FRASER INSTITUTE **Digital** Publication

February 2008

A Vision for a Continental Energy Strategy

Ralph Klein and Brian Tobin with Gerry Angevine

THE FRASER INSTITUTE

1 Introduction

We are greatly honoured to have been asked by The Fraser Institute to work together to guide the Institute's North American Continental Energy Strategy project. We expect that the Continental Energy Strategy project will have a significant and measurable impact on public debate regarding the development of energy resources and the benefits that can be expected to flow from increased intra-continental energy trade. In particular, this project will help to define the appropriate roles for the public and private sectors in the development of energy resources, and the bounds of public policy in this regard.

The continental energy strategy that we shall be working towards will focus, for the most part, on prospective policy changes that would allow the continent's energy markets to function more efficiently and would provide greater opportunities for energy commodity trade among Canada, the United States, and Mexico. Governments, on behalf of the citizens who own the energy resources, have an important role to play in ensuring that the policy framework pertaining to energy resource investment, development, production, consumption, and trade is stable, fair, and appropriate. If additional investment were attracted to the energy production and transportation sectors, then that investment would bring economic benefits, including employment and income growth, as well as greater choice for consumers as they decide how to meet their energy requirements.

Because market forces will determine the most efficient allocation of our energy resources, our objective is not to put detailed energy production and trade targets forward. Rather, we wish to contribute to the energy policy debate to ensure that the policy settings and institutional arrangements are appropriate for facilitating expansion of the continent's energy supply capacity—subject, of course, to competition from other sources of supply.

The continental energy strategy that we envisage is one that is clearly focused, first and foremost, on policy measures that will facilitate private energy investment that benefits Canadians. Accelerated investment in the development of Canada's energy resources that takes advantage of export opportunities holds considerable promise. Such investment would improve Canada's economic performance and contribute to improvements in the quality of life of all Canadians.

More broadly, the development of a comprehensive North American energy strategy that supports a business environment conducive to increased development and production of the continent's resource base, to the extent that market conditions allow, will bolster the security of energy supply in all three countries. Furthermore, if the continent's advantages in relation to the supply of energy commodities such as uranium, coal, and bitumen from oil sands allow us to increase our reliance on them, then the resulting direct and indirect economic benefits will help improve living standards in all three countries.

Canada, as one of the continental partners, likely has the greatest potential to become a world energy leader due to its hydropower potential, proven nuclear power technology, and large quantities of uranium and hydrocarbon reserves, including coal, oil sands bitumen, coal-bed methane, and "frontier" petroleum reserves.

For its part, the United States has relatively little remaining hydropower potential and has depleted much of its growth potential with respect to domestic supplies of natural gas and crude oil. The United States does, however, still have considerable conventional petroleum reserves yet to be developed in Alaska and offshore, and substantial reserves of non-conventional oil and gas, such as coal-bed methane and petroleum associated with shale formations.

Mexico, the third partner in this continental energy strategy, is also facing increasing natural gas shortages as well as rapidly growing demand for electricity. More importantly, there is concern that Mexico may not be able to maintain its current rate of oil production, a direct result of its state-directed model of economic development.

In order to meet these and other challenges, the three countries have developed considerable petroleum pipeline and electric transmission connections to facilitate cross-border trade, but a great deal more can be done to facilitate transnational energy commerce.

This report presents our vision for a North American-based continental energy strategy and includes what we regard as the fundamental elements of that strategy. These elements, such as greater energy supply security and energy and environmental policy compatibility, will be examined in a number of separate papers that culminate in a special report with recommendations for a continental energy strategy. We plan to publish these discussion papers between now and the fall of 2010, at which time a final paper will be released and the program will, ideally, move to a new stage, perhaps on a more formal tri-national basis. From now until publication of the final report, The Fraser Institute's focus will be on research leading to the publication of papers focused on the "cornerstone" subjects noted below. Potential topics for these papers are:

1. The North American Energy Supply Potential;
2. Compatibility of Energy and Environmental Policy;
3. North American Energy Security;
4. People Issues in Relation to the Development and Construction of Energy Projects;
5. Regulation in the North American Energy Sector; and,
6. Financing North American Energy Investment.

2 The need for a continental energy vision and strategy

A number of current global and intra-continental factors affecting North America's energy sector suggest that the development of a comprehensive energy strategy is important at this time. These factors—including policy considerations, certain aspects of international agreements pertaining to North American energy trade, and the current geopolitical situation—are discussed in this section.

Energy market developments

In the last 10 years, the most significant factor affecting the continental energy sector has undoubtedly been the remarkable increase in the prices of crude oil and natural gas. This increase has been necessary in order to balance growing global and continental demand in the face of slower production growth.

The higher prices are generally having a very positive impact on the attractiveness of investment in the production and refining/processing of crude oil and natural gas, and, especially, in the development of oil sands. However, analysis of the impact of the higher price levels on continental energy consumption, investment, and trade, as well as consideration of the possible implications for Canadian and continental energy policy, are needed.

Policy considerations

North America has a large energy resource base, yet it is becoming more dependent on low-cost imported supplies of oil and natural gas. For this reason, policy settings and institutional arrangements need to be reviewed by governments so as to ensure that they are appropriate for attracting the investment required for energy development, production, and transportation projects. Considerable investment will be necessary to effectively reduce the continent's dependence on unreliable regions for the energy supplies warranted by market conditions. Such investment would improve energy supply security, reduce the pressure on energy commodity prices, and allow Canadians, in particular, to enjoy continued employment and income benefits from an expanding energy sector. Policy changes should not be implemented with the intention to distort trade patterns, as with tariffs on non-continental supplies or on economically-beneficial activities. Instead, these changes should be implemented with the intention to open the economy to the greatest extent possible and to reap the benefits that result from investment, trade, and wealth creation.

The three national governments have committed, through the Security and Prosperity Partnership of North America (SPP), to working towards defining the fundamental elements of a long-term continental strategic framework which would support further integration of North American energy markets. Hopefully, this framework will lead to broader regional and continent-wide markets, and increased opportunities for the convergence of energy commodity markets. If markets converged, consumers would pay less for the energy they consume and would be able to switch from one energy commodity to another more readily because of greater efficiency and technological developments.

In addition to contributing to the convergence of North America's energy markets, a long-term continental energy strategy would signal to international investors that North America, which already offers a stable policy environment with less risk than competing world regions, is determined, not only to maintain, but to improve its advantage. A low risk environment would put developers of projects in North America and their financial supporters in a position to benefit from better financing terms than if they were investing in similar projects in other regions, such as Latin America. Certainly, local and foreign investors would both be more inclined to proceed with energy development projects—planned or potential—if North America's public policy framework in relation to the energy sector were clearly defined. Policy certainty in the energy sector—an industry that plans in terms of decades—is absolutely essential. A continental energy agreement and a stable North American policy framework would facilitate planning by industry and investors. Similarly, project proponents would be more comfortable in planning beyond the completion of current projects.

As current policies and institutional arrangements are reviewed, Canada must include the provincial and territorial governments in the process. In general, the provinces and territories have not been involved in important international energy policy discussions to the extent that they might have been. Canada's energy resources are most often owned by the Crown in right of present and future generations, which creates property rights issues and responsibilities for the stewardship of resources that the provinces cannot ignore. Moreover, provincial revenues and budgets for infrastructure and other spending categories, such as education, are impacted by energy project and trade developments. For these reasons, the interests of the provinces and territories need to be recognized. Provinces and territories need to be involved in discussions concerning continental energy policy objectives and the respective roles of the public and private sectors in facilitating the achievement of those objectives.

Continental energy strategy and NAFTA

Our vision for a continental energy strategy is built on the assumption that the North American Free Trade Agreement (NAFTA) will remain in place. Our vision is fully

consistent with the Agreement's objective to facilitate trade between Canada, the United States, and Mexico.

NAFTA has facilitated the flow of energy commodities across the borders and the phasing out of various tariffs and export/import fees. The Agreement was intended to create a much more integrated market—in effect, a single economic zone—and it has done much to ensure this in terms of energy trade between Canada and the United States; however, this has not been the case with cross-border energy trade between Mexico and the other two nations because Mexico was able to achieve exclusion from key aspects of the Agreement [Foreign Affairs and International Trade Canada, 2002]. For example, Annex 602.3 to the Agreement allows Mexico to retain its right to the exploration, exploitation, refining, processing, and pipelining of crude oil, natural gas, and basic petrochemicals. In addition, in accordance with Annex 602.3, all trade in energy and basic petrochemicals is reserved for the Mexican government. However, in the case of natural gas and certain chemicals where end-users and suppliers find cross-border trade in their interests, such interested parties may negotiate supply contracts. Similarly, only the state may generate, transmit, distribute, and sell electricity, and only the state-owned oil company, Petroleos Mexicanos (PEMEX), may invest in the development and production of petroleum. Furthermore, Mexico is exempt from the "proportionality" clause in Article 605 which states that if exports are restricted by one of the parties because of conservation considerations, supply shortages, or price stabilization, then the share of total supply of the commodity available for export must not fall below the average level in the previous 36 months.

As the late Campbell Watkins (1993) indicated, the lack of symmetry in NAFTA with respect to Mexico may be regarded as a flaw, but it also may be "a lever to pry open the Mexican energy sector over time in a way that would lead to greater and more efficient integration of North American energy flows." This lack of symmetry may be the beginning of a process that will eventually lead to greater Mexican participation in continental energy trade and investment [Watkins, 1993].

Another concern with respect to NAFTA is the cross-border movement of professionals, which is limited to professionals such as engineers, scientists, and educators. This issue and the Agreement's asymmetry, as well as other issues, underscore the fact that certain aspects of NAFTA require attention.

In this paper, we will not try to predict the results of future deliberations by the NAFTA signatories, but we will offer policy recommendations that could facilitate changes to the Agreement in a manner that is compatible with the objectives of a continental energy strategy. These recommendations would be fully consistent with the expectation that the energy component of NAFTA will evolve through time as implied by the "Description" part of the Agreement which refers to the enhancement of the role of energy trade through "sustained and gradual liberalization" [Foreign Affairs and International Trade Canada, 2002].

Since the signing of NAFTA in December 1992, the North American energy sector has developed, in general, under the assumption of open and free markets in the three countries, and the energy sector has been shaped by the existing regulatory framework with respect to intra-continental trade, investment, and manufacturing. As the times have changed, the need for new legislation concerning North America's energy framework has increased. NAFTA's open-ended position on the regulatory frameworks affecting energy, which essentially allows each country to do what it will, leaves much to be desired with respect to increasing the integration of North American energy policy, markets, and transportation systems. For example, North America needs an implementation plan for streamlining regulations pertaining to cross-border energy flows. Also, energy policies in Mexico, Canada, and the United States must be reviewed in relation to the changes being made in environmental policy and in other related policies, and the three countries need to strive for cohesive approaches to market, pricing, and environmental issues.

To encourage the further integration and prosperity of North America, the leaders of the three countries unveiled the Security and Prosperity Partnership of North America (SPP) in March 2005. The partnership was formed to promote and enhance the development of greater cooperation between the North American countries [North American Energy Working Group and Security and Prosperity Partnership Energy Picture Experts Group, 2006]. The SPP has been the most organized and advanced continental undertaking with respect to energy since the inception of NAFTA. Numerous working groups were established under the SPP to investigate various issues faced by continental energy sector stakeholders, including the North American Energy Working Group (NAEWG). However, the SPP has been inundated and largely stymied by six security working groups and 10 prosperity working groups, which have diluted the importance, urgency, and impact of continental energy supply issues.

The SPP has provided a number of documents that give a high-level overview of the data and needs of the energy sector. However, the SPP has not provided a pro-active agenda—with deadlines—that would facilitate increased integration and cooperation among the three countries' energy sectors. For this reason, the authors envisage a continental energy strategy that would focus on the issues that must be addressed so that North Americans can benefit from increased energy resource development and energy sector employment, and, if market conditions allow, reduced dependence on riskier foreign energy supplies.

The geopolitical situation

The increased risk of disruptions in the supply of oil and liquefied natural gas (LNG) provides another important reason to address and develop a continental energy strategy at this time. As remaining oil reserves become increasingly concentrated among

a small group of countries—notably, a few Middle Eastern producers and Russia—and as countries such as China, India, and others in the Middle East require additional supplies, increased trade will carry higher risks [International Energy Agency, 2007]. As the International Energy Agency has pointed out, oil-consuming countries "will grow increasingly reliant on imports from an ever-smaller group of suppliers" and "the risk of a major supply disruption—whether from terrorism, piracy, accidents, severe weather, political tensions or war—will increase" as a result [Birol, 2006]. In countries such as Iraq, Mexico, Nigeria, and Saudi Arabia, terrorists have recently been disrupting petroleum pipelines and processing facilities to which they have access. As LNG shipments from the Atlantic and Pacific Basins increase to meet the growing demand for natural gas, LNG supplies may also be targeted in the future [Birol, 2006]. In addition, oil supplies may be threatened if the leaders of a number of Organization of the Petroleum Exporting Countries (OPEC) members have their way. These countries—Venezuela, Iran, and Bolivia—have been pressing OPEC to raise oil prices because they believe that this would enable a substantial transfer of wealth from industrialized countries to "poor" oil-producing countries. These factors, as well as continued instability in the Middle East, put a considerable "geopolitical premium" on the price of oil and cause this price to be quite volatile.

In light of the geopolitical situation and its effect on oil supplies, Canada, the United States, and Mexico have great reason to ensure that their citizens have access to secure supplies of energy in the event of a supply crisis. A comprehensive continental energy strategy that facilitates production growth and, depending on market conditions, increases reliance on the continent's own energy sources would help to lower North America's risk exposure.

The need for a continental energy vision and strategy

Clearly, recent oil price developments, the geopolitical situation, aspects of NAFTA, and Canada's still tremendous resource development potential all suggest that considering a continental energy strategy would be particularly useful at this time. The fundamental goals of this strategy and the principles that should guide its development are discussed in the next section. This is followed by a brief overview of the current North American energy situation and a discussion of what we regard as the cornerstones of a continental strategy. We believe that the primary goal of the strategy should be to ensure that energy markets operate efficiently so that the price signals consumers and investors rely on when choosing the types and quantities of energy they consume will accurately reflect the underlying costs.

3 Principles and goals

Principles

There are a number of principles that we feel must underlie the development of the continental energy strategy. These principles are based on a recognition of the need for:

- Reliance on market price signals to allocate energy resources and on the capital needed to develop those resources efficiently;
- Free and open trade in energy resources and products, both internally and across the intra-continental borders;
- Policy frameworks that support energy market competition and innovation, and allow investors to determine production locations and define the scope of their businesses in accordance with market conditions; and,
- Limited government involvement and intervention in energy markets beyond ensuring that the policy and institutional setting is fair, appropriate, and competitive with other jurisdictions.

These important principles are discussed more fully below.

Reliance on market price signals

The vision that we have for continental energy policy is built on the principle that the government's role is to establish an appropriate policy and institutional framework within which economic decisions can be made. Energy investment, consumption, production, and trade should be market driven and conducted by individuals and business corporations, rather than the government. Energy projects such as LNG facilities, electricity generation plants, bitumen upgraders, transmission lines, and pipelines ought to be initiated in accordance with investors' and owners' market intelligence and economic analysis.[1] Economic freedom and freedom of choice will ensure that energy investment is channeled to projects that have the potential to remain viable and to benefit those employed directly and indirectly in their construction, operation, and maintenance over a period of many years. When investors risk their own money, they are less likely to make mistakes, and when mistakes are made, they suffer losses

[1] Subject, of course, to the will of duly elected political representatives at the local, provincial, and national levels.

and taxpayers at large do not. Basing critical energy project investment decisions on free market fundamentals will also help to reduce project risk and, as a result, provide stable employment and income opportunities for workers.[2]

The importance of free and open trade

The free trade of energy commodities between the NAFTA partner countries is one of the most important principles guiding our vision for a continental energy strategy. The free movement of energy between the three countries would ensure that all continental producers have access to the same market, which would provide them with the opportunity to expand their markets and benefit from the related economies. Furthermore, it would diversify the choices that are available to energy consumers and, by increasing the size of the market, would reduce the cost of energy (as long as competitive market forces rule). Opening the market to new producers and shippers would also help to ensure that consumers benefit from greater choice and increased competition.

But continental energy trade means more than just unrestricted cross-border trade of energy products. Our vision for a continental energy strategy also requires that the cross-border flow of workers needed to construct, operate, and maintain energy projects be unrestricted. Similarly, in order to facilitate project financing, the flow of energy across the border must be supported by an unrestricted flow of capital between the three countries.[3]

Supporting competition and innovation

Competition and innovation are two additional principles that are essential to the energy strategy we envision for North America. Competitive markets, in which consumers can choose from a number of suppliers and between different energy commodities and products, will ensure that the cost of energy is low relative to the cost in non-competitive markets. Where competition is insufficient to ensure that the price signals from an energy commodity market are accurate, governments must strive to enhance competition through measures that remove barriers to entry into or exit from the market.

---

[2] Where, in relation to a particular element of the continental energy strategy, obstacles prevent markets from achieving the desired outcomes, practical reforms that would help to overcome the obstacles will be put forward. Non-market solutions will be considered only if justified by the need for energy security or by some other important reason.

[3] Although foreign investment in Canada is virtually unrestricted as long as all applicable federal, provincial, and local laws and regulations are met, this is not the case in Mexico where, for example, investment in energy resource development is mainly reserved for the state. Whether investment in resource development, production, and trade by foreign state-owned or controlled companies should be restricted is the subject of considerable debate. This issue will be examined within the context of North American energy security.

A competitive environment will induce innovation as companies seek to reduce their costs, distinguish their products from those of their competitors, and grow revenue by adding new product lines. Through innovation, new opportunities for energy production and trade will evolve, increasing employment and incomes in the energy sector and providing consumers with lower costs and a greater range of choices.

Unrestricted integration of energy markets

The integration of the North American energy markets is another important principle underlying our vision for a continental energy strategy. Energy production, distribution, and service companies in the energy sectors of the three countries should have the freedom to integrate their energy businesses so that they may take full advantage of the economies of scale that result from their increased size and scope. For example, merging gas and electricity distribution activities would allow for single billing and would reduce administrative and management costs per customer.

A limited role for government

The final principle underlying our vision for a continental energy strategy is that the role of government in relation to the production and distribution of energy should be limited, given the current legislative frameworks.[4] Simply put, governments should focus on ensuring that the business environment is conducive to the development and operation of efficient energy markets.[5]

Goals

In concert with the principles discussed above—and, in particular, the presence of open and efficient energy markets—the goals of the continental energy strategy we envision are as follows:

- The infrastructure, labour supply, and capital needed for the development of energy production, refining, and processing facilities, as well as the capacity for transportation, storage, and delivery of energy commodities, should be adequate as determined

[4] As noted earlier, governments have an important responsibility: to ensure that the policy and institutional frameworks governing energy commerce are conducive to the development and operation of competitive markets that are attractive to investors and increase the array of choices available to the consumers of energy commodities.

[5] If legislation requires direct government participation in energy markets, governments should ensure that the extent of their involvement is as limited as possible, and should explore options for diminishing the role of the public sector and allowing energy markets to develop and function efficiently.

by market forces operating to the greatest extent possible under the existing institutional arrangements;

- The regulation of energy sector activity should be minimal and based on cost-benefit analysis, and its outcomes should be clearly defined and measurable; all regulations should have sunset clauses;

- The continental energy strategy must ensure economic freedom, which attracts investment in energy projects and in industries that provide energy services;

- The energy sector growth should contribute to economic growth and to improvement in the quality of life in each country;

- Citizens should be protected from sudden energy supply disruptions arising from geopolitical crises or natural disasters to a larger extent than at present through greater diversification of energy supply sources in accordance with market and economic conditions; and,

- Secure, reliable, and affordable energy for all citizens should be guaranteed.

4 North American energy use and supply: an overview

An overview of North America's current energy use and supply situation is presented in this section. In conjunction with the more detailed information regarding the energy supply potential that will be provided in subsequent analysis, this overview will allow us to reflect on the range of possibilities for intra-continental energy trade in the context of a comprehensive continental energy policy framework.

Between 1996 and 2006, the Gross Domestic Product (GDP) of Canada and the United States grew at a real annual average rate of 3.3%. The real average rate of growth of Mexico's GDP was 3.6%. The annual average rate of economic growth among OECD (Organisation for Economic Co-operation and Development) countries was only 2.6% [OECD, 2007].

In 2004, the world's total primary energy consumption (TPEC) was 446.7 quadrillion BTUs.[6] Global energy consumption is expected to increase to 701.6 quadrillion BTUs by 2030, with most of the increase coming from consumption in non-OECD countries. North America's TPEC is expected to increase 33.7% from 120.9 quadrillion BTUs to 161.6 quadrillion BTUs by 2030.

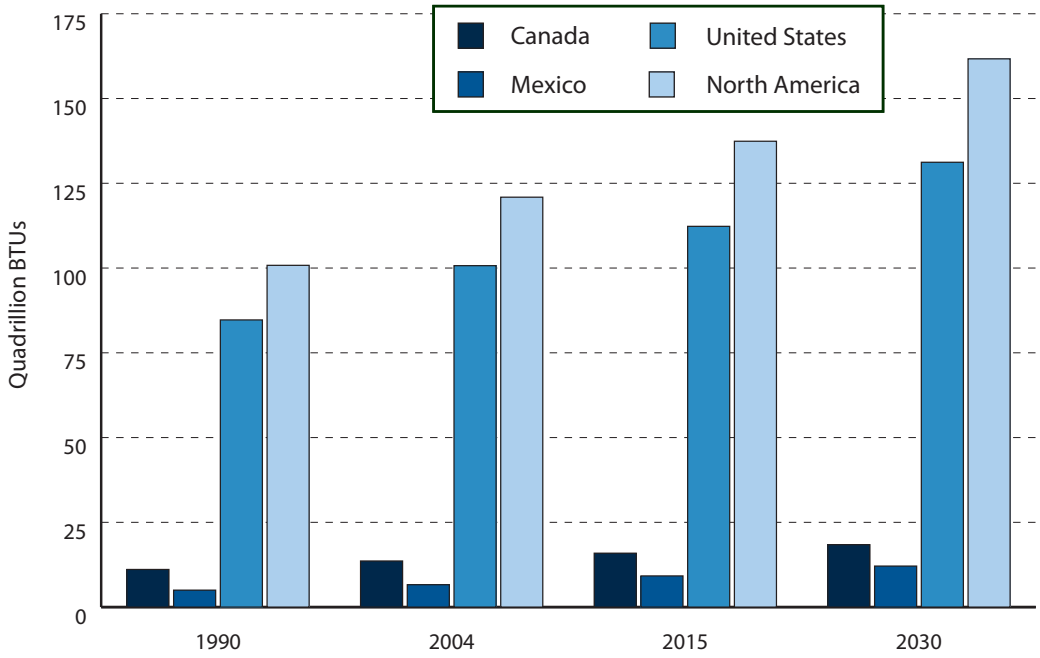
In 2004, North America's energy consumption was greater than that of European countries in the OECD, and this gap is expected to widen substantially under current policies (figure 1). Total North American energy consumption was also greater than that of China and India combined, but this is anticipated to change as early as 2015, due to a projected increase in per capita energy consumption in those countries [Energy Information Administration, 2007c]. While all of the developed OECD countries are exposed to the risk of petroleum supply disruptions, the projected energy demand growth pattern suggests that the risk faced by North America will become greater than that faced by Europe.

By way of background, it is helpful to place North America's population, GDP, and energy production and consumption in perspective. In 2004, the total population of North America was approximately 432 million people, accounting for roughly 7% of the world's population. The relative population shares of the three North American countries are illustrated in figure 2. Although the United States and Mexico will continue to experience moderate growth by 2030, Canada's population is expected to increase only marginally compared to the United States and Mexico.

Despite North America's relatively small population, the region accounts for over 30% of the world's GDP [World Bank, 2007]. Out of the 183 countries ranked by the World Bank, the United States ranks 1st, Canada ranks 8th, and Mexico ranks 14th in terms of GDP.

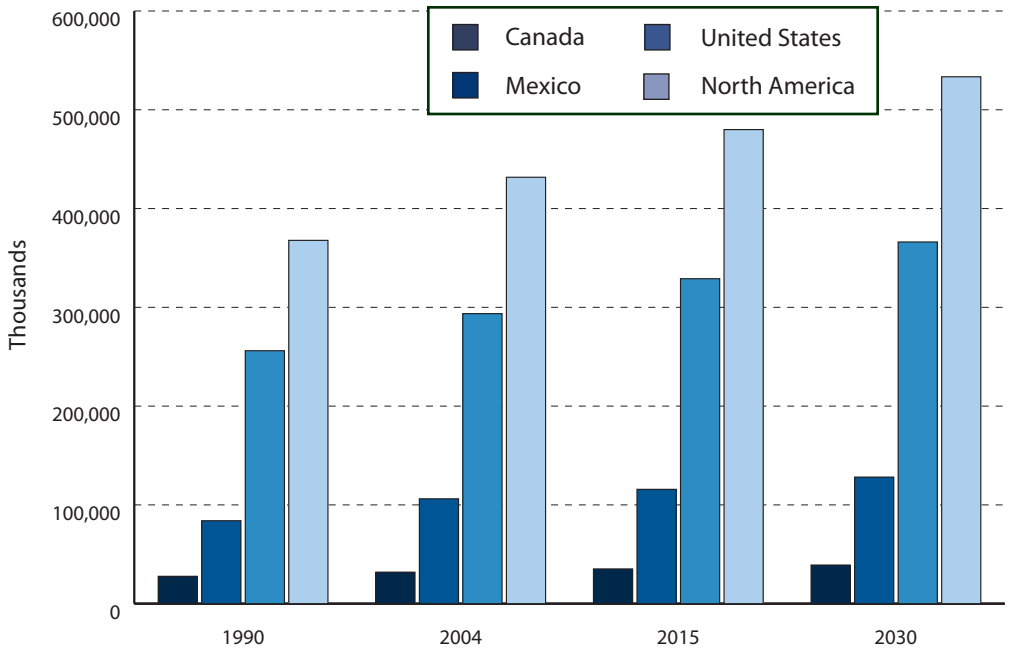
[6] BTU is an abbreviation for British thermal units, a commonly used measure of energy that is based on heat content under certain standard conditions.

Figure 1: Total primary energy consumption (TPEC) in North America, 1990-2030



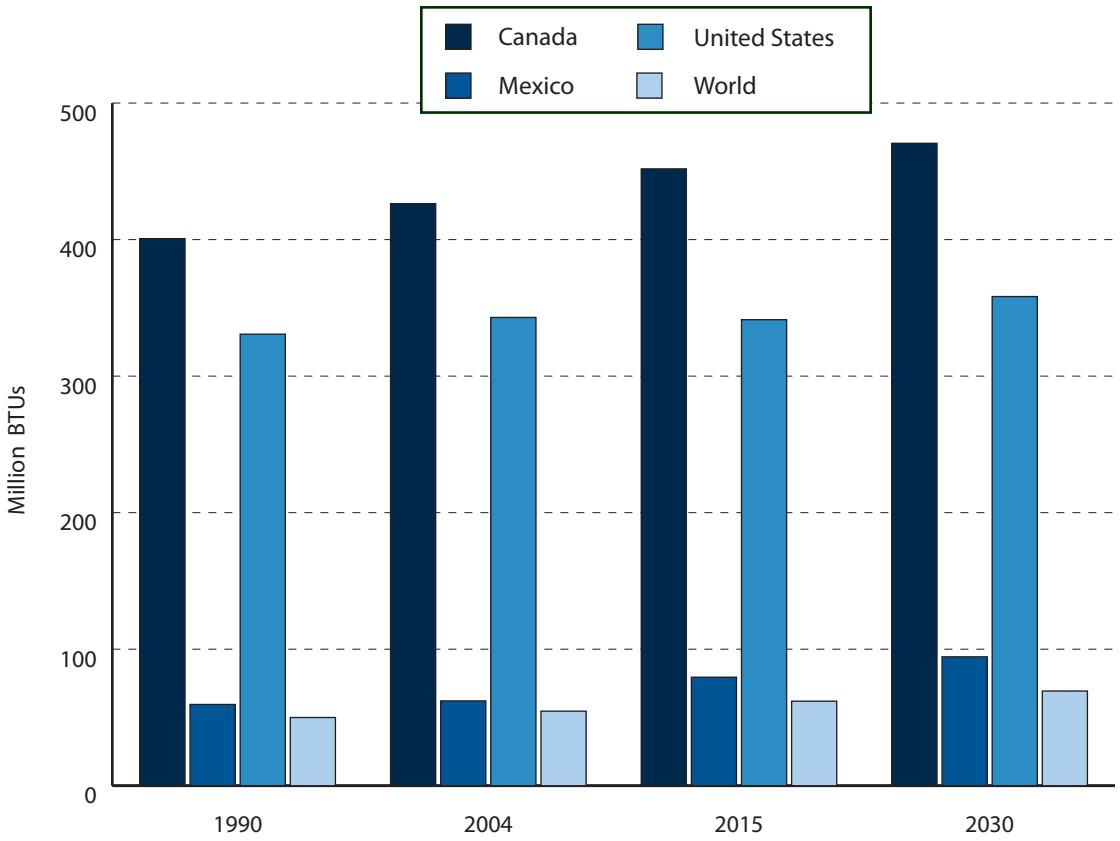
Source: Energy Information Administration (2007c).

Figure 2: Population of North America, 1990-2030



Source: United Nations (2007).

Figure 3: World primary energy consumption per capita, 1990-2030

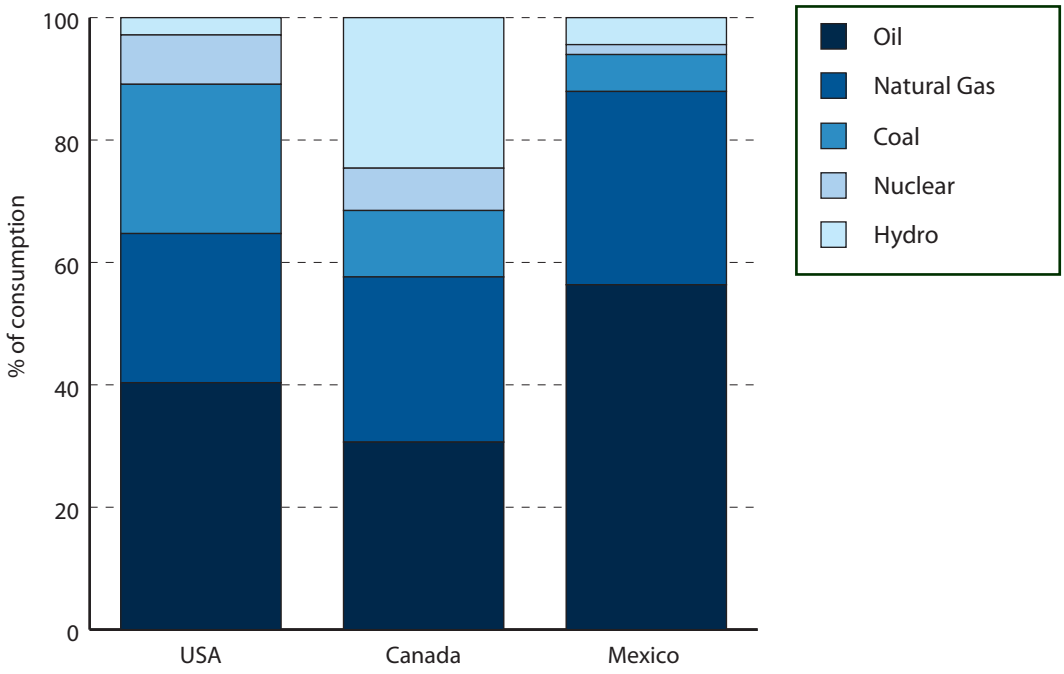


Sources: Energy Information Administration (2007c) and United Nations (2007).

The world's consumption of primary energy resources per capita was 54.6 million BTUs in 2004 (figure 3). Remarkably, North America's consumption per capita was more than five times that quantity, with Canada leading the region in consumption per capita [Energy Information Administration, 2006]. Energy consumption per capita in Mexico is much lower than in Canada and the United States.

North American energy consumption by fuel type is illustrated in figure 4. Dependence on oil is greater in the United States than in Canada, but even greater in Mexico. Mexico also relies to a much greater extent on natural gas than either the United States or Canada. Coal and nuclear power, on the other hand, both constitute greater shares of primary energy consumption in the United States than in Canada or Mexico. Hydroelectric power is relatively much more important in Canada.

Figure 4: North American primary fuel consumption



Source: BP p.l.c (2007).

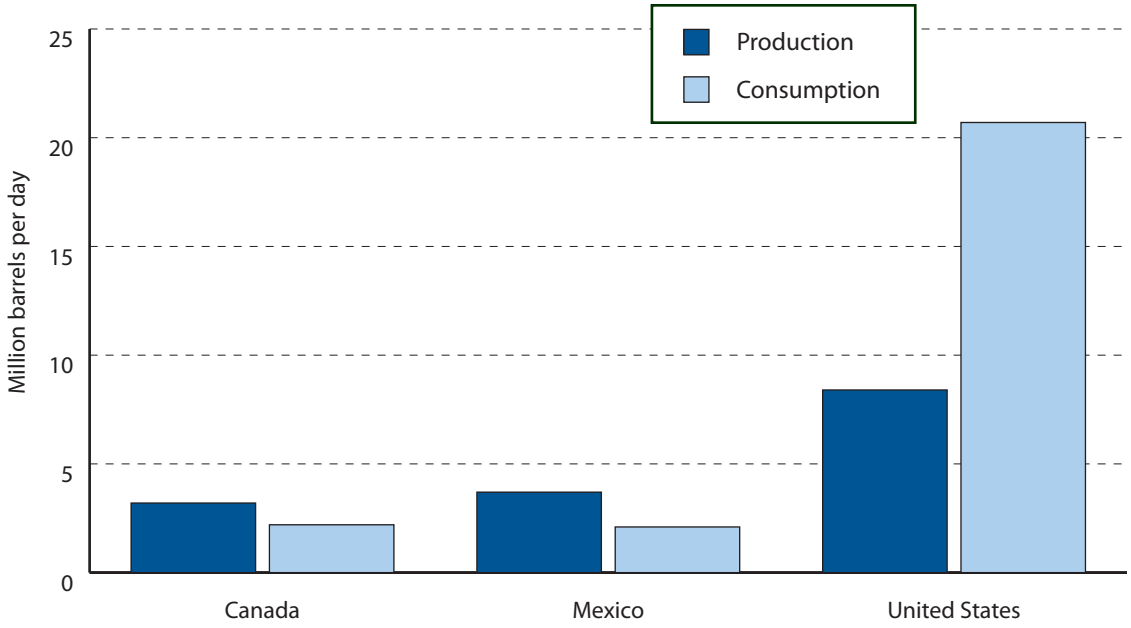
Oil

North America is home to only about 7% of the world's population, yet the continent accounted for 27.5% of the world's oil consumption in 2006. This is a greater share than that of any other world region [Energy Information Administration, 2007d]. The three North American countries produce about 18.1% of the world's oil—an average of 15.3 million barrels per day (MMb/d) [Energy Information Administration, 2007d]. However, North America's combined daily consumption exceeds 25 MMb/d (figure 5). The continent is importing oil at the rate of about 10 MMb/d.

Due to supply disruptions in an unsettled Middle East, the erosion of excess capacity (especially in Venezuela and Nigeria), and increasing global demand (led by emerging economies such as China and India), the nominal price of crude oil increased roughly five-fold between 1998 and the first quarter of 2007 (figure 6).[7]

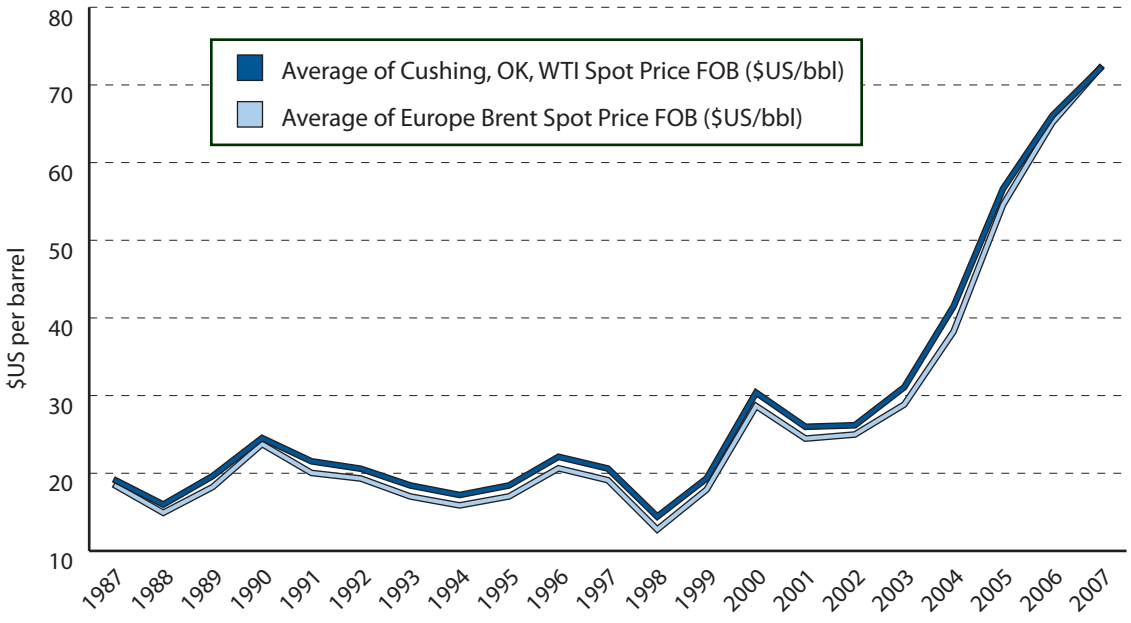
[7] On January 10, 2008, the West Texas Intermediate (WTI) oil price was trading in the vicinity of $94 (US) per barrel (bbl). This price of oil is about six times greater than its 1998 level.

Figure 5: North American oil production and consumption, 2006



Source: Energy Information Administration (2007d).

Figure 6: Crude oil spot prices, 1987-2007



Source: Energy Information Administration (2008).

North American oil production has been focused mainly on conventional, light varieties of crude oil which are relatively inexpensive to produce and refine.[8] The depletion of conventional sources of crude oil in North America, the increase in the price of oil, and the inaccessibility of petroleum resources in the Middle East to international oil companies have increased North American producers' interest in non-conventional oil sources such as shale and oil sands.

Non-conventional sources are the key to the future of North America's oil supply if the region wishes to reduce its dependence on foreign sources. However, non-conventional sources are generally heavier and less fluid. As a result, they are more difficult to extract and require alternative methods for recovery, including mining and in-situ processes. Non-conventional oil exploration and development has been most prominent in Canada, where estimated proven oil reserves, including non-conventional sources, place Canada among the world's top three oil countries.[9] Canadian heavy oil and tar-like bitumen from Alberta's oil sands are attracting increasing interest from American investors, as the United States is Canada's main market for oil exports. In fact, Canada is now America's number one source of crude oil and refined petroleum products (table 1).

Mexico is also an important supplier of crude oil to the United States. However, the amount of funding that is available to PEMEX to search for and develop new oil reserves for production is constrained by the company's obligation to meet a large share of the Mexican government's revenue requirements. Consequently, Mexico's ability to maintain its current level of exports is in doubt [Morales, 2006: 1].

Natural gas

Natural gas is a key component of North America's energy supply and will continue to be very important in the future. It is the cleanest burning fossil fuel, it is relatively easy to transport, and it can be stored easily [FERC, 2006]. Natural gas is used mainly for heating, but also for industrial process heat (as in Alberta's oil sands) and power generation.

Natural gas is produced by both conventional and non-conventional methods. Conventional sources are tapped through drilled wells either on land or offshore.

[8] In this context, "light" refers to crude oil of low specific gravity (i.e., oil with a relatively high American Petroleum Institute (API) rating).

[9] In 2005, three main sources contributed to the 2.8 MMb/d of world unconventional oil production: 1.1 MMb/d from Alberta oil sands; 0.6 MMb/d from Venezuela's heavy oil; and nearly 0.3 MMb/d of ethanol from the United States [Energy Information Administration, 2007b]. It is expected that unconventional oil will make up 9% of total world oil supplies by 2030 [Energy Information Administration, 2007b].

Table 1: American crude oil and petroleum product[1] average daily imports by country of origin, 2006

Country	Thousands of barrels
Canada	2,353
Mexico	1,705
Saudi Arabia	1,463
Venezuela	1,419
Nigeria	1,114

Notes:

[1] Petroleum products include heating oil, jet fuel, diesel fuel, heavy oil, and gasoline.

Source: Energy Information Administration (2007e).

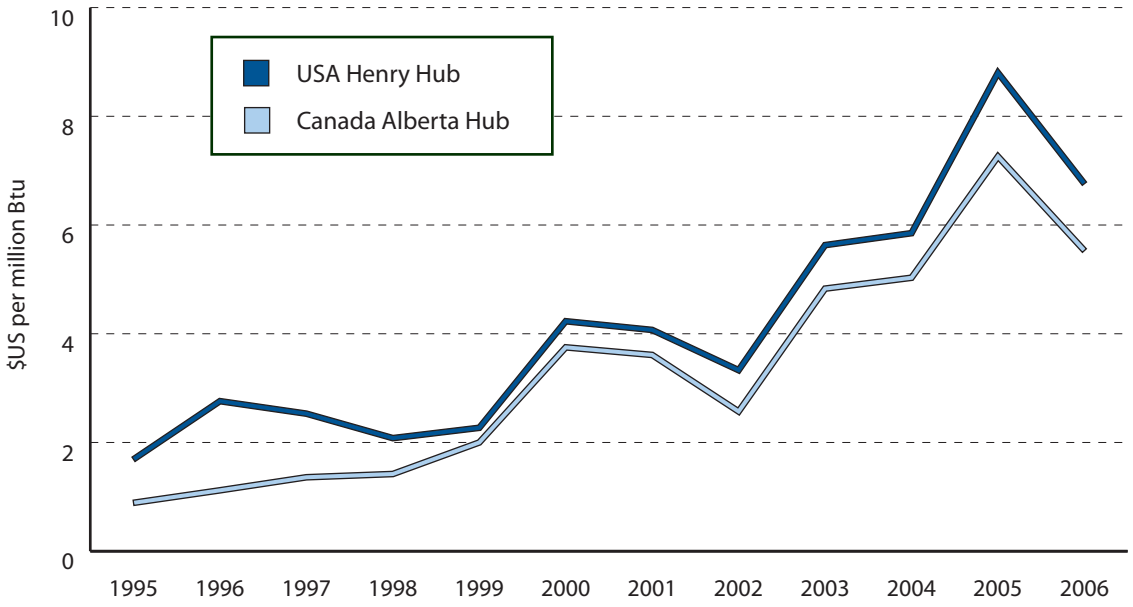
Unconventional supply sources include coal-bed methane, shale gas, gas produced from tight sands formations, and imports of LNG.[10]

In Canada and the United States, the price of natural gas is determined by market forces. Gas-producing regions, states, or provinces and major gas-importing areas are connected by a complex gas transmission pipeline system which allows consumers to choose between different supply sources. While the price of gas in a particular region may be temporarily higher or lower than the price in an adjacent region because of special conditions or factors, the regional price differentials are, for the most part, a function of the cost of transporting the gas between regions. In Mexico, however, the price of natural gas is determined by an administrative pricing arrangement that links the price to market reference prices in the United States.

Canadian and American natural gas prices increased sharply between 2002 and 2005, mainly due to increases in oil prices and demand for gas for generating electricity, and a decline in productivity at maturing basins (figure 7). Prices peaked in fall 2005 following damage to production facilities caused by Hurricanes Katrina and Rita. In November 2005, the price of gas at the Henry Hub market-clearing centre was $11.20/MMBtu ($US). A year later, the price had fallen back to $5-$6/MMBtu ($US), due to mild winter conditions, which allowed storage volumes to return to normal, and a

[10] LNG is simply natural gas in liquid form. When cooled to a temperature of around minus 160 degrees (minus 260 degrees Fahrenheit), natural gas becomes a clear, odourless, non-toxic liquid. It is generally stored at slightly above atmospheric pressure. LNG is considerably easier to transport by ship than non-liquefied natural gas which reduces to one six-hundredth of its original volume when liquefied. LNG is not explosive in its liquid state, but escaping vapour is highly explosive if its concentration in the air is between 5% and 15% and it comes into contact with an ignition source. Adding air dilutes the concentration, making it less flammable.

Figure 7: Natural as prices ($US per million Btu), 1995-2006



Source: BP p.l.c. (2007).

potentially permanent decrease in industrial gas demand resulting from high price levels in 2004 and 2005.

Proven worldwide natural gas reserves totaled 6,348 trillion cubic feet (Tcf) at the end of 2005 [BP p.l.c., 2007]. Of that amount, North America had proven reserves of 263 Tcf, located mainly in the United States. In 2006, North America produced 26.5% of the world's natural gas but consumed 27.3% because consumption in both the United States and Mexico exceeded their domestic production (figures 8 and 9) [BP p.l.c., 2007].

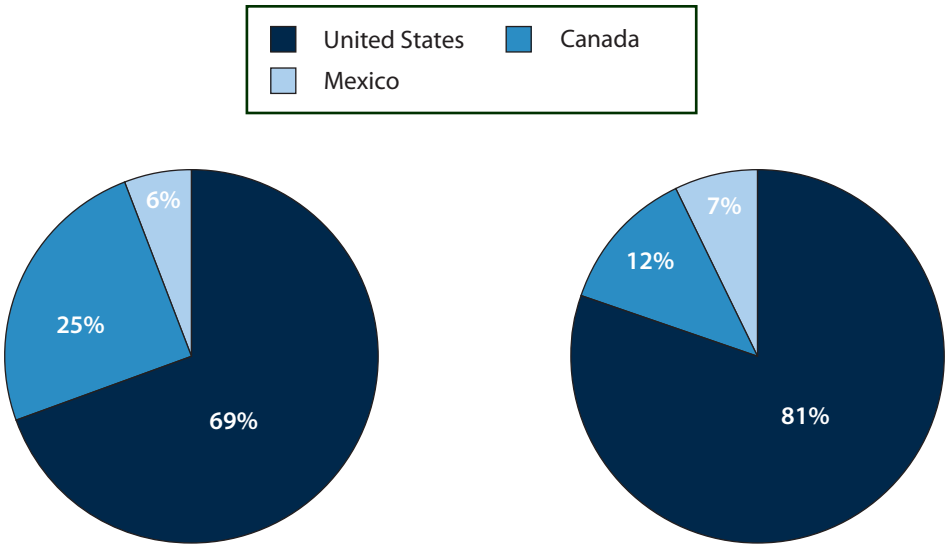
In 2006, the United States produced and consumed 50.7 and 60.0 billion cubic feet of gas per day (bcfd), respectively, while Mexico produced 4.2 and consumed 5.2 bcfd. Canada produced gas at a rate of 18.1 bcfd—almost double its consumption rate of 9.3 bcfd.

Considering that only 4% of the world's conventional natural gas reserves are located in North America [FERC, 2004], non-conventional natural gas supplies are increasingly being sought. These supplies include coal-bed methane, shale gas, gas from tight formations, and liquefied natural gas imports.

LNG is increasingly being viewed as the gas supply source that will fill the growing gap between domestic gas production and demand in North America. All three North American countries are involved in the development of infrastructure that will support LNG facilities. The LNG supply chain has evolved into a worldwide operation,

Figure 8: Shares of North American natural gas production, 2006

Figure 9: Shares of North American natural gas consumption, 2006



Source: BP p.l.c. (2007).

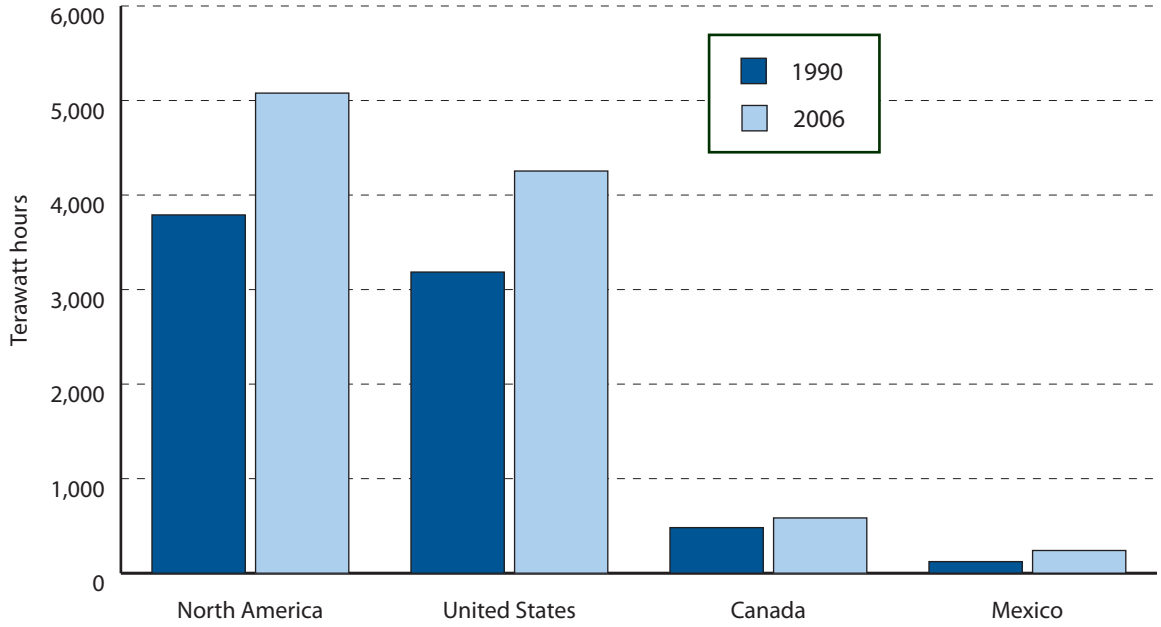
with more than a dozen countries either exporting or developing export terminals to provide LNG to the international market.

LNG import facilities, including marine terminals, are located at major coastal ports. There are five American LNG import facilities in operation, and numerous import projects currently under construction or being proposed in North America [Energy Information Administration, 2007g; Natural Resources Canada, 2006]. Canada's first LNG facility, now under construction, is in Saint John, New Brunswick, where gas that is not consumed locally will be exported to New England via a connection to the Maritimes and Northeast Pipeline.

Electricity

In 2006, North America generated almost 27% of the world's electricity. Canadian electricity generation totaled 584 TWh (terawatt hours), while 4,254 TWh were generated in the United States [BP p.l.c., 2007]. Mexican electricity generation, which has more than doubled since 1990, totaled 240 TWh—less than half that of Canada (figure 10).

Figure 10: North American electricity generation, 1990 and 2006



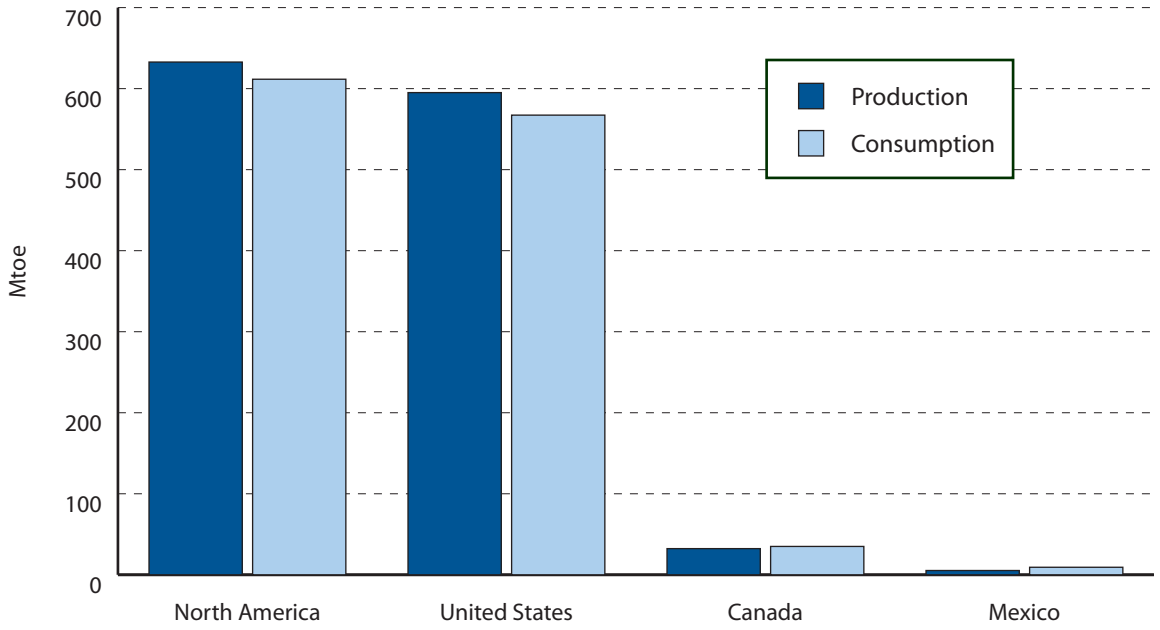
Source: BP p.l.c. (2007).

The five main fuels used for electricity generation in North America are coal, petroleum, natural gas, nuclear, and hydro. Total American electricity imports were 44.5 billion kWh in 2005, coming mostly from Canada but also from Mexico [Energy Information Administration, 2007h]. Looking ahead, American electricity consumption is expected to increase by 1.5% per year until 2030, while the generation of electricity is expected to increase by 1.3% [Energy Information Administration, 2007b]. This suggests that both Mexico and Canada have the opportunity to increase power exports to the United States.

Coal

Coal remains a major source of energy in North America and the rest of the world due to its relatively low cost and ample supply. In 2006, North America's share of the world's coal reserves was 28%. In that year, coal production reached 632.8 Mtoe (million tons of oil equivalent), more than fully meeting domestic demand of 611.6 Mtoe [figure 11; BP p.l.c., 2007]. North America is a small net exporter of coal and its exportable surplus comes mainly from the United States. Mexican annual coal consumption, which is about 9.3 Mtoe, is approximately 75% greater than the country's coal production (5.3

Figure 11: North American coal production and consumption, 2006



Source: BP p.l.c. (2007).

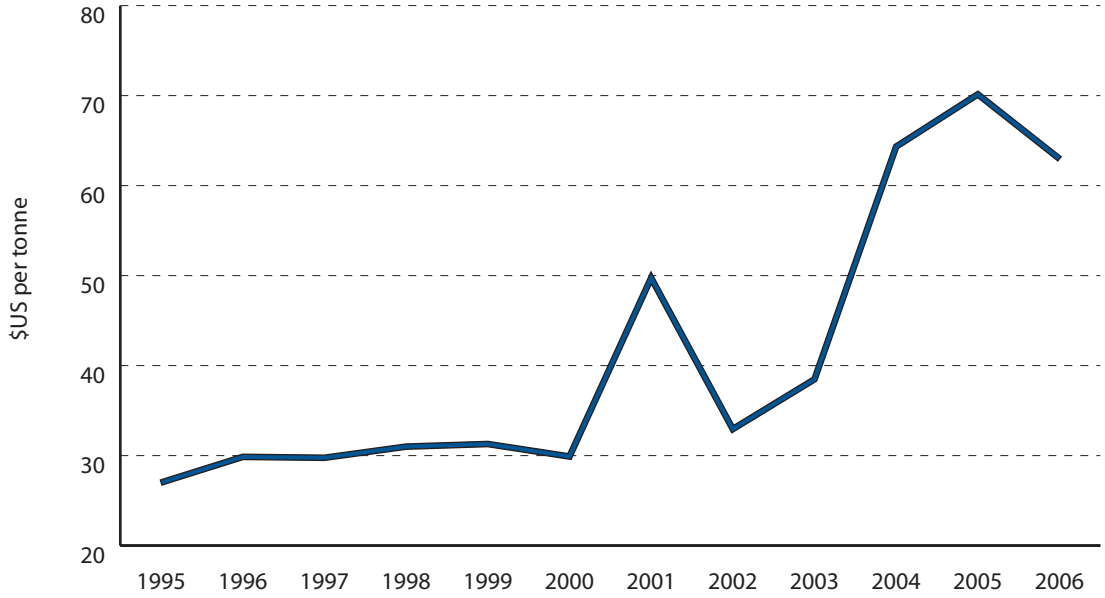
Mtoe). At present, Canada's coal production and consumption are approximately the same, but this will change if Ontario follows through with its plans to reduce coal-fired electricity generation.[11]

Since 1995, American coal prices have increased substantially but have remained competitive with other energy sources [BP p.l.c., 2007]. As figure 12 shows, coal prices have approximately doubled since 1995. They are expected to continue to increase because of rising mining costs [Energy Information Administration, 2007b].

The use of coal for electricity generation has grown steadily in North America since the 1970s and is expected to increase over time despite serious concerns about increased CO_2 emissions related to coal-fired power generation [Energy Information Administration, 2007b]. This increase is the result of two factors: first, there is growing concern with respect to higher and more volatile natural gas prices than in the past;

[11] On June 13, 2006, the Ontario Minister of Energy directed the Ontario Power Authority (OPA) via a letter to the CEO to "plan for coal-fired generation in Ontario to be replaced by cleaner sources in the earliest practical time frame that ensures adequate generating capacity and electricity system reliability in Ontario" [Ontario Energy Board, 2006]. The Integrated Power Supply Plan that the OPA filed with the Ontario Energy Board for scrutiny on August 29, 2007 calls for coal generation in Ontario to be phased out by the end of 2014, by which time the OPA claims that the existing coal-fired generation facilities will no longer be required for capacity, energy production, or system reliability reasons [Shalaby, 2007].

Figure 12: Coal prices according to the US Central appalachian coal spot price index, 1995-2006



Source: BP p.l.c. (2007).

and second, there is the expectation that there will soon be breakthroughs in research pertaining to the development of "clean coal" technologies, including integrated gasification combined cycle power generation plants which have the potential to greatly reduce CO_2 and other greenhouse gas emissions.

Nuclear power

Within the last five years, interest in nuclear energy has experienced what some may call a rebirth. This has mainly been the result of concerns about climate change and, in particular, the impact some believe greenhouse gases, such as CO_2, can have on the environment. Because the combustion of fossil fuels constitutes the main source of anthropogenic CO_2 emissions, alternative fuels for power generation are being sought. Since the production of nuclear energy emits no greenhouse gases and is highly reliable[12], it is increasingly being seen as a possible source of future electric generation,

[12] However, nuclear power generation is prone to high construction, refurbishment, and insurance and liability costs. It also requires spent fuel management and radioactive waste disposal.

both to replace aging and inefficient coal-fired generating stations and to meet the increase in energy demand. While nuclear-powered electricity production provides a constant flow of power at a low cost, it cannot respond quickly to fluctuations in demand. Since electricity cannot be stored, nuclear generation must be accompanied by gas-fired or other types of peak-load generation. In contrast to nuclear power plants, thermal peaking plants generally have higher operating costs, although they can respond quickly to increases in electricity demand for short periods.

In 2005, North America consumed 209.2 Mtoe or 33.4% of the world's nuclear power generation [BP p.l.c., 2007]. Because of national and international pressures to reduce greenhouse gas emissions, it is anticipated that nuclear energy will play a larger role in North American electric generation. All three North American countries have committed to continuing and expanding their nuclear energy programs in the future. Furthermore, following recent government support for a new reactor program, the United States Department of Energy anticipates that a number of new nuclear plants will be built in the United States in the next 20 years [Energy Information Administration, 2007b].

Renewable energy

Renewable energy sources include hydro, geothermal, solar, wind, and ethanol. These will be discussed briefly in this section. The potential for these energy sources will be examined in the continental energy supply analysis that will be undertaken during the course of the Continental Energy Strategy project.

Hydroelectricity

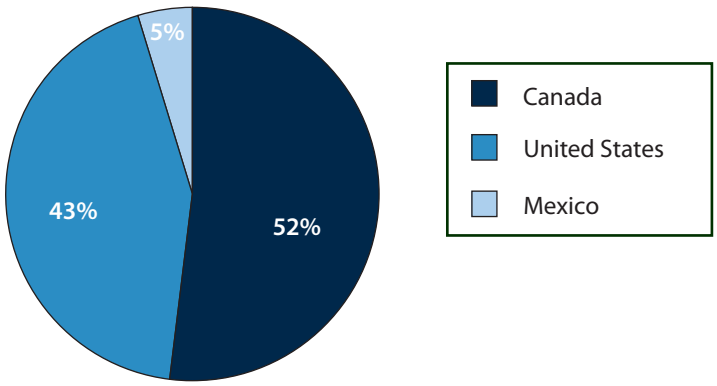
In 2006, 22% of the world's hydroelectricity was consumed in North America and 671.2 TWh of power were generated by its hydro facilities. North American hydroelectricity generation is greatest in Canada, where over 60% of the country's electricity comes from hydro resources. Canada produced 350.3 TWh of hydro power in 2006 while the United States and Mexico produced 291.2 TWh and 30.2 TWh, respectively [figure 13; BP p.l.c., 2007]. Canada is a net exporter of electricity to the United States mainly because of its abundant hydroelectric supplies.

Geothermal energy

Geothermal electricity is produced from hot water or steam from the earth, which is tapped to power turbines that produce electricity. Geothermal energy can be used for either power generation or space heating, depending on its temperature and location. Heating applications can be direct or indirect (via heat pump technology).

Worldwide geothermal installed energy capacity remains quite small (totaling 9,538.8 MW in 2006) with only 25 countries reporting substantial geothermal electric-

Figure 13: Share of hydroelectric generation among North American countries, 2006



Source: BP p.l.c. (2007).

ity generation capacity [BP p.l.c., 2007]. Of those countries, the United States was the leader in geothermal capacity in 2006, with a capacity of 2,831 MW (28.5% of the world's installed capacity) [BP p.l.c., 2007]. In 2006, Mexico had the third highest geothermal capacity in the world, and now has 37 generating units, which provide about 3% of total public electricity [BP p.l.c., 2007; Comision Federal de Electricidad, 2007]. A major portion of Mexican electricity from geothermal sources is exported to the United States or used to provide electricity to more remote areas.

Geothermal energy production has yet to make a major contribution to Canadian energy requirements. The main reasons for the low use of geothermal energy are a lack of public awareness, incompatible building systems, and the low cost of other forms of electricity. It is expected that geothermal energy will become more attractive for heating homes and generating electricity in Canada if natural gas prices continue to increase.

Wind power

In 2005, the world's installed wind energy capacity was 59,264 MW. North American wind generation capacity represented 16.6% of that amount. The United States had the greatest wind power generation capacity of the three countries, with 9,181 MW, while Canada had 683 MW and Mexico had only 3 MW. Mexico, however, is believed to have a number of sites with considerable wind power generation potential. In fact, Mexico's wind power capacity jumped to 86 MW in 2006. American and Canadian wind capacity increased in 2006 as well, jumping to 11,635MW and 1,459 MW, respectively [BP p.l.c., 2007].

Solar Power

With 514 MW of solar power generation capacity, North America represented about 14% of the world's solar energy installations in 2005 [BP p.l.c., 2007], down from approximately 15% in 2004. With a current solar capacity of 479 MW, the United States has experienced the most growth in solar generation of the North American countries recently, with a 127% increase in 2005 alone. Mexico has 18 MW of solar energy capacity and Canada, 14 MW [BP p.l.c., 2007].

Ethanol

Ethanol is a liquid transportation fuel that is produced from grains, corn, and other plants. Depending on motor design, it can be mixed with gasoline or utilized in "neat" or pure form. In Canada and the United States, it is most often sold at normal gas stations in a gasoline blend with ethanol comprising 10% or less of the blend by volume.[13]

North America is a dominant player in ethanol production. Production is led by the United States, where production accounted for 45.4% of total world production in 2006, and followed by Brazil, which accounts for 43.9% of the world's ethanol production. Total ethanol production in the United States was 8,010,000 toe [BP p.l.c., 2007]. Canada produced 284,000 toe of ethanol in 2006, up sharply from 127,000 toe in 2005 [BP p.l.c., 2007]. Mexico will begin producing ethanol in the near future because its government recently passed renewable fuels legislation that will require a 10%/90% ethanol/gasoline blend [*Ethanol Producer Magazine*, 2007].

The agricultural communities in North America are vigorously promoting ethanol as a transportation fuel. Of course, the agricultural community is eager to promote ethanol because it requires the production of corn or other feedstock, which generates incremental farm income. But to a large and growing degree, their case is based on claims that ethanol can help to reduce greenhouse gas emissions.[14] Mounting political pressure to appear "green" has led federal and many state and provincial governments to approve ethanol subsidies that lobbyists have been touting as necessary to attract investment in ethanol production and related infrastructure. However, much of the government's support for ethanol in the United States is also based on the desire to slow the growth of oil imports and bolster energy security.

Unfortunately, the consequences of ethanol subsidization policies have not been examined in sufficient depth. For example, the subsidies are driving up the prices of

[13] This 10% limit exists because most vehicle manufacturers refuse to warrant their vehicles if more than 10% is used in the blend.

[14] It is unclear, however, whether ethanol use will result in a net reduction in carbon emissions, given the transportation fuel that is required in the planting and harvesting of feedstock, and the energy that is required by ethanol plants. In Iowa, for example, coal provides the energy required to grow ethanol plants.

Table 2: Canadian Net Energy Exports to the United States (1980-2006), before and after NAFTA came into effect

	Pre-NAFTA			Post-NAFTA	
	1980	1990	1993	2000	2006
Natural gas (Tcf)	0.8	1.4	2.2	3.5	3.3
Crude oil and bitumen (million barrels)	42.2	229.3	333.7	496.6	637.3
Electricity (GWhs)	27,240.8	349.6	27,477.8	36,060.6	17,182.5

Sources: Statistics Canada CANSIM II database.

corn and corn-based foods, distorting agricultural commodity markets, and creating water shortages [Mukherjee, 2007]. As well, on a fuel-cycle basis, it is unclear whether it is useful to produce ethanol fuel because producing ethanol requires approximately the same amount of energy as it can be expected to yield [Pimenthal and Patzek, 2005]. Moreover, with different types and levels of subsidies cropping up in different jurisdictions throughout the continent, an ethanol producer's after-tax cost of production can vary substantially from one region to another. This is bound to distort ethanol trade within and between the three countries.[15]

The Contribution of NAFTA

The North American Free Trade Agreement came into effect on January 1, 1994, facilitating trade in energy commodities among the three countries, although with several important limitations (some of which were noted in the previous section, "The need for a continental energy vision and strategy").

Since NAFTA was put in place, Canadian petroleum exports to the United States have increased (table 2). The door to increased natural gas exports was opened by the deregulation of natural gas export prices and volumes during the latter part of the 1980s, and there were no important obstacles to the export of Canadian crude oil and electricity prior to NAFTA. Because of this, the extent to which growth in Canadian exports of energy commodities to the United States since 1993 may be attributable to the removal of tariffs and charges, in accordance with NAFTA provisions, is most likely small.

[15] We anticipate that this issue will be examined in some depth in an analysis of the continent's energy supply potential. This analysis will help to create a foundation for the major elements of a continental energy strategy.

The concessions granted to Mexico in NAFTA (which reserves for the state all investment in oil and gas exploration, development, production, refining, and processing, as well as electricity transmission, distribution, and most generation in that country) prevent Canadian and American investors from contributing to the development of Mexico's energy resources. By so doing, these concessions constrain the development of continental energy trade. While we understand and appreciate the political sensitivities with which Mexico is confronted on this issue, a high priority needs to be placed on exploring means to overcome this and other asymmetries in NAFTA so that energy may be traded freely.

Conclusion

Comparing current and projected energy demand to current and potential domestic energy production in North America underscores the fact that the United States is a major and growing net importer of both crude oil and natural gas. Mexico has been unable to keep up with domestic natural gas demand and, without new discoveries and development, the country is at risk of also becoming a net oil importer. Canada, however, is a growing net exporter of oil thanks to its oil sands, but its strength as a natural gas exporter is declining because production of conventional natural gas is falling.

Given the petroleum resources of the three countries and their increased value because of higher oil and gas prices, there is considerable incentive for Canada, the United States, and Mexico to streamline regulations in order to facilitate the efficient development, transportation, and use of the continent's energy resources in accordance with market conditions. There is also reason to believe that the examination of continental energy supply options pertaining to electricity—including the use of fossil fuels, nuclear energy, hydro, and other renewable resources—could lead to policy changes that would benefit North American consumers by increasing competition and providing a greater array of relatively low cost energy supply options. Analysis of this kind will be a focus of the energy supply study that will be carried out within the Institute's Continental Energy Strategy research project. For now, we would like to note that there are varying degrees of government involvement in the energy commodity markets discussed above, and such involvement can produce pricing, regulatory, and investment distortions that inhibit opportunities for economic gains for consumers.

5 A North American energy transportation network

As indicated by table 2, net Canadian exports of crude oil and natural gas to markets in the United States increased considerably from 1980 to 2006. The flow of natural gas across the United States-Mexico border also increased. This increase in flow volumes was made possible by the pipeline infrastructure that has been put in place over the years. Because of this infrastructure, the energy sectors and the economies of the three countries have become increasingly intertwined and interdependent.

In the future, the expansion of the existing network of oil and gas pipelines and electric transmission lines will be important for North American energy production growth and improved energy security. For this reason, we believe that examining the potential for enhancing the energy transportation system will be an important part of the deliberations that lead to the articulation of a continental energy strategy.

The crude oil and refined product pipeline linkages

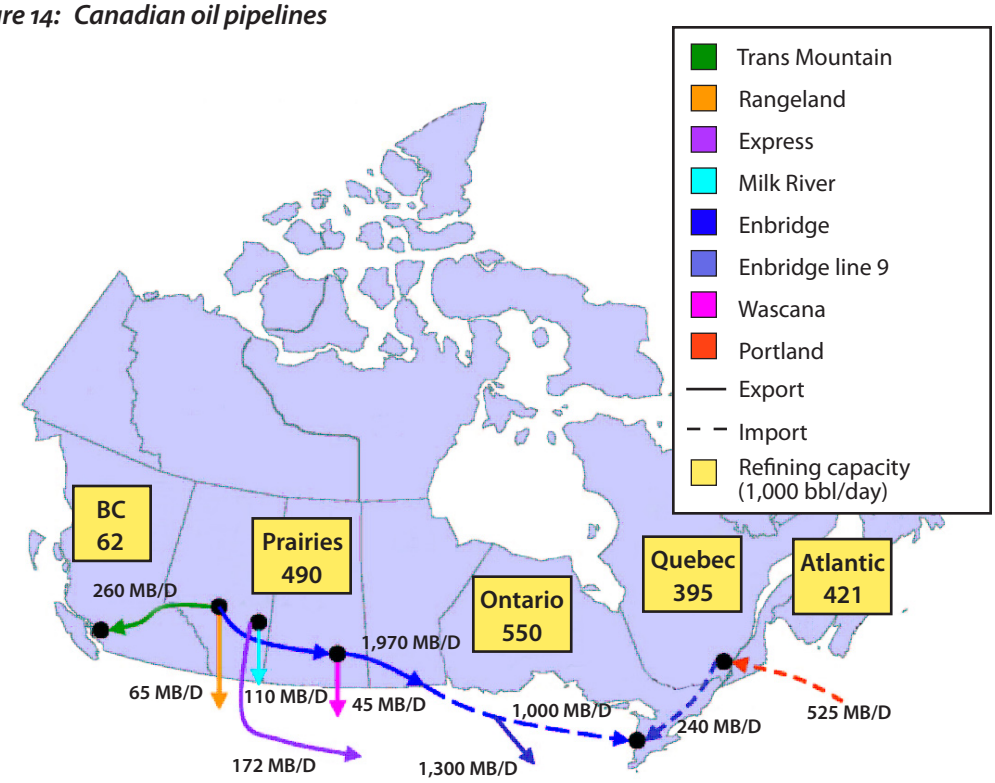
The first map (figure 14) depicts the oil pipeline network in Canada and its connections to the United States, as well as Canada's regional oil refining capacities [North American Energy Working Group and Security and Prosperity Partnership Energy Picture Experts Group, 2006].

With heavy crude oil and bitumen gradually comprising a greater portion of the products travelling through the pipeline, an increasing portion of the crude oil transportation system consists of pipelines carrying bitumen and synthetic crude oils from Alberta to refineries in central Canada and the United States. At the same time, the capacity of Alberta's refineries that process heavy crude oil is increasing.

Canadian oil exports reach all five of the American Petroleum Administration for Defense District (PADD) market areas that are illustrated in figure 15. In addition, small quantities of Canadian bitumen are shipped to markets overseas. Crude oil is shipped to America's continental states and to foreign destinations (including Canada) from Alaska. The rest of the American oil pipeline and refinery infrastructure is located near its oil reserve areas—mainly Texas, California, and Louisiana—and its major consuming areas along the East Coast and in the Midwest.

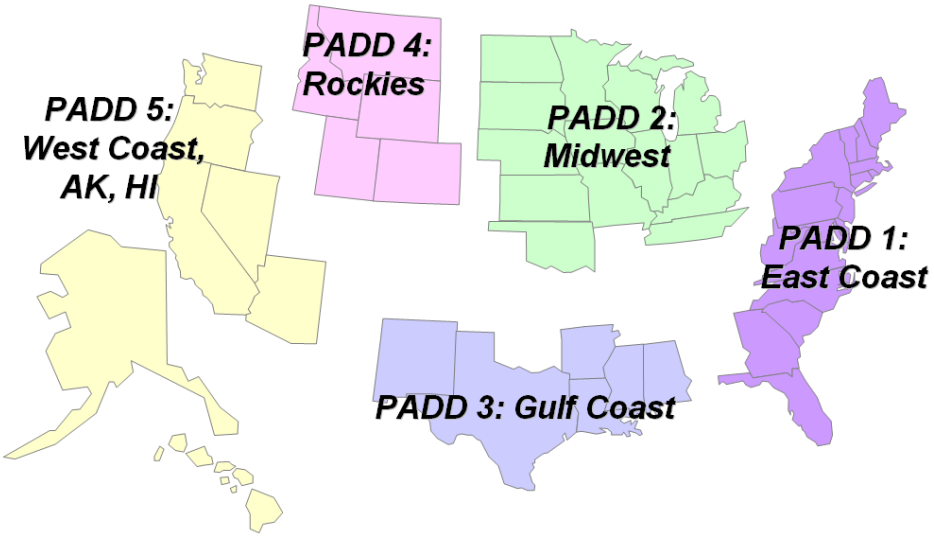
The United States has a well developed crude oil and refined petroleum product pipeline system that facilitates the transportation of crude oil from production and import points on the Canadian and Mexican borders to refineries, and the delivery of refined product to distribution points. The network of crude oil pipelines in the United States is extensive, with approximately 55,000 miles of "trunk" pipelines (generally 8-24 inches in diameter) that connect regional markets. There is also an estimated

Figure 14: Canadian oil pipelines



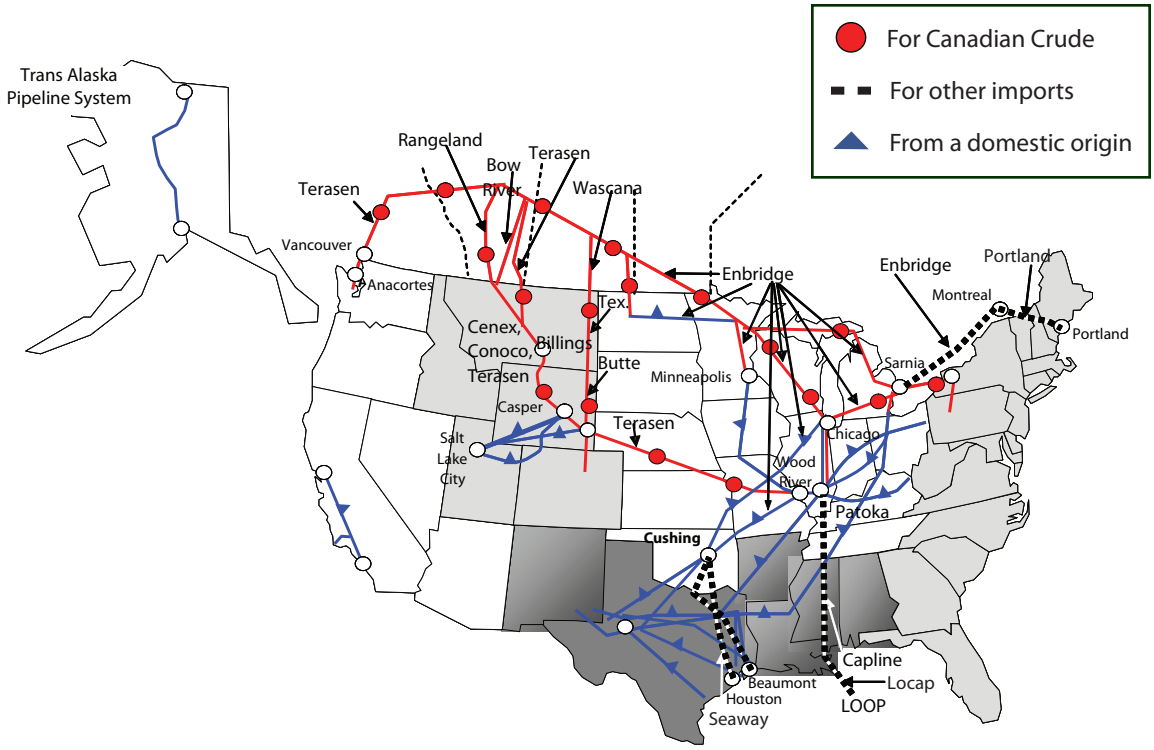
Source: North American Energy Working Group and Security and Prosperity Partnership Energy Picture Experts Group (2006). Used by permission.

Figure 15: US Petroleum Administration for Defense Districts (PADD) market areas



Source: Energy Information Administration (2007f). Used by permission.

Figure 16: Selected crude oil trunkline systems serving the United States



Source: Allegro Energy Group (2001). Updated to 2008. Used by permission.

40,000 miles of smaller diameter pipelines, connected to the trunk lines, that gather the crude oil at well sites [Association of Oil Pipe Lines and the American Petroleum Institute, 2007]. The locations of the main oil trunkline systems in Canada and the United States are illustrated in figure 16.

Mexico's national crude oil pipeline system (figure 17) has become integrated with that of the United States, thereby allowing exports of Mexican crudes via cross-border connections. For example, PEMEX provides heavy Mayan crudes to the Shell refinery at Deer Park, Texas.

The natural gas transportation system

The North American natural gas transportation system is highly integrated and is becoming increasingly so. The development of new and expanded LNG terminals at coastal points will have a significant effect on the system because new pipelines will

Figure 17: Mexico's national pipeline

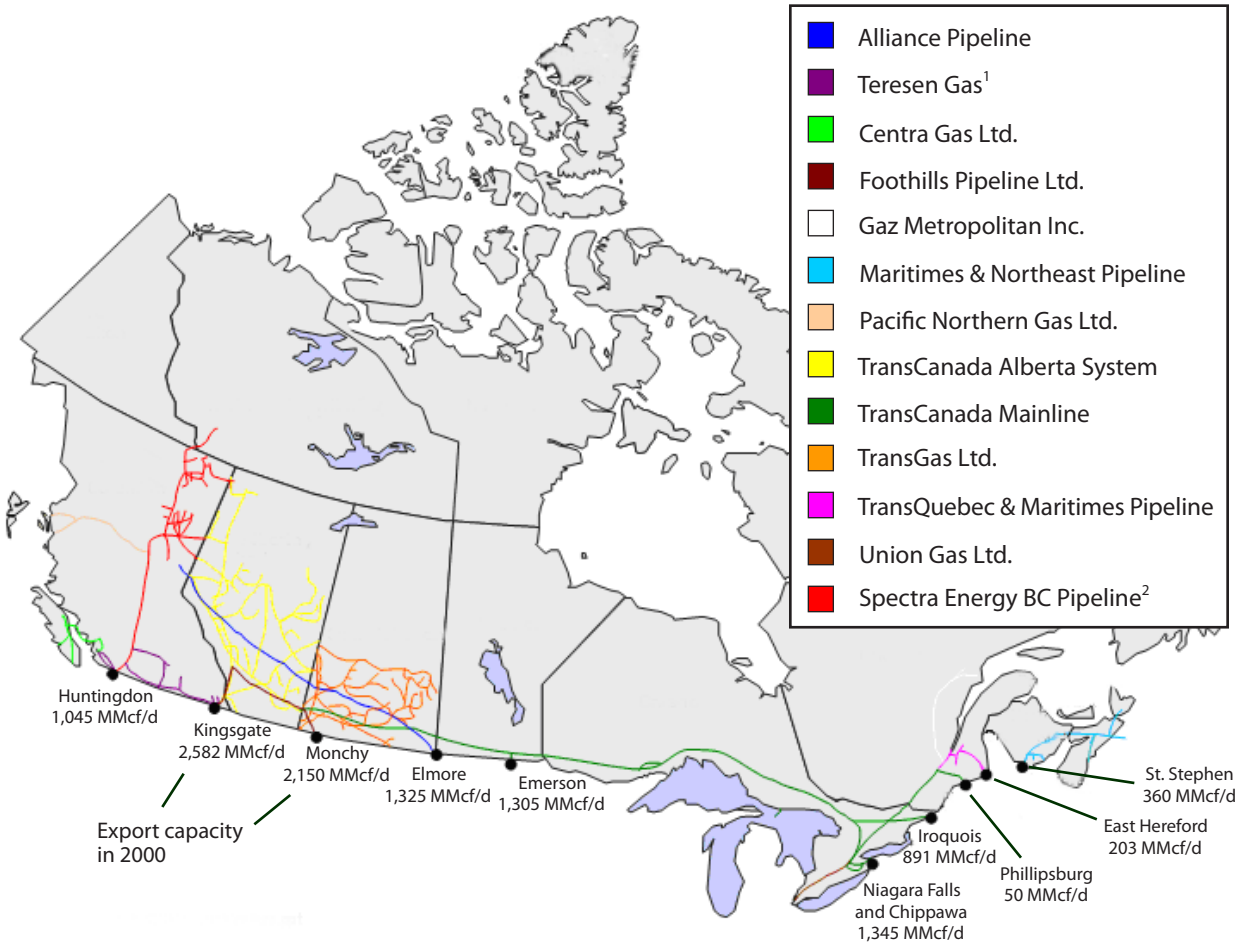
Source: North American Energy Working Group and Security and Prosperity Partnership Energy Picture Experts Group (2006). Used by permission.

be required to connect LNG supplies to gas transmission/distribution systems. For example, development of the Cacouna LNG terminal in Quebec will require a pipeline connection to the existing TransCanada system [TQM, 2007]. Similarly, a pipeline connecting the Irving Oil-Repsol Canaport LNG terminal in Saint John, New Brunswick to the Maritimes and Northeast Pipeline has been proposed by Emera Brunswick Pipeline Co., which has applied to the National Energy Board for approval to construct the facility [Emera Brunswick Pipeline, 2006].

Although some gas from the United States flows into Ontario, most of the gas that flows across the Canada-US border is from Canada to four main market areas in the United States: the Midwest, the Northeast, the Pacific Northwest, and California. Though Canadian gas is mostly produced in western Canada, it is marketed in central Canada and the United States (figure 18).

The United States has a complex interstate system of natural gas pipelines that has been expanding over the years to accommodate increased gas supply and demand,

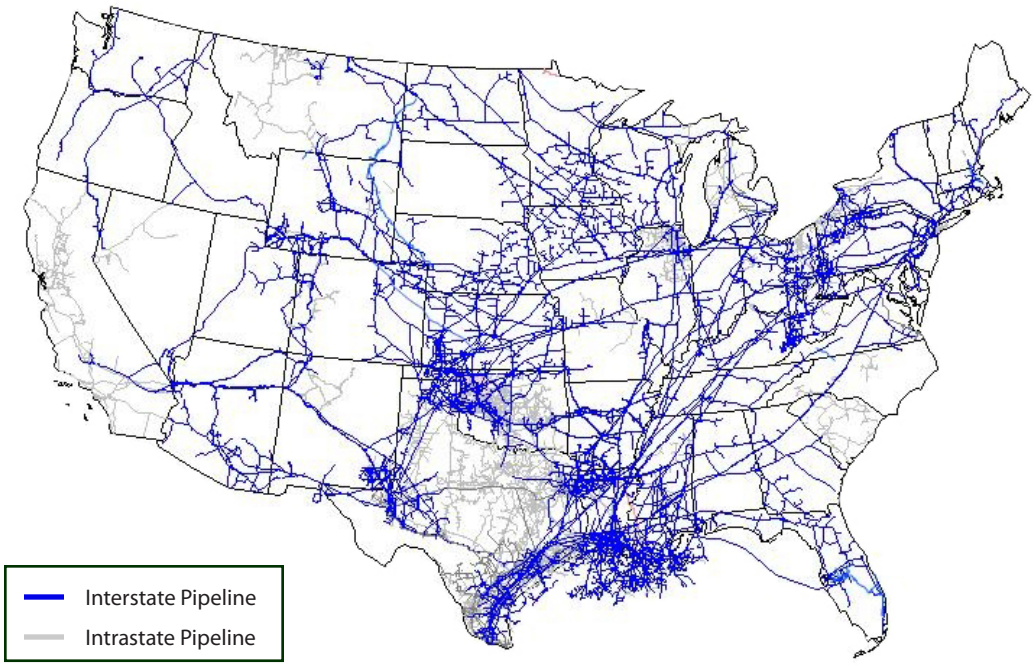
Figure 18: Main Canadian natural gas pipelines



Notes:
[1] Formerly BC Gas Ltd.
[2] Formerly Duke Energy Gas Transmission.

Source: North American Energy Working Group and Security and Prosperity Partnership Energy Picture Experts Group (2006). Used by permission. Updated by the authors.

Figure 19: Natural gas transmission system in the United States



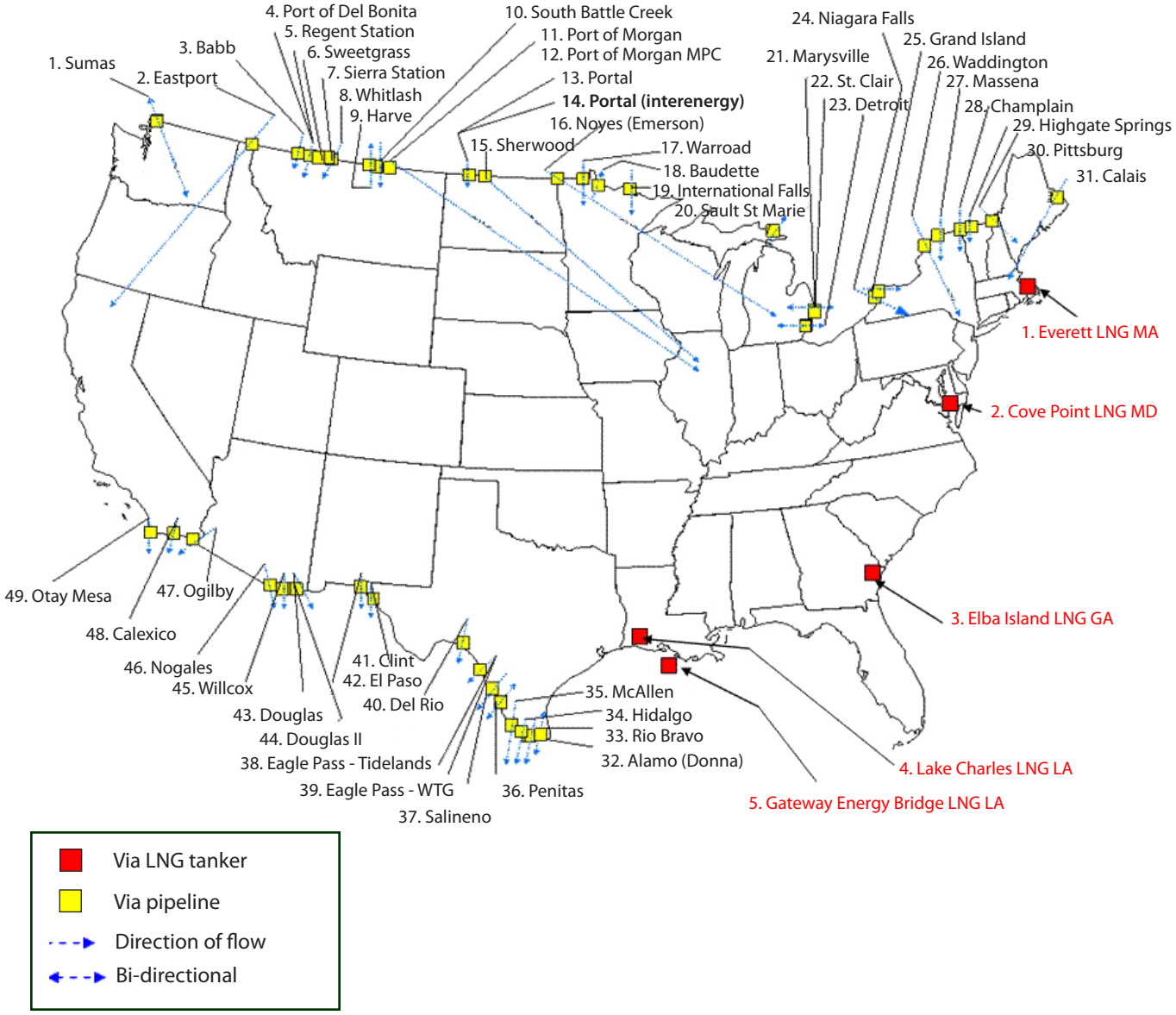
Source: Energy Information Administration (2007a). Used by permission.

including the transportation of re-gasified LNG from LNG import terminals. Figure 19 provides a glimpse of the network and the regions where transportation activities are most intense—Louisiana and Texas [Energy Information Administration, 2007a].

The American gas transportation system is heavily supported by natural gas from both Canada and Mexico, although Mexico is now a net importer of gas from the United States. The following map (figure 20) shows where the American gas transportation system connects with the Canadian and Mexican natural gas pipelines along the American border. Because 95% of American natural gas imports come from Canada, the flows are greatest across the Canada-US border [North American Energy Working Group and Security and Prosperity Partnership Energy Picture Experts Group, 2006].

Natural gas pipelines across the US-Mexico border were initiated via the Texas-to-Monterrey pipeline in 1997. Numerous connections sites have been established since then by both PEMEX and private corporations.

Figure 20: United States gas transportation system connection points with the Canadian and Mexican pipelines



Source: Energy Information Administration (2007i). Used by permission.

The electricity transmission network

There also are considerable cross-border flows of electricity. Canada is a major supplier of electricity to American markets (figure 21, pg. 37). Quebec is the top Canadian supplier of electricity to the United States. There are numerous other transmission routes for Canadian electricity exports to (and imports from) the United States, including transmission system connections at the American border with British Columbia, Manitoba, Ontario, and New Brunswick. Alberta power exports to and imports from the United States mainly flow through the connection with BC Hydro at the British Columbia-Alberta border. However, a new link, the Montana-Alberta Tie Line (MATL), is in the final stages of approval.[16]

A major challenge in the development of a truly integrated North American electricity market will be developing a system that is compatible with cross-grid capabilities. There are three separate systems—the Eastern Power Grid, the Western Power Grid, and the Electric Reliability Council of Texas—that will need to be further integrated. In addition, the Mexican electric transmission grid will need to be incorporated into the larger system. Though Mexico is a net importer of electricity from the United States, it does export some power to California and Texas.

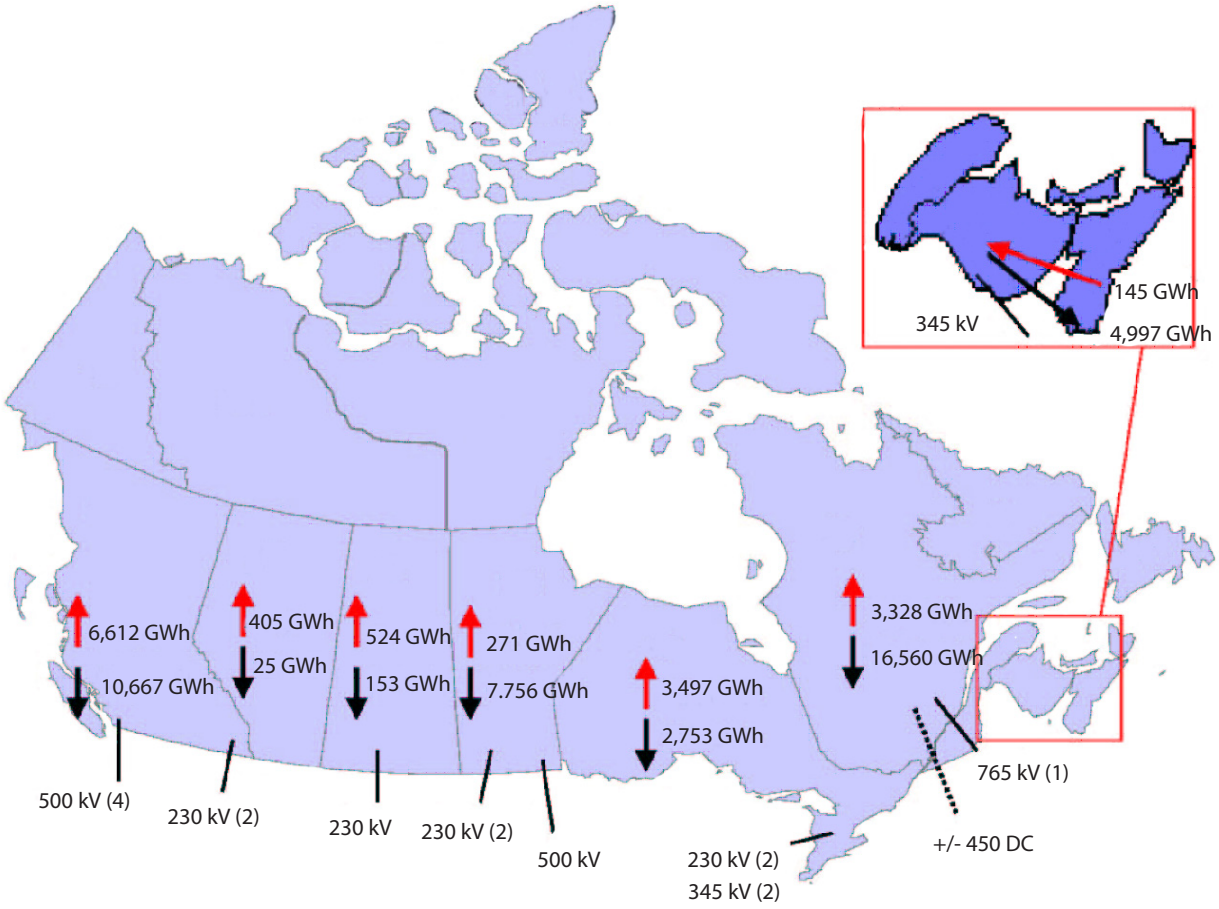
Coal transportation

In Canada, some coal is transported by railway from Saskatchewan to Thunder Bay, Ontario, and from there is shipped to the coal-fired electric generation facility in Nanticoke, Ontario. Most coal-fired electric generation in western Canada is at so-called "mine-mouth" generating plants—that is, plants located at the place of coal extraction. Most of the coal that is exported is coking coal, which is moved to tidewater terminals in Vancouver and Prince Rupert, BC, among other locations. Export-bound coals from Alberta and British Columbia are transported to Vancouver by Canadian Pacific Railway and Canadian National Railway (CN), depending on where the mines are located, and to Prince Rupert via CN. Because the United States has extensive coal resources, there is little north-south coal transportation across the Canada-US border.

In the United States, coal is transported to domestic market places and export terminals via an extensive system of railway and waterways (barges) from coal mines. For the most part, these mines are located in Appalachia (mainly West Virginia, Kentucky, and Pennsylvania), the "interior" states (mainly Texas, Illinois, Indiana, and

[16] Unlike transmission lines in the past, the MATL will be a merchant line owned by investors who will determine the fees that parties moving electricity on the system will pay for service.

Figure 21: Canadian electric transmission interties and trade



Source: North American Energy Working Group and Security and Prosperity Partnership Energy Picture Experts Group (2006). Used by permission.

western Kentucky), and the western states. The western states are led by Wyoming, in which 75% of their mines are located. These states also have active mines in Montana, Colorado, North Dakota, Utah, and several other states.

Canada represents the single largest market for American steam coal, which is used primarily for power generation. American steam coal exports to Canada (mainly for power generation in Ontario) accounted for 58.6% of total American steam coal exports during the first nine months of 2007. Exports to Canada accounted for 70.3% of total steam coal exports a year earlier. During the first nine months of 2007, Canada imported 10.7 million short tons of steam coal—7% less steam coal than during the comparable period of 2006 [Energy Information Administration, 2007j].

6 The cornerstones of a continental energy strategy

A number of important issues must be addressed when assessing the need for a continental energy strategy and identifying its key elements. For example, since the terrorist attacks of September 11, 2001, the desire to make North America a safer place and to ensure that energy and other vital commodity supplies remain secure has become a major point of discussion among North American leaders and policy makers, and an issue of considerable public concern.[17]

In addition to the surging cost of crude oil imports, North America has had to face international environmental policy pressures spurred by the Kyoto Protocol and the International Panel on Climate Change (IPCC) Reports. The issues of energy security and environmental concerns have caused North American governments to accelerate their investigations of alternative sources and technologies for energy production and consumption.

The continental energy supply potential

Under the continental energy strategy we envision, energy policies in North America would focus on facilitating increased production of the continent's remaining resources—oil and gas (both conventional and non-conventional sources), coal, uranium, hydro, and other renewable energy sources—to the extent that they can compete with imported energy supplies so that North Americans may benefit from greater use of indigenous resources. Essentially, this would require that physical and financial constraints to market forces (including taxes and tariffs), which could, without constraints, be expected to foster such development, be overcome. In addition, energy supply policies should facilitate the development of production facilities that utilize state-of-the-art technologies and a scale and pace of development that would help to ensure that North American consumers benefit from competitive energy costs and an increased diversity of supply. Maximizing continental energy development, production, and refining/processing opportunities in accordance with market conditions would help to ensure that the energy sector's contribution to employment, income, and GDP growth is strong.

A number of important issues in relation to the future development of continental energy supplies need to be investigated before recommendations for possible revisions to energy supply policy can be developed. For example, because oil production from

[17] This concern is of such high importance that there is a risk that it could evolve into a set of policies that reduces reliance on markets, thereby making the energy system even more vulnerable to shock.

conventional oil reservoirs in the United States is declining, more American domestic oil production will have to come from frontier regions such as the Deep Gulf, other offshore locations, and non-conventional sources such as shale. But to what extent will this be possible with known technologies and expected oil prices? What is the potential for growth in Canadian bitumen and synthetic crude oil exports to the United States? And to what extent will Mexico be able to continue to be a major supplier of oil to the United States, given the constraints on PEMEX's ability to allocate funds to exploration and development because of the government's revenue requirements?

A second set of energy supply issues relates to the emergence of LNG imports as an energy supply source in North America. This reliance on LNG is the result of the growing shortfall of natural gas production in the United States in relation to indigenous supplies, declining conventional gas production in the Western Canada Sedimentary Basin, and the failure of Mexican gas production to keep pace with local demand. First and foremost, the implications of this growing reliance on LNG imports require scrutiny from a continental energy supply perspective. For example, policy makers must fully understand the effect that increased reliance on LNG is likely to have on the ability to develop additional productive capacity of both conventional and unconventional continental gas supplies. Other LNG-related issues pertain to the need for consistent regulations with respect to the siting of LNG terminals and regasification facilities, the impact of new gas flow patterns on existing pipeline infrastructure, and the impact on the environment.

Another energy supply issue relates to the potential for natural gas supplies from the offshore frontiers, and how such development may contribute to the continental energy supply mix, reduce North American reliance on energy imports, and generate economic and social benefits. The potential of unconventional gas production—such as gas that is embedded in tight sands or shale rock, or is associated with coal (coal bed methane)—requires analysis to determine whether and to what extent it could become a more significant part of the energy supply picture, especially in Canada where unconventional gas production still accounts for only a small percentage of total production. If there is significant development potential, analysis may be required to determine whether special policies may be necessary.[18]

Opportunities for investment in electric generation facilities also need to be considered so that their implications for energy supply policy, as well as the probable timing and extent of the associated capital and construction labour requirements, may be determined. Investment opportunities include Canadian power generation projects that target the American market, such as the long-discussed Lower Churchill Falls hydroelectric project, a facility with up to 3,000 MW of potential. This project has

[18] In the United States, where unconventional gas production already accounts for approximately 25% of gas production, this may not be as significant an issue.

been stymied for some time by the inability of the governments of Newfoundland and Quebec to reach agreement on Newfoundland's proposal to direct much of the energy generated by the facility through Quebec to markets in the United States. In order to facilitate power exports and imports and help meet growing power demand, large, new electricity transmission projects will be needed throughout the continent.[19]

The extent to which technological improvements, changes in relative costs, and environmental issues are likely to impact investment in new coal-fired and nuclear generation facilities also requires examination in order to identify the capital and labour implications and the possible need for policy changes. Similarly, the role that renewable energy facilities could play needs to be explored before recommendations regarding possible changes to continental energy supply policy can be put forward.

Energy demand

The continental energy strategy we envision relies on governments to establish an economic framework that not only encourages and facilitates energy resource development in accordance with market conditions, but also encourages energy consumption that reflects the ability of consumers to make rational choices on the basis of price signals emerging from the marketplace. Therefore, policies with respect to energy demand in Canada, Mexico, and the United States should be reviewed to ensure that they allow industrial, commercial, and residential consumers to choose from a variety of energy alternatives in accordance with market conditions. As well, where demand response to price fluctuations is weak relative to what is generally believed to be necessary to achieve efficient adjustments in crisis situations (as with unexpected outages in the case of an electricity market), governments may be able to contribute to the development of more efficient markets through education programs and institutional arrangements that improve demand responsiveness.

Finally, governments have a role in ensuring that the policy framework is conducive to greater energy conservation and to improvements in energy utilization efficiencies. Lower energy utilization rates will assist businesses and households in managing their energy costs when facing rising energy prices resulting from oil market developments and other factors. Reduced energy requirements will also be compatible with environmental policy objectives.

[19] In general, it has not been difficult for investors to obtain approvals to construct natural gas transmission lines that cross provincial and international boundaries; however, in some cases, it has been almost impossible to obtain the agreements necessary to build new electricity transmission facilities.

Compatibility with environmental policy

Environmental policy developments aimed at reducing greenhouse gas emissions are occurring at various levels of government. The fact that many of the environmental policy changes that are taking place and being proposed will or could result in distorted resource allocation underscores the need for market-based solutions.[20]

As the first compliance period under the Kyoto Protocol rapidly approaches, the parties to it are now focusing on a framework to succeed it. In this respect, the agreements reached at the United Nations Climate Change Conference held in Bali in December 2007 were regarded by the Conference President as a significant milestone. In his closing remarks, President Witloelar indicated that the delegates had established a road map for launching a new negotiation process that would help to achieve a new climate future [Witloelar, 2007].

The expected proliferation of measures to curb greenhouse gas emissions will have a profound impact on energy use patterns because of the increased costs and the shift in relative fuel prices that these measures will inflict on the producers and users of the targeted fuels. The continental energy strategy program must assess how environmental policy changes that are likely to be implemented in Canada, the United States, and Mexico may impact the energy sector.

Currently, there are many important considerations that are, for the most part, being ignored in the environmental policy debate. For example, few prominent voices are being heard that support an assessment of climate change policy options with explicit reference to their consistency with property rights and/or policies that minimize market distortions. The continental energy strategy program will examine environmental policy prescriptions that impact the energy sector and, where appropriate, discuss opportunities for replacing subsidization schemes and other policies that distort market outcomes with market-based solutions.

Security of supply

The continental energy strategy must place high priority on ensuring that North Americans are protected as much as possible from the risks of disruptions in the availability of energy supplies. Security of supply could be improved to some degree by greater integration of energy markets in Canada, the United States, and Mexico, through the expansion of continental energy trade, facilitated by increased energy production, improved transportation systems, and trade policies.

[20] An example of an environmental policy change that has had unintended and undesirable outcomes is the subsidization of ethanol production which is pushing up grain and food prices.

However, energy security in North America should not be confused with energy independence. If North America were able to eliminate its reliance on overseas energy resources—a virtually impossible scenario—the economic and geopolitical consequences would be extreme. The high costs resulting from independence would have to be absorbed by the North American economy, and would slow productivity and provoke protectionism, turning North America against foreign trading partners that operate on cheaper energy models. The North American countries would also lose their economic and political influence over the development of the global energy sector.

The ability of North American policymakers to improve the continent's overall energy security situation by influencing developments outside the continent should not be underestimated. As a leading consumer of energy, a primary financer of energy trade and investment, and a top technology provider, North America is a critical mainstay of the global energy economy. In order to maximize North America's supply security, North American leaders must continue to rely on and support market-based aspects of the global energy system.

A viable strategy to secure supply must recognize the commercial and industrial direction of the energy sector and incorporate market mechanisms as a strategic tool to promote demand management and supply diversification within North America. The sheer volume of energy that is moved through the present infrastructure makes systemic enhancements, such as additional liquefied natural gas (LNG) terminals, greater integration of electricity transmission systems, and more oil storage capacity a matter of considerable economic significance. In addition, similar regulations among the three countries with respect to storage, pipeline, and electric transmission capacity would provide a stable and balanced mechanism for addressing internal security issues in relation to supply bottlenecks. The external dimension of continental energy supply security ought to capitalize on the collective size and relative efficiency of North America's energy sector, in order to influence the policies of foreign trading partners with respect to energy supply.

Diversification of energy supply and the drive for market efficiency will inevitably entail reliance in some cases on long supply chains that are susceptible to short-term disruptions and volatilities. Resisting the temptation to alter market-based mechanisms during periods of crisis will be critical to the development of a North American energy security strategy in the context of a growing continental energy market.

Workers

An efficient continental energy market would require people to build, manage, operate, and maintain energy infrastructure. People are intrinsic to the framework upon

which the North American energy industry has been built and from which it will grow. Based on free market principles, skilled workers would need to have better access to areas within the integrated energy market where market signals indicate that they are most needed. As well, by having improved access to North America's workforce, energy firms could be assured that their projects would be built in an orderly and timely fashion. Cross-border policies that alleviate barriers to intra-national and international worker mobility need to be developed to help ensure that there is an adequate pool of skilled and unskilled workers available to facilitate and sustain the growth of the North American energy market.

In 1997, Quebec and Newfoundland improved the mobility of Canadian workers through a labour mobility agreement that was designed to facilitate construction of the proposed Lower Churchill Falls hydroelectric development. More recently, there has been considerable excitement with respect to the Trade, Investment, and Labour Mobility Agreement (TILMA) between British Columbia and Alberta, which took effect on April 1, 2007, with a transition period lasting until 2009 [Ministry of Economic Development, 2006]. One of the main components of TILMA is the mutual recognition of qualifications for all occupations, including skilled crafts required in the energy and construction sectors.[21]

Currently, NAFTA facilitates the temporary cross-border movement of business people such as professionals, entrepreneurs, and investors [Foreign Affairs and International Trade Canada, 2002]. By extending the NAFTA labour mobility clause to include tradespeople, it would be much easier for Canadian, American, and Mexican workers to cross the border for employment within North America.

Adequate labour supply is a very important element of the energy strategy that we envision for North America. For this reason, a future paper on "people issues" will address possible policy changes for improving labour mobility, as well as other suggestions for ensuring that sufficient skilled labour is available to meet energy project construction, operating, and maintenance requirements.

Regulation

Another cornerstone of the continental energy strategy as we envision it at this preliminary stage relates to the regulation of energy supply. Regulation should be limited to situations where competition is not viable because of the economics associated with project size (as with major electricity and natural gas transmission lines) and regulations that are needed to protect consumers from monopoly pricing. In such situations,

[21] TILMA's mutual recognition of occupational certification will be phased in gradually until 2009, at which time it will be fully implemented.

regulation ought to be market-based to the greatest extent possible in order to reduce the cost of state intervention. In addition, regulatory processes should be fair and efficient. To this end, the regulation of oil, natural gas, and other energy resource (i.e., coal and uranium) development and production in North America and the procedures for approval of related infrastructure must be examined in order to determine whether there are opportunities for simplification and streamlining.

Streamlined regulatory approval processes are desirable because they ensure that decisions are rendered in an efficient time frame so that the construction of energy projects is not unduly delayed. For the same reason, it is important that regulatory tribunals, boards, and commissions have sufficient members and support staff because unnecessarily long hearing and deliberation periods can be very costly, leading either to increased capital costs or to the cancellation of investment plans. Ensuring that regulatory processes are not of excessive duration and that light-handed regulation is practiced will ensure that the cost of regulation is minimized. Allowing for negotiated rate settlements between oil and gas pipelines operators and shippers, whenever practical, will also help minimize these costs. In general, incentive regulation where the regulated party and the consumer share the benefits of efficiency improvements in the operation of a pipeline or other regulated entity is preferred because of the efficiency that it can bring.

Agreements and protocols that directly or indirectly impact the intra-continental movement of energy commodities and related services must not constrain such flows. With respect to trade, a review of oil, natural gas, electricity, coal, and uranium trade performance under NAFTA and other agreements and protocols should be carried out under the continental energy strategy research program and possible improvements should be proposed. This review should also include an assessment of the movement of related labour and materials.

Investment

In order to realize the construction of projects needed to produce incremental supplies of energy, as determined by market conditions and expectations, project proponents will require access to capital pools that are sufficiently broad and deep to facilitate the financing of energy commodity production, transportation, and transmission projects at costs commensurate with project risk. To this end, Canada must assure American and other foreign investors that it offers a low-risk business-friendly environment. As well, a continental energy strategy must embrace the development of policies that will allow greater foreign participation in the development of Mexico's energy sector. From a broader, continental perspective, this means convincing potential overseas investors that North America is a politically stable arena with considerable growth potential.

A future paper on energy investment issues will address the anticipated range of capital requirements in relation to energy project development in Canada, the United States, and Mexico from now until 2030. In addition, it will examine where development funds are most likely to come from, the main geographic centres and industry sectors with which North American energy projects will have to compete for funds, and policy options for mobilizing capital flows.

7 Conclusion

In this paper, we have presented our vision with respect to a continental energy strategy, including the principles and goals that we believe must underlie such a strategy. These principles include:

- relying on signals emanating from energy markets to guide investment;
- limiting the role of government to that of ensuring that the policy and institutional framework is conducive to the development and operation of competitive and innovative energy markets; and,
- ensuring free and open energy trade in energy commodities, both within the continent and with the rest of the world.

We have also identified a number of important factors that, in our view, will shape and condition continental energy development and trade. These factors must be carefully examined, weighed, and well understood before a comprehensive continental energy strategy that defines the respective roles of the public and private sectors can be put forward. As discussed, the North American continental energy strategy must consider:

- The energy supply potential of the region and its ability to compete with energy supplies from overseas. If, for example, the resource base in relation to a certain commodity is large but it is not being developed to its potential, then we must ask whether there are barriers to investment and whether policy changes are required to allow us to move forward at a reasonable, sustainable pace;
- The security of the energy supply in North America. If energy security is an issue that is limiting or slowing North American economic development, then whether the problem can best be resolved by broadening, rather than limiting, ties to energy sources outside the region must be examined. Also, the strategy must address whether there is need for policy to improve the ability of our regional markets to respond quickly and efficiently to curtailments in energy supply, either internal or external;
- How the changes in environmental policy taking place throughout the world will affect the competitiveness of North American energy producers, compared to producers in other regions. In developing the strategy, we must ask: Will changes in

relative costs arising from environmental policy changes mean that our resource developers will face greater hurdles to investment and that development and employment growth will be impeded to the detriment of communities and families? Will our energy resource development policies need to be altered and, if so, how?

- The energy investment outlook and the ability of the developers of North American energy production, refining, processing, and transportation projects to compete with other sectors and countries. Based on a reasonable consensus regarding the outlook for expansion of the continental energy sector through the next quarter century, and on current demographic trends in our three countries, will there be sufficient experienced people available to plan and sufficient skilled and non-skilled workers to build, operate, and maintain the new facilities?

- Labour issues. If the outlook for energy investment and projections of the outlook for the incremental labour supply needed to plan, construct, maintain, and operate the added facilities indicate that energy development is likely to be constrained by a shortage of labour, how can this be mitigated?

- The energy regulatory framework. In addition to the above-noted issues and factors that must be examined, the regulations and regulatory processes pertaining to energy investment, production, and trade need to be reviewed. This is very important because smarter, streamlined regulatory processes, which need less time for regulatory bodies to reach decisions and, therefore, cost less, will reduce barriers to investment in pipelines, transmission lines, and other facilities that are needed to further integrate the continental energy market.

Considerable work remains before a comprehensive continental energy strategy can be developed. But we are eager to lead this very important project and to contribute to its success. In particular, we look forward to fruitful dialogue on the key issues delineated above with Canadians in all parts of the country, as well as with our friends in the United States and Mexico, during the coming months.

References

Allegro Energy Group (2001). *How Pipelines Make the Oil Market Work—Their Networks, Operation and Regulation*. Memorandum prepared for the Association of Oil Pipe Lines and the American Petroleum Institute's Pipeline Committee (December).

Association of Oil Pipe Lines and the American Petroleum Institute (2007). *Overview: Crude Oil Pipelines*. Pipeline 101. <www.pipeline101.com/Overview/crude-pl.html>.

Birol, Fatih (2006). World Energy Prospects and Challenges. *Australian Economic Review* 39, 2: 190-195.

BP p.l.c. (2007). *BP Statistical Review of World Energy June 2007*. BP p.l.c.

Comision Federal de Electricidad (2007). *Generation*. (December). <www.cfe.gob.mx/en/LaEmpresa/generacionelectricidad/>.

Emera Brunswick Pipeline (2006). Application to the National Energy Board by Emera Brunswick Pipeline Company Ltd. (May 23).

Energy Information Administration (2006). *International Energy Outlook*.

Energy Information Administration (2007a). *About US Natural Gas Pipelines–Transporting Natural Gas*. <http://www.eia.doe.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/ngpipelines_map.html>.

Energy Information Administration (2007b). *Annual Energy Outlook 2007 with Projections to 2030*. <http://www.eia.doe.gov/oiaf/archive/aeo07/index.html>.

Energy Information Administration (2007c). *International Energy Outlook*. Energy Information Administration

Energy Information Administration (2007d). *Table 3a. International Petroleum Supply, Consumption, and Inventories*. <http://tonto.eia.doe.gov/ftproot/steo/oct07_base.xls#'3atab'!A1>.

Energy Information Administration (2007e). *US Imports by Country of Origin*. <http://tonto.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbblpd_a.htm>.

Energy Information Administration (2007f). *Petroleum Administration for Defense Districts*. <http://www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/paddmap.htm>.

Energy Information Administration (2007g). *Short-Term Energy Outlook Supplement: US LNG Imports—The Next Wave*. <http://www.eia.doe.gov/emeu/steo/pub/pdf/LNG_Jan2007.pdf>.

Energy Information Administration (2007h). *Table 10: Electricity Trade*. <http://www.eia.doe.gov/oiaf/archive/aeo07/excel/aeotab_10.xls>.

Energy Information Administration (2007i). *About US Natural Gas Pipelines—Transporting Natural Gas*. <http://www.eia.doe.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/ngpipeline_maps.html>.

Energy Information Administration (2007j). *Table 9: US Steam Coal Exports*. <http://www.eia.doe.gov/cneaf/coal/quarterly/html/t9p01p1.xls>.

Energy Information Administration (2008). *Spot Prices for Crude Oil and Petroleum Products*. <http://tonto.eia.doe.gov/dnav/pet/pet_pri_spt_s1_d.htm>.

Ethanol Producer Magazine (2007). Mexican Ethanol Use, Production Forecast to Take Off (April). <www.ethanolproducer.com/article-print.jsp?article_id=2857>.

Federal Energy Regulatory Commission [FERC] (2004). *LNG Briefing.* The FERC Office of Energy Projects (April).

Federal Energy Regulatory Commission [FERC] (2006). *A Guide to LNG—Liquefied Natural Gas—What All Citizens Should Know.* <http://www.ferc.gov/for-citizens/citizen-guides/citz-guide-lng.pdf>.

Foreign Affairs and International Trade Canada (2002). *North American Free Trade Agreement: Text of the Agreement*. <http://www.dfait-maeci.gc.ca/nafta-alena/agree-en.asp>.

International Energy Agency (2007). *World Energy Outlook* (November). International Energy Agency.

Ministry of Economic Development (2006). *Trade, Investment and Labour Mobility Agreement Between British Columbia and Alberta*. <http://www.gov.bc.ca/ecdev/down/BC-AB_TILMA_Agreement-signed.pdf>.

Morales, Isidro (2006). *Mexico's Energy Policy Options in North America's Continental Energy Markets*. American University Center for North American Studies, Working Paper No. 3.

Mukherjee, Andy (2007). Biofuels Will Make China, India More Thirsty. *Bloomberg* (February 8). <http://www.bloomberg.com/apps/news?pid=20601039&sid=aFruG4mf4HAI&refer=home>.

Natural Resources Canada (2006). *Canadian LNG Import Projects: Status as of September 2006*. Government of Canada, Natural Gas Division, Petroleum Resources Branch, Energy Policy Sector.

North American Energy Working Group and Security and Prosperity Partnership Energy Picture Experts Group (2006). *North America: The Energy Picture II* (January) <http://www.pi.energy.gov/documents/NorthAmericaEnergyPictureII.pdf>.

Ontario Energy Board (2006). *Report of the Board on the Review of, and Filing Guidelines Applicable to, the Ontario Power Authority's Integrated Power System Plan and Procurement Processes*. Ontario Energy Board.

Organisation for Economic Co-operation and Development [OECD] (2007). *OECD In Figures 2006-2007*. <http://www.oecd.org/document/43/0,3343,en_2649_34489_37806443_1_1_1_1,00.html>.

Pimentel, David, and Tad W. Patzek (2005). Ethanol Production Using Corn, Switchgrass, and Wood; Biodiesel Production Using Soybean and Sunflower. *Natural Resources Research* 14, 1: 65-76.

Shalaby, Amir (2007). *Overview of IPSP for Web Teleconference*. Ontario Power Authority.

Statistics Canada (undated). *CANSIM II Database*. Government of Canada.

Trans Quebec and Maritmes Pipeline Inc. [TQM] (2007). Preliminary Information Package on the Eastern Access Project filed by Trans Quebec and Maritimes Pipeline Inc. with the National Energy Board, August 2007.

United Nations (2007). *World Population Prospects: The 2006 Revision Population Database*. <http://esa.un.org/unpp/>.

Watkins, G. Campbell (1993). NAFTA and Energy: A Bridge Not Far Enough. *Assessing NAFTA: A Trinational Analysis*. The Fraser Institute.

Witoelar, Rachmat (2007). Address to Closing Plenary at the United Nations Conference on Climate Change in Bali, December 15.

World Bank (2007). *World Development Indicators Database: Total GDP 2006.* <http://siteresources.worldbank.org/DATASTATISTICS/Resources/GDP.pdf>.

About the Authors

Ralph Klein is a Senior Business Advisor with Borden Ladner Gervais LLP in their Calgary office. Mr. Klein served as Premier of Alberta from 1992 to 2006. He also served as the Provincial Minister of the Environment and had a very successful term as Mayor of the City of Calgary during which he oversaw the 1988 Olympic Winter Games in Calgary. Through his more than 30 years in public service, Mr. Klein has built the knowledge and relationships that will enable him to provide unique insights into public policy issues for Canadian and international clients. His particular areas of interest include oil and gas, electric energy, securities and capital markets, health law, and aboriginal law.

Mr. Klein holds the Chair in Media Studies, named in his honour, at Mount Royal College's Centre for Media Studies in Calgary. He conducts lectures, seminars, and tutorials, and serves as a Senior Fellow of The Fraser Institute, where he is leading a team in the development of a Continental Energy Strategy for North America. He has also accepted a term appointment as a Public Policy Scholar in residence at the Woodrow Wilson International Centre for Scholars.

Mr. Klein has received numerous honours and awards, including an induction into the Olympic Order, the Order of St. John, the Alberta Achievement Award, the Governor General's Award, B'nai B'rith's Citizen of the Century Award, and Calgary's Outstanding Citizen of the Century. He is the second Caucasian in history to be adopted into the Siksika Nation and was given the name Otskoipiiksi. In 1996, the Blood Tribe also made Mr. Klein an honourary chief in the Kainai Chieftainship.

Brian Tobin served as the Federal Minister of Industry from October 2000 to January 2002. Previously, he served as the Premier of Newfoundland and Labrador from 1996 to 2000 and won two consecutive majority governments in provincial elections held in February 1996 and February 1999. Mr. Tobin served as a Member of Parliament from 1980 to 1996 and served as Minister of Fisheries and Oceans in the federal cabinet from 1993 to 1996.

Mr. Tobin is currently a Senior Business Advisor with Fraser Milner Casgrain LLP in Toronto. He serves on a number of public company boards, including Lions Gate Entertainment Corp. and Aecon Group Inc., and is Vice-Chairman of the board for Consolidated Thompson Iron Mines Limited and Chairman of the board for New Flyer Industries Inc.

Mr. Tobin is also Chairman of the board for CommerceTel Canada Inc. and a director for Marport Deep Sea Technologies Inc., Sonnen Energy, and Canpages Inc.

In addition, Mr. Tobin is a strategic advisor to a number of Canadian corporations. He is a Senior Fellow of The Fraser Institute, focusing his work at the Fraser Institute on Canada's energy policy. He is also the Special Advisor for the Canadian Youth Business Foundation.

Mr. Tobin has completed his memoirs, entitled *All in Good Time* and published by Penguin Books.

Gerry Angevine is a Senior Economist in The Fraser Institute's Centre for Energy Policy Studies. Dr. Angevine has been President of Angevine Economic Consulting Ltd., an energy economics consulting firm, since 1999 and was a Managing Consultant with Navigant Consulting Ltd. from 2001 to 2004. He was President, CEO, and a Director of the Canadian Energy Research Institute from 1979 to 1999. Prior to that, he worked as an economist at the Canadian Imperial Bank of Commerce in Toronto and with the Bank of Canada in Ottawa.

Dr. Angevine is contributing to and coordinating research in relation to the Centre for Energy Policy Studies' Continental Energy Strategy project. He has also been overseeing the annual survey of upstream petroleum companies' perspectives on the relative attractiveness of jurisdictions around the globe for investment in petroleum exploration and development. In addition, he has authored a study examining the economics of a proposed "backbone" CO_2 pipeline in Alberta that would connect areas with surplus CO_2 production to depleted oil reservoirs amenable to enhanced oil recovery processes. Dr. Angevine has also published Fraser Institute reports on the demand responsiveness of the industrial sector of the Ontario electricity market and on the potential for public-private partnerships to assist the Regional Municipality of Wood Buffalo.

In addition, Dr. Angevine has undertaken studies pertaining to the domestic and international markets for natural gas (including trade, pipelines, and storage), oil and oil products (including oil sands, refining, and investment), and electricity (including deregulation, water rentals, and renewables). He has advised the Alberta Department of Energy and testified before the National Energy Board as an expert witness. He has AM and PhD degrees in Economics from the University of Michigan, an MA in Economics from Dalhousie University, and a BComm from Mount Allison University.

Acknowledgments

We wish to thank The Fraser Institute's Executive Director, Dr. Mark Mullins, who initiated the Continental Energy Strategy (CES) project, and for his confidence in our ability to lead the CES program. We also wish to express our gratitude to Fraser Institute policy analysts Graham Thomson and Dara Hrytzak-Lieffers (now with the Saskatoon Regional Economic Development Authority) for their tireless research assistance in locating and summarizing essential data, in preparing the figures and tables contained in the report, and in ensuring that the many references to other publications are accurate.

Connie Magnusson, Ralph Klein's secretary, and Jennifer Cropley, Brian Tobin's assistant, helped to move the project forward by advising the authors of deadlines, and arranging meetings with Institute staff, in addition to many other things. We are also grateful to the Institute's Kristin Fryer for her contribution as editor of the text and graphics, and as layout designer, and to Kristin McCahon, for overseeing and coordinating the publication process.

Thanks are also due to Fraser Institute Senior Energy Fellow Wilf Gobert and to the Institute's Director of Research Quality and Resident Scholar in Fiscal Studies, Jason Clemens, as well as Dr. Mullins, for providing comments and suggestions on earlier drafts. Although we benefited considerably from the insights and advice put forward by them and other persons who were involved in this first stage of the Continental Energy Strategy project, we are fully responsibility for the ideas, suggestions and interpretations of events and developments which are contained in this document.

Publishing information

Fraser Institute Digital Publications are published from time to time by The Fraser Institute to provide, in a format easily accessible on-line, timely and comprehensive studies of current issues in economics and public policy.

Distribution

These publications are available from <http://www.fraserinstitute.org> in Portable Document Format (PDF) and can be read with Adobe Acrobat® or with Adobe Reader®, which is available free of charge from Adobe Systems Inc. To down-load Adobe Reader, go to this link: <http://www.adobe.com/products/acrobat/readstep2.html> with your Browser. We encourage you to install the most recent version.

Ordering publications

For information about ordering the printed publications of The Fraser Institute, please contact the publications coordinator

- e-mail: sales@fraserinstitute.ca
- telephone: 604.688.0221 ext. 580 or, toll free, 1.800.665.3558 ext. 580
- fax: 604.688.8539.

Media

For media enquiries, please contact our Communications Department

- 604.714.4582
- e-mail: communications@fraserinstitute.ca.

Disclaimer

The authors of this publication have worked independently and opinions expressed by them are, therefore, their own, and do not necessarily reflect the opinions of the supporters or the trustees of The Fraser Institute.

Copyright

ISSN

1714–6739

Date of issue

February 2008

Editing, production, and design

Kristin Fryer and Lindsey Thomas Martin

About The Fraser Institute

Our vision is a free and prosperous world where individuals benefit from greater choice, competitive markets, and personal responsibility. Our mission is to measure, study, and communicate the impact of competitive markets and government interventions on the welfare of individuals.

Founded in 1974, we are an independent research and educational organization with offices in Calgary, Montréal, Tampa, Toronto, and Vancouver, and international partners in over 70 countries. Our work is financed by tax-deductible contributions from thousands of individuals, organizations, and foundations. In order to protect its independence, the Institute does not accept grants from government or contracts for research.

菲沙研究所的願景乃一自由而昌盛的世界，當中每個人得以從更豐富的選擇、具競爭性的市場及自我承擔責任而獲益。我們的使命在於量度、研究並使人知悉競爭市場及政府干預對個人福祉的影響。

創辦於1974年，我們乃一獨立的研究及教育機構，在卡加利、滿地可、坦帕、多倫多及溫哥華均設有辦事處，並在超過七十個國家擁有國際伙伴。我們的工作得到不同人仕、機構及基金透過可免稅捐獻資助。為了保持其獨立性，本研究所不接受政府的撥款或研究合約。

Nous envisageons un monde libre et prospère, où chaque personne bénéficie d'un plus grand choix, de marchés concurrentiels et de responsabilités individuelles. Notre mission consiste à mesurer, à étudier et à communiquer l'effet des marchés concurrentiels et des interventions gouvernementales sur le bien-être des individus.

Fondé en 1974, notre Institut existe en tant qu'organisme indépendant de recherches et établissement éducatif. Nous avons des bureaux à Calgary, à Montréal, à Tampa, à Toronto, et à Vancouver, ainsi que des associés internationaux dans plus de 70 pays. Notre œuvre est financée par la contribution déductible d'impôt de milliers de personnes, d'organismes et de fondations. Pour protéger son indépendance, l'Institut Fraser n'accepte ni subvention gouvernementale ni recherche sous contrat.

Supporting The Fraser Institute

For information about how to support The Fraser Institute, please contact

- Development Department, The Fraser Institute
  Fourth Floor, 1770 Burrard Street
  Vancouver, British Columbia, V6J 3G7 Canada
- telephone, toll-free: 1.800.665.3558 ext. 586
- e-mail: development@fraserinstitute.ca

Calgary

- telephone: 403.216.7175 ext. 227
- fax: 403.234.9010

Montréal

- telephone: 514.281.9550 ext. 303
- fax: 514.281.9464
- e-mail: montreal@fraserinstitute.ca.

Tampa, USA

- telephone: 813.961.6543
- fax: 636.773.2152
- e-mail: Joyce.Weaver@fraserinstitute.org.

Toronto

- telephone: 416.363.6575 ext. 232
- fax: 416.934.1639.

Vancouver

- telephone: 604.688.0221 ext. 586
- fax: 604.688.8539