Latest Developments in Canada's Natural Gas/LNG Sector

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Summary

Canadian gas production is forecast to rise as output from sizable tight and shale gas formations in the Western Canadian Sedimentary Basin (WCSB) is expected to outpace declines in conventional production. Upstream growth prospects will in part depend upon finding new export markets for Canadian gas as the United States, Canada's current sole export market, increases its own domestic production. The current continental supply situation has resulted in low hub prices which when combined with prospects of higher price realization in Asian LNG markets, have motivated many Canadian operators to build the infrastructure and relationships to support new LNG export linkages. At the same time, new and existing global suppliers are also seeking to take advantage of arbitrage opportunities to increase their LNG trade with Asia and abroad. There are currently three optional routes for suppliers and consumers interested in LNG exports of Canadian gas: British Columbia's West Coast with 115.2 million tonnes per year [mtpa] (156.7 billion cubic metres [bcm]) in liquefaction capacity with export approval, the United States West Coast with 16 mtpa (21.8 bcm) and Canada's East Coast with 22.5 mtpa (30.6 bcm). To maximize opportunities for LNG exports, Canadian projects should seek to make timely final investment decisions (FID) through confirmation of sales agreements to establish and lock in market share, working to address potential for upward pressure on construction/development costs, and searching out mutually beneficial terms for producers and consumers on supply agreements.

1. Canada's gas production is shifting as tight and shale gas output replaces declining conventional volumes. Finding new export outlets beyond North America will play an important role in growth prospects for Canada's upstream gas sector.

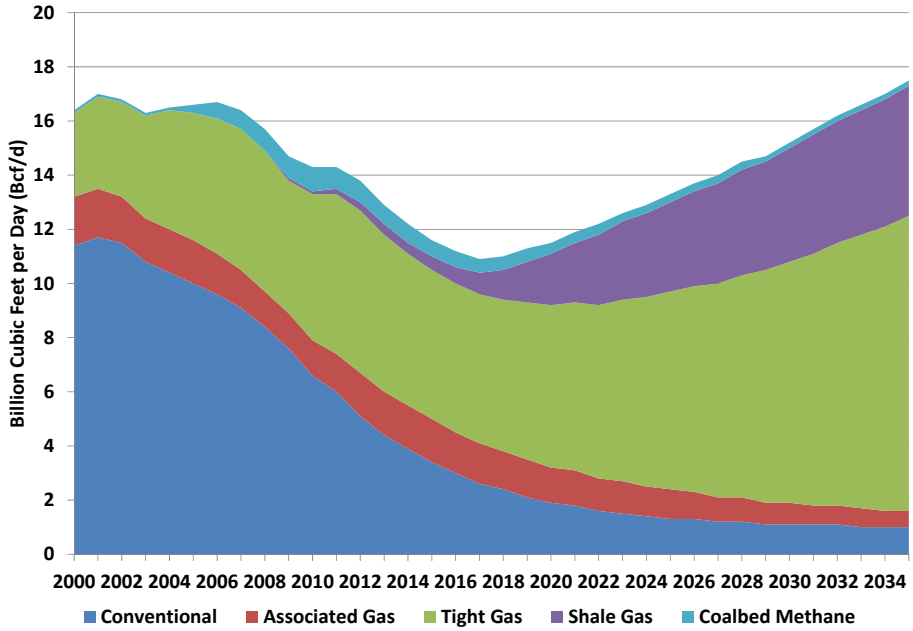
Canada's natural gas sector is undergoing change as conventional natural gas production has been in decline with volumes expected to taper off, to be replaced by growth in unconventional output, especially from tight and shale formations.[1] A recent National Energy Board (NEB) forecast estimates that even with declines in conventional gas, Canadian production is expected to grow in the future and could see a net-rise from 142.6 bcm (13.8 Bcf/d) in 2012 to 179.7 bcm (17.4 Bcf/d) by 2035.[2] As part of this rise Canada is expected to become a key player in growth of worldwide unconventional gas production in the future. According to the International Energy Agency's (IEA) Medium-Term Gas Market Report 2014, North America, the United States and Canada primarily, led global

[1] Shale and tight gas are unconventional resources hosted in low-permeability rock requiring application of technologies like hydraulic fracturing and/or horizontal drilling to extract. Tight gas refers to gas trapped in low-permeability/porosity formations, most often comprised of sandstone, siltstone and carbonate rock, while shale gas is produced from low-permeability sedimentary rock made of fine-grained clay and silt particles. NEB, 2013

[2] Reference case assumptions include higher natural gas prices from a rise in drilling levels in part facilitated by LNG exports. The forecast makes an assumption of 1 Bcf/d of LNG exports from West Coast British Columbia projects by 2019, increasing to 2 Bcf/d by 2023. The assumption does not reflect prospects for or factors impacting the construction and commissioning of LNG plants in the future.

unconventional gas production, with 541 bcm (52.4 Bcf/d, 86% of global unconventional output) in tight gas, shale gas, and coalbed methane production in 2013.

Fig 1: WCSB Natural Gas Production Forecast (Reference Case)



Source: NEB, "Canada's Energy Future 2013 – Energy Supply and Demand Projections to 2035"
Note: Please see footnote on page 1 for additional information on assumptions for Reference Case scenario

The vast majority of growth in Canada's unconventional production will come from the Western Canadian Sedimentary Basin (WCSB), which is the historical cornerstone of Canadian gas production and currently accounts for 98%+ of its marketable gas supply.[3] The NEB and Alberta/British Columbia energy regulators estimate the WCSB holds 17.9 tcm (632 Tcf) of gas including conventional resources, with the unconventional plays of the Montney formation, which straddles the British Columbia-Alberta border, estimated at 12.7 tcm (449 Tcf) of ultimate gas potential and British Columbia's Horn River estimated at 2.2 tcm (78 Tcf). In British Columbia the Montney is the most active of the province's production regions, accounting for approximately half of gas production, while conventional gas provides 28.2% and Horn River, 13.1% of production.[4]

While forecasts suggest Canadian natural gas production is expected to rise, growth prospects will likely depend on addressing and overcoming several challenges that are emerging in the sector. Canada's pipeline exports to its primary customer, the United States, are in decline as the United States is increasingly able to meet demand through its

[3] The Western Canadian Sedimentary Basin (WCSB) is a large region of sedimentary rock overlaying much of Western Canada, including Alberta, Saskatchewan as well as northeast British Columbia, and parts of Manitoba and the Yukon. It is Canada's largest hydrocarbon producing region. NEB, 2013
[4] Does not include Alberta portions of Montney production. BCOGC, 2014

own domestic production. Canadian exports to the United States have dropped from a peak of 107.1 bcm (10.4 Bcf/d) in 2002 to 78.8 bcm (7.6 Bcf/d) in 2013 according to the United States Energy Information Administration (EIA). At the same time, the United States is increasingly exporting larger volumes of gas to Canada, where pipeline shipments reached 25.8 bcm (2.5 Bcf/d) in 2013, up from 2.1 bcm (0.2 Bcf/d) in 2000.[5] This rise is primarily attributable to increased exports of Marcellus shale gas to Eastern Canada, supplies which have begun to displace Western Canadian gas deliveries to Eastern Canadian markets.

Fig 2: United States Natural Gas Supply, Demand & Trade Flows

Source: EIA, Energy Statistics, 2014

The abundance of natural gas in North America has impacted upstream activity in Canada where the number of total wells drilled has dropped from 18,926 in 2005 to 1,057 in 2012, due in part to declining natural gas prices as well as shrinking conventional production. [6] To deal with these challenges, drilling has increasingly focused on unconventional gas and deposits rich in natural gas liquids (NGLs) in places like the Montney and Duvernay, which provide additional revenue for operators. In light of ample supply, North American gas prices at Henry Hub (HH) and Alberta's AECO Hub have softened, averaging just US$3.76/Million Btu at HH and US$2.93/Million Btu at AECO in 2013. At the same time, landed Japanese LNG prices were on average US$16.17/Million

[5] The United States has also increased pipeline exports of natural gas to Mexico.
[6] NEB, 2013

Btu during the same period.[7] The prevailing differential between North American and Asian gas prices has added extra incentive for Canadian operators to examine potential for LNG exports as a means of garnering higher prices for their gas.

2. British Columbia has the largest number of proposed projects for Canadian exports, but the United States West Coast provides an additional route for consumers, with potential for hub-indexed pricing. Canada's East Coast also offers supply to the Atlantic Basin.

As Canada currently only exports gas via pipeline to the United States, new export infrastructure including liquefaction plants and pipeline capacity will be needed to connect its gas supply with LNG markets abroad. The proposed pathways for exports of Canadian gas can be divided into three routes, supply sent via British Columbia's West Coast, the United States West Coast and Canada's East Coast.

Fig 3: Proposed LNG Infrastructure for WCSB Exports

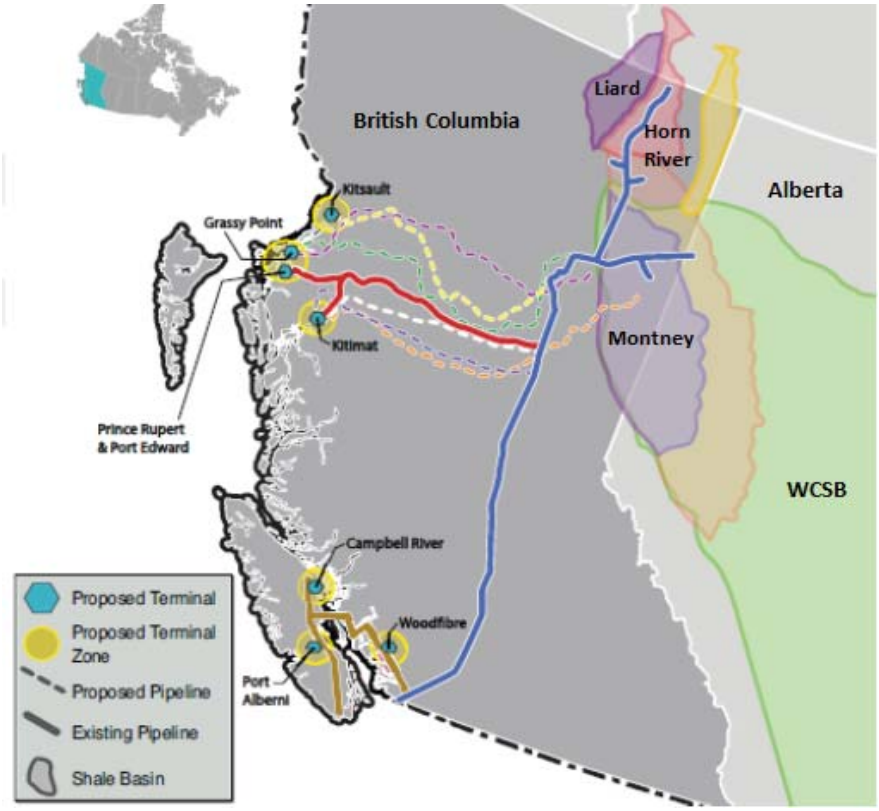
	Project	Location	Stakeholders	Liquefaction Capacity (mtpa)	Listed Target FID	Targeted Operational
Canada	Kitimat LNG	Kitimat, BC	Chevron, Apache[8]	10	2014+	2018+
	BC LNG	Kitimat, BC	LNG Partners, Haisla First Nation	1.8	2014+	2018+
	LNG Canada	Kitimat, BC	Shell, PetroChina, Kogas, Mitsubishi	24	2014+	2019+
	Pacific NorthWest LNG	Port of Prince Rupert, BC	Petronas-Progress Energy, Japex, Petroleum Brunei, Indian Oil Co, Sinopec	12+	2014+	2018+
	Prince Rupert LNG	Port of Prince Rupert, BC	BG	21	2015	2021+
	WCC LNG	Prince Rupert, BC	Imperial, ExxonMobil	30	n/a	2021+
	Woodfibre LNG	Squamish, BC	Woodfibre	2.1	2015+	2017+
	Triton LNG	TBD	AltaGas, Idemitsu	2.3	2014+	2017+
	Aurora LNG	Prince Rupert, BC	CNOOC-Nexen, Inpex, JGC	12+	2015+	2021+
US	Jordan Cove LNG	Port of Coos Bay, Oregon	Veresen Inc.	6	2015	2019
	Oregon LNG	Warrenton, Oregon	Leucadia National Corp.	10	2015	2019

Source: IEA, "Medium Term Gas Market Report 2014," Government of British Columbia & Corporate Websites
Note: Only includes projects with NEB export approval. "bcm" refers to billion cubic metres, "mt" to million tonnes, "mtpa" to million tonnes per year, "FID" to final investment decision. Conversion factor: 1 bcm = 0.735 mt

[7] LNG import prices under traditional long-term contracts are commonly derived on an oil-indexed basis; however, this trend has recently resulted in widening price differentials between oil-indexed supply in Asia and hub-indexed North American supplies.
[8] Woodside Petroleum has agreed to acquire Apache's share in Kitimat LNG in addition to the company's upstream holdings in the Horn River and Liard Basins. Olson, 2014

A. British Columbia West Coast

Fig 4: Select Canada West Coast LNG Export Schemes



Source: Moore, M.C. *et al*, "Risky Business: The Issue of Timing, Entry and Performance in the Asia-Pacific LNG Market," University of Calgary School of Public Policy, 2014
Note: Additional names included by author.

British Columbia on Canada's Pacific Coast is home to the largest number of proposed LNG export projects. As the WCSB holds immense gas potential and will serve as the backbone of Canadian production in the future, many prospective LNG exporters have proposed building or expanding pipelines to tap gas from the Montney, Horn River, Liard and Cordova fields to supply liquefaction plants to be built on the coast. Nine projects with 115.2 mtpa (156.7 bcm) in liquefaction capacity have received export licences from the NEB. A further seven have been proposed and are under consideration but have not received export approval.[9] The projects range in size from small 1.8 to 2.3 mtpa (2.4 to 3.1 bcm) plants such as Woodfibre LNG, BC LNG and Triton LNG, utilizing existing or expanded pipeline capacity, up to large-scale 12 to 30 mtpa (16.3 to 40.8 bcm) schemes such as LNG Canada, Pacific Northwest LNG and Kitimat LNG which propose construction of new pipelines over extended distances. Several key factors have caught the

[9] The total amount of proposed capacity is greater than current Canadian production. It is expected only a portion of projects will likely go ahead.

attention of prospective customers potentially interested in British Columbia's West Coast projects.

Fig 5: Investments of Asian Countries in United States & Canada

	Japan		Korea		China		India		Malaysia	Indonesia
Upstream	US	Canada	US	Canada	US	Canada	US	Canada	Canada	-
LNG	US	Canada	-	Canada	-	Canada	-	Canada	Canada	-
Offtake	US	Canada	US	Canada	-	Canada	US	Canada	Canada	US

Source: IEA, "The Asian Quest for LNG in a Globalising Market," November, 2014

The province's close proximity to Asian markets and lack of potential choke points provides a more direct, cost-effective and less risk-prone route for gas supply to reach Asian markets. Shipping times from British Columbia to Japan are approximately 10 days and involve no potential choke points, while LNG cargos from the United States Gulf Coast take an estimated 20 days and require transit of the Panama Canal. The alternative route to the Panama Canal is passage around the southern tip of South America, which could add significant costs to LNG shipment.[10] In addition, transit of the Panama Canal will involve payment of transit tariffs, which have yet to be determined and may require LNG ships to compete with other vessels such as container ships for transit allocation. These factors could lead to increased transportation costs and risk for consumers not shared by West Coast Canada's direct and proximate access to Asia.

Canadian projects have also offered companies opportunities to acquire equity stakes in projects in addition to purchasing LNG offtake. The chance to acquire equity in LNG projects has attracted significant interest from Asian companies, with two-thirds of proposed LNG projects in British Columbia with export approval, having active participation from key Asian companies from countries such as Japan, China, Korea, Malaysia and India. There is also support for companies to vertically integrate their upstream holdings into the LNG supply chain, as many equity stakeholders have also invested in upstream holdings in the WCSB. According to the Canadian Energy Research Institute (CERI), the Montney and Horn River have attracted CAD$21 billion in investment since 2007, with significant investments from Asian companies, including examples such as Mitsubishi's CAD$2.9 billion Cutbank Ridge holdings and Petronas's CAD$6 billion acquisition of Progress Energy, who are one of the most active drilling companies in the WCSB, in anticipation of supplying gas from the region to its proposed export facilities.[11] The IEA and CERI have both raised this type of vertical integration as one of the key strategic considerations that could provide a deciding factor for Canadian

[10] IEA estimates place shipping costs for Canada's West Coast projects to Japan, Korea and China in a range of US$1.30-1.60/Million Btu, versus US$3.00-3.20/Million Btu for US Gulf Coast projects via the Panama Canal and US$4.30-4.50/Million Btu via the Suez Canal or direct route.

[11] CERI estimates that between 2010 and July 2014, Progress has licensed 758 wells, of which 358 are now producing, while 403 await drilling or are capped in anticipation of LNG exports. CERI further estimates Progress will need to drill 1,360 additional wells out to 2019 to supply gas to its LNG plant.

projects.[12] Development of vertically integrated LNG projects would allow upstream operators the chance to sell their North American gas at higher global prices than those available on the continent which remain low presenting challenges for upstream operators. As integrated operators, companies would seek a balance by trying "to reduce the cost [of gas supplied for export] while at the same time ensuring reasonable returns on [their upstream output]."[13] In part as a result of flexibility of the options available in its LNG supply-chain, Canada has seen significant participation from Asian stakeholders.

British Columbian projects do face some challenges, including the need to develop expansive new infrastructure, due to lack of existing gas transportation capacity between resource fields and the proposed liquefaction plants on the coast. Greenfield projects on Canada's West Coast that will cross geographically challenging terrain are expected on average to cost more than brownfield projects in places like the United States Gulf Coast, where much of the required infrastructure is already in place. As such, given potential for increased costs, project proponents and financiers may be more likely to request stricter contractual terms like oil-linked pricing, due to the need for clarity on long-term cash-flow and returns required to backstop projects.

B. United States West Coast

Another route for exports of Western Canadian gas in addition to British Columbia is via the United States Pacific Northwest. Canadian gas along with volumes produced in the United States would be carried to Oregon using a combination of existing pipelines and new extensions, or spurs, to reach proposed LNG plants on the coast. If approved, the Oregon LNG and Jordan Cove LNG projects would provide 16 mtpa (21.8 bcm) of export capacity available for Asian markets. Both projects have received export approval from Canada's NEB and United States Department of Energy (DOE) conditional approval to export natural gas to countries that do not have a free trade agreement with the United States, but are still undergoing review by the Federal Energy Regulatory Commission (FERC).

The projects share similar location and shipping advantages with neighbouring British Columbia, having roughly equivalent shipping times and distances and routes that avoid potential choke points. The two projects also propose to use a liquefaction tolling agreement system similar to those employed at several United States Gulf Coast projects, which would provide prospects for LNG buyers to purchase Canadian gas on a hub-indexed basis.[14]

C. Canada East Coast

[12] IEA, 2014 & Walden, 2014
[13] IEA, 2014
[14] A tolling model approach is where the "[liquefaction plant] owner will charge a fee to process the natural gas that remains in possession of the upstream producer. The upstream producers will then sell the LNG to downstream buyers. A reservation fee may be charged by the tolling company that is paid whether the gas is liquefied or not." CERI, 2012

Three export projects have also been proposed for Canada's East Coast, totalling 22.5 mtpa (30.6 bcm), including the 10 mtpa (13.6 bcm) Goldboro LNG project in Nova Scotia, which is the furthest along having received environmental assessment approval from the Nova Scotia government. In addition, the 8 mtpa (10.9 bcm) Bear Head LNG and 4.5 mtpa (6.1 bcm) H-Energy LNG projects have indicated interest in exporting LNG via the East Coast, but are in earlier stages of development. Gas sourcing is still under consideration by project proponents, but East Coast offshore gas, of which the NEB estimates there is 5 tcm (178 Tcf) in marketable resources, as well as volumes from the Marcellus or Utica formations are cited as possible sources for the plants. The existing Maritimes and Northeast (M&NE) Pipeline, which currently supplies East Coast Canadian gas to the north-eastern United States has run under capacity as American production ramps up. Consideration has been given to reversing the flow of the pipeline to supply gas from the United States to the Canadian Maritimes region, and could possibly provide a feedstock for the proposed East Coast LNG projects subject to permitting approval.

Given its geographic location, Canada's East Coast projects are expected to primarily to serve Atlantic Basin markets such as Europe, in which security of supply has regained importance given ongoing geopolitical developments in the region. Latin America is also viewed as a potential market in need of additional LNG supply in the future, while Pacific Basin markets such as India could also see shipments.

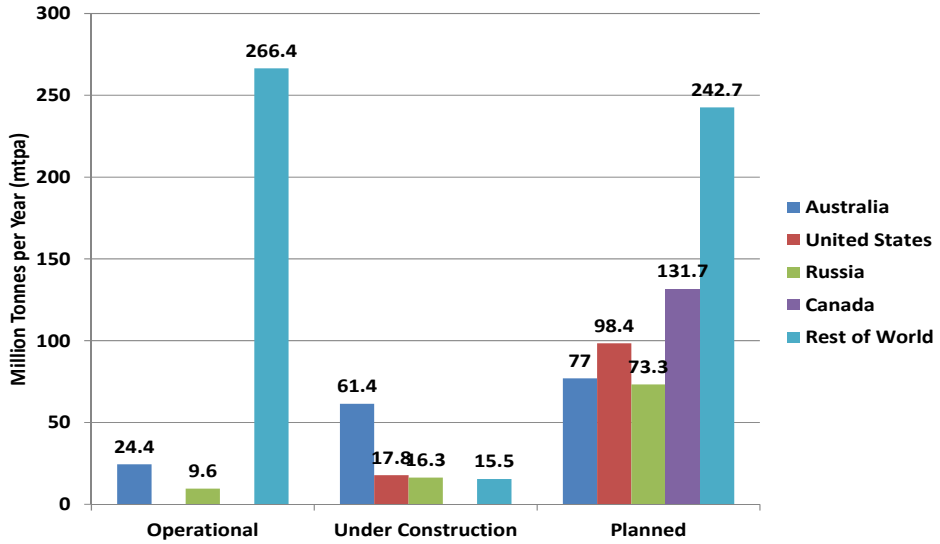
3. **Canada has bright prospects for unconventional gas and LNG, with North American and global market trends driving a move in this direction. At the same time, other competitors are seeking a share of the global LNG trade. Canada can take several steps to maximize opportunities for Canadian projects in the global LNG sector.**

Canadian gas production looks set to grow in the future and the country has attracted interest from key Asian companies, with its large resource base, legal/regulatory stability, expertise in unconventional resource development, support for foreign investment and exports, as well as its proximity and direct access to Asian markets. But as Canada prepares to export LNG, it enters a market evolving as demand and price trends have drawn interest from other new and established suppliers like Australia, the United States, and Russia, who are eager to secure a share of rising global LNG trade. Consuming countries are also beginning to seek offtake agreements that address the ongoing high price of LNG, or "Asian Premium," as a means of lowering gas procurement costs, as well as seeking more flexible contract destination terms. The competitive landscape will mean that Canada's success in building its share of global trade will depend in part on when its projects become operational; how effectively it is able to manage project development costs; and, what sales and contracting terms project proponents develop with customers. To maximize opportunities for Canadian LNG exports, proponents should seek timely final investment decisions (FID) and sales agreements to secure market share, address

potential for upward pressure on construction/development costs, and search out mutually beneficial terms for producers and consumers on supply agreements.

A. Timely FIDs and Confirmation of Sales Agreements Key to Establishing Market Share

Fig 6: Existing/Planned Global Liquefaction Capacity (by Status)



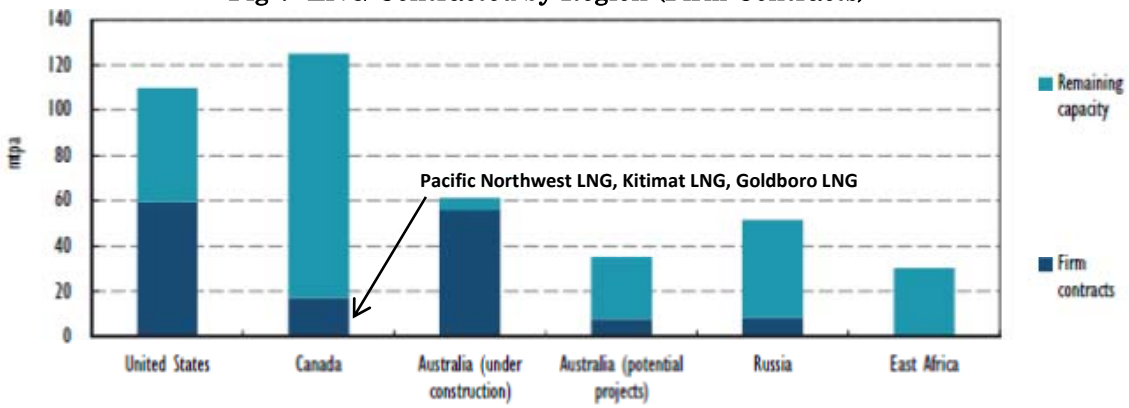
Source: IEA, "Medium-Term Gas Market Report 2014," 2014

Timing of Canadian project development will be important to the country's entry into the LNG sector and earlier possible entry points may help proponents to maximize their market share. According to the IEA's Medium-Term Gas Market Report 2014, global LNG trade is forecast to grow by 130 bcm (95.6 mtpa) between 2013 and 2019, to 450 bcm (330.8 mtpa), a rate twice that expected for pipeline trade. This trend is primarily driven by projected growth in demand in Asia where LNG imports currently total 243 bcm (178.6 mtpa) and comprise 76% of global trade in LNG. New suppliers have emerged seeking to meet rising demand and to take advantage of favourable arbitrage opportunities, with 842 bcm (618.9 mtpa) in proposed liquefaction capacity, an amount approximately 2.6 times larger than current global LNG imports. At this rate, proposed global liquefaction capacity is expected to outstrip forecast LNG demand worldwide in the future, which could increase competitive pressure on players looking to secure market share. Most of the projected short-term growth will be provided by a forthcoming tranche of liquefaction plants currently under construction in three countries: Australia, which has 61.4 mtpa (83.5 bcm), the United States with 17.8 mtpa (24.2 bcm), and Russia with 16.3 mtpa (22.2 bcm). LNG deliveries from the Australian projects under construction and the first of projects in the United States are expected as early as 2015-16.

While Canada's list of proposed liquefaction capacity is significant, at this time, no FIDs have been made. There are several projects aiming to make an FID in the near-term, with

some evaluating the feasibility of FIDs in early- to mid-2015, according to company statements. The development timelines associated with these FID dates mean Canadian projects generally have approximate target operational dates from 2017 to 2020 and onwards. This means Canadian projects will likely miss the first wave of projects expected to come online but will be competing with the next tranche of proposed projects in the 2018-20 supply window, potentially under different and possibly greater competitive terms due to the higher volume of proposed liquefaction projects in the queue. In order to meet this target Canada's ability to reach timely FIDs in the short- to medium-term will be an important metric of success for the sector.

Fig 7: LNG Contracted by Region (Firm Contracts)



Source: IEA, "The Asian Quest for LNG in a Globalising Market," November, 2014
Note: Australia includes (Arrow LNG, Pluto LNG train 2, Gorgon LNG train 4, Sunrise FLNG, Bonaparte FLNG and Browse FLNG), United States includes (Sabine Pass, Freeport LNG, Cameron LNG, Lake Charles, Cove Point, Jordan Cove, Oregon LNG, Corpus Christi and Magnolia LNG), Canada includes (Kitimat LNG, BC LNG, LNG Canada, PNWLNG, Prince Rupert LNG, WCC LNG, Woodfibre LNG, Triton LNG, Aurora LNG and Goldboro LNG).

Confirmation of sales offtake agreements is a vital step towards an FID and operational start-up as they provide the basic terms underpinning possible project revenues, which impact return on investment and serve as the means of repayment for project financing. Canadian projects have been making steady progress in establishment of sales agreements, with the IEA noting three proposed projects, Pacific Northwest LNG, Kitimat LNG and Goldboro LNG (combined 32 mtpa), have secured 17 mtpa (23.1 bcm) in binding contracts with customers. Equity owners in Canadian projects make up the largest portion of firm contracts. For example, Pacific Northwest LNG has reportedly contracted 1.8 mtpa (2.4 bcm) to Sinopec, with an additional 3 mtpa (4.1 bcm) to be sourced from Petronas, primarily from the Pacific Northwest LNG project. When combined with equity lifting from other purchasers, more than half of Pacific Northwest LNG offtake has been committed to long-term agreements.[15] The remaining 5 mtpa (6.8 bcm) of firm offtake is likely from East Coast project, Goldboro LNG, which has signed a supply agreement with German utility company, E.On, equivalent to half of its export nameplate capacity. Other projects, while in earlier stages of development, have made progress on establishment of

[15] Forbes, 2014

sales agreements. Woodfibre in British Columbia has signed a memorandum with potential customers such as Guangzhou Gas Group to explore terms for future sales, while various other projects continue efforts in preparation of non-binding Heads of Agreement (HOA).[16]

By comparison, Australian and American projects, having made earlier FIDs and with some benefitting from brownfield infrastructure already in place, have a larger portion of their offtake already committed. For the United States, the IEA notes, of a proposed 108.6 mtpa (147.7 bcm) in liquefaction capacity with export approval, nearly 60 mtpa (81.6 bcm) is committed to firm contracts.[17] For Australia, of approximately 61.4 mtpa (83.5 bcm) in liquefaction capacity under construction, more than 91% (55.9 mtpa) of volumes are committed to firm contracts most of which is bound for Asia.[18] However, while Australia benefits from higher commitment rate for offtake at facilities currently under construction, projects still in the proposal stage do not share the same level of confirmed volume purchases.

Growth in global LNG demand is expected in the future, but as favorable differentials have brought a large quantity of proposed liquefaction capacity forward, Canada could face increased competition in the 2018-20 supply window from countries including Australia and Russia, who have yet to confirm sales agreements. Quick movement towards FIDs and ongoing progress in signing supply agreements with customers will help to place Canadian projects in the best position to secure market share.

B. Managing Project Development Cost Pressures & Risk

Managing project costs during the construction phase is key to development of LNG exports, as they can comprise up to 68% of total costs.[19] Due to the large-scale nature and complexity of the global LNG industry, a general trend towards increased capital costs for development of liquefaction capacity has emerged over the last decade. For example, average liquefaction costs have grown from US$300/tpa in 2000 to US$1,200/tpa in 2013.[20] To put Canadian projects into context, Moore et al provide an estimated liquefaction cost range of US$900-1,200/tpa for greenfield Western Canadian liquefaction plants, while United States Gulf Coast brownfield projects fall in an approximate range of US$500-620/tpa.[21] In addition to construction of new liquefaction capacity, Canada's West Coast greenfield LNG projects will entail investment in new pipelines across a remote region to connect WCSB resources with the coast. In comparison, many projects in United States Gulf Coast will make use of existing infrastructure.

[16] LNG World News, 2014
[17] Includes United States West Coast projects expected to also export volumes of Canadian gas.
[18] IEA, 2014
[19] Murillo, 2014
[20] Songhurst, 2014
[21] Excludes pipeline development costs. Costs based on studies by Wood Mackenzie, Macquarie and NERA Economic Consulting as well as cost estimates for Cheniere's Sabine Pass project.

On the labour front, an ample supply of skilled workers will be needed to oversee building of LNG infrastructure. Construction of three to five LNG plants on Canada's West Coast is estimated to require up to 11,790 to 22,610 onsite workers, plus 6,800 to 22,600 associated positions in the upstream, oil and gas services and pipeline sectors. [22] Given the considerable need for labour, one potential challenge to address is the possibility for increasing labour costs due to shortages of skilled workers and labourers. As many of Canada's proposed LNG projects will also share similar development timelines with other energy projects, they will likely draw on the same labour supply, which could add further pressure to development costs if not managed effectively. Development of training and education in in-demand professions and skilled trades along with moving to reduce barriers to labour mobility including harmonization of professional standards across jurisdictions are key ingredients in developing a more comprehensive capacity to oversee project construction.

In addition, the influx of a large new population to remote regions raises challenges for accommodation and public services that will require effective management of community services and infrastructure. Work camps to support construction will be needed along the entire LNG supply-chain. This is an area where best practices from managing upstream resource development in remote northern communities of Western Canada, including in the areas of work camp development, well-organized operation and coordination of resources and services between camps as well as effective community planning to anticipate and accommodate a large population increase can be employed to maximize outcomes.

Managing cost on materials and equipment for construction is another vital step in remaining competitive during the project development phase. To help manage materials costs, companies can evaluate the use of pre-fabricated and/or modular construction methods, and where applicable, use of barge-based or floating LNG (FLNG) plants to see if these approaches would help maintain cost competitiveness. Finally, companies can assess the economies of scale of their project to determine if resizing of operations would help improve overall project economics.

C. Seeking Mutually Beneficial Supply Agreements for Producers & Consumers

Another vital component to building successful long-term LNG trade between producers and consumers are the pricing and terms of supply contracts. As global LNG markets continue to evolve, new supply sources are emerging offering contractual approaches that could address some ongoing market challenges and contribute to more flexible and responsive trade in LNG. Canadian projects and natural gas have some significant

[22] Petroleum Human Resources Council of Canada, 2013

advantages and could play a strategic role in the evolution of markets. Given the diversity of export paths available via the British Columbia, the United States West Coast and Canada's East Coast, the country offers some optionality in choice of projects, routes and contractual arrangements in support of ongoing market development.

West Coast projects in Canada and the United States will tap into abundant resources in the WCSB. British Columbia's projects will give purchasers the chance for equity lifting and vertical integration of upstream operations, which could help provide a hedge against potential variations in future gas prices. For Canadian gas purchased via Oregon, given the tolling model employed, customers will also have the opportunity to buy Canadian gas on a hub-indexed basis, offering additional pricing optionality for consumers. The WCSB also has its own natural gas hub, the AECO Hub, which provides a liquid supply of gas and common price point for much of WCSB gas purchases and generally trades at a price mirroring or similar to Henry Hub. AECO provides a clear pricing signal for Canadian gas and could play a valuable role in future supply arrangements.

Canadian LNG proponents could also evaluate potential for use of new pricing and contract mechanisms such as hybrid pricing. In a hybrid-pricing model, producers and consumers would negotiate on how to split the pricing ratio between hub and oil-linked mechanisms, along with the slopes and constants of the pricing formulae. For increasing flexibility of supply flows in contracts, sellers could also consider assessing presence of Final Destination Clauses (FDC), which restrict potential for redirection of cargos based on need and opportunity in the future. If feasible, flexibility on FDCs in supply contracts could provide an additional competitive advantage for Canadian LNG and contribute to development of a more dynamic LNG market.

It remains to be seen what the long-term outcome of ongoing negotiations for supply contracts will be, as they have a significant impact on project revenues and financing, and are considered on a case-by-case basis between suppliers and consumers. Solutions will likely be reflected in the terms of final sales agreements, but strategic advantages in the optionality of Canadian projects and considering new and innovative contracting methods may help Canada to further maximize its market share, while helping to produce win-win scenarios for both Canada and customers in Asia and around the world.

4. Outlook: Potential FIDs in 2015?

Canada has developed close partnerships with important markets in Asia and offers significant potential for building strong LNG supply linkages with the region, due to its sizable resource base, stable legal and regulatory environment and expertise in unconventional resource development. Canada's three possible export paths for gas supply, also provide attractive optionality for supply routes as well as contracting for consumers when evaluating potential for Canadian gas. The Government of British Columbia has set a target of two to three operational LNG plants by 2020, a goal CERI has recently

suggested is feasible at 38 to 46 mtpa (5-6 Bcf/d) of capacity depending on prevailing market conditions.

While at this time no FIDs have been made on Canadian LNG projects as proponents continue to assess long-term market prospects, several have proposed making an FID in 2015. Should one or several positive FIDs be reached in 2015, Canada could find out soon when LNG exports could possibly begin. Given current timelines, Canadian projects could be export-ready closer to the end of this decade. One trend that could emerge in the short- to medium-term is a consolidation of efforts to develop LNG export projects, as a means of reducing infrastructure requirements and to improve efficiency, although at this time it is unclear what shape these efforts could take. Exploration of opportunities to promote development and strengthening of supply arrangements between Canada and its partners in Asia will help contribute to security and diversity of supply for Asia, while boosting the long-term prosperity of Canada's natural gas and LNG industry

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