

SPECIAL REPORT

TD Economics



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WHAT DOES THE SHALE GAS REVOLUTION MEAN FOR CANADA?

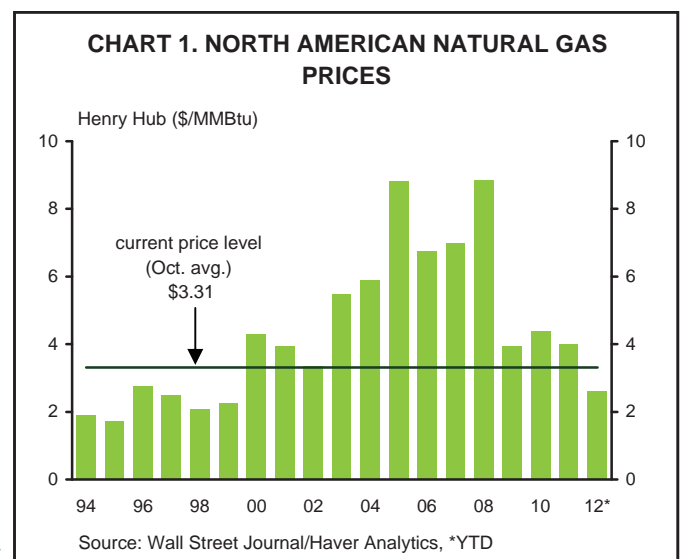
Highlights

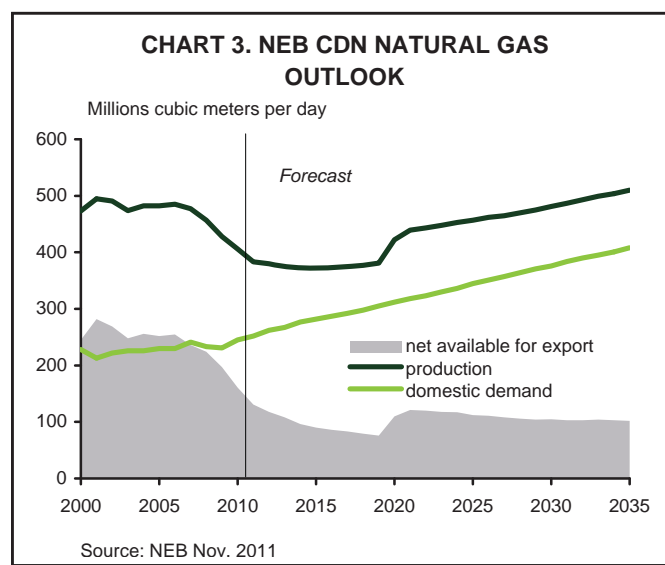
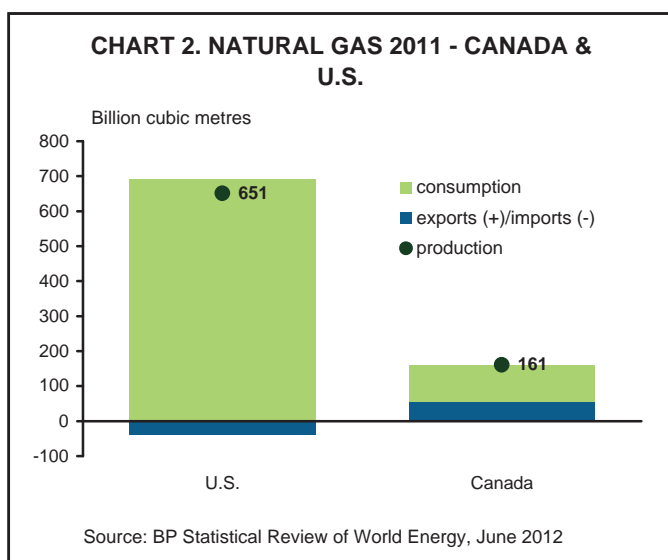
- The advent of shale gas production in North America has radically changed the game for natural gas markets over the past few years. First and foremost, it has resulted in far lower natural gas prices than would otherwise have been the case. As the world's third largest producer, this has both positive and negative implications for Canada.
- On the negative side, the distance from major North American markets puts Canadian natural gas production at a competitive disadvantage to U.S. shale plays. The result has been lower imports of gas from Canada, and declining levels of production and reduced revenues from existing output.
- On the positive side, lower prices are a positive for consumers of natural gas; be they households, businesses or industry. Moreover, as lower prices induce switching from more polluting fuels like coal, lower greenhouse gas emissions are another benefit.
- A key difference for Canada is the expected growth in demand for natural gas from the industrial sector. Expansion of the oil sands is expected to be a major driver of gas demand going forward. With Canada's traditional export market now able to meet far more of its own natural gas needs, Canada needs to find new customers at home and abroad to extract the greatest value for our gas resources.

The shale gas revolution, led by the United States, has turned North American natural gas markets on their head. (Please see the companion report "[The Shale Shift - Exploring the impact of shale gas on the U.S. economy](#)" for an analysis of the effects on the U.S. economy.) The principal impact has been far

lower natural gas prices than would otherwise have been the case. The fall in prices has been remarkable. Over the past four years the price of natural gas has been over 50% lower than it was in the previous four years (see Chart 1). Research indicates that were it not for increased production of shale gas, the price of natural gas would be in the neighbourhood of \$10-12 per MMBtu¹, versus the roughly \$3.40 level it is today. Part of the decline in price has been due to such strong supply growth driven by shale plays, within a relatively mature North American market. However, it is also due to the nature of shale gas production. Shale gas wells are expensive to drill relative to conventional gas wells in terms of up front capital costs, but the full-cycle cost of shale gas wells in 2011 is 40-50% less than conventional wells².

As the world's third largest producer of natural gas, lower prices have both positive and negative implications for Canada. Like the United States, Canada is an early leader in the field of





shale gas production. According to the International Energy Agency (IEA), the U.S. and Canada account for virtually all the shale gas produced commercially in the world. However, Canada's shale gas production thus far is miniscule compared to that south of the border³ (see Chart 2) and reserves are similarly dwarfed by those in the U.S. (see Text Box on page 3). Canada's remaining technically recoverable natural gas resources are roughly one third of those in the United States. Not surprisingly, with the U.S. being the only customer for Canada's natural gas exports, the implications of the 'shale gale' are very different for Canada.

As natural gas production in the U.S. has risen, the demand for imports from Canada has shrunk dramatically, taking Canadian production down with it. In 2011, Canada produced 16% less natural gas than it did in 2006, the recent peak for annual production. Looking ahead, Canada's National Energy Board (NEB) expects essentially stagnating production trends until 2020.

Not only does the supply side of the natural gas equation look quite different for Canada, demand growth in Canada is also on a very different path. Canadian natural gas consumption is expected to outpace supply growth over the forecast horizon, leaving less gas available for export (see Chart 3). Relatively stronger demand growth is driven primarily by continued expansion of oil sands production, which is a heavy user of natural gas, as well as growth of natural gas-fired power generation. However, even with less gas available for exports in the future, lower demand from our traditional export market – the U.S. – means there is also the opportunity for producers to realize greater value for their reserves with the prospects for liquefied natural gas exports from B.C. to Asia.

Lower prices a positive for consumers & businesses

The cost of natural gas for heating homes or businesses in Canada over the past twelve months is near a ten-year low. While this is a positive for Canadians' pocketbooks, space heating costs represent a very small share of budgets. Natural gas accounts for approximately 1% of Canada's consumer price index, compared to electricity, which is 2 ½%. Over the past 30 years efficiency gains have reduced the share of real consumer spending on electricity and home heating from over 5%, to less than 3%.

However, unlike the United States, Canadian households have seen less of an impact of lower natural gas prices on their electricity bills. Primarily due to the prevalence of hydroelectric power in Canada, natural gas makes up a smaller share of the power mix, producing less of a relationship between natural gas and electricity prices than is the case south of the border. Partially because Canada has enjoyed relatively low and regulated power rates over history – and broadly speaking those rates have been rising in recent years for reasons unrelated to natural gas prices – Canadian homes and businesses haven't seen their electricity rates fall due to lower natural gas prices.

Cheaper natural gas is a very modest positive for consumers and businesses in Canada. The decline in prices, as measured by the CPI has been uneven across the country (see Chart 4) with the biggest decline seen in the key producing province of Alberta. Natural gas is not widely available for home heating in Atlantic Canada and so consumers there have not benefited from lower prices. Looking ahead, demand for natural gas from homes and commercial heating is expected to grow at a very modest pace. Similar to the

Shale Gas in Canada

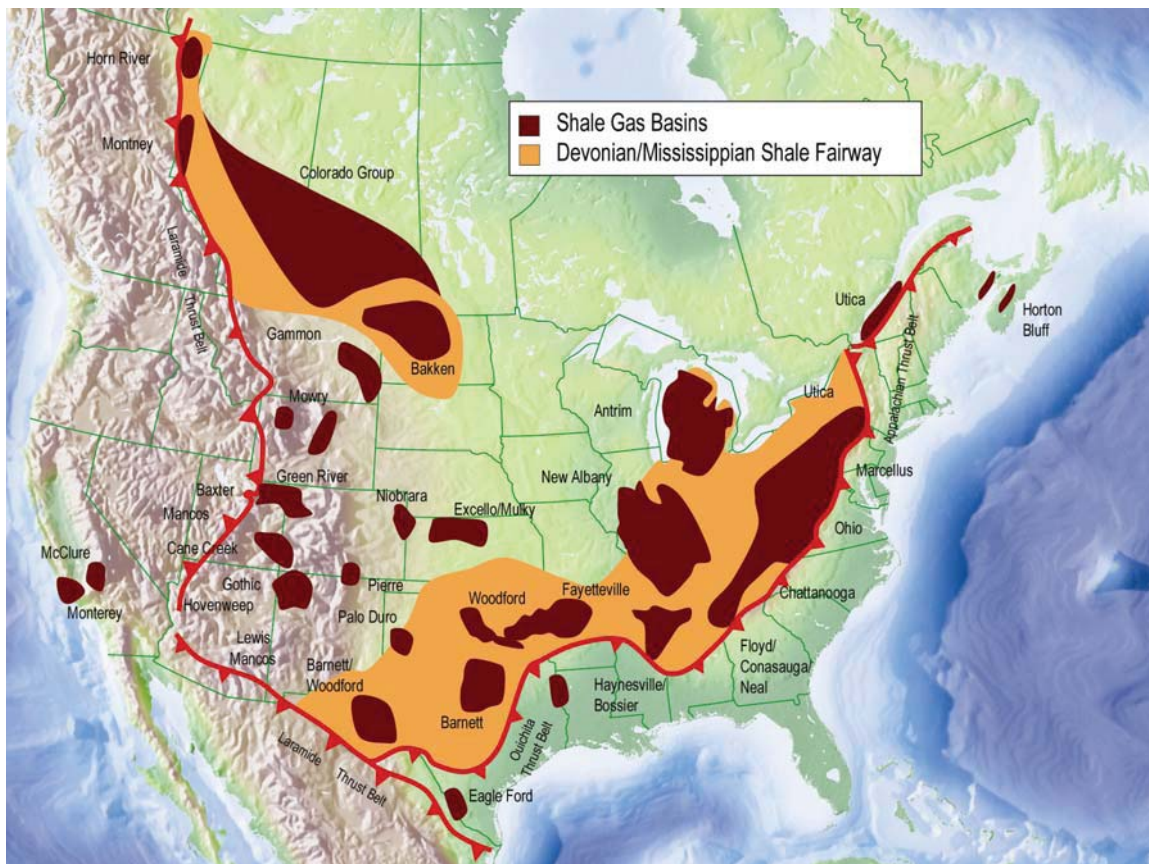
Shale gas refers to natural gas that is trapped within shale formations. Over the past decade, the combination of horizontal drilling and hydraulic fracturing has allowed access to large volumes of shale gas that were previously uneconomical to produce. Shale gas is found in shale "plays," which are shale formations containing significant accumulations of natural gas and which share similar geologic and geographic properties.

Although shale gas development is a relatively mature industry in the United States (with more than 40 000 producing wells), shale gas is still in its nascent stages in Canada. In Canada, potential and producing shale gas resources are found in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick and Nova Scotia (see map). Most of the current drilling and production activities are occurring in northeast British Columbia in the Montney and Horn River shale basins.

The Horn River Basin is a large shale gas region located in the northeastern corner of B.C. near Fort Nelson. It is estimated that there are 61 to 96 tcf of natural gas resources in the area (CSUG), with annual production

estimated to be between 1.5 or 2.5 bcf per day by 2020 (CAPP 2011). The Montney Basin is also a shale gas and tight gas development located in the northeastern part of the province, but principally around Fort St. John and Dawson Creek, extending into Alberta. It is estimated there are 77 to 166 tcf of natural gas resources in the Montney Basin (CSUG), with annual production estimated to range from 3.3 and 4.3 bcf per day by 2020. (CAPP 2011)

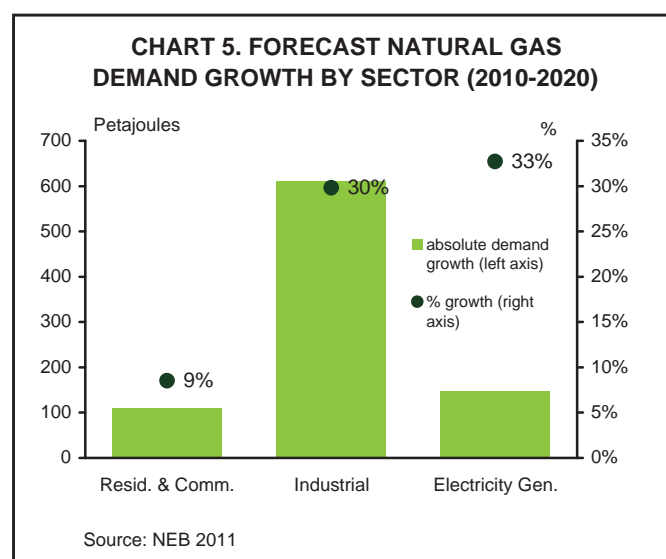
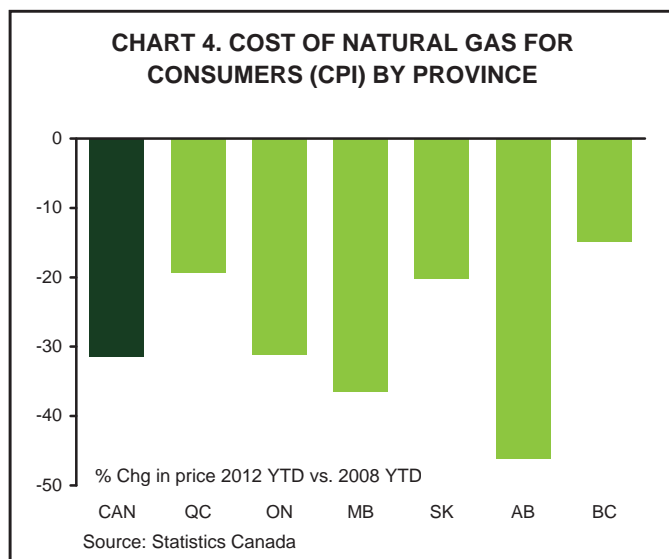
Alberta also has significant shale formations, including the Duvernay, Montney and Muskwa, which could ultimately contain 3,324 trillion cubic feet of natural gas, 58.6 billion barrels of gas liquids and 423.6 billion barrels of oil, according to the Alberta Energy Resources Conservation Board and Alberta Geological Survey, although development is in the very early stages. The Utica formation is located in Quebec, has an estimated recoverable resource between 18 and 40 trillion cubic feet if fully developed. However, the province has a moratorium on shale gas activity. In New Brunswick, there is an estimated 80+ tcf of natural gas in the McCully and Stoney Creek fields, and if commercially viable, approximately 20% of this total would be retrievable.



Reference: Natural Resources Canada <http://www.nrcan.gc.ca/energy/sources/natural-gas/1349>

Sources: CAPP (2011) "Upstream Dialogue - The Facts on Natural Gas".

The Atlantica Center for Energy (2011) "The Future Supply of Natural Gas in Our Region: Impacts, Challenges and Opportunities".



U.S., a combination of modest economic growth, slowing population growth and improved energy efficiency should contain overall demand for natural gas from the residential and commercial sectors (see Chart 5).

Oil sands expansion key to natural gas demand

A notable difference in the outlook for the demand for natural gas in Canada versus the United States is that Canada is expected to have much stronger demand growth from the industrial sector (see Chart 5), largely due to the expansion of oil sands production. The oil sands industry is a large consumer of energy, and natural gas is used to generate electricity and steam used in production and upgrading bitumen. In fact, the single highest operating cost for in situ extraction (which differs from mining operations) in the oil sands is the cost of natural gas. In 2011, the oil sands consumed 10% of all natural gas produced in Canada, and its consumption grew 14% versus 2010.

Oil sands output is expected to double by 2020, and its consumption of natural gas along with it. The growth in natural gas demand in Canada due to the expansion of the oil sands is a key differentiating factor in the outlook for natural gas demand in Canada, which is expected to grow at a much stronger pace than in the U.S. over the next twenty years.

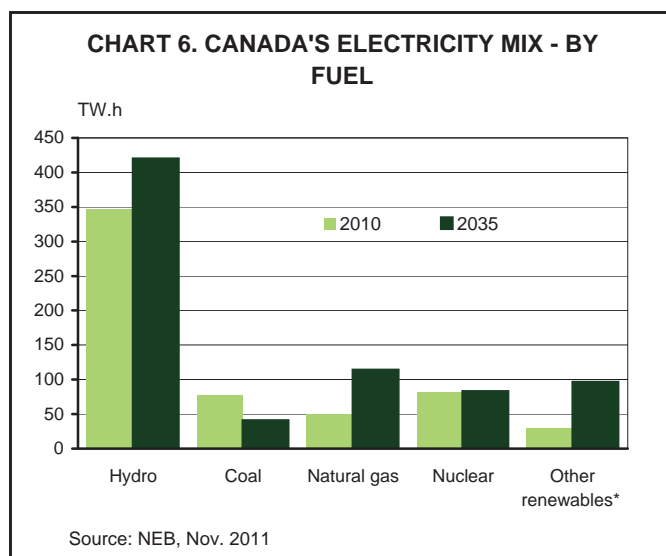
Demand from power generation also to grow

The power generation landscape in Canada is far different from that south of the border. Canada's large endowment of hydroelectric power means fossil fuels make up a much smaller share of our power generation mix (natural gas 9% and coal 14%⁴) – making our electricity grid one of the “greenest” in the world. That leaves much less scope for

environmentally beneficial switching from coal to natural gas-fired power generation compared to the United States.

However, natural gas is still expected to make up an increasing share of Canada's power mix in the years ahead. Canada still burns coal, particularly in certain provinces where it makes up a large share of the mix: Alberta (65%), Nova Scotia (57%) and Saskatchewan (43%). Since Ontario is well along the path of phasing out coal, Alberta is now the largest burner of coal for electricity. Strong economic growth in Alberta is fuelling demand for power, and natural gas makes up the majority of planned capacity additions over the next few years. Ontario is also adding significant gas-fired generation in the coming years.

All in, natural gas-fired electricity generation is expected to double over the NEB's base-case forecast to 2035, increasing its share in the power generation mix (see Chart 6). Sev-



eral factors favour natural gas including lower greenhouse gas (GHG) emissions relative to coal, shorter construction time and the ability to be built in smaller increments to match load growth, lower investment costs, and a well-developed supply infrastructure, all enhanced by lower prices. Natural gas-fired generation is also an ideal partner for renewable power sources. Power from wind or solar can be intermittent, and requires a back-up power source that can be dispatched quickly, making flexible gas-fired generation a good match.

The future path of gas demand from the power sector is highly contingent on government policy, and there is upside potential for demand if GHG emission rules were strengthened, which would favour more rapid coal-to-gas switching. Also, if the Ontario government were to change its “green” energy policy it could realize significant cost savings by adopting more natural gas in the power mix, rather than refurbishing its aging nuclear capacity and adding new reactors as planned. The levelized costs (which include the present value of the total cost of building and operating new capacity) of new nuclear capacity is almost twice as expensive as combined-cycle natural gas plants (see Chart 7)⁵. While the current Ontario government’s policy is to pursue “green” energy, Quebec recently decided against refurbishing its aging nuclear reactor due to the high cost.

Natural gas in transportation – likely in niche markets

With the ratio of the price of oil relative to the price of natural gas very high by historical standards there is a lot of talk about the increased use of natural gas as a transportation fuel (NGVs). This can either be achieved through compressed natural gas (CNG) or LNG vehicles. Much like switching from coal in the power sector, CNG emits

significantly less pollutants compared to gasoline, fewer GHG emissions, and was roughly half the cost of diesel this past summer. Worldwide, CNG vehicles aren’t new, with Iran, Pakistan, Argentina, Brazil and India all leading users of natural gas vehicles.

Looking at the potential for greater adoption in passenger vehicles, NGVs have to compete against electric cars in the “alternative fuel” market. While the difference in upfront cost is a toss-up between the two, efficiency, availability of fuelling stations, and fuel costs all favor electric cars over NGVs. NGVs do have the advantage of a longer range and faster refueling time, which are more important for trucking and fleet applications. Overall, wide-scale adoption among consumer vehicles looks unlikely without preferential subsidies.

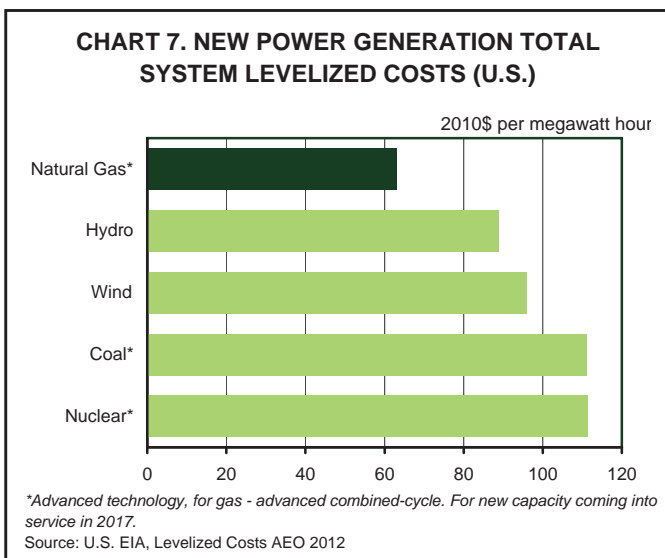
There is greater opportunity for natural gas in the heavy-duty vehicle (HDV) market, mainly because under current technology, it is difficult to run a truck on a battery. Industrial vehicles also look to show potential, and Caterpillar and Westport have announced a joint venture to power off-road heavy equipment with natural gas. But, commercial production of the vehicles is not planned to start for another five years.

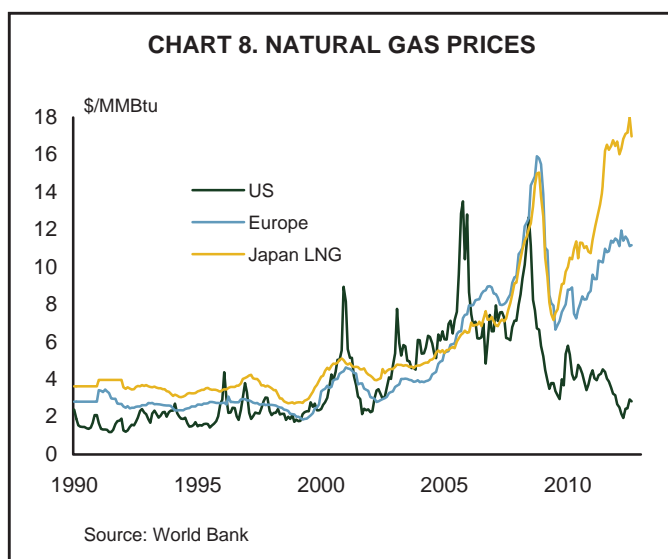
In line with the economics above, direct vehicle use is unlikely to be a major source of natural gas demand going forward. Still, it may increasingly be the case that natural gas indirectly fuels cars through electricity generation.

LNG - The key to unlock production potential

Due to rising shale gas production in the U.S., the American government forecasts that gas imports from Canada will fall 65% to 2035. Against a backdrop of a relatively strong demand forecast in Canada, the amount of natural gas available to be exported from Canada also declines, leaving only a modest amount of natural gas available to be exported as LNG. However, there are significant unconventional natural gas deposits (shale and tight gas) in Northern B.C. that could be developed beyond what the NEB is forecasting if new export markets are opened.

There are several projects in the planning stages for B.C.’s west coast, in addition to one recently proposed in Nova Scotia. The opportunity for LNG exports is driven by the very large spread between North American natural gas prices and prices elsewhere (see Chart 8) which are typically indexed to the price of oil. Currently, the price differential for LNG in Japan (\$15.45/Mcf) and what Western Canadian suppliers are receiving (\$3.38/Mcf) is \$12.07/Mcf, and the





costs of liquefaction and shipping are approximately \$4.50/Mcf⁶. That shows a significant opportunity for producers, even if North American natural gas prices rise.

In fact, with demand in B.C. not growing rapidly, and exports to the U.S. declining, the development of B.C.'s significant unconventional natural gas deposits (such as Montney and Horn River) hinges on opening up new export markets. There is currently 9 Bcf/d of proposed LNG capacity on the table for the B.C. coast, an amount equivalent to roughly two thirds of total Canadian production last year.

Canada isn't the only country keen to supply the lucrative Asian market with natural gas. Australia is already a major LNG exporter, and is also ramping up its capacity. Indications are that Canadian costs are competitive with Australia, the distance is only modestly farther and Asian buyers likely want to diversify their supply. The project that is the furthest along is Kitimat LNG, targeted to be in service in 2016. However, it is still working to secure finalized contracts with potential customers as negotiations over pricing continue.

It is unlikely that all of the proposed LNG export capacity currently proposed for northern B.C. will ultimately be built, so the race is on for Canadian producers to ink deals. Most industry forecasts expect LNG exports from Canada to commence in the second half of this decade, but the volumes are likely to be modest in the context of total Canadian production. Notably, the IEA includes LNG exports to Asia in its base-case forecast, but believes that they are limited due to increases in gas production in Asia and LNG from Australia.

The Bottom Line

Compared to the U.S., North America's shale gas revolution is a very different story for Canada. As the world's third largest producer, it has both positive and negative implications for Canada. It has hit prices hard, lowering production and exports, and hence revenues to producers and royalties to governments. On the other hand, lower prices are a positive for consumers of natural gas, including industrial users. Quite apart from saving money, as lower natural gas prices help induce more switching in power generation from coal to natural gas, reduced GHG emissions are another benefit.

So where do lower prices and fewer exports to the U.S. leave Canada? Well for starters, domestic demand is expected to grow at a much stronger pace than in the U.S. driven primarily by expansion of the oil sands. All else being equal, that reduces the amount of gas available for export in a straight-line production forecast scenario. We expect natural gas prices to rise back above \$4/MMBtu over the medium term, which should help producers. But, with Canada's traditional export market now able to meet far more of its own natural gas needs, Canada needs to find new customers at home and abroad to extract the greatest value for our gas resources.

Expansion of natural gas-fired power generation is one avenue, as is the potential for LNG exports, particularly to Asia. The prospects for LNG exports are highly sensitive to the expected price differential between gas in North America and Europe or Asia. That differential looks to remain high enough to induce exports for now, but any change in the structure of oil-linked natural gas prices overseas or increased competition from LNG exports elsewhere, has the potential to shift the economics of the proposed mega projects, and Canada must act quickly to secure contracts. If the shale gas revolution has taught us anything, it's that resource economics can shift dramatically in a relatively short period of time.

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416-983-7053

Endnotes

1. “The Economic and Employment Contributions of Shale Gas in the United States” IHS Global Insight, December 2011
2. Ibid.
3. “Golden Rules for a Golden Age of Gas” World Energy Outlook Special Report on Unconventional Gas, International Energy Agency, 2012.
4. “Canada’s energy future: Energy Supply and Demand Projections to 2035” The National Energy Board, November 2011.
5. Cleland, F. Michael. “Seismic Shifts: The Changing World of Natural Gas”. The Canada West Foundation, July 2011.
6. “Laying the Groundwork for BC LNG Exports to Asia” by Gerry Angevine and Vanadis Oviedo. The Fraser Institute, Oct 2012.

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