

Market Overview LNG

Introduction of the commodity:

The aim of this section is to have a better understanding of LNG.

First of all there are three states of natural gas:

- In gas state, natural gas (NG).
- Liquefied natural gas (LNG).
- Compressed natural gas (CNG), which is highly pressured gas but not liquefied.

More specific information concerning LNG:

- This gas is mainly composed of methane (between 87-99%) and ethane (between 1-10%).
- LNG is natural gas which is cooled to -162° Celsius to become liquid. Liquefaction also has the advantage of removing oxygen, carbon dioxide, sulfur, and water from the natural gas, resulting in LNG that is almost pure methane.
- LNG facilitates the shipping and storage of natural gas.
- The volume is 600 times smaller than in gas form.

The quantity of LNG delivered is expressed in Metric Million British Thermal Unit (MMBtu). Btu is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

Despite natural gas being a fossil fuel, this energy is considered as an energy of the future. The reason relates to the trend going on about sustainability. Indeed, natural gas is the cleanest fossil fuel and generates approximately 30% less carbon than fuel oil and 45% less than coal depending on the purity of the product.

Market Structure:

The value chain of the LNG product consists of 4 highly linked stages. First we have the exploration phase and production if it is viable. Then we have the liquefaction process followed by the shipping from the location of liquefaction to the final destination. Finally we have the storage and usually the regasification at the end of the process if the product is not used as a final energy.

The major reason why LNG is liquefied is due to the fact that it cannot be transported by pipeline, as there is no land connection. Hence, natural gas is liquefied which massively decreases the volume and allows it to be transported easily by sea. This explains why the main LNG exporters, which is Qatar at the first place with 107.1 billion cubic meters followed by Australia in 2019, and the main importer, which is Japan in the same year, are easily accessible by the sea.

The major actor from the supplier side are Qatargas company which is owned by the government is currently the world largest LNG producer. The company is followed closely by the Chevron Australia Holdings and Royal Dutch Shell in Australia. From the consumer side Japan's Jera Co is the biggest buyer of LNG in the world.

Despite LNG usually go to the regasification process. This commodity can also be sell as a final energy, which mean instead entering the process of re-gasification it can be sell directly has liquified natural gas, which will be directly use as fuel for vessel and big truck. As an example, the vessel Aidaprima is one of the first using LNG as a direct fuel. However the market for small vehicles such as car or motorbike remain not viable, as some estimate demonstrate that tank of smaller vehicule will lose 1% of LNG per day when the engine remain stopped. This is one of the major reason why the market focus on bigger engine that are mostly on the road.

Key driver:

Many key drivers are driving and increasing the global demand for this commodity. Indeed, known to be the cleanest burning fuel on the market, LNG energy efficiency is one of the main selling arguments on the market. In the last decade, due to environmental concerns and raising awareness of the final consumers, LNG exportation has drastically increased. Moreover, thanks to technological innovation within the domain, the storage of this energy has become much easier and cheaper. Usually, natural gas is stored under-ground in natural "caves" ' formed naturally. However, by liquefying it, LNG can be stored in tankers which is safer and more convenient, in liquid form the gas is not flammable nor explosive.

To continue, as this commodity is becoming more and more attractive for investors, new producing capacity are in projects in several places including US and Australia.

This new excess capacity will have a significant impact on the price and might tend to be cheaper in the long term as this market is already a saturated market. That's to say, the liquefaction process has a direct consequence on the product quality because it allows the gas to be purer. In fact, the greater the quantity of methane, the purer LNG is considered.

Finally, once the LNG has reached its destination, it's turned back into natural gas in a process called re-gasification. However, if it has to be stored or when used as fuel for vehicles or vessels, it's kept in its liquid form which allows the energy to be stored in a smaller space. Thus, there is different utility depending on the states of matter of this energy which gives a wilder range of utilisations and business opportunities.

Trade flows:

The overall international trade flow is focused and mainly divided into three main markets. The first one is the Asian market for which it accounts the major share of worldwide trades. Indeed, Asia (and in particular Japan) began to dominate the global LNG picture by the late 1970s and continues to be the largest single importing regional market. Japan, South Korea and Taiwan, lacking significant domestic production, rely on LNG for their natural gas requirements. The market context and supply security mindset so engendered has been largely responsible for the somewhat „traditional“ supply contracting custom and practice

which has characterised Asian LNG. On one side, the major producers with surplus for exportation of this area are Australia, Indonesia and Malaysia, on the other, the net importer are: China, India, Japan, South Korea, Taiwan. The second most influential market of LNG trade flows is the European one. In fact the market structure is not the same as the Asian one because of pipeline imports. Indeed, pipeline infrastructures began to make a significant contribution to Europe's gas supply requirements by 1980, by 2008 they represented 39% (excluding Norway and LNG imports 10%). However European countries are showing more and more interest in it. That is to say, in 2019, EU imported the highest ever volume of LNG in 2019 at 108 billion cubic meters (bcm), marking 27% of total gas imports and 22% of the EU's gas consumption. Finally, the American market is mostly composed of countries producing LNG rather than importing one. Indeed, these countries are exporting countries and supply markets such as the Asian market and the Indonesian one. The major producing countries within this market are the United States, Canada and Mexico.

Pricing:

One of the realities of the LNG market is that it must be shown that it can compete with other energy sources in terms of price. Even in the countries where politics encourages the use of natural gas, like China for example, difference in prices still matters a lot when decisions have to be made. As a consequence, the price of LNG has traditionally reflected the energy economics of the market into which it was being sold under long-term sales contracts.

Among the three main LNG markets that are Asia, Europe and the US, there are marked differences when it comes to pricing. Indeed, LNG in the Asian market has typically been indexed against crude oil prices. On average, one MMBtu of natural gas approximates 17% of the energy content of a barrel of oil. Thus, the price of a LNG MMBtu when linked to crude oil will be a similar percentage of the price of one barrel of oil based on the relevant oil price index. This is known as the price slope. For example, if one barrel of Brent crude oil is USD 70 and we have a price slope of 13%, the price for one MMBtu would be USD 9.10. Additionally, the crude oil benchmark used is usually applied with a three to six month lag to ensure the LNG price changes accordingly.

In Europe, the gas market is much more developed and it must compete directly with pipeline gas. It results in the Asian pricing formula being replaced by one which is set by reference to competing gas prices at gas hubs such as the Dutch Title Transfer Facility and the UK's National Balancing Point.

In the US, when LNG was imported, the price was linked to the gas market and most notably to the Henry Hub trading price. The price would be 115% Henry Hub price plus a fixed liquefaction fee to give a price per MMBtu. Even if the US have now turned into an LNG exporter, producers also set their export prices against the Henry Hub which means to LNG buyers that there is no correlation to competing energy sources in the domestic market.

In the short and medium term, oil-linked pricing is likely to remain dominant in Asia. However, there is a developing movement towards gas-on-gas pricing driven by gas buyers

demanding a pricing mechanism more representative of the regional gas market they are subject to. A popular developing benchmark price is the Platts Japan Korea Marker (JKM). The prevailing view is that this benchmark will continue to grow and LNG contracts will increasingly move away from crude oil towards gas-on-gas trading prices at gas hubs around the world.

Henry Hub Natural Gas Spot Price - Historical Annual Data

Year	Average Closing Price	Year Open	Year High	Year Low	Year Close	Annual % Change
2020	\$1.87	\$2.05	\$2.57	\$1.33	\$1.74	-16.75%
2019	\$2.56	\$3.25	\$4.25	\$1.75	\$2.09	-35.69%
2018	\$3.15	\$6.24	\$6.24	\$2.49	\$3.25	-11.92%
2017	\$2.99	\$3.71	\$3.71	\$2.44	\$3.69	-0.54%
2016	\$2.52	\$2.28	\$3.80	\$1.49	\$3.71	62.72%
2015	\$2.62	\$3.01	\$3.32	\$1.63	\$2.28	-27.39%
2014	\$4.37	\$4.32	\$8.15	\$2.74	\$3.14	-27.15%
2013	\$3.73	\$3.30	\$4.52	\$3.08	\$4.31	25.66%
2012	\$2.75	\$2.97	\$3.77	\$1.82	\$3.43	15.10%
2011	\$4.00	\$4.54	\$4.92	\$2.84	\$2.98	-29.38%

Cost curve:

There are four elements into which we can breakdown the full break-even price for an LNG project :

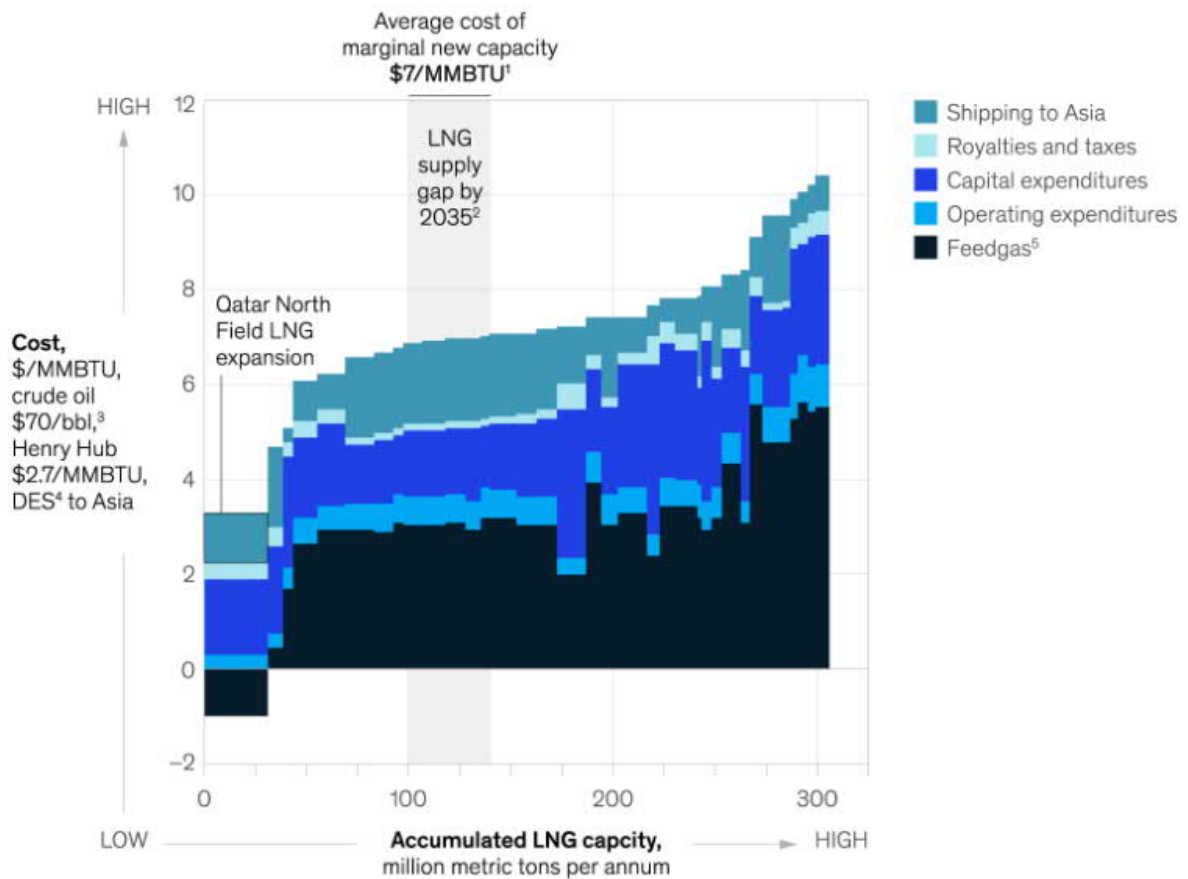
- The feed gas cost. To lower this element, we have to obtain access to privileged upstream gas and liquid sources
- Capital and Operating expenditure on liquefaction facilities. The optimization of development projects is the means to reduce this cost.
- Royalties and taxes. These can be managed by engaging host governments and stakeholders.
- Shipping cost and trading margin. This last one can vary by proximity to destination markets and can be managed through shipping-fleet optimization and also includes portfolio trading margin.

What the operators control the most out of these four elements is capital and operating expenditure on liquefaction facilities. For the others, plant location and the size of an operator's LNG portfolio are what primarily influence them. Royalties and taxes depend on the governments, shipping cost depends partly on the distance to the demand center while operators with large portfolios can shift supply to optimize trading margin.

But getting back to the one controlled mostly by the operators, capital expenditure on liquefaction facilities accounts for about a third of the overall project break-even price of LNG projects, though it can rise up to 60 when the feed-gas price is lower than average. Operators would therefore be well advised to target this expenditure in their cost reduction efforts.

To stay competitive, projects need to be priced at \$7 per MMBTU.

Liquefied-natural-gas (LNG) cost curve for future projects



Source:

Statista. 2020. *LNG Exporting Countries 2019* | Statista. [online] Available at: <<https://www.statista.com/statistics/274528/major-exporting-countries-of-lng/#:~:text=The%20world's%20largest%20exporter%20of,of%20107.1%20billion%20cubic%20meters.>> [Accessed 1 October 2020]

Qatargas.com. 2020. *Qatargas - Homepage*. [online] Available at: <<https://www.qatargas.com/english>> [Accessed 1 October 2020].

Naturalgas.org. 2020. » *Focus On LNG* Naturalgas.Org. [online] Available at: <<http://naturalgas.org/lng/>> [Accessed 1 October 2020].

Slideshare.net. 2020. *INTRODUCTION TO LNG*. [online] Available at: <<https://www.slideshare.net/BPfanpage/introduction-to-lng>> [Accessed 1 October 2020].

Contracts, S. and trade, I., 2020. *Implementation Of Smart Contract In The Liquefied Natural Gas Trade*. [online] Lawinsider.com. Available at: <<https://www.lawinsider.com/documents/bf4Wecx93hw>> [Accessed 1 October 2020].

Dspace.mit.edu. 2020. [online] Available at: <https://dspace.mit.edu/bitstream/handle/1721.1/92403/MITJPSPGC_Rpt271.pdf;sequence=1> [Accessed 1 October 2020].

Aa.com.tr. 2020. *EU Reaches Record High LNG Imports In 2019*. [online] Available at: <<https://www.aa.com.tr/en/economy/eu-reaches-record-high-lng-imports-in-2019/1797059>> [Accessed 1 October 2020].

2020. [online] Available at: <<https://www.mckinsey.com/industries/oil-and-gas/our-insights/setting-the-bar-for-global-lng-cost-competitiveness#>> [Accessed 1 October 2020].

Macrotrends.net. 2020. *Natural Gas Prices - Historical Chart*. [online] Available at: <<https://www.macrotrends.net/2478/natural-gas-prices-historical-chart>> [Accessed 1 October 2020].

Statista. 2020. *International LNG Prices By Select Region 2020* | Statista. [online] Available at: <<https://www.statista.com/statistics/252984/landed-prices-of-liquefied-natural-gas-in-selected-regions-worldwide/>> [Accessed 1 October 2020].

DLA Piper. 2020. *What Is The Future Of LNG Pricing? | | Insights | DLA Piper Global Law Firm*. [online] Available at: <[https://www.dlapiper.com/en/us/insights/publications/2019/08/energy-infrastructure-and-projects-global-insight-issue-2/what-is-the-future-of-lng-pricing/#:~:text=The%20price%20of%20LNG%20will,British%20thermal%20units%20\(MMBtu\).&text=The%20price%20slope%20will%20then,70%20%3D%20USD%209.10%20per%20MMBtu.](https://www.dlapiper.com/en/us/insights/publications/2019/08/energy-infrastructure-and-projects-global-insight-issue-2/what-is-the-future-of-lng-pricing/#:~:text=The%20price%20of%20LNG%20will,British%20thermal%20units%20(MMBtu).&text=The%20price%20slope%20will%20then,70%20%3D%20USD%209.10%20per%20MMBtu.)> [Accessed 1 October 2020].

Statista. 2020. *LNG Largest Public Companies Worldwide 2019* | Statista. [online] Available at: <<https://www.statista.com/statistics/332361/largest-public-lng-companies-worldwide/>> [Accessed 1 October 2020].

Latimer, C., 2020. '*LNG Boom Is Back*': Surge In Projects Tipped For Next Six Years. [online] The Sydney Morning Herald. Available at: <<https://www.smh.com.au/business/the-economy/lng-boom-is-back-surge-in-projects-tipped-for-next-six-years-20190426-p51hj3.html>> [Accessed 1 October 2020].