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Comments for the Environmental Assessment of the proposed Alton Underground Natural Gas Storage Facility

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1 Introduction

Worldwide, natural gas consumption is increasing (BP 2007). This growth is not uniform, with OECD members showing little, and in some cases, negative, growth; while the former Soviet Union and emerging market economies are showing significant growth, as shown in Table 1.

Table 1: World consumption of natural gas 2005-2006 (Mtoe[1]) (BP 2007)

Region	2005	2006	Growth
Total world consumption	2,512.2	2,574.9	2.5%
OECD	1,282.5	1,287.0	0.3%
Former Soviet Union	537.4	559.0	4.0%
Other EMEs	692.3	728.9	5.3%

The global demand for natural gas is projected to have an average annual growth of between 1.9 and 3 percent for the period 2005 and 2025 (EIA 2006). In the United States, consumption is expected to grow by almost one percent per year between 2005 and 2025 (EIA 2007).

Although a number of countries have significant reserves of natural gas, others have peaked and are in decline. For example, in North America, reserves of natural gas peaked in the early 1980s and have been in decline ever since; however, the decline is not uniform, with Mexico exhibiting significant depletion, Canada less so, and the United States showing reserve growth (BP 2007).

Natural gas, like crude oil and oil products, can be extracted and stored to meet subsequent demand or take advantage of pricing differentials. Natural gas can be stored in a number of ways, including both above- and below-ground facilities—a common below-ground technique is to store the natural gas in salt caverns. In the 2001 Nova Scotia Energy Strategy, the presence of salt caverns in Nova Scotia was considered to be an asset for the province's fledgling natural gas industry as they could be used to store natural gas, thereby helping the United States meet its energy security needs (NS Petroleum Directorate 2001).

In 2002, Landis Energy Corporation commenced an exploration program in Nova Scotia to identify a salt formation suitable for natural gas storage. Alton Natural Gas Storage L.P. (formed by Landis Energy and Fort Chicago Energy Partners), plans to develop an underground

[1] Mtoe – Million tonnes of oil equivalent

storage facility for natural gas near Alton, Nova Scotia. Initially, four caverns will be excavated with capacity of four billion cubic feet (BCF) of natural gas; as well, Landis has plans for developing an additional 10 to 15 caverns (Landis 2007). The reason for this facility is "to meet the growing demand for natural gas storage in Nova Scotia, New Brunswick, and Northeast U.S. Presently, no storage facilities connect to the Maritimes & Northeast Pipeline system" (Alton 2006).

The Alton facility requires a provincial environmental assessment. One of the principal reasons for this assessment is because the excavation process entails extracting brine from the salt caverns, pumping it from the Alton site to the Shubenacadie River.

This submission examines the proposed Alton salt cavern excavation by addressing two energy-related questions:

- Is there a sufficient supply of natural gas?

  A supply of natural gas is needed for any natural gas storage facility; for the Alton facility, this supply would have to be met from natural gas available in Nova Scotia.

- Is there sufficient demand in Nova Scotia for natural gas to justify the storage facility?

2 Sources of natural gas for the Alton storage facility

There are four possible sources of natural gas for the proposed Alton natural gas storage facility: offshore, onshore, liquefied natural gas, and compressed natural gas.

2.1 Offshore

Nova Scotia has one active offshore natural gas play with the possibility of a second coming on stream later this decade.

2.1.1 Sable Offshore Energy Project

Nova Scotia's natural gas supply comes from the Sable Offshore Energy Project (SOEP) which consists of a series of five natural gas fields located about 225 kilometres off the east coast of Nova Scotia in the Atlantic Ocean. Originally, the Sable project was divided into two tiers of three fields each (see Table 2).

Table 2: Sable's fields and production dates (Exxon-Mobil, 2005)

Tier	Field	Date of initial production
I	Thebaud	December 1999
I	Venture	February 2000
I	North Triumph	February 2000
II	Alma	November 2003
II	South Venture	December 2004
II	Glenelg	Abandoned, see [2]

The individual production profiles for each field and Sable's total production for its first seven years of production is shown in Figure 1. Sable's monthly production peaked in November 2001, at 512,241,110 cubic metres or 18.1 billion cubic feet (BCF). Production ceased in the North Triumph field in 2005 due to pressure declines.

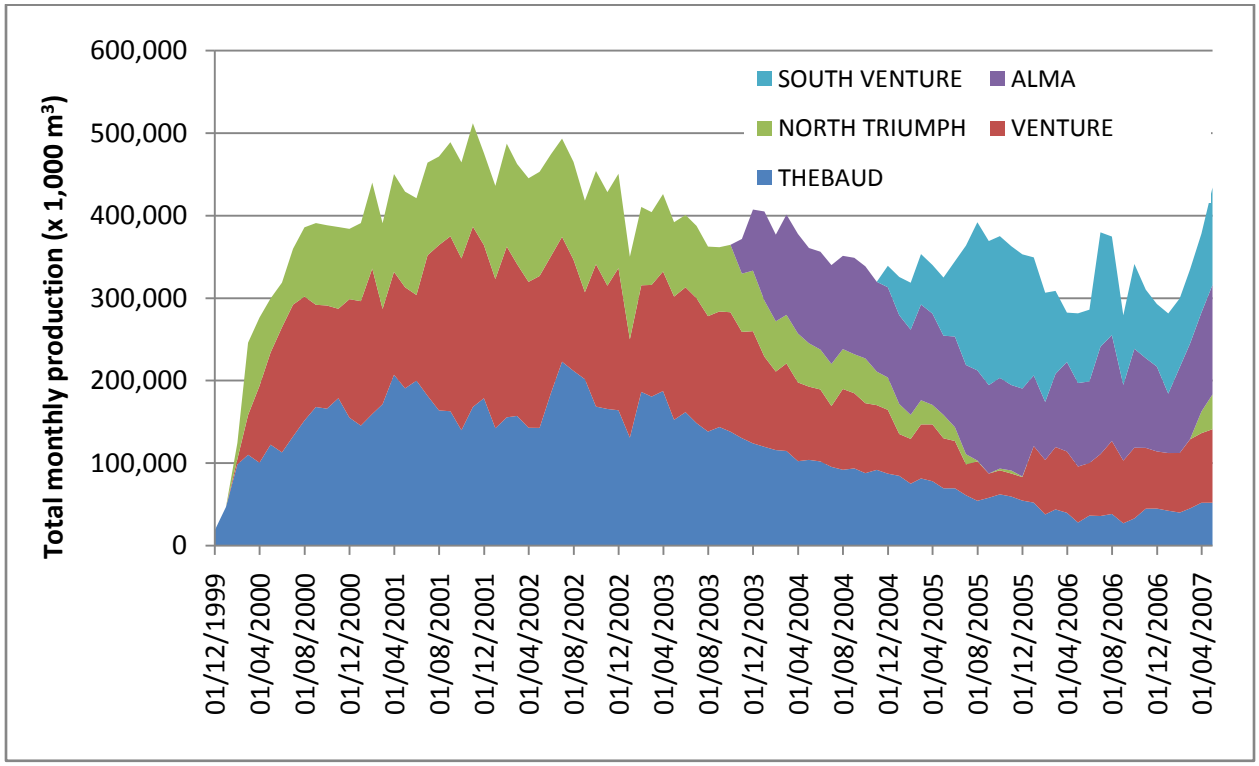

Figure 1: Monthly production from SOEP (Hughes 2007)

It is believed that Exxon-Mobil is subject to penalties when the volume of natural gas supplied to Maritimes and Northeast (M&NE) pipelines falls below a certain value—this is informed

[2] Shell Canada considers the Glenelg project a "write-off" (Shell 2004).

speculation as the contract is confidential. In order to boost production, in mid-to-late 2006, a compression deck was added to the project enabling production volumes to increase in early 2007, as can be seen in Figure 1. It is unclear how long this level of production can continue, although the National Energy Board projects a decline in production within a year (see Figure 2).

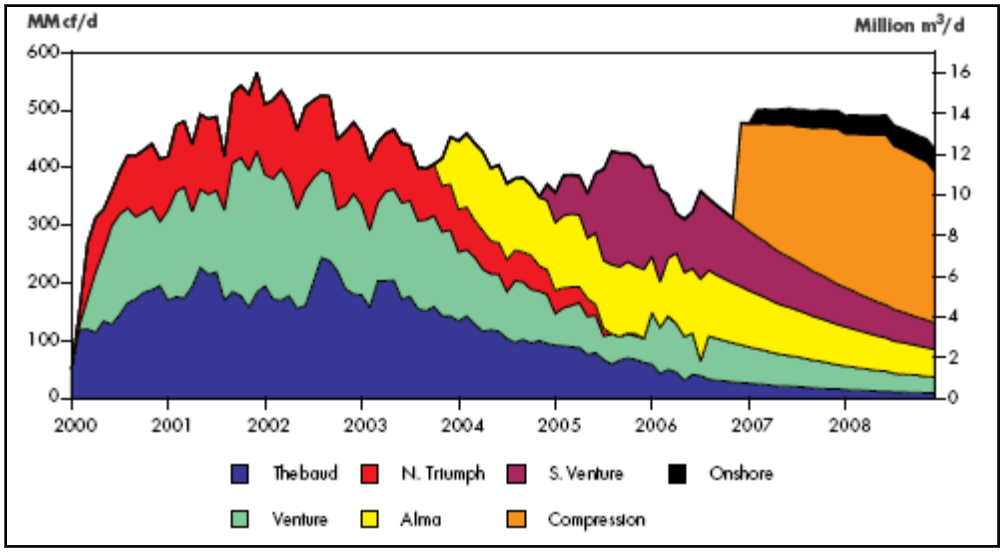

Figure 2: Projected volumes of natural gas from SOEP (from (NEB 2006))

The total volume of the fields—the size of the reserve—has undergone considerable revision over the past several years, ranging from a high of about 3.6 trillion cubic feet (TCF) soon after production began in December 1999 to 1.36 TCF in February 2004 (Myrden 2004). As of May 2007, total production had reached about 1.17 TCF. The compression deck can increase the total reserve size; however, it is expected to deplete the reserves faster. The Sable project is expected to be abandoned sometime around 2012.

At present, Sable is producing about 400 million cubic feet of natural gas a day. If all of this natural gas could be supplied to the proposed Alton storage cavern, it would take about 10 days to fill—this, of course, would mean that no natural gas would be flowing through the M&NE pipeline from Sable.

2.1.2 Deep Panuke

A second offshore natural gas field, Deep Panuke, is undergoing a lengthy review process by its leaseholders, EnCana. The field has an on-again off-again history, with EnCana originally announcing that it would develop the field, then requesting (and re-requesting) a delay in its decision. In June 2006, EnCana and the province jointly announced a new royalty regime for Deep Panuke, which was taken as a sign that development of Deep Panuke would proceed. The EnCana Board will make the final decision by December 2007 (Premier's Office 2006).

Deep Panuke is a small field, with an estimated size of less than one TCF, and contains sour gas.[3] If the project proceeds, its output will be fed into the M&NE pipeline, carrying natural gas from Nova Scotia to New England (Proctor 2006).

2.1.3 Future projects

The lack of offshore exploration can be attributed to several issues: the high cost of exploring in Nova Scotia's deep water, elevated rig costs, and the worldwide scarcity of deep-water rigs. These, coupled with the fact that very few commercial quantities of natural gas have been found in Nova Scotia's offshore waters, are discouraging exploration.

Clearly some natural gas exists in the Nova Scotia offshore; the absence of commercially viable amounts may mean that these small fields, referred to as stranded gas, are simply too small and too expensive for companies to pursue. The belief, promoted by Offshore/Onshore Technologies Association of Nova Scotia (OTANS), that small fields will attract small companies assumes that they are able to find sufficient funds to undertake the exploration (Dawe 2004). To date this has not happened.

There are fewer and fewer countries in the world where multinational companies such as Shell, Exxon-Mobil, and BP can operate without the interference of national governments. An excellent example of this is Sakhalin Island, off Russia's Pacific coast, where Shell and Exxon-Mobil had been fighting the elements, the Russian government, and the oil giant, Gazprom, to ensure the extraction of natural gas and crude oil (MosNews 2006a)(MosNews 2006b). Since neither the Canadian nor Nova Scotian governments are threatening to expropriate energy

[3] Sour gas is natural gas with high sulphur content.

companies working in Nova Scotia's offshore, it is reasonable to assume that if the offshore had considerable reserves of natural gas, these large multi-national companies would be here doing business.

2.2 Onshore

To date, onshore natural gas production in Nova Scotia is limited to a significant find of coal bed methane (CBM) near Springhill, Nova Scotia, by Calgary-based Stealth Ventures. The find apparently exceeds one trillion cubic feet, of which between 25 and 50 percent is recoverable (Massinon 2007).

Although Nova Scotia's Minister of Energy, Bill Dooks, claims that the methane (natural gas) from the project is "another step towards meeting our (i.e., Nova Scotia's) energy security", the lack of natural gas infrastructure in the province means that almost all of the natural gas is destined for the Boston market via the M&NE pipeline (Massinon 2007).

2.3 Liquefied Natural Gas

With the decline of natural gas from Nova Scotia's offshore and limited onshore discoveries, the provincial government is searching for sources of natural gas both to keep the pipeline active and to maintain commercial interest in the offshore. This has led the provincial government and the Department of Energy to encourage the development of liquefied natural gas (LNG) facilities in the province (Hughes 2007):

- In 2004, the province announced that Anadarko Petroleum was to construct an LNG regasification facility in Bear Head.[4] After failing to secure a long-term supplier of LNG throughout 2005, Anadarko put the site up for sale in 2006; a potential buyer was found but this sale collapsed in late 2006. In February 2007, Anadarko announced that it was abandoning the Bear Head site (Energy Online 2007).
- In late December 2005, Keltic Petrochemical and 4Gas[5] (a subsidiary of Petroplus) announced that they would jointly create an LNG regasification facility (4Gas) and a

[4] Regasification is the process of taking the super-cooled liquefied natural gas and allowing it to return to the gaseous state.
[5] A second Petroplus company, Maple, is also involved with the Nova Scotia LNG project.

petrochemical plant (Keltic) (Clarke 2006).[6] Since then, Keltic has sold its interest in the LNG facility, opting instead to pursue its interest in the petrochemical plant (Guysborough 2006). At present, it is unclear whether Petroplus or 4Gas have found any suppliers of LNG.

Overshadowing Nova Scotia's push for LNG is Irving's "energy hub" being created in Saint John, New Brunswick, where in addition to expanding their refinery, Irving is working with Repsol to build an LNG regasification facility. Unlike Anadarko or 4Gas, Repsol has a supply of LNG, in this case from Trinidad and Tobago.

The Saint John facility is of concern to the Nova Scotia government for three reasons (Hughes 2007). First, it has put Saint John and New Brunswick ahead of Nova Scotia in the LNG "game". Although at least three sites in the region are pushing for LNG facilities (Bear Head and Goldboro in Nova Scotia and Saint John in New Brunswick), only Saint John has been successful. One concern in Nova Scotia is that there may be no further LNG development in the region if Saint John proves successful.

Second, Irving has partnered with Emera (the parent company of Nova Scotia Power) to build the Emera-Brunswick pipeline from Saint John to the Maine border, bypassing the M&NE pipeline. Without natural gas from Saint John, the volume of natural gas in the M&NE pipeline will continue to decline, making the pipeline less economic to operate, and apparently less attractive for other potential suppliers to use.

The third reason is related to the second, and is based upon the belief that if major energy shortages were to occur in Nova Scotia, natural gas from New England or Saint John could be shipped to Nova Scotia via the M&NE pipeline. This scenario is being promoted by the Nova Scotia government (NS Energy 2006). The likelihood of this occurring is remote, not only because the United States is "gas hungry" and unlikely to share its supply of natural gas, but because Nova Scotia lacks a significant natural gas infrastructure and distribution network. Quite simply, there is no point in supplying natural gas to a jurisdiction without the infrastructure to distribute it.

[6] Keltic originally wanted to build a petrochemical plant using Nova Scotia's offshore natural gas as its feedstock. Only when offshore natural gas failed to meet expectations did Keltic turn to LNG (Foran 2006).

Although there is a growing demand for natural gas worldwide, there is an overcapacity of LNG regasification facilities in Europe and the United States because of past construction and growing operational experience resulting in higher throughputs and, surprisingly perhaps, there is an excess of LNG shipping capacity (Skrebowski 2007). In the United States, demand for LNG declined from 2005 to 2006, slowing the push for new construction (BP 2007). Meanwhile, other countries are looking to LNG as a way of improving energy security and covering natural gas production shortfalls.

Overcapacity, relatively low natural gas prices, and an inflation in LNG supply train construction costs, is causing many LNG suppliers to reassess LNG projects; in fact, the number of planned projects is virtually unchanged from a year ago (Skrebowski 2007). Natural gas analysts are suggesting that by 2012 there could be a shortage of LNG supply (Skrebowski 2007).

2.4 Offshore Newfoundland and Labrador

A fourth possible source of natural gas that could make landfall in Nova Scotia for transshipment to the Boston market is compressed natural gas (CNG) obtained from Newfoundland and Labrador's Jeanne d'Arc Basin, where small quantities of natural gas have been found in association with oil plays. The options being considered by the consortium include the direct shipment of CNG to the Boston market or transporting the CNG to Nova Scotia and then having it shipped to Boston by the Maritime and Northeast Pipeline. The pipeline route is considered to have two drawbacks: a lack of pipeline capacity should an LNG project go ahead in Nova Scotia and the pipeline tolls that would be avoided by direct shipment to Boston (Hanrahan 2006).

3 Natural gas demand in Nova Scotia

Demand for an energy product, such as natural gas, requires a supply of the energy and the infrastructure to distribute it to consumers (Hughes 2007). Although Nova Scotia has a supply of natural gas (see next section), it has limited natural gas distribution infrastructure. The principal infrastructure consists of a pipeline running from Country Harbour in Nova Scotia—the landfall for natural gas from the Sable Offshore Energy Project—past Amherst to New Brunswick.

One of Nova Scotia's two natural gas distribution franchises was awarded to Heritage Gas in 2003, for a period of 25 years and covering five areas of the province: Cumberland, Colchester, Pictou and Halifax Counties, the Municipality of the District of East Hants and the Goldboro area of Guysbourough County (NSUARB 2007). According to a Nova Scotia government press release at the time, Heritage Gas planned to spend $120 million in the first six years of development and expected to bring natural gas to 20,000 homeowners and 6,500 businesses in Nova Scotia (NS Energy 2003).

Despite these objectives, the most recent publically available data (August-September 2006) from Heritage Gas suggests that attracting new consumers is proving to be a challenge, with a total of 423 consumers in Dartmouth and 104 in Amherst (Heritage Gas 2006). This situation is expected to change should natural gas reach peninsular Halifax in late 2007 or early 2008.

4 Discussion

There are two underlying assumptions driving the Alton natural gas project:

- The "growing demand for natural gas storage in Nova Scotia, New Brunswick, and Northeast U.S."

  Of these three markets, two are in no particular need of natural gas storage:

  - Residential and commercial demand for natural gas in Nova Scotia is almost non-existent. At present, there is little or no demand for natural gas storage in Nova Scotia.
  - Natural gas in New Brunswick has a greater market penetration than does Nova Scotia, with more residential and commercial consumers (NEB 2003). As with Nova Scotia, the market size would suggest limited demand for storage in New Brunswick.
  - At present there is considerable natural gas storage in the northeastern United States, with most of it concentrated in New York, Pennsylvania, and West Virginia, although there is 18.4 BCF of LNG storage in New England (FERC 2007). Storage in Nova Scotia could meet periods of demand; however, there would have to be sufficient pipeline capacity to carry this supply.

- There will be a supply of natural gas to fill all or part of the salt caverns.

The storage can be used to accommodate seasonal demand variations, hedging, and offer a degree of security. In order to meet any of these goals, it is necessary to have an adequate supply of natural gas:

- The Sable project is expected to be abandoned around 2012.
- The Deep Panuke project is not yet a reality and because of its size, will have a limited life should it ever come on-stream.
- Existing on-shore plays are small.
- There is no prospect of LNG arriving in Nova Scotia in the foreseeable future.
- CNG from Newfoundland and Labrador, although a possibility, would come at a time when volumes of natural gas in the M&NE pipeline would be in decline.

In order to fill the proposed storage facility, there must be an excess supply of natural gas. Nova Scotia's present supplies of domestic natural gas (Sable), future domestic supplies (Deep Panuke and some onshore plays), and the depletion of its major field, means it is questionable whether the M&NE pipeline could maintain the minimum required volume. In these cases, it would be a question of whether a supplier would be willing to pay the penalty now and store natural gas in the hope of higher prices later.

For this project to be justifiable it will be necessary to have a significant source of natural gas, either from a major offshore discovery or a long-term supply of LNG—such a supply (or supplies) would require—and benefit from—storage.

To argue that such a project would be beneficial to Nova Scotia's energy security implies a significant construction program, installing natural gas distribution infrastructure that would meet and exceed Heritage Gas's six-year plan. Furthermore, a significant supply of domestic natural gas would have to be available to meet Nova Scotia's natural gas demands.

5 Recommendations

There is no obvious need for the Alton salt caverns to be converted into storage facilities for natural gas storage as, at present, there is neither sufficient demand for natural gas in Nova

Scotia nor is their sufficient guaranteed sources of supply. With no major new natural gas projects on the horizon in Nova Scotia, LNG would appear to be the sole potential source of supply that could justify the development of the Alton storage facility; however, the province has neither a supply of LNG nor an LNG regasification plant.

If the impact on the environment is deemed acceptable, the project should be permitted to proceed on the understanding that it will be funded entirely by the project's proponents, not by any level of government, nor any special fund that has been set aside to encourage the development of natural gas in the province.

Arguments for the project based upon the supply of and demand for natural gas in Nova Scotia should not be used to influence the decision if the impact on the environment be deemed unacceptable.

6 Bibliography

Alton. "Alton Natural Gas Storage Project - Public Open House." Alton Natural Gas Storage LP, November 22, 2006.

BP. *BP Statistical Review of World Energy .* BP, 2007.

Clarke, Cecil. "North American Prospectors' Exchange – Team Canada Luncheon." *Department of Energy.* February 1, 2006. http://www.gov.ns.ca/energy/AbsPage.aspx?id=1535&siteid=1&lang=1 (accessed March 1, 2007).

Dawe, Neal. "Offshore Perception and Reality." *Chronicle Herald*, September 1, 2004.

EIA. *Annual Energy Outlook 2007 - With projections to 2030.* Washington: Energy Information Administration, 2007.

EIA. *International Energy Outlook 2006.* Washington, DC: Energy Information Administration, 2006.

Energy Online. "Bear Head LNG project mothballed." *LCG Consulting.* February 9, 2007. http://energyonline.com/Industry/News.aspx?NewsID=7128&Bear_Head_LNG_Project_Mothballed (accessed March 1, 2007).

FERC. "Northeast Natural Gas Market: Overview and Focal Points." *Federal Energy Regulatory Commission.* July 2007. http://www.ferc.gov/market-oversight/mkt-gas/northeast/2007/archives/07-2007-ngas-ne-archive.pdf (accessed July 18, 2007).

Foran, Steve. *Personal communication.* December 18, 2006.

Guysborough. "Keltic Petrochemicals to hold open house." *Municipality of the District of Guysborough.* 2006. http://www.municipality.guysborough.ns.ca/pdfs/Word%20Pro%20-%20Fall%20newsletter%2006.pdf (accessed March 1, 2007).

Hanrahan, Michael. "Compressed Natural Gas." *Energy Futures Project.* National Energy Board, 2006.

Heritage Gas. "Heritage Gas Pipeline News August/September Issue 2006." *Heritage Gas.* 2006. http://www.heritagegas.com/pipelinenews/PipelineNewsSept2006.pdf (accessed July 18, 2007).

Hughes, Larry. *Energy Security in Nova Scotia.* Ottawa: Canadian Centre for Policy Alternatives, 2007.

Landis. *Alton Natural Gas Storage Project.* 2007. http://www.landis.ca/ (accessed July 18, 2007).

Massinon, Stephane. "Counting down the days." *Atlantic Business*, July/August 2007: NR14-NR17.

MosNews. "Gazprom says Shell made new proposal for Sakhalin-2 asset swap." *www.mosnews.com.* December 11, 2006a. http://www.mosnews.com/money/2006/12/11/gazpromshell.shtml (accessed December 12, 2006).

—. "Russia to create giant company to control oil and gas production at sea shelf – paper." *www.mosnews.com.* December 11, 2006b. http://www.mosnews.com/money/2006/12/11/megashelf.shtml (accessed December 12, 2006).

Myrden, Judy. "Offshore outlook turns sour." *Chronicle-Herald*, September 10, 2004.

NEB. *Short-term Canadian Natural Gas Deliverability 2006-2008.* Calgary: National Energy Board, 2006.

NEB. *The Maritimes Natural Gas Market - An Overview and Assessment.* Calgary: National Energy Board, 2003.

NS Energy. "Heritage Gas Bringing Natural Gas to Nova Scotians Later This Year." *Nova Scotia Department of Energy.* June 3, 2003. http://www.gov.ns.ca/news/details.asp?id=20030603011 (accessed July 18, 2007).

—. "Province to defend Nova Scotia interests." *Nova Scotia Department of Energy.* November 6, 2006. http://www.gov.ns.ca/news/details.asp?id=20061106004 (accessed March 1, 2007).

NS Petroleum Directorate. *Seizing the Opportunity.* Halifax: Nova Scotia Petroleum Directorate, 2001.

NSUARB. "Natural Gas." *Nova Scotia Utility and Review Board.* April 16, 2007. http://www.nsuarb.ca/functions/regulatory/naturalGas/index.html (accessed July 18, 2007).

Premier's Office. "New Energy Developments in Offshore Nova Scotia." Halifax: Nova Scotia Premier's Office News Release, June 30, 2006.

Proctor, Steve. "Scaled-back offshore project ready for government review – Deep Panuke will cost $700m." *Chronicle-Herald*, November 11, 2006.

Skrebowski, Chris. "LNG – few new projects and no project go-aheads ." *Petroleum Review*, July 2007.