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LNG Portfolio Optimization: Challenge, Opportunity and Necessity

Why optimization?

Optimization is defined as: 'the process of making something as good or effective as possible'[1]. As the LNG industry matures and increases in complexity, so the emphasis on the value achievable through optimization increases.

LNG originated as a floating pipeline to provide supply from (typically) stranded gas reserves in locations with limited local markets to richer markets where gas demand was growing and required gas imports. Over time, in some markets, LNG began to compete effectively with pipeline gas, whilst still fundamentally being a supply/procurement transaction.

As global gas markets have evolved and through a series of significant LNG market step-changes, an increasing number of elements of the LNG market resemble a traded market – with more short-term trade, cargo churn and the emergence of reference prices and futures markets, although there remains a fair way to go before LNG resembles a truly liquid traded commodity.[2]

The impact of the COVID-19 pandemic – crashing demand and price, at least in the short term – has only served to amplify the market conditions already being felt by late 2019. Global oversupply (even before COVID-19) was depressing prices and driving greater price linkages between different markets. Although in the medium- to long-term LNG still looks resilient with BP's Energy Outlook[3] published in September 2020 forecasting significant growth in LNG demand by the mid-2030s in two of its three scenarios. [4] These market shocks have accentuated the increased inter-regional price communication and the value of LNG portfolio flexibility.

In this context, two, related, trends have occurred:

1. **greater correlation of global pricing, with regional arbitrage opportunities declining in scale and (perhaps) frequency as price differences get closer to transportation differences and correlations get priced into transaction valuation, and**
2. **increased competition for value – with more and more organizations building flexible portfolios capable of meeting spot and opportunistic demand and following price signals (arbitrage opportunities).**

[1] https://dictionary.cambridge.org/dictionary/english/optimization
[2] OIES research think piece 'New Players, New Models', March 2019
[3] https://www.bp.com/en/global/corporate/energy-economics/energy-outlook.html
[4] https://www.argusmedia.com/en/news/2141108-lng-demand-growth-to-rebound-from-covid19?backToResults=true&selectedMarket=Natural%20gas

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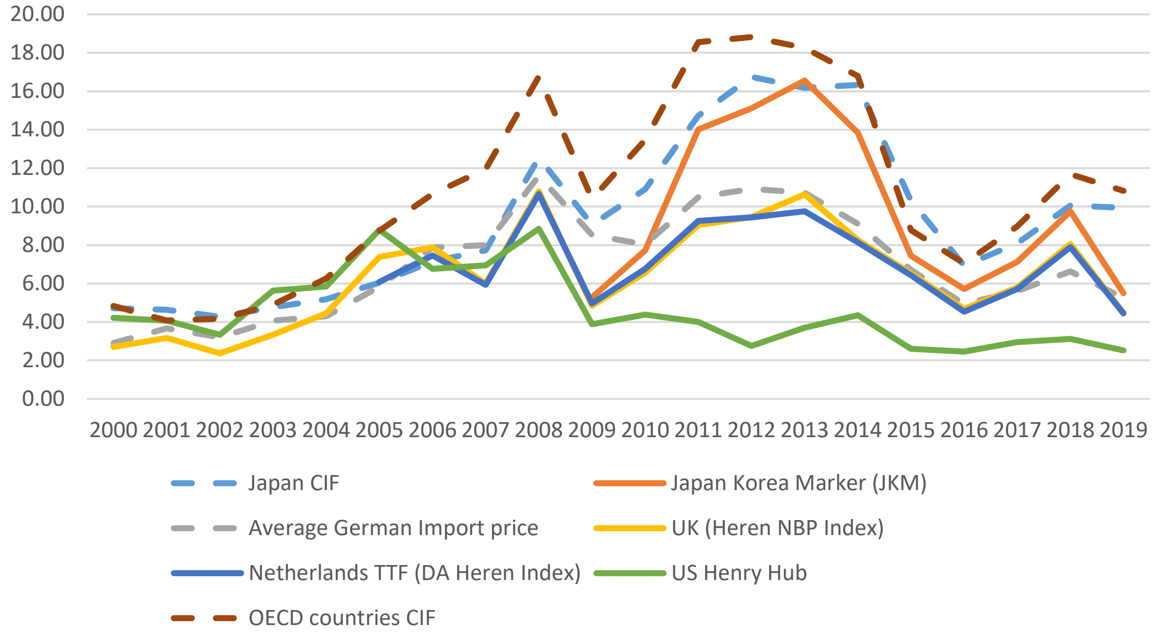
Mashal Jaffery, Senior Manager, Baringa Partners &
Peter Thompson, Director, Baringa Partners

Alongside this, there are ever-greater moves to increase the liquidity of the LNG market. First, this included the development of the JKM[5] index by Platts, something that is now subject to a nascent futures market. Imperfect as it may be, JKM futures – along with indices such as US Gulf of Mexico free on board (FOB) LNG and attempts to standardise spot contracts (see BP[6]) – are signs of the increased 'commoditization' of LNG and a change towards a more mature and challenging market in which to operate. These developments follow the emergence of NBP and TTF[7] as critical liquid market pricing references and market access points for LNG. Observing gas and LNG reference sources over the last few years shows the emergence of a clear correlation on a global level.

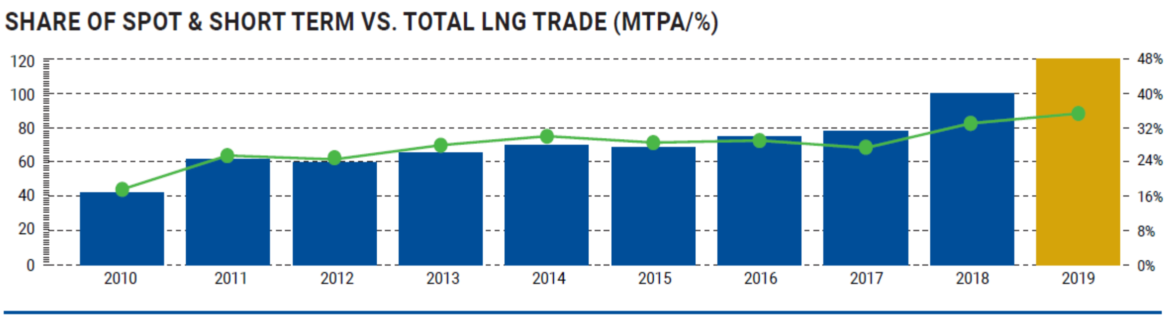
Figure 1: Selected global gas prices ($/MMBtu)
Recent price correlation



Source: OIES

With the evolution of LNG industry transitioning from procurement based transactions to an actively traded market there is a consistent growth in the share of spot and short term volumes and the growth in the JKM futures open interest. This is driven by increased liquidity and organisations in the LNG value chain, especially buyers, investing in building LNG trading and optimization capability**.**

Figure 2: Increased proportion of spot trade

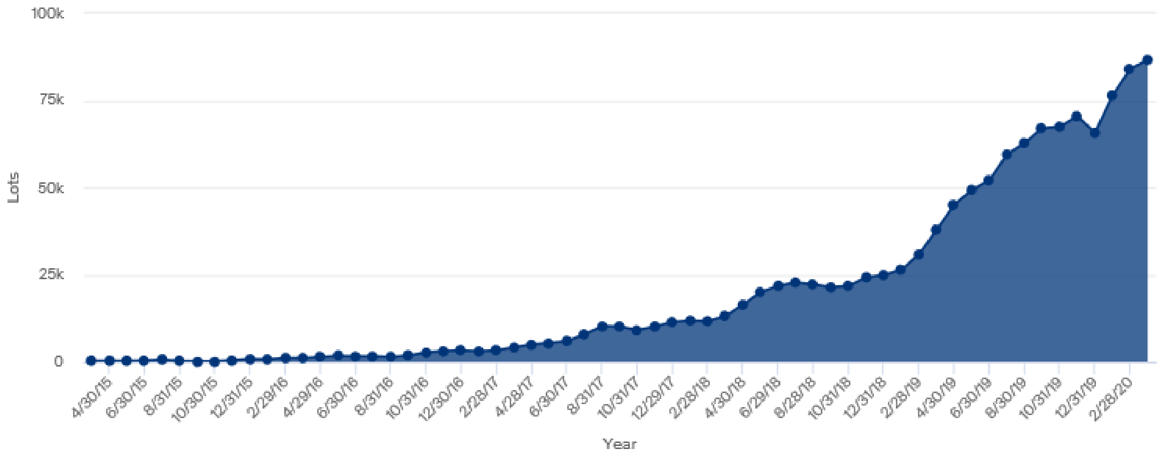


Source: The LNG industry GIIGNL Annual Report 2020

[5] Platts JKM™ is the Liquefied Natural Gas (LNG) benchmark price assessment for spot physical cargoes
[6] https://www.bp.com/en/global/bp-global-energy-trading/features-and-updates/technical-downloads/lng-master-sales-and-purchase-agreement.html
[7] NBP – National Balancing Point, UK gas hub; TTF – Title Transfer Facility, Dutch gas hub

JKM futures and options open interest has increased by more than 100 per cent year-on-year. In May 2020, JKM hit record open interest of more than 100,000 contracts.[8] This increase in volume has also been driven by new players entering the LNG market and managing price risk using the JKM futures tools.

Figure 3: JKM futures open interest



Source: https://www.theice.com/global-natural-gas-futures

Historically, when the LNG market was more illiquid, there were much greater opportunities for large margins to be delivered as a result of regional pricing disconnections (with Asian markets typically offering huge premiums). At the time, BG Group had the only truly substantial flexible portfolio, assets (ships) and commercial 'nous', and took advantage of this and spawned an oft-imitated, rarely-bettered LNG Aggregator Business Model. Such a business model – effectively optimizing assets and market access to maximize the value available from the flexibility of a supply portfolio – has typically been achieved by these organizations' 'black box' of optimization tools and models, typically in-house built and bespoke for their particular needs. The intention in this article is to begin to unpack that black box by identifying some of the key principles and methods applied to effectively optimize and how organizations today, with increasingly significant flexible portfolios, can approach this challenge.

With many players subsequently seeking to achieve similar benefits through portfolio flexibility, market proliferation and significantly greater contractual flexibility in LNG Sale and Purchase Agreements (SPAs), extracting value from portfolios through dynamic management of optionality and flexibility, is increasingly the norm: everyone is becoming a trader.

Returning to the starting definition of optimization – 'the process of making something as good or effective as possible' – and applying it to such an LNG portfolio, in practical terms this means:

- maximising the efficient utilization of infrastructure (vessels are full as much of the time as possible and travel the shortest distance possible; regasification terminal capacity is used; supply volumes are maximised as long as it is profitable to do so);
- maximising profitability by accessing the highest available prices from a supply portfolio to maximise overall profitability (i.e. not single cargo margin, but overall portfolio margin), and
- efficient utilization of risk management mechanisms (e.g. hedges) to meet risk appetite needs without eroding more value than necessary.

[8] *Businesswire* (2020). 'ICE's global Natural Gas markets attract record open interest as participants navigate volatile energy markets'. May. https://www.businesswire.com/news/home/20200520005401/en/ICE%E2%80%99s-global-Natural-Gas-markets-attract-record)

As more and more companies transform their LNG procurement/divestment activities into true trading, so they are evolving their perspectives and behaviours from ‘buy/sell’ to risk management and optimization.

This is demonstrated very well by simply observing the companies that have set up LNG trading desks in recent years and procured Energy/Commodity Trading and Risk Management (ETRM/CTRM) systems to support this business.[9] ETRM or CTRM are portfolio and transaction lifecycle management systems, while different software solutions might differ in the depth of functionality and sophistication, in most settings they are the system of record for managing the traded portfolio.

In short, greater competition for value, narrower margins and an ever-more liquid trade has created an irresistible force of change in LNG. As a consequence, players must work harder for profitability and where before some inefficiency was overwhelmed by the size of arbitrage margins available, in the modern market, an effective – and optimized – approach to LNG portfolio management is a necessity.

What are the levers to enable effective portfolio optimization?

Portfolio optimization is the maximizing of returns for a given level of risk. For an LNG portfolio it is the maximization of profit by extracting value from imbedded optionality while operating within certain constraints. For example, this could include destination flexibility on the part of a supplier, who can send cargoes to higher priced markets at its discretion, or volume and timing flexibility on the part of a buyer, able to manoeuvre delivery volumes and schedule them to best fit its needs (and economic benefit).

In financial markets this would be achieved by maximizing the ‘Sharpe Ratio’[10], which is derived by dividing excess returns of an asset or portfolio by the standard deviation. Excess returns are difficult to calculate for a physical commodity portfolio as the financial benchmark of the risk-free rate is somewhat irrelevant, but the non-traded/optimized value, return or cost of an LNG position can be used as a proxy. For example, for an LNG buyer such as a utility which traditionally procures LNG via fixed long-term SPAs, excess returns could be calculated as any cost saving achieved by timing its cargo purchase on the most favourable terms and price, including potentially on the spot market, or diverting supply cargoes to other destinations when favourable arbitrage exists. The standard deviation is essentially the volatility and is a measure of risk associated with the portfolio. The Sharpe Ratio is hence a neat way to articulate the risk-reward trade off. What imbedded optionality allows for, in theory, is an increase in the excess returns without increasing risk. In practice, for a physical LNG portfolio, there are multiple additional considerations and constraints that will influence optimization and these will be explored.

When looking to understand how best to optimize a portfolio two things need to be established, namely the levers for optimization and the constraints. The optimization levers are derived from optionality and, for the most part, are specific to the portfolio under consideration. Constraints are also dependent on the portfolio characteristics but it is important to consider the rationale for optimization and overlay the strategic ambitions and risk appetite considerations. These themes will be developed in greater depth in section four.

First of all, where might LNG players find optionality in their portfolios and what cases or ‘strategies’ can they employ to optimize their operations?

Optimization levers

Optimization levers fall into the three broad categories outlined below:

[9] https://www.baringa.com/en/insights-news/news/baringa-partners-supports-jera-global-markets-(1)/

[10] Investopedia. ‘The Sharpe ratio’ was developed by Nobel laureate William F. Sharpe and is used to help investors understand the return of an investment compared to its risk. The ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. Volatility is a measure of the price fluctuations of an asset or portfolio’. https://www.investopedia.com/terms/s/sharperatio.asp

1. **Portfolio configuration**

The portfolio configuration is the fundamental constitution of the LNG portfolio and will drive how it can be optimized. For example, an aggregator will operate very differently to a downstream LNG consumer like a regional utility. Below are some illustrations of where different types of LNG players might find optionality and how they can leverage this:

- an aggregator will have midstream flexibility to manage the optimal pairing of LNG cargoes and their destinations. It will be able to draw on the optionality and economies of scale as a result of having a large portfolio. This global supply footprint enables it to service LNG demand from a variety of sources, for example it can supply Japan with LNG from Sakhalin and Europe with molecules from Ras Laffan thereby minimising journey transit times.[11]
- While the primary purpose of a regional utility importing LNG is to secure fuel for domestic use and power production, in the right market conditions it can seek to opportunistically optimize. A utility can use its supply portfolio as a sink for LNG when global gas prices are depressed. This would be especially effective if the utility has access to a strong physical and futures traded gas market and/or certain flex assets such as gas storage and uncommitted regasification capacity. For example, in Singapore where storage at the regasification facility is used not only to meet local demand but also by its capacity owners (for example Shell, Pavilion) as a strategic storage facility for the East Asian market allowing them optimize temporally and enable smaller-scale LNG sales.
- An upstream gas producer, either alone or as part of a joint venture in an LNG liquefaction project, is fundamentally motivated by securing a return on the investment it has made upstream. Historically, this meant selling the LNG to third parties on long-term SPAs and whilst this still remains the dominant means of monetizing their gas, they may also seek to optimize through marketing additional quantities using and seeking to secure the best possible price. IOCs have, in many cases, become aggregators as they have moved further into the mid- and downstream. For NOCs this is rarer, but not unheard of and increasingly a midstream 'trading' presence is used to optimize portfolio value (see for example Petronas, QP).
- Infrastructure capacity holders – be that those with LNG shipping capacity or regasification capacity – have always sought to 'optimize' the capacity at their disposal, either as part of a supply portfolio or independently as infrastructure only. In the case of ship owners and charterers this is done by assessing the market and making their vessels available on short- or long-term charters. For regasification terminal owners and capacity holders, (notably in Europe) underused regasification facilities in relatively unattractive markets, have driven the establishment of a range of additional services such as cargo reloading, truck-loading and facilitation of LNG for marine fuel bunkering. Conversely, these positions can become highly sought after in a long LNG market (as now) providing the opportunities for optimization for these capacity holders meet the needs of suppliers. While this might not be considered traditional portfolio optimization, there is value in optimizing infrastructure assets and may be something the LNG industry needs to develop commercial strategies for, for example can idle regasification capacity be monetized?

2. **Geographical position**

Due to its physical characteristics, the need for capital-intensive infrastructure and the segmented nature of global gas markets, the value of an LNG portfolio is dependent on its geographical footprint. This means:

Location of access to liquefaction and regasification capacity;

- access to gas supply and demand markets and the nature of these markets, and
- access to gas storage.

[11] https://www.shell.com/energy-and-innovation/natural-gas/liquefied-natural-gas-lng/lng-supply-projects-and-regasification-plants.html

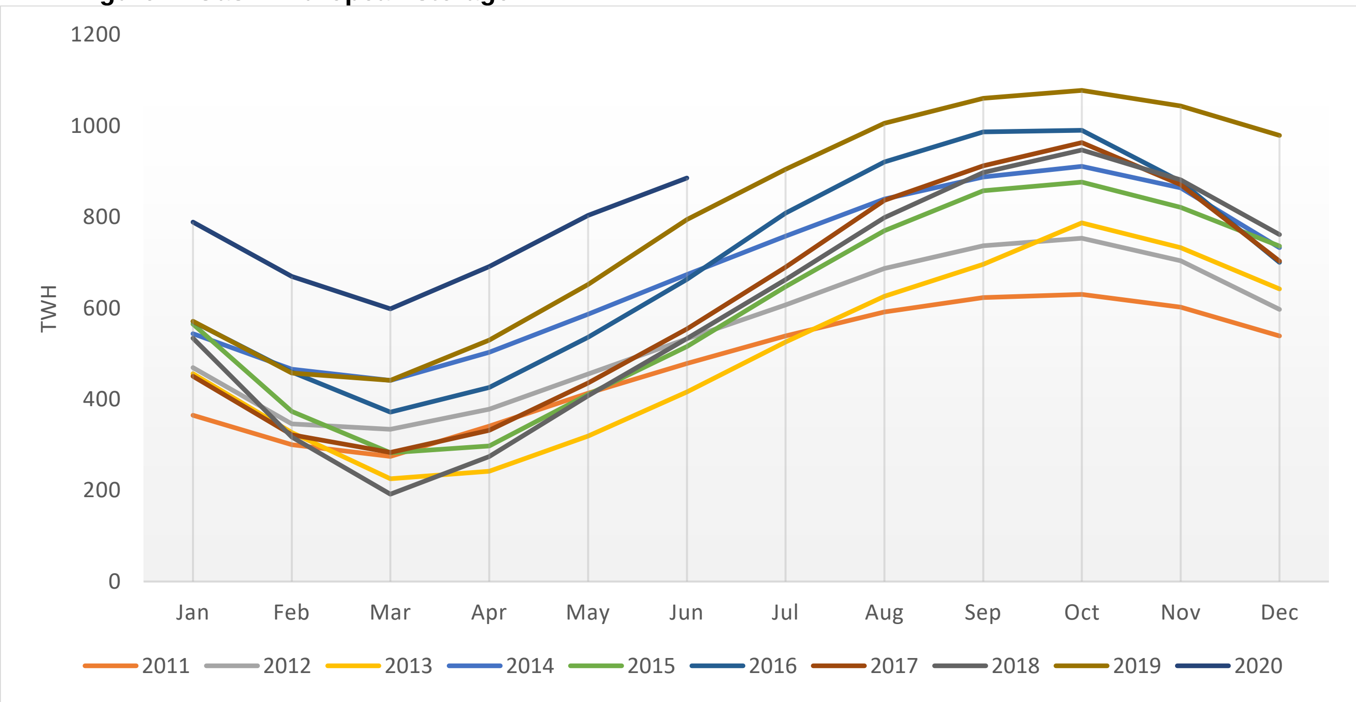
This geographical position needs to be evaluated in the context of the market structure and current conditions and prices. LNG and gas capacity rights are physical options and will only be in the money in the right market conditions. For example, with demand destruction triggered by COVID-19 and the free fall of hydrocarbons prices, having access to spare storage capacity globally and holding regasification rights in certain geographies is a valuable option.

The market structure will greatly influence the ability and extent to which a portfolio player can capitalize on the price and supply/demand dynamics. For example, consider having access to servicing demand in Europe versus Japan. Europe has a liberalized and competitive gas market with access to multiple supply points. A gas import dependent country like Poland will have the option to meet its demand by optimizing supply from pipeline gas from its European neighbours, Russia (in theory at least), or from LNG imports (as well from the Norwegian continental shelf via the Baltic pipeline once operational). Whereas, Japan is fully dependent on LNG imports and any change in demand will be perfectly correlated with LNG import cargoes, give or take the use of LNG tank storage at import facilities.

Similarly, let us consider the value of holding regasification capacity into Europe, which has excess and underutilized regasification capacity, compared to India, an LNG demand growth hub but with limited downstream infrastructure constraining the ability of the market to absorb additional LNG deliveries.[12] Portfolio players that hold regasification rights at a terminal in a market such as Europe, which is able to react to global gas market dynamics, coupled with access to other markets, will be able to exploit global arbitrage and create portfolio value compared to a local utility owning regasification access in a closed domestic market.

As evidenced by events of 2020, global gas supply/demand dynamics are pushing cargos into Europe. Being the marginal and balancing market for global LNG flows, European LNG send-outs into domestic grids[13] have hit record levels with underground gas storage close to capacity.[14] Being long gas storage in Europe during this time period has been a valuable option for capacity holders.

Figure 4: Gas in European storage



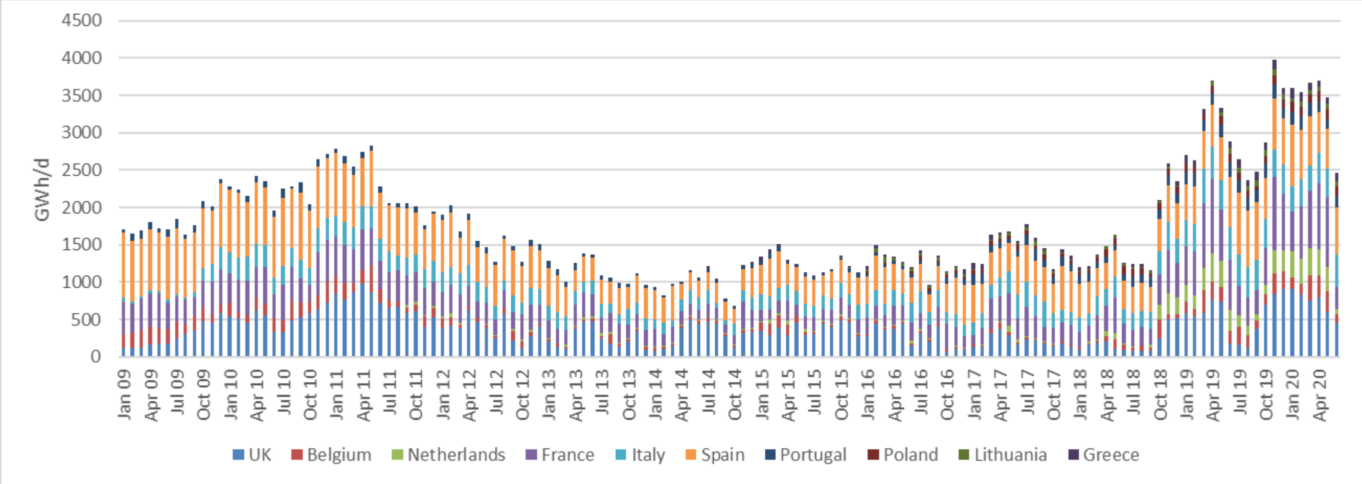
Source: https://agsi.gie.eu/#/historical/eu

[12] The LNG industry GIIGNL Annual Report 2020

[13] Argus. (2020) 'European LNG sendout slips in June'. July. https://www.argusmedia.com/en/news/2121019-european-lng-sendout-slips-in-june

[14] https://www.gie.eu/index.php/gie-publications/databases/storage-database

Figure 5: European LNG sendout



Source: Argus

3. Flexibility

The value of the optionality afforded to storage and regasification capacity holders has already been touched upon. Now other sources of flexibility that can be leveraged to provide arbitrage opportunities to create value are explored:

The global LNG shipping fleet and fixed point-to-point journeys hold untapped optionality and wasted nautical mileage that is ripe for better management and optimization. Figure 6 shows the major LNG flows in 2019, as published in the annual GIIGNL report.

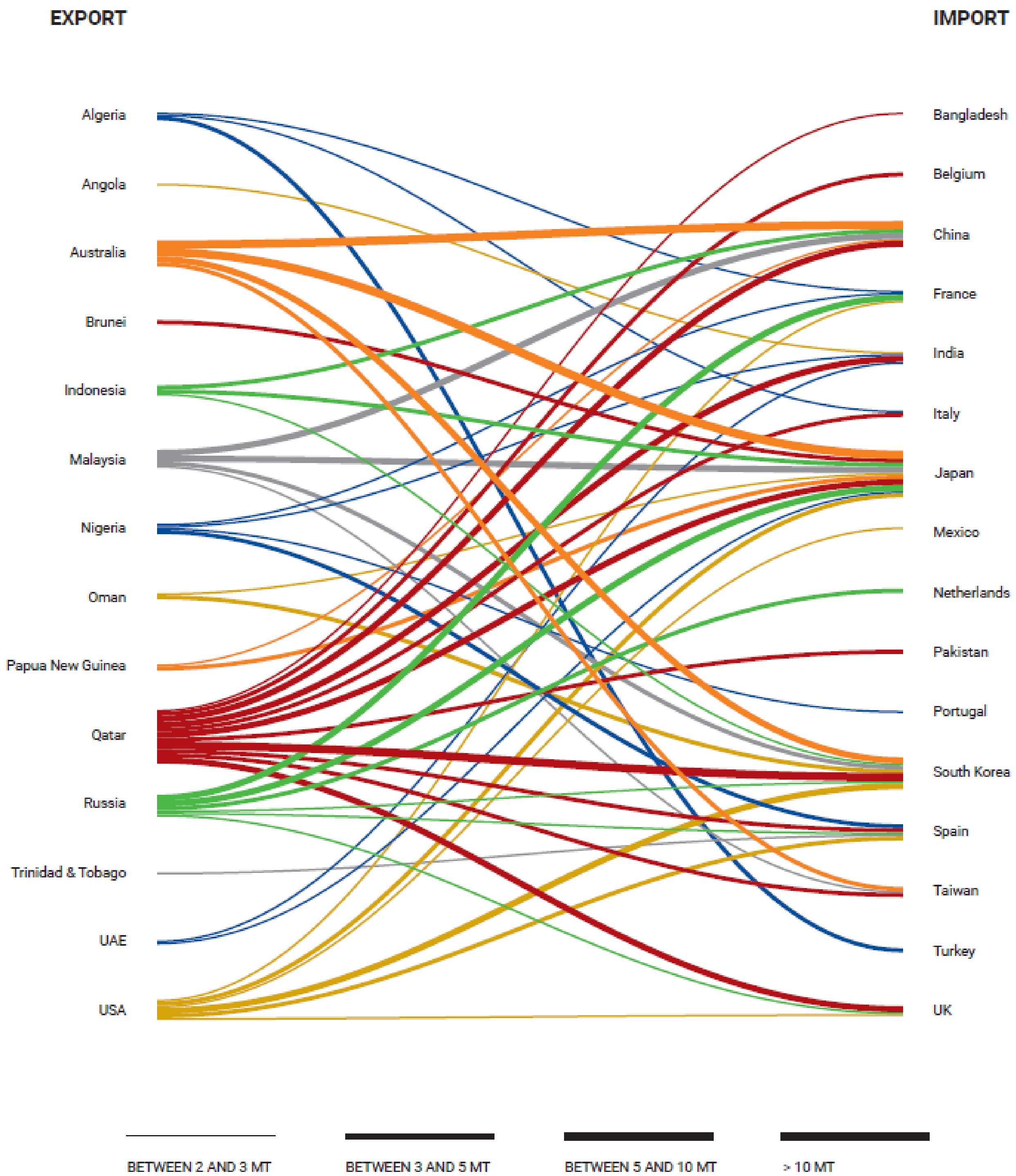
A rudimentary analysis of the origin and destination shows the crossflows of cargoes and sea routes for LNG journeys. Of the top five LNG exporting countries Australia, Russia and Malaysia tend to have cargoes delivering to markets in proximity to their geographies. In the case of Russia; Sakhalin mainly to Japan and Korea, and Yamal to Europe. The picture is very different for Qatar and the USA, these exporting countries supply a multitude of destinations covering a variety of sea routes.

For example, US cargoes deliver 5.05 mt of LNG to South Korean ports. The average transit time for an LNG vessel from Sabine Pass to South Korea, assuming the vessel travels via the Panama Canal, is 22 days covering about 10,000 nautical miles. At the same time Qatar supplies the UK and Belgium with 6.56 mt and 3.32 mt of LNG with an average journey time of 14 days covering over 6,000 nautical miles, assuming transit via the Suez Canal. The aggregate transit for the US deliveries to Japan and Qatari deliveries to the European destinations is 36 days and 16,000 nautical miles.

Qatar can supply cargoes to South Korea with a transit time of just 14 days covering over 6,000 miles and US gulf coast deliveries take 11 days to travel the 5,000 nautical miles to deliver the North Western Europe (UK). The aggregate transit time in this scenario is 15 days and just over 9,000 nautical miles.

If there was a cargo swap between these deliveries, with US LNG servicing UK and Belgian demand and Qatari LNG fulfilling demand in South Korea instead this could see a saving of 11 days. Assuming average charter rate of $80,000/day that gives a monetary saving of $880,000 for just one cargo swap. This does not include the additional benefit less boil-off gas, lower fuel cost and emissions reduction associate with short journeys by 7,000 nautical miles nor does it include charges incurred for utilizing the Suez and Panama Canals.

Figure 6: Major LNG flow in 2019



Source: GIIGNL, the LNG Industry 2020

Figure 7: Voyage Times[15]

From	To	Via	Duration Days	Nautical Miles	Vessel Size m3
Qatar	Korea		14	6,221	145,000
Qatar	UK	Suez	14	6,377	235,000
US (Sabine Pass)	Korea	Panama	22	10,082	160,000
US (Sabine Pass)	UK		10.85	4,961	160,000

Note: Assuming ship speed of 20 knots

Source: OIES

The way this swap could work is by a profit share of the $880,000. Qatar's geographical position means there is practically no difference in diverting cargoes from South Korea to North Western Europe, the cost savings come from the US legs of the swap. To incentivize Qatar to US liquefaction, capacity owners would have to offer Qatar a share of their savings.

An alternative way to look at this is to consider how many additional journeys can the fleet of LNG vessels servicing these routes undertake and how much more LNG can be shipped with the optimization? For simplicity, ignoring cargo loading and discharging times, port wait times and maintenance windows etcetera, a vessel delivering LNG from the US gulf coast to South Korea will be able to complete 17 journeys over a year compared to 34 journeys to the UK. In essence, if the cargo swap described above is executed it would reduce the need for a vessel in the fleet delivering US gulf coast LNG.

This type of optimization benefits the entire industry and also reduces the global carbon footprint for the LNG industry. A key development to enable this on an industrial level would be the emergence of a liquid exchange or market place for trading cargoes and agreeing swaps.

Closely linked to this is the flexibility imbedded within LNG SPAs. LNG projects require large capital outlay and the need for LNG projects to be underpinned by demand security in the form of rigid long-term contracts. Traditionally such contracts have had limited destination and delivery flexibility and have often prevented cargo destination diversion optimization. This is now changing and the industry is increasingly moving towards FOB, destination free contracts. This is increasingly evidenced by the spot cargo churn and growth in short-term traded volumes as illustrated by Figure 2. Not being bound by destination clauses will allow for cargoes to be allocated to the most profitable market rather than just the original intended markets.

SPA flexibility is not limited to destination freedom; it can also include optionality in contracted versus delivered volumes, delivery windows and gas quality, to name a few.

Strategies for optimization

There are different options any LNG player can consider over time as it looks to develop its optimization capability:

Time Horizon	Strategies
Short-term	Develop trading capability
Medium-term	Partnering and establishment of trading joint ventures
Long-term	Portfolio and asset acquisitions

[15] OIES calculations from Nexant World Gas Model

In the short-term, LNG portfolio players can look to leverage their existing geographical positions targeting the appropriate markets for buying and selling LNG and establishing spot trading capability (more on this later).

In the medium-term, players with complementary portfolios can look to establish trading and optimization joint ventures (JV) to create synergies between their positions. One of the most well-known of these joint ventures is JERA Global Markets, bringing together access to the world's largest LNG demand portfolio from JERA (itself a joint venture owned by TEPCO and Chubu Electric Power) and EDF's trading, risk management and optimization capabilities.

While the physical location of gas and LNG infrastructure cannot be moved, a number of companies take a view on how best to leverage and enhance the optionality and value of their existing portfolio. The recent acquisition of Iberdrola's LNG portfolio by Pavilion to complement its native demand, or Glencore's acquisition of DONG/Orsted's LNG portfolio are good examples

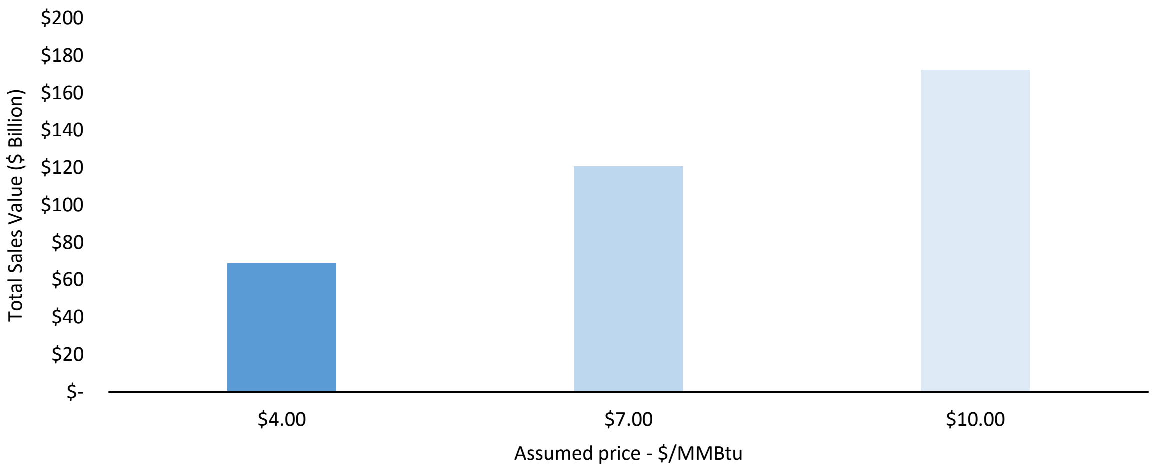
The potential impact of optimization

Quantifying the true benefits possible with optimization of an LNG portfolio is not a straightforward exercise – after all, if it was, to do so would not require a series of tools and systems and all the complexity therein. If it were easy, everyone would be doing it (well).

That said, there are some headline numbers that can give a macro view of the opportunities as yet untapped to optimize LNG. Note: although the implications of this analysis are for greater cooperation between portfolios and optimization at a very much top level, it is aimed to articulate a relatively simple basis for understanding how much additional value could be accessible solely in the optimization of costs.

Starting from the observation that there was 354.7 mtpa of LNG imported in 2019 (GIIGNL 2020), at various different average prices, that places the LNG industry at a sales value of $69-172 billion.

Figure 7: Total LNG sales value at different prices



Source: GIIGNL data, Baringa Partners analysis

It is simplistic but instructive to point out that if one per cent of sales value could be preserved through optimization, that would be worth $690 million – $1.724 billion. On a per cargo basis (assuming 170,000m^3 cargoes), that one per cent is in the range of $142-355k.

In the 2016 OIES book, 'LNG Markets in Transition: The Great Reconfiguration' it was estimated that the benefits of 'optimizing shipping would range from $2.0-2.7 billion per year over the whole period 2020-2030. This means a saving of around $0.1 /MMBtu'.[16]

In a world of multimillion dollar regional spreads, optimizing that last one per cent or $0.1/MMBtu is less of a priority but in a low price environment, with minimal regional differences, such value is of critical importance. Both now, as it goes through a period of extreme low prices but also enduringly if the LNG industry continues on a trajectory of commoditization, such margins will matter more and more.

A five mtpa portfolio is worth around a billion dollars, even at $4 realized prices, and the ability to increase the margins on that size of portfolio should be a significant incentive to LNG players facing a challenge to generate value.

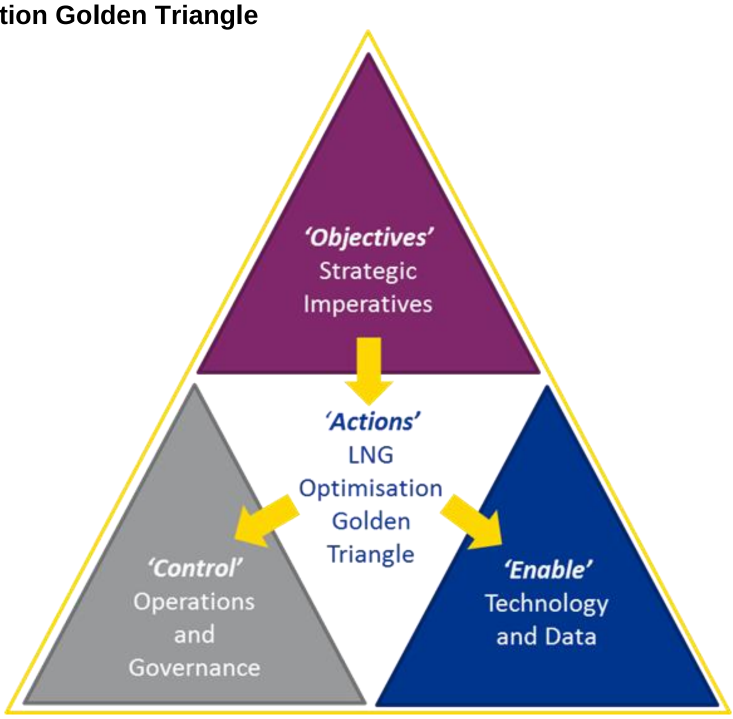
Approaches taken and tools used to support effective optimization

Having established that there is untapped value in global markets and significant returns to be achieved from the efficient management of LNG portfolios, how can portfolio players in the industry harness this potential to drive profitability?

Often when trading firms seek to optimize their portfolios they tend to look for the algorithms and individual optimization routines they need to implement. This can lead to a failure to articulate their 'raison d'être' for optimization and identify the organizational capability gaps to fulfil their strategic ambitions.

In a complex, physical and relatively opaque industry such as LNG, effective optimization requires a coordinated and concerted approach across three key dimensions: strategy, operational governance and people, and tools and systems.

Figure 8: Optimization Golden Triangle



Source: Baringa Partners

[16] 'LNG Markets in Transition: The Great Reconfiguration'. (2016). OIES. 545

Clarity on strategy

As with the execution of any strategy the objective and imperatives should be clearly defined. Any optimization approach must be built first around an understanding of the ambitions, constraints and wider context of the organization.

Different organizations start this journey at different points, and have different maturity levels, and therefore the aspiration of an optimized LNG portfolio can mean different things. For some, this can be as simple as optimization of destination: ensuring that LNG cargoes are traded into markets that offer the best possible prices. In others, it can mean ensuring costs associated with shipping and other elements are minimised and infrastructure utilized as efficiently as possible. In more complex portfolios it may include trading off between pipeline gas and LNG to meet customer needs and finding ways to maximise opportunity whilst managing risk. It could further include utilizing contractual flexibility and physical asset positions to generate and monetize flexibility as options.

All of these versions of optimization are valid and whilst some organizations may seek just one, others will look to take advantage of as many as possible.

A key question players must ask themselves is as follows: 'is the ambition to capture marginal value from the existing hydrocarbons value chain or to proactively identify and take advantage of arbitrage opportunities?' If it is the former, optimization is a means to an end, that is, the effective management of costs, as might be expected of a utility responsible for ensuring the security of energy supply for its domestic market. If the latter, it is the end itself and the underlying business driver for profitability, for example a commodity trader taking speculative positions. In reality most organizations fall somewhere in between the two extremes of this spectrum. Utilities are gradually moving away from simple procurement functions and 'trading' LNG requires significant risk capital and investment for it to be a pure optimization-driven decision to participate in the value chain.

The optimization strategy should address the following:

- what is the risk appetite, both financial and operational?
- How much risk capital can be allocated to support optimization activities?
- What is the primary business function, for example security of supply or shareholder value generation?
- What is the portfolio asset position and construct (see Chapter 2, Optimization Levers) and what are the optimization opportunities native to the portfolio?
- Is the optimization strategy focused on the short- or long-term or both?
- Are there other constraints that need to be accounted for?

Governance

Once the strategy has been set out, gaps in the current organizational capability need to be identified and a road map needs to developed to implement the business operating model. This should set out the governance and decision-making framework and the risk control mechanisms within which the business will operate to execute the optimization strategy. The governance should always link back to the strategic drivers for optimization, be they efficiency driven cost reduction or profit maximization by leveraging arbitrage opportunities and a great risk tolerance.

Key things to consider as part of this exercise are as follows:

- organizational structure and ownership of risk and profitability: is optimization centralised in one core function responsible for overall decision making or are different teams mandated with different areas of the portfolio, for example shipping, short-term trading, origination, liquefaction plant production optimization?

- Oversight and management of risk: how is risk managed and what are reporting requirements on portfolio risks?
- Measurement of risk: how should risk be measured for an illiquid commodity especially when it is not a trivial exercise to unwind physical positions? Traditional measures of risk, such as Value at Risk, were designed for financial markets and while they can be leveraged for liquid commodities like competitive gas and power markets, holding periods for LNG positions are very different. Other operational risks such as loss of gas due to boil off on a stranded cargo, piracy, health/safety and reputational risks are all factors that need to be considered when managing and optimizing an LNG portfolio.
- Performance measurement and key performance indicators (KPI): if investment is being made in developing organizational capability for optimization there needs to be adequate reporting mechanisms to track the return on investment. Following from the organizational structure, teams need to be appropriately rewarded based on their contribution to capturing value via optimization.

Technology & Data

Optimization involves mapping multiple scenarios of possible options and identifying the optimal or most profitable option within certain operational constraints and risk parameters. The number of possibilities or paths for an LNG portfolio can be infinite.

Consider optimizing for a single DES[17] cargo purchase, a few factors to consider would be:

- cost of sourcing LNG from various global supply points (including waterborne cargoes without a contractual destination);
- appropriateness of vessel that can berth, load and discharge safely at the respective ports;
- cost of transport and charter rates;
- transit times from the source to destination, and
- date range for delivery and margin for error.

Now layer on to this the possible volatility of contracted and market forward price curves, risk exposure arising from the geographical and time spread while the cargo is in transit, weather factors impacting voyage times, loading and discharge windows, minimizing boil off from longer journey times versus sloshing on rough seas, and voyage speed over consumption of fuel to reach destination in time. The list goes on but this illustrates that the complexity of optimizing for a simple fixed destination delivery has endless possibilities to be executed manually by the human brain.

What is the LNG optimization tool supposed to do?

Often LNG optimization engines are referred to as 'black boxes' and this is partially because optimizations are, by their very nature, computational exercises that rely on robust systems and data-processing capability – and thus lend themselves to bespoke software solutions. Additionally, they need to run within the constraints and flexibilities of SPA terms. Organizations that have successfully managed to build optimization solutions achieved this by having a clear view of the portfolio optionality and arbitrage they were looking to harvest, and how those fitted within their risk mandate and operating framework of people and teams.

A well optimized portfolio would not only be able to execute individual optimization opportunities, but would also be able to perform multiple optimization actions together as a series of interdependent algorithms.

[17] Delivery ex Ship

While it is relatively straightforward to set out ‘what needs to be optimized’, non-functional and usability requirements such as performance and visualization also need to be considered.

How does the optimization tool fit within the organization’s technology and systems architecture?

By itself a portfolio optimizer is not the silver bullet technology solution. Any LNG player looking to build this capability needs to undertake a holistic assessment of its overall trading and risk management technology solutions and architecture. The requirements for an optimization tool should not be confused with the need for a deal lifecycle and position management system, a market and price curve builder, or a shipping solution. But these are some of the systems that an optimization solution will need to be able to interact with. A target systems landscape should set out the functional components residing within each software interfacing with the optimizer, clearly identifying the integration points and data flows. The target systems landscape should address questions like; will the portfolio optimization solution also build forward price projections and compute non-linear portfolio valuations or, alternatively, will it rely on a separate risk engine for these?

Often it becomes clear that even a state-of-the-art optimization software solution will not enable the business to achieve its objectives. For instance, if position and contractual data is not well maintained and easily accessible from the ETRM system running an optimization routine is a bit of waste of computing power. A well implemented and maintained ETRM solution is necessary for accurate position reporting. Even when ETRM solutions are only used for the most basic function of deal lifecycle management they are still the system of record and should capture all the portfolio and deal optionality parameters.

Data, data and more data…

The key to capitalizing on portfolio optionality is to invest in the right technology architecture and data governance, but it is also important to understand the limitations of automation in optimization execution. While certain financial markets, such as currencies and equities, are now often traded via automated algorithms, energy markets – in particular physical LNG – require a significant amount of human judgement to manage the operational risk. Hence, at most, an LNG optimization tool can be considered a decision support function.

The output of any optimization tool is only going to be as good as the data provided. This is often where LNG trading desks fail in being able to optimize. An optimization solution needs to function in an ecosystem of data flows. Industries at the forefront of data analytics innovation see data as an asset. The scale and diversity of data for an LNG optimizer are broad, ranging from publicly available weather and price data to contractual commitments within SPAs and asset-specific information, such as production cycles boil-off rates, regasification rates, and so on. All this data comes in a variety of formats (structured versus unstructured), from multiple sources, and is updated at different times. It is therefore important to have an effective data governance and maintenance strategy.

Data is king and in an increasingly competitive environment, banks, conventional traders and energy companies are becoming technology companies. Every day brings news of yet another industry or organization experimenting with data science, artificial intelligence and machine learning. The LNG industry is ripe for use of these applications.

When it comes to portfolio management and optimization, the LNG industry is less advanced than other commodity industries – at least in part because of a greater operational complexity. Drawing parallels with oil, pipeline gas or power trading, LNG has a long way to go, but this also means that there is a lot of potential value to be captured. Successful optimization – and capturing the value associated with it – relies on the ability of portfolio players to manage the operational complexity of LNG by effectively harnessing data and leveraging technology.

Figure 9: Example portfolio optimizer

Source: Baringa Partners

Conclusion

As global gas markets liberalize and converge, traditional arbitrage margins will be likely to decline and profitability will be driven by efficient management of portfolios. In the wake of COVID-19 and the associated hydrocarbons price crash and demand destruction, the need to adapt to this changing world is amplified. It is the most agile and nimble organizations that will weather the storm most effectively to endure and outlast these market shifts.

LNG is often seen as the ‘bridging fuel’ both connecting geographically distant markets and playing a key role in facilitating the energy transition to low or zero carbon economies. However, it has a high cost of production and investment threshold and, in the current environment, LNG players need to maintain their competitive advantage. Some see the market impact of COVID-19 as an opportunity to accelerate the ‘greening’ of the energy sector by moving away from hydrocarbons. The coal industry would advocate its use as a cheaper more easily transportable source of energy in the short- to medium-term (when economies are recovering from the unprecedented drop they have faced) and then a complete transition to renewables. LNG has to fight its corner!

Economic recovery, when it happens, is highly unlikely to be ‘V’ shaped and the industry will need to navigate challenging times however long it takes. Strategies must adapt and business models evolve as firms look to identify and build their competitive advantage. It is expected that LNG players will come together to form mutually beneficial partnerships where complementary portfolios can enhance optimization of the end-to-end hydrocarbons value chain, right through to generated electrons.

As the industry matures and heads towards ever-growing globalization and commoditization all players regardless of where they sit in the LNG value chain need to operate more efficiently: any company buying and selling LNG will need to optimize. In the short-term at least players are faced with demand destruction fuelled by a global economic shutdown and, over the long run, LNG is facing competition from other sources of energy supply (other hydrocarbons as well as renewables driven by green agenda).

It is no longer a matter of ‘nice to have’ optimization alongside the LNG value chain. Rather it is a necessary capability in which all LNG players need to invest. The pertinent question is what and how to optimzse? This paper has sought to shed some light on the considerations and approach organizations may adopt on their journey to building this capability. It is important to remember that there is no ‘one size fits all’ solution and that optimization strategy and execution must be developed to meet each organization’s specific needs.

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David Ledesma

Chairman, Natural Gas Research Programme
Oxford Institute for Energy Studies