LNG trade began as a regional business; supplied by a dedicated ‘chain’ locked by contracts and financing with no cargo diversions permitted. Although trade is still mostly regional, LNG has developed into a global business.

Increased short-term trade has put more emphasis on fleet flexibility – the spot and short-term shipping market has become more liquid, expanding to meet rising demand; but how might flexibility / liquidity in the LNG fleet evolve?

A common discussion among market participants is if (and if so, when) LNG shipping will become ‘commoditised’, i.e. where LNG vessel capacity will become homogenous and always available for prompt hire.

Our LNG shipping market forecast and outlook will be presented and discussed in order to address these questions and issues.
Company Background

Poten & Partners (Poten) is a leading provider of advisory and brokerage services to the energy and ocean transportation industries. Poten’s team includes many senior Liquefied Natural Gas (LNG) / marine experts who have been involved in most of the world’s major LNG projects.

Poten undertakes assignments along the whole LNG chain ranging from the development of corporate strategies and specific consulting assignments through to commercial advice and resources for procurement of LNG supply and transportation in both existing and new vessels.

We are positioned to offer a unique service through the combination of our consulting activities, our hands-on commercial expertise and direct knowledge of the LNG shipping market.

We also publish respected industry journals such as LNG in World Markets (LNGWM) and the quarterly Global LNG Outlook (GLO), in addition to maintaining a comprehensive online LNG database (LNGas) which is available to our clients on a subscription basis.
Introduction / Background

Commercial LNG shipping began in 1964. All early projects were developed on a conservative and rigid point-to-point basis. LNG trade began as a regional business – Atlantic Basin producers supplied Atlantic Basin buyers, and Pacific Basin producers supplied Pacific Basin buyers.

In the 1960s, LNG trade routes were North Africa (Algeria and Libya) to Europe, and Alaska to Japan. In the 1970s, additional trade routes were Algeria to the U.S., and the Middle East (Abu Dhabi) to Japan. In the 1980s, additional trade routes were Australia and South East Asia (Brunei, Indonesia and Malaysia) to Japan and Korea.

By 2000, there were 10 export projects, 12 importing countries and a total LNG trade of 103 million tonnes per year (MMt/y). Up to the early 2000s, the key anchor LNG customers were in Asia (Japan, then Korea and Taiwan). LNG was supplied by a dedicated ‘chain’ locked by contracts and financing. These contracts were negotiated for long periods, typically for 15 years on a Delivered Ex-Ship / Delivered At Place (DES / DAP) basis, i.e. the seller / project was responsible for transportation of the volumes. Cargo diversions were not permitted. Shipping routes were defined, and based on point-to-point deliveries, leading to efficient use of the fleet.

LNG is a capital-intensive industry and remains underpinned by long-term agreements. However, contracts have become more flexible – terms are generally shorter, and many of the new contracts are on a Free On Board (FOB) basis, i.e. where the buyer is responsible for shipping. In addition, many new contracts have destination flexibility; for example, contracts with the U.S. and the U.K. as primary destinations provide flexible gas which could be diverted to other markets. Contract volumes have also reduced – most new contracts are for 1 MMt/y or less. This volume flexibility is of greater importance as buyers look to manage uncertain demand and volatile prices. LNG pricing terms now include more variety as the use of oil indexing has declined.

Short-term LNG trade (defined as volumes delivered under contracts of four years or less) and diverted volumes have made global trading patterns complicated. Short-term trade has increased, from virtually nothing in 2000 to nearly a third of total LNG trade. This increase is largely due to growth in LNG demand in Asia and in niche markets, increased feed gas supply (from existing projects, new supply projects and a significant increase flexible Qatari LNG) and diversion of volumes from the U.S. due to low gas prices.

As a result, global LNG trade has grown increasingly complex. In 2000, there were only 43 country-to-country trade routes globally, but in 2017 the number of had expanded to 261. By the end of 2017, there were over 30 export projects, 38 importing countries and a total LNG trade of 291 MMt. On a more granular port-to-port level, the number of trade routes increased to 686. Trade routes have grown faster than total trade volumes.
Pacific Basin LNG demand has grown substantially, far exceeding Pacific supply. Therefore, inter-regional trade (from the Middle East / Atlantic Basin) to the Pacific Basin has increased, resulting in longer voyages. LNG trade remains mostly from Pacific Basin and Middle East suppliers to Asian markets.

**Increasing LNG demand and increasing inter-regional trade have boosted shipping demand.**

LNG shipping demand is defined as the number of ships required to serve LNG trade. Shipping demand is determined by the volume of LNG traded globally (supply / demand) and the distance it is shipped.

Due to the increase in average trade distance, the rate of LNG fleet growth has outpaced that of LNG demand. Demand increased by around 180% between 2000 to 2017, whereas fleet size increased by around 300%.
Increasing flexibility in LNG supply, and shorter contract terms have challenged the traditional LNG shipping model. As a result, the LNG shipping market has had to evolve.

*Increasing short-term trade and diversion opportunities have put more emphasis on fleet flexibility.*

Term charter length has fallen dramatically; from an average of around 20 years (i.e. mostly long-term contracts) in 2000 – 2007 to an average of 8 years (i.e. mostly medium-term contracts) in 2017.

Changes in accounting regulations have resulted in long-term charters being shown as liabilities rather than operating leases. These accounting principles have also helped drive charter periods down. More importantly, shipowners are willing to take on more residual value risk, therefore there is no need for charterers to do so.
Ship ownership has become more diverse and competitive, increasing the liquidity of the shipping market.

In the traditional LNG ship ownership model, vessels were owned by the LNG project itself, with volumes delivered on a DES / DAP basis. This tied in with the traditional LNG business model where projects were developed on a conservative and rigid point-to-point basis.

However, there has been an ownership shift from project companies to independent shipowners as the project companies focus on their core activities. There are also several traders / utilities that own LNG ships. This shift in ownership is evident when comparing the existing fleet with the orderbook.

As LNG contracts are becoming more flexible in nature, larger independent shipowners seek co-owners / investors. Many LNG vessels are owned by Joint Ventures (JVs) consisting of multiple owners. As a result, LNG ship ownership is becoming more diverse and competitive.

Liquidity requires a large number of players in the market. There is now a large pool of LNG shipowners, with over 100 individual owners in the fleet. New market entrants seek to take advantage of this increasingly diverse market.

The spot and short-term LNG shipping market has generally become more liquid, expanding to meet demand. However, preliminary figures show a decline in spot chartering activity in 2018.

Liquidity requires a high level of trading activity, and an active spot market. Growth in liquidity in the LNG shipping market began in 2013 as a wave of ships were delivered, many without term business, adding length to the available shipping market. Over the next few years, newbuild deliveries continued apace while aggregate global LNG trading volumes remained mostly flat.
Trade volatility increased due to a disruption in trading patterns as traditional import markets saw little change in demand or even declined, and incremental growth came from new or emerging markets.

By the end of 2015, the available pool of vessels for hire had grown to over 30 vessels, new import markets opened, and Pacific basin suppliers ratcheted up exports.

In 2016, new import terminals and competitive LNG prices saw higher than expected imports into India, China, and the Middle East. While global LNG trade increased by 20 MMt, the average trade route distance decreased as new supply capacity came online in both the Atlantic and Pacific basins. Charterer demand largely remained regional.

With around a third of total LNG trade on a short-term basis, spot fixtures also increased. Although spot chartering activity (defined as periods of six months and under) continues to make up a significant proportion of the LNG charter market, it decreased from around 90% of fixtures in 2016 – 2017 to around 80% in 2018.

Single voyage fixtures make up most this spot activity. Medium-term chartering activity has been low in recent years as charterers rely on a sizeable pool of modern tonnage available on a short-term basis.

The year-on-year decrease in spot fixtures in 2018 could be regarded a decrease in liquidity (i.e. compared to 2016 – 2017). Spot fixtures decreased as charterers, concerned about vessel availability, chartered in existing vessel for longer periods. A liquid LNG shipping market can be defined as one where a charterer is able to find a vessel whenever it is required, and available to deliver wherever they want. This is still not always the case.

LNG shipping technology has evolved rapidly. Vessels have become larger and more efficient, resulting in vessels that are more economical for trading and enabling LNG to move towards commoditisation.

The ‘standard size’ LNG ship increased from around 125,000m\(^3\) in the 1990s to 155,000m\(^3\) - 180,000m\(^3\) today.

LNG ship size was originally determined by restrictions at Japanese import terminals, but new terminal facilities reflected an increase in size – limits were subsequently increased to 137,500m\(^3\), then 145,000m\(^3\), 154,000m\(^3\), 160,000m\(^3\) etc.

Current LNG ship sizes are determined by the Panama Canal expansion (‘Panamax’) – the most common size of LNG ship on order is 170,000m\(^3\) - 180,000m\(^3\).
LNG ship size increased due to project-driven requirements and marginal cost of larger size vs incremental cost of an additional ship. Larger ships have been designed to achieve economies of scale, allowing them to be more competitive on long distance voyages and enabling more efficient transportation.

Note that the large Q-flex (210,000m$^3$ - 216,000m$^3$) and Q-max (263,000m$^3$ - 266,000m$^3$) ships were built for specific long-haul deliveries from Qatar and are not standard for the LNG industry.

**LNG ship propulsion systems have diversified rapidly in recent years, bringing greater efficiencies in trading.**

The main propulsion technologies are Steam Turbine (ST), Slow Speed Diesel with Reliquefaction (SSD/RL), Dual Fuel Diesel Electric (DFDE), M-Type Electronically-controlled Gas Injection (ME-GI) and X-type Dual Fuel (X-DF).

ST propulsion has been used in LNG ships since 1964. It has proved to be a simple and reliable solution for LNG ships, rating highly in maintainability and fuel flexibility. However, its relatively low efficiency and the increasing size of LNG ships prompted a move to alternative propulsion systems.

Energy saving demands led to diesel electric propulsion systems for LNG ships. The first DFDE LNG ship was delivered in 2006. TFDE, with more fuel flexibility, has dominated since 2010. There is now a trend towards higher pressure systems. ME-GI and X-DF have greater efficiencies than TFDE. Re-Heat Steam Turbine (RHST), Ultra Steam Turbine (UST) and Steam Turbine and Gas Engine (STaGE, also known as US Dual Fuel, USDF) are more efficient than traditional ST systems but not as efficient ME-GI and X-DF.

Figure 8  Evolution of LNG Ship Propulsion Systems

Boil-off rates for LNG ship containment systems are continuously reducing as incremental improvements in insulation are introduced, but only to match the fuel requirements of more efficient propulsion systems.

This evolution of propulsion technologies is redefining LNG shipping optionality. Charterers may seek medium-term charters of existing vessels as the natural means to ensure shipping capacity while reducing their exposure to technological obsolescence.

Charterers may also want to keep options on their vessels open to procure larger, more fuel-efficient vessels if possible. Such vessels are more economical in a trading environment, where the focus is on maximising trading margins. This enables LNG to move towards commoditisation.

However, the rapid pace of evolution of LNG shipping technology is easing off, and technical development will plateau for some time. A fundamental change in fuel is likely to be the next big game changer.
Ramp-up of U.S. LNG production and growing demand in Asia and Europe are key drivers for increasing LNG supply / demand over the next few years.

Poten’s base case projection for LNG supply / demand represents our best view of development of the LNG market. We project global LNG supply / demand to grow to around 380 MMty in 2022; rising from around 290 MMty in 2017. Our forecast is built up from energy demand fundamentals and projected on a country-by-country basis.

Growth is anticipated in most regions over the next few years; particularly in China, India and South East Asian niche markets, and in Europe (U.K. and Spain). Strong long-term natural gas demand growth is driven by growing use in power generation. Short-term trade is expected to retain its share of around 30% of the market, but will continue to grow in volume as the LNG market size increases.

![Figure 9: Global LNG Demand Forecast by Country / Region](image)

Our forecast shows the key LNG supply countries by 2022 to be Qatar (20% of global LNG production), Australia (20%) and the U.S. (16%). U.S. production is projected to ramp up from 13 MMty in 2017 to 63 MMty in 2022.

![Figure 10: Global LNG Supply Forecast by Country / Region](image)
Increasing flexibility leads to uncertainty in future trade patterns and in LNG shipping demand levels.

Our global LNG shipping demand forecast (i.e. the number of ships required to transport the volumes) is calculated based on our LNG supply, demand and trade projections. Shipping demand is calculated for each explicit trade, based on the shipping distance, sailing speed, port time and canal transit time (if applicable).

Based on our projected LNG supply / demand of 380 MMt/y in 2022 and our best estimate of future trading patterns, we estimate an LNG shipping demand of around 560 vessels in 2022. Ship capacity is normalised to 160,000m³, i.e. the average ship size in the fleet.

As the U.S. will become a key LNG supplier by 2022, and as most of the U.S. supply contracts are on an FOB basis, there is uncertainty in future trade patterns. This leads to uncertainty in ton-mile demand and therefore uncertainty in LNG shipping market demand.

A substantial portion of U.S. volumes may be shipped to Asian markets to meet demand, requiring a high level of shipping (these are longer distances compared to Europe) and will result in a larger shipping requirement per MMt shipped than the average trade. For example, preliminary data shows that over 50% of U.S. LNG produced in 2018 was exported to Asia, due to higher than expected demand in China, Korea and India.

Scheduling and utilisation inefficiencies (due to the rise in short-term trade) are accounted for in our forecast via a global ship utilisation rate of 88% (a recent historical average). This factors in idle time between cargo liftings. In theory, there is potential for improved fleet utilisation / efficiency through cargo swaps as a means of optimisation; however, in practice this may be complicated to achieve. Many contracts remain destination inflexible.

Note that there is seasonality of LNG demand in key Asian markets, and this makes shipping flexibility important.

**LNG shipping capacity is set to increase in anticipation of increased demand.**

LNG shipping capacity is set to increase over the next few years. This is necessary to meet growing demand and is also key for spot trade development.

Note that the data shown below includes existing ships and firm orders only, and does not include projections of future ship orders or options to build new ships. As it takes 2 – 3 years to build an LNG vessel, in practice the ship supply picture will change from 2021.
Based on our LNG shipping demand forecast versus the current shipping supply picture, the shipping market will be tight, with periods of volatility, for the next two years.

Liquidity may also be defined as the level of shipping oversupply in the market. Vessel availability currently remains low (as at the end of 2018). This has resulted in record high spot prices, as spot charter rate levels have a direct relationship with the number of vessels competing in the spot market.

actual spot charter rates are highly volatile. in november / december 2018 the arbitrage was shut, but charter rates were high which meant charterers fully exposed to the spot market were selling at a loss. this is a counterpoint against the development of a 'fully commoditised' market.
Post 2020, we expect the market will be long again thanks to new owners entering the market speculatively until the next wave of export projects are built.

If the number of vessels actively competing in the spot market falls, spot charter rates should increase. A market low on tonnage available on a short-term basis will tip the scales towards owners who will be better positioned to secure more favourable charter terms.

**Conclusion**

Global LNG trade is becoming more complex and dynamic. Increasing flexibility in LNG supply and contract terms have challenged the traditional LNG shipping model. As a result, the shipping market has had to evolve.

LNG vessels were the first link in the value chain to evolve away from a rigid project-linked commercial structure, with independent shipowners willing to take on the asset ownership instead of the projects or energy majors. Increasing short-term trade and diversion opportunities have put more emphasis on fleet flexibility, and the average term charter length has fallen from around 20 years in 2000–2007 to 8 years in 2017.

A liquid, flexible and competitive shipping market is required to facilitate commoditisation of the LNG market. Liquidity requires a large number of market players, a high level of trading activity, and an active spot market. LNG ship ownership is becoming more diverse and competitive. There is now a large pool of LNG shipowners, with over 100 owners in the fleet. Spot chartering activity continues to make up a significant proportion of the LNG charter market, accounting for around 80% of fixtures in 2018. However, this decreased from around 90% in 2016–2017. This decrease in spot fixtures can be deemed a decrease in liquidity.

Liquidity may also be defined as the level of shipping oversupply in the market. Vessel availability currently remains low (as at the end of 2018). This has resulted in record high spot prices. A liquid LNG shipping market is one where a charterer is able to find a vessel whenever it is required, and available to deliver wherever they want. However, this is still not always the case.

Increasing LNG demand and increasing inter-regional trade have boosted shipping demand. LNG shipping demand will continue to increase over the next few years, due to ramp-up of U.S. LNG production and growing demand in Asia and Europe. Based on our LNG shipping demand forecast versus the current shipping supply picture, the shipping market will be tight, with periods of volatility, for the next two years. Post 2020, we expect the market will be long again thanks to new owners entering the market speculatively until the next wave of projects are built.
Actual spot charter rates are highly volatile. In November / December 2018 the arbitrage was shut, but charter rates were high which meant charterers fully exposed to the spot market were selling at a loss. This is a counterpoint against the development of a ‘fully commoditised’ market.

LNG shipping technology has evolved rapidly. Vessels have become larger and more efficient, resulting in vessels that are more economical for trading and enabling LNG to move towards commoditisation. However, the rapid pace of evolution of LNG shipping technology is easing off, and technical development will plateau for some time.

LNG ships are not commodities (they are capital intensive assets built by shipping companies seeking a return on their investment). However, the service they provide charterers is becoming increasingly flexible and competitive.