THE LNG FLEXIBILITY IMPERATIVE:
UNLOCKING LNG COMPETITIVENESS AND LIQUIDITY THROUGH COMMERCIAL CHANGE AND FLEXIBILITY

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The US LNG export boom, modest LNG demand growth, mounting surpluses, and low oil prices will drive sustained convergence of oil-indexed long-term contracts ("LTCs") and traded natural gas hub prices used for shorter-term trading. The oversupply and convergence of LTC and short-term market prices, in turn, will squeeze trading margins and stimulate supply flexibility and market liquidity. In this environment, buyers will demand and sellers will need to provide increased use of hub pricing and commercial flexibility for deliveries under LTCs and/or greater use of shorter-term supply arrangements. A critical commercial challenge facing buyers and sellers has become the value – and pricing – of flexibility for both existing and new supply arrangements, as well as the development of new LNG portfolio strategies that optimize the relationship between LNG prices and supply flexibility.

This paper evaluates the implications of increasing LNG supply flexibility on LNG value, pricing, contracting, liquidity, and trade over the next decade. It analyzes the market drivers and outlook for supply-demand balances and regional price differentials, and the commercial conditions for increased flexibility. It provides an illustrative example to assess the value of commercial flexibility to buyers and sellers. Accurate pricing of LNG flexibility is critical to unlocking LNG value, competitiveness, and market liquidity. Finally, the paper provides conclusions regarding the future implications for LNG buyers and sellers with respect to LNG contract (re)negotiations, trading, and portfolio strategy.
The LNG industry has grown up very fast in the new millennium. Previously a boutique industry for marginal sources of relatively inflexible supply between individual suppliers and buyers in a few markets worldwide, LNG has since 2000 become a major source of natural gas supply and trade used extensively worldwide. LNG supply is now engaged in its third post-millennial export boom -- with the North American supply boom following the Middle Eastern wave in the late 2000s and the Australian additions of the early- and mid-2010s -- LNG trade now involves 22 exporters and 40 importers. Total trade volumes in 2017 reached 397 Bcma, equivalent to 11% of total global gas consumption, 75% of consumption in Europe, 52% in Asia, and 42% in North America. Further, LNG derivatives trading volumes, which represented about 2% of global LNG production in early 2017, grew to almost 23% of total LNG production as of year-end 2018 -- further proof that the LNG market is maturing and its liquidity is increasing. By any measure, LNG is now a very substantial segment of the global gas industry.

Supply and trade growth has been accompanied by the financial maturation of production infrastructure. Of all LNG liquefaction capacity, over 167 Bcma or 34% is now over 15 years old, meaning that a large segment of global supply is produced by terminals whose original investment and financing is largely or fully amortized. Additionally, some of the original sales and purchase agreements (SPAs) used to anchor that financing have expired or will expire soon. Legacy suppliers in Trinidad, Algeria, and Indonesia, for example, now have a great deal more financial flexibility to engage in short-term LNG sales and trading than they did when they took FID for their integrated upstream and liquefaction investments decades ago.

Further, the most recent export boom now underway in North America has introduced a new flexible LNG business model to the industry. Driven to market over the current decade by the shale gas revolution and rapid expansion of natural gas production capacity, the new LNG exporters in the U.S., Canada, and Mexico can tap into the world’s largest, deepest, and most liquid natural gas hub markets to obtain their feed gas supply. This means that they don’t require their customers to commit to long-term, oil-indexed take-or-pay contracts for integrated commodity production and liquefaction, but rather offer bundled or unbundled access to liquid hub pricing and liquefaction tolling fees. As a result, the ultimate buyers of this new LNG supply do not need to enter commercial commitments that underwrite substantial upstream investments in natural gas production as well as liquefaction. Instead, they can make flexible or variable commitments to feed gas costs at hub pricing plus the fixed cost of liquefaction. As a result, the North American LNG supplies are introducing substantial new volumes of gas-indexed supply with enhanced commercial flexibility to the market.

Commercial Outlook

The financial and commercial profile of future LNG production will be far more conducive to commercial flexibility than was possible in the past. By 2025, the compound effect of the financial maturation of 328 Bcma of legacy liquefaction capacity reaching over 15 years of service (including all of capacity having taken COD by 2010) and the expected COD for at least 175 Bcma of new, flexible North American LNG liquefaction capacity, imply that up to 503 Bcma (or 70% of total LNG production) could be made available on a full or semi-flexible basis.

The commercial transformation of LNG supply will be accompanied by similar trends on the demand side. In the largest and oldest LNG markets of East Asia and Western Europe, regulatory and market change continue to

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stimulate ever greater competition between LNG and natural gas supply sources intensifying buyers’ interest in commercial flexibility.

This is very advanced in Europe and just beginning in Asia. Destination restrictions are generally not included in LNG SPAs with European buyers because the European Commission made it clear that such provisions constitute a serious breach of European competition law. In Asia, there is now an initial, ongoing analysis in Japan and other countries regarding the removal of destination restrictions in LNG SPAs because of their anti-competitive effect.

Further, many of the new buyers that are entering the LNG import business have opted for smaller scale, flexible FSRU infrastructure that reduces investment volumes and allows for relocation if LNG supply can be displaced by domestic production, pipeline imports, or other energy sources in the mid-term. These new buyers also seek a measure of supply flexibility.

Combined, these commercial trends continue to stimulate substantial growth in flexible LNG trade. By many estimates, short-term and spot trade has already reached approximately 25-30% of total trade and could reach 50% by the mid-2020s.

**Competition and Pricing**

LNG industry growth and maturation, and the growth of short-term trade, have broadly fostered increased supply and price competition worldwide. These trends do not form a straight line, but they are clear over the long term.

For example, since the advent of vast new supplies of Qatar LNG in the 2000s, the amount of inter-hemispheric trade between markets East of Suez (EOS) and West of Suez (WOS) has broadly increased, despite significant changes after the Great Japan Earthquake and nuclear tragedy of early 2011 and the arrival of large volumes of Australian supply during the current decade. Figure 1 plots inter-regional LNG trade flows, demonstrating the substantial growth in WOS flows to EOS markets and the decrease in EOS flows to WOS markets – especially after 2011 when large volumes of Middle Eastern LNG were diverted from Atlantic Basin destinations to Pacific Basin markets. Inter-regional trade flows are now approximately balanced.

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Key LNG price benchmarks for LNG trade have also broadly converged despite periods of substantial divergence, as presented in Figure 2.

Looking ahead, these trends will become more pronounced. We project that inter-hemispheric trade from WOS to EOS will grow substantially as Asian markets outgrow the recent Qatari and Australian supply booms and

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6 BRG Energy analysis based on price data from Platts, Bloomberg, and FERC/Waterborne.
increasingly turn to WOS supplies from North America. As represented in Figure 3, the trade flows from WOS to EOS will more than treble from 2017 to 2025.

Figure 3: Forecast of Inter-regional LNG Trade Flows

The increased volume, depth, and liquidity of flexible short-term LNG trade will also support a substantial trend toward price convergence over time, despite some significant variations in 2018-2020 as winter demand levels spike and new capacity comes online. As presented in Figure 4, Japan Korea Marker (JKM) and National Balancing Point (NBP) prices will become even more closely aligned with each other, and their respective price differentials to HH will decrease by the early 2020s. These trends will be driven by the substantial volumes of new destination and volume flexible, hub-priced US LNG supply coming online over the coming several years, and the enhanced depth and diversity of supply options worldwide. Decreasing oil price expectations have also reduced LNG and natural gas price differentials by lowering the price of LNG delivered under oil-indexed LTCs.

7 BRG Energy analysis based on LNG Horizon model forecasts.
As legacy LNG terminal investments are further amortized, large volumes of flexible North American supplies come to market, and the flexibility needs of legacy and new LNG markets increase, the amount of LNG-on-LNG and LNG-on-gas price competition will continue to intensify. Additionally, liquefaction capacity growth will outpace demand growth, keeping commercial leverage tilted toward buyers.

From 2017 through 2025, post-FID and advanced pre-FID projects will add 256 Bcma of new liquefaction capacity (see Figure 5).\(^9\) Overall LNG liquefaction capacity will increase to 714 Bcma.

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\( ^8 \) BRG Energy analysis based on LNG Horizon model forecasts.

\( ^9 \) The incremental liquefaction capacity includes capacity from new post-FID and advanced pre-FID projects.
During the same time period, total LNG demand should grow by approximately 214 Bcma to reach 611 Bcma. This represents a 5.5% Compound Annual Growth Rate (CAGR), 1.0% below the historical rate over the prior decade. Compared to the liquefaction capacity growth, the overall result will be an approximate 103 Bcma capacity buffer by 2025, as shown in Figure 6.

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10 BRG Energy analysis based on LNG Horizon model forecasts and GIIGNL, Global LNG Info, and Wood Mackenzie data.
Over the near- to mid-term, this competition will primarily accrue to the benefit of buyers. This imbalance should be corrected by the mid-2020s, however. As provided in Figure 7, the global liquefaction load factor will remain in the range of 84%-87% from 2018 to 2025, as liquefaction investments keep ahead of demand growth.

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11 BRG Energy analysis based on LNG Horizon model forecasts and BP Statistical Review, GIIGNL, Global LNG Info, and Wood Mackenzie data.
Another critical competitive factor for LNG supply will be the ongoing rapid penetration of renewable energy sources into the wholesale and retail power generation businesses worldwide. Just as large global gas companies were surprised by the technology-driven shale gas production cost efficiencies and booming volumes, the global gas industry is witnessing a similar trend with the rapidity of renewable energy technology improvement, cost efficiencies, and market penetration. This has begun to have a substantial impact on natural gas demand and pricing in several key markets in Europe and North America, and this trend is expected to intensify. As the marginal source of natural gas supply worldwide, the effect on LNG demand and pricing could be quite substantial.

The Flexibility Imperative

Decreasing LNG capacity utilization, increasing supply competition, and downstream natural gas competition with renewable energy will confront the LNG industry with strong competitive headwinds over the coming several years. This will keep prices under pressure, but price will not be the only field of competition. The growing needs of legacy and new buyers for greater levels of supply flexibility will be a critical part of the competitive equation. LNG producers, aggregators, and traders are poised to master these challenges due to the amortization of legacy investments and access to flexible supplies from North America.

Commercial flexibility can provide a potent source of additional value to buyers and sellers in uncertain future market environments, but to unlock that value, LNG buyers and sellers need to deploy new methods and tools for

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12 BRG Energy analysis based on LNG Horizon model forecasts. Liquefaction load factors equals total LNG demand divided by total liquefaction capacity.
market forecasting and flexibility valuation. The value of flexibility can be measured as the incremental economic value from a contractual flexibility option, or flexible short-term trade, as compared to an inflexible contract. This can be done by means of detailed, rigorous, forecasting of global natural gas and LNG market equilibrium prices, combined with probabilistic analysis of the volatility of these prices.

The flexibility value of specific contractual options or portfolio strategies will differ depending upon each buyer’s and/or seller’s specific capabilities and constraints in relation to identifying and executing optimal trades. Additionally, LNG buyers and sellers have fundamentally different perspectives on the value of volume and destination flexibility due to their different commercial needs and interests.

Whereas buyers primarily use commercial flexibility to minimize their supply costs and to capture additional economic value by reselling excess supplies on a short-term or spot basis, sellers primarily use commercial flexibility to constantly sell LNG into markets offering the highest netback prices and to procure LNG from supply sources offering the lowest prices proximate to sales opportunities. As a result, no two parties should ascribe an identical value to the same unit of commercial flexibility.

BRG Energy uses proprietary models to help buyers, sellers, and traders identify the economic value associated with flexibility. These include our LNG Horizon model, which provides fundamental market analysis and forecasting of natural gas and LNG supply, demand, trade, and prices, and our Flexibility Valuation Model (FVM), a real option model that quantifies the value of volume and destination flexibility in a company’s individual LNG contracts and/or commercial portfolio.

To illustrate how these tools can be used to evaluate the benefit of a flexible sales strategy, consider a hypothetical example in which a seller is comparing a LTC sales strategy with restricted flexibility (Strategy 1) to a spot sales strategy with full volume and destination flexibility (Strategy 2). Assuming the same sales volumes under both strategies, we use the LNG Horizon model and FVM to calculate the net present value (NPV) of future sales revenues from each scenario.

FVM calculates the sales value of Strategy 2 by forecasting the equilibrium prices and their implied volatility over the forecast horizon to determine the probability distribution of the economic value of sales and most probable sales results in light of pricing conditions, the seller’s trading capabilities and constraints, and competitive market conditions. The sales value of Strategy 1 is equal to all discounted LTC netback revenue. The NPV of the most probable revenue results from Strategy 2 minus the NPV of expected revenue from Strategy 1 determines the incremental economic value of the incremental commercial flexibility of spot sales.

To further illustrate this analysis, assume that the seller is a large aggregator or trader holding a SPA for LNG supply from a US Gulf Coast (USGC) producer and is evaluating whether to resell this supply to a Japanese buyer under a firm back-to-back SPA or to sell it in the spot and short-term markets on a fully flexible basis. This is an extreme and unlikely example designed to provide a stark illustration of the potential value of flexibility. Table 1 summarizes this illustrative example.
Table 1: Illustrative & Hypothetical Case Study for Resale of USGC LNG Supply

<table>
<thead>
<tr>
<th>No.</th>
<th>Strategy</th>
<th>Flexibility</th>
<th>Volumes</th>
<th>Sales Value – NPV</th>
<th>Destination Flexibility Uplift</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LTC</td>
<td>Restricted Volume and Destination</td>
<td>10 billion m³/year</td>
<td>All discounted LTC netback revenue.</td>
<td>Difference between the NPV of the full portfolio value of sales strategy no. 2 minus NPV of sales under strategy no. 1.</td>
</tr>
</tbody>
</table>

2 Spot Basis Full Volume and Destination 10 billion m³/year The highest probability result for the cargo netbacks of a highly effective trader’s LNG delivery to the best short-term markets.

The commercial flexibility available in strategy no. 2 can provide for economic uplift due to the magnitude of market change and price volatility over time. Given the convergence of LTC and spot prices toward historically low levels, a traditional LTC sales strategy would yield unprofitable sales that do not recover the full fixed and variable cost of the LNG supply. By comparison, the flexible sales strategy would provide sufficient economic uplift to yield sales that recover all costs and generate additional profit. For the hypothetical USGC LNG exporter described above, this difference is illustrated in Figure 8, which presents the probability distribution of the value achievable from the volume and destination flexibility. There is an equal chance that the flexibility value above the LTC would be above or below $655 million. The resulting flexibility value uplift is approximately $0.31 per MMBtu for the full ACQ.

Figure 8: Flexibility Value Uplift – High Trading Effectiveness

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13 BRG Energy analysis based on LNG Horizon model forecasts and FVM analysis.
A similar analysis could be performed for the same seller to analyze a hybrid approach of reselling the USGC LNG on a portfolio basis, with a mix of firm long-term SPA sales and short-term trading.

The analysis can also be deployed for buyers seeking to use greater commercial flexibility to minimize procurement costs and/or generate additional value from trading. The LNG Horizon model and FVM can be used to identify the additional economic risk and/or benefit above a traditional take-or-pay LTC purchasing approach of a flexible purchase and trading strategy for an individual contract or a portfolio of supply. This is useful for contract negotiation and renegotiation, as well as portfolio strategy, planning, and optimization.

**Conclusion**

LNG is now a very substantial segment of the global gas industry, and the amount of value available from new commercial flexibility demanded by buyers and offered from sellers is enormous. The maturation of global LNG liquefaction capacity as well as the recent boom in the North American LNG export market now affords suppliers greater flexibility. A large segment of global LNG supply is produced by terminals whose original investment is largely or fully amortized, meaning that these sellers have more financial flexibility to engage in short-term trading than during their early years of operation. Further, North American suppliers can now procure feed gas from some of the world’s largest and most liquid natural gas hub markets, meaning that these suppliers no longer need inflexible LTCs to underwrite substantial upstream investments in natural gas production. On the demand side, buyers continue to seek greater flexibility in tandem with the removal of destination restrictions and LNG import strategies that increasingly emphasize smaller scale FSRU infrastructure.

These supply and demand dynamics will continue to foster a market environment characterized by increased inter-regional trade and convergence of LTC and short-term prices. Particularly in the near- to mid-term as large volumes of flexible North American supplies come to market and capacity growth outpaces demand, the LNG industry faces strong competitive headwinds not only in terms of pricing, but also in terms of commercial flexibility. This will require industry players to identify and quantify the value of strategies based on a greater use of short-term contracts, greater use of FOB over DES supply, and/or greater engagement in LNG trading and resale for unnecessary supplies. Buyers and sellers alike will require the use of new analytic tools and new ways of thinking regarding contract (re)negotiation and strategic portfolio planning and optimization. No sales strategy based on enhanced volume and destination flexibility is without its risks and costs, but for those parties well positioned to take advantage of additional optionality, it can provide substantial returns and presents a compelling value proposition in the face of increasing market competition.