79,* Rapport ER 79-5F, June 1979.
EMR, OERD, *Estimated Energy R&D Funding by the Governments of the Provinces and Territories in 1978-79, 1979-80 and 1980-81,* December 1982.
International Energy Agency, *Energy Policies and Programmes of IAE Countries,* OCDE 1977 Review, Paris 1978; 1978 Review, Paris 1979; 1980 Review, Paris 1981; 1982 Review, Paris 1983.
Government of Canada, Statistics Canada, Science, Technology and Capital Stock Division, *Industrial Research and Development Statistics,* 1981, 1982, 1983, 1984.

minimal environmental, social or economic costs and maximum industrial or quality of life advantages".[16] For the next decade, this objective of self-sufficiency was at the core of the Canadian energy policy.[17]

Toward greater equilibrium

In its survey of the state of energy R&D at the federal level, the report of the Task Force showed that research into nuclear energy was by far the main activity in energy R&D and that it accounted for more than three quarters of the total expenditures over the years 1972-1975. At the time, nuclear power provided only 6% of electricity production in Canada, but it was still seen as the energy of the future. Though production was concentrated in Ontario — where it contributed 17% of the total electricity in 1973 — nuclear energy R&D was the responsibility of the federal government through the Atomic Energy Commission of Canada Ltd (AECL), a Crown Corporation responsible for the development of the CANDU nuclear power plant.

To obviate this concentration of resources on a single form of energy, the report recommended the initiation of new programs in gap areas like conservation, coal, renewable energy sources and the expansion of existing programs (like fossil fuel research) in an attempt to reach self-sufficiency.

Starting with the fiscal year 1975-1976, the Interdepartmental Panel on Energy R&D would distribute additional funds according to the objectives of diversification and self-sufficiency which were at the basis of the federal energy policy. The Panel only decides on the allocation of new funds and is not directly responsible for energy R&D projects undertaken by departments and agencies on the basis of their own budget. In fact, the Panel will never be responsible for more than 41% of the total energy R&D federal budget (for example C$170 million out of C$407 million in 1984: see Table 1). Comparing Tables 2, 3 and 4 we see that the major part of these funds go to research on nuclear fission coordinated by the AECL which receives its budget directly from Parliament.

On the basis of these tables we can distinguish three periods in the evolution of federal energy R&D budget allocation. The first period covers the year 1975-1980 during which the Panel concentrated more than half its resources on renewable energy and conservation followed by oil sands and heavy oil which received 17% of the C$142 millions distributed. These three domains translated into R&D measures the objectives of conservation and

Table 2. Allocation of Panel on energy R&D resources for the 1975-1987 period (millions, current dollars)

	Energy conservation	Oil sands heavy oil	Nuclear fusion	Renewable	New liquid fuels	Conventional energy	Co-ordination	Total
1975-76	.114	.410	0	0	.429	0	.020	.973
1976-77	1.977	3.017	1.909	1.150	.930	1.716	.160	10.048
1977-78	4.957	4.017	1.090	4.915	2.179	2.680	1.025	20.863
1978-79	8.408	5.417	1.450	10.236	2.959	3.860	1.238	33.568
1979-80	7.902	5.417	.310	15.427	3.054	3.830	1.388	37.328
1980-81	7.607	6.136	.310	15.574	3.750	4.722	1.238	39.337
1981-82	15.290	8.479	2.884	21.355	14.936	10.008	2.026	77.948
1982-83	26.850	12.421	5.200	28.500	34.418	12.691	3.054	123.134
1983-84	32.290	16.747	10.329	36.141	35.526	29.302	2.234	162.569
1984-85	33.773	19.957	9.793	38.446	36.594	29.584	2.220	170.367
1985-86	18.100	20.132	9.492	20.067	22.102	22.612	1.751	114.256
1986-87	15.512	20.546	8.935	9.871	17.560	21.523	1.290	95.237

Sources: Energy, Mines and resources Canada, Office of Energy Research and Development, *Report on the review of the new liquid fuels task and task coordinator's response,* 1984, PERD 84-04E.

Table 3. Energy R&D expenditures by federal and provincial governments (millions, current dollars)

	Fossil fuels	Fission	Coal	Renewable energy	Supporting technologies*	Conservation	Fusion
1976	11	90	5.2	5.6	29.5	9.3	1.7
1977	28.3	91.2	14.2	10.5	35.3	15.4	1.8
1978	36.2	107.5	15.8	21.1	42.1	17.3	2.6
1979	45.6	109.2	14	23.5	44.7	18.3	2.9
1980	47.1	121.9	16.1	41	48.6	29.1	3.8
1981	44.9	118.7	20.6	62.9	63	40.9	7
1982	79	162.9	33.6	57.9	19.1	52.5	7.2
1983	100.5	170.5	39.4	67.5	28	70.2	12.3
1984	154.7	166.8	36.2	54.4	25.1	72.5	8.3
1985	134.9	186.3	30.7	33.2	18.2	78.4	11
1986	163.9	188.3	29.2	15.8	15.4	44	11

Note: *include conversion, transmission and distribution of electricity, energy storage, analysis.

Sources: Energy, Mines and Resources Canada, Office of Energy Research and Development (EMR, OERD), *An Inventory of Energy Research and Development Supported by the Government of Canada,* 1978-1980, Report ER 80-6e, October, 1980.
EMR, OERD, *Committee on Energy Research and Development. National Energy R&D program reviews information on Government Energy R&D Budgets.* 1981, 1982, 1983, 1984, 1985, 1986.
EMR, OERD, *Estimated Energy R&D Funding by the Governments of the Provinces and Territories in 1976-77, 1977-78, 1978-79,* Report ER 79-5F, June 1979.
EMR, OERD, *Estimated Energy R&D Funding by the Governments of the Provinces and Territories in 1978-79, 1979-80 and 1980-81,* December 1982.
International Energy Agency, *Energy Policies and Programmes of IAE Countries,* OCDE 1977 Review, Paris 1978; 1978 Review, Paris 1979; 1980 Review, Paris 1981; 1982 Review, Paris 1983.

Table 4. Total energy R&D expenditures of provinces by sector for the period 1976-1981 (millions, current dollars)

	Fossil fuels	Fission	Coal	Renewable energy	Supporting technologies	Conservation	Total
Alberta	123.529	.251	2.027	2.053	5.021	1.010	137.793
British Columbia	-	.050	1.591	5.782	3.461	.949	12.165
Manitoba	-	-	-	.875	.250	.328	1.886
New-Brunswick	.069	.025	1.149	1.167	-	.637	3.081
Northwest Territory	-	-	-	.202	-	.197	.399
Nova Scotia	-	-	17.243	8.590	.013	2.074	28.225
Ontario	.239	21.565	.115	9.362	78.731	14.182	127.502
Prince Edward Island	-	-	-	.878	.003	.339	1.658
Quebec	.132	1.170	-	3.850	66.790	1.181	77.905
Saskatchewan	9.735	.780	1.485	2.235	3.248	1.915	15.625

Sources: EMR, OERD, *Estimated Energy R&D Funding by the Governments of the Provinces and Territories in 1976-77, 1977-78, 1978-79,* Report ER 79-5F, June 1979.
EMR, OERD, *Estimated Energy R&D Funding by the Governments of the Provinces and Territories in 1978-79, 1979-80 and 1980-81,* December 1982.

enhanced production of petroleum put forward by the government in *An Energy Strategy For Canada* published in 1976.[18] During this period, energy R&D accounted, on average, for 15.8% of the total R&D budget of the federal government.

In addition to doubling the budget of the Panel in 1977-1978, the federal government gave additional funds to the Natural Sciences and Engineering Research Council (NSERC) with the stated requirement that they be used to support university research in areas of national importance. Accordingly, NSERC created in 1977-1978 a Strategic Grants program focused on environmental toxicology, oceans and energy. From C$2.3 millions, the budget gradually rose to C$32.3 millions in 1984-1985 and the number of eligible sectors rose to eight, energy always remaining the most important in terms of received funds (54% in 1979 when three sectors were eligible and 29% in 1983 when eight sectors were eligible).

With this program, the federal government's energy R&D policy was thus extended to cover basic research in order to develop scientific expertise in energy areas of potential importance in the long term. It also assured the training of scientists in a sector of national importance. In order to secure a certain relevance to industrial needs, however, 50% of the members of the evaluation committee for strategic grants on energy were drawn from industry — the highest proportion of all the strategic grants committees.[19]

The second period runs from 1981 to 1984 and follows the implementation of the National Energy Policy of 1980. While still concentrating on renewable energy and conservation the Panel gave some priority to research on new liquid fuels for transportation — such as natural gas, alcohol, gasification and liquefaction of biomass and coal — which was the main consumer of petroleum.[20]

During this period the budget of the Panel grew rapidly from C$39 million in 1980 to C$78 millions in 1981 and C$170 millions in 1984. This raised the proportion of energy R&D in the total R&D budget of the federal government to an average of 20%, with a peak at 22% in 1983. All sectors were strengthened and nuclear fusion came of age during this period, so to speak, with the construction of a Tokamak reactor at Varennes near Montreal, a joint project of the federal government and Hydro-Quebec.

The third period begins with the election of the Conservatives in November 1984 and is characterized by major cutbacks in energy R&D and the abandonment of the National Energy Policy. A major objective of the new government was to diminish the budget deficit and to reorient R&D activities to serve short term economic benefits.

All government activities were affected, but the impact on energy R&D projects was not evenly distributed. Between 1985 and 1987, energy conservation and renewable energy budgets diminished by 50% and 75% respectively. The budget of the Panel was reduced by 33% in 1985 and by a further 16% in 1986. This reduced the proportion of the federal energy R&D administered by the Panel from 41% in 1984 to only 27% in 1986.

Reflecting the central place of fossil fuels in Canada's energy resources, oil sands and heavy oil activities are the only sectors which have not been affected by the reductions and have had a continuous growth over the period 1975-1986. The relative priorities of the Panel have thus been reversed over the last two years. Ranked fourth between 1981 and 1984, in terms of its portion of the Panel's budget, this sector took first place in the period 1985-1987, followed in second place by new liquid fuels. From its first place during the first two periods, renewable energy declined to fourth place during the 1985-1987 period while energy conservation stayed in third place.

If we compare the distribution of the Panel's funds (Table 2) with the distribution of the total amount of money invested in energy R&D by the federal and provincial governments (Table 3 and 4), we can see what the real effect of the Panel has been over this ten year period. In concentrating its resources on non-nuclear energy, one effect of the Panel's action has been to diminish the relative share of nuclear energy in the basket of energy R&D.

The budget cuts of 1984 and 1985, however, reversed this tendency and the relative weight of nuclear energy rose for the first time in the last ten years. It is too early to see if this trend is there to stay or if it is only a transient effect of the restructuring of priorities.[21]

The sectors which depend heavily on funds provided by the Panel are clearly conservation and renewable energy as well as new liquid fuels. We have seen that these domains have suffered major reductions during the last two years. If the net effect of the work of the Panel was to extend the range of research and development on energy sources that had been neglected before 1975 it seems that the impact of the recent years' budget restrictions is to bring us back to a pre-1975 period when energy conservation was not an important objective of the energy policy of the federal government.

Provincial and industrial commitments

At the provincial level, the distribution of energy R&D investment is even more out of balance than at the federal level, for each province depends on a particular source of energy for its development. Moreover, the fluctuations over the years are more important than at the federal level for the levels of R&D in the provinces depend more critically on specific projects like James Bay in Quebec or the tar sands in Alberta.

Though we do not have separate information for the provinces' and the federal government's energy R&D budgets after 1981, Table 4 reflects adequately the priorities of research of each province.[22] Petroleum is by far the most important resource in Alberta, which created the Alberta Oil Sands

It seems that the impact of recent years' budget restrictions is to bring us back to a pre-1975 period when energy conservation was not an important objective of federal government

Table 5. Energy R&D expenditures by industry (millions, current dollars)

	Fossil fuels	Nuclear	Coal	Renewable energy	Supporting technologies	Conservation	Total
1977	72.8	6.9	0.7	6.2	21.1	5.3	113
1978	85.8	13.3	4.9	5.5	30.9	20.7	161.1
1979	108.4	n.d.	5.4	5.6	44.5	22.7	186.6
1980	134.7	20.1	3	6.3	51.3	44.3	259.7
1981	255.7	19.9	11.5	18.2	59.2	38.1	402.6
1982	239	33	7	17	61	47	404
1983	179	41	6	16	51	54	347
1984	172	48	9	18	65	50	362

Sources: International Energy Agency, *Energy Policies and Programmes of IAE Countries*, 1982 Review, Paris 1983, for the years 1979, 1980.
Government of Canada, Statistics Canada, Science Technology and Capital Stock Division, *Industrial Research and Development Statistics*, for the years 1977, 1978, 1981, 1982, 1983, 1984.

Technology Research Authority (AOSTRA) to assure the full exploitation of this resource, which accounted for 90% of the total energy R&D budget of this province over the years 1976-1981. This organization is considered by the federal government as the principal source of funds for research of oil sands.

By contrast, the province of Ontario depends heavily on nuclear energy whose 16 reactors generate (in 1986) 45% of its electricity, and 86% of Canada's total nuclear electricity which accounts for 16% of the total production of electricity of the country. This explains the concentration of Ontario's energy R&D on nuclear and supporting technologies (which includes transmission and distribution of electricity). In comparison with other provinces Ontario also makes important efforts in the conservation and renewable energy sectors.

The third province in terms of the importance of its energy R&D budget is Quebec which concentrates its efforts on hydro-electricity production and transportation. Its main research center is the Hydro-Quebec Research Institute which also studies fusion technology.

Coal research is mainly found in Nova-Scotia while the other provinces have fairly small energy R&D budgets devoted to renewable and energy conservation projects.

This great diversity of priorities among the provinces and the fact that natural resources fall under provincial jurisdiction, calls for a constant collaboration between the federal and provincial governments which takes the form of joint funding in many projects. We have already mentioned the fusion project in Quebec: other similar joint endeavors involve Hydro-Ontario and AECL on the production of tritium; AOSTRA and the Canada Center for Mineral and Energy Technology (CANMET) on the treatment of oil sands. Some of these projects are part of international endeavors through the IEA. In 1983, for instance, Canada was participating in 34 of the 64 projects coordinated by IEA.[23]

A fluctuating commitment to energy R&D is also visible in the industry. Whereas federal government can pursue long term objectives, industry is driven by the market. In order to stimulate R&D in industry and the diffusion of innovation, the federal government instituted in 1972 a contracting-out policy limiting the amount of R&D within governmental laboratories.[24]

In the case of energy R&D, this policy stimulated contracting out 36% of the budget of the Panel in 1976 and 70% in 1985. In addition to these funds obtained from government for specific projects, industry invested its own money in energy R&D.

As Table 5 shows, the major research commitment was on technology related to the production of petroleum.[25] Though their contribution to energy consumption has fallen from 61% in 1973 to 36% in 1986, fossil fuels are still a strategic source of energy and the federal government and the province of Alberta invest substantial amounts of money in this sector, especially after the implementation of the National Energy Policy in 1980. They thought it could not be left entirely in private (and foreign) hands if its maximum utilization for the benefit of Canadians was to be assured.

In response to the growing cost of energy, industrial investment in conservation technologies grew steadily between 1977 and 1984 to augment the efficiency of the production processes and of transport vehicles. On the other hand, research on new energy was rather low and the government invested in this sector specifically to help finance and commercialize its products.[26]

In the nuclear domain, industry concentrates its investment on uranium exploration and production but the main actor is the federal government which, through AECL, tries to save a collapsing nuclear industry that provides jobs to thousands of highly qualified researchers at a time when no power plant construction is in view. This is probably the sector in which the government will have the most difficult choices to make as only Ontario is really dependent on nuclear technology.

Coal research is another important sector that has been neglected by an industry which does not possess sufficient funds. However, coal is considered a potentially important source of diversification and its use has been increasing over the last ten years, contributing 12% to energy consumption in 1986 compared to only 5% in 1973. Accordingly, the federal and provincial governments have invested in this sector to help in the modernization of the technology in order to assure a clean burning of coal.

Conclusion

In addition to helping industrial sectors which cannot by themselves invest sufficiently in energy R&D — such as coal and new energy related

The private sector probably shows a reasonable equilibrium between short and long term objectives but recent federal cutbacks in energy R&D make this unlikely in the public sector

industries — or to invest in sectors considered as particular to the Canadian situation in terms of natural resources — such as tar sands — or in terms of scientific and technical capability — such as the vertical axis wind turbine developed by the National Research Council — the role of the federal government energy R&D program is to achieve longer term goals such as self-sufficiency in petroleum production and diversification of its energy sources so as to become independent of non-renewable ones.

A recent document estimates that the actual distribution of energy R&D investments in the public and private sectors shows a reasonable equilibrium between short and long term objectives. Though this statement is probably true for the private sector, it is doubtful whether the recent governmental cutbacks in energy R&D will leave the public sector with an equilibrated program.[27]

Whereas the private sector's investments are legitimately skewed toward short term goals, the role of the government should be to provide for longer term options. It is therefore doubtful that further diversification and less dependency on oil will be achieved by reducing budgets in new energy and conservation technologies. In fact, except for the nuclear energy sector, the distribution of the federal government's investments in energy R&D in 1986 has the same structure as that of the private sector and reflects the government's economic renewal policy with its emphasis on short term economic benefits.

Moreover, given that about 70% of the budget of the Panel was contracted out to industry, the reductions have more effect on the private than on the public sector and in a sense can hardly contribute to 'economic renewal'.[28]

Though this general survey of the emergence and development of energy R&D policy in Canada is not intended as an evaluation of the policy itself, or of its benefits,[29] one cannot fail to observe that the effective role of the Interdepartmental Panel on Energy R&D was less to drastically reorient the priorities of the mid-1970s in the fact of a crisis situation than to open new avenues without disturbing the existing distribution of power among the departments and agencies active in the energy sector. AECL, for instance, was not really affected by the Panel's decision.

Moreover, being less entrenched in the governmental structure than the individual departments, the Panel was more susceptible to its budgets being reduced. The effect of these restrictions could only be to diminish the degree of coordination among the various projects and to weaken the sectors of energy R&D which were depending on the Panel's budget. In fact, to really strengthen the coordination of energy R&D at the federal level, the Panel should be responsible for the effective coordination of all the energy R&D related budget instead of the 27% left in 1986.

The problem of energy R&D policy is part of the larger problem of the appropriate governmental organization for horizontal activities which pass through the usual departmental and vertical structures. As the case of the Ministry of State for Science and Technology (MOSST) has shown,[30] coordination faces the obstacle of the autonomy of the departments which do not want to lose control of a part of their sector be it of broad and horizontal interest as science, technology or energy.

In this perspective, the solution adopted for energy R&D policy in Canada — an Interdepartmental Panel with its own funds — could perhaps be a more appropriate structure than a MOSST without a portfolio, for a real coordination of science and technology activities at the federal level.

Notes and references

1. Richard K Vietor, *Energy Policy in America Since 1945* (Cambridge U. Press, 1984) pages 321-322.
2. John Surrey and William Walker, "Energy R&D: a UK perspective, *Energy Policy*, June 1975, pages 90-115.
3. *Energy Policies and Programmes of IEA Countries, 1977 Review* (International Energy Agency, Paris, OECD, 1978) page 2, Only 19 of the 24 OECD member countries were part of the IEA.
4. Ian Lowe, "Who benefits from Australian energy research?", *Science and Public Policy*, December 1983, pages 278-284.
5. *Energy R&D* (Paris, OECD, 1975).
6. The Senate of Canada, First Session, Thirteen Parliament 1974-1976, *Proceedings of the Special Committee of the Senate on Science Policy*, Issue No 18, Wednesday, August 11, 1976, page 22.
7. C M Drury, *Brief to the Senate Committee on Science Policy*, November 1975. Appendix 8 to the Minutes of the Senate Committee on Science Policy, 3 December 1975, page 1:96.
8. *Summary Report of Activities, 1985-1986, Federal Panel on Energy Research and Development* (Energy, Mines and Resources, Ottawa, Canada) OERD 86-03.
9. *Energy R&D, 1978 Review* (OECD, Paris, 1979).
10. *Summary Report of Activities, 1985-1986, Federal Panel on Energy Research and Development* (Energy Mines and Resources, Ottawa, Canada) OERD 86-03, page 1.
11. *Canada's Energy Opportunities*, Science Council of Canada, Report no 23, March 1975.
12. *Roads to Energy Self-Reliance: the Necessary National Demonstrations*, Science Council of Canada, Report no 30, June 1979.
13. For a review of the period 1944-1980 see H V Nelles, "Canadian energy policy, 1945-1980: a federalist perspective", in *Entering the Eighties, Canada in Crisis*, edited by R Kenneth Carty and W Peter Ward (Toronto, University of Toronto Press, 1980) pages 91-117. For the recent period see G Bruce Doern and Glen Toner, *The Politics of Energy, The Development and Implementation of the NEP* (Methuen, Toronto, 1985).
14. H V Nelles, see reference 13, page 98.
15. H V Nelles, see reference 13, page 99.
16. *Science and Technology for Canada's Energy Needs*, Report of the Task Force on Energy Research and Development, EMR, Ottawa, April 1975, page 8.
17. *An Energy Strategy For Canada: Policies For Self-Reliance* (EMR, Ottawa, 1976); *The National Energy Program* (EMR, Ottawa, 1980); *The National Energy Program: Update 1982*, (EMR, Ottawa, 1982).
18. *An Energy Strategy For Canada: Policies For Self-Reliance* (EMR, Ottawa, 1976).
19. NSERC, *Report of the President, 1978-1979*, Ottawa,

1979, page 16; *Completing the Bridge to the 1990's. NSERC's Second Five Years Plan* (Ottawa, 1985) page 65.

20. The details of these proejcts are given in *Energy Research and Development by the Federal Government, Summary of Realization, 1975-1985.* EMR, OERD, 85-01.
21. A recent document published by the Minister of Energy Mines and Resources of Canada notes that there is still a strong emphasis on nuclear R&D and that the government will reduce its investment in this sector over the next five years. *La sécurité énergétique au Canada. Document de travail,* Ottawa, June 1987, page 87.
22. For the period 1978-1981, OERD published separate documents for federal and provincial energy R&D. After 1981, only aggregate data are produced by the Office. See *Estimated Energy R&D Funding by the Governments of the Provinces and Territories in 1978-1979, 1979-1980 and 1980-1981* (EMR, Ottawa, December 1982).
23. *Energy R&D, 1983 Review* (OECD, Paris, 1984).
24. *Policy and Guidelines on Contracting-out the Government's requirements in Science and Technology* (Treasury Board, Ottawa, 1977).
25. The data for the years 1979 and 1980 are not directly comparable with the other data because the definition of energy R&D used by IEA is different from the one used by Statistics Canada.
26. K Whitman, "Programme fédéral de recherche et de dévelopment énergétiques", exposé presented to the permanent senatorial committee on energy and natural resources, mimeo, 4 March 1985, page 5.
27. *La sécurité énergétique au Canada. Document de travail.* (EMR, Ottawa, June, 1987) page 87.
28. K Whitham, see reference 26, page 17.
29. Such an evaluation has already been published by the OERD itself after ten years of operation and at a time when the program was seriously threatened by the government's all azimuths search for budget restrictions. *An Assessment of the Economic and Energy Supply Benefits From the Energy R&D Program Administered by the Federal Interdepartmental Panel on Energy R&D* (EMR, OERD, October 1985).
30. Peter Aucoin and Richard French, *Savoir, Pouvoir et politique générale,* Canadian Council of Sciences, Study no 31, November 1974; see also, by the same authors, "The Ministry of State for Science and Technology", *Canadian Public Administration,* vol 17, Fall 1974, no 3, pages 461-481.