



An Assessment of North American Natural Gas Exports

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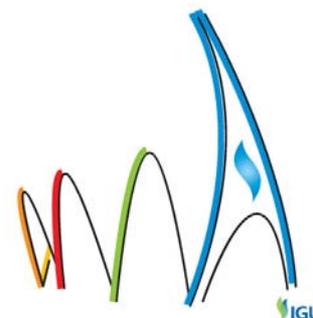


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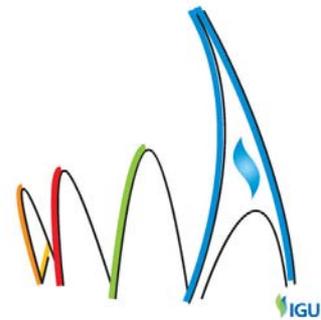
Background¹

Increased natural gas production in the United States and Canada has fueled a lively debate on natural gas exports. This debate has focused so far predominantly on exports of liquefied natural gas (LNG) from the United States. Several elements of this debate deserve further empirical attention. First, the debate is clouded with a lot of confusing statements about the regulatory regime related to natural gas exports. Second, estimates about the amounts of US natural gas that will be competitive on global markets vary widely. Third, US LNG from the lower 48 states is only a part of the equation with Alaska also possibly a major potential source of LNG exports. Alongside the US, Canada is also producing increasing amounts of natural gas, leading its provincial and federal authorities to search for opportunities to market large volumes of this gas elsewhere in the world, especially to Asia. Moreover, with markets in North America reasonably well integrated, an increasing amount of natural gas is exported by pipeline either through the US from Canada or directly from the US to Mexico.

Aim

Taking into account natural gas production trends, price formation, legal and infrastructural limitations as well as environmental opposition to many LNG projects, this article provides an assessment of North American natural gas exports in the coming years. It begins with a brief description of the regulatory framework related to LNG exports. The article then proceeds with an updated timeline for infrastructural projects coming on stream. Finally, based on production and spot market prices around the world, the article makes an assessment of the viability of North American natural gas exports by 2020.

¹ The authors want to thank Heather Greenley for her great research support.



Methods

This article builds on existing studies to outline the debate on potential LNG exports from the US. It adds to existing literature an overview of potential Canadian LNG exports, as well as potential hurdles that will have to be overcome for large scale Canadian supplies to enter the world market. Moreover, it outlines the potential for pipeline exports from the US into both Canada and Mexico, and based on US Energy Information Administration (EIA) data provides both a quantitative as well as qualitative assessment of the viability of all projects from North America. All these numbers and considerations are combined in a forecast for natural gas exports from North America, containing both a time element and a quantity forecast.

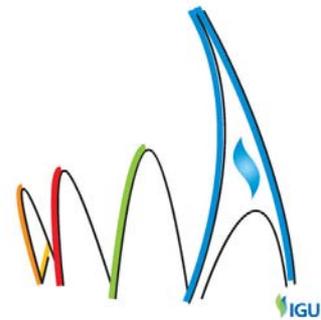
Results

The results of this study have been organized along the lines as described in the introduction. First, we discuss the US regulatory process governing exports of LNG. Second, we use EIA data to demonstrate what amounts of natural gas were exported from the US in 2013. We then give an overview of the LNG projects that have been proposed, and discuss the hurdles these projects have to overcome. We also touch upon the competition these projects will face in the world market as well as other factors that play a role. We then conclude with our assessment of what should realistically be expected in terms of exports of natural gas from North America.

THE EVOLUTION OF THE US LNG EXPORT LICENSING PROCESS

Prior to 2014, LNG gas exports were subject to the statutory provisions requirements of the 1938 Natural Gas Act (NGA) Section 3(15 USC§717b) requiring authorizations from the Department of Energy's Office of Fossil Fuels as well as the Federal Energy Regulatory Commission (FERC).² The process required an application to the Department of Energy (DOE) and a finding that the LNG exports were deemed consistent with the public interest. If a free trade agreement existed with the country wanting to purchase LNG, then the sale was deemed consistent with the public interest. If no free trade agreement existed, the Office of Fossil Energy still had to issue an export permit unless it found grounds for deeming it not to be in the public interest after publishing the application in the Federal Register seeking public comments and receiving protests against the sale or notices of intervention by parties opposed to the sale. One major shortcoming in this process was that there were very imprecise grounds in determining what was meant by the "public interest." Under the regulatory process, DOE also had the right to issue permits up to a certain cumulative volume of LNG exports and then to deny subsequent applications if it perceived that tight market conditions made such additional exports to not be in the public interest.

² For a more in depth assessment of the process for approval for LNG exports prior to 2014, please see: Charles Ebinger et al., "Liquid Markets: Assessing the Case for U.S. Exports of Liquefied Natural Gas," Brookings Institution, May 2012.

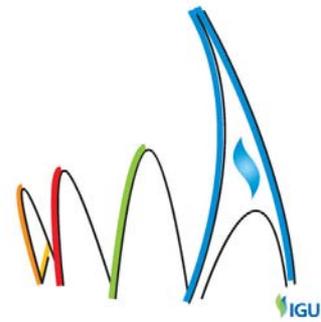


Authorization by FERC was also required for any LNG export facilities requiring the siting, construction or operation of said facilities, or to amend an existing FERC authorization. Certain additional regulatory approvals involving the export of LNG are sometimes also needed from the Coast Guard and the Department of Transportation. If a favorable finding is made by these agencies, then approved applications were issued a Certificate of Public Convenience and Necessity allowing the project to proceed.

ENVIRONMENTAL REVIEW AND ASSESSMENT

Finally, both the approval by the Office of Fossil Energy and by FERC required an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA of 1970). All projects must have an EIS for every proposed major federal action that is expected to have a significant impact on the environment, in accordance with NEPA's requirements. Even projects with less significant impacts still require documentation. For example, even if the environmental impacts are uncertain, an EIS must be done in order to determine if an EIS is necessary. If the ensuing EIS determines that the proposed project has no significant environmental impacts, then a Finding of No Significant Impact report is provided. Finally projects perceived to have no significant impacts on the environment can be processed as Categorical Exclusions alleviating them of any requirement to provide either an EIS or a less robust Environmental Assessment (EA). In preparing all the documentations required by NEPA, both the Department of Energy and the FERC are also responsible for identifying any other compliance requirements applicable to the project such as the Clean Air Act, the Clean Water Act, the Endangered Species and the National Historic Preservation Act as well as any approvals under these or state-related requirements falling under these federal statutes. In addition to the environmental requirements, LNG export projects can also be subject to the oversight requirements of other agencies such as the Department of Transportation's Office of Pipeline Safety, the National Fire Protection Association and the Federal Emergency Management Agency.

This seemingly simple, but in reality complex, regulatory approval process was made more problematic by the uncertainty of how long the process would take, particularly for those applying to export to non-FTA countries. Again, prior to 2014, the DOE reviewed applications to export LNG to countries without a free trade agreement in the order in which they were received resulting in a cumbersome and painstakingly time consuming process, which provided industry with little to no certainty that their projects would be approved if they were way down the applicant list even if they had strong technical partners, sound balance sheets and strong prospects for certain financing. While the DOE, per its legal mandate, intended to process these applications in a timely manner (at an average of every eight weeks), by March 2014 the mounting number of applications had extended the approval process to nearly four years, regardless of the project's environmental complexities or lack thereof. "The result was that projects which might make it through the environmental review, led by the Federal Energy Regulatory Commission (FERC) or the U.S. Maritime Administration (MARAD) depending on jurisdiction, might not be considered until they came up in the



queue, possibly years later, or might be rejected altogether because they exceeded the soft cap of 12 billion cubic feet per day (Bcf/d).³

On May 29, 2014, the DOE announced a revision of the application process for LNG exports to countries without a US free trade agreement. First, the DOE effectively terminated conditional decisions to export to non-FTA countries without a NEPA review. "DOE typically issued these conditional authorizations after completion of the notice and comment process, but before completion of NEPA review."⁴ Previously, many projects had to wait in queue in the order in which they were received; some of these were still undergoing environmental review because assessing the environmental impact could be highly complex, while other projects that had no new environmental impact still waited in line. Following the change in policy, the DOE only issues the public interest approval for projects that have secured their NEPA requirement, making the DOE approval process much more streamlined.

Furthermore, the DOE eliminated the queue system and moved to approving applications in the order in which an application, "has completed the pertinent NEPA review process and when DOE has sufficient information on which to base a public interest determination."⁵

Despite this attempt to clarify and streamline the approval process, industry still remains a bit uncertain on how the changed policy will work in reality. The issue of what criteria DOE uses and what weight each criterion is given in determining what constitutes the "public interest" is not fully guaranteed by the issuing of an export permit. The US government still reserves the full right to withdraw export permits deemed no longer in the public interest. Unfortunately this determination is outside the DOE's jurisdiction and can only be changed or clarified by Congress. Nonetheless with the change in policy, DOE has made a vast improvement in the approval process providing industry with considerably more confidence in the approval timeline.

EXPORTS OF NATURAL GAS

During the course of our investigation, our working hypothesis has been that the prospects of huge volumes of North American LNG exports predicted by many analysts are unlikely to occur at least between now and 2020. Since 2007, Canadian gas pipeline exports to the United States have been in a slow decline as new US domestic supplies, largely from unconventional gas and the construction of new pipelines to access them, have obviated the need for Canadian gas imports. In 2013, virtually all natural gas imports in the US came from Canada, the total amounting to 2,785 Bcf.⁶ Given these market trends, in the absence of new export markets Canadian gas production will remain stagnant serving only the domestic economy and some niche US regional markets. It is worth noting though, that even those

³ David L. Goldwyn, "DOE's New Procedure for Approving LNG Export Permits: A More Sensible Approach," Brookings Institution, June 10, 2014, www.brookings.edu/research/articles/2014/06/10-doe-approving-lng-export-goldwyn-hendrix.

⁴ US Department of Energy, "Proposed Procedures for Liquefied Natural Gas Export Decisions," 79 FR 32262, June, 04, 2014, <https://federalregister.gov/a/2014-12932>.

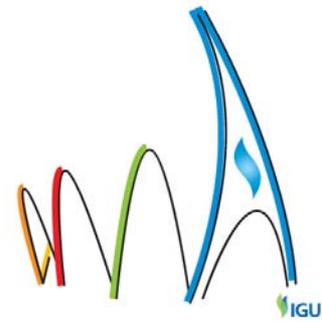
⁵ Ibid.

⁶ US Energy Information Administration, US Natural Gas Imports & Exports 2013, Natural Gas, May 28, 2014, <http://www.eia.gov/naturalgas/importsexports/annual/>.

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niche markets may evaporate, as US domestic infrastructure investments continue to expand bringing previously stranded gas supplies to market. To give an example, in 2013 Canadian imports into the northeastern US dropped by almost 12%, attributed to increased production from the Marcellus shale and expanded pipeline capacity.⁷

In response to this Canadian "existential" market crisis and the perception in the United States that it is a "low cost" gas producer, the Canadian gas industry has embarked on ambitious schemes to ship Canadian gas to Asian markets where as a result of exiting oil indexed contracts Canadian gas is viewed as quite competitive. Currently there are 19 proposed LNG liquefaction plants along the coast of British Columbia.⁸ There are also two more in Oregon that if built would be supplied by gas from Canada and several proposed plants in Canada's Maritime Provinces on its east coast. Much of the delay in Canada has been the result of significant environmental backlash particularly from First Nations as well as hesitancy to invest large capital sums with little certainty. Recently, Ottawa has announced a federal tax break for proposed LNG terminals in British Columbia. This has been instituted with intentions to spur investment, make British Columbian LNG more competitive, and alleviate some economic uncertainty.⁹

In the United States, the euphoria brought on by the unconventional gas revolution has been even more startling as natural gas reserves have soared to over 2,200 trillion cubic feet, an amount in excess of 87 years supply at current consumption levels.¹⁰ The size of these reserves has led to FERC's approval of five LNG export terminals (Figure 1). In addition there are 14 additional proposed projects pending review by US regulatory authorities, and 11 existing import terminals that want to be converted into export facilities. In addition it is estimated that there could be an additional 13 theoretically possible facilities in terms of available sites.¹¹

⁷ Ibid.

⁸ For a list of British Columbian projects see: Explore B.C.'s LNG Projects, <http://engage.gov.bc.ca/Inginbc/Lng-projects/>. For a list of Canadian projects applying for an LNG export terminal license with the Government of Canada, see: Natural Resources Canada, Canadian LNG Projects, September 23, 2014, <http://www.nrcan.gc.ca/energy/natural-gas/568>.

⁹ Brent Jang and Ian Bailey, "Ottawa grants tax breaks for LNG sector in BC," The Globe and Mail, February 19, 2015, <http://www.theglobeandmail.com/news/british-columbia/harper-announces-tax-breaks-for-lng-industry-in-bc-to-spur-job-growth/article23106853/>.

¹⁰ US Energy Information Administration, Frequently Asked Questions: "How much natural gas does the United States have and how long will it last?" December 3, 2014, <http://www.eia.gov/tools/faqs/faq.cfm?id=58&t=8>.

¹¹ Federal Energy Regulatory Commission, Existing and Proposed Terminals, LNG, March, 4, 2015, <http://www.ferc.gov/industries/gas/indus-act/lng.asp>.

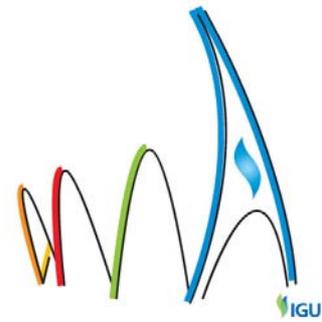
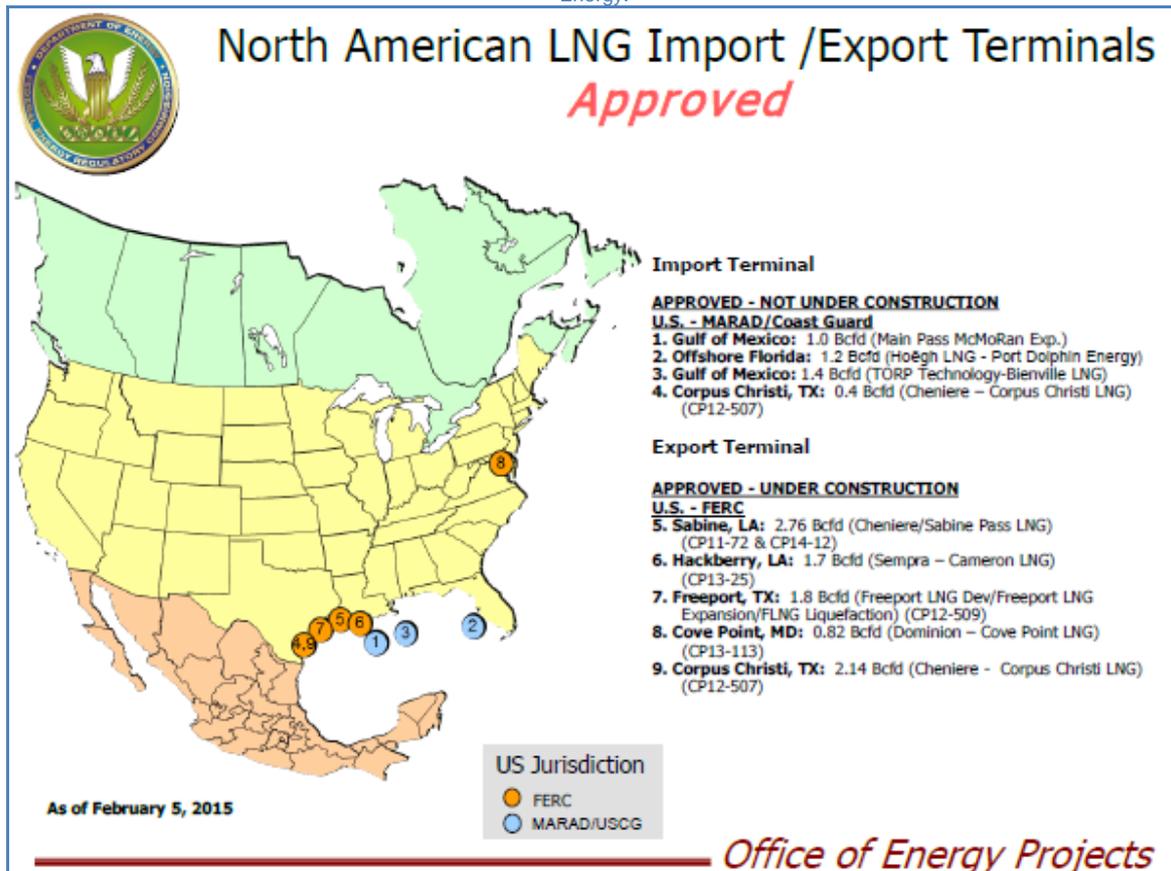


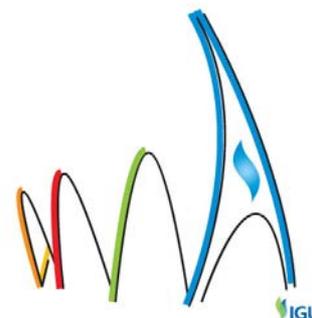
Figure 1: North American LNG Import/Export Terminals Approved

Source: Federal Energy Regulation Commission, U.S. Department of Energy.



While the projected number of North American LNG export facilities is huge, closer examination of the projects' financial realities project a more nuanced story. Almost all of the existing analysis and forecasts have been based on three central precepts. First, that spot market prices at Henry Hub will remain at record low levels. However, in reality, Henry Hub prices while remaining relatively low are projected in many forecasts to rise gradually in the coming years, albeit marginally. The second assumption is that prices in Asia and Europe will remain high. Currently, Henry Hub prices have remained low at around \$3/mcf. Spot prices in Asia, roughly \$6-7/mmBtu for 2015-2016,¹² and Europe have tumbled over recent months to levels where it would be increasingly difficult for North American LNG projects to be financed if they are not fully contracted. Third, with the fall of global prices there is a debatable assumption that low prices will stimulate steady demand growth. It turns out, that this is not the case, as current low prices in North America illustrate the fact that this is a

¹² Osamu Tsukimori, "Japan Feb LNG spot price falls a quarter to \$7.60/mmBtu," Reuters, March 10, 2015, <http://www.reuters.com/article/2015/03/10/lng-japan-spot-idUSL4N0WC1JL20150310>.



market response to a surplus of supply and a demand deficit.¹³ What the future world gas market may be is subject to many unknown market forces including: (1) the pace at which China ramps up pipeline imports from Russia and Central Asia; (2) how many countries with large shale gas resources (China, Argentina, South Africa and Algeria to name a few) successfully develop them and at what pace; (3) inter-fuel competition from other sources such as coal and renewables with LNG especially in the Asian power market; (4) whether Russia will also commence large scale pipeline exports to Japan, the Koreas, and Taiwan owing partially to the pace and scale of Russian LNG exports from its Arctic regions as well as how much of Russian LNG from Yamal and Sakhalin will continue as it is already in market; (5) the speed and degree to which Japan brings its nuclear reactors back on line; (6) the ability to utilize LNG as a transportation fuel, particularly in the Chinese and Indian market where pollution and health concerns are growing, and; (7) whether after the United Nations Framework Convention on Climate Change in Paris meeting the world reaches a global agreement on reducing CO₂ emissions. If there are no vigorous efforts to reduce CO₂, and we are skeptical that there will be, then it seems that coal will remain very competitive.¹⁴

There is also competition from other LNG projects coming on stream. There are several reasons why US projects look favorable with respect to their competitors, e.g. their capital costs (which are relatively low because several projects will to use existing import terminals for which they already have environmental approvals if the export facility is contained in the same geographic area) and the fact that the US offers significant skilled labor at reasonable cost.¹⁵ But the sky is not the limit going forward for US projects. First, capacity costs are not fixed and may well rise with an increase demand for skilled labor, as the overall economy improves.¹⁶ Second, the oil price level plays an important role. Leonardo Maugeri makes a compelling case that US LNG projects may be less competitive at an oil price (Brent) level of 80 USD, instead of the 100 USD, that for instance, Cheniere Energy has assumed. With many LNG projects indexed to the price of crude, the current price level would make LNG from Australia once again competitive in Asia.¹⁷ Moreover, in Europe in general LNG producers have to wonder what the absorptive capacity of the market will be. In Europe, LNG competes with cheap coal, price supports for renewables, and very competitive pipeline gas from Russia, Norway, the Netherlands, and Algeria. We believe it is likely that, even if large amounts of US LNG would make it to the European market that traditional suppliers would want to start a price war, rather than giving up market share.¹⁸ There is some

¹³ M.C. Moore et al., "Risky Business: The Issue of Timing, Entry and Performance in the Asia-Pacific LNG Market," The School of Public Policy SPP Research Papers, Volume 7, Issue 18, July 2014, <http://policyschool.ucalgary.ca/sites/default/files/research/moore-lng-onl.pdf>.

¹⁴ Brian Songhurst, "LNG Plant Cost Escalation," The Oxford Institute for Energy Studies, February 2014, <http://www.oxfordenergy.org/wpcms/wp-content/uploads/2014/02/NG-83.pdf>.

¹⁵ Leonardo Maugeri, "Falling Short: A Reality Check for Global LNG Exports," Harvard Kennedy School, December 2014, p. 21, <http://belfercenter.ksg.harvard.edu/files/Falling%20Short-LNG%202014.pdf>.

¹⁶ Ibid, p. 23.

¹⁷ Ibid, p. 33.

¹⁸ Tim Boersma et al., "Business as Usual European Gas Market Functioning in Times of Turmoil and Increasing Import Dependence," Brookings Institution, October 2014, p.22, http://www.brookings.edu/~media/Research/Files/Papers/2014/10/european-gas-market-import-dependence/business_as_usual_final_3.pdf?la=en.

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empirical evidence that US LNG could be very competitive in the more liquid parts of the European market, in particular the UK, but not in continental Europe. Moreover, in the case of Canada as well as the US, there may be substantial constraints (environmental and financial) that will hinder LNG projects to get to the market in time to compete against other emerging players in the market.

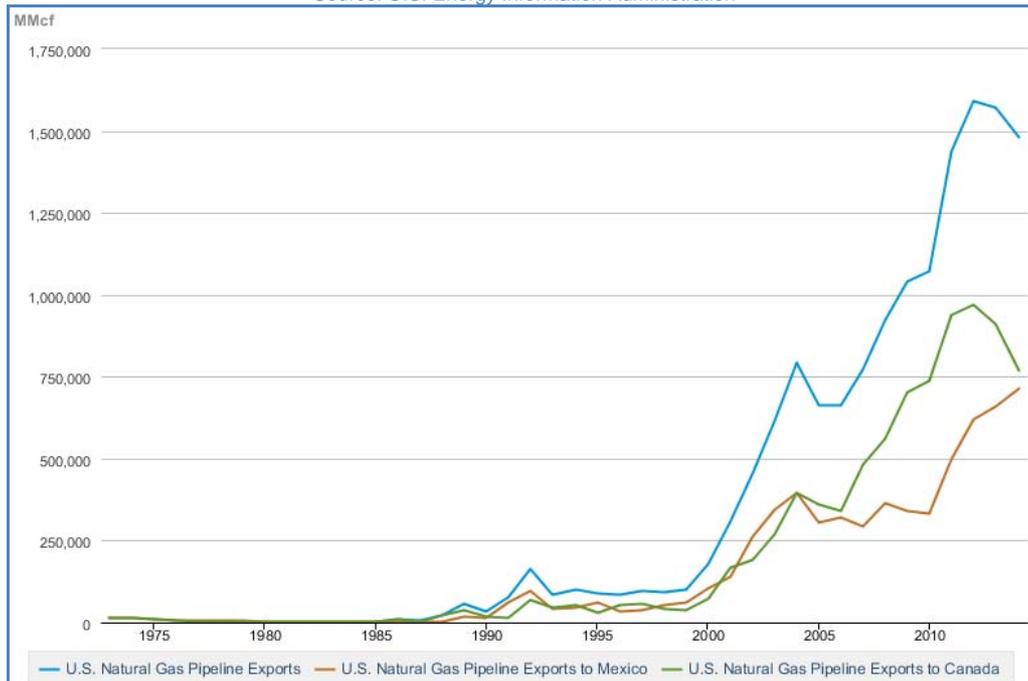
Some studies suggest that one of Canada's greatest obstacles is the timing of its market penetration in Asia, as they must have projects on-line by the 2020s to remain competitive. According to M.C. Moore et al., "delays beyond 2024 risk complete competitive loss of market entry for Canadian companies. Already British Columbia is behind schedule on the government's goal of having at least one terminal in operation by 2015."¹⁹ Thus, it is highly uncertain what amount of North American LNG will eventually make it to the market. We observe that at this point in time the amount of firm projects in the US can be counted on one hand, while in Canada there is no firm project. We also note that even full regulatory approval from FERC and DOE does not guarantee that a project is eventually built. After regulatory approval it requires financing, and at current price levels, and with more LNG (particularly the Australian projects) coming on stream, we believe that it is increasingly unlikely that projects other than the ones that are fully licensed will make it to the market before the mid-2020s. We do believe that the trend of increased regional gas exports will continue however, resulting in particular with vastly increased exports from the US to Mexico (Figure 2), and a further erosion of Canadian – US gas trade.

¹⁹ M.C. Moore et al., "Risky Business: The Issue of Timing, Entry and Performance in the Asia-Pacific LNG Market," The School of Public Policy SPP Research Papers, Volume 7, Issue 18, July 2014, <http://policyschool.ucalgary.ca/sites/default/files/research/moore-lng-onl.pdf>.



Figure 2: U.S. Natural Gas Exports and Re-exports by Country

Source: U.S. Energy Information Administration



Conclusions

From this overview, we reach the following conclusions:

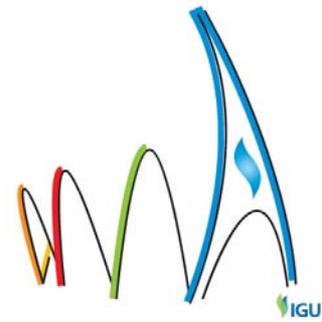
First, though the US regulatory process for LNG exports to countries with which the US does not have a free trade agreement are convoluted, lengthy, expensive, and could be further streamlined even though there is no outright ban to sell natural gas to any country. To date no project has been rejected by either DOE or FERC.

Second, we believe that 2-3 US LNG projects will make it to the market before 2020, and perhaps 5-6, totaling 6 – 8 bcf / day by 2025 but after that it becomes highly uncertain whether or not US LNG projects can be competitive in the global market. As noted, factors that are important to consider are alternative suppliers of LNG about to enter the market (Australia, Mozambique, Tanzania, Papua New Guinea, Russia, and Canada) as well as competition from existing suppliers such as Qatar, and pipeline supplies from Russia, Norway, Algeria, and perhaps by the mid-2020s Iran. Demand in Asia will be also be affected by the success, or lack thereof of additional, intercontinental pipeline projects. Russia continues to expand to new markets in Asia particularly in China, the Koreas, and Japan. Additionally, Central Asian countries are continuing to add new production and pipelines to the Asian power and industrial markets. Demand will also be affected by the likelihood of at least some countries tapping into their unconventional gas reserves in the coming years. If a country like China is successful in this endeavor this will decrease the

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market share of exporters. Prices too could also be affected, if for example, a country like Argentina or Algeria is successful with new quantities of gas beyond their domestic requirements then more supplies will reach global markets putting downwards pressure on prices. As well as, the possibility to increase the use of gas in transportation to reduce air pollution in India and China and other highly polluted megacities around the globe.

Furthermore, the degree to which Japan brings its nuclear reactors back on-line, whether in whole or in part, will have a dramatic impact on LNG demand. Finally, it remains to be seen whether there will be a global agreement on carbon emissions, as many energy forecasts seem to assume. Absent such an agreement, coal likely remains very competitive with LNG especially in Asia's burgeoning electricity market. Given all these market trends, the US will be a supplier to markets having the best market prices but those who believe that US .US cargoes will be a major alternative supplier to Europe will be mistaken.

Third, owing to strong environmental opposition by First Nations groups, leading local and international environmental organizations and fishing interests, it is unlikely that Canada will have a LNG terminal up and running before the end of the decade. Canadian projects are opposed on a number of grounds (siting, impact on fisheries, adding to CO2 emissions, pipelines serving the projects crossing wilderness areas in BC).

In sum, while North American LNG exports projects will have an impact on the market by offering alternative supplies to the market, they will not be nearly as transformative as many market observers currently forecast.