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U.S. Natural Gas Exports: New Opportunities, Uncertain Outcomes

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January 28, 2015

Congressional Research Service
7-5700
www.crs.gov
R42074

CRS REPORT
Prepared for Members and
Committees of Congress

Summary

As estimates for the amount of U.S. natural gas resources have grown, so have the prospects of rising U.S. natural gas exports. The United States is expected to go from a net importer of natural gas to a net exporter by 2016. With recent natural gas prices relatively low compared to global prices and historically low for the United States, producers are looking for new markets for their natural gas. Projects to export liquefied natural gas (LNG) by tanker ship have been proposed—cumulatively accounting for over 60% of current gross U.S. natural gas production. Pipeline exports, which accounted for 99% of all exports of U.S. natural gas in 2013, are also likely to continue rising. However, under the Natural Gas Act, the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC) must authorize the export of the natural gas commodity and related facilities, respectively. This overarching federal role in the expansion of U.S. natural gas exports has been the subject of ongoing oversight and debate in Congress.

What effect exporting natural gas will have on U.S. domestic prices is a central question in the debate over whether to export. A significant rise in U.S. natural gas exports would likely put upwards pressure on domestic prices, but the magnitude of any rise is uncertain. There are numerous factors that will affect prices: export volumes, economic growth, differences in local markets, and government regulations, among others. Producers contend that increased exports will not raise prices significantly as there is ample supply to meet domestic demand, and there will be the added benefits of increased revenues, trade, and jobs, and less flaring. Consumers of natural gas, who also benefit from the current low prices, fear prices will rise if natural gas is exported. The DOE's most recent price study concluded that greater LNG exports "result in higher levels of real gross domestic product (GDP), which more than offsets the adverse impact of somewhat higher energy prices." Export opponents have been critical of DOE's conclusions.

Environmental groups are split regarding natural gas use, with some favoring increased use to curb emissions of certain pollutants, while others oppose expanded use of natural gas because it is not as clean as renewable forms of energy, such as wind or solar. The use of hydraulic fracturing to produce shale gas for export markets has also raised concerns among environmental groups particularly concerned with its possible impacts on groundwater quality. The possibility of a significant increase in U.S. natural gas exports will factor into ongoing debates on the economy, energy independence, climate change, and energy security.

Congressional interest has focused on the DOE's process and criteria for approving LNG commodity exports to non-free trade agreement (FTA) countries. Several bills in the 114th Congress would facilitate the approval of such permits. Both the House and Senate versions of the LNG Permitting Certainty and Transparency Act (H.R. 351 and S. 33), the Domestic Prosperity and Global Freedom Act (H.R. 89), and the Export American Natural Gas Act of 2015 (H.R. 428) would impose various deadlines on DOE export permit decisions. The American Job Creation and Strategic Alliances LNG Act (H.R. 287) would extend free trade treatment to World Trade Organization member nations with respect to LNG export permitting by DOE. The Crude Oil Export Act (H.R. 156) would repeal limitations on export of Outer Continental Shelf natural gas under the Outer Continental Shelf Lands Act (43 U.S.C. 1354). Other bills have been introduced that would affect natural gas production and infrastructure.

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Introduction

The United States has exported natural gas for close to 100 years, but has generally exported less natural gas than it has imported.[1] U.S. gas exports have been primarily via pipeline to Mexico and eastern Canada. Historically, the United States has also exported liquefied natural gas (LNG) from Alaska—almost exclusively to Japan—but the volumes of those shipments have been relatively small and Alaska's natural gas market has been isolated from the rest of the United States.[2] Natural gas companies are now considering exporting greater quantities of U.S. LNG by tanker ship to a number of other countries. Increased development of U.S. natural gas resources—primarily shale gas—along with low domestic prices and idle LNG import infrastructure, have driven the change in the U.S. position.

Within the next several years, the United States may become a much larger natural gas exporter, particularly in the form of LNG. However, natural gas exports from the United States require federal approval pursuant to Section 3 of the Natural Gas Act (NGA, 15 U.S.C. §717b). The Department of Energy's (DOE's) Office of Fossil Energy and the Federal Energy Regulatory Commission (FERC) must authorize the export of the commodity and related facilities, respectively. This overarching federal role in the expansion of U.S. natural gas exports has been the subject of ongoing oversight and debate in Congress.

The prospect of the United States supplying a global market with large quantities of LNG from the lower-48 states raises concerns in Congress, particularly about a potential rise in what consumers pay for natural gas and effects on the economy.[3] Developers of natural gas export projects and natural gas producers argue that domestic gas prices will not rise significantly if U.S. natural gas exports increase because the United States has ample gas resources to meet both export and domestic demand. They argue that any domestic gas price increases due to exports would be more than offset by benefits from the increased gas production, such as higher employment and an improved trade balance. DOE has used the results of several studies it commissioned about the impact on domestic natural gas prices of exports and the effect on the U.S. economy to justify the approval of LNG export proposals. However, some stakeholders disagree with the agency's conclusions.

U.S. natural gas prices are lower than those in other international markets, partly because of the nature of the natural gas resources and partly due to competition in the U.S. market. Nevertheless, natural gas prices within the United States vary by region because of transportation limitations, access to supplies, and differences in demand. As new volumes of shale gas are developed, these supplies seek markets where little or no natural gas production has existed before. Over time, the U.S. natural gas market is reconfiguring itself to balance supply and demand regionally and nationally. But getting new natural gas supplies to market may be an ongoing challenge for the

[1] CRS held a seminar on LNG exports in 2013 for congressional staff. The archived seminar video is available for staff on the CRS website, http://www.crs.gov/programs/Pages/RecordedEventDetail.aspx?PRODCODE=WRE00058.

[2] For further background on Alaskan LNG, see CRS Report R43753, *U.S. Exports of Crude Oil and Natural Gas: The Case of Alaska*, by Paul W. Parfomak and Ian F. Fergusson.

[3] Exports of natural gas from Alaska are viewed differently as those resources are isolated from the rest of the U.S. market because natural gas prices in the lower 48 do not justify building the required infrastructure to transport natural gas via pipeline or as LNG. Additionally, there may not be any, Jones Act-compliant LNG tankers to transport natural gas to the market in the lower 48 states. In DOE's analysis of U.S. LNG exports, it has not factored LNG exports from Alaska into its analysis regarding impacts on the U.S. economy and domestic prices.

industry, whether within the United States or abroad. Infrastructure constraints, such as limited pipeline capacity, environmental regulations, and other regulatory requirements will play a part in how the natural gas market adjusts. Exports of natural gas either by pipeline or as LNG will be a factor as the market seeks balance, especially on a regional basis. Hence the potential export of more U.S. natural gas may have economic effects that vary significantly from region to region, and regional impacts may diverge from impacts on the nation as a whole. (For an illustration of regional natural gas price differentials in the lower-48 states, see **Appendix B**).

Other issues have also been raised regarding natural gas exports. Environmental groups are divided on the desirability of greater use of natural gas at home and abroad. Advocates see it as reducing emissions compared to other hydrocarbons, especially coal, whereas opponents point out that natural gas still emits carbon dioxide and other pollutants. Concerns about contamination of water supplies during gas production have been raised because of hydraulic fracturing ("fracking")—which uses water, sand, and chemicals to create fissures in shale, allowing the trapped natural gas to be cost-effectively extracted.[4] Other groups want to see greater use of natural gas in the U.S. economy for economic and national security concerns before it is exported overseas.[5]

The prospect of growing U.S. natural gas exports, particularly LNG, continues to be a factor as Congress debates the economy, energy independence, climate change, and energy security. Bills to expedite and expand LNG exports have been introduced in the 114th Congress, including the LNG Permitting Certainty and Transparency Act (H.R. 351 and S. 33), the American Job Creation and Strategic Alliances LNG Act (H.R. 287), the Crude Oil Export Act (H.R. 156), the Domestic Prosperity and Global Freedom Act (H.R. 89), and the Export American Natural Gas Act of 2015 (H.R. 428). This report examines what has changed in the U.S. natural gas market and the prospects and implications of the United States becoming a larger net exporter of natural gas.

U.S. Natural Gas Market Trends

Heading into the 2000s, the United States was expected to be a growing importer of natural gas because domestic gas production was declining and demand was rising (**Figure 1**). The U.S. Energy Information Administration (EIA) in its 1999 *Annual Energy Outlook* forecasted that net natural gas imports between 1997 and 2020 would grow from 12.9% of consumption to 15.5%, based on consumption growing faster than production.[6] To accommodate the potential increase in imports, five new LNG import terminals were built by industry in the latter half of the 2000s, and some existing LNG import facilities were re-commissioned and expanded. The United States currently has LNG import capacity of almost 14 billion cubic feet per day (bcfd) or over 5 trillion cubic feet (Tcf) per year. However, higher domestic production has made imports largely unnecessary, leaving existing import capacity mostly idle. In its *Annual Energy Outlook 2014*,

[4] For additional information and analysis of shale gas and fracking see CRS Report R41760, *Hydraulic Fracturing and Safe Drinking Water Act Regulatory Issues*, by Mary Tiemann and Adam Vann.

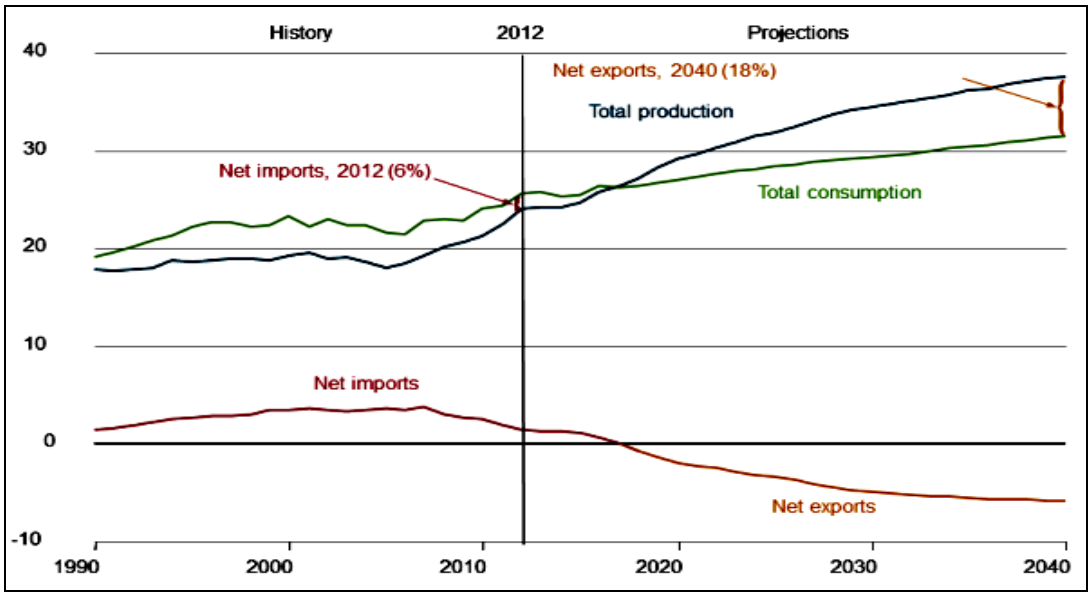
[5] For additional analysis of natural gas and the U.S. economy see CRS Report R42814, *Natural Gas in the U.S. Economy: Opportunities for Growth*, by Robert Pirog and Michael Ratner

[6] Energy Information Administration (EIA), *Annual Energy Outlook 1999 with Projections to 2020*, DOE/EIA-0383(99), Washington, DC, December 1998, p. 71, http://www.eia.gov/oiaf/archive/aeo99/pdf/0383(99).pdf.

EIA projects that the United States will be an overall net natural gas exporter by around 2016, when U.S. production exceeds domestic consumption (**Figure 1**).[7]

Figure 1. U.S. Natural Gas Production, Consumption, and Trade

Trillion Cubic Feet



Source: Energy Information Administration, *Annual Energy Outlook 2014*, DOE/EIA-0383(2014), April 2014, Fig. MT-42, http://www.eia.gov/forecasts/aeo/mt_naturalgas.cfm.

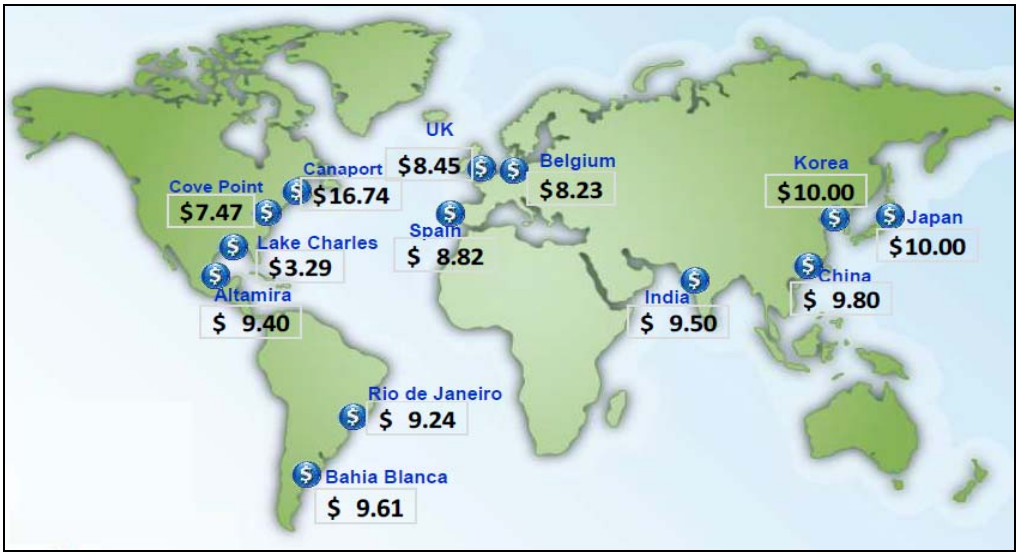
The abundance of new domestic natural gas supplies shifted industry interest from building LNG import terminals to constructing LNG export terminals. As of the beginning of January 2015, there have been 48 applications for permits either to construct liquefaction facilities at existing LNG import terminals (also known as regasification facilities) or for new LNG export facilities, in order to export domestically produced natural gas as LNG. The total capacity proposed is approximately 42 bcfd. In addition, companies have active permits to re-export LNG cargos from existing import terminals, which involves taking in foreign LNG cargos, holding them in storage, and then reloading them onto LNG tankers for shipment to foreign markets. Increased pipeline exports to Canada and Mexico may also continue to rise if their domestic demand continues to increase.

Low U.S. natural gas prices (especially in the Gulf of Mexico) relative to other international markets have spurred interest in exporting U.S. produced natural gas (**Figure 2**). What effect exporting natural gas will have on U.S. prices and the overall U.S. economy are central questions in the debate over whether to export. DOE has commissioned several studies as part of its evaluation of whether LNG exports to non-free-trade-agreement (non-FTA) countries are in the public interest, further discussed later in this report.

[7] Energy Information Administration, *Annual Energy Outlook 2014*, DOE/EIA-0383(2014), April 2014, Fig. MT-42, http://www.eia.gov/forecasts/aeo/mt_naturalgas.cfm.

Figure 2. Estimated Global Natural Gas Prices—January 2015

Dollars per MMBtu



Source: FERC, *National Natural Gas Market Overview*, December 2015, http://www.ferc.gov/market-oversight/mkt-gas/overview/ngas-ovr-lng-wld-pr-est.pdf.

Notes: MMBtu = million British thermal unit. Landed prices are based on a netback calculation.

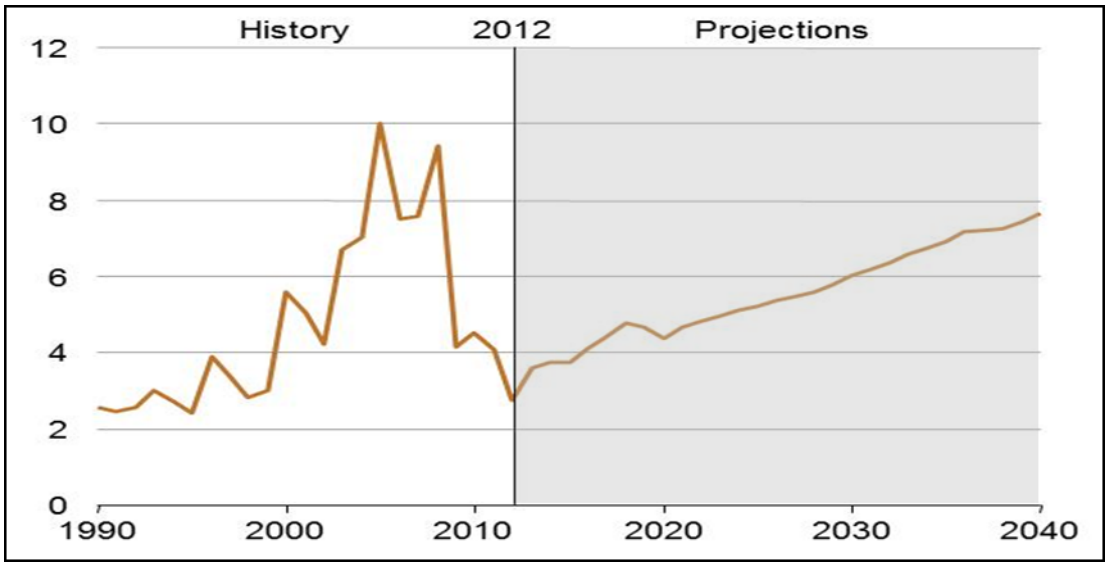
Lower U.S. natural gas prices since 2008 along with a large and growing resource base have also prompted calls for greater use of natural gas in the nation's overall fuel mix. Natural gas comprised about 27% of U.S. primary energy consumption last year and has averaged approximately 24% per year since 1973.[8] Instead of exporting U.S. natural gas, some say, the United States should increase use of natural gas in the electric power sector to displace coal, as an alternative transportation fuel to displace oil, and to provide fuel and feedstock to domestic industries such as petrochemicals. Some transition to natural gas is already occurring, particularly in the electric power sector.[9] However, the EIA's annual average projected prices to 2040 (which assume no changes in U.S. policy) never reach the price peaks of the latter 2000s (**Figure 3**).

[8] Energy Information Administration, *Monthly Energy Review December 2014*, December 23, 2014, Table 1.3.

[9] For additional information about natural gas in electrical power generation, see CRS Report R42950, *Prospects for Coal in Electric Power and Industry*, by Richard J. Campbell, Peter Folger, and Phillip Brown.

Figure 3. Annual U.S. Natural Gas Prices, 1990-2040

2012 dollars per Million British Thermal Units (MMBtu)



Source: Energy Information Administration, *Annual Energy Outlook 2014*, DOE/EIA-0383(2014), April 2014, Fig. MT-40, http://www.eia.gov/forecasts/aeo/mt_naturalgas.cfm

Notes: Annual average Henry Hub spot natural gas prices in the Reference case.

U.S. Natural Gas Exports to Date

Total U.S. natural gas exports are relatively small but have grown since 1999, increasing more than 15-fold through 2012 (**Figure 4**). The United States has been exporting natural gas since at least the 1930s, primarily to Canada and Mexico.[10] In 2013, over 99% of exports were by pipeline to these two countries. Starting in 1969, a small amount of natural gas was also exported as LNG to Japan via the Kenai LNG terminal in Alaska. Kenai LNG operated continuously from its opening until its temporary idling in 2012. In April 2014, the facility's owner announced that it would reopen the Kenai LNG terminal because the local area gas supply forecast had increased, providing a renewed opportunity to export Alaskan natural gas production in excess of local demand.[11] It remains the only completed LNG export facility in North America although it is currently not shipping any LNG.

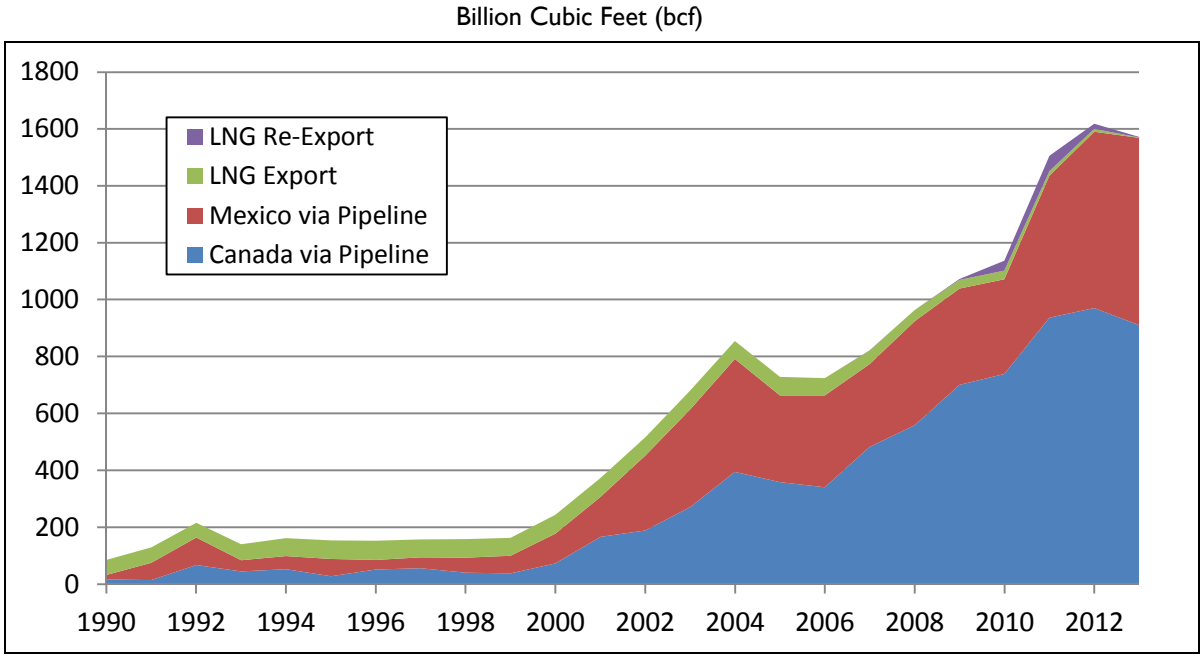
In 2010, the United States, through DOE's Office of Fossil Energy, allowed LNG import terminals to re-export foreign-sourced LNG to international markets. LNG volumes that are re-exported from the United States after being imported from third countries are not treated the same way as exports of domestically produced natural gas for the purposes of federal regulation. LNG re-export volumes are small, but have exceeded U.S. LNG export volumes in recent years due to the steady decline of LNG exports since 2005 (**Figure 4**).

[10] Data are unavailable earlier than the 1930s and are distinguished by receiving country only since the 1950s.

[11] ConocoPhillips Alaska, "ConocoPhillips Announces Resumption of Exports from the Kenai LNG Facility," press release, April 14, 2014.

Growing U.S. natural gas production, primarily from shale gas, has decreased the demand for both pipeline imports and LNG imports, leaving the import terminals mostly idle. Although most of the applications for LNG exports would build new facilities, the projects considered most viable are those that add liquefaction to existing import terminals. In some cases companies that have partnered in a facility have both applied for licenses, but the volumes are only included once in DOE's data.

Figure 4. U.S. Annual Natural Gas Exports and Re-Exports 1990-2013



Source: EIA natural gas exports database, http://www.eia.doe.gov/dnav/ng/ng_move_expc_s1_a.htm.

Notes: LNG exports by volume are negligible to other countries besides Japan. Full year data have not been released for 2014.

Pipeline Exports Increase

Natural gas exports by pipeline have risen since 1999, increasing over 15 times through 2013 and accounting for over 99% of total natural gas exports that year. Canada and Mexico, both free trade partners, are the only recipients of U.S. natural gas exports by pipeline. As countries with which the United States has free trade agreements (FTAs), exports of natural gas to both are assumed to be in the national interest by statute, thereby expediting the approval process for projects. The St. Clair, MI, transit point to Canada and the Roma, TX, transit point to Mexico are the busiest for U.S. natural gas exports (**Appendix A**).

Gross exports to Canada and Mexico have both increased since 1999, growing 24-fold and 10-fold, respectively. Facilitated by the 1994 North American Free Trade Agreement, new cross border natural gas pipelines have expedited this trade. However, Canadian natural gas production has declined almost 17% since peaking in 2002, but still remains above the level of Canadian consumption. Some of Canada's "imports" of natural gas from the United States are actually from gas produced in Canada's western provinces, imported into the United States, and re-exported to

Canada's eastern provinces. This is a cost-effective way to transport the natural gas given pipeline constraints within Canada. Mexican natural gas consumption has increased about 80% since 2002, growing more than Mexico's production.

LNG Activity on the Move

As stated above, U.S. LNG exports began in 1969 with the opening of the Kenai LNG export terminal in Alaska. While this facility was the only U.S. LNG export terminal for several decades, numerous new LNG export projects have been advancing in the United States.

LNG Re-Exports: A Temporary Fix

As stated above, some U.S. LNG exporters try to take advantage of the idle U.S. import terminals to store foreign-sourced LNG and wait for higher world prices. This trend almost doubled U.S. LNG exports to other countries, including new recipients such as Brazil, India, Spain, and the United Kingdom. Using these idled LNG facilities for re-export helps maintain their operating capabilities in light of significantly decreased use to import LNG. Currently, seven companies have received permission to re-export LNG cargos from foreign countries with four applications pending.[12] In order to re-export LNG, minimal or no additional equipment may need to be added to an import terminal. As mentioned above, DOE's Office of Fossil Energy must approve the change as does FERC.

Exports of Domestically Produced Natural Gas as LNG

There have been 48 applications for permits to export domestically produced natural gas as LNG, with a cumulative capacity of almost 15,330 billion cubic feet (bcf) per year or almost 63% of current U.S. production (**Table 1**).[13] Eight of these liquefaction projects plan to adapt an existing LNG import terminal for export, which would require construction of liquefaction facilities at the import terminals, a major financial investment in the range of $6 billion to $10 billion per terminal, mostly depending on capacity. The other projects would construct new LNG export terminals, costing in the range of $20 billion each. Almost all the projects have received approval to export to free trade countries, but only the Sabine Pass Liquefaction (first application), Freeport LNG Expansion, Cameron LNG, and Carib Energy projects have received DOE final approval to export U.S. produced natural gas to non-FTA countries.[14] Of the FTA countries, only Canada, Chile, Dominican Republic, Mexico, and South Korea have existing LNG import terminals. South Korea is the second-largest importer of LNG globally.

[12] Department of Energy, Office of Fossil Energy, *Status of Short-Term Applications to Export Previously Imported LNG*, March 5, 2013, http://fossil.energy.gov/programs/gasregulation/reports/Previously_Imported_LNG.pdf.

[13] DOE, Office of Fossil Energy, *Authorizations Database*, Washington, DC, January 30, 2013, http://fossil.energy.gov/programs/gasregulation/reports/summary_lng_applications.pdf.

[14] Free Trade Agreement countries that require national treatment include Australia, Bahrain, Canada, Chile, Dominican Republic, El Salvador, Guatemala, Honduras, Jordan, Mexico, Morocco, Nicaragua, Oman, Peru, Singapore, and South Korea.

Table 1. Proposed North American LNG Export Projects

Company	Location	Volume (bcfd) FTA/ non-FTA	Permit Status: DOE FTA/non-FTA Commodity	Permit Status: FERC/ MARAD Facility	Permit Status: Facility Construction
Sabine Pass Liquefaction	Louisiana	2.2	Approved/Approved	Approved	Approved
Freeport LNG Expansion and FLNG Liquefaction[a]	Texas	1.4	Approved/Approved	Approved	Approved
		1.4/0.4	Approved/Approved		
Lake Charles Exports[b]	Louisiana	2.0	Approved/Cond. Approval	Pending	
Carib Energy[c]	NA	0.03/0.01	Approved/Approved	NA	NA
Dominion Cove Point LNG	Maryland	1.0/0.77	Approved/Cond. Approval	Approved	Approved
Jordan Cove Energy Project	Oregon	1.2/0.8	Approved/Cond. Approval	Pending	
Cameron LNG	Louisiana	1.7	Approved/Approved	Approved	Approved
Gulf Coast LNG Export	Texas	2.8	Approved/Pending		
Gulf LNG Liquefaction	Mississippi	1.5	Approved/Pending	Pending	
LNG Development Company (Oregon LNG)	Oregon	1.25	Approved/Cond. Approval	Pending	
SB Power Solutions[c]	NA	0.07	Approved/NA		
Southern LNG Company	Georgia	0.5	Approved/Pending	Pending	
Excelerate Liquefaction Solutions	Texas	1.38	Approved/Pending	Pending	
Golden Pass Products	Texas	2.0	Approved/Pending	Pending	
Cheniere Marketing	Texas	2.1	Approved/Pending	Approved	
Main Pass Energy Hub[d]	Louisiana	3.22	Approved/NA		
CE FLNG	Louisiana	1.07	Approved/Pending	Pending	
Waller LNG Services	Louisiana	0.16	Approved/NA		
Next Decade Partners	Texas	1.09	Approved/Pending		
Magnolia LNG	Louisiana	0.54	Approved/NA	Pending	
Trunkline LNG Export[b]	Louisiana	2.0	Approved/Pending	Pending	
Gasfin Development USA	Louisiana	0.2	Approved/NA		
Freeport-McMoRan Energy[d]	Louisiana	3.22	Approved/Pending		
Sabine Pass Liquefaction[e]	Louisiana	0.28	Approved/Pending	Pending	
Sabine Pass Liquefaction[e]	Louisiana	0.28	Approved/Pending	Pending	
Venture Global Calcasieu Pass	Louisiana	0.67	Approved/Pending	Pending	

			Permit Status		
Company	Location	Volume (bcfd) FTA/ non-FTA	DOE FTA/non-FTA Commodity	FERC/ MARAD Facility	Facility Construction
Advanced Energy Solutions[c]	Florida	0.02	Approved/NA		
Argent Marine[c]	NA	0.003	Approved/NA		
Eos LNG[d]	Texas	1.6	Approved/Pending		
Barca LNG[d]	Texas	1.6	Approved/Pending		
Sabine Pass Liquefaction	Louisiana	0.86	Approved/Pending		
Delfin LNG	Louisiana	1.8	Approved/Pending		
Magnolia LNG	Louisiana	0.54/1.08	Approved/Pending		
Annova LNG Common Infr.	Texas	0.94	Approved/NA		
Texas LNG	Texas	0.27	Approved/Pending		
Louisiana LNG	Louisiana	0.28	Approved/Pending	Pending	
Alturas	Texas	0.2	Pending/NA		
Strom	Florida	0.08	Approved/NA		
Strom	Florida	0.02	NA/Pending		
Strom	Florida	0.02	NA/Pending		
SCT&E LNG	Louisiana	1.6	Approved/Pending		
Venture Global Calcasieu Pass	Louisiana	0.67	Approved/Pending	Pending	
Sabine Pass Liquefaction	Louisiana	0.56	Pending/NA		
Downeast LNG	Maine	0.46	Pending/Pending	Pending	
Cameron LNG	Louisiana	0.42	Pending/NA		
Air Flow North America	Texas	0.002	NA/Pending		
American LNG Marketing	Florida	0.008	Pending/Pending		

Source: Department of Energy, Office of Fossil Energy, Natural Gas Regulatory Responsibilities databases, http://fossil.energy.gov/programs/gasregulation/reports/summary_lng_applications.pdf.

Notes: NA = Not Applicable. Conditional Approvals by DOE were issued under the previous approval procedures and were pending Federal Energy Regulatory Commission (FERC) approval. No additional Conditional Approvals will be issued, but those in affect will be processed under the previous procedures. If one number appears in the Volume column it is for both FTA and non-FTA permits, but is not cumulative.

a. DOE received a new application from FLEX to add 1.4 bcf/d of capacity at the Freeport LNG terminal for both FTA and non-FTA countries.

b. Lake Charles Exports and Trunkline LNG Export have both filed to export LNG from the Lake Charles Terminal. The 2.0 bcf/d volumes are not additive.

c. Project will use cryogenic containers to export LNG in small amounts on cargo ships and does not need a specialized export terminal like the other projects.

d. Main Pass Energy Hub, LLC (LCE) and Freeport McMoRan Energy LLC (FME) have both filed to export from the Main Pass Energy Hub. The 3.22 bcf/d volumes are not additive and only FME includes exports to non-FTA countries. As an offshore facility project, these companies have applied to the Maritime Administration (MARAD), which improves offshore facilities instead of FERC.

e. This is an expansion of the Sabine Pass Liquefaction project at the top of the table.

The modification or expansion of existing LNG terminals to incorporate liquefaction equipment, storage tanks, compressors, piping, and other equipment, requires authorization from FERC. Depending on the nature of individual facility modifications, compliance with additional state or federal statutory or regulatory requirements may also be required. For example, facility modifications would be subject to environmental review under the National Environmental Policy Act (NEPA). Potential regulatory requirements are discussed later in this report.

Alaska LNG Project

As stated earlier, Alaska represents a distinct natural gas market with substantial natural gas resources. The U.S. Geological Survey (USGS) has estimated that conventional natural gas reserves on Alaska's North Slope potentially exceed 200 trillion cubic feet (Tcf), over eight times the total annual gas consumption of the United States.[15] Alaskan officials and North Slope producers have been pursuing a proposal to construct a pipeline from the North Slope to Nikiski, on the Kenai Peninsula, where a new LNG terminal would be constructed for LNG export. The project—Alaska LNG Project L.L.C. (Alaska LNG)—would consist of a gas treatment plant on the North Slope, an 800-mile pipeline, and a new LNG liquefaction plant and marine terminal at a total project cost estimated between $45 billion and $65 billion.[16]

On July 18, 2014, Alaska LNG's sponsors applied to the DOE for authorization to export approximately 929 billion cubic feet of LNG annually to both FTA and non-FTA countries over a 30-year term (beginning no later than 12 years after authorization is granted).[17] In submitting its application, Alaska LNG requested expedited review and exemption from new procedures under DOE's current Order of Precedence administrative queue on the grounds that the project's gas reserves were "more than sufficient" to serve local demand as well as exports and were "geographically isolated from the lower-48 states."[18] Energy Secretary Moniz reportedly agreed to "treat Alaska differently" from the other export applications because export of natural gas from Alaska would not affect markets in the lower-48 states and, therefore, the "public interest is not an issue" for the DOE.[19] On September 5, 2014, Alaska LNG submitted a request to FERC to commence the commission's pre-filing process in preparation for filing an application for the facility authorization.

[15] U.S. Geological Survey, *Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle,* Fact Sheet 2008-304, 2008, Table 1, http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf; U.S. Energy Information Administration, *Annual Energy Outlook 2013*, DOE/EIA-0383(2013), April 2011, p. 147.

[16] ExxonMobil, "Alaska LNG Project Selects Lead Terminal Location," press release, October 7, 2013.

[17] Alaska LNG Project LLC, *Application of Alaska LNG Project LLC for Long-Term Authorization to Export Liquefied Natural Gas*, Department of Energy, Office of Fossil Energy Docket No. 14-96-LNG, July 18, 2014, p. 1.

[18] Ibid.

[19] Tim Bradner, "DOE to Streamline Export License for Alaska LNG Project," *Alaska Journal of Commerce*, August 19, 2014.

Trade: Agreements or Disagreements?

Most companies seeking permits to export LNG have applied to export LNG to countries with which the United States does not have a free trade agreement (FTA) in addition to those with which the United States does have an FTA. As mentioned above, exports to FTA countries are presumptively considered "in the public interest" under the Natural Gas Act, as amended. Of the 38.07 bcfd non-FTA applications, 5.74 bcfd have received final approval from DOE. As noted above, South Korea is the only major importer of LNG of the countries with which the United States has a free trade agreement. Of the other FTA countries, four have LNG import terminals, while the rest export natural gas, receive natural gas via pipeline, or do not import natural gas. In order for LNG export projects to be financially viable, they will likely need the ability to export to non-FTA countries.

The United States is in negotiations on two multi-nation free trade agreements: the Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership (TTIP).[20] Both these agreements would give the signatories free trade status when it comes to U.S. natural gas exports. TPP includes Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, and Vietnam. Japan is the largest LNG importer in the world and would add significantly to potential markets for U.S. LNG exports. Of the four U.S. LNG export projects that have received approval to export to non-FTA countries, Japanese companies have signed contracts with two of the projects directly and one indirectly. Japan was a late participant in the TPP process; one of its motivations for joining was access to U.S. LNG exports.[21] TTIP is a proposed agreement between the United States and the European Union. Among other negotiating objectives, the EU is seeking to gain access to U.S. LNG through a comprehensive energy chapter in the TTIP, to lessen its dependence on Russian and other sources of natural gas and to increase purchasing options or a stronger position in price negotiations.

The prospect of the United States limiting or restricting LNG exports has raised questions, particularly as a member of the World Trade Organization (WTO). The General Agreement on Tariffs and Trade's (GATT's) Article XI, General Prohibition Against Quantitative Restraints, states:

> No prohibition or restrictions other than duties, taxes or other charges made effective through quotas, import or export licenses or other measures, shall be instituted or maintained by any contracting party on the importation of any product of the territory of any other contracting party or on the exportation or sale for export of any product destined for the territory of any other contracting party.

There are exceptions to Article XI based on the conservation of exhaustible natural resources or the necessity to protect human health, which may apply if the United States restricts LNG exports.[22] However, these exceptions may be dependent on a country restricting its own production. Additionally, restricting LNG exports may put the United States in a contradictory position vis-à-vis cases it has brought to the WTO, specifically its successful case against China

[20] For additional information on the two agreements see CRS Report, *The Trans-Pacific Partnership Negotiations and Issues for Congress*, by Ian F. Fergusson and CRS Report R43158, *Proposed Transatlantic Trade and Investment Partnership (T-TIP): In Brief*, by Shayerah Ilias Akhtar and Vivian C. Jones

[21] Discussion with Amb. Koji Tsuruoka, Chief Negotiator for the Trans-Pacific Strategic Economic Partnership, August 6, 2013.

[22] See GATT Article XX.

for limiting the export of rare earths and other metals. The position of the United States as a promoter of free trade may also be challenged.

Natural gas imports and exports comprise a small fraction of overall U.S. international trade, totaling about $25.7 billion in 2013, with a little more than half of the value coming from imports.[23] While the United States was a net importer of natural gas of almost $8 billion in 2012, U.S. net imports were only about $650 million in 2015. LNG imports and exports accounted for 5% of total trade in petroleum gases and gaseous hydrocarbons (HTS2711) in 2013. Since 2000, the value of HTS 2711 exports has averaged almost $6.1 billion per year while imports averaged $24.9 billion.[24]

The Global LNG Market

If all the proposed U.S. LNG export projects were operational today, the United States would rank first in the world, by far, for global export capacity. However, U.S. LNG exports will face competition in the global LNG market. According to one study, global liquefaction capacity is projected to rise by almost 50% by 2020 (**Figure 5**), including only one of the U.S. projects. Many non-U.S. projects are much further along than the U.S. projects. In 2013 LNG trade accounted for 31% of all natural gas traded internationally.[25]

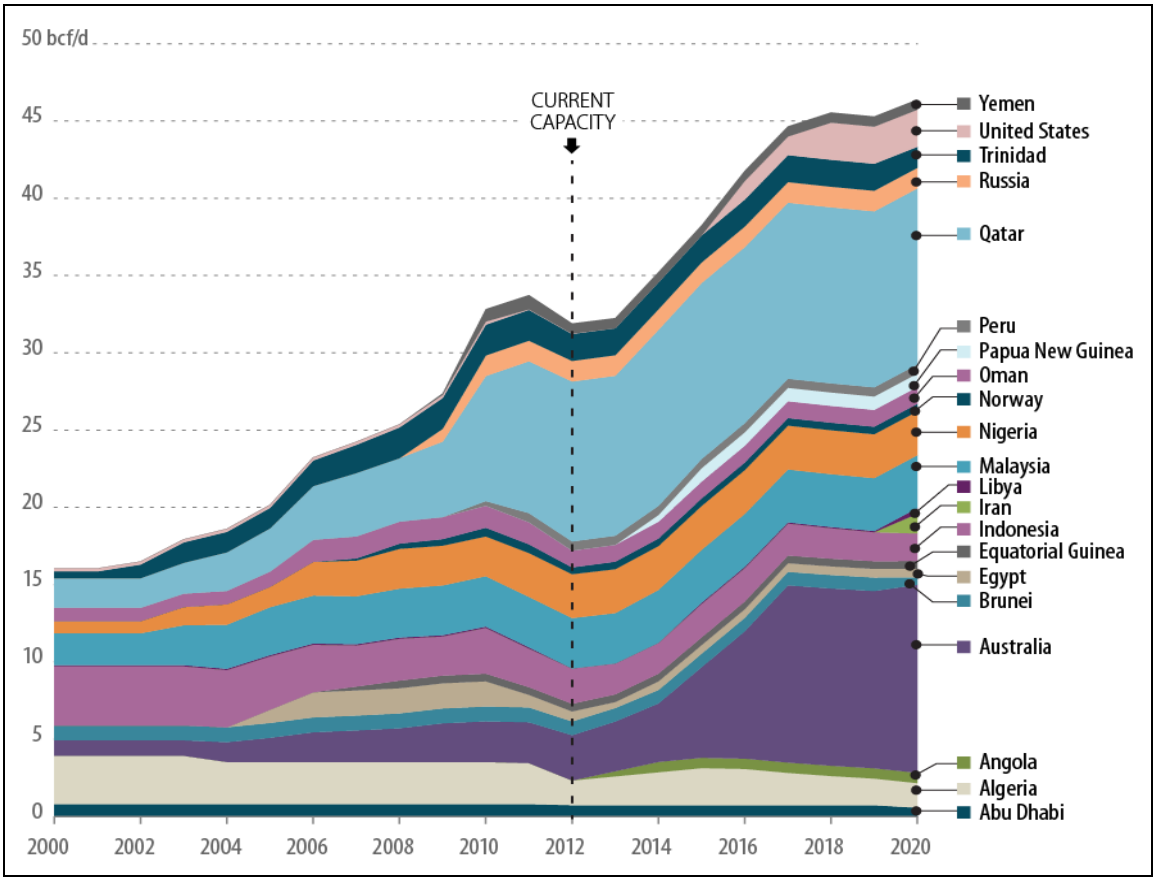
[23] U.S. Energy Information Administration, *U.S. Imports by Point of Entry and U.S. Exports by Point of Exit*, Washington, DC, January 31, 2013, http://www.eia.gov/naturalgas/data.cfm#imports.

[24] International Trade Commission, Trade Dataweb, HTS2711, general import/total export figures, compiled January 27, 2015.

[25] BP, *BP Statistical Review of World Energy 2014*, June 2014, p. 28, http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2014/BP-statistical-review-of-world-energy-2014-full-report.pdf.

Figure 5. Actual and Projected LNG Production Capacity 2000-2020

Billion cubic feet per day (Bcfd)



Source: PIRA Energy Group, 2012.

Notes: This graphic includes projects that are operating, under construction, or have reached a final investment decision. The only new U.S. project included is Cheniere's Sabine Pass terminal. The other proposed U.S. projects are still considered speculative. Units = billion cubic feet per day (bcfd).

Most LNG sold in the world is under long-term contracts indexed to oil prices. Long-term contracts are needed to finance the liquefaction facilities, usually the most expensive part of the LNG supply chain, which also includes LNG tankers, storage, and LNG import terminals. U.S. natural gas prices are natural gas market-based, which can give U.S. LNG export projects an advantage because the differential with oil-indexed natural gas prices can be large compared to the U.S. price (**Figure 2**). U.S. LNG exports could add to the pressure for other countries to delink their natural gas exports—either as LNG or by pipeline—from oil-indexed prices. Japanese companies, for example, have been vocal about their interest in a natural gas-based pricing mechanism to reduce costs and exposure to oil prices. Several recent LNG supply contracts with proposed U.S. exporters are of this type. However, recent declines in global oil prices have reduced the oil-indexed versus gas-indexed price differential. Furthermore, U.S. LNG export contracts will still need to be long-term (usually 20 or longer) to obtain financing. For some facilities, this may be a difficult hurdle to overcome given market and financial conditions and recent price volatility. Providing LNG to countries that use oil for heating, industrial processes, or electricity generation could also decrease demand for petroleum products, putting further downward pressure on oil prices.

The dip in 2012 in **Figure 5** is due to major declines in Algeria, Trinidad & Tobago, Oman, and Indonesia. Algeria's two export terminals have been undergoing maintenance and one is being rebuilt. Trinidad & Tobago's decline is mostly because the United States is no longer a big importer of LNG. Egypt and Libya declined because of the turmoil in those countries.

Many of the projected projects in **Figure 5** are targeting the Asian LNG demand centers. Although the locations of most of the proposed U.S. export terminals are on the U.S. Gulf Coast and the East Coast, Asia may be the target market for U.S. LNG, as it tends to pay higher prices for its natural gas imports. The widening of the Panama Canal, scheduled to be completed in 2015, would contribute to U.S. competitiveness in Asia. Europe has a lot of LNG import capacity and growing demand, but needs to continue to improve its infrastructure connections to transport gas to markets.[26] Russia, the main supplier of natural gas to Europe, may be put under increasing pressure by U.S. export projects to further delink its natural gas prices from oil. U.S. LNG exports could also provide options for some countries that are highly dependent on one supplier.

Federal Approvals Required for LNG Exports

Overview of Approvals Required Under the NGA

Pursuant to Section 3(a) of the Natural Gas Act, parties seeking to enter into natural gas transactions with foreign buyers must file for an export authorization under the rules and procedures established by DOE.[27] If the United States has an FTA in effect with the nation to which the LNG would be exported, that application will be automatically deemed consistent with the "public interest."[28] Exports to non-FTA countries are presumed to be in the public interest, unless, after opportunity for a hearing, DOE finds that the authorization would not be consistent with the public interest.[29] Pursuant to Section 3(e) of the NGA, the siting, construction, expansion, or operation of an LNG export terminal, onshore or in state waters, requires approval from FERC.[30] Depending on the details of the commodity export or terminal facility, compliance with requirements established under additional state, tribal, or federal law may also apply to the project.

LNG permit approvals from DOE and FERC are federal actions subject to environmental review under the National Environmental Policy Act (NEPA, 42 U.S.C. 4321 *et seq*.). For DOE, this means that, before it can decide whether to approve a request to export natural gas, it must complete its public interest evaluation of the export, to ensure compliance with the NGA, and its review of the environmental impacts of the export, to ensure compliance with NEPA. If an application to DOE to export LNG requires a separate approval from FERC, DOE does not

[26] For more information on Europe's natural gas situation, see CRS Report R42405, *Europe's Energy Security: Options and Challenges to Natural Gas Supply Diversification*, coordinated by Michael Ratner.

[27] 15 U.S.C. §717b(a); DOE regulations implementing those requirements were promulgated at 10 C.F.R. Part 590, "Administrative Procedures with Respect to the Import and Export of Natural Gas."

[28] 15 U.S.C.§717b(c).

[29] 15 U.S.C.§717b(a).

[30] See 15 U.S.C. §717b(e). FERC regulations implementing this section of the NGA were promulgated at 18 C.F.R. Part 153, "Applications for Authorization to Construct, Operate, or Modify Facilities Used for the Export or Import of Natural Gas."

prepare a separate environmental review under NEPA. Instead, DOE has chosen to adopt FERC's review of environmental impacts related to the LNG export terminal.

Summary of DOE Public Interest Evaluation Process

The NGA does not detail what DOE must evaluate to make a public interest determination. According to DOE, its primary public interest evaluation is on the domestic need for natural gas that is proposed to be exported, but may consider any other issues determined to be appropriate. Those other factors may include U.S. energy security, economic impacts (e.g., domestic natural gas prices), and environmental considerations, among others. Generally, the administrative process for reviewing applications to export natural gas includes the following steps:

- An entity submits an application to DOE with information regarding the proposed export;[31]
- After ensuring it has all necessary information about the project, DOE publishes a notice in the *Federal Register* inviting public participation and comment on the proposed project;[32]
- DOE and, typically, the applicant respond to comments or protests;
- DOE considers any other relevant information included in the administrative record and issues a final opinion and order on the application, attaching any necessary conditions it determines are needed to ensure the project is in the public interest.[33]

In addition to public comments and protests and responses to those comments and protests, the administrative record for any given request for export authorization will include, among other information, the necessary NEPA documentation (see discussion in "NEPA and Other Federal Requirements Applicable to LNG Exports") and reports prepared by or for DOE that evaluate issues that are broadly applicable to the export of natural gas (see discussion in "Reports Informing DOE's Public Interest Evaluation").

Reports Informing DOE's Public Interest Evaluation

The administrative record for a given request to export LNG includes certain reports that DOE will use to inform its decision related to natural gas exports. In particular, as part of its process in determining whether LNG exports to non-FTA countries are "not consistent with the public interest," DOE's Office of Fossil Energy has commissioned three studies: (1) a domestic price impact study by EIA and released in January 2012;[34] (2) an economic impact study by NERA

[31] As required in 10 C.F.R. §590.202.

[32] 10 C.F.R. §590.205.

[33] 10 C.F.R. §590.404.

[34] Energy Information Administration, Effect of Increased Natural Gas Exports on Domestic Energy Markets, January 2012, http://energy.gov/sites/prod/files/2013/04/f0/fe_eia_lng.pdf.

Economic Consulting (NERA) and released in December 2012;[35] and (3) another domestic price impact study by EIA and released October 2014.[36]

Both the first EIA price analysis and the subsequent NERA economic study were criticized. When EIA released its 2012 price analysis study, the scenarios it examined per DOE's request were viewed as unrealistic. The high export scenario EIA examined was for 12 bcf/d, which is now well below the cumulative volumes for which companies have applied to DOE. According to EIA's analysis, the range of increases to domestic prices was 9.6% to 32.5%. Proponents of exports emphasized the former figure, while opponents focused on the latter. The basic conclusion of the 2012 NERA study was that LNG exports would benefit the overall U.S. economy. The study acknowledged that there would be parts of the economy that would be hurt by LNG exports, mainly large consumers of natural gas, but that on a net basis the U.S. economy would be better off in all export cases. The net benefits would be highest if the United States could produce large quantities of low cost shale gas and global demand for natural gas increases rapidly. Criticism of the NERA report from some Members of Congress focused on the narrowness of its results, the use of outdated data, and incomplete market information, among other things.[37] Both reports left enough latitude in their results for supporters and opponents of exports to promote their opinions.

The overall conclusions of EIA's 2014 price study were generally in line with those of the two prior studies from 2012. Among its specific findings were the following:

- Increased LNG exports in the scenarios considered lead to projected average natural gas prices in the lower-48 states 4% (12 bcfd scenario) to 11% (20 bcfd scenario) higher than their base projection over the 2015-2040 period.
- Natural gas markets in the United States balance in response to increased LNG exports mainly through increased natural gas production.
- Supply from higher domestic production is augmented by reductions in natural gas use by domestic end-users, who respond to higher domestic natural gas prices.
- Increased LNG exports result in higher total primary energy use and energy-related CO^2 emissions in the United States.
- Consumer expenditures for natural gas and electricity increase modestly with added LNG exports.
- Added U.S. LNG exports, and associated investment, result in higher levels of real gross domestic product (GDP), which more than offsets the adverse impact of somewhat higher energy prices when the export scenarios are applied. [38]

[35] NERA Economic Consulting, *Macroeconomic Impacts of LNG Exports from the United States*, December 2012, http://energy.gov/sites/prod/files/2013/04/f0/nera_lng_report.pdf.

[36] Energy Information Administration, *Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets*, October 2014, http://www.eia.gov/analysis/requests/fe/pdf/lng.pdf.

[37] Office of Senator Ron Wyden, "Wyden Highlights Flaws in DOE Export Study," press release, January 10, 2013, http://www.wyden.senate.gov/news/press-releases/wyden-highlights-flaws-in-doe-export-study-.

[38] Energy Information Administration, October 2014, p.12, http://www.eia.gov/analysis/requests/fe/pdf/lng.pdf.

Like the earlier studies, however, some opponents have focused on the higher ranges of the projected price impacts in the EIA's 2014 study,[39] or have been critical of its methodology.[40]

Criticism of the DOE's studies is open to debate. For example, in its conditional approval to export to non-FTA countries for the Cove Point LNG terminal, DOE defended its data use from EIA's *Annual Energy Outlook 2011* due to timing, but also noted that critics often cite the subsequent rise in demand projected in EIA's Annual Energy Outlook 2012 and the Early Release data from EIA's *Annual Energy Outlook 2013* while neglecting to highlight the corresponding rise in domestic production.[41] These studies are predicated upon a predetermined a set of parameters (e.g., volumes of LNG exported) to examine and asked for the impact on the overall U.S. economy.

A full analysis of the NERA and EIA studies, as well as the myriad of other studies that have also been undertaken by other groups, is beyond the scope of this report. It is important to remember, however, that these price studies are just one part of DOE's criteria for determining whether LNG exports to non-FTA countries are or are not in the public interest. In its approval of Cheniere Energy's non-FTA permit, DOE listed other criteria it used to make that determination: domestic need, adequacy of supply, the environment, geopolitics, and energy security. DOE has also provided insights into the "public interest" evaluation in a set of Policy Guidelines issued in 1984, Order No. 1471, and Delegation Order No. 0204-111. These were mostly to assess imports, but DOE has held that they also apply to exports.[42]

NEPA and Other Federal Requirements Applicable to LNG Exports

NEPA requires federal agencies to identify and consider the environmental impacts of an action and to inform the public of those impacts *before* a final agency decision is made.[43] To demonstrate compliance with NEPA, a federal agency must prepare an environmental impact statement (EIS) if a project will have significant environmental impacts.[44] If impacts are uncertain, an agency may prepare an environmental assessment (EA) to determine whether an EIS is needed or if a finding of no significant impact (FONSI) may be issued. Projects that are known to have no significant impacts are categorically excluded from the requirement to prepare

[39] See, for example, American Public Gas Association, "EIA Study Shows Exports Cause Natural Gas Price to More than Double," press release, 2014, http://www.apga.org/i4a/headlines/headlinedetails.cfm?id=2227.

[40] Laura Barron-Lopez, "Feds: Natural Gas Exports Would Boost Economy, Raise Prices," *The Hill*, October 29, 2014.

[41] U.S. Department of Energy, Office of Fossil Energy, Order Conditionally Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Cove Point LNG Terminal to Non-Free Trade Agreement Nations, DOE/FE Order No. 3331, Washington, DC, September 11, 2012, pp. 86-87, http://energy.gov/sites/prod/files/2013/09/f2/Order%203331.pdf.

[42] Department of Energy, Office of Fossil Energy, *Opinion and Order Conditionally Granting Long-Term Authorization to Export Liquefied Natural Gas from Sabine Pass LNG Terminal to Non-Free Trade Agreement Nations*, FE Docket No. 10-111-LNG, Washington, DC, May 20, 2011, pp. 28-29.

[43] Under Section 102 of NEPA, all federal agencies are required to include in "every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on—the environmental impact of the proposed action" (42 U.S.C. §4332(2)(C)(i)).

[44] The Council on Environmental Quality (CEQ) promulgated regulations implementing NEPA, broadly applicable to all federal agencies, under 40 C.F.R. Parts 1500-1508. DOE adopted and supplemented the CEQ regulations to establish procedures the agency must use to comply with NEPA at 10 C.F.R. Part 1021. FERC promulgated its own regulations implementing NEPA at 18 C.F.R. Part 380.

an EA or EIS (referred to as categorical exclusions or CEs). In its regulations implementing NEPA, DOE identifies the types of projects that it is authorized to approve and the level of review generally required for those actions. With regard to actions it is authorized to approve under Section 3 of the NGA, DOE identifies—

- **actions that require an EIS** to include export approvals that would require construction of major new natural gas pipelines/related facilities, significant expansions and modifications of existing pipelines/related facilities, or major operational changes;[45]
- **actions that require EA and result in a FONSI** to include export approvals that would require minor new construction (e.g., adding new connections to an existing LNG pipeline);[46]
- **actions approved as a CE** to include export approvals that would require minor operational changes (e.g., changes in natural gas throughput or storage operations), but not new construction.[47]

It would appear that DOE's determination of whether or not an LNG export approval would result in significant impacts on the environment is largely dependent on factors related to an export terminal (i.e., actions subject to FERC approval). To date, FERC's evaluation of impacts related to export terminals has involved the preparation of an EA/FONSI or EIS.[48] As required under NEPA, FERC serves as the lead agency responsible for preparing those documents and DOE serves as a "cooperating agency."[49] Once completed by FERC, DOE adopted FERC's final EIS or EA/FONSI to serve as its own NEPA document. However, DOE has also issued the following environmental reports that address issues more broadly related to LNG exports:

- *Addendum to Environmental Review Documents Concerning Exports of Natural Gas From the United States*;[50] and
- *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States*.[51]

Each report has been and will be included as part of the public record for requests to export LNG. With regard to the first report, DOE stated that it was prepared to evaluate the environmental impacts associated with natural gas exploration and development. DOE did so to be responsive to concerns raised by the public, but asserted that it was not required to do so to comply with NEPA. DOE stated that the purpose of the second report is to provide additional information to both the public and to DOE to inform its decisions regarding the life cycle greenhouse gas (GHG) emissions of U.S. LNG exports for use in electric power generation.

[45] 10 C.F.R. Part 1021, Subpart D, Appendix D, actions D8 and D9.

[46] 10 C.F.R. Part 1021, Subpart D, Appendix C, action C13.

[47] 10 C.F.R. Part 1021, Subpart D, Appendix B, action B5.7.

[48] For FERC's summary of it pre-filing process, see https://www.ferc.gov/help/processes/flow/lng-1.asp.

[49] A cooperating agency is one with special expertise or legal jurisdiction over some element of the project. The agency is obligated to assist the lead agency in preparing the required NEPA document (see 40 C.F.R. §§1501.6, 1508.5, and 1508.15).

[50] The report and DOE's discussion of its purpose is available at http://energy.gov/fe/draft-addendum-environmental-review-documents-concerning-exports-natural-gas-united-states.

[51] The report and DOE's discussion of its purpose is available at http://energy.gov/fe/life-cycle-greenhouse-gas-perspective-exporting-liquefied-natural-gas-united-states.

Generally, within the context of identifying potential environmental impacts of an action, under NEPA, a federal agency identifies any environmental compliance requirements that would apply to the project as a result of those impacts. Compliance may require FERC or DOE to obtain some level of input, analysis, or approval from another federal agency, or possibly a tribal or state agency, before a final decision on the application is made. For example, the following are federal statutes that often apply to the construction or expansion of LNG export terminals and the agencies that may be required to evaluate and/or approve some element of the project:

- Clean Water Act—the U.S. Army Corps of Engineers, the Environmental Protection Agency (EPA), the U.S. Coast Guard, and state environmental protection agencies;
- Clean Air Act—EPA and state environmental protection agencies;
- Endangered Species Act—the Department of the Interior's U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration Fisheries Service, and state natural resource agencies;
- National Historic Preservation Act—the Advisory Council on Historic Preservation, the State Historic Preservation Officer, or Tribal Historic Preservation Officer; and
- Rivers and Harbors Act—the U.S. Coast Guard.

In addition to meeting applicable environmental requirements, a project may be subject to safety or security-related requirements implemented by agencies including, but not limited to:

- The Department of Homeland Security's U.S. Coast Guard and Department of Transportation's Office of Pipeline Safety (OPS) within the Pipeline and Hazardous Materials Safety Administration (PHMSA);
- National Fire Protection Association (NFPA); and
- Federal Emergency Management Agency (FEMA).

For additional information on siting a liquefied natural gas terminal see CRS Report RL32205, *Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety, and Regulation*, by Paul W. Parfomak and Adam Vann.

DOE Permit Application Order of Precedence

DOE has not laid out a specific timetable for when it will process pending LNG export applications. Prior to August 15, 2014, the department followed an export approval process involving "conditional" approvals for commodity exports prior to FERC's issuance of terminal facility authorization. At any point before issuing a final order to authorize an applicant's request to export natural gas, DOE may issue a conditional authorization/approval to that applicant.[52] Conditional decisions to approve natural gas exports were issued after completion of the public notice and comment process, but before completion of DOE's NEPA review (i.e., adoption of FERC's NEPA document). When it issued such an approval, DOE stated that it considered all factors relating to the public interest, other than environmental factors, and that it would

[52] As allowed under 10 C.F.R. §590.402.

reconsider all relevant issues associated with the conditional approval once the required NEPA documentation is complete. Under this scheme, DOE processed LNG export applications in the following order of precedence:

1. All pending DOE applications where the applicant had received approval (either on or before December 5, 2012)[53] from the FERC to use the FERC pre-filing process, in the order the DOE application was received,
2. Pending DOE applications in which the applicant did not receive approval (either on or before December 5, 2012) from FERC to use the FERC pre-filing process, in the order the DOE application was received,
3. Future DOE applications, in the order the DOE applications are received.[54]

On August 15, 2014, DOE announced its new "Procedures for Liquefied Natural Gas Export Decisions."[55] In that announcement, DOE stated that the new procedures do not amend existing regulations to eliminate conditional authorizations, but that it will cease the practice of issuing such approvals. Instead, DOE will now act on an application for non-FTA exports when it is "ready for final action," described by DOE as when it has sufficient information on which to base a public interest determination and when it has completed its NEPA review.[56] More specifically, for projects requiring an EIS, that would be 30 days after publication of a final EIS; for projects requiring an EA, that would be upon publication of a FONSI; or upon DOE's determination that an application may be approved as a CE. DOE has not further specified conditions under which it may have sufficient information to base a public interest determination. The change was made in part because the DOE had concluded that conditional approvals were not necessary for LNG projects to secure financing, as was assumed under the prior process. The department also wished to focus its resources more effectively on those LNG export proposals most likely to proceed.[57]

Regardless of whether an entity received a conditional authorization from DOE, no applicant can export natural gas until it receives a final order and approval from DOE and, if needed, approval from FERC. Further, since the adoption of the FERC NEPA document currently serves as DOE's NEPA compliance process, DOE cannot finalize its public interest review until FERC's NEPA review is complete.

New Sources of Natural Gas

The growth in U.S. natural gas resources, particularly from shale gas, and the projected continued growth are what make increased natural gas exports a possibility. U.S. natural gas reserves have climbed approximately 80% since 2000 and 60% since 2005 (**Figure 6**). These data include reductions for natural gas extracted during the period and so are net increases. In recent years, the increase in reserves is mostly attributed to development of shale gas, which has grown from 10%

[53] The December 5, 2012, date coincided with the NERA study's publicly release.

[54] Office of Oil Gas Global Security Supply, *Pending Long-Term Applications to Export LNG to Non-FTA Countries - Listed in Order DOE Will Commence Processing*, Office of Fossil Energy, U.S. Department of Energy, Washington, DC, September 10, 2013.

[55] At 79 *Federal Register* 48132, also available at http://energy.gov/fe/downloads/order-precedence-non-fta-lng-export-applications.

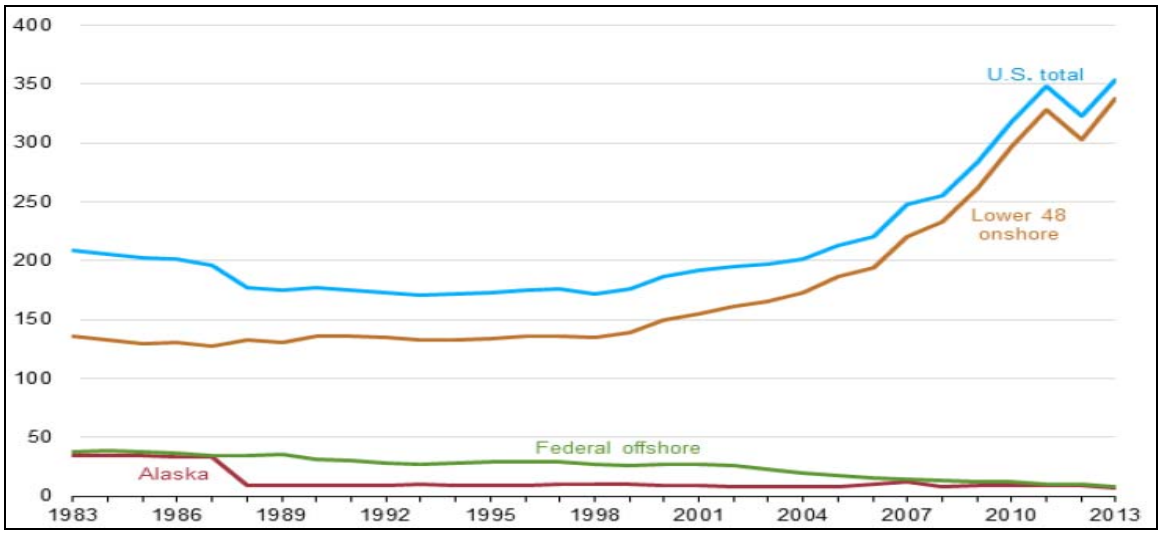
[56] Ibid, p. 48133.

[57] 79 *Fed. Reg*. 158. August 15, 2014, p. 48133.

of U.S. natural gas reserves in 2007 to 45% in 2013. By comparison, conventional U.S. natural gas reserves declined between 2007 and 2008, and fell again in 2010. Though the decline was marginal, it highlights the importance of shale gas to future U.S. natural gas production. Many industry analysts expect shale gas reserves to continue to rise and make up a greater portion of U.S. natural gas reserves unless new restrictions are placed on the industry, such as rules related to hydraulic fracturing, power plant emissions, pipeline development, or other factors.

Figure 6. U.S. Total Natural Gas Proved Reserves, 1983-2013

Trillion cubic feet



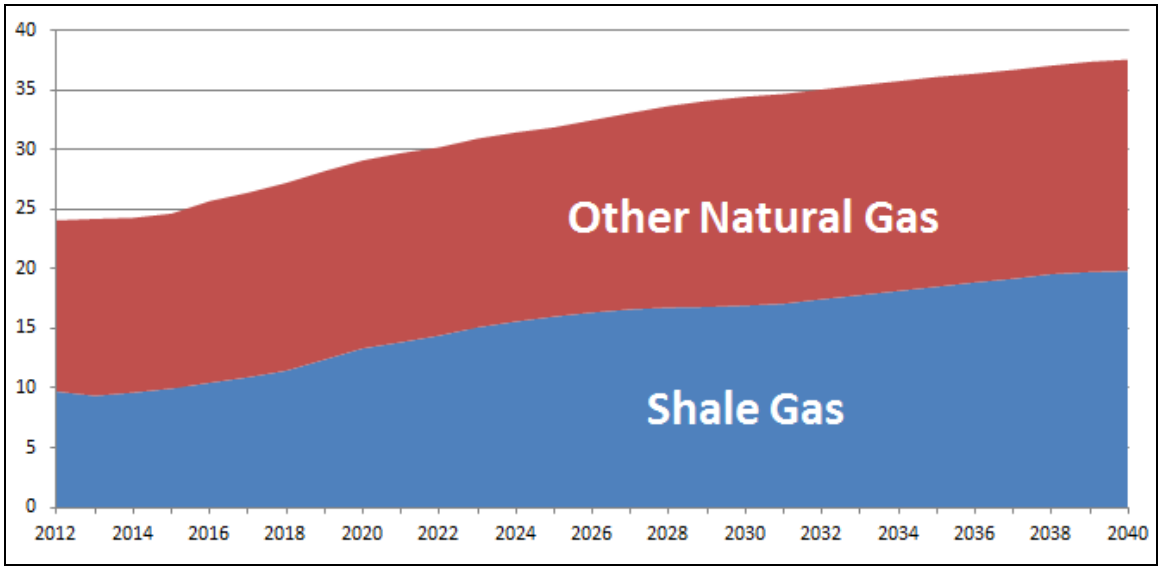
Source: Energy Information Administration, *U.S. Crude Oil and Natural Gas Proved Reserves*, December 2014, p. 11.

Projected Future Growth

In 2012, natural gas became the most produced fuel, on an energy equivalent basis, in the United States, surpassing coal for the first time. This change was driven by the success of shale gas development. EIA, which makes projections based on current policy and information, estimated in its *Annual Energy Outlook 2014* that overall U.S. natural gas production will grow 56% between 2012 and 2040 (**Figure 7**). Shale gas will comprise over 50% of that production.

Figure 7. Projected Annual U.S. Natural Gas Production

(Trillion cubic feet)



Source: Energy Information Administration, *Annual Energy Outlook 2014*, DOE/EIA-0383 (2014), April 2014, p. A-28.

Natural Gas Liquids: A Production Driver

Natural gas liquids (NGLs) have taken on a new prominence as shale gas production has increased and prices have fallen. NGL is a general term for all liquid products separated from natural gas at a gas processing plant including ethane, propane, butane, and pentane. When NGLs are present with methane, which is the primary component of natural gas, the natural gas is referred to as either "hot" or "wet" gas. Once the NGLs are removed from the methane the natural gas is referred to as "dry" gas, which is what most consumers use. Each NGL has its own market and its own value. As the price for dry gas has dropped because of the increase in supply and other reasons such as the warm winter of 2011, the natural gas industry has turned its attention to producing more wet gas in order to bolster the value it receives. Some companies have shifted their production portfolios to tight oil formations, such as the Bakken in North Dakota, to capitalize on the experience they gained in shale gas development. Historically, the individual NGL products have been priced against oil, except for ethane, and as oil prices have remained higher since 2005 relative to natural gas, it has driven an increase of wet gas production, thereby maintaining the amount of dry gas as a production "byproduct" despite its low price.

Congressional Actions and Considerations

Several bills in the 114th Congress directly relate to LNG exports, primarily facilitating the approval of exports to non-FTA countries. Both the House and Senate versions of the LNG Permitting Certainty and Transparency Act (H.R. 351 and S. 33) would impose a 30-day or 45-day deadline, respectively, on DOE export permit decisions after a final environmental impact statement is issued under NEPA, among other provisions. The Domestic Prosperity and Global Freedom Act (H.R. 89) would impose a similar 30-day deadline on DOE permit decisions. The Export American Natural Gas Act of 2015 (H.R. 428) would impose a 60-day deadline on DOE permit decisions beginning on the date the DOE receives a completed application, an applicant

signs an LNG export contract, or enactment of the bill, whichever is later. The American Job Creation and Strategic Alliances LNG Act (H.R. 287) would extend FTA nation treatment to World Trade Organization member nations with respect to LNG export permitting by DOE. The Crude Oil Export Act (H.R. 156) would repeal limitations on export of Outer Continental Shelf natural gas under Section 28 of the Outer Continental Shelf Lands Act (43 U.S.C. 1354). Other bills, such as the Natural Gas Pipeline Permitting Reform Act (H.R. 161), would also affect natural gas production and infrastructure affecting LNG exports.

Issues and Interests

The public focus on U.S. exports of natural gas has been on the applications to export LNG, despite the United States exporting much more natural gas by pipeline. Groups such as the Industrial Energy Consumers of America (IECA), a national association of manufacturing companies, and the American Public Gas Association (APGA), a national association of publicly owned natural gas distribution systems, have filed motions to intervene against or have lobbied Congress in opposition to various LNG export projects or bills to facilitate exports.[58] Both of these organizations represent firms that use natural gas and would be negatively affected if natural gas prices rose. Natural gas producers and certain local businesses have supported the projects, as they would benefit from access to new overseas markets and higher international prices. Analyses of the price effects of potential natural gas exports likely will receive continued attention as companies move forward with their projects. The Sierra Club has filed against projects on environmental grounds, particularly related to the source of natural gas for export.

Expectations about the economic impacts of greater U.S. natural gas exports depend on assumptions about the volume of exports, economic growth, market segmentation, and environmental regulations, among other market parameters. Some initial estimates projected a modest rise in absolute terms in domestic natural gas prices if all the proposed export projects are built, premised on a relatively flat supply curve for natural gas. These estimates also projected that U.S. natural gas prices would stay relatively low in historic terms as well as in comparison to global prices. Those in favor of exports add that increased production could result in increased revenue for local, state, and federal governments (through taxes, royalty payments, and economic development), more employment, an improved international trade balance, and reductions in natural gas flaring.[59] Natural gas consumers counter that higher natural gas prices abroad could eventually lead to higher prices in the United States, and possible supply shortages, as producers seek to maximize profits by diverting more and more U.S. natural gas to overseas markets.[60]

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[58] See, for example: Paul N. Cicio, President, Industrial Energy Consumers of America, Letter to Senator John Barrasso, "Re: IECA Opposes S. 33, the "LNG Permitting Certainty and Transparency Act," January 27, 2015, http://www.ieca-us.com/wp-content/uploads/01.27.15_S-33-Opposition-Letter.pdf.

American Public Gas Association, "APGA Files Motion to Intervene and Protest Freeport Export Application," press release, March 28, 2011, http://www.apga.org/files/public/Press%20Releases/2011/Press%20Release%20-%20Motion%20to%20Intervene%20in%20Freeport%20Application,%202011.pdf.

American Public Gas Association, "APGA Files Motion to Intervene in Sabine Pass LNG Export Facility Application," press release, March 4, 2011, http://www.apga.org/files/public/Press%20Releases/2011/Press%20Release%20-%20Comments%20Sabine%20Pass-%20March%203,%202011.pdf.

[59] Flaring is combusting natural gas as a means to eliminate it because it may be impracticable to use, capture, or transport. Flaring is usually done as a safety or health precaution, during the exploration and development phases leading to production.

[60] Margaret Ryan, "USAEE Notebook: DOE Weighing LNG Export Price Effect," *AOL Energy*, Internet blog, October

(continued...)

In the near term, increased use of natural gas in the U.S. economy is limited, primarily to electric power generation.[61] Natural gas-fired electric power plants account for a significant and growing share of U.S. natural gas demand. Although coal remains the dominant fuel for U.S. electric power generation, environmental concerns regarding atmospheric emissions are limiting its use and prompting the retirement of older coal plants that are less equipped to curtail emissions. Switching from coal to natural gas in electric power generation may consume incremental U.S. natural gas supply increases before exports do. There are many proposed petrochemicals projects, but these are at various stages of development and will take a number of years to come to fruition. Other sectors such as transportation, industrial, commercial, and residential are not likely to see a substantial rise in natural gas demand in the next couple of years. This could change if technologies can be improved to increase the use of natural gas in transportation, such as gas-to-liquids, natural gas vehicles, or electric vehicles (assuming the electricity is generated by natural gas). Although proponents see strategic value in such fuel-switching as a means to reduce U.S. dependence on imported oil, high technology costs diminish this prospect in the near term.

Although much less attention is paid to natural gas exports by pipeline, it is anticipated that these will continue to increase. Canada's natural gas production has been declining, but it is possible this will be reversed as Canada develops its own shale gas resources, which are estimated to be large. However, Canadian consumption may also increase as production from oil sands is projected to rise. Natural gas is heavily used in the extraction of petroleum from oil sands. Canada also has at least two of its own LNG export projects being considered. A recent EIA study estimated Canada's technically recoverable shale gas resources at 573 trillion cubic feet, over 100 years' worth at the country's current production rate.[62] If Canada develops these resources, they could be an additional source of natural gas for the United States as well.

Mexico's natural gas production has been rising steadily for the last decade, but not quickly enough to keep up with consumption. Imports now account for almost 27% of consumption compared to under 10% in 2000, and imports from the United States made up over 70% of all natural gas imports to Mexico in 2013.[63] Although Mexico may have significant technically recoverable shale gas resources, 545 trillion cubic feet or 364 years at their current production level, Mexico is much further behind in developing these resources than the United States and Canada,[64] and will likely remain dependent on U.S. supplies to meet growing demand.

Receiving permits to export natural gas by pipeline to Canada and Mexico is typically easier than receiving a permit to build an LNG export facility, even though pipeline projects require authorization from the Secretaries of Defense and State. Both Canada and Mexico are FTA

(...continued)

10, 2011, http://energy.aol.com/2011/10/10/usaee-notebook-doe-weighing-lng-export-price-effect/.

[61] For additional information on natural gas in the U.S. economy, see CRS Report R42814, *Natural Gas in the U.S. Economy: Opportunities for Growth*, by Robert Pirog and Michael Ratner.

[62] U.S. Energy Information Administration, Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States, Washington, DC, June 2013, p. 6, http://www.eia.gov/todayinenergy/detail.cfm?id=11611.

[63] BP, *BP Statistical Review of World Energy 2014*, June 2014, p. 28, http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2014/BP-statistical-review-of-world-energy-2014-full-report.pdf.

[64] U.S. Energy Information Administration, *Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States,* Washington, DC, June 2013, p. 6, http://www.eia.gov/todayinenergy/detail.cfm?id=11611.

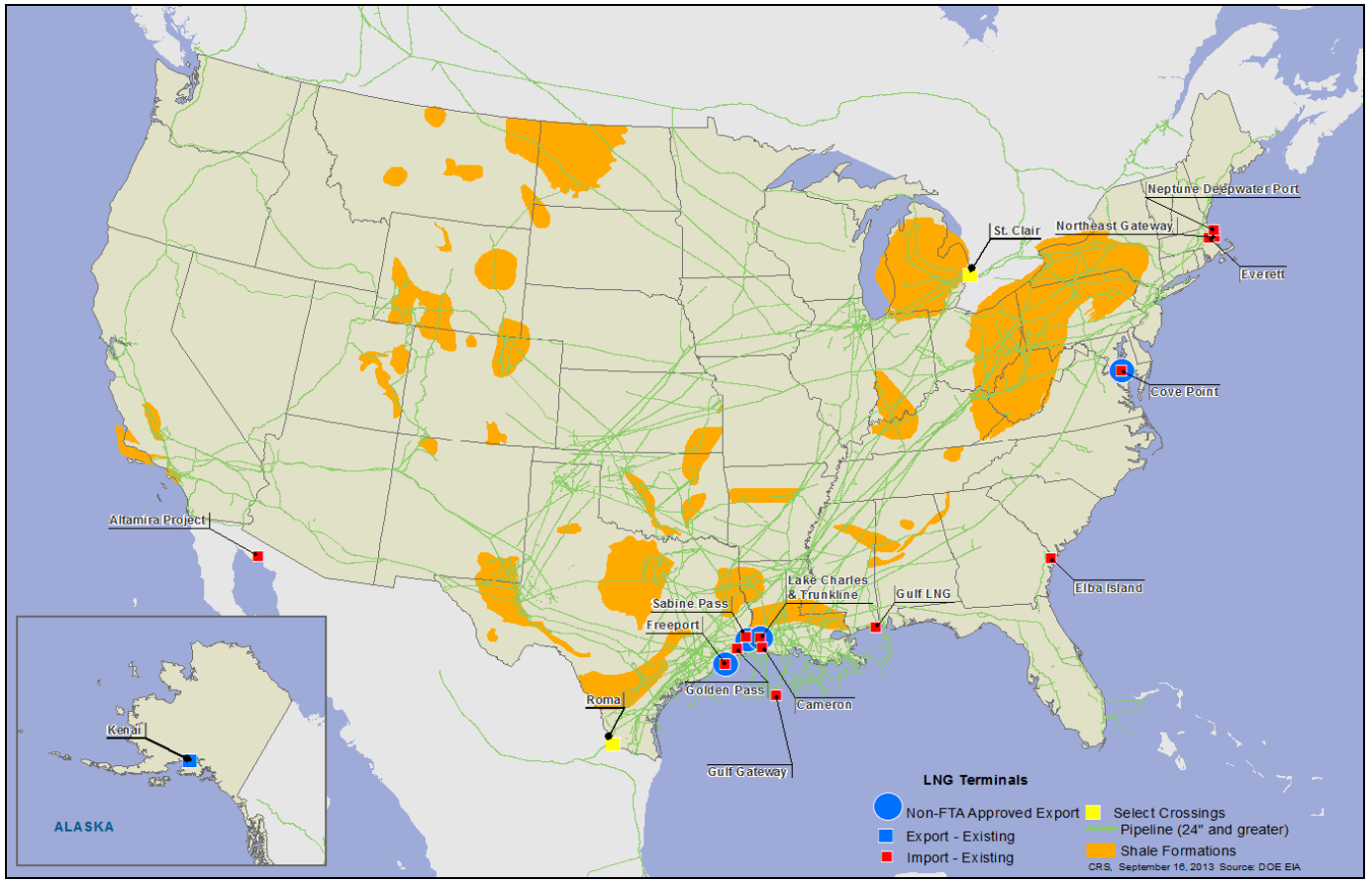
countries and exports are assumed to be in the U.S. national interest by statute. Pipeline export projects tend to be less costly and easier to finance than LNG export projects may be.

As highlighted above, the development of shale gas resources will be a key factor in the United States becoming a net natural gas exporter. Infrastructure constraints within some of the major shale gas producing areas may limit the amount of natural gas that can reach markets and be available for export. Changes to the regulatory environment would also have an impact on natural gas production.

Environmental groups differ on the desirability of greater natural gas use in general. Although burning natural gas produces less pollution than burning other fossil fuels, it still emits greenhouse gases and other atmospheric pollutants. Some environmental groups view natural gas as a necessary bridge fuel to a zero carbon economy, while others want to go to the zero carbon economy directly. Some environmental groups see natural gas exports raising domestic natural gas prices, making renewables more viable. Additionally, there are concerns about risks to water supplies associated with hydraulic fracturing, the technique for extracting shale gas which uses water, sand, and chemicals to create fissures in shale, allowing the trapped natural gas to be cost-effectively extracted. The possibility of increased shale gas development and pipeline construction in the United States to supply overseas LNG buyers troubles some environmental advocates.

Appendix A. Select U.S. Natural Gas Import and Export Infrastructure

Figure A-1. Select U.S. Natural Gas Import and Export Infrastructure



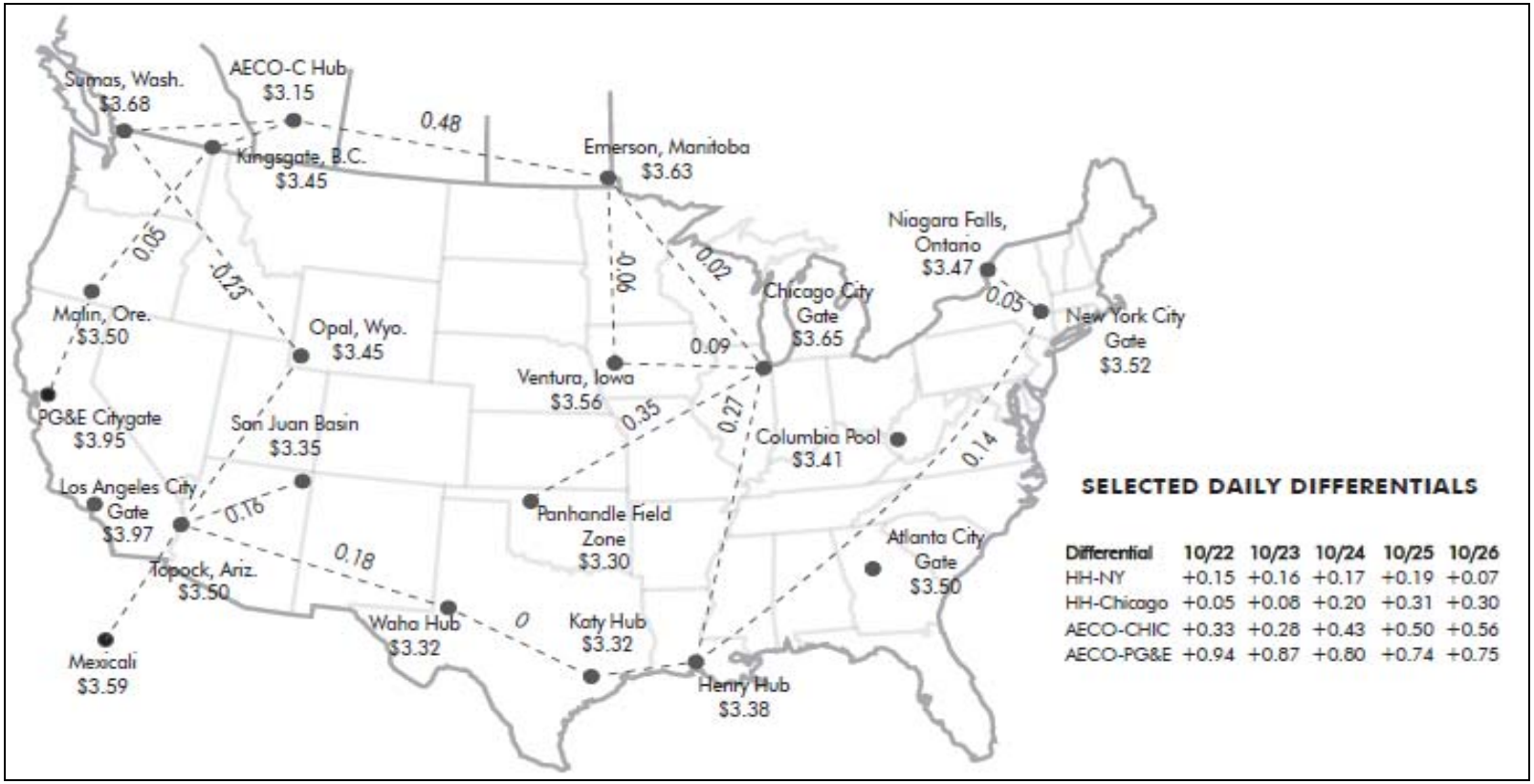
Source: Compiled by CRS from EIA sources.

Notes: Hawaii is not shown on this map because it has very limited natural gas infrastructure.

Appendix B. Lower-48 States Natural Gas Hub Map

Figure B-1. Natural Gas Hub and City Gate Prices and Differentials, October 29, 2012

(Dollars per MMBtu, Volume-weighted)



Source: *Natural Gas Week*, October 29, 2012, p. 4.

Notes: The figures along the dotted lines indicate transportation costs between hubs and city gates. Hubs are major intersections of multiple pipelines. City gates are the transfer point between interstate pipelines and local natural gas distribution systems. Alaska and Hawaii are not included on this map as their markets are distinct from the lower 48 states.

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Acknowledgments

Elizabeth Roberts, Laura Hanson, and James Uzel of CRS's Knowledge Services Group contributed to the research for this report. Amber Wilhelm in CRS's Publishing and Editorial Resources Section contributed to the completion of this report.