

LNG Exports

US Exports Prepped to Surge in Leaner LNG Market

The Takeaway:

There are several truths known to be self-evident in the world of LNG: first, demand is rising quickly due to a variety of economic and political factors; second, near-term oversupply will give way to an aggregate supply deficit, probably by the early 2020s; and third, LNG export terminals require years to build, and secure, long-term contracts. This framework is widely accepted by players in the LNG market – buyers know they can't wave a "magic wand" and cause LNG capacity to appear when they need it. All the same, buyers also know that many of the proposed and rumored export projects will not make it to a final investment decision. Indeed, picking a project to sign on with is like betting on horses. Ultimately, buyers must balance a project's estimated pricing while determining whether it is likely to meet its gas production targets on time and on budget. On a certain level, buyers are running out of time. Certain markets are growing rapidly, while others are stagnant or shrinking, and volumes are not perfectly fungible between countries. Additionally, the increasingly seasonal market suggests that a season's or short-term supply deficit could precede the deficit in aggregate supply by several years (our model suggests 2019). We believe the US is uniquely positioned to take advantage of this window of economic and political opportunity, despite the bruising, low-priced LNG spot market that has claimed so many projects around the world.

- › In this report, we explore trends in global LNG capital expenditures for greenfield and brownfield LNG facilities. The US is distinct among global competitors due to its relatively low Capex costs, which define a relatively narrow \$550-750/tonne Capex cost band for most projects under consideration.
- › Within the US, certain market regions have different characteristics. We explore what makes the three dominant regions for US projects unique.

Changing Trends Thin the Herd of LNG Projects

The LNG market is significantly leaner and more competitive than it was in 2013 and 2014, when many of the newly operational LNG export facilities made their final investment decisions. Low oil prices and somewhat lower demand for the fuel have led to cancellation or slow-walking of many projects, including, most recently, Petronas' proposed Pacific NorthWest LNG export facility (19 mtpa) planned for British Columbia. However, a number of projects have also emerged in the past couple years, including Tellurian's (TELL) Driftwood LNG facility (26 mtpa), NextDecade's (NEXT) Rio Grande (27 mtpa), Venture Global's Plaquemines project (16 mtpa) and others, mostly concentrated in the US. This churn – cancellation of mega-projects backed by majors and introduction of new projects backed by smaller, lesser-known companies – creates a great deal of uncertainty for buyers who are trying to plan for their future gas needs.

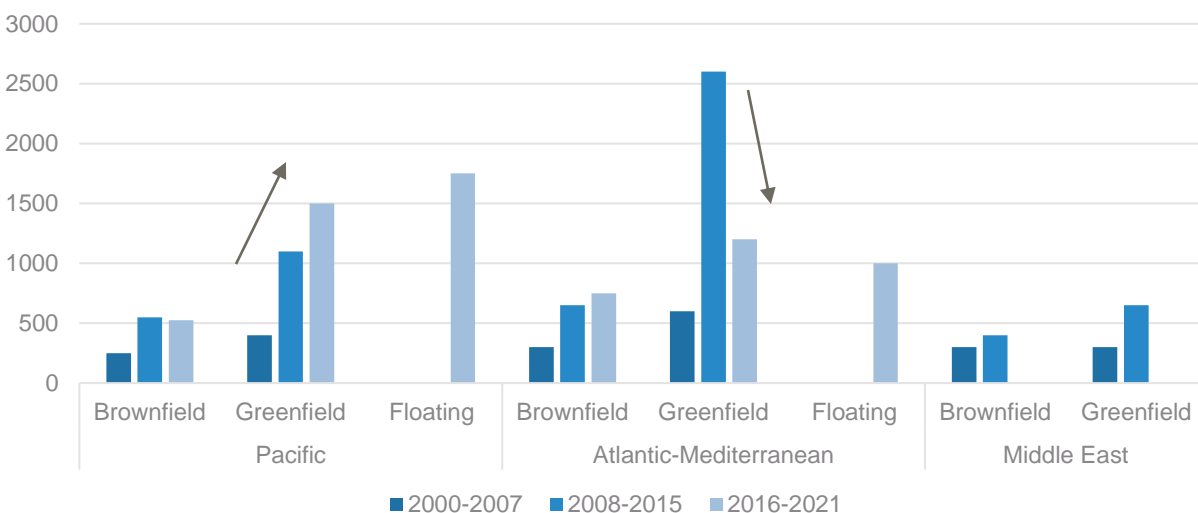
Add to this the volatility in oil prices and the shifting and unpredictable nature of LNG demand, and it is clear that buyers are in a difficult position trying to decide not only which projects might be viable long-term but also whether they will be able to successfully incorporate more LNG into their portfolios.

Capex Trends

Trends in capital expenditures among LNG projects tell an interesting story about how increasing competition is driving uneconomically high-cost projects out of the market. Over the last 20 years, capex costs for new LNG export infrastructure, in particular, have risen dramatically (from \$379/tonne in 2000-2007 to \$807/tonne in 2008-2015, on average). This shift is particularly pronounced for greenfield LNG facilities, which have seen costs rise from under \$500/tonne in the 2000-2007 period to \$1,162/tonne in 2008-2015. Brownfield facilities have also seen costs rise, though not as much – from under \$300/tonne to \$502/tonne by 2008-2015. While this trend reflects a variety of factors, including rising EPC costs and a very high-priced oil environment, it also illustrates a number of large, expensive, remotely located LNG projects like Chevron's (**CVX**) and Shell's (**RDS.A**) Gorgon (15 mtpa). When they took FID, these projects had massive up-front costs that include not only the facility but also a significant amount of upstream development and infrastructure, including gas production, processing, and transport. Additionally, many new, remote LNG facilities experienced significant cost overruns (from 30-50%), with costs for Gorgon ballooning from A\$11 Billion in 2007 (USD\$650/tonne) to A\$53 billion (USD\$2,700/tonne).

As Figure 1 illustrates, the trend of rising costs is expected to continue through the 2016-2021 period, according to data from the International Gas Union. The only area that breaks this trend, according to their survey of company reports, is US greenfield projects, which are expected to show declining average costs over the next five years.

Figure 1. Capex Trends by Region – Average Unit Liquefaction Costs (\$/Tonne)



Source: International Gas Union Annual Report, 2016

Buyers, especially Japanese and Korean utilities that have been the cornerstone of the LNG market since its emergence in the 1960s, were burned by frequent cost overruns and delays and are understandably skeptical of any project's ability to be on time and on budget. In this vein, Cheniere Energy (**LNG**) has boosted the profile of US LNG facilities meaningfully by managing to meet, and even exceed, its construction targets. By and large, US projects like Dominion's (**D**) Cove Point have remained on schedule once they put shovels in the ground (though Freeport has experienced some delays), which indicates that the US is unlikely to experience the kinds of labor shortages that drove costs through the roof in Australia.

As Figure 1 shows, projected costs for new infrastructure in the US come in well below global competitors, since these projects require substantially less infrastructure than their global peers. US projects are benefitting from competition among EPC contractors, at the moment, who see a much smaller field of potential projects than they did several years ago. US projects also benefit from the robust North American gas market, and therefore they do not need to justify major upstream investments or any significant gas processing activity. Figures 2 and 3 show the average cost breakdown for liquefaction components.

Figure 2. Average Cost Breakdown of Liquefaction Components

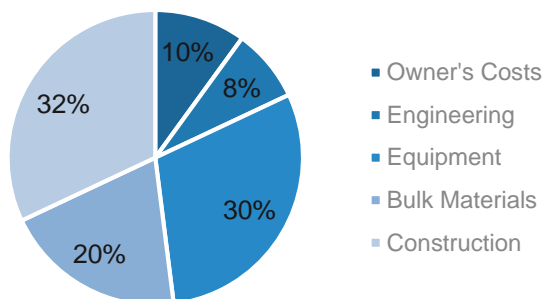
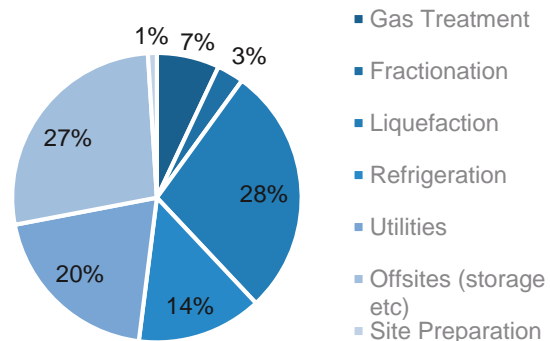


Figure 3. Average Cost Breakdown of Liquefaction Expense Category



Source: Oxford Institute for Energy Studies

As Figure 3 illustrates, many US projects do not require the same investment in certain expense categories because they receive pipeline gas that has already been subject to processing, and, therefore, can offer cheaper contracts to customers than many global competitors. While it is superficially true that a typical oil-linked contract would price lower than a typical Henry Hub linked contract at the present time, (roughly \$5.50 for oil versus \$6 for Henry Hub, plus delivery, for a 12% slope and a \$3 tolling charge), our analysis clearly indicates that there are few, if any, global projects that would be able to enter economically the market at the current oil price.

Regional Advantages

While the US, as a whole, offers a number of construction advantages over its global competitors, not every US project can make it to FID. Over 27 Bcf/d export capacity has applied to FERC and not yet made it to

FID – representing nearly 200 million tonnes of additional export capacity. Clearly, not every project will be able to sign contracts with buyers for their liquefaction capacity. Factors like location, ownership, gas availability, and project capitalization create some separation in this crowded field, where Capex costs for most US projects largely converge within a pretty narrow range (and are well below international peers). We see three major regions within the US as the key differentiators across projects, each with their own benefits and disadvantages:

Gulf / Louisiana (TELL, LNG's Sabine Pass, Venture Global's Calcasieu Pass, Cameron)

Roughly half of the proposed US export capacity is located along the Calcasieu Pass in Louisiana. This region is well-developed and experienced in handling infrastructure projects and shipping. Pipeline networks traverse the area, making large volumes of gas readily accessible to projects and their buyers. The region is also proximate to the Henry Hub, and gas sold to buyers is extremely likely to be priced off of the Henry Hub. These projects will likely face the highest gas prices of any under development in the US, though these prices will likely continue to look low by global standards. Cheniere (and others, potentially) is exploring ways to drive cheaper gas to the Gulf, however, including linkages with the Montney shale in Canada. If this strategy plays out, some LA projects may be able to bring down gas prices somewhat, but they will need to have sufficient capital to be counterparties on gas supply deals.

Gulf / Texas (NEXT's Rio Grande, LNG's Corpus Christi, Texas LNG, Port Arthur):

A number of other projects are scattered along Texas' Gulf Coast, from Port Arthur to Corpus Christi and Brownsville. While this area is somewhat less developed, it is still heavily industrialized and has access to skilled labor and gas infrastructure. A chief advantage for plants in this region is their proximity to growing, and somewhat stranded, gas resources in the Permian basin. Associated gas production in the Permian is expected to rise as oil production continues to expand, but there is inadequate takeaway capacity to properly integrate these gas resources with the US market. For this reason, expect facilities to have similar capital costs as those in Louisiana, but they could potentially offer buyers access to a cheaper gas market (perhaps even compatible with oil-linked contracts).

US West Coast (Veresen (**VSN.TO**) Jordan Cove):

The US West Coast has two major advantages over the Gulf Coast: it is geographically proximate to Asia (shipping times fall to six days, versus two to three weeks for the Gulf) and can access low-priced Western Canadian gas. However, the regulatory environment in the Pacific Northwest makes it nearly impossible to construct new infrastructure here. Veresen's (**VSN.TO**) Jordan Cove project is the only one under active consideration, and it has already been denied once by FERC. The project is moving through the regulatory process slowly, by design, in order to line up as much public support as possible before attempting to enter commercial service in 2024.

RISKS

The legislative and regulatory agendas are subject to change at the discretion of leadership. Unprecedented economic conditions could instigate unanticipated and/or sweeping shifts in policy. Predicting the future is a hazardous endeavor and economic / market forecasting is an imprecise science. Actual outcomes may differ substantially from our forecasts. The predictions and opinions expressed herein are subject to change at any time.

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