International Gas Union

News, views and knowledge on gas – worldwide

World LNG Report - 2014 Edition

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1. Message from the President of the International Gas Union

Dear colleagues,

I am pleased to present the second World LNG Report produced under the French Triennium. It is a follow up to the 2013 Edition and covers the most important global LNG developments in 2013 and early 2014.

This report is the fruit of the work of IGU Programme Committee D, which benefits from unique expertise from over 100 international professionals.

This edition includes a special report on the “Small LNG Value Chain” that focuses on small liquefaction and regasification projects, small shipping and onshore transportation facilities. It also highlights the challenges and opportunities in every region worldwide.

Global gas demand is surging, nurtured by a growing preference for low-carbon energies and uncertainty over possible Korean and Japanese nuclear policies.

The global LNG market is experiencing major change. 2013 was a year of “unprecedented” tightness, as the IEA pointed out in its latest Medium-Term Gas Report and forecasters predict that 2014 is set to be another tight year due to increased demand from several regions including South Korea and China (+4 MT each) and delays in new supply projects. Major new sources of supply are not expected to come online before 2015 even though buyer activity is intensifying in Latin America. The LNG market has stabilised at around 240 MT (more than 1/3 of which is marketed under <5 year contracts) until new supplies are available from Australia and Papua New Guinea.

The world is keenly awaiting new LNG supplies from the US although some uncertainty remains over the actual number of liquefaction projects that will start delivering soon.

To counter this uncertainty, LNG buyers are changing their procurement strategies and are proposing new pricing mechanisms; for example, some contracts have been signed based on Henry Hub prices for supplies coming from the US. Markets will remain segmented, with prices fluctuating from one region to another and this will continue to stimulate world LNG trade.

European regasification terminals are continuing to see fewer LNG cargoes. Furthermore, a growing number of cargoes are re-exported from Europe to Asia and Asia Pacific, as Asian LNG prices remain high, surfing on the wave of strong demand and a lack of regional supply. Following the liberalization of the Russian export market, the world’s largest pipe gas producer is expected to grow as a supplier for the Asian market.

This exciting picture is analysed in detail in our report, which I hope you will find most informative and compelling.

Yours sincerely,

Jérôme Ferrier
President of the International Gas Union

2. State of the LNG Industry

236.8 MT
Global trade in 2013

Global Trade: LNG trade was stable in 2013, at 236.8 MT compared to 237.7 MT in 2012. Still, traded volumes remained below the peak of 241.5 MT reached in 2011. Supply-side issues in the Atlantic Basin – markedly force majeure in Nigeria and feedstock diversions in Egypt – offset output gains in the Middle East and Asia Pacific, limiting trade growth. Qatar was by far the largest global LNG supplier, while Japan remained the world's dominant importer (37% of global imports).

77.3 MT
Non long-term trade in 2013

Non Long-Term LNG Market (as defined in Chapter 9): A total of 77.3 MT of LNG was traded on the non long-term market in 2013, up from 73.5 MT in 2012. Equivalent to 33% of global trade, this marked a new high for the industry. Though Qatar and Nigeria remained the dominant spot exporters, accounting for 44% of total non long-term volumes, the largest growth in supply came from Brunei LNG. 74% of spot LNG was consumed by Asian market, with China showing particularly strong demand growth in non long-term trade.

$15.3/mmBtu
Average LNG import price in Japan, 2013

Global Prices: While Henry Hub rebounded tentatively in 2013, finishing above $4/mmBtu, it continued to trade at a deep discount to European and Asian markets. The German cross-border price remained essentially flat ($11.5-12/mmBtu), showing a weaker correlation with Brent than in previous years. Japanese LNG prices continued to be among the highest globally, averaging $15.3/mmBtu.

290.7 MTPA
Global liquefaction capacity, end-2013

Liquefaction Plants: Two new projects were brought online in 2013: the 5.2 MTPA Angola LNG project and the 4.5 MTPA Skikda Rebuild in Algeria. Global nominal liquefaction capacity thus grew from 282.6 MTPA in 2012 to 290.7 at the end of 2013. While only moderate capacity growth is expected in 2014, over 100 MT of new capacity is scheduled to come on-stream between 2015 and 2018. Australia will lead the way: with 62 MT of new capacity expected online by 2018, the country is set to become the world's largest exporter.

500+ MTPA
Proposed liquefaction capacity in new LNG frontiers

New Liquefaction Frontiers: The future impact of emerging LNG frontiers remains a key issue for the industry. Several new regions could change the market in a material way, either by offering new sources of supply or alternatives to traditional oil-linked contracts. These frontiers include the US Gulf Coast and Western Canada (due to shale gas production), East Africa (due to prolific deepwater basins), floating LNG globally (because of stranded gas), Asia Pacific brownfield projects, Russian projects (following LNG export liberalization) and East Mediterranean projects (Cyprus, Israel).

688 MT
Global regasification capacity, end-2013

Regasification Terminals: Global nominal regasification capacity reached 688 MTPA in 2013 (up from 644 MTPA in 2012). New and existing markets, especially in Asia, are increasingly turning to LNG to meet their growing energy needs. In 2013, Singapore, Malaysia and Israel joined the list of LNG importing countries. 29 countries now have regasification capacity globally. China saw particularly strong capacity growth in 2013, bringing four new terminals online with a combined capacity of 12.2 MT.

44.3 MT
FSRU capacity, end-2013

Floating Regasification: Global floating regasification capacity reached 44.3 MTPA in 2013 (+34% over 2012), spread across nine countries. Four new terminals were completed in 2013 in China (2.2 MTPA), Italy (2.7 MTPA), Brazil (3.8 MTPA) and Israel (2.5 MTPA). The Chinese and Italian FSRUs were the first in these markets. Globally, 10 out of 29 LNG importing countries now have floating regasification capacity.

357 Carriers
LNG fleet, end-2013

Shipping Fleet: Sixteen new LNG vessels entered the global LNG fleet in 2013, bringing the total to 357 vessels with a combined capacity of 54 mmcm. Though short-term charter rates outdid expectations in 2013, the wave of speculative newbuild deliveries in 2014 (31 LNG carriers scheduled for delivery) could prompt a deep softening of the market.

400+ Stations
LNG re-fueling stations in China

Small-Scale LNG: Though traditionally limited to a few markets, new regions have turned to small-scale LNG to cut emissions, reduce fuels costs, access isolated customers and reach new markets. LNG is a particularly cost-effective and flexible alternative to conventional oil derivatives. It is now used in a wide and growing variety of industrial and power applications, as well as in the transport sector as a marine fuel and for heavy trucking. China is leading the way in the latter, with over 400 LNG refuelling station.

10% of Supply
Share of LNG in global gas supply

LNG Positioning: Natural gas accounts for ~1/4 of global energy consumption. LNG has been the fastest growing source of gas supply (+7% per year since 2000) and now meets 10% of global demand. LNG is uniquely positioned to take a more commanding share of future gas consumption.

3. LNG Imports, Exports and Prices

Over the past three years, global LNG trade has stabilized at around 240 MT. Still, traded volumes in 2013 remained below the peak reached in 2011 as supply side constraints in the Atlantic Basin offset output growth in the Middle East and Asia Pacific. Since the end of 2008, eleven new countries began importing LNG – including three in 2013 – expanding the geographic reach and diversity of end markets. In tandem, interregional trade flows have shifted as a tight supply market and weak European demand have seen volumes redirected towards premium markets in the Middle East, Asia, Asia Pacific and Latin America.

European LNG imports declined for the second consecutive year in 2013, with cargoes largely diverted to higher paying markets in the Pacific Basin and Latin America. Economic stagnation, combined with the continued call on coal and renewables in power generation, will likely limit European LNG demand into 2014. The Pacific Basin is set to remain the largest source of demand, though the potential restart of nuclear generation in Japan may lower the import requirements of the world's largest LNG consumer.

3.1. OVERVIEW

236.8 MT
Global LNG trade remained stable in 2013

Exports reached 236.8 MT in 2013, nearly on par with 2012 levels though still below the peak of 241.5 MT reached in 2011. Historically, the Asia Pacific region (Brunei, Indonesia, Malaysia and Australia) have been the world's most important LNG suppliers; but they have been supplemented and, ultimately, surpassed by the Middle East as Qatar, in particular, became the world's largest LNG supplier in the mid-2000's. In 2013, the Middle East supplied 42% of the world's LNG, while Asia Pacific provided 30%.

On the demand side, the Asia Pacific region continued to show the most substantial growth (+7.7 MT), driven by higher levels of consumption in South Korea and China. Conversely, sustained demand weakness in Europe saw LNG imports fall by 14.6 MT, with Spain, the UK and France witnessing the most substantial drops in consumption.

In 2013, the number of LNG exporters reached 17. While the last operational plant in the US was temporarily shut-down following the expiration of Kenai LNG's export license in March 2013 (though the project has since been granted a new export license), Angola joined the list of LNG exporting countries, loading its first cargo in June 2013. In the meantime, the Netherlands and South Korea both re-exported cargoes for the first time, bringing the total number of re-exporting countries to eight in 2013.

The resumption of normal operations in Malaysia and Yemen, and the full-ramp up of Pluto LNG in Australia boosted LNG output in 2013. Still, these gains were offset by difficulties in the Atlantic Basin. Repeated force majeure in Nigeria, technical issues at Snøhvit LNG in Norway and the increased redirection of LNG feedstock towards the domestic market in Egypt were among the major factors limiting supply.

The number and geographic spread of countries importing LNG continues to grow. From end 2008 to 2012, Brazil, Canada, Chile, Kuwait, Indonesia, the Netherlands, Thailand and the United Arab Emirates (UAE) began importing LNG. In 2013, Malaysia, Singapore and Israel joined the list, bringing the total number of importers to 29.

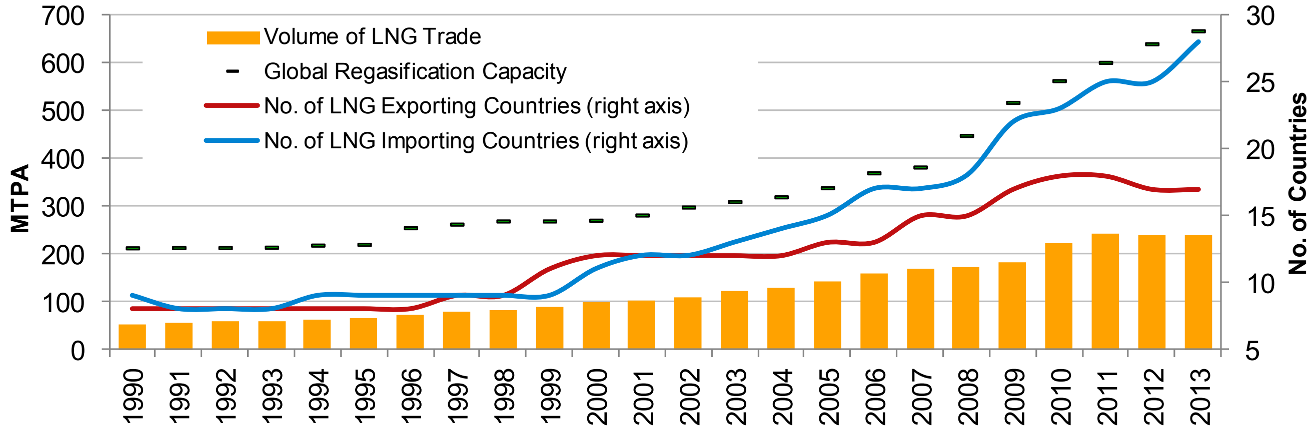


Figure 3.1: LNG Trade Volumes, 1990-2013

Source: IHS, IEA, IGU

Many of these countries were not considered to be potential LNG importers a decade ago and the US, which was then expected to be the largest LNG import market by now, has seen imports slow to a trickle. In some countries, such as Japan and South Korea, LNG is used to meet the entire gas needs. Still other countries use LNG to fill the gap between domestic energy supply and demand imbalances.

The emergence of so many new importers and changes in regional demand patterns have led to large trade swings in recent years. The most notable is the growing redirection of volumes – particularly from the Middle East – away from Europe towards higher paying markets in the Pacific Basin.

Latin America has also emerged as a small but growing LNG destination, with the premium prices offered by countries like Brazil and Argentina making the region an attractive import market. Going forward, the Pacific Basin is expected to remain the largest source of LNG demand, though the eventual resumption of nuclear generation in Japan will likely see China and others act as the main drivers of demand growth.

In spite of increased interregional trade, there is still no "global" LNG market with a single price structure. Rather, there are strong regional supply and demand dynamics, with global LNG flows creating links between these regional markets.

3.2. LNG EXPORTS BY COUNTRY

17 countries were exporting LNG at the end of 2013. While the last operational liquefaction plant in the US (Kenai LNG in Alaska) was temporarily shut down in March 2013, Angola joined the list of LNG exporting countries, sending out five commissioning cargoes in the second half of 2013.

Eight additional countries – Belgium, Brazil, France, the Netherlands, Portugal, South Korea, Spain and the US – re-exported LNG, with the Netherlands and South Korea re-exporting their first cargoes in 2013.

LNG trade in 2013 was supported by export growth in the Asia Pacific and the Middle East regions, with the biggest incremental gains seen from Yemen (+2.1 MT), Malaysia (+1.6 MT) and Australia (+1.4 MT). While Qatar remained by far the largest LNG exporter, supplying 77.2 MT of LNG to the market (33% of global supply), an improved security situation limited production disruptions at Yemen LNG, allowing for the largest global YOY increase of 2.1 MT.

Production in Malaysia, the world's second largest exporter, returned to near 2011-levels after technical issues limited output in late 2012. In Australia, the increase can predominantly be explained by the ramp-up of Pluto LNG, which saw its first full year of production. Global exports were further supported by the addition of Angola's first cargoes in the second half of 2013 and modest export growth from a collection of countries including Trinidad, Oman, Brunei and Peru.

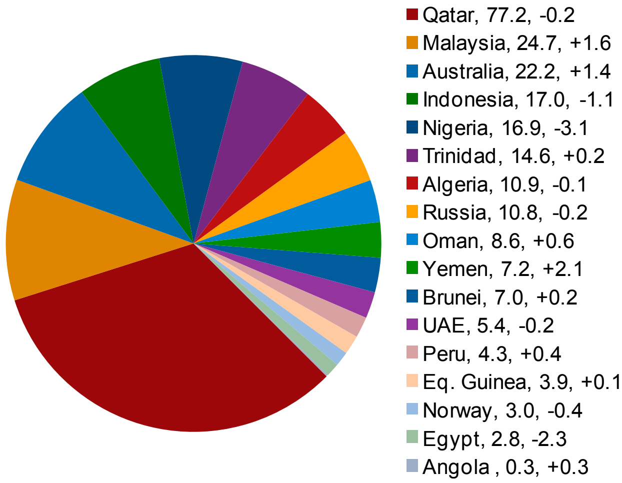


Figure 3.2: 2013 LNG Exports by Country & Incremental Change Relative to 2012 (in MTPA)

Sources: IHS, US DOE, IGU

These output gains, however, were counteracted by supply-side constraints in the Atlantic Basin. In Nigeria, repeated force majeure due to a tax-related blockade by the government and pipeline sabotage saw exports fall by 3.1 MT. Production was also weaker in Norway (due to technical issues at Snøhvit LNG in the first half of 2013) and Egypt, where exports dropped 2.3 MT as feedstock was increasingly redirected to the domestic market to meet growing local demand.

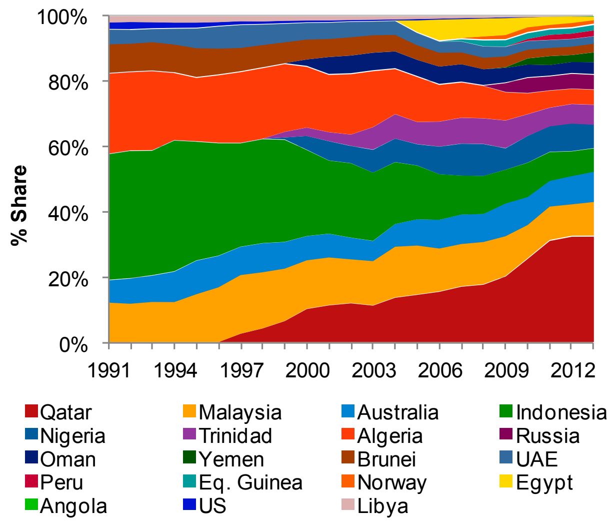


Figure 3.3: Share of Global LNG Exports by Country, 1990-2013

Sources: IHS, US DOE, IGU

Historically, the Asia Pacific region has been the world's most important source of LNG. Yet Asia Pacific exports have been supplemented and, ultimately, surpassed by the Middle East since 2006. This growth is largely due to developments in Qatar, where liquefaction capacity surged from 25.5 MTPA in 2006 to 77.0 MTPA in 2011.

While a slew of new Australian projects coming online post-2014 will likely see the Asia Pacific region take back the lead, prospects for LNG export growth in newer frontiers such as North America, East Africa, Russia and East Mediterranean countries could further rebalance regional market shares.

In 2013, the Middle East supplied 42% of the world's LNG (98.5 MT), while the Asia Pacific region supplied 30% (70.9 MT). Volumes from Nigeria, Equatorial Guinea, Algeria, Egypt and most recently Angola, made Africa the third-largest LNG producing region in 2013, accounting for 15% (34.8 MT) of global exports.

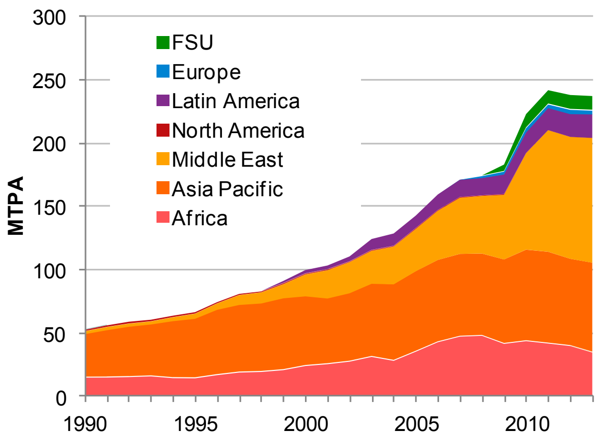


Figure 3.4: LNG Exports by Region, 1990-2013

Sources: IHS, US DOE, IGU

4.6 MT

Re-exported LNG volumes in 2013

Re-exports grew rapidly for the fourth consecutive year, reaching a high of 4.6 MT in 2013. As in the previous two years, re-exports were largely the product of weak European demand, which prompted Belgium, France, Portugal, Spain and – for the first time – the Netherlands to resell cargoes into higher paying markets in Latin America and Asia Pacific.

Spain was the most important re-exporter, accounting for 43% of global re-exported volumes as domestic gas demand continued to suffer from an ongoing economic recession combined with cheap coal and higher renewable generation. Belgium was the second largest re-exporter, reloading 47% of its received volumes. The country was responsible for 25% of global re-exported volumes.

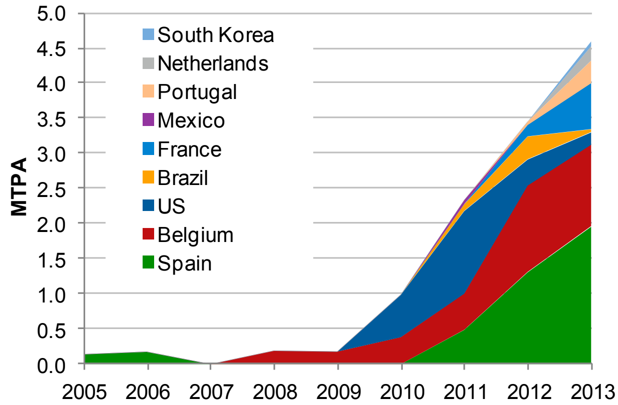


Figure 3.5: Re-Exports by Country, 2005-2013

Sources: IHS, US DOE

3.3. LNG IMPORTS BY COUNTRY

29 countries imported LNG in 2013. The Asia Pacific region is by far the leading market for LNG, accounting for 61% of total imports in 2013. Japan is the largest market in that region, followed by South Korea and Taiwan. Europe is the second most important destination for LNG, taking 14% of total volumes in 2013, with Spain and the UK being the region's main importers. Europe is closely followed by the Asia region, where China and India now represent 13% of global imports. Combined, these three regions cover 88% of total LNG imports.

Nuclear outages in South Korea and rapidly rising gas demand in China were the strongest growth factors for LNG demand (+7.9 MT), though this was more than offset by continued decline in the UK and Spain (-8.5 MT), where pipeline imports and competition from coal and renewables in power displaced LNG demand.

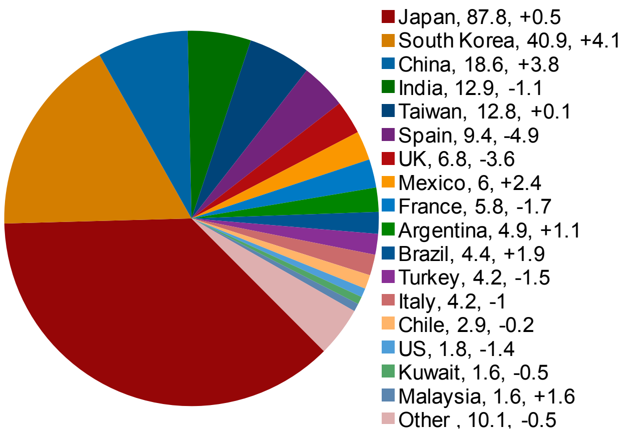


Figure 3.6: 2013 LNG Imports by Country & Incremental Change Relative to 2012 (in MTPA)

"Other" includes Belgium, Canada, Dominican Republic, Germany, Greece, Israel, the Netherlands, Portugal, Puerto Rico, Singapore, Thailand, UAE

Sources: IHS, US DOE, IGU

Japan – the world's single largest LNG market – saw a significant demand increase in 2011-12 as utilities expanded gas-fired power generation to make up for lost nuclear output after the Fukushima-Daiichi nuclear disaster. Nuclear generation, which previously accounted for 30% of power supply on average, made up just 3% of electricity supply by the second half of 2012 as plants were shutdown. In response, LNG imports grew by 24% from 2010 to 2012.

In 2013, Japanese LNG demand continued to grow, though at a more moderate pace. While LNG demand was bolstered as Japan's two remaining active plants were idled for scheduled maintenance in the fourth quarter, warmer temperatures in the first half of the year and incremental coal-fired generation tempered gas demand. Going forward, Japan's LNG needs will depend on the role of nuclear power and the ability of offline plants to restart.

The nuclear shut-down in Japan has had broader implications for the global LNG market, expediting the tightness in supply-demand dynamics. With little supply coming online to meet the surge in demand, LNG prices have risen to new highs. A strong oil market has also impacted prices for LNG associated with long-term, oil-linked contracts. LNG has not made up the nuclear shortfall alone, however, as crude and HFO purchases by

Return from Algeria on the Energy LNG tanker (Arzew-Fos)

Japanese utilities have also increased substantially. This has solely been an emergency response to boost power generation; the country is not expected to continue to have a high reliance on oil-fired power plants (many of which are aging and inefficient) once nuclear plants restart.

Globally, the share of gas demand met by LNG has been rising quickly. In 1990, LNG made up just 4% of gas demand, but this has since grown to 10%. Other sources of gas supply remain more dominant (pipeline imports account for 21% and domestic production for 69%), but LNG is quickly catching up. LNG has been the fastest-growing source of supply, increasing by 7.5% per annum on average since 2000. This compares to slower growth of 4% per annum for pipeline imports and 1.8% per year for domestic production.

+ 7,5% p.a.

Average yearly growth rate of LNG demand since 2000

Of the LNG importing markets where gas plays the largest role in the energy mix (40% or greater), many have been major gas producers in the past (and in some cases exporters). These include the UAE, Argentina, the Netherlands and the UK. As production in these countries has matured, they have turned to LNG to maintain supply. For the the UAE, LNG imports have allowed domestic gas to continue to feed domestic liquefaction trains. Argentina has all but ceased pipeline gas exports, and the Netherlands still produces more gas than it consumes, but now also acts as a transit country for LNG in the integrated continental European gas supply network.

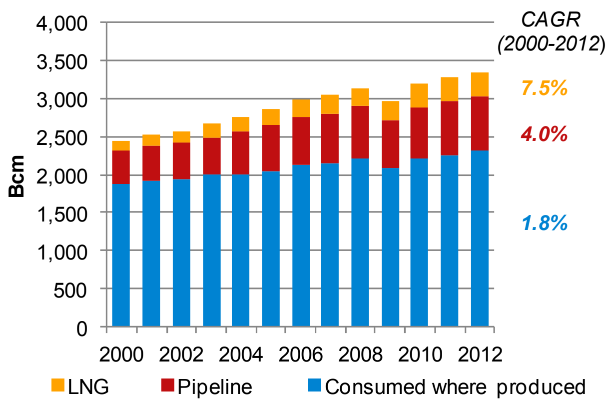


Figure 3.7: Global Gas Trade, 2000-2012

Sources: IHS, BP Statistical Review of World Energy

Other markets with long-standing domestic gas production have turned to LNG to increase gas supply security. These include Italy, whose supply is chiefly piped gas from North Africa; Turkey, a key gas transit point from Central Asia to Europe that offtakes piped gas for domestic use; Thailand and Kuwait, whose demand growth has surpassed gas production; and Canada and Mexico.

Asia Pacific countries are by far the most dependent on

LNG imports to meet gas demand, more than double the share in Latin America and Europe. For three of the most important LNG markets – Japan, South Korea and Taiwan – LNG provides nearly 100% of gas supply as they have little to no domestic production or pipeline import capacity.

Other markets that rely on LNG for more than half of their gas supply are Spain and Portugal, though for them the trend has been driven by diversification from Algerian supply rather than a lack of non-LNG import capacity. In other European markets without or with limited domestic production such as France, Belgium, Italy, Greece and Turkey, most supply comes from pipeline imports, with LNG playing more of a supplementary role.

Over the past few years, internal market dynamics have changed the trends in several countries. In North America, the US shale gas revolution has reduced LNG import needs in not only the US, but also Canada and Mexico due to the interconnectedness of the North American grid. Still, Mexican LNG imports surged in 2013, reversing the decline in North American imports. This growth resulted from bottlenecks in Mexico's domestic pipeline network that constrained low-cost imports from the US.

Europe's share of global LNG demand dropped 6% in 2013, declining for the second year in a row as fuel switching from gas to coal in power and stagnant economic conditions continued to depress consumption. In Asia and Asia Pacific, demand is resilient, though future growth will likely come from China and India as nuclear capacity in Japan comes back online. Finally, Latin American countries picked up market share in 2013, surpassing North America as an LNG export destination for the second year in a row. While low hydropower in Brazil led to a surge in LNG imports to meet demand for gas-in-power, Argentine LNG purchases continued to rise to offset declining domestic production.

3.4. LNG INTERREGIONAL TRADE

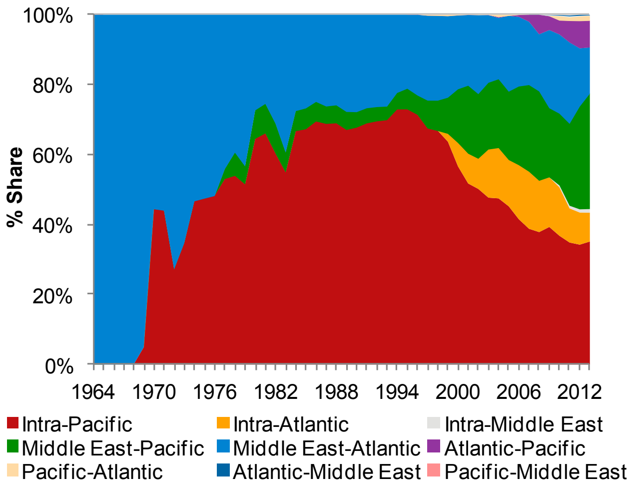


Figure 3.8: Inter-Basin Trade Flows 1964-2013
Sources: IHS, US DOE, IGU

The two largest inter-basin trade flows are Intra-Pacific and Middle East-Pacific. While the former accounted for as much as 71% of global LNG trade in 1995, new LNG exporters in the Middle East and Atlantic Basins have since entered the market, changing global flows. The most significant change over the past decade has been the rapid expansion of the Middle East to Pacific LNG trade.

Exporting Region / *Importing Region*	Africa	Asia	Asia Pacific	Europe	FSU	Latin America	Middle East	North America	Re-exports	Total
Asia	2.8	-	8.9	0.1	-	0.1	19.5	-	-	**31.4**
Asia Pacific	13.8	-	61.7	0.4	10.8	2.5	55.6	-	(0.1)	**144.6**
Europe	15.0	-	-	1.8	-	3.1	17.2	-	(4.3)	**32.8**
L. America	1.6	-	-	0.4	-	9.1	1.3	-	(0.04)	**12.4**
Middle East	0.4	-	0.1	-	-	0.2	2.2	-	-	**2.9**
N. America	1.3	-	0.3	0.4	-	3.8	2.6	-	(0.2)	**8.2**
Re-exports	-	0.1	0.8	1.0	-	2.2	0.2	0.4	-	**4.6**
Total	**34.8**	**0.1**	**71.8**	**3.9**	**10.8**	**21.0**	**98.6**	**0.4**	**(4.6)**	**236.8**

Table 3.1: LNG Trade Between Basins, 2013, MT
Sources: IHS, EIA, US DOE, IGU

The growth of Middle East – Pacific trade largely resulted from the divertibility of European supply contracts, combined with the price spread between Asia and Europe, resulting in Qatari volumes re-directed eastward. Middle East-Pacific LNG flows are now roughly on par with Intra-Pacific exchanges at around one-third of global trade. Another re-direction has been the diversion of volumes originally intended for North America and Europe to Latin America. Latin America surpassed North American imports for the first time in 2012. Strong demand in Argentina and Brazil saw this spread grow to 6.0 MT in 2013. In this decade or later, the emergence of new LNG plays in North America, East Africa and Russia has the potential to further alter inter-basin supply dynamics.

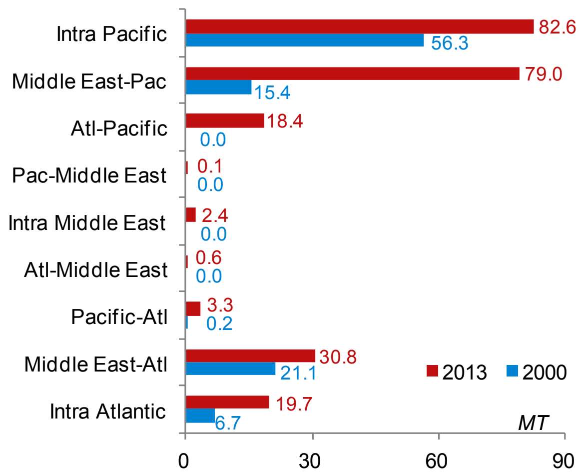


Figure 3.9: Inter-Basin Trade, 2000 v. 2013
Sources: IHS, IGU

	Algeria	Angola	Australia	Brunei	Egypt	Equatorial Guinea	Indonesia	Malaysia	Nigeria	Norway	Oman	Peru	Qatar	Russia	Trinidad	UAE	US	Yemen	Reexports Received	Reexports Loaded	2013 Net Imports	2012 Net Imports
China	0.06	0.07	3.43	-	0.44	0.41	2.68	2.77	0.43	-	-	-	7.02	-	0.12	-	-	1.12	0.06	-	18.60	14.77
India	0.12	-	-	0.07	0.32	-	-	-	0.91	0.06	-	-	10.76	-	-	-	-	0.61	0.06	-	12.92	13.99
Asia	0.18	0.07	3.43	0.07	0.76	0.41	2.68	2.77	1.35	0.06	-	-	17.78	-	0.12	-	-	1.72	0.12	-	31.52	28.76
Indonesia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Japan	0.42	0.12	17.90	5.07	0.58	2.30	6.22	15.04	3.82	0.24	3.97	0.72	16.07	8.73	0.28	5.40	-	0.51	0.39	-	87.79	87.26
Malaysia	0.25	-	-	0.57	0.10	-	-	-	0.33	0.06	-	-	0.16	-	-	-	-	0.14	-	-	1.62	-
Singapore	-	-	-	-	-	0.61	-	-	-	-	-	-	0.09	-	0.24	-	-		-	-	0.94	-
South Korea	0.13	0.06	0.73	1.28	0.68	0.12	5.93	3.87	2.80	0.06	4.54	0.51	13.68	1.96	0.73	-	-	3.57	0.27	(0.07)	40.86	36.78
Taiwan	-	-	0.06	0.06	0.18	0.39	1.95	3.00	0.58	0.01	-	-	6.30	0.06	0.06	-	-	0.06	0.12	-	12.83	12.78
Thailand	-	-	-	-	-	0.06	-	-	0.25	-	-	-	1.00	-	-	-	-	0.06	0.04	-	1.42	0.98
Asia Pacific	0.80	0.19	18.69	6.98	1.55	3.48	14.10	21.91	7.79	0.38	8.51	1.23	37.30	10.76	1.31	5.40	-	4.34	0.82	(0.07)	145.46	137.80
Belgium	-	-	-	-	-	-	-	-	-	0.03	-	-	2.20	-	-	-	-	-	0.03	(1.17)	1.10	1.91
France	3.95	-	-	-	-	-	-	-	0.82	0.06	-	-	1.48	-	-	-	-	0.07	0.07	(0.65)	5.80	7.48
Greece	0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	0.51	1.07
Italy	0.03	-	-	-	-	-	-	-	-	-	-	-	4.00	-	-	-	-	-	0.22	-	4.25	5.23
Netherlands	-	-	-	-	-	-	-	-	-	0.33	-	-	0.19	-	-	-	-	-	-	(0.20)	0.32	0.61
Portugal	0.07	-	-	-	0.07	-	-	-	0.86	0.19	-	-	0.20	-	0.07	-	-	-	0.19	(0.32)	1.32	1.66
Spain	2.39	-	-	-	-	-	-	-	2.35	0.82	0.12	1.14	2.43	-	1.75	-	-	-	0.31	(1.96)	9.36	14.22
Turkey	2.64	-	-	-	0.13	-	-	-	0.93	0.13	-	-	0.20	-	-	-	-	0.07	0.14	-	4.24	5.74
UK	0.22	-	-	-	-	-	-	-	-	0.20	-	-	6.25	-	0.18	-	-	-	-	-	6.84	10.45
Europe	9.79	-	-	-	0.20	-	-	-	4.97	1.77	0.12	1.14	16.95	-	2.00	-	-	0.14	0.97	(4.31)	33.74	48.37
Argentina	-	-	-	-	0.12	-	-	-	0.38	0.06	-	-	0.69	-	2.48	-	-	-	1.21	-	4.93	3.82
Brazil	0.06	0.07	-	-	0.06	-	-	-	0.86	0.31	-	-	0.22	-	1.96	-	-	-	0.94	(0.04)	4.44	2.52
Chile	-	-	-	-	-	-	-	-	-	-	-	-	0.13	-	2.42	-	-	0.31	-	-	2.86	3.03
Dominican Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.09	-	-	-	-	-	1.09	0.96
Puerto Rico	-	-	-	-	-	-	-	-	0.06	-	-	-	-	-	1.14	-	-	-	-	-	1.20	0.97
Latin America	0.06	0.07	-	-	0.18	-	-	-	1.29	0.37	-	-	1.04	-	9.09	-	-	0.31	2.15	(0.04)	14.51	11.30
Israel	-	-	-	-	-	-	-	-	0.06	-	-	-	-	-	0.18	-	-	-	0.17	-	0.41	-
Kuwait	-	-	0.06	-	-	-	-	-	0.18	-	-	-	1.32	-	-	-	-	-	-	-	1.56	2.11
UAE	0.06	-	-	-	0.13	-	-	-	-	-	-	-	0.89	-	-	-	-	-	-	-	1.08	1.24
Middle East	0.06	-	0.06	-	0.13	-	-	-	0.24	-	-	-	2.21	-	0.18	-	-	-	0.17	-	3.06	3.35
Canada	-	-	-	-	-	-	-	-	-	-	-	-	0.57	-	0.18	-	-	-	-	-	0.75	1.28
Mexico	-	-	-	-	-	-	0.26	-	1.21	0.28	-	1.88	1.19	-	0.30	-	-	0.48	0.36	-	5.97	3.55
US	-	-	-	-	-	-	-	-	0.05	0.12	-	-	0.14	-	1.46	-	-	0.23	-	(0.18)	1.83	3.26
North America	-	-	-	-	-	-	0.26	-	1.27	0.40	-	1.88	1.90	-	1.94	-	-	0.71	0.36	(0.18)	8.54	8.09
2013 Exports	10.90	0.33	22.18	7.05	2.81	3.89	17.03	24.68	16.89	2.97	8.63	4.26	77.18	10.76	14.63	5.40	-	7.23	4.59	(4.59)	236.83	
2012 Exports	11.03	-	20.78	6.85	5.08	3.75	18.12	23.11	19.95	3.41	8.08	3.89	77.41	10.92	14.40	5.57	0.19	5.13	3.45	(3.45)		237.67

Table 3.2: LNG Trade Volumes between Countries, 2013 (in MTPA)

Note: Indonesia conducted domestic LNG trade in 2012 and 2013, so this is not reflected as an international trade between countries.

Sources: IHS, US DOE, IGU

3.5. NON LONG-TERM MARKET

77.3 MT
Non long-term trade in 2013; 33% of total trade

Before 2000, non long-term trade was marginal, accounting for less than 5% of volumes traded. By 2005, its share had grown to 8%, before experiencing another step change in 2006. Between 2007 and 2010, the non long-term market accounted for 17 to 20% of total LNG trade. In the past three years, a variety of factors have vaulted the non long-term market to new heights – the market reached 77.3 MTPA in 2013, or 33% of global trade. These factors include:

- The growth in LNG contracts with destination flexibility, chiefly from the Atlantic Basin and Qatar.
- The increase in the number of exporters and importers which has amplified the complexity of the trade and introduced new permutations and linkages between buyers and sellers.
- The lack of domestic production or pipeline imports in Japan, Korea and Taiwan which means that they need to resort to the spot market to cope with any sudden changes in demand (i.e. Fukushima).
- The surge in global regasification capacity.
- The availability of volumes from destination-flexible producers facilitated diversion to high-demand markets
- The continued disparity between prices in different basins which has made arbitrage an important and lucrative monetization strategy.
- The large growth in the LNG fleet which has allowed the industry to sustain the long-haul parts of the non long-term market (chiefly the trade from the Atlantic to the Pacific).
- The decline in competitiveness of LNG relative to coal (chiefly in Europe) and shale gas (North America) that has freed up volumes to be re-directed elsewhere.
- The large increase in demand in Asia and in emerging markets (i.e. Southeast Asia and South America).

In 2013, there were 27 non long-term importers and 25 exporters. While the Dominican Republic did not receive re-exports, this was more than offset by the addition of France, Israel, Malaysia and Singapore, increasing the total number of importers by three versus 2012. The number of exporters also grew by three due to the start of production in Angola, along first re-exports from the Netherlands and South Korea.

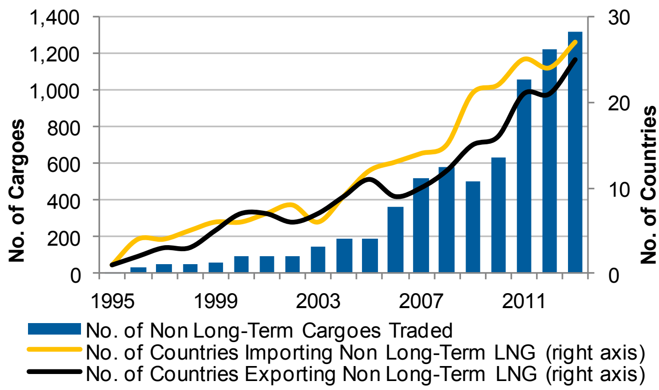


Figure 3.10: Non Long-Term Cargo Market Development, 1995-2013

Sources: IHS, US DOE, IGU

The largest growth in spot supply came from Brunei LNG (+3.5 MT): long-term contracts with Japanese buyers, set to expire in 2013, were extended through 2023 at roughly half the volume of the original contracts, thereby freeing up residual volumes for the spot trade. On the demand side, China (+2.3 MT), Malaysia (+1.6 MT), Argentina (+1.1 MT) and Brazil (+1.5 MT) absorbed the majority of additional spot volumes.

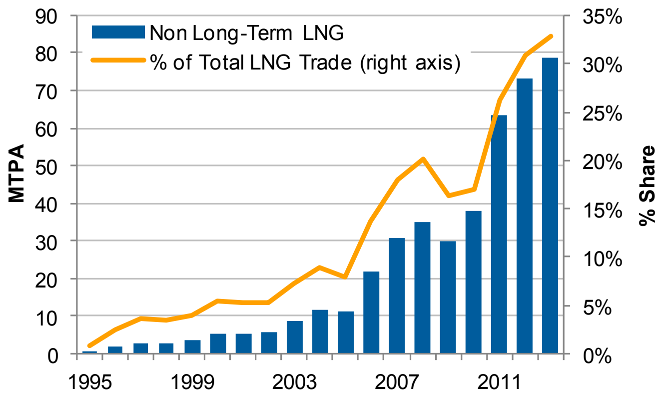


Figure 3.11: Non Long-Term Volumes, 1995-2013

Sources: IHS, US DOE, IGU

3.6. LNG PRICING OVERVIEW

Regional gas prices have been driven and reshaped by several dynamics, some temporary, others permanent; and some change leading to lower prices and some to higher. These factors include:

- An unprecedented boom in LNG capacity from 2008 to 2011 with new projects in Qatar, Russia, Indonesia, Peru, Yemen and Malaysia.
- Low gas demand in Europe due to a weak economy, the growth of renewables and the drop in carbon prices, which led to a mini-renaissance of coal at the expense of gas.

- The rise of shale gas in the US that reduced that country's need for imported gas.
- Cost escalation at new LNG projects, making it necessary to sign new long-term contracts at traditional, oil-linked prices.
- The Great East Japan Earthquake of March 2011 that altered both short and long-term demand dynamics in Japan, the world's largest LNG buyer.

These trends have produced wide and sustained regional price disparities. In North America, shale gas production saw Henry Hub prices plummet; in Asia, Japan is still paying oil-linked prices; and in Europe, a hybrid system that combined oil-linked and hub-based prices has meant that gas is available under (at least) two pricing systems.

Over the past five years, North American gas prices have almost exclusively traded at a discount to most other major gas markets. Sustained unconventional production in the US saw the Henry Hub discount widen in 2010-2011. When Henry Hub bottomed out at $1.9/mmBtu in April 2012, the discount stood at ~$8-10/mmBtu relative to Europe and up to $14/mmBtu relative to Asia. North American prices rebounded tentatively in 2013, slightly narrowing these differentials. Henry Hub pushed off from a low of $3.3/mmBtu in January 2013 to reach a high of $4.2/mmBtu in December, trading at a discount of ~$7/mmBtu to NBP and ~$10/mmBtu to Japan.

In Asia, LNG prices have stayed relatively constant over the past two years after increasing rapidly in the wake of the Fukushima crisis and the associated supply tightness. Japan continues to pay the highest prices. In 2013, average monthly LNG imports into Japan hovered at $14.5-$16.1/mmBtu. Asian buyers have become increasingly vocal about shifting away from the traditional, fixed-destination, long-term, oil-linked LNG contract. Japanese, Korean and Indian companies have markedly increased their interest in US LNG, signing several offtake agreements based on Henry Hub pricing. Still, on a global scale, the opportunities to negotiate non-oil-linked contracts remain few. As such, these contracts may not yet mark a widespread disruption of the current system.

The majority of European gas contracts are indexed with a lag to crude and fuel oil, though the region has increasingly moved towards a hybrid pricing system (particularly in the Northwest). This trend, which originally emerged in reaction to the drop in gas demand in 2009, involves the incorporation of trading hub pricing into pipeline gas price. Under pressure from European buyers, major gas suppliers including Gazprom and Statoil have since increased the share of hub pricing in the formulation of pipeline export prices for certain contracts.

In 2013, the German border gas price was relatively flat, hovering around $11.5-12.0/mmBtu. This price showed a weaker correlation with Brent crude prices that in previous years owing to the greater presence of European hub indexing.

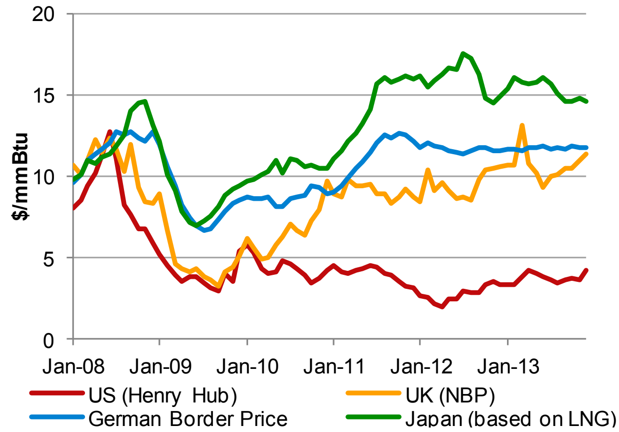


Figure 3.12: Monthly Average Regional Gas Prices, 2008-2013

Sources: IHS, Cedigaz, US DOE

European spot gas prices were considerably lower, however, at an average $10.6/mmBtu. Europe's most liquid hub, the NBP, saw prices drop $2/mmBtu between March and June 2013 as the UK market recovered from the near exhaustion of storage volumes. Nonetheless, the floor on summer prices was approximately $1/mmBtu higher compared to the preceding summer on continued declines in domestic production, significant demand from storage refilling and less LNG deliveries due to more diversions to the Asian markets. This trend continued over the year and NBP finished December at $11.4/mmBtu, its highest for the month since 2005. Moreover, European LNG re-exports in 2013 traded on average at a $2-3/mmBtu premium to NBP.

Looking Ahead:

The LNG market will continue to be supply constrained at least until 2015. *With new few liquefaction capacity additions in the past two years combined with higher gas demand in Asia Pacific, the market has been tight. This condition will continue until 2015 when new Australian projects start up, adding an estimated ~18 MT of effective capacity, followed by another ~20 MT in 2016. Beyond 2015, the US may also introduce new capacity that can be traded flexibly adding more supply to the global market.*

How will the availability of nuclear capacity in Japan and South Korea affect LNG demand? *Japan and Korea will be the major drivers of change in the next two years – both have upside potential and downside risks. Japan is expected to restart nuclear plants – but how many will be online by the end of the year is unclear depending on operators successfully clearing inspections and local opposition. Korea also faces uncertainty regarding nuclear power given the ongoing safety shut-downs at several nuclear plants. Thus, Korea's near-term demand trajectory is highly unpredictable.*

2013 saw many new Henry Hub-based LNG contracts from US projects. What is the impact of this going forward? *In the US, over 50 MT of offtake contracts were signed (some preliminary agreements, some finalized SPAs). Buyers have turned to the US as a source of alternative LNG-supply, and this has led them to negotiate for more flexible terms with other suppliers. However, oil-indexation will continue to be the dominant pricing mechanism outside of the US.*

Yemen LNG at Balhaf - Aerial view of the site with storage tanks and the first cargo

4. Liquefaction Plants

Qatar remains the largest liquefaction capacity holder, with more than 27% of the global total. Two or three new projects are anticipated online in 2014, marking the first year of substantial liquefaction growth since 2011. Post-2014, Australia is expected to lead liquefaction capacity growth through the end of the decade, though projects in North America and frontier regions are also gaining momentum.

With 62 MTPA of capacity under construction, representing 53% of all projects that have reached FID, Australia is projected to become the main source of near-term liquefaction capacity growth. Though Qatar is currently the largest liquefaction holder, Australia is expected to gain the lead in 2017. Aside from Australia, North America has witnessed a surge in liquefaction project proposals in the past two years, driven by the expansion of shale gas production. The US now counts 265 MTPA of proposed pre-FID capacity; a further 134 MTPA has been proposed in Canada. Although some of these projects are expected to materialize, a significant number may not be built due to regulatory and global demand constraints. While Russian liquefaction projects gained momentum in the wake of the LNG export liberalization in early 2014, new gas discoveries in East Africa have also spurred proposals, though considerably risks abound in this untested region.

4.1. OVERVIEW

290.7 MTPA
Global liquefaction capacity at the end of 2013

Global nominal liquefaction capacity stood at 290.7 MTPA at the end of 2013, up from 282.3 in 2012. Two new projects were brought online: the 4.5 MTPA Skikda Rebuild in Algeria and the 5.2 MTPA Angola LNG T1.

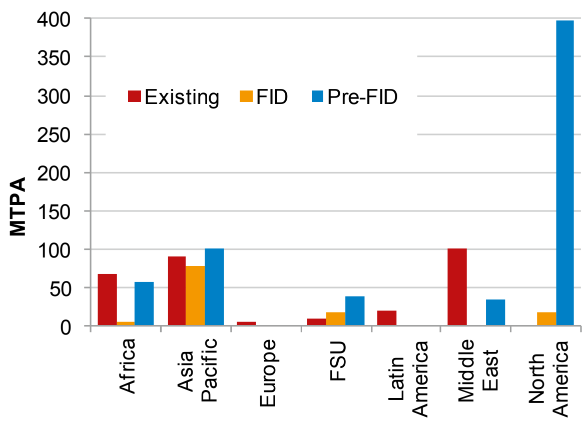


Figure 4.1: Nominal Liquefaction Capacity by Status and Region, as of Q1 2014

Note: "FID" does not include the 10.8 MTPA announced to be under construction in Iran, nor is the project included in totals elsewhere in the document.

Sources: IHS, Company Announcements

Liquefaction capacity is set to see more rapid expansion ahead, with 117 MTPA having reached FID and 626 MTPA of proposed capacity (260 MTPA of which is in some stage of FEED). Still, many projects face a variety of risks that will likely impede them from coming online.

In 2014, new capacity has been announced to come online in Algeria, Australia and Papua New Guinea. The project in Papua New Guinea will be the first in this country, expanding the number of countries with active liquefaction capacity from 17 to 18.

This capacity growth will be somewhat offset by the decommissioning of the two remaining trains at Indonesia's Arun LNG plant. Moreover, new capacity in Algeria will primarily serve to counterbalance aging facilities, which subsequently will be decommissioned. As in 2013, other factors – including disruptions to supply infrastructure in Nigeria and feedstock shortages in Egypt – could further weigh on LNG output moving forward.

Post-2014, Australia is expected to be the largest source of new liquefaction capacity, followed by the US. While Australian capacity is set to surpass that of Qatar by 2017, transforming the country into the world's largest liquefaction capacity holder, growth in the US may be limited by a more stringent regulatory environment.

New liquefaction frontiers in Western Canada and East Africa offer huge potential for liquefaction growth in the long run. Russian projects also gained momentum following the LNG export liberalization in late 2013, allowing Yamal LNG to reach FID. Other proposed projects in Russia and the East Mediterranean region could offer a further source of long-term supply growth.

4.2. GLOBAL LIQUEFACTION CAPACITY AND UTILIZATION

At the end of 2013, global nominal liquefaction capacity stood at 290.7 MTPA. Following three years of rapid growth, driven by the commissioning of major projects in Qatar, the expansion of global liquefaction capacity slowed in 2012 and 2013. While only one new train was brought online in 2012 – Woodside's 4.2 MTPA Pluto LNG in Australia – new capacity in 2013 was limited to the 4.5 MTPA Skikda Rebuild in Algeria (which began commercial operations in December) and the 5.2 MTPA Angola LNG project. Though Angola LNG experienced a series of technical difficulties, the plant produced five commissioning cargoes in 2013.

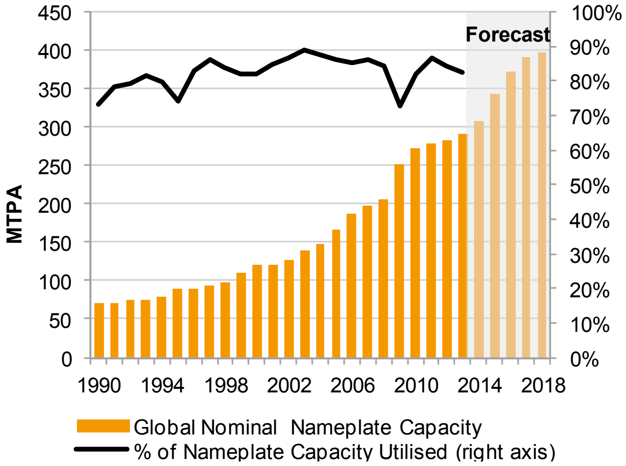


Figure 4.2: Global Liquefaction Capacity Build-Out, 1990-2018

Sources: IHS, IGU, Company Announcements

With 117 MTPA of liquefaction capacity under construction, global capacity is expected to grow by 36% over the next five years to reach 397 MTPA in 2018.

In 2014, liquefaction capacity growth is anticipated from the commissioning of plants in Algeria (Arzew - GL3Z), Papua New Guinea (PNG LNG) and Australia (Queensland Curtis LNG). Growth will accelerate starting in 2015 as a series of under construction projects in Australia and the first of the US projects come on-stream.

Global liquefaction capacity utilization has trended downward over the past two years, from 87% in 2011 to 82% in 2013. In spite of higher Qatari and Malaysian production, as well as the recovery of Yemen LNG following a series of attacks on feedstock pipelines in 2012, Atlantic Basin plants continued to experience supply disruptions. Rising domestic demand in Egypt and Algeria, repeated force majeure in Nigeria and technical difficulties in Norway saw plant utilization drop in all three countries. Utilization was particularly low in Egypt, where insufficient feedstock led to the closure of SEGAS LNG, with country utilization dipping to just 23%. Continued feedstock issues in early 2014 led to the temporary closure of Egypt's second LNG plant, Egyptian LNG. No timeline has been established for the resumption of Egyptian exports.

4.3. LIQUEFACTION CAPACITY AND UTILIZATION BY COUNTRY

Existing

17 countries (including Angola) held active LNG export capacity at the end of 2013 due to the closure of the LNG plant Marsa El Brega in Libya and the temporary shutdown of Kenai LNG in the US. Nearly two-thirds of the world's capacity is held in just five countries – Qatar,

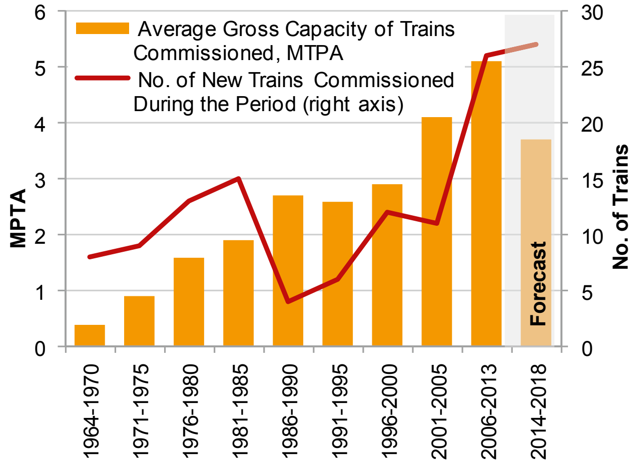


Figure 4.3: Number of Trains Commissioned vs. Average Train Capacity, 1964-2018

Sources: IHS, Company Announcements

Indonesia, Australia, Malaysia and Nigeria – with Qatar and Indonesia alone holding 38% of the total. With the exception of Algeria (which decommissioned 0.9 MTPA of capacity in 2010), Libya and the US, liquefaction capacity either grew or remained constant in each of the exporting countries between 2006 and 2013.

Under Construction

Though Australia was the third largest LNG capacity holder in 2013, it will be the predominant source of new liquefaction over the next five years, eclipsing Qatari capacity by 2017. With Pluto LNG online in 2012, seven Australian projects are now under construction with a total nameplate capacity of 61.8 MTPA (53% of global under construction capacity).

Outside of Australia, the US is expected to see the largest growth in liquefaction capacity. Though ConocoPhillips temporarily shut-down Kenai LNG in Alaska in late 2012[1], 18 MTPA is currently under construction at Sabine Pass LNG in the US. A further 15.2 MTPA of capacity is under construction in Papua New Guinea, Malaysia and Indonesia. The Papua New Guinea plant will be the first in the country; its completion will bring the number of countries with liquefaction capacity to 19 (including the US).

The most recent projects to reach FID were the Yamal LNG plant in Russia (16.5 MTPA) and the 1.5 MTPA Rotan FLNG project in Malaysia. The former reached FID in December 2013; the latter in January 2014.

[1] *In December 2013, ConocoPhillips applied for a two-year permit to export LNG from Kenai. The FTA export license was granted in February 2014; non-FTA approval is expected in the near-term with the project back online in the second half of 2014.*

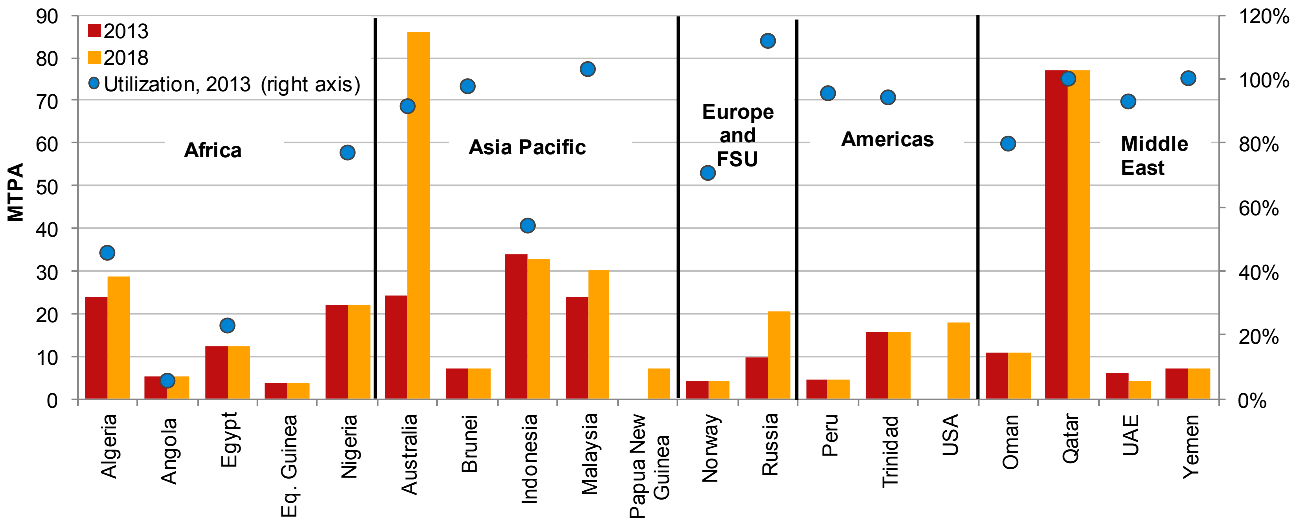


Figure 4.4: Liquefaction Capacity by Country in 2013 and 2018

Note: Liquefaction capacity only takes into account existing and under construction projects expected online by 2018.

Sources: IHS, IGU, Company Announcements

Proposed

Several large-scale projects have been proposed in recent years that are expected to add significantly to global liquefaction capacity, including projects in the US Lower 48 states, Russia, Western Canada and East Africa. At the end of 2013, a total of 65 trains representing 265 MTPA of capacity had been proposed in the US for projects that have yet to reach FID. The vast majority of this capacity is located on the coast of the Gulf of Mexico, with only six projects planned elsewhere in the country. Projects in two other LNG frontiers – Western Canada and East Africa – have also gained momentum. While 25 trains (120 MTPA) have been proposed in Western Canada, prolific resource discoveries in Mozambique and Tanzania have led to the proposal of seven trains totalling 35 MTPA (though the potential exists for major expansions).

Decommissioned

A number of liquefaction plants are set to be decommissioned in the coming years. Arun LNG in Indonesia is approaching the end of its life as an export project, with its two remaining trains scheduled to be decommissioned by 2014 as the facility transitions to an import terminal. In Algeria, new trains at Skikda and Arzew (totalling 9.2 MTPA) will likely lead to the decommissioning of older LNG capacity. While the UAE is set to decommission aging capacity later this decade, Oman intends to shutdown all LNG capacity by 2024 resulting in a 10.8 MTPA reduction in global capacity. Although Egypt has not officially announced the decommissioning of its liquefaction plants, rising domestic demand and limited feedstock are likely to increasingly be a drag on utilization.

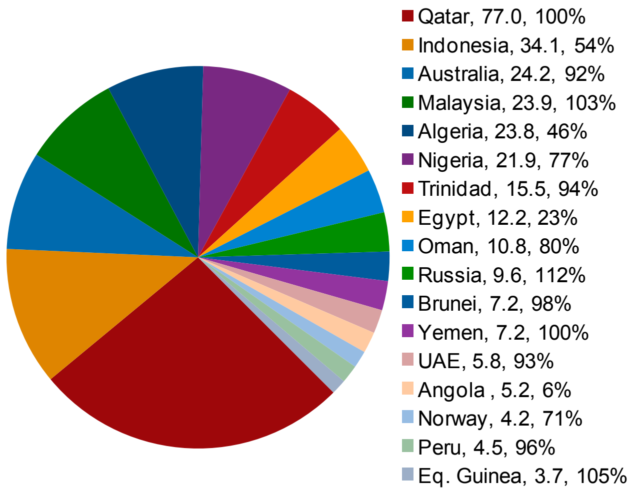


Figure 4.5: Liquefaction Capacity and Utilization by Country, 2013

Sources: IHS, IGU

4.4. LIQUEFACTION CAPACITY BY REGION

The Asia Pacific region accounted for 31% of global capacity in 2013 (89.4 MTPA) – a share that is set to rise to 41% by 2018 as under construction projects come online. Australia will provide the bulk of new capacity, while projects in Malaysia and Papua New Guinea will also contribute to capacity growth.

Outside of the Asia Pacific region, sizeable growth is expected in the FSU and North America. Yamal LNG in Russia – the first two trains of which are announced to come online in 2017 and 2018 – could increase FSU

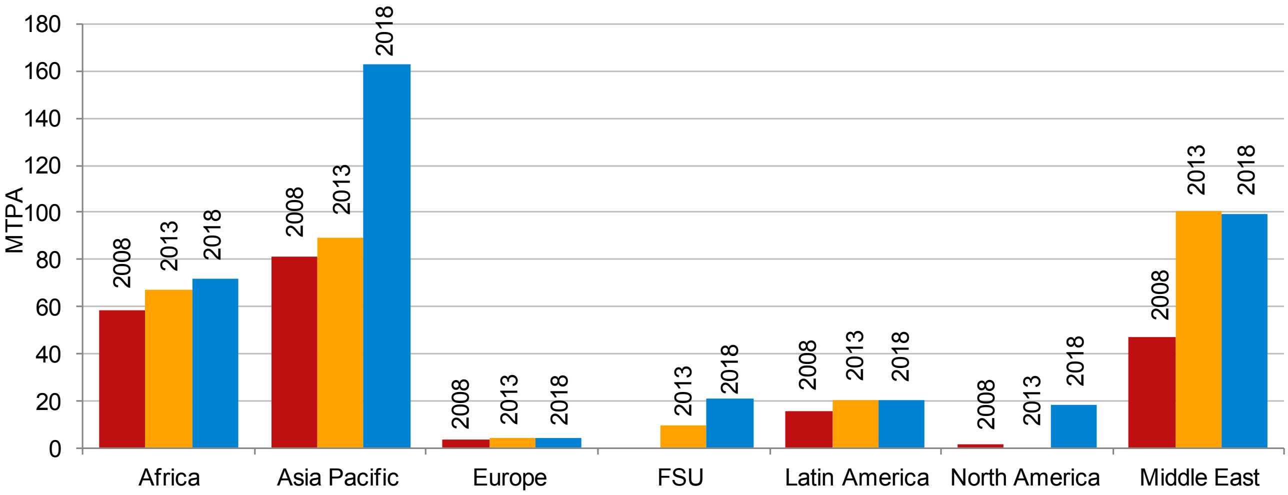


Figure 4.6: Liquefaction Capacity by Region in 2008, 2013 and 2018
Note: Liquefaction capacity only refers to existing and under construction projects.
Sources: IHS, Company Announcements

Region	2008	2013	2018 (Anticipated)	% Growth 2008-2013 (Actual)	% Growth 2013-2018 (Anticipated)
Africa	58.7	66.8	71.5	14%	7%
Asia-Pacific	81.2	89.4	163.2	10%	83%
Europe	3.4	4.2	4.2	25%	0%
FSU	-	9.6	20.6	-	115%
Latin America	15.5	19.95	19.95	29%	0%
North America	1.5	-	18.0	-	-
Middle East	46.8	100.8	99.1	115%	-2%
Total capacity	***207.0***	***290.7***	***396.6***	***40%***	***36%***

Table 4.1: Liquefaction Capacity by Region in 2008, 2013 and 2018
Note: Liquefaction capacity only refers to existing and under construction projects.
Sources: IHS, Company Announcements

capacity by 11.0 MTPA. In North America, though massive capacity additions have been proposed, particularly on the US Gulf Coast, only the under construction Sabine Pass LNG is expected online in the next five years given the nascent state of other projects.

In the Middle East, liquefaction capacity has grown rapidly over the past decade, driven by Qatar. In 2013, the region held 100.8 MTPA or 36% of the global capacity. Still, this is expected to decline slightly to 2018 with the decommissioning of aging plants in the UAE.

Liquefaction capacity in Africa has grown 14% since 2008 with the introduction of new capacity in Algeria and Angola. The completion of the Algerian Arzew GL3Z plant will add further capacity, though older facilities are likely to be decommissioned in the near-to medium-term. Latin American liquefaction is limited to plants in Trinidad & Tobago and Peru. Peru LNG came online in 2010, increasing the region's capacity by 25%. No capacity additions are expected through 2018.

4.5. LIQUEFACTION PROCESSES

Air Products continued to dominate the market in 2013. Of the seven major liquefaction technologies employed worldwide, Air Products' four LNG processes covered 82% of global nameplate capacity. APC C3MR remained the most heavily utilized technology in 2013, accounting for 51% of capacity. AP-X was used in the Qatari megatrains for another 16% of capacity.

Given the nature of the APC C3MR technology as a reliable liquefaction technology, new projects continue to announce plans to use the technology, including Gorgon LNG, Papua New Guinea LNG, Donggi-Senoro LNG and Ichthys LNG. Out of all APC technologies, the APC C3MR/Split MR process is projected to see the most substantial growth, representing 21% of the market by 2018.

By 2018, Air Products' market share is expected to fall to 71% as new projects come online using competing technologies. ConocoPhillips' Optimized Cascade® technology will see particularly strong growth: with 12 of the 30 liquefaction trains that have reached FID (all located in the US or Australia) adopting this technology, its market share is set to rise from 11% to 23% by 2018.

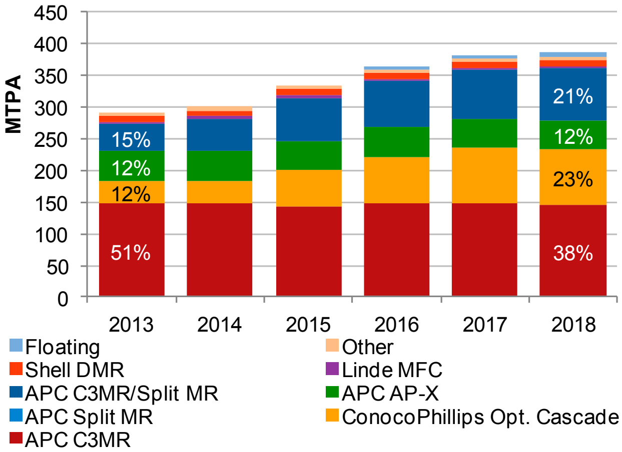


Figure 4.7: Liquefaction Capacity by Type of Technology, 2013-2018

Sources: IHS, Company Announcements

4.6. NEW DEVELOPMENTS

The emergence of new areas with tremendous supply potential has been one of the most striking changes in the LNG industry over the past three years.

Traditionally an LNG importer, the boom in US unconventional gas extraction has led to a surge in domestic production and low natural gas prices, transforming the US Lower 48 states into a hotspot for liquefaction proposals. This has been supported by largely positive project economics resulting from extensive existing infrastructure. Developments in the US have also generated interest in Western Canada, though this area has seen less drilling thus far. Combined with the more nascent state of commercial and project structures, proposed plants in the region are on a longer timeframe.

Beyond North America, major gas discoveries off the coast of Mozambique and Tanzania since 2010 have led to the proposal of several liquefaction projects, making East Africa an important new development area. Upwards of 35 MTPA of capacity has been proposed, though current discoveries could underpin over 85 MTPA. Given the lack of large-scale onshore demand and its strategic geographic position close to high-value Asian markets, the

GDF SUEZ Global Energy LNG tanker

region is ripe for LNG exports. However, Mozambique and Tanzania differ from many other LNG provinces in that both countries are underdeveloped and come with major project risks such as evolving domestic demand requirements and a lack of infrastructure.

The Arctic is another potential source of new supply, though projects face significant challenges. These include less attractive project economics – due to the higher capital investments required to develop infrastructure in remote locations – as well as regulatory uncertainty (Alaska, Russia). However, the announced liberalization of Russian LNG exports from 2014 on allowed for the three-train Yamal LNG plant to reach FID in December 2013. This is only the second project in Russia to reach FID, preceded by Sakhalin 2 LNG, which came online in 2009. Construction on Yamal LNG's first train is scheduled for 2016, with commercial operations announced for 2017.

Aside from new LNG frontiers, the advent of floating liquefaction could have a potentially transformative impact on the industry. The 3.6 MTPA Prelude LNG project was the first to reach FID in 2011. It was shortly followed by two smaller scale projects – the 1.2 MTPA PETRONAS FLNG in Malaysia and the 0.5 MTPA Pacific Rubiales LNG in Colombia – which both reached FID in 2012. The small-scale Colombian project is now the most advanced, announced to start commercial operations in mid-2015. In January 2014, a fourth floating liquefaction project reached FID: the 1.5 MTPA Rotan FLNG project in Malaysia, scheduled to come online by 2018.

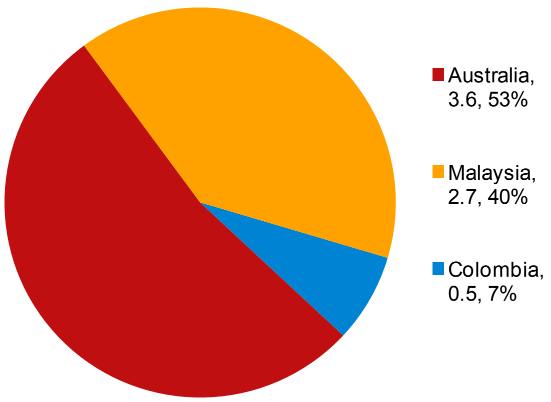


Figure 4.8: Under Construction Floating Liquefaction Capacity by Country in MTPA and Share of Total, as of Q1 2014

Sources: IHS

Companies are increasingly turning to floating liquefaction as a development option for stranded gas. Other than the four projects listed above, six other proposals have moved into the engineering phase – with projects located in the US, Israel and Australia – though none of these has reached FID. Floating liquefaction is further being discussed as the development concept for more than a dozen other projects, including multiple projects in Australia, the US Gulf of Mexico and frontier African plays.

Once proven commercially and technologically viable, floating liquefaction has the potential to create a new natural gas monetization avenue for otherwise stranded gas. However, the technology encompasses a range of operational uncertainties, raising the question as to how quickly it will add meaningful volumes to the LNG market. Though Pacific Rubiales LNG is the first floating liquefaction project expected online, the success of the large Prelude LNG project due online in 2017 will provide a clearer indication of how quickly and to what scale floating liquefaction could progress.

4.7. PROJECT CAPEX

Total spending on liquefaction projects has increased dramatically since 2000. Unit costs for liquefaction plants (excluding upstream and financial costs) increased from an average \$349/tonne from 2000-2006 to \$785/tonne from 2007-2013.

Since 2007, Middle Eastern projects have had the lowest project CAPEX on a \$/tonne basis, largely due to the low cost of brownfield expansions in Qatar and Oman. Conversely, Atlantic Basin projects registered the highest average costs from 2007-2013, chiefly a result of cost overruns at Snøhvit LNG in Norway, Sakhalin 2 LNG in Russia and Angola LNG.

In 2012 and 2013, several LNG projects – particularly in Australia – announced cost escalations suggesting other new projects could face similar challenges. As such, the Pacific Basin is expected to have the highest average unit costs to 2018. Costs in the Atlantic Basin will remain lower due to brownfield economics at projects in the US, where developers will continue to benefit from building on existing regasification sites.

Cost escalation has been particularly severe for greenfield projects: plants that came online from 2007 to 2013 had an average liquefaction unit cost of \$1,200/tonne versus \$360/tonne from 2000-2006. This upward trend is expected to continue, with average costs reaching \$1,278/tonne for projects on-stream from 2014 to 2018.

The recent escalation of greenfield costs are largely a result of higher materials costs, labour competition and mitigation costs for project delays. A number of projects reported cost overruns in the range of 30-50% after construction had started.

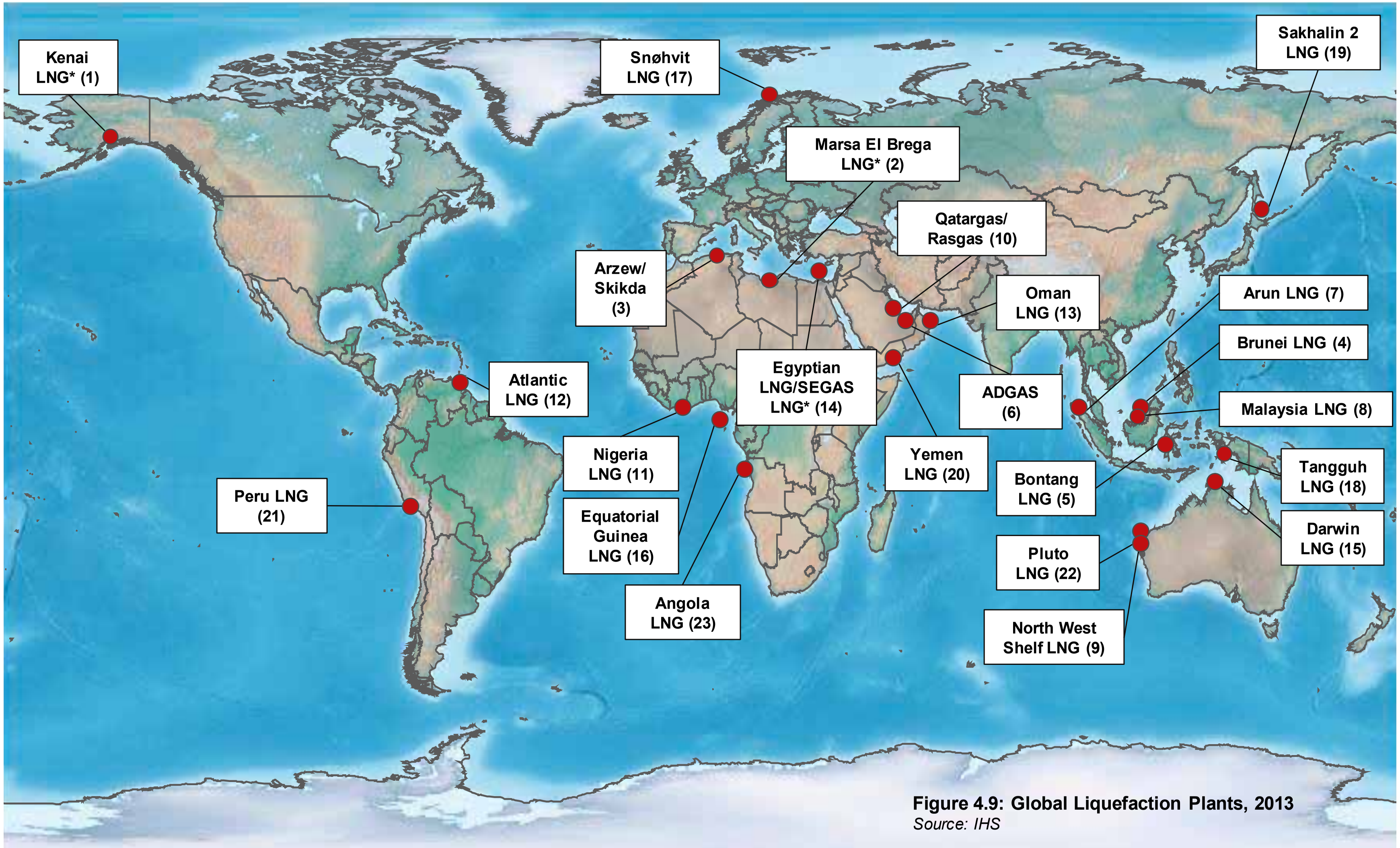


Figure 4.9: Global Liquefaction Plants, 2013
Source: IHS

Note: Further information on each of these plants can be found in Appendix I by referring to the reference numbers listed in parentheses above. The liquefaction projects are numbered in the order in which they were brought online.
** Kenai LNG in the US, and Egyptian LNG and SEGAS LNG in Egypt have been temporarily shutdown. The Marsa El Brega plant in Libya is included for reference although it has not been operational since 2011.*

Beyond greenfield projects, the 2014-2018 period will see the emergence of floating liquefaction. Given the nascent quality of this technology, very few data points exist to evaluate capital costs. The data here represents estimated liquefaction costs per tonne for two Asia Pacific projects – Prelude LNG and Rotan LNG – as well as the Atlantic Basin Pacific Rubiales LNG project.

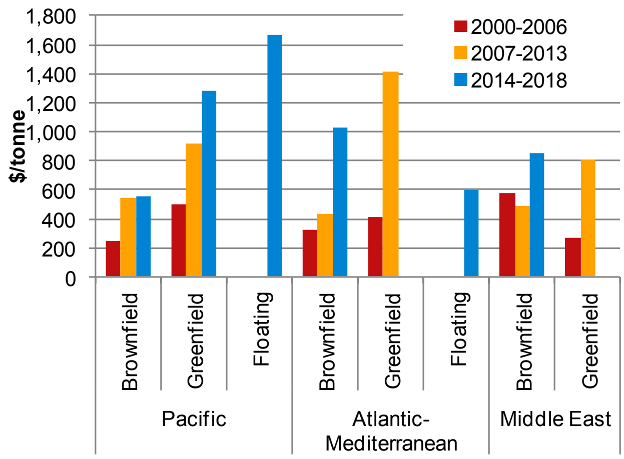


Figure 4.9: Average Liquefaction Unit Costs in $/tonne (real) by Basin and Project Type, 2000-2018

Sources: IHS

4.8. UPDATE ON NORTH AMERICAN LIQUEFACTION

The surge in US unconventional gas production over the past five years has transformed North America from an LNG importer into a new frontier for LNG exports. While global LNG demand continues to grow, particularly in Asia Pacific, North American imports have dropped precipitously, resulting in underutilization of the majority of US regasification terminals. As terminal owners seek to improve on their investment and a growing price differential emerges between North America and Asia, a great number of LNG export projects have been proposed.

The US has the largest queue of projects: as of this writing, 28 liquefaction projects had been proposed, representing nearly 285 MTPA of capacity (188 MTPA of projects with announced start dates). The vast majority of this capacity is located on the coast of the Gulf of Mexico, with only six projects planned elsewhere (two in Alaska, two on the West Coast and two on the East Coast). Post-2013, the US is forecasted to be the second largest tranche of new capacity after Australia. Still, the US government is keen to control the project build-out for fear that a massive growth in LNG exports could impact domestic prices and supply and could result in an overbuild. As such, the US is projected to start up slower than many other plays.

At present, Sabine Pass LNG is the only project to have received both US Department of Energy (DOE) approval to export to FTA (Free-Trade Agreement) and non-FTA countries, as well as the requisite environmental approvals from the Federal Energy Regulatory Commission (FERC). The project's first four trains, now under construction, are announced to come online by 2017, increasing US liquefaction capacity to 18 MTPA.

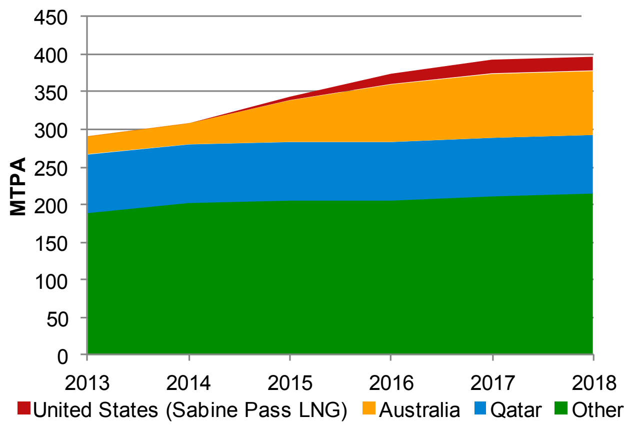


Figure 4.10: Post-FID Liquefaction Capacity Build-Out, 2013-2018

Note: This build-out only takes into account existing and under construction projects; Canada is not expected to bring online projects in this timeframe.

Sources: IHS, Company Announcements

Twenty-three other US projects (all located in the Lower 48 states) have received DOE approval to export LNG to FTA countries; four of these – Freeport LNG, Cove Point LNG, Corpus Christi LNG and Lake Charles LNG – have also been sanctioned to export to non-FTA states. However, the ability of these projects to move forward will be determined by the speed of FERC approvals, the next of which is expected in the third quarter of 2014 (Cameron LNG). Given the time required to secure financing and reach FID after receiving FERC approval, this means that no additional US projects will likely begin construction until late 2014. With an estimated brownfield construction time of 4 years, this pushes the earliest achievable start dates for these projects to late 2019. As such, US LNG exports will likely remain limited until the end of this decade.

Beyond a difficult regulatory approval process, US liquefaction projects also face commercial uncertainty, which could further limit exports. The demand for US LNG is partly tied to the perception of a major arbitrage potential due to the differential between a low Henry Hub price and high oil-linked LNG prices elsewhere. However, as Henry Hub begins to rise due to fewer prolific plays and a shifted focus toward oil production, demand for US LNG may wane, presenting commercial risk for projects that have yet to make contracting progress. Furthermore, in an effort to avoid repeating the regasification overbuild phenomenon of the late 2000s, companies may be wary of financing more liquefaction capacity than the global LNG market can absorb.

In Western Canada, enormous upstream potential has led to the proposal of 13 liquefaction projects, equating to nearly 120 MTPA of capacity (85 MTPA with announced start dates). Three more groups have submitted expressions of interest to the government of British Columbia for potential LNG projects. While the region is often considered an extension of the North American market, its potential is expected to be delayed relative to the US due to less developed infrastructure and slower unconventional gas development. Though four projects are now conducting preliminary engineering studies, none are under construction, likely pushing the timeline for first Canadian liquefaction to the end of the decade at the earliest.

LNG Pipeline

Table 4.2: Proposed Liquefaction Projects in the US, as of Q1 2014

Project		Capacity	Status	Latest Company Announced Start Date[1]	DOE/ FERC Approval	FTA/non FTA Approval	Operator
United States Lower 48							
Sabine Pass LNG*	T1-2	9	UC**	2015	DOE/FERC	FTA/ non-FTA	Cheniere Energy
	T3-4	9	UC**	2016-17	DOE/FERC	FTA/ non-FTA	
	T5	4.5	Pre-FID	2019	DOE	FTA	
	T6	4.5	Pre-FID	N/A		FTA	
Freeport LNG*	T1-2	8.8	Pre-FID	2018	DOE	FTA/ non-FTA	Freeport LNG Liquefaction
	T3	4.4	Pre-FID	2019	DOE	FTA/ non-FTA	
Corpus Christi LNG T1-3		13.5	Pre-FID	2018	DOE	FTA	Cheniere Energy
Cameron LNG T1-3*		12	Pre-FID	2017-18	DOE	FTA	Sempra Energy
Cove Point LNG*		7.8	Pre-FID	2017	DOE	FTA/ non-FTA	Dominion Resources
Jordan Cove LNG		6	Pre-FID	2018	DOE	FTA	Veresen
Oregon LNG T1-2		9	Pre-FID	2018	DOE	FTA	Oregon LNG
Lavaca Bay Phase 1-2 (OS)		8	Pre-FID	2018	DOE	FTA	Excelerate Energy
Magnolia LNG T1-4		8	Pre-FID	2018-2019	DOE	FTA	LNG Limited
Lake Charles LNG T1-3*		15	Pre-FID	2019-20	DOE	FTA/ non-FTA	Trunkline LNG
Elba Island LNG T1-2*		2.5	Pre-FID	2016	DOE	FTA	Southern LNG
Gulf LNG T1-2*		10	Pre-FID	2019	DOE	FTA	Gulf LNG
Golden Pass LNG T1-3*		15.6	Pre-FID	2018	DOE	FTA	Golden Pass Products
Gulf Coast LNG T1-4		21	Pre-FID	N/A	DOE	FTA	Gulf Coast LNG Export
CE FLNG T1-2 (OS)		8	Pre-FID	2018	DOE	FTA	Cambridge Energy Holdings
Waller Point LNG (OS)		1.25	Pre-FID	2016	DOE	FTA	Waller Marine, Inc
South Texas LNG T1-2		8	Pre-FID	2019-2020	DOE	FTA	Pangea LNG
Main Pass Energy Hub LNG T1-6 (OS)		24	Pre-FID	2017	DOE	FTA	Freeport-McMoran Energy
Gasfin LNG		1.5	Pre-FID	2019	DOE	FTA	Gasfin Development
Venture Global LNG		5	Pre-FID	N/A	DOE	FTA	Venture Global Partners
Eos LNG (OS)		6	Pre-FID	N/A	DOE	FTA	Eos LNG
Barca LNG (OS)		6	Pre-FID	N/A	DOE	FTA	Barca LNG
Annova LNG T1-2		2	Pre-FID	2018	DOE	FTA	Annova LNG LLC.
Delfin LNG T1-4 (OS)		13	Pre-FID	2017-2021	DOE	FTA	Delfin FLNG
Texas FLNG		2	Pre-FID	N/A			Texas LNG
Lousiana LNG		2	Pre-FID	N/A			Louisiana LNG Energy

Project	Capacity	Status	Latest Company Announced Start Date[1]	DOE/ FERC Approval	FTA/non FTA Approval	Operator
Alaska						
REI Alaska	20	Pre-FID	2019			Resources Energy Inc.
Alaska South Central LNG T1-3	18	Pre-FID	2023-2024			BP, ConocoPhillips, ExxonMobil

** Denotes existing regasification terminal. US Lower 48 projects are listed in the order in which they applied to FERC, followed by the order in which they applied to export to FTA countries at the DOE.*
*** UC denotes "Under Construction"*

Sources: IHS, Company Announcements

Table 4.3: Proposed Liquefaction Projects in Canada, as of Q1 2014

Project		Capacity	Status	Latest Company Announced Start Date[1]	NEB Application Status	Operator
Canada						
LNG Canada T1-4		24	Pre-FID	2019-2020	Approved	Royal Dutch Shell
Kitimat LNG	T1	5	Pre-FID	2018	Approved	Chevron
	T2	5	Pre-FID	N/A		
Pacific Northwest LNG T1-2		12	Pre-FID	2018	Approved	Progress Energy (PETRONAS)
West Coast Canada LNG		15	Pre-FID	2021-2022	Approved	ExxonMobil
Prince Rupert LNG	T1-2	14	Pre-FID	2019-2020	Approved	BG Group
	T3	7	Pre-FID	N/A		
BC LNG T1-2		1.4	Pre-FID	2016-2018	Approved	BC LNG Export Co-Operative
Goldboro LNG		10	Pre-FID	2018	Filed	Pierdae Energy
Nova Scotia LNG		4.5	Pre-FID	2020	Not Filed	H-Energy
Kitsault LNG (OS)		8	Pre-FID	N/A	Filed	Kitsault Enery
Triton LNG (OS)		2	Pre-FID	2017	Filed	Altagas (Assumed)
Woodfibre LNG		2.1	Pre-FID	N/A	Approved	Pacific Oil and Gas
Discovery LNG		N/A	Pre-FID	2019	Not filed	Quicksilver Resources
Aurora LNG T1-4		24	Pre-FID	2021-2022	Filed	Nexen (CNOOC)

Sources: IHS, Company Announcements

How much capacity will be brought online in the United States? *Sustained liquids-rich unconventional gas production and weak Henry Hub prices have led to a flurry of liquefaction proposals in the US Lower 48. As of the first quarter of 2014, a total of 28 projects had been proposed, representing approximately 285 MTPA. Still, only one project – Sabine Pass LNG – is currently under construction. Given current regulatory timelines, only two projects – Cameron LNG and Freeport LNG – may reach FID in 2014, pushing the earliest achievable start date for projects other than Sabine Pass to 2019. Regulatory obstacles, combined with potential Henry Hub volatility and the limits of global LNG demand, will likely contain the number of projects coming online through the end of the decade.*

Will more Russian liquefaction projects reach FID in 2014? *Russia liberalized LNG exports on December 1, 2013, effectively ending Gazprom's former gas export monopoly. Just two weeks after the introduction of the new law, Novatek-led Yamal LNG T1-3 was the first non-Gazprom export project to reach FID. Several other projects have been proposed in Russia, though most face serious obstacles that will likely prevent them from reaching FID in the year ahead. The only exception is an expansion at the two-train Sakhalin 2 plant: though the addition of a third train had been on hold due to feedstock concerns, these are now announced to be resolved. Partners Shell and Gazprom intend to start FEED for a third train in February 2014. Depending on how quickly partners move through this process, the project could reach FID in 2014.*

Will East African and Western Canadian liquefaction proposals move forward? *East Africa's prolific resource discoveries could translate to even higher liquefaction potential than the 35+ MTPA that has been proposed. The region is optimally located to feed Asian buyers – and these companies have been willing to invest in the resource base as a means to secure LNG offtake. Yet Mozambique and Tanzania are under-developed and come with major political risks. Although the presence of active LNG traders and Asian buyers improves the marketability of East African LNG, no SPAs have been signed as buyers continue to evaluate the progression of other LNG plays. Similarly to East Africa, the slate of liquefaction projects in Western Canada suggests enormous upstream potential. However, getting the gas to market will be difficult and cost-intensive. To date, liquefaction projects have been slow to move forward; none of the four proposed projects have begun construction, pushing the timeline for Canadian exports to the end of the decade at the earliest.*

Qatargas Train at Night

5. LNG Carriers

The shipping market outperformed expectations in 2013. While short-term charter rates softened in the first half of the year, primarily due to outages at key LNG export plants that reduced the LNG supply in need of transport, rates firmed in the second half of the year on a low number of fixtures. More importantly, shipping companies pushed the delivery of speculative new-build orders – placed in the wake of the Fukushima nuclear crisis – into 2014, postponing the impending supply glut and allowing charter rates to hold firm.

Two factors will govern the shipping market in 2014 and beyond. First, the bulk of unchartered, post-Fukushima new-build orders is now set to enter the market. Second, LNG projects and offtakers have largely chosen to take advantage of cyclically weak new-build prices to order their own new-build tonnage rather than signing premium charter deals for speculative tonnage. Market participants have taken stock of this reality and are bracing for an inevitable imbalance between supply and demand. Excess supply is expected to create a multiple tier market, with older steam vessel competing with more efficient new-builds to find charterers, exerting strong downward pressure on charter rates in 2014. While this may result in the accelerated decommissioning of older vessels, timing for the longer-term recovery of the LNG shipping market will depend on new project demand, which is subject to project delays and competition from newbuilds.

5.1. OVERVIEW

357 Carriers, end-2013

Only includes those above 18,000 cm

The post-Fukushima new-build ordering cycle began to deliver tonnage in 2013, with eighteen new vessels entering the global LNG fleet. These additions brought the total fleet to 357 vessels of all types with a combined capacity of 54 mmcm (vessels below 18,000 cm are not counted in the global fleet for the purposes of this report).

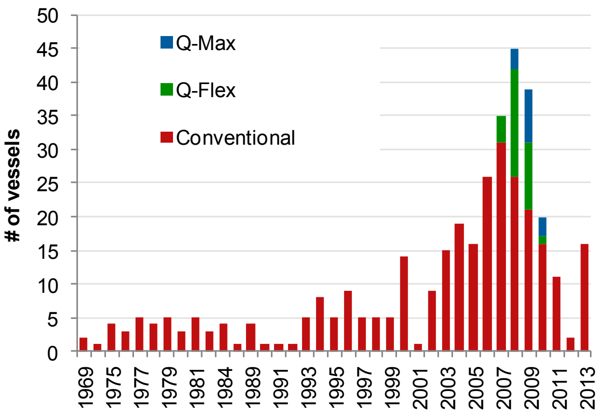


Figure 5.1: Global LNG Fleet by Year of Delivery, 1969-2013
Sources: IHS

The average size of LNG carriers has increased in recent years partly due to the commissioning of larger Q-Series vessels associated with Qatari projects. In 2013, the average capacity in the global fleet was approximately 150,000 cm. Shipping concerns continue to demonstrate a bias towards vessels with larger capacity, with the average size of vessels in the new-build order at approximately 165,000 cm.

At year-end 2013, 108 conventional vessels were on order, equivalent to nearly 18 mmcm of new capacity. While 69% of vessels (81) in the order book are associated with charters, 36 vessels are covered by neither a short nor long-term charter deal as of the end of the year. 21 unchartered vessels are scheduled for delivery in 2014. In spite of short-term charter rates strengthening to the 100,000$/day level in the second half of 2013, the impoundment of vessels in Nigeria and a limited number of fixtures, the large availability of speculative tonnage in 2014 is expected to prompt renewed softening in the short-term charter market.

A new wave of new-build ordering began in late 2012 and 2013. Rather than the LNG demand factors that drove orders in past years, LNG supply factors lead the current cycle, with new-build orders primarily tied to projects in Australia and the US. Asian buyers, specifically utilities in Japan and South Korea, account for the vast majority of offtake from under-construction trains in the US and Australia. Delays in the start-up of these projects versus the delivery dates of the ships could prolong the softer market.

5.2. VESSEL TYPES

Conventional LNG vessels are Moss-type or membrane-type vessels, with a capacity ranging from 125,000 cm to 180,000 cm. Conversely, non-conventional vessels include the oversized Q-Flex and Q-Max types, which offer the largest currently available capacities.

Membrane-type systems continue to lead the new-build order book as the preferred containment option. Within the existing fleet, the alternative Moss-type system saw its share slip from 31% in 2012 to 27% in 2013.

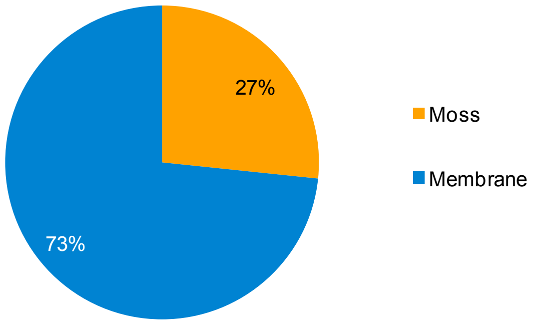


Figure 5.2: Global LNG Fleet by Containment System, end-2013

Sources: IHS

5.3. VESSEL CAPACITY AND AGE

LNG carriers range significantly in size, though more recent additions to the fleet demonstrate a bias toward vessels with larger capacities. The smallest cross-border LNG vessels, typically 18,000 cm to 40,000 cm, are mostly used to transport LNG from Southeast Asia to smaller terminals in Japan. Carriers under 18,000 cm are used in domestic and coastal trades, facilitating delivery of LNG to remote areas.

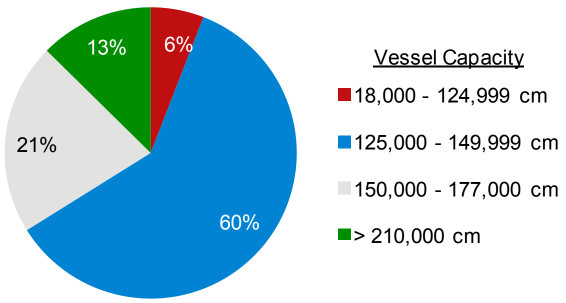


Figure 5.3: Global LNG Fleet by Capacity, end-2013

Sources: IHS

As of end-2013, 60% of the global fleet had a capacity between 125,000 and 149,000 cm, making it the most common class of LNG carrier. However, ships in the 150,000 cm to 177,000 cm range have dominated new-build orders over the past decade. These vessels currently make up 21% of the global fleet, a share that is expected to grow rapidly in the years ahead. The largest category of LNG vessel is the Q-Series, accounting for 13% of the vessels in operation in 2013. The Q-Series is composed of both Q-Flex (210,000-217,000 cm) and Q-Max (261,700-266,000 cm) vessels.

At the end of 2013, the average age of the global LNG fleet stood at approximately 11 years, a reflection of the new-build order boom that occurred in 2004. 91% of the vessels in the global fleet were under 25 years of age. In general, safety and operating economics dictate that vessel owners begin considering retiring a vessel after it reaches the age of 30, although several vessels may operate for closer to 40 years. Around 10% of the global fleet is now over 30 years in age, with many vessel owners postponing the retirement of older tonnage to compete in the short-term charter market. However, these ships may eventually be pushed out of the market by more efficient vessels.

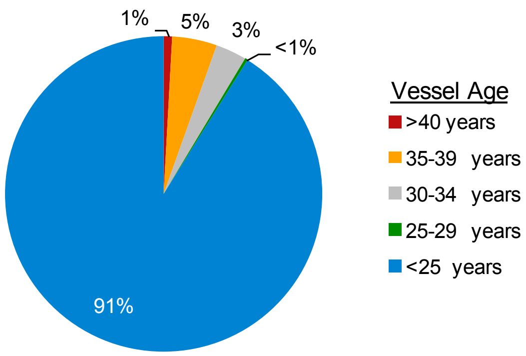


Figure 5.4: Global LNG Fleet by Age (# of Carriers, % of Total), end-2013

Sources: IHS

5.4. CHARTER MARKET

The softening of charter rates seen in the second half of 2012 continued into 2013. As in 2012, this drop was associated with unscheduled outages at key LNG export plants that reduced the LNG supply in need of transport while temporarily freeing associated shipping assets for use in the short-term charter market. This situation was compounded by delays at Angola LNG, freeing the projects seven vessels for the short-term charter market. Spot rates fell from $120,000/day to $90,000/day in the first half of 2013. Nevertheless, the impoundment of multiple vessels during Nigeria LNG's force majeure, combined with a small number of fixtures, saw rates for short-term charters rise above the $100,000/day level from mid-third quarter 2013 through year-end. Rates were further supported by delays in new-build vessel deliveries, with only three unchartered vessels delivered in the second part of the year.

Renewed weakness in short-term charter rates is however expected in 2014 as 21 unchartered vessels are scheduled for delivery. Bargain hunting has begun among commercial parties looking to capitalize on the weak positions of a number of independent shipping companies with unassociated vessels. Recent shorter-term deals for previously unassociated vessels have been at near breakeven charter rates of $70,000/day-$80,000/day. Prompt/spot market rates for older, less-efficient vessels with steam propulsion systems are

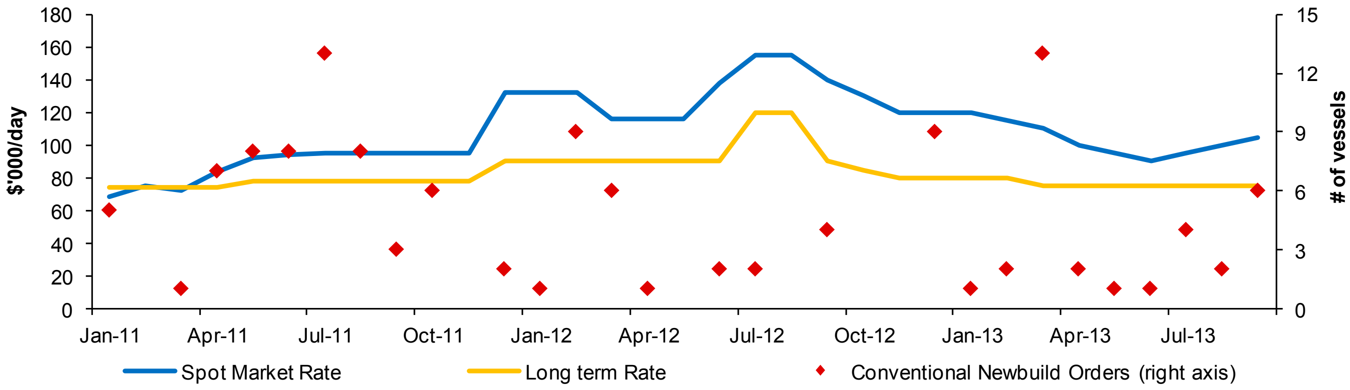


Figure 5.5: Estimated LNG Charter Rates and New-build Orders, end-2013

Sources: IHS

typically fetching $45,000/day. As these vessels come off their existing charters, would-be charterers could acquire considerable market leverage in their choice between the older steam vessels and the large number of newer unchartered Tri-Fuel Diesel Electric (TFDE) vessels. Ultimately, the larger average capacity of the newbuild TFDE vessels may justify a certain premium in the market for modern vessels.

5.5. FLEET AND NEW-BUILD ORDERS

At the end of 2013, the global LNG fleet stood at 357 vessels. Shipping interests continued to be dominated by three companies – Nakilat, MISC and Bonny Gas Transport – tied to NOC-led liquefaction projects located in Qatar, Malaysia and Nigeria. Since the Fukushima nuclear crisis, however, other players have made a push into the ranks of the largest LNG carrier owners. Japanese shipping concerns have equity stakes in a growing number of vessels, though they do not always exercise direct commercial control in their marketing. These companies are becoming increasingly active in the order book to serve new supply from Australia and the US. Many independent shipping companies have also made moves to dramatically grow their fleet sizes, often on a speculative basis.

The conventional order book stood at 108 vessels at the end of 2013. While 43 of these vessels are believed to be associated with existing or under-construction liquefaction projects, several others will ultimately serve a collection of projects within a given charterer's LNG offtake portfolio.

A striking feature of the current order book is that – in spite of a marked slowdown in the pace of speculative ordering in 2013 – 36 vessels remained uncovered or "Available" vessels at year-end. Most these orders were placed by independents in 2011 and 2012 in anticipation of higher demand for LNG transportation following the Fukushima nuclear disaster. Yet cyclically weak new-build prices have also led to a flurry of orders associated with LNG projects or LNG offtaker charters.

36 Available Vessels, end-2013

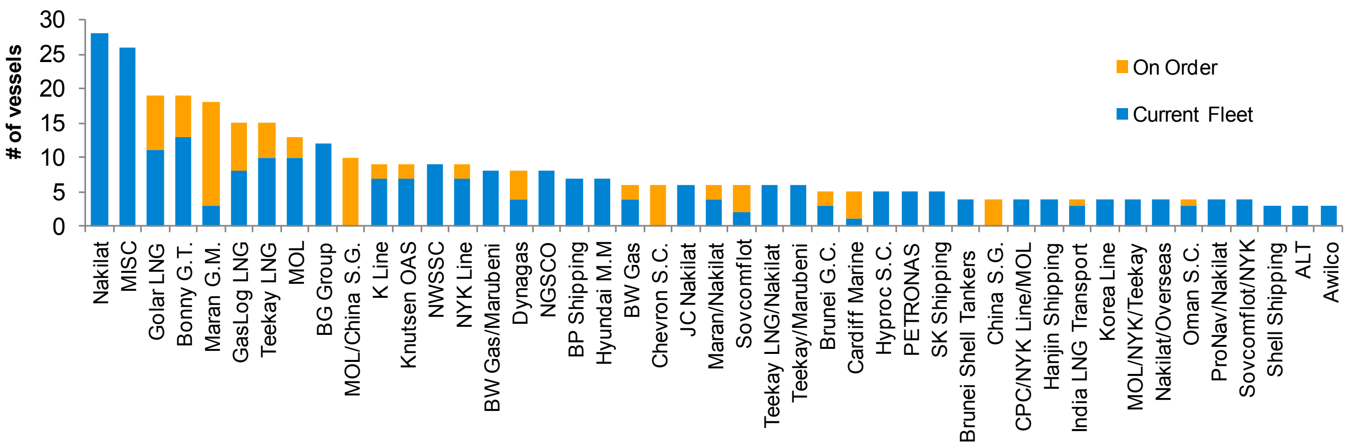


Figure 5.6: New-build Orders (3 or more vessels), end-2013

Sources: IHS

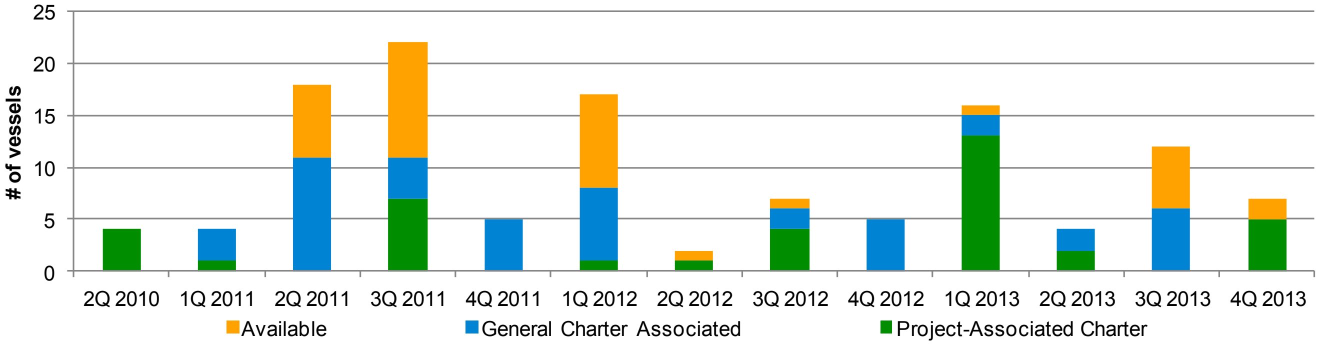


Figure 5.7: Firm Conventional New-build Orders by Fixture Type, end-2013

Sources: IHS

Fear of a shipping supply glut sharply reduced speculative ordering in 2013: whereas nearly half of the 40 vessels ordered in 2012 finished the year unchartered, only 9 of the 38 orders placed in 2013 do not have firm charter contracts. Speculative orders are expected to further subside in 2014, with orders associated with projects or LNG offtakers in Australia and North America providing the bulk of new growth.

5.6. LIQUEFACTION AND SHIPPING CAPACITY GROWTH

While shipping capacity closely tracked liquefaction growth during the first half of the 2000's, the two began to diverge in the middle of the decade due to a boom in new-build orders by IOCs, independent shipping companies and Q-Series vessels associated with the new Qatari trains. These additions saw shipping capacity outstrip production in the second half of the decade, weakening the charter market for vessels not active in the shipping of long-term offtake contracts.

Starting in late 2010, higher levels of cross-basin arbitrage – supported by weak demand in Europe and North America – increased charter distances and strengthened short-term charter rates. The charter market was further bolstered by the Fukushima crisis, which led to a surge in demand for distance-intensive, cross-basin ships and prompted a new-build order cycle. This cycle began to deliver new tonnage in 2013 with 16 vessels added to the fleet.

31 vessels are scheduled for delivery in 2014. While two new liquefaction plants are expected online in 2014 – Arzew GL3Z and PNG LNG T1 – the associated demand for shipping will be minimal as the projects have largely secured their shipping needs. Barring an unanticipated structural change in LNG demand, these deliveries may lead to a softening of the short-term charter market.

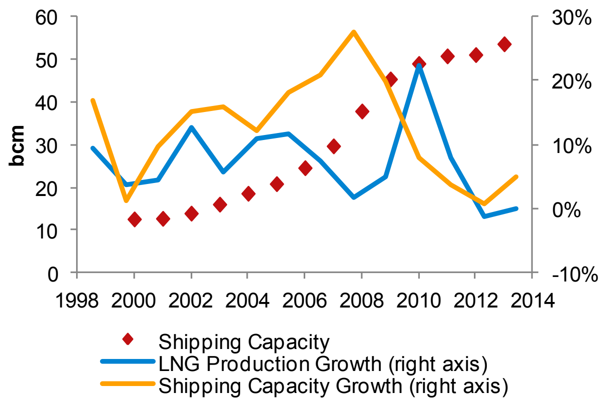


Figure 5.8: Shipping Capacity and Liquefaction/ Shipping Capacity Growth, 2000-2013

Sources: IHS

5.7. VESSEL UTILIZATION

Starting in 2010, the growing disparity between spot rates in the Atlantic and Pacific Basins favoured higher utilization levels (a vessel is counted as "utilized" if it makes at least one delivery in a quarter), particularly among vessels capable of serving any port. The Fukushima disaster bolstered this trend. Utilization stood at 91% in 2013, lower than its peak of 93% in 2012 due to flat LNG output driven by NLNG's force majeure.

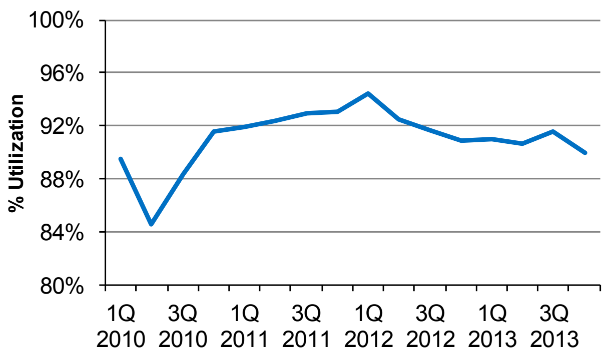


Figure 5.9: Global Fleet Utilization, 2010-2013

Sources: IHS

Looking Ahead:

How quickly will a more pronounced three-tier market for LNG vessel charters emerge? *The varying degrees of propulsion system efficiency in the global fleet will likely drive a more rigid segmentation of the LNG charter market into three distinct categories in 2014. The large number of speculatively-ordered and highly efficient TFDE vessels will compete with Steam, Dual-Fuel Diesel Electric (DFDE) and existing TFDE vessels coming off charters for any fixture opportunities available in 2014. Similarly, ME-GI (gas injection) vessels will also be entering the market, providing another alternative to older steam ships. Charter rates associated with these distinct propulsion systems will have to quickly adjust to remain competitive in voyage economics.*

How will the tight LNG supply picture restrict the number of charter opportunities in 2014? *Incremental LNG supply from greenfield LNG projects reaching their commercial start up is expected to be minimal in 2014. Chartered shipping capacity has already been dedicated to much of the new supply associated with the two new Algerian trains, Angola LNG, QCLNG T1 and PNG LNG T1. In addition, any plant utilization weakness among existing LNG projects would result in even fewer charter opportunities for the speculatively ordered vessels entering the market in 2014.*

How will the Panama Canal's toll fees be finalized and will the canal's construction experience further delay? *The Panama Canal Authority continues to near a decision regarding the toll formula for LNG vessels eventually transiting the widened canal. The added costs will not only have an impact for the economics of US LNG exports to Asian markets, but could also impact marketing from other Atlantic Basin exporters such as Trinidad. Marketing operations at Peru LNG in the Pacific Basin could also be affected. Panama Canal toll costs are nevertheless irrelevant until construction associated with the canal's widening is completed. A payment dispute between the Panama Canal Authority and the Spanish construction consortium Grupo Unidos por el Canal halted work in January 2014, thereby jeopardizing the 2015 start date.*

How will global warming and new projects in Russia open the Arctic routes? *Two LNG carriers with low Ice Class notation have already transited the Northern Sea Route during the navigation period in 2012-13, escorted by nuclear ice-breakers. A new project in Russia (Yamal LNG) has introduced an innovative shipping solution: the ice breaking LNG carrier. The first of its kind, currently under construction in a Korean shipyard, this carrier offers a high Ice Class notation (ARC7) and an innovative propulsion system (3 azimutal thrusters).*

Flexibility at the GATE jetties

6. LNG Receiving Terminals

Global regasification capacity continues to grow as both new and existing markets, particularly in Asia, increasingly rely on LNG to meet rising energy demand and to replace existing fuels like coal and oil. However, utilization at terminals in North America and Europe has declined due to weak LNG market forces, either as a result of competition from domestic production and pipeline gas or a slow economy.

LNG import capacity continues to outpace export capacity around the world, with global regasification capacity growing to 688 MTPA in 2013. The market looks significantly different from even five years ago, with the addition of 11 new countries, including several traditional LNG exporters. These new markets have added a combined 54 MTPA since 2008. The market has also become increasingly flexible, as the growing popularity of floating regasification units has allowed smaller importers to bring relatively inexpensive capacity online to respond to sudden changes in demand or shortages in alternative gas supply.

6.1. OVERVIEW

688 MTPA
Global LNG receiving capacity, end-2013

In 2013, the regasification market was characterized by growth in Asia. As Israel, Malaysia and Singapore completed large-scale LNG import terminals, the number of countries with LNG import capacity grew to 29.[2] This is an increase of 11 countries over 2008, when only 18 markets had the capacity to import LNG.

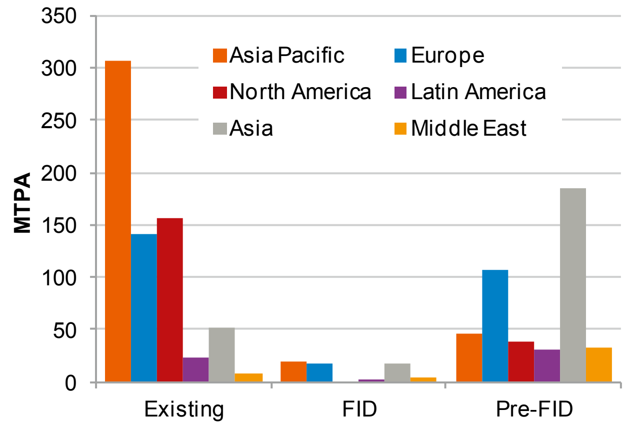


Figure 6.1: LNG Receiving Capacity by Status and Region, as of Q1 2014

Sources: IHS, Company Announcements

Capacity in existing markets also expanded in 2013; Israel, China, India, Italy and Brazil all completed new terminals, bringing the total number of regasification terminals in the world to 94, up from 56 in 2008. Combined, this equates to 688 MTPA of global LNG import capacity. In early 2014, Japan also completed the Naoetsu terminal, bringing capacity up to 690 MTPA.

[2] *This count, along with all other totals within this section, only includes countries with large-scale LNG import capacity (1 MTPA and above). This differs in methodology from Chapter 5 of the 2013 IGU World LNG Report, which included small-scale terminals in all totals. Refer to Chapter 9 for a description of the categorization of small-scale versus large-scale LNG.*

6.2. RECEIVING TERMINAL CAPACITY AND UTILIZATION GLOBALLY

Over the past decade, new regasification capacity has expanded not just into new markets, but entirely new regions. Floating regasification technology, flexible shipping strategies and the growth of the spot market has aided in the rapid increase of capacity in unexpected and traditionally export-oriented regions (such as the Middle East and Southeast Asia). In 2012-2013, the four new import markets were all located in these two areas: Indonesia, Malaysia, Singapore and Israel. Further, new capacity is under construction in both of these regions: Jordan began construction on its first FSRU in 2013, while Singapore and Indonesia are working to expand their capacity in 2014.

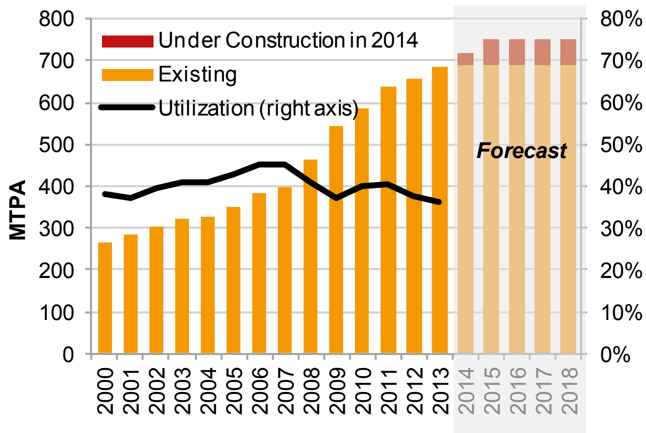


Figure 6.2: Global Receiving Terminal Capacity, 2000-2018
Sources: IHS, IGU, Company Announcements

In total, twelve new terminals were completed in 2013. Four of these were located in China (Ningbo/Zheijang, Zhuhai, Tangshan and Tianjin). Another four were located in South and Southeast Asia: Dabhol and Kochi in India, Jurong Island in Singapore and Melaka LNG in Malaysia. Additionally, India completed the only terminal expansion project in 2013 at Hazira LNG.

12 terminals
Number of new receiving terminals brought online in 2013

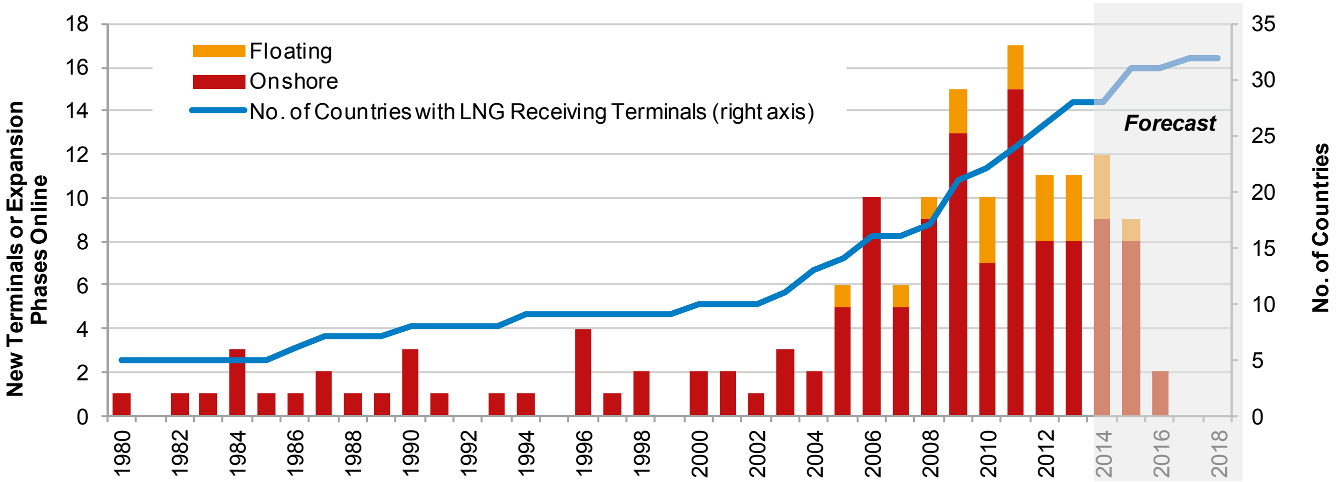


Figure 6.3: Start-Ups of LNG Receiving Terminals, 1980-2018

Source: IHS, Company Announcements

Elsewhere in the world, Brazil brought the Bahia/TRBA terminal online, Italy commissioned the Livorno/LNG Toscana terminal in 2013 and Israel completed the Hadera Gateway terminal.

The LNG market is continuing to expand into new areas. Out of the 14 terminals under construction, three are in markets entirely new to LNG: Jordan, Lithuania and Poland. In a shift from previous years, these three markets are located in Europe and the Middle East. Still, 61% of capacity under construction is located in the Pacific Basin.

Global utilization of LNG import terminals is consistently less than 50% due to the seasonal nature of many gas markets. In 2013, global utilization averaged 35%, down 2% from 2012 due to a continued slump in European and US LNG demand. Excluding the US, which holds the world's second largest import capacity and is a significant outlier with 1% capacity utilization in 2013, global utilization averaged 46%.

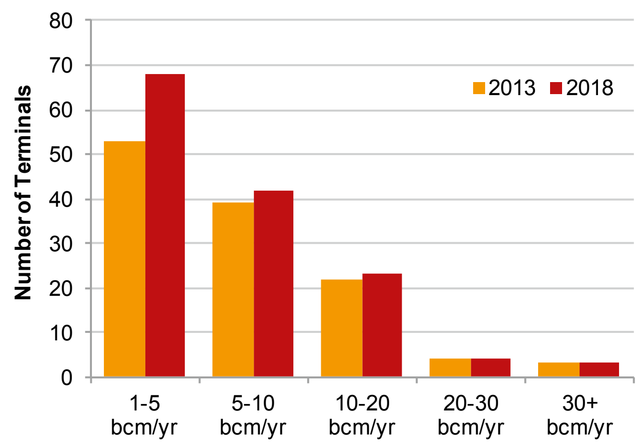


Figure 6.4: Annual Send-out Capacity of LNG Terminals in 2013 and 2018

Sources: IHS, Company Announcements

Excluding small-scale terminals, the maximum send-out capacity of regasification terminals averaged 9.6 bcm/a (7.0 MTPA) in 2013. This has declined over the past few years as more floating units and terminals in smaller markets came online; in 2012 average capacity was 10.5 bcm/a (7.6 MTPA).

6.3. RECEIVING TERMINAL CAPACITY AND UTILIZATION BY COUNTRY

Japan continues to dominate as the largest regasification market, with 28% of global capacity. This position is not expected to change, particularly as Japan brings new terminals online. It completed the Naoetsu terminal in early 2014 and has another four under construction, for at least an additional 6.5 MTPA of capacity (one terminal has yet to release capacity). Japan usually averages a utilization rate around 50% due to import seasonality; utilization stood at 48% in 2013.

Although China is still only the sixth largest regasification market, it is the 3rd largest and one of the fastest growing LNG importers. The country has rapidly expanded its LNG import capacity over the past five years, from 6 MTPA in 2008 to 32 MTPA at the end of 2013. Further, it currently holds 20% of LNG regasification capacity under construction. China also had a much higher utilization than the five largest regasification markets (in terms of capacity), at 94% in 2013.

In addition to China and Japan, ten more countries have reached FID on new large-scale LNG import terminals. Of these, three are new to the LNG market: Jordan, Lithuania and Poland. Most of the remainder are, unsurprisingly, in Asia. However, a few are in highly under-utilized markets in Europe; both Spain and France currently have onshore capacity under construction.

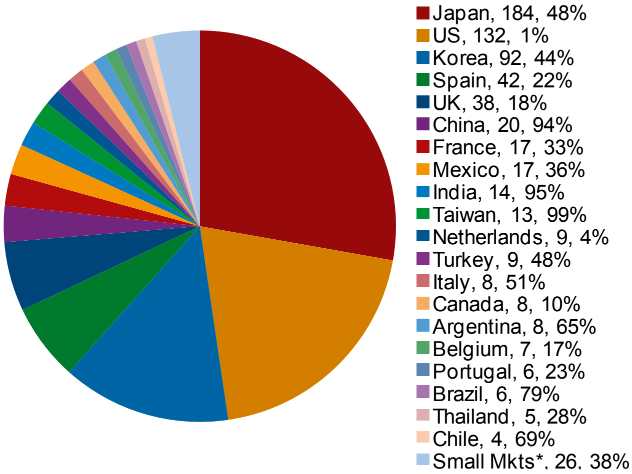


Figure 6.5: LNG Regasification Capacity by Country (MTPA) and Utilization, 2013

Note: "Smaller Markets" includes capacity in Kuwait, Indonesia, Greece, the United Arab Emirates, Malaysia, Singapore, Israel and the Dominican Republic. Each of these countries has less than 4 MTPA of regasification capacity.

Sources: IHS, IGU

Indonesia, which began importing LNG in 2012, plans to nearly double import capacity by 2014. Notably, it plans to complete the conversion of the Arun liquefaction plant into a regasification facility in order to meet growing domestic demand. Utilization was fairly low in 2013 (38%) as a result of ramp-up at its relatively new terminal; this is likely to increase in 2014.

6.4. RECEIVING TERMINALS BY REGION

Of the seven markets that added or increased regasification capacity in 2013, five were in Asia or Asia Pacific. Although the region's dominance in global regasification capacity had declined through the 2000s (falling to ~50%), it has begun to rebound due to strong growth in China and India, with the region's global share increasing in 2013 for the first time since 2002. Latin America and the Middle East have both shown rapid growth over the past five years as individual markets have been able to bring capacity online quickly, aided by the increased use of FSRUs.

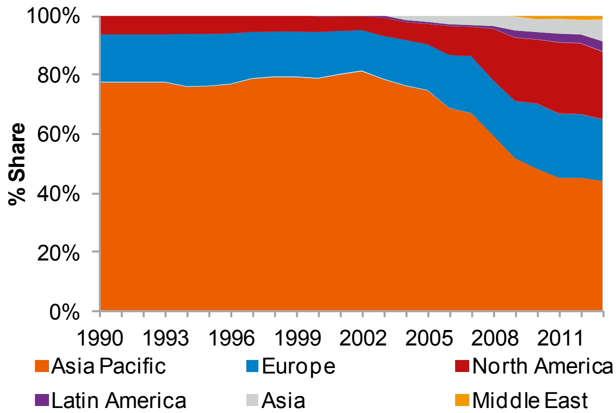


Figure 6.6: Regasification Capacity by Region, % Share of Total, 2013

Sources: IHS, Company Announcements

Despite a lull in European demand, capacity continues to increase. In contrast, North American capacity responded more predictably to low demand, with capacity decreasing in 2013 as the US' Neptune terminal was temporarily decommissioned. In 2013, US terminal utilization rates hit their lowest levels ever; the country averaged 1.4% utilization as six out of eleven terminals failed to import a single cargo. European utilization rates fared slightly better at an average 26%, but still showed serious decline over 2012, when utilization averaged 35%.

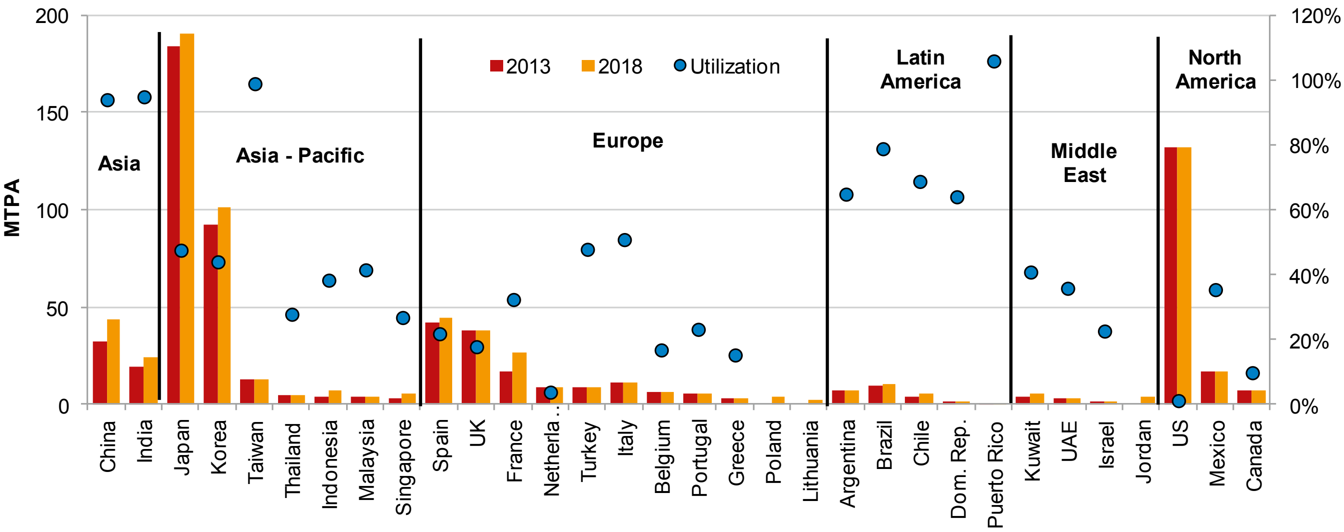


Figure 6.7: Receiving Terminal Import Capacity by Country in 2013 and 2018

Sources: IHS, IGU, Company Announcements

6.5. RECEIVING TERMINAL LNG STORAGE CAPACITY

At end-2013, global storage capacity at regasification terminals totalled nearly 50 mmcm. Among new terminals, there are two trends in LNG storage. The increased use of FSRUs in emerging markets typically accompanies smaller storage, as storage at floating terminals is only as large as the regasification vessel used (125-170 mcm).

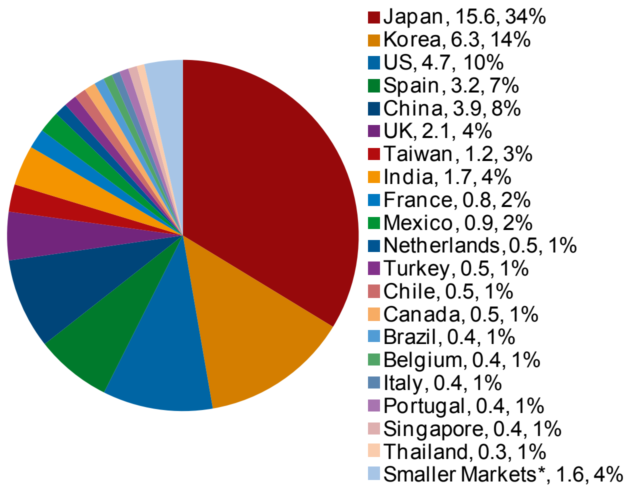


Figure 6.8: LNG Storage Tank Capacity by Country (mmcm) and % of Total, as of Q1 2014

Note: "Smaller Markets" include Argentina, Malaysia, Indonesia, the Dominican Republic, Puerto Rico, Kuwait, Israel, Greece and the UAE. Each of these markets has under 0.3 mmcm of capacity
Sources: IHS, Company Announcements

In contrast, new onshore terminals in Asia have been building larger capacity (350-650 mcm) to allow for greater flexibility and security of LNG supply during periods of higher demand, particularly since many of these markets (Japan, China, India, South Korea) have little gas storage capacity outside of LNG terminals.

In response to high LNG demand, several Asian terminals increased their storage capacity in 2012-2013. Two terminals in China (Dalian and Rudong), two in South Korea (Pyeongtaek and Gwangyang) and one in Japan completed additional storage tanks.

6.6. RECEIVING TERMINAL BERTHING CAPACITY

Roughly 62% of the world's LNG importing markets (18 of 29) have at least one terminal capable of receiving Q-Series vessels (over 180,000 cm). Notably absent from this list is Taiwan, a large-scale importer. Similarly, 62% of the world's total regasification terminals can receive Q-Series vessels; only half of these are believed to be capable of handling a Q-Max vessel. To date, 22 terminals have accepted a Q-Max cargo. Although the general trend has been an increase in berthing capacity, emerging small-scale markets, particularly those that utilize FSRUs, have served to maintain growth in smaller berthing capacity.

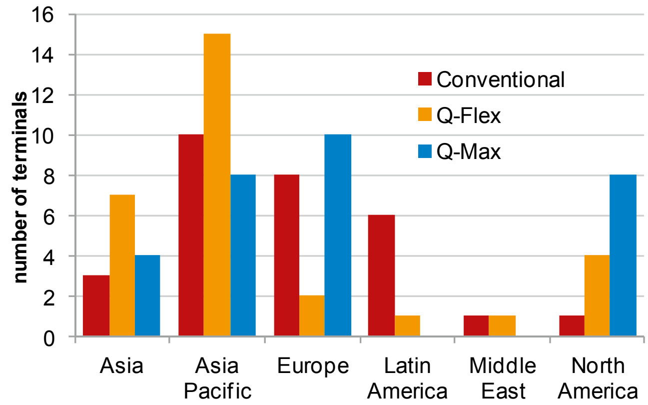


Figure 6.9: Maximum Berthing Capacity of LNG Receiving Terminals by Region, 2013[3]
Sources: IHS, Company Announcements

6.7. FLOATING AND OFFSHORE REGASIFICATION

In 2013, ten LNG import markets had offshore regasification capacity (though half also have onshore capacity). An additional 23 countries have put forth plans to add offshore regasification capacity, two of which have reached FID, for terminals in Jordan and Lithuania. Both Brazil and Kuwait plan to take existing FSRUs offline in order to accommodate new larger vessels in 2014.

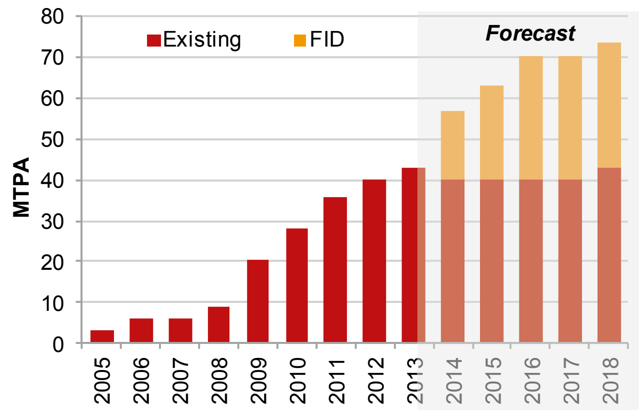


Figure 6.10: Active Floating Regasification Capacity by Status, 2005-2018
Sources: IHS, Company Announcements

Four new offshore regasification terminals were completed in 2013, two of which were the first FSRUs in their respective markets: China completed the Tianjin terminal, while Italy completed the Livorno/LNG Toscana terminal

[3] *Terminals that can receive deliveries from more than one size of vessel are only included under the largest size that they can accept.*

(although Italy is also host to the offshore Adriatic LNG terminal, this is technically not an FSRU as the terminal is built on the sea shore; see the 2013 World LNG IGU Report for more information). The Bahia/TRBA terminal in Brazil was the country's third FSRU, bringing total offshore South American capacity to 17.1 MTPA, or 38% of the world's total floating regasification capacity.

6.8. RECEIVING TERMINALS WITH RELOADING CAPABILITY

In 2013, two new terminals added reloading capabilities, bringing the total up to thirteen terminals in eight countries. The GATE terminal in the Netherlands added reloading capacity as continually low LNG demand in Western Europe led it join fellow European re-exporters France, Spain and Portugal. The Gwangyang terminal in South Korea added reloading capacity despite strong LNG demand; the decision was part of the strategic plan of one capacity holder after a 4th storage tank came online.

Additionally, the Canaport terminal in Canada was approved for re-exports; though it has yet to implement reloading capabilities, low regional demand may provide an incentive to do so. However, it may follow the example of the US Cove Point terminal, which received authority to re-export cargoes, but had not done so as of early 2014.

As Europe continues to dominate the re-export market, a few terminals are working to expand reloading capacity; both Montoir in France and Mugardos in Spain have undertaken expansion activities in 2013.

6.9. PROJECT CAPEX

Country	Terminal	Reloading Capability	Storage (mcm)	No. of Jetties
Belgium	Zeebrugge	4-5 mcm/h	380	1
Brazil	Rio de Janeiro	N/A	151	1
France	FosMax LNG	1.8 mcm/h	330	1
France	Montoir	4.5 mcm/h	360	2
Netherlands	GATE LNG	2.5 mcm/h	540	2
Portugal	Sines	N/A	390	1
S. Korea	Gwangyang	N/A	530	1
Spain	Cartagena	1.8 mcm/h	587	2
Spain	Huelva	3.7 mcm/h	760	1
Spain	Mugardos	2.0 mcm/h	300	1
USA	Freeport	2.5 mcm/h*	320	1
USA	Sabine Pass	1.5 mcm/h*	800	2
USA	Cameron	0.9 mcm/h*	480	1

Table 6.1: Regasification Terminals with Reloading Capabilities in 2013

** Reloading capacity permitted by the US DOE*

Sources: IHS

Project capital expenditures (CAPEX) – including berthing, storage, regasification, send-out pipelines and metering – have risen with time. Although average costs registered a small uptick in 2013, larger escalations are expected over the next three years. The weighted average unit cost of onshore regasification coming online in 2013 based on a three-year moving average was $192/tonne of import capacity; that same number in 2016 is expected to be $274/tonne. The rise in onshore regasification costs has recently mirrored the trend in increased storage capacity; as countries add larger storage tanks to allow for higher imports and greater supply stability, the average storage capacity per unit of regasification capacity has increased.

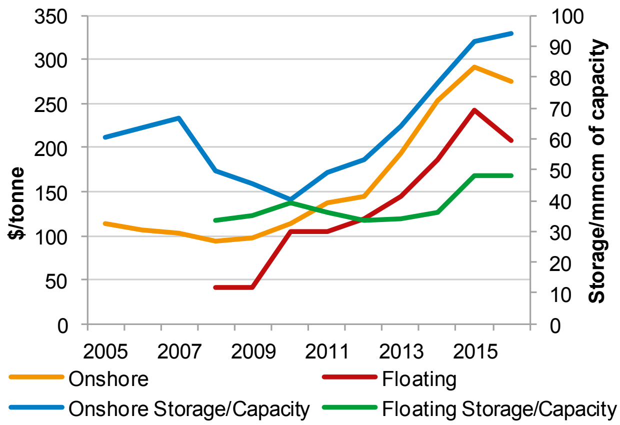
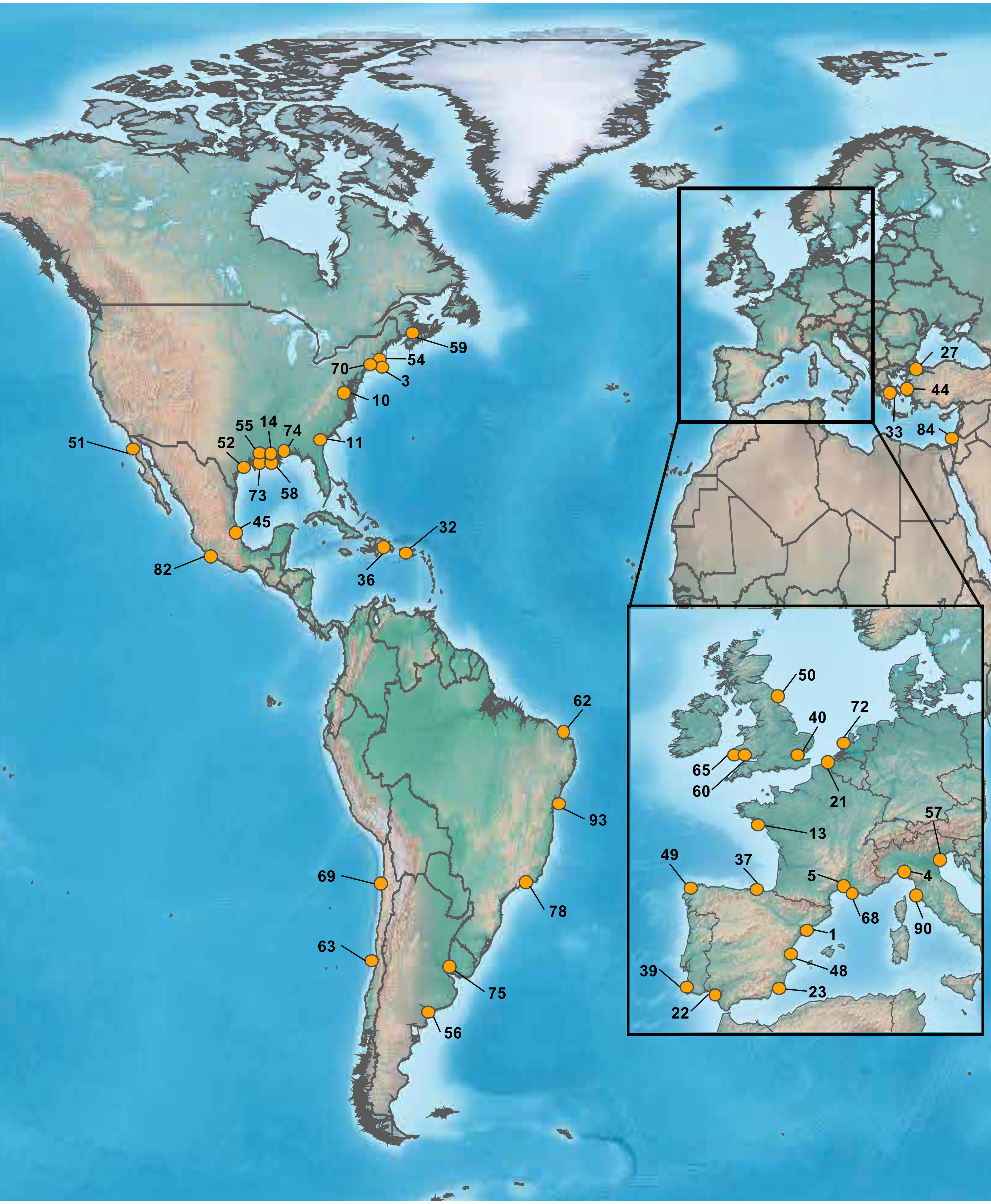


Figure 6.11: Regasification Costs based on Project Start Dates, 2005-2017

Sources: IHS, Company Announcements

Floating regasification costs also follow an upward trend. Since the late 2000s, costs have risen by over $100/tonne; in 2013 the weighted average unit cost of offshore regasification based on a three-year moving average was $145/tonne. However, floating costs are consistently lower than onshore costs as a result of fewer infrastructure requirements for an FSRU. This trend is expected to continue over the next three years.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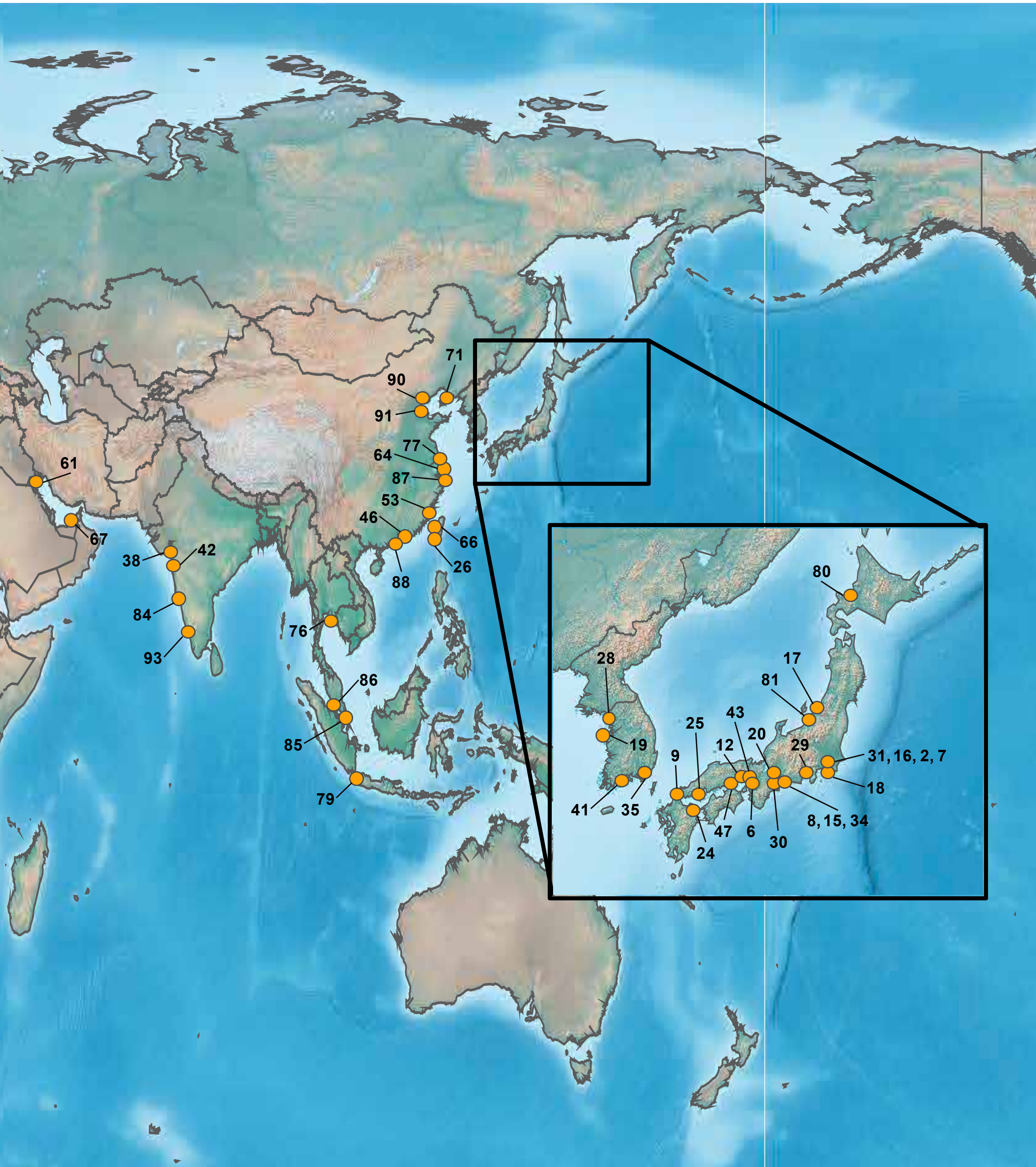

Figure 6.12: Global LNG Receiving Terminal Locations

Note: Terminals numbers correspond to Appendix III: Table of LNG Receiving Terminals.

Looking Ahead:

What new countries will enter the regasification market in the next three years? *In 2012 and 2013, the regasification market expanded to include new markets in traditionally exporting areas. This trend will alter over the next few years. Although the Middle Eastern country of Jordan is expected to begin importing LNG, several new European markets (Lithuania, Poland) are also set to bring capacity online. No other new large scale markets have currently begun construction on regasification terminals, but the short development and construction schedule of mid-scale or floating terminals could allow other countries to enter the market. Countries in nearly every region have proposed such schemes; the success of each will depend on the ability of developers to overcome political (Ireland, Philippines), developmental (Vietnam, Jamaica), or financial (Ghana, South Africa) hurdles.*

Will floating regasification aid in expanding LNG import capacity to new regions? *The advent of floating terminals was instrumental in the quick build-up of capacity in the Middle East, Latin America and Southeast Asia. Floating systems are proposed to be used in many more countries, including several in Sub-Saharan Africa and Central America, regions currently unknown to the LNG market. Although many challenges face the development of LNG infrastructure, the speed and relatively lower cost of bringing a floating import terminal online may improve the outlook for these regions.*

Will more terminals add reloading capacity in the face of low domestic LNG demand? *The number of terminals with LNG reloading capabilities increased in 2013 as GATE LNG in the Netherlands and Gwangyang in South Korea reexported their first cargoes. The number of reloaded European cargoes also increased due to continually weak demand. Additionally, Canaport in Canada has been approved for reloading activities, but has not yet made the decision to reload cargoes.*

Dunkerque LNG Under Construction

7. Special Report on the Small-Scale LNG Value Chain

The production and consumption of LNG on a small scale has historically been limited to a few countries. However, new environmental emissions policies and diverging oil and gas prices have led many regions to begin building up small-scale infrastructure.

In the past, small-scale LNG (SSLNG) was mainly traded in a manner similar to its large scale counterpart, and consumed within the power and industrial sectors. As the technology and feasibility has improved, the SSLNG business has rapidly expanded. New players are entering the market, while existing players are expanding. Many new regions have turned to small-scale liquefaction and retail LNG in order to cut emissions or fuel costs. LNG is also growing in the transportation sector, both as a marine fuel and for heavy trucking, mainly in the US and China. As SSLNG is a dynamic, fast-moving industry, the information presented here is a representative sample of the industry; all developments may not be included.

7.1. OVERVIEW

IGU defines small-scale liquefaction and regasification facilities as plants with a capacity of under 1 MTPA. In turn, SSLNG ships are defined as vessels with a capacity of under 18,000 cm.

This small-scale production and consumption of LNG can be separated into two basic categories: wholesale and retail. Small-scale wholesale LNG is essentially a miniaturization of the conventional LNG value chain; gas is liquefied in small quantities, transported on a small vessel, and then imported at a small regasification plant. Retail LNG is the small-scale consumption of LNG in end-user applications, such as transport, power generation, or industrial activities. Compared to the well-established large-scale LNG industry, SSLNG is characterized by different dynamics and drivers. Therefore the production, transportation and regasification of SSLNG for new market segments such as the transportation and small industrial sectors requires the application of a variety of different technologies and commercial models to meet efficiency and cost requirements.

Wholesale SSLNG mirrors the large scale LNG business in that it typically involves the intercontinental transport of LNG from a liquefaction plant in a producing country to a regasification plant closer to the end-user (e.g. power plants, industrial users).

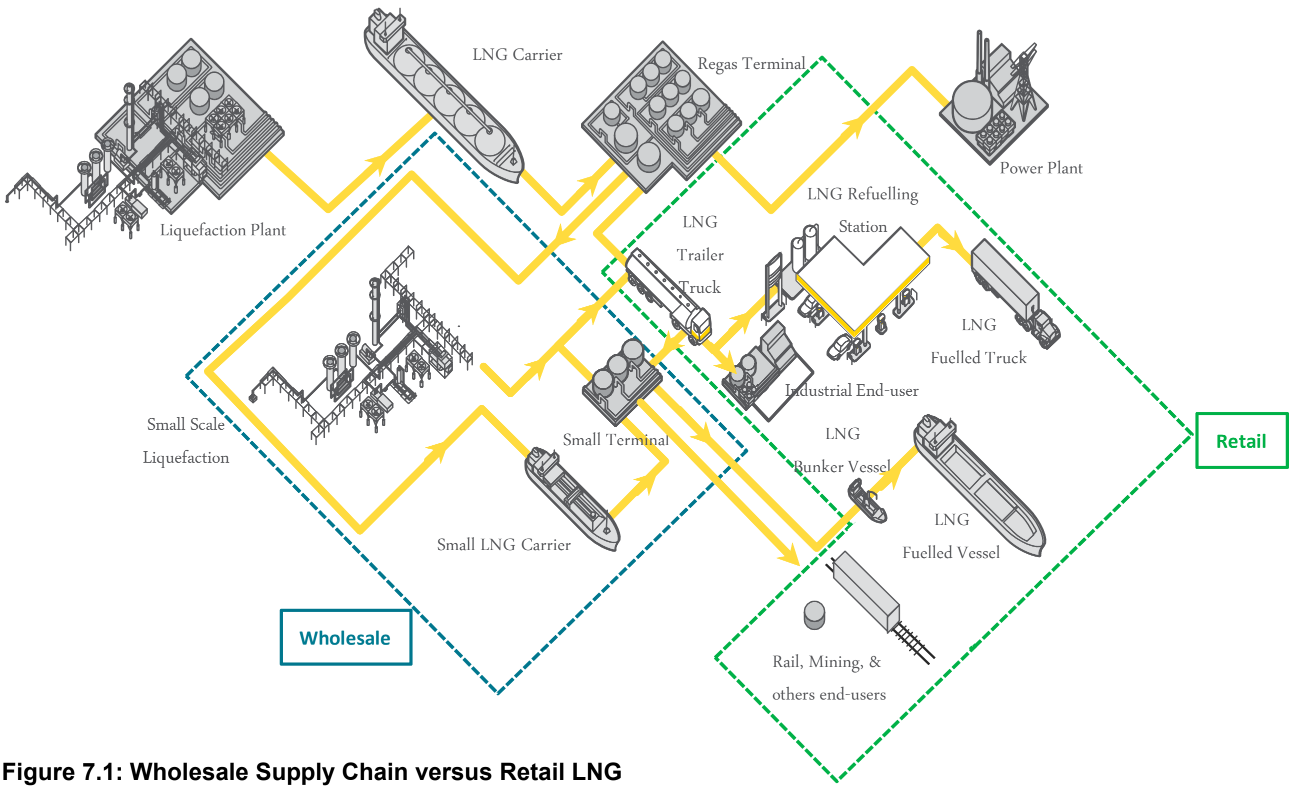

Figure 7.1: Wholesale Supply Chain versus Retail LNG
Sources: Shell, IGU

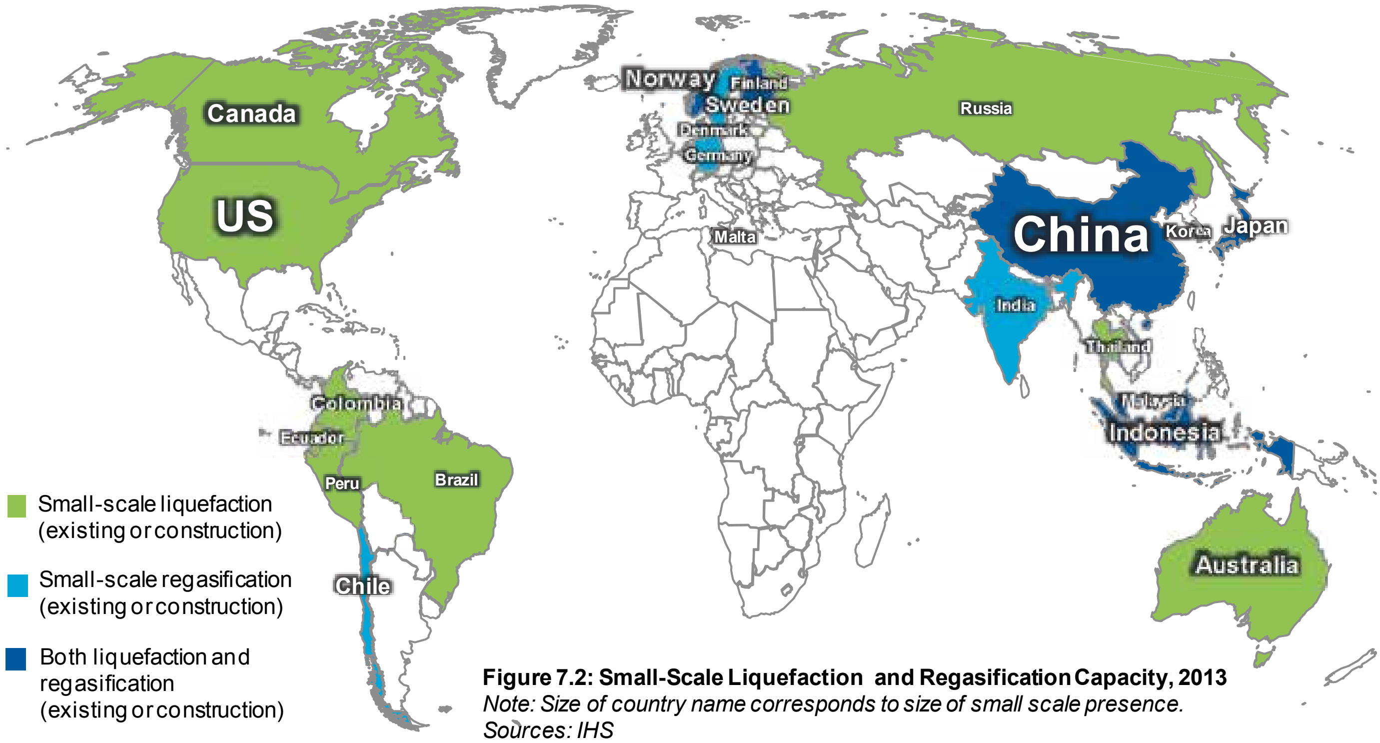

Figure 7.2: Small-Scale Liquefaction and Regasification Capacity, 2013
Note: Size of country name corresponds to size of small scale presence.
Sources: IHS

The **retail** LNG business is characterized more by an “end-user oriented” value chain. Such a value chain represents a more regional or local business that distributes and delivers smaller parcels of LNG from the liquefaction source directly to end-users, using various modes of transport (e.g. ships, trucks, semitrailers, ISO containers, or trains). This new value network can link into an existing large scale value chain at any point, including the liquefaction plant, LNG carrier, or regasification plant. It can cater LNG for new applications, such as LNG as marine and road transport fuel, but can also allow access to LNG to previously stranded customers, such as scattered islands or coastal areas (e.g. coastal areas of Norway and Japan, archipelagos in the Caribbean and Indonesia).

The production and transportation of LNG at such a smaller scale requires the application of different technologies. For example, less efficient liquefaction processes may become a more optimal choice at a smaller scale, such as Single Mixed Refrigerant and Nitrogen Expansion cycles. Different types of equipment may also be selected: reciprocating and screw type compressors may be preferred to the centrifugal compressors usually employed in large scale liquefaction plants, while plate-fin cryogenic heat exchangers might be preferred over coil wound heat exchangers.

The development of a small-scale value network also poses new logistical challenges, such as the management of boil-off gas (BOG) produced during the transport of LNG (in contrast to the large scale business, BOG management corresponds often to containment under pressure in vessels), limited availability of small LNG carriers on the market, and ensuring the compatibility and safety standards among all elements of the value chain.

7.2. SMALL-SCALE LIQUEFACTION

Small-scale liquefaction plants are built with a variety of objectives in mind, including commercializing small gas fields, shortening gas-to-market times, marketing small quantities of gas usually flared, peak shaving and direct use of LNG.

While many companies are developing stand-alone small-scale units, others have proposed building ‘large scale’ projects with multiple small modular liquefaction units. This is the concept behind many large floating proposals, which contain multiple 0.25-1.0 MTPA units on a barge or vessel, but is also proposed to be used in onshore projects.

The developers of most small-scale projects turn to small-scale liquefaction either because their targeted gas reserves are not large enough to support a bigger project, or because they hope to take advantage of cost and time efficiencies from less infrastructure and a more modular design. Smaller plants are estimated to have a shorter construction time and a much shorter design and engineering schedule. This particularly true if they target pipeline gas as feedstock rather than a small gas field, allowing for more rapid responses to demand surges. The 0.3 MTPA Skangass LNG facility was completed in around 3 years, compared to 4-5 years for a large scale facility.

Project	Country	Status	Original Capacity	Announced Start	Operator
Skangass LNG	Norway	Existing	0.3	2010	Lyse
Sengkang LNG T1	Indonesia	Construction	0.5	2014	Energy World Corp.
Sengkang LNG T2	Indonesia	Construction	0.5	2014	Energy World Corp.
Pacific Rubiales (Floating)	Colombia	Construction	0.5	2015	Exmar
PETRONAS FLNG	Malaysia	Construction	1.2	2016	PETRONAS

Table 7.1: Sample of Recent Small-Scale Marine-Based Liquefaction Export Projects, 2010-2016
Sources: IHS

Further, CAPEX requirements are obviously significantly lower, but on a $/tonne basis they are not necessarily more competitive than their large scale counterparts. Small-scale plants lack any benefits that economies of scale give to larger projects, but due to their minimal size and relative simplicity, there is a lower need for on-site infrastructure (such as independent power generation) and specialized equipment.

In addition to global exports, small-scale liquefaction plants are also being constructed for a variety of domestic uses. Traditionally, LNG has been consumed as a replacement fuel for diesel or other oil products for power generation or industrial uses, either due to a plant's remote location or as a way to cut costs.

SSLNG units are also often used as peak shavers to help meet demand. These facilities contain both liquefaction and regasification abilities to more compactly store gas until times of peak demand, when the LNG can be quickly regasified for use in retail applications, such as power generation or residential consumption.

The construction of liquefaction units for the purpose of providing LNG as a fuel for transportation is a more recent phenomenon that has gained fast ground in China and the US, though has proliferated around the globe. Both countries have a sizeable LNG in trucking industry. China, in particular, has rapidly built up its domestic liquefaction infrastructure to replace diesel and cut vehicle emissions. For more on consumption of LNG in trucking, see Chapter 8 of the 2013 IGU World LNG Report.

7.3. SMALL-SCALE REGASIFICATION

The majority of small independent regasification units (not including those in peak shavers) are used to import globally-produced LNG, and are located in areas with limited demand or size constraints.

Currently, Japan holds the most existing small-scale import terminals, many of which were built as satellite plants or units near larger, older terminals, though some can attribute their small size to space constraints or lower demand. Small-scale import functions similarly to floating regasification; their advantages are primarily lower cost, speed of construction and added flexibility. Indonesia has proposed building nearly a dozen "mini" LNG terminals in order to service islands with no gas pipeline infrastructure; the plants would all be supplied by domestic LNG produced at Bontang LNG. Multiple European countries have proposed building small-scale import terminals, spurred by EU subsidies for developing LNG that could be as large as 10-20% of the terminal development cost.

There are several different LNG sourcing strategies among small-scale terminals. Some, like the Fredrikstad terminal in Norway, are supplied by regional small-scale liquefaction (in this case, Skangass LNG in Norway). In Japan and China, some small-scale terminals are supplied by traditional large-scale liquefaction plants, such as Malaysia LNG and Bontang, using SSLNG carriers. A third

Project	Country	Status	Original Capacity (MTPA)	Announced Start	Operator
Sakaide	Japan	Existing	0.7	2010	Shikoku Electric
Fredrikstad	Norway	Existing	<0.1	2011	Skangass LNG
Nynashamn LNG	Sweden	Existing	0.3	2011	AGA Gas AB
Yufutsu	Japan	Existing	<0.1	2011	JAPEX
Yoshinoura	Japan	Existing	0.5	2012	Okinawa Electric
Lysekil	Sweden	Construction	0.2	2014	Skangass LNG, Preem
Kushiro LNG	Japan	Construction	0.5	2015	JX Nippon Oil & Energy

Table 7.2: Sample of Small-Scale Marine-Based Regasification Import Projects, 2010-2015
Sources: IHS

set of terminals receive LNG that has been produced by large-scale international terminals (hubs), but is first delivered to larger import plants and then transferred by small shuttle vessels or onshore trucks. Several of the Japanese terminals operate in this way, while Chile has a small onshore regasification facility located near a refinery in Pemuco, to which it transports LNG from the large-scale Quintero regasification plant on the coast.

7.4. OFFSHORE SMALL-SCALE LNG TRANSPORTATION

A portion of small-scale coastal terminals are able to receive traditional LNG carriers, though the vast majority utilize LNG shuttle vessels. These small vessels, which range in size from 1,000 cm to 18,000 cm, primarily carry cargoes between large- and small-scale terminals, though can occasionally make the trip between large-scale liquefaction plants and small-scale terminals.

In addition to shuttle vessels, which are essentially miniaturized versions of conventional LNG carriers, some small-scale trade is also proposed to be carried out by conventional cargo ships carrying 10,000 gallon (0.02 MT) ISO containers full of LNG. This concept, which is fairly nascent, provides the basis for all of the small-scale export applications currently before the US DOE (such as Carib Energy's 0.2 MTPA proposal to deliver volumes to the Caribbean).

7.5. RETAIL LNG

LNG is consumed in a number of retail applications, including transport, power and industry.

The use of LNG in **road transportation** as a replacement fuel for diesel has proliferated most rapidly in areas with more stringent environmental standards for vehicle emissions, such as the US West Coast, Europe and China. The latter has seen the strongest growth, with over 400 stations in place at the end of 2012; there are plans to more than quadruple this by 2015. Further, in 2013, LNG-powered trucks accounted for 7% of all heavy duty vehicle sales in China. Outside of China, the US has the next largest presence in the onshore LNG transportation industry. Refuelling stations are concentrated mainly in the state of California due to its more aggressive emissions standards. As of January 2014, over 50% of stations were located there, with most of the remainder scattered in isolated markets throughout the rest of the country.

400+ LNG re-fueling stations in China at end-2012

84 LNG re-fueling stations in US as of January 2014

Multiple European markets have some LNG fuelling infrastructure, including Portugal, Spain, Italy, Sweden, Estonia, Finland and the Netherlands. As in the US, these stations are isolated and do not form transportation corridors, though the LNG Blue Corridors Projects are underway to invest in infrastructure along the four major European trucking routes. The current European Commission's four-year project aims to demonstrate and roll-out the feasibility of four LNG Corridors throughout Europe. This will include building new LNG or L-CNG stations and building up a fleet of LNG Heavy Duty Vehicles which will operate along the corridors.

LNG can also be consumed as fuel for **marine transport**. In order to cut down on sulphur emissions, the EU has been promoting the consumption of LNG as marine fuel. Although currently there are few vessels that are capable of using LNG as bunker fuel (apart from LNG carriers), the number of proposals has been growing. Given the level of government support in Europe, schemes located in countries such as Norway and the Netherlands are furthest along, while several more have been proposed along the Gulf Coast and Great Lakes regions of the US.

As with the growing use of LNG in transportation, the use of LNG in the **power and industrial sectors** is spurred by a desire to cut emissions. Several oil and gas companies in the US and Canada have proposed plans to install LNG capabilities at production sites to fuel drilling rigs and hydraulic fracturing units. These plans have also been influenced by the cost differential between LNG and alternate liquid fuels. In areas like the US or Europe where gas or LNG prices are consistently lower than oil and diesel prices, the price disparity between oil and gas is a major argument for onshore LNG consumption. Countries that rely heavily on higher-priced diesel for power and industrial uses have also begun to look to LNG as a replacement fuel in these sectors. This is particularly relevant for remote areas and islands where pipeline infrastructure is too costly.

7.6. REGIONAL OVERVIEW: ASIA PACIFIC

In the Asia Pacific region, the most developed SSLNG industry is in China. Since the first liquefaction plants went into operation approximately 10 years ago, the SSLNG business in China saw a very dynamic and fast development. This was the result of major drivers like limited access to gas via pipeline outside of major cities and large truck fleets operating in industries like coal mining. Replacing diesel with LNG can provide significant cost savings for fleet operators. Meanwhile, public bus fleets have also been converted from diesel to LNG in some cities. It is expected that nearly 90 small-scale liquefaction plants are currently in operation or close to start-up with a total design liquefaction capacity in the order of 12 MTPA. Plant liquefaction capacities range from 0.005 to 0.5 MTPA in a single train. Due to its limited conventional natural gas resources, China's SSLNG

12 MTPA
Capacity at small-scale liquefaction plants in China

business utilizes a variety of sources for feedstock, including synthetic/substitute natural gas (SNG) from coal gasification, coke gas and coal bed methane.
Since domestic natural gas resources and the national pipeline grid are owned by Chinese NOCs, they are also the major players in the SSLNG market. Most prominent is CNPC and its subsidiary Kunlun Energy, which runs a significant number of projects in various provinces. In addition to the NOCs, SSLNG chains are also being set up by newcomers to the energy business looking for an attractive investment opportunity.

Beyond China, SSLNG growth has been more limited, with various applications among the different markets. Japan and Australia have the longest small-scale presence. Japan runs some small-scale distribution projects from its numerous LNG receiving terminals, mainly utilizing dedicated SSLNG vessels. The small volumes of LNG are used in power stations as well as by residential and industrial consumers. Australia entered the SSLNG business around 10 years ago and since then has constructed a few liquefaction plants, which distribute LNG regionally by truck, mainly to remote power stations and mining trucks.

India, Thailand and Korea have just begun to build SSLNG infrastructure, but so far only with demonstration projects strongly supported by government and state-owned gas companies. In India, approximately 18-20 industrial customers have set up small LNG storage and regasification facilities and have been sourcing LNG from existing large-scale LNG terminals. Thailand and Korea have each installed one small-scale liquefaction plant with regional distribution by road tanker.

Multiple small-scale liquefaction and regasification projects have been proposed in the island nations of Southeast Asia in order to bring gas to remote areas. Malaysia's PETRONAS took FID on a small-scale floating LNG project in 2012, but no land based SSLNG projects exist so far. Indonesia has proposed a major build-up of small-scale regasification plants, while Singapore is also considering small-scale infrastructure, though these projects are still in the planning phase.

7.7. REGIONAL OVERVIEW: EUROPE

The growth of the SSLNG market in Europe is mainly demand driven, linked to increasingly strict policies and targets for reducing emissions and increasing the sustainability of the transport sector. These have made LNG an increasingly attractive option for the short sea shipping sector, as well as for heavy road transport. The attractiveness of LNG as an alternative fuel is a strong incentive for Europe to overcome major barriers to full development, namely poor infrastructure and the lack of a consistent normative and regulatory framework that would include safety standards for the handling of SSLNG.

In the Netherlands, the large scale GATE terminal in Rotterdam receives LNG from small up to Q-Max LNG carriers, from which LNG can then be reloaded via the two modified existing large jetties onto small LNG carriers. This LNG is then delivered to customers in Scandinavian and Baltic states, where it is sold as a substitution fuel for industry to lower energy costs (as a replacement of oil indexed commodities like LPG) and at the same time reduce environmental impacts. Additional demand could come from the required replacement of HFO fuel in the maritime sector. Since early 2014, the GATE terminal also has a truck loading facility. In May 2010, the Belgian terminal Zeebrugge began similar activities, supplying small LNG carriers delivering to Norway. Truck loading activities have also grown over the past few years.

The small-scale industry in Sweden is a prime example of the multiple end uses for small volumes of LNG. The sector is demand driven, with one small-scale import terminal (Nynäshamn) in operation since 2011. The terminal supplies LNG to the nearby Nynäs refinery via pipeline and to other small industrial customers via trucks, as well as to a small regasification unit for the local gas grid in Stockholm. LNG is also trucked to the Loudden storage facility in Stockholm, from which the bunkering ship Seagas sources LNG that it uses to supply the passenger ferry Viking Grace at Stadsgårdskajen in Stockholm. A second import terminal in Lysekil, owned and operated by Skangass, is expected to begin operations mid-2014. The terminal will primarily feed the Preem refinery (replacing naptha and butane), as well as other industrial customers and potentially bunkering ships.

In Norway, SSLNG development is driven by the lack of pipe gas infrastructure in areas with difficult terrain and the state NOx funds which subsidize a large portion of additional costs for LNG investments in shipping. Norway has two small-scale liquefaction plants that receive pipe gas from the Norwegian Sea. Skangass, commissioned in 2010, primarily delivers LNG using the Coral Energy (15,400 cm) to Norway and Sweden, but has also delivered volumes to Spain and the Netherlands. The plant also includes truck loading facilities and plans to offer bunkering facilities directly from its storage tanks. Norway's other liquefaction plant is the Shell Gasnor facility, which consists of two plants, commissioned in 2004 and 2007. LNG production is sent to ferries and industrial users along the Norwegian coastline, delivered by Shell Gasnor's small-scale Coral Methane (7,500 cm) and Pioneer Knutsen (1,100 cm) vessels. LNG is also delivered to trucking and bunker customers.

The Iberian Peninsula (Portugal and Spain) has a wide geographic distribution of LNG terminals; the maximum distance from a terminal at any one point is less than 500 km. This has facilitated the development of LNG distribution via truck. The Barcelona terminal began truck loading operations in 1973 and delivers LNG to re-fueling stations, industrial LNG satellite plants, and remote natural gas distribution networks. Every month, 140,000 cm of

LNG is loaded onto 3,500 trucks.

Portugal's Sines terminal also offers truck loading services that fuel over 60 satellite LNG plants throughout the country. The terminal, which came into operation in 2003, has a total storage capacity of 390,000 cm of LNG. New projects have also been implemented in Portugal, including small satellite plants for industries (10-20 cm capacity) and natural gas vehicles, and micro satellites for household (2-5 cm capacity).

France and the UK are currently developing SSLNG projects, some of them being linked to their receiving terminals.

7.8. REGIONAL OVERVIEW: AMERICAS

In North America the growth of the SSLNG business is currently mostly supply driven, led by the increasing surplus of dry gas in liquid-rich shale gas development areas. However, demand fundamentals such as the need to meet emission standards and the substantial price differentials between natural gas and oil products have also led to the proliferation of small-scale infrastructure.

In the US, the market is growing rapidly and several companies are developing small liquefaction plants to serve a diversified array of applications, including the conversion of drilling rigs and hydraulic fracturing equipment, industrial mining equipment, transportation fleets and retail fueling stations. Small LNG suppliers are also developing distinctive business models: the "for sale" model involves the turnkey supply of a complete liquefaction plant; in the "rental" model the LNG equipment provider will lease the equipment and work with the client in the marketing of the product. Other innovative models for marine transportation include bulk distribution by ships designed to transport up to 20,000 cm of LNG and intermodal distribution using LNG containers which can be transported by ships, trucks and trains.

On the supply side, there are 29 small liquefaction stations in the US and Shell is commissioning a 0.25 MTPA plant near Calgary in Canada. Major oil companies are planning to build LNG fueling corridors in North America catering to long-haul trucks, appealing to the estimated spread of $10/mmBtu between LNG and retail diesel.

Demand-driven projects fall in two categories: those driven by environmental policies and those resulting from a lack of infrastructure in remote locations. Atmospheric emissions standards have encouraged the utilization of LNG in transit buses in large cities such as Los Angeles, Phoenix and Washington, DC. In certain remote regions not served by gas pipelines, several towns are planning to import LNG by truck or rail. For example, Canadian towns in the Yukon Territory and in the Northwest Territories are planning to truck LNG from other regions to supply power plants that burn diesel in winter, while the state of Alaska has approved a $430 million trucked LNG project. In the island state of Hawaii, the gas utility Hawaii Gas is planning to import LNG in ISO containers to back-up synthetic natural gas supplies.

Goldenergy micro LNG satellite plant for LNG retail in Portugal

Similarly, remoteness and lack of pipe gas infrastructure is a main driver for the demand-driven SSLNG business in South and Central America. Under a "virtual pipeline" model, LNG is supplied to end-users by conventional importing terminals (Chile, Dominican Republic, Argentina, Peru) or by small liquefaction plants (Brazil, Ecuador). In Colombia, the Pacific Rubiales LNG project is driven by the need to monetize gas from the La Creciente onshore field in northern Colombia. The project comprises a 0.5 MTPA offshore floating liquefaction barge, which will be leased from EXMAR under a 15-year tolling agreement.

7.9. OUTLOOK

SSLNG is growing across the globe and is expected to go a long distance. The industry is very dynamic in North America, driven by increased gas availability from shale gas production, as well as economic factors such as the substantial price differentials between gas and oil products. The economic and environmental advantages of using LNG as fuel will drive growth in China, to fight pollution in urban areas, while stricter regulations on the marine sector will boost the use of LNG in Europe.

The growth of the SSLNG business is tightly linked to the development of LNG demand. However, this creates a potential stalemate where consumers wish for security of supply before committing to LNG, while potential suppliers need to secure a market to justify the investment. The unlocking of such a dilemma is being addressed in different ways in different parts of the world. Regional factors such as the lack of pipeline infrastructure and increasing emission regulations strongly support the growth of SSLNG.

The main challenges for SSLNG lie in the development of a consistent normative and regulatory framework, including safety standards for the handling of SSLNG and investments to provide the infrastructure to support a wider distribution without jeopardizing cost effectiveness. However, implementation of this value chain will introduce new challenges, for example in the area of BOG management and meeting fuel quality requirements to use LNG as fuel. Still, no technical bottlenecks hinder the growth of this sector. Moreover, improvements to project economics are expected from standardization and modularization for production facilities.

8. The LNG Industry in Years Ahead

How much new LNG from the start up of greenfield trains will hit the market in 2014? While three projects are expected to achieve commercial start up in 2014 – Arzew GL3Z, PNG LNG T1 and QCLNG – project delays and feedstock issues could diminish the level of new supply they collectively deliver to market in 2014. While Algeria's Sonatrach plans to bring online its second new train within a 12 month period following the successful commercial start up of the Skikda GL1K Rebuild in late 2013, both trains face ongoing declines in available feedstock for LNG exports. PNG LNG T1 is not scheduled to come online until the second half of 2014, which may limit its ability to achieve full ramp-up by December. Finally, BG Group's decision to move forward the start date for QCLNG's from 2015 into late 2014 is also expected to deliver minimal new volumes due to ramp-up.

Will European LNG imports fall for a third consecutive year? European LNG imports fell for their second consecutive year for the first time since the early 1990s. In the power sector, imports of cheap coal from the US, higher generation levels from renewable capacity and the low price of carbon challenged the economics of gas-fired power. In addition, increases in European regasification terminal capacity capable of performing re-export operations played a growing role in lowering the region's net LNG imports. Still, flexible LNG volumes may find a way to Europe if needed.

Will Mexico's call on LNG imports continue to surge? Mexico's LNG imports soared in 2013, primarily due to bottlenecks in Mexico's domestic pipeline network that constrained low-cost imports from the US. Over half of the 29 spot cargoes for which Comisión Federal de Electricidad (CFE) signed agreements in May 2013 had been delivered through December 2013. New cross-border pipeline capacity – Sonora/Noroeste, Los Ramones I and Los Ramones II – are not expected online unit 2015 and 2016.

Will LNG buyers continue to seek pricing amendments for legacy LNG supply contracts? In contrast to buyer-spearheaded pricing revisions that have become more prevalent in European gas markets, key suppliers of LNG into Asia commanded more favorable pricing terms in 2013. Legacy suppliers PETRONAS and Yemen LNG were both successful in renegotiating the terms of their LNG contracts to better reflect fundamentals in the Asian LNG market.

Will the high activity of portfolio and short-term LNG contracts persist? The level and number of short-term (1-3 year) LNG supply deals jumped following the Fukushima nuclear crisis. Buyers and sellers scrambled to re-allocate existing supply in a tight market. While players with deep flexible-destination supply portfolios continued to sign deals through 2013, the large levels of new greenfield LNG supply on the short-term horizon starting in late 2015 could decrease buyer appetite for these deals.

How will delays in the construction of the Panama Canal impact the LNG market? A dispute over $1.6 billion in cost overruns halted construction for the Panama Canal's expansion in January 2014, threatening the start date for LNG vessels to transit the Panama Canal for the first time. Through February 2014, the Grupo Unidos por el Canal (GUPC) construction consortium and the Panama Canal Authority had yet to reach a resolution. The expansion was previously scheduled to come online in 2015, but construction time missed due to the negotiation deadlock could push back the start date by at least a number of months if not multiple years (depending on its duration). The delay would have the most immediate impact on the Asian marketing prospects for exports from Trinidad and the under-construction projects in the US Gulf of Mexico. The first under-construction US project expected online is Sabine Pass LNG T1 in late 2015. The lack of a Panama Canal passage would increase the voyage distance between Sabine Pass LNG and northeast Asia by approximately 10 days.

Will the DOE or FERC cause more delays to US export projects still in the permitting phase? Although Freeport LNG, Lake Charles LNG and Cove Point LNG overcame a major regulatory hurdle in 2013 by receiving non-FTA approval from the US DOE, all still need approval from FERC, where additional informational requests have created delays for the most advanced projects (Cameron LNG and Freeport LNG). This has pushed back the earliest possible FID in the US to the second half of 2014. Further, as the level of approved exports surpasses the DOE economic impact study's three benchmarks, the agency could begin to slow or even halt its approval pace once again. Both agencies have a major potential to hold back progress; although FERC is currently the biggest bottleneck, will a rethink of the DOE's export allowance ultimately be the more cumbersome issue?

How much spot LNG will China import? A multi-year policy shift away from coal, an expansion of gas infrastructure and an emerging cyclical pattern in gas consumption are accelerating China's LNG demand. With approximately 18.5 MT consumed in 2013 and only 15.4 MT of contracted supply in 2014, coastal Chinese gas markets will look to spot LNG to balance market needs, especially in the winter. Moreover, in June 2013, policy changes lifted city gate gas prices 37% from year-earlier levels, which could justify more costly spot purchases by Chinese LNG buyers. By end-2014, the market is expected to reach almost 38 MT of regasification capacity.

Will price changes in India impact LNG demand? Beginning in April, domestic production will be priced at \$8.4-8.5/mmBtu, or double the current benchmark price. A major increase in production is unlikely to respond very quickly to this new price. As a result, Indian consumers will continue to rely on more expensive LNG (which averaged 33% of total consumption in 2013). New terminals – Kochi and Dabhol – experienced technical difficulties in 2013, but if these are alleviated, India could see more available capacity. Given the uncertainty around future domestic production, Indian buyers have engaged the US for new volumes, but 2014 could see them sign new deals in other regions.

How many reactors will Japan bring online by the end of the year? The lack of clarity in Japanese power sector policy continues to provide significant uncertainty in the global LNG market. Although the current administration has a pro-nuclear stance, local governments must also grant approval and in some areas opposition remains strong. Consequently, further clarification regarding a timeline for reactor restarts has been elusive so far. Furthermore, it is unclear if the current pro-nuclear government stance will persist. Japan has reversed its nuclear stance twice in the past two years: nuclear was set to grow substantially before the crisis, and then after the crisis, Prime Minister Abe's predecessor aimed to phase-out nuclear completely.

PETRONAS FLNG to be commissioned in 2015

How many reactors will South Korea have offline by the end of the year? The discovery of incorrectly certified nuclear components in November 2012 continues to impact the nuclear sector, forcing multiple plants to be taken offline to replace these parts. As of the beginning of January 2014, three nuclear plants were offline for maintenance, down from eight in mid-June 2013. While policy rather than accident continues to dictate changes in the availability of nuclear power generation in Japan since Fukushima, unpredictable technical mishaps continue to frustrate predictions regarding the availability of nuclear generation in South Korea.

Will an East African project reach FID? Although considerable progress has been made on the exploration front and important potential LNG buyers have entered as equity holders, project conceptualization still needs more clarity in both Mozambique and Tanzania. Given the scale of resources and the many political obstacles to overcome, East Africa is unlikely to see an FID in 2014.

How will European re-exports impact the market? Re-exports from underutilized regasification terminals are helping the weak European LNG market create greater value in the global LNG market. While net European LNG imports continued to decline in 2013 due to weak gas demand across the continent and destination-divertible LNG contracts, re-exports from Europe grew by 60% YOY and contributed 4.3 MT of supply to the tight global market. Although volumetrically still a small portion of global LNG trade, European re-exports are not at the margins of supply in Latin America, where they provided 13% of the region's import volume in 2013. This trend is likely to continue in the short term as the market remains tight until Australian projects come online.

Accommodation Camp Sabetta, Yamal LNG

9. References Used in the 2014 Edition

9.1. DATA COLLECTION

Data in the 2014 World LNG Report is sourced from a variety of public and private domains, including the BP Statistical Review of World Energy, Cedigaz, the International Energy Agency (IEA), the US Energy Information Agency (EIA), the US Department of Energy (DOE), GIIGNL, IHS and company reports and announcements. This report should be read in conjunction with the 2013 World LNG Report, available on the IGU website at www.igu.org.

The data and associated comments have been reviewed and verified by IGU.

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PETRONAS, Malaysia
Qatargas, Qatar
Vopak, Netherlands

9.2. DEFINITIONS

Brownfield Liquefaction Project: A land-based LNG project at a site with existing LNG infrastructure, including but not limited to storage tanks, liquefaction facilities and regasification facilities.

Large-Scale vs. Small-Scale LNG: IGU defines the large-scale LNG industry as every LNG business above 1 MTPA of LNG production and/or consumption. Conversely, small-scale LNG is any business under 1 MTPA.

Forecasted Data: Forecasted liquefaction and regasification capacity data only takes into account existing and under construction capacity (criteria being FID taken), and is based on company announced start dates.

Greenfield Liquefaction Project: A land-based LNG project at a site where no previous LNG infrastructure has been developed.

Liquefaction and Regasification Capacity: Unless otherwise noted, liquefaction and regasification capacity throughout the document refers to nominal capacity. It must be noted that re-loading and storage activity can significantly reduce the effective capacity available for regasification.

LNG Carriers: For the purposes of this report, only Q-Series and conventional LNG vessels with a capacity greater than 18,000 cm are considered part of the global fleet discussed in the “LNG Carriers” chapter (Chapter 5). Vessels with a capacity of under 18,000 cm are considered small-scale LNG carriers and are discussed in the Special Report on the “Small-scale LNG Value Chain” (Chapter 7).

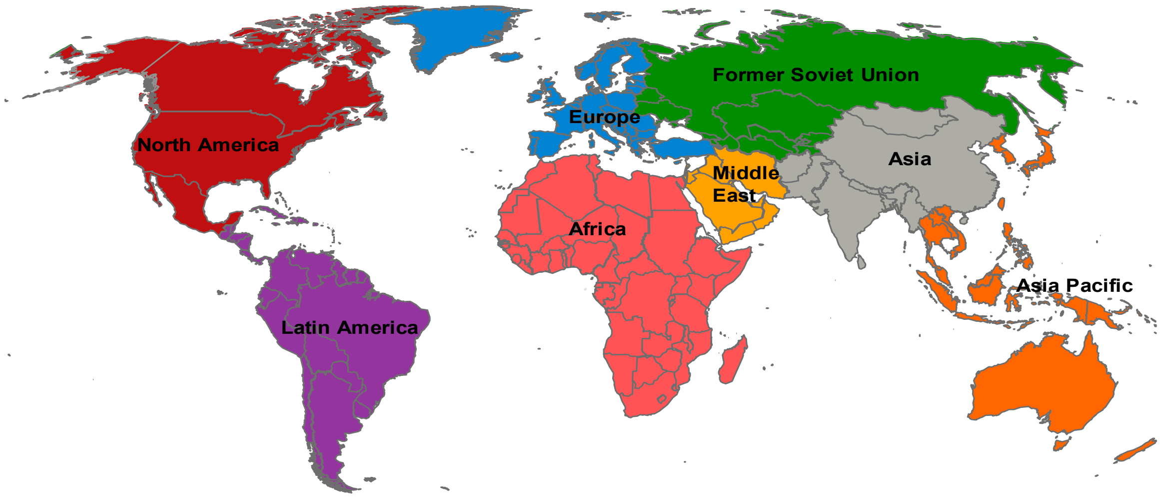
Non Long-Term LNG Market: The non long-term market refers to cargoes not supported by a long-term (5+ years) Sales and Purchase Agreements, cargoes diverted from their original or announced destination, and cargoes over and above take-or-pay commitments (upward flexibility).

Short-Term Charter Rates: Estimated average rate for a 165,000 cm TFDE/DFDE LNG vessel available on a prompt basis.

Traded LNG Volumes: Trade figures are measured according to the volume of LNG imported at the regasification level. Only international trade is taken into account. Domestic LNG trade in Indonesia is thus excluded from the global figures.

9.3. REGIONS AND BASINS

The IGU regions referred to throughout the report are defined as per the colour coded areas in the map below.



The report also refers to three basins: **Atlantic-Mediterranean**, **Pacific** and **Middle East**. While the Atlantic-Mediterranean Basin encompasses all countries that border the Atlantic Ocean or Mediterranean Sea, the Pacific Basin refers to all countries bordering the Pacific Ocean. However, these two categories do not include the following countries, which have been differentiated to compose the Middle East Basin: Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Oman, Qatar, UAE and Yemen. IGU has also taken into account countries with liquefaction or regasification activities in multiple basins and has adjusted basin-level data accordingly.

9.4. ACRONYMS

BOG = Boil Off Gas
boe = barrel of oil equivalent
CAGR = Compound Annual Growth Rate
DFDE = Dual-Fuel Diesel Electric LNG vessel
EU = European Union
FEED = Front-End Engineering and Design
FERC = Federal Energy Regulatory Commission
FID = Final Investment Decision
FTA = Free-Trade Agreement
FSRU = Floating Storage and Regasification Unit
FSU = Former Soviet Union
p.a. = per annum
PNG = Papua New Guinea
SPA = Sales and Purchase Agreement
SSLNG = Small-scale LNG
TFDE = Tri-Fuel Diesel Electric LNG vessel
UAE = United Arab Emirates
UK = United Kingdom
US = United States
US DOE = US Department of Energy
US Lower 48 = United States excluding Alaska and Hawaii
YOY = Year-on-Year

9.5. UNITS

MT = million tonnes
mcm = thousand cubic meters
tcm = trillion cubic meters
MTPA = million tonnes per annum
mmcm = million cubic meters
mmBtu = million British thermal units
cm = cubic meters
bcm = billion cubic meters
tcf = trillion cubic feet

9.6. CONVERSION FACTORS

Multiply by

	Tonnes LNG	cm LNG	cm gas	cf gas	mmBtu	boe
Tonnes LNG		2.222	1,300	45,909	53.38	9.203
cm LNG	0.450		585	20,659	24.02	4.141
cm gas	7.692×10^{4}	0.0017		35.31	0.0411	0.0071
cf gas	2.178×10^{5}	4.8×10^{-5}	0.0283		0.0012	2.005×10^{-4}
mmBtu	0.0187	0.0416	24.36	860.1		0.1724
boe	0.1087	0.2415	141.3	4,989	5.8	

Appendix I: Table of Global Liquefaction Plants

Reference Number	Country	Project Name	Start Year	Nameplate Capacity (MTPA)	Owners*	Liquefaction Technology
1	US	Kenai LNG**	1969	1.5	ConocoPhillips	ConocoPhillips Optimized Cascade®
2	Libya	Marsa El Brega	1970	3.2	LNOC	APC C_3MR
3	Algeria	Skikda - GL1K (T1-4)	1972	1	Sonatrach	Teal (T1-3), PRICO (T4)
4	Brunei	Brunei LNG T1-5	1972	7.2	Government of Brunei, Shell, Mitsubishi	APC C_3MR
5	Indonesia	Bontang LNG T1-2	1977	5.4	Pertamina	APC C_3MR
6	United Arab Emirates	ADGAS LNG T1-2	1977	2.6	ADNOC, Mitsui, BP, TOTAL	APC C_3MR
3	Algeria	Arzew - GL1Z (T1-6)	1978	6.6	Sonatrach	APC C_3MR
5	Indonesia	Arun LNG T1	1978	1.65	Pertamina	APC C_3MR
3	Algeria	Arzew - GL2Z (T1-6)	1981	8.2	Sonatrach	APC C_3MR
3	Algeria	Skikda - GL2K (T5-6)	1981	2.2	Sonatrach	PRICO
5	Indonesia	Bontang LNG T3-4	1983	5.4	Pertamina	APC C_3MR
8	Malaysia	MLNG Satu (T1-3)	1983	8.1	PETRONAS, Mitsubishi, Sarawak State government	APC C_3MR
7	Indonesia	Arun LNG T6	1986	2.5	Pertamina	APC C_3MR
9	Australia	North West Shelf T1	1989	2.5	BHP Billiton, BP, Chevron, Shell, Woodside, Mitsubishi, Mitsui	APC C_3MR
9	Australia	North West Shelf T2	1989	2.5	BHP Billiton, BP, Chevron, Shell, Woodside, Mitsubishi, Mitsui	APC C_3MR
5	Indonesia	Bontang LNG T5	1989	2.9	Pertamina	APC C_3MR
9	Australia	North West Shelf T3	1992	2.5	BHP Billiton, BP, Chevron, Shell, Woodside, Mitsubishi, Mitsui	APC C_3MR
5	Indonesia	Bontang LNG T6	1994	2.9	Pertamina	APC C_3MR
6	United Arab Emirates	ADGAS LNG T3	1994	3.2	ADNOC, Mitsui, BP, TOTAL	APC C_3MR
8	Malaysia	MLNG Dua (T1-3)	1995	7.8	PETRONAS, Shell, Mitsubishi, Sarawak State government	APC C_3MR
10	Qatar	Qatargas I (T1)	1997	3.2	Qatar Petroleum, ExxonMobil, TOTAL,, Marubeni, Mitsui	APC C_3MR
10	Qatar	Qatargas I (T2)	1997	3.2	Qatar Petroleum, ExxonMobil, TOTAL, Marubeni, Mitsui	APC C_3MR
5	Indonesia	Bontang LNG T7	1998	2.7	Pertamina	APC C_3MR
10	Qatar	Qatargas I (T3)	1998	3.1	Qatar Petroleum, ExxonMobil, TOTAL, Mitsui, Marubeni	APC C_3MR
5	Indonesia	Bontang LNG T8	1999	3	Pertamina	APC C_3MR
11	Nigeria	NLNG T1	1999	3.3	NNPC, Shell, TOTAL, Eni	APC C_3MR
10	Qatar	RasGas I (T1)	1999	3.3	Qatar Petroleum, ExxonMobil, KOGAS, Itochu, LNG Japan	APC C_3MR
12	Trinidad	ALNG T1	1999	3.3	BP, BG, Shell, CIC, NGC Trinidad	ConocoPhillips Optimized Cascade®
11	Nigeria	NLNG T2	2000	3.3	NNPC, Shell, TOTAL, Eni	APC C_3MR
13	Oman	Oman LNG T1	2000	3.55	Petroleum Development Oman (PDO), Shell, TOTAL, Korea LNG, Partex, Mitsubishi, Mitsui, Itochu	APC C_3MR
13	Oman	Oman LNG T2	2000	3.55	Petroleum Development Oman (PDO), Shell, TOTAL, Korea LNG, Partex, Mitsubishi, Mitsui, Itochu	APC C_3MR
10	Qatar	RasGas I (T2)	2000	3.3	Qatar Petroleum, ExxonMobil, KOGAS, Itochu, LNG Japan	APC C_3MR
11	Nigeria	NLNG T3	2002	3	NNPC, Shell, TOTAL, Eni	APC C_3MR

12	Trinidad	ALNG T2	2002	3.5	BP, BG, Shell	ConocoPhillips Optimized Cascade®
8	Malaysia	MLNG Tiga (T1-2)	2003	6.8	PETRONAS, Shell, Nippon, Sarawak State government, Mitsubishi	APC C_3MR
12	Trinidad	ALNG T3	2003	3.5	BP, BG, Shell	ConocoPhillips Optimized Cascade®
9	Australia	North West Shelf T4	2004	4.4	BHP Billiton, BP, Chevron, Shell, Woodside, Mitsubishi, Mitsui	APC C_3MR
10	Qatar	RasGas II (T1)	2004	4.7	Qatar Petroleum, ExxonMobil	APC C_3MR/ Split MR™
14	Egypt	ELNG T1**	2005	3.6	BG, PETRONAS, EGAS, EGPC, GDF SUEZ	ConocoPhillips Optimized Cascade®
14	Egypt	ELNG T2**	2005	3.6	BG, PETRONAS, EGAS, EGPC	ConocoPhillips Optimized Cascade®
14	Egypt	SEGAS T1**	2005	5	Gas Natural Fenosa, Eni, EGPC, EGAS	APC C_3MR/ Split MR™
10	Qatar	RasGas II (T2)	2005	4.7	Qatar Petroleum, ExxonMobil	APC C_3MR/ Split MR™
15	Australia	Darwin LNG T1	2006	3.6	ConocoPhillips, Santos, INPEX, Eni, TEPCO, Tokyo Gas	ConocoPhillips Optimized Cascade®
11	Nigeria	NLNG T4	2006	4.1	NNPC, Shell, TOTAL, Eni	APC C_3MR
11	Nigeria	NLNG T5	2006	4.1	NNPC, Shell, TOTAL, Eni	APC C_3MR
10	Oman	Qalhat LNG	2006	3.7	Omani Govt, Petroleum Development Oman (PDO), Shell, Mitsubishi, Gas Natural Fenosa, Eni, Itochu, Osaka Gas, TOTAL, Korea LNG, Mitsui, Partex	APC C_3MR
12	Trinidad	ALNG T4	2006	5.2	BP, BG, Shell, NGC Trinidad	ConocoPhillips Optimized Cascade®
16	Equatorial Guinea	EG LNG T1	2007	3.7	Marathon, Sonagas, Mitsui, Marubeni	ConocoPhillips Optimized Cascade®
17	Norway	Snøhvit LNG T1	2007	4.2	Statoil, Petoro, TOTAL, GDF SUEZ, RWE	Linde MFC
10	Qatar	RasGas II (T3)	2007	4.7	Qatar Petroleum, ExxonMobil	APC C_3MR/ Split MR™
9	Australia	North West Shelf T5	2008	4.4	BHP Billiton, BP, Chevron, Shell, Woodside, Mitsubishi, Mitsui	APC C_3MR
11	Nigeria	NLNG T6	2008	4.1	NNPC, Shell, TOTAL, Eni	APC C_3MR
18	Indonesia	Tangguh LNG T1	2009	3.8	BP, CNOOC, Mitsubishi, INPEX, JOGMEC, JX Nippon Oil & Energy, LNG Japan, Talisman Energy, Kanematsu, Mitsui	APC C_3MR/ Split MR™
18	Indonesia	Tangguh LNG T2	2009	3.8	BP, CNOOC, Mitsubishi, INPEX, JOGMEC, JX Nippon Oil & Energy, LNG Japan, Talisman Energy, Kanematsu, Mitsui	APC C_3MR/ Split MR™
10	Qatar	Qatargas II (T1)	2009	7.8	Qatar Petroleum, ExxonMobil	APC AP-X
10	Qatar	Qatargas II (T2)	2009	7.8	Qatar Petroleum, ExxonMobil, TOTAL	APC AP-X
10	Qatar	RasGas III (T1)	2009	7.8	Qatar Petroleum, ExxonMobil	APC AP-X
19	Russia	Sakhalin 2 (T1)	2009	4.8	Gazprom, Shell, Mitsui, Mitsubishi	Shell DMR
19	Russia	Sakhalin 2 (T2)	2009	4.8	Gazprom, Shell, Mitsui, Mitsubishi	Shell DMR
20	Yemen	Yemen LNG T1	2009	3.35	TOTAL, Hunt Oil, Yemen Gas Co., SK Corp, KOGAS, GASSP, Hyundai	APC C_3MR/ Split MR™
8	Malaysia	MLNG Dua Debottleneck	2010	1.2	PETRONAS, Shell, Mitsubishi, Sarawak State government	APC C_3MR
21	Peru	Peru LNG	2010	4.45	Hunt Oil, Shell, SK Corp, Marubeni	APC C_3MR/ Split MR™
10	Qatar	Qatargas III	2010	7.8	Qatar Petroleum, ConocoPhillips, Mitsui	APC AP-X
10	Qatar	RasGas III (T2)	2010	7.8	Qatar Petroleum, ExxonMobil	APC AP-X
20	Yemen	Yemen LNG T2	2010	3.35	TOTAL, Hunt Oil, Yemen Gas Co., SK Corp, KOGAS, GASSP, Hyundai	APC C_3MR/ Split MR™
10	Qatar	Qatargas IV	2011	7.8	Qatar Petroleum, Shell	APC AP-X
22	Australia	Pluto LNG T1	2012	4.3	Woodside, Kansai Electric, Tokyo Gas	Shell propane pre-cooled mixed refrigerant design

2	Algeria	Skikda - GL1K Rebuild**	2013	4.5	Sonatrach	APC C_3MR
23	Angola	Angola LNG T1	2013	5.2	Chevron, Sonangol, BP, Eni, TOTAL	ConocoPhillips Optimized Cascade®

Sources: IHS, Company Announcements

** Companies are listed by size of ownership stake, starting with the largest stake*

*** Though Kenai LNG is temporarily shut-down, the DOE renewed its FTA export license in February 2014. Non-FTA approval is expected soon with the project back online in the second half of 2014.*

**** SEGAS LNG and Egyptian LNG were temporarily shutdown in late 2012 and early 2014, respectively. The Marsa El Brega plant in Libya is also included for reference, although the plant has not been operational since 2011.*

APPENDIX II: Table of Liquefaction Plants Under Construction

Country	Project Name	Start Year	Nameplate Capacity (MTPA)	Owners*
Algeria	Arzew - GL3Z (Gassi Touil)	2014	4.7	Sonatrach
Papua New Guinea	PNG LNG T1	2014	3.5	ExxonMobil, Oil Search, Govt. of PNG, Santos, Nippon Oil, PNG Landowners (MRDC), Marubeni, Petromin PNG
Papua New Guinea	PNG LNG T2	2014	3.5	ExxonMobil, Oil Search, Govt. of PNG, Santos, JX Nippon Oil & Energy, MRDC, Marubeni, Petromin PNG
Australia	Queensland Curtis LNG T1	2014	4.3	BG, CNOOC
Australia	Queensland Curtis LNG T2	2015	4.3	BG, Tokyo Gas
Colombia	Pacific Rubiales	2015	0.5	Exmar
Indonesia	Donggi-Senoro LNG	2015	2	Mitsubishi, Pertamina, KOGAS, Medco
Malaysia	PETRONAS LNG 9	2015	3.6	PETRONAS
Australia	Australia Pacific LNG T1	2015	4.5	ConocoPhillips, Origin Energy, Sinopec
Australia	Australia Pacific LNG T2	2015	4.5	ConocoPhillips, Origin Energy, Sinopec
Australia	Gladstone LNG T1	2015	3.9	Santos, PETRONAS, TOTAL, KOGAS
Malaysia	PETRONAS FLNG	2015	1.2	PETRONAS
US	Sabine Pass T1	2015	4.5	Cheniere
Australia	Gorgon LNG T1	2015	5.2	Chevron, ExxonMobil, Shell, Osaka Gas, Tokyo Gas, Chubu Electric
Australia	Gorgon LNG T2	2015	5.2	Chevron, ExxonMobil, Shell, Osaka Gas, Tokyo Gas, Chubu Electric
Australia	Gorgon LNG T3	2016	5.2	Chevron, ExxonMobil, Shell, Osaka Gas, Tokyo Gas, Chubu Electric
Australia	Gladstone LNG T2	2016	3.9	Santos, PETRONAS, TOTAL, KOGAS
Australia	Wheatstone LNG T1	2016	4.5	Chevron, Apache, Pan Pacific Energy, KUFPEC, Shell, Kyushu Electric
US	Sabine Pass T2	2016	4.5	Cheniere
US	Sabine Pass T3	2016	4.5	Cheniere
Australia	Prelude LNG (Floating)	2016	3.6	Shell, INPEX, KOGAS, CPC
Australia	Ichthys LNG T1	2016	4.2	INPEX, TOTAL, Tokyo Gas, CPC, Osaka Gas, Chubu Electric, Toho Gas
US	Sabine Pass T4	2017	4.5	Cheniere
Australia	Wheatstone LNG T2	2017	4.5	Chevron, Apache, Pan Pacific Energy, KUFPEC, Shell, Kyushu Electric
Australia	Ichthys LNG T2	2017	4.2	INPEX, TOTAL, Tokyo Gas, CPC, Osaka Gas, Chubu Electric, Toho Gas
Russia	Yamal LNG T1	2017	5.5	Novatek, TOTAL, CNPC
Russia	Yamal LNG T2	2018	5.5	Novatek, TOTAL, CNPC
Malaysia	Rotan FLNG	2018	1.5	PETRONAS, MISC, Murphy Oil
Russia	Yamal LNG T3	2019	5.5	Novatek, TOTAL, CNPC

Sources: IHS, Company Announcements

** Companies are listed by size of ownership stake, starting with the largest stake.*

APPENDIX III: Table of LNG Receiving Terminals

Reference Number	Country	Terminal Name	Start Year	Nameplate Receiving Capacity (MTPA)	Owners*	Concept
1	Spain	Barcelona	1969	12.4	ENAGAS 100%	Onshore
2	Japan	Negishi	1969	12	TEPCO 50%; Tokyo Gas 50%	Onshore
3	US	Everett	1971	5.4	GDF SUEZ 100%	Onshore
4	Italy	Panigaglia (La Spezia)	1971	2.5	Eni 100%	Onshore
5	France	Fos Tonkin	1972	4	GDF SUEZ 100%	Onshore
6	Japan	Senboku	1972	15.3	Osaka Gas 100%	Onshore
7	Japan	Sodegaura	1973	29.4	TEPCO 50%; Tokyo Gas 50%	Onshore
8	Japan	Chita LNG Joint/ Chita Kyodo	1977	8	Chubu Electric 50%; Toho Gas 50%	Onshore
9	Japan	Tobata	1977	6.8	Kitakyushu LNG 100%	Onshore
10	US	Cove Point	1978	11	Dominion 100%	Onshore
11	US	Elba Island	1978	12.4	Kinder Morgan 100%	Onshore
12	Japan	Himeji	1979	13.3	Osaka Gas 100%	Onshore
13	France	Montoir-de-Bretagne	1980	7.3	GDF SUEZ 100%	Onshore
14	US	Lake Charles	1982	17.3	Southern Union 75%; AIG Highstar (Private Equity) 25%	Onshore
15	Japan	Chita	1983	12	Chubu Electric 50%; Toho Gas 50%	Onshore
16	Japan	Higashi-Ohgishima	1984	14.7	TEPCO 100%	Onshore
17	Japan	Nihonkai (Niigata)	1984	8.9	Nihonkai LNG 58.1%; Tohoku Electric 41.9%	Onshore
18	Japan	Futtsu	1985	16	TEPCO 100%	Onshore
19	Korea	Pyeong-Taek	1986	34.5	KOGAS 100%	Onshore
20	Japan	Yokkaichi LNG Works	1987	7.1	Chubu Electric 100%	Onshore
21	Belgium	Zeebrugge	1987	6.6	Publigas 89.97%; Fluxys 10.03%	Onshore
22	Spain	Huelva	1988	8.4	ENAGAS 100%	Onshore
23	Spain	Cartagena	1989	7.6	ENAGAS 100%	Onshore
24	Japan	Oita	1990	5.1	Kyushu Electric 100%	Onshore
25	Japan	Yanai	1990	2.4	Chugoku Electric 100%	Onshore
26	Taiwan	Yong an (Kaohsiung)	1990	10	CPC 100%	Onshore
27	Turkey	Marmara Ereglisi	1994	4.4	Botas 100%	Onshore
28	Korea	Incheon	1996	38	KOGAS 100%	Onshore
29	Japan	Sodeshi/Shimizu LNG	1996	1.6	Shizuoka Gas 65%; TonenGeneral 35%	Onshore
30	Japan	Kawagoe	1997	7.7	Chubu Electric 100%	Onshore
31	Japan	Ohgishima	1998	6.7	Tokyo Gas 100%	Onshore
32	Puerto Rico	Peñuelas (EcoElectrica)	2000	1.2	Gas Natural Fenosa 47.5%; International Power 25%; Mitsui 25%; GE Capital 2.5%	Onshore
33	Greece	Revithoussa	2000	3.3	DEPA 100%	Onshore
34	Japan	Chita Midorihama Works	2001	8.3	Toho Gas 100%	Onshore
35	Korea	Tong-Yeong	2002	17	KOGAS 100%	Onshore
36	Dominican Republic	AES Andrés	2003	1.7	AES 100%	Onshore
37	Spain	Bilbao (BBG)	2003	5.1	ENAGAS 40%; EVE 30%; RREEF Infrastructure 30%	Onshore
38	India	Dahej LNG	2004	10	Petronet LNG 100%	Onshore
39	Portugal	Sines LNG	2004	5.8	REN 100%	Onshore
40	UK	Grain LNG	2005	15	National Grid Transco 100%	Onshore
41	Korea	Gwangyang	2005	1.8	Posco 100%	Onshore
42	India	Hazira LNG	2005	5	Shell 74%; TOTAL 26%	Onshore

43	Japan	Sakai	2005	2	Kansai Electric 70%; Cosmo Oil 12.5%; Iwatani 12.5%; Ube Industries 5%	Onshore
44	Turkey	Aliaga LNG	2006	4.4	Egegaz 100%	Onshore
45	Mexico	Altamira LNG	2006	5.4	Vopak 60%; ENAGAS 40%	Onshore
46	China	Guangdong Dapeng LNG	2006	6.7	Local companies 37%; CNOOC 33%; BP 30%	Onshore
47	Japan	Mizushima LNG	2006	1.7	Chugoku Electric 50%; JX Nippon Oil & Energy 50%	Onshore
48	Spain	Saggas (Sagunto)	2006	6.9	RREEF Infrastructure 30%; Eni 21.25%; Gas Natural Fenosa 21.25%; Osaka Gas 20%; Oman Oil 7.5%	Onshore
49	Spain	Mugardos LNG (El Ferrol)	2007	2.6	Grupo Tojeiro 36.5%; Gas Natural Fenosa 21%; Comunidad Autonoma de Galicia 17.5%; Other Companies 15%; Sonatrach 10%	Onshore
50	UK	Teesside GasPort	2007	3	Excelerate Energy 100%	FSRU
51	Mexico	Costa Azul	2008	7.5	Sempra 100%	Onshore
52	US	Freeport LNG	2008	11.3	Michael S Smith Cos 45%; ZHA FLNG Purchaser 30%; Dow Chemical 15%; Osaka Gas 10%	Onshore
53	China	Fujian LNG	2008	5	CNOOC 60%; Fujian Investment and Development Co 40%	Onshore
54	US	Northeast Gateway	2008	3	Excelerate Energy 100%	FSRU
55	US	Sabine Pass	2008	30.2	Cheniere Energy 100%	Onshore
56	Argentina	Bahia Blanca GasPort	2008	3.8	YPF 100%	FSRU
57	Italy	Adriatic LNG/Rovigo	2009	5.8	ExxonMobil 46.35%; Qatar Petroleum 46.35%; Edison 7.3%	Offshore
58	US	Cameron LNG	2009	11.3	Sempra 50.2%; GDF SUEZ 16.6%; Mitsubishi 16.6%; Mitsui 16.6%	Onshore
59	Canada	Canaport	2009	7.5	Repsol 75%; Irving Oil 25%	Onshore
60	UK	Dragon LNG	2009	4.4	BG Group 50%; PETRONAS 30%; 4Gas 20%	Onshore
61	Kuwait	Mina Al-Ahmadi GasPort	2009	3.8	Kuwait Petroleum Corporation 100%	FSRU
62	Brazil	Pecém	2009	1.9	Petrobras 100%	FSRU
63	Chile	Quintero LNG	2009	2.7	ENAGAS 20.4%; ENAP 20%; ENDESA 20%; Metrogas 20%; Oman Oil 19.6%	Onshore
64	China	Shanghai LNG/Yangshan	2009	3	Shenergy Group 55%; CNOOC 45%	Onshore
65	UK	South Hook	2009	15.6	Qatar Petroleum 67.5%; ExxonMobil 24.15%; TOTAL 8.35%	Onshore
66	Taiwan	Taichung LNG	2009	3	CPC 100%	Onshore
67	UAE	Dubai	2010	3	Dubai Supply Authority (Dusup) 100%	FSRU
68	France	FosMax LNG (Fos Cavaou)	2010	6	GDF SUEZ 71.97%; TOTAL 28.03%	Onshore
69	Chile	Mejillones LNG	2010	1.5	GDF SUEZ 63%; Codelco 37%	FSRU
70	US	Neptune LNG	2010	3	GDF SUEZ 100%	FSRU
71	China	Dalian	2011	3	PetroChina 75%; Dalian Port 20%; Dalian Construction Investment Corp 5%	Onshore
72	Netherlands	GATE LNG	2011	8.8	Gasunie 40%; Vopak 40%; Dong 5%; EconGas OMV 5%; EON 5%; RWE 5%	Onshore
73	US	Golden Pass	2011	15.6	Qatar Petroleum 70%; ExxonMobil 17.6%; ConocoPhillips 12.4%	Onshore
74	US	Gulf LNG	2011	11.3	Kinder Morgan 50%; GE Energy	Onshore

					Financial Services 30%; Sonangol 20%	
75	Argentina	Puerto Escobar	2011	3.8	Enarsa 100%	FSRU
76	Thailand	Rayong (Map Ta Phut)	2011	5	PTT 50%; Electricity Generating Authority of Thailand (EGAT) 25%; Electricity Generating Company 25%	Onshore
77	China	Rudong/Jiangsu LNG	2011	3.5	PetroChina 55%; Pacific Oil and Gas 35%; Jiangsu Guoxin 10%	Onshore
78	Brazil	Guanabara LNG/Rio de Janeiro	2012	3.8	Petrobras 100%	FSRU
79	Indonesia	Nusantara	2012	3.8	Pertamina 60%; PGN 40%	FSRU
80	Japan	Ishikari LNG	2012	1.4	Hokkaido Gas 100%	Onshore
81	Japan	Joetsu	2012	2.3	Chubu Electric 100%	Onshore
82	Mexico	Manzanillo	2012	3.8	Mitsui 37.5%; Samsung 37.5%; KOGAS 25%	Onshore
83	China	Dongguan	2012	1	Jovo Group 100%	Onshore
84	Israel	Hadera Gateway	2013	1.8	Israel Natural Gas Lines 100%	FSRU
85	India	Dabhol	2013	2	GAIL 31.52%; NTPC 31.52%; Indian financial institutions 20.28%; MSEB Holding Co. 16.68%	Onshore
86	Singapore	Jurong Island LNG	2013	3.5	Singapore Energy Market Authority 100%	Onshore
87	Malaysia	Lekas LNG (Malacca)	2013	3.8	PETRONAS 100%	Onshore
88	China	Ningbo, Zhejiang	2013	3	CNOOC 51%; Zhejiang Energy Group Co Ltd 29%; Ningbo Power Development Co Ltd 20%	Onshore
89	China	Zhuhai (CNOOC)	2013	3.5	CNOOC 30%; Guangdong Gas 25%; Guangdong Yuedian 25%; Local companies 20%	Onshore
90	Italy	Livorno/LNG Toscana	2013	2.7	EON 46.79%; IREN 46.79%; OLT Energy 3.73%; Golar 2.69%	FSRU
91	China	Tangshan (Caofeidian) LNG	2013	3.5	PetroChina 100%	Onshore
92	China	Tianjin (OS)	2013	2.2	CNOOC 100%	FSRU
93	Brazil	Bahia/TRBA (OS)	2013	3.8	Petrobras 100%	FSRU
94	India	Kochi LNG	2013	2.5	Petronet LNG 100%	Onshore

Sources: IHS, Company Announcements

** Companies are listed by size of ownership stake, starting with the largest stake.*

APPENDIX IV: Table of LNG Receiving Terminals Under Construction

Reference Number	Country	Terminal or Phase Name	Start Year	Nameplate Receiving Capacity (MTPA)	Owners*	Concept
95	Spain	El Musel (Gijon)**	N/A	1.7	ENAGAS	Onshore
96	Spain	Bilbao (Expansion)	2014	3	ENAGAS 40%; EVE 30%; RREEF Infrastructure 30%	Onshore
97	India	Dahej LNG (Second Expansion Phase 1)	2014	2.5	Petronet LNG 100%	Onshore
98	Chile	Quintero LNG (Expansion)	2014	1	ENAGAS 20.4%; ENAP 20%; ENDESA 20%; Metrogas 20%; Oman Oil 19.6%	Onshore
99	Chile	Mejillones LNG (Phase 2)	2014	1.5	GDF SUEZ 63%; Codelco 37%	Onshore
100	Brazil	Guanabara LNG/Rio de Janeiro Expansion	2014	6	Petrobras 100%	FSRU
101	Singapore	Jurong Island LNG Phase 2	2014	2.5	Singapore Energy Market Authority	Onshore

					100%	
102	Indonesia	Arun LNG	2014	3	Pertamina 70%; Other Companies 30%	FSRU
103	Japan	Hibiki LNG	2014	3.5	Saibu Gas 90%; Kyushu Electric 10%	Onshore
104	Indonesia	Lampung LNG (OS)	2014	2	PGN 100%	FSRU
105	Japan	Naoetsu	2014	1.5	INPEX 100%	Onshore
106	China	Hainan LNG	2014	2	CNOOC 65%; Hainan Development Holding Co 35%	Onshore
107	Lithuania	Klaipeda LNG	2014	2.2	Klaipedos Nafta 100%	FSRU
108	China	Qingdao	2014	3	Sinopec 100%	Onshore
109	India	Kochi LNG Phase 2	2015	2.5	Petronet LNG 100%	Onshore
110	France	Dunkirk LNG	2015	10	EDF 65%; Fluxys 25%; TOTAL 10%	Onshore
111	Japan	Hachinohe LNG	2015	1.5	JX Nippon Oil & Energy 100%	Onshore
112	Jordan	Jordan LNG (OS)	2015	4	Jordan Ministry of Energy and Mineral Resources 100%	FSRU
113	Japan	Kushiro LNG	2015	0.5	JX Nippon Oil & Energy 100%	Onshore
114	Colombia	Pacific Rubiales LNG	2015	N/A	Exmar 100%	FSRU
115	Korea	Samcheok	2015	6.8	KOGAS 100%	Onshore
116	Poland	Swinoujscie	2015	4	GAZ-SYSTEM SA 100%	Onshore
117	China	Beihai, Guangxi LNG	2015	3	Sinopec 100%	Onshore
118	China	Shenzhen (Diefu)	2015	4	CNOOC 70%; Shenzhen Energy Group 30%	Onshore
119	Japan	Hitachi	2016	N/A	Tokyo Gas 100%	Onshore
120	Korea	Boryeong	2016	2	GS Caltex 50%; SK Energy 50%	Onshore

Sources: IHS, Company Announcements

** Companies are listed by size of ownership stake, starting with the largest stake.*
*** Construction on ENAGAS' El Musel terminal in Gijon was completed in 2013. However, the terminal was immediately mothballed.*

APPENDIX V: Table of LNG Fleet

Ship Name	Shipowner	Shipbuilder	Type	Delivery Year	Capacity (cm)
SCF Arctic	Sovcomflot	Kockums	Conventional	1969	71,500
SCF Polar	Sovcomflot	Kockums	Conventional	1969	71,500
Bebatik	Brunei Shell Tankers	Chantiers de l'Atlantique	Conventional	1972	75,056
Bilis	Brunei Shell Tankers	CNIM	Conventional	1975	77,731
Belanak	Brunei Shell Tankers	CNIM	Conventional	1975	75,000
Bubuk	Brunei Shell Tankers	CNIM	Conventional	1975	77,670
Hilli	Golar LNG	Moss Stavanger	Conventional	1975	125,000
Mostefa Ben Boulaid	Hyproc S.C.	La Ciotat	Conventional	1976	126,130
Gimi	Golar LNG	Moss Stavanger	Conventional	1976	125,000
LNG Lagos	Bonny Gas Transport	Chantiers de l'Atlantique	Conventional	1976	126,400
Larbi Ben M'Hidi	Hyproc S.C.	La Seyne	Conventional	1977	129,700
LNG Aquarius	MOL	GD Quincy	Conventional	1977	126,300
LNG Port Harcourt	Bonny Gas Transport	Chantiers de l'Atlantique	Conventional	1977	122,000
Gandria	Golar LNG	HDW	Conventional	1977	125,800
LNG Aries	MOL	GD Quincy	Conventional	1977	137,500
LNG Capricorn	MOL	GD Quincy	Conventional	1978	141,000
LNG Gemini	General Dynamics	GD Quincy	Conventional	1978	126,300
Methania	Distrigas	Boelwerf	Conventional	1978	125,260
LNG Leo	General Dynamics	GD Quincy	Conventional	1978	126,400
Bachir Chihani	Hyproc S.C.	La Seyne	Conventional	1979	129,767

LNG Libra	Hoegh LNG	GD Quincy	Conventional	1979	126,400
Matthew	GDF SUEZ	Newport News	Conventional	1979	126,540
LNG Taurus	Burmah Gas Transport	GD Quincy	Conventional	1979	127,547
LNG Virgo	General Dynamics	GD Quincy	Conventional	1979	138,000
LNG Edo	Bonny Gas Transport	GD Quincy	Conventional	1980	126,530
Mourad Didouche	Hyproc S.C.	Chantiers de l'Atlantique	Conventional	1980	126,000
LNG Abuja	Bonny Gas Transport	GD Quincy	Conventional	1980	141,000
Ramdane Abane	Hyproc S.C.	Chantiers de l'Atlantique	Conventional	1981	126,000
Tenaga Dua	MISC	Chantiers de l'Atlantique	Conventional	1981	130,000
Tenaga Lima	MISC	La Seyne	Conventional	1981	130,000
LNG Bonny	Bonny Gas Transport	Kockums	Conventional	1981	149,600
Tenaga Tiga	MISC	Chantiers de l'Atlantique	Conventional	1981	130,000
Echigo Maru	J3 Consortium	Mitsubishi Nagasaki	Conventional	1983	129,299
WilEnergy	Awilco	Mitsubishi HI	Conventional	1983	125,542
WilPower	Awilco	Kawasaki Sakaide	Conventional	1983	125,000
Koto	BW Gas	Kawasaki Sakaide	Conventional	1984	125,199
LNG Finima	Bonny Gas Transport	Kockums	Conventional	1984	127,705
Senshu Maru	J3 Consortium	Mitsui Chiba	Conventional	1984	138,000
WilGas	Awilco	Mitsubishi HI	Conventional	1984	136,026
Wakaba Maru	J3 Consortium	Mitsui Chiba	Conventional	1985	127,125
Northwest Sanderling	NWSSSC	Mitsubishi Nagasaki	Conventional	1989	127,452
LNG Swift	NWSSSC	Mitsubishi Nagasaki	Conventional	1989	127,215
Northwest Swallow	NWSSSC	Mitsui Chiba	Conventional	1989	138,000
Ekaputra	Competco Shipping	Mitsubishi HI	Conventional	1989	145,000
Northwest Snipe	NWSSSC	Mitsui Chiba	Conventional	1990	127,000
Northwest Shearwater	NWSSSC	Kawasaki Sakaide	Conventional	1991	127,500
Northwest Seaeagle	NWSSSC	Mitsubishi Nagasaki	Conventional	1992	127,541
Arctic Spirit	Teekay LNG	IHI Chita	Conventional	1993	89,089
Polar Spirit	Teekay LNG	IHI Kure	Conventional	1993	90,000
Northwest Sandpiper	NWSSSC	Mitsui Chiba	Conventional	1993	127,000
LNG Flora	Osaka Gas/J3 Consortium	Kawasaki Sakaide	Conventional	1993	125,095
Aman Bintulu	Asia LNG Transport Dua	NKK Tsu	Conventional	1993	18,928
Dwiputra	Humpuss Intermoda Transportasi	Mitsubishi HI	Conventional	1994	125,568
Al Khaznah	NGSCO	Mitsui Chiba	Conventional	1994	137,500
Hyundai Utopia	Hyundai Merchant Marine	Hyundai	Conventional	1994	125,000
LNG Vesta	Osaka Gas/Tokyo Gas Consortium	Mitsubishi Nagasaki	Conventional	1994	125,095
Puteri Intan	MISC	Chantiers de l'Atlantique	Conventional	1994	130,000
Shahamah	NGSCO	Kawasaki Sakaide	Conventional	1994	137,500
Northwest Stormpetrel	NWSSSC	Mitsubishi Nagasaki	Conventional	1994	125,525
YK Sovereign	SK Shipping	Hyundai	Conventional	1994	127,125
Puteri Delima	MISC	Chantiers de l'Atlantique	Conventional	1995	130,000
Ghasha	NGSCO	Mitsui Chiba	Conventional	1995	137,500
Puteri Nilam	MISC	Chantiers de l'Atlantique	Conventional	1995	130,000
Hanjin Pyeong Taek	Hanjin Shipping	Hanjin	Conventional	1995	138,214
Ish	NGSCO	Mitsubishi Nagasaki	Conventional	1995	138,017
Mubaraz	NGSCO	Kvaerner-Masa	Conventional	1996	137,000
Surya Aki	MCGC International	Kawasaki Sakaide	Conventional	1996	23,096
Puteri Zamrud	MISC	Chantiers de l'Atlantique	Conventional	1996	130,000
Mraweh	NGSCO	Kvaerner-Masa	Conventional	1996	137,000

LNG Portovenere	Eni	Sestri	Conventional	1996	65,262
Puteri Firus	MISC	Chantiers de l'Atlantique	Conventional	1996	130,000
Hyundai Greenpia	Hyundai Merchant Marine	Hyundai	Conventional	1996	125,000
Al Khor	J4 Consortium	Mitsubishi Nagasaki	Conventional	1996	137,050
Al Zubarah	MOL	Mitsui Chiba	Conventional	1996	137,050
Al Hamra	NGSCO	Kvaerner-Masa	Conventional	1997	137,000
Al Rayyan	K Line	Kawasaki Sakaide	Conventional	1997	137,050
Aman Sendai	Asia LNG Transport Dua	NKK Tsu	Conventional	1997	18,928
Umm Al Ashtan	NGSCO	Kvaerner-Masa	Conventional	1997	145,000
Al Wajbah	MOL	Mitsubishi Nagasaki	Conventional	1997	137,050
LNG Lerici	Eni	Sestri	Conventional	1998	65,000
Broog	K Line	Mitsui Chiba	Conventional	1998	137,050
Aman Hakata	Asia LNG Transport Dua	NKK Tsu	Conventional	1998	18,928
Al Wakrah	MOL	Kawasaki Sakaide	Conventional	1998	137,050
Zekreet	J4 Consortium	Mitsui Chiba	Conventional	1998	135,420
Doha	K Line	Mitsubishi HI	Conventional	1999	137,050
Hanjin Muscat	Hanjin Shipping	Hanjin	Conventional	1999	130,600
Hyundai Technopia	Hyundai Merchant Marine	Hyundai	Conventional	1999	135,000
SK Summit	SK Shipping	Daewoo	Conventional	1999	135,244
Al Bidda	MOL	Kawasaki Sakaide	Conventional	1999	137,050
Golar Mazo	Golar LNG	Mitsubishi Nagasaki	Conventional	2000	135,000
Hanjin Sur	Hanjin Shipping	Hanjin	Conventional	2000	126,227
Hyundai Cosmopia	Hyundai Merchant Marine	Hyundai	Conventional	2000	135,000
K Acacia	Korea Line	Daewoo	Conventional	2000	135,256
SK Supreme	SK Shipping	Samsung	Conventional	2000	135,490
Hyundai Aquapia	Hyundai Merchant Marine	Hyundai	Conventional	2000	138,000
SK Splendor	SK Shipping	Samsung	Conventional	2000	135,603
K Freesia	Korea Line	Daewoo	Conventional	2000	145,700
Al Jasra	J4 Consortium	Mitsubishi Nagasaki	Conventional	2000	137,050
Hanjin Ras Laffan	Hanjin Shipping	Hanjin	Conventional	2000	138,333
Hyundai Oceanpia	Hyundai Merchant Marine	Hyundai	Conventional	2000	138,000
LNG Jamal	Osaka Gas/J3 Consortium	Mitsubishi Nagasaki	Conventional	2000	148,565
Surya Satsuma	MCGC International	NKK Tsu	Conventional	2000	19,474
SK Stellar	SK Shipping	Samsung	Conventional	2000	135,540
Sohar LNG	Oman SC/MOL	Mitsubishi Nagasaki	Conventional	2001	138,000
Puteri Delima Satu	MISC	Mitsui Chiba	Conventional	2002	137,000
Abadi	Brunei Gas Carriers	Mitsubishi Nagasaki	Conventional	2002	137,106
LNG Rivers	Bonny Gas Transport	Hyundai	Conventional	2002	137,231
LNG Sokoto	Bonny Gas Transport	Hyundai	Conventional	2002	126,300
Hispania Spirit	Teekay LNG	Daewoo	Conventional	2002	140,500
Excalibur	Exmar/Teekay	Daewoo	Conventional	2002	138,106
Galea	Shell Shipping	Mitsubishi Nagasaki	Conventional	2002	126,538
British Trader	BP Shipping	Samsung	Conventional	2002	138,000
Puteri Intan Satu	MISC	Mitsubishi Nagasaki	Conventional	2002	137,100
BW Suez Boston	BW Gas/GDF Suez	Daewoo	Conventional	2003	138,059
LNG Bayelsa	Bonny Gas Transport	Hyundai	Conventional	2003	145,952
British Innovator	BP Shipping	Samsung	Conventional	2003	138,200
Catalunya Spirit	Teekay LNG	IZAR Sestao	Conventional	2003	138,000
Gallina	Shell Shipping	Mitsubishi Nagasaki	Conventional	2003	153,500
BW Suez Everett	BW Gas	Daewoo	Conventional	2003	138,028
British Merchant	BP Shipping	Samsung	Conventional	2003	138,000

Methane Princess	Golar LNG	Daewoo	Conventional	2003	137,990
Energy Frontier	Tokyo LNG Tankers	Kawasaki Sakaide	Conventional	2003	144,795
Excel	Exmar/MOL	Daewoo	Conventional	2003	138,000
Pacific Notus	Pacific LNG Shipping	Mitsubishi Nagasaki	Conventional	2003	137,000
Puteri Nilam Satu	MISC	Mitsubishi Nagasaki	Conventional	2003	137,000
SK Sunrise	I.S. Carriers	Samsung	Conventional	2003	138,200
Castillo de Villalba	Empresa Naviera Elcano	IZAR Puerto Real	Conventional	2003	138,000
Golar Arctic	Golar LNG	Daewoo	Conventional	2003	147,200
Bilbao Knutsen	Knutsen/Marpetrol	IZAR Sestao	Conventional	2004	138,000
Fuwairit	Camartine Shipping	Samsung	Conventional	2004	134,425
Madrid Spirit	Teekay LNG	IZAR Puerto Real	Conventional	2004	138,000
Puteri Zamrud Satu	MISC	Mitsui Chiba	Conventional	2004	137,000
Disha	India LNG Transport	Daewoo	Conventional	2004	137,354
Gemmata	Shell Shipping	Mitsubishi Nagasaki	Conventional	2004	137,514
Milaha Ras Laffan	Nakilat	Samsung	Conventional	2004	138,200
Northwest Swan	NWSSSC	Daewoo	Conventional	2004	137,000
Fuji LNG	Cardiff Marine	Kawasaki Sakaide	Conventional	2004	145,000
Puteri Firus Satu	MISC	Chantiers de l'Atlantique	Conventional	2004	130,000
Cadiz Knutsen	Knutsen/Marpetrol	IZAR Puerto Real	Conventional	2004	138,826
Methane Kari Elin	BG Group	Samsung	Conventional	2004	138,200
Berge Arzew	BW Gas/Hyproc S.C.	Daewoo	Conventional	2004	138,089
Galicia Spirit	Teekay LNG	Daewoo	Conventional	2004	140,500
LNG Akwa Ibom	Bonny Gas Transport	Hyundai	Conventional	2004	126,300
LNG River Orashi	BW Gas/Marubeni	Daewoo	Conventional	2004	145,914
GDF SUEZ Global Energy	GDF SUEZ	Chantiers de l'Atlantique	Conventional	2004	74,000
Lalla Fatma N'Soumer	Algerian Nippon Gas TC	Kawasaki Sakaide	Conventional	2004	145,000
Raahi	India LNG Transport	Daewoo	Conventional	2004	126,130
Golar Viking	Golar LNG	Hyundai	Conventional	2005	140,000
Energy Advance	Tokyo LNG Tankers	Kawasaki Sakaide	Conventional	2005	144,795
Puteri Mutiara Satu	MISC	Mitsui Chiba	Conventional	2005	137,000
Lusail	Peninsula LNG	Samsung	Conventional	2005	138,000
LNG Adamawa	Bonny Gas Transport	Hyundai	Conventional	2005	141,000
Rasgas Asclepius	Maran Gas Maritime/Nakilat	Daewoo	Conventional	2005	145,700
LNG Pioneer	MOL	Daewoo	Conventional	2005	122,000
Al Thakhira	K Line	Samsung	Conventional	2005	145,000
LNG Cross River	Bonny Gas Transport	Hyundai	Conventional	2005	126,540
LNG Enugu	BW Gas/Marubeni	Daewoo	Conventional	2005	145,926
Seri Alam	MISC	Samsung	Conventional	2005	145,000
Umm Bab	Maran Gas Maritime/Nakilat	Daewoo	Conventional	2005	145,000
Al Deebel	Peninsula LNG	Samsung	Conventional	2005	145,000
LNG Oyo	BW Gas/Marubeni	Daewoo	Conventional	2005	145,842
Nizwah LNG	Oryx LNG Carriers	Kawasaki Sakaide	Conventional	2005	145,000
Salalah LNG	Oman SC	Samsung	Conventional	2005	145,000
Arctic Discoverer	Northern LNG Transport	Mitsui Chiba	Conventional	2006	140,000
Arctic Princess	Hoegh LNG/MOL	Mitsubishi Nagasaki	Conventional	2006	147,200
Golar Grand	Golar LNG	Daewoo	Conventional	2006	145,700
Ejnan	Peninsula LNG/Nakilat	Samsung	Conventional	2006	136,400
LNG Benue	BW Gas/Marubeni	Daewoo	Conventional	2006	145,952
Methane Rita Andrea	BG Group	Samsung	Conventional	2006	145,127

Pacific Eurus	LNG Marine Transport	Mitsubishi Nagasaki	Conventional	2006	137,006
Seri Amanah	MISC	Samsung	Conventional	2006	145,000
Arctic Voyager	K Line	Kawasaki Sakaide	Conventional	2006	140,000
Milaha Qatar	Nakilat	Samsung	Conventional	2006	145,130
Arctic Lady	Hoegh LNG	Mitsubishi Nagasaki	Conventional	2006	147,200
LNG River Niger	Bonny Gas Transport	Hyundai	Conventional	2006	145,914
Golar Maria	Golar LNG	Daewoo	Conventional	2006	145,700
Methane Jane Elizabeth	BG Group	Samsung	Conventional	2006	145,127
Ibra LNG	Oman SC	Samsung	Conventional	2006	145,000
Ibri LNG	Oman SC	Mitsubishi Nagasaki	Conventional	2006	145,000
Ob River	Dynagas	Hyundai	Conventional	2006	150,000
Simaisma	Maran Gas Maritime/Nakilat	Daewoo	Conventional	2006	145,000
LNG Dream	Osaka Gas	Kawasaki Sakaide	Conventional	2006	126,530
Methane Lydon Volney	BG Group	Samsung	Conventional	2006	145,127
Iberica Knutsen	Knutsen OAS	Daewoo	Conventional	2006	138,000
Al Marrouna	Teekay LNG/Nakilat	Daewoo	Conventional	2006	140,500
Energy Progress	Riverstone Marine	Kawasaki Sakaide	Conventional	2006	144,795
Provalys	GDF SUEZ	Chantiers de l'Atlantique	Conventional	2006	154,500
Seri Anggun	MISC	Samsung	Conventional	2006	145,000
LNG Lokoja	BW Gas/Marubeni	Daewoo	Conventional	2006	148,471
Al Areesh	Teekay LNG/Nakilat	Daewoo	Conventional	2007	140,500
Grace Acacia	NYK Line	Hyundai	Conventional	2007	150,000
LNG Kano	BW Gas/Marubeni	Daewoo	Conventional	2007	148,565
LNG Ondo	BW Gas/Marubeni	Daewoo	Conventional	2007	148,478
Stena Blue Sky	Stena Bulk	Daewoo	Conventional	2007	145,700
Neo Energy	Tsakos Energy Navigation	Hyundai	Conventional	2007	145,000
Seri Angkasa	MISC	Samsung	Conventional	2007	145,000
Clean Energy	Pegasus Shipholding	Hyundai	Conventional	2007	150,000
Gaselys	GDF SUEZ/NYK	Chantiers de l'Atlantique	Conventional	2007	154,500
Al Daayen	Teekay LNG/Nakilat	Daewoo	Conventional	2007	140,500
Methane Shirley Elizabeth	BG Group	Samsung	Conventional	2007	145,127
Seri Bakti	MISC	Mitsubishi Nagasaki	Conventional	2007	152,300
Al Jassasiya	Maran Gas Maritime/Nakilat	Daewoo	Conventional	2007	145,700
Cheikh El Mokrani	Mediterranean Liquified Natural Gas Transport Corporation	Universal	Conventional	2007	75,500
LNG Ogun	NYK Line	Samsung	Conventional	2007	148,478
Maran Gas Coronis	Maran Gas Maritime	Daewoo	Conventional	2007	145,800
Cheikh Bouamama	Skikda Liquified Natural Gas Transport Corporation	Universal	Conventional	2007	75,500
British Emerald	BP Shipping	Hyundai	Conventional	2007	151,945
Methane Heather Sally	BG Group	Samsung	Conventional	2007	145,127
LNG Borno	NYK Line	Samsung	Conventional	2007	149,600
Methane Alison Victoria	BG Group	Samsung	Conventional	2007	145,127
Sun Arrows	Maple LNG Transport	Kawasaki Sakaide	Conventional	2007	19,474
Dukhan	ProNav Ship Mgmt.	Daewoo	Conventional	2007	127,386
Grace Barleria	Swallowtail Shipping	Hyundai	Conventional	2007	149,700
Seri Ayu	MISC	Samsung	Conventional	2007	145,000
Grand Elena	Sovcomflot/NYK Line	Mitsubishi Nagasaki	Conventional	2007	147,000
Al Gattara	Nakilat/Overseas Shipholding	Hyundai	Q-Flex	2007	216,200

Al Ruwais	ProNav Ship Mgmt./Nakilat	Daewoo	Q-Flex	2007	210,100
Al Safliya	ProNav Ship Mgmt./Nakilat	Daewoo	Q-Flex	2007	210,100
Sestao Knutsen	Knutsen OAS	C. N. del Norte	Conventional	2007	135,496
Tembek	Nakilat/Overseas Shipholding	Samsung	Q-Flex	2007	216,000
Celestine River	K Line	Kawasaki Sakaide	Conventional	2007	145,000
Seri Begawan	MISC	Mitsubishi Nagasaki	Conventional	2007	152,300
Methane Nile Eagle	BG Group	Samsung	Conventional	2007	145,127
Taitar No. 2	CPC/NYK Line/MOL	Kawasaki	Conventional	2007	144,627
Al Ghariya	ProNav Ship Mgmt./Nakilat	Daewoo	Q-Flex	2008	210,100
Al Gharrafa	Nakilat/Overseas Shipholding	Hyundai	Q-Flex	2008	216,200
Clean Force	Seacrown Mariti	Hyundai	Conventional	2008	150,000
Duhail	ProNav Ship Mgmt./Nakilat	Daewoo	Q-Flex	2008	210,000
Grand Aniva	Sovcomflot/NYK Line	Mitsubishi Nagasaki	Conventional	2008	147,000
Seri Bijaksana	MISC	Mitsubishi Nagasaki	Conventional	2008	152,300
Al Hamla	Nakilat/Overseas Shipholding	Samsung	Q-Flex	2008	216,200
Al Aamriya	JC Nakilat	Daewoo	Q-Flex	2008	216,000
Alto Acrux	NYK Line	Mitsubishi Nagasaki	Conventional	2008	147,200
Energy Navigator	Tokyo LNG Tankers	Kawasaki Sakaide	Conventional	2008	145,000
K Jasmine	Korea Line	Daewoo	Conventional	2008	145,700
Methane Spirit	Teekay/Marubeni	Samsung	Conventional	2008	165,500
Trinity Arrow	K Line	Koyo Dock	Conventional	2008	154,982
Al Thumama	JC Nakilat	Hyundai	Q-Flex	2008	216,200
Dapeng Sun	Yuepeng LNG SC Ltd	Hudong	Conventional	2008	147,210
Al Oraiq	JC Nakilat	Daewoo	Q-Flex	2008	216,000
Al Huwaila	Teekay LNG/Nakilat	Samsung	Q-Flex	2008	216,000
Al Kharsaah	Teekay LNG/Nakilat	Samsung	Q-Flex	2008	216,000
Grace Cosmos	NYK Line	Hyundai	Conventional	2008	147,500
Marib Spirit	Teekay/Marubeni	Samsung	Conventional	2008	165,000
Murwab	J5 Consortium/Nakilat	Daewoo	Q-Flex	2008	216,000
Al Sahla	JC Nakilat	Hyundai	Q-Flex	2008	216,200
Al Shamal	Nakilat	Samsung	Q-Flex	2008	217,000
LNG Imo	BW Gas/Marubeni	Daewoo	Conventional	2008	148,452
Dapeng Moon	Yuegang LNG SC Ltd	Hudong	Conventional	2008	147,000
British Ruby	BP Shipping	Hyundai	Conventional	2008	151,945
Al Khuwair	Teekay LNG/Nakilat	Samsung	Q-Flex	2008	216,000
Al Ghuwairiya	Nakilat	Daewoo	Q-Max	2008	261,700
Al Utouriya	J5 Consortium/Nakilat	Hyundai	Q-Flex	2008	215,000
Arwa Spirit	Teekay/Marubeni	Samsung	Conventional	2008	165,500
Fraiha	JC Nakilat	Daewoo	Q-Flex	2008	210,100
LNG Ebisu	LNG Ebisu Shipping	Kawasaki	Conventional	2008	147,000
Umm Al Amad	JC Nakilat	Daewoo	Q-Flex	2008	216,000
British Diamond	BP Shipping	Hyundai Samho	Conventional	2008	155,000
British Sapphire	BP Shipping	Hyundai	Conventional	2008	151,945
Seri Balhaf	MISC	Mitsubishi HI	Conventional	2008	152,000
Mozah	Nakilat	Samsung	Q-Max	2008	266,000
Grand Mereya	Primorsk/MOL/K Line	Mitsui Chiba	Conventional	2008	145,700
STX Kolt	STX Panocean	Hanjin	Conventional	2008	145,700
K Mugungwha	Korea Line	Daewoo	Conventional	2008	151,800
Tangguh Foja	K Line/PT Meratus Line	Samsung	Conventional	2008	155,000

Umm Slal	Nakilat	Samsung	Q-Max	2008	266,000
Tangguh Towuti	Sovcomflot/NYK Line	Daewoo	Conventional	2008	145,700
Tangguh Hiri	Teekay LNG	Hyundai	Conventional	2008	155,000
Tangguh Jaya	K Line/PT Meratus Line	Samsung	Conventional	2008	155,000
Bu Samra	Nakilat	Samsung	Q-Max	2009	266,000
Hyundai Ecopia	Hyundai Merchant Marine	Hyundai	Conventional	2009	145,000
Lijmiliya	Nakilat	Daewoo	Q-Max	2009	263,000
LNG Barka	Oman SC/MOL	Kawasaki	Conventional	2009	153,000
Tangguh Batur	Sovcomflot/NYK Line	Daewoo	Conventional	2009	145,700
Al Mayeda	Nakilat	Samsung	Q-Max	2009	266,000
Min Rong	Minrong LNG SC Ltd	Hudong	Conventional	2009	147,000
Al Sheehaniya	Nakilat	Daewoo	Q-Flex	2009	210,100
Cygnus Passage	TEPCO	Mitsubishi HI	Conventional	2009	145,400
Tangguh Palung	K Line/PT Meratus Line	Samsung	Conventional	2009	155,000
Al Samriya	Nakilat	Daewoo	Q-Max	2009	261,700
Mesaimeer	Nakilat	Hyundai	Q-Flex	2009	216,200
Al Sadd	Nakilat	Daewoo	Q-Flex	2009	210,100
Mekaines	Nakilat	Samsung	Q-Max	2009	266,000
Trinity Glory	K Line/Imabari Shipbuilding/Mitsui	Koyo Dock	Conventional	2009	154,000
Seri Balquis	MISC	Mitsubishi HI	Conventional	2009	154,600
Abdelkader	MOL	Hyundai	Conventional	2009	177,000
Onaiza	Nakilat	Daewoo	Q-Flex	2009	210,100
Tangguh Sago	Teekay LNG	Hyundai Samho	Conventional	2009	155,000
Pacific Enlighten	Pacific Hope Shipping	Mitsubishi HI	Conventional	2009	145,400
Magellan Spirit	Teekay/Marubeni	Samsung	Conventional	2009	165,500
Al Ghashamiya	Nakilat	Samsung	Q-Flex	2009	217,330
Energy Confidence	Tokyo LNG Tankers/NYK Line	Kawasaki	Conventional	2009	152,675
Al Mafyar	Nakilat	Samsung	Q-Max	2009	266,000
Al Rekayyat	Nakilat	Hyundai	Q-Flex	2009	216,200
Al Kharaitiyat	Nakilat	Hyundai	Q-Flex	2009	216,200
LNG Jupiter	NYK Line	Kawasaki	Conventional	2009	153,000
Min Lu	Minlu LNG SC Ltd	Hudong	Conventional	2009	147,100
BW GDF SUEZ Paris	BW Gas	Daewoo	Conventional	2009	162,400
Al Karaana	Nakilat	Daewoo	Q-Flex	2009	210,000
Al Dafna	Nakilat	Samsung	Q-Max	2009	266,000
Al Khattiya	Nakilat	Daewoo	Q-Flex	2009	210,100
Taitar No. 1	CPC/NYK Line/MOL	Mitsubishi HI	Conventional	2009	145,000
Woodside Donaldson	Teekay/Marubeni	Samsung	Conventional	2009	165,500
Aseem	India LNG Transport	Samsung	Conventional	2009	154,800
Ben Badis	MOL	Hyundai	Conventional	2009	177,000
Al Nuaman	Nakilat	Daewoo	Q-Flex	2009	216,000
Shagra	Nakilat	Samsung	Q-Max	2009	266,000
Dapeng Star	Yueyang LNG SC Ltd	Hudong	Conventional	2009	147,100
Taitar No. 3	CPC/NYK Line/MOL	Mitsubishi HI	Conventional	2010	145,000
Meridian Spirit	Teekay/Marubeni	Samsung	Conventional	2010	165,500
Al Bahiya	Nakilat	Daewoo	Q-Flex	2010	210,100
GDF SUEZ Point Fortin	Trinity LNG	Imabari Higaki	Conventional	2010	154,200
Zarga	Nakilat	Samsung	Q-Max	2010	266,000
Barcelona Knutsen	Knutsen OAS	Daewoo	Conventional	2010	173,400
Methane Julia Louise	BG Group	Samsung	Conventional	2010	170,000

Aamira	Nakilat	Samsung	Q-Max	2010	266,000
GasLog Chelsea	GasLog LNG	Hanjin	Conventional	2010	159,600
GasLog Savannah	GasLog LNG	Samsung	Conventional	2010	154,800
Sevilla Knutsen	Knutsen OAS	Daewoo	Conventional	2010	173,400
GasLog Singapore	GasLog LNG	Samsung	Conventional	2010	154,800
Rasheeda	Nakilat	Samsung	Q-Max	2010	266,000
Castillo de Santisteban	Empresa Naviera Elcano	STX Shipbuilding	Conventional	2010	173,600
Methane Becki Anne	BG Group	Samsung	Conventional	2010	170,000
Valencia Knutsen	Knutsen OAS	Daewoo	Conventional	2010	173,400
Taitar No. 4	CPC/NYK Line/MOL	Kawasaki	Conventional	2010	144,596
Methane Patricia Camilla	BG Group	Samsung	Conventional	2010	170,000
Ribera del Duero Knutsen	Knutsen OAS	Daewoo	Conventional	2010	173,400
Methane Mickie Harper	BG Group	Samsung	Conventional	2010	170,000
Arkat	Brunei Gas Carriers	Daewoo	Conventional	2011	148,000
Stena Clear Sky	Stena Bulk	Daewoo	Conventional	2011	171,800
Amali	Brunei Gas Carriers	Daewoo	Conventional	2011	148,000
Stena Crystal Sky	Stena Bulk	Daewoo	Conventional	2011	171,800
Soyo	MOL/NYK/Teekay	Samsung	Conventional	2011	160,276
Energy Horizon	Tokyo LNG Tankers/NYK Line	Kawasaki	Conventional	2011	177,000
Malanje	MOL/NYK/Teekay	Samsung	Conventional	2011	160,276
Sambizanga	Sonangol	Daewoo	Conventional	2011	160,500
Etosha	Sonangol	Daewoo	Conventional	2011	160,500
Lobito	MOL/NYK/Teekay	Samsung	Conventional	2011	160,276
Benguela	Sonangol	Daewoo	Conventional	2011	160,500
Cubal	MOL/NYK/Teekay	Samsung	Conventional	2012	160,276
Shen Hai	Shanghai LNG SC	Hudong	Conventional	2012	147,000
GasLog Shanghai	GasLog LNG	Samsung	Conventional	2013	155,000
Lena River	Dynagas	Hyundai	Conventional	2013	155,000
GasLog Santiago	GasLog LNG	Samsung	Conventional	2013	155,000
Arctic Aurora	Dynagas	Hyundai	Conventional	2013	155,000
Yenisei River	Dynagas	Hyundai	Conventional	2013	155,000
GasLog Skagen	GasLog LNG	Samsung	Conventional	2013	155,000
GasLog Sydney	GasLog LNG	Samsung	Conventional	2013	155,000
Woodside Rogers	Maran Gas Maritime	Daewoo	Conventional	2013	159,800
WilForce	Teekay LNG	Daewoo	Conventional	2013	156,000
Grace Dahlia	NYK Line	Kawasaki	Conventional	2013	177,000
Golar Seal	Golar LNG	Samsung	Conventional	2013	160,000
Golar Celsius	Golar LNG	Samsung	Conventional	2013	160,000
WilPride	Teekay LNG	Daewoo	Conventional	2013	156,000
Woodside Goode	Maran Gas Maritime	Daewoo	Conventional	2013	159,800
Cool Voyager	Thenamaris Ships Management	Samsung	Conventional	2013	160,000
GasLog Seattle	GasLog LNG	Samsung	Conventional	2013	155,000

Sources: IHS, Company Announcements

Partners for the Future of

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Natural gas holds great promise for the global energy future, and the American Gas Association is pleased to be working with the IGU in advocating for natural gas as an integral part of a sustainable global energy system.

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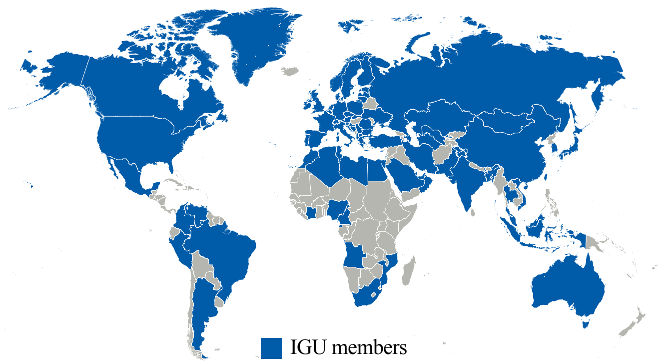
The International Gas Union (IGU), founded in 1931, is a worldwide non-profit organisation promoting the political, technical and economic progress of the gas industry with the mission to advocate for gas as an integral part of a sustainable global energy system. IGU has more than 110 members worldwide and represents more than 95% of the world's gas market. The members are national associations and corporations of the gas industry. The working organization of IGU covers the complete value chain of the gas industry from upstream to downstream. For more information please visit www.igu.org.



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