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Achieving Energy Security through Integrated Canadian-American Markets

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Executive summary

The Canadian-US oil and gas sector has become deeply integrated over the last two decades. This is a success story in which competitive market forces by and large have displaced various attempts at government intervention on both sides of the border. Deregulation here does not mean the end or absence of regulation but rather regulatory measures that are geared to optimize free-market exchanges. Without much formal governance, Canada and the United States enjoy the world's most integrated and efficient energy border. In fact, the border is usually invisible as trade in oil, gas (and also electricity) flows in a patchwork of densely interconnected regions.

Canadians (and Americans) should not tamper with this development. While few political actors in either country are challenging the current energy set up, there are mounting pressures on the horizon. In Canada, two temptations must be resisted. First, energy nationalism is not quite dead. The steeply rising importance of Alberta's oil-sands deposits may cause other regions to look at political means to redistribute the wealth or redirect the trade flows. High oil prices may lure governments to nationalize energy exploration or production. Second, oil and gas exploration always pose environmental challenges and the extraction and processing of oil sands and bitumen as well as Arctic, offshore oil and gas, and gas production from coal do so even more. Oil sands exploration is a complex environmental challenge as well as an energy intensive process and as production is ramped up, it is bound to attract critics who will call for ceilings or freezes on production and excessive government intervention.

High prices and energy security

At this time when many are becoming concerned about high energy prices and energy security, Canadians and Americans must understand why industry needs to increase the energy supply and why it needs to do so in both countries. We define energy security as a function of diversity of supply within an integrated regional market. It rejects national energy independence or reliance on stockpiles as alternatives.

The Canadian public debate is skewed towards solutions that deal with energy conservation and energy diversification. We do not disagree with the importance of either of these objectives. In fact, in the face of persistent high prices for oil and gas we expect that demand for higher efficiency, hybrid cars, and possibly fuel-cell technology will increase. However, none of these options can address our energy needs in the short and medium term and none are likely to substitute for long-term energy supply.

Many Canadians simply assume that there is a large abundance of oil and natural gas in their country and that only America has an energy-supply crisis. In fact,

Canada has relatively little conventional oil and most of its fields are in decline. In the not too distant future, both our economies will begin to depend on the bitumen production from the oil sands. Moreover, Canada is now the single largest foreign source of crude oil and oil products for the United States. Reducing this flow in any way or not expanding it quickly enough would have large ramifications for the North American economy and might also have an impact on world prices. North America as a whole possesses less than 5% of global natural-gas resources. If the combined obstacles to drilling for natural gas in new areas are not removed and coal-bed methane production is not enhanced, Canada could run out of natural gas in less than ten years.

Canada is now a large exporter of natural gas to the United States. Increasing American demand and a supply shortage in Canada means that the United States will come to rely more on liquefied natural gas (LNG) imported from overseas. LNG imports into Canada are further away but both trends will likely mean changes to the pipeline structures between the two countries. Canadian gas industry needs to reposition itself in the North American market to benefit from these anticipated changes.

Trade between Canada and the United States in oil and gas benefits from five factors that together make it one of the most integrated energy markets in the world:

1. political stability and legal transparency;
2. private industry operating in a competitive market;
3. regional supply-and-demand areas with a high degree of north-south integration;
4. regulatory compatibility;
5. a single financial/investment area and congruent capital markets.

The recommendations that conclude our analysis are measures to enhance the integrated market-based relationship in oil and gas between Canada and the United States. While asset allocation and investment should be left to the market, government plays an important role in creating an optimal environment for investment. Government has to see its role as using market forces and providing targeted incentives for industry to invest in new technologies and additional capacity. Therefore, federal and provincial measures should be focused in three areas:

1. signaling a long-term commitment to market-based solutions and removing policy uncertainties arising from environmental restrictions and First Nations land claims;
2. streamlining and consolidating regulations and regulatory procedures within the framework of an integrated Canada-US market; modernizing regulations and developing best practices in the exploration and production of unconventional oil and gas;
3. providing market-based incentives for investment to overcome impediments to developing greater capacity and new technologies.

Recommendations

1 Government incentives rather than environmental freezes to help speed up technological advances in energy efficiency and emissions reduction for the process of producing and upgrading oil-sands bitumen.

2 Targeted tax incentives for developing a heavy oil pipeline infrastructure to encourage industry to move beyond the current piecemeal approach.

3 The enhanced use of the Temporary Foreign Worker Program to bring in foreign skilled labour as well as provincial and federal tax incentives for specialized training and on-the-job training in order to alleviate the acute labour shortages now experienced in the oil sands industry.

4 Critical review by the Canadian government of sizeable and geopolitically-motivated investments in Canadian oil-sands leases by foreign, state-owned companies to avert cost distortions for private-sector players and control by foreign states of resources now managed by market forces only.

5 Investment by the Alberta government (in cooperation with the Federal government where appropriate) in public infrastructure for communities currently stretched to the limit by the rapid growth in the oil-sands industry to maintain investor confidence.

6 A joint British Columbia-Federal task force to fast-track the opening of British Columbia's offshore natural-gas production.

7 Canadian-American cooperation on developing harmonized and streamlined best practices and regulations in approving new liquefied natural gas (LNG) facilities and in regulating LNG imports, using some of the new provisions of the 2005 *US Energy Policy Act*.

8 Canadian consideration of time limits on environmental reviews for oil and gas pipelines and tax incentives (harmonized with those of the United States) for pipeline construction to reflect changes in the 2005 *US Energy Policy Act*.

9 A clear time frame for the settlement of disputes between the Canadian government and the Deh Cho that are delaying the building of the proposed MacKenzie Valley Pipeline.

10 A new federal tax and royalty regime for Arctic oil and gas modeled on results-based tax-and-royalty principles now in use in Alberta and Alaska in order to re-kindle investor confidence in the resource-rich Beaufort Basin.

11 Simplification of the well-drilling approval process for coal-bed methane gas that would include allowing closer well spacing and "commingling" of two or more zones [1] to reduce impediments for tight-gas exploration and production.

12 Government review of regulations, application processes, and incentives in order to make nuclear reactors for steam and electricity generation a more attractive option in oil-sands production and to lessen demand for natural gas as well as provide a cleaner source of energy.

13 New Alberta legislation that replaces its surplus natural-gas capacity regulation on short-term gas export permits with the National Energy Board's policy of issuing short-term export permits with no restrictions on volume or requirements for public hearing. Such a law would remove any potential for export controls and add further confidence in the market-based gas trade between Canada and the United States.

[1] The term "commingling" applies to the regulatory process when drilling on an adjacent parcel of land is allowed with only notification to the regulatory authorities and not a re-application.

1 Introduction, qualifications, and context

The energy relationship between Canada and the United States in a global context

Canada and the United States benefit from a broadly integrated energy market. While most oil and natural gas in the world is owned, mined, and exported by state-controlled companies, the market shared by Canada and the United States is almost entirely private. The enormous demand for both oil and natural gas on the part of American customers has led to considerable investment, exploration, and exports of Canadian natural gas and oil resources. This demand-and-supply relationship between the two nations has been streamlined and made highly efficient when both countries beginning in the late 1980s dropped most nationalistic policies such as price controls, export limits, and restrictions on foreign ownership. Unencumbered by nationalist or protectionist laws and regulations, and guided by a world price for oil and regional price for natural gas, the flow of energy products closely mirrors market demand and supply. This has created multiple north-south trade corridors. For example, Western Canada sells oil and natural gas to the US Midwest and the Pacific Northwest while Eastern Canada imports crude oil from overseas as well as natural gas from the area around the Gulf of Mexico.

The same logic of interconnectedness applies to the North American electricity grid though provincial crown corporations put some limits on competitive pricing. The US suppliers sell electricity north during the winter season and Canadian suppliers sell to the US during the summer months. The grid is so interconnected that problems with reliability in one section can very quickly cascade and affect an entire region, as was witnessed in August 2003 when two Canadian provinces and eight American states experienced massive blackouts due to transmission problems in Ohio. Greater reliability controls for the entire grid have been pursued by both Canadian and American regulators in a co-operative manner. Increased interconnectedness in all directions where appropriate would improve reliability and system stability.

The fundamentally competitive nature of the energy market between Canada and the United States is reflected in the Canada-US Free Trade Agreement (CUFTA) and the North American Free Trade Agreement (NAFTA). Mexico largely exempted itself from the benefits of NAFTA as it sought multiple provisions to maintain the monopoly given to Petróleos Mexicanos (PEMEX) and Mexico's Federal Electricity Commission (CFE)—its state-owned energy companies set up after 1938 when Mexico nationalized its oil, gas, and electricity sectors. Thus, while Mexico sells a large amount of crude oil to the United States, and the United States increasingly sells natural gas to Mexico, there is at this point no integrated market between Mexico and the United States comparable to that between Canada and the United States.

Qualifications

This study highlights the role competitive market forces play in oil and gas supply and security, and how these apply to the relationship between Canada and the United States. It provides an overview of the problems, challenges, and options of increased energy security between these two trade partners in North America as a result of the global and regional pressures on oil and gas. It aims to review the main economic and political issues and make recommendations for strengthening the Canada-US oil and gas market. It concentrates on supply security with special emphasis on investment and production issues.

What the report does not do

While the report discusses Mexico's oil and gas sector in describing the North American situation, it does not offer recommendations on how to fix lagging oil production in Mexico and its growing dependence on natural gas exports from the United States because the problem is determined by Mexico's constitutional and political system and is, therefore, outside the scope of this study. A competitive oil and gas sector in Mexico would greatly enhance the prospects of North American energy security.

This study does not offer a comprehensive review of energy in North America nor does it purport to solve all aspects of energy security on the continent. It focuses mainly on oil and gas production in Western Canada and only makes reference to other forms of energy such as coal, nuclear energy, and electricity to help explain the relationship between the oil and gas markets of Canada and the United States. The study is not an exhaustive analysis of the regulatory regimes in each energy sector or each region. Given the dominance of Alberta in the oil sands, many recommendations are directed towards this province.

While we recognize the importance of energy efficiency and environmental factors in the energy question, this report does not focus on these topics. The report also does not claim to be exhaustive in terms of exploring alternate forms of energy, including renewable energy that may address the tightening relationship between demand and supply in oil and gas. Finally, the study does not seek to make a case for any particular industry or investment choice.

Statistics

Most oil and natural gas statistics used in this report come from the International Energy Agency, the US Energy Information Administration, Canada's National Energy Board, and are additionally buttressed by other reputable sources such as the BP Statistical Review. Variations in measurements and statistics are abundant in this sector. We have sought to use those sources that both provide 2005 figures and make for the easiest comparisons between Canadian and American numbers. Still, there are no

rigorous international standards for estimating oil or gas reserves and some differences in reserve figures may occur. [1] And, while the market functions via a complicated exchange of types of crude oil, levels of refined oil, as well as various oil products, most statistics in this paper are in terms of barrels of crude oil.

Context

The energy crunch

It is important to re-assess the Canadian-American market in energy at a time when three factors are simultaneously putting considerable strain on the supply of crude oil and crude oil prices. Though it is less well known, there are also comparable pressures on the supply of natural gas. These emerging production shortfalls bring to the fore the question of the security of the energy supply. The three pressures on the supply of crude oil are as follows.

[1] Robust economic growth

First, the global economy is experiencing robust rates of economic growth in many areas at the same time. The "Asian flu," which kept economic growth rates in Asia at a modest level in the 1990s, is certainly over. Traditionally, industrializing economies in their take-off stage are highly dependent on crude oil. Led by robust growth in China and India, the global market is experiencing sustained rising demand for crude oil. This Asian demand is compounded by strong American economic growth. Furthermore, the rapidly developing economies in Latin America and central and eastern Europe add additional pressure on oil demand.

Thus, from 2003 onward, with the exception of several large economies such as France and Germany, almost the entire world has experienced strong growth rates at the same time. World GDP rose by 5.1% in 2004 and by 4.4% in 2005. In the five-year period between 1997 and 2002, world demand for crude oil rose by about 4 million barrels per day (Mbbl/d) from just under 74 Mbbl/d in 1997 to 78 Mbbl/d in 2002. However, between 2003 and 2005, oil consumption rose to nearly 86 Mbbl/d, gaining a full 8 Mbbl/d in just three years [Tertzakian, 2006: 110]. The International Energy Agency forecasts that world demand for oil will continue to grow by over 30% from today's levels to 115 Mbbl/d by 2030 [Bahree and Cummins, 2006].

[1] While there are various methods of estimating crude oil reserves, most of the world's investor-owned oil reserves are accounted for by the standards set by the US Securities and Exchange Commission. The current "1978 system" is based on older technology and modernized standards for estimating reserves are currently being considered [Yergin, 2005].

Even if economic growth rates were to decline, both Europe and North America would still need to import more oil and gas than they do now as their own supplies are dwindling. The European Union's recent "Green Paper" on Energy estimated that Europe's dependence on imported oil and gas will go from 50% today to 70% by 2020 [Beunderman, 2006].

[2] Geopolitical forces in major oil-producing regions

The second source of pressure on the supply of crude oil has come from geopolitical forces in nearly all the major oil producing regions. These political constraints make the future supply of oil look increasingly uncertain and drive up the price of crude oil in the futures market. The various pressures in the Persian Gulf area are well known. Iraqi production levels are only half of its 3.5 Mbbl/d output before 1990 [British Petroleum, 2005]. The threat from Al Qaeda to Saudi production facilities is now widely discussed. Finally, the possibility of sanctions on Iran as a result of its standoff with the United States and Europe over its nuclear program and, in the case of a military conflict, the safety of the Strait of Hormuz—the main gateway for tanker traffic out of the Persian Gulf—has increased the price of oil in the futures market. The only good news in the region is normalization of relations between Libya and the West, which is leading to new inflows of investment to Libya's oil fields.

While there is increasing risk to the supply of oil from the Persian Gulf, civil unrest in Africa's largest producer, Nigeria, adds to the pressure on global oil supplies. Nigeria is an important exporter of sweet, light crude, the oil that is low in sulpher and not too dense for which most of the older Western refineries are best equipped. Frequent sabotage of the oilfields or threats to foreign oil workers as a result of a brewing civil war has slowed down Nigeria's production and export rate.

The trend away from market-based oil production in Russia and Latin America and towards nationalization and more state control are yet another geopolitical factor affecting the supply and price of crude oil. Some have called this effect the "dictatorship dividend" [Boot, 2006]. The president of Venezuela, Hugo Chavez, is trying to foment a Bolivarian revolution on the continent in which foreign oil firms lose their investments and their share of the returns by state fiat. Bolivia and Ecuador are following suit. Venezuela's considerable oil reserves have as a result not attracted enough recent investment while Chavez's policies—including massive layoffs—have caused a significant drop in oil production. Russia's obvious move away from its ten-year democratic experiment struck home when it turned off its natural gas supply to Ukraine, an action that in turn affected supply levels in Western Europe. Vladimir Putin had earlier reversed the privatization process in the Russian economy that began under Boris Yeltsin. The most visible sign of Putin's desire to rein in the private energy industry came with the forcible expropriation of the Yukos oil company and the politically-motivated trial and imprisonment of its founder, Mikhail Khodorkovsky. State-owned firms are

again monopolizing the Russian market as Western companies such as Exxon Mobil Corp. and Royal Dutch Shell PLC are forced to cede control over oil and gas projects. Putin also appears intent on using oil and gas exports as tools in Russia's foreign policy. The resulting lack of private foreign investment in exploration and infrastructure is at the same time constricting Russia's output.

Going counter to the general trend of globalization, oil and gas reserves are increasingly held directly by state-owned firms. Today, less than 20% of world oil production is in the hands of private firms [Firey, 2006].

[3] Conventional oil reserves dwindling

Finally, there is mounting evidence that conventional oil reserves in North America and in the North Sea as well as reserves on existing oil fields in the Persian Gulf are dwindling [Tertzakian, 2006: 125]. Two factors underlie this growing realization. Even with increasingly sophisticated three-dimensional seismic technology and horizontal drilling techniques, fewer large fields of conventional oil are being found. In addition, production in many established reservoirs is clearly slowing down, as is evident in North American and North Sea conventional reserves, regardless of how many extra wells are being drilled.

Stating that production in conventional fields is falling is not the same as concluding that oil production will soon peak or that the era of oil dependency is drawing to a close. While there are many analysts who conclude that total world supply in conventional oil will soon peak, one basic factor on the supply side is overlooked in this prognosis.**[2]** The big Persian Gulf producers such as Saudi Arabia, Iran, and Iraq have simply not invested in new exploration or more intensive production processes as their state-owned companies have diverted most oil revenues into national coffers. A handful of older wells produce nine million barrels of oil per day in Saudi Arabia. Although the United States produces five million barrels per day, over one million exploration wells have been drilled in Texas alone, while less than two thousand of such wells have been drilled in Saudi Arabia and Iraq combined [Maugeri, 2006]. If the Persian Gulf area allowed more private investment and ownership of the resources and competition in the various segments of this complex industry, increases in capacity and output would be substantial. The tremendous incompetence of state-run oil companies living off decaying 1960s era infrastructure and expertise should not be mistaken for an oil peak.

[2] Whether oil is peaking is an extensive debate that cannot be covered here. There are some who believe that big producers such as Saudi Arabia are in fact covering up just how depleted their reserves are while using the latest technology to keep existing fields productive. See for example, Roberts, 2005 and Simmons, 2005.

Even if existing supplies of conventional oil should begin to peak after 2030, this would not mean that the world was running out of oil, for there has been relatively modest exploration of vast regions with probable oil and gas reserves. The problem is that most of this oil is in remote areas, at great depths under the ocean, or in politically unstable jurisdictions.

Looking beyond conventional oil, Alberta now has economically viable reserves of some 175 billion barrels of bitumen in its oil sands, second only to Saudi Arabia's conventional reserves (250 billion barrels). Beyond the oil sands lies the long-term prospect of shale oil. Should this even heavier form of oil become economically viable, the US Energy Information Administration estimates that the world contains 2.9 trillion recoverable barrels of this oil with the United States having the single largest deposit (790 billion barrels).

The volume of oil reserves are not the only factor in this complex calculation. There will inevitably be changes on the demand side as the price of oil increases. Higher prices will spur greater fuel efficiency (as happened in the 1970s and early 1980s) and more energy diversification away from oil to other fossil and non-fossil fuels. Not to be excluded is the possibility that higher prices will stimulate more research, which may lead to a technological break-through (the "silver bullet") that could bring an energy source competitive with crude oil. Demand continues to shape markets in unpredictable ways.

It is clear that growth in demand, increasing political instability in the vast majority of producer nations, and diminishing supplies of sweet, light crude are causing a tighter market in oil supplies and spare global oil capacity. Throughout the 1980s and 1990s, the producers around the Persian Gulf typically had upward from five million barrels per day spare capacity to produce oil in order to offset any temporary shortfalls. In 2003, world spare capacity for the first time fell below 3.5 Mbbl/d. After Hurricanes Rita and Katrina in 2005 severely limited American output, world spare capacity fell below 1 Mbbl/d. As a result, any contingency anywhere in the global supply chain has an immediate effect on price. Tightness in crude-oil capacity puts continual pressure on the price of crude oil. A general shortage of newer oil refineries that can handle heavier crude oil and synthetic crude oil puts further pressure on gas prices for consumers at the pump.

Even though the current bout of tight oil supplies may be followed by a period of plentiful supply, long-term energy security in North America depends on a variety of measures including diversifying sources of oil and gas, energy conservation and conversion, and higher levels of energy efficiency. However, in the short to medium term, energy security depends just as much on increasing the continent's supply potential. The highly-integrated Canadian-American energy market offers several options for improvement in this regard.

Nationalist and environmentalist energy policies

The Canadian Centre for Policy Alternatives (CCPA) combined forces with the Parkland and Polaris Institutes to publish *Fueling Fortress America* [McCullum, 2006], a report claiming that oil-sands development has hurt Canada. The report's author, Hugh McCullum, argues that Canada should re-assess the rapid development of Alberta's oil sands in light of their alleged social and economic cost, environmental impact, and Canada's long-term energy security. The report quickly reveals a deep political suspicion of the United States "as the world's predominant economic and military superpower … with imperial characteristics on the global scene" [McCullum, 2006: 9]. The United States is labeled "a war-based economy" and Canada its "military fuel pump" [McCullum, 2006: 39–42].

The report's recommendations pose a threat to market-based integration between Canada and the United States. It calls for a moratorium on further expansion of the oil sands [McCullum, 2006: 58]. The federal and provincial governments are urged to revert back to a command-and-control function in the Canadian energy sector: Canada should return to the policies of the National Energy Plan (NEP) that created two price systems, one for Canadian demand and another for foreign export. It calls for incentives for more petrochemical manufacturing, fertilizers, paints, and other petroleum derivatives in order to create more value-added industries in Canada. While we agree that diversification in the petrochemical industry is a sound long-term investment, the report is oblivious to the poor global track-record of such export-substitution schemes as engineered by governments rather those undertaken by individual investors. Finally, the author suggests that Ottawa should "emulate Mexico" by seeking an exemption from the proportional sharing clause in NAFTA [McCullum, 2006: 61]. In other words, the report calls on Canada to exercise its powers to limit exports in oil and gas.

In *Oil Sands Fever: The Environmental Implications of Canada's Oil Sands Rush*, published by the Pembina Institute, authors Woynillowicz, Severson-Baker, and Raynolds offer a more substantial and balanced argument than McCullum [Woynillowicz et al., 2005]. Still, their diagnosis and recommendations could lead to excessive government intervention in the oil industry and slow down the needed growth in Canadian oil production. They argue that the environmental costs of the current rush to mine the oil sands calls for substantive government intervention. In their view, regulatory agencies must ensure that development is "fair, responsible, and in the public interest. These agencies must be empowered to effectively and proactively manage the growth" [Woynillowicz et al., 2005: 10].

Unrestrained development of the oil sands, in their view, will destroy forests, displace animals, and change river flows and also magnify the problem of greenhouse-gas emissions as the process of refining oil from the sand into a usable form for consumption uses significant quantities of energy. Further, oil sands development, they

continue, must be part of a national energy strategy sensitive to Kyoto requirements and reflective of Canada's role as an environmental leader. The Pembina report recommends that provincial royalty rates be increased and that federal and provincial subsides going to oil companies be redirected to "conservation of energy, energy efficiency, and expansion of low-impact renewable energy" [Woynillowicz et al., 2005: 67].

Clearly, the Pembina Institute's report identifies important environmental aspects of the oil and gas industry but its recommendations fail to perceive broader opportunities in making the energy sector more efficient and environmentally friendly. We argue that a more integrated North American energy sector will provide flexibility and economies of scale for higher-cost alternative fuels and more efficient production technologies. The provincial and federal governments already regulate the responsible use of water, land, and air and the industry is equally interested in building a long-term sustainable sector that includes reclamation of land and replanting of forests. *Oil Sands Fever* speaks of "irresponsible demand," [8] and advocates a policy that removes exploration incentives and ratchets up royalty rates. Such a policy invariably retards the investment in technological innovations. Instead, close cooperation between government and industry on water use, tailing ponds, and land reclamation as well as the provision of infrastructure should be pursued without putting an artificial ceiling on activity. Alberta has extensive experience with surface coal mining and a good record in subsequent reclamation projects.

The energy relationship between Canada and the United States has benefited both partners. Answers on how to strengthen energy security are not found in nationalistic policies or environmental freezes but in public policy that, by good regulations and regulatory cooperation, fosters opening up market access to more supplies and deepening the market integration already existing between the two countries.

2 Energy production, consumption, and trade in North America

The North American energy picture [3]

North America is endowed with moderate conventional oil reserves and relatively small reserves of natural gas but has robust oil-sands reserves. Taken together, proven crude-oil reserves total 213.1 billion barrels (Bbbl) of oil or 16.5% of total global reserves and 265.1 trillion cubic feet (Tcf) of natural gas or 4.9% of global reserves.

United States

Still an energy giant, the United States has seen oil production fall and reserves decrease but demand consistently increase. [Table 1] Crude oil reserves in 2005 continue to decrease since peaking in 1961 when there were 31.8 billion barrels: 2005 reserves have decreased 7.5% since 1993. The United States has also seen its production slow in the last few years: 2005 saw the United States produce 5.1 million barrels a day, 0.3 million barrels a day (bbl/d) less than 2004 and 12% less than in 2000. Yet, the United States consumed 15.2 million (bbl/d) of crude oil plus 5.5 million bbl/day in petroleum products for a total of 20.7 million (bbl/d), 9.1 million (bbl/d) in the transportation sector alone.

Like oil, natural gas reserves have fallen 34.3% since 1967, when total proven reserves were 292.9 trillion cubic feet (Tcf). Total reserves in 2005 were estimated at 192.5 Tcf. Production fell from 19.2 Tcf in 2000 to 18.9 Tcf in 2004 (3.2% drop), to 18.3 Tcf in 2005, (4.7% drop). In 2005, the United States consumed 22.2 Tcf of natural gas to heat (mostly) homes and to power electrical generating stations.

The use of thermal coal for electricity production has made a resurgence in the last few years. The United States has 246.6 billion short tons of coal, enough to supply its current demand for coal for the next 250 years [BP Statistical Review, 2005: 30]. Improvements in technology, such as clean coal and scrubbers, have made coal more environmentally acceptable than in years past. This, coupled with the increasing cost of natural gas, has made coal into the leading fuel for electricity generation within

[3] All figures in this section are based on data provided by the US Department of Energy's Energy Information Administration (EIA) <http://www.eia.doe.gov/>. Canadian and Mexican consumption and production figures are based on Organization for Economic Co-operation and Development (OECD) data as published by the EIA. "Domestic Consumption" in this section is defined as consumption plus changes to stock. All natural gas figures are only for marketable customer-grade natural gas, also known as "dry natural gas." In other words, no account is taken of "lease and plant natural gas" used or lost in the production of oil and gas.

Table 1: The United States' Energy Picture, 2005

Reserves		**Net Canadian Exports to US**	
Crude Oil (Billions of barrels)	21.4	*Crude Oil (Mbbl/d)*	1.6
Natural Gas (Trillion cubic feet)	192.5	*Natural Gas (Bcf/d)*	9.1
Domestic Production		**Net Mexican Exports to US**	
Crude Oil (Million barrels per day)	5.1	*Crude Oil (Mbbl/d)*	1.6
Natural Gas (Billion cubic feet per day)	50.0	*Natural Gas (Bcf/d)*	–0.8
Domestic Consumption		**Net non-NAFTA Exports to US**	
Crude Oil (Mbbl/d)	15.2	*Crude Oil (Mbbl/d)*	6.9
Natural Gas (Bcf/d)	59.9	*Natural Gas (Bcf/d)*	1.6

Source: Energy Information Administration (EIA), US Department of Energy, <http://www.eia.doe.gov/>.

the United States. The United States produced 4.1 million terawatt hours [4] worth of electricity, generating roughly half of it through coal. Since 1996, American coal production has exceeded 1.1 billion tons annually. In 2005, the United States produced 1.1 billion short tons of coal, 2% of which went to coke plants, 5.8% to retail and industry, and 92.1% into the production of electricity.

The nuclear-power generating industry arose in the United States, as in other industrial countries, mainly as a response to the rise in crude oil prices in the early 1970s. As of October 31, 2005, the United States operated 104 commercial reactors: 69 pressurized water reactors and 35 boiling water reactors. In 2004, nuclear plants produced 788,528,000 megawatt hours of power or 19.9% of total electric power. But nuclear plants are operating at, or near, total capacity and have been doing so since 1989.

Despite the continued use and stretched capacity of nuclear generators, no new commercial reactors have been ordered since 1979. After the incidents at Three Mile Island and the accident at Chernobyl, and fuelled by the ongoing controversy over how to dispose of waste material, there has been no political will to build additional nuclear power plants. Only in the last two years, spurred by consistently high crude prices, has the option of more nuclear power been renewed, though it is still at an early stage.

Renewable sources of energy accounted for less than 10% of American electric generation in 2004. Hydroelectric generation accounts for 6.5% of American electric production. Wind, biomass, and other alternate forms of electricity production account for the remaining 2.9% of energy used to generate electricity. Despite renewed interest

[4] One terawatt hour equals 1 trillion watt hours. A watt is a "unit of electrical power equal to one ampere under a pressure of one volt, or 1/746 horsepower." <http://www.eia.doe.gov/glossary/index.html>.

in alternate energy sources, both their small share of the overall market and the high costs associated with increasing the rate of growth makes it unlikely that these sources will have a major impact on energy supply in the next ten to 15 years.

Canada

Increased global demand and a newly profitable source of oil have placed Canada on the cusp of an economic and strategic windfall. [Table 2] Counting bitumen from Alberta's oil sands, Canada has 178.8 billion barrels of proven oil reserves, second only to Saudi Arabia. Of this, 95% is found in Alberta, covering an area roughly the size of Florida. Approximately half of Alberta's 2.7 million bbl/d oil production in 2005 was synthetic crude oil. The bitumen is separated from oil sands, where molecules of oil are stuck between grains of sand. The process of separation is costly and energy intensive and is dependent on the price of a barrel of oil staying above the US$25 to $30 range. Further distillation of the crude produced after separation results in a grade of refined crude oil ("syncrude") that is similar to that of Brent (North Sea) or West Texas Intermediate and the grades of oil found in Saudi Arabia.

In addition to the bitumen that is extracted from oil sands via shallow mines, Alberta also has huge quantities of bitumen contained in oil sands deep below ground. This oil is buried deep and is very viscous, rendering conventional methods for extraction useless. Instead, in a process called *in situ*—literally, "in place"—two pipes are drilled into the ground, one in the middle of the pocket the other below it. In so-called steam-assisted gravity drainage technology, steam is pumped into the top pipe making the oil more fluid and enabling it to flow into the second pipe and be drawn to the surface. Production of crude oil from both methods continues to rise from 850,000 bbl/d in 2003 to well over 1 million bbl/d in 2005. The oil drawn

Table 2: Canada's Energy Picture, 2005

Reserves		**Net US Exports to Canada**	
Crude Oil (Billions of barrels)	178.8	*Crude Oil (Mbbl/d)*	–1.6
Natural Gas (Trillion cubic feet)	56.6	*Natural Gas (Bcf/d)*	–9.1
Domestic Production		**Net Mexican Exports to Canada**	
Crude Oil (Million barrels per day)	3.1	*Crude Oil (Mbbl/d)*	0.0
Natural Gas (Billion cubic feet per day)	18.1	*Natural Gas (Bcf/d)*	0.0
Domestic Consumption		**Net non-NAFTA Exports to Canada**	
Crude Oil (Mbbl/d)	2.3	*Crude Oil (Mbbl/d)*	0.8
Natural Gas (Bcf/d)	9.0	*Natural Gas (Bcf/d)*	0.0

Source: Data from the Organisation for Economic Co-operation and Development (OECD), as published by the Energy Information Administration (EIA), US Department of Energy, <http://www.eia.doe.gov/>.

from *in situ* mining will become the dominant source in the medium term, going to as much as 80% of the total reserves.

Canada consumed 2.3 million bbl/d of oil in 2005. The rate of increase in Canada's domestic oil demand is far lower than the rate of increase in its oil production, positioning the Canadian oil industry more and more as a fast-growing export market. The primary market for bitumen and synthetic crude oil is in the United States.

Canada's 56.6 trillion cubic feet of proven and recoverable conventional natural gas reserves does not give it nearly as much of a future cushion as it has in the oil sands. **[5]** Canada's natural gas production increased from 14.4 Bcf/d in 1994 to 17.7 Bcf/d in 2000. But since 2000, production has remained largely flat as 2004 production was 17.8 Bcf/d. However, Canadian consumption has grown steadily in the last ten years. In 1994, consumption was at 7.5 Bcf/d but increased to 8.2 Bcf/d in 2000 and to 9.3 Bcf/d in 2004. If the rate of increase in both exports and domestic demand remains constant and no new reserves are explored, Canada will exhaust its currently proven reserves by 2011.

Unlike the United States where coal is the primary source of electric power, Canada derives most of its electric power through renewable sources. In 2005, Canada generated 580 terawatt hours of electricity, up slightly from 2004 but down from 2000. Of this, 60% comes from renewable sources, primarily hydro. The reliance on hydroelectric sources to generate electricity has largely remained flat since 2000. Unlike the United States, Canada has a relatively small supply of thermal coal at 7.3 billion short tons [National Energy Board, 2005]. The rest of the Canadian electricity generation breaks down in the following way: 60.4% hydroelectric, 25.0% oil and coal, 14.6% from nuclear sources. As in the United States, nuclear power has not been a growth option in Canada for over 25 years. Also, growth in alternate energy, with the exception of hydroelectric for which there remains some potential in British Columbia, Manitoba, Quebec, and Newfoundland, has been very slow and cannot offer much extra supply in the near future.

Canada and the United States have one of the most integrated electricity grids of any two countries in the world. While Canada remains overall a net exporter of electricity to the United States, Canadian exports are less than 1% of total US consumption. As both the United States and Canada have opted to use more natural gas to generate electricity, the future pressures on this commodity will have an increasing impact upon the electricity trade as well. Additional nuclear power as the solution for lessening this dependence has again been put on the agenda, especially in Ontario, the main location of Canada's nuclear energy sector.

[5] This conservative number does not include discovered reserves in the Mackenzie Delta/Beaufort Sea area or off Newfoundland that, according to the North American Energy Working Group, brings the number up to 87 trillion cubic feet [North American Energy Working Group, 2006]. The National Energy Board estimates that, if all potential natural gas resources are counted, including both onshore and offshore undiscovered resources, unconventional gas, and Coal Bed Methane gas (gas that is found in coal seams), the number totals over 500 Tcf [National Energy Board, 2003].

Mexico

Despite its potential for considerable reserves and some recent finds of new large fields, Mexico is the weak link in the North American energy chain. [Table 3] Pemex, the state-owned and state-operated company responsible for the exploration, production, and delivery of oil and natural gas, is under a heavy debt burden and, as a result, there is a lack of exploration to offset its depleted reserves. Mexico's total proven oil reserves continue their downward trend extending back to 1999. Production decreased in 2004 while demand increased. Clearly, Mexico needs to make major political and market reforms to maintain its current oil exports.

Mexico has small natural gas reserves, 16 trillion cubic feet, and even these are not optimally used. A good deal of gas is simply flared as there is no infrastructure in place to sell it as a commodity. Recently, Mexico has had to import gas from the United States to make up for the production shortfall, mainly in electricity generation. Mexican production of natural gas stood at 4.1 billion cubic feet per day but its demand was close to 5 billion. In 2005, Mexico's electricity sector generated 218 terawatts of electricity, 50% of which came from oil and coal.

The lack of investment and private competition and the inefficiency in the Mexican oil and gas sector with the resultant under-production in oil and gas shows how even a resource-rich country can fall behind when free-market conditions are prohibited. In Mexico's case, the state regularly pulls more than half of PEMEX's oil revenues into its general accounts. Dependent on this income, Mexico's Congress resists changing the constitution. As Mexico's economy continues to grow, it increasingly relies on US natural gas to run its electricity plants. US supply of Mexican gas demand more than doubled from 7% in 2001 to 15% in 2003. Thus, Mexico is putting even more pressure on the Canada-US gas supply when it could be a large-scale exporter of both oil and gas.

Table 3: Mexico's Energy Picture, 2005

Reserves		**Net US Exports to Mexico**	
Crude Oil (Billions of barrels)	14.6	*Crude Oil (Mbbl/d)*	–1.6
Natural Gas (Trillion cubic feet)	14.9	*Natural Gas (Bcf/d)*	0.8
Domestic Production		**Net Canadian Exports to Mexico**	
Crude Oil (Million barrels per day)	3.3	*Crude Oil (Mbbl/d)*	0.0
Natural Gas (Billion cubic feet per day)	4.1	*Natural Gas (Bcf/d)*	0.0
Domestic Consumption		**Net non-NAFTA Exports to Mexico**	
Crude Oil (Mbbl/d)	2.0	*Crude Oil (Mbbl/d)*	0.3
Natural Gas (Bcf/d)	4.7	*Natural Gas (Bcf/d)*	0.2

Source: Data from the Organisation for Economic Co-operation and Development (OECD), as published by the Energy Information Administration (EIA), US Department of Energy, <http://www.eia.doe.gov/>.

North American oil and gas trade

According to the US Energy Information Administration (EIA), Canada exported 1.6 million barrels per day of crude oil to the United States in 2005. Since 2000, Canadian exports of crude oil to the United States have increased by 19.9%. Mexican oil exports to the United States have fluctuated, rising in one year only to fall in the next. In 2005, Mexico exported 1.6 million barrels of crude oil per day to the United States. Most experts believe this energy trade will soon slow as Mexican domestic demand will rise and production lags behind. Canada is the largest single supplier of the 3.5 million (bbl/d) of petroleum products the United States imported in 2005. At 0.6 million (bbl/d), it exported nearly ten times as much in oil products as Mexico. Total exports of crude oil and oil products from Canada to the United States in 2005 amounted to nearly 800 million barrels.

The United States remains the number-one destination for natural gas exports from Canada. In 2005, Canada exported 3.7 Tcf of natural gas to the US or about 85% of all American gas imports. The remaining 15% is imported from the Caribbean and other points overseas as liquefied natural gas (LNG). Canada's exports have grown steadily over the last five years, increasing an average of 3.1% per year since 2000. Still, given the rise in Canadian demand and declining volume of conventional gas production, the volume of exports from current reserves is expected to decline. This could, however, be offset by growth in non-conventional gas and Coal Bed Methane production. Mexico has seen its natural gas export trade to the United States decline significantly since 2000: 2005 saw a mere 0.6 Bcf of natural gas exported to the United States. Between 2003 and 2004, all exports to the United States stopped as domestic consumption outstripped domestic supply. Since 2000, Mexican exports to the United States have decreased 95.1%.

American exports of natural gas to Canada have risen in recent years, though a large part of these "imports" has to be accounted for as transits, since Canadian gas exported to the US Midwest is then re-imported into Canada's central and Eastern regions. Western Canada is self-sufficient in natural gas, while Quebec and the Maritime provinces import natural gas from the United States. In 2005, 364 Bcf of natural gas was exported to Canada, compared to 73.0 Bcf in 2000. It should be noted that more than half of this increase is a function of growing gas transits and not a net increase in American gas exports to Canada. Exports to Mexico from the United States have risen sharply to make up for the shortfall in Mexican natural gas supply. In 2005, the United States exported 358 Bcf, down slightly from 397 Bcf in 2004.

3 The evolution of market and regulatory conditions

Historically, market and regulatory conditions in the Canadian energy sector have reflected the status of the energy-trading relationship with the United States. While general energy relations between the two countries have gone through cycles of tension and cooperation, since the 1950s two underlying conditions have consistently provided incentives for market integration: (1) The propensity of the sizable American market to absorb marginal output from Canada; and (2) the opportunities for arbitrage from cross-border trade in segmented regional markets on both sides of the border. Although it is generally perceived that cross-border trade in energy is defined by the American consumption of Canadian production, the reality is more complex. Moreover, it has been in dealing with the political and economic complexities of the energy trade with the United States that Canadian regulators have historically faced the most significant conundrums. Paradoxically, these problems have been simplified and reduced by the advancement of infrastructure, regulatory, and financial integration between the energy sectors of both countries. Producers and consumers in both countries are getting more of the economic benefits of market-driven integration.

Even though the petroleum sectors of both countries have been thoroughly linked since the late nineteenth century, it is not coincidental that the politicization of Canada's energy trade with the United States only occurred in the 1950s, when cross-border oil and gas pipelines were proposed. It was American demand that served as the main incentive for their construction. Even as two-thirds of Alberta's production capacity remained idle, Canada's major refineries in Montreal found it significantly cheaper to import foreign oil by tanker, than to have Alberta oil trucked or piped in. The American Midwest region was geographically close enough to Alberta, and far enough from alternative supply chains, to make oil pipelines seem commercially viable. Canadian nationalists were wary of cross-border energy networks developing at the expense of national integration.

The National Energy Board

In many ways, the setting up of the National Energy Board (NEB) in Canada was a reaction to the politicization of the pipeline approval process. The concerned stakeholders appreciated the economic benefits of oil and gas pipelines but disagreed on the geographical paths the pipelines were to trek. Until the establishment of the NEB in 1959, parliament directly authorized pipeline routes and operations by virtue of the 1949 *Pipe Lines Act* of Canada, a bill closely patterned on the *Railway Act*, which provided for federal regulation of pipelines crossing provincial and national boundaries.

By 1959, there was a parliamentary consensus that the regulatory process had to be depoliticized and handled by professionals. For the next three decades however, the professionals at the NEB had to grapple with the sobering questions, first, how each pipeline approval would affect the future development of the broader transmission network; and, second, whether reserves committed to the United States would constrain long-term domestic supply [Fraser, 1984].

Although the NEB has a mandate to regulate the interprovincial and international trade in natural gas, oil, and electricity, there have been marked differences in how it has regulated the trade in each commodity. Since the beginning, electricity has been the commodity that the NEB has been least inclined to regulate, especially after *The Constitution Act* of 1982 shored up provincial authority over the electricity sector. While the intensity with which the NEB regulated the trade of oil went through cycles that generally reflected Canada's evolving oil relationship with the UnitedStates, the NEB's role was substantially limited in the 1970s. At the height of heavy-handed government regulation of the oil sector, policy making and regulatory functions were shifted from the NEB to its political masters at the then newly established Ministry of Energy, Mines, and Resources (EMR) [Gray, 2000: 37].

Historically, the NEB has been most active as a regulator of natural gas. The reasons for this have less to do with the original mandate of the NEB than the coincidental realities of the natural gas trade since the early years. Moreover, the lessons derived from the NEB's regulation of natural gas have become increasingly relevant to the contemporary trade in oil and electricity.

Although the advancement of liquefied natural gas (LNG) technology in recent years is likely to cause change, the natural gas business in North America has been characterized by the commercial infeasibility of transporting natural gas in any other way than through pipelines. When in its natural state, natural gas has a significantly lower energy density than oil and is therefore unsuitable for transportation by tanker over sea or land. Consequently, the North American natural gas market has been insulated until recently from overseas suppliers. Furthermore, limited reserves in North America have meant that American demand for Canadian natural gas—unlike that for oil in the 1960s and 1980s—has remained consistent throughout the decades. In the 1950s and 1960s, when the Canadian natural gas transmission grid was still in its infancy, there were fears in Canada that sizable pipeline links to the United States could permanently alter the development of a grid that would sufficiently serve the interests of Canadian consumers.

Today, however, the pipeline infrastructure throughout Canada and the United States for natural gas, oil, and refined petroleum has been extensively expanded and integrated. Instead of soothing tensions between communities fighting to attract pipeline investments, the NEB has spent much of the last decade assuring the safety, reliability, and environmental friendliness of the already vast network. Even as the

demand for natural gas is projected to significantly grow in the coming years as a clean and efficient alternative to oil, Canadian-American natural gas integration is already in an advanced state and will not require major additions in transmission capacity [Bradley and Watkins, 2003: 25–26]. This stands in contrast to the electricity sector, which, according to the North American Electric Reliability Council (NERC), severely lacks transmission capacity [NERC, 2004]. What accounts for this difference?

Unbundling and "deregulation" of the oil and gas sector

The answer lies in a regulatory concept known as "unbundling." In the "deregulation" of the oil and gas sector in the 1980s under EMR Minister Pat Carney, the federal government removed an assortment of special regulations and taxes that it had been using since the 1970s to micromanage the Canadian oil and gas sector. In its place, regulatory practices were established to promote market-based competition at each level of the production, refining, transmission, and distribution process. In essence, the unbundling of the oil and gas sector has meant that, even if a producer has control over its own transmission and distribution network, it cannot refuse to transmit or distribute the products of other producers at fair market price. Consequently, a producer can directly strike a contract with a customer, independent of the transmission and distribution operators. The desired result from the regulator's perspective is to foster competition in the end market, promote flexibility and creativity within the industry, and to provide incentives for investment at each level of the supply chain. While this concept was quickly implemented in the Canadian oil and gas sector once there was a change of direction in federal policy, the provincially controlled electricity sector has been less affected.

In contrast to what the term "deregulation" implies (fewer or no regulations), the unbundling of services in the Canadian oil and gas sector has in fact required the establishment of sophisticated rules and regulations, which are generally welcomed by the market players. These regulations are meant to promote market forces instead of hindering them. In the unbundling of pipelines, much of the regulatory framework established by the NEB was borrowed from practices already developed in the United States. The salient dilemma in unbundling the services of transmission lines—be they oil, gas, or electricity lines—is how to establish a fair market price. While there are variations throughout North America, regulators are mandating pricing systems based on a calculated fair rate of return on fixed costs, rather than predetermining an absolute rate of return. Consequently, the profitability of the transmission operators is based upon the skill and efficiency with which they work their fixed assets.

In heeding the lessons learned from previous policy mistakes, the new regulatory mind-set recognizes that it is diversity and flexibility in a competitive energy

sector that can best ensure energy security. During the depression of oil prices in the 1960s, the federal governments of both the United States and Canada set up protectionist measures to secure the local upstream sector. [6] In effect, revenues from tariffs imposed on imported oil were used to subsidize the struggling domestic sectors. From 1960 to 1970, the United States gradually escalated restrictions on Canadian supply to provide relief to American producers. In reaction to these measures, the Canadian government established the National Oil Policy (NOP) and subsidized the Albertan upstream sector through an assortment of tariffs and quotas on the foreign oil favoured by the eastern refineries. When the Arab oil embargo caused a spike in oil prices and the situation completely turned around, the federal authorities became even more involved in commercial arrangements, but this time squeezed the domestic upstream sector. The political fallout from the rise in oil prices also encouraged politicians to take control away from professional regulators and use intrinsic regulatory measures to award political goods to their constituents. Precisely because market forces were identified as part of the problem rather than part of the solution, government measures exacerbated the problem.

At the height of centralized control of the American oil industry in the 1970s, companies were known to receive opposite directives from various entities within the federal government. A few were even sued by the justice department for anticompetitive collusion when participating in government-coordinated programs. Similarly, in Canada the National Energy Program (NEP) brought in a messy cocktail of special taxes, quotas, and regulations to determine how much oil from which producer a refinery could purchase, the volume it could refine, and the price it could charge for the end product. The federal government even determined investments in upstream exploration. In a speech given in 1983, former NEB chairman Jack Stabback expressed his frustration: "there is little doubt that the industry's expenditure plans would be far different if PIPs [Petroleum Incentive Payments] did not exist. One has to wonder whether it is appropriate that over 50% of Canada's exploration expenses are being devoted to frontier exploration" [Foster, 1983: 256].

The chief lesson learnt from these missteps was that the market remains the best comprehensive source of reliable signals that producers and consumers should adjust their economic behaviour. During the period in which price controls were in effect, a disconnection between regulated prices and real prices meant that producers found no incentives to produce more, and consumers found no incentives to consume less. Moreover, by relying on price-controlled historic patterns to make future projections, government decision-makers consistently overestimated future consumption

[6] The upstream component in the oil industry refers to the extraction and production of oil. The midstream sector denotes the storage and transportation of crude oil. Downstream activity includes refining and distribution of finished oil products.

and underestimated future production. Consequently, even more drastically centralized redistribution measures were undertaken to remedy the 'gap' between supply and demand. In truth however, no gap would have existed had the market been allowed to clear without price regulation. More importantly, the focus on the gap rather than on the price left a strong implication that prices would not be allowed to rise and that the gap would be rationed away. The fear of physical shortage served as a self-fulfilling prophecy by encouraging a frantic build-up of inventories by traders, refineries, utilities, and households. In the panic of 1979/80, it is estimated that inventory building alone cost a total shortage of about 10% of consumption [Yergin, 1992: 686–87].

In contrast, despite the severe disruption to North American production and refining capacity caused by Hurricane Katrina in 2005, virtually no physical shortage was reported outside of flooded areas. Evidently, regulators have started to recognize market competition as a source of security by itself. Critical federal and local regulatory measures were temporarily relaxed to allow supplies from around North America and abroad to move more quickly to where they were needed [Yergin, 2006]. The highly integrated nature of the Canadian-American market also meant that additional volumes of Canadian oil and gas were delivered to the United States on short notice. Much of this was done almost immediately by increasing the pumping pressures in pipelines carrying Canadian supplies to the United States and by reversing the flow of pipelines that would normally be making American deliveries to Canada. In the context of Canadian-American energy relations, it is important to note that, notwithstanding the integrated pipeline infrastructure, this feat was only possible because of the functioning of an integrated market-based trading mechanism. Not only did the various market participants find the economic incentives to transact as soon as possible, they were aided in doing so by a highly integrated and buoyant market for energy-specific financial instruments.

Integration

In the context of the Canadian-American energy trade, the word "integration" can have various meanings. Most fundamentally, the word is used to denote an increase in the volume of trade that would signify interdependence between suppliers and consumers. Secondly, integration could mean the coordination or consolidation of market mechanisms to reduce costs of entry to both suppliers and consumers. Thirdly, integration could refer to the harmonization of regulatory policies and practices. While these three definitions are not independent of one another, they are distinct.

Between 1950 and 1980, the Canadian-American energy trade consistently became more integrated based on the first definition, even though it regressed on the other two counts. To allow seamless trade on short notice, alterations were made in

the 1980s to cross-border energy-trading regulations. Among these changes were a faster approval process for short-term trading as well as a less restrictive calculation of tradable "surplus" capacity.

Even while changes to the formal treaty framework have been made sparingly, North American integration in the energy-related markets for products, services, capital, and information, has occurred with amazing momentum. A comparative survey of other regions suggests that commercial compatibility has been a better indicator of successful energy integration than the formalization of supranational frameworks. The market-driven integration of the electricity sector within the Nordic Council (Denmark, Finland, Norway, and Sweden) has generally been accepted as a successful example of contemporary cross-border energy integration. In contrast, the policy-driven and supranational integration of the EU electricity and gas sectors has been much less sucessful. Even more precarious has been the attempt to integrate the electricity and gas sectors of MERCOSUR (Argentina, Brazil, Paraguay, and Uruguay), where chronic under-investment has continued despite supranational pronouncements, largely because private industry lacks confidence that it will be protected from the collusion of policymakers, regulators, and state-owned companies along national lines [Pineau, et al.: 2004].

In comparison to the other regional examples, Canadian-American energy integration has been relatively successful since the era of deregulation. Unlike energy integration in the EU and MERCOSUR, Canadian-American energy integration has proceeded speedily without being politicized on national lines. Contrary to the fear of some Canadian nationalists, the market-driven integration of the energy sector has in fact presented Canada with the opportunity to obtain far better terms of trade than would otherwise be possible. Precisely because the rationalization of treaty agreements (including the Canada-US Free Trade Agreement [CUFTA] and the North American Free Trade Agreement [NAFTA]) in the energy sector has been increasingly based upon already existing market conditions, it is much tougher for special-interest groups in domestic American politics to make a case against Canadian interests.

Both CUFTA and NAFTA made little change to the terms of trade in energy. Apart from the impracticability of imposing free trade on Mexico's heavily nationalized energy sector, the United States and Canada were also intent on preserving the authority of their respective federal agencies that regulated energy. Since the regulatory mandate of both the American and Canadian federal governments is largely derived from the regulation of cross-border trade (both state/provincial as well as international) and not the direct regulation of the means of production, both federal governments were wary of entirely losing their policy-making capabilities. Therefore, it was agreed that each country could limit the exports of energy in order to promote the reliability and security of domestic supply. However, in order to protect foreign investors and suppliers, it was decided that imports would not be restricted. Consequently, investor

confidence in the Canadian-American energy sector has remained strong and this, in turn, has reduced the risks that under-investment would bring to consumers. In an era where, because of budgetary pressures, North American municipalities and local governments have started to divest en masse from public utilities, keeping investor confidence in the energy sector has been recognized as vital for energy security and economic prosperity in both Canada and the United States.

The vitality of the North American free market for energy has been most vividly demonstrated by the voluntary submission to its rules of the notoriously independent-minded state and provincial energy authorities. This has especially been the case in the electricity sector, which has not only been traditionally controlled by states and provinces but is also where the economic benefits of integration have been most obvious. Unlike oil and gas, (alternating current) electricity produced for the grid cannot be stored. Production and consumption have to be balanced instantaneously and therefore an integrated grid has the marked advantage of more easily absorbing short-term surges in demand or shocks to production. Additionally, since electricity can be produced by power plants running on vastly different economic models and primary sources of energy, the potential for arbitrage is significant. Consequently, market integration allows producers of low-cost electricity with an inconsistent supply of primary energy (hydroelectric or wind) to engage in swaps and futures contracts with producers with higher costs who otherwise could reliably increase production on short notice (combined-cycle gas, thermal, or nuclear).

Because of the cross-border electricity trade, the Canadian provinces of British Columbia, Quebec, New Brunswick, and Newfoundland have been able to use hydroelectric production to sell electricity at high prices (during peak hours) but buy it back at low prices. In recent years, British Columbia has in fact been a net exporter to the United States in dollar terms, even though it has been a net importer in terms of gigawatthours (GWh).

As in the oil and gas sector, price deregulation and the unbundling of transmission lines has been critical for market-based integration in the electricity sector. The precedence for this direction was set as far back as 1961 when British Columbia's premier, W.A.C. Bennett, exerted pressure on the Canadian federal government to make critical alterations to the Columbia River Treaty that Ottawa had just signed with the Eisenhower administration. Bennett insisted that the treaty be revised so that the electricity trade was denominated in dollars and not in GWh. The forward-thinking Bennett recognized not only that it was US dollars—and not US electric power—that would enable his province to undertake even more significant hydroelectric power developments but also that the province could in the long-term use its low-cost competitive advantage to extract far superior terms of trade in a competitively priced electricity market.

Another significant regulatory watershed came in 1996 when a directive from the US Federal Energy Regulatory Commission (FERC) settled a long-standing inter-

provincial dispute within Canada. For more than a decade, the Newfoundland government had been fiercely objecting to Hydro-Quebec's practice of using its monopoly power over transmission lines between Newfoundland and the United States to extract the arbitrage opportunities that would have otherwise been available to Newfoundland. Although the NEB was sympathetic towards Newfoundland's complaint and had recommended the unbundling of interprovincial electric transmission lines on the model that already had been adopted for oil and gas transmission lines, it remained powerless to enforce this principle. Even while the NEB supposedly still continued to have regulatory authority over provincial and international trade, the federal authorities were reluctant to clash with Quebec, especially since it was pointed out that the 1982 *Constitution Act* explicitly granted provincial jurisdiction over "development, conservation, and management" of electric power generation. The legal question centered on whether the unbundling of interprovincial transmission lines was a matter of *inter*provincial trade or *intra*provincial "management." In any case, the dispute was settled for all practical purposes when the FERC issued an independent directive ordering the unbundling of all electricity sold in the United States, whether by domestic or foreign companies. Hydro-Quebec was essentially forced to provide free-market access to its transmission lines to Newfoundland producers in order to maintain its own access to the domestic American market [Gray, 2000: 108–10].

Clearly, it is the strong economic incentives for trade—on both sides of the border—that are driving and sustaining North American energy integration. As the integration of the physical, legal/regulatory, financial, and information infrastructure has taken root, costs and risks to both consumers and producers have been reduced. Consumers are reaping the benefits of choice and "security of supply" while producers are benefiting from the advantage of selling their marginal production in a larger market and thus deriving "security of demand." This latter benefit should not be underestimated. It is generally recognized that Canada has the potential to be a leading supplier of energy to the United States. However, all sizable increases in Canadian production capacity are expected to come from what the industry considers "unconventional" sources of energy (i.e., oil sands, Arctic and offshore gas, and Coal-Bed Methane). Given the higher cost associated with exploring these unconventional resources, "demand security" for Canadian production will be of vital importance to Canada's economic interests.

While the production cost of Persian-Gulf crude oil is on average US$6 per barrel, crude oil produced from Alberta's oil sands can cost as much as US$36 per barrel [Maugeri, 2006]. On the one hand, the Canadian oil-sands industry produces a commodity with a volatile short-term price while, on the other, it has to contend with considerable long-term fixed costs. While the employment of American capital and personnel in the production of "unconventional" Canadian sources of energy—as envisioned by NAFTA—will mitigate some of the down-turn risks to the Canadian economy, sizable

capacity expansion on the Canadian side will only be commercially prudent when a large-enough market can be relied upon to absorb marginal production.

In the future development of the oil sands sub-sector in particular, the most significant potential in mobilizing marginal production will lie in engineering, industrial, financial, and legal/regulatory innovations that are geared towards the unsung benefits of an integrated market. The emphasis should be placed on unshackling the interaction between consumers and producers from unnecessary and out-dated regulations at all levels of the supply chain. Much cost-savings can be extracted from business-to-business interactions within the industry itself. For example, a recent technological innovation in the oil-sands extraction process is to use steam from a combined-cycle gas turbine to produce crude oil. Among other things, this process is more energy-efficient and commercially sensible because it will produce electricity as a by-product. Therefore, the economic model employed by such a producer will be greatly affected by accessibility to the gas and electricity markets.

4 Challenges and opportunities in the oil and gas sector

Oil

In 2005, about 40% of US imports of crude oil came from Canada, Mexico, and Venezuela, with Canada having the largest share at 16%. Given the structural problems with the oil sectors in the latter two countries and, in the case of Venezuela, also political problems, it is uncertain if the United States will receive more oil from either one. Since both American and Canadian conventional reserves are in gradual decline and offshore oil still has limited access, much of the increase in North American oil is expected to come from Alberta oil sands. The good news is that with crude-oil prices well above $30 per barrel, 174 billion barrels of oil are recoverable. Some estimate that oil-sands reserves will eventually prove much larger. Increasingly, oil-sands exploration will go from mining and extraction to *in situ* operations. Total investment in capital projects in new oil sands and expansion of existing projects till 2015 is estimated at between $94 and $135 billion, with 45 new projects and 135 expansion plans [Cattaneo, 2006d]. Goldman Sachs estimates that heavy oil investments will constitute 19% (versus 13% from traditional extraction) of global total investment by oil companies in the next six years [Bahree and Cummins, 2006]. In comparison, capital spending on oil-sands projects in the period between 1996 and 2004 was "only" $28 billion [Canadian Association of Petroleum Producers, 2006]. [7]

Even accounting for the likelihood that the rate at which demand for crude oil grows will ease somewhat due to substitution by fuels such as ethanol as well as more energy preservation and more fuel efficiency, American imports of crude oil and petroleum products are estimated to continue to rise substantially from the current number of nearly 13 million barrels per day. It is logical and profitable for both Canada and the United States that Alberta's production of both heavy oil and synthetic crude increase substantially. Given the investment intentions and the applications that have been approved, Alberta's production from oil sands is expected to go from just over 1 million barrels per day in 2005 to between 3 million bbl/d in 2015 as predicted by the National Energy Board in early June 2006, or 3.5 million bbl/d as predicted in a recent survey undertaken by the Canadian Association of Petroleum Producers [Cattaneo, 2006c]. Given the high rate of increase in construction costs, serious labour shortages,

[7] These investment numbers are in addition to substantial ongoing investment in Alberta's conventional oil and gas sector estimated at $21.2 billion in 2005 [Alberta Energy Integrated Vision, 2006].

and the complex challenge of water supply and land reclamation that government and industry have to resolve, it is difficult to see how more than 4.5 million bbl/d from oil sands (NEB's most aggressive scenario, four times the amount produced in 2005) could be brought online by 2015.

Still, global demand may slacken due to lower economic growth rates or oil substitution or energy efficiency in places such as China and India. After all, the oil industry has been a cyclical industry for over 100 years. Thus, a risk to oil-sands development in particular is that more investment and efficiency in Persian-Gulf oil production could increase output significantly from that region, producing a high-quality grade of oil at a lower cost of extraction than the deeply buried bitumen. In both cases, the price for crude could fall low enough to put profitability at risk in the oil sands. While at the moment the biggest challenge to the United States is security of supply, should the above conditions materialize, the main challenge for Canada will be security of demand.

The best long-term strategy for controlling these risks in Alberta oil sands and for keeping them as competitive as possible includes three prongs:

1 a highly integrated industry in which American (and international) investors share the risks with Canadian investors: the anticipated American joint ventures or takeovers of Canadian oil-sands companies is not a threat, as some Canadian commentators put it, but rather part of long-term risk-sharing providing stability for the Canadian oil industry;

2 further improvements and expansion of the interconnected pipeline system that reduces transportation costs and allows for flexibility in flows;

3 more heavy oil refinery capacity in Canada and the United States to improve the economies of scale of this heavy oil.

It is unlikely that the Canadian federal government will again attempt to impose nationalist energy policies. The constitutional powers of the provinces as well as the benefits of competitive markets have been generally understood. There is another political threat, however, in Canada to oil and gas exploration emanating from the environmental movement. Oil-sands production and upgrading was Canada's third largest (behind cars and electricity generation) emitter of CO_2 in 2005. Given the need for ramped-up oil production, the oil-sands industry may well climb to the top. At the same time, given the way in which the Kyoto Protocol has framed the debate, oil-sands production may well get squeezed by environmental policies aimed at decreasing Canadian CO_2 emissions.

Natural gas

The current glut of natural gas, mainly the result of a warm 2005/2006 winter, is filling storage facilities to their maximum and brought the price down from a high in 2005 of US$15 per million Btu to US $5 per million Btu in June of 2006. Most experts agree that this short over-supply is not a good indicator of the long-term future of natural gas and the National Energy Board is expecting a particularly tight market between 2006 and 2010 [NEB, 2004].

North America as a whole has a small portion (4.9%) of the world's established reserves of natural gas. Growth in the consumption of natural gas has outpaced growth in production in most mature economies, including North America, by 1% per year in the last several years and is expected to continue to do so long into the future [International Energy Agency, 2004b]. At current rates of usage and no new exploration, the continent will run out of natural gas in less than ten years.

There are, however, considerable extra reserves available but development of these are currently held up for the following reasons:

1. political moratoria: both Canada and US west-coast offshore as well as US east-coast offshore;
2. native land claims and/or opposition from environmentalists: pipeline to bring gas south from the Mackenzie Valley;
3. technological and/or economic feasibility: coal-bed methane and the safe disposal of saline water produced in the mining process.

Even if these extra reserves were opened up to production—a big 'if' in the case of the BC offshore, for example, given the clout of the environmental movement—the growing rate of consumption of natural gas in both the residential and industrial sectors and in electricity generation means that the continent would need to import large amounts of natural gas beyond 2015. Currently, Canada supplies 85% of the imports of natural gas into the United States but these constitute only 15% of American demand. Beyond 2015, Canada's own supplies will dwindle. US Energy Secretary Samuel Bodman stated in April of 2006 that he expects the United States to become dependent for 10% to 20% of its natural gas consumption on non-North American sources, mainly Russia [Smith, 2006].

Liquefied natural gas (LNG)

Given the declining conventional gas reserves and the unavailability of northern and offshore gas, liquefied natural gas (LNG) will be needed in the short and medium term. LNG is currently also seen as a key component in the long-term solution to North

America's shortage of natural gas. Technological advances and the rising price of natural gas are increasingly making the costly process of liquefying and re-gasification economical. Still, the investments are huge and the time necessary to build these facilities is around ten years. The United States is ahead of Canada in terms of existing LNG ports. Currently, the United States has five operating LNG terminals, mostly in the Gulf Coast area, and 30 more projects under proposal. Still, there are many regulatory obstacles to gaining approval for LNG facilities, especially at the state level. The 2005 *Energy Policy Act* gave the US Federal Energy Regulatory Commission (FERC) additional powers to speed up the approval process. Canada has two ports on the East coast under construction and five more in the application stage with partial approval now in place for the project in Kitimat, British Columbia [Natural Resources Canada 2006].

The current relationship between Canada as the oil and gas exporter and the United States as the importer will weaken, and possibly even reverse, in the case of natural gas if Canada does not open up access to its extra reserves (including offshore, arctic, and unconventional) and at the same time speed up its process of approving and developing LNG terminals. A very important factor that adds to this supply pressure is the increasing use of natural gas for steam production and electricity generation to extract oil from the oil sands in Northern Alberta.

Given the considerable profitability of the oil sands as a major long-term export earner for Canada and the fact that the integrated north-south trade in natural gas with the United States cannot simply be displaced by a nationalistic Canadian policy that restricts the export of natural gas, Canada is going to need more gas for domestic production and for continued sizeable exports to the United States. Substantial change in access policies and ramped-up exploration is needed to bring to market the potential natural-gas reserves estimated by the National Energy Board to be several hundred trillion cubic feet (see footnote 5 above).

Calls for reductions in oil-and-gas exports to the United States can only be justified on NAFTA's principle of conservation and would most likely trigger the proportionality clause by which American importers could demand that the share of total exports available would not be below the average of the last 36 months. Thus far, none of NAFTA's provisions on energy have been invoked and it would be unwise and counterproductive to invoke them. Furthermore, since natural gas has become the fuel of choice for American electricity generation, an abrupt cut in Canadian deliveries could result in a reciprocal cut in electricity exports to Canada. This would not only be detrimental to markets in Canada that rely on American electricity exports but also hurt the exporting provinces that optimize hydroelectric production by engaging in swaps and futures contracts with American producers using natural gas and thermal power plants.

Only by means of a large LNG capacity and by developing currently untapped gas reserves, including coal-bed methane, is Canada going to be able to remain a net gas exporter within North America beyond the 2020-to-2030 timeframe. Offshore

gas as well as Arctic and coal-bed methane gas is very costly to produce. Just as the development of oil sands faces the risk of being undercut by cheaper Persian Gulf oil, so deep well and other unconventional gas face the risk of lower LNG prices making exploration uncompetitive.

Liquefied natural gas has the potential to revolutionize the global gas market by making it more flexible. Thus, it is possible that as LNG becomes a major supply of gas in North America and Europe (as it has in parts of Asia) that the price of gas will become global rather than regional. If a world price for natural gas were to come about as it did for crude oil, the propensity for price collusion among the small number of very large suppliers would grow. As a result, higher prices for natural gas may return, making non-conventional gas exploration feasible.

The world's reserves of natural gas are even more concentrated in a few countries than global conventional crude-oil reserves. Russia, Iran, and Qatar own nearly 60% of the total. Natural gas security, like oil security, depends on diversity of supply. Given the more limited possibilities for diverse suppliers, North America will need a highly integrated set of pipelines and LNG terminals in order to benefit from fast flows of supply within the continent to different parts and different sectors and in different seasons. Canada cannot afford short-term nationalist policies that would disrupt existing regional and north-south integration. Rather, it needs to continue to encourage natural-gas exploration and pipeline development and ensure that the regulatory framework allows for flexible and rapid adaptation to changing market conditions such as the arrival of Arctic oil and gas and increased LNG imports.

5 Recommendations for the Canada-US oil and gas sector

Trade between Canada and the United States in oil and gas benefits from five factors that together make it one of the most integrated energy markets in the world:

1. political stability and legal transparency;
2. private industry operating in a competitive market;
3. regional supply-and-demand areas with a high degree of north-south integration;
4. regulatory compatibility;
5. a single financial/investment area and congruent capital markets.

As described in section 3, both countries have at various points in time experimented with forms of price and export controls. Canada also tried a national energy plan that included forced divestment of American firms and a state-owned oil company (Petro-Canada). But even before the Canada-US Free Trade Agreement emerged, both countries had already moved away from most of these arbitrary market interventions. With individuals free to determine investments, exports and imports, regional markets flourished in which north-south flows between Canada and the United States in both oil and gas became part of the exchange. Between 1989 and 2002, the volume of American oil and gas imports from Canada doubled.

The recommendations that follow are measures to enhance the integrated market-based trade in oil and gas between Canada and the United States. While asset allocation and investment should be left to the market, government plays an important role in creating an optimal environment for investment. Despite past policy mistakes, the role of government is still critical, albeit government has to see its role as using market forces and providing targeted incentives for industry to invest in new technologies and additional capacity. Therefore, federal and provincial measures should be focused in three areas:

1. signaling a long-term commitment to market-based solutions and removing policy uncertainties arising from environmental restrictions and First Nations land claims;
2. streamlining and consolidating regulations and regulatory procedures within the framework of an integrated Canada-US market; modernizing regulations and developing best practices in the exploration and production of unconventional oil and gas;
3. providing market-based incentives for investment to overcome impediments to developing greater capacity and new technologies.

Recommendations for oil

[1] Reduce environmental impact through technological innovations

The high level of engineering now being applied to the various processes for the production of unconventional oil should be recognized as a strategic opportunity to cultivate more environmentally friendly technology. Recent pilot projects for injecting CO_2 into mature conventional oil fields by Penn West Energy Trust and EnCana Corporation have produced encouraging results. This process not only increases yield of once unrecoverable crude, it also has the added advantage of taking CO_2 out of the atmosphere and thus creating a "carbon sink." Capture and removal of CO_2 should also be actively pursued in bitumen production and upgrading. However, wider implementation of the method has been hampered by the lack of a CO_2 pipeline infrastructure. At present, CO_2 is expensive to move and plans for the development of a pipeline network hinge on certainty about the federal government's CO_2 policy.

We recommend that rather than curtailing the production of bitumen from oil sands on environmental grounds, provincial and federal incentives should be provided for technological advances in energy efficiency, emissions reduction, and waste disposal during the production process. Secondly, we propose that government provide tax incentives for technological development and a clear policy on CO_2 in order to speed up the development of a pipeline network for CO_2.

[2] Enhance marketability of heavy crude through transmission capabilities

Currently about 60% of oil-sands production is upgraded to synthetic crude oil and synthetic crude oil-bitumen blends in Alberta, while the remainder is sold in the United States as lower-priced bitumen. A transmission bottleneck is hampering more sizable heavy-oil deliveries into the American market. The Canadian Association of Petroleum Producers (CAPP) states that much of the refining capacity on the Gulf Coast and California is already capable of processing heavy oil. There are currently several projects underway to deliver heavy crude to those markets and TransCanada Pipeline Ltd is in the process of converting some of its gas pipelines connecting to the United States into heavy oil pipelines [*Oilweek*, 2006a: 27–30].

However, a piece-meal approach towards increasing heavy-oil transmission capacity may not remove the bottlenecks restricting the marketing of Albertan heavy oil. The Federal government (in conjunction with the provinces) should consider targeted tax incentives that would encourage industry to find an overall strategy to enhance the development of a pipeline infrastructure for heavy oil.

[3] Fast-track and streamline the recruitment of skilled foreign labour

Costs to producers in Alberta oil-sands projects have risen dramatically in the past two years. There is widespread concern that rising costs for materials, equipment, and

labour is slowing down all aspects of the oil industry [Harding, 2006b]. Canada and the United States should therefore explore new arrangements for the free and quick movement of skilled labour across the border to bring down labour costs. The general shortage of skilled labour in Alberta is a major challenge that needs to be overcome in order to preserve the dynamism of Alberta's energy sector. The federal and Alberta governments should work together and implement a memorandum of understanding to fast-track and streamline the recruiting of skilled labour, possibly through the federal Temporary Foreign Worker Program. Second, the Alberta government should consider tax incentives for industry to train specialized labour on the job and offer funding for specialized training programs for skilled labour such as rig management.

[4] Keep the market in private hands

Acquisitions of oil-sands leases by state-owned foreign oil companies may increasingly be made for geopolitical considerations and further inflate the price of Canadian resources. Given the political and regulatory stability of the Canadian oil resource, it is in Canada's interest to enhance the benefits of an integrated North American energy market that operates on free-market principles. Integration with private companies from the United States and other foreign companies has allowed for increased stability, efficiency, and specialization in the capital-intensive segments of the Canadian energy sector. We recommend that Industry Canada explore ways to discourage sizeable and geopolitically motivated investments by state-owned foreign companies in the oil-sands industry.

[5] Address public infrastructure needs

Many municipalities where the oil sector makes up a large part of the local economy—especially the Regional Municipality of Wood Buffalo—struggle to expand public infrastructure, including schools, roads, water treatment facilities, health, and other services to keep up with the rapid pace of oil-sands development. In order to maintain investor confidence and the ability to attract future labour in the oil-sands sector, the Alberta government (in cooperation with the Federal government where appropriate) should be much more proactive in facilitating investment in infrastructure in communities affected directly by the oil-sands industry.

Recommendations for gas

[1] Lift moratorium on BC's offshore natural gas exploration

Estimated reserves of natural gas off the coast of British Columbia range from 14 to 43 trillion cubic feet. Given current technology and drilling experience in other offshore areas, the risk of environmental damage from blowouts and operational spills is dramatically lower [Lieberman, 2006b]. The Roland Priddle Public Review Panel of 2004 did

not adequately address the factors that call for added supply [Natural Resources Canada, 2004]. The federal and British Columbia governments should create a joint task force to fast-track opening British Columbia's offshore exploration for natural gas. Given the ten-year time lag between exploration and production's coming on line, the time to start exploration is now.

[2] Reduce the hurdles for building LNG infrastructure

Currently, conflicting federal and state regulations, and differences between Canadian and American regulations in relation to liquefied natural gas (LNG) have the potential to hamper the flow of investment into facilities required to ensure security of supply. The US *Energy Policy Act* of 2005 has awarded FERC exclusive jurisdiction over the site location, construction, expansion, and operation of LNG terminals and storage facilities in the United States, although it is still unclear to what extent FERC will be able to override local (state) jurisdiction.

Canadian federal and provincial authorities should work together with their American counterparts to develop streamlined best practices and expertise in approving new LNG facilities and in regulating LNG imports. The barriers and costs associated with the construction of LNG infrastructure can be reduced by the development of best practices and standards. The various local and federal authorities should invest in a joint working group to overcome bottlenecks in expertise and information in developing Canadian-American LNG infrastructure.

[3] Create incentives for transmission investments

The 2005 *Energy Policy Act* in the United States has shored up incentives for expansion of natural gas pipelines by, among other things, putting a 90-day cap on environmental assessments for pipeline expansion and allowing utilities to depreciate the value of new distribution pipelines over 15 years instead of 20 years. Canada should implement a shorter time frame for the approval processes, including environmental approval, for gas exploration and pipeline construction. Canadian federal authorities should also provide equally attractive incentives for investment in the Canadian section of the integrated Canada/US gas-transmission system.

[4] Put time limits on land claims

All Native Peoples except for the Deh Cho have become major stakeholders in the MacKenzie Valley Pipeline project by forming the Aboriginal Pipeline Group. The Deh Cho appear determined to block or slow down the project in order to extract a maximum land-claims settlement from the Federal government. Current cost estimates of the "Mac Line" ($10.5 billion) combined with low current natural gas prices may unravel the plans according to some industry leaders if further delays continue [Cattaneo, 2006b]. A clear time frame should be introduced to deal with the native land claims that affect oil and gas pipelines.

[5] Revitalize confidence in Arctic gas

According to industry experts, the success of the MacKenzie Valley Pipeline will be critical in re-kindling investors' confidence in the Beaufort Basin, which has natural gas reserves estimated at 48 Tcf. The federal government should move quickly to manage the myriad of political and regulatory issues associated with Arctic oil and gas in general. Federal tax incentives should be extended towards the research and development of new exploration, production, and transmission technologies suitable for cold terrain. The Canadian federal tax and royalty regime for Arctic oil and gas development, which is based on old land leases, should be modeled on the principles of the Alberta and Alaska systems, which are based on a percentage of profit, or revenue minus capital and operating expenditures and in which producers pay a 20% tax rate and receive a 20% tradable tax credit [*Oilweek*, 2006a: 34–36].

[6] Re-examine regulations for unconventional gas exploration and production

Both federal and provincial governments in Alberta, British Columbia, and Saskatchewan should reexamine their treatment of exploration for, and production of, unconventional natural gas. Since gas from coal-bed methane or shale typically requires more numerous wells, the process for granting well-drilling approval for such gas should be simplified and differentiated from that used for conventional natural gas. At present, regulatory limitations on the spacing of wells create a major impediment for tight-gas exploration and production. Canadian regulators should consider adopting the Wyoming Bureau of Land Management's innovation of allowing closer well spacing (five to ten acres) but limiting the environmental impact by basing the approval on the measured total-surface disturbance [Wyoming Bureau of Land Management, 2005]. British Columbia's decision to allow "commingling" to two or more zones **[8]** without prior approval is an encouraging step towards finding creative regulatory solutions that reduce the costs of the production of unconventional gas. Since new technologies such as directional and lateral well drilling are key in successfully producing gas and reducing the environmental impact, the federal and provincial governments should more aggressively encourage capital expenditure by providing tax credits and research incentives.

[7] Explore the use of nuclear power in the oil-sands production process

Federal and provincial regulators should explore the feasibility of using nuclear reactors to replace some of the energy currently supplied by natural-gas plants for extracting oil from oil sands. If feasible, they should consider a fast-track approval process for building nuclear power plants to supply energy for oil-sands production. The 30-year freeze on new nuclear plants in most OECD countries is gradually thawing. New legislation

[8] The term "commingling" applies to the regulatory process when drilling on an adjacent parcel of land is allowed with only notification to the regulatory authorities and not a re-application.

is currently pending in the US Congress to speed up the construction of 25 such plants [Pulizzi, 2006]. The United Kingdom is also considering nuclear power to offset decreasing oil flows from the North Sea and dependence upon imported natural gas. A 1999 Canadian study concluded that a CANDU reactor would reduce CO_2 emissions from bitumen production by 20% [Donnelly and Pendergrast, 1999]. A 2003 study showed that an ACR-700 Advanced CANDU Reactor would match the cost (capital and operating) of a natural-gas plant with a gas price of $3.50 mbtu [Dunbar and Sloan, 2003]. The point is to make regulations as streamlined as possible so that a commercially viable nuclear industry can compete in oil-sands production and at the same time reduce the overall environmental impact. Another benefit from such nuclear plants would be the surplus electricity generated and made available to the Alberta grid, which might also help offset some of the environmentally unfriendly production of electricity with coal-fired generators.

[8] Remove Alberta's surplus gas regulation

Currently the export of Alberta's natural gas is permitted only if gas supply is deemed to be 15 times the surplus of the estimated needs of Alberta's "core consumers." This contrasts with the NEB's policy of granting short-term export permits using a market-based procedure (MBP) that assures Canadian customers access to supply, without providing them special treatment. Based on the theory that acquiring supply for export is in itself a demonstration of surplus, the NEB's export permits for two years or less have no restrictions on volume and require no public hearing. Though Alberta is not applying the policy strictly today, if export and price controls were imposed on Alberta's natural-gas market, the consequences would be devastating for market-based Canadian-American energy integration and for Alberta as a transmission hub of British Columbian, Alaskan, and Canadian Arctic oil and gas. The Alberta government's regulatory criteria for accounting for "surplus" natural-gas capacity should be reformed in accordance with National Energy Board (NEB) policy. Alberta Premier Ralph Klein has indicated his commitment to an open natural-gas market but it would be better to have it put into legislation.

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