

ENERGY, TRADE AND POLLUTION IN CANADA AT THE END OF THE SECOND MILLENNIUM: A STUDY IN SHORT-SIGHTEDNESS?

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Introduction

A single, all important caveat should be stressed at the onset. This is simply that an essential prerequisite of effective environmental management is a recognition of the basic connection that exists between pollution and consumption patterns. Thus factors of the market place such as consumer goods' prices, domestic and international patterns of trade, industry taxation and governmental subsidies, and so on, will in most cases prove to be fundamentally important in terms of the effort to contain the environmental spill-over that results from various sorts of economic production. In other words, the question of environmental management must be dealt with on the level of complexity which has historically been all too easily overlooked. Its relationship to the harder economic facts of life concerning production and the welfare of the national community cannot be successfully ignored. In this regard perhaps the most promising accomplishment of the future will be the implementation of management techniques that can take these inter-relationships into account.

The proliferation of computers and data storage systems should allow substantial progress to be made in this direction by 2000 A.D. But two somewhat mooter questions are, first, whether this sophistication will occur rapidly enough to allow us to avoid the major environmental carnage that will otherwise come to burden the country, and second, assuming that it does, whether Canada will be able to marshall the internal governing forces necessary to make constructive use of the information that is acquired.

Since the awakening of the "environmental crisis" in late 1969, considerable effort has been applied to the question of developing appropriate legislative, judicial and administrative controls. To

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some extent Canada has been in the vanguard of this movement, having passed such legislation as the Canada Water Act and the Federal Air Pollution Control Guidelines at a relatively early stage. However, it is also equally true that we have seriously lagged behind in terms of the battle to identify and control the most serious sources of environmental dispoilment. In parallel with our concern for pollution control measures, we have paradoxically involved ourselves with energy-producing projects whose adverse environmental consequences are of almost unequalled gravity.

This paradox has a number of possible explanations. One answer is to point out the fact that the most significant projects today have occurred through provincial initiative (but often spurred on by American interests) with the federal government becoming involved on an "11th hour" basis. A second reason can be found in the fact that, in most cases, the projects' primary impact is felt in what are now sparsely-populated hinterland regions. Thus, while there may be a great hue and cry about environmental conditions in our urban centers, the long-term status of the James Bay Indians, or the native population of the MacKenzie Delta is of little concern for most of us. The past "environmental activism" has been principally focussed on urban problems. With our concern for urban air and water contamination we have permitted the abuse of the often sensitive Canadian hinterland to continue unabated.

Between the time of writing and the end of the millennium it is safe to assume that the environmental problems of Canadian urban centres will be largely resolved. Even today most of the technology necessary to accomplish this is at hand. Radical changes in metropolitan transportation and land use planning are in the offing. And concern has grown steadily since 1969 thereby heightening the pressure placed upon urban politicians to make meaningful improvements.

If the future is to offer us promise of accomplishments of substance, a redirection of our concern for the environment will have to take place. An awareness will have to build in relation to problems that effect areas to which few of us have travelled, but upon which we all depend in one way or another. Without this shift our visions of a northern resource treasure house will be forever foreclosed. Yet as of 1973, the evidence to suggest that such an alteration in attitudes has begun to occur in a significant way is slight indeed.

Canada has experienced a somewhat depressing history of large-scale projects aimed principally at export market service that has been to our net disadvantage. As of the time of writing, every indication suggests that between now and the turn of the century we will do little to improve upon our past record, and much to worsen it further. In view of the relatively confident predictions

that can be now made of the future course of conditions in the industrialized world, Canada is in an enviable position to apply these lessons and enjoy options in the future that few other jurisdictions can match. To accept the fate of countries such as the United States, Germany, Japan and Great Britain, when so much opportunity exists to do a better job of preserving the natural environment, is both unnecessary and foolish.

This article has thus been organized around three headings. The first is concerned with considering global conditions as of the end of the century with special emphasis upon the United States, and with periodic reference to a number of external demands that it will place upon Canadian resources. The second is concerned with a discussion of energy resource development, past, present, and projected in Canada. Attention is paid to a number of common undercurrents evidenced in relation to such projects, and the long-term environmental consequences. The final section briefly argues that, in terms of resource management generally, there is a pressing need for a comprehensive over-view to be taken in the country's best interest. Thus perhaps strangely, the most important development of law and the environment in the future may ultimately prove to be constitutionally-oriented rather than resource-oriented.

I. Shades of Apocalypse: the Coming of the Third Millennium.

The concept of future shock, and the theory of adaptation that derives from it strongly suggests that there must be a balance, not merely between rates of change in different sectors, but between the pace of environmental change and the limited pace of human response. For future shock grows out of the increasing lag between the two.

It is perhaps difficult to postulate a more fulfilling illustration of the notion of "future shock" than the saga of mankind's often inadvertent war with his natural environment as of the end of this century. The continued abuse of the global ecology and nature's response before this point in time gave little cause for alarm. While pollution of the Great Lakes caused some inconvenience for the recreation industries, and the loss of Bengal tigers was bemoaned by various naturalists and sportsmen, it was still possible to find new holiday centres, or mount a water buffalo head instead of a tiger's. But with the inability of isolated water bodies to cleanse themselves, or of the more exotic fish, plant, and animals, to reproduce at a faster rate in order to survive as a species, we marked the beginning of a forbidding regression where only the simpler and most basic life forms could comfortably survive. In turn, this simplified ecology will exhibit a tendency towards progressively greater behavioral extremes that at some point will become critical. It will be necessary to deal with the reality that nature's stability

is the product of interactional processes of all life forms, and that to reduce their variety or number invariably diminishes nature's self-control and exposes mankind itself to greater and greater risks.

Yet the tension between the objectives of "development for developments sake" on the one hand, and Boulding's "economics of ecology" on the other is unlikely to be peacefully resolved before 2000. It seems more probable that its resolution will be the product of fear and widespread suffering which has every promise of abounding before the present century's close.

The world in 2000 A.D. will be a changed place. For example England, as one of the world's highest per capita food importers, will be experiencing grave difficulties. Cost of food imports will have risen dramatically in response to the market forces of an ever much more hungry and over-populated world, and an alarmingly high incidence of yield collapses in many of the world's major "breadbasket" areas. Harvest failures as a consequence of successive increases in artificial fertilizer usage (in an attempt to synthetically bolster agricultural productivity in pace with population increases) will have numerous spillovers quite apart from the high mortality rates that are apt to result. It will also generate extreme political instability in the third world and a corresponding growth of strong antagonisms towards the relatively wealthy Western industrialized nations.

However, political turmoil may prove an all too frequent attribute of the world's development areas at the turn of the century also. Here too population growth will create internal burdens to the extent that technology and the indigenous resource bases are insufficient to maintain the standards of "high mass consumption" once enjoyed. By 2000 not only will it be unlikely that poverty in the industrialized world will have been eliminated, but in many jurisdictions its incidence will have risen alarmingly. Resentment of the economically underprivileged, matched by growing hostility of a middle income grouping that is anxious to defend its status against income redistribution will create a potentially volatile political climate.

Even the effort to maintain the status quo of the majority's consumption power will be strained in many western nations. Geometrically rising energy demand and its concomitant impact upon energy prices will be a problem of critical importance by the century's end. Internal political pressure to hold energy costs to a minimum will strongly influence foreign relations. Harsh foreign economic imperialism over outside energy supplying regions will result in some cases. Simultaneously, in other instances, energy problems will catalyze trading detentes between states with sharp ideological divergencies. For example, it is probable that the United States and the Soviet Union will have initiated massive joint un-

dertakings to exploit the latter nation's enormous oil and natural gas reserves.

For the United States particularly, the fear of becoming too externally dependent, balanced by the wish to placate a demanding resource-hungry population will produce a situation where numerous environmentally-offensive projects will have to proceed, the ecological risks notwithstanding. The compounding scarcity of indigenous petroleum reserves, coupled with the necessity to maintain stable energy marketing conditions, will lead towards greater utilization of the more environmentally sub-optimal modes of power production. Included here will be oil and coal fired thermal plants and thermonuclear fission installations. The once relatively inexpensive and clean burning sources of indigenous natural gas will have long since been exhausted. But notwithstanding the rapid increment that will have been made to the total United States power production capacity, strict rationing of energy usage will probably be quite common, particularly during winter months. The measures first employed in the United States midwest in 1973, that included running trains at half speed, cutting down upon commercial airline schedules, and slowing down winter production of large energy-consuming industries will be extensive by the century's end. And under such circumstances Canada will increasingly be asked to augment United States energy needs to the limit of our ability.

Offsetting these disturbing trends will be crash programmes aimed at first, making more efficient use of available energy supplies, and second, developing cheaper and easier means of bolstering present production. The United States breeder-reactor programme, which lagged for two decades behind that of the Soviet Union, will have been extremely active after the mid 1980's. In addition productive research will have been devoted towards the evolution of hydrogen and oxygen fuel cells, and the economic feasibility of large scale solar power production will be on the foreseeable horizon. The transportation industries will be beginning to experience revolutionary changes. The electric automobile will have been abandoned in its infancy for the double energy waste entailed in the conversion of hydrocarbons into electricity, and the subsequent energy escape involved in battery storage. Direct energy-power conversion will be emphasized. In this regard turbine use will be common, and generally the ratio of passenger mile output per unit of fuel consumed will have risen substantially as a consequence. This improvement will be assisted by first, raising the efficiency rating of power plants used by transporting vehicles, and second, increased density of usage. The age of private automobiles that were designed for six passenger travel, and yet were usually operated by a single individual, will have long past.

Notwithstanding such developments other significant problems

will plague attempts at maintaining environmental quality standards in the industrialized world. Waste heat disposal will be a difficulty reaching intolerable proportions. At the beginning of the third millennium the equivalent of the total United States fresh water supply will be cycled through power plant coolant systems three times each day. The impact that this fact will have upon the stability of fresh water aquatic life and the maintenance of water quality standards generally will be nothing short of staggering. Regions of the United States that escape the many adverse effects of thermal pollution will thus be rare indeed and access to potable water supplies will be placed at a large premium. Because of this, American enthusiasm for a substantial Canadian water export scheme to augment internal supplies should reach hysterical proportions before 2000.

Urban air contamination may also increase into the twenty-first century. The effort to contain energy prices and conserve energy may often have served to deter the installation of the stack precipitating equipment which would otherwise have mitigated the environmental spillovers from power production. Yet over the longer term, the promise of innovating more efficient energy technologies, coupled with the advances that will then be occurring in the transportation industries, will be grounds for legitimate optimism that the problem of airborne contaminants can be significantly abated.

A less-easily resolved question will be the widespread presence of chemical residuals. This will prove to be of growing global concern for the contamination of human and animal tissue with herbicide and pesticide chemicals, mercury tracings and, in urbanized areas, lead poisoning, will precipitate serious health and food supply difficulties. Unfortunately it is an all too reasonable prediction that the tragic mercury pollution experiences of Japan in the late '60's will be duplicated throughout the globe.

The exponential rate of consumption of certain basic major metals since 1960 will endanger severe supply shortages at the turn of the century. In particular, silver, bauxite (aluminum), gold, cobalt, copper, mercury, manganese, molybdenum, nickel, lead, platinum, tin, tungsten, and zinc will be both priced at a large premium, and in short supply. Exhaustion of chromium and iron will be anticipated in the foreseeable future in addition. Yet, regardless of the danger of strategic material shortages, in the year 2000 A.D. the developed world will better comprehend the notion that the "limits to growth" conceive of more than merely the point in history when a global economy runs out of needed industrial inputs. Indeed, this point will probably never occur, for an economy's notion of "resources" fluctuate with alterations in consumption preferences, shifts in technology, and general changes

in political and social outlooks. Instead mankind will, perhaps belatedly, comprehend that the "limits" are more sophisticated, given that they derive from his apparent reluctance to grapple with a conservation problem of unparalleled magnitude because of the obvious personal sacrifices that are involved.

The "limits" are thus better described as political in so far as there appears to exist a threshold beyond which a society is incapable of marshalling the resources needed to conserve the natural environment upon which the future depends. For example, a hungry population in need of more income, employment, food, shelter, clothing, and transportation is unlikely to elect political candidates that advocate output quotas, elimination of environmentally destructive industries, higher end product cost, higher energy costs, higher taxes, and stringent population controls. The changes involved for the present generation may well be regarded as being simply too disruptive and too costly notwithstanding the fact that the failure to adopt them spells certain disaster for the next generation.

It is a fair supposition that many of the economic exigencies that have been described *supra* will limit the capacity of the world's major industrial powers to provide leadership in the field of environmental management, including especially the United States and Great Britain, Germany and other major European powers. If a standard is to be set, it will have to derive from nations that did not experience growth to the degree that the vicious cycle of a demanding population and a rapidly contracting resource base frustrated all efforts to institutionalize the environmental protections necessary to preserve the natural environment. In the Northern Hemisphere only two major nations even have the potential (as of today) of being in this position thirty years hence: Canada and the Soviet Union. Both nations have massive economic potential in terms of resource reserves and sheer open habitable space relative to their populations. Each has the benefit of advanced technical knowledge which has been to some extent applied to environmental management problems at a very early stage. At issue here is the common trusteeship both jurisdictions hold over the Arctic region which, of itself, has given rise to an early appreciation of the inter-relationship of man's activities and the response of a delicate environment. These considerations, however, are of themselves by no means a guarantee that either Canada or the Soviet Union will enjoy so fortunate a position in 2000 A.D. as has been described. The latter, from the competitive pressure of western industrial strength, may well ignore environmental considerations in its effort to maintain a global position in both economic and military power. Canada may also squander her future, but in our case the incentive will derive not so much from

a wish to assume and maintain world power status, as much as it will for the reason of being too short-sighted in our trade dealings with the United States.

II. *Economic Nationalism and Environmental Protection.*

Canadian environmental conditions as of 2000 A.D. will not be so much the product of legislative, administrative, and judicial controls specifically aimed at pollution prevention as much as they will be the result of the type of continental trade relations that Canada has engaged in during the course of the four decades preceding the century's end. Over this period the United States will have confronted mounting vexations of primary resource scarcity and rising end product costs. It will as a concomitant focus greater attention upon the reserves of its less-developed neighbours and principal allies. Canada's qualifications have been unique in both spheres. The country is a richly-endowed neighbour, and historically we have shown ourselves to be a devoted ally. For both reasons we will continue to be the obviously optimal source for many of the primary resource inputs badly needed by the Americans.

From the standpoint of Canadian economic sovereignty this trend promises only to compound any problems that we might have experienced in the past. The degree of United States dependence will expand, and any Canadian effort to either arrest or retard the exploitation of our internal primary assets will have obvious direct and adverse implications for our neighbours. Such "protectionism" would force the United States to rely upon strategically-less secure and more costly sources of supply off-shore of the continental land mass. Given the dependence that, all else being equal, will continue at an unabated rate between now and 2000 A.D., passive acquiescence by the United States in the face of a surge of Canadian economic nationalism will grow to become a less and less reasonable expectation.

Assuming that the development and export policies propounded in the '60's and '70's remain substantially unchanged, Canada should experience an investment wave of unprecedented proportions. Much of the country's hydro-electric potential within commercial distance of American markets will be fully exploited. A North American transmission grid should be an accomplished fact. The early hydro-electric developments on the Columbia-Kootenay, Peace, St. Lawrence and Hamilton (Churchill) Rivers will likely be followed by massive undertakings on the Nelson, Churchill, La Grande, and possibly Thompson, Skeena, Laird, Yukon and Fraser Rivers.

These power projects, and their after-effects, will constitute one of the most substantial environmental problems that Canada

will have to confront in the twenty-first century. Some of the losses that have resulted from developments that have occurred as of the date of writing, or have been reliably projected serve to well illustrate the contention.

1. *Peace River Power Development.*

The Peace-Athabasca Delta region, already a cause of grave concern in the late '60's, will likely mature to become an environmental disaster. Substantial decimation of a major flyway of the continent, permanent forfeiture of a significant portion of the Woods Buffalo recreation-conservation area, alarming declines in the land-bound gaming resources of the region, and the displacement of the economic foundations of many of the area's native communities will be a few of the results. Primary effects will expand over an area of upwards of 5,000 square miles to ultimately involve British Columbia, Alberta, Saskatchewan and possibly the Northwest Territories.

2. *Columbia-Kootenay Development.*

The Columbia-Kootenay River works realized pursuant to the 1961 Columbia River Treaty and 1964 Protocol have of course entailed the permanent forfeiture of the Arrow Lake Recreational region and the lower portion of the Kootenay Valley in British Columbia. Given the scarcity of usable land acreage available in so mountainous a province, coupled with the strain that will be placed upon the available recreational areas as a result of its sharply expanding population, we can be guaranteed that the opportunity costs of losing both river valleys will rise geometrically in the future. The wide fluctuation in the storage reservoirs, and the limited timber clearing that occurred prior to the construction of the High Arrow (H. L. Keenlyside), Mica Creek, Duncan Lake, and Libby damsites promise that the Treaty will exist as a timeless monument to the short-sightedness of the governments and individuals that approved of it; a fact which will be more than underscored by the additional and heavy financial losses it subsequently imposed upon the country.

3. *Nelson-Churchill Power Development.*

The Nelson-Churchill power project will probably still qualify as the largest single water diversion ever attempted on the North American continent at the close of the second millennium. By this time it too will have evolved into an irreversible environmental tragedy. Complete destruction of the underlying ecological stability of the lower reaches of the Churchill River, the Southern Indian Lake Region, the Granville and High Rock Lakes region, and

much of the length of the Nelson River will be some of the preliminary consequences. The underlying climate of a huge area, that includes a sizable portion of James and Hudson Bays, will have been altered. One of the more attractive recreational centres in central Manitoba, with a significant sporting and commercial fishing potential, will have been laid waste (as a result of problems associated with submerged timber litter, oxygen starvation, turbidity rises, and repetitive shoreline instability). As was true of the Peace project, one of the finer native communities in the country will have been largely ruined. In addition, enough archeological treasure to keep available researchers busy for a hundred years will have been inundated by the project's flood waters.

4. *The James Bay Hydro-Electric Project.*

Quebec's James Bay project will have been operational, if all proceeds according to plan, for a decade by 2000 A.D., and by that time the contemplated expansions to the original La Grande project sequence will be well under way.

Included in this second phase of the scheme will be the Notaway, Broadback, Rupert, and Eastmain Rivers (or in other words all of the major fresh water inflows of James Bay that originate in the Province of Quebec). Many of the problems encountered by the Nelson-Churchill project will re-occur as a result of this undertaking. The low energy, environmentally-sensitive northland will again form the background for the development. Again a large native population will have been displaced (around 6,000 in number). And again an enormous region of the country will have been inundated with flood waters with all of the attending difficulties of fish kills, turbidity rises, wild life decimations, and possibly broadly felt climatic alterations.

These projects have evidenced a number of strikingly common features. Most have been aimed at satisfying (in part) the United States energy export market and without it would not have been initiated. Only the Peace River project is preponderantly Canadian in terms of where its power output is directed, but even in this case, were it not for the Canadian forfeiture of most of the hydroelectric potential of the Columbia, it probably would not have been built (and the consequent damages to the Peace-Athabasca Delta would not have occurred). The Canadian willingness to undertake such projects, in advance of domestic requirements has had the concomitant effect of first, providing the United States with low cost energy imports, and second, enabling that country to export all of the associated environmental costs. The propensity of the provincial and federal governments to understate the value of the national resources at issue has been only too consistent and, by 2000 A.D., will be the cause of much regret.

Similar forfeitures will very likely be made in respect of other energy projects aimed at augmenting United States energy needs. Some of these follow:

5. *Development of Canadian Oil and Gas Reserves.*

Rapid exhaustion of the gas and oil reserves of southern Alberta in favour of the short term needs of the United States export market will unfortunately lead to hurried exploitation of both the Arctic sedimentary areas, and the coastal off-shore regions of British Columbia and the Maritimes. The comparative advantage of production from this latter group of hydrocarbon bearing zones will be considerably below that of the original southern Albertan areas principally because of the proportionally greater transmission and exploration costs. But development will have to proceed at a brisk pace beginning in the late '70's due to the lag in the effort to develop economical alternative power production technologies. Petroleum costs will for this reason ultimately rise considerably, and yet for Canada, as the petroleum exporter, the revenue picture will probably not improve. Any negotiating strength Canada might have had will be offset by the fact that the opening up of Arctic and northern frontier areas will be as crucial to this country as it will be for the United States. The demise of the relatively less expensive western Canadian reserve areas will, in other words, rob Canadian bargaining power, for, like the Americans, Canada will have no alternative source of badly needed petroleum supplies (save through foreign imports). Yet, the magnitude of the investment necessary to build access to the Arctic fields will compel the acquisition of United States financing which will in turn entail a commitment to serve the United States export market.

6. *Environmental Impact "North of 60".*

Because both Canada and the United States will share a common concern about holding petroleum and gas production costs to a minimum, environmental losses involved in northern pipeline and highway construction and off-shore production will tend to remain uncompensated. And the environmental encroachment we should expect to be both massive and permanent.

2000 A.D. should see at least two major north-south oil and gas pipelines: one through the MacKenzie Valley and a second extending from the Melville Island discoveries around either the eastern or western shore of Hudson Bay. Each will bridge extensive muskeg and permafrosted zones, and it is a reasonable expectation that major breakages and spills will occur in the Arctic over the operational history of each. Problems of lenticular shifting (due to the subsurface thermal changes as a result of the

great weight of the lines) will repeatedly frustrate attempts at maintaining a continuous delivery of throughput.

While gas spills may not impose a heavy burden upon the Arctic ecology, the situation in case of an oil leakage will be in sharp contrast. The immediate impact will be the destruction of the surface vegetation. In muskeg areas extensive quagmires will develop as permanent scars (muskeg is the most important water-regulatory mechanism in the north, and for all practical purposes, has next to no regenerative capacity). Environmental effects that will result from the construction phase will probably be as devastating as will be the operational phase in terms of the surface instability caused. But the most severe consequence, however, will not be the scarring of the tundra's surface. A far greater danger is the likelihood of at least one major oil spill being flushed into the Arctic coastline region by a northerly flowing river such as the MacKenzie. The seriousness of such a spill upon the delicate delta, and eventually a wide expanse of the Arctic Ocean, in terms of ecological disequilibrium (including climatic patterns over a possibly significant portion of the northern hemisphere) may be extreme.

7. Environmental Impacts in the Off-Shore Regions.

The off-shore developments also involve risks. A major spill resulting from a well blow-out, the loss of a super tanker, or the breaching of a submarine pipeline is regrettably not a matter of conjecture; only of time. Fortunately improvements in spill containment and collection techniques are at hand for calm seas, and no doubt will be refined to the point where they will become operational in rougher swell conditions before the century's close. The danger in this respect will derive from the possible failure to keep such costly equipment close at hand more than it will from our inability to cope with the problem itself. It is far from unreasonable to assume that major destruction of segments of both the eastern and western Canadian coasts will occur prior to 2000 A.D., by which time we can only hope that the necessity of having adequate stockpiles of preventative equipment will have been made patently obvious.

8. A Canadian Water Export(?).

As noted above, pressure will undoubtedly be placed on Canada to agree to other major resource-export arrangements that ultimately could have a significant bearing upon the preservation of domestic environmental conditions. The long history of discussions about a water export might well be placed in this group, although the precise nature of such a scheme is not so easily

predicted. Certainly past schemes such as that put forward by the Parsons Engineering Company (The North American Water and Power Alliance or simply "NAWAPA") will not qualify, for the problems entailed in re-directing the major Western Cordillera Waters into the Rocky Mountain trench, or creating a trans-national "barge" canal are probably insurmountable, and certainly too costly a means of accomplishing a "delivery". The alternative scheme advanced by the head of the Policy and Planning Branch of the Canadian Department of the Environment, The Central North American Water Project (or simply CeNAWP), the Alberta "Prime" plan, or the James Bay "Grand Canal" plan are more likely candidates for consideration over the next three decades. But the costs in terms of environmental waste, potential loss of sovereignty, and ultimate economic costs make the realization of any of these monumental undertakings a forbidding prospect for Canada and would no doubt be the cause of profound sorrow before the century was ended.

9. *Minerals Trade.*

Major expansion in the mining sectors of the economy is a certainty as a consequence of enlarging United States needs. Invariably environmental damage will occur, but with luck can be both contained and worked into the export prices which are negotiated. It is to be hoped that extensive scarring that resulted from the Kaiser coal development in the east Kootenay region of British Columbia will not set the precedent, for here again the gain for Canada has proved non-existent. A detailed screening process for such sales will have to be evolved if the situation is to be improved, and, as of the moment, there is little basis for the belief that Canada in 2000 A.D. will not have more than just the Kaiser plant to remind us again of a history of short-sightedness.

Once again all of the above resource issues share a number of common elements. Each has involved, or will involve, the inflow of enormous capital sums into the Canadian economy. Each affects enormous regions of Canadian territory in a potentially adverse fashion. All but the Arctic and off-shore petroleum developments will have occurred at provincial initiative, and have the service of the United States export market as their principal objective. And all involve substantial ecological or economic losses for Canada, or both and concomitant economic or environmental gains, or both for the ultimate consumers south of the forty-ninth parallel.

By the end of the second millennium Canada will have to cope with the usual run of air and water pollution issues common to any industrial society. But in relation to the enormous vestigial

environmental scars of these pre-2000 A.D. resource projects, the more common day questions will pale into insignificance.

Conclusions

So far as urban areas are concerned, it is a safe assumption that by 2000 A.D. it will be possible to control all forms of on-going pollution sources in respect of land (soil), water and air. As noted, the basic technology exists today with the only issue being a matter of practical implementation given the present-day economic priorities. And it should be stressed that the issue is one of priorities alone, for on the basis of net benefits there has never been a case for not controlling pollution. The economic gains are only too clear. Less clear is the question of who should pay the costs necessary to achieve them; the delinquent industries (and ultimately the consumers of their products) or the elements in the economy that will gain as a result of the increased pollution control.

A variety of approaches have been tested in relation to this controversy, including private actions at common law aimed at forcing producers to instantly "internalize" pollution costs, administrative regulation aimed at a similar objective, but usually allowing a period of grace that can facilitate the gradual implementation of abatement equipment without undue financial hardship, and direct legislative controls aimed at prohibiting or discouraging environmental abuse. To an extent a pre-condition for the effective employment of any or all of these methods in combination has been a high level of public concern. As this grows over the course of the century, progressively refined approaches to the regulation question at a local level are guaranteed.

But in relation to resource issues of the scale of some of the projects listed in this article, the situation is in distinct contrast. In terms of the damages done, there will be virtually no effective set of remedies at hand. Management and containment of adverse environmental effects may in some cases be within the realm of possibility before work commences. In other cases neither *ex post* or *ex ante* project effort will suffice. The solitary option in such cases will be to abandon the proposed undertaking in the name of preserving the otherwise wasted project environs. James Bay and the Nelson-Churchill hydro-electric developments are two that fall into this category, and the MacKenzie Valley corridor concept may also qualify.

The key issue in terms of environmental management on this scale is thus the institution of a general authority to make the broader assessment of project costs and benefits vis-à-vis the national interest. In this sense the existence of appropriate controls in the future may simply hinge upon the assertiveness of the fed-

eral government. If the provinces are left to themselves to confine their assessment of the virtues of such massive works strictly on the basis of intra-provincial impact, and accordingly ignore adverse consequences that spill over to the detriment of their neighboring jurisdictions, or the nation as a whole, then the turn of the century will bear witness to waste of globally unprecedented proportions. It is to be hoped that the history of federal responsibility as of 2000 A.D. will be more promising than is true as of 1973 A.D.

This article began with an initial assessment of what can only be called a "bleak picture" of the world's condition some thirty years hence. The fact that this description is both possible, and so commonly heard, makes all the less excusable the shocking waste entailed in so many of the past, present, and projected Canadian energy-related projects discussed in Part II. Federal reticence to overrule provincial resource sell-outs in favour of the United States export markets betrays not only weakness in face of a clear duty in the national interest, but ignorance as well of the superb opportunity that this country has to profit from the rich history of resource mismanagement in the industrialized world.
