NATIONAL ROUND TABLE ON THE ENVIRONMENT AND THE ECONOMY
TABLE RONDE NATIONALE SUR L'ENVIRONNEMENT ET L'ÉCONOMIE

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# Business Strategies for Sustainable Development in the Canadian Energy Sector

**A Discussion Paper for the**
**National Round Table on the Environment and the Economy**
**Workshop on Business and the Environment**

**to be held on the occasion of**
**"Caring for the Earth"**
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**of the**
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Prepared by:
**Ralph Torrie**
**Torrie Smith Associates**
302-255 Centrum Blvd.
Orléans, Ontario K1E 3V8

The views expressed herein are those of Torrie Smith Associates.

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# Preface

This paper has been written as a discussion paper for a workshop that will be held in Montreal in October 1996 to consider the ways Canada generally, and Canadian businesses in particular, are exploiting the capacity of the private sector in realizing sustainable development. To help contain the discussions, the workshop will focus on the Canadian energy sector.

The workshop is being organized by Canada's National Round Table on the Environment and the Economy (NRTEE), in response to an invitation from the International Union for the Conservation of Nature (IUCN). It will take place during the World Congress of the IUCN to be held in Montreal in October 1996.

Since its inception in 1948, the IUCN has been recognized as one of the pre-eminent players on the international scene in biodiversity, conservation and sustainable use of natural resources. Indeed, the modern concept of sustainable development owes much to the IUCN's *World Conservation Strategy*, first published in 1980.[1] In recent years, the IUCN has attempted to pay more attention to the role that business can play in furthering its goals, and to that end it approached Canada's National Round Table on the Environment and the Economy (NRTEE) to convene a workshop on the theme of "business and the environment". Some of the earliest work on this theme was done under the auspices of the Canadian Science Council's Conserver Society Project in the mid-1970s.[2] The National Round Table on the Environment and the Economy is continuing in that tradition with its current emphasis on business strategies for sustainable development.

1 International Union for the Conservation of Nature, *Conservation Strategy: Living Resource Conservation for Sustainable Development* (Gland: IUCN, 1980).

2 Science Council of Canada, *Canada As A Conserver Society: Resource Uncertainties and the Need for New Technologies*, Report No. 27 (Ottawa: Supply and Services Canada, August 1977). Among the report's conclusions: "A move toward a Conserver Society does not mean a move away from industry, technology or private enterprise. On the contrary, a conserver approach will lead to the introduction of new technologies, new opportunities for Canadian business, and unprecedented challenges to the entrepreneurial spirit."

# Business Strategies for Sustainable Development in the Canadian Energy Sector

## Energy and Sustainable Development — Utopian Dream or Practical Possibility?

> *So what exactly does a resource management company mean if it adopts a policy of sustainable development? Does that mean, for example, that it takes the needs of future generations fully into account in making day-to-day decisions? How many companies really do this, or would even know where to start?... Can individuals, corporations, and societies ever hope to live up to these lofty standards? Or are we better off aiming for more modest objectives such as "conservation", "due diligence", or "not screwing up the environment too badly"?*
>
> *B.C. Hydro's Virtual Ecologist*
> *B.C. Hydro Environment World Wide Web Site*
> *http://ewu.bchydro.bc.ca/bchydro/environment/virtual/susdev00.html*

Visitors to the environment section of B.C. Hydro's World Wide Web Site are invited to take a walk with a "virtual ecologist" and debate the question: "Sustainability: Realistic Goal or Impossible Dream?" It's a good question.

In the face the hardening consensus in the climatological community that global $CO_2$ reductions of 50% or more will be required to avert catastrophic climate change, it is now generally accepted that few, perhaps none, of the rich countries will even be able to stabilize emissions at 1990 levels. On this issue, Canada's energy industry has put forward the so-called "no regrets" measures (i.e. emission reduction measures that pay for themselves, notwithstanding their environmental benefits) as a *ceiling* rather than a *floor* on the voluntary actions they will undertake to reduce greenhouse gas emissions. In the power industry, environment and sustainable development considerations are afterthoughts in the rush to restructure the electricity sector and dismantle public power. Meanwhile, notwithstanding their expressed concern for the environment, average Canadians continue to consume more energy, for example by abandoning public transit in droves in favour of ever less fuel efficient cars, vans and, most recently, various types of four-wheel drive overpowered vehicles designed more for the Australian outback than the trip to the local suburban shopping mall. In general, there is not a single country that is responding to the environmental threats from unsustainable energy systems with the same resolve that was mustered when the security of oil supply was threatened in the 1970s.

Modern industrial economies like Canada's are powered by fuels and electricity that are derived mostly from non-renewable resources whose production and consumption consistently rank among the highest contributors to environmental stress.[3] This is the context in which we approach a consideration of business strategies for sustainable development in the energy economy, and this is the context from which the hapless, albeit virtual, ecologist at B.C. Hydro's web site poses her question. There is no point in being naïve about the magnitude of the transition required to create an energy system consistent with sustainable development, and the sentiment that "you can't get there from here" is understandable, even if ultimately unacceptable.

Just 100 years ago, the fledgling oil industry faced a very uncertain future, and many thought it was doomed. Its primary market was illumination and Rockefeller had already made a fortune with Standard Oil selling kerosene for lamps. But kerosene was rapidly losing market share

3 Environment Canada, "Energy: A Balance of Power", chapter 12, *The State of Canada's Environment*, (Ottawa: Environment Canada, 1991).

to the clearly superior electric light, which was gaining in popularity and accessibility at a phenomenal rate. With no obvious replacement for kerosene as its primary product, the growth potential for the oil industry appeared limited. It would be another five years before the first rotary drilling rigs would strike the giant Spindletop oil field in Texas. The automobile had been invented but was not yet considered a serious alternative to the established modes of transportation; in 1896, most cars were either electric or steam driven. Henry Ford was working on a prototype but the first Model T assembly line was still an idea more than ten years away from realization

Tomorrow's reality is very often yesterday's utopian dream, and before dismissing sustainable development as an "impossible dream", we would do well to remember the powerful catalytic force for change that comes from the right combination of circumstance, opportunity for profit, and entrepreneurial vision.

# Energy for Sustainable Development — Some Design Principles

By now, most people with any interest in this field are familiar with the Brundtland Commission's definition of sustainable development, and in this paper we adopt a variation developed by the International Institute for Sustainable Development specifically for the business enterprise:

*Sustainable Development: for the business enterprise, sustainable development means adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future.*[4]

The goal of sustainable development — meeting the needs of the present generation without diminishing the ability of future generations to meet their needs — challenges business and government planners to incorporate long-term considerations in their plans in a way in which traditional techniques have not. Among other things, this means changing human behavioural patterns — including those manifest in technological development — so that environmental costs are not transferred to future generations and so that long-term ecosystem health can be restored and maintained.

We do not have detailed blueprints for what the energy part of a sustainable society would look like, and there will not be a single solution that works for every society. It is possible, however, to put forward what we might call "design guides" for sustainable energy development, based on the principles of sustainable development and the nature of the technological energy system. (See next page.)

These design principles for sustainable energy will very rarely all be embodied in a single system and there will often be tensions between them and trade-offs required in the design of real technologies. For example, emission controls are easier and cheaper when applied to large-scale technologies, whereas system resilience and reliability are better served by networks of smaller technologies. Some primary energy resources must be developed with a high degree of centralization, and the principle of least cost can sometimes be achieved only with the utilization of large, centralized developments.

Notwithstanding the inevitable trade-offs between the idea and the reality, an energy system developed with the design guides would be characterized by diversity, resilience, self-reliance and efficiency. It would make use of environmentally sustainable and highly efficient technologies to provide elegant solutions to the energy service needs of its citizens. Its design would be integrated into the very form of our technologies and our communities.

4 International Institute for Sustainable Development (IISD), *Business Strategy for Sustainable Development: Leadership and Accountability for the '90s*, a joint project of the IISD and Deloitte Touche (affiliated with DRT International), with the participation of the Business Council for Sustainable Development (IISD, 1996). (Order at http://iisd1.iisd.ca/)

## ***Design Guides for Sustainable Energy Development***

*A Demand Side Focus*

Above all, sustainable development is about meeting people's needs, and an energy strategy focused on human welfare will focus on the demand-side of the energy equation. We will have more to say below about the implications of this point to business strategies for sustainable energy, but essentially it means refocusing on the fundamental demands for services. It leads directly to a much broader definition of what constitutes the "energy sector" of the economy, with the traditional energy commodity providers representing only one component in the mix of resources, technology, information and added value that together meet demands for access and energy services.

*Efficiency*

In sustainable energy futures, there is a premium on efficiency, on matching both the scale and the quality of the energy source with the end use demand.

*Environmentally Benign*

Energy services are provided by technologies which are ***environmentally benign*** and which maintain rather than diminish the health of the ecosystems in which they operate. Technologies with the potential to cause irreversible ecological damage are rejected in favour of ***"safe-fail"*** technologies which allow for the capacity of the ecosystem to recover from technology-related stress. Emissions of toxic and radioactive substances must be reduced to zero or nearly zero, and emissions of carbon dioxide and other potentially destabilising substances must be lower than the ecosystem's ability to absorb them.

*Least Cost*

Energy services are provided at the ***least cost***, consistent with social, environmental and other objectives. An energy economy rife with unjustifiable subsidies and market distortions is ultimately a vulnerable energy economy, sluggish in its response to changing circumstances and prone to sudden disruptions. Among the unjustifiable subsidies, however, must be counted the one we receive from future generations every time we take an action that runs down a non-renewable resource or in some way diminishes the ability of ecosystems to provide the basis for health and prosperity.

*Diversity*

The demands for energy services are matched in both scale and thermodynamic quality by a ***diversity*** of ***dispersed*** sources so that both risks and benefits are widely spread and vulnerability to any single failure is minimized. All else being equal, a system composed of ***smaller rather than larger units*** exhibits greater reliability and is less vulnerable to massive failure, provided the units are optimally interconnected.

*Flexibility, Resilience*

Energy services are provided by technologies with ***short lead times***, the elapsed time from drawing board to statup thus allowing a quick response to changes and ***flexibility*** in planning. Energy services are provided by ***indigenous*** sources, thus providing ***self-reliance*** and insulating the society from the adverse impacts of geopolitical events beyond its control. Energy services are provided by technologies that allow ***early failure detection*** and quick repair.

*Equitable*

The equitable distribution of costs and benefits is a defining feature of sustainable energy futures. All else being equal, ***decentralized*** technologies are preferred over centralized technologies that tend to have a disproportionate share of the costs at the upstream end of the pipeline or transmission line, often with First Nations communities bearing the brunt. Technologies and energy options are rejected unless they can be deployed in a way that eliminates the passing on to future generations of wastes, risks and costs.

*Socially Benign*

Technologies, even apparently simple technologies, contain embedded social values. If we are on the threshold of a "post-industrial" society, it is because we are formulating new values about technology. In considering technologies for our future energy systems, we must ask ourselves the question: is this a technology that is compatible with the principles of sustainable development, of human welfare, social justice and self-determination, or is this a technology that may constrain society from developing in a sustainable way?

# Energy and Environment in Canada — the Current Situation

So much for the dream; now what about the reality? The evolution of Canada's primary energy use is shown in Figure 1, and it reveals much about the evolution of the nation itself. The phenomenal growth in oil consumption that has dominated our energy economy for 40 years is largely responsible for the urbanization, increased mobility and centralized industrial production that characterize Canadian society today. Now over half Canada's oil consumption is for transportation fuels; most of the remainder is in the form of industrial boiler fuel, some power production, and the consumption of the petroleum industry itself.

Natural gas has increased in use and now accounts for about one-third of the domestic demand for primary energy commodities in Canada, but the pipeline system does not yet extend to the eastern provinces (New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland). Coal, at one time a major energy source for Canada, is now limited to a small number of large, industrial users, mainly for steel-making and electricity production in some parts of the country. It has all but disappeared as a space heating fuel and is no longer widely used as a boiler fuel by industry.

In most of Canada, electricity production has developed via state monopolies operating at the provincial level, and there are marked differences in the mix of primary fuels used to make electricity from one province to the next, as illustrated in Figure 2. British Columbia, Manitoba, Quebec and Newfoundland produce almost all their electricity from hydro power; Alberta, Saskatchewan and Nova Scotia are heavily dependent on fossil-fired thermal generation; Ontario and New Brunswick have a mix of hydro, nuclear and fossil-fueled stations. These differences are important in considering the environmental consequences of electricity production in different regions of the country.

Per capita use of fuels and electricity in Canada is more than double typical levels in Europe, more than five times the world average, and over 25 times higher than the average for African nations. Both the level and rate of improvement of the energy productivity of the Canadian economy are low by world standards. There are many reasons for this high level of energy use, including lifestyle, climate, industrial structure, distances between centres, relatively low energy prices, and a somewhat lower policy emphasis on energy conservation and efficiency than has been the case in many other OECD nations.[5]

Figure 3 illustrates the flow of energy resources and commodities through Canada's modern, industrial economy in 1993, from the extraction of primary resources (at the top of the page) through to the final consumption of fuels and electricity by sector (at the bottom of the page). Energy analysts use these types of diagrams to summarize in one picture a great deal of information about primary resource production, secondary end use consumption, imports and exports of energy commodities, and the flows and relations between them. However, the Figure can also serve as a framework for considering the many and various ways in which the technological energy system affects the environment. Along the chain of activities that leads from the primary resource to the final end use, all the generic types of ecosystem stress can be found: pollution loading, overharvesting of renewable resources, extraction and depletion of nonrenewable resources, and environmental restructuring.

5 World Resources Institute, Table 12.2 in *World Resources: A Guide to the Global Environment 1996-1997* (Oxford University Press, 1996).

**FIGURE 1**
**Domestic Demand for Primary Energy in Canada 1926-1994 (Actual) and 1995-2020 (Forecast)**

- Air pollution from fuel burning is perhaps the most widely recognized environmental impact of the energy system, particularly in urban areas where the concentration of people (and fuel burning) often leads to severely degraded and unhealthy local air quality. In fact, fuel combustion is the leading source of the most serious local air pollutants — nitrogen oxides, volatile organic compounds, sulphur dioxides, and particulate matter.

- Fuel combustion also releases carbon dioxide, which does not pose a local air quality threat, but does contribute to the global greenhouse effect, considered one of the most serious international environmental problems.

- The production of hydro electricity is a leading cause of environmental restructuring in Canada. Although often described as an environmentally clean source of energy, hydro electric development in Canada has resulted in enormous ecological damage, often totally transforming entire eco-regions in the course of massive river diversions.

- Nuclear power development has introduced a new class of energy-related pollutants in the form of the radioactive materials produced at various stages of the nuclear fuel chain, sometimes in extremely concentrated and volatile forms. These radioactive materials depend on technological systems for their perpetual containment.

- The extraction of primary energy resources is another major contributor to environmental stress in the form of non-renewable resource depletion, environmental restructuring, waste generation and pollution loading. In parts of western Canada, the primary energy resource industry (oil, gas, coal) represents the largest source of ecosystem stress.

- Above ground electric transmission lines, and oil and natural gas pipelines, along with the rights of way and access corridors they require, constitute significant linear land uses in Canada, with associated environmental and aesthetic impacts.

- The environmental impact of automobiles bears particular emphasis in a discussion of energy and environment. The automobile and its associated infrastructure represents not only the largest direct source of environmental stress in urban areas (from tailpipe emissions) but also the largest indirect driving force behind many other types of ecosystem stress found in cities that

**FIGURE 2**
**Electricity Production from Primary Sources in Canada, 1994**

result from the land use patterns and urban forms associated with high levels of automobile dependence.

There are qualitatively different impacts from different types of energy, and this makes it difficult to compare one source with another. How does one compare, for example, an occasional Chernobyl with the day-to-day fouling of the air by fossil fuel combustion? Or the depletion of non-renewable stocks of oil and gas with the massive restructuring of the environment and loss of habitat associated with major river diversions for hydro power megaprojects? These are not simple or easy choices, and perhaps not even the best choices we can define for ourselves.

***In contrast, conservation, efficiency and renewable energy technologies emerge as clear preferences in the search for sustainable energy systems and are always identified as key components of sustainable development (SD) strategies. Energy efficiency, conservation and small-scale renewable technologies satisfy more of the criteria for sustainable energy development listed in the box "Design Guides for Sustainable Energy Development" than any commodity. They are as dispersed and diversified as the market for services itself; they are absolutely renewable, often cost much less than commodity supply options and are generally environmentally benign and amenable to easy fault detection and quick repair. They are almost always based on indigenous resources and knowledge and they have short lead times.***

Most important, any gain from conservation and renewable energy technologies which allows a particular task to be performed with less fuel or electricity will cause a reduction in environmental risk and ecological stress. This reduction in ecological stress occurs not only at the point of end use, but works its way "upstream" to the primary resource extraction, reducing environmental risks all along the way.

***As consideration of Figure 3 suggests, there are many different players involved in determining the level and pattern of energy commodity production and consumption in Canada. At one end of the system are the fuel and electricity producers, with their large central facilities that are often major point sources of environmental stress. At the other end of the system are the millions of end users comprised of individuals, households, businesses and institutions. And all these players are inside a physical infrastructure and built environment with a design that puts absolute constraints on the level of energy efficiency and/or the choice of energy options avail-***

**FIGURE 3**
**Canadian Energy Flow Chart 1993 (petajoules)**

*able to the end users. Thus the problem of achieving sustainable energy futures is one that can only be solved by engaging a very broad cross section of society from community planners to tax policy specialists, from large, integrated energy commodity producers to small firms with innovative solutions for meeting energy needs in ways that add value and reduce the contribution from energy commodities.*

*The challenge of developing sustainable energy futures cannot therefore be laid only, or perhaps even primarily, at the feet of the traditional fuel and electricity producers. There will be enormous opportunities for profitable, entrepreneurial innovation in the transition to sustainable energy futures; a firm's ability to be forward looking and to understand the market redefinition that is taking place will be more important than whether or not its traditional line of business involves the production of energy commodities or services.*

# Business Trends and Sustainable Development: Key Points of Convergence and Divergence

Sustainable development will be achieved through invention, innovation and risk taking, and in these respects it has a strong resonance with the entrepreneurial spirit. On the other hand, sustainable development is a social goal that requires being willing to trade short term gains for long-term economic and ecosystem health and in this respect it will often run against the grain of the profit motive. It involves a fundamental change in ethics, including business ethics, toward a recognition of environmental and intergenerational responsibilities.

Business strategies for sustainable energy will identify and build on trends in the energy economy that can help move in the direction described by the design guides for a sustainable energy future outlined above. At the same time, where trends are identified that diverge from the goal of sustainable development, governments will have a role in creating a policy and regulatory framework for sustainable development that also works for business.

There are a number of trends, some convergent with SD and some not, that must be taken into account in the development of business strategies for sustainable energy futures. These include a market redefinition from commodities to services, continuing low energy commodity prices, a movement toward 'corporate environmentalism', a power sector facing privatization and competition, and a possible role for strategic government involvement in the energy sector.

## 1. Market Redefinition from Commodities to Services

The "decoupling" of economic growth and the demand for energy commodities that began in the early 1970s (see Figure 4) is the single most important positive trend affecting the prospects for sustainable energy development. Fuels and electricity are not demanded or needed for their own sake, but for the *services* they provide. Fuels and electricity are in demand because they help (along with technology) to provide human needs for heat, motive power, light, mobility, etc. and it is the underlying demand for these services that drives the energy commodity market. While this plain fact is now widely acknowledged, it has profound implications which have not yet been fully realized by business and government. It affects the way we think about energy security, energy trade opportunities, energy technologies and environmental impacts of the energy system. In terms of business strategies, it goes to the issue of market and product definition.

To the extent that the business and policy responses to the energy security scares of the 1970s were misguided, it was because the market was incorrectly believed to be for energy commodities (rather than for the services they provide). Hundreds of billions of dollars of capital investment were sunk into everything from solar furnaces to synthetic fuel technology to nuclear power plants in the mistaken belief that only supply-side alternatives to oil would bring us the energy security we sought.

Meanwhile, it was the demand side that delivered the goods. In Canada and throughout the OECD, the energy productivity of the economy, measured as the ratio of GDP to final consumption of fuels and electricity, has increased from 25-35% since 1973, thus contributing more to new energy "supply" over this period than all the new oil, gas, coal, nuclear and hydro resources ***combined.*** This impressive growth, comprised of a mixture of technological advances and structural changes in the economy, has happened almost in spite of itself. So rich and deep is the demand side resource that it has been able to go from zero to a 25-30% market share of the energy end-use pie in twenty years without the same access to

**FIGURE 4**
**Relative Growth (1961-1994) and Forecast (1995-2020) of Gross Domestic Product and Energy Demand in Canada**

capital, government largesse, and established business infrastructures enjoyed by the supply side alternatives. Indeed, the demand side gains were achieved to a very large extent without there even being a demand side industry, or at least one that perceives itself as such.

The demand side resource essentially consists of human ingenuity in finding ways to meet human needs for energy services with new combinations of value added information, technology, services and energy commodities. It is a super-giant that has only been high graded so far; it has very large and very deep growth potential. It will continue to be the toughest competitor for energy commodities and the largest source of new business opportunities in the energy economy. Whether traditional energy commodity producers stick to their traditional line of business or "forward integrate" to take advantage of these new opportunities, successful business strategies will be built on a clear understanding of the fundamental demand for services.

## 2. Low Energy Commodity Prices

On the other side of the ledger, working against the interest of SD, is the outlook that energy commodity prices will remain essentially flat for the next twenty years. The mistaken projections of the 1970s and early 1980s, that a barrel of oil would cost well over $60 by 1996, have been replaced by the current outlook which predicts energy commodities of all sorts will show little real price increases for the next twenty years or more. A diversity of new supplies and the relentless (if often overlooked) pressure from the demand side options has brought this reversal. The most recent outlook of Canada's federal energy department is based on a world oil price that inches up to US$20/barrel by 2010 and then stops increasing altogether, with natural gas prices following a similar curve, stabilizing at CDN$1.80 per Mcf by 2010. As for electricity, conventional wisdom currently holds the view that the changes sweeping through that industry will hold prices at current levels or less well into the next decade and beyond.

The pressure on the commodity producers to keep prices down is intense. Proposals to force environmental "externalities" into the commodity prices can expect resistance from the producers. It is perhaps a telling indicator that when Maurice Strong, a global leader in the promotion of sustainable development and of energy prices which more accurately reflect the true cost of energy, took over Ontario Hydro in 1993, one of his very first actions was to publicly commit the utility to zero price increases for the rest of the decade.

Low energy commodity prices and forecast low energy prices have a number of effects on the move toward sustainability. The obvious one is the effect they have on demand; it is no coincidence that Canada has both low energy commodity prices and low energy productivity. It is important not to overestimate the leverage offered by price increases as a means of reducing demand. With some important exceptions, the cost of fuel and electricity is a secondary consideration in determining the level of energy demand associated with energy using behaviour and with the design of energy using equipment. It represents a small and often hidden contribution to value added for many firms and industries. Even in the final demand sector, fuel and electricity costs are of secondary importance. Fuel costs represent well under 20% of the cost of owning and operating a car, and annual household heating fuel and electricity bills are typically in the range of one or two months' mortgage payments. The recent analysis of carbon tax proposals confirm that it would take very large fuel and electricity price increases (in the order of 50%-300%) to stimulate the demand response necessary for, say, a 20% reduction in carbon dioxide emissions.

A related claim is that low energy commodity prices are important to maintaining Canada's international competitiveness. This is obviously true for the energy commodity producers themselves and for a handful of energy intensive industries for whom fuel and electricity costs represent a significant percentage of value added (primary metals and steel, pulp and paper, industrial chemicals, non-metallic minerals). In general the cost of fuel and electricity is not a major factor in determining the competitiveness of Canadian industry, especially not for the high value added, high growth industries (plastics, pharmaceuticals, high tech, etc.) for whom fuel and electricity costs represent less than 5% of value added, and often much less.

In any event, the outlook is for low energy commodity prices, and this means that there will be virtually no price-induced constraint on demand, that the commodity producers will be under pressure to maximize throughput and market share while minimizing costs (including investments in efficiency and environmental improvements), that internalization of environmental externalities is likely to remain unrealized, and that research and development of energy efficient and renewable energy technologies will stagnate.

## 3. Corporate Environmentalism and Managing for Sustainable Development

The move toward corporate environmentalism is clearly a positive trend for sustainable energy strategies, and Canadian companies, including energy commodity producers, are on the forefront of this trend. Traditionally, environmental management was perceived as a cost centre by corporate management, with a strong compliance orientation and a modus operandi that essentially involved reacting to problems as they arose.

A number of firms, particularly in the chemicals industry, began to see the potential for going "beyond compliance" in their environmental policies, especially when it was realized that the energy savings and materials conservation measures that could help improve the company's environmental performance also led to large cost savings that go directly to the bottom line; that voluntary, preemptive initiatives to address environmental problems cost less than responding to mandatory clean-up orders and regulations; and that leadership in environmental issues leads to competitive advantage and in general improves a company's ability to attract and maintain employee, customer, investor and community support.

Elements of advanced corporate environmental strategies include:

a) the formulation of a environmental mission statement that clearly sets out the company's commitment to sustainable development;

b) the integration of environment and sustainable development considerations at all levels of corporate management, especially in product and market development strategies;

c) a commitment to "eco-efficiency", demonstrated by a continuous reduction of waste and pollution and a continuous improvement in environmental performance, including energy efficiency;

d) the identification and monitoring of quantifiable indicators of environmental performance, and the regular auditing and reporting of those indicators; and

e) the engagement of the entire organization in the implementation of environmental policies and in the identification of opportunities to simultaneously enhance competitiveness, profitability and environmental performance.

The ultimate objective of corporate environmentalism is to completely integrate sustainable development as a core value. Ontario Hydro has done as much as any Canadian company to help define what this means and has defined the following four part-test:[6]

Sustainable energy development has become a core value when:

a) it is integrated into the central management philosophy via Total Quality Management (TQM), Total Loss Management or some other results-based integrating framework;

b) it is seen, along with health and safety, as always taking precedence over marginal production gains;

c) it is translated into a small number of understandable stretch targets which are then built into business unit leaders' performance contracts; and

d) it is continuously reinforced throughout the organization by senior management and consistent messages.

## 4. The Power Sector Transformed

The electric power sector in Canada is being rocked by the same changes that are sweeping through this industry everywhere, including the introduction of competition, the breaking up of monopolies, and the privatization of public utilities. Opinion is mixed on whether these trends will be a positive or negative for environment and sustainable development, although there is definite majority opinion that the emerging competitive market in electricity will set back utility demand-side management, renewable energy development, integrated resource planning, and environmental research and development.

## 5. Regulatory Reform

For more than twenty years, the United States has utilized a "command and control" approach to environmental regulation in which detailed specifications are set out with respect to technologies that must be employed and individual facility emission rates that must be achieved. One result has been a remarkable improvement in air and water quality, fairly successful protection of parks and wilderness lands and in general a record of environmental improvement that equals or surpasses that of most other OECD nations. However, there is an emerging consensus in the business, government and even environmental communities that the transition from "react and cure" to "anticipate and prevent" requires a change in the regulatory contract in a direction that will give business much more latitude to take innovative and creative approaches to protecting the environment.

It is important to realize here that the rejection of "command and control" is not a rejection of the need for environmental regulation. While there will always be an element in the business sector that would prefer (or at least think they would prefer) to operate in a world with no rules or regulations, the mainstream opinion behind the rejection of "command and control" is that society can move forward toward sustainable development more effectively with a less detailed and more performance-based system of environmental regulation in which business is given the latitude to utilize the creativity of competitive innovation and the efficiency of market mechanisms to achieve "bottom line" environmental results (e.g. a specified level of greenhouse gas emissions for a particular jurisdiction). In the words of Dow Chemical's representative on the President's Council on Sustainable Development:

*The President's Council on Sustainable Development agrees environmental regulation is necessary. We certainly don't*

6 Ontario Hydro, Project 2000, "Opportunities for Sustainable Energy Development in a Competitive Market Structure", Phase I Report (Ontario Hydro, December 20, 1995).

*advocate a roll-back in regulations. Instead, constructive change is needed in the regulatory framework. We need to embrace a new paradigm for regulatory oversight that fosters a spirit of responsibility rather than merely an obligation to comply. If we can change the paradigm, regulations tomorrow will be more inspiring and less prescriptive than those on the books today. They will set overarching performance-based environmental goals, then introduce flexibility and market incentives to stimulate innovation among industry.*

*Industry has a big responsibility here, too. Companies must invest today to build trust. If we act now, change will be more palatable to representatives of government and the environmental community. Long-term, it will make traditional environmental regulation less necessary and less costly for businesses and taxpayers.*[7]

Historically, Canada has not utilized "command and control" type regulation to the same extent as the United States. For one thing, the Canadian and American economies are so closely integrated that Canada has received many of the benefits of U.S. regulations (e.g. fuel economy standards on vehicles) without having to incur the expense of maintaining a U.S. style regulatory regime. But it is also true that Canada has always tended more toward performance based regulation than has the United States (e.g. U.S. vs. Canadian nuclear safety regulations).

Voluntary commitments are also being used in Canada and other countries as a means of achieving environmental objectives. In this case, there is not even a performance-based regulation, only an agreement that business will voluntarily work toward achieving a particular environmental goal in return for being spared regulations. The Voluntary Challenge and Registry for greenhouse gas emission reductions is an example of this type of program in Canada; it remains to be seen how effective it will be although the early indications are not encouraging. The energy commodity producers are well represented in the program's membership, but very few of them have committed to quantitative targets and timetables for emission reductions.

## 6. Government in the Economy

In Canada, there has been a tradition of direct government involvement in the economy when it has been perceived that a public policy objective can be achieved more effectively, more equitably or more efficiently if the government participates directly as an investor or producer. The energy sector has been a particular focus of such involvement, where methods for achieving various policy objectives have ranged from equity partnerships in oil and gas development, direct ownership and operation of petroleum production companies, and widespread adoption of provincially owned public utilities in the electricity sector, usually with de facto monopolies in their respective areas of service.

In recent years, a combination of factors have led to a trend away from direct government participation in the economy. Aside from outright rejection on ideological grounds, there is a widely shared perception that government lacks the entrepreneurial culture to be an efficient member of the producing economy, or even an owner of productive capacity.[8] Nevertheless, the use of government/industry partnerships in Canada has not been an altogether unsatisfactory experience, and there are elements of the sustainable development agenda that could be well suited to such partnerships, particularly where issues of equity, risk spreading and social vs. private investment criteria are concerned. Given the current political climate, however, any argument for government involvement in the economy in order to achieve SD-related policy objectives will have to be very strong, and probably supported by industry itself, before it is likely to go forward.

7 David T. Buzzelli, Vice-President and Corporate Director, Environment, Health & Safety, The Dow Chemical Company, "Remarks at the University of Cambridge", September 21, 1995. Full text available on Dow's Web site at http://www.dow.com/news/buzzell.html.

8 It does seem that spectacular business failures in the private sector are regarded as outcomes of the market doing what it should (the "iron fist", and all that) while similar failures in the public sector are regarded as outcomes of government doing what it shouldn't (i.e. participating directly in the productive economy). It would be interesting to systematically study whether the record of public utilities in North America, for example, is any better or worse than their private counterparts in terms of their failure to anticipate change in time to avert costly overshoot in their investment strategies.

These are a few of the trends which form the context in which business strategies for sustainable development must be developed. There are many others and we may not have captured the most important ones. The internationalisation of the petroleum industry, the continued predominance of automobile-dependent suburban sprawl, rising community concerns over the public health and environmental consequences of deteriorating urban air quality, and the dismantling of the institutional capacity for the construction of megaprojects are all important trends that affect the design and implementation of strategies for sustainability.

***On balance, however, it would seem that current trends in the energy economy will make it more, rather than less, difficult to achieve a sustainable energy future. The outlook for continuing low energy commodity prices, the relative insignificance of energy efficiency as a factor in the design of most equipment and infrastructure, the withdrawal of government from the energy economy, the restructuring of the power sector, and the trend toward fewer and less rigorous government regulations and enforcement all tend to increase the onus on corporate environmentalism and voluntary initiatives to deliver environmental improvement and performance.***

# Four Business Challenges for Sustainable Energy

The following presents four challenges we must meet in the years ahead if we are to make significant progress toward sustainable energy. None of them is simple or straightforward, and all will require a concerted effort from the business community to integrate environmental and sustainable development in their day-to-day operations and in their strategic planning.

## The "Conservation Gap" as a Business Opportunity

The phrase "conservation gap" refers to the difference that persistently shows up between the actual level of energy efficiency improvement taking place in the economy and the level that appears to be cost effective. In a recent review of the potential for energy efficiency improvements in the Canadian economy, a multi-sector committee appointed by the Royal Society reviewed the work that has been done on this subject in Canada. They found that the studies concluded energy savings of 20%-40%, relative to business-as-usual, could be achieved in Canada with measures that are cost effective relative to today's fuel and electricity prices.[9] These studies typically are based on methods which apply life-cycle costing to investments in new and replacement equipment and retrofit measures, and then compare the levelized cost of saved energy (in cents per kilowatt-hour or dollars per Mcf, etc.) with the prevailing price of the corresponding saved energy.

In contrast, recent analyses by Natural Resources Canada project that the ratio of total secondary energy demand to Gross Domestic Product (a ratio which includes both efficiency gains and all the other factors that contribute to a declining energy/GDP ratio) will decline by only one percent per year. The strongest improvements are projected for the residential sector at over 1.5% per year (a direct result of appliance efficiency standards, energy efficiency provisions in building codes and the improved thermal performance of new housing) and the weakest performance is projected for the industrial sector at less than 0.5% per year, the result of continuing low energy commodity prices and relatively low capital stock turnover rates.

Projections in this range are supported by a recent review of energy demand trends in Canada[10] indicating that over the 1984-1994 period, energy intensity improvements (including both energy efficiency gains and other trends that tend to decrease the amount of energy used

9 Panel on Canadian Options for Greenhouse Gas Emission Reduction, *Final Report to the Canadian Global Change Program and Canadian Climate Change Board*, September 1993. Available from Canadian Global Change Program Secretariat, The Royal Society of Canada, P.O, Box 9734, Ottawa, Ontario, Canada, K1G 5J4. Summary of report available on the World Wide Web at http://datalib.library.ualberta.ca/~cgcp/publications/cogger/cogtoc.html.

10 Natural Resources Canada, *Energy Efficiency Trends in Canada*, Demand Policy and Analysis Division, Energy Efficiency Branch. (Ottawa: Natural Resources Canada, April 1996).

per unit of economic activity)[11] averaged only about 1.5% per year over the 1984-1994 period, and are generally declining in the face of flat price projections and the cutbacks and elimination of many government programs for encouraging conservation and efficiency improvements.

Canada has made a commitment to stabilize its greenhouse gas emissions at 1990 levels by the year 2000, a goal which cannot and will not be reached without a concerted effort from the private sector to increase energy efficiency beyond these projected rates. At this point, the government is counting on that effort to come voluntarily, and has established the Voluntary Climate Challenge and Registry (VCR)[12] for businesses and organizations to express their intentions to develop action plans to limit or reduce their net greenhouse emissions. A public registry documents the commitments, action plans, progress and achievements of all participants in the VCR, and energy efficiency improvements are central to the program.

The VCR program is less than two years old, but results to date give some indication of whether Canadian business is rising to the challenge. Over 530 participants have registered from a variety of industrial and institutional sectors, making it one of the most broadly-based voluntary initiatives ever undertaken in Canada, although only about 60 of the participants have prepared comprehensive action plans.[13] The energy sector is very well represented in this group (49 of the 60) and is clearly taking a leading role in the business response to the VCR. However, only 7 of the plans contain commitments to stabilize emissions by the year 2000, and most of those are from electric utilities. To date at least, the VCR has failed to generate the initiative required by Canada's commitments under the Framework Convention on Climate Change. This situation is not unique to Canada; very few of the OECD nations, perhaps none, will have greenhouse gas emissions in 2000 that are at or below 1990 levels, let alone be on a track for the much deeper reductions that the Intergovernmental Panel on Climate Change[14] has concluded will be necessary to avert the worst effects of global warming.

The finding that there is a large amount of cost-effective energy efficiency improvement in the economy which is not taking place has been a feature of the "energy debate" for the last twenty years and opinions vary over the explanation for the "conservation gap". Some argue that market failures stand in the way of these cost effective opportunities, citing asymmetries in the capital markets, information gaps, subsidies to the energy commodity suppliers, tax policies that discriminate against efficiency investments, failure to cost environmental externalities, and various other ways in which the "playing field is tilted against efficiency."[15] Others argue that the gap does not really exist, at least not to the extent these studies suggest, because there are a number of real, if hidden, costs which are not taken into account in the analyses, and that investors quite rationally demand premiums for the illiquidity, perceived risk and high transaction costs associated with the demand side investments.[16]

***Regardless of which of these perspectives is closer to the***

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11 The term "energy intensity", as used in the NRCan review, refers to the amount of fuels and electricity used per unit of economic activity. The unit of "economic activity" varies by sector (number of households in the residential sector, building floor area in the commercial sector, dollars of output in the industrial sector, and vehicle-kilometres of travel (VKT) and tonne-kilometres of freight movement in the transportation sector). Energy intensity is a broader and more aggregate concept than energy efficiency; improvements in the energy efficiency of buildings, vehicles and equipment will contribute directly to an improvement in energy intensity, but energy intensity is also affected by factors such as household size, appliance ownership rates, commercial building occupancies, trends in value added of industrial product, etc.)

12 Submissions to the VCR are public documents, and many of the action plans, as well as a description of the program can be found on the Internet at http://vcr-mvr.ca/.

13 Some of the data presented here are based on a review of the VCR conducted by the Pembina Institute of Drayton Valley, Alberta. http://www.dvnet.drayton-valley.ab.ca/environ/pembina.HTM

14 Summaries of the Intergovernmental Panel on Climate Change (IPCC) most recent assessment reports can be found on the Internet at http://www.unep.ch/ipcc/ipcc-0.html.

15 Roger Carlsmith, W. Chandler, J. McMahon and D. Santino, "Energy Efficiency: How Far Can We Go?" ORNL, TM-11441 (Oak Ridge National Laboratory, January 1990).

16 Ronald J. Sutherland, "Market Barriers to Energy-Efficiency Investments", *The Energy Journal*, Vol. 12, No. 3, 1991.

***truth, it is clear that the demand-side resource does exist, that it is very large, that it offers enormous environmental benefits, and that there are some difficult institutional and financial challenges that must be overcome before it can be fully exploited.***

In fact, all the conventional energy commodity resources have come with their own sets of difficult financing, engineering and institutional infrastructure challenges — think of the state of the oil industry in 1880, or the hydro electric industry in 1900, or the nuclear industry in 1960. Indeed, the contribution that has already been made by the demand side resource is all the more remarkable in the context of its technological complexity, its capital intensity, the entrenched political and market power of its competition, and the helter-skelter state of its institutional structure.

From a business perspective, the question is how to profitably exploit the demand side resource? If there are market barriers, how to remove them? If transaction costs are high, how can the industry organize to reduce them? If illiquidity and perceived risk are forcing up the returns investors demand, how can the industry be organized to attract lower cost capital?

The generally accepted view is that for significant energy efficiency gains to be made, especially in the business economy, there must be widespread mobilization, not only of the energy commodity producers but also of the commodity consumers, not only at the point of end use (where decisions are made about what energy-using devices are purchased and how they are used) but also wherever buildings, vehicles, equipment and even community infrastructures are being planned and designed. Short of a much greater level of alarm over the impending environmental consequences of business-as-usual, it isn't going to happen.

The problem is that many, perhaps even most, of the decisions that are made that determine the level of energy use in the economy are made with very little or no regard for energy efficiency. At the design level, life-cycle costing is rarely employed to calculate the level of energy efficiency that results in the lowest cost for the user on a life cycle basis. For producers there is always an incentive to reduce "first cost", even when it means the consumer's life cycle cost will be higher. Thus for example, we see some representatives of the housing industry lobbying for rollbacks in the energy efficiency provisions of building codes so that they may shave a few hundred dollars off the cost of a new home.

At the end use level, there is a similar tendency to discount the value of energy efficiency in both purchasing and operating decisions. Thus, for example, we see consumers opting for power over efficiency in new car purchases, and convenience over conservation in the operation of their home heating systems (e.g., decline in the use of the night setback). When vehicles and equipment begin to age and energy efficiency begins to deteriorate, the option of investing now to produce savings in the long-term is very often rejected in favour of continuing to operate the higher cost equipment in order to avoid the immediate cash outlay for the replacement or upgrade.

The trend to corporate environmentalism will help; businesses that make a serious commitment to eco-efficiency as part of their corporate environmental strategy will improve their energy performance. Beyond this, producers and sellers of everything from housing to appliances, vehicles and other energy using equipment should be able to realize a competitive advantage in their marketing strategies by promoting the environmental and energy efficiency attributes of green products. The market has demonstrated its responsiveness to such approaches, and presumably they will become more prevalent in the years ahead.

But the challenge to business to make significant improvements in energy efficiency has so far gone largely unanswered, and new ideas are needed on how the "demand side resource" can be more effectively mined. Perhaps a solution lies in the creation of new industry that would extend the basic concept of the energy service company to a much broader market, including all sectors and energy using activity, and both retrofit projects and incremental efficiency improvements. Water and waste could also be incorporated in a comprehensive approach to *eco-efficiency* investments. Such an information and finance-based industry would specialize in achieving sustainable development gains throughout the economy in ways that provide incentives for businesses to participate and that remove the financial and technological risks from the client/host.

If "cap-and-trade" market mechanisms develop as the preferred mode of environmental regulation, such an industry could also act as a broker (and perhaps also play a role in monitoring and verification) for emission reductions. While the premiums for $CO_2$ will be small (at least initially) compared to the cost of energy itself (e.g., at current prices natural gas costs in the range of $75-$100/tonne of $CO_2$ emitted) they could play a key role in leveraging energy saving investments that might not otherwise take place.

As unfashionable as it may seem today, there may eventually emerge a role for government investment in such an industry in order to buy down the cost of capital, perhaps by providing insurance or underwriting some or all of the risk. The energy efficiency resource consists essentially of technology and "know-how" and it increases exponentially in size as the rate of return goes down: for example, an efficiency investment with a 10% rate of return will often yield more than twice as much energy saving as an investment yielding a 20% return. With environmental costs valued at zero in the market, there is little incentive for private firms to go after the lower return investments; even within a single organization, it is common to find a much higher hurdle rate for energy efficiency investments than for other investments. To the extent society places a higher value on energy savings (for the environmental benefits) than does private capital, government may find investing in energy efficiency a more cost effective way to meet its environmental policy objectives than through taxes or direct control measures

***Finding a way to mine the demand-side resource more systematically and much more deeply is one of the great SD-related business challenges of the 21st century. It is also one of the great business opportunities of the 21st century — will Canadians be buyers or sellers?***

## Restructuring the Canadian Power Sector — What About the Environment?

The electric power sector in Canada has been, and continues to be, dominated by large, centralized, vertically integrated, monopolistic and mostly publicly owned utilities. The changes that are sweeping through this industry world wide are also transforming the Canadian electricity industry; a recent review commissioned by Natural Resources Canada[17] summarizes what appears to lie ahead for the Canadian power sector:

- Within the next ten years, most provinces will have introduced competitive markets in electricity in one form or another. Open access to the grid with wholesale competition seems to be the preferred option, but full retail competition may be implemented in some provinces.
- Open access to the grid will create pressure for lower bulk electricity prices and this, combined with the surplus generating capacity, may keep prices flat or even declining for the next ten years.
- The provincially owned utilities with very high debt ratios and high electricity prices will not be able to compete with the lower cost producers. Transitional arrangements will be required in these provinces to recover stranded costs, including the possibility of government bailouts where the Crown has backed the utility's bonds.
- When new capacity is required, it is expected that natural gas cogeneration and natural gas combined cycle units will be the preferred options in many areas. Except for possible green niche markets, small renewables will not be competitive, and neither will new coal, hydro electric, or nuclear units. There will be pressure to increase plant utilization and to extend the life of older coal-fired plants.
- With a competitive generation market there is no central planning of new generation resources and generating companies will not prepare integrated resource plans. Generating companies will not pursue demand management as an alternative to generation. Generating companies will not voluntarily use a higher cost process to reduce environmental impact; it would put them at a disadvantage compared to their competitors.

The power sector is a major source of environmental stress in Canada and the question arises as to how (or whether) this transformation can be managed for sustainability. In fact, ***environmental considerations, much less sustainable development considerations, have been neither a driving force behind the trends toward utility restructuring nor even a significant consideration, and this by itself indicates the extent to which environment and SD have yet to be integrated into key economic and business decisions in this segment of the energy economy.***

17 J. Kenneth Snelson, "Competition in Electricity Supply: Implications for the NRCan Energy Outlook", (Snelson International Energy for NRCan, June 1996).

The recent report of the Macdonald Committee in Ontario[18], for example, starts out by recommending that "full retail competition be phased in to Ontario's electricity market as soon as practicably possible" and then, over 40 recommendations later, makes the following comments on the environmental dimension of restructuring:

*The Advisory Committee believes that there is an important role for the Government in advancing society's environmental objectives; and*

*The Advisory Committee believes that the process of restructuring Ontario's electricity system must be accompanied by consideration of the most appropriate regulations or other instruments to secure the protection of the environment and specifically to support energy efficiency and the introduction of renewable energy technologies.*

The danger with this "shoot first, ask questions later" approach to utility restructuring is that the greatest environmental consequences flow from the restructuring itself, not from any remedial "react-and-cure" measures that may be taken later.[19]

There can be some environmental gains from the move to a competitive electricity market. Where there are new sources of generation that are both cheaper and cleaner than the traditional sources, they will be adopted, and innovative marketing approaches to attract and hold customers (i.e., retail competition in energy services) may result in electricity efficiency gains that would not otherwise occur. A competitive electricity market may also be more compatible with the performance-based market mechanisms for environmental regulation, when they come to pass. However, the utilities, the government agencies considering restructuring options and most private analysts tend to agree that the move to a competitive market means a setback for demand-side management, small scale renewables, research and development, integrated resource planning, social costing, environmental research, greenhouse gas emissions (in most provinces) and small-scale cogeneration.

They also tend to agree that special government assistance for energy efficiency improvements, small-scale renewables and other sustainable development-type activities will be necessary to maintain progress in these areas.[20] As stated by Larry Ruff during the initial stages of the restructuring debate in Ontario:[21]

*There is nothing in the logic of a competitive market that will automatically take environmental factors into account if these have not been reasonably internalized by environmental authorities. If the kinds of environmental targets that Hydro claims to take into account in its planning are to be enforced on a competitive market, some external authority will have to do it.*

Privatization is often connected with the introduction of competition in the electric power sector, but it is a stronger political connection than it is a technical one. In the context of environment and sustainable development, the issue here is whether the government can more effectively achieve its policy objectives by being a direct participant in the power sector. Many of Canada's publicly owned utilities have operated as *de facto* unregulated monopolies, with a board of directors appointed by the government and with ultimate accountability to the government, but without the type of formalized regulatory framework that exists, for example, in the case of privately owned utilities in the United States. There is therefore an understandable concern that privatization will remove what government leverage does exist to achieve environmental and sustainable development progress in the power sector.

18 *A Framework for Competition*, The Report of the Advisory Committee on Competition in Ontario's Electricity System to the Ontario Minister of Environment and Energy, Honourable Donald S. Macdonald, Chairman (Queen's Printer for Ontario, May 1996). The full report is available on the Internet at the Ontario Ministry of Energy and Environment web site: http://www.ene.gov.on.ca/.

19 Michael Margolick, Lynn Casey and Sharon Maskerine, "Electricity Competition in Ontario: Environmental Issues", prepared by ARA Consulting Group for the Advisory Committee on Competition in Ontario's Electricity System (Toronto: Ontario Ministry of Environment and Energy, April 1996). There is a persuasive case, for example, that since the grid itself is a natural monopoly, retail competition for electricity adds no economic value that is not already achieved with wholesale competition, but it does significantly increase the environmental downside of electricity sector restructuring: .

20 Ontario Hydro, Project 2000, "Opportunities for SED in a Competitive Market Structure", Phase I report (December, 1995).

21 Larry E. Ruff, Putnam, Hayes and Bartlett, Inc., "Ontario Hydro's Demand/Supply Plan: The Case Against Central Planning", submission on behalf of Energy Probe before the Environmental Assessment Board DSP hearings, Exhibit 760 (October 1992).

**FIGURE 5**
**Greenhouse Gas Emissions From Canada's Oil and Gas Sector, 1985-1994**

Countering this position is the view that in a competitive market government must use environmental regulation to achieve its environmental objectives and, since both public and private companies would be subject to those regulations, the question of ownership is not directly relevant to the issue of environmental protection.[22] In this context, it is especially important to look at the effect that the very form and design of the restructured industry will have on its environmental performance and the government's ability to exert influence.

***The environmental stakes are high in the round of changes occurring in the Canada's electricity industry, and the Brundtland Commission's maxim of "anticipate and prevent" is not being applied as rigorously at it could be in weighing the options. Is retail wheeling worth the extra environmental and regulatory risks it carries? Are we trading a relatively short-term financial gain for longer term environmental pain? Are we "throwing the baby out with the bath water" by linking privatization of public power with the introduction of a competitive market in electricity? These questions are both more important and more urgent to the future sustainability of our electric power sector than the design of this or that remedial program for dealing with the environmental fallout of electricity restructuring, after the fact.***

## Upstream Greenhouse Gas Emissions from Oil and Gas Production — Environment and the Declining Quality of Petroleum Resources

A third environmental challenge facing Canada's energy sector is the growing environmental cost of fossil fuel extraction and processing. As shown in Figure 5, greenhouse gas emissions from Canada's oil and gas sector grew an average of 5% per year from 1985-1994 (without counting the emissions from petroleum refining or the emissions associated with electricity use by the upstream industry). By 1994, greenhouse gas emissions from the upstream oil and gas industry (expressed in $CO_2$ equivalents) were more than 100 Megatonnes and rising, representing about 20% of energy related emissions in Canada and around 17% of all energy and non-energy related emissions. Over the 1990-1994 period, the growth in

22 Michael Margolick et. al., op. cit.

greenhouse gas emissions from the upstream oil and gas sector accounted for as much as 50% of the total net increase in all greenhouse gases from all sources in Canada.

As Canadian oil and gas production shifts toward oil sands, sour gas and frontier resources, it takes more energy to get the fuels out of the ground, cleaned up and ready for market than for conventional sweet crude and gas. The declining quality of the country's oil and gas resources is also reflected in the growing emissions of methane, sulphur dioxide and non-combustion $CO_2$ (from gas stripping) and other pollutants. On a full fuel cycle basis, synthetic crude oil emits over 20% more $CO_2$ than conventional crude and nearly ten times more sulphur dioxide. Considering only the upstream emissions, new sour gas fields are nearly twice as greenhouse-gas intensive as conventional oil, and oil sands crude is about five times more greenhouse gas intensive than conventional crude.[23] Notwithstanding the very significant efforts of Canada's oil and gas producers, the environmental stress from their operations is on the rise, and the bringing down of greenhouse-gas emissions and other environmental impacts from the upstream oil and gas industry represents one of the biggest environmental challenges facing the Canadian energy sector.

Production from oil sands is projected to double over the next 25 years, and total gas production is projected to increase from 5 Tcf to 7 Tcf over the same period. To the extent this growth is being driven by U.S. demand, a policy issue arises as to which county's greenhouse gas account should carry the increase, but the environmental challenge remains. The commitment from the petroleum producers to voluntarily address this problem and stop the growth in emissions is among the most significant of the commitments made under the Voluntary Challenge and Registry Program. The government is counting on it, not only to help the country reach its emissions stabilization goal but also as a demonstration of the effectiveness of the voluntary program.

The petroleum producers (along with the electric utilities) will be among the first industries to take a serious interest in the prospects for carbon offsets as a means of meeting their emission reduction commitments and a consortium of Canadian petroleum and utility companies has recently been incorporated to begin developing capacity for carbon offset investments. The Canadian Greenhouse Emissions Management Consortium (GEMCo)[24] was established in 1995 to demonstrate industry leadership in developing voluntary market-based approaches to greenhouse gas emissions management. It is also a risk mitigation initiative; the companies involved own and operate over 90% of Canada's natural gas transmission and distribution infrastructure, over 90% of the independent power production capacity, and over 50% of Canada's electricity generating plant (including both the largest coal producer and the four largest generators of coal-based electricity in the country). GEMCo is actively pursuing carbon offset investments that are profitable in their own right.

One of the challenges facing initiatives like GEMCo is the lack of rigor and conventions in the Voluntary Challenge and Registry program. Carbon trading will only work if it is based on a set of guiding principles and technical requirements (on issues such as reporting, monitoring, verification) that are sufficiently rigorous to support potential offset transactions. Whether trading is voluntary or not, buyers, sellers and government referees must be playing by the same set of rules. The challenge here is exacerbated by the difference in the level of awareness and interest in trading between potential offset buyers and potential offset sellers. There are a number of companies who are seriously interested in the prospects of purchasing carbon offsets (as exemplified by the GEMCo Consortium) but the potential sellers are often not even aware that they are producing potentially salable emission reductions as the result of various actions which they are undertaking. Even when this awareness is established, the premiums that are likely to be offered for the foreseeable future tend to be small compared to the cost of the measures, or even to the costs of quantifying, verifying and selling those emissions to an offset buyer. Bringing buyers

23 Pembina Institute, "Oil Sands Greenhouse Gas Efficiencies and Climate Change Policy: An Analysis", (February, 1996).

24 Members of GEMCo include Canadian Utilities Ltd., EPCOR, Nova Gas Transmission, Nova Scotia Power, Ontario Hydro, SaskPower, TransAlta Corporation, TransCanada Pipelines and Westcoast Energy Inc. The GEMCo president is Aldyen Donnelley, who can be reached at GEMCo, 1965 West 4th Avenue, Suite 101, Vancouver, British Columbia, Canada V6J 1M8, tel. (604) 731-4666, fax (604) 731-4664.

and sellers together in mutually beneficial transactions is the central challenge of establishing offset trading, and establishing effective emissions trading protocols in Canada will be instrumental in determining whether or not the much heralded performance-based "cap and trade" environmental regulations will work.

## Market Redefinition and Transportation — From Mobility to Access

Now, for the fourth challenge, let's consider something difficult — transportation energy. There can be no effective attempt to implement sustainable energy that does not include the reduction of the energy and environmental impacts of transportation energy. Demand is persistently up and the story is more or less the same everywhere:

- The weekday morning peak rush hour, the focus of urban transportation planning techniques and infrastructure investments for nearly fifty years, is rapidly spreading out in both space and time as urban origin/destination patterns become increasingly complex. Congestion is no longer only a rush hour phenomenon.
- The environmental and public health costs of automobile use in cities are beginning to come home to roost. The connection between transportation and the environmental deterioration of cities will become stronger as the underlying growth in vehicle ownership and usage overtakes the gains that have been made in fuel efficiency and emissions controls.
- Across North America urban transit systems are in trouble, caught in a difficult downward spiral of declining ridership, reduced service and higher fares. Public transit is beyond fixing; it needs reinventing. The traditional approach of diesel buses feeding rapid transit trunk lines is less and less relevant to the travel patterns of modern urban Canada. Somewhere between the private taxi and the feeder/trunk line system there lie alternatives that rely heavily on information technologies to bring a much more customized level of service to public transit. Aging capital stock will soon force the issue of whether there are smarter ways to provide public transportation.
- Short, home-based trips for shopping and errands, etc. contribute disproportionately to energy and emissions; they merit higher priority in targeting auto trip reduction. Does it really make sense to lay out our neighborhoods so we have to move a half ton of steel, aluminum and plastic every time we run out of milk?
- Work-based trips are relatively long, but represent declining share of total trips and they too, are spreading out in time.
- Urban sprawl continues to create structural automobile dependence, and the skyrocketing costs of infrastructure investment in traditional suburban land use patterns have become a concern in their own right.

The list goes on, but the point is that the experience and perception of personal mobility in Canada are changing. Congestion, photochemical smog, and the bleak environment in which so much of the urban driving experience takes place are leading individuals and local governments alike to seek ways to reduce the amount of vehicle traffic in their communities. This is something new, and this is where the issue of access vs. mobility becomes critically important.

In what we might call the "mobility paradigm", the demand for vehicle kilometres traveled ("VKT" in the parlance of transportation planners), has been taken as a given, much the way the demand for fuels and electricity was taken as a given in the first, misguided responses to the oil price shocks of the 1970s. To the extent that reducing VKT is considered as an option in the mobility paradigm, it is regarded as a somewhat negative option, much the way energy conservation was regarded before we learned to fully appreciate the derived nature of the demand for fuels and electricity and the tremendous economic and environmental benefits of improved energy productivity.

In contrast, in what we might call the "access paradigm", society seeks ways to provide access to the various goods and services and experiences that people desire, while at the same time minimizing VKT. In this paradigm, success is not measured in traffic counts and average speeds, or even in transit modal shares, but by indicators such as the level of pedestrian activity, the total number and average length of vehicle trips, and the ratio of access to VKT. Once the derived nature of the demand for personal mobility is fully appreciated, then the extent to which a community can function and thrive while reducing VKT becomes a measure of strength and success, much the way energy conservation — reducing energy use per dollar of economic output — is now seen as an indicator of economic strength.

Under the "mobility paradigm", the transportation market is defined in terms of vehicles and infrastructure capacity, and solutions to the environmental problem tend to focus on alternative fuels, alternative vehicles, transit mode share and traffic management. To be sure, there is much to be gained here, but unless and until technological change in automobile design and manufacture makes the integrated, North American auto making industry obsolete,[25] there will be little that Canada can do on its own to change the nature of the vehicles that are on the market.

***Under the "access paradigm", the focus widens to include all sorts of innovations related to urban form and spatial structure — of neighborhood and community design; of how we can get access to the things we need and want without unnecessary or inefficient or even unpleasant "personal mobility."***

While much has been achieved and can still be achieved with more fuel efficient and cleaner-fueled vehicles, the deeper and more permanent changes that are needed to create sustainable transportation systems are in the area of neighborhood and community designs with inherently lower levels of VKT, substitution of information technologies for personal mobility, and radical rethinking of public transportation. In all these areas, there are fortunes to be made in devising and delivering alternatives. The market fro solutions will continue to expand as transportation-related environmental problems and urban gridlock continue to grow to unacceptable levels in more and more cities around the world.

25 This possibility should not be dismissed too lightly. Technology futurist Amory Lovins, who correctly foresaw the transformation in the energy economy, believes the auto industry could be blindsided by technological change in a strikingly similar scenario to what is already unfolding in the electric power sector. A new generation of "hypercars", based on lightweight composite materials and high tech control systems could be produced by relatively small companies with very little in common (except the target market) with the traditional "die-making/steel stamping/mechanical culture" of the traditional auto industry. See "Reinventing the Wheels" by Amory B. Lovins, in the January 1995 issue of *Atlantic Monthly*.

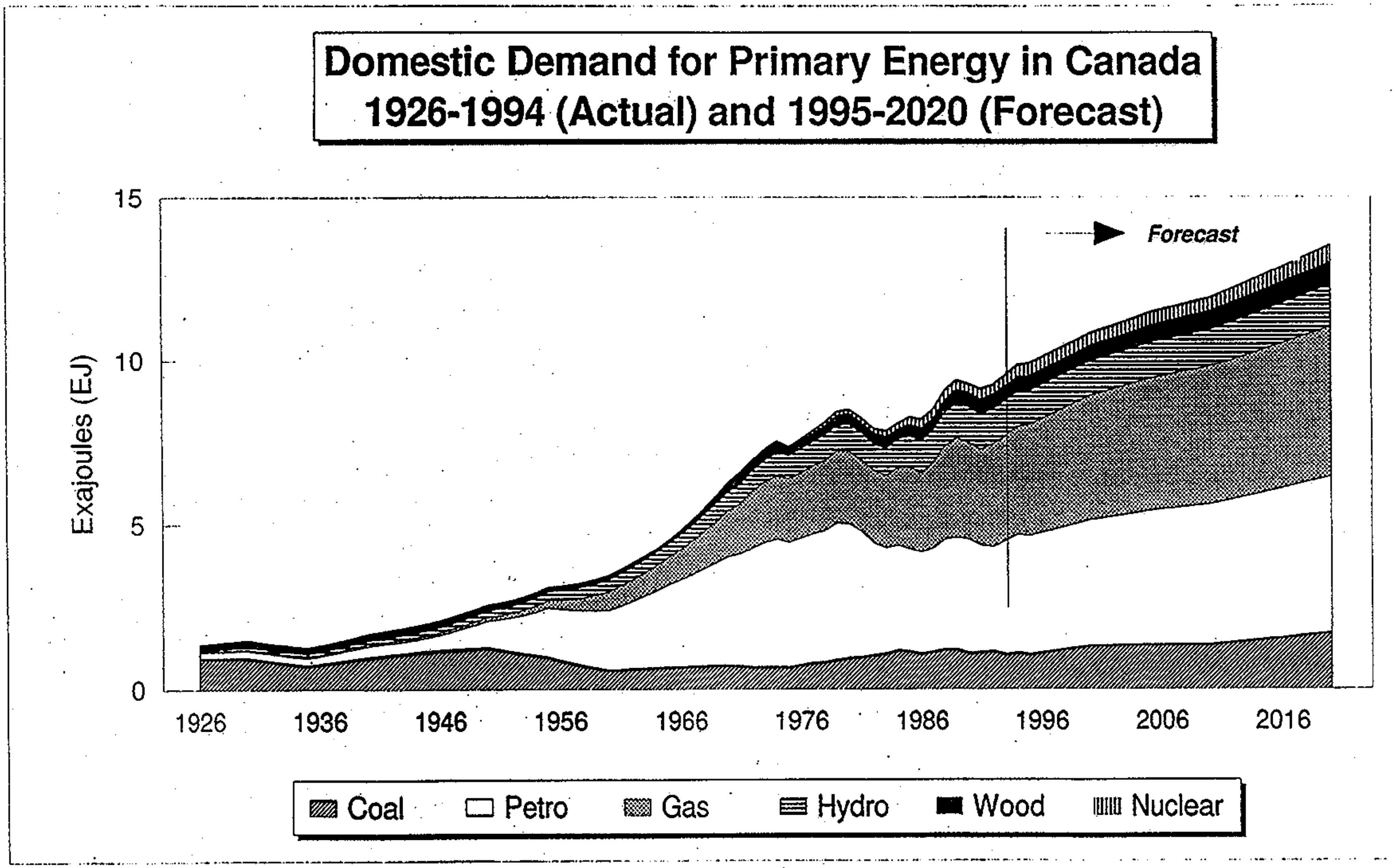
# Concluding Remarks

Comparing the design guides for a sustainable energy system with the characteristics of the current technological energy system clearly reveals a large gap between the idea and the reality of sustainable energy development; the climate change issue alone presents an almost overwhelming challenge to the human community; but the response "you can't get there from here" doesn't apply to the future we have nowhere else to go!

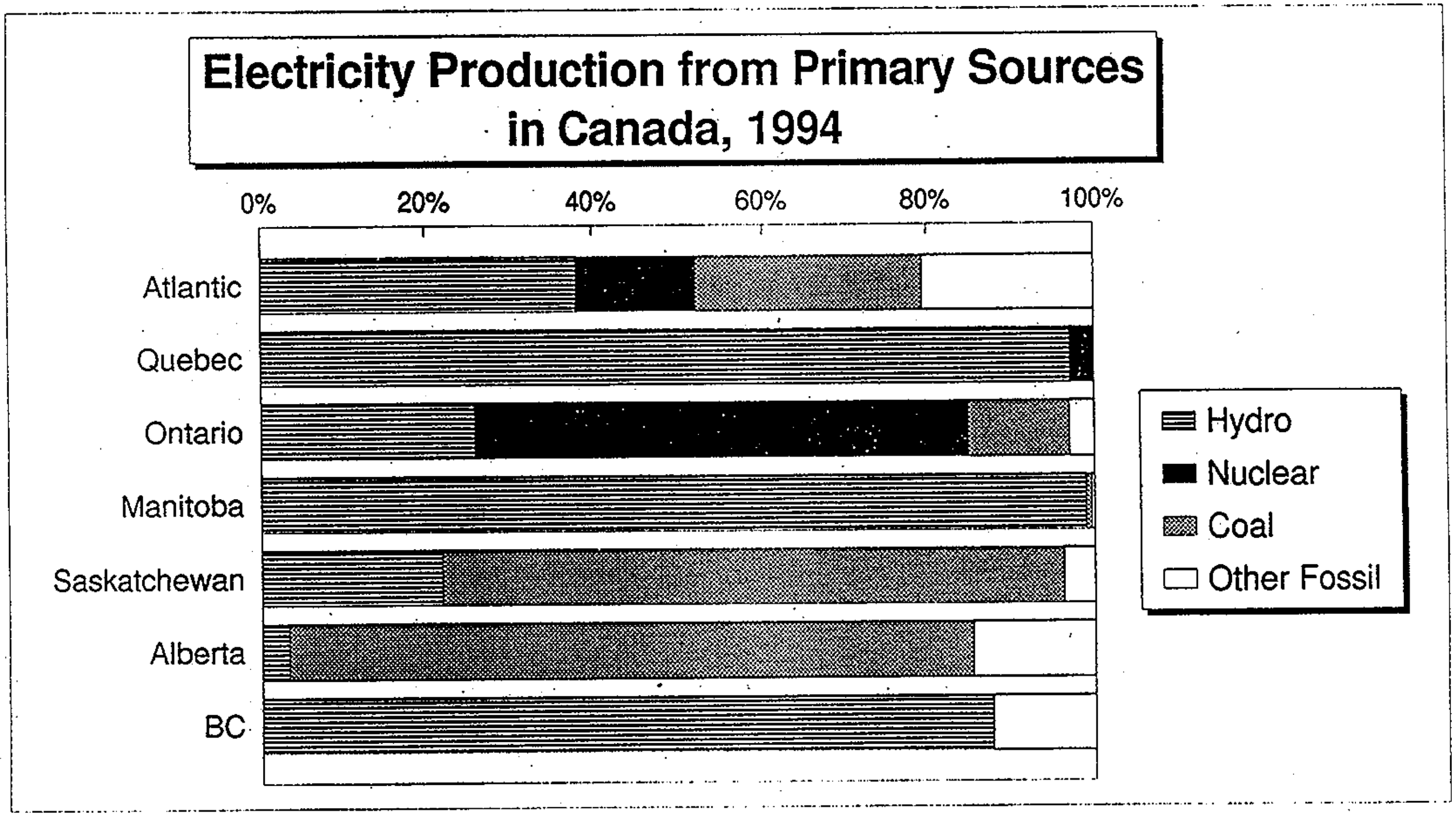
What the Brundtland Commission called "the environmental imperative" will define the dynamics of the 21st century. This is a major historical and social transformation. It has at its root the way that we see ourselves in relation to the rest of nature and in that sense is at least as profound as the Copernican revolution and other great turning points in western thinking. Before it is over, it will have changed every facet of the way we live, and every facet of the way we do business. And as with other great transformations in Western civilization, much depends on the business and entrepreneurial class rising to the challenge. The last word goes to that "virtual ecologist" from B.C. Hydro who started off this discussion with the question: Sustainability: Realistic Goal or Impossible Dream?

***Like many things, the value of the sustainability journey seems to be in the journey itself rather than the destination. Even though the goal is elusive, and perhaps impossible, the challenge of responding creatively is what motivates many of us. Aiming for sustainability necessitates the re-examination of fundamental assumptions about the business we are in, the objectives we set and the way we organize ourselves. It places everything we do directly into an ecological context.***

## FIGURE 1

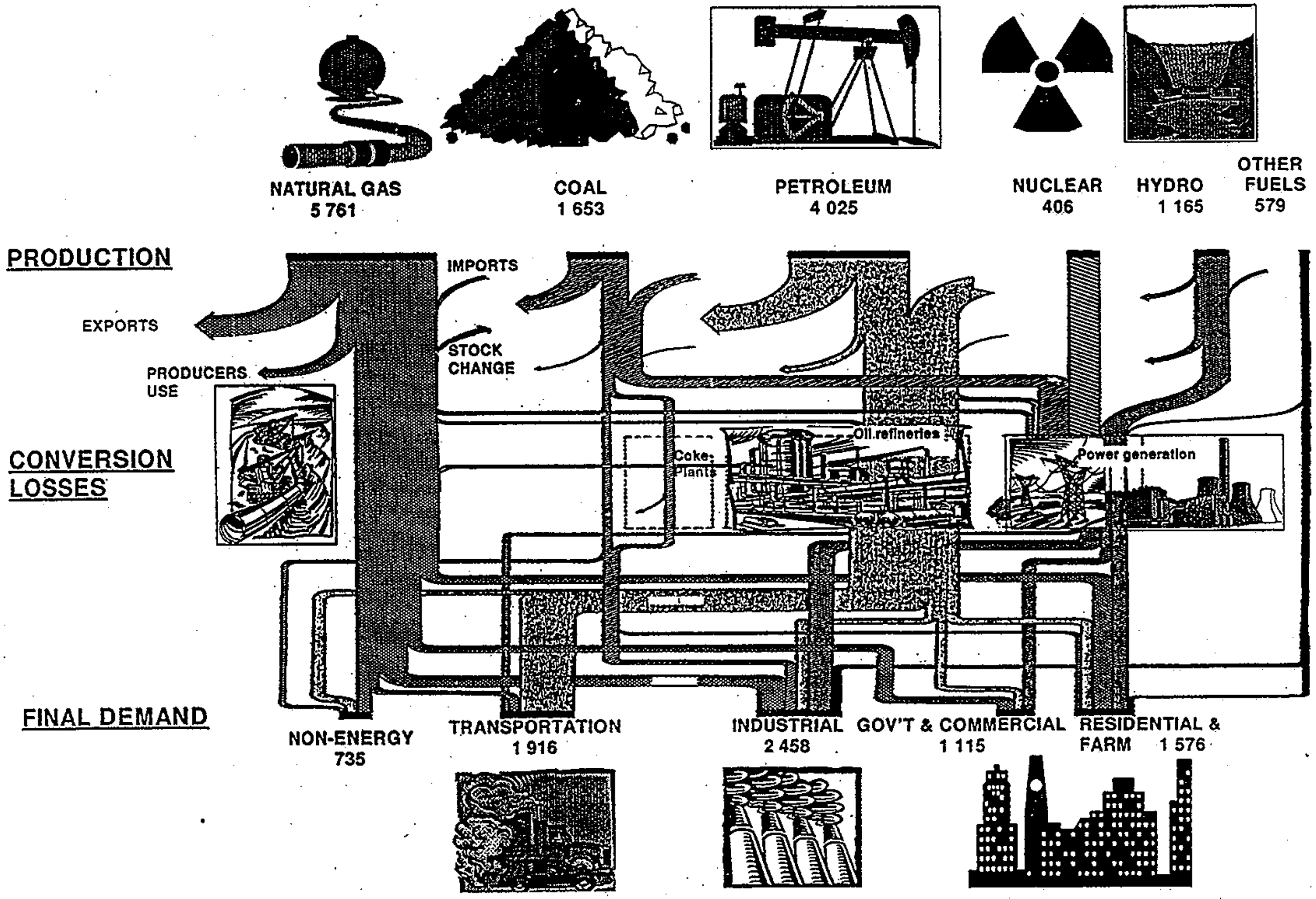

Domestic Demand for Primary Energy in Canada
1926-1994 (Actual) and 1995-2020 (Forecast)
Forecast
Exajoules (EJ)
15
10
5
0
1926
1936
1946
1956
1966
1976
1986
1996
2006
2016
Coal
Petro
Gas
Hydro
Wood
Nuclear

## FIGURE 2

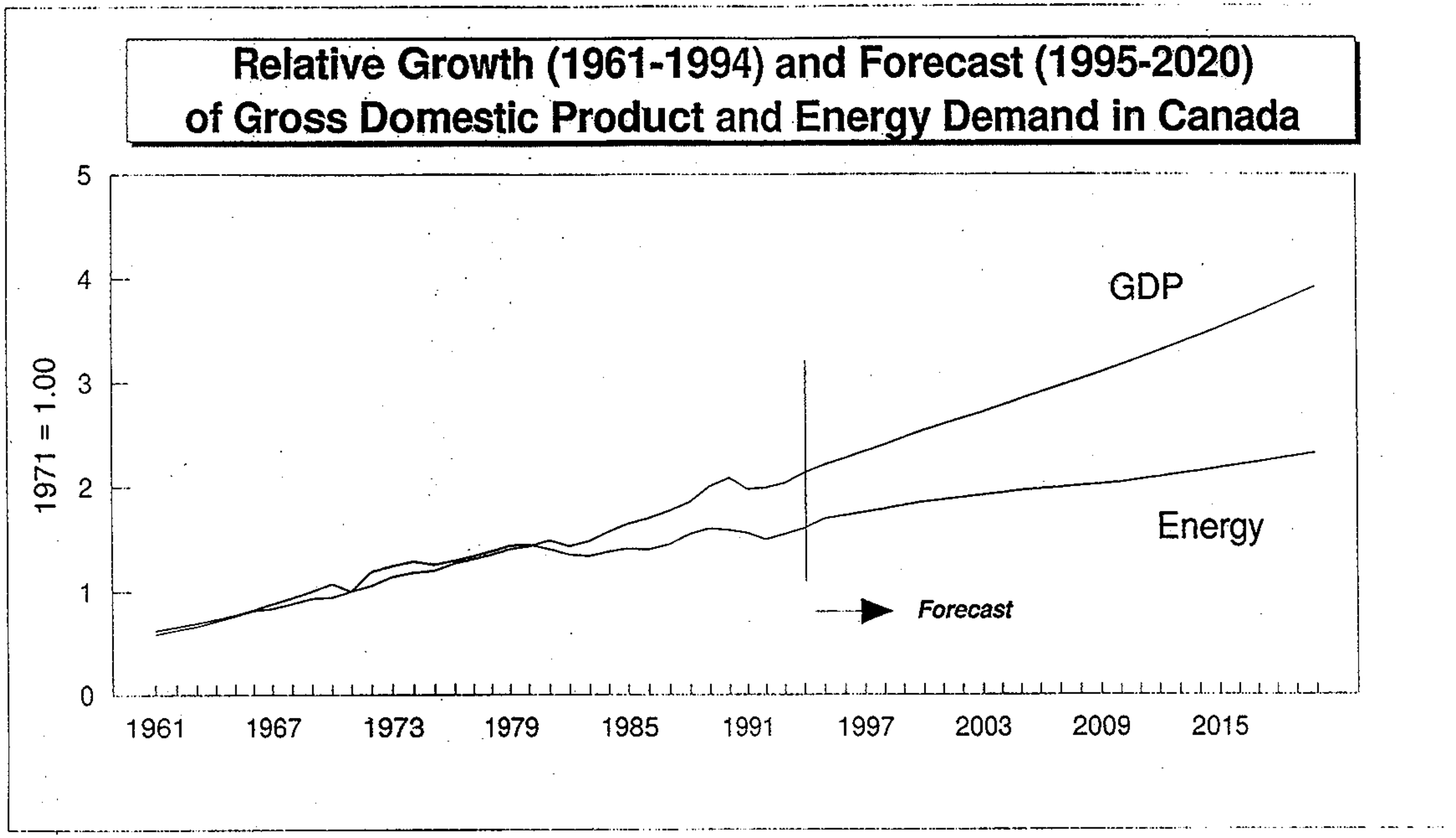


Electricity Production from Primary Sources in Canada, 1994
0%
20%
40%
60%
80%
100%
Atlantic
Quebec
Ontario
Manitoba
Saskatchewan
Alberta
BC
Hydro
Nuclear
Coal
Other Fossil

## FIGURE 3
## Canadian Energy Flow Chart
## 1993 (petajoules)

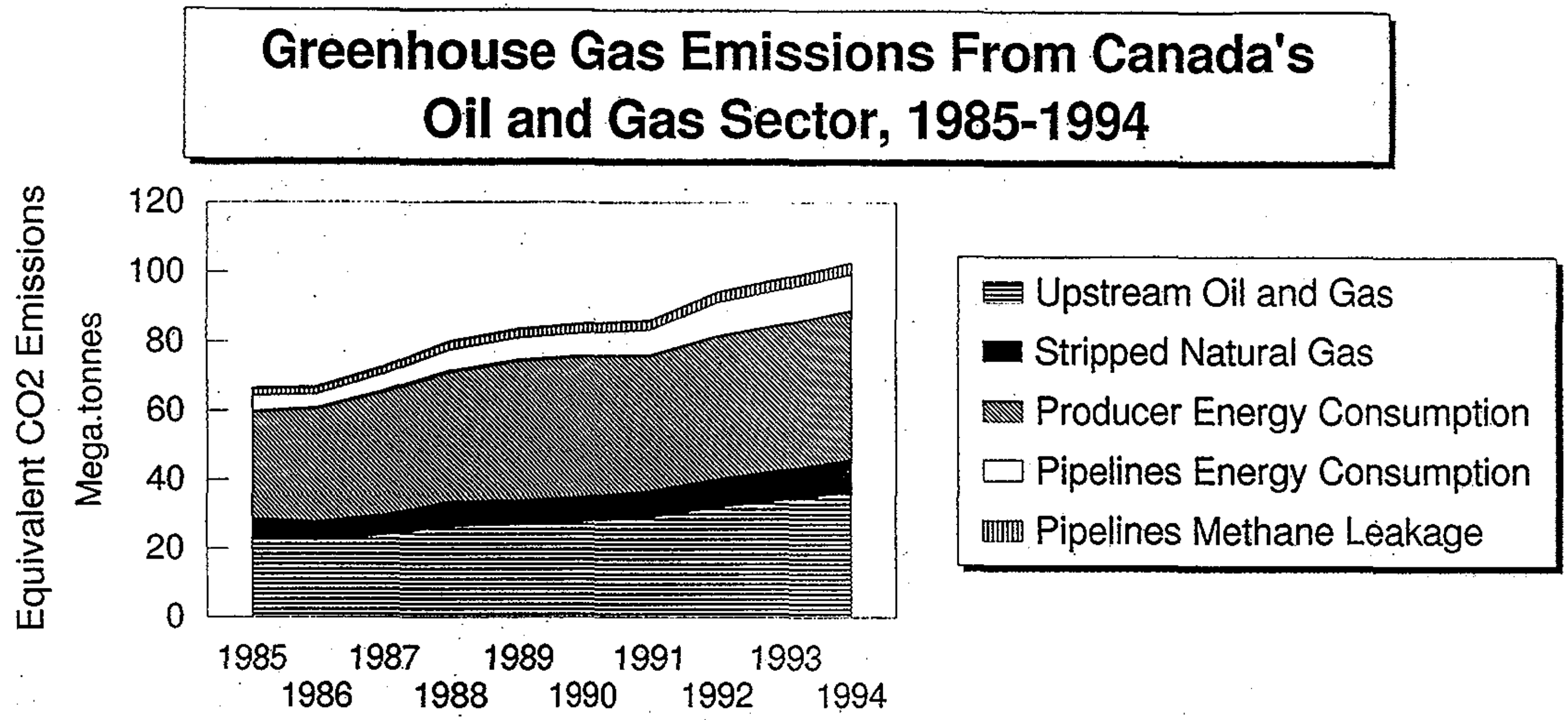


# FIGURE 4




Relative Growth (1961-1994) and Forecast (1995-2020)
of Gross Domestic Product and Energy Demand in Canada

# FIGURE 5




***Growth in Total Emissions Has Averaged 5% p.a. During Period***

Does not include petroleum refining or any emissions associated with electricity use by the industry.