

USLNG Exports: A Brief Introduction

Natural gas—one of the world’s most useful substances—is burned to heat homes and run highly-efficient electrical powerplants. It is used as a feedstock in the manufacture of chemicals and fertilizers. And, it can also replace diesel and bunker fuel to power trucks, locomotives, and even the largest seagoing vessels.

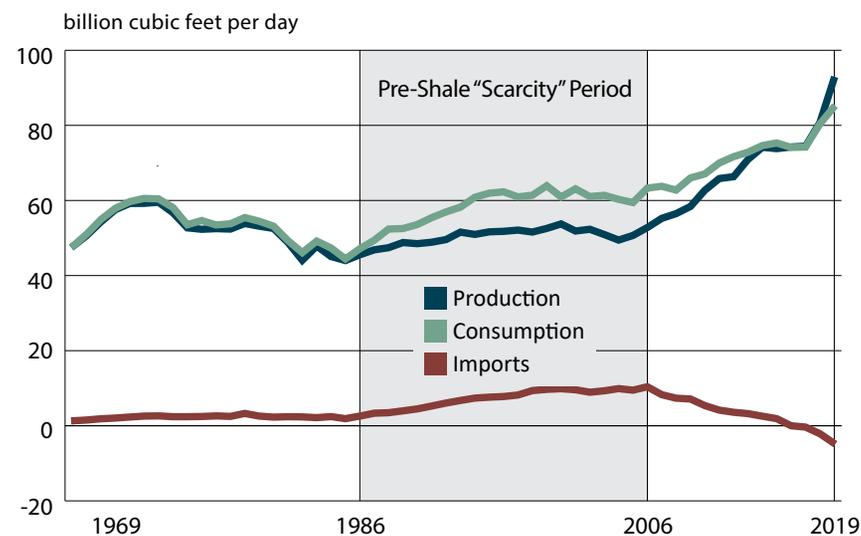
Because of its clean-burning nature and tremendous versatility, U.S. natural gas use has grown over the past 50 years. (Fig. 1) From the mid-1960s to the mid-1980s U.S. gas production and consumption were closely aligned. However, for the two decades beginning in 1986, demand increased faster than supply. As a result, substantial volumes of pipeline gas were imported from Canada and 11 terminals were built to import liquefied natural gas (LNG) from countries such as Nigeria and Trinidad.

This was all before the shale energy revolution.

Starting in the mid-2000s, American hydrocarbon entrepreneurs began to combine two techniques—horizontal drilling and hydraulic fracturing—to extract oil and gas from shale formations. (Fig. 2) Since then, shale gas production has grown from a rarity to about 60 percent of U.S. production. As a result, the United States now has more than enough gas to meet domestic consumption indefinitely. (Fig. 3)

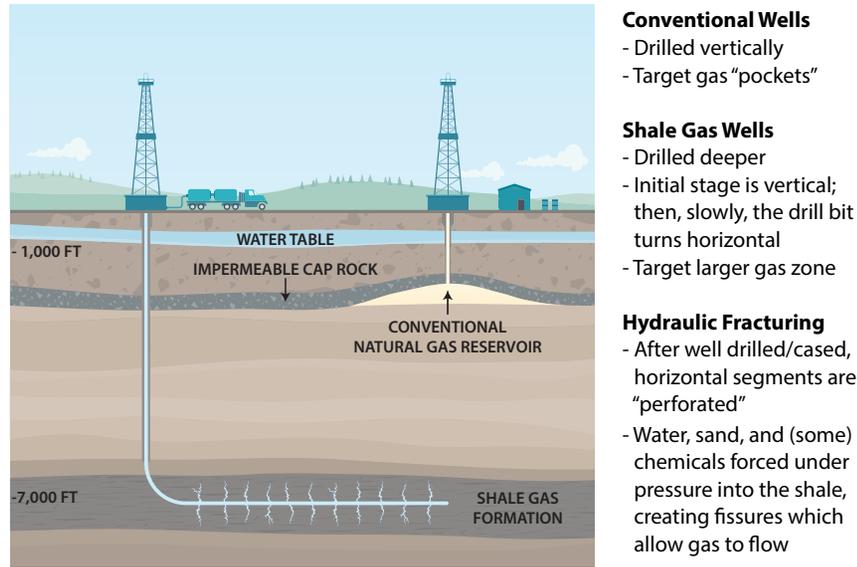
As U.S. gas production grew, there was little need to import higher-priced LNG and most of the U.S. LNG import terminals were idled in the late 2000s. (The Northeastern states were and remain an exception.) Subsequently, the owners of the LNG import terminals began to contemplate adding export capabilities. In July 2010, Cheniere Energy filed an application with the federal government to add liquefaction capabilities its Sabine Pass facility. Applications from other import terminal owners soon followed.

Fig. 1 - U.S. Natural Gas Production, Consumption, Imports



Source: EIA Annual Energy Outlook - 2020

Fig. 2 - Shale Gas Versus Conventional Extraction



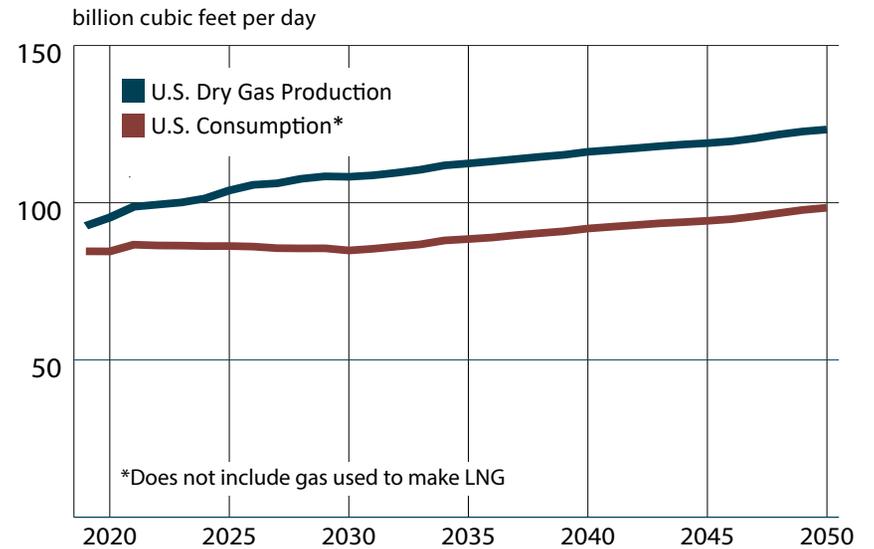
Source: LNG Allies, The US LNG Association

U.S. government approval is necessary because the Natural Gas Act requires Federal Energy Regulatory Commission (FERC) authorization to construct an LNG export facility (or U.S. Maritime Administration in the case of a floating offshore facility) and an authorization from the U.S. Department of Energy (DOE) to export the gas itself.

Under the law, LNG exports are presumed to be “in the public interest,” unless DOE finds otherwise. For nations that have a free trade agreement (FTA) with the United States that includes the “national treatment of natural gas,” such exports are automatically deemed to be in the public interest and must be approved “without modification or delay.” For nations without FTAs, DOE conducts a “public interest” review (in which “interested parties” can intervene).

To support its public interest reviews, DOE commissioned six macroeconomic studies on LNG exports between Jan. 2012 and June 2018. All six studies found that: (1) the macroeconomic benefits of LNG exports are “net positive” for the United States; (2) nearly

Fig. 3 - EIA Gas Production / Consumption Estimates



Source: EIA Annual Energy Outlook - 2020 (Reference Case)

all of the gas to be exported will come from additional production (rather than domestic demand reduction); and (3) the price effects of LNG exports are minor.

Currently, DOE has issued full (FTA + non-FTA) long-term export authorizations to the 14 major U.S. LNG projects which have received a FERC or MARAD license.

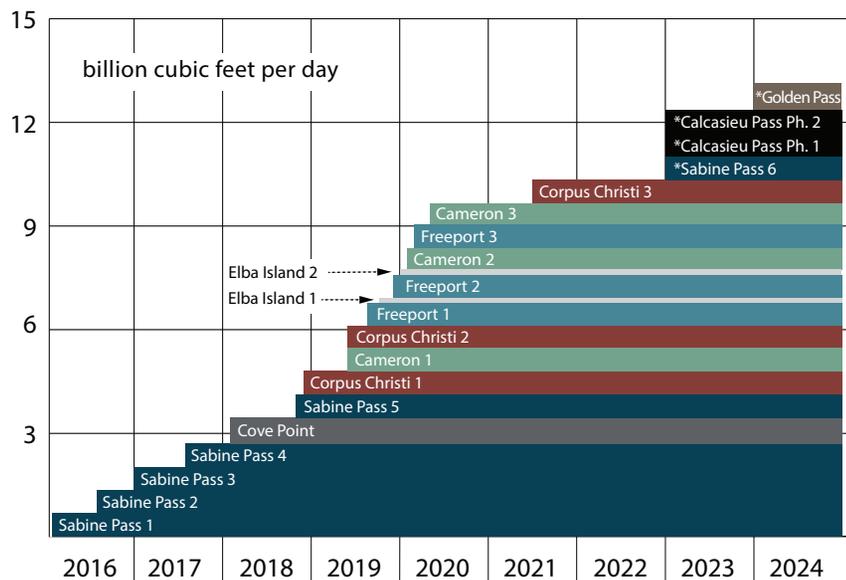
Long-term DOE authorizations are granted for a 20-year period that commences on the earlier of the date of first export or within seven years from the date of the issuance of the authorization. Under these authorizations, the only nations that cannot receive U.S. LNG are those on the applicable sanctions lists kept by the Office of Foreign Assets Control of the U.S. Department of the Treasury.

Although U.S. LNG exports from the contiguous 48 states only began in Feb. 2016, the International Energy Agency (IEA) predicts that the United States will become the world’s leading LNG exporter by 2024, surpassing Qatar, the present top producer.

Currently, there are six LNG export projects in operation and two under construction in the United States (six large terminals on the Gulf of Mexico and two smaller facilities on the East Coast), representing ≈ 108 million metric tons per annum (mtpa) of capacity which will require ≈ 14.2 billion cubic feet per day (bcf/d) of feedgas at completion of all.

LNG from the first of these projects—Cheniere Energy’s Sabine Pass liquefaction and export terminal in Louisiana—began shipping in early 2016 and has increased in steps as the project’s first five trains entered service. As this is written (Feb. 2020), LNG cargoes are shipping from five other U.S. LNG export projects: Dominion Energy’s Cove Point project in Maryland, Cheniere’s Corpus Christi project in Texas, the Cameron LNG project (Semptra Energy and partners) in Louisiana., Freeport LNG in Texas, and Kinder Morgan’s Elba Island Liquefaction in Georgia. (Fig. 4)

Fig. 4 - U.S. Liquefaction Capacity Growth thru 2025



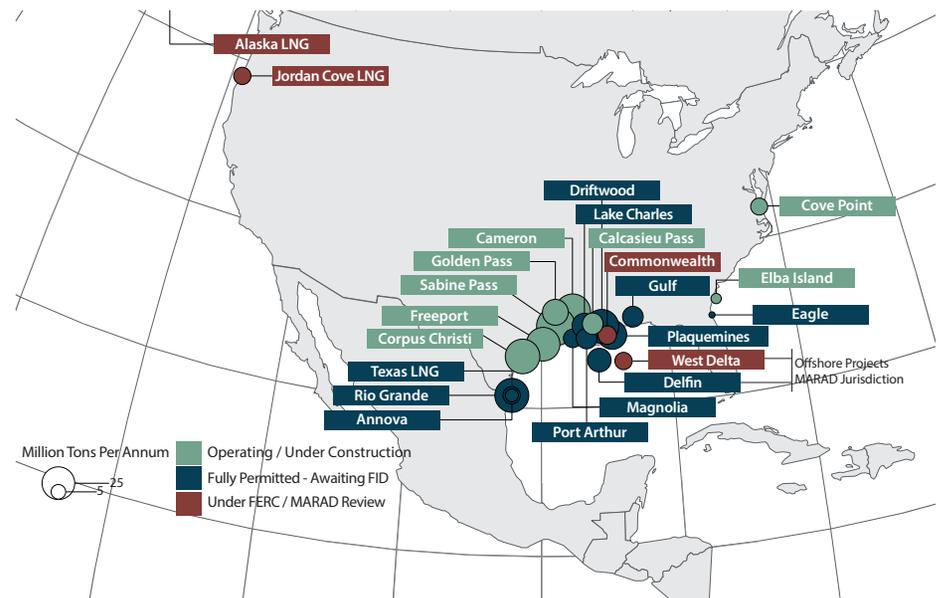
Source: LNG Allies, The US LNG Association (Feb. 2020)

In addition to the eight projects being built, 11 more have been fully permitted (but have not yet taken a “final investment decision”), another four are under formal environmental review at FERC or MARAD and four have received approval to enter the mandatory FERC pre-filing process. (Fig. 5 & Fig. 6)

At this juncture, it is difficult to predict how much additional U.S. liquefaction capacity will be built. (This will depend upon the growth of LNG demand worldwide, the availability of project financing, and many other factors.)

However, the EIA’s Annual Energy Outlook 2020 (AEO-2020) estimated that by 2030, U.S. LNG exports could reach 18.2 bcf/d in the “Reference Case,” 18.2 bcf/d in the “High Oil & Gas Supply Case,” and 23.1 bcf/d in the High Oil Price Case.” (Fig. 7)

Fig. 5 - Existing and Planned U.S. LNG Export Projects



Source: LNG Allies, The US LNG Association (Feb. 2020)

Fortunately, the U.S. has sufficient gas to meet domestic needs and support high levels of LNG exports without exhausting supplies or raising prices unduly for consumers.

With regard to supply, the Potential Gas Committee (PGC)—a group of 80 natural gas experts from industry, academia, and government—has been conducting biennial U.S. natural gas surveys since 1964. The latest PGC assessment (Sept. 11, 2019) found that the future supply of U.S. natural gas at year-end 2018 stood at 3,838 trillion cubic feet, an increase of 20% from year-end 2016. (Fig. 8) This is enough gas to meet U.S. domestic requirements and support robust exports for a century or more.

And, with regard to prices, the AEO-2020 estimated that Henry Hub prices should range between \$3.00 and \$3.80 per mmbtu through 2050 even as LNG exports increase significantly over the next three decades. (Fig. 9)

Concluding Thoughts...

Natural gas has a bright future as a clean, reliable, and affordable fuel. With flexible contract terms, U.S. LNG exports are driving the transformation of the international gas trade to an increasingly well-connected and liquid global market. This benefits global

Fig. 6 - U.S. LNG Export Projects Under Development

Project Stage	Projects	mtpa	bcm/yr	bcf/day
Permitted & Under Construction	8	107.9	148.8	14.2
Permitted Pre-FID	11	170.5	235.0	22.4
Formal FERC/MARAD Review	4	42.1	58.1	5.5
FERC Pre-Filing	4	61.0	83.6	8.0
Total	27	399.5	550.5	52.6

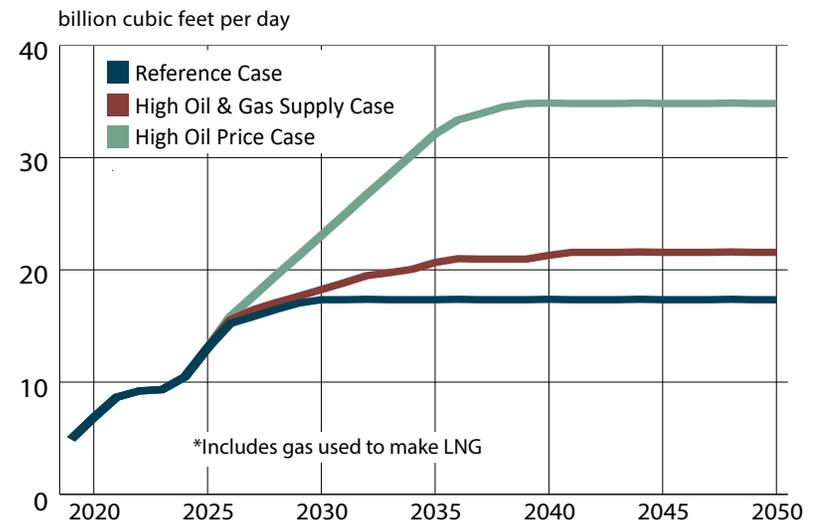
Notes: (1) Projects = individual projects. (2) Additional trains for existing projects not included in the project count, but in mtpa, bcm/year, and bcf/day totals (Sabine Pass #6, Cameron #4 #5, Freeport #4, Port Arthur #3 #4). (3) This table only includes projects with a liquefaction capacity of 1.0 mtpa or greater.

Source: LNG Allies, The US LNG Association (21 Aug. 2019)

energy security, especially for those of America’s allies who are dependent on energy imports. LNG exports also provide important economic benefits to the United States.

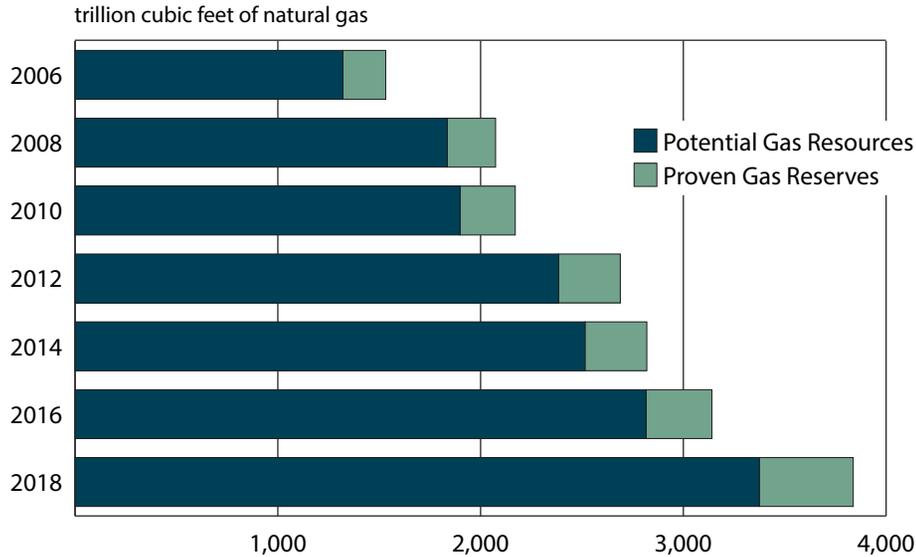
According to a study prepared for LNG Allies by ICF (April 2018), considering the whole value chain (LNG Plants + Natural Gas Supply): (1) the cumulative direct, indirect, and induced value added from U.S. LNG exports would range from \$1.664 trillion to \$3.255 trillion for the three selected AEO-2018 cases over the 2013 to 2050 time frame; and (2) the direct, indirect, and induced employment benefits from U.S. LNG exports would range from 7.346 to 15.459 million job-years over that same period (an average of 205,403 to 432,897 direct, indirect, and induced jobs per year). (Fig. 10 & Fig. 11)

Fig. 7 - EIA Estimates of U.S. LNG Exports to 2050



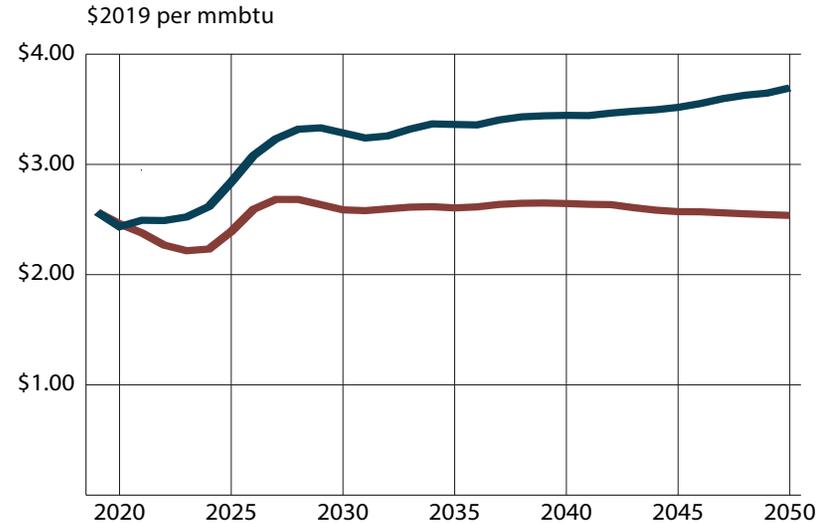
Source: EIA Annual Energy Outlook - 2020

Fig. 8 - PGC/EIA Estimates of the Future U.S. Gas Supply



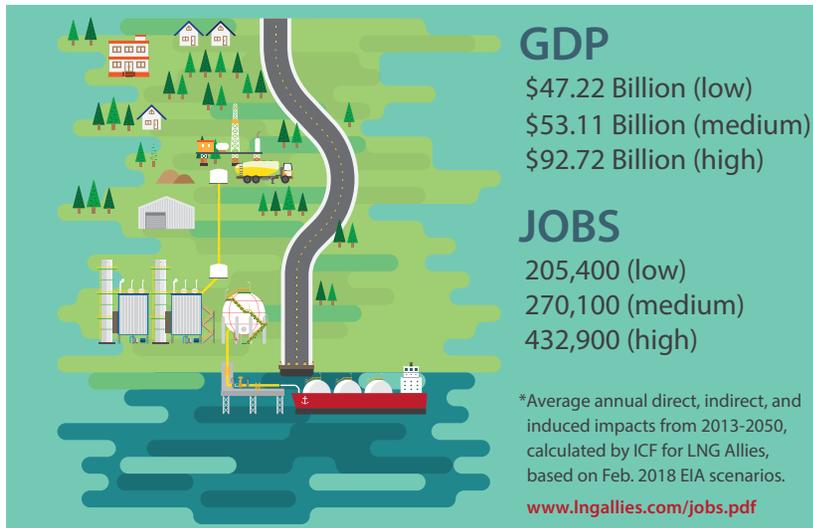
Sources: Potential Gas Committee (Resources); EIA (Reserves) - Sept. 2019

Fig. 9 - EIA Estimates of U.S. Henry Hub Prices to 2050



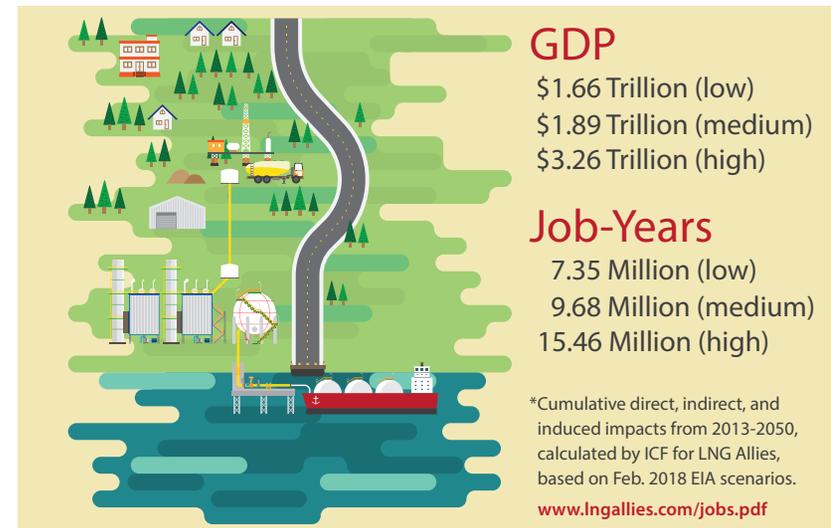
Source: EIA Annual Energy Outlook - 2019

Fig. 10 Average Annual Benefits of U.S. LNG Exports



Source: ICF Estimates Based on AEO-2018 Selected Cases

Fig. 11 Cumulative Benefits of U.S. LNG Exports



Source: ICF Estimates Based on AEO-2018 Selected Cases