



## Industrial Energy Consumers of America

*The Voice of the Industrial Energy Consumers*

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1776 K Street, NW, Suite 720 • Washington, D.C. 20006  
Telephone (202) 223-1420 • [www.ieca-us.org](http://www.ieca-us.org)

April 13, 2017

The Honorable Rick Perry  
Secretary  
U.S. Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585

Dear Secretary Perry:

We again, congratulate you as our 14<sup>th</sup> Secretary of Energy. The Industrial Energy Consumers of America (IECA) is sending this letter in response to the LNG policy positions and claims made by the Center for Liquefied Natural Gas (CLNG), in a letter sent to you dated March 20. The information provided by CLNG is misleading and their position on accelerating LNG exports is inconsistent with President Trump's "America First" pledge and the desire to build a sustainable manufacturing sector with growing middle class jobs. Instead of a focus on LNG exports, we believe that U.S. natural gas policy should focus on how to use natural gas to "maximize" job growth. The continued growth of LNG exports does not maximize American jobs or economic growth. The exception is exporting LNG from Alaska. This is stranded natural gas that is not accessible by the lower 48 and should be a priority for LNG exports.

A study by Charles River Associates<sup>1</sup> compared the economic benefit of using natural gas in manufacturing versus exporting it (see Figure 1 in appendix). The study concludes that using natural gas in manufacturing creates eight times more jobs, twice the direct value added per year and 4.5 times the direct construction employment than exporting the natural gas. In contrast, if excessive LNG exports increase domestic natural gas prices long-term, it will result in manufacturing job destruction. This is what happened from 2001 to 2008 when natural gas prices increased and manufacturing jobs decreased. The Energy Information Administration (EIA) AEO 2017 is predicting Henry Hub prices will increase 51 percent by 2020 and 118 percent by 2025.<sup>2</sup>

Low cost natural gas is the driver behind the 264 chemical industry-related projects that represent over \$161 billion in new investment announced since 2010. According to the American Chemistry Council, the projects are estimated to create 426,000 high paying jobs and

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<sup>1</sup> Charles River Associates: "US Manufacturing and LNG Exports: Economic Contributions to the US Economy and Impacts on US Natural Gas Prices", February 25, 2013

[http://www.crai.com/sites/default/files/publications/CRA\\_LNG\\_Study.pdf](http://www.crai.com/sites/default/files/publications/CRA_LNG_Study.pdf)

<sup>2</sup> EIA AEO 2017, <https://www.eia.gov/outlooks/aeo/pdf/0383%282017%29.pdf>

\$301 billion in economic output.<sup>3</sup> This can continue long-term, but not without low-cost globally competitive natural gas.

Total LNG export volumes already approved by the U.S. Department of Energy (DOE) represent a serious threat to U.S. manufacturing competitiveness and jobs long-term. Every additional increment of LNG export volume compound this threat. This is a very significant and a timely policy issue due to the unique, long-term legal nature of the DOE approval of LNG export applications for periods of up to 30 years. DOE decisions made today, committing LNG exports for 30 years, creates significant risk to domestic manufacturers. And, the Obama Administration's DOE failed to conduct appropriate "public interest" determinations required under the Natural Gas Act. DOE LNG export approvals to non-free trade countries have been made without having defined public interest, according to a Government Accountability Office (GAO) study.<sup>4</sup> This letter addresses concerns and seeks to work with you to provide a remedy.

IECA is a association of large natural gas and electricity consuming manufacturing companies with over \$1.0 trillion in annual sales and with more than 1.6 million employees worldwide. Company members are from a diverse set of industries that include chemicals, plastics, steel, iron ore, aluminum, paper, food processing, fertilizer, glass, industrial gases, pharmaceutical, building products, automotive, brewing, independent oil refining, and cement.

#### **I. IECA RESPONSE TO CLNG LETTER DATED MARCH 20, 2017**

**CLNG:** CLNG is voicing strong support for "expedited approval of Department of Energy (DOE) reviews of all pending liquefied natural gas (LNG) export permits to Free Trade Agreement (FTA) and non-Free Trade Agreement countries."

**IECA response:** The DOE has already approved applications for LNG shipments to FTA countries equal to 52.9 Bcf/day, or an equivalent of 70.3 percent of 2016 U.S. natural gas demand (see Figure 2). And, DOE has approved or conditionally approved LNG shipments to non-free trade agreement countries equal to 17 Bcf/day, or an equivalent of 22.7 percent of 2016 U.S. natural gas demand (see Figure 3). Combined, FTA and non-FTA approved or conditionally approved LNG exports total 92.7 percent of 2016 U.S. natural gas demand. The Federal Energy Regulatory Commission (FERC) reports that 10.4 Bcf/day of LNG export capacity is under construction (see Figure 4).

This is a stunningly significant amount of natural gas exports, which raises enormous concerns of future price risk upon trillions of dollars of existing and future U.S. manufacturing facilities. There is absolutely no need to expedite approval of further applications to export. In fact, we urge the DOE to halt further approvals until the DOE, or Congress defines public interest and with that determination, reconsider the status of applications to export. Exports of this volume are clearly inconsistent with President Trump's agenda to increase U.S. manufacturing jobs.

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<sup>3</sup> American Chemistry Council, 2016, "Economic Impact of Shale Gas Investments and the Chemical Industry"

<sup>4</sup> "Federal Approval Process for Liquefied Natural Gas Exports," Government Accountability Office, <http://www.gao.gov/assets/670/666177.pdf>

**CLNG:** The CLNG letter states that, “The United States has an abundance of natural gas. Large reserves coupled with technological advancements in natural gas development pushed domestic production to 28.75 trillion cubic feet (Tcf) in 2015, roughly 1.4 Tcf more than we used that year. In fact, EIA predicts that production of natural gas in the U.S. will outpace domestic consumption through the next two decades at least. In short, with such a significant resource base we have a surplus that can be shipped overseas providing trading partners abroad with energy resources they need while ensuring demand at home is affordably met; truly a win-win for the American economy.”

**IECA response:** CLNG’s use of EIA data is not correct. Using the EIA AEO 2017, the U.S. had a surplus of only 0.7 Tcf in 2015, not 1.4 Tcf. More importantly, CLNG’s claim that EIA predicts that production will outpace consumption is misleading and incorrect. CLNG is only comparing production versus domestic consumption. The correct way to address whether the U.S. has a surplus or not, is to include EIA’s prediction of net exports as illustrated in Figure 5.

IECA points to the fact that in every year to 2050, the surplus is so small that it is within the margin of error. Plus, EIA is only predicting net maximum LNG export volume of 4.3 Tcf in 2050, which only represents the LNG export capacity that is under construction today. If LNG exports reach the level of already approved applications, the U.S. will be in a deficit of natural gas. In summary, the EIA is not predicting a surplus of supply that would be available for additional LNG exports. In fact, if any additional export capacity comes online that is not included in the EIA AEO 2017, the U.S. annual surplus changes to a deficit.

CLNG also provides misleading information regarding the abundance and certainty of natural gas reserves (see Figure 6). For clarity, IECA has deleted Alaska resources from the Figure 5 total because lower 48 consumers do not have pipeline access to those resources. Even though some states have placed a moratorium on fracking, we have not excluded those resources.

Using EIA AEO 2017 demand, which includes net exports of natural gas, the U.S. has only a 9.5-year supply of proved resources and a 53-year supply of resources that are classified as technically recoverable. Technically recoverable resources do not mean they are economically recoverable. In fact, Table 9.2 in the EIA Assumptions to the Annual Energy Outlook 2016<sup>5</sup>, the resource for the cited data, and on page 132 states, “**Estimates of TRR (Technical Recoverable Resources) are highly uncertain, particularly in emerging plays where few wells have been drilled.**” This uncertainty regarding how much of the natural gas can be economically recovered is of critical importance.

A more appropriate way to examine resource adequacy is to look at the cumulative net U.S. demand for natural gas from 2016 to 2050, as compared to total technically recoverable resources. Using the EIA AEO 2017 total net demand from 2016 to 2050 (a 34-year period), 1,227 Tcf would consume 56 percent of the entire technically recoverable U.S. resource base. Another appropriate scenario to examine is the resource adequacy that includes DOE approved LNG exports for shipments to FTA countries. Adding the EIA AEO 2017 cumulative volumes from 2016 to 2050, and 19.3 Tcf/year volumes equal to approved applications starting five years (time to build new export capacity) from now to 2050 combined, would consume 1,767 Tcf of natural

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<sup>5</sup> Annual Energy Outlook 2016, [https://www.eia.gov/outlooks/aeo/assumptions/pdf/0554\(2016\).pdf](https://www.eia.gov/outlooks/aeo/assumptions/pdf/0554(2016).pdf)

gas by 2050 or 80 percent of all technically recoverable resources. These bookend scenarios expose the seriousness of the implications to the U.S. economy and manufacturing jobs that cannot be understated.

It is also important to consider the higher LNG export demand on the availability of economically recoverable shale natural gas resources. Shale gas resources are usually referred to as the lowest cost resources. Figure 7 is from page B-20 of the DOE report “The Macroeconomic Impact of Increasing U.S. LNG Exports”<sup>6</sup> dated October 29, 2015. DOE used this report to justify the approval of applications to export to countries with which the U.S. does not have a free-trade agreement.

The DOE chart illustrates the shale breakeven cost curves for the U.S., Canada, and Mexico. Using the EIA AEO 2017 net U.S. demand as illustrated in Figure 7 from 2016 to 2050, a cumulative volume of 1,227 Tcf of natural gas, and comparing this volume of natural gas to the breakeven cost to produce gas, and without additional LNG exports above the EIA AEO 2017 prediction, would require U.S. shale natural gas supply with a breakeven cost of up to \$20/mcf. Importantly, this exercise assumes the EIA prediction of only 4.4 Tcf per year of LNG net exports. The obvious point is that LNG exports greatly speed up the consumption of our lowest cost natural gas.

The above point was made by Ryan Lance, CEO of ConocoPhillips in an April 3 Reuters story<sup>7</sup> that implies that low-cost natural gas will be depleted by mid 2020s.

By the mid-2020s, the existing brownfield supply expansion options will be exhausted both in the U.S. and other countries. New greenfield projects will be needed. To justify those investments, higher energy prices will be required. As supplies grow tighter, the industry will also need to return to longer term contracts that provide security of supply for end-users and security of demand for suppliers.

CLNG states that LNG exports are a win-win for the economy. This is not the case. IECA is on record as having pointed out significant errors in all three DOE LNG export reports. And, none of the DOE export studies were peer-reviewed, even though they rise to the level of economic importance that would have justified it.

This first EIA report dated January 2012 admits on page 5 that the “Macroeconomic results have not been included in the analysis because energy exports are not explicitly represented in the NEMS macroeconomic model.”<sup>8</sup> This means that the economic cost impact of LNG exports are not reflected in their estimated impact to energy-intensive industries. “For energy-intensive industries, the price of energy is particularly important to utilization decisions for existing plants and siting decisions for new ones. Given its domestic focus, however, NEMS does not account for the impact of energy price changes on global utilization pattern of existing capacity or siting of new capacity inside or outside of the United States in energy-intensive industries. Capturing

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<sup>6</sup> “The Macroeconomic Impacts of Increasing U.S. LNG Exports,” U.S. Department of Energy, October 29, 2015, [http://energy.gov/sites/prod/files/2015/12/f27/20151113\\_macro\\_impact\\_of\\_lng\\_exports\\_0.pdf](http://energy.gov/sites/prod/files/2015/12/f27/20151113_macro_impact_of_lng_exports_0.pdf).

<sup>7</sup> U.S. LNG exports will slow as domestic gas demand grows, April 3, 2017, Reuters <http://www.reuters.com/article/japan-gastech-conocophillips-idUSL3N1HC0PE>

<sup>8</sup> EIA: Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets

these linkages requires an international model of the particular industry in question, paired with a global macroeconomic model.”

The second report, produced by NERA, said that there was net economic benefit, but that net economic gain was only \$20 billion by 2020 at its peak, and would decline every year. Given that the U.S. is a \$19 trillion economy, a \$20 billion gain is less than one hour of GDP work and is within error of the model’s capability. It also said that the gains were concentrated in the oil and gas industry. The report concludes that “expansion of LNG exports has two major effects on income: it raises energy costs and, in the process, depresses both real wages and the return on capital in all other industries.”<sup>9</sup> In our opinion, depressing real wages on the total U.S. population and a reduction of return on capital on all U.S. industries would conclude that increasing LNG exports cannot possibly be in the public interest. Finally, the study used outdated information on energy-intensive industries, the largest consumers of natural gas, our contribution to GDP, and how many people we employ. Because of this, the study underreported the negative impacts to the economy and jobs.

The third report dated October 2015<sup>10</sup> also included serious flaws. The report said that LNG exports increase domestic prices and decreases prices to foreign countries, especially in Asia (page 8). The report failed to combine the relative loss of manufacturing competitiveness from higher domestic natural gas prices and the lowering of natural gas prices to our competitors in Asia. This means that the report underreported the negative economic impact of increased LNG exports.

**CLNG:** The CLNG letter states, “LNG exports are also a substantial opportunity for U.S. economic and job growth, as each new terminal represents billions of dollars of investment in local economies. It's estimated that the LNG industry could create up to 450,000 jobs by 2035, collectively generating as much as \$86 billion in net benefits to the national economy. These projects also provide vital tax revenues, as a single LNG export terminal is expected to provide nearly \$11 million in new revenue every year for federal, state and local governments.”

**IECA response:** CLNG’s prediction of jobs and benefits data are not independently verified and its assumptions are questionable. While it is true that each export terminal can result in local investment that creates construction jobs and local tax revenue, construction jobs go away as soon as the project is completed. LNG terminals only require a couple of hundred employees to operate as illustrated in Figure 8. And, according to the U.S. Bureau of Labor Statistics, total oil and gas industry 2016 employment was only 180,000 versus 12,348,000 for the manufacturing sector (see Figure 9). BLS says that U.S. manufacturing employment grew by 820,000 jobs from 2010 to 2016, while the oil and gas industry created only 21,300 jobs. The point is that exporting LNG is does not create as many jobs as compared to using natural gas in manufacturing.

## II. KEY SUMMARY POINTS

- The EIA AEO 2017 net natural gas demand, plus already approved LNG application volumes to export to FTA countries, would consume about 80 percent of the U.S. technically recoverable natural gas resources by 2050.

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<sup>9</sup> NERA: Macroeconomic Impacts of Increased LNG Exports from the United States

<sup>10</sup> Oxford Economics, Rice University: The Macroeconomic Impact of Increased U.S. LNG Exports

- The EIA AEO 2017 net natural gas demand from 2016 to 2050, that includes only 4.4 Tcf of LNG exports by 2050, would consume all shale natural gas resources up to a break-even cost of about \$20 / mcf.
- Shipments of LNG to countries that do not have a U.S. FTA undermine fair trade bilateral agreements. Countries that do not have a U.S. FTA should not be rewarded.
- Low-cost natural gas is not renewable. Sound national energy and economic policy should prioritize use of natural gas in manufacturing to maximize job and economic growth.

### III. IECA REQUEST TO THE SECRETARY

Given the importance of this issue to President Trump's "America First" agenda, and to increase U.S. manufacturing jobs, we offer the following key summary points and important requests.

It is our hope that the Trump Administration fully considers how exports of LNG impacts U.S. manufacturing jobs long-term. Coming from Texas, a state with a significant manufacturing and natural gas production base, you understand that policy must reflect a balance between the need for affordable natural gas prices to support both existing and new manufacturing capital investment, and high enough prices to support increased drilling. Your experience also reflects an understanding of the uncertainties, that is, the unanticipated boom and bust cycles of the oil and natural gas industries. This experience renders a seasoned perspective that policy actions reflect caution and a long-term risk factor that considers the welfare of the American public, who either benefit or are damaged by price changes.

With that said, IECA has the following requests.

- a. Establish a moratorium on further LNG export approvals until the definition of "public interest" is fully explored, vetted, and agreed upon.*

The definition of "public interest" is at the core of this entire discussion. Yet, we cannot find where the DOE has articulated any such definition. More concerning is that the Government Accountability Office (GAO) reached the same conclusion in the September 2014 report.<sup>11</sup> The GAO finds that neither the Natural Gas Act, nor the DOE, has defined "public interest" (page 10). Given the centrality of this term to the public policy decision of approving or not approving LNG export applications, this is a glaring omission, if not a legal issue. If the DOE has not defined "public interest," how is it that they can make informed decisions on behalf of the over 72 million<sup>12</sup> consumers of natural gas and 145 million<sup>13</sup> consumers of electricity? Without a definition of the "public interest," how does the DOE determine when the export volume from the next LNG export application, and the resulting increase in natural gas and electricity prices, or a slowdown in manufacturing job creation and investment, justifies a "disapproval" of the

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<sup>11</sup> "Federal Approval Process for Liquefied Natural Gas Exports," Government Accountability Office, <http://www.gao.gov/assets/670/666177.pdf>

<sup>12</sup> [http://www.eia.gov/dnav/ng/ng\\_cons\\_num\\_dcu\\_nus\\_a.htm](http://www.eia.gov/dnav/ng/ng_cons_num_dcu_nus_a.htm)

<sup>13</sup> [http://www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table1.pdf](http://www.eia.gov/electricity/sales_revenue_price/pdf/table1.pdf)

LNG export application? Without a definition of public interest, how much public hardship must be inflicted before the DOE denies the next application?

We urge you to establish a rulemaking process that is transparent and provides opportunities for public input on the definition of “public interest.” With a definition of public interest, then complete peer reviewed economic studies to determine whether or not further LNG exports, whether already approved or not, are consistent with the public interest.

- b. DOE should implement its authority to establish a process of ongoing monitoring and adjustment to LNG export volumes. Establish a safety valve for U.S. consumers and condition all applications.*

The NGA specifically anticipates that adjustments to LNG exports would also be in the public interest when it states that the DOE “may from time to time, after opportunity for hearing, and for good cause shown, make such supplemental order in the premises as it may find necessary or appropriate.”<sup>14</sup> Contrary to the NGA, the Obama Administration’s DOE did not plan to make any such adjustments. Rather, the DOE has stated that once it issues an order regarding LNG exports, it will not alter them. In fact, by stating that it would make such an adjustment only under “extraordinary circumstances”<sup>15</sup> DOE creates an obstacle to the exercise of its authority that is not in the law. Consequently, these DOE orders on LNG export will be fixed for decades.

- c. Establish a national LNG export policy that is consistent with the Trump Administration’s fair-trade policy.*

We request the Administration to establish a national LNG export policy that is consistent with the objective of negotiating bilateral trade agreements that result in “fair trade” agreements. Shipping LNG to countries that do not have free trade agreements with the U.S. is inconsistent with fair trade and reduces the Administration’s negotiating leverage and rewards these countries. For example, in 2016, according to the EIA, over 50 percent of U.S. LNG exported shipped to 12 countries that do not have a free trade agreement with the U.S. (see figure 10). Only six countries receiving U.S. LNG had a free trade agreement.

Many of these non-free trade agreement countries impose tariffs on imported U.S. manufactured goods and/or subsidize their manufacturers for unfair advantage. The DOE LNG studies confirm that shipments of U.S. LNG reduce the costs of natural gas, especially to Asian countries and to their manufacturing sectors. Countries should not be rewarded with U.S. LNG before providing fair trade for our manufactured products.

- d. Recognize that LNG public policy needs special treatment due to its unique circumstances.*

Excessive LNG exports pose a special risk to the U.S. economy and manufacturing.

- According to the most recent DOE LNG export study, high levels of exports could increase domestic natural gas prices to international natural gas price levels. If this

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<sup>14</sup> 15 U.S. Code § 717b - Exportation or importation of natural gas (a) mandatory authorization order.

<sup>15</sup> DOE Letter to Senator Lisa Murkowski, October 17, 2013.

occurs, domestic prices will be subject to the will of international demand by other countries. If domestic prices rise to global levels, the U.S. will have given up what only a few years ago was considered a sustainable competitive advantage for the manufacturing sector.

- Most buyers of LNG are sovereign entities of countries. LNG buyers are “not price sensitive” like U.S. homeowners and manufacturing consumers, they are “countries.” They are state-owned enterprises and fully regulated electric/gas utilities whereby all costs are either paid for directly by the government or automatically passed through to the consumer. And, some countries do not pass the full cost onto their consumers. Because of this, they can be indifferent or insensitive to price, and can and will pay whatever price is needed to supply LNG to keep their country operating. In future times of a tighter market supply, LNG buyers will “buy away” natural gas from U.S. consumers.

On March 23, the three top buyers of LNG, representing 55 percent of LNG purchases globally created a memorandum of understanding (MOU) to exchange information and cooperate in the joint procurement of LNG.<sup>16</sup> They include China National Offshore Oil Corporation, South Korea’s KOGAS, and Japan’s Jera. This agreement would be illegal in the U.S. Each of these buyers are backed by their government and have automatic cost pass-throughs.

- Almost all major LNG consuming countries are located in the Northern Hemisphere, which means they have winter when we do. This means that peak LNG demand will occur during our winter heating season, spiking prices for U.S. consumers.
- U.S. industry and other consumers do not have an alternative to natural gas. For example, natural gas is a primary raw material for a chemical or fertilizer company and there is no alternative. As such, natural gas must be considered as a preferential resource that requires special consideration as compared to LNG exports.

There is substantial justification for concern. Today’s decisions regarding the approval or disapproval of LNG applications have long-term 30 year implications to the competitiveness of the manufacturing sector. Given these concerns, we request a meeting with you at your earliest convenience.

With kind regards,

Paul N. Cicio  
President

cc: The Honorable Wilbur Ross, U.S. Department of Commerce  
The Honorable Ryan Zinke, U.S. Department of the Interior  
Senate Committee on Energy and Natural Resources  
House Committee on Energy and Commerce

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<sup>16</sup> World’s top LNG buyers form alliance to push for flexible contracts: <http://uk.reuters.com/article/asia-lng-markets-idUKL3N1H02FJ>



Gary Cohn, National Economic Council

Peter Navarro, White House

Mike Catanzaro, White House

APPENDIX

Figure 1 – CRA Study: Natural Gas in Manufacturing Creates 8 Times More Jobs than LNG Exports

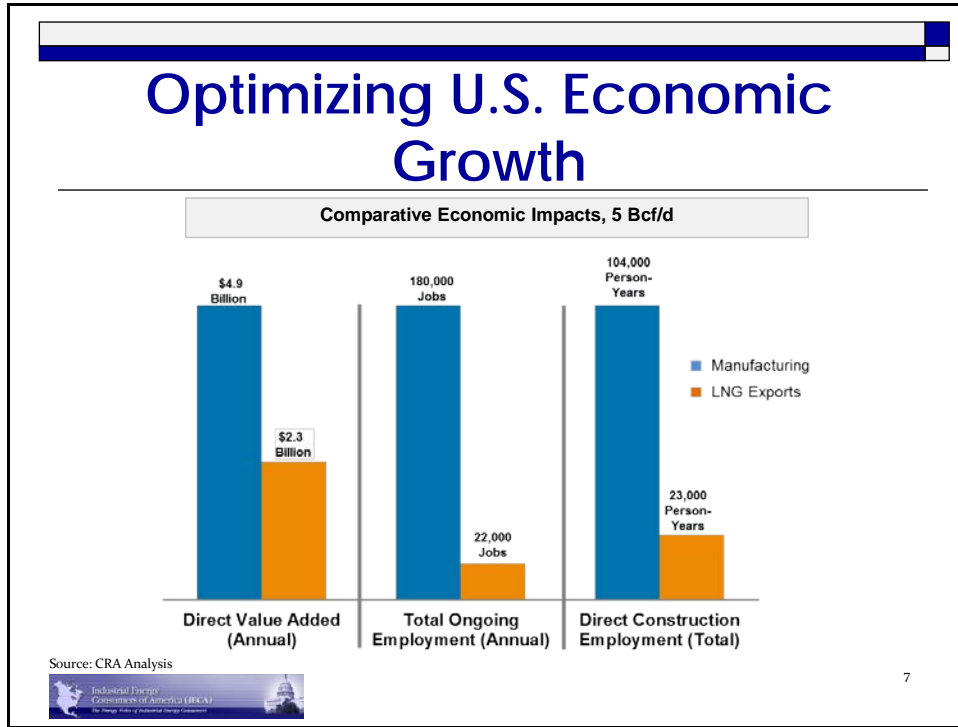


Figure 2 – DOE: FTA

	Approved
Bcf/day	52.9
Tcf	19.3

Source: U.S. Department of Energy (DOE)

Figure 3 – DOE: Non-FTA

	Approved	Conditionally Approved	Total Volumes
Bcf/day	16.2	0.8	17.0
Tcf	5.9	0.3	6.2

Source: U.S. Department of Energy (DOE)

Figure 4 – FERC: Non-FTA

	Approved	Proposed	Under Construction
Bcf/day	17.1	22.5	10.4
Tcf	6.2	8.2	3.8

Source: U.S. Department of Energy (DOE)

**Figure 5 – U.S. Natural Gas: EIA AEO 2017 Base Case (Trillion Cubic Feet)**

Year	Dry Production*	U.S. Consumption	Net LNG Exports	Net Exports to Mexico	Net Exports to Canada	Total Consumption	Surplus
2000	19.2	23.3	0	0.1	-3.4	20.0	-0.8
2001	19.6	22.2	0	0.2	-3.5	18.9	0.7
2002	18.9	23.0	0	0.3	-3.6	19.7	-0.8
2003	19.1	22.3	0	0.3	-3.1	19.5	-0.4
2004	18.6	22.4	0	0.4	-3.2	19.6	-1.0
2005	18.1	22.0	0	0.3	-3.3	19.0	-0.9
2006	18.5	21.7	0	0.3	-3.3	18.7	-0.2
2007	19.3	23.1	0	0.3	-3.3	20.1	-0.8
2008	20.2	23.3	0	0.4	-3.0	20.7	-0.5
2009	20.6	22.9	0	0.4	-2.6	20.7	-0.1
2010	21.3	24.1	0	0.4	-2.6	21.9	-0.6
2011	22.9	24.5	0	0.5	-2.2	22.8	0.1
2012	24.0	25.5	0	0.6	-2.0	24.1	-0.1
2013	24.2	26.2	0	0.7	-1.9	25.0	-0.8
2014	25.9	26.6	-0.05	0.7	-1.8	25.5	0.4
2015	27.1	27.3	-0.07	1.1	-1.9	26.4	0.7
2016	26.5	27.5	0.09	1.4	-2.1	26.9	-0.4
2017	27.9	27.9	0.5	1.2	-1.9	27.7	0.2
2018	29.1	28.1	1.0	1.6	-1.8	28.9	0.2
2019	30.1	27.9	1.8	1.7	-1.5	29.9	0.2
2020	30.8	27.3	2.9	1.8	-1.3	30.7	0.1
2021	31.0	27.2	3.0	1.8	-1.2	30.8	0.2
2022	31.3	27.2	3.1	1.7	-1.0	31.0	0.3
2023	31.8	27.4	3.3	1.7	-0.9	31.5	0.3
2024	32.4	27.8	3.5	1.8	-0.8	32.3	0.1
2025	33.1	28.3	3.6	1.8	-0.8	32.9	0.2
2026	33.6	28.7	3.8	1.8	-0.7	33.6	0
2027	34.0	28.8	3.9	1.8	-0.6	33.9	0.1
2028	34.3	29.0	4.0	1.8	-0.6	34.2	0.1
2029	34.7	29.3	4.0	1.7	-0.4	34.6	0.1
2030	34.9	29.5	4.0	1.7	-0.4	34.8	0.1
2031	35.0	29.4	4.1	1.7	-0.4	34.8	0.2
2032	35.3	29.7	4.2	1.7	-0.4	35.2	0.1
2033	35.5	29.8	4.3	1.7	-0.3	35.5	0
2034	36.0	30.2	4.3	1.6	-0.3	35.8	0.2
2035	36.5	30.7	4.4	1.6	-0.2	36.5	0
2036	36.7	30.8	4.4	1.6	-0.2	36.6	0.1
2037	37.1	31.2	4.4	1.6	-0.2	37.0	0.1

Year	Dry Production*	U.S. Consumption	Net LNG Exports	Net Exports to Mexico	Net Exports to Canada	Total Consumption	Surplus
2038	37.4	31.5	4.4	1.6	-0.2	37.3	0.1
2039	37.6	31.7	4.4	1.6	-0.2	37.5	0.1
2040	37.7	31.9	4.4	1.5	-0.2	37.6	0.1
2041	38.0	32.2	4.4	1.5	-0.2	37.9	0.1
2042	38.2	32.4	4.4	1.5	-0.2	38.1	0.1
2043	38.3	32.6	4.4	1.5	-0.2	38.3	0
2044	38.6	32.9	4.4	1.5	-0.2	38.6	0
2045	38.9	33.2	4.4	1.4	-0.2	38.8	0.1
2046	39.1	33.5	4.4	1.4	-0.2	39.1	0
2047	39.4	33.8	4.4	1.4	-0.2	39.4	0
2048	39.6	34.0	4.4	1.4	-0.2	39.6	0
2049	39.8	34.2	4.4	1.4	-0.2	39.8	0
2050	40.3	34.6	4.4	1.3	-0.2	40.1	0.2

Source: Energy Information Administration (EIA), AEO 2017

\*The process of producing consumer-grade natural gas. Natural gas withdrawn from reservoirs is reduced by volumes used at the production (lease) site and by processing losses. Volumes used at the production site include (1) the volume returned to reservoirs in cycling, repressuring of oil reservoirs, and conservation operations; and (2) gas vented and flared. Processing losses include (1) nonhydrocarbon gases (e.g., water vapor, carbon dioxide, helium, hydrogen sulfide, and nitrogen) removed from the gas stream; and (2) gas converted to liquid form, such as lease condensate and plant liquids. Volumes of dry gas withdrawn from gas storage reservoirs are not considered part of production. Dry natural gas production equals marketed production less extraction loss.

**Figure 6 – EIA: Technically Recoverable U.S. Natural Gas Resources (Trillion Cubic Feet)**

	Proved Reserves	Unproved Reserves	Total Technically Recoverable Resources
Lower 48 (Onshore)	322.2	1,548.9	1,871.1
Lower 48 (Offshore)	8.7	316.2	324.9
<b>TOTAL</b>	<b>330.9</b>	<b>1,865.1</b>	<b>2,196.0</b>

Source: Technically recoverable U.S. dry natural gas resources as of January 1, 2014, Energy Information Administration (EIA) <https://www.eia.gov/outlooks/aeo/assumptions/pdf/oilgas.pdf>

Note: Data does not include Alaska (onshore and offshore).

Figure 7 – DOE Report “The Macroeconomic Impact of Increasing LNG Exports”

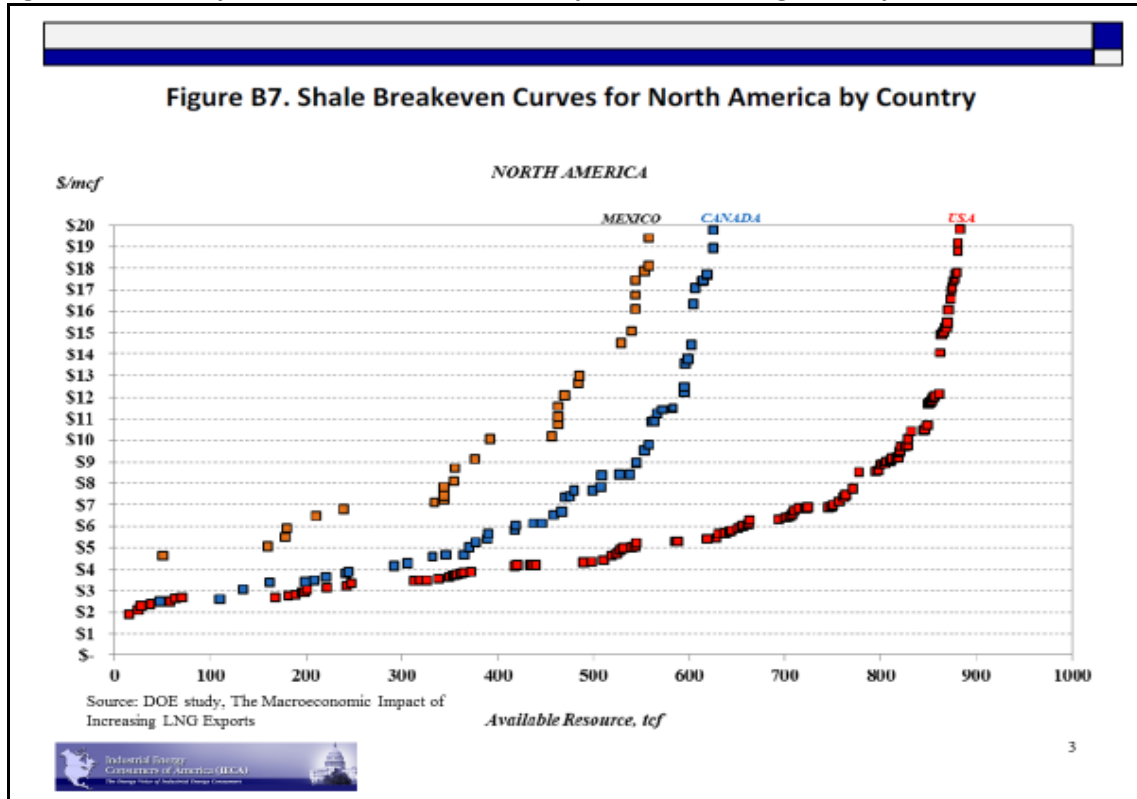


Figure 8 – Stated Future Employment by LNG Export Terminals

Export Facility	Permanent Jobs
Sabine Pass Liquefaction	580
Freeport LNG Expansion and FLNG Liquefaction	300
Lake Charles Exports	250
Dominion Cove Point	175
Jordan Cove Energy	150
Cameron LNG	185
Gulf Coast LNG Export	250

**Figure 9 – U.S. Employment**

Year	Manufacturing (thousands)	Oil & Gas Extraction (thousands)
2010	11,528	158.7
2011	11,726	172.0
2012	11,927	187.4
2013	12,020	193.5
2014	12,185	197.7
2015	12,336	193.4
2016	12,348	180.0
Jobs Added	820	21.3

Source: U.S. Bureau of Labor Statistics (BLS)

**Figure 10 – EIA U.S. LNG Exports, 2016**

Country (2016)	Volume Shipped (million cubic feet)	% Total	Free Trade Agreement
Chile	29,405	16.0%	Yes
Mexico	27,845	15.1%	Yes
India	17,462	9.5%	
Argentina	17,273	9.4%	
China	17,221	9.4%	
Japan	11,137	6.1%	
Brazil	10,629	5.8%	
South Korea	10,166	5.5%	Yes
Jordan	9,870	5.4%	Yes
Turkey	8,762	4.8%	
Kuwait	7,068	3.8%	
Egypt	3,606	2.0%	
Portugal	3,700	2.0%	
Italy	3,328	1.8%	
United Arab Emirates	3,391	1.8%	
Dominican Republic	2,945	1.6%	Yes
Barbados	100	0.1%	
Canada	2	0.001%	Yes
<b>TOTAL</b>	<b>183,910</b>	<b>100%</b>	<b>6</b>
<b>Total FTA</b>	<b>80,233</b>	<b>43.6%</b>	
<b>Total NFTA</b>	<b>103,677</b>	<b>56.4%</b>	

Source: Energy Information Administration (EIA)