ABDULLAH BIN HAMAD AL-ATTIYAH INTERNATIONAL FOUNDATION
FOR ENERGY AND SUSTAINABLE DEVELOPMENT

Issue 01: September 2016

Al-Attiyah Foundation Research Series

Expert energy opinion and insight

Global LNG: looking beyond the slump

The world's liquefied natural gas sector is in a period of flux, characterised by rising liquefaction capacity, sluggish consumption growth and a shift in power from producers to importers. But it can also be a period of opportunity for established exporters. Beyond a short-term glut, a rebalancing is visible in the arrival of new sources of demand and the now-inevitable delays to upstream development. The changes in the market involve new contract flexibility and a greater volume of spot trade – and they will spur LNG's uptake in pent-up demand centres and emerging economies. Exporters must do more than adapt to these new conditions: flexible and strategically minded LNG producers should help create new markets, encourage gas's penetration in transport and usher in a new era of consumer-producer cooperation. Doing so will solidify established producers' premium position in an expanding trade as the market rebalances after 2020.

Power to the consumer

Supply is greater than the market needs; demand in the past year has been weaker than expected; prices have plunged; and importer power is on the rise. Global gas and its seaborne trade in LNG have, in short, been afflicted by the broad reversal in fundamentals that has hit most commodities over the past two years.

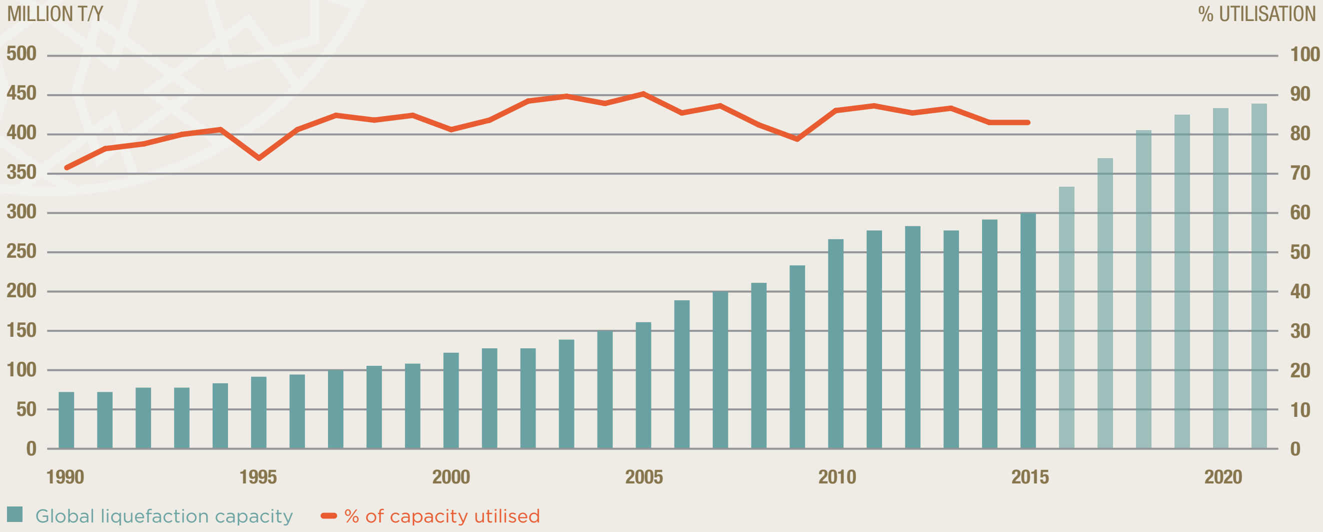
As in oil, perceptions of scarcity and ever-rising demand growth have been replaced by notions of a long-term glut. Yet the latest paradigm is no less erroneous than the first proved to be. The short-term outlook for LNG does indeed look difficult for producers; but beyond 2020 we can expect yet another turn in the cycle and a broad recovery to get underway, rewarding established exporters as the market shifts back to balance or even deficit.

Start, though, with the near-term outlook, for the seeds of the recovery are now being sown – only through a period of correction, including painful pricing, will rebalancing be achieved later. The origins of the long market are straightforward. Huge investments in gas-liquefaction capacity over the past decade and more are behind the abundance. Qatar led the trend, building the world's biggest LNG-export business. Australia followed, and its capacity, already well over 30m tonnes a year (t/y), is expected to overtake Qatar's pretty constant 77m t/y by around 2020. The US is now following.

Events in the US – now well understood – were central to the change in fundamentals just as they were for oil. Just over a decade ago, the US was expected to be the dominant importer for much of this new LNG, especially from Qatar. American engineering ingenuity intervened, and surging shale production since 2005 not only sent Henry Hub prices sharply lower but also allowed the Lower-48 to become self-sufficient in supply and then plan for exports. In recent years, new discoveries – from the eastern Mediterranean to East Africa and western Canada – as well as plans from Russia to open new gas-trade routes have all expanded LNG's supply-side potential. New plants are either under construction or planned from northern Siberia to Mozambique, British Columbia to Cyprus.

For established exporters, the raw numbers certainly make for uneasy reading. At the start of 2016, global liquefaction capacity stood at around 300m t/y. By 2018, the figure could reach around 400m t/y, and may rise (albeit more slowly) again after that, perhaps reaching 420m t/y in the early 2020s (see figure 01). This includes projects that have been proposed but have not yet received a final investment decision (FID) – and makes the numbers speculative. But the headline figure is important, because the market's perception remains one of endless supply potential – indeed, in terms of possible liquefaction capacity, no shortage of projects is on the horizon.

FIGURE 01: **GLOBAL LIQUEFACTION CAPACITY BUILD-OUT PROJECTIONS 1990-2021**

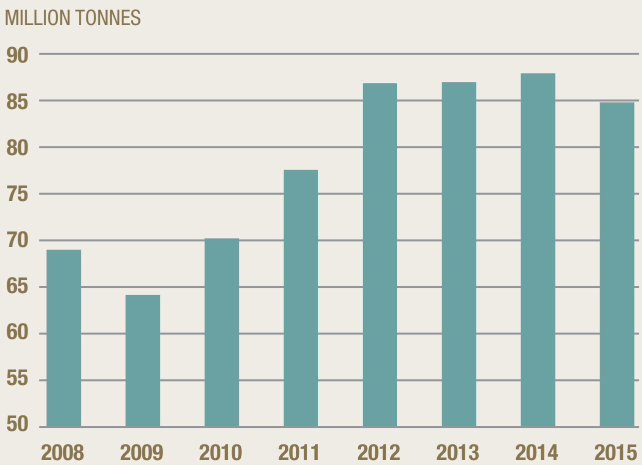


Source: IHS, public announcements

Natural gas demand growth has also been cooling. In June 2016, for example, the International Energy Agency revised its five-year global consumption forecast down by half a percentage point from its forecast a year earlier, saying annual consumption to 2021 would now rise by 1.5% a year, to 3.9 trillion cubic metres. Economic weakness – hitting all consumption of primary energy – and improved energy efficiency were the reasons for the revision.

LNG has suffered some hits specific to its segment of the market. In Japan, still the world's biggest buyer of LNG, the restart of nuclear reactors taken offline following the Fukushima Daichii accident of 2011 is biting into its LNG needs. Japanese imports, now around 85m t/y, are about 5% beneath their historical peak just after the disaster (see figure 02). Of Japan's 51 reactors operating before the accident, six have been closed permanently and five are back on-line, leaving significant scope for further restarts and a subsequent reduction in LNG demand. Economic weakness in South Korea, the second-biggest LNG importer, and the fall in global coal prices have sharply reduced its appetite for LNG too.

FIGURE 02: **JAPAN LNG IMPORTS 2008-15**



Source: Bloomberg, Bernstein

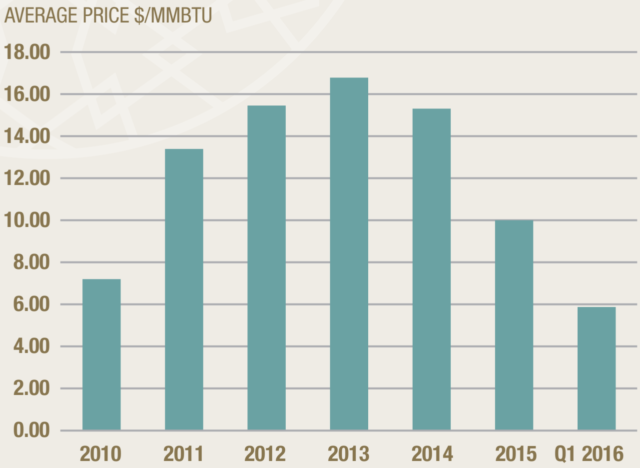
The forecast rise of Chinese LNG demand might have compensated for the drops in these two major importers — but in China, too, recent imports have disappointed. After years of double-digit LNG-demand growth, imports shrank last year, reflecting some trouble in the economy, coal's lingering appeal, and (until November 2015) artificially high domestic prices, which discouraged all gas consumption. Changes in these big Asian LNG markets contributed to the relatively weak, sub-3%, growth in global LNG demand last year; and the slump in global prices for seaborne gas (see figure 03).

Importers, faced with an array of competing suppliers and more availability of spot cargoes, have successfully clawed back contractual terms they considered disadvantageous: re-export restrictions have been scrapped in some contracts; oil-indexation has been eased; terms have shortened; and take-or-pay penalties have been waived. Above all, the entry of Henry Hub-based LNG to the global market ought to be deflationary for prices.

Indeed, developers in the US are so confident of this price advantage that new, more flexibly priced and constructed proposals continue to hit the drawing board in the American Gulf. The most recent is that offered by Martin Houston and Charif Souki – executives with extensive experience in the new US LNG sector – who intend to build fresh liquefaction capacity in Louisiana with the intent of landing gas in Europe for just $7 per mmBtu.

For the short term, established exporters will not be able to hide from or resist these new market changes: the wave of supply about to hit the market is too great. If construction updates in late 2016 are adhered to, almost 70m t/y of new LNG production capacity will have been added in 2016 and 2017 – almost the equivalent of the arrival in the market of another Qatar. Of the 45% increase in liquefaction capacity the IEA expects between 2016 and 2021, Australia and the US will account for nine of every 10 tonnes. All told, the growth in supply, combined with sluggish demand, mean that the market will be long by 60m t/y by 2019, forecasts McKinsey.

FIGURE 03: **ASIA LNG SPOT PRICE**



Source: Platts

Notwithstanding huge inflationary pressures, Australia has been leading this surge. Three new plants on Curtis Island, near Gladstone in Queensland, have taken advantage of abundant coalbed-methane feedstock in the state's interior: Curtis LNG, which started operations in 2014, Australia Pacific LNG and Gladstone LNG. Other Australian projects, such as Gorgon, Wheatstone and Ichthys, make use of more conventional gas reserves offshore Western Australia. Those Australian projects alone are forecast to add almost 19m t/y of capacity in 2016, another 18m t/y in 2017 and more afterwards.

In the US, the Sabine Pass project – the Lower 48's first major LNG export plant – started operations at its first train early in 2016, with another due on line before the end of the year, bringing total capacity to 9m t/y. Another 14m t/y or so is scheduled to be added in Texas and also Cove Point on Chesapeake Bay in Maryland in 2017. A host of other plants are planned.

Even some troubled projects will add to the short-term glut. The $10bn Angola LNG facility, led by Chevron, should complete its restart later in 2016, adding 5.2m t/y of supply. Originally opened in 2013, the plant has spent more time out of action than operating. In spite of sanctions, Russia is also adding capacity, if not as quickly as Gazprom or the Kremlin once expected. Novatek's Yamal LNG project should supply 5.5m t/y in its first phase in 2017 (trebling to 16.5m t/y with two other trains, later).

While the timelines for LNG from East Africa and western Canada, or expansion in West Africa, all remain unknown, more certainty is visible in the floating LNG arena. That technology should make its debut in the coming months, when Petronas's PFLNG 1 vessel starts operating on the Kanowit gas field, 180 kms off Sarawak. Shell's massive Prelude facility – one of the world's largest offshore structures – should come on line later, in the Browse Basin off Western Australia. If these floating plants prove successful, the technology might be suitable also in areas such as West Africa and even the Mediterranean.

Beyond the slump

But beware the notions of LNG cornucopia. Gas's demand-side travails are overestimated and may now be over anyway. Even conservative forecasts expect a 10% rise in consumption between 2015 and 2021. (Trend growth for LNG, aside from the past three years, has tended to come in at about 6% a year.) Imports into Japan and South Korea are stabilising and likely to pick up again.

Reforms in China and the start-up of new Australian export capacity contracted to the country will see its imports surge again. More significant, new LNG demand centres and downstream segments are emerging – and will be spurred along by a period of weaker prices. On the supply side, few projects now awaiting a decision from developers will receive FID in the next two years. The re-correction, returning LNG demand to its long-term growth trajectory, is on the way.

Prime among the supportive forces is the broad momentum behind global climate-change policy, which will be positive for natural gas and LNG. This is especially true in the EU, South Korea and Japan, where recent growth in coal use can only be temporary given their policies on emissions. While the rise of renewable energy poses a displacement threat to fossil fuels, intermittency of wind and solar energy remain obstacles to full penetration. That leaves an important role for reliable power sources that can fill the gap: gas emits half as much CO2 as coal in combustion and will be the main beneficiary as decarbonisation policies begin to reverse recent trends in coal use.

Despite Japan's return to nuclear power, meanwhile, the attitude in Europe – a key target market for established LNG exporters like Qatar – is increasingly hostile to the construction of new reactors. Alongside greater use of renewable energy, gas-fired generation is still considered the most cost-effective form of baseload power in the continent.

Qatar recently shipped the first commercial cargo of LNG to Polskie LNG, an East European project advanced to curb reliance on Russian gas

In Europe, the climate imperative that will eventually kill off coal's recent surge is matched by the urge to diversify supplies of natural gas – factors that will grow in force as North Sea output declines and shale-gas prospects remain distant. Regasification terminals are springing up, especially in the continent's east. Qatar recently shipped the first commercial cargo to Polskie LNG, a project designed to curb reliance on Russian pipeline gas. Lithuania's LNG terminal at Klaipeda received its first cargo earlier in the year. Croatia, Bulgaria, Romania, Albania and Estonia are among eastern European countries that have proposals in place to build new receiving terminals or lease floating, storage and regasification units (FSRUs). The UK, France and Italy may also add such capacity.

These factors are already promoting LNG demand growth in Europe – although in recent months this has mainly had the effect of taking cargoes originally intended for Asia. But longer-term growth will be a net draw on global supply (especially as Asia's own growth resumes).

Europe is also speeding ahead with connecting infrastructure. The continent's regasification capacity is already sufficient to meet 43% of the EU-28's total gas demand. So, from the perspective of exporters targeting customers in the region, growth will depend on interconnectors allowing LNG to reach interior demand centres – particularly outside northwest Europe. Conscious of this, the European Commission has designated such infrastructure projects in the southwest, southeast/Baltics and northeast regions as priority.

As these projects advance, LNG imports will rival piped gas – especially if prices remain competitive with supplies from Gazprom. Thus, though it is little acknowledged, internal progress in Europe on pipeline construction will be a crucial factor in the coming years for global LNG consumption. For example, we calculate that improvement in the utilisation rate of existing LNG terminal send-out capacity (191bn cubic metres a year) in Europe from just 19% at present to just 30% (in line with the global average) would increase LNG send out from 36.3bn to 57.3bn cm/y, or from 26.5m to 48m t/y of LNG. Even at just a 19% send-out rate, half of the proposed additional receiving terminal capacity would add another 11m t/y.

Europe is not the only (re-)emerging demand centre. While China, Taiwan, Japan and South Korea will resume (or in Taiwan's case maintain) strong growth, even more rapid uptake can be expected in the Middle East, Southeast Asia and, especially, India – countries that represent huge pockets of pent-up demand.

The Middle East will be an especially dynamic market for LNG. Qatar sold Jordan its first LNG cargo earlier this year, which was landed through the FSRU *Golar Eskimo*. Notwithstanding recent discoveries in its Mediterranean waters, Egypt plans to maintain at least two FSRUs to meet rapidly rising domestic gas needs and, once local production arrives, allow for flexibility in supply (even while it seeks to revive its own mothballed export projects).

Egypt's imports rose rapidly in 2015, from zero to 3m tonnes between April and the end of the year – the fastest rate of import growth anywhere ever. Kuwait, already importing, plans to expand its regasification capacity from around 6m t/y to about 20m t/y. Between them, by the same time the UAE (already importing) and Bahrain intend to have regasification capacity of 15m t/y.

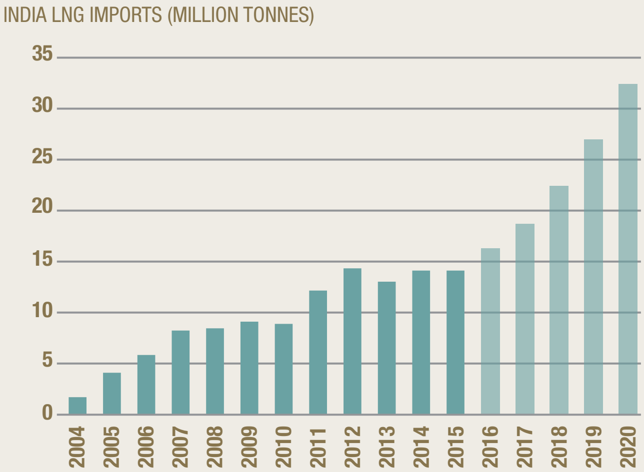
India's potential remains underestimated. Gas accounts for just 7% of India's primary energy consumption at present, but the attractions of plentiful low-cost gas on the global market over coming years have prompted a strategic shift from New Delhi towards a rapid gasification of the economy: a target to increase gas's share of power supply to 20% by 2030-35 is in place.

Although India is making efforts to increase domestic production, much of this gas will have to come from LNG. India imported just over 15m tonnes of LNG in 2015. But unlike other markets, India's potential is hampered by infrastructure. At present, all of the country's LNG-import terminals are on its west coast, but three terminals are now under construction on the east coast too: at Chennai, Kakinada and Dhamra. These would add capacity of 29m t/y, and provide crucial new infrastructure given plans to promote gas use in industry and the retail segment.

India has already contracted future supplies of 15m-20m t/y, but according to Indian officials plans to double gas consumption will require another 20m-30m t/y of LNG. The increase is already visible. Analysts from Bernstein note that Indian imports have risen in 2016 by 50% compared with last year (35%, year-on-year, in the first quarter). Their outlook for the country shows remarkable potential (see figure 04).

The market's conditions give rationale to India's strategic gasification. The renegotiation of Petronet's supply contract with RasGas last year – including a price cut and easing of the take-or-pay terms – reflects the country's intention to strike while power lies with the buyer. RasGas's acquiescence suggests it is keen to keep a solid foothold in what could soon be LNG's fastest-moving market. East African suppliers would also be a natural partner for India's LNG sector, given favourable shipping times – another reason why Qatar and other established producers must lock in this growing market while their supply pre-eminence is unchallenged.

FIGURE 04: **INDIA LNG DEMAND 2004-20**



Source: Bloomberg, Bernstein estimates and analysis

While India offers scale, other demand clusters are emerging thanks to the rapid uptake up FSRUs – another product of the new flexibility in the market. Importers from Egypt to Croatia to Pakistan and a host of southeast Asian countries increasingly see such floating facilities as offering a cheap but swift means to take advantage of abundant supply.

Global FSRU regasification capacity stood at about 65m t/y last year, but is expected to reach almost to 80m t/y by the end of this year (see figure 05). McKinsey recently linked the addition of 10 new small LNG importers to the advent of FSRUs (see figure 05). A more sophisticated market system – akin to the integration in oil and refining – could be envisaged as big LNG producers enter the FSRU business themselves, helping to promote it.

Indeed, LNG exporters seeking security of demand beyond 2020 should be encouraged by – and do their best to strengthen – other downstream opportunities for their fuel. The biggest of these is in the transportation sector. Natural gas vehicles – which power an internal combustion engine using fuel from a compressed natural gas (CNG) tank – have long been popular in developing countries, such as Iran and Pakistan, or where government policy favours it, such as China and Brazil.

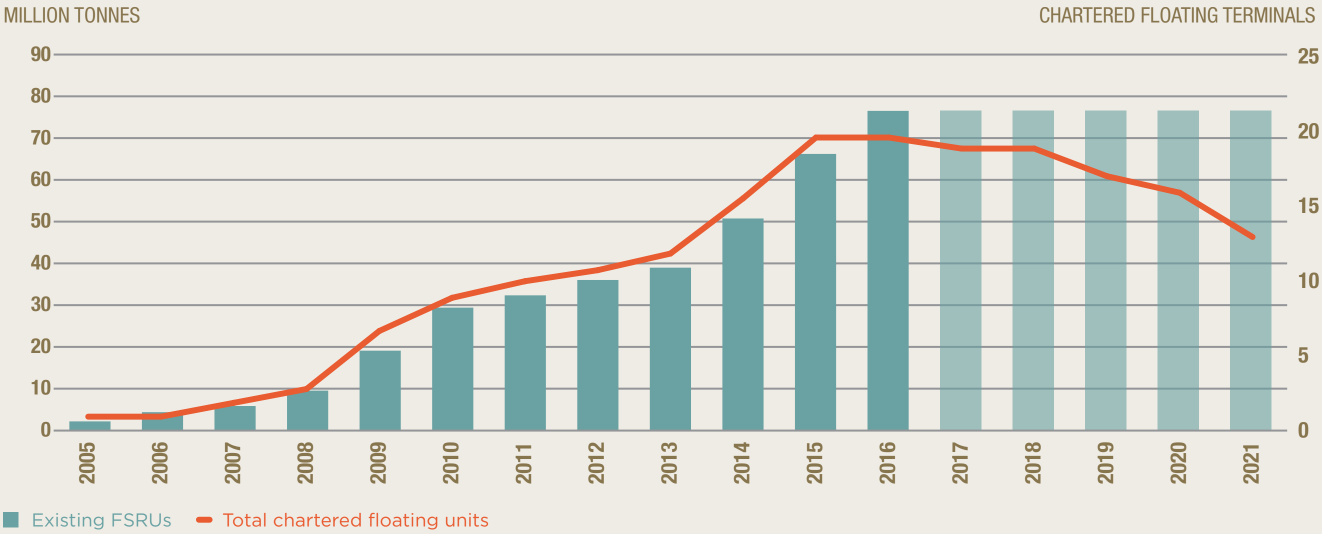
Gas is increasingly being considered as an outright alternative to petroleum in some parts of the transport sector, spurred by progress in developing small-scale LNG technology, which means either LNG or natural gas can be made available more readily to users. Not only does gas have slightly lower carbon emissions than the latest petroleum-fuelled engine technology, it scores more highly in comparison when looking at other forms of pollution: gas in transport produces zero SOx emissions and much lower emissions of NOx and other particulates, which pose a major health hazard in diesel engines.

LNG itself, rather than compressed gas, should also make inroads as a transport fuel. It has the big advantage of occupying a smaller physical space than CNG, which an LNG tank can carry three times as much fuel as an equivalent-sized CNG tank, as well as having lower running costs than diesel, once purchased. That's a big plus for the long-distance road-haulage sector in particular. The latest LNG powered trucks can achieve ranges of approaching 1,500 km from a single tank. These are competitive advantages for LNG, with benefits for consumers, and producers should proclaim them.

India, again, shows promise in this domain. Petronet, for example, wants to convert a third of India's truck fleet to LNG – equivalent to the addition of another 22m t/y of LNG demand. Annually, the incremental need for LNG-powered long-haul lorries could amount to 6m t/y. Such increases would on their own soak up some excess LNG supply that is forecast to emerge in the short term.

The potential for penetration of other downstream segments was signalled by a recent agreement between Qatar and Shell – which operates Qatari LNG trains – and Danish shipping company Maersk, which agreed to collaborate over supply of LNG as a maritime fuel in the future. Qatar's strategic location makes it an ideal refuelling point for ships plying the Asia-Europe route or operating in the Middle East. Across transportation, on land and at sea, demand for LNG could rise by almost 12% by 2030, according to some forecasts.

FIGURE 05: **FLOATING REGASIFICATION CAPACITY BY STATUS AND NUMBER OF TERMINALS 2005-21**



Source: IHS, company announcements

Notes: The forecast only includes floating capacity sanctioned as of end 2015. Owing to short construction times for FSRUs, additional projects that have not been sanctioned may still come online in the forecast period. The decline in numbers of terminals is the result of short-term FSRU lease contract expirations.

Conclusion

No one should be shocked by these new emerging sources of LNG demand. If the market of the past was chiefly a business of supplying feedstock for power generation in Japan and South Korea under long-term contracts, that of the future will be a disaggregated industry providing fuel to a plethora of buyers, commercial and strategic, for use also as direct fuel in transport, seasonal and permanent electricity feedstock, and strategic storage.

Above all, these new sources of demand are the consequence of a period of strong supply and weak prices – the same forces that will also further delay new upstream and liquefaction projects. Thus, at current accepted rates of market growth, the market will remain long until 2020, when it begins to tighten (see figure 06).

But this may also underestimate the potential of this new restructuring in the market, which should also see the unlocking of pent-up demand in India and smaller centres, the rapid rise of FSRUs, and the opportunity for LNG in the downstream. This can happen both directly in LNG-powered vehicles but also indirectly as electric vehicles begin to replace petroleum-fired ones, at least on the margin, and a global shift away from liquid fuels to the grid takes place.

Finally, the same market forces that we expect to spur faster uptake of LNG in the coming years will also continue to deter upstream investment – a market outcome similar to that underway in global oil supply. We expect few FIDs to be taken under present market conditions. Capacity additions and greenfield projects – particularly those in western Canada, the East Mediterranean, Russia and East Africa – will be vulnerable to further delays and many proposals will be deferred indefinitely, lacking guarantees from buyers and therefore access to project finance. Presently, more than 33m t/y of planned capacity in nine global locations awaits FID.

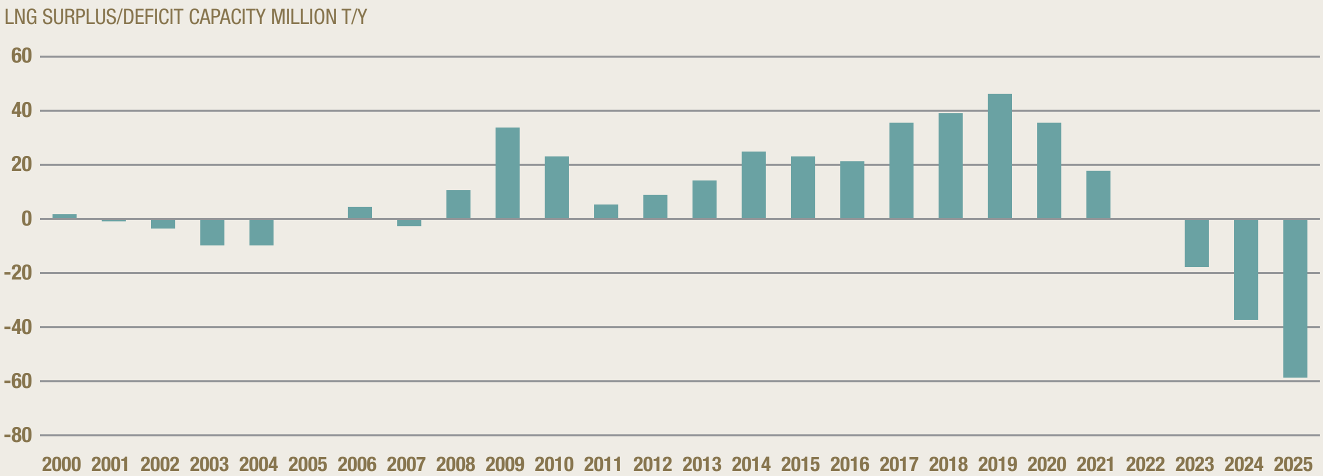
Although a more profitable future awaits them after 2020, exporters must use their strong position now to build future market share – and help shape the terms of producer-consumer cooperation

But outside the US, no greenfield project has gained FID since 2013. Only those projects able to bring capacity on stream cheaply will gain approval. (BP's Tangguh train 3 was sanctioned in June, but is a greenfield expansion – and may have set a new, difficult cost benchmark for new projects: it will be built at a cost of around $2,000 per tonne of capacity, according to Bernstein, almost a third lower than some recent Australian projects' costs.) Given the preponderance of greenfield developments awaiting FID, at best we expect to see just one or two of these sanctioned by end-2017.

So, while established producers can assume some risks in newly flexible contracts, greenfield developers are likely to insist on traditional long-term contracts before proceeding with development. Even as the market begins to tighten after 2020, the legacy of the latest downturn will linger in investor minds, delaying the next supply wave.

This should not make established producers and exporters complacent. Although a more profitable future awaits them after 2020, they must use their market position now to build future market share – and help shape the terms of producer-consumer cooperation. These strategies will include more flexible contract arrangements, but also must involve efforts to stimulate new sources of demand. Lobbying and market promotion will be part of this, but the most successful strategy will maintain an acceptable pricing formula for consumers. Low-cost producers, in other words, might embrace a period of weaker prices, knowing that this will promote healthy demand growth again in future.

FIGURE 06: **LNG LIQUEFACTION CAPACITY (EXISTING PLUS UNDER CONSTRUCTION)**



Source: Bloomberg, Bernstein analysis and estimates

Note: LNG surplus/Deficit = (LNG demand *90%) - Capacity (existing and under construction)
60mn t/y of new projects need to be sanctioned by 2020 to meet log term market demand by 2025