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Small going big

Why small-scale LNG may be the next big wave

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Executive summary

Small-scale liquefied natural gas (ssLNG), a niche but nascent industry that is already profitable and scalable, boasts significant potential. It is well placed to meet the growing demand from the shipping and trucking industries for fuels that are more environmentally friendly than oil and diesel. ssLNG also enjoys advantages in addressing off-grid power generation for industrial and residential needs in remote locations. Because LNG burns more cleanly than other fossil fuels such as petroleum and coal, ssLNG is likely to gain further traction as market and regulatory pressures to transition to lower-carbon energy intensify. In the same way that "fracking" transformed the U.S. energy landscape, ssLNG has the potential to transform the role of gas in a number of key geographies and industry sectors.

As companies approach the ssLNG market, they should be prepared to act quickly. In selected applications, such as marine and off-grid power generation, it will be vital for participants to establish first-mover advantage. But they will also need to have the right strategy in place, underpinned by the appropriate capabilities, which include the ability to build partnerships across the LNG chain.

A small business gains scale

In the vast global natural gas industry, much of the conversation revolves around major trends such as oversupply, the growth of liquefied natural gas (LNG) spot trades, and the prospects of mega-LNG projects like the US$54 billion Gorgon project in Australia. Amid this forest, the comparatively diminutive tree of small-scale LNG (ssLNG) doesn't get much attention. Aside from a handful of market players, this segment is not yet on the radar of many industry participants. It should be.

The term ssLNG refers to the direct use of liquefied natural gas in its liquid form, as opposed to the traditional model of regasification and subsequent introduction into the gas transmission grid. Small-scale liquefaction plants are usually developed to serve specific markets and have a production capacity of less than 500,000 tons per year (by contrast, a large industrial-scale LNG plant like the Gorgon facility has an export capacity of approximately 16 million tons per year). These plants provide supply to end-users in places where traditional infrastructure does not reach, or to consumers requiring liquid fuel.

There are three major end uses for ssLNG: marine fuel (bunkering), fuel for heavy road transport, and power generation in off-grid locations. The market is relatively immature. However, several major energy companies are already involved in ssLNG, including Shell, Engie, ENI, Gasum, and Gazprom. The size of the market is expected to grow to approximately 100 million tons per year by 2030. Shell is developing bunkering services in the Amsterdam-Rotterdam-Antwerp region and in northern Germany. In August 2016, Shell and the government of Gibraltar signed an agreement for the supply of LNG for use in power generation there. Engie, the French natural gas production and distribution company, has pledged to invest €100 million (US$112 million) in ssLNG and compressed natural gas (CNG) trucking infrastructure across Europe by 2020, and it has just started ship-to-ship LNG bunkering service in the port of Zeebrugge, Belgium. For several years, Italian oil and gas company ENI has been leveraging its presence at Zeebrugge to get involved in ssLNG. The Finnish company Gasum is focusing on expansion in the Nordic region, investing heavily in reloading and storage facilities in Sweden and

Finland. In late 2016, Gazprom approved a development program for 2017–19 that includes construction of natural gas filling stations and the production and use of small-scale LNG in Europe and China. In Southeast Asia, players such as the Indonesian national oil company Pertamina are investing in ssLNG facilities.

Given the dynamics in the global natural gas markets — lower commodity prices, oversupplied gas markets, and industry focus on cost reduction — it may seem that any subsector would have difficulty attracting interest. But a number of powerful factors favor the growth of ssLNG. First, ssLNG initiatives, in contrast to large-scale LNG projects, offer investors more immediate and potentially attractive returns in the medium term. The proven technology allows ssLNG projects to offer a "plug and play" service with lower investment requirements and accelerated commissioning schedules. And that leads to reduced uncertainty on the project execution timing. Second, ssLNG is scalable, meaning operators can easily add capacity to serve increased demand while gaining supply chain synergies. That makes ssLNG an ideal way to meet short-term fluctuations in demand. And finally, precisely because of this flexibility, ssLNG can stimulate demand in areas of the market that were previously unsuited to LNG as a fuel source, such as off-grid power generation on islands and in remote areas.

A number of powerful factors favor the growth of ssLNG.

Lofty ambitions

Today, ssLNG is still a niche and nascent market. But it is projected to expand rapidly. The International Gas Union forecasts a rise in annual global demand to 30 million tons in 2020. Engie projects that demand at 75 million to 95 million tons by 2030, with demand split between power at 26 percent, marine LNG at 32 percent (but potentially further increasing after 2030), and trucking at 42 percent (*see Exhibit 1, next page*).

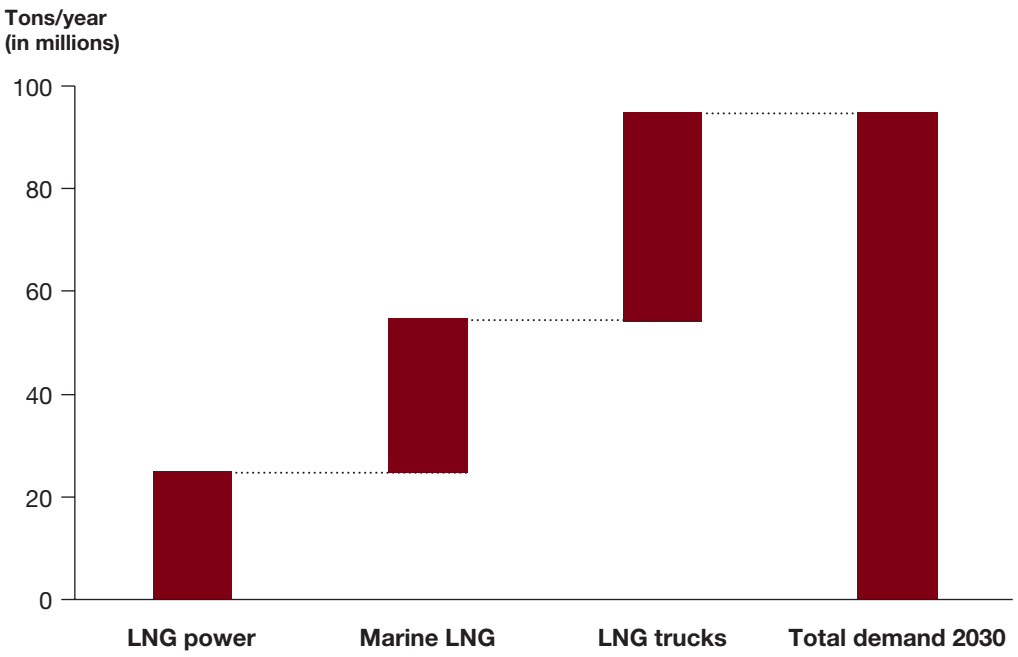
One of the most important factors in the uptake of ssLNG will be the difference in price between LNG and oil. Exhibit 2 (*page 8*) maps out the wide variation in potential demand based on different scenarios. By 2030, if the price of LNG stays between $3 and $4 per million British thermal units (mmBtu) while oil is above $90 a barrel, ssLNG demand will be more than four times what it would be if LNG cost more than $9 per mmBtu while oil was between $50 and $60 a barrel.

As noted in Exhibit 1, the heavy-duty transport (trucks) and marine sectors will drive the bulk of demand, while power will make up the smallest component (a typical ssLNG power plant consumes 200 to 1,500 tons of LNG annually).

Currently, most ssLNG growth is occurring in China, where the government is tackling air pollution in major cities and where the availability of gas and the price differential with diesel make ssLNG viable. China boasts the largest number of LNG trucks (more than 200,000) and will remain the dominant market for at least the next decade. It is implementing an aggressive LNG refueling infrastructure project that aims to build about 3,000 CNG/LNG refueling stations by 2025, led by China Clean Energy and ENN Energy Holdings. China has also built 19 LNG bunkering pontoons and plans to build 23 more.

The U.S. is also a significant locus of activity. In the transport sector, price arbitrage is the primary growth driver thanks to the abundance of shale gas. Stricter emissions regulations in the marine sector are also stimulating the use of LNG as a bunker fuel in the U.S. and Europe. This trend is particularly advanced in the Scandinavian and Baltic regions; Norway is playing a pioneer role in the LNG for bunkering business.

Exhibit 1
Forecast demand for ssLNG by segment, 2030



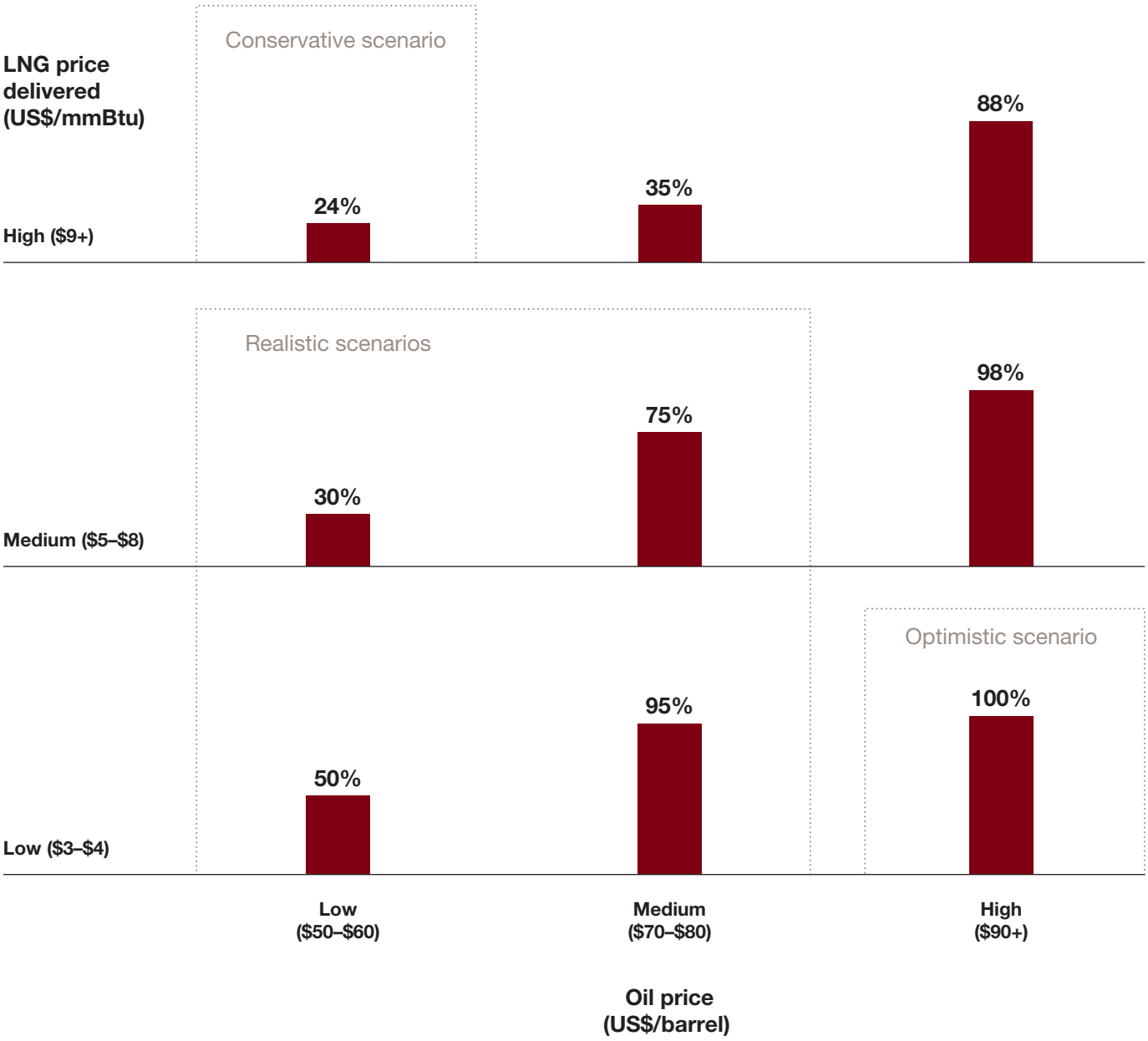
Source: Engie; Strategy& research

In Europe, as Exhibit 3 shows, the growing network of LNG import terminals offering ssLNG infrastructure is mainly concentrated in northern Europe and Spain, but is spreading to Greece and Turkey (*see page 9*).

As for the third important sector of ssLNG — power — there are significant opportunities for island-based LNG to drive demand, especially in countries in Southeast Asia such as Indonesia, Philippines, and Myanmar. Islands in the Mediterranean Sea such as Sardinia and Malta are investing in LNG infrastructure.

Exhibit 2

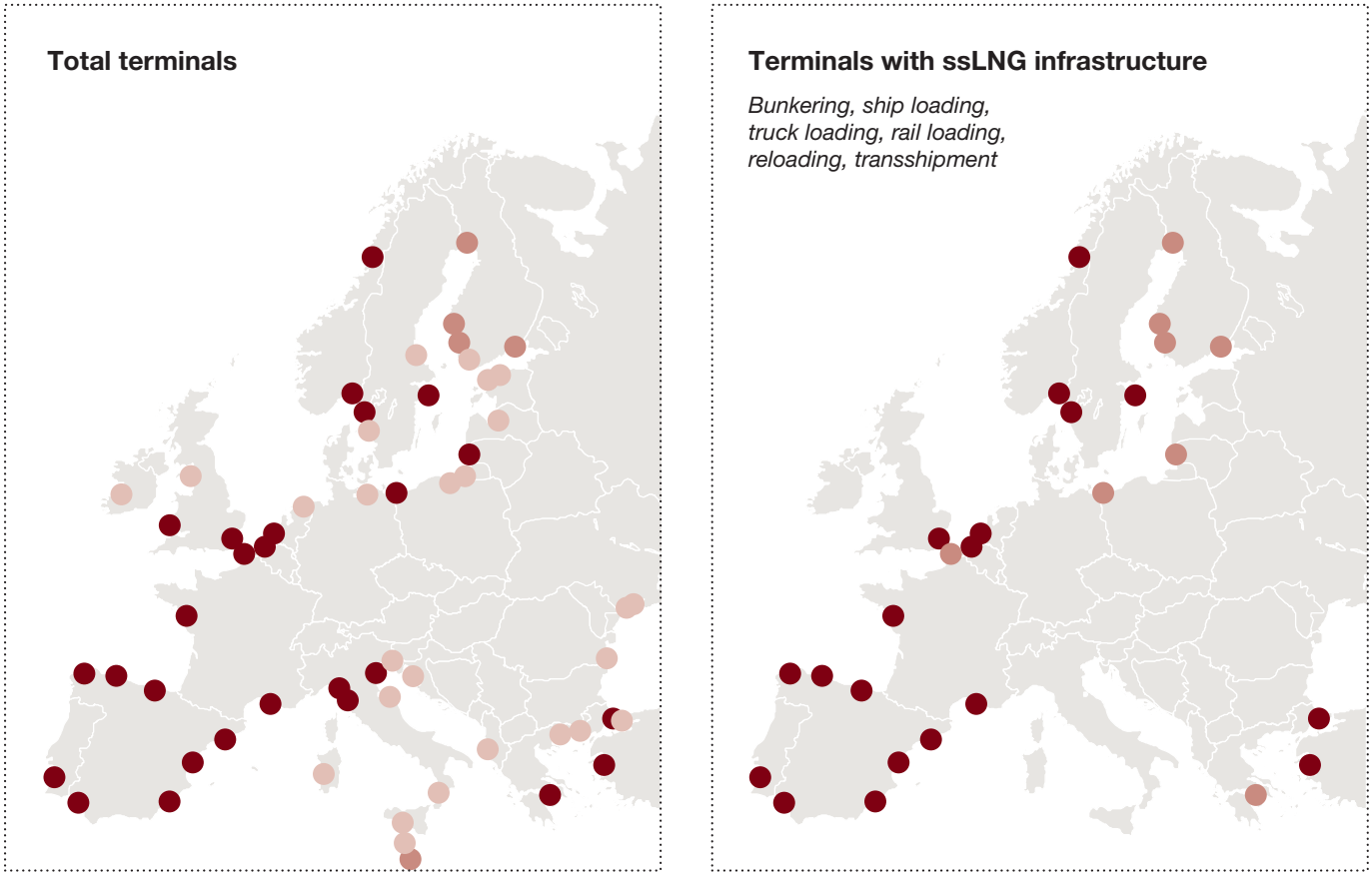
LNG potential demand, 2030



Source: Strategy& analysis

Exhibit 3

European LNG import terminals



Source: GLE LNG Map 2016, GIE Small-Scale LNG Map 2015

Trends favoring growth

As these markets evolve, a number of trends are converging to propel the potential of ssLNG. LNG itself is increasingly becoming a commodity, supported by the increased liquidity of regional markets and the wider availability of LNG due to new projects and modifications of existing terminals. This commoditization has accelerated the scale and scope of redistribution of LNG. At the same time, the environmental and economic benefits of ssLNG are key drivers for business development in the U.S., Europe, and China, where new environmental emissions policies and arbitrage in oil and gas prices allow the full exploitation of LNG potential.

Looking ahead, we see different trends supporting the growth of ssLNG in the three main sectors.

Bunkering	Road transportation	Off-grid power
Regulation (International Maritime Organization)	Economic convenience (total cost of ownership for the truck owners)	Economic convenience (total cost of ownership for the end-users)
Economic convenience (total cost of ownership for the ship owners)	Green image	Green image and sustainability
LNG availability in key ports		Infrastructure: LNG stations

Bunkering

The regulatory environment surrounding the use of shipping fuel is likely to become more stringent as climate change initiatives build momentum. In 2015, pursuant to new regulations imposed by the International Maritime Organization, sulfur limits were reduced from 1 percent to 0.1 percent in emission control areas (ECAs), including the Baltic Sea, the North Sea, and most of the Canadian and North American coast. Those stringent limits will be extended to the Mediterranean Sea in 2020. In January 2020, a new global emissions cap will reduce permissible emissions of sulfur in regions that are not

ECAs from 3.5 percent to 0.5 percent. These limits are pushing the maritime industry to study and implement abatement measures, including the greater use of LNG, which has a far lower sulfur content than diesel as a bunker fuel. At the same time, LNG is becoming more widely available at key ports. Regulation is a prerequisite for LNG development in the bunkering sector. When new emission caps are imposed (e.g., in the Mediterranean in 2020), LNG will emerge as an effective alternative that can compete economically with other solutions such as scrubbers and clean diesel. The main target segments for LNG for bunkering are vessels that are fuel intensive and follow regular and repetitive transportation routes, such as point-to-point cargo and passenger ships, ferries, and container ships. Transoceanic containers entering ECA zones could potentially be a second, but important, target.

Road transportation

The key driver for LNG as a fuel for road transportation will be the economic optionality it offers. The willingness of truck owners to switch to LNG is mainly related to the ease of use — i.e., the availability and accessibility of fueling infrastructure and truck performance — and to the price competitiveness of LNG with diesel. If LNG can deliver a reduction in the total cost of ownership and accelerate the recouping of the initial investment, it becomes a more attractive substitute. Typical end-users are heavy-duty and special trucks of haulage companies, large logistic operators, and retail and consumer companies. The fact that LNG is regarded as a cleaner-burning, green transport fuel provides an additional incentive for corporate adoption.

Off-grid power

The decision to switch to LNG from diesel, fuel oil, liquefied petroleum gas, and petroleum is highly correlated with the economics of alternative fuels. The investment required to switch to LNG power is relatively lower than for the other applications (trucking and bunkering), and no major infrastructure is required to sustain the business. In many instances, as with trucking, users switching to LNG will be motivated by the environmental and sustainability benefits. The key enabler for this market segment is the development of an efficient and sustainable logistics network, as most of the end-users are in remote locations.

Capabilities-driven strategy

If the ssLNG industry is to realize its growth potential, it will have to overcome significant challenges. The industry still has to grapple with the "chicken and egg" dilemma. Further investment in infrastructure, especially coastal storage, is required to stimulate demand and ease of use. But the sector is reluctant to invest until the demand materializes. As noted, ssLNG has to compete with and displace more mature alternative fuels that are backed by decades' worth of infrastructure investment. Finally, uncertainty about how the regulatory framework may evolve in some segments, and the perception of potential safety issues (especially in the bunkering sector), may hinder the evolution of ssLNG in certain markets.

That said, this remains an attractive market across a number of dimensions:

- ssLNG is on average a profitable business with relatively lower capex requirements than the traditional LNG sector.
- Bunkering demand focuses on several key ports and a few key clients. The capex requirements for bunkering are high compared with those for other end applications — e.g., €30 million to €60 million for a port storage facility with a capacity of 6,000 to 15,000 cubic meters, and €30 million to €40 million for a bunkering barge with a capacity of 3,000 to 10,000 cubic meters. That means there is a natural barrier to entry in this subsector protecting first movers that have secured contracts with ship owners.
- Investments for road transportation are scalable and relatively low (e.g., €600,000 for an LNG refueling station).
- Investments for off-grid applications (as much as €200,000 for an average installation) are usually secured by a long-term agreement with end-users, although they require a strong local market presence.
- For companies that already have a substantial gas portfolio, ssLNG provides a scalable business with the flexibility to meet demand from a number of emerging core segments.

To succeed in the ssLNG business, companies will have to develop the right business model, engineer a flexible strategy, and build crucial core capabilities.

With regard to strategy and capabilities, we believe integrating operations across the value chain and building successful partnerships are fundamental to long-term success.

Simply put, in ssLNG, size still matters. The winning players will need to be active across all segments of the industry, from the supply of gas, to transportation and distribution, right down to the point of direct commercial relationships with end-users (where sizable). Underpinning this approach are some key points. Players should focus on the core activities, while outsourcing the low-value-added activities that require specific local presence and knowledge of national regulations, such as bunkering, "last-mile" transportation, and scouting of smaller off-grid potential users. Equally, companies should leverage their key competencies in commodity hedging to reduce the price risk for end-users in the initial market development phase. Examples of potential ways to play in the LNG bunkering segment are illustrated in Exhibit 4 (*next page*).

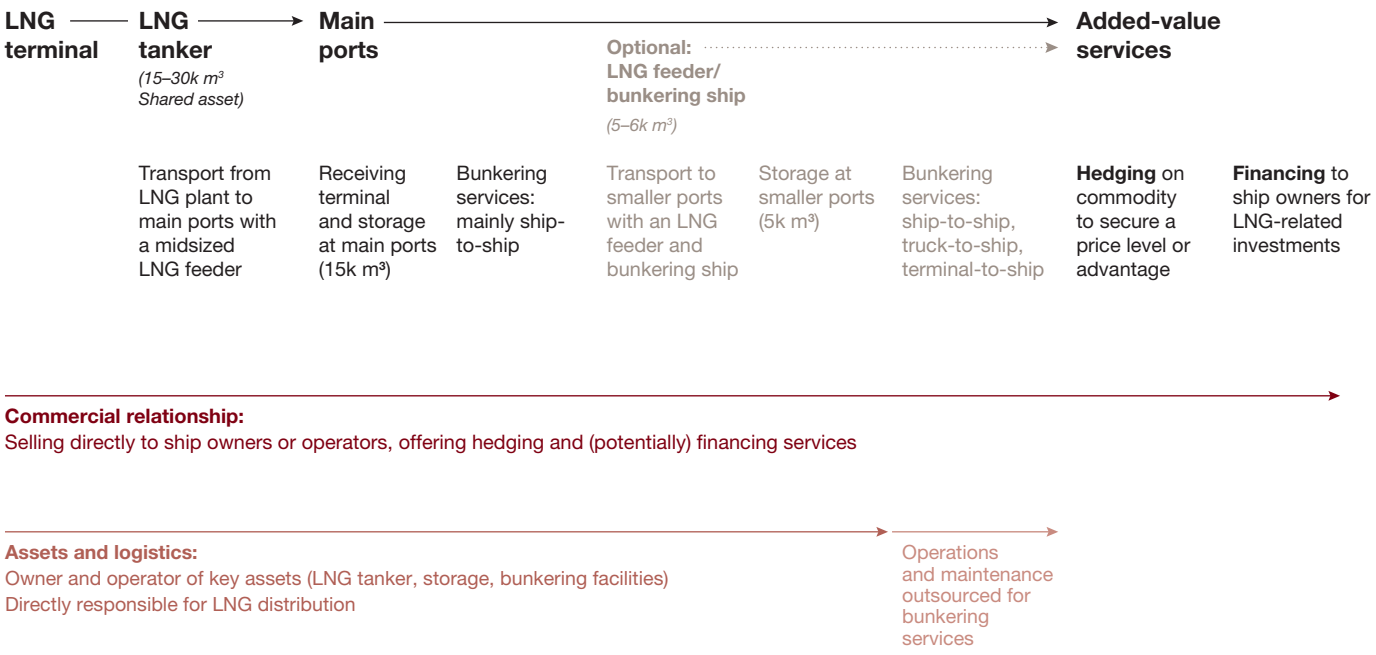
The other key element to future success is a company's competency to broker partnerships. Building collaborative partnership models will be essential to mitigate commercial risks, align business interests, and move supply and demand projects forward in parallel. The development of these partnership models is precisely what companies like Shell and Engie have delivered. Shell's strategy is focused on integration across the value chain, leveraging its subsidiary Gasnor's positioning in the Nordics while capturing long-term contracts with major clients like Sovcomflot and Carnival. Shell has signed an agreement with Sovcomflot (SCF Group) to fuel the first four Aframax crude oil tankers in the world to be powered by LNG; the ships will operate in the Baltic Sea and northern Europe beginning in late 2018. Shell has also signed a supply agreement with Carnival to fuel the world's first LNG-powered cruise ships, which will begin sailing in northwest Europe and the Mediterranean in 2019.

Engie has targeted agreements with OEMs such as Wärtsilä, the Finnish company that manufactures and services power sources and other equipment in the marine and energy markets; auto manufacturer Fiat Chrysler Automobiles; and Iveco, the Italy-based industrial vehicle manufacturer. Engie also participates in joint ventures promoting European LNG; an example is Gas4Sea, a partnership with Mitsubishi Corporation, NYK Line, and Connect2LNG that is targeting the trucking industry.

Building collaborative partnership models will be essential to mitigate commercial risks and move projects forward.

Exhibit 4

An ssLNG entry strategy for bunkering



Source: Strategy& analysis based on previous studies

Conclusion

It is clear that ssLNG is currently a small market. However, demand is likely to grow rapidly, catalyzed by increasingly stringent environmental regulations and the industry's ability to unlock new seams of consumption. But success in this market will not be open to all players. Companies that can move with agility, that have the right strategy and capabilities in place, and that can build partnerships across the LNG value chain will benefit from the advantage that accrues to first movers. In the same way that "fracking" transformed the U.S. energy sector, ssLNG may be the next "small" revolution in the gas sector. Those first off the mark will be the most likely to reap the benefits.

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