



# CRA Insights: Energy

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## The impact of US LNG on European gas prices

### **Increasing US exports of LNG will change how gas prices are determined in Europe**

Import dependency for the European Union, pushed higher as a result of both increasing demand and declining EU production, reached over 70% in 2016 as compared to 62% in 2010. This trend continued in the first half of 2017 with net imports increasing a further 10% (as reported in the European Commission's Quarterly Report on European Gas Markets). These imports principally comprised pipeline gas from Russia (41% import share), Norway (35% import share) and Algeria (10% import share) together with some liquefied natural gas (LNG), mainly from Qatar, Algeria and Nigeria (collectively a 13% import share).

In 2017, the US has been only the sixth largest LNG supplier to Europe. However, this constitutes a substantial increase from its 2016 market share of overall LNG imports of 0.6% to over 5%. Moreover, as explained below, US LNG export capacity is set to increase further over the next few years. This, in turn, means that US LNG will over time play an increasingly important role in European gas price determination.

Under current models for the determination of wholesale market gas prices, the marginal price-setting gas supply is imported LNG or flexible oil-indexed pipeline gas from Russia above take-or-pay levels. In this model, whether LNG or Russian gas is price-setting largely depends on Asian hub prices. Increases in Asian gas prices tend to draw LNG away from Europe, leaving Russian gas to be price-setting at the margin. Decreases in Asian gas prices tend to push LNG into Europe, displacing Russian gas and making LNG price-setting for marginal supplies in Europe. However, with increased supply from the US as export LNG terminals come online, the drivers of US LNG export pricing are set to become important influences on European prices.

The rest of this paper:

- sets out the potential scale of US LNG exports relative to European import demand;
- explains the dynamics behind US LNG pricing, which will introduce a significant "step" into the European supply curve as US LNG export terminal utilisation increases; and

- concludes that competing US LNG will increasingly constrain European gas prices.

## US LNG will soon have a substantial market share in Europe

The US currently has three operational LNG trains at Cheniere Energy's Sabine Pass facility with a total capacity of 18.6 bcm/year. This is set to significantly increase with the commissioning of additional projects. With the projects that are already operational and under construction, total LNG export capacity will reach over 90bcm/year before 2020. This is around 20% of total European demand.

**Table 1: New US LNG Export Capacity\***

Facility		Developer	Capacity bcm/year	Start Date
<b>Operational</b>				
Sabine 1-3		Cheniere Energy	18.6	2016
<b>Under construction</b>				
Sabine Pass 4		Cheniere Energy	6.2	2017-18
Sabine Pass 5		Cheniere Energy	6.2	2017-18
Cove Point, MD		Dominion	7.2	2017
Elba Island 1-5		Kinder Morgan-Southern LNG	3.6	2018
Freeport 1		Freeport LNG	6.2	2018-19
Freeport 2		Freeport LNG	6.2	2018-19
Freeport 3		Freeport LNG	6.2	2018-19
Corpus Christi 1		Cheniere Energy	6.2	2018-19
Corpus Christi 2		Cheniere Energy	6.2	2018-19
Cameron 1		Sempra-Cameron	6.2	2019
Cameron 2		Sempra-Cameron	6.2	2019
Cameron 3		Sempra-Cameron	6.2	2019
<i>Sub-total</i>			72.9	
<b>Approved by Federal Energy Regulatory Commission but not under construction</b>				
Lake Charles 1-3		Lake Charles LNG-Shell	21.7	
Golden Pass		Qatar Pet. /ExxonMobil	21.7	
Magnolia LNG		LNG Ltd	11.4	
Corpus Christi 3		Cheniere Energy	6.2	
Cameron 4-5		Sempra	13.4	
<i>Sub-total</i>			74.4	
<b>In planning</b>				
Gulf Coast LNG, Brownsville		Gulf Coast LNG	28.9	
Gulf Coast LNG, Pascagoula		Kinder Morgan	15.5	
Freeport 4		Freeport LNG	6.2	
Texas LNG, Brownsville			3.1	
Calcasieu Pass		Venture Global	13.4	

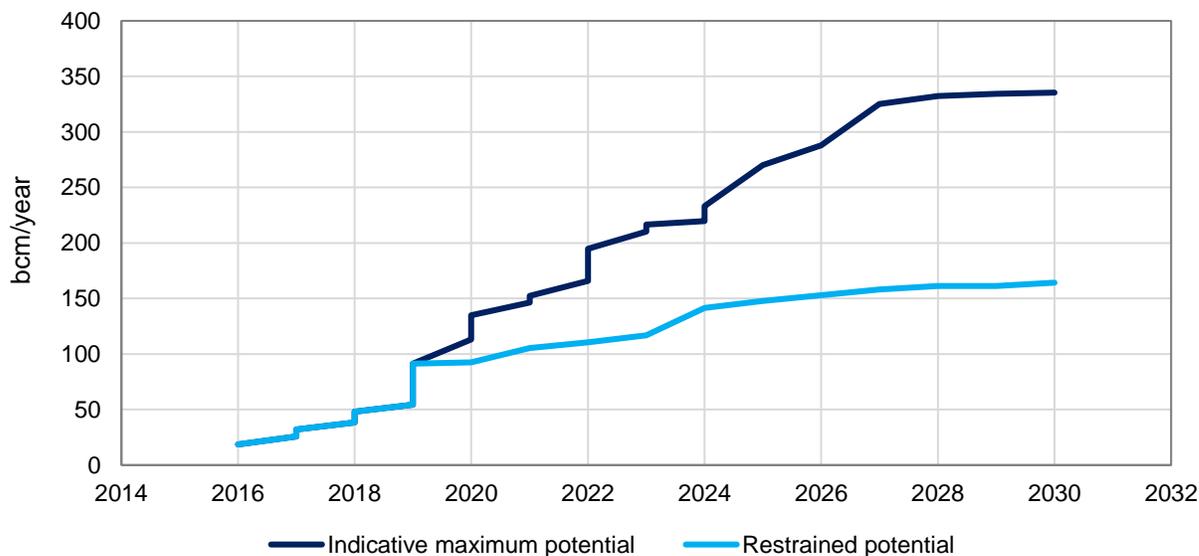
Facility		Developer	Capacity bcm/year	Start Date
Driftwood LNG, Calcasieu Pass		Tellurian	37.2	
Delfin Offshore floating		Delfin LNG/Bechtel	17.6	
Rio Grande LNG, Brownsville		NextDecade	37.2	
Live Oak LNG		LiveOak/Parallax Energy	7.2	
Commonwealth LNG, Cameron Parish		Commonwealth LNG	2.1	
Strom LNG, Crystal River		Glauben Besitz/Strom LNG	1.0	
<i>Sub-total</i>			<i>169.5</i>	
<b>TOTAL</b>			<b>335.5</b>	

Source: CRA analysis

\* Numbers may not cast due to rounding

Further projects could take US LNG export capacity to 335bcm/year. However, for projects still in planning, the final investment decision will depend on recovery in expected global LNG prices to levels sufficient to remunerate the full costs of supply which, as shown below, is not currently being achieved. This could shift the further increase in US LNG export capacity until later in the 2020s. The figure below also shows, as an alternative, a more modest increase in US LNG exports derived from projections by the US Energy Information Administration, but which is based on Henry Hub prices reaching \$5/Mmbtu by 2030.

**Figure 1: Development of US LNG export capacity**



Source: CRA analysis

Clearly, not all the US LNG cargoes will be routed to Europe; indeed European total regasification capacity is currently around 200bcm/year (though this may be expanded further

with extensions to some terminals and the addition of Floating Storage and Regasification Units). To date, most of Cheniere’s shipments have been to Mexico. However, deliveries of LNG to Mexico will decline as they are replaced by pipeline gas from the US. The Texas to Tuxpan Pipeline has a capacity of 2.6 Bcf/d and is scheduled to be in service by June 2018. In any event, even a relatively modest share of total US export capacity could constitute a significant share of European demand. By 2030, 50% of the restrained potential export capacity as estimated by the US Energy Information Administration (EIA) would constitute nearly 20% of the European Union 2016 overall demand.

## US LNG pricing is based on marginal, not average, costs

The initial shipments of US LNG have been priced on the basis that revenues are sufficient – after allowing for variable costs – to make a contribution to unavoidable fixed costs. In the first quarter of 2017, the daily reference price at The Netherlands TTF hub averaged around \$5 MMBtu, while US Henry Hub prices averaged around \$3/MMBtu. This spread of \$2/MMBtu is less than the average US liquefaction fee, shipping cost and regasification fee, but enough to make a contribution toward fixed costs as shown below.

**Table 2: Contribution to US LNG Fixed Costs (\$/MMBtu)**

		Illustrative revenue	
		\$5/MMBtu revenue	\$4.7/MMBtu revenue
<b>Cost structure</b>			
<b>Fixed cost</b>			
Liquefaction fee (see below)	[1]	3	3
<b>Variable cost</b>			
Henry Hub	[2]	3	3
Shipping	[3]	1.1	1.1
Regasification	[4]	0.5	0.5
<b>Total cost</b>	[5]=[1]+[2]+[3]+[4]	7.6	7.6
<b>Revenue</b>	[6]	5	4.7
<b>Loss</b>	[7]=[6]-[5]	-2.6	-2.9
<b>Contribution to fixed costs</b>	[8]=[6]-[2]-[3]-[4]	0.4	0.1
<b>Henry Hub - Europe spread</b>	[9]=[6]-[2]	2	1.7

Source: CRA analysis

However, US LNG shippers have committed to long-term liquefaction contracts with take-or-pay obligations covering around 80% of the export terminals’ liquefaction capacity. This means that liquefaction fees are effectively unavoidable costs until this capacity is utilised. Consequently, the spread between European hub prices and Henry Hub could even fall below \$2/MMBtu and US LNG shippers would still be incentivised to take US LNG to Europe while capacity utilisation of US terminals is below 80%. This is illustrated in Table 2 in which the spread falls to \$1.7/MMBtu.

In practice, forward markets currently exhibit a spread of up to \$2/MMBtu or more through to 2020. European NCG futures on the EEX for calendar year 2020 are around \$5/MMBtu, while NYMEX futures at Henry Hub for 2020 are less than \$3/MMBtu. This indicates the continuing prospect of US LNG exports to Europe (subject of course to the draw of other LNG markets).

But, at the point at which utilisation of export terminal capacity exceeds take-or-pay levels, then marginal US LNG shipments will be priced to recover full costs. This will introduce around a 50% (or \$2.5/MMBtu) increment in required prices. This could lead to a significant step-up in LNG prices.

### The erosion of the LNG global market surplus

So, a key question is: *when will US LNG terminal capacity utilisation surpass take-or-pay levels?* Several forecasters expect the existing global LNG supply surplus to be eliminated by the mid-2020s. This follows from increasing global gas demand despite the continued addition of new LNG capacity in the US (as indicated by the projects under construction in Table 1), as well as in other parts of the world. According to the US Energy Information Administration (EIA), between 2017 and 2030, US gas production is forecasted to increase by 200bcm/year, which is well in excess of the expected output from existing projects under construction. It is also well in excess of the forecast increase in US domestic consumption of only 46bcm/year. This represents additional export-oriented US LNG production above existing or currently under construction capacity which, of course, would not reach final investment decision unless full costs were expected to be recovered.

### Implications for European gas prices

The structure of the US LNG supply curve means that European LNG prices should be expected to step-up by around \$2.5/MMBtu in the mid-2020s as global LNG demand rises to allow LNG terminal capacity to surpass take-or-pay levels, *unless* other sources of gas to Europe, such as Russian gas, seek to exploit the return to supply/demand balance in the global LNG market and undercut US LNG to increase their own sales.

US Henry Hub prices in the period to 2030, based on the EIA and other projections, are expected to remain around \$3-5/MMBtu as a result of the substantial availability of low-priced production capacity. This then indicates a breakeven US LNG price of around \$7.5-9.5/MMBtu (given liquefaction and shipping costs) providing a restraint on European prices, but still providing headroom for a substantial step up from the levels currently traded in futures though to 2020.

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