British Columbia at the Crossroads: Clean Energy or More Pollution?

David Suzuki Foundation

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As British Columbia enters the 21st century energy policy makers will be called upon to meet the challenges of this new period - challenges substantially different than those that shaped energy decisions in the 20th century. Foremost among those challenges are the closely related problems of regional air pollution and global climate change, linked by the fact that both result from the combustion of fossil fuels, our dominant energy source. For decades, medical authorities and regulators have compiled the deadly statistics associated with criteria air contaminants such as smog and particulates. Now, with an increasing body of concrete scientific evidence that is documenting the causes, the characteristics and the widespread impacts of global warming, there is an even more compelling case to be made for energy policy choices that are truly sustainable.

The political and business leaders who met in Davos, Switzerland for the 2000 World Economic Forum declared that "climate change is the greatest challenge facing the world at the beginning of the century". Subsequent to that declaration, 178 nations, including Canada, forged a historic compromise in July, 2001 on how to implement the 1997 Kyoto Protocol. As Canada prepares for formal ratification and then implementation, it becomes even more important that energy policy decisions fit and support climate protection needs. The threat of dangerous, on-going climate change is such that it must now be a significant and, indeed, dominant perspective in determining energy choices. At risk is the balance of nature itself, which, in turn, determines that fate of key aspects of our human activities. In BC, that includes resource industries such as forestry, fishing, tourism, and agriculture; it includes water supplies and flows; it includes infrastructure reliability and costs; and it includes important public health factors.

The federal government has committed to the ratification of the Kyoto Protocol in 2002, following the consultations with provincial governments and industries now underway. In order for BC and BC emitters of greenhouse gases to come into compliance, it is possible that some sources would be able to expand emissions. But in that situation, other sectors will have to reduce emissions that much more in order that the overall profile comes down. It is in this context, that today's policy choices become so critical. If, for example, the natural gas production of the north-east region is steadily increased, then emissions will also rise (even with the efficiencies and other steps that we recommend). In that instance, another sector such as transportation will have to not only reduce to Kyoto levels, but also reduce further to compensate for the increased emissions in the upstream gas sector. This simplified example may well become more complex as implementation policies are finalized over the next two or three years, but in one form or another, this situation will closely resemble the coming Kyoto-compliant framework.

In this emerging situation, BC simply cannot continue to produce and use energy, particularly fossil fuels, in isolation of its demonstrated impacts upon the very 'services' of nature that determine much of our economic activity, our quality of life, our public health and our physical environment. These 'external costs' are significant, mounting rapidly, and can no longer be ignored in an emerging marketplace and regulatory framework that will be pricing carbon dioxide and other greenhouse gases. Now, with this broad policy review, it is a time to pause and assess decisions in light of the possibilities and needs of the future, taking into account both new constraints, such as ecological impacts, as well as new opportunities, such as advanced energy efficiency and production techniques and technologies.

It is critical that the citizens of BC are presented with an outline and a vision of those new opportunities, as well as analysis of the challenges that are part of changing our energy patterns. British Columbians should know that the Government of Alberta initiated a successful incentives program to kick-start the growing wind energy industry in that province. The fact that BC is home to a growing number of successful high-tech, 'new energy' firms such as Westport, Ballard, Dynamotive and others is important when evaluating the benefits of climate protection actions. Today, over 12,000 Danes work in the wind energy, exporting high-value machinery around the world. Shell and British Petroleum are investing hundreds of millions of dollars each in solar power. In BC, through both the public (BCBuildings Corporation, BC Hydro) and the private sector we have repeatedly demonstrated the bottom-line gains and job-producing features of energy efficiency projects such as building design and retrofit.

All of these demonstrable successes can help BC build energy policies and related economic initiatives that lead to new industries, new jobs, and increased energy security in a period of economic instability. Over two billion people in the world have no electricity. Just as the cellular phone has allowed some of those same people communications access without wires, it is likely that electricity will evolve with new, decentralized systems such as wind, solar, small hydro and others.

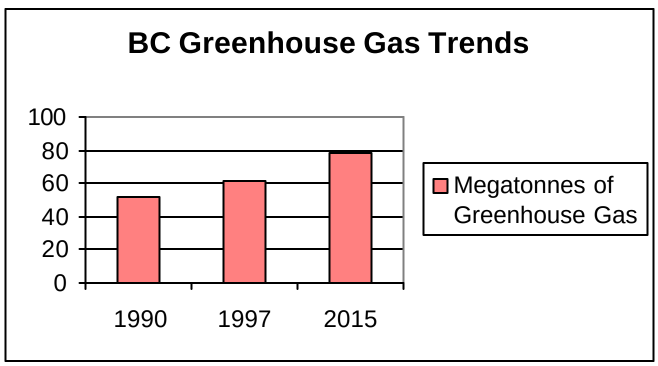
BC could play a growing role in those new industries, at home and in export markets. But it will require new approaches to ensure that those opportunities are not missed by a reluctance to reduce almost total reliance on fossil fuel use and production. It is in that vein of positive change that we urge this task force to present a vision and policy options which recognize the realities of fossil fuel emissions, the impacts of those emissions on the climate and public health, and the responsibility and the opportunities for emission reductions.

I. The BC Situation: Trends and Impacts

Within BC, energy use is growing rapidly in the transportation sector, in the natural gas and petroleum industry, for commercial and residential buildings and for industrial processes. Much of that energy is produced from burning fossil fuels. The main by-product of fossil fuel combustion is carbon dioxide, a major contributor to human induced climate change. Canada, along with185 other countries has signed and ratified the 1992 United Nations Framework Convention on Climate Change. This international treaty aims to prevent dangerous human induced interference with the climate system. It would be highly unlikely that a broad based discussion on BC energy policy could avoid examining the ramifications of climate change policy on energy. In fact, our position is that the two are inextricably linked.

Energy is a critical component of the modern industrial and post-industrial society. Electricity powers our heavy resource-based industries and our swiftly growing “soft” industries, even though that industry is primarily based on intellectual power and information exchange. Natural gas heats our homes, powers our industrial plants, and provides significant revenues as an export product. Petroleum products supply power to our personal and commercial transportation systems.

In all of these instances and many more, energy plays a fundamental role in our lives, our businesses and our economy. However, this energy use also has a serious impact on our environment particularly in air pollution. Primarily, as a result of growth in energy use, BC’s greenhouse gas emissions grew from 51.2 million tonnes in 1990 to approximately 63.4 million tonnes by 1999, an increase of nearly 24 per cent. Canada, under the Kyoto Protocol on climate change, has committed to reducing annual emissions by 6 per cent below 1990 levels over the 2008-2012 time period.



Following the recent UN meeting on the Protocol, held in July 2000, Prime Minister Chretien stated that Canada will ratify this agreement over the next year, making it a legally binding treaty. As such, the use of the earth’s atmosphere as a free and unlimited repository for the by-products of burning fossil fuels is not likely to continue. Over the next few years we can expect to see greater definition of the mitigation efforts that will be required to prevent dangerous levels of global warming and rapid climate change. To better prepare British Columbians for what lies ahead in the evolving energy market, industrial, institutional and residential energy management practices must be adopted and promoted throughout the economy.

For BC, energy is both a commodity and a service. As a commodity it provides economic benefits to corporations, governments, employees of energy companies and brokers. As a service it helps provide heat, light and power for homes, businesses and institutions. In a normal year BC consumers spend about $10 billion buying energy commodities, such as litres of gasoline, gigajoules of natural gas and kilowatt hours of electricity to acquire energy services.

Various levels of government receive revenue from the sale of energy commodities including $1.2 billion in fuel taxes, $500 million for natural gas and petroleum royalties and leases, and about $750 million from electricity sales, including the sale of Columbia River Treaty electricity. Water rentals to generate electricity bring in a further $276 million from BC Hydro. Clearly, the Province receives significant financial benefits from the sale of energy commodities. In 2000, following an electricity supply shortage in California, compounded in part by drought conditions on the US west coast, government revenues from natural gas and electricity reached record levels. Natural gas royalty and lease revenues exceeded $1.8 billion, while electricity revenues reached over $1 billion. However, this increase in government revenue was not a windfall for BC consumers since about half of the natural gas royalty increase of $1 billion, an additional $500 million, was collected from end-use natural gas customers in BC.

In this context, one of the keys to achieving economic and environmental stability is to develop and adopt a provincial energy policy that reduces price volatility, manages environmental risks and optimizes investment in energy infrastructure. To formulate a robust energy policy we believe three critical issues need to be tackled: our role as a producer of energy commodities, our role as consumers of energy services and the environmental impacts caused by both. While there are a variety of available policy instruments for addressing these issues, there are some common and overlapping areas. For example, commodity production may be enhanced by enticing the fossil fuel industry to become more energy efficient. Similarly, energy policy for consumers may also involve enhancement of energy efficiency through specifically designed programs.

Such efficiency also contributes to price stability. While some energy analysts believe that producing an ever growing supply of fuels will meet market demand with minor price fluctuations, the price volatility which occurred in the natural gas markets over the past two years exemplifies how a deregulated energy market, dependent on large investment by monopoly carriers, behaves in the real world. Due to the lag in market response between short term price signals and large capital investment, increasing production alone will not moderate price fluctuations. However, optimizing the efficient use of the natural gas and the electric utility system does contribute significantly to price stability. The history of the deregulated natural gas distribution system demonstrates that, through the creative use of rate design and the development of conservation and efficiency measures for large and small customers, long term rate stability can be enhanced. As a byproduct, environmental impacts are also minimized.

Enhancing energy efficiency in BC can also help stabilize government revenue. Reducing natural gas use in BC frees up pipeline capacity and makes more gas available without expanding production and emissions. Similarly, reducing electricity use frees up transmission capacity and electricity to meet new demand. Therefore, the Province should not have to be concerned with revenue reduction as a result of reduced domestic energy consumption. In fact, the direct cost savings brought to residential, commercial and industrial energy customers will result in significant economic gain throughout BC. However, we must ensure that the emissions associated with the production and transmission of natural gas and electricity do not force us into non-compliance with the Kyoto Protocol. Clearly, conservation offers a win-win solution to energy price volatility and environmental issues.

BC Energy Consumers

The services which energy provides to consumers are not intrinsically tied to any one energy source. For example a home can be heated with electricity, natural gas, oil, wood or a ground source heating system. At one time in BC many homes and businesses were heated with saw dust or coal. Light was provided by kerosene lantern and refrigeration was provided by ice blocks. Today, natural gas and electricity provide many of those same services with a much higher degree of safety and efficiency. In the near term the delivery of these energy services is expected to become much more efficient, particularly as small scale distributed combined heat and power systems become available.

In addition, new and more efficient technologies are being developed and marketed on an ongoing basis. For example, it is anticipated that hydrogen and natural gas fuel cells which can provide heat, hot water and electricity to small and large buildings will become commercially available over the next three to five years. However, we don't have to wait for new energy technologies. As "low carbon" or carbon constrained energy markets develop, many existing technologies and practices are becoming economically competitive. For example, wind power as a source of electricity is growing at a rate of 40 per cent per year, globally, and is making significant in-roads in North America. The US, which has 2,500 megawatts of wind generation, is expected to double that capacity within the next year. BC has no committed wind energy development, even though it is an entirely carbon-free source of generation. The one area which seems to have significant wind energy, Vancouver Island, is in danger of losing a major portion of its submarine cable transmission system, which is scheduled to be replaced by a natural gas pipeline. This plan will reduce overall system flexibility as well as significantly increasing air pollution of all forms from BC Hydro's proposed gas-fired plants.

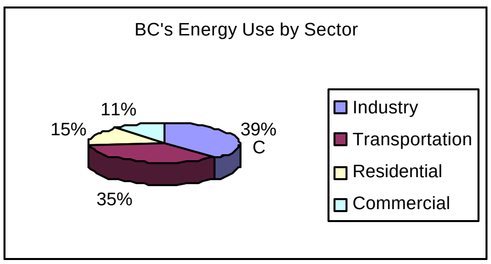
BC Energy Facts

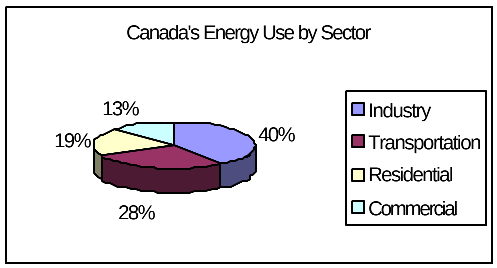
Production

In the natural gas market, Canada, with BC and Alberta in particular, is a major producer – the third largest in the world. As a petroleum supplier Canada ranks as the tenth largest producer of petroleum. Roughly half of Canada's coal production is exported for use as metallurgical coal making us the sixth largest exporter of hard coal. Due to our abundant fresh water river system Canada is the world's largest producer of hydroelectric power.

BC is a major contributor to Canada's energy production. We produce about 15 per cent of Canada's natural gas. Like the rest of Canada, over half of BC's natural gas production is exported to the United States. Due to large metallurgical coal markets in Japan, BC also captures 70 per cent of the Canadian coal export market. In addition we produce about 15 per cent of the country's hydroelectricity. In 2000 BC Hydro produced 44.8 thousand gigawatt hours of hydroelectricity, most of which was used in BC. BC Hydro also bought and sold a further 27.7 thousand gigawatt hours of electricity through independent power producer contracts, through the Alberta and US markets and as a marketer for power owned by the provincial government, the Columbia River Treaty Downstream Benefits.

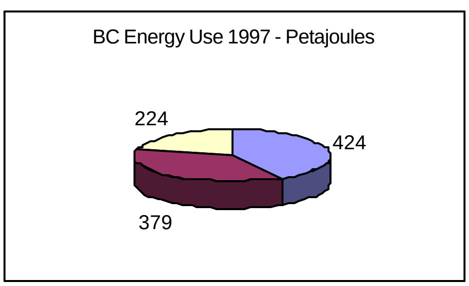
In total, BC produces 11.6 per cent of Canada's energy and consumes 11.4 per cent.[1]

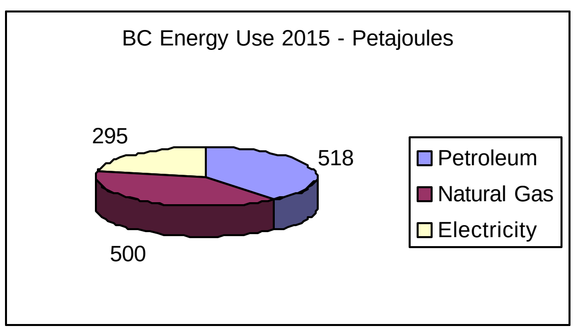




A petajoule is equivalent to 1,000,000 gigajoules. A gigajoule of energy is the amount contained in approximately 29 litres of gasoline. Annually, it takes about 8 petajoules of electricity to power every residence in the City of Vancouver. BC's total energy use is equal to 30 billion litres of gasoline.

Our Energy Profile





As a portion of total energy use we use more energy for transportation than the rest of Canada, which generally has higher energy use for residential and commercial heating. Canadians annually spend approximately $75 billion on energy use. On a pro-rated basis BC spends approximately $10 billion on energy.[2]

On average, each year, BC households spend approximately $338 on home heating fuel, $868 on electricity and $1,304 on fueling a household vehicle.[3]

Environmental Impacts

Producing and consuming energy comes at a cost. In the 1960's, BC developed a series of hydro-electric projects which permanently alienated significant quantities of land and altered the natural flow of specific river systems. Today, BC Hydro customers enjoy significantly lower electricity rates as a result of these projects, without ever having to pay for the ecological consequences of their electricity use. At the same time, large hydro projects are no longer acceptable from an ecological or social perspective and with genuine full-cost accounting, in many cases may not be economic either. Instead, BC Hydro is now pursuing a natural gas strategy with combustion turbines as the primary source of new electricity. Under BC Hydro's current Integrated Electricity Plan, over the next ten years natural gas fired electricity generation will grow from 9 per cent to 16 per cent of Hydro's resources.

Like large hydro projects, the environmental and health impacts of producing and consuming natural gas and other fossil fuels are often borne by communities and ecosystems that are removed from the direct responsibility of the ultimate electricity user. These external costs include opening up wilderness areas to exploration, exposing communities to long range, health-impacting air pollutants like nitrogen oxides and ground level ozone, and contributing to the destabilization of the climate systems on which we all depend.

The climate in BC is already changing. During the past one hundred years, coastal temperatures have increased by about 0.6 degrees, while the interior has warmed by over 1 degree - twice the rate of the global average.[4] It is expected that due to our mid-latitude location, BC will continue to follow this trend in relation to global average temperature. The Lower Fraser Valley is projected to experience some of the largest climate change impacts in southern BC. Climate models suggest warmer, drier summers will include periods of hot, stagnant weather which would result in more severe smog episodes.[5]

In addition to increased air pollution, climate change may also affect the way air pollution disperses through the atmosphere because of its impact on air currents and heating patterns.[6] Climate change will also change water levels, temperature and peak flow timing for rivers and streams leading to further pressures on already critically threatened species, such as salmon, and the communities that depend on them. For example the Fraser River, one of Canada's biggest salmon producers, often reaches temperatures of 21-22 degrees while the salmon are returning to spawn. If the temperature increases a further one or two degrees, most of the returning salmon will likely die before spawning.[7]

Climate change will also impact on BC forests. As a result of warmer drier summers and milder winters we can expect to see more insect infestations. For example, as noted in a recent BC Government news release:

"The mountain pine beetle infestation in the west central Interior has increased four-fold in the last year and is now the largest in B.C.'s history. The beetle attacks lodgepole pine, which accounts for over 50 per cent of the growing stock in B.C.'s Interior and is the predominant species of commercially harvested timber in the province.
• Over 500,000 hectares of trees are infested within an area of 5.7 million hectares, which is twice the size of Vancouver Island.
• The market value of the up to 50 million cubic metres of infested timber is about $4.2 billion."[8]

This type of insect infestation is in line with climate change impact projections for this region. Clearly climate change is an issue which has pressing economic implications for BC's natural resource industries – forestry, fishing, agriculture and tourism.

Air pollution is already responsible for increasing the number of premature deaths and forcing people to reduce daily activities. A Health Canada study reviewed 10 years of data and found that non-accidental deaths in Greater Vancouver increased by 8.3 per cent as a result of air pollution. [9] Using the same study, the federal government concluded that up to 16,000 Canadians die prematurely each year.[10] The annual cost to human health alone in the Lower Fraser Valley was estimated to be $830 million in 1990 and is projected to rise to $1.5 billion by 2005.[11] With climate change we can expect that figure to become even worse as higher temperatures contribute to more intense smog.

Because these costs are not included in the market price of fossil fuels they are considered to be "externalities". In essence, the market is failing to account for the use of the atmosphere as a repository for the byproducts of these fuels. Therefore, the users of fossil fuels have no financial incentive to reduce the externalities. While it is widely recognized that the price of a good is a form of information, a "price signal," which consumers use to decide how much of a product to buy, the information about environmental externalities is now being delivered through other mechanisms such as regulations or education campaigns and moral suasion. Currently, there is an ongoing debate across industrialized countries as to which form of information delivery will best address the environmental externality problem associated with global warming: regulations or market mechanisms such as tradable permits, since voluntary, educational and moral suasion campaigns have failed to have any measurable effect on greenhouse gas emissions.

We believe that the costs of climate change and air pollution in BC must be considered in the formulation of energy policy and in the evaluation of new energy projects. The promise of future revenues from energy exports must be compared to the cost to the climate, the environment and human health.

BC Emissions and Trends: Up, Up, Up

British Columbia, which contains 13 per cent of Canada's population, is responsible for approximately nine per cent of Canada's greenhouse gas emissions. In 1995, BC committed to stabilize greenhouse gas emissions at 1990 levels by the year 2000. In fact, BC missed this target and as a result emissions grew from 51.2 million tonnes in 1990 to approximately 63.4 million tonnes by 1999. Energy related emissions and emissions from industrial processes accounted for 54 million tonnes of that total. Emissions from agricultural operations and from decomposing organic matter and waste handling made up the remainder.

The largest components of energy and process related emissions in 1997, the last date for which detailed information is available, were: commercial and industrial operations which produced 24 per cent; oil and gas production and distribution with 17 per cent; and a further three per cent from electricity which was produced to power these sectors; freight transportation which produced 12 per cent, personal motor vehicles accounted for 16 per cent and residential buildings with 8 per cent.[12]

Without policy intervention, emissions are likely to grow to 78 million tonnes by 2015, with electricity generation contributing significantly to this growth. As the following section demonstrates there are critical risks associated with this growth in the electricity sector which have not been evaluated through any public process, despite the implications for the government, BC ratepayers and the environment. In particular the costs and rate implications of developing the gas fired power plants on Vancouver Island have been exempted from a thorough review by the BC Utilities Commission.

Volatility in Energy Prices: an Economic Vulnerability

In early 2001 the price of natural gas and electricity hit record levels. Due to a convergence of events on the west coast of North America, electricity and natural gas prices in North America reached exceptionally high levels. These events include a relatively low water year for Pacific Northwest hydro-electric dams, a shortage of pipeline capacity for natural gas, high summer demand in California, a move away from co-operative wholesale power transactions towards competitive bulk power trading, and flaws in the design of the 'deregulated' competitive power pool.

As a result of these events, short term prices for wholesale electricity reached US$377 per megawatt hour in December 2000, over 11 times higher than the average price of US$29.71 per MWh in December 1999.[13] Since natural gas fired power plants are the primary marginal resource on the western integrated electricity system, the shortfall from hydro-electric plants was made up by natural gas combustion. This in turn drove the price of natural gas to record levels, particularly gas at the BC border. Due to the necessity of providing electricity to their core customers, and a requirement to buy all of their power through the power pool, this forced a number of utilities into bankruptcy proceedings. Following significant government intervention in the market, the capacity crisis has now been averted.

More Gas-Fired Electricity: More Uncertainty for BC Business, Consumers

BC Hydro is a significant player in the California and west cost power markets. As such BC buys and sells wholesale power in every jurisdiction on the Western Transmission System. This area ranges from Alberta to Baja Norte, Mexico and reaches as far east as Montana, Wyoming, Colorado and New Mexico. Powerex, BC Hydro's power marketing subsidiary, received a license to market anywhere in the United States in 1997. As a condition of that license, BC Hydro was required to implement a cost-based wholesale transmission rate that would allow other power producers to use the transmission system.

In effect, the BC Hydro Wholesale Transmission Tariff had to comply with the US Federal Energy Regulatory Commission (FERC) order which opened up the entire US transmission system for competitive access. This allows competitive bulk power trading to occur between utilities, independent power producers and power marketers over the entire US and in parts of Canada. Because BC Hydro owns large reservoirs, Powerex can buy electricity when the market price is low, hold back water in the reservoirs and then later release the water when market prices are high. This allows BC Hydro to optimize its electricity production and maximize its profits in the wholesale electricity markets in the US and in Alberta. In order to function in the high priced markets of summer and fall 2000, Hydro saw its costs for purchasing energy increase to $5.45 billion. Trade revenues also increased to $5.46 billion.

Over the past decade electric utilities in North America have undergone significant changes in how they plan for additional electricity supply. In anticipation of entering more competitive markets for their services, they began to focus on minimizing long term costs in terms of capital investment and focused their new resource additions on natural gas fired combustion turbines which have low capital costs. In addition, prices for natural gas supply were at historically low levels creating the impression that there was an overabundance of this fuel.

As a result, over 90 per cent of new power plants in the US have been gas fired. On the western electrical system approximately 24,000 megawatts of new generating capacity is currently under construction or has recently been completed. The vast majority of these new additions are for gas fired power plants.[14] BC Hydro, as noted above, has followed the same strategy and is expected to increase its natural gas fired electricity generation from 9 per cent to 16 per cent. As well as incurring growing climate and environmental impacts, we believe that this strategy will expose BC Hydro ratepayers to significant risk and rate volatility, as occurred with natural gas distribution utilities last year.

In North America natural gas is bought and sold through a fully deregulated commodity market. Utilities and small and large customers can buy their natural gas on short term or long term contracts. Since natural gas usage is weather dependent the price for natural gas has historically varied with the seasons. While the daily variations over a year may range from $1.50 to $50 per gigajoule, the system as a whole has been fairly predictable. Utilities, who primarily purchase gas on behalf of their residential and commercial customers, have been able to plan their purchases and optimize their portfolio of short and long term contracts to mitigate these predictable fluctuations.

Over the past year this ability to optimize portfolios was seriously challenged, in large part due to California's electricity crisis. As a result, residential rate payers saw their natural gas bills increase from $6.73 per gigajoule to $12.12 per gigajoule in a period of months. Increased prices for natural gas are eventually passed on to consumers, and BC Gas applied for and was granted two 10% increases in January and September, 1999; an additional 7% in January, 2000 and a major 33% increase in July, 2000. In December, 2000 the BC Utilities Commission granted BC Gas yet another 27% rate increase.[15] In two years, the average annual lower mainland residential gas bill had more than doubled, from $737 to almost $1,500.[16]

Today, in part because of California's intensive electricity demand reduction programs, natural gas is trading a cost of US$2 per MMBTU. A year ago it traded at US$5. As a result of changes in the natural gas commodity price, BC Gas recently applied to the BCUC for a 15 per cent rate reduction for its customers. Recently, the BCUC noted that: "Across North America, natural gas prices rose dramatically in 2000 due to the strong Canadian and U.S. economies, strong growth in the demand for electricity, forecasts of a colder winter, and concerns about a slow supply response from natural gas producers." (our emphasis)

As we can see, on a continental basis, natural gas and electricity prices are strongly linked. In BC, due to the modest amount of gas fired electricity generation, our electricity prices are largely shielded from gas price fluctuations. Current plans are increasing the risk and exposure of electricity rate payers. While gas costs soared last winter, gas customers were forced to pay significantly higher prices for home heating and commercial and industrial uses.

Adding more gas fired electricity generation to BC Hydro's portfolio of supply projects has the potential to impact on electricity rate stability. The only way to mitigate against this is to enter into long term gas contracts, which also have a rate impact since they tend to be priced at a premium. Policies which reduce the risk and promote rate stability can provide a stable, optimum investment climate for business and provide the most security to individual householders. Since BC Hydro has several large reservoirs, the ability to capture and store energy for price and cost optimization is a critical asset which BC should utilize, in a way that adds to sustainable energy policies, not just maximization of revenues and earnings. As such, within the North American market we are ideally situated to develop intermittent renewable energy resources, such as wind and solar, and to offer significantly higher prices for supply derived from efficiency since the value can be enhanced through reservoir storage.

II. BC Hydro and the Rush to Gas

As its name suggests, BC Hydro currently generates most of its 11,668 MW of electricity at hydro generation stations, backed by a series of large dams and storage reservoirs. The 950 MW natural gas-fired Burrard generating station at Port Moody in the lower mainland is BC Hydro's main thermal generating unit, capable of supplying up to 12% of Hydro's firm power.[17] BC Hydro does not directly burn coal to generate electricity, although it does purchase coal-fired electricity from Alberta at off-peak rates for later resale. The legacy of government owned hydro power has resulted in decades of low-cost power for British Columbians.

However, in recent years BC Hydro has adopted a policy of meeting at least 90% of new demand by burning gas in combined-cycle generating plants. This policy will significantly increase BC greenhouse gas emissions, add to local air pollution, and put upward pressure on the cost of both electricity and gas.

To fulfill this policy, BC Hydro partnered with independent power producers (IPPs) to build two new 240 MW gas-fired generators on Vancouver Island. One is already built at Campbell River but is not yet in service, and a similar plant is planned for Port Alberni although following well-attended public meetings, planning permission was refused for the chosen site.[18] A third plant, which could be as large as 600 megawatts, has also been proposed for Vancouver Island by BC Hydro. Although the location has not been specified, BC Hydro has stated that a location near Duncan would be preferred.

BC Hydro is also partnering with US-based Williams Pipelines to build the GSX natural gas pipeline across the Strait of Georgia. This 41 cm diameter line will run 137 km from Cherry Point in Washington State to connect with the existing Centra Gas line at Cobble Hill on Vancouver Island. GSX will supply gas to feed these and other Island gas-fired projects. It will be subject to a National Energy Board review, scheduled to begin in the first quarter of 2002.

However, the Campbell River plant has suffered many start-up problems and is a full year behind schedule. This is not uncommon for such combined-cycle gas turbine (CCGT) plants, which are proving to be difficult to commission, expensive to operate and maintain, and often unreliable. Despite the claims of its manufacturers, this relatively new technology is not yet fully mature.

We believe that the current policy of using natural gas as a "bridge" to renewable energy technologies not only will have a severe and detrimental impact on the environment, but will also restrict the BC government's ability to benefit fiscally from the emerging post-Kyoto energy market and adversely affect provincial business, industrial and consumer energy costs.

In joining the "Rush to Gas", BC Hydro is following other North American electrical utilities and energy corporations down a path that increasingly points towards rate instability, price risk and severe environmental liability.

The Combined-Cycle Gas Turbine

Combined-cycle gas turbines are a relatively recent development in power generation. Based on aviation jet engine technology, they consist of one or more large gas turbines fuelled by natural gas or oil distillates, in combination with a secondary steam unit that captures much of the otherwise wasted exhaust heat. The secondary steam is used to power a steam turbine, and both the gas and steam turbines drive an electrical generator on a common shaft.[19]

Utilities and energy corporations lacking hydro facilities traditionally have burned coal, oil distillates, or natural gas in large boilers to make steam to generate electricity. In some jurisdictions, wood waste is also available as a fuel. The energy conversion efficiency of conventional fossil-fuel plants is generally only in the order of 30-35%. Large quantities of carbon dioxide and toxic gases, as well as heavy metals, particulates, and in the case of solid fuels ash, are created and emitted by conventional fossil fuel plants.

When operated as single-stage heat source to power a boiler, gas turbines increase the efficiency of conventional power plants only by five percent. But by combining the Brayton Cycle gas turbine with the Rankine Cycle steam system, thermal efficiencies currently claimed to be in the 50-55% range (GE "F" generation technology) can be achieved. Future developments ("H" generation) promise even higher thermal efficiencies, approaching 60%.[20]

Combined-cycle technology offers many advantages over conventional power plants. Besides much higher thermal efficiencies, which greatly reduce fuel costs, its modularity lends itself to fast and efficient construction. Rather than being designed specially for each power plant and assembled on site, the various components are pre-assembled in modules at the manufacturer's factory and transported to the plant site for attaching to prepared foundations.

This modularity also means that new or existing generating facilities can be developed in stages, with power coming on stream as each unit is completed. More units can be added as demand grows. Modularity and pre-assembly enable utilities and independent energy companies to select a manufacturer, model and capacity suitable to their projected energy market opportunities, without having to wait while engineers design each new plant.

The Rush to Gas

This combination of thermal efficiency, lower capital costs, flexibility and fast construction, has lead to the enthusiastic adoption of combined-cycle gas turbine technology by utilities and merchant power corporations.

As noted above, the extent of the trend to new gas-fired generation is unprecedented in its scale. Over 111,000 MW of new power, mainly gas-fired CCGTs, is proposed for the integrated western North America power grid by 2007. This is equivalent to adding ten new BC Hydros, except that it is all gas-fired. California (33,410 MW) and Arizona (22,836 MW) will have the largest number of new plants.[21] In our neighbouring Washington State 5,900 MW of new CCGT projects are currently proposed or being built, equivalent to half the capacity of BC Hydro. Most of these are large power plants, including a 1200 MW CCGT planned for Starbuck in Columbia county and the 1300 MW Wallula Power Project.[22]

All of this new gas-fired power follows two decades of strong growth in the adoption of CCGT technology. From 1980 to 1999, 267,030 MW of new CCGT power was added worldwide, of which 67,173 MW was in the USA, 25,389 MW in the U.K., and 174,806 MW in the rest of the world, Canada included.[23] There has been a huge movement to gas-fired electricity worldwide, and far from cooling off in a post-Kyoto world, its pace is increasing dramatically. CCGTs offer many advantages -- but does this new technology also have its drawbacks?

Pollution Control Issues

Combined-cycle gas turbines create large amounts of carbon dioxide (CO_2), the primary greenhouse gas, approximately 1.9 kg CO_2 per cubic metre of gas. They also create and emit oxides of nitrogen (NO_x), carbon monoxide (CO), products of incomplete combustion (PICs), sulphur oxides (SO_2 and SO_3), fine particulates (both PM_{10} – less than 10 microns and $PM_{2.5}$ -- less than 2.5 microns), as well as trace amounts of heavy metals and other pollutants.[24] These are all injurious to human, animal and ecosystem health.

Unburned hydrocarbons contain volatile organic compounds (VOCs), which react with NO_x in the presence of sunlight to form ground-level ozone, a highly toxic component of urban smog. Because of stringent US EPA regulations designed to reduce NO_x emissions, much engineering effort has gone into reducing NO_x output from CCGTs.

"Front-end" NO_x control technologies include water or steam injection into the combustion zone; dry low- NO_x combustion; and catalytic combustion. "Back-end" technologies include selective catalytic reduction (SCR) and the proprietary SCONOX system. Although each of these systems can be effective, all have significant drawbacks, including cost and reduced fuel efficiency. NO_x production falls sharply as combustion temperature decreases, so steam or water injection is effective as a NO_x control, capable of achieve emission rates around 25 ppm when firing natural gas and 42 ppm when firing oil.[25] But because steam or water injection drastically lowers fuel efficiency and increases combustion turbulence and noise, dry low- NO_x combustion in which the fuel/air mixture is kept very lean is favored by manufacturers.

SCR can achieve NO_x emission rates of 9-25 ppm, but its use of ammonia (NH_3) as a reducing agent introduces concerns about ammonia transportation, storage and "slippage" to the atmosphere. A tradeoff must be made between low NO_x emissions and low NH_3 slippage. Around 10-30 ppm ammonia slippage is considered normal, as excess ammonia is needed to achieve low NO_x emission rates. However, ammonia slippage is inconsistent and cannot be measured accurately.[26]

Particulate matter is especially a concern with SCR, as unreacted ammonia will combine with sulphur oxides in the exhaust stream to form ammonium sulphate and bisulphate salts, which plug steam generation units, raising maintenance costs. More important, they are released to the atmosphere as fine PM_{10} and $PM_{2.5}$ particulates, which can cause emphysema and increased incidence of asthma.[27]

Because of the formation of ammonium salts, the use of SCR with sulphur-bearing fuels such as diesel oil is no longer recommended by major CCGT manufacturers.[28] This negates the previously highly-touted ability to fuel-switch a CCGT plant, for example to use diesel oil when the price of natural gas is high. Disposal of the used SCR catalyst is also a problem; the EPA lists it as an extremely hazardous material.

Operational Drawbacks

Despite manufacturers' claims that CCGTs can provide low-cost, reliable power within a short startup time, operator experience with these plants often has proved otherwise. Commissioning delays and breakdowns have been reported at many CCGT plants in the UK[29], and in the US[30] Here in BC the Campbell River plant has experienced major teething problems and has not yet come into service, a full year behind its original schedule.[31]

Although gas-turbine plants can be brought on line in three to five hours in response to changing market conditions, substantial extra costs are incurred for each startup. Variable operational and maintenance costs for GE F-class machines are quoted as being as high as $40,000 to $50,000 per start. As one report states: "Considering that some of these machines may exhibit several hundred starts in a year.... pretty soon, you're talking about real money."[32]

Besides the maintenance problems and extra costs experienced with emission control units described above, other operational problems include: damaging combustion zone noise and vibration – especially with steam injection, vibration of turbine assemblies, catastrophic failure of turbine blades, poor performance at high ambient temperatures, failure to achieve advertised availability rates, and even local low-level fog from the exhaust plume.[33]

"Humming" is a dangerous condition that can suddenly be triggered in low-NOx operating conditions. A heavy, low-frequency vibration sets up in the combustion zone if the fuel/air mixture becomes too lean. Humming can be triggered by reducing pilot gas supply, or simply by running on a cold day. It increases fatigue wear and can cause severe damage or even turbine failure. The only solution seems to be to reduce power or shut down completely.[34]

Many of these performance problems are a result of the relentless drive of the dominant manufacturers to achieve ever-higher fuel efficiencies. This fierce competition, driven by the desire of utilities and power corporations to reduce fuel costs as natural gas prices rise, has meant that successive generations of technology are being bought “off the drawing board” -- in effect prototypes -- even before the previous generation has been adequately tested and proven.

Environmental Impacts

Greenhouse gas emissions and local air pollution are the two environmental impacts of greatest concern from gas-fired, combined-cycle plants. Water consumption and waste water discharge also are significant issues, as large amounts of clean water are needed for steam generation if the plant is a cogeneration unit, and for cooling. Other localised impacts include noise pollution, low-level fog, and plume shadowing. Natural gas pipelines, the upstream emissions associated with producing and processing the gas, and the development of electrical transmission corridors add to their total environmental impact.

Greenhouse Gas Emissions

Gas turbines burn fossil fuels, converting hydrocarbons into carbon dioxide, the primary greenhouse gas, and steam. Although a modern CCGT is capable of converting well over 50% of the heating value of natural gas into useful electricity and process steam, the laws of chemistry dictate that 1.9 cubic metres of CO_2 will be created for each cubic metre of natural gas burned, equivalent to 50kg of CO_2 per gigajoule of natural gas energy.[35]

In addition to CO_2, nitrous oxide (N_2O) and methane (CH_4) emitted by CCGTs are powerful greenhouse gases. Each of these have a different potential to bring about global warming, so for comparison purposes each has been given a CO_2-equivalence rating by the Inter-Governmental Panel on Climate Change (IPCC), the international body responsible for research on this topic. In their affect on the global climate over a 100-year period, CH_4 is 21 times as potent as CO_2, while N_2O, is 310 times more potent than CO_2.[36]

Other than increasing the overall energy efficiency of the unit, nothing can be done to reduce greenhouse gas emissions directly from fossil-fuelled plants. Various schemes have been suggested to compensate for them, either by buying offsets -- paying for reductions at another source -- or by national and international greenhouse gas emissions trading programs in which emission ‘credits’ are created, which can be traded on an emissions market. Both will entail major financial costs that today are unknown but are expected to increase as implementation of the climate change treaty occurs. Some pilot programs are in operation, but at this time these proposals are in their infancy.[37]

Greenhouse gas emissions from the proposed Port Alberni plant are estimated to be 921,467 tonnes CO_2 annually with duct firing (which increases output from 265 MW to 295 MW) or 810,903 tonnes without duct firing.[38] Because of questions about the emission reductions gained by supplying steam to the Elk Falls mill, greenhouse gas emissions from ICP at Campbell River are not known with any accuracy, but should be in the same range.[39]

BC Hydro has committed to offsetting 50% of the greenhouse gas emissions from the two Vancouver Island CCGTs through to 2010, including 300,000 tonnes/yr. for ICP and 350,000 tonnes/yr. for Port Alberni.[40] BC Hydro has not undertaken to offset Vancouver Island emissions beyond 2010, nor any emissions from the 950 MW Burrard plant. Again, cost considerations of these offsets must be considered particularly in evaluating non-fossil fuel alternatives and efficiency.

Air Pollution and Health

Public concern at both Port Alberni and Campbell River has focussed on two main issues: air pollution and greenhouse gases. Similar concerns have been raised in the US and Canada around the siting of new CCGT plants. Local air pollution is the main concern, as this directly impacts the host community.

Air pollution has become, quite properly, a major public health concern. Between 1989 and 1992, asthma, allergies and other chronic breathing problems increased by as much as 60% across Canada, and one in five Canadians now have some form of respiratory distress. Lung disease is the third leading cause of death in Canada and its incidence is increasing. Between five and ten percent of Canadian children suffer from childhood asthma, the leading cause of school absenteeism.[41]

The two leading pollutants from fossil-fuelled power plants, NO_x and SO_x by themselves are harmful if inhaled. These pollutants also cause acid rain. NO_x and ammonia salts nitrogenate soils when deposited, altering pH balance and increasing algae bloom in lakes and stagnant waterways.

Besides causing harmful effects on their own, NO_x will combine together with VOCs in an airborne reaction to form ground level ozone (O_3), a secondary pollutant. This reaction takes about four hours to complete, so the worst effects of smog may be experienced many kilometers downwind of the original pollution source.

Elevated levels of ground-level ozone (and by inference, smog) have been linked with a broad spectrum of health effects, including reduced lung function, pain, and difficulty in breathing. Chronic ozone exposure damages the deep portions of the lung, including the individual air sacs (alveoli).[42]

Ground-level ozone can also damage vegetation. In 1990, the Ontario Ministry of the Environment and Energy valued crop losses due to this pollutant at $70 million.[43] Crop losses of $8 million/yr. due to low-level ozone have been estimated for agriculture in the lower Fraser Valley.

Although attention has been focussed on reducing NO_x emissions from power plants, there is much evidence that fine particulates of between 10 and 2.5 microns (PM_{10} to $PM_{2.5}$) are a primary cause of ill health. Particulates under 2.5 microns ($PM_{2.5}$) are an even greater concern. To give an idea how small these are, the average human hair is about 70 microns in diameter.

The EPA estimates that 77% of CCGT particulate emissions will be $PM_{2.5}$. Due to the high-speed airflow in gas turbines, it is likely that all the particulate matter produced by gas turbine power plants will be less than 2.5 microns in diameter, with some less than 1 micron in size.[44] So although gas turbines can emit only 10% of the fine particulates of the best coal-fired plants, they are of a size that gives rise to the highest concern for human health.

Many studies show that there is no known safe limit below which exposure to fine and ultra-fine particulates does not impact human health, especially in children, the elderly, and people with compromised immune systems. Fine particulates are now considered the worst kind of air pollution in BC, more hazardous than ground-level ozone and all other air pollutants.[45]

Exposure to high levels of PM_{10} can play a role in the development of many kinds of respiratory diseases, including asthma, bronchitis, pneumonia and emphysema. Even more serious, this kind of air pollution is associated with a significant rise in the number of premature deaths. Senior citizens and people who already have lung or heart problems are most at risk, but normal healthy adults and children can also be affected.[46] The Canadian government has declared PM_{10} toxic under the 1999 Canadian Environmental Protection Act.[47]

Obviously, combined-cycle gas turbine plants can cause serious environmental impacts, especially during periods of adverse meteorological conditions such as a temperature inversions. Health impacts are worsened if emissions are released into enclosed airsheds in mountain valleys or close to the sea. This describes almost all of BC, including the populated Lower Mainland and the coastal communities of

Vancouver Island. Yet new gas plants have been built or proposed for just such communities, including Campbell River, Port Alberni, and the Cowichan valley.

Even if the Lowest Attainable Emission Rate (LAER) approach is applied to one pollutant, generally NO_x, a tradeoff must be made between it and other pollutants, with greenhouse gas emissions staying constant and substantial. Thus there is no guarantee that human health or ecosystems will not be affected by any level of pollution control applied to a CCGT project.

Water Consumption Issues

Around 96% of the water used by a combined-cycle turbine unit is for the cooling system used to condense and cool steam exhaust from the steam turbine. Small additional amounts are needed to top up the boilers, for general plant cleanup, and as potable water for kitchens and washrooms.[48]

The 245 MW ICP plant at Campbell River requires 109 litres/sec. (9,420 m^3/day),[49] while the proposed 265 MW (295 MW with duct firing) PAC plant at Port Alberni would require up to 83 litres/sec. (7,173 m^3/day) without duct firing or up to 103 litres/sec. (8,901 m^3/day) with duct firing,[50] The ICP plant uses water currently designated for waste cooling at the Elk Falls mill, while the PAC project proposes to draw its water from nearby Sproat Lake.

Concern was expressed during public hearings at Port Alberni about possible water level reductions at Sproat Lake. Water use also became a major public issue in public hearings for the proposed Sumas 2 plant in the Lower Fraser Valley. The Sumas 2 plant would draw up to 802 US gallons/minute (61 litres/sec. or 5,271 m^3/day) of water from the 100 square mile Sumas-Abbotsford aquifer,[51] which is used as a ground water source by many Canadian and US farmers and acreage owners.

Waste water discharge from CCGTs must be handled properly, as it can contain particulates and other pollutants. ICP will discharge 35 litres/sec. (3,060 m^3/day) through the Elk Falls mill system, while PAC would discharge 61 litres/sec. (5,333 m^3/day) without duct firing or 75 litres/sec. (6,153 m^3/day) with duct firing. Sumas 2 would discharge up to 34 US gallons/minute (2 litres/sec. or 223 m^3/day) into the City of Sumas sewerage system.[52]

Natural Gas as Coal Displacement?

Energy industry proponents often state that burning gas in combined-cycle turbines is much better for the environment than burning coal to generate electricity. This is only valid if gas is used to displace coal-fired generation. Recently, it has become apparent that gas-fired plants are built in addition to existing coal-fired plants, which due to the increasing demand for electricity and the opportunities to market power continent-wide, are being used even more.[53]

Coal is abundant and relatively inexpensive to mine in the US and Canada, as it is in Australia, China, and many developing countries. Here, significant displacement of coal-fired generation by gas-fired plants has not taken place. Only in the U.K. have gas-fired CCGTs displaced coal to any large degree. It is estimated that CCGTs will provide 40% to 50% of U.K. power by 2003.[54]

In Alberta, despite its massive natural gas reserves, the three largest new power projects currently proposed or in construction are all coal-fired. These include TransAlta Utilities' 900 MW plant at Wabamun, EPCOR's 400 MW Genesee expansion at Wabamun, and Enmax's 400 MW plant in Newall county.[55]

Total Alberta generating capacity in 2000 was 7,572 MW, of which 5,621 MW was coal (74%) and 1,156 MW natural gas (15%). Alberta Energy figures show that 1,860 MW of coal-fired generation will be added in Alberta by 2006, along with 992 MW of gas-fired generation. New cogeneration projects, mainly gas-fired but which could include existing process heat, will add another 1,612 MW, to Alberta's generating capacity.[56] By 2006, Alberta will have a total generating capacity of 11,941 MW of which 7,481 MW will be coal-fired (63%), 2,078 MW gas-fired (17%), and 1,612 MW from cogeneration (13%).[57]

New gas turbine projects often are built within existing industrial complexes so as to be able to supply process steam to an adjacent plant. Besides the energy efficiency gain, the main environmental benefit claimed for such cogeneration is that the total air emissions of a complex are reduced by replacing inefficient and "dirty" gas, oil, pulp liquor or wood waste steam boilers with "clean" and efficient steam generation from gas-fired CCGTs. However, these air quality gains to the local and global environment are not always achieved, especially if overall industrial production is increased.

Economic Consequences

As well as producing emissions that directly impact the environment and contribute to global warming, the economics of the new gas-fired generation favored by BC Hydro revolve around the cost of natural gas and access to an adequate supply of this commodity, which is traded openly on a deregulated North American gas market. But cheap natural gas, the main reason why this new technology was so attractive in the first place, is no longer guaranteed. The reason for this is directly linked to the 'rush to gas'.

As noted above, electricity utilities and energy corporations in North America and in many other countries, dazzled by the prospect of flexible, low-cost, marketable power, rushed to build natural gas-fired, combined-cycle gas turbine generating plants to satisfy the apparently insatiable growth in demand for electricity and in response to new opportunities to market their power. This impacted the natural gas market, setting off a chain of events that has permanently affected the price and availability of this vital commodity. It also has been a major factor in restructuring the North American energy industry.

What Are The Financial Costs of BC Hydro's Gas Strategy?

When it comes to examining the actual costs of BC Hydro's new gas-fired generation, researchers and energy analysts do not have access to sufficient data. It used to be that BC Hydro's costs were known. They could either be accessed from corporate records or gleaned from cross-examination of BC Hydro officials during a Revenue Requirement Application or other hearings held by the BC Utilities Commission.

But the last Revenue Requirement Application hearing for BC Hydro was held in May, 1995.[58] Now, attempts to find cost information concerning new projects generally meet with a blank wall. Agreements between BC Hydro and its partners on the new gas-fired generation projects considered in this report are classified as "commercial information" and shrouded in mystery.

As a result, the potential costs and revenues of the two gas-fired Vancouver Island power generation projects and the GSX pipeline itself, are unknown. The terms of any agreements already entered into between BC Hydro and its partners are kept secret, even as to whether they are binding or not and what penalties may be incurred if they are not completed. Thus the financial basis on which the government's new energy policy would rest is not a matter of public record. It may already have been set *de facto* by these contracts.

This lack of transparency over BC Hydro's energy costs must be corrected to gain public acceptance of possible future directions that the Energy Policy Task Force may propose. The importance of transparency in energy pricing and transactions has been specifically recognised as an objective of British Columbia's forthcoming energy policy.[59]

Royalties and Rebates

The BC government profited handsomely from the increase in the price of natural gas. In 1996, provincial natural gas royalties were $152 million; in 2000 they approached $770 million. Total energy industry revenue to the BC government jumped from $425 million in 1996 to $1.2 billion this year.[60]

Energy royalties and sales provide a dilemma for provincial governments. Although energy income is undoubtedly attractive, the good news is often offset by the need for subsidies to maintain some form of social equity. Last year the federal government announced a one-time, $250 rebate to low-income families who qualified for a GST rebate, and $125 for qualifying individuals.[61] The program is reported to have cost $1.3 billion.[62]

In November, 2000 the Alberta government ordered its Energy and Utilities Board to suspend all electricity rate increases to cushion consumers from the jump in energy costs predicted to accompany its January 1, 2001 provincial electricity deregulation.[63] The Alberta government then announced a rebate of $50/month for the four winter months to offset higher gas prices.[64]

This program would rebate over $275 million to Alberta consumers, but in January, 2001 the Alberta government tripled the household rebate to $150/month, adding another $487 million to the cost. This brought the total of energy rebates to households, business, farms and non-profit organisations up to an astounding $4.1 billion, $2 billion of which was recovered from power auctions held as part of Alberta's electricity deregulation plan.[65]

The BC government also felt that it should share some of its windfall with less-affluent British Columbians. The B.C Energy Rebate was administered by Canada Customs and Revenue Agency (CCRA). It returned $100 per family or $50 per qualifying individual to British Columbia residents who were entitled to receive the GST credit based on their 1999 income tax return.[66]

Despite the large amounts involved, there is no evidence that energy rebates do achieve social equity goals in periods of high energy costs, especially for low- and fixed-income consumers. Statistics Canada data for 1998 show that the average household spent 4.2% of its budget, or $1,521, on fuel, electricity and water used in the home. The lowest income sector, consisting of 20% of households, spent 5.6% of their budget on these items, an average of $880.[67] This data was collected before the recent large increases in energy costs, which particularly impacted seniors and others who have to pay their monthly gas bills out of a fixed income. In December, 2000 the BC Utilities Commission estimated that gas bills for residential consumers would rise by $320/yr. in the lower mainland and by $430/yr. in Dawson Creek.[68] Recent decreases in gas rates announced by BCUC reduced these by bills 11% and 15% respectively.[69]

Energy rebate programs, besides not fully covering some increases, take time to deliver cheques to low- and fixed-income households. Unlike utilities and corporations, which can expense costs within an annual budget, low-income residents do not have the luxury of deferring their monthly energy bills. These difficulties do not change as a result of episodic rebates that fail to address the fundamentals of household energy use and costs - only efficiency or very expensive, continuous energy rebates can address that issue.

Costs and Market Volatility

Even with its water-based system, BC Hydro has enjoyed fairly predictable generating costs from one year to another. Fuel costs do vary from year to year, depending on the amount of natural gas needed to fuel the Burrard thermal generating plant to make up for variations in the winter snowpack. But BC Hydro has developed system planning models to cope with this.[70]

However, if BC Hydro pursues its current policy of building natural gas plants to supply 85% of new generation, energy price volatility and not high fuel costs would become its biggest problem. BC Hydro would be exposed to the same cost environment as competing fossil fuel-based utilities, eroding its competitive advantage and leading to more volatile and potentially higher energy costs for BC consumers once the electricity rate freeze is lifted.

The loss of dual-fuel capability -- the ability to switch to diesel fuel or another petroleum distillate when the price of natural gas was high or deliveries constrained -- has greatly reduced the economic attractiveness of these plants. Dual-fuelling was seen as a primary way of mitigating fuel price volatility, but technical difficulties and greatly increased operational and maintenance costs due to dual-fuelling have virtually ruled out this option. Their fuel needs are now coincident with seasonal demand for both electricity and natural gas. Depending on the extent of fuel cost hedging strategies, this could double the impact on energy costs by raising the price both of natural gas and electricity.

Due to the interaction between the electricity and natural gas markets, BC corporations, businesses and consumers already have been subject to natural gas price volatility. Energy cost fluctuations also have had a volatile and unpredictable affect on provincial government revenues. Increased exposure to market price volatility would further add to the uncertainty of business and government budgeting. The higher the percentage of gas-fired generation purchased by BC Hydro, the greater the degree of budgetary uncertainty.

As well as fuel price volatility, rising equipment costs and delayed deliveries due to the strong demand for new gas turbines have impacted CCGT costs. Gas turbine orders have doubled and some equipment prices have risen 20% in the past two years.[71] US manufacturer Siemens-Westinghouse recently raised delivery times for new equipment from one year to two, while CCGT GE Power Systems increased its annual turbine production from 65 in 1997 to 180 last year. GE expects to produce 270 turbines this year.[72]

III. The BC Gas Turbine Experience: Conflict and Controversy

ICP and Air Pollution in Campbell River

Campbell River sits between the coastal mountains of Vancouver Island and the Strait of Georgia. Pollution from the Elk Falls mill often drifts over the town, as well as Quadra Island. Sea haze, which contains salt particulates as well as naturally-occurring VOCs from coastal forests, mixes with mill pollution to form fine particulate. In 1998, a new monitoring station on Tyee Spit reported that PM_{10} exceeded 25µg/ m^3 8.8% of the year.[73]

The Island Cogeneration Project (ICP) plant at Campbell River is a combined-cycle cogeneration unit to supply 90 tonnes/hr of process steam at 190 psig to the Norse Skog Elk Falls pulp mill, with optional duct burning in the heat recovery unit for supplemental steam generation to 135 tonnes/hr. The plant also can supply BC Hydro with up to 245 MW of base-load electricity.[74] ICP began as a joint venture between Fletcher Challenge Energy Canada and Westcoast Power Inc. of Vancouver, but Fletcher Challenge Energy sold its 60% interest to Westcoast Energy in October, 1998.[75] Westcoast Energy sold its 100% interest in ICP May, 2001 to US energy giant Calpine.[76]

The 1997 project application stated that the ICP plant would meet the BC NO_x guidelines of 25ppm (48 mg/m^3) when burning natural gas where SCR emission control was inappropriate[77] by dry low-NO_x combustion. It also would be able to fuel-switch to diesel, using water injection to reduce NO_x output to 42ppm (80 mg/m^3). Fuel-switching would be limited by agreement to an average of five days/year, with a maximum of 10 days in any one year. Because of the steam available from ICP, the Elk Falls mill would be able to shut down two of their oldest wood-fired boilers (#1 and #2) and reduce gas-fired boiler #4 to standby status, estimated at 800 hrs/yr.[78] The application stated that the existing Elk Falls oil-, natural gas-and hog fuel-fired boilers emitted on average 1338 tonnes/yr. of NO_x, 5339 tonnes/yr. of CO, 1053 tonnes/yr. of particulate, 588 tonnes/yr. of SO_2 and 94 tonnes/yr. of VOC.[79]

With ICP in place, the shut-down of boilers #1 and #2, and boiler #4 running at only 400 hrs/yr., the application stated that compared to 1994-96 averages, net combined annual emissions of NO_x would increase by 434 tonnes (32%), CO by 516 tonnes (10%), particulate by 20 tonnes (2%) and VOCs by a 161 tonnes (171%). Only SO_2 emissions would be reduced, by 266 tonnes (45%).[80]

The plant's air emission figures became subject to public scrutiny late in 2000, after the plant had been built but before it had completed its testing phase. Air emission numbers from the plant compared poorly to the emission figures for the proposed 660 MW Sumas 2 project, slated for a site directly across the US border from Abbotsford in the lower Fraser Valley.[81]

Sumas 2 would employ SCR emission controls to generate almost three times as much electricity while emitting only one third the NO_x pollution and one tenth the CO emissions of ICP, which also would emit 19 times more NO_x as BC Hydro's much larger Burrard thermal generating plant in Port Moody.[82] Around the same time it became apparent that the Elk Falls mill had shut down boilers #1 and #2 in December, 1999, negating the claim that the cogeneration plant was needed to reduce emissions from the mill.[83]

In response, ICP released new numbers suggesting that the estimates in the original 1997 application were incorrect. The turbine would produce only 613 tonnes of NO_x each year, while the mill's estimated annual NO_x emissions were reduced by 645 tonnes, producing an annual combined net reduction of 32 tonnes of NO_x. Other emission estimates were similarly lowered.[84]

The company released CO_2 emission totals for the first time at the same news conference. ICP would generate 781,275 tonnes/yr. of CO_2 while eliminating 150,543 tonnes/yr. from the mill, for a net annual CO_2 increase of 630,732 tonnes.[85] Carbon dioxide emission data had not been not included in the original application, and in granting a project approval certificate the Environmental Assessment Office (EAO) only stipulated that the company must submit a greenhouse gas mitigation plan to the government, without requiring the company to perform any mitigation suggested by the plan.[86]

A group of Campbell River and Quadra Island citizens subsequently decided to appeal the final air permit, which had been issued by the Ministry of Environment, Lands and Parks air resources branch.[87] The appeal has been heard by the Environmental Appeal Board, and a decision is pending.

BC Hydro's Port Alberni Proposal: the Community Responds

The original proposal to build a CCGT at Port Alberni was a joint venture between PanCanadian Petroleum Ltd. and ATCO Power Canada Ltd., both of Calgary. Similar to the Campbell River plant, Port Alberni Cogeneration (PAC) would supply up to 91 tonnes/hr. of process steam to the Pacifica Papers mill, and up to 240 MW of electricity to BC Hydro.

Submitted to the EAO in August, 1999, the project aroused little public interest. The EAO Project Report noted that the public had expressed “few concerns,” and the project committee had received no written comment from the public during the review, although some questions about air impacts, noise, and water quality were asked during the proponent’s open houses.[88]

This initial lack of public concern was echoed in Campbell River regarding the ICP proposal. It contrasts sharply with the controversy currently surrounding gas-fired generating plants. This can be attributed to the fact that the GSX pipeline had not been announced and the environmental community had not grasped the combined impact of these projects on BC greenhouse gas emissions; nor had the Sumas 2 proposal become the subject of public and political attention. As well, the EAO process was not advertised in the major metropolitan areas.

EAO issued a permit for the plant,[89] but the project was stalled by the failure of BC Hydro to conclude a commercial agreement with the partners, who attributed increased equipment costs due to higher US demand for CCGTs during a protracted negotiating period, plus BC Hydro’s refusal to offer the project similar terms as ICP, as the reasons for failure to reach agreement.[90] This apparently revolved around the fact that ICP was allowed to proceed without SCR pollution controls, while PAC was required to install them.

BC Hydro announced that it would seek a new partner for the project.[91] It found one in December, 2000 in Calpine Canada Power Holdings Ltd., a Calgary-based subsidiary of US energy giant Calpine Corporation.[92] This project marked Calpine’s first entry into the BC energy industry. In May, 2001 Calpine Canada purchased a 100% interest in ICP at Campbell River.[93]

However, the new Alberni proposal was sufficiently different that a new Environmental Assessment was required. Although the original proposal was for a cogeneration plant located at the Pacifica Papers mill, the recently proposed site was further away and there are was no provision for supplying steam to the mill. Public input was once again invited, and this time citizen response was substantial. Considerable concern was voiced about the new site, which is within city limits and immediately adjacent to a residential area.

Port Alberni sits in a bowl enclosed by mountains, and winter inversions often trap industrial and residential pollution under a layer of warmer air. People were concerned about having to breathe emissions from the plant and their fears were not allayed by a noted BC air quality expert, who raised questions about the proponent’s air modeling assumptions.[94]

Based on the input it received, the EAO Project Committee recommended that the project move to Stage 2 of the EAO process. This requires a new project report from the proponent, which would be subject to another public review.[95] The Project Committee noted that several concerns remained and that further information would be required on air emission modelling, air quality assessments including public health impacts, noise impacts, project risks, socio-economic effects and First Nations traditional uses.[96]

Following several well-attended public meetings that reflected the overwhelming public opposition to the plant proposal, Port Alberni City Council rescinded planning permission for the site and announced that it would not reconsider that option in the future. This triggered a warning of potential future energy curtailments Vancouver Island-wide from a BC Hydro spokesperson.[97] Unfortunately, we have seen this type of scare-mongering from BC Hydro before, in the case of the failed Site C proposal in the 1980s. Fortunately, PowerSmart was developed to deliver that same quantity of electricity through efficiency, with many co-benefits that continue today. If Site C had been built, PowerSmart would not have happened. Today, we are in a similar situation and rather than responding to dire, but unfounded warnings of brown-outs, we believe that PowerSmart should be revived and other, more positive alternatives implemented.

Sumas 2 and Fraser Valley Pollution and Health Concerns: BC Says 'No'

The technology chosen for the 265 MW Port Alberni plant is similar to that selected by National Energy Systems Co. (NESCO) of Kirkland, Wa. for its 660 MW Sumas 2 combined-cycle generating plant, slated to be built across the US border one kilometre south of Abbotsford in the lower Fraser Valley.

Sumas 2 has been the subject of much controversy. Because of the poor air quality in the region, Canadian citizens and governments strongly expressed their opposition to the project. While Washington State regulators rejected the proposal in its first form, the process on an amended application is continuing. The provincial government as an intervenor is expressing strong opposition to this plant, in conjunction with the City of Abbotsford and many local citizens and organizations.

Considerable public opposition exists from groups as widely different as the local Chamber of Commerce, community groups, and religious organisations. Company plans to build a power line through downtown Abbotsford also angered local residents.[98] This application was to be subject to an NEB hearing, but this has been set aside until the results of a second consideration of the project by US authorities (see below) is concluded.

NESCO has run the 120 MW Sumas power plant since 1990, which is owns jointly with Calpine Corporation. In January, 1999 the company applied to the Washington State Energy Facility Siting Evaluation Council (EFSEC) for a permit to build Sumas 2, but in February, 2001 the 11-person EFSEC panel unanimously rejected the application, stating that the plant would not produce direct energy or economic benefits to consumers or lead to lower energy costs in Washington or in the region.[99]

“The analysis of environmental impacts and SE2’s proposals for mitigation are insufficient to address the environmental impacts of this facility; especially with respect to air quality impacts in the Lower Fraser River Valley, greenhouse gas emissions, oil tanker truck traffic impacts, water quality and impacts at local wells, and increased risk of flood hazard,” stated the Council. It also pointed out that the company was unsuccessful in obtaining any offsets for emissions, most of which would end up in the lower Fraser valley.[100]

The company submitted a first then a second revised proposal and has been granted another hearing by EFSEC. The BC government applied for and received intervenor status, and presented evidence to oppose the plant.[101] This action, although laudable, contrasts with the current gas plant strategy of a major Crown agency, BC Hydro.

Some Regulatory Implications: Technology Versus Public Health

This review of the three major combined-cycle gas turbine projects in or near British Columbia points to some clear regulatory implications. The first is that current provincial standards for gas turbines are based on what the technology is capable of achieving, not on health data or ecological impacts.

British Columbia uses Best Available Control Technology (BACT) policy in setting standards for industrial and other waste emissions.[102] Adopted in 1975, this policy is designed to ensure that new plants have appropriate and modern pollution controls. However, BACT is in essence technology-centric, it is not based on public health facts or ecosystem data. The technology sets the standard, not that the standard directs technological solutions.

The 1992 BC emission criteria for gas turbines establishes one-hour average guidelines for gas turbines greater than 25 MW capacity only for NO_x, carbon monoxide (CO) and ammonia (NH_3), under continuous monitoring.[103] For NO_x these are 17 mg/m^3 (9 ppm) if fuelled by natural gas with SCR or 48 mg/ m^3 (25 ppm) in situations where SCR is demonstrated to be inappropriate (claimed to be the case for ICP in Campbell River). For periods of oil-firing, the NO_x limit is raised to 34 mg/ m^3 (50 ppm) and 48 mg/ m^3 (90 ppm). The CO emission guideline is 58 mg/ m^3 (122 ppm,) and for NH3 is 7 mg/ m^3 (15 ppm).

In light of recent information about the health effects of fine particulates, these BACT guidelines would appear to be inadequate, even if their recommended pollution levels are actually achieved. Because they are only guidelines they are not backed up by legislation. Their legal basis comes when they are written into an emissions permit. If they are not complied with the ministry of Water, Land and Air protection can impose a fine, add the infraction to an annual non-compliance list it publishes, and work with the company to attempt to address the non-compliance.

However, this relatively gentle approach does not always guarantee that the BC guidelines will be met. This year the Elk Falls pulp mill at Campbell River was listed for the third time for its non-compliant air emissions and third time for its effluent, while the Crofton mill was listed for the ninth time for its pulp mill emissions.[104] Clearly, the admonitions are not effective.

Because the BACT policy is still being used, new plants can be permitted even though they may afflict public health or ecosystem integrity. The BACT policy also tends to restrict deliberation at environmental assessment hearings to whether a plant can or cannot achieve the ministry’s guidelines, not whether the facility or policy may be in reality harmful to health or the environment.

BACT also leads to attention being paid only to those pollutants listed in the guidelines. Both Sumas 2 and Port Alberni Generation proposes to use SCR to reduce NO_x emissions to 3.5 ppm (6.6 mg/ m^3), the respective proponents claiming their plant to be among the cleanest in North America.[105] But we have pointed out that the use of SCR results in an increase in PM10-2.5 emissions and ammonia “slippage,” which in turn creates even more fine airborne particulates that are extremely harmful to human health.

The obsession with NO_x emissions from CCGTs can be counter-productive. Ultra-low NO_x levels are difficult to maintain as dry low-NO_x technology requires very lean fuel combustion. This can lead to problems even if continuous base-load operation is maintained.[106] As well, NO_x levels in the 3.5 ppm range are difficult to measure with accuracy. A 10 ppm range is the lowest certified for a process NO_x analyser and based on current monitoring technology, New York State has declared 6 ppm as the lowest NO_x emission rate accurately measurable in the stack.[107] With a 3.5 ppm NO_x limit, even the slightest variation in ambient conditions or plant output would make instrument error a significant factor. Even a CCGT manufacturer’s report concluded that such low NO_x emission limits are not practical.[108]

Even if the Lowest Attainable Emission Rate (LAER) approach is applied, a tradeoff always must be made between different CCGT pollutants, in this case NO_x and fine particulates, with greenhouse gas emissions being the only constant. Thus there is no guarantee that human health will be unaffected by any level of pollution control applied to combined-cycle gas turbines, but the current regulatory environment does not seem to recognise this fact.

IV. Gas and the Changing Dynamics of the BC Energy Market

The Power Merchants

Combined-cycle gas turbines, far from proving to be the panacea that utilities and energy corporations expected them to be, have severe environmental impacts and often perform below their claimed performance. They require constant attention from specialised and knowledgeable operating personnel, and the support of sophisticated gas purchase and energy marketing teams. Yet despite their drawbacks, utilities and energy corporations continue to attempt to site increasing numbers of these plants, often in the face of strong public opposition. Why is this?

In the past, electricity was generated in large central generating stations, connected to a transmission network that could distribute power to a defined service area. To build such a system was capital-intensive, and after a brief period when monopoly practices threatened to concentrate ownership of electric power into a few hands, electricity companies were turned into closely-regulated public utilities. Some of these were, like BC Hydro, created and owned by government. Each utility was granted a monopoly within its service area. Reliable electricity supply provided by large monopoly electricity utilities, backed by state-sponsored construction of hydro dams and power plants, laid the foundation for decades of industrial and economic growth.

The development of gas-turbine technology changed this stable pattern. Just as the invention of the personal computer shook the foundations of the nascent information technology industry, the small, light and efficient gas turbine has changed the shape of the power industry. Their relatively low capital cost and flexibility allowed new players to enter the market with far less capital investment, provided they could move their new power through existing utility transmission lines and compete against the utilities.

Following the deregulation of the North American natural gas market, the legislative framework for a competitive, deregulated electricity market was laid down in stages over the past two decades. A new class of merchant power generation and retail electricity marketing company has risen to challenge the formerly monopolistic government- and privately-owned electricity utilities.

Leaving aside whether this movement towards electricity deregulation has been successful or even desirable, the point is that most combined-cycle projects have been proposed as merchant power plants, selling power to the highest bidder on an almost continent-wide electricity market. Proponents of Sumas 2 have stated clearly that it is a merchant power plant. However, BC Hydro is suggesting that its two Vancouver Island CCGTs are base load plants.

<u>But while BC Hydro has surplus electricity, which it can create by demand management and energy efficiency programs plus gas-fired energy from CCGTs and Burrard, it can sell this surplus power on the export market. This puts BC Hydro into a merchant power situation, and we suggest that its new gas-fired projects are in fact indistinguishable from merchant power plants</u>.

BC Hydro claims that the new gas-fired projects are base-load plants that will supply additional power on Vancouver Island to replace the power lost by removing the obsolete power lines that cross the Strait of Georgia and to keep up with demand growth. But we suggest that even if its demand projections are correct, BC Hydro has many cost-effective options with which it can meet the energy needs of Vancouver Island. These include energy efficiency and demand-side management programs, repowering its existing generators, refurbishing the transmission cables to Vancouver Island, and committing to more ambitious investment in non-polluting and renewable energy.

The real advantage of new gas-fired generation to BC Hydro is that as long as it has excess generating capacity and access to adequate fuel supplies at reasonable prices, it can turn on these plants at any time to fulfill export orders. BC Hydro is in process of becoming a power merchant, and we believe that these proposed new gas-fired plants are part of this strategy.

Calpine Corporation

Some indication of BC Hydro's emphasis on merchant power is reflected in its choice of partner for the two Vancouver Island CCGT power projects. Calgary-based Calpine Canada is a subsidiary of Calpine Corporation of San Jose, California, the fastest-growing private energy producer in the US and ranked third in *Fortune* magazine's 100 fastest-growing companies.[109] Calpine is a major US power merchant.

Calpine Corporation currently has 9,000 MW of power in operation, 16,000 MW in construction and 15,500 MW in announced development.[110] The corporation recently announced a $22 billion energy construction program, which it claims is the largest in US power industry history. It has placed firm orders for 203 gas turbines, representing 50,000 MW of baseload capacity, part of its strategic plan to have 70,000 MW of generation on line by the end of 2005.[111] To give some comparison of Calpine's size, by 2005 BC Hydro estimates it will have just under 12,000 MW of firm power.[112]

Calpine Canada owns and operates the 250 MW Calgary Energy Centre, and last May it purchased a 100% interest in the 250 MW ICP plant at Campbell River plus a 50% interest in the Whitby Cogeneration project in Ontario from Westcoast Energy of Vancouver for approximately $405 million. Calpine has also acquired almost one trillion cubic feet of proven and probable Canadian natural gas reserves to feed its generation base.[113]

Calpine's growth is an indication of the rapid consolidation of the energy generation industry in North America. Fuelled by the windfall profits provided by the huge spike in oil, natural gas and electricity of the past year, successful energy companies have been on a buying spree.[114] The recent $12 billion acquisition of Westcoast Energy by Duke Energy Corp. of Charlotte, NC is also part of this trend. Duke Energy is the largest US energy company, with revenues of nearly $78 billion in the year 2000.[115]

V. The Clean Energy Path: Lessons and Policy Recommendations

Demand Management Successes in California, Seattle, and BC

Over the previous two decades California has led the world in energy conservation and efficiency efforts, including utility sponsored incentive programs, appliance and building standards. As a result of these efforts, peak demand was reduced by 9,000 megawatts.[116] In recent years many of these efforts were sidelined as utilities began anticipated competing in a deregulated electricity market. Between 1994 and 1997 utility funding for conservation and demand side management was cut by over 50 per cent.[117] Recently, due to the massive rate shock felt in California and as a result of government interventions to prevent blackouts, California revamped its energy conservation programs. As a result, over $859 million is being allocated to the state energy commission and other state agencies to assist in peak load reduction programs. These programs are expected to reduce overall load by 3,400 megawatts. [118]

Some of California's programs include:

- A real time meter program for customers with loads greater than 200 kilowatts. This is expected to result in a peak reduction of 1,500 MWs at a cost of US$35 million.
- A door to door program in low income areas which will allow for the free distribution of high efficiency compact fluorescent light bulbs and will deliver 10 megawatts at a cost of $20 million.
- Commercial lighting incentives at a cost of $60 million will deliver 60 MWs.
- Low income weatherization at a cost of $20 million delivers 8 MWs.
- A further $30 million will be spent on renewable resources through net metering with a delivery of 10 MWs.

There was also a 20 percent rebate program that provided California ratepayers with a 20 percent credit on their monthly utility bills if they cut back their electricity use by 20 percent during the months of June, July, August, and September of 2001. In total, over 4 million customers participated in the program resulting in savings of over 3,000 MWs per month. The consumers who participate in this program get a double incentive for conserving electricity since they pay a lower bill for their actual energy use and then receive an additional credit of 20 per cent for achieving the savings goal.

The results of the California energy conservation and demand reduction programs have been impressive. The September, 2001 weather-adjusted load reduction, including growth for the region, was over 3,100 megawatts, the equivalent of 12 of the proposed Port Alberni natural gas power plants. Efficiency obviously has a role to play in the California energy market. It should have a similar role in BC.

Our nearest comparable neighbouring utility, Seattle City Light has also chosen to aggressively pursue energy conservation measures. They have are attempting to reach an objective of reducing their energy use by 10 per cent over one year. By June, they reached a 6.5 per cent goal with four out of 10 households reducing their energy use by more than 10 per cent, thereby saving the city US$65 million in energy purchases. In one innovative program the utility offered free compact fluorescent lights which resulted in savings of 45,500 megawatt hours[119].

Reinventing PowerSmart: Conservation and Efficiency in BC Hydro

BC Hydro has stated its intention to re-engage Power Smart with the intent of capturing significant electricity capacity and energy through conservation and efficiency. Most recently the new Chair and CEO of BC Hydro, Mr. Larry Bell, stated in the Vancouver Province on September 9, 2001 that

“Conservation is the most cost-effective source of new energy we have and there's a potential to save 15-20 per cent of our current consumption down the road. That's probably about one-and-a-half Site C hydro projects so we're talking about a lot of electricity here." This would equal 1,300 megawatts and would be more than five times the output of the proposed Port Alberni power plant.

This is a welcome change in attitude which will serve BC ratepayers and the environment well and must be encouraged through this policy review. Until recently Powersmart was a terminally ill program at BC Hydro. As can be seen from the budget analysis, BC Hydro was allowing Powersmart to die a slow death with ever decreasing funding and ever smaller results.

Power Smart Budgets ($Millions) and Electricity Savings

Year	Budget (Millions)	Energy (GWh)
1989	11.9	45
1990	44	182
1991	50	431
1992	62	373
1993	52	402
1994	54	331
1995	28	248
1996	24	300
1997	18	274
1998	9.2	165

This chart demonstrates how expenditures and savings are linked and shows that, once momentum is generated, savings continue to accumulate for a brief period after the budgets decreased. It is also apparent that a certain amount of time was required before decreases in energy use occurred. However, as the California experience shows, if a significant investment is made in efficiency and conservation, immediate and long term reductions can be quickly achieved.

By applying the California zeal and the previous experiences of PowerSmart to Vancouver Island and the rest of BC, we believe that BC Hydro can avoid the need for natural gas turbines, the GSX pipeline and the expenses of transmission replacement. This would be doubly beneficial as it would also avoid the financial liability of the carbon dioxide emissions associated with natural gas turbines and avoid the price volatility of natural gas markets.

BC Energy Policy

“The goal of energy policy should not be cheap energy prices, but cheap energy services.”[120]

In recent years the principal objective of BC energy policy has been the maximization of government revenue through royalty collection, dividends and water rentals. In essence, policy has focussed on marketing energy commodities. As a result, key public concerns regarding energy use and production, as well as long term price stability, have been ignored. While BC Hydro customers have enjoyed a rate freeze since 1996, information regarding the long term energy supply choices and financial status of BC Hydro has not been publicly reviewed through a regulatory process since 1994.

We need to develop and implement policies which reduce energy demand, save consumers money and reduce emissions. In fact, this is not only necessary but it is also good for the economy, as earlier energy crises demonstrated. In fact, due to energy price increases in the 1970's, the energy intensity of the economy actually decreased. Fuel prices forced companies to become more energy efficient and government regulations forced manufacturers and home builders to produce more efficient products. As a result, between 1973 and the present, economic productivity outpaced growth in energy consumption by 25 per cent. Energy consumption per dollar of GDP fell from 16.57 megajoules in 1973 to 12.41 megajoules in 1997.[121]This means that the economy used 0.5 litres of gasoline per dollar of GDP in 1973 and 0.34 litres of gasoline per dollar in 1997. Without that efficiency gain Canada's total energy consumption would have been 35 per cent higher for the same level of economic activity. In all likelihood that level of economic growth could not have taken place since some of the expanded economic activity happened due to increases in energy efficiency. More energy was saved over that period than all of the new energy supply from new oil, gas, coal, nuclear and hydro resources combined.[122] The US Department of Energy estimates that energy savings resulting from efficiency gains in the US during this period are currently saving the US between $150 and 200 billion per year.

Recently, the Union of Concerned Scientists released a comprehensive report on US energy policy which highlighted a series of key measures aimed at diversifying US energy supply. Through a combination of renewable energy portfolio standards, improved energy efficiency standards, enhanced building codes, net metering, tax credits for efficiency and tax incentives for renewabkle energy, the US could reduce carbon dioxide by 60 per cent from projected 2020 levels and save consumers $440 billion.[123]

We believe that similar savings from energy efficiency efforts are available to British Columbians. The following specific policy recommendations can form a foundation for the development of energy polciy which provides economic and environmental benefits. Such policy will further enhance BC's competitive advantages and protect future generations from energy security concerns, price fluctuations and from environmental and health impacts.

Specific Policy Recommendations

- **A Public Benefits Wires Charge**

One means of ensuring that energy conservation and efficiency programs receive adequate funding is to adopt a non-bypassable systems benefits charge on the electricity and/or gas distribution system. In the United States, 17 states have passed legislation which includes this type of funding mechanism. We believe that such a charge can be used to develop a province-wide fund to invest in specific efficiency measures and that BCUC oversight could be used to ensure that funds are invested appropriately. This can provide an optimal level of conservation throughout the province since programs, funding levels and program evaluation would receive regular and accountable public review.

While BC Hydro has, in the past, performed exceptionally in the conservation and efficiency area, in recent years there has been the above-noted aversion to making substantial or meaningful investments in these programs. In part this was stated to be a response to the potential threats of retail competition for electricity customers. As an alternative to the public benefits charge the provincial government, through the Minister of Energy, could direct BC Hydro and the BCUC to set conservation targets aimed at minimizing energy waste and the need for large infrastructure investments. Again, public accountability and involvement would be necessary to ensure proper oversight.

Some of the programs which we believe are appropriate for funding through a BC public benefits charge or through regulated utility rate base funding are included in Chapter 2, Commercial and Industrial Energy Reduction Measures, found in the David Suzuki Foundation publication: "Climate Crisis: Energy

Solutions for BC". These include programs aimed at improving the efficiency of commercial and institutional building heating and cooling as well as lighting and other operations.

- **Improving the energy efficiency of residential and commercial buildings**

Canada's R-2000 and C-2000 program for building efficiency should be adopted as provincial residential and commercial building standards. This standard would ensure that BC's housing and building stock becomes 35-40 per cent more energy efficient than today's conventional buildings, resulting in major, ongoing economic savings as well as environmental savings.

This will not only help reduce the need for fossil fuel fired power plants, but will also reduce demand for natural gas, which in turn helps natural gas compete with coal for utility power projects.

In addition, BC can assist and encourage the residential, commercial and institutional building sector by providing support for retrofit projects throughout the province, thereby providing real security against the higher energy prices that are arising from the overheated continental energy market At the same time, building retrofit projects are significant sources of new employment and, in commercial and industrial settings, often result in productivity gains that flow from improved lighting, ventilation, and indoor air quality.[124]

The Toronto Better Buildings Partnership exemplifies the best in commercial building retrofit programs. The Buildings Partnership uses innovative financial strategies to engage building owners, the energy services community, the financial community and the financial services industry. Since 1996, 467 buildings have been retrofitted, creating 3,800 person years of employment, saving $19 million per year and reducing 132,000 tonnes of greenhouse gas emissions.[125] Through energy management firms building owners gain access to pools of capital from private sector lenders or from the firms themselves.

The province can assist by financial and program support to local and regional governments, school and health districts, universities and colleges and in all other institutions receiving public funds. BCBC and private sector specialists are already recognized as international leaders that can assist these other building owners and managers. For public institutions, this offers the opportunity to significantly reduce operating costs, as efficiency gains in the 30-60 percent range are usually achievable.

- **Regularly review and update standards for major appliances and industrial equipment**

Provincial governments are responsible for regulating the efficiency of approximately 25 per cent of the appliances in Canada including some home heating appliances. Standards create the economies of scale which transform the market for high efficiency equipment. As the market place changes and more efficient equipment is developed standards must be implemented which raise the basic level of energy efficiency. This allows for, and encourages, continuous improvement. Without such improvements in standards, newly designed equipment is less price competitive, even though consumers save money over the long run due to reduced operating costs. Within the existing supply of appliances and equipment most of the manufacturers' capital costs have been recovered, therefore, the poorest performing equipment continues to be priced lower than newer designed, more efficient equipment.

Updated standards remove that disadvantage against innovation and technological improvement and encourage constant upgrading, thereby cutting energy waste and the costs of that waste. For example, the $12 billion that the US Department of Energy has invested in energy efficiency since 1978 is estimated to have saved US consumers $100 billion in avoided energy expenditures.[126] These savings from avoided waste continue to accrue to customers every day. By reducing energy demand through improved standards, the financial and ecological costs of energy development and use are likewise reduced.

- **Economic instruments**

As a means of encouraging the adoption of renewable technologies by utilities and other users of electricity, and in order to achieve the Kyoto climate treaty target in a cost effective manner, the federal government should quickly implement an economy-wide economic instrument such as a carbon tax, or a domestic carbon trading system with an enforced national cap on overall emissions. This would help begin the process of integrating the 'external' environmental cost of fossil fuel pollution into the market price for energy and thereby eliminate some of the unfair advantage which is currently enjoyed by fossil fuels. BC should continue to actively participate in the national discussion on designing and implementing appropriate economic instruments for meeting greenhouse gas reduction targets.

There are many examples of both carbon tax and 'cap and trade' systems in industrialized nations that can inform the development and implementation of either or both policies in Canada. Many incorporate revenue recycling features that utilize new energy-related revenues to fund efficiency improvements and cost savings that, in turn, balance new energy prices and/or taxes. The challenge for Canadians is to move forward gradually now with these approaches, so as to avoid more difficult 'shocks' in energy costs later. While actions on climate change and sustainable energy policies can obviously be delayed, they are inevitable and our society can more easily handle planned, gradual changes.

- **Promote and encourage renewable energy sources**

In order to support the renewable energy industry, the BC government should encourage the development of low impact renewable sources of electricity such as wind, solar and micro-hydro through specific initiatives such as net metering and portfolio standards. These will encourage utilities to purchase renewable energy, or to encourage producers to build new projects. This would help curtail the growth in fossil fuel electricity generation and reduce greenhouse gas emissions and other air pollutants.

It is worth noting that wind power is increasingly competitive with new natural gas-fired sources of electricity in many North American jurisdictions and is now the fastest growing source of new energy in the world, sparking major new industries and technological development. Rapid growth is also underway in the solar, biomass (wood and agricultural waste), micro-hydro, ground source, and geothermal energy sectors. Research also promises more advances in wave, tidal and hydrogen-based energy. With innovative policies, BC could be well placed to enjoy growth in all of these renewable sectors.

- ♦ **Net Metering**

Net metering allows utility customers, such as individuals, institutions, businesses, or governments to use renewable technologies to generate up to 150 kilowatts of power for their needs and feed excess power back to the utility when producing more electricity than is needed. This would cause the electric meter to run backwards, reducing the customer's electricity bill. When the energy source is not available, the customer uses electricity from the utility system and the meter runs forwards. At the end of the billing period, customers pay the utility for their net electrical consumption. In some instances, the utility may even pay the customer if a surplus of power is produced. To take advantage of the renewable energy sources all around us, government must require utilities to implement a net metering program.

In particular, we recommend that the BC government direct BC Hydro to develop a net metering program and a financial assistance program for small-scale renewable energy projects. The government should also implement a tax incentive for consumers who invest in renewables. An arrangement with commercial lending institutions should be set up to provide capital financing for renewable energy technologies, similar to the energy efficiency financing mechanisms available through utilities today. This will allow British Columbians to benefit from the province's tremendous renewable energy resources, leading to reduced urban air pollution and greenhouse gas emissions, lowered demand on the electric utility grid, and smaller electrical bills for the consumer. Net metering is already in place in two provinces and 34 states. The David Suzuki Foundation publication "Clean Power at Home" which analyses this issue is available at: http://www.davidsuzuki.org/Publications/Climate_Change_Reports/default.asp#Clean.

- **Portfolio Standards**

Net metering is only one element in a wide array of potential mechanisms for taking advantage of renewable energy in British Columbia. These include renewable energy portfolio standards, which require electrical utilities to purchase renewable energy; environmental cost adders, which equalize the cost of renewable energy sources; tax rebates and incentives for renewable electricity producers; and equipment financing-mechanisms.

For example, the Texas renewable energy mandate requires that utilities build 2000 MWs of new renewable capacity by 2019. The program has a series of targets beginning with 400 MW in 2002, 850 by 2004, 1400 by 2005 and 2000 between 2008 and 2019. Another 11 states in the US have similar programs. In Germany the "100,000 PV Roofs" program provides a no interest, 1 year no payment loan to promote the adoption of photovoltaic generation. The program requires utilities to pay 99 Pfennigs or Can $0.72 per kwh. Japan has a similar program. In California photovoltaics are promoted with a "buy-down" program that sees the state pay for half of the cost of an installation and requires utilities to allow net metering. Together policies such as these can make renewable energy sources cost-effective and desirable.

These policies can help BC meet greenhouse gas reduction targets in a cost-effective manner by reducing the use of fossil fuels to generate electricity. By nurturing a provincial renewable energy industry, British Columbia will be well positioned to take advantage of emerging energy markets worldwide. Today, approximately 2 billion people are without electricity. In many instances electric utility infrastructure is absent, and renewables offer the best and lowest cost opportunity for electrification. By facilitating the growth of the BC renewable energy market, we can develop the export potential for these emerging technologies and new industries.

Renewable energy sources offer clear economic and environmental benefits to electric utility companies, shareholders and customers. To the extent that renewable energy resources contribute to the avoidance of potential future fossil fuel liabilities then they provide tangible ratepayer benefits for electric utility customers. While there may be an immediate upfront capital premium paid for some renewable energy resources, that premium must be considered as a wise investment which can help mitigate the risk of higher rates caused by future fossil fuel penalties and which reduce the cost of various pollutants. The quantification of this ratepayer benefit can be made explicitly through a properly designed, open and accountable, resource planning process.

To date, BC Hydro has committed to acquiring up to 10 per cent of its new resources from small scale renewable energy projects, if they are commercially competitive and cost effective. One can only assume that any utility would purchase all of its energy from these sources if it met these criteria, since they have no future greenhouse gas liability. While this policy is a welcome first step it must be noted that this is a "voluntary" program designed to mitigate greenhouse gas emissions, and can be dropped at any time by the utility, unlike the regulated portfolio standards adopted elsewhere.

- **Electric and Gas Rate Design**

There are many examples of creative rate designs in the utility sector which send price signals to customers in an effort to curb consumption at key times or to reward conservation. Those familiar with the regulated utilities know that the system is designed to meet peak requirements. Since many components in the current utility infrastructure are designed and built to economies of scale they require significant capital investment. Often utilities have to overbuild their systems and have excess capacity as a result.

However, few economists consider this investment to be imprudent due to the future benefits which accrue to ratepayers due to economies of scale. Once these systems has been built there is little or no incentive for utilities to optimize the efficiency with which a pipeline, transmission line or power plant is used, since they must reach minimum capacity levels to justify the infrastructure investment. As such, the time to promote demand reduction is before these large, expensive investments have been made. In the case of Vancouver Island, and indeed, throughout BC, that would be now and in the near future.

Electricity real time pricing along with demand rates for natural gas will send the correct price signal and minimize the need for large capital investments in transmission upgrades or the need for the new gas pipeline. For example, large natural gas customers currently receive gas at a reduced rate in exchange for giving up the right to pipeline transportation capacity on days when the utility requires extra deliverability for core residential customers heating requirements. This allows the utility to avoid having to expand pipeline capacity to service all of its potential customers, thereby providing economic savings to all of its customers.

Real time pricing allows customers that have the ability to vary their use over a given period, the option of reducing their usage when the price is high. Again this allows the utility to price the use of its system in a way that avoids the need for costly upgrades, such as BC Hydro's current Vancouver Island pipeline/gas turbine projects. We recommend that the BC government direct BCUC to utilize rate design as a tool for conserving capacity and energy.

- **Utility Line Extension Policies**

The formulas and polices which utilities use in evaluating the size and timing of electric and gas extensions into new residential and commercial developments can send a correct or incorrect price signal regarding the type of development which takes place in a new subdivision or industrial park. By factoring in the long term resource costs of supplying gas or electricity to particular developments, the utility can work with developers to determine that is in the best interest of future occupiers of the development. For example, a small distribution system with a form of combined heat and power may offer the best utility service to that development.

Rather than building transmission systems on a requested basis, utilities should engage in pro-actively working with planners, developers and builders to anticipate and build for power needs that best match the community's requirements with the aim of reducing those requirements. Since utility ratepayers have no choice but to pay for the system, and since all British Columbians pay for the environmental costs associated with unnecessary energy consumption, regulators and policy makers should ensure that such investments are made with the public interest in mind.

- **Upstream Oil and Gas Emission Reduction Opportunities**

While emissions from the combustion of oil and gas as energy sources are well known, the consumption of fossil fuel during the production and processing of these fuels, in preparation for marketing, is often omitted from considerations regarding fuel choice. In addition, atmospheric emissions of methane, the principal commercial constituent of natural gas and a powerful greenhouse gas, during the production, processing and transportation of natural gas, is a major contributor to global warming. This is well recognized within the gas industry and, apart from the obvious commercial benefits from conserving methane, numerous measures have been adopted by leading edge companies in an effort to prepare for compliance with a greenhouse gas reduction regime. However, many of these measures are voluntary and there is a great deal of scope to expand mandatory, universal application of these technologies and techniques in the BC oil and gas industry.

In 2001, the David Suzuki Foundation commissioned the Pembina Institute for Appropriate Development to investigate the conservation and efficiency measures and practices adopted by gas companies in

Alberta and BC. The resulting report, “Reducing greenhouse Gas Emissions from Oil and Gas Production” found at:

http://www.davidsuzuki.org/Publications/Climate_Change_Reports/default.asp#Bcsolutions

contains numerous recommendations for improvement this industry. Some of the measures include:

- Reducing emissions from equipment leaks by minimizing the number of leak points and performing more regular leak detection and repair activities.
- Collecting and processing gas which might be flared during testing or maintenance.
- Increasing the overall energy efficiency of buildings, plants and general operations in the industry.

We urge provincial attention to this expanding sector with a view to curbing emissions of all forms – many of which relate to community health concerns that are tied to conflicts within gas-producing regions.

- **Transportation: Cleaner Options**

In BC, personal and commercial transportation is responsible for the largest and a growing portion of fossil fuel energy use, air pollution and greenhouse gases. In part, this size and growth arise out of the nexus between consumer and corporate choices on the one hand and the lack of meaningful regional co-ordination between urban planners and zoning agencies on the other. As well, patterns in business inventory, warehousing and trade have significantly added to freight truck use.

Fuel consumption is rising due to purchasers responding to marketing campaigns for bigger, less energy efficient vehicles. Auto manufacturers are using these aggressive marketing campaigns to advance these vehicle choices due to the immense profit margin associated with the bigger vehicles. The distances travelled in these bigger vehicles are also increasing, leading to greater overall fuel consumption. This is partly due to the market’s largely unfettered response to the demand for affordable, single family housing, which results in the phenomenon known as “urban sprawl.” This sprawling residential development is not exclusively “big city” problem, but manifests itself throughout all areas of BC including many towns and small cities.

In addition to these personal transportation problems, more and more companies are using highways, instead of railroads, for freight transportation which is leading to more stress on roads as well as drastic increases in the amount of diesel fuel being used in BC, which in turn results in more air pollution of all forms, with associated health impacts.

As an energy policy problem, the transportation issue is often difficult to address. Understanding how energy policy relates to urban sprawl, or vice versa, is a puzzle to most regulators and frequently to public officials and individual citizens. Some consider urban sprawl a pollution issue that requires federal intervention through the “tailpipe” regulation of automobiles. Others consider it a transportation and planning issue within the bailiwick of municipal or regional agencies who choose which types of communities get built within their jurisdiction and which type of transportation systems get priority. Still others prefer to believe that it is an architectural response to consumer demand and, therefore, a market solution to housing preference which is beyond regulation.

In truth, urban sprawl and energy use for, and pollution from, transportation are intrinsically linked. In a carbon constrained economy energy policy will be restricted by sprawl. Runaway growth in energy use for transportation, caused in part by urban sprawl, will reduce the ability to achieve our greenhouse gas emission targets and therefore reduce opportunities for growth in other sectors of the economy.

If provincial energy policy is based on the principles of demand side management, curbing urban sprawl is an achievable policy objective. By establishing the legislative and financial framework to allow the integration of transportation demand and land use planning as tools to mitigate the environmental and social impacts of sprawl, transportation energy waste and costs are reduced and the incremental growth of other energy sectors within the economy can be offset while meeting our greenhouse gas mitigation commitments.

In addition to curbing sprawl, the province must address rapid growth in vehicle emissions and vehicle populations by significantly and constantly expanding public transit (and actively urging federal funding for it), increasing intermodal passenger connectivity (eg. BC Ferries and bus services), working to encourage US and Canadian federal governments to improve auto fuel efficiency standards (the average new vehicle efficiency has declined 13% in the past decade). Instituting vehicle tax policies based on fuel efficiency and emission levels.

In regard to highway freight transportation, growth in this sector has implications for energy consumption, air pollution and highways safety and maintenance. An analysis completed for David Suzuki Foundation in 2000 found that a 20 per cent shift in freight to rail from roads by 2015 would reduce direct public costs by $63 million and reduce greenhouse gas emissions significantly.[127] Clearly these costs should be considered as part of the price we pay for energy use and through creative policy measures these costs can be captured and their impacts reduced.

Some of the measures which we have proposed for this area of energy use include:

- Pooling urban delivery systems by having several firms combine their pick-up and distribution, based out of an intermodal freight terminal and distribution centre.
- Establishing new short-line railways which take truck traffic off the highways in key regions.
- Using road pricing based on truck weight and distance travelled to end existing subsidies, provide a level playing field with rail and more fully recover road damage costs not covered by truckers' fuel taxes and other fees.

Jobs, jobs, jobs

BC is at an important point in the determination of energy policy, which, by definition, will largely shape the policy on climate protection as well. Public policies can be developed and implemented that put our national commitments on climate change first, climate science first, and public health first, by moving to energy efficiency and renewable energy sources.

There are significant employment benefits arising out of greenhouse gas reduction strategies and programs which promote the efficient use of energy and resources. In the freight transportation sector there are opportunities for increased employment in the development of alternative fuels, fuel cells, more fuel-efficient vehicles and better management processes between modes such as truck and rail. Similarly reducing greenhouse gas emissions in the upstream oil and gas industry generally results in an overall increase in employment particularly in higher skilled jobs. For example, there are increased employment opportunities for engineering and construction jobs for upgrading and replacing key components for oil and gas extraction and processing units. There is also an increased need for technical and field staff resources for power balancing, testing and leak detection and repair programs. Highly trained staff and operators will also be needed to install, maintain and operate centrally operated control systems.

Increasing the energy efficiency of residential and commercial buildings, as well as commercial and industrial operations, will also lead to increased employment throughout BC. <u>While directing investment towards improvements in energy efficiency results in a decrease in the need for energy supply projects</u>

and power plants for domestic supply, the net result is an increase in overall employment and economic activity. A 1993 study commissioned by the BC Energy Council on the employment impacts of investments in energy efficiency found that, when compared with traditional energy supply projects, investments in energy efficiency create:

- Similar numbers of direct and indirect jobs but create about twice as many total jobs, due to the respending of cost savings
- Jobs that better match the skills of BC's unemployed and, therefore, make a much large contribution to reducing BC unemployment
- Jobs whose geographical distribution better matches that of the BC population, rather than jobs that are concentrated in less populated areas.
- Jobs that, on average, last longer.

The study also found that construction-related measures (e.g., improved insulation, window replacement) tend to produce more direct and indirect jobs per investment dollar than the substitution of more energy efficiency equipment (e.g., lighting or motors). [128]

Similar work by the Pembina Institute found even greater disparity between job creation for energy supply in comparison to energy efficiency. Pembina reviewed 30 studies and research reports on job creation from energy related projects and found that energy efficiency investments created 35 person years of employment per million dollars invested, compared to seven person years of employment for similar investments in conventional energy resources.[129]

Government can further enhance the environmental, economic and employment benefits in all of these sectors by developing greenhouse gas reduction policies which :

- Encourage industries to proactively pursue their own research and development into equipment and process-related improvements
- Support BC firms with the ability to pioneer new technologies (e.g. Ballard fuel cells)
- Support energy efficiency in houses and businesses
- Keep research and development dollars in BC and help to preserve and develop high technology jobs. [130]

BC Energy Policy in a Carbon Constrained World

Canada has expressed a willingness and a desire to ratify the Kyoto Protocol. In fact it is almost certain that the targets and timetables outlined in the Protocol will become law in Canada. As noted in a recent speech by the Prime Minister:

> *"I am confident that the agreement reached this weekend in Bonn opens the way for Canada's ratification of the Kyoto Protocol next year, following full consultations with the provinces, the territories, stakeholders and other Canadians."*
>
> Right Honourable Jean Chretien, Prime Minister, July 23, 2001

A critical question for the BC Energy Policy Task Force is how Canada's Kyoto commitments impact on the future energy choices facing this province. We have undertaken to present the Task Force with our research and analysis concerning the opportunities and liabilities particular to BC in a carbon constrained world. Specifically, we hope that BC will do its part to become Kyoto compliant and in so doing, position itself as a winner in the 21st century economy.

To date, this has generally been presented as a painful, expensive process that threatens economic and social stability. In fact, those descriptors apply to the policy of ignoring climate change. The need to address the challenge of multiple goals in the mix of climate and energy policies should not be dismissed. In fact, it can and must be met. However, the majority of current models that drive the 'economic disaster' scenarios by and large ignore the benefits of positive climate protection actions, ignore the costs of conventional energy policies, and are based upon assumptions of economic development that often ignore technological innovation. As one former member of US President Ronald Reagan's Council of Economic Advisors has written, "The restrictive assumptions made for mathematical convenience in most economic models are not innocuous; they skew the policy process toward passivity and inaction".[131]

Increasingly, in jurisdictions throughout the industrialized world and in many without the options and flexibilities that BC enjoys, this multiple-goal challenge is being met and met with success. The co-benefits of energy security, new industries, new jobs, cleaner air and improved public health conditions are being factored into decision-making and are being realized. This aspect of energy and climate policy considerations must be front and centre in this process to fully allow for the rapid development of new techniques and technologies that exist toady and that hold many of the answers that will take us beyond a narrow conflict between climate protection and fossil fuel expansion.

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