



**CASTING A COLD EYE ON LNG:  
The Real Possibilities and Pitfalls  
for Atlantic Canada**



**ANGELA TU WEISSENBERGER**

The AIMS Oil and Gas Papers (Paper #4)  
Brian Lee Crowley,  
Series Editor

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The Atlantic Institute for Market Studies (AIMS) is an independent, non-partisan, social and economic policy think tank based in Halifax. The Institute was founded by a group of Atlantic Canadians to broaden the debate about the realistic options available to build our economy.

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- b) investigating and analyzing the full range of options for public and private sector responses to the issues identified and acting as a catalyst for informed debate on those options, with a particular focus on strategies for overcoming Atlantic Canada's economic challenges in terms of regional disparities;
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# EXECUTIVE SUMMARY

Atlantic Canada has a narrow window of opportunity to be a “first mover” in the North American market for liquefied natural gas (LNG). The region has several competitive advantages, including the accessibility of its ports and transportation access to the high-priced US northeast markets. Three proposed LNG projects in Atlantic Canada, representing more than \$5 billion of direct investment, are located in industrial areas where local support is strong. Two projects — the Irving Oil/Repsol terminal at Canaport, in Saint John, New Brunswick, and Anadarko’s terminal at Bear Head, Nova Scotia — are among the few in North America to receive major environmental and regulatory permits and begin construction. Both are expected to be in service by 2008. A third project, Keltic Petrochemical’s proposed integrated petrochemical plant and LNG terminal at Goldboro, Nova Scotia, is currently undergoing environmental assessment, for a planned in-service date in 2009.

Despite Atlantic Canada’s locational advantage, a number of market issues need to be addressed before any of the region’s LNG projects can be successful — for example, whether long-term supply contracts can be lined up, whether the market can absorb incremental volumes from more than one project at the same time, and how Maritimes and Northeast, the only pipeline structure in Atlantic Canada to move natural gas to markets, can be expanded optimally to accommodate the successful projects while achieving the lowest tolls.

Markets and the regulatory process ultimately will decide these issues. Whatever market decisions are made, however, and whether one or more terminals proceed as planned, political and local co-ordination and support for LNG throughout the regulatory process will be critical if Atlantic Canada is to win a place in global LNG markets.

Atlantic Canadians need to recognize several critical factors if the region is to make the most of the opportunity. One is the importance of *first-mover advantage*. In a growing natural gas market with initially limited supplies, those who can capture market share early will enjoy higher prices, access to better customers, and potential economies of scale from a well-established presence. Atlantic Canada can be a first mover, but the window of opportunity is narrowing as more LNG facilities in North America are under consideration.

Another factor is the need to *focus on long-term energy interests*. The benefits of the jobs created by the construction and operation of a terminal and the municipal tax revenues it would generate are short lived and small compared with the long-term advantages for the entire region’s energy supplies. Among the long-term benefits would be:



- transportation cost savings from pipeline expansion to accommodate LNG shipments to the United States, which could help the economics of developing gas fields where geology and the high cost of production present challenges;
- potential access to additional gas supplies that could provide energy supply diversification, as well as competitively priced and environmentally friendly fuel options for Atlantic Canada's future electricity generation capacity; and
- gains for regional prosperity, since access to diversified and more competitive energy supplies, environmentally cleaner energy options, and cheaper gas transportation costs could increase Atlantic Canada's global competitive position.

A third factor is the need to *strengthen trade ties in Atlantica* — the international Northeast, which includes Atlantic Canada, New Hampshire, Vermont, and upstate New York. The northeastern United States might well benefit from receiving additional gas supplies without having numerous LNG facilities situated in the region, while Atlantic Canada would benefit from increased investment activity and potential access to long-term gas supplies to diversify and grow its economic base.

A fourth factor is the need for *access to US gas markets*, since the Atlantic Canadian market alone is not big enough to justify investment in LNG terminals for its own sake.

Even with the endorsement of the market, however, Atlantic Canada will still need political and public support for LNG. If the market decides there is room for fewer than three LNG regasification terminals in Atlantic Canada, there is a risk that provinces might view the LNG projects as rivals and fight among themselves to a regulatory standstill, thereby jeopardizing the opportunity that LNG offers. Accordingly, the provinces should focus on:

- recognizing the long-term benefits of having access to LNG in Atlantic Canada;
- extending regional cooperation in energy matters to include specific LNG opportunities; and,
- creating a coordinated approach to assessing LNG projects in the regulatory process, not only within various Canadian jurisdictions, including provinces and municipalities, but with regulators and key stakeholders on both sides of the border.

The global gas market is evolving as a major capital investment opportunity to meet growing energy demand. In the next several years, up to US\$250 billion could be dedicated to bringing LNG supplies to markets worldwide. Atlantic Canada has the potential to be part of this unprecedented growth provided it seizes the opportunity.



# INTRODUCTION

The recent rapid rise in oil and gas prices has brought with it a focus on the high cost of energy, price volatility, and security of supply. Of particular concern is the mounting evidence that North America may not have enough conventional production to meet growing Canadian and US natural gas demand. Persistently high prices have spurred record domestic drilling activity, but productive capacity continues to decline. Natural gas consumers may face a supply-constrained market in the next several years until additional North American gas supplies can be brought to market. There is an opportunity for liquefied natural gas (LNG) to fill the supply gap, and Atlantic Canada could be part of this opportunity.

LNG is natural gas cooled to a temperature of  $-160^{\circ}$  Celsius to reach its liquid form, which takes up one six-hundredth the volume of its gaseous state, making transportation of large quantities over long distances economic. Brought by LNG tankers from locations as varied as Trinidad and Tobago, the Middle East, and Africa, the liquid is returned to its gaseous state in a process called regasification, then put into the pipeline system to transport to customers. At a landed cost of US\$3.50 per million British thermal units (MMBtu, the heating value of a thousand cubic feet of gas), the economics of LNG are compelling in a North American market where prices have exceeded double digits.<sup>1</sup> So compelling, in fact, that more than 55 LNG regasification terminals have been proposed for North American locations, three of which are in Atlantic Canada: Irving Oil's terminal at Canaport, New Brunswick; Anadarko's Bear Head facility at Point Tupper, Nova Scotia; and Keltic Petrochemical's at Goldboro, Nova Scotia (Federal Energy Regulatory Commission 2005 — see the Appendix).<sup>2</sup> Yet the capacity of all the proposed projects exceeds three-quarters of current North American gas consumption, and most forecasts show that North America's demand for gas will not increase sufficiently to support them all. In a race to capitalize on shifting gas supply opportunities, what factors make one terminal more likely to be built than another? What benefits would be associated with the building of LNG terminals in Atlantic Canada, and how could the region maximize its attractiveness as a location for them?

This paper reviews the critical factors that drive the economic viability of a proposed LNG project and how that might play out in Atlantic Canada's energy future. It provides a brief review of why LNG is needed in North America, and focuses on the key drivers of the economics of an LNG project. It concludes with implications for Atlantic Canada and suggestions for policy approaches to take advantage of the opportunity to attract key new investments into the region's economy.

1 \$3.50/MMBtu was the landed cost of LNG at Lake Charles from Qatar in 2004 (EIA 2004). The average spot price in 2005 at "Henry Hub" — a convergence of pipelines connected to major industrial, commercial, and residential markets throughout the United States — was US\$8.91/MMBtu (ARC Financial 2006, 12). It reached into the double digits in the second half of 2005.

2 A fourth terminal has been proposed for a site on the Strait of Canso, NS, but the project is not yet under regulatory review.



# NORTH AMERICA'S NEED FOR LNG IMPORTS

The relative abundance and clean burning properties of natural gas make it a fuel of choice in North America, the largest energy-consuming market in the world. More than a quarter of the primary energy consumed in the United States now comes from natural gas. The fastest-growing area of demand is the electric power generation sector, where gas consumption is expected to increase by 40 percent by 2020 (see Table 1). In the United States, many combined-cycle natural-gas-fired plants have been built to replace aging, more expensive, and less environmentally friendly coal and oil-fired plants. Their capacity utilization is expected to increase substantially, and more are slated for construction over the next five years. Although clean coal technology is making a resurgence, significant coal capacity is not expected to be added until after 2010.

At the same time, US conventional natural gas production has remained flat and even decreased, despite sustained high prices and record drilling activity. As production in North American natural gas basins matures, new pool sizes have shrunk. US productive capacity<sup>3</sup> has been declining since the late 1970s, and more expensive high-risk natural gas has replaced conventional low-cost production. Volumes from these sources are now not sufficient to offset the decline. Canadian production has made up much of the US shortfall since the 1990s, but Canada's conventional productive capacity is also now declining (see National Energy Board 2004, 21; Bradley and Watkins 2003).

This is not to say that North America is running out of gas. Several years of low prices in the 1990s discouraged major investment in exploration and development and commercialization of natural gas reserves. The United States and Canada still have vast reserves, although some of them are inaccessible due to regulatory and environmental restrictions or because they are geologically challenging or in remote places requiring large amounts of capital investment to produce and transport to market.

Higher gas prices will lead to the development of some new reserves in areas such as the Mackenzie Delta and Alaska, as well as unconventional sources such as coal bed methane, "tight sands" (poor-quality) gas reservoirs, and shale. There are also technologically difficult but potentially large reserves of methane hydrate and offshore gas in Atlantic Canada, the Arctic islands, and the west coast. It could be years, if not decades, however, before additional supplies from such sources reach markets. Mexico, too, has large natural gas reserves, but political and regulatory constraints have minimized their development and blocked imports to the United States.

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3 "Productive capacity" is defined as the maximum production available from natural gas wells considering limitations of the production, gathering, and transportation systems.

**Table 1: Projected Natural Gas Supply and Consumption United States, 2004–20**

Sector	2004	2005	2006	2010	2015	2020
<i>(trillions of cubic feet)</i>						
<b>Supply, by Source</b>						
Dry gas production	18.46	18.14	18.16	18.58	20.36	21.44
Supplemental natural gas	0.06	0.07	0.07	0.07	0.07	0.07
Net imports	3.40	3.39	3.65	4.35	5.10	5.02
Pipeline	2.81	2.75	2.63	2.28	2.05	1.32
Liquefied natural gas	0.59	0.64	1.02	2.07	3.05	3.70
Total supply	21.92	21.60	21.88	23.00	25.54	26.54
<b>Consumption, by Sector</b>						
Residential	4.88	5.06	5.00	5.17	5.36	5.51
Commercial	3.00	3.06	2.92	3.08	3.36	3.57
Industrial	7.41	7.22	7.27	7.82	8.08	8.26
Electric power	5.32	5.16	5.16	5.51	7.14	7.46
Transportation	0.02	0.03	0.03	0.05	0.08	0.09
Other	1.78	1.81	1.78	1.71	1.90	2.02
Total consumption	22.14	22.21	22.17	23.35	25.91	26.92

Note: Numbers may not add up due to balancing, which is natural gas lost as a result of converting flow data measured at varying temperatures and pressures to a standard temperature and pressure and the merger of different data reporting systems that vary in scope, format, definition, and respondent type. In addition, data for 2003 and 2004 include net storage injections.

Source: EIA 2005.

The prospect of a supply-constrained North American natural gas market has made LNG an attractive source of diversification and a new incremental source of supply. In addition, the reduction in liquefaction and shipping costs due to technological advances over the past ten years has made LNG deliveries to North America more economic and price competitive. LNG is still only a small part of the North American natural gas market, however, comprising 3 percent of total gas demand in 2004, although that share is expected to rise to 10 percent by 2010 and to 15 percent by 2015 (EIA 2004b, 48), when the volume of US imports of LNG from overseas is forecast to exceed imports of pipeline gas from Canada (see Table 1).



# ENTER LNG

LNG is not a new industry. Since the first commercial shipment of LNG from Algeria to Europe in 1962, volumes traded have grown to 6 trillion cubic feet annually, or 6 percent of global natural gas consumption in 2003. Natural gas markets are highly regionalized, however, because the movement of gas is restricted by the reach of the pipeline network, and much of the world's gas reserves are located far from consuming regions that cannot be reached by pipeline. The advantage of investment in LNG infrastructure is that it enables remote, low-value natural gas production (or “stranded production”<sup>4</sup>) to be connected with high-value consuming markets through liquefaction and shipping by ocean tanker.

Between 1993 and 2004, the demand for LNG grew by 110 percent, almost double that of global gas demand, largely as a result of declining reserves or an absence of reserves in major consuming countries (EIA 2004b, 48). The continuing industrialization of developing economies, the increasing preference for natural gas for power generation, and environmental concerns will support the global growth of consumption of LNG for the next several years.

The largest LNG users are Japan, at 44 percent of global demand, and South Korea, which takes 17 percent (see Table 2). Europe and China will become increasingly major importers of LNG over the next decade, but the largest importer could be the United States. Historically a small importer, the United States is expected to consume nearly 10 percent of global LNG demand by 2010, a share that could rise to 15 percent by 2015 and to 25 percent by 2030 (EIA 2005b).

Although North America accounts for one-quarter of global gas demand, it has only 2 percent of the world's reserves, the largest of which are located in Russia, the Middle East, and Asia (see Figure 1). Today, Indonesia and Malaysia together make Asia the largest exporter, although the Middle East, including Qatar, will likely overtake Asia as the largest producing region in the next decade. Large integrated oil companies are making significant investments in areas such as Qatar, west Africa, Trinidad, Venezuela, and Russia to bring on additional supplies over the 2010–13 period. The industry has poured an average of US\$4 billion annually into new infrastructure over the past five years, and is expected to spend nearly US\$250 billion in the LNG business over the next 30 years (see Rigby 2004). At the end of 2003, global annual LNG liquefaction capacity was 6.8 trillion cubic feet, with another 2.8 trillion cubic feet under construction or expected to be on-stream by 2007 (EIA 2004a, 55–56) — the equivalent volumes to two or three proposed terminals in North America.

4 “Stranded production” is natural gas production that lacks an economic market, usually owing to its remote location relative to the existing transportation infrastructure and/or to the fact that it is too volumetrically small to bear the cost of installing a pipeline.

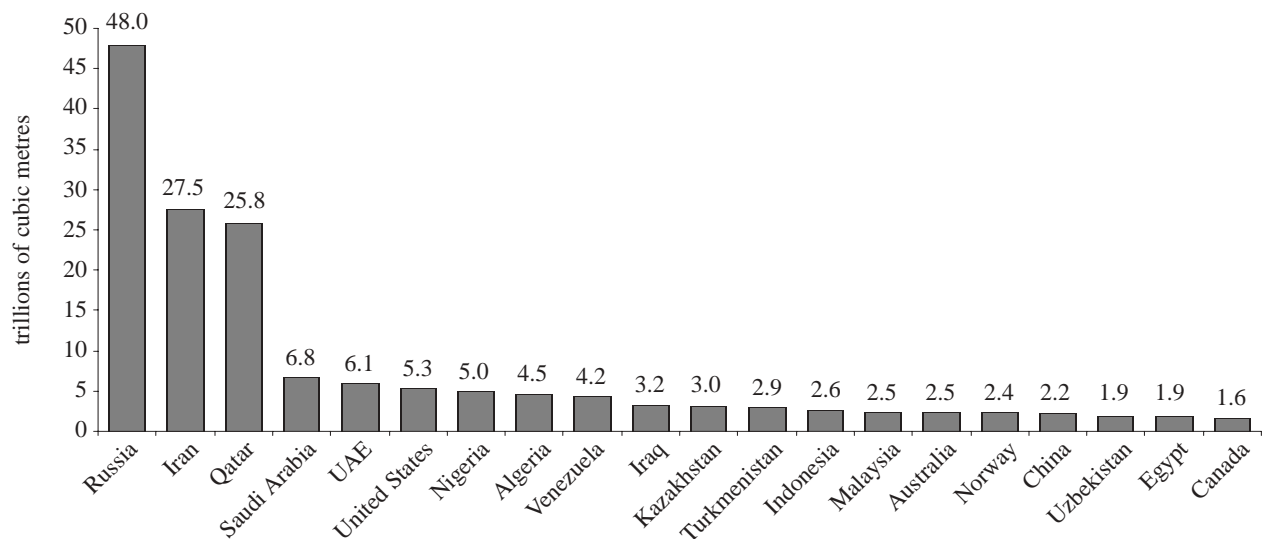
Table 2: *World's Largest LNG Importers and Exporters, 2004*

Country	Share of World Imports (percent)	Country	Share of World Exports (percent)
Japan	44	Indonesia	19
South Korea	17	Malaysia	16
Spain	10	Algeria	14
United States	10	Qatar	14
Taiwan	5	Trinidad and Tobago	8
France	4	Australia	7
Italy	3	Nigeria	7
Belgium	2	Brunei	5
Turkey	2	Oman	5
India	1	United Arab Emirates	4
Portugal	1	United States	1

Note: Numbers may not add to 100 percent due to rounding.

Source: BP 2005.

Figure 1: *World's Largest Proven Gas Reserves, by Country, 2005*



Source: BP 2005.

The demand for LNG is expected to grow faster in the United States than in any other market in the next ten years. These growth prospects and sustained high prices have led to significant interest in LNG import opportunities. Currently, the United States has four LNG facilities in operation,<sup>5</sup> as well as an offshore facility on the Gulf Coast. All are being expanded in the next three years. However, many observers believe that the market will need only eight to ten of the 55 new regasification terminals now proposed (see EIA 2004c). What is the likelihood that the proposed projects in Atlantic Canada could be among them?

5 The four US terminals are located in Elba Island, Georgia; Lake Charles, Louisiana; Everett, Massachusetts; and Cove Point, Maryland.



# THE ECONOMICS OF LOCATING LNG TERMINALS

The decision to locate a terminal in an area such as Atlantic Canada is a complex one. LNG is a private investment opportunity, but one not without large risks. The two critical factors driving the economics of a project are location and contractual arrangements.

Site location involves an economic assessment of the terminal site: proximity to markets, access to supplies, regulatory and local support, access to pipeline transportation and storage facilities, appropriate infrastructure to accommodate shipments, costs, and LNG compatibility with pipeline gas.

## *Markets*

An ideal terminal site is one located in a high-value consuming market. In North America, this includes regions along the east and west coasts in heavily populated and growing power generation markets, or in the Gulf of Mexico's large industrial base and where pipeline transportation to most major markets is abundant. The US northeast is particularly desirable because it has been one of the fastest-growing gas-consuming regions in North America, primarily due to the conversion of power plants from coal and oil to cleaner-burning gas. Distance from indigenous supply sources and limited pipeline transportation to the area have kept prices in this market relatively high. Atlantic Canada is seen as an attractive place to locate LNG terminals because of its proximity to populous US northeast markets and because the region's access to the existing pipeline infrastructure could be expanded in a cost-competitive manner.

Market risks include new sources of supplies reaching markets simultaneously, a decline in gas demand due to conservation efforts, curtailed industrial gas usage due to high prices or as energy intensive enterprises shift overseas, fuel substitution from nonrenewable and renewable sources, and technological advances such as clean coal technology.

## *Local Support and Safety*

Strong local support is critical for a project to proceed, as delays can hamper access to financing, run up construction costs, and reduce the project's competitive position, particularly if it is a "first mover" in a new market.

Public concern about the safety of LNG is one of the largest barriers to the location of a terminal. Most commonly cited worries are environmental, safety, and security issues — including the potential

for tanker accidents, the vulnerability of tankers to terrorist attacks, cargo spills, and fires<sup>6</sup> — that are sometimes poorly understood by the public. In fact, LNG regasification is a safe, simple technological process that has been proven over the past 30 years. It does not spill or explode, and it is not combustible. The US Federal Energy Regulatory Commission (FERC) is working with experts to develop safety guidelines that are acceptable to both the consuming public and the LNG projects (see FERC 2004). For now, much of a project's success depends on the developer's ability to satisfy the public and political leaders that the risks are acceptable and manageable.

Some proposed projects, especially in the US northeast, have been cancelled or delayed due to strong local opposition.<sup>7</sup> Even if a terminal has all the federal and environmental approvals in place, local opposition over safety and other concerns can significantly delay the final permits necessary for the project to be economic.<sup>8</sup> Indeed, lack of public local support has made the siting of terminals difficult all along the east coast and in California as well. Most LNG terminal project proposals are located along the Gulf Coast because of favourable industrial zoning, strong local support, and access to Henry Hub, the most liquid and visible natural gas pricing point in the United States, used in the NYMEX contract and physically connected to significant gas infrastructure and markets. Many US players, in fact, see the proposed terminals in Canada or Mexico as gas bridges to project-adverse regions such as the US northeast or California.

In Atlantic Canada, the proposed terminals have not faced the same degree of local opposition as have those in the United States, largely because the sites are in industrial areas. Dialogue among project sponsors, independent safety specialists, and the local communities continues to take place to assure the communities that the safety risks are manageable. The general level of local support for these projects has made Atlantic Canada an attractive location given the challenges of locating terminals in the US northeast. Those challenges could ease, however, particularly if high gas prices and potential supply shortages persisted. In August 2005, the US *Energy Policy Act* was modified to grant FERC exclusive jurisdiction over the siting and construction of LNG terminals, which could increase the chances that a project will proceed despite local and state opposition. Broader local acceptance of US northeast projects could then alter the economics of projects that were located further from consuming markets.

6 See Hightower et al. (2004), who outline the safety risks of LNG and suggest standards for mitigating the risks.

7 Three LNG projects foiled by local opposition in 2003–04 were those at Mare Island, California, where Shell had to withdraw from the construction of an LNG-receiving terminal in early 2003; Harpswell, Maine, where voters turned down a terminal sponsored by TransCanada PipeLines (with supply contracts from ConocoPhillips) after a referendum in March 2004; and Hope Island, Maine, where TCPL attempted to site a facility but public pressure forced the local council to quash a rezoning agreement that was to have gone to a public referendum.

8 For example, on May 25, 2005, the LNG terminal project at Weaver's Cove, Massachusetts, received federal approval subject to 76 environmental mitigation measures. The project nevertheless faces strong opposition from local residents who fear that LNG infrastructure and tankers would pose a public safety hazard. In contrast, although the Gulf Coast Keyspan terminal won environmental approval, FERC deemed that the project did not meet current safety standards. See Energy Intelligence (2005, 3).





In the absence of that acceptance, however, Atlantic Canada's proposed LNG terminals could gain benefits by being the first to enter markets in the US northeast. Such "first-mover" advantage is critical in the relatively new and competitive LNG industry in North America. Gas supplies will likely be tight over the next five years until additional domestic volumes can be brought on-stream, and those that are able to meet supply requirements during this period will benefit from the initial high price. Moreover, conditions are ripe for first-mover advantage, for a variety of reasons. First, the market cannot support all the proposed LNG regasification facilities, and not all terminals will be built. Obtaining successful environmental and regulatory approvals before other competitors and then gaining local public support could give project sponsors an advantage in capturing a share of the market. Second, a first mover will be able to contract for the limited supplies of LNG that will be available in the next five years. Third, a first mover will be able to take advantage of any existing transportation capacity to bring supplies to markets. Fourth, once a project is well established in the market, it is more cost effective to add to existing infrastructure than to build "greenfield" projects from scratch.

## *The Regulatory Environment*

An LNG terminal site cuts across a number of regulatory jurisdictions, ranging from provincial/state and federal environmental assessment to marine port safety, where a large number of stringent conditions need to be satisfied. A stable, predictable, and efficient regulatory process enhances the economics of a project. Uncertainty over regulatory authority or policy, or lack of jurisdictional clarity, may slow the development of the facility, which could be costly for the project sponsors and jeopardize the economics of the entire project.

In Canada, regulatory jurisdiction for LNG is unclear and there are no guiding precedents, since no facility with importing capabilities has yet been built in this country. The regulatory approval process would, however, likely involve participation from the various ministries, departments, and assessment and regulatory bodies of the province of the LNG site, as well as branches of the federal government, including the National Energy Board (NEB), the Canadian Environmental Assessment Agency, Fisheries and Oceans Canada, and the Canadian Coast Guard. In addition, provincial regulators and regional, county, and municipal jurisdictions would also become involved, particularly in the context of urban planning and land use. This is exactly what has happened in the regulatory and environmental process experienced by the two Atlantic Canadian LNG projects that have received approval.

Given the large number of regulators involved in the LNG proposals for Atlantic Canada, their coordination across jurisdictions and on both sides of the Canada-US border will be critical for the projects to advance. Clarity regarding jurisdictional authority and a consistent approach to standards governing the construction, safety, and operations of an LNG terminal would be beneficial. Market conditions and regulations in the United States could change over time, exposing Canadian LNG facilities to a greater degree of risk because the pipelines connecting them to markets effectively would be governed by both US and Canadian regulators. Successful projects require close coordination among Canadian stakeholders, US and Canadian regulators, and US end-users.



The three Atlantic Canadian projects have received slightly different regulatory treatment, depending on the jurisdiction in which they are located and the process chosen to review the projects, and they will continue to do so. The region's pipeline system, Maritimes and Northeast Pipelines Limited Partnership (M&NP), is expected to be the main trunk line to US markets, but the regulatory treatment of the lateral links to Anadarko's Bear Island, NS, terminal or to the Irving Oil terminal at Canaport, NB, or the treatment of the interconnect to Keltic's project at Goldboro, NS, could have implications for tolls. The Irving and Anadarko projects have already successfully navigated some major environmental shoals, but more regulatory approvals will be required, including permits to connect to M&NP, licences from the NEB to import and export LNG, and permits from the NEB and FERC to expand the pipeline system to accommodate greater volumes of exports to the United States, to name just a few.

Challenges to the proposed LNG terminals in Atlantic Canada could arise from interests within the region itself. Atlantic Canada has yet to develop its long-term gas supply potential — although offshore gas reserves are significant, production is declining — and the region does not have a well-developed local gas market. Another risk is that provinces might view competing LNG projects as rivals and fight themselves to a regulatory standstill, thereby jeopardizing the chance that any LNG project will proceed. Such interprovincial rivalry has already occurred over the development of offshore natural gas and its access to US markets.

A positive regulatory environment is a major factor in determining the economic reality of a terminal. The facilities that line up regulatory permits, supply contracts, and financing early in the process have the potential to become operational the quickest.

## *Access to Pipeline Transportation*

An LNG terminal must have access to pipeline infrastructure to move gas to consuming markets. In the case of targeting markets in the US northeast, the decision to locate a terminal on the Gulf Coast or in Atlantic Canada depends on a number of factors, including transportation access. Although there is some spare capacity on pipelines connecting the Gulf Coast to the US northeast, volumes reaching that region are not always readily accessible — at times, much Gulf Coast gas is diverted to closer markets in, for example, the US southeast (see EIA 2005a). With a significant number of LNG projects now under way on the Gulf Coast, however, it will become possible to deliver natural gas from there to US northeast markets as economically as from Atlantic Canada — provided transportation capacity is available.

As noted above, locating an LNG terminal in Atlantic Canada would require expanding the M&NP pipeline to move volumes to market. Fortunately, the pipeline was originally constructed with oversized pipe in anticipation of an expansion of offshore gas flows. More gas can be transported by compressing it further, which is usually much less expensive than building additional pipeline unless the incremental fuel becomes a prohibitively high operating cost. One drawback of the M&NP system, however, is that it operates in a regulatory structure where costs are absorbed up front and depreciated



over time. Because it is relatively new (just six years old) and its capital costs have not been fully amortized, M&NP's transportation costs are among the highest in North America. In contrast, Gulf Coast pipelines are much older and have been nearly fully depreciated, resulting in lower transportation costs for natural gas landed in the US northeast.<sup>9</sup> It is therefore imperative that the M&NP pipeline be expanded in an economic fashion.

Despite higher pipeline costs, Atlantic Canada's attractiveness relative to the Gulf Coast as a location for new LNG terminals is its proximity to growing and high-value markets in the US northeast and its shorter distance to major suppliers of LNG in the Middle East and Algeria. An Atlantic Canada terminal would also give the LNG seller access to gas markets in Canada in addition to those in the US northeast and, by displacement, the midwest. It remains to be seen whether these benefits would offset the higher pipeline transportation costs to get the gas to consumers.

### ***Storage Availability***

Although LNG is a just-in-time delivery process, its long lead times for delivery — a round trip of up to 45 days from Qatar to Atlantic Canada — can make responses to changes in demand difficult for suppliers. Accordingly, adequate storage capacity is required to reduce the likelihood of delivery interruptions and to minimize the time that the carrier is in the port. In addition, higher storage capacity increases flexibility in shipping logistics and in dispatches of volumes to end markets to meet peak demands. It also makes it easier to manage how volumes are released to the market, in order to minimize gas price volatility.

### ***Deep Water Accessibility***

Year-round, unobstructed access to deepwater channels and compatibility with shipping traffic are critical to LNG port operations. There must be sufficient frontage to create a facility large enough to accommodate the growing number of newer, larger LNG tankers.<sup>10</sup> Increasingly large liquefaction facilities and ships drive down unit costs, and the newer facilities that are equipped to receive the larger ships will benefit from these economies of scale. Atlantic Canada is fortunate in that its deep-water ports are among the few facilities in North America that can accommodate these large ships.

### ***Technology and Compatibility***

Technological advances are enabling offshore regasification facilities to be located offshore, away from populated areas. The world's first offshore terminal to receive LNG was completed by

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9 For a detailed explanation of pipeline transportation rates, see Tucker (2002).

10 Currently, these tankers hold up to 2.8 billion cubic feet of gas, but ships with a capacity of 4.3 billion cubic feet are being considered.

Excelerate Energy on the Gulf Coast in April 2005.<sup>11</sup> If these types of facilities gain broader public acceptance in project-averse areas such as the US northeast, it could have a negative effect on the economics of terminals in more remote locations. Technology is also enabling the construction of ever-larger liquefaction trains and ships, leading to reductions in the unit delivery cost of LNG, especially to North American markets. The delivered cost has already fallen from \$6/MMbtu in the mid-1990s to between \$3 and \$3.50/MMbtu in 2003 (Foss 2005b, slide 3), and is expected to fall further with the larger units under construction.

Another issue is the quality of LNG, which needs to be compatible with North American pipeline specifications. Much of the LNG produced in the Middle East and Africa has a higher Btu (heat) content than can be accommodated by US pipeline specifications. Terminals that can modify LNG for US pipelines thus would have the flexibility to receive it from any source. One way to modify LNG is to strip it of its excess Btu content before it enters the North American pipeline system, although the manner in which this is done will affect the economics of the terminal. Extracting natural gas liquids is an expensive, involved process, but these liquids could be sold to specific end-markets. Other options are to mix the supply with inert gases to arrive at the appropriate heat content, to boil the excess Btu off the liquid gas, or to strip the gas of excessive Btu content at the liquefaction plant before it is shipped to North America — although that would restrict the cargo to the North American market, since the European market has higher Btu-content specifications.

## *In Summary*

To sum up, site location is an important driver of the economic viability of an LNG project. The site needs access to deepwater channels year-round, and safety, environmental and other regulatory criteria need to be satisfied. It is important to have assured markets and access to transportation to move volumes to the markets. Having the flexibility to receive large ships and varying qualities of gas assures that the terminal can receive LNG from all parts of the world. Atlantic Canada has many of these advantages.

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11 Most LNG terminal proposals are onshore in populous areas, such as the US northeast, where local opposition is strong. With new technology, terminals can receive LNG offshore and move it to shore through underground pipelines. Excelerate Energy's proposal for a US northeast project offshore (and thus under US Coast Guard jurisdiction) might not have to go through the onerous hoops, including the need to gain local support, that onshore projects do.



# CONTRACTUAL ARRANGEMENTS AND THE LNG VALUE CHAIN

A second critical factor driving the economics of an LNG project is the contractual arrangements regarding supply. The LNG market in North America is in its infancy, and long-term supply contracts might be required at first to make a North American terminal project feasible. A project would be seriously jeopardized if it received a smaller supply of LNG than expected. LNG is a capital-intensive business — a typical LNG facility able to process about 0.7 billion cubic feet per day could cost up to US\$4 billion from production and liquefaction to regasification (EIA 2004b) — and project sponsors will not put up the capital or obtain financing unless they are assured that the risks will be mitigated. While these unit costs will decrease with larger projects as a result of economies of scale, total costs will likely increase with size.

Each link in the value chain — from the costs of developing and producing reserves, to capital investment in getting the gas to liquefaction facilities, the facilities themselves (including any capital required for the port), shipping, regasification facilities, and transportation to consuming markets — is essential to the viability not just of the LNG terminal but of the whole LNG project. The regasification terminal is, in fact, the least expensive part of the value chain, comprising only 10 percent of the final unit cost of LNG, as Table 3 shows. It also generates lower returns relative to production.

The individual components of the value chain are interdependent because project development and financing in all parts of the chain need to occur simultaneously for new LNG deliveries to take place. Project delays are thus costly. The project structure must include numerous long-term, enforceable contracts between creditworthy parties that guarantee the generation of sufficient revenues and cash to cover capital costs. Mitigating price and volume risk is essential to preserving the project's economic returns.

## *Supply Risks*

### Political

The world's largest gas reserves are found in politically risky places that are far from consuming regions. The significant outlay of capital required to develop these resources has limited the number of LNG producers worldwide to the national oil companies of the host countries — which are taking an increasing share of LNG liquefaction ownership (Foss 2005b, slide 34) — and to the major integrated oil and gas companies and a few large independent companies. For reserves to become commercial requires agreements between host countries and producers, with the risks of production disruptions

Table 4: *Capital Costs and the LNG Value Chain*

	Cost				Total
	Upstream Production	Liquefaction	Shipping	Regasification	
Typical 5 million ton project ( <i>US\$ billions</i> )	1.0	1.25	0.8	0.325	3.375
Share of total cost (%)	29.7	37.0	23.7	9.6	100.0
Typical return (%)	15–20	8–12 if tolling; 10–20 otherwise	8–10	13.7	

Source: Sankey 2004, 13.

due to political instability, national oil companies' increasing their share in the project, the government's fiscal take, and labour disputes. It is thus important for suppliers to have good working relations with their host countries.

The concern that excessive dependence on a foreign supply source increases exposure to political risk does not, in my view, apply to LNG. In North America, LNG will be a minor supply source, at best — even under the most optimistic projections LNG would account for about 25 percent of total gas consumed in the United States by 2025. Moreover, as Lee (2005) argues, alternative LNG supplies from other sources would be available in the event of supply disruptions caused by political difficulties in the source country. The global LNG market is, in fact, expected to become increasingly liquid, with increased opportunities to access uncontracted spot cargoes. As well, more indigenous North American supplies will become available over the next few years as production from frontier regions and other unconventional sources begins to step up.

### Supply Availability

Some sponsors of LNG projects could face the challenge of finding supplies to “backstop” long-term contracts before 2008. (Backstopping means that producers will pay the shipping charges on the shortfall if volumes shipped are less than contracted.) Historically, the development of LNG supplies has been underpinned by long-term (15- and 25-year) demand contracts signed with utilities or gas distribution companies based on expected revenues that would cover the capital costs of the project. Because of the large amount of capital invested and the very small market for uncontracted cargoes, virtually no supplies were developed without a long-term contract with an end-user.

Owing to the long lead times of new LNG projects, additional volumes that become available in the next five years will come from projects that were started three to four years ago, before the sustained run-up in North American natural gas prices, and most of these volumes are already dedicated to long-term contracts. Until more liquefaction facilities are brought on-stream during the 2007–10 period, there may be little gas waiting to be contracted to supply new regasification terminals.



Demand for LNG is growing fastest in the United States, but there are other markets as well. A number of terminals have been proposed in Europe, as declining gas production, deregulation, and environmental measures place focus on LNG. Although Russia has the biggest reserves, it is unclear at what point production from these reserves will be able to reach the market, as much depends on the ability to raise capital, not only for the liquefaction facilities but also for pipelines to move the gas to Europe. Increased gas demand will also come from Asia, particularly the emerging economies of China and India.

## Evolution of the Spot Market and Arbitrage Opportunities

As more supplies become available, contracts will become more flexible. End-user contracts with Asian utilities are being renegotiated as they come up for renewal and the trend is toward renegotiation of prices and shorter tenures. In addition, some new projects are being developed without long-term contracts. Trinidad and Tobago's Atlantic LNG Train 4 is the first liquefaction facility to be developed without committed markets; the 253 billion cubic feet per day production, the equivalent volumes for one proposed terminal, began start-up activities in 2005. It will be marketed by the project sponsors BP, BG, and Repsol. The United States is expected to be the main market (EIA 2004a, 56). One estimate of the maximum additional LNG volumes to be brought on-stream is about 6 billion cubic feet per day between 2004 and 2007 (King 2005).<sup>11</sup> These volumes are equivalent to the yearly capacity take for four regasification terminals, not the 50 currently proposed for North America.

The size of the spot market for LNG, while growing substantially, is still too small to support terminals without supply contracts. In 2003, only 400 billion cubic feet of uncontracted gas was available, constituting 8 percent of the global gas market, and most of these volumes went to the United States, Japan, and South Korea (EIAa 2004). In 2004, short-term volumes were estimated as rising to 11 percent of the market, with most volumes going to the United States, where LNG imports are at record levels (BP 2005; Foss 2005a; Jensen 2005). This number is expected to be much smaller in 2005. Problems associated with the start-up of new production facilities and the scarcity of LNG supplies have meant only a 3 percent increase in US LNG imports during 2005, despite high prices and the start-up of an additional terminal. Total imports are no greater than levels in 2002 (EIA 2005c). The gas requirements of the large number of proposed terminals in North America would almost certainly exceed supply.

As the spot market grows in the next two decades, terms and conditions of the contracts are likely to change. LNG buyers could have more flexible arrangements in procuring LNG supply and consummating purchase agreements, including the ability to divert certain volumes to other destinations and a longer time in which to make up volume obligations. Many large players are now positioning themselves to exploit market price differentials by "arbitrage" — that is, by diverting uncontracted volumes destined for Asia or Europe to markets in North America if prices increased there. Suppliers are moving to own every piece of the value chain so that they can optimize the movement of LNG.

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11 The estimate for existing suppliers was 4 billion cubic feet per day and for emerging suppliers 2 billion per day.



The spot market will remain a small part of the LNG market. Unlike the market for oil, which has become more liquid (easily convertible into cash) and fungible (interchangeable), it will be some time before LNG develops into a pure spot market. Logistically, three completely different pricing mechanisms affect the disparate markets. The Asian market, still the largest, is driven by a basket of crude oil prices known as the Japanese Crude Cocktail. Europe's market is influenced by a combination of fuel oil and coal prices, whereas the North American market price is determined by "gas on gas" competition. As more spot volumes enter the market beyond 2008, there could be a global convergence in LNG pricing. Although volume flexibility will be built into contracts, the LNG markets in the next few years will continue to be dominated by long-term contracts. Reliability of supply through a long-term contract or a large supplier will be critical to the economics of the first LNG terminals built in North America.

## ***Market Risks***

### **Price Risks**

Historically, the risks of LNG projects were mitigated by long-term contracts with end-users. Today, it is difficult for terminal sponsors to find a buyer who is willing and able to enter into a long-term contract. In the deregulated North American energy markets, potential LNG buyers, such as power companies and gas distributors, no longer have captive customers to whom they can pass on price or volume risks. When suppliers purchase LNG at a fixed price, volatile prices in the end-user market can leave them exposed to commodity price risk.

### **Volume Risks**

As a marginal supply source in the United States, LNG is currently used mainly to meet incremental demand arising from unpredictable circumstances, including sudden surges in gas demand by power plants due to extreme temperatures or weather conditions. On the other hand, LNG supplies, which are generally sufficient for such demand, have long shipping lead times, arrive in large quantities, and cannot be modified quickly to meet changes in demand. Accordingly, terminals without contractual arrangements may be exposed to swings in volumes and prices. There is also the issue of whether the markets could absorb all the volumes that would be available if several LNG terminals proceeded at the same time — the first projects to tie up satisfactory contracts or assured takers are likely to have an advantage over projects that come later.

## ***Mitigating Risk***

Supply and market risks, as we have seen, can have a significant impact on the economic feasibility of an LNG project. In order to mitigate the risks, a number of different types of contracts are emerging, such as a supplier-contracted tolling structure, a buyer-contracted tolling structure, the integrated project terminal, and the merchant terminal.



## A Supplier-Contracted Tolling Structure

Under a supplier-contracted tolling structure, the terminal has a direct long-term contract with a supplier (third party) who owns the LNG volumes, either by having produced the gas or purchased it on the market. Since the supplier pays for the space in the facility whether or not it is used, the terminal's revenues are shielded from volume risk; instead, the risk falls on the supplier to procure LNG volumes.<sup>12</sup> Issues of where and when the supplier obtains the LNG volumes are outside the contract. The supplier who owns the rights to the terminal capacity will decide when to dispatch the LNG to an end-use market or sell it at Henry Hub. All such contracts contain some type of *force majeure* clause where monies are paid in the event of supply disruption from political conflict, strikes, natural disturbances, or other unforeseen events. In addition, some parties take out insurance against political and other supply-disruption risks.

Such long-term contracts could be a major determining factor in the movement of LNG volumes to the United States, and will likely influence which regasification facilities are built. A milestone for a proposed LNG terminal would be a long-term contractual arrangement with one or two host countries or major integrated oil companies.

## A Buyer-Contracted Tolling Structure

Another type of agreement that is common for an LNG facility is a “take or pay” contract with a buyer, such as an industrial user, a local gas distribution utility, or marketer/supplier that contracts with a terminal for capacity and then contracts with an LNG supplier for long-term gas. The end-user could also be a gas distribution utility that contracts with a terminal project for capacity and then contracts with an LNG supplier for long-term gas.

Under a take or pay contract, the buyer is responsible for procuring LNG from an LNG project/producer or LNG marketer, and determines when to import the LNG and at what price. The buyer also pays for the space at the terminal whether or not it is used. The contract might also include back-stopping arrangements, which allow for third-party gas supplies to make up any shortfall. As with supplier-contracted structures, the terminal itself is protected from volume risk, since the take or pay contract enables revenue to be generated regardless of the amount of LNG received.<sup>13</sup>

## The Integrated Project Terminal

Suppliers with investment interests in regasification terminals effectively shift the risk from the downstream end-user to the upstream producer. With an integrated project terminal, the project's

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12 An example of such a contract is the 22-year contract for space that British Gas has with the Lake Charles Facility on the Gulf Coast. Cheniere Energy's Sabine Pass facility, also on the Gulf Coast, recently completed 20-year agreements with Total SA and ConocoPhillips.

13 An example of this type of arrangement is the 500 million cubic feet per day of capacity that Dow Chemicals has contracted with Cheniere Energy's Freeport terminal on the Gulf Coast.



sponsors implicitly bear the volume and market risk. They are able to do so because they have an interest in or control of every part of the value chain from production to end-user, and the regasification terminal is simply the final link in the physical supply chain. The most likely parties to benefit from this type of arrangement are highly capitalized players, such as the major oil companies and independent oil and gas companies, which are well positioned to take an equity interest in every part of the value chain. In some projects, companies are assuming price and volume risks by taking an equity interest in the terminal. Repsol's equity interest with Irving Oil in the Canaport Terminal, NB, and Anadarko's Bear Head terminal in Nova Scotia are examples.<sup>14</sup>

For many proposed projects, what remains to be seen is the nature of the supply contracts they are able to obtain. Short-term contracts might have to suffice until long-term supply commitments are awarded. The creditworthiness of the supplier and the structure of the contracts for the volumes used to meet peak demand would also be critical. In contrast to major oil and gas companies such as ExxonMobil, ConocoPhillips, and Shell, large independents likely would procure some third-party supplies since their production ownership might not be sufficient to provide bridging supplies.

## The Merchant Terminal

The merchant terminal is one that is built without supply or end-user contracts. The terminal's revenues are dependent on its finding uncontracted LNG supplies. Few project sponsors have attempted this business model because of the revenue risk associated with unpredictable volumes. This type of arrangement does not assure revenues to cover large upfront capital costs and is unlikely to receive traditional project financing unless a major creditworthy sponsor backed the transaction. If the project were located advantageously, however, a major supplier or end-user might be tempted to take an equity interest in the terminal well before construction begins. As the LNG market matures, more merchant traders are emerging with assets in all parts of the value chain.

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<sup>14</sup> Repsol, a large independent oil and gas company based in Spain, acquired an equity interest in the proposed Canaport facility in October 2004. The company also is in partnership with British Gas and British Petroleum in a Trinidad and Tobago LNG liquefaction facility that began start-up activities late in 2005, and has secured additional supplies from Algeria's Gas Touil project. The next step is for project sponsors to convince suppliers that Canaport represents the best point of entry for gas shipments to North America.

Anadarko's purchase of Bear Head gives the company access to the North American market and completes the missing link in its LNG value chain (see Anadarko Petroleum 2004). This US-based, large, independent oil and gas producer has operating partnerships or interests with Sonatrach, the National Oil Company in Algeria, and a small interest in Qatar LNG.



# CRITICAL SUCCESS FACTORS FOR ATLANTIC CANADA

Atlantic Canada has a narrow window of opportunity to be a first mover in the North American LNG market. The region has several competitive advantages, including the accessibility of its ports and their proximity to the high-priced markets of the US northeast, as well as the pipeline infrastructure to move the gas. Moreover, two of the three proposed LNG projects in Atlantic Canada — Irving Oil's terminal at Canaport, NB, and Anadarko's Bear Head facility at Point Tupper, NS — representing more than \$1.2 billion in direct investment, are located in industrial areas where local support is strong. These projects are also among the few in North America to receive major environmental and regulatory permits. Keltic Petrochemicals' proposed terminal in Goldboro, NS, is proceeding through the environmental approval process. It announced in December 2005 that it had signed a supply agreement with Netherlands-based Petroplus International B.V.

In this section, I discuss the market environment in which these Atlantic Canadian projects are being considered and the benefits they would bring to the region.

## *A Fleeting Window of Opportunity*

In a growing natural gas market with initially limited supplies, those who can capture market share early will enjoy higher prices, more profitable customers, and potential economies of scale from a well-established presence. Atlantic Canada as a region appears to have first-mover advantage primarily because of its location, the existence of some regulatory approvals, local support, and difficulties in siting terminals in the US northeast.

Yet Atlantic Canada is not the only region vying for the US markets. With more than 55 terminals currently under proposal in North America, ten of them in the US northeast (see the Appendix), Atlantic Canada has only a fleeting window of opportunity to gain a share of the LNG market. Even though some US projects currently face fierce local opposition, attitudes might change over time through persistence, technological changes, resources, price volatility, and regulatory evolution. In Washington, emphasis on the growing need for LNG imports to satisfy US gas demand was behind an energy bill, passed in August 2005, making the Federal Energy Regulatory Commission the final arbiter of the siting of LNG terminals, a move that might increase the likelihood that projects receive the necessary permits to proceed, even in the face of strong local and state opposition.

One LNG project already approved by FERC is Weaver's Cove, Massachusetts. A major factor behind the May 2005 approval was a cooperative process developed among key stakeholders and regulators,

including FERC, and the US Coast Guard, that set safety standards and procedures — a strategy that could set the groundwork for the approval of other projects. FERC also approved three projects on the Gulf Coast in 2004–05. Sabine Pass, the first greenfield LNG project to be built in the United States in 20 years, will also start up in 2008, with some volumes destined for northeast markets if the pipeline bottlenecks can be sorted out. Also on the Gulf Coast, Gulf Gateway Deepwater, the world's first offshore terminal receiving facility, is now operational. Commissioned by Excelerate Energy, it is also the first new US import terminal in 20 years and of a type that might gain local acceptance in the US northeast.

Canadian rivals exist as well. Two proposed LNG terminals in Quebec are in the process of filing for environmental and regulatory approval. Start-up is expected in 2009 and most volumes are destined for eastern Canada, with the potential to penetrate US northeast markets.

## ***Local Benefits***

The local benefits of locating LNG terminals in Atlantic Canada would be relatively small and short lived. Constructing each terminal would likely create 600 to 1000 jobs lasting about two years. The number of permanent full-time jobs is expected to be about 40 per terminal. LNG project sponsors might attempt to maximize the number of jobs given to people in the region, but some technical expertise inevitably would be brought in from outside.

The LNG terminals would also be limited sources of additional taxes. In determining the feasibility of a project, applicable municipal, provincial, and other taxes are weighed against taxes in other North American jurisdictions, and often reduced in order to entice projects to be built in a particular location. For example, Irving Oil and the City of Saint John, NB, agreed on a low municipal tax rate of \$500,000 a year for 25 years for its proposed terminal at Canaport, presumably in recognition of the long-term economic benefits to the region in having the facility located there.

Given the relatively limited local benefits of LNG terminals, focusing on them could distract provinces and municipalities from working together to maximize the long-term economic advantage for Atlantic Canada as a whole. All too often, there is a tendency to think of the various projects as rivals in terms of local benefits, and that one project can proceed only at the expense of another. In Atlantic Canada, however, whether one, some, or all the proposed projects go ahead, the long-term benefits for the whole region would far outweigh the benefits to any local area, particularly in terms of potential cost savings to the offshore natural gas industry and energy diversification.

## ***Benefits for the Offshore Gas Industry***

Having LNG terminals would improve Atlantic Canada's access to global gas supplies and bolster the region's energy transportation corridor, which extends to markets in the US northeast. Expanding the M&NP pipeline to accommodate additional gas volumes could result in transportation cost savings



over the long term. Increased volumes generally result in lower tolls because larger volumes are spread over fixed costs, resulting in lower per unit costs. Lower transportation costs, in turn, could improve the economic attractiveness of Atlantic Canada's offshore gas industry, where geology and the high cost of production present challenges. A larger issue outside the scope of this paper is the fragmented regulatory process and the burden on the producer, which still remain to be addressed.

## *Energy Diversification*

Canada is the largest per capita energy user in the world, due to its climate, distances, and a resourced-based economy that is energy intensive. Reliable and competitively priced energy sources are critical to the social and economic well-being of Canadians.

Atlantic Canada currently depends on fuel oil, coal, nuclear power, and hydro for its electricity generation. Comparatively little gas is in the energy mix — accounting for just 7 percent of total electric generation capacity in New Brunswick and 13 percent in Nova Scotia (Dominion Bond Rating Service 2005, 53). Thus, a major long-term benefit of locating an LNG regasification terminal in Atlantic Canada is the potential access it would offer to alternative gas supplies. Having the infrastructure to access gas would diversify the region's energy sources, as well as encourage competitively priced and environmentally friendly options for Atlantic Canada's future electricity generation capacity. Spin-offs could include greater security of electricity supply at competitive prices, which could enhance Atlantic Canada's global competitive position in the long term, particularly for the energy-intensive forestry industry.

Atlantic Canada is now at a crossroads in determining its electricity future and how that might be linked to reliability of supply and a cleaner environment. The region faces the challenge of increasing electricity generation to meet growing demand at a competitive price while reducing sulphur dioxide and other emissions to meet Canada's obligations under the Kyoto Accord. Although enough electricity is now being generated to meet current needs, much of the supply comes from older, inefficient fuel oil or coal-fired plants that will require replacement or refurbishing in the next five to ten years. With elevated environmental concerns and the Kyoto Accord's emissions guidelines in the public's mind, Atlantic Canada's energy consumption mix will be examined carefully.

Despite the estimated \$1.4 billion cost, New Brunswick has decided to refurbish its nuclear power plant at Point Lepreau, which currently generates one-quarter of the province's electricity generation. The province has another potential energy supply problem with NB Power's Coleson Cove facility. In November 2004, Coleson Cove was converted to use a fuel called Orimulsion, a mixture of bitumen (a sticky tar-like substance) and water. Unfortunately, the world's only supplier of Orimulsion — BITOR, a subsidiary of the state-owned Venezuelan oil company — is abandoning the money-losing business altogether and will no longer supply the New Brunswick plant. The generation unit there is now running on more expensive fuel oil.

In Nova Scotia, more than half the electricity is generated by inefficient and environmentally unfriendly coal-fired plants. The province must now decide whether to refurbish or replace facilities that will approach the end of their life cycle in the next ten years. If they are retired, however, the province must find alternative sources of generation. Nova Scotia Power has taken some steps toward investigating alternatives by investing in windpower generation, but it would take the considerable investment in an estimated 900 wind turbines to generate the same amount of electricity as a coal-fired plant (Todesco 2004). Furthermore, because windpower production is subject to weather conditions, the source would need to be complemented by other energy sources. Gas-fired, combined-cycle power generation and cogeneration are among the environmentally friendlier options for Nova Scotia's energy diversification and emissions reduction.

### ***Benefits for the Petrochemical Industry***

Another potential long-term benefit of having an LNG terminal in Atlantic Canada is the boost it would give to the development of the petrochemical industry in the region. Keltic Petrochemicals is proposing an integrated petrochemical plant alongside its LNG terminal, and Irving Oil's operations could also engage in plastics and petrochemical production. It is difficult to gauge the extent of these benefits, however, as the proposed petrochemical projects are still in the early stages of review. The industry is highly cyclical, and producers with low-cost positions and access to markets have better prospects of thriving in the long term. Reliable access to competitively priced supplies under a long-term contractual arrangement will be critical in keeping costs down.

### ***The Benefits of Access to US Gas Markets***

Without access to US markets, none of the LNG projects proposed for Atlantic Canada would be feasible, since the region by itself is not large enough to support even one terminal.<sup>15</sup> The business decision by international players to locate and support facilities in Atlantic Canada is based instead on moving the gas to the valuable markets of the US northeast, where there is the critical mass to support investment in infrastructure. US northeast markets are particularly desirable because that area has been one of the fastest-growing gas-consuming regions in North America, primarily due to the conversion of power plants from coal and oil to cleaner-burning gas. Distance from indigenous supply sources and limited pipeline transportation to the area have kept prices in these markets high.

Potential investors in Atlantic Canadian LNG terminals are depending on the capital returns from accessing the US northeast markets, together with a favourable business and regulatory environment in Atlantic Canada, and that these returns will outweigh the risks associated with sinking large amounts of capital into infrastructure. The investment decision is part of a greater value chain that

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<sup>15</sup> Natural gas consumption in the Atlantic provinces is less than a quarter of a billion cubic feet per day, compared with nearly 9 billion cubic feet per day in the US northeast. The three proposed LNG projects in Atlantic Canada would supply 3 billion cubic feet per day, more than 12 times the gas consumption of the entire Atlantic Canadian gas market.



involves billions of dollars invested in exploration, liquefaction, and infrastructure to bring LNG to markets. A small change in the business, contractual, transportation pricing, or operating environment could have a significant effect on the economics of these complex projects of massive scale involving hundreds of contractual agreements. Furthermore, an optimal tolling structure could be critical for project volumes to be competitive in US gas markets.

Although Atlantic Canadian gas markets are undeveloped and lack the critical mass in demand or available supplies to justify large amounts of investment in infrastructure, the presence of one or more LNG terminals could provide needed infrastructure and transportation cost savings from which Atlantic Canada's offshore gas industry could benefit. If the region chose to include natural-gas-fired generation capacity in its electricity future, one or more LNG terminals could be expanded.

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16 More gas can be transported by compressing it further, which is usually much less expensive than building additional pipeline unless the extra fuel becomes a prohibitively high operating cost. Pipeline expansion is possible to accommodate the equivalent volumes of both projects in Atlantic Canada, but the least risky expansion would result in optimal tolling to accommodate 600 million cubic feet per day, the equivalent of one LNG project's flows averaged over a year. Accommodating two LNG projects would require a more expensive looping — that is, adding additional pipe instead of simply installing less costly compressors on an existing line. Much larger and sustainable flows would then be required to attain economic tolls.



# POLICY IMPLICATIONS AND CONCLUSIONS

Beyond acting together, what can Atlantic Canada do to maximize the opportunity that has been presented by the proposals to build LNG terminals in the region? The contractual agreements will be determined by the sponsors of the projects, but it is the markets and the regulatory process that will decide how many terminals proceed. Governments in Atlantic Canada could play their part in the following ways.

First, *the provinces should recognize the long-term benefits of having access to LNG in Atlantic Canada.* Expanded transportation infrastructure to move LNG volumes to markets would result in better economics for the offshore gas industry through reduced transportation costs and potential access to a reliable, diversified, environmentally friendly and competitively priced energy supply. In the event that only one project proceeds, the provinces would do well to recognize that the long-term benefits Atlantic Canada stands to gain far outweigh the short-term, local gains of jobs and a potentially increased tax base.

Second, *Atlantic energy ministers should extend regional cooperation on energy matters to include specific LNG opportunities.* The energy ministers have already initiated regional cooperation, particularly in planning Atlantic Canada's electricity supply future. A similar approach could be taken in assessing the region's long-term LNG opportunities, particularly in light of its electricity future and environmental sustainability. At their roundtable meetings in 2004, ministers saw LNG as a viable option for ensuring more reliable energy availability and accessibility in Atlantic Canada. LNG's potential role in increasing the reliability of electricity supplies, enabling the region to meet its environmental commitments, and improving the economics of the offshore gas industry are compelling reasons for the Atlantic provinces to work together.

Third, *the Atlantic provinces and the federal government should create a coordinated approach to support the projects in the regulatory process.* The projects will continue to go through a number of regulatory jurisdictions to gain the necessary permits to proceed. With the regulatory review process split into many parts and crosscutting many jurisdictions, it is easy to lose sight of Atlantic Canada's interests as a whole. Rather than focusing on the merits of the projects from each jurisdictional perspective, the provinces should work with the appropriate federal agencies to enhance the focus of the regulatory process on the broader public interests, including greater regional prosperity from an enhanced global competitive position.

Fourth, *the provinces should refrain from pursuing protectionist “Canada First” policies that attempt to force sales of LNG in the still-undeveloped Atlantic Canadian market by blocking exports of surplus gas to the United States.* New Brunswick tried such an approach when it asked the NEB to allow it to close off natural gas exports and force suppliers to bring the product to the uneconomic and under-served northern part of the province. As the Atlantic Institute for Market Studies noted in a submission to the NEB, “If we had to wait until the Atlantic Canadian market was built up...before exporting surplus gas to the U.S., offshore gas would never have been developed. Atlantic Canada is not a big enough energy market to be the driver for offshore development” (AIMS 2002, 1; see also Crowley 2002). Although the NEB turned down New Brunswick’s request, the province has indicated it would continue with environmental and other regulatory challenges in pursuit of its protectionist gas policy. Such tactics can serve only to make potential investors in Atlantic Canadian LNG terminals nervous.

Fifth, *provincial governments should encourage regulators to continue to reduce overlap and duplication by sharing practices and by focusing regulation on market-based principles.* It is important to ensure a predictable regulatory environment and rate stability so that sound investment decisions can be made in an efficient manner.

Sixth, *the provinces should join with US states and the US and Canadian federal governments to continue crossborder discussions to improve coordination of the energy regulatory process.* This would include bringing together key stakeholders — marketers, pipelines, regulators, and other government officials — with the goal of finding common benefits for the Atlantica region.<sup>17</sup>

Seventh, *provincial governments should do a better job of educating the public about the long-term benefits of LNG to the Atlantic region.* The public needs to know more about LNG’s demonstrated safety and reliability and about its economic, environmental, and energy security benefits. The provinces, together with the appropriate federal agencies on both sides of the border, should emphasize the common goals of Canadian and US energy policies as they relate to LNG, energy supply diversification, and security.

The global gas market is evolving as a major capital investment opportunity to meet growing energy demand. In the next several years, up to US\$250 billion of capital will be dedicated to bringing LNG supplies to markets worldwide. Atlantic Canada has the potential to benefit from this unprecedented growth provided the provinces can act together to maximize the investment opportunity.

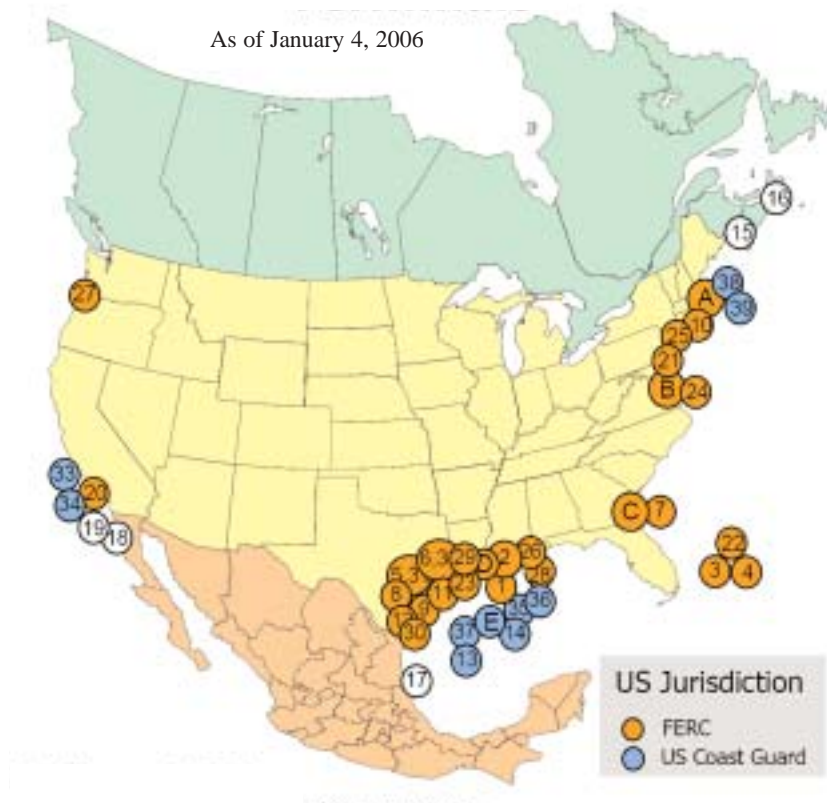
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17 Several initiatives are already ongoing. See, for example, the Woodrow Wilson International Center’s web site: <<http://www.wilsoncenter.org>>. Roundtable discussions have also been convened among New England governors and Atlantic Canadian premiers; see web site: <<http://www.Atlantica.org>>.



# APPENDIX

## Existing and Proposed North American LNG Terminals



### Constructed

- A. Everett, MA: 1.035 Bcfd (Tractebel-DOMAC)
- B. Cove Point, MD: 1.0 Bcfd (Dominion-Cove Point LNG)
- C. Elba Island, GA: 0.68 Bcfd (El Paso-Southern LNG)
- D. Lake Charles, LA: 1.2 Bcfd (Southern Union-Trunkline)
- E. Gulf of Mexico: 0.5 Bcfd (Gulf Gateway Energy Bridge-Excelerate Energy)

### US-Approved Terminals

- 1. Lake Charles, LA: 0.6 Bcfd (Southern Union-Trunkline)
- 2. Hackberry, LA: 1.5 Bcfd (Semptra Energy)
- 3. Bahamas: 0.84 Bcfd (AES Ocean Express)
- 4. Bahamas: 0.83 Bcfd (Calypto Tractabel)
- 5. Freeport, TX: 1.5 Bcfd (Cheniere/Freeport LNG)
- 6. Sabine, LA: 2.6 Bcfd (Cheniere LNG)
- 7. Elba Island, GA: 0.54 Bcfd (El Paso-Southern LNG)
- 8. Corpus Christi, TX: 2.6 Bcfd (Cheniere LNG)
- 9. Corpus Christi, TX: 1.0 Bcfd (Vista Del Sol-Exxon/Mobile)
- 10. Fall River, MA: 0.8 Bcfd (Weaver's Cove/Hess LNG)
- 11. Sabine, TX: 1.0 Bcfd (Golden Pass-Exxon/Mobile)
- 12. Corpus Christi, TX: 1.0 Bcfd (Ingleside-Occidental Energy)
- 13. Port Pelican: 1.6 Bcfd (Chevron Texaco)
- 14. Louisiana Offshore: 1.0 Bcfd (Gulf Landing-Shell)

### Canadian-Approved Terminals

- 15. Saint John, NB: 1.0 Bcfd (Canaport-Irving Oil)
- 16. Point Tupper, NS: 1.0 Bcfd (Bear Head-Anadarko)

### Mexican-Approved Terminals

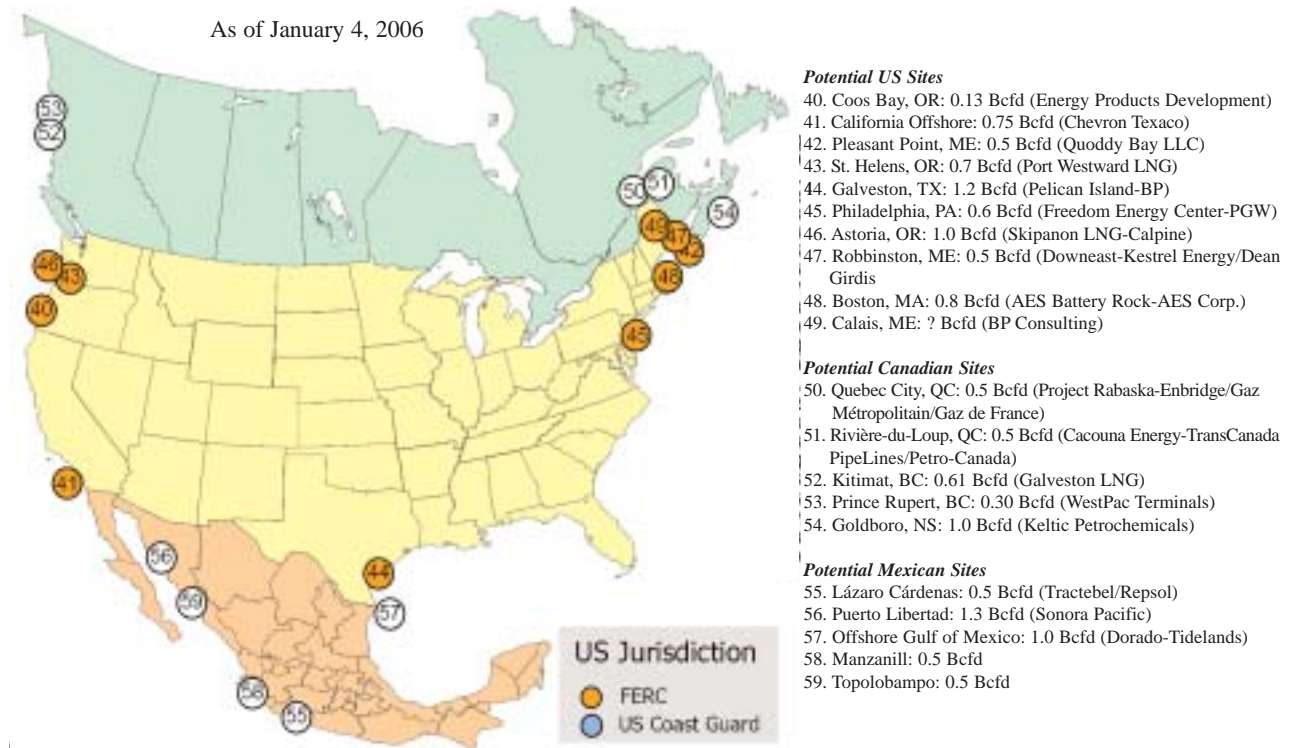
- 17. Altamira: 0.7 Bcfd (Shell/Total/Mitsui)
- 18. Baja California: 1.0 Bcfd (Semptra)
- 19. Baja California Offshore: 1.4 Bcfd (Chevron Texaco)

### Proposed

- 20. Long Beach, CA: Everett, MA: 0.75 Bcfd (Mitsubishi/ConocoPhillips-Sound Energy Solution)
- 21. Logan Township, NJ: 1.2 Bcfd (Crown Landing-BP)
- 22. Bahamas: 0.5 Bcfd (Seafarer-El Paso/FPL)
- 23. Port Arthur TX: 1.5 Bcfd (Semptra)
- 24. Cove Point, MD: 0.8 Bcfd (Dominion)
- 25. Long Island Sound, NY: 1.0 Bcfd (Broadwater-TransCanada/Shell)
- 26. Pascagoula, MS: 1.0 Bcfd (Gulf LNG Energy)
- 27. Bradwood, OR: 1.0 Bcfd (Northern Star)
- 28. Pascagoula, MS: 1.3 Bcfd (Casotte Landing-ChevronTexaco)
- 29. Cameron, LA: 3.3 Bcfd (Creole Trail-Cheniere)
- 30. Port Lavaca, TX: 1.0 Bcfd (Calhoun-Gulf Coast LNG)
- 31. Freeport, TX: 2.5 Bcfd (Cheniere/Freeport)
- 32. Sabine, LA: 1.4 Bcfd (Cheniere LNG)
- 33. California Offshore: 1.5 Bcfd (Cabrillo Port-BHP Billiton)
- 34. So. California Offshore: 0.5 Bcfd (Crystal Energy)
- 35. Louisiana Offshore: 1.0 Bcfd (Main Pass McMoRan)
- 36. Gulf of Mexico: 1.0 Bcfd (Compass Port-ConocoPhillips)
- 37. Gulf of Mexico: 1.5 Bcfd (Beacon Port Clean Energy Terminal-ConocoPhillips)
- 38. Offshore Boston, MA: 0.4 Bcfd (Neptune-Tractebel)
- 39. Offshore Boston, MA: 0.8 Bcfd (Northeast Gateway-Excelerate Energy)



## Potential North American LNG Terminals



# REFERENCES

- AIMS (Atlantic Institute for Market Studies). 2002. “Canada First” Puts Canada (and New Brunswick) Last.” Submission to the National Energy Board re: Hearing Order MH-2-2202, Application of the Province of New Brunswick; available from web site: <<http://www.aims.ca/oilandgas.asp?typeID=3&id=329&fd=0&p=1>>.
- Anadarko Petroleum. 2004. Presentation to the Canadian Offshore Resources Exhibition and Conference, Halifax, NS. October 17.
- ARC Financial. 2006. *Energy Charts: Snapshot of Energy Fundamentals*. Calgary. January 16.
- BP. 2005. *BP Statistical Review of World Energy*. June; available from web site: <[www.bp.com/statisticalreview](http://www.bp.com/statisticalreview)>; accessed September 27, 2005.
- Bradley, Paul G., and G. Campbell Watkins. 2003. “Canada and the U.S.: A Seamless Energy Border?” *C.D. Howe Institute Commentary* 178. Toronto: C.D. Howe Institute. April.
- Chetan, Modi, and Stuart Lawton. 2004. “Liquefied Natural Gas: Strong Growth and Business Fundamentals, but with Greater Credit Variability as New Industry Models Develop.” New York: Moody’s Investor Service. December
- City of Saint John [New Brunswick]. 2005. *Common Council*. March 14 and 29.
- Crowley, Brian Lee. 2002. “N.S. and N.B.: Stop squabbling, think big.” *Halifax Chronicle-Herald*, July 31; available from web site: <<http://www.aims.ca/oilandgas.asp?typeID=4&id=426&fd=0&p=1>>.
- Dominion Bond Rating Service. 2005. *The Canadian Electricity Industry 2004*; available from web site: <[www.dbrs.com](http://www.dbrs.com)>; accessed August 2005.
- EIA (Energy Information Administration). 2004a. *Global Liquefied Natural Gas Market: Status and Outlook*. Washington, DC: Department of Energy. December.
- . 2004b. *International Energy Outlook*. Washington: DC: Department of Energy. July.
- . 2004c. *US LNG Markets and Use*. Washington: DC: Department of Energy. June update.
- . 2005a. *Annual Energy Outlook 2006 (Early Release)*. Washington: DC: Department of Energy. December 12.
- . 2005b. *International Energy Outlook*. Washington: DC: Department of Energy. July.
- . 2005c. *Monthly Energy Review, Natural Gas Trade by Country*. Washington: DC: Department of Energy. November 23.
- Energy Intelligence. 2005. *Natural Gas Week*. May 30.
- FERC (Federal Energy Regulatory Commission). 2004. *LNG Safety*. Washington: DC.



- . 2005. Office of Energy Projects. *Existing, Proposed and Potential LNG Terminals*. Washington: DC. August 22.
- Foss, M.M. 2005a. “Global Natural Gas Issues and Challenges: A Commentary.” *Energy Journal* 26 (2): 111–28.
- . 2005b. “LNG Access.” California Energy Access Workshop. Centre for Energy Economics, Bureau of Economic Geology, University of Texas, Austin; available from web site: <[http://www.energy.ca.gov/lng\\_docket/documents/2005-06-01\\_workshop/presentations\\_2005-06-01/5Foss\\_2005-06-01.pdf](http://www.energy.ca.gov/lng_docket/documents/2005-06-01_workshop/presentations_2005-06-01/5Foss_2005-06-01.pdf)>; accessed September 2005.
- Hightower, Mike, et al. 2004. *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas Spill over Water*. Albuquerque, NM: Sandia National Laboratories. December.
- Jensen, James T. 2003. “The LNG Revolution.” *Energy Journal of International Association for Energy Economics* 24 (2): 1–45.
- . 2004. *The Development of a Global LNG Market. Is it Likely? If So, When?* Oxford: Oxford Institute for Energy Studies.
- . 2005. “The Globalization of LNG.” Presentation to the IEA-GTE Workshop “LNG: Making Gas Markets Global,” Paris, May 19; available from web site: <[www.iea.org/textbase/work/2005/LNGGasMarkets/session\\_3/1](http://www.iea.org/textbase/work/2005/LNGGasMarkets/session_3/1)>; accessed November 28, 2005.
- King, Martin, 2005. *Outlook for Crude Oil and Global Gas Markets*. Calgary: First Energy Capital Corporation May.
- Lee, Henry. 2005. *Dawning of a New Era: The LNG Story*. Environmental and Natural Resource Program, Belfer Center for Science and International Affairs, John F. Kennedy School of Government. Cambridge, Mass: Harvard University. April.
- National Energy Board. 2004. *Short-Term Canadian Natural Gas Market Deliverability*. Ottawa. November.
- Rigby, Peter. 2004. “Hot Prospects for a Cold Fuel: Project Finance Seeks the LNG Business.” *Global Project Finance Yearbook 2005*. New York: Standard and Poors.
- Sankey, Paul. 2004. *Integrated Oils: Global LNG: Exploding the Myths*. New York: Deutsche Bank Securities. July 22; available from web site: <[www/jec.senate.gov/\\_files/SankeyTestimony.pdf](http://www/jec.senate.gov/_files/SankeyTestimony.pdf)>; accessed September 26, 2005.
- Todesco, Ralph. 2004. Notes to Sydney and Area Rotary Clubs. Nova Scotia Power, April 1.
- Tucker, Thomas. 2002. *Having Our Gas and Selling It Too*. Halifax, NS: Atlantic Institute for Market Studies.
- Woodrow Wilson International Center Energy Forum. 2005. *Security of Continental Gas Supplies Forum Proceedings*. March; available from web site <[www.wilsoncenter.org/index.cfm?topic\\_id=1420&fuseaction=topics.event\\_summary&event\\_id=113225&doc\\_id=113916](http://www.wilsoncenter.org/index.cfm?topic_id=1420&fuseaction=topics.event_summary&event_id=113225&doc_id=113916)>; accessed September 29, 2005.

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