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GLOBAL ATMOSPHERIC RISKS AND THE SCIENCE COUNCIL OF CANADA: THE CASE OF CLIMATE CHANGE

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This Annex examines the treatment of climate change in publications of the Science Council of Canada, identifying for expository purposes five phases:

Phase 1. (1968-1976). In this phase the Council moved from the early formulation in 1968 of goals and policies related to the environment , and early exploration of scientific data related to the global warming issue in 1972, to a Conference sponsored by the Council in 1975 on "Living with Climatic Change" and the publication of the proceedings from this conference in 1976.

Phase 2. (1977) The Science Council published its significant document, Conserver Society: Resource Uncertainties and the Need for New Technologies. In the same year, the Council also published documents related to environmental and health regulations, and the Government of Canada passed legislation requiring environmental regulations to be subjected to Socio-Economic Impact Analysis (SEIA).

Phase 3. (1978-1983) In this third phase, Council documents are more strongly oriented toward economic issues, coupled with a few significant publications on regulation of activities affecting the environment.

Phase 4. (1984-87) Pre-Brundtland: During this period of Brundtland Commission hearings , there was in Council policy documents a continued emphasis on the economy; if there was concern for sustainability it was primarily for economic sustainability.

Phase 5. (1988-1992) Post-Brundtland: In this phase the Council embraced the expansive interpretation which the National Task Force on the Environment and the Economy gave to the concept of "sustainable development".

These phases reflect to some extent the different frames through which actors might view issues related to the environment and the economy. In the policy reports from the Council there appears to be some swing from a perspective initially giving environmental concerns primacy over economic issues to a stronger concern for the economy and competitiveness.

More generally, in the twenty five years from 1967 to 1992, Canada moved from a policy culture much like the British tradition of elite advice to one much more like the American populist approach. That is, an emphasis on orderly administrative processes of policy formation and regulation founded on expert advice and an influential scientific elite gave way to a culture dominated by multi-sectoral interest-based consultation, concern for participatory mechanisms and the interaction of advocacy groups advancing scientific argument to further their particular interests. The creation in 1966 of the Science Council of Canada as a federally-funded agency to provide independent scientific and analytical advice governments, industry, and educational institutions, and its demise (along with a wider range of other independent advisory bodies) at the hands of the Conservative government in the Mazankowski budget of February, 1992 thus neatly brackets not only an extraordinary swing in political outlook but also a dramatic shift in policy culture. At the time, the termination of the array of independent bodies offering expert policy advice based on a maintained database and continuing analytical capacity was justified in part on the grounds that a wide range of consultative bodies had been created, and a wide array of non-governmental think-tanks and advocacy groups had sprung up to offer advice to government, so that the analytical work of government -funded advisory groups was largely deemed redundant. In particular, for example, the work of the Science Council on atmospheric risks or environmental issues had been overtaken by the activities of federal, provincial and local roundtables on environmental and economy, established in the wake of the Brundtland Report, on the unanimous recommendation of a national Task Force on the Environmental and the Economy, representing industry, environmental groups and a range of other constituencies.

An interesting consequence may lie in the psychological weight attached to environmental risks as social issues. In the early history of the Council, many of its reports reflected serious concerns emerging from the academic scientific community about environmental degradation and the possible consequences of uncontrolled discharges from human activity. These concerns thus carried the weight of "objective " science and were seen as general problems to be addressed by all society. In the more recent setting of consultative processes and roundtables, by contrast, "the environment', rather than being recognized as the space within which we must all live, and the over-riding context within which social structures as well as economic activity must operate, often becomes slotted as just another interest pressed by just another set of interest groups, to be balanced against equally valid interests in some compromise outcome, usually on the basis of something other than scientific considerations.

Around the middle of its short life, the Science Council itself took note, as mentioned below, of this interesting cultural transition in process, commenting on the shift in emphasis from "reasoned outcomes" to" negotiated outcomes" inherent in the move from councils made up generally of independent scientists seeking a consensus in interpretation of uncertain scientific evidence to consultative bodies and conflict resolution processes seeking consensus, usually compromise amongst representatives of interest groups advocating responses to that uncertain scientific evidence. The creation of the Council at the height of "Sixties" enthusiasm for reason and the analytic way in government and its replacement by roundtables reflecting a new enthusiasm for what Canadians have come to call "the Rio Way (openness, transparency inclusiveness)" provides a perfect cameo image of the larger social swing.

In a separate working paper we hope to explore some of the fascinating larger implications of this process for the effectiveness of representative government, for the nature of ministerial responsibility and the definition of the public interest, and for the utilization of analytical and advisory work in consultative and advocacy processes. (In particular it will be important to examine the procedural consequence of substituting direct interest-based negotiations seeking a consensus which governments might be bond to respect in place of earlier advisory processes from which traditionally those with significant private interests would feel obligated to exclude themselves. It is perhaps ironic that a positive conflict of interest — the existence of a private interest sufficient to influences, or perceived to be sufficient to influence, official action — is precisely what is sought in the representatives participating in these new wave consultative processes.) Here we explore only one aspect of the Council's work, its advice and commentary on the possible risks associated with anthropogenic impacts on processes of global atmospheric change. It is interesting that even within the Council's oven work, one can see the evolution over a couple of decades toward the consensus-seeking negotiation role emphasized with the broader political system.

1. PHASE 1
(1968-76)

1.1. 1968-1971 Preliminary formulation of atmospheric issues

In this early period, there were a number of recognitions that form a basis for the full formulation of the climate change issue by the Science Council in 1972. These moved from a concern about the impact of anthropogenic activities on the atmosphere (air pollution) or an interest in the possibility of climate amelioration or modification in 1968; through linking of associative issues like deforestation to climate change, and proposals for goals to control emissions; to calling for an environmental conscience and environmental assessment, and advocacy of a preventive approach to environmental risks.

Certain fundamental principles related to policy goals, strategy and implementation advocated at this time have important implications for the global warming issue.

From the inception of the Science Council there was not only a recognition of the potential policy conflict between public and private interest

One man's effluent is another man's intake. It has become clear that there is a public interest which is not always coincident with or optimized by the pursuit of private interest. The problems which stand in the way of realizing the optimum condition for life in contemporary society, as a society, will not necessarily be solved in an optimum way, or may not even be soluble at all by private or piecemeal approaches. A total "systems approach" may be essential. (1968, 30)

but also an emphasis on the systems approach to "community planning and human environment" (41).

These two themes were continued throughout the reports from the 1968-76 period.

The 1968 policy report, Towards a National Science Policy in Canada, referred to various underlying aspects of the global warming issue: the need for implementation of policies for (a) "development of sound programs for the use, conservation and replenishing of resources" (14); (b) establishment of methods for the "control of existing and threatened health hazards already created by the misuse of science and technology—e.g. Pollution". (15); and (c) the need to move from unsuccessful "fragmented efforts" to a "co-ordinated approach" because of the "complex nature of the total ecology" (p.41).

Even though these observations related to the environment are noted, the thrust of the report suggested that the Council's primary role is to assist industry (24), and it referred primarily to social and economic rather than environmental costs (35).

Interest in the atmosphere emphasized the advancement of Canadian capability in the science and technology of the upper atmosphere and space; for furthering the development of Canadian industry in relation to the use of the upper atmosphere and space; and for the planning and implementation of an overall space program for Canada" (Science Council Report No. 1, A Space Program for Canada. 1968 (36)

At this time the concern about climate change appeared to be confined to recognition of the possibility of weather modification and control "with the objectives ...to maximize the advantages which Canada's climate offers and to minimize its deleterious effects" (ibid, 47).

In the 1970 Report, Seeing the Forests and the Trees, an important aspect of the global warming issue was referred to: the linking of deforestation and climate change. On page 10, the report indicated that "the cutting of large areas... can have major effects on local climate". The possibility of the impact of reforestation on local climate was also suggested.

In another Report, This Land is their Land, the need to develop "environmental science as well as an environmental conscience" was expressed (18). This report also advocated several key elements of policy and goal formation related to environmental issues generally: the policy of requiring resource developers to be partially responsible for the financial costs of environmental assessment (20); and the importance of undertaking preventive measures (36).

In another report the same year, Canada, Science, and the Oceans, the Council, without identifying the full complexity of the global warming issue, did recognize an essential aspect, the interlinking of pollution, oceans and climate:

Knowledge of the various processes occurring in the oceans (e.g. ocean currents, mixing mechanisms and energy-transfer processes) is required for a better understanding of phenomena such as marine biological productivity and climate, for the design of equipment and instruments to be used in the marine environment, and to cope with pollution problems.

In the 1971 Report, Cities For Tomorrow: Some Applications of Science and Technology to Urban Development, acknowledgement of the urgency of the environmental crisis , a key element in the global warming issue, was forcefully made, in language foreshadowing the message from the Toronto Conference in 1988.

But recently the alarm has sounded loud and clear. Spoilage of landscape, radiation fallout, pollution, were seen to lead to an eco-catastrophe potentially as ravishing as war itself. (p.6).

Not only was the urgency acknowledged but also the inadequacy of our "solutions" or "response assessments" was revealed, through the recognition that sometimes solutions could be more severe than the problems solved (6).

There was also mention of the alarming increase of gaseous wastes being discharged into the atmosphere (48).

Two significant concerns related to the global warming issue were also articulated: the goal to reconsider our "Growth-oriented approach of society:

...just what is economic growth other than a reduction in the scarcity of goods and services? So long as goods such as pure air, unpolluted water and amenities derived from nature or a pleasant environment were regarded as 'free" goods belong outside the economic sphere, it was quite legitimate not to account for them. Today an altogether different situation has arisen—to make these goods less scarce is to add to the world's assets and to increase human satisfaction. It thus means contributing to economic growth taken in a broader sense than the mere expansion of production, which itself is but one means of better satisfying man's needs.'Extending the goals of economic policy to embrace a new' quality of existence' concept is apt to change the allocation of resources significantly, and the goal to include the intangibles of the environment in accounting:

A more comprehensive accounting system would add to these internal costs involved in the total production-to-waste process (e.g.. such measurable costs as are involved in waste treatment and disposal, as well as some indication of intangibles involved in environmental decay, discomfort, etc.). Even more comprehensively, from a national welfare point of view, a pricing system should take account of increasing scarcity of resources. It is ironic in this connection that through the mechanism of depletion allowances the incentive is precisely the opposite, i.e. favouring rapid exploitation of non-renewable resources. (54)

All these insights recognitions, goals and strategies, remain still to be adequately reflected in contemporary practices.

1.2. 1972-75. Formulation of Climate Change issue:

In the council's report, It is Not Too Late—Yet, published in June 1972 at the same time as the UN conference in Stockholm; the global warming issue was well formulated:

" On a global scale, a growing body of fragmentary evidence suggests that the sum of a large number of local pollutants may be creating some world-wide air problems. The average concentration of carbon dioxide in the troposphere in the Northern Hemisphere has been increasing at the rate of 0.7 + or - 0.1 p.p. m. per year over the last decade. This is much less than would be expected from an evaluation of the total increase of man-made emissions over the same period, indicating that there are some compensatory mechanisms in the global carbon dioxide cycle, but it is nevertheless an indicator of change. An increase in atmospheric carbon dioxide should, acting alone, cause an increase in global temperature due to the so-called "greenhouse effect": accordingly there has been speculation that world climate will become warmer. (p. 14)

Acting in the opposite direction is the possible effect of increasing quantities of particulate matter in the atmosphere, from industrial sources, jet aircraft, and so on. The screening effect of these particles should theoretically cause global air temperatures to fall. Considering that energy production and heat release, manipulation of surface and underground waters, change and destruction of vegetation, and changes to the Arctic ice pack may also cause changes in global air temperature, the net climatic result is difficult to predict. There is at present no compelling information on the nature of the total impact of air pollution on world climate. (p. 14-15)

"Climatic changes may also occur in local areas as a consequences of large-scale human activity, such as seeding clouds to increase rainfall, construction of major dams, deforestation or the construction of airports. (p. 15)

The Science Council considers that studies ...should he carried out at an earlier stage of planning, and recommends that projects having a possible significant impact on the environment should include as essential elements of feasibility and planning studies, assessment of climatic and ecological consequences as well as proposals for the alleviation of harmful effects, before the projects are considered for implementation. (p. 15)

The food security concern is also mentioned, reiterating the discussion by Reid Bryson in 1967. In the Report, there was reference to the effect of any temperature change:

Canada's productive land areas could be profoundly affected by any global air temperature change, either upward or downward, because most of our crops are sensitive even to small average air temperature variations. (p. 15)

This report also reflected on the "scope, complexity and inevitability of environmental problems"

(10), then reiterated the urgency of the environmental crisis, the global impacts and the need for the global action :

"As an added element, environmental impacts now transcend national and continental limits, and we have gained direct appreciation of the greater quantity of human activity everywhere in the world. Beginning with the news of world-wide radioactive fallout, there has been increasing evidence of the global air circulations that disperse contaminants widely and imply the need for global action. ...It is now necessary for every nation to ponder not only the abuses it tolerates in its own territories, but also the problems it creates for others or receives from others. (p. 13)

and concluded with strong recommendations for the development of and implementation of strategies to address concerns about potential climate change and its impacts.

After assessing the present status of the quality of the physical environment of Canada, the Science Council recommends:

1. a) continuing Canadian participation and initiative in programs for international monitoring and research, to improve understanding of the trends in changes in the chemistry and physics of the atmosphere, related to the increase of pollutants and their possible long-term environmental consequences; (b) the development of strategies to reverse harmful effects.

2. that projects having a possible significant impact on the environment should include, as essential elements of feasibility and planning studies, assessment of climatic and ecological consequences as well as proposals for the alleviation of harmful effects, before the projects are considered for implementation

3. that the attention of federal and provincial governments focus on the environmental effects of modern industrial agricultural practices, particularly those of 'monoculture'

(i.e.. the wide-spread and repetitious cultivation of single crops)

4. that increasing attention be given to the application of forest technology that is mindful of environmental considerations, as well as of maintenance of the long-term production and other advantages of forest lands.

and with the admonition that "Our accidental experiment in planetary engineering still has a long way to go" (4).

In a 1972 background study Air Quality— Local, Regional and Global Aspects. Professor R.E. Munn recommended extending the definition of "Air Pollution" in Bill C-224, An Act Relating to Ambient Air Quality and to the Control of Air Pollution (1971), to accommodate new knowledge about climate change to cover "not only the conventional trace gases and particles monitored by control agencies, but also carbon dioxide, water vapour and heat" because of their possible climatic effects (p. 10). Munn also reiterated the need for a systems approach to environmental issues, where decision makers move away from "quick engineering solutions".

We must remember above all else that ecological systems must be examined in total. Quick engineering solutions suitable for application to small components of an ecosystem may treat the symptoms without curing the causes of environmental degradation. (32)

In its 1973 Report, Science and International Affairs, the Science Council advocated new national goals beyond those of the vested interests that "have for a long time been accustomed to being the unquestioned suppliers of 'National goals' ". The Council called for the creation of a "symbiotic combination of scientific and political expertise" (18). (This symbiosis appeared to have been conceived of as part of the 1975 Conference on "Living with Climatic Change".)

This report also reiterated the "transnational character of many areas related to science and technology; protection of the environment...the earth's atmosphere (18).

In another 1973 Report, Natural Resource Policy Issues in Canada, the Council chastised administrative policies that failed to address the urgency of the global crisis:

folly of policies which could lead to a heavily armed global community existing under severe strains due to environmental deterioration, misallocation of resources, crowding, or irreconcilable extremes of poverty and affluence. (39)

In this report, the "conserver society" principle was mentioned for the first time in Science Council documents. The "conserver society," because of its emphasis on moving away from resource consumption, would have been one that could address concerns related to climate change, though these do not appear to be explicitly linked in this document.

Within this global context, the Science Council recommends that Canadians as individuals, and their governments, institutions and industries, begin the transition from a consumer society preoccupied with resource exploitation to a conserver society engaged in more constructive endeavours. Ideally, Canada could provide the leadership necessary to work toward more equitable distribution of the benefits of natural resources to all mankind.

One of the recommendations emphasized compatibility between short and long-term goals in language made more familiar in the Brundtland Commission's later definition of "sustainable development":

It might appear that this recommendation for movement away from a growth-oriented society is in direct conflict with other recommendations the Science Council has made. This is not the case. It should be possible to work toward satisfaction of the short-term demands for employment and material benefits without jeopardizing long-term goals. Every effort should be made to keep the solutions to the short-term problems compatible with long-term goals. (39)

Professor F.K. Knelman in Energy Conservation. (Science Council of Canada Background study No. 33 (1975), enunciated what he perceived to be the goal for the initiation of the "conservation ethic":

Historically, conservation has been the group of measures adopted to prevent rapid resource depletion and despoliation. ...Today we have detailed and precise insights into the set of intricate and delicate interactions between the use of particular renewable resources... Further to this we have countless more recent examples of the gross impact of the rapid and ruthless exploitation of non-renewable resources such as minerals and fossil fuels on the air, the water and the soil. (11)

"Human intervention through the application of new technologies has increased our capacity to affect our environment. The ever-increasing scale and intensity of this intervention now seems capable of threatening the integrity of much larger ecosystems and even some of the great natural bio-geochemical balances. (11)

"With both conservation and efficiency, care must be taken to consider situations holistically, i.e., as total systems, or we will simply discover that seemingly rational actions on a part of the system will lead to unanticipated and undesirable interactions with the whole system. (12)

The profligate practice of depleting non-renewable resources at the highest possible rate is no longer an acceptable international behaviour. Canada in particular has demonstrated and established its international commitment to global environmental and resource management at the UN Stockholm Conference on the Human Environment. The Man and Resources Conference of the Canadian Council of Resource and Energy Ministers (CCREM) in October 1973 confirmed that a conservation ethic needs to be accepted as both a national and international goal. (13)

In summary, this survey of the reports from 1968 to 1975 outlines the basis for the framing of the issue of global warming, and recommendations for goals that could assist the global community to address the risk of climate change more generally. These reports were the precursor for an important Conference in 1975.

1.3. 1976. Scientific analysis of the issue of Climate Change

In the 1976 Science Council Report, Living with Climatic Change , the proceedings of the 1975 Conference on Climatic Change, organized by the Science Council with co-sponsorship from US and Mexican scientific bodies, were reported.

This conference was designed to address the "absence of communication between the meteorologists with the knowledge of climate change and the economic and social decision makers and planners". The first phase was to bring together the scientists; the second phase was to be a series of meetings with decision makers and planners.

In this report scientists analyzed the data related to the history of climate change, and to current theories. On the basis of these data they made predictions about the nature and extent of climate change and variability that could occur by the year 2000. Although the main focus of the document was on climate change, and although the scientists acknowledged the potential cooling effect of volcanoes and of dust particles, they appeared to lean toward the view that there could be a general warming of 1 degree by the year 2000.

In the preface there was a strong call for the need to include climate and climatic variability in the planning process.

There is growing evidence that the world is entering a new climate regime. Both the rate of change of the climate and the amplitude of short period climatic variations will be much more pronounced. (Foreword)

Small changes in the basic underlying premises of our plans for meeting present and future needs may produce large effects. Climate and climatic variability must be taken into account in the planning of nearly all facets of human life. (9) (Emphasis in original)

The scientists, however, though acknowledging the need to consider climatic variability in planning considerations, were cautious about the claims they made. Comments about "climatic variability" were almost always expressed in conditional language with emphasis on the "uncertainty" associated with any forecasts of climate change.

In addition to natural climate variations, we are also faced with the possibility that we may be changing the climate by our own actions. In the aggregate, the burning of fossil fuels for heating and energy production releases enormous quantities of carbon dioxide (CO2) and particles into the atmosphere. These can potentially alter the workings of critical physical processes and therefore alter local, regional or global climate. Even man-made changes in trace constituents such as chloro fluorocarbons (better known under the Du Pont trade name "Freon") may be capable of producing significant changes. More perplexing is the recent discovery that nitrogen fertilizers might also perturb the natural atmosphere. (11)

They appeared, however, to be certain about the cause of potential climate variability, even thought hesitant about the outcome, extent and nature of changes to be anticipated.

Causes of climatic change

Carbon Dioxide

Atmospheric carbon dioxide participates in the chain of interactions which form the natural carbon cycle. This cycle involves the storage and transfer of carbon, in various forms, in and between the atmosphere, ocean, biota, on the land surface, and in ocean sediment. The concern for climate arises from the perturbation of the natural carbon cycle due to burning of fossil fuels. It is generally agreed that there has been an increase in atmospheric carbon dioxide of about 10 percent since the late 19 the century and that the increase is continuing and possibly accelerating.

As a result of increased CO2 heat is retained in the atmosphere, particularly in polar latitudes. This increase is theoretically predicted to contribute to higher surface temperatures.
The effect of the manufacture of CO2 on climate depends on the rate of production and on the processes which remove CO2 from the atmosphere. Such processes include storage in the biota and absorption in the ocean. There is the troublesome question of possible feedback effects. Warming due to CO2 may reduce the oceanic ability to store CO2, for instance. A doubling of atmospheric CO2 is considered likely by the early 21st century, although this could be averted by a more rapid than expected phase-out of fossil fuels as a prime energy source. The potential effects of CO2 production on climate therefore merit close attention, (87)

Ozone

Predictions that some human activities will lead to depletion of the atmospheric ozone shield have received considerable attention recently. The bulk of the ozone lies in the stratosphere, where its absorption of solar ultraviolet radiation both screens the surface from biologically damaging radiation, and provides the major heat source for this region. Since the atmosphere is coupled to lower layers radioactively and dynamically, changes in ozone amount may cause significant changes of climate at the ground.

The total amount of ozone may change as a result of variations in the solar ultraviolet output and as a result of variations in the amounts of variety of a chemical species involved in photo-chemical reaction (88).

Nitrogen Oxide

Nitrogen oxides (NO x) are important in the natural photochemical balance of ozone. One of the major sources of NOX is the activity of micro-organisms in the soil and in the oceans. Of growing importance, however, are various anthropogenic sources related to the increasing use of nitrogen fertilizers and the engine emissions of stratospheric aircraft. NOx may also be deposited in the stratosphere by nuclear explosions.

In addition to NOx, chlorine compounds reaching the stratosphere may be very effective in depleting the ozone layer. Of particular concern here are chlorofluorocarbons (CFC, or 'freons') and other chlorine compounds... (88)

Other possible causes of climatic change

Additional human effects on climate may follow from the release of waste heat, and from alterations to the energy and hydrological cycles due, for instance, to land use practices, to irrigation and to alterations of natural waterways. While such factors are at present assumed to be important only to local climate, the possibility exists that they may lead to or reinforce large scale climatic disturbances.

Water vapour-greenhouse feedback

The atmosphere is believed to maintain a somewhat uniform distribution of relative humidity over a large range of lower atmosphere temperatures even though the absolute amount of water vapour in the air varies strongly with temperature. The absolute amount of water vapour in the air varies strongly with temperature. the absolute amount of water vapour in the atmosphere determines, to a large extent, the opacity of the lower atmosphere to infrared radiation. Increased temperature at constant relative humidity leads to increase trapping of thermal radiation (greenhouse effect') which gives rise to further increases in the temperature of the lower atmosphere. In this manner, external forcing which leads to an increase of temperature (for example, an increase in CO_2) may amplify the warming effect. (89)

Cryospheric feedback

The high reflectivity of snow and ice, as compared to water or land surfaces, is a dominant factor in the climate of polar regions. The extent of the snow and ice cover of the earth's surface depends strongly upon surface temperature. If a lowering of the planetary temperature would lead to a long-lasting and more extensive snow and ice cover, this would cause a decrease in the amount of solar energy absorbed by the earth-atmosphere system and thereby a further lowering of temperature. Again, any factor that tends to warm (cool) the climate may have the warming (cooling) effect amplified by this feedback. (89)

The predictions related to climate change were ambiguous. It is difficult to know whether they believed that the global warming trend indicated by increases of CO_2 would be counteracted by the cooling caused by natural activities such as volcanoes or by anthropogenic activities leading to particle formation, or whether a global warming trend would be initiated with potentially catastrophic implications. An overall but slight warming trend seemed to be the general expectation, but the emphasis was very much less than in the Council's own 1972 analysis. Climate variability appeared to have replaced global warming as the risk to be confronted.

Predictions of climatic change

The ability to predict the time sequence of future climatic events is still very limited (90).

There is an important class of predictive problems for which we are forced to rely exclusively on mathematical models. These involve the assessment of human impacts on climate. Because certain human activities are known (or suspected) to alter the environment in hitherto unprecedented ways, we cannot draw upon past experience alone to estimate their potential significance to climate. Despite their shortcomings, models will have to be relied upon to evaluate the impacts of society on the climate. (91)

(See Table 6 in Fig. 1)

An associated table set out "possible causal factors in future climatic change to the year 2000 A.D," identifying

—Total solar output (effect not clear),

—Volcanic activity (leading to possible cooling)

— Increased Anthropogenic carbon dioxide (leading to a cumulative warming effect of about 1 degree)

— Increased particulates (unclear)

— CFC emissions (leading to warming of 1 degree)

It is interesting to note also an estimate of 10% depletion of stratospheric ozone, based on the assumption that controls on CFC and other emissions are put into effect by 1980 A.D.

2. PHASE 2. (1977) "CONSERVER SOCIETY" AND ENVIRONMENTAL REGULATIONS

2.1. Conserver Society: sustainable environment or sustainable resources?

In the 1977 Report, Canada as a Conserver Society: Resource Uncertainties and the Need for New Technologies, the Science Council delineated a complex proposal for a society that would recognize the limits on its resources and would be responsible for acting within those limitations. As a footnote on the hesitant processes of social learning, it is perhaps noteworthy that there is no specific reference to climate change in this significant Science Council document. In the 1976 publication Living with Climatic Change, as mentioned above, it was concluded and underscored that Climate and climatic variability must be taken into account in the planning of nearly all facets of human life. (9)

In the 1977 Report, however, there were numerous generic references that would have had implications for the climate change issue: a) the need to preserve ecosystems; b)the need to recognize that cause and effect could be separated by significant periods of time ; c) the need to consider intergenerational equity; and d) the need to move away from non-renewable sources of energy.

Considerations related to "the ecological theme" were implicit throughout the recommendations, and this ecological theme appeared to be encompassing enough to include provisions to address global warming.

Recommendations:

Throughout these recommendations we recognize as an underlying assumption that the ecological systems of the biosphere are resources to be conserved. Without due care, the long-term health of the biosphere could be irreversibly damaged. We must care for natural elements even though they may have no immediately apparent ecological role. We need an attitude of stewardship, that will act as a restraining influence on human activities, and will stem not simply from fell [felt] needs but from recognition that human beings are dependent on the well-being of the things and creatures around them. This kind of conservation may require some radical innovations in technology. For instance, population growth is recognized as a world problem, but some of the world's difficulties arise from an even more rapid growth in some kinds of technological systems, with consequent growing consumption of energy and raw materials, environmental damage, and production of wastes. We have to guard the natural environment against threats from ourselves. We have to be aware that cause and ultimate effect may be separated by decades and we have to learn to recognize as early as possible signs of damage. Our concept of nature must change from seeing it as a shopping basket of unrelated goods that we can consume at will, to a set of living ecosystems from which we may take only that part that does not threaten the continued viability of the whole.

Thus although no specific recommendations on the ecological theme may appear explicitly, these considerations will be implicit throughout. (72)

Particularly relevant to the issue of climate change issue was the recognition that " cause and ultimate effect could be separated by decades" (72). .

This report also emphasized a further significant feature that must be considered in any discussion of climate change — that is, "the carrying capacity or the regenerative capacity of the biosphere"

" Much has been made of the implications of rising costs and, ultimately, finite limits to material resources, fossil fuels, and so on. There is another kind of limit, one with consequences at least as serious and perhaps more imminent. This is the carrying capacity, or the regenerative capacity, of the biosphere.

A central thrust of the conserver approach is to promote techno-socio-economic processes that are in principle sustainable. From this follow a preference for obtaining our energy ultimately from "renewable" sources, and for methods of food production that do not 'mine' the soil. Not only do we look to the biosphere for these self-renewing productive processes, but we depend on it to assimilate, store, and digest the various waste effluents of industrial civilization. The consequences have been recently surfacing to make us more and more aware that for decades we have been releasing new chemical molecules into our environment at a rate that has far exceeded our knowledge of their potential effects. (3)

A crucial, still unresolved, aspect of social response to environmental concerns was explored—the linking of awareness of full environmental costs with the willingness to act:

Environmental problems will move from concern to action...When all costs of industrial processes are reflected in the prices of products, dislocation will be inevitable. Some commodities may be priced out of international markets. International cooperation and resource-environment treaties will become essential.

Most Canadians are aware of the problems caused by wasteful and thoughtless consumption. Many of them are willing to make personal choices that would help to redress this situation. They are waiting now for worthwhile opportunities to do so — and for the assurance that the appropriate technologies are at hand....The need to come to terms with resource scarcity, environmental pollution and the associated social questions is, of course, not specifically a Canadian problem. (6)

Recognition of total costs

Much of the waste and excess that has characterized our 'consumer' culture has resulted from not taking the total costs of our actions into account. If the total costs — the true costs to others, to ourselves, and to future populations — could be seen for what they are, a conserver society would be an almost automatic result. (34)

To the extent that costs are externalized and become social rather than private, or are deferred into the future, prices are lower than they should be. With lower prices we tend to produce and consume more than if prices reflected all costs. (34)

We often do not know how to measure the costs we may impose on others or on the future by our careless housekeeping. They may be smaller than the costs we avoid, but they may also be much larger. For that reason it is not always enough to depend on prices and the market system. (35)

Thus people are willing to pay more for gasoline, and persist in driving large cars, in spite of the aggregate effect on the national balance of payments or on the cost of energy to future generations. (35)

When we ask just what we produce altogether, what are the total costs of doing so, and is it sustainable — whether we are paying as we go — we shall find some things we want to change. (35)

In this report the concern for moving away from specific energy sources reflected primarily their non-renewability, not their contribution to global warming, and it would appear that the term "sustainable" was used in some cases not in the sense of sustaining the environment but rather in sustaining the sources of energy.

Renewable energy

The aim of a conserver society will be to achieve reliance on sources of energy which are in principle sustainable over the long term. This will mean a preference for sources such as hydro, solar, wind, and vegetation that are in ongoing equilibrium with and are constantly renewed by the sun's energy. This will contrast with present policies in the industrialized countries of maintaining high standards of living by drawing down the world's capital stocks of non-replaceable fossil fuels. (46)

Energy in its various forms has been given little consideration in economic theory. It has been used and wasted in vast amounts, without a thought for the consequences; depletion has been so rapid that it has caught us almost unaware. This once relatively hidden but important factor of production has erupted centre stage. It is now recognized to be the sine qua non of industrialization. (47)

But fossil fuels are a non-renewable resource. They are, in many respects, a capital stock. In the world of capital goods which can be replaced, methods have been devised to ensure that capital stocks are replaced as they are used up. In the case of fossil fuels, however, we have been drawing down a capital stock with little thought to ensuring that the service it provides can be maintained in perpetuity. The service provided by non-renewable fossil fuels is, of course the work that is accomplished as the energy transformation process takes place. The rates of depletion have been so great in recent years and new finds have become so infrequent that we can no longer avoid recognizing the finiteness of this capital resource. We are coming close to being able to calculate just how much longer it will last. (47)

"Sustainable" was also used in other cases to reflect concern for sustaining the environment. Although the report did call for eventually moving away from non-renewable sources, it did not call for phasing out development of fossil fuels. The report, in its quest for renewability, appeared to embrace the "breeder reactor", without seriously considering the military or ecological implications of continuing to promote nuclear energy:

Until these renewable sources become firmly established and provide a major share, present plans to open and develop new supplies of fossil fuels and electric power will have to continue (present uranium fission nuclear reactors are generally regarded as a 'temporary' or 'bridging 'source; at this point in time, along with the U.S. . the U.K. and Sweden, we should leave open for choice the extent to which we will become dependent on the longer-term 'breeder' reactors and/or thorium-cycling reactors, with the fuel handling and re-processing they will entail). (46)

2.2. Regulations and risk analysis

In the 1977 Report, Regulatory Processes and Jurisdictional Issues in the Regulation of Hazardous Products in Canada by Bruce Doern, an important element in the dynamics of social debate around atmospheric risks such as climate change was identified: the call from potential contributors to the problem for more research into the causal connections as a means to delay action and as a justification for inaction:

Industry

The question of hypothetically is one important feature of the political economy of the regulatory process surrounding hazardous products, but it is clearly not the only issue in the relationship of knowledge, science, technology and regulation. Who does the research and how independent it is perceived to be, the general advocacy of better processes of technology assessment, the need for basic research, the need for better or new applied technologies for monitoring and compliance, and when the call for more research becomes merely an excuse for not taking action, are all important issues on which some comments are essential. (29)

They [industry]cloak their arguments in the politics of research by arguing almost ritualistically that there is insufficient causal knowledge or that the technology is not available.(156)

This report also recognized that hesitancy on the part of scientists had been used by opponents to the regulations that might address issues such as global change as a reason for inaction or for more relaxed standards:

In many areas of the regulation of hazardous products and substances, lack of research is not the main problem. A very normal conflict emerges in this regard. Scientists, for example, are naturally and necessarily cautious about the statements they make about causal knowledge. They have a more cautious sense of evidence about standards of TLV's (threshold limit values) for example. They are likely to advocate, therefore, that the standards be viewed as guidelines and that more research needs to be done. Economic interests will exploit this argument and use it to justify looser standards or to postpone action until more conclusive cause-and -effect evidence is produced. Unions and other s who must seek more precise administrative and legal criteria of evidence will opt for precise legislated standards. (29)

It is interesting to note that at the same time these publications — calling for serious transformation of society, and the implementation of regulations and standards to protect the environment and health — surfaced from the Science Council, a Socio-Economic Impact Analysis (SEIA) program was instituted by the Government of Canada. This program was later described in 1981 in the following way:

"In December, 1977, The Socio-Economic Impact Analysis (SEIA) program for major proposed health, safety, and fairness (HSF) regulations (economic regulations are excluded) was jointly announced by the President of the Treasury Board and the Minister of Consumer and Corporate Affairs, and came into effect on 1 August 1978" [cited in 1981 in Scientific and Technological Controversy in Federal Policy Formation, Science Council of Canada, G Bruce Doern] It was a more particular response to the growing criticism , primarily by business interests, of growing government regulations; a criticism strengthened by the declining state of the economy and increasing rate of inflation. (34)

3. Phase 3. (1978-1983)

3.1. Energy

In the 1979 Council Report, Roads to Energy Self-reliance , all previous concerns for the environment appeared to have been dropped. In the introduction, this report made no reference to Canada as a Conserver Society (1977) — other than a questionable interpretation in a footnote — or to Knelman 's Energy Conservation (1975). It did, however, select Report 23, Canada's Energy Opportunities (1975), claiming that this report "set the framework for such discussions [energy matters]. It also referred to An Energy Strategy for Canada, (1976) published by the Federal Government, which "identified self-reliance as central to any future energy policies, of which important components would be the urgent need for conservation and the development of renewable energy sources" (p.9).

Throughout this period, indeed, not only was there no reference to climate change but there appeared to be less commitment to the environment in general.

The response in this report to uncertainty was quite distinct from that in the other documents that called for precautionary measures. The focus of "uncertainty" was no longer possible impacts on the environment but the "uncertainty" of supplies.

Uncertainty is the greatest enemy of forward planning, both by industry and governments. It appears to be widening the credibility gap and generating social and international alienation. The energy "crisis" is one manifestation. To a large degree uncertainty constitutes the rational for a national strategy and determines the selection of its instruments.

The basic concept underlying this Report is the postulated increase in the range of Canada's energy options. The main thrust is not to make rigid decisions, but — because of uncertainty — to advance a diversified and broadened supply options base, and thus providing, with greater confidence, more choices for future decisions. An important by-product will be an increase in the system's stability. In addition, an increased differentiation in accordance with regional characteristics and needs will be expected, and further implementation of renewable forms of energy will follow during the next century. (17)

Although "the environment" was included in the list of national goals, along with conservation and alternative options, emphasis rested on the continuation and strengthening of the status quo in energy production (including accelerated exploration for fossil fuel resources and revived interest in coal):

Any energy 'future' must be designed to support national goals — security, prosperity, social equity, health, the environment — within Canada's physical, economic, social and institutional constraints. While Canadians may differ on the specifics of 'how to do it,' there is growing consensus on the direction that energy policy should take. The major elements entering into these discussions are:

1. Need for a major national energy conservation program

2. Increased substitution for conventional oil by alternative fuels

3. Expanded efforts in the renewable energy technologies, such as biomass and solar. (21)

It is also interesting to note the way in which the essence of the "Conserver Society" document was reported in this 1979 Report:

The Science Council, in the report on the economic and social implications of a conserver society, suggests ways to use our energy resources more efficiently (26)

Economic growth, level of industrial activity, regional development, equitable distribution of wealth, environmental impact and personal freedom of choice are inextricably involved. ...Notwithstanding the understandable desire to upgrade exports, it is probably in the national as well as the global 'interest' that an appropriate level of unit energy consumption, consistent with our socio-economic aims, and probably not very different from today's level will be required to preserve a socially acceptable quality of life.

Energy requirement are tied to economic and political aspirations. Canadians must keep all energy options open if these aspirations are to be fully satisfied. Economists, industrialists, financiers, politicians and other decision makers must understand that energy contributes to Canada's well-being , perhaps more so than in other countries (28)

3.2. Regulations and Environmental Assessment

In the 1981 Council report, Scientific and Technological Controversy in Federal Policy Formation, G. Bruce Doern) there appeared again to be no specific reference to climate change. There were, however, significant references to generic environmental assessment principles that have implications for climate change.

Environmental assessment processes

In response to the pressures of the Canadian environmental movement and to the passage of the US Environmental Protection Act, the federal government established, in December 1973, the Federal Environmental Assessment and Review Process (EARP). EARP was created by Cabinet directive and has no statutory basis. Its purpose was to ensure that environmental effects and impacts were assessed and taken into account at the earliest planning stages of federal programs and projects. EARP operates in two phases. The first is at the departmental or agency level; agencies make the initial determination whether proposals or projects are likely to have significant environmental consequences. If so, then the second phase begins, namely a formal review of major projects conducted by the Federal Environmental Assessment and Review Office (FEARO). A panel of experts appointed by FEARO and the Department of the Environment undertakes a public review, including hearings, of a detailed impact assessment document prepared by the proponent agency in accordance with guidelines specified by the review panel.

Since 1974, EARP has reviewed several major federal projects but critics of the process point to several weaknesses such as its lack of legal influence and its purely advisory status. Much like the Ministry of State for Science and Technology in respect of science, EARP functions as little more than the 'ecological conscience' of the federal government, this authority being based more on moral suasion than on legal force.

The 1982 policy report of the Council Regulating the Regulators, contained an important examination of risk. In the earlier publication (Policies and Poisons...1977) a distinction was made between "risk assessment" and "risk adjudication". Throughout the 1982 report there is an important distinction made between the need for a "reasoned outcome of the assessment of risk" and the "negotiated outcome of the acceptability of the risk". This distinction was particularly important in the determination of risk in the context of climate change, and the potentially strategic use of scientific uncertainty.

When we began this study, matters of immediate economic concern to Canadians were much less pressing than they are today. Nevertheless, despite the present state of the economy, we emphasize the urgency of contending with value-scientific questions. Often it is too late to respond to the impact of advances in science and technology...the development of a 'proactive system' is vital (Bates, Introduction).

Science and technology have revolutionized the standard, quality, and style of living of most people. But many of the attendant costs were either hidden, ignored or not foreseen when a scientific advance was realized or a new technology was introduced. Along with benefits...we have seen environmental deterioration, depletion of non-renewable resources and stresses on the moral and ethical fabric of our society. (10)

The interaction between law and science at present is insufficient to allow anything other than a crisis-to crisis response. In the 1980s, technological advance is happening too fast for social and legal processes to adapt. (10)

" many of the critically important modern problems which our society must today resolve —

what I have called 'socio-scientific disputes' — are different in degree, and sometimes in kind, from those that our existing dispute resolution mechanisms were designed to handle"(Milton Wessel, cited on p. 10)

The complexity of the interaction of the two aspects [facts and values] contributes to the difficulty in resolving value-scientific disputes. (11)

One must also distinguish between scientific and value-scientific controversy. Scientific controversy is dispute over the validity of scientific findings or the completeness of a data base. Value-scientific controversy is dispute over the social, ethical and political implications of scientific findings and their uses. Dispute over the interpretation of scientific findings bridges the two. Overlaps of these two categories are sometimes inevitable. In nearly every value-scientific controversy the science involved is also disputed, often because of its hypothetical and trans-scientific nature [trans-scientific describes hypotheses that cannot be verified experimentally for ethical or practical reasons, e.g. human experimentation to test whether certain compounds are cancer-producing] (12)

4. Phase 4. (1984-87) Pre-Brundtland

Reports during this phase to some extent form two streams: those which gave the environment or regulations primacy and others which gave the economy primacy. The policy reports, however, appeared to address primarily the need to give primacy to economic concerns.

It is interesting to note that the Science Council which organized the "Living with Climatic Change " Conference in 1976 has not again returned to the issue, even as late as 1987. To the extent that the Council deals in its policy reports with issues of sustainability in this period coinciding with the work of the Brundtland Commission, these were questions of sustainable economic growth in a more competitive environment, not ecological sustainability. The following excerpt was representative of the Council's apparent orientation during this period.

Canadian Industrial Development: Some Policy Directions. Report 37 (1984)

Chapter 1: Obstacles and Opportunities

All advanced industrial countries confront new situations today as the world economic order changes rapidly. Competition has heightened. Governments have displayed limited capacities to deal with their individual financial and economic problems in isolation, and the international situation has become very fragile .... the Science Council believes that the key to Canada's ability to move with the times is to establish a climate in which technological advances, innovation and new industrial companies can flourish. Initiatives must be directed to specific areas to stimulate and support the innovative process, provide better incentives for risk takers, heighten the commitment to research and development, increase the supply of trained technical people, and improve access to domestic and foreign markets. All levels of government can participate in helping to fulfill these goals and each should avoid legislative, regulatory or other actions that curtail their fulfillment. (22)

Canada and the Challenge of Change in the 1980s

In the early 1980s the global and domestic economies faltered. The extended recession and rapidly changing economic conditions left no country unaffected. Canada proved more vulnerable than most. In its evaluation of international competitiveness, the European Management Forum calculated that Canada's rank slipped from sixth to eleventh among 22 industrial countries between 1981 and 1982.

Broad financial support from the government is also needed to improve productivity and international competitiveness in Canadian industry, because many activities (notably R&D, investment in new plants and machinery, and development of international marketing skills) are insufficiently funded by the private sector. Moreover, because innovative activity tends to be risky, governments must offset risk to encourage innovation....Government measures designed to influence industrial development are generally termed industrial policy, and a consistent set of specific industrial policies constitutes an industrial strategy. An overall strategy maximizes the benefits of industrial policy. The industrial policies chosen will decide the industrial structure....Failure to make choices or to target activities such as R&D or the development of particular sectors would leave Canada's industrial structure at the mercy of random events and the short-term political whims and often predatory initiatives of other countries. (11)

A Canadian industrial policy should not, however, concentrate solely on a few high-profile successes. A number of traditional industries already involve considerable human and physical investment. Adjustment away from these activities would entail very high costs. It is in the national interest to upgrade sectors such a steel, forest products or automotive parts with new production technologies, provided that they can maintain or renew their international competitiveness. [It is interesting to note that both the forest industry and the steel industry are represented on the Science Council at this time]

Phase 5 (1988-1992) Post-Brundtland. In this phase, the Science Council embraces the National Task Force interpretation of "sustainable development"

Sustainable development

In the 1988 statement by the Science Council of Canada, Environmental Peacekeepers, the concept of sustainable development as interpreted by the National Task Force on the Environment and the Economy was endorsed.

Summary

The deterioration of the planet's ecological base is accelerating. To a large extent, environmental deterioration in advanced countries is caused by unsustainable development, and in the Third World it is caused by crushing poverty that leads people to destroy the resource base. Science and technology offer a way out of both predicaments. In the advanced countries, new technologies promise to reduce demands on the resource base while increasing industrial competitiveness, and in the Third World, development is the key to relieving poverty and averting ecological disaster.

It is in Canada's long-term interest to respond to the global crisis by cleaning up her own backyard and addressing global issues through international organizations. Even in the short term, concern for the global environment could be rewarding. The early development and export of ecologically sound technologies could bring immediate profits to Canadian entrepreneurs.

The Canadian response to this crisis must include the integration of environmental and economic decision-making — what is referred to in Our Common Future as sustainable development. Canadian industries must adopt preventive technologies, which , unlike remedial technologies, offer opportunities to conserve our natural resources and reduce waste and pollution, as well as increasing productivity and competitiveness. The Science Council also recommends that science to measure and understand the state of the environmental resource base in Canada must be supported and organized. (p.7)

Recommendations:

1. The report of the National Task Force on Environment and Economy submitted to the Canadian Council of Resource and Environment Ministers be given top priority by Canadian governments and that steps be taken to implement its recommendations as soon as possible

2. The federal and provincial governments over a 10-year period take steps to put in place an environmental assessment capability in all departments, ministries, and corporations that through their policies and programs impinge directly or indirectly on the environment.

3. Between now and the beginning of the next century, Canada under the co-ordinated leadership of the federal and provincial governments, and with the commitment to sustainable development that emerged from the recent (June 1988) Toronto economic summit, double its efforts in support of the technological modernization of Canadian industry.

4. The Department of Industry, Science and Technology take a leadership role in promoting awareness of technologies for preventing or minimizing environmental degradation, and in encouraging and facilitating their development, diffusion, and application.

5. The Department of Industry, Science and Technology immediately develop and make operational an effective in-house environmental assessment capability for new and modified technologies.

6. Environment Canada and the Department of Industry, Science and Technology develop an Interdepartmental Working Group to ensure greater consistency in policies and actions in support of science and technology for sustainable development.

7. The Canadian Council of Resource and Environment Ministers appoint a task force, perhaps organized under the auspices of the Science Council, to identify the scientific and technological resources and infrastructure needed for the collection, overall coordination, and integration of reliable, credible, and publicly accessible data on the quality of ecosystems.

8. The Canadian Council of Resource and Environment Ministers support and organize the appropriate national science and technology efforts needed to deal with current and emerging ecological problems. (9)

• THE ECOLOGICAL CRISIS

The continuing and accelerating deterioration of the planet's ecological base poses a significant threat to the long-term viability of our world. Evidence concerning global warming, ozone depletion, species depletion and elimination, the spread of the deserts, forest destruction, soil degradation, acidified lakes, rivers and streams, and groundwater pollution exists in abundance in the scientific literature.

Much of the evidence is subject to many qualifications and even scientific debate, but the overall trend and its gravity for our planet, to its multitude of species and to the generations to come, are beyond question. (11)

1. Consider, for example, the accumulation in the atmosphere of carbon dioxide, principally from the combustion of fossil fuels and the cutting and burning of forests, which is largely responsible for creating an invisible heat shield around the planet. The global average surface temperature is predicted to rise by between 1.5. degrees C and 4.5.degrees C within the next 50 years. [Worldwatch Institute, State of the World, 1988]

...It is not too difficult to foresee that dramatic consequences are possible in the next 50 years, in view of the fact that during the last ice age, when vast sheets of ice covered much of Europe and North America, the Earth's average temperature was only 5 degrees colder than the average today. (19)

Re: Our Common Future;

..thesis that we cannot save the environment without development, and that we cannot continue to develop anywhere unless we save the environment. Thus economic development must go on to avoid disasters in the poorest, most heavily populated countries, but must do so within ecologically sustainable limits. (11)

The role of science and technology in undoing the global ecological crisis — if it is to be undone at all — is of paramount importance. Because, to a large extent, science and technology narrowly applied for economic growth and development have created the crisis, they are frequently perceived as villains that destroy the planet's ecological base. But as this statement points out, science and technology can be heroes as well as villains: they can be applied to help prevent adverse environmental consequences of population growth and development, and to minimize demand on the planet's resource base. Science and technology policy is therefore central to the Canadian response to this crisis. (11)

THE CANADIAN RESPONSE

"The actions recommended in the Conference Statement [the Toronto Conference on Our Changing Atmosphere: Implications for Global Security"] if acted upon globally, could slow and eventually reverse deterioration of the global atmosphere. (11)

To be most effective in this leadership role Canada must set a good example at home. If Canadians are not prepared to tackle environmental problems that are solvable through our actions alone, such as the pollution of ground and surface water caused by our resource-based industries, who will pay attention to use when we broach problems that can only be solved through international collaborations? (12)

Even if that responsibility could be set aside, Canadians would be acting in a manner detrimental to their country's long-term good if they failed to arrest and reverse degradation of Canada's environment, including its resource base. Paradoxically, the very activities that have improved economic well-being in Canada have also had serious negative effects on our environment, particularly on our agroecosystems, forest ecosystems, and aquatic ecosystems. The Science Council observed in a recent statement for example, that '...soil degradation is an ongoing insidious problem that occurs in all parts of the country at a cost of over $3.0 million per day or $1.3. billion annually. Canada's resource-based industries, despite erosion of their competitive power, could go on playing a key role in the Canadian economy for many years if degradation of the Canadian environment is arrested and reversed. (12)

6. Summary Observations on Issue Framing as Seen in the Policy Reports of the Science Council of Canada

The most striking feature to emerge from this extended review of selected publications of the Science Council of Canada is the extent to which an initial concern for the environment and the integrity of the biosphere became submerged in the economic concerns of the late 70's and eighties.

From an initial emphasis in general on environmental issues at the time of its formation in the late 1960's, the Council published a fairly full account of potential impacts of anthropogenic activity on climate change, emphasizing the question of global warming in 1972, and moved on to organize the 1975 Living with Climatic Change Conference, publishing the proceedings in 1976. In 1977 in its major program on the Conserver Society, the Council documented the underlying structural features of economic organization which account for otherwise inexplicable environmental degradation, focussing on the misleading price systems, incomplete market mechanisms, inadequate structures of property rights and distorted accounting systems which drive economic decisions and industrial activity. Thereafter, the risks of global environmental change, and particularly atmospheric change, drop from view in the wave of publications responding to the new social enthusiasm for privatization, deregulation and downsizing government. Environmental concern resurfaces in Science Council documents in the aftermath of the Brundtland Commission, but then primarily in respect of Canada's opportunities to find a competitive niche in the production of environmental technologies and services (although the Council does embrace strongly the National Task Force's conclusion on institutions and decision-making directed toward environment-economy integration).

Thus the Council brought the relevant science into public view early, but seemed to drop out of the public debate on global warming when its own competition for survival in the leaner and meaner world of government restraint and manufactured recession became more acute. In that world, innovation, technology and competition emerged as concerns that dominated long term risks of global climate change, and that domination was amply reflected in the Council's own work.

References: Annex on Science Council