**North American Natural Gas Demand Pathways**

Peter Howard, Canadian Energy Research Institute  
Kevin Petak, ICF International  
Zoey Walden, Canadian Energy Research Institute

Peter Howard  
President/CEO  
Canadian Energy Research Institute (CERI)  
#150, 3512 – 33 Street NW, Calgary, AB, Canada, T2L 2A6  
Phone: 1(403)220-2379/Fax: 1(403)284-4181/e-mail: phoward@ceri.ca

Abstract

The North American natural gas (NG) market has been transformed by the emergence of unconventional gas development. With significant NG continental supplies the question has become, “How can industry, government and others work together to grow natural gas demand in the coming decades?” The Canadian Energy Research Institute (CERI) in collaboration with ICF International and Scenarios-2-Strategies (S2S) developed 4 scenarios depicting the influence of high/low NG usage for power generation, and high/low liquefied natural gas (LNG), export scenarios for both the United States (US) and Canada on North American NG market dynamics. The quantitative translation of the 4 scenarios resulted in two distinct but opposing outcomes. The scenarios based on significant LNG exports and a healthy economic recovery saw substantial short-term increases in Henry Hub (HH) gas prices supporting upstream production. However, increased LNG exports do not support the Canadian upstream industry with the exception of BC who was able to increase production dramatically in isolation to the rest of the country. Furthermore, Canada becomes a net-importer of NG from the US. The remaining 2 scenarios allow for end-users to increase their NG and for Canada to remain as an exporter to the US. The main conclusions of this report are that substantial LNG exports have the potential to drastically affect North American NG dynamics and there is more potential in the US than Canada to increase end-user NG demand growth.

**Introduction**

Natural Gas (NG) has been viewed as a low-carbon fuel that could play a significant role as a bridging fuel in the transition to a low-carbon future. Currently, North American NG markets have shifted radically with the advent of unconventional gas developments. Game-changing fracking technology has recently led to the unprecedented growth in production and market area supply, which has depressed prices and challenged the North American NG industry. Consequently, North American gas producers are shifting from dry gas production to more lucrative liquids rich resources. However, liquids rich resources and increased oil drilling activity also contributes to continental supplies due to the methane present in wet gas and within associated gas present in oil wells. These
continuous additions to supply places downward pressure on North American prices in relation to the rest of the world.

The US shale gas potential growth has primarily been focused on the Marcellus, Eagle Ford, Haynesville, Bossier, Fayetteville and Woodford plays. Canadian shale gas growth has been focused on the Montney, and Horn River basins of British Columbia (BC). Recent developments have included testing within Atlantic Canada and Alberta (AB) shale gas plays are in the early stages of development. Lastly, the Utica Shale in Quebec is under a drilling moratorium and is not expected to become commercial in the near future. All of these deposits contain significant gas resource potential. Therefore, there have been debates on how to generate NG demand. As the next few years will be pivotal in the future of the industry, the key question is: “Looking out to 2030, in the face of robust supply, how will industry, government and others work together to understand and grow the demand for NG?”

As demand grows there may be significant structural changes that influence the use and pricing of NG in relation to competing fuels. Demand growth is complicated by the following non-exhaustive list:

a) Feasibility of substantial liquefied natural gas (LNG) exports
b) National energy security policies
c) Supply flexibility
d) Infrastructure and capital requirements
e) Uncertainty in environmental regulations.
f) Volatility in international oil markets
g) Geopolitical stability
h) Unconventional NG developments abroad
i) Domestic end-user consumption
j) Moratoriums on future development in key fields
k) Economic stability and ability to attract capital

Forecasting of demand is uncertain due to the plethora of drivers which may range from price/supply relationships to political interventions. When looking at demand side forecasting it is useful to adopt scenarios based on extreme assumptions. While the likelihood of the low or high scenarios is remote, they serve to interpret the confidence interval around a reference case. Therefore the questions of future demand and how to grow demand are best answered as a range of scenarios describing alternative future outcomes for the NG sector. Scenario building is not a new concept and scenarios are loosely designed to represent a plausible reality. Durance & Godet (2010) define the scenario to be a description that assumes various key events and conditions have transpired between the original time and a future time. Scenario analysis requires that attention is paid to a set of different descriptions of the future organized as narratives. Each one of the scenarios is considered to be feasible but there is no determination of the most likely scenario. Well described scenarios allow for the illumination of uncertainties and the range of potential developments. Scenario development can be approached a variety of ways but two common narratives are either a future state (anticipatory scenario), or an evolution from the present onwards (exploratory scenario) (Bunn & Salo 1993). The flexibility of scenario forecasting helps pinpoint and plot factors that influence future NG market dynamics and NG demand patterns.
Methodology

Reference Forecast

The starting point for this type of analysis is to establish a reference case which is intended to represent a view of the future based on reasonable estimates of supply growth, economic growth and demand growth. Supply growth, or decline, is attributed to each known hydrocarbon basin in the US and Canada and is a future supply perspective based on short term producer drilling activity, continuing trends of drilling activity, changes to the estimated ultimate recovery per well, initial production rates, future decline type curves etc. Economic growth includes growth (or decline) in the national gross domestic product (GDP), the influence of oil prices, and growth in the industrial and commercial sector, electric load growth, demographic changes and inflation rate. Demand growth covers residential, commercial, industrial, power generation, LNG exports and the potential conversion of the heavy duty truck fleet over to compressed natural gas or LNG. Factors used in the development of the reference case include:

- US GDP growth = 2.3% growing to 2.6% per year by 2015
- Industrial growth = 2.3% per year
- Oil price = $95 per barrel (real 2010 $)
- Inflation rate = 2.5% per year
- National population growth = 1% per year
- Residential, commercial demand growth = 0.5% per year
- AB Oil sands NG growth = 3.3bcf/day by 2030
- BC LNG exports growing to 2 bcf/day by 2020
- Gulf of Mexico LNG Exports growing to 4 bcf/day by 2020
- Natural Gas Liquids development = 2.5 bcf/day
- Electric load growth = 1.2% per year
- Existing gas-fired power plants pick up power growth by increasing load factor
- State Renewable Portfolio Standards are met as specified in EIA AEO2012 report
- Coal Plant retirements = 60 GW by 2030
- Nuclear plants decommissioned after 60 years of operation
- Mackenzie Valley Gas pipeline not constructed
- Alaska Gas does not enter the North American market

The reference case shows:

- Total gas demand in North America grows at an average rate of 1.5% per year
- Total U.S. and Canada gas consumption grows from 74.5 bcf/day in 2010 to 100.5 bcf/day in 2030
- Total U.S. and Canada shale gas production increases from 5 Tcf in 2010 to 27 Tcf in 2030
- Marcellus production grows from 1 bcf/day in 2010 to 18 bcf/day in 2030.
- NG fired power generation grows from 21.9 bcf/day in 2010 to 36.0 bcf/day in 2030
- Henry Hub prices (real) grow from $4.38 / mmbtu in 2010 to $5.43 / mmbtu in 2030. 2012 gas price = $2.67 / mmbtu
Scenario Development

The first stage of the scenario development was a series of 21 interviews conducted with participants in Canada and the US. The interviews consisted of nine questions in an open/informal format. These questions may be found in the Appendix. Key issues that were brought up from the interviews were brought forward into workshops designed to explore the future of the NG industry to 2030 with emphasis on strategic implications for the Canadian NG industry.

The Narratives were established using 6 steps: The first was to identify key issues in the future of the NG industry. The second was trying to answer the focal question “Looking out to 2030, in the face of robust supply, how will industry, government and others work together to understand and grow demand for NG and improve the competitiveness of the Canadian NG Industry?” The third step was identifying driving forces that will affect the future of the industry. The fourth step was brainstorming critical uncertainties that would have a high impact on future developments and are also highly uncertain. The fifth step was to generate 4 narratives representing combinations of critical uncertainties. The last step was then to determine characteristics of each of the 4 narratives as time progresses forward.

The major forces driving the future of the North American NG Industry are shown graphically in Figure 1 below. How these forces interact and unfold over time will shape the future of the industry. Some forces will lead to outcomes that are predictable, while others are highly uncertain and some may have a greater impact than others. Critical uncertainties are vital in developing the narratives because they are the driving forces that will bring about divergence, and, thus, leads to distinctly different futures. The 2 critical uncertainties that were defined are:

1. LNG Exports from North America: There is a wide range of uncertainty over whether LNG exports from North America will be low or high in the future.
2. Power Generation Demand: There is a wide range of uncertainty over whether there will be low or high growth in power generation in North America.

Figure 1: Key Drivers in the North American NG Industry
The Critical uncertainties may be represented as continuums or dimensions forming orthogonal axes as shown in Figure 2 below. Each quadrant of this narrative framework represents a unique combination of the critical uncertainties (e.g., High-High, High-Low, Low-High, Low-Low), which creates a logical framework for developing four distinctive and ideally challenging narratives. The four resulting narratives are:

1. **Power Wave** (High power generation and Low LNG exports): *Global competition and regulatory uncertainties close the window on LNG exports while pragmatic policies and a responsive market allow gas to penetrate power markets.*

2. **Full Speed ahead** (High power generation demand and High LNG exports): *Carbon policy drives expanded LNG exports and an expanded role for gas in power generation – demand fires on all cylinders.*

3. **Nowhere Fast** (Low power generation demand and Low LNG exports): *A weak economy and stakeholder gridlock stymie LNG export opportunities and any significant demand growth for gas.*

4. **LNG Tsunami** (Low power generation demand and High LNG exports): *A surge of investment drives LNG exports as politics and rising prices undermine the competitiveness of gas in power generation.*

Figure 2: Critical Uncertainties
The following table has the key characteristics of each narrative:

**Table 1: Key Characteristics of Each Scenario**

<table>
<thead>
<tr>
<th>Power Wave</th>
<th>Full Speed Ahead</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Intense global competition for LNG markets in Asia &amp; Europe with shift away from oil price related contracts</td>
<td>- Strong global economy &amp; high oil prices fuel Asian LNG demand</td>
</tr>
<tr>
<td>- Regulatory delays in North America means that LNG misses the window</td>
<td>- Weather-related events attributed to climate change</td>
</tr>
<tr>
<td>- Graduate revival in North American economy increases demand for power and gas gains market share</td>
<td>- Environmental concerns drive carbon policy in North America &amp; globally</td>
</tr>
<tr>
<td>- Problematic fracking policy &amp; societal expectations to cut carbon support NG</td>
<td>- Collaboration helps industry engage stakeholders &amp; weather near-term challenges</td>
</tr>
<tr>
<td>- Market efficient: supply responsive to price allowing supply-demand balance at modest prices</td>
<td>- Carbon policy drives expanded role for gas in power generation within North America &amp; globally – supports LNG exports from North America</td>
</tr>
<tr>
<td>- Medium-term wave of small and large NG power facilities</td>
<td>- North American industrial and transportation demand growth</td>
</tr>
<tr>
<td>- Low cost power supports industrial expansion</td>
<td>- North American gas markets are balanced, efficient and profitable and environment is improved</td>
</tr>
<tr>
<td>- Regional differences persist in NG markets</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nowhere Fast</th>
<th>LNG Tsunami</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Global economy falls sharply</td>
<td>- Global growth in LNG supports high prices &amp; oil-linked contracts</td>
</tr>
<tr>
<td>- Rising geopolitical tensions and protectionism stymie trade</td>
<td>- Aggressive development of LNG projects in North America: no regulatory or financial restrictions</td>
</tr>
<tr>
<td>- Low oil prices close the door to LNG exports from North America</td>
<td>- Integration of markets lead to convergence of North American &amp; global prices</td>
</tr>
<tr>
<td>- Canadian commodities and energy hit hard by downturn</td>
<td>- Economy growth greater than electricity growth as efficiencies decouple economic and electricity growth</td>
</tr>
<tr>
<td>- Rising stakeholder tensions stymie development</td>
<td>- Rising NG prices linked to LNG markets undermines NG in power generation</td>
</tr>
<tr>
<td>- Political and regulatory gridlock</td>
<td>- Coal lobby influence in extracting concessions – trade-off for support of coal is increased support of renewables – reduced opportunity for gas in North America</td>
</tr>
<tr>
<td>- No new demand in LNG, power generation, industrial or transportation</td>
<td>- Advances in power storage enhance value of renewable energy</td>
</tr>
<tr>
<td>- Industry under siege hunkers down – a survivors game</td>
<td></td>
</tr>
</tbody>
</table>
Quantitative Translation of Scenario Development

The multiple scenarios determined from the workshops were then quantitatively translated from the baseline case using the ICF Gas Market Model (GMM). The ICF Model was used to balance the North American supply and demand and pricing. Key assumptions are summarized in the following table.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Full Speed Ahead</th>
<th>Nowhere Fast</th>
<th>Power Wave</th>
<th>LNG Tsunami</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Growth</td>
<td>3.5%</td>
<td>1.5%</td>
<td>2.0%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Industrial Growth</td>
<td>2.5%</td>
<td>1.0%</td>
<td>1.5%</td>
<td>2.0%</td>
</tr>
<tr>
<td>GTL (Diesel Market)</td>
<td>15.0%</td>
<td>0.0%</td>
<td>10.0%</td>
<td>5.0%</td>
</tr>
<tr>
<td>LNG Exports (BCFPD)</td>
<td>15</td>
<td>0</td>
<td>2-3</td>
<td>10-12</td>
</tr>
<tr>
<td>Oil Prices (2010 $ Real)</td>
<td>90 to 130</td>
<td>90 to 60</td>
<td>90 flat</td>
<td>90 to 130</td>
</tr>
<tr>
<td>Elec Load Growth (yr)</td>
<td>1.5%</td>
<td>0.7%</td>
<td>1.0%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Coal Retirement (GW)</td>
<td>-100</td>
<td>- 35</td>
<td>-100</td>
<td>- 35</td>
</tr>
</tbody>
</table>

CERI extended the GMM results by utilizing the CERI supply forecast model to determine required drilling activity. Lastly, particular attention was paid to the effects of LNG development on import and export dynamics in Canada and the US.

Results

Future Supply

Figure 3 shows that the US gas supply is more responsive than Canadian gas supply in three of the four narratives. The reason for this can be attributed primarily to the Marcellus Shale play. The Marcellus Shale is projected to increase production from its current level of 8 bcf/day to a peak of 27 bcf/day under the Full Speed Ahead narrative. Under the Power Wave and LNG Tsunami cases the production would peak at 20 bcf/day. In all three of these narratives the production would push into the New England area and compete against the interstate pipelines emanating from the Gulf of Mexico. In addition the production levels are sufficient to displace gas in the Chicago market area which results in a push back of Canadian gas. In the fourth case, Nowhere Fast, Canadian gas can enter the Chicago market and compete against the mid continent supplies while the Marcellus captures the north east markets. Development of the Marcellus which originally occurred in the dry gas portion of the play in the northern area of Pennsylvania has changed with current activity centered in the southern portion of West Virginia. Driven by estimated ultimate recoveries of 4-5 bcf/well, initial production rates in excess of 20 mmcf/day, and lastly, natural gas liquids recovery of 30-35 barrels/mmcf, the producers in the southern portion are expected to drill 1800 to 2400 wells per year with an estimated supply cost of $2.5 - $3.0 per mcf /day. Although Canadian shale resources are equally impressive in size and potential, the geographical location and associated differential to Henry Hub (HH) is a negative factor. In fact, Canadian drilling activity will remain weak as a result of the Marcellus Shale’s proximity to the premium New York/Boston markets and thus, improvement will only occur if LNG export terminal can be developed on the west coast of BC. Figure 3 displays the forecasts of NG production within the United States and Canada for each of the 4 scenarios.
Figure 3: US and Canada Gas Production

![Graph showing US and Canada Gas Production.](image)

Figure 4 contains Lower-48 LNG Exports and Figure 5 displays Pipeline Net Exports for the Lower-48 States.

Figure 4: Lower-48 LNG Exports

![Graph showing Lower-48 LNG Exports.](image)
Low continental NG prices have generated interest in the prospect of exporting LNG to foreign markets. Of particular interest is the future of Asian gas demand and the potential of accessing markets with oil-linked LNG prices. The key emerging markets are India and China with additional potential in Korea and Japan. North American exporters will also compete with potential newcomers, and existing LNG exporters, as well as deal with an increasing domestic NG price as new domestic demand emerges. Consequently, exporting LNG is becoming increasingly risky and less lucrative for North American companies. Nonetheless, there is room for some North American export in the emerging Asia Pacific Market. Figure 6 illustrates that the competition for LNG supplies in the Asian Pacific basin will become intense post 2015 as North America, Australia and East Africa projects come on line and compete for supply contracts. In fact, it can be suggested that projects that are not on line by 2019-2020 might wait until the middle of the next decade before proceeding with development. Figure 6 depicts this contrast.

Key points from Figure 6 are as follows:

- Most major liquefaction additions are post-2015. Thus, as multiple players try to access Asian markets, there will be a constraint around 2020.
- Rapid growth in Australia has driven up construction costs and it may make sense for North American companies to develop LNG projects in a staggered manner post 2020.
- While Figure 6 shows the US being temporarily “shut out”, the reader should interpret the graph to denote that all North American projects are at risk of not having an Asian-Pacific buyer; therefore, some Canadian and some American projects may not proceed due to the constraint.
- There are other supply sources not explicitly depicted in the figure that would also like and/or are currently accessing Asian markets. The analysis assumes that those suppliers find other markets but in reality this may not happen. This further constrains the room for supply and could create downward pressure on the price for LNG in Asian markets.
In 2 of the 4 narratives (LNG Tsunami and Full Speed ahead) Canada becomes a NG pipeline importer and in Power Wave the net exports of NG to the United States is all but eroded to zero. As stated earlier if the future for the North American economies remains bleak, as in the case of the Nowhere Fast narrative, Canadian production increases as a result of reduced, but still positive, development of the Marcellus and other shale gas plays, but not enough to restrict access to the Chicago market. The following figures depict the forecasted LNG and Pipeline net-exports.
Substantial LNG exports and robust economic recovery are beneficial to BC and allows BC to significantly increase their NG production. AB is not significantly affected by either robust economic recovery or substantial LNG exports. The following figures display forecasted AB and BC gas production for each of the scenarios.

**Figure 9: Alberta Gas Production**
AB and BC gas developments compete for access to increased Canadian demand (Oil Sands projects) and maintenance of export flows to the United States. BC has the upper hand with respect to linking Montney and Horn River Shale gas developments if LNG terminals are developed in Kitimat and/or Prince Rupert. However, the development of improved pipeline connections between the two provinces could result in a more level playing field with respect to future gas developments. Emerging shale developments in AB (Duvernay and others) are proving to be equal to the BC plays in the terms of initial production rates, resource size etc.; however, the AB plays have an added advantage of an existing infrastructure (roads, pipelines conventional developments etc.) and significant take away capacity and connectivity to the Canadian, California and Illinois market centers.

**Future Demand Results**

**US Demand Deposition**

The United States has a power generating capacity of over one million megawatts (2011). On an annual power generation basis, coal accounts for 42%, natural gas 25%, nuclear 19%, hydro 8% and all other sources 6%. Canada has a power generating capacity of 135,000 megawatts (2011). On an annual power generation basis, coal accounts for 13%, natural gas 8.5%, nuclear 15%, hydro 59% and all other sources 4.5%.

In the United States there is approximately 32,000 megawatts of coal-fired power generating capacity that is scheduled to be decommissioned primarily because of the age of these facilities, and partly because of the refurbishment cost to bring the facility criteria air contaminant and greenhouse gas emissions in line with new federal regulations. Nuclear decommissions will account for a reduction of an additional 30,000 megawatts of capacity; however, two thirds of this will occur post 2025. New nuclear is being proposed and will add 9,000 megawatts of power, solar will account for an additional 23,000 megawatts, wind 10,000 megawatts and new gas-fired power generation already has applications for 8,000 megawatts. These additions are scheduled to come on stream by 2016 with the exception that the bulk of the nuclear is scheduled for later in the decade.

Focusing on the natural gas power generating system in the United States, in 2011 these facilities burned on average 20,400 million cubic feet per day which accounts for approximately 31% of total US demand.
Figure 11 shows the growth in natural gas power generation demand, expressed as natural gas burned on a daily basis, based on the four narratives. In all these cases, the individual states are assumed to develop renewable power generating systems to reach their individual renewable portfolio standard as reported in the EIA’s AEO2011 report. For the LNG Tsunami and Nowhere Fast narratives, coal plant retirements were held at the reported 32,000 megawatts with new natural gas power systems assumed to be the replacement choice as well as accounting for new growth in power demand. For the Power Wave and Full Speed Ahead, coal plant retirements grow to 70,000 and 100,000 megawatts, respectively, with natural gas fired power generation being the replacement and future growth choice.

The following figure has the NG demand disposition for the Lower-48.

Figure 12: Lower-48 Gas Demand Disposition
US NG demand by end-user is primarily dominated by power generation in the Power Wave and Full Speed Ahead Scenarios. Most demand begins increasing substantially post 2020 as the world economy picks up momentum. The Full Speed Ahead case had aggressive growth from annual requirements of 27 Tcf today to 41 Tcf by 2030. The LNG Tsunami scenario had slightly greater growth by the end of the projection scenario than did Power Wave.

**Canadian NG Demand Deposition**

Figure 13 displays the Canadian NG demand disposition for the forecasted years.

![Figure 13: Canada Gas Demand Disposition](image)

High oil prices enhance gas use in the oil sands. NG demand increases are not as prominent as US Gas demand disposition and LNG exports create the most significant potential for NG demand growth in Canada.

**Pricing Results**

Of particular concern would be the effect of significant NG demand development on continental prices. Both in Canada and the US the Full Speed ahead and LNG Tsunami affect NG pricing in the short-term while Nowhere Fast and Power wave do not. Initially as multiple projects come on-stream for LNG tsunami there is a large increase but this tapers off post 2022 as LNG projects become better established. This is due to LNG projects require significant volumes of NG that diverts NG from other areas which would need time to adjust to this development.

Figure 14 depicts the change in Henry Hub (HH) prices for each of the 4 scenarios.
Discussion

Participants of the interview discussions were particularly concerned with the impact of LNG developments on North American dynamics and the influence of increased gas-powered generation. Prominently displayed amongst supplementing themes was a concern on the state of the economy in the future and the effect of environmental policies. The quantified results reflected that the two critical uncertainties uncovered in the forums can have a significant impact on the North American NG market.

Upstream Story

The quantified projections of the scenarios illuminated two distinct but opposing outcomes within the scenarios. The first outcome was prominently portrayed in the LNG Tsunami and Full Speed Ahead scenarios where there were considerable LNG exports combined with a healthy economic recovery. In both these scenarios there was a substantial short-term increase in HH gas prices which supported increased development of upstream gas production. Conversely, it is unsurprising that low gas prices did not support prolific expansion of upstream gas production. In the scenarios that did promote upstream gas the production, the proliferation of gas supplies in the U.S. was greater than in Canada; consequently, increased LNG exports do not support Canada’s upstream gas industry and Canada becomes a net importer of gas from the US commencing somewhere between 2021-2027. The exception is the province of BC whose upstream industry benefited considerably from significant LNG exports (see Figure 10) and seemed to have the ability to produce NG in isolation to the rest of the country. This isolation is not surprising given the integrated nature of Canadian LNG projects combined with a lack of a traditional gas market in BC connected to the rest of Canada especially in the Northern Horn River area.

Interestingly, despite AB having unconventional reserves of its own, the ERCB (2012) estimates that there is approximately 100.9 billion m$^3$, none of the scenarios forecasted a significant increase in AB gas production (see Figure 9). This has to due to the perception that BC gas supplies will supply the west coast LNG terminals.
However, AB gas should not be discounted because pipelines do exist between the two provinces; Thus, if it makes economic sense there could be back-hauling of AB gas supplies into the BC pipeline system. The scenarios do not take this possibility into account since there is no committed volume of AB gas to a West Coast LNG export project and current contracts suggest BC suppliers. Another factor for the lack of AB gas production in the scenarios is that full speed ahead and LNG tsunami have significantly increased Marcellus production. This decreases the exports from AB and decreases upstream production of conventional and coal bed methane (CBM) due to development being uneconomic to continue. The scenarios indicate that for upstream production BC may benefit from LNG exports but they benefit in isolation from the rest of Canada.

**Demand Story**

Canada had less potential for NG demand growth than did the US. Allowing LNG exports had a more significant contribution on Canada’s demand disposition than did power use. This may be due to the fact that in 2010 59% of Canadian power generation came from hydro with only 14% generated from coal (NEB, 2011). Thus, there is significantly less opportunity for fuel switching to NG for power generation in Canada than the US. In contrast, Canada still has significant NG reserves of its own and has received approval to begin exporting LNG. End-use demand in Canada might also be tempered by the fact that the LNG Tsunami and Full Speed Ahead Scenarios increase NG prices more substantially than the other scenarios.

**United States**

The US can considerably increase their NG demand especially in a healthy economy. Unlike Canada the US generates a significant amount of power by coal. Resultantly there is more room for NG penetration in power generation. Moreover, in the Power Wave scenario NG prices remain depressed which potentially aids in the conversion. An interesting thing to note is that the LNG Tsunami does result in increased HH prices. Recently, with HH prices declining to ten-year lows, the energy intensive parts of the US manufacturing sector have again been seeing healthy profit margins. Consequently there have been arguments to restrict LNG exports as they have provided US manufacturers with a comparative advantage in global markets. While NERA consulting (2012) has stated that substantial LNG exports will be of net benefit to the US economy, the magnitude of LNG exports from the US is yet to be determined. Having HH prices increasing substantially may in fact hinder domestic end-user NG demand growth.

**Canada’s NG Export Future**

Increasing US domestic demand combined with an even faster rate of US gas production coming online means that Canada’s role as a gas exporter to the US diminishes overtime. The exception is the Nowhere Fast scenario where a lack of LNG exports and economic growth in Canada forces gas to flow into US markets even though prices are not lucrative. The Power Generation scenario in the US also results in end-users increasing their use of NG and Canada was able to remain as a net exporter to the US in the Nowhere Fast and Power wave scenarios. Aggressive LNG development considerably changes Canada’s NG market flow as most of western Canada gas travels westward to be exported to Asia as LNG. In Full Speed Ahead, and LNG Tsunami, Canada becomes an LNG importer by 2021 and 2026 respectively.
Conclusions

The critical drivers determined from the forums were that NG use in power generation and increased LNG exports had the most influence with the most uncertainty. The scenarios illuminated two distinct but opposing outcomes. The first outcome was due to the LNG Tsunami and Full Speed Ahead scenarios where there were considerable LNG exports and a healthy economic recovery. In both these scenarios there was a substantial short-term increase in HH gas prices which supported increased development of upstream gas production. However, the proliferation of gas supplies in the U.S. was greater than in Canada; consequently, increased LNG exports do not support Canada’s upstream gas industry and Canada becomes a net importer of gas from the U.S. approximately beginning 2021-2027. The exception to the Canadian situation is that LNG exports primarily benefit BC who will be able to increase upstream production to meet export requirements in isolation to the rest of the country. In contrast the Power Wave and Nowhere Fast scenarios do not allow for considerable LNG exports and depict slow economic recovery which resulted in the opposite outcome. End-users increased their use of NG and Canada was able to export between 4-6 BCFPD to the US. The main conclusions of this report are that substantial LNG exports have the potential to drastically affect North American NG dynamics, and there is more potential in the US than Canada to increase end-user NG demand growth.

References


Appendix

Interview Questions:

1) Thinking back over the past 10-20 years, what changes have had a significant impact on the Canadian natural gas industry?
2) Reflecting on the past changes, what has made the industry successful in the past? As it looks to the future, what does the industry “need to remember”? What does it “need to forget”?
3) What are the key capabilities that the Canadian natural gas industry has that distinguishes it from the competitors?
4) What are the current and near-term challenges facing the Canadian natural gas industry?
5) What things need to be changed for the industry to be successful in the future? What are the barriers to change and innovation?
6) There is a dark spot on the horizon. It is not here and now but it could impact the industry in the future. What is it?
7) Suppose you were looking back from 20 years from today and you were telling a story where the Canadian natural gas industry has done extremely well. How would that story go? What does a good future look like? What needs to happen for that good future to occur?
8) The future is unknowable, but if you could talk with an oracle who could predict the future, what two questions would you ask?
9) If there was a major technology development that would significantly help the Canadian natural gas industry, what would it be? If there was a major policy change that would significantly help the Canadian natural gas industry, what would it be?