International Gas Union (IGU)

News, views and knowledge on gas – worldwide

WORLD LNG REPORT 2010

PETRONAS

INTERNATIONAL GAS UNION · UNION INTERNATIONALE DE L'INDUSTRIE DU GAZ ·

Message From The President Of The International Gas Union

Datuk (Dr) Abdul Rahim Hashim

The past few years have indeed been transformational for the LNG industry, and 2010 was an equally eventful year. With LNG volume having doubled between 2006 and 2010, LNG has become an increasingly important medium for transporting natural gas across borders. Countries which used to be small LNG importers have now emerged as major buyers, while several others have now joined the list of LNG importers. Latin America, the Middle East and Southeast Asia will all become importers by the end of 2011.

To accommodate this increasingly complex web of buyers and sellers, the structure of the LNG trade is evolving. While long-term contracts will continue to underpin new investments, they are being increasingly supplemented by a growing short-term and spot trade, made possible in part by destination flexibility in LNG contracts. More than a fifth of the world's LNG trade in 2010 was in the short-term market, and the volume is expected to grow further in the next few years. Evidently, more companies are now constructing regasification terminals without first securing long-term supply contracts - such is the new landscape of the LNG market.

The backdrop for these changes is robust demand, where in developed and emerging markets, natural gas has now become the fuel of choice to supply electricity, provide heating and cooling, and support economic growth. Defying earlier forecasts of a possible glut in supply due to the economic crisis, a strong demand was experienced in both OECD and non-OECD markets. OECD countries consumed 90 bcm more LNG in 2010 than in 2009, with several countries exceeding the consumption levels of 2008. In the BRIC countries demand grew by 100 bcm, well above 2008 levels. In a carbon-constrained world, natural gas is a fuel whose awareness and attractions have continued to grow, and the fundamentals for this industry are as strong as ever.

The boom in demand has been matched by an equally sharp increase in supply. Although growth in supply was contributed by several countries, Qatar's completion of its 77 MMtpa capacity in early 2011 stands out. Australia is also fast joining the LNG big league with the number of new FIDs recently announced. An equally important development is the dramatic growth in unconventional gas in the United States, which is set to alter the global energy scene. In 2010, shale gas had accounted for 20% of the nation's domestic gas output and that share is expected to grow further. Large regasification terminals, built over the last few years, now stand almost idle as Henry Hub has remained disconnected from the rest of the world.

Against this background, the world has been paying close attention to the human tragedy which had unfolded in Japan as a result of that country's worst ever earthquake and tsunami. The multiple-layered shock which had rocked Japan's nuclear power will also serve to support natural gas demand even further. Meanwhile, recent changes in the Governments of some of the countries in the Middle East are expected to reshape the region's political and economic environment. So far, although the *supply shock has not been very significant, the alacrity at which events have unfolded is a prudent reminder of how volatile the current state of the world's oil and natural gas industry is.*

At a time when the LNG business is changing very rapidly, the International Gas Union under the Malaysian Presidency is very pleased to publish our first annual World LNG Report. This report aims to serve as a reference for veterans and newcomers in the LNG industry, and we trust that this document will also inspire discussion on how our industry will continue to change and evolve in the years to come. Solid facts and information are the basis for any sound commercial decision, and we hope that this report will provide plenty of both.

Finally, I would like to thank PFC Energy and the Task Force for Programmed Group Committee for LNG (PGC D) for preparing and making this IGU document a reality. Our special thanks also to PETRONAS for helping to sponsor the publication of this inaugural report.

Thank you.

2. State of the LNG Industry at the End of 2010

During 2010 . . .

- *LNG volumes grew by a record 41 million tonnes per annum (MMtpa), or 22%, reaching nearly 224 MMtpa. This growth was driven by newly-commissioned liquefaction trains as well as the ramp-up in output from trains commissioned in 2009. When compared to the 143 MMtpa of LNG traded in 2005, the market has grown by more than 50% over the past five years.*
- *The LNG market became even more flexible with spot volumes growing to 47 MMtpa, over one-fifth of the LNG trade. By comparison, the spot market made up only 10% of trade in 2005, with a majority of spot and short-term transactions coming from the Atlantic Basin.*
- *Four liquefaction trains located in Peru (1 train), Qatar (2 trains) and Yemen (1 train) were commissioned, bringing the total number of operational liquefaction trains to 94. Specifically, the start-up of the Peru LNG facility made Peru the second LNG exporter in South America, and bringing the total number of countries exporting LNG to 18.*
- *Newly-commissioned liquefaction trains as well as the completion of debottlenecking at Malaysia LNG Dua's plant increased global liquefaction capacity by 24 MMtpa, or almost 10%, to 271 MMtpa at year-end. Since 2005, capacity has risen by 100 MMtpa from 171 MMtpa.*
- *One project – Queensland Curtis – made a final investment decision (FID) in 2010, while two others – Gladstone LNG and Donggi Senoro LNG – achieved FID in January 2011.*
- *Five new LNG receiving terminals began operations, bringing the total to 83. Commissioning of the Mina Jabel Ali floating regasification terminal in Dubai brought the total number of LNG importing countries to 23.*
- *The combination of newly-online receiving terminals and expansion projects at existing facilities increased global regasification capacity by 41 MMtpa to 572 MMtpa, a 71% increase over 2005.*
- *The LNG carrier fleet grew to 360 ships, up from 195 ships at end-2005. The combined capacity of the 2010 fleet totaled 53 million cubic metres.*
- *The US gas market continued to experience a profound transformation, driven in large part by a boom in shale gas production. As a result, LNG volumes previously destined for the US market have been re-directed to other markets.*
- *The success of shale gas in the United States sparked enormous interest in other countries that are believed to have significant deposits. These countries hope to increase their shale gas production and lessen their need for LNG imports. In most places, however, that process will take many years to materialise.*

Key:

MMt = million tonnes	MMtpa = million tonnes per annum	cm = cubic metres
mcm = thousand cubic metres	MMcm = million cubic metres	bcm = billion cubic metres
MMBtu = million British thermal units		

3. LNG Imports and Exports

Traded LNG volumes doubled over the last decade with several new countries joining the LNG market.

At the start of 2010, the LNG market was faced with the prospect of record supply growth, driven mostly by Qatar, and a weak demand environment in the aftermath of the economic crisis and the shale gas boom in the United States. Yet demand recovered impressively, and so did LNG imports: in fact, most countries imported more LNG in 2010 than in the pre-crisis year of 2008. As a result of strong demand and high oil prices, LNG prices remained high.

3.1. Overview

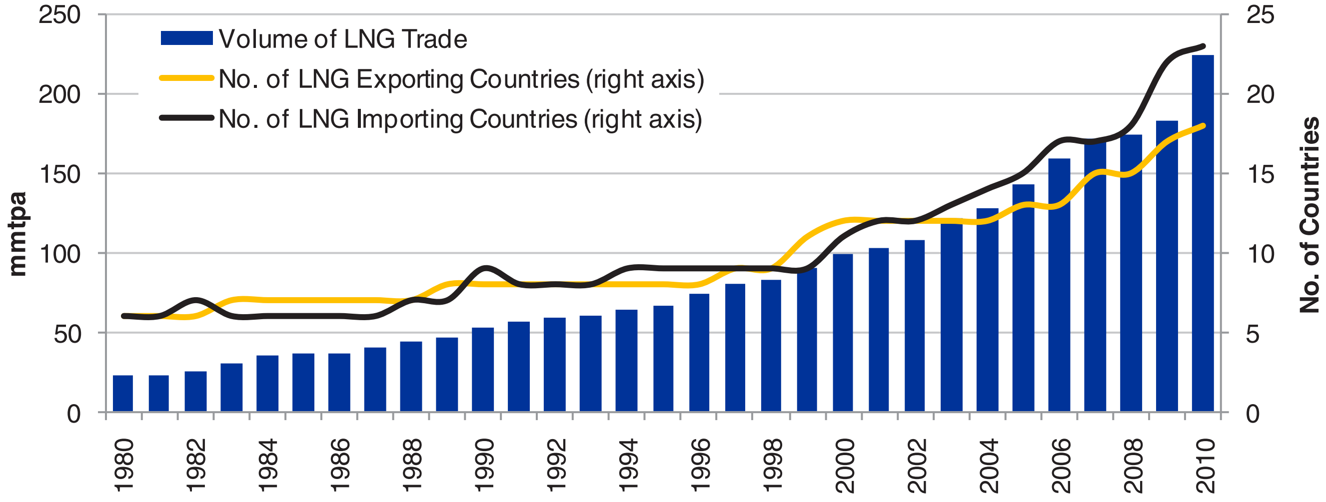
In 2010, the volume of LNG traded reached 223.8 MMtpa, representing a 41 MMtpa increase from 2009. This is the largest year-on-year growth the industry has ever experienced, with 2006 realizing the next highest growth at 16 MMtpa. For the five years leading up to 2010 (2005-2009), the LNG trade grew by an average 7% per annum, compared to a 22% jump in 2010.

The LNG trade has not only grown in volume, but in geographic reach as well. In 2005, there were 13 countries exporting LNG: Algeria, Australia, Brunei, Egypt, Indonesia, Libya, Malaysia, Nigeria, Oman, Qatar, Trinidad & Tobago, United Arab Emirates (UAE) and the United States (US). During the past five years (2006-2010), five additional countries began to export LNG: Equatorial Guinea, Norway, Peru, Russia and Yemen; this list excludes countries that re-export foreign-sourced LNG.

Over the same period, eight countries – Argentina, Brazil, Canada, Chile, China, Kuwait, Mexico, and the UAE – began importing LNG, adding to the existing 15 importers which include Belgium, Dominican Republic, France, Greece, India, Italy, Japan, Portugal, Puerto Rico, South Korea, Spain, Taiwan, Turkey, the United Kingdom (UK) and the US.

3.2. LNG Trade Volumes

Figure 1: LNG Trade Volumes, 1980-2010



Sources: Cedigaz, Waterborne LNG Reports, US Energy Information Agency (EIA), US Department of Energy (DOE), PFC Energy

The volume of LNG traded worldwide as well as the number of countries involved in the import and export of LNG, has continued to grow, especially during the last decade. During 2006 to 2010, the trade grew by 81 MMtpa – 78% of this incremental LNG came from previously existing LNG exporting countries, the other 22% from countries that began LNG exports during the period. On the demand side, 72% of the 81 MMtpa of incremental LNG was consumed by previously existing LNG importing countries; the other 28% was consumed by countries that started importing during the period.

3.3. LNG Exports by Country

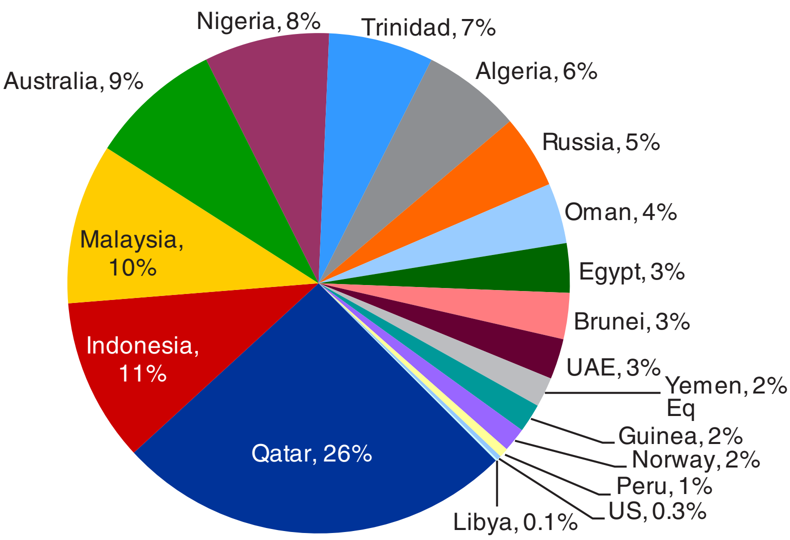
By the end of 2010, 18 countries were exporting their natural gas as LNG. In addition, four countries – Belgium, Mexico, Spain and the US – were re-exporting LNG imported from another source.

Qatar is by far the largest LNG exporter. In 2010, the country supplied 57.5 MMtpa of LNG to the market – more than one quarter (26%) of global supply – and its LNG exports will continue to grow as the mega-trains realise full-year production. Pacific Basin countries, namely Indonesia, Malaysia and Australia, are the next largest exporters and together accounted for 29% of the world's LNG supply in 2010.

Table 1: LNG Exports by Country, 2010

Exporter	MMtpa
Qatar	57.5
Indonesia	23.6
Malaysia	23.1
Australia	19.1
Nigeria	18.1
Trinidad	15.2
Algeria	14.3
Russia	10.6
Oman	8.7
Egypt	7.1
Brunei	6.7
UAE	5.8
Yemen	4.3
Equatorial Guinea	4.1
Norway	3.5
Peru	1.3
US	0.6
Libya	0.2
Total Exports	**223.8**

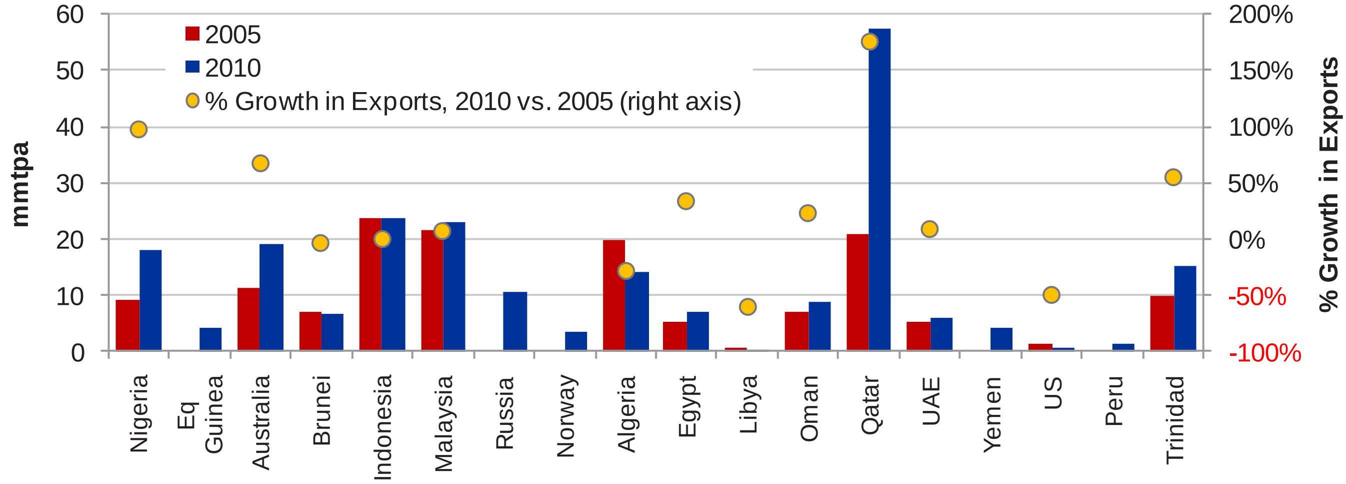
Figure 2: LNG Exports by Country, 2010



Sources: Waterborne LNG Reports, US DOE, PFC Energy

In 2005, Indonesia was the world's largest exporter, a position the country had held since 1984. However, by 2006, Qatar overtook Indonesia as the largest LNG supplier in the market. In fact, since 2005, Qatar's LNG output has increased by over 150%.

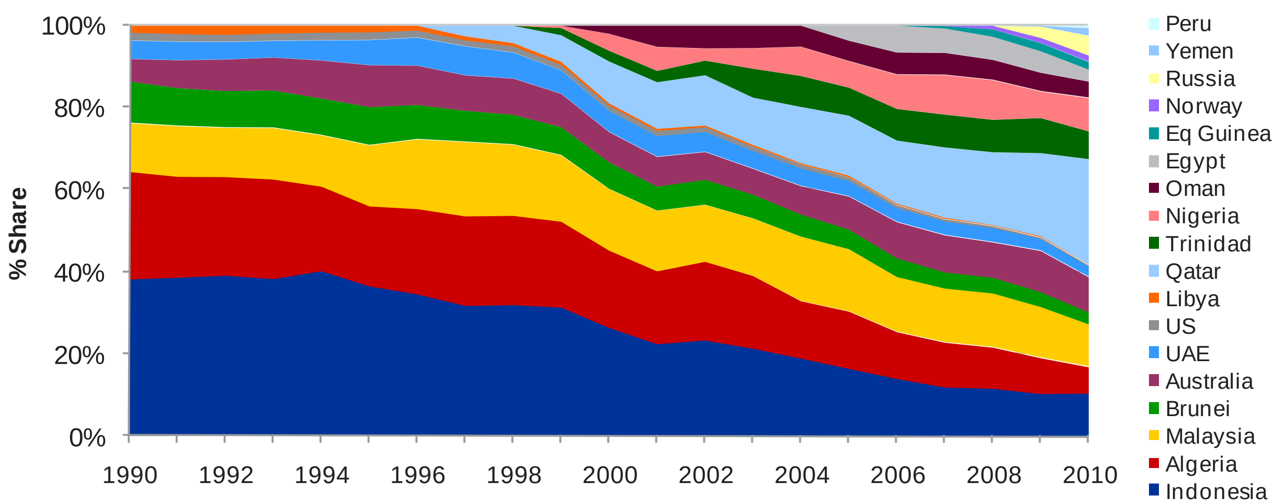
FIGURE 3: LNG EXPORTS BY COUNTRY IN 2005 AND 2010



Sources: Waterborne LNG Reports, US DOE, PFC Energy

In addition to the unprecedented growth from Qatar over the last decade, the entrance and growth of LNG exports from non-traditional LNG exporters has meant a significant diversification of the LNG supplier base over the last decade. The graph below shows how countries' shares of LNG exports have transformed as new players entered.

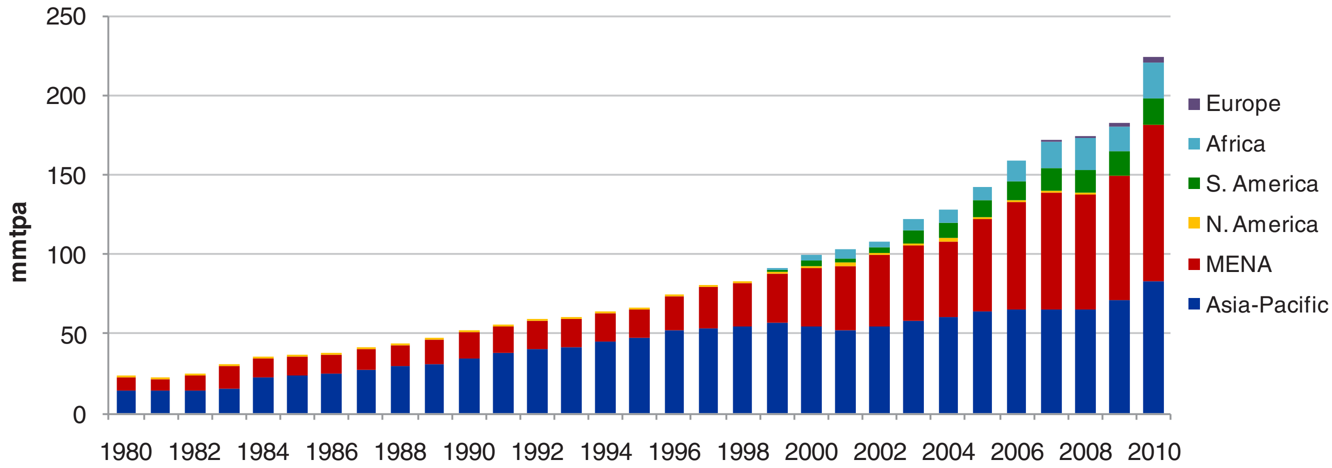
FIGURE 4: SHARE OF GLOBAL LNG EXPORTS BY COUNTRY, 1990-2010



Sources: Cedigaz, Waterborne LNG Reports, US DOE, PFC Energy

At the regional level, changes in the LNG supplier base have brought about two noteworthy shifts: in 2006, the Middle East and North Africa region (MENA) overtook the Asia-Pacific as the largest LNG exporting region; and in 2007, Europe became the sixth region to export LNG.

FIGURE 5: LNG EXPORTS BY REGION, 1990-2010



Sources: Cedigaz, Waterborne LNG Reports, US DOE, PFC Energy

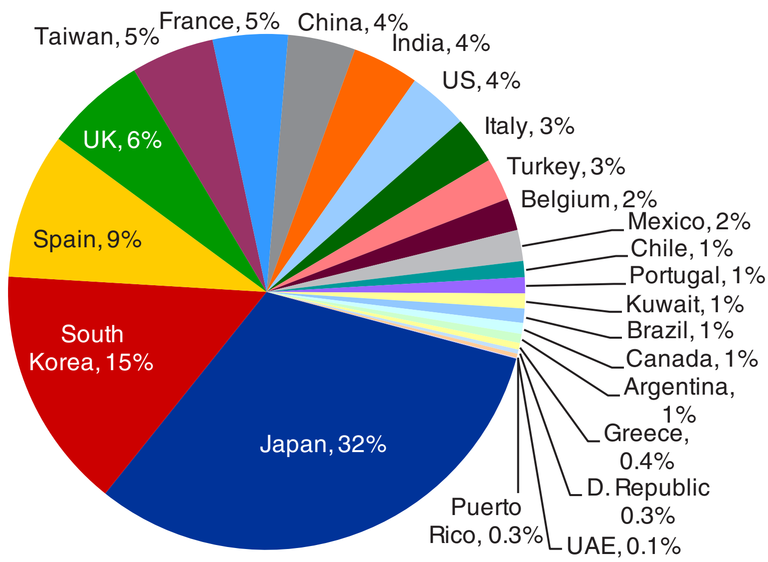
3.4. LNG IMPORTS BY COUNTRY

Japan has traditionally been the largest consumer of LNG and remains so today with an annual consumption of 71 MMtpa of LNG in 2010, followed by South Korea at 34 MMtpa. Together, these two countries account for just less than half (47%) of the world's LNG consumption.

TABLE 2: LNG IMPORTS BY COUNTRY, 2010

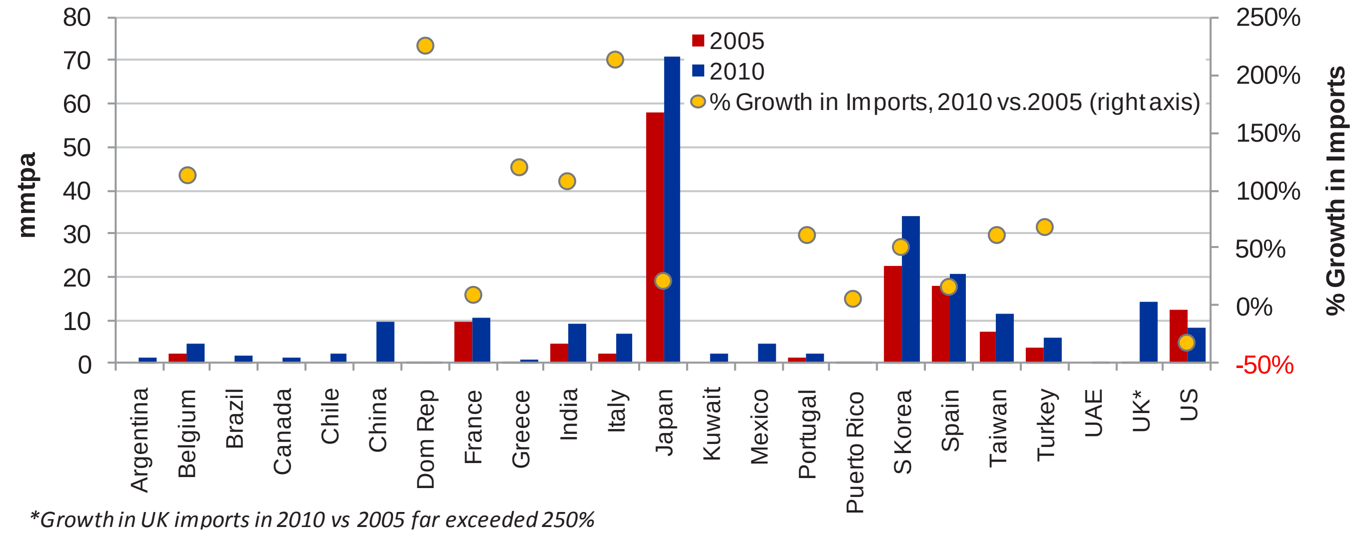
Importer	MMtpa
Japan	70.6
S Korea	34.1
Spain	20.5
UK	14.2
Taiwan	11.6
France	10.5
China	9.5
India	9.3
US	8.5
Italy	6.7
Turkey	5.9
Belgium	4.5
Mexico	4.4
Chile	2.3
Portugal	2.2
Kuwait	2.1
Brazil	2.0
Canada	1.5
Argentina	1.3
Greece	0.9
Dominican Rep.	0.6
Puerto Rico	0.6
UAE	0.1
Total Imports	**223.8**

FIGURE 6: LNG IMPORTS BY COUNTRY, 2010



Sources: Waterborne LNG Reports, US DOE, PFC Energy

FIGURE 7: LNG IMPORTS BY COUNTRY IN 2005 AND 2010



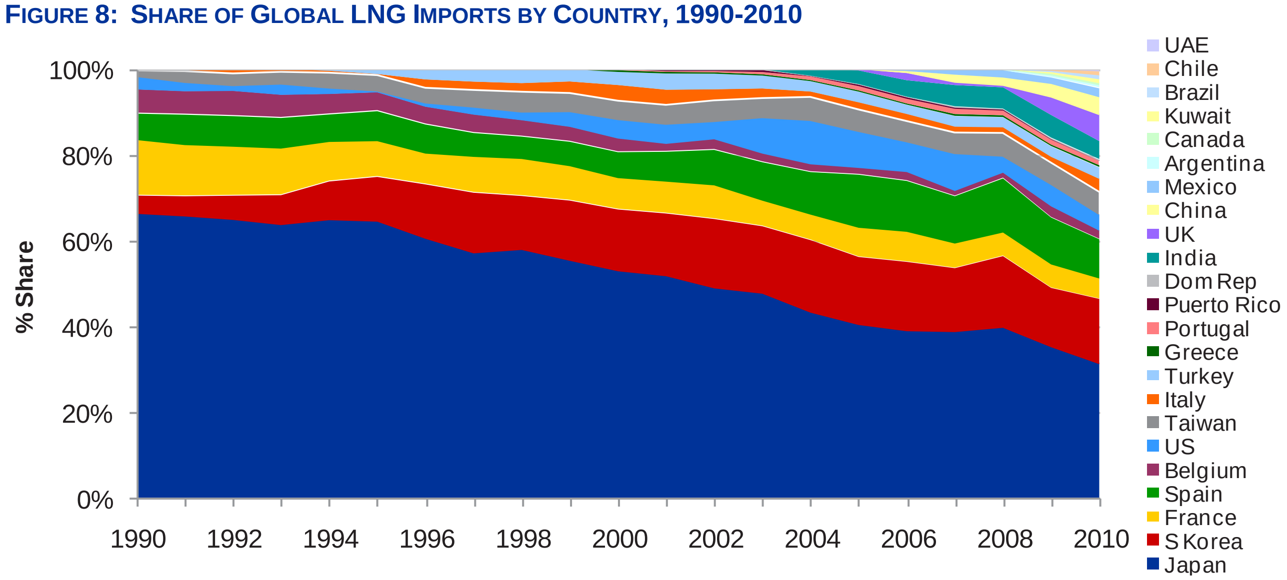
**Growth in UK imports in 2010 vs 2005 far exceeded 250%*

Sources: Waterborne LNG Reports, US DOE, PFC Energy

As shown in the figure above, all LNG importing countries saw their LNG imports increase between end-2005 and 2010, except for the US, which was due to the unanticipated additional domestic supply from unconventional gas, in particular shale gas.

In developed and emerging markets, gas is increasingly a fuel of choice to supply electricity, provide heating and cooling, and support economic growth. During the last five years (2006-2010), eight new countries began to import LNG to meet domestic needs: Argentina, Brazil, Canada, Chile, China, Kuwait, Mexico and the UAE. Notably, three of these countries are located in South America and two in the Middle East – two regions which were not importing LNG and not considered to be significant potential LNG markets even six years ago. In the near-term, Southeast Asia is also expected to become a LNG importer with the startup of Thailand's first receiving terminal in 2011.

FIGURE 8: SHARE OF GLOBAL LNG IMPORTS BY COUNTRY, 1990-2010



Sources: Cedigaz, Waterborne LNG Reports, US DOE, PFC Energy

3.5. LNG Interregional Trade

In 2010, 60% of the world's LNG was consumed by the Asia-Pacific region. During the year, Asian countries consumed 135.1 MMtpa of LNG, of which a majority (60%) was sourced from within the region, while 40% was imported from other regions.

Table 3: LNG Trade Between Regions, 2010, MMtpa

Importing Region / *Exporting Region* [1]	Europe	Asia-Pacific	Middle East	N. America	S. America	**Total**
Africa	12.2	5.3	0.3	2.6	1.9	**22.2**
Asia-Pacific	-	81.4	0.3	1.6	-	**83.0**
Europe	2.4	0.3	0.1	0.6	0.1	**3.5**
MENA	45.4	45.4	1.3	4.5	1.3	**98.0**
N. America	0.2	0.9	-	(0.5)	0.1	**0.6**
S. America	5.3	1.7	0.3	6.2	2.8	**16.5**
Total	**65.5**	**135.1**	**2.2**	**14.9**	**6.1**	**223.8**

Sources: Waterborne LNG Reports, EIA, DOE, PFC Energy

Table 4: LNG Trade Volumes Between Countries, 2009, MMtpa

Importer / *Exporter*	Argentina	Belgium	Brazil	Canada	Chile	China	Dom Rep	France	Greece	India	Italy	Japan	Korea	Kuwait	Mexico	Portugal	Spain	Taiwan	Turkey	UK	US*	**Total**
Algeria	-	-	-	-	-	-	-	5.82	0.39	0.12	0.96	-	0.06	-	-	0.09	3.99	-	3.16	-	1.27	**15.9**
Australia	-	-	-	-	-	3.48	-	0.06	-	0.81	-	12.33	1.13	0.06	-	-	-	0.38	-	-	0.06	**18.3**
Belgium	-	-	-	-	-	0.06	-	-	-	-	-	-	-	0.06	-	-	0.06	-	-	-	-	**0.2**
Brunei	-	-	-	-	-	-	-	-	-	-	-	6.17	0.55	-	-	-	-	-	-	-	-	**6.7**
Egypt	0.12	0.07	-	0.06	-	0.06	-	1.20	0.18	0.12	0.06	0.24	0.33	-	0.31	-	3.32	0.06	0.06	-	0.38	**9.9**
Eq. Guinea	-	-	-	-	0.25	0.13	-	0.06	-	0.19	-	1.07	1.30	-	-	0.07	-	0.58	-	-	-	**3.6**
Indonesia	-	-	-	-	-	0.46	-	-	-	0.06	-	12.56	3.12	-	0.06	-	-	2.80	-	-	-	**19.1**
Libya	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.55	-	-	-	-	**0.5**
Malaysia	-	-	-	-	-	0.81	-	-	-	0.19	-	12.84	5.87	0.07	-	-	-	2.83	-	-	-	**22.6**
Nigeria	-	0.07	0.06	-	-	0.06	-	1.76	-	0.24	-	0.53	0.25	-	1.95	1.59	3.33	0.87	0.79	-	-	**11.8**
Norway	-	0.13	-	-	-	-	-	0.33	-	-	-	-	-	-	0.06	-	1.02	-	-	-	0.17	**2.3**
Oman	-	-	-	-	-	0.06	-	-	-	0.18	-	2.58	4.06	0.06	-	-	0.98	0.19	0.06	-	-	**8.2**
Qatar	-	4.52	-	0.09	0.06	0.40	-	0.13	-	6.53	1.30	7.93	6.68	-	0.09	-	3.39	1.22	0.32	-	4.12	**37.0**
Russia	-	-	-	-	-	0.19	-	-	-	0.51	-	2.84	1.02	0.31	-	-	-	0.12	-	-	-	**5.0**
Trinidad	0.59	0.12	0.44	0.71	0.18	0.06	0.42	0.54	0.03	0.51	-	0.10	0.75	0.11	0.06	0.30	3.31	0.07	0.06	-	1.68	**15.5**
UAE	-	-	-	-	-	-	-	-	-	0.13	-	5.14	-	-	-	0.06	-	-	-	-	-	**5.3**
US	-	-	-	-	-	-	-	-	-	-	-	0.55	-	-	-	-	-	-	-	-	-	**0.6**
Yemen	-	-	-	-	-	-	-	-	-	-	-	-	0.20	-	0.06	-	0.07	-	-	-	-	**0.3**
Re-exports	-	-0.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-0.3**
Total	**0.7**	**4.7**	**0.5**	**0.9**	**0.5**	**5.8**	**0.4**	**9.9**	**0.6**	**9.6**	**2.3**	**64.9**	**25.3**	**0.7**	**2.6**	**2.1**	**20.0**	**9.1**	**4.5**	**7.7**	**10.0**	**187**

**Includes Puerto Rico*

Sources: Waterborne LNG Reports, US DOE, PFC Energy

[1] *Export volumes for N. America and Europe include re-exported cargoes, which are subtracted from the region's imports.*

TABLE 5: LNG TRADE VOLUMES BETWEEN COUNTRIES, 2010, MMTPA

Importer / Exporter	Argentina	Belgium	Brazil	Canada	Chile	China	Dom Rep	France	Greece	India	Italy	Japan	Korea	Kuwait	Mexico	Portugal	Spain	Taiwan	Turkey	UAE	UK	US*	**Total**
Algeria	-	-	-	-	0.18	-	-	4.77	0.71	-	1.23	0.06	-	-	-	-	3.54	-	2.83	-	0.95	-	**14.3**
Australia	-	-	-	-	-	3.90	-	-	-	0.06	-	13.28	0.91	0.06	-	-	-	0.83	-	-	-	-	**19.0**
Belgium	-	-	0.06	-	-	-	-	-	-	-	-	0.06	0.07	0.07	-	-	0.06	-	0.07	-	-	-	**0.4**
Brunei	-	-	-	-	-	-	-	-	-	-	-	5.93	0.73	-	-	-	-	-	-	-	-	-	**6.7**
Egypt	-	0.13	-	-	0.36	-	-	0.53	0.06	0.06	0.44	0.43	0.81	0.21	0.12	-	2.11	0.06	0.19	-	0.12	1.49	**7.1**
Eq. Guinea	-	-	0.02	-	1.17	0.07	-	-	0.06	0.12	0.06	0.54	1.45	0.19	-	-	-	0.45	-	-	-	-	**4.1**
Indonesia	-	-	-	-	-	1.88	-	-	-	-	-	12.75	5.54	-	1.38	-	-	1.98	-	-	-	-	**23.5**
Libya	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.25	-	-	-	-	-	**0.2**
Malaysia	-	-	-	-	-	1.19	-	-	-	-	-	13.89	4.96	0.13	-	-	-	2.96	-	-	-	-	**23.1**
Nigeria	-	0.06	0.68	-	-	0.20	-	2.81	-	0.25	-	0.58	0.87	0.06	1.73	2.06	5.71	0.81	1.08	-	0.31	0.88	**18.1**
Norway	-	0.06	-	0.06	-	-	-	0.33	-	-	0.13	-	0.13	-	-	-	1.33	0.06	0.12	-	0.70	0.55	**3.5**
Oman	-	-	-	-	-	-	-	-	-	-	-	2.86	4.64	0.71	-	-	0.12	0.39	-	-	-	-	**8.7**
Peru	-	0.08	0.06	0.12	-	-	-	-	-	-	-	-	0.07	-	0.18	-	0.49	-	-	-	-	0.34	**1.3**
Qatar	0.18	4.51	0.38	0.18	0.12	1.26	-	1.77	0.03	8.05	4.56	7.91	7.50	-	0.81	0.06	4.19	2.89	1.46	0.12	10.46	0.96	**57.4**
Russia	-	-	-	-	-	0.38	-	-	-	-	-	6.23	3.39	0.07	-	-	-	0.51	-	-	-	-	**10.6**
Trinidad	1.10	0.06	0.70	1.18	0.37	0.05	0.59	0.24	0.06	0.48	0.24	0.11	0.66	0.29	-	0.13	2.51	0.37	0.19	-	1.29	4.52	**15.1**
UAE	-	-	0.04	-	-	-	-	-	-	-	-	5.10	0.19	0.18	-	-	-	0.33	-	-	-	-	**5.8**
US	-	-	0.06	-	-	-	-	-	-	-	-	0.63	0.26	-	-	-	0.09	-	-	-	0.14	-	**1.2**
Yemen	-	-	-	-	0.06	0.47	-	0.07	-	0.28	-	0.12	1.88	0.14	0.13	-	0.13	-	-	-	0.20	0.82	**4.3**
Re-exports	-	-0.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.74	**-1.1**
Total	**1.3**	**4.6**	**2.0**	**1.5**	**2.3**	**9.4**	**0.6**	**10.5**	**0.9**	**9.3**	**6.7**	**70.5**	**34.1**	**2.1**	**4.3**	**2.2**	**20.5**	**11.6**	**5.9**	**0.1**	**14.2**	**8.8**	**224**

**Includes Puerto Rico*

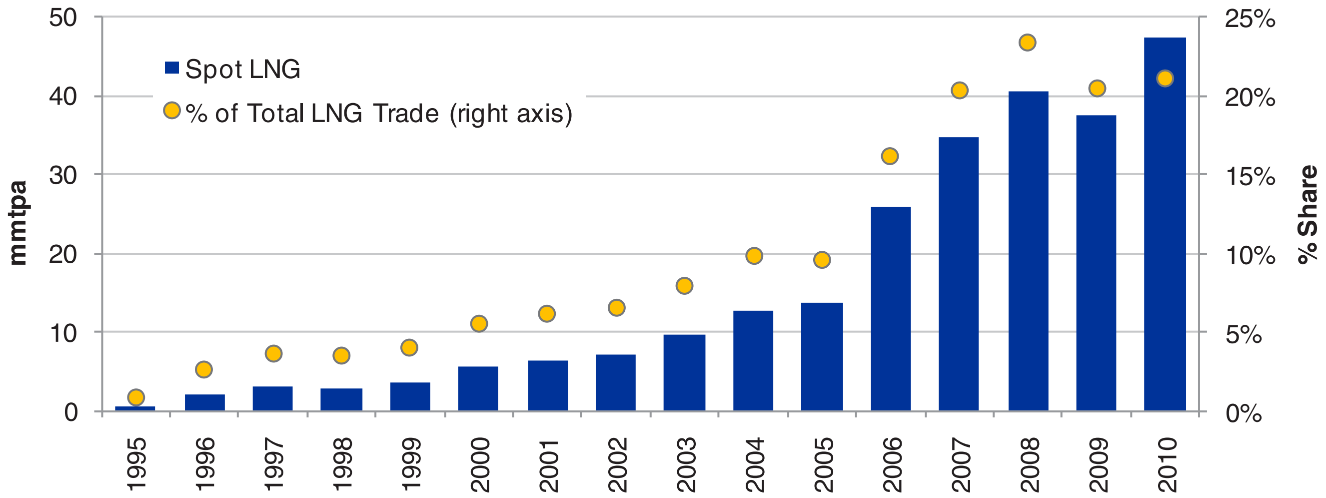
Sources: Waterborne LNG Reports, US DOE, PFC Energy

PETRONAS Malaysia LNG (MLNG) Complex
Bintulu, Sarawak

3.6. LNG SPOT MARKET[2]

The structure of the LNG trade is evolving. Traditionally, LNG has been delivered under long-term arrangements between buyers and sellers and was only marginally traded on a spot basis. But since the 1990s, spot LNG trading has grown steadily, with more rapid growth during the last five years. Up till 2005, the spot trade accounted for only 10% of total LNG traded, but has since grown to more than a fifth (21% or 47 MMtpa) in 2010.

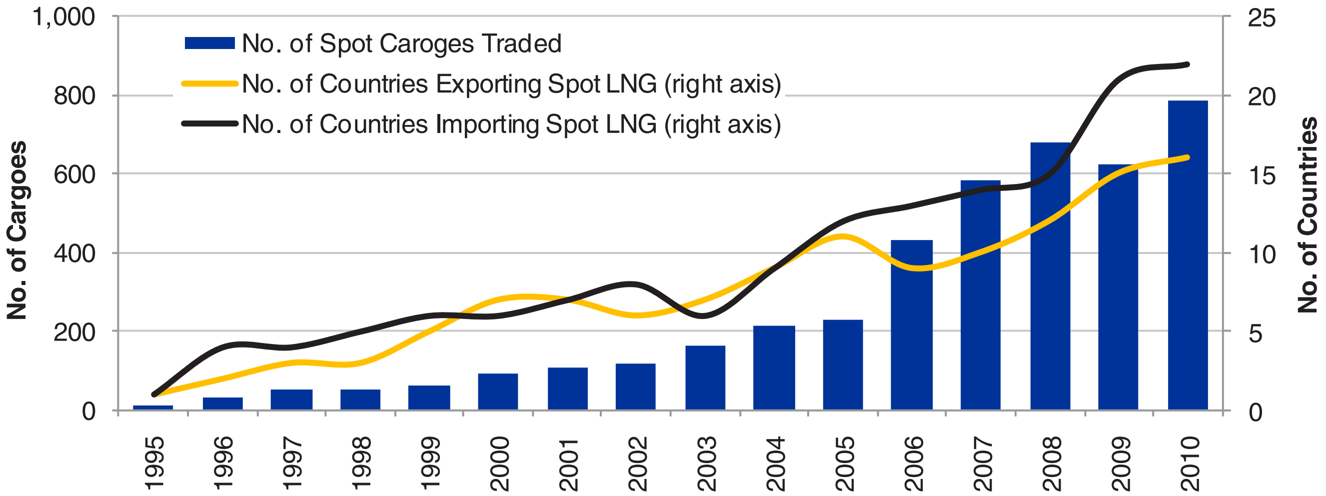
FIGURE 9: VOLUME OF SPOT LNG TRADE AND SHARE OF TOTAL LNG TRADE, 1995-2010



Sources: Cedigaz, Waterborne LNG Reports, US DOE, PFC Energy

In 2005, 11 countries were active spot LNG exporters and 12 countries were spot cargo importers. However, by end 2010, these numbers have since increased to 16 and 22, respectively. The appetite to buy LNG on a spot basis has increased significantly as the list of spot buyers has nearly doubled, whereas the list of spot sellers has increased, albeit at a slower pace.

FIGURE 10: NUMBER SPOT CARGOES TRADED AND EXPORTERS AND IMPORTERS OF SPOT LNG, 1995-2010



Sources: Waterborne LNG Reports, US DOE, PFC Energy

[2] *Spot and short-term trade (hereafter referred to as spot) is defined as any transition that is not supported by a contract with a duration of more than four years. Spot trade figures also include cargoes that are over and above contracted volumes. For example, if a company has a 5 MMtpa long-term contract with a supplier but in one year imports 6 MMtpa from that supplier, that additional 1 MMtpa is considered spot.*

Looking Ahead. . .

- ***The LNG market experienced two shocks in early 2011:*** *the devastating earthquake and tsunami which hit Japan in March 2011 produced a demand shock, while the political unrest in several MENA countries has led to a supply shock. Together, these developments will accelerate the arrival of a tight LNG market.*

- ***Increased short-term LNG needs in Japan*** *has already provided a boost to spot prices in the Pacific Basin. Longer-term, changing public opinion toward nuclear safety poses significant upside for natural gas and LNG demand as governments across regions are rethinking nuclear policy. In MENA, the cessation of Libyan LNG exports has had only a modest impact on LNG supply, but concerns loom about further regional shut-ins.*

- ***Where will Qatari LNG volumes flow in the future?*** *The world's largest LNG supplier, Qatar, has a significant volume of flexible LNG supply; where it will send those volumes, could significantly impact on the LNG balance in the Atlantic and Pacific Basins.*

4. LNG Liquefaction Plants

The geography of growth in liquefaction capacity will be shifting from Qatar to Australia.

Qatar drove liquefaction capacity growth in recent years, reaching its target of 77 MMtpa in February 2011. However, over the next decade, Australia's liquefaction capacity is set to grow significantly. Of the remaining projects under construction, the majority are in Australia, in part driven by conventional reserves and in part by coal-bed methane (CBM) to LNG projects. Three LNG projects utilizing CBM reserves have received environmental approval and two have already begun construction.

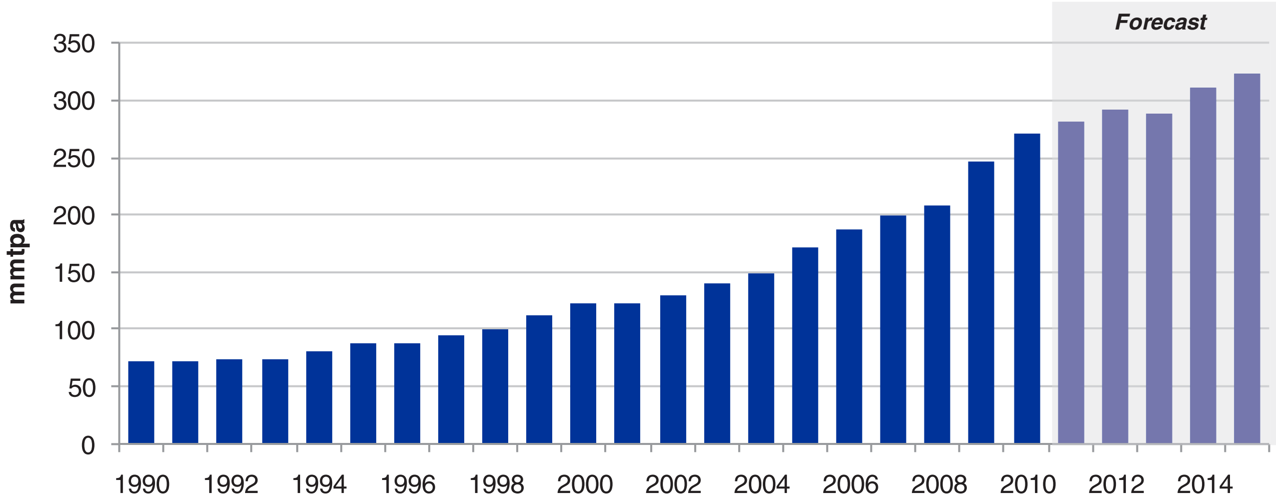
4.1. Overview

At the end of 2010, there were 94 liquefaction trains in operation, representing global liquefaction capacity of 270.9 MMtpa. In 2011, one additional train has been commissioned (Qatargas IV, 7.8 MMtpa) and by the end of the year, one more (Pluto LNG, 4.8 MMtpa) is expected to complete construction. Since 2005, five countries have commissioned greenfield LNG plants: Equatorial Guinea, Norway, Peru, Russia and Yemen; whilst another seven have expanded existing liquefaction capacity: Australia, Egypt, Indonesia, Malaysia, Nigeria, Oman and Qatar.

4.2. Liquefaction Capacity Globally

At the end of 2010, global liquefaction capacity stood at 270.9 MMtpa, compared to 171.4 MMtpa at end-2005, with another 64.9 MMtpa under construction. Current liquefaction capacity is a reflection of tremendous growth over the past decade. During 2006-2010, new liquefaction capacity was added at an average annual rate of 10% as compared to an average 5% per annum during 1990-2000.

Figure 11: Global Liquefaction Capacity Build-Out, 1990 - 2015[3]



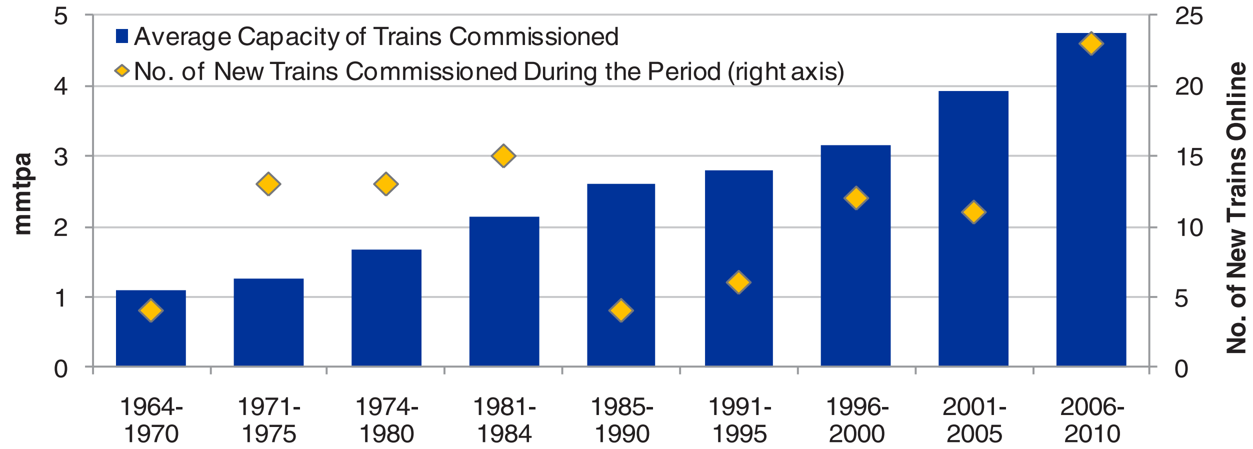
Source: PFC Energy, Company Announcements

The first liquefaction plant in Arzew, Algeria (which has since been decommissioned) had a nameplate capacity of 0.85 MMtpa in 1964, but train capacities have steadily increased over the years. The recently completed Qatari mega-trains, which utilise the APCI AP-X liquefaction process (Qatargas II T1-2, Qatargas III, Qatargas IV and RasGas III T1-2) have a nameplate capacity of 7.8 MMtpa each.

[3] *Forecast for LNG capacity to 2015 are calculated based on company-announced start dates for sanctioned projects only. As of May 2011, all sanctioned liquefaction project had already begin construction. Planned decommissioning of plants in Algeria and Indonesia are also included.*

Since 2005, 24 trains have been commissioned, bringing the total number of LNG trains in operation at end of 2010 to 94. The 95th train, Qatargas IV, came onstream in February 2011. The average size of new trains has also since increased; in the first years of LNG, an average train was 1.1 MMtpa, compared to 4.8 MMtpa during the last five years.

FIGURE 12: NUMBER OF TRAINS COMMISSIONED VS. AVERAGE TRAIN CAPACITY, 1964-2010



Source: PFC Energy

4.3. LIQUEFACTION CAPACITY BY COUNTRY

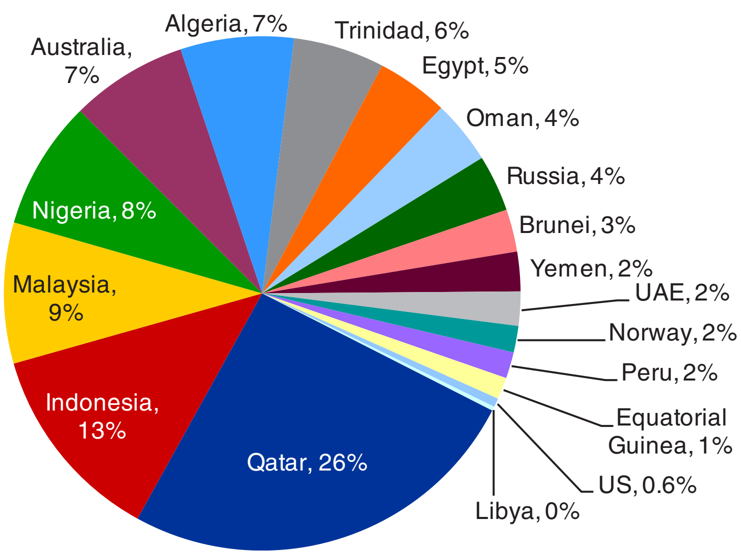
During 2010, Peru commissioned its first liquefaction plant, making it the 18th country to have liquefaction capacity to export LNG. The seven largest countries based on total liquefaction capacity accounted for 75% of the world's liquefaction capacity in 2010; with the top three – Qatar, Indonesia and Malaysia – accounting for nearly 50%.

TABLE 6: LIQUEFACTION CAPACITY BY COUNTRY, 2010

Country	MMtpa
Qatar	69.2
Indonesia	34.1
Malaysia	23.9
Nigeria	21.9
Algeria	19.9
Australia	19.3
Trinidad	15.5
Egypt	12.2
Oman	10.8
Russia	9.6
Brunei	7.2
Yemen	6.7
UAE	5.8
Norway	4.5
Equatorial Guinea	4.5
Peru	3.7
US	1.5
Libya	0.7
Total Capacity	**270.9**

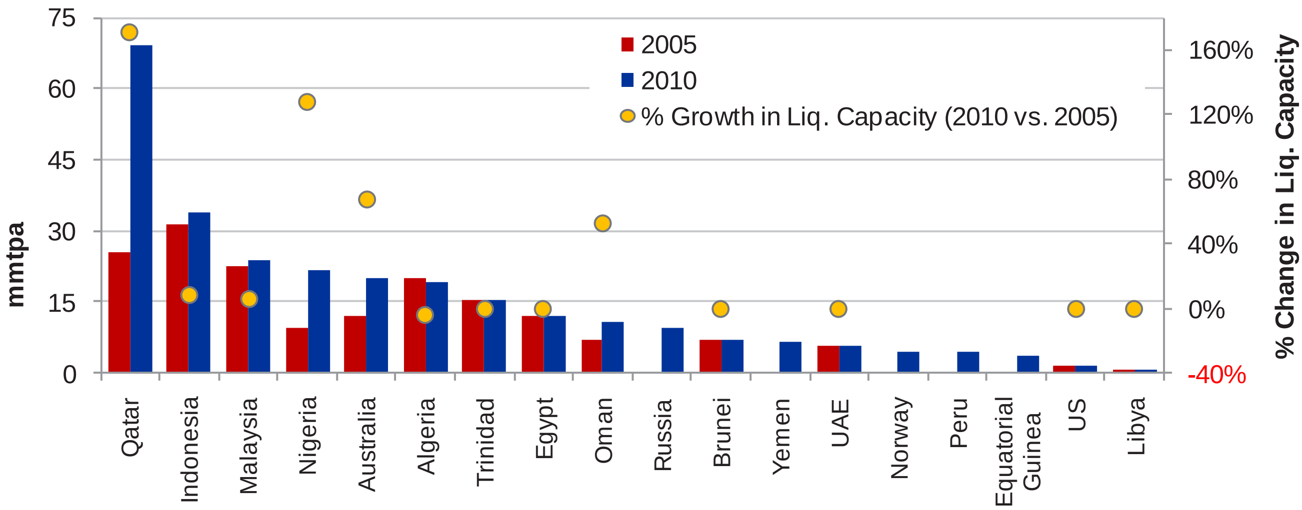
Source: PFC Energy

FIGURE 13: LIQUEFACTION CAPACITY BY COUNTRY, 2010



Since 2005, all countries saw their liquefaction capacity remain the same or grow, except for Algeria, whose liquefaction capacity dropped 4% due to decommissioning of LNG trains. Moreover, since 2005, five countries commissioned greenfield LNG plants: Equatorial Guinea, Norway, Peru, Russia and Yemen; while another seven expanded existing liquefaction capacity: Australia, Indonesia, Malaysia, Nigeria, Oman, Qatar and Trinidad &Tobago.

FIGURE 14: LIQUEFACTION CAPACITY BY COUNTRY IN 2005 AND 2010



Source: PFC Energy

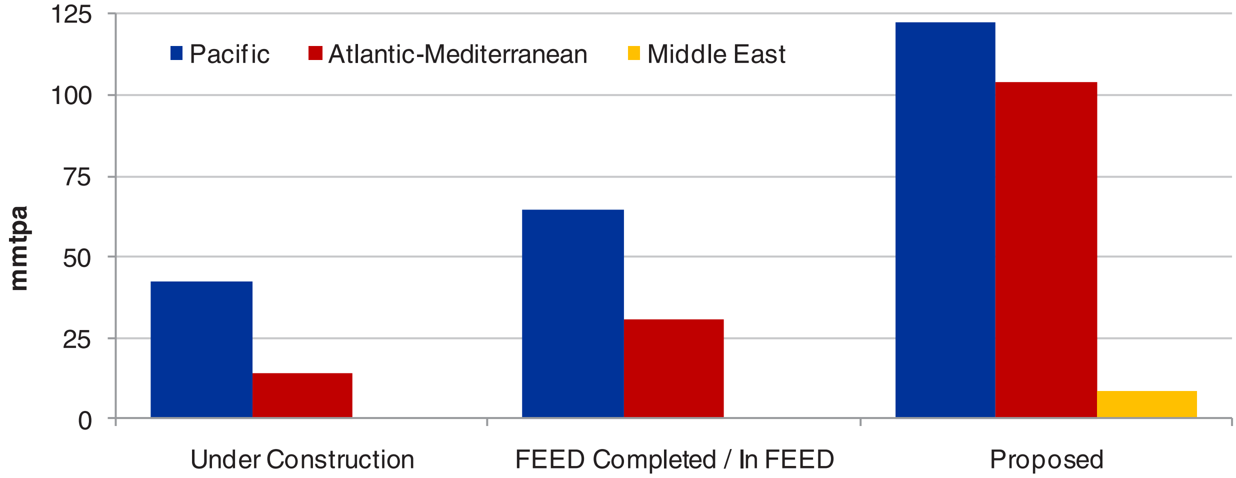
The 1.5 MMtpa Kenai LNG – the only commercial LNG plant in the US – is slated to go offline in 2011, with no new liquefaction capacity expected to come onstream in the US until Cheniere's planned liquefaction plant at Sabine Pass in the Gulf of Mexico. Indonesia's Arun LNG as well as additional trains in Algeria are also scheduled to be taken offline.

In recent years, Qatar contributed the largest volume of global incremental liquefaction capacity. During the past five years (2006-2010), Qatar commissioned approximately 44 MMtpa in liquefaction capacity. In February 2011, Qatar achieved its planned target of 77 MMtpa of nameplate capacity; but a moratorium on new production from the North Field limits expansion potential, though the Qataris have discussed debottlenecking the existing mega-trains.

Over the next decade, Australia will be the driving force behind growth in global liquefaction capacity. Thirty-six MMtpa of capacity is currently under construction in Australia and more than 120 MMtpa is being proposed or in the planning stages – a number that keeps growing as companies discover additional natural gas reserves. There is also a significant amount of proposed capacity in Nigeria – 40 MMtpa – but developers have yet to start construction or reach a final investment decision on any of the proposed projects.

There is 57.1 MMtpa of liquefaction capacity currently under construction, 63% (36.1 MMtpa) of which is in Australia. In addition to the trains under construction, 95.4 MMtpa of liquefaction capacity has been completed or is currently undergoing front-end engineering and design (FEED), and over 230 MMtpa of additional capacity has been proposed. For the 95.4 MMtpa of capacity that has been completed or is in FEED, Australia is again dominant, accounting for 61% (58.5 MMtpa). Atlantic Basin Russia accounts for the second largest volume (24 MMtpa) of liquefaction capacity that has been completed or is in FEED.

FIGURE 15: FUTURE LIQUEFACTION CAPACITY BY STATUS AS OF Q1 2011



Source: PFC Energy

4.4. LIQUEFACTION CAPACITY BY REGION

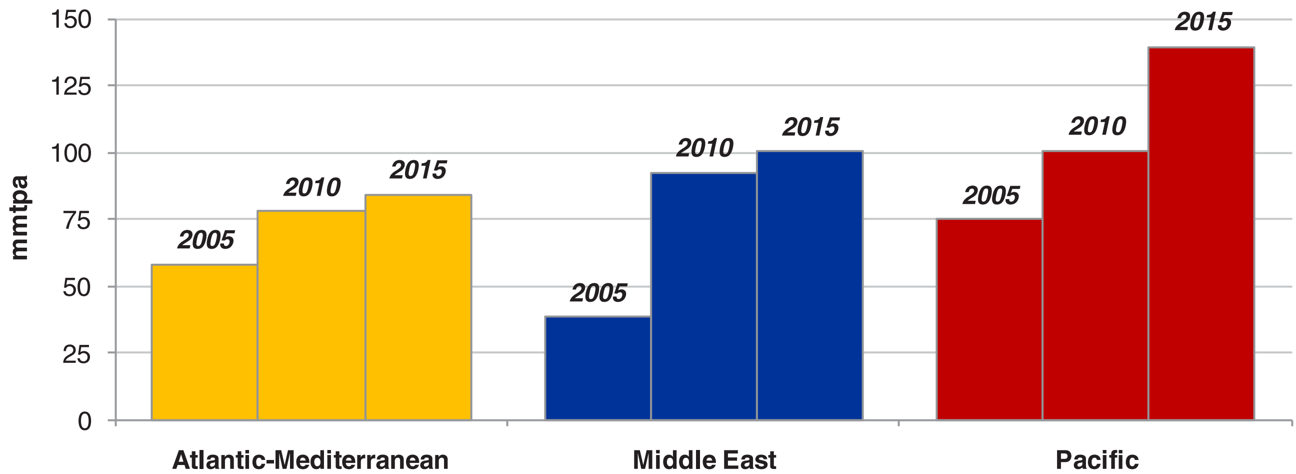
Three quarters of global liquefaction capacity is located in the Pacific Basin and the Middle East, with the remaining quarter in the Atlantic Basin.

TABLE 7: LIQUEFACTION CAPACITY BY BASIN IN 2005 AND 2010, MMTPA

Basin	2005	2010
Atlantic-Mediterranean	58.2	77.8
Middle East	38.4	92.5
Pacific	74.75	100.6
Total Capacity	**171.4**	**270.9**

Source: PFC Energy

FIGURE 16: LIQUEFACTION CAPACITY BY BASIN IN 2005, 2010 AND 2015



Source: PFC Energy

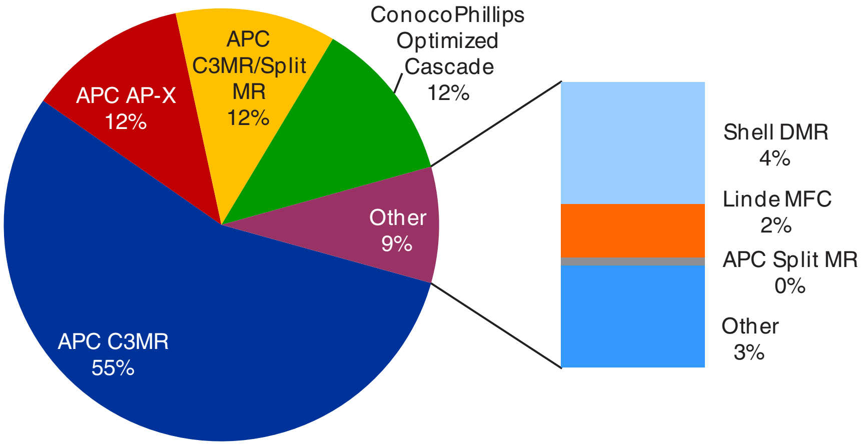
Growth in the last five years has centred in the Middle East, notably Qatar. Qatar ramped up to full production the first of its 7.8 MMtpa mega train in July 2009 and, through February 2011, had brought another five plants onstream, representing 46.8 MMtpa in new liquefaction capacity.

Future growth can be expected from the Pacific Basin, driven by LNG developments in Australia: 76% of this capacity is currently under construction (44.7 MMtpa out of 59.1 MMtpa) in the Pacific Basin, 36.1 MMtpa of which is in Australia. There is also another 64.5 MMtpa of liquefaction capacity in the Pacific Basin which is either in the FEED phase, or has completed FEED.

4.5. LIQUEFACTION PROCESSES

There were eight types of liquefaction processes in use at liquefaction plants by the end of 2010. The most extensively used process was APCI C3-MR, which accounted for 144 million tonnes (55%) of the global nameplate liquefaction capacity.

FIGURE 17: LIQUEFACTION CAPACITY BY TYPE OF TECHNOLOGY, 2010



Source: PFC Energy

Air Products and the ConocoPhillips Optimized Cascade® technology are the most widely used liquefaction technologies, present in 92% of global LNG capacity. Air Products technology is the most widely used, present in 80% of the LNG trains around the world in 2010 – roughly the same market share it had enjoyed for more than 30 years. ConocoPhillips Optimized Cascade® technology is the second most widely used, present in about 12% of the world's liquefaction plants.

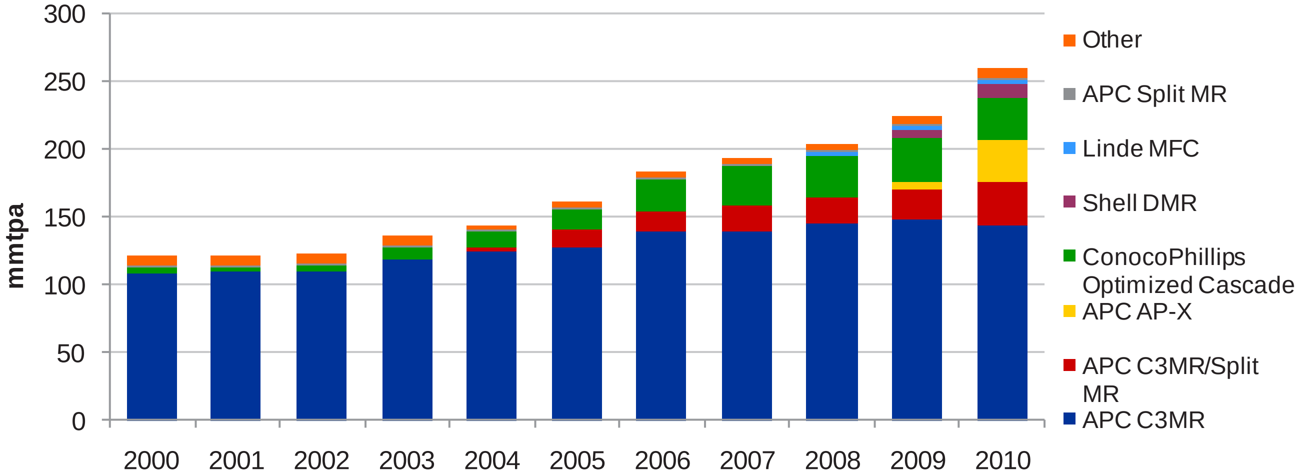
New processes are being employed at several projects. Shell's Dual Mixed Refrigerant (DMR) process is being used at Sakhalin LNG in Russia, APCI's AP-X technology at the Qatari mega-trains, and the Linde Mixed Fluid Cascade (MFC) process is in use at Snøhvit LNG in Norway.

The Snøhvit LNG plant, which came online in 2007, uses a new process developed by Linde/Statoil. The Mixed Fluid Cascade (MFC) process comprises three refrigeration cycles in series. Novel project features include all electrically-driven compressors and direct use of seawater for cooling. Carbon dioxide present in the feedgas is removed and re-injected underground.

ExxonMobil and Qatar Petroleum were the first to employ the APCI AP-X technology at the two-train, 15.6 MMtpa Qatargas II project. The same design was repeated for all the 7.8 MMtpa mega-trains in Qatar: RasGas III, Trains 2 and 3 and Qatargas III and IV. A nitrogen sub-cooling loop has been added to the C3/MR process to increase capacity for the same sized MCHE. It is also the first application of a GE Frame 9 gas turbine as a mechanical driver for the refrigerant compressors.

The Shell Dual Mixed Refrigerant (DMR) process is being used for the Sakhalin project in Russia. This novel process uses two Mixed Refrigerant cycles in series and the process is air cooled for process and environmental reasons. It is sufficiently flexible to support the wide range of ambient temperature experienced in the sub-arctic environment. Train capacity is 4.8 MMtpa.

FIGURE 18: LIQUEFACTION CAPACITY BY TYPE OF TECHNOLOGY, 2000-2010



Source: PFC Energy

Looking Ahead. . .

- ***Will the LNG industry be able to sanction projects at a rate necessary to keep pace with LNG demand growth?*** *Significant liquefaction has been proposed, but how much and how fast the proposed capacity comes on-stream will be critical to enable meeting projected demand growth.*

- ***Will floating liquefaction technology be a game-changer for the industry?*** *Floating liquefaction technology has yet to be commercially proven, but success could open up previously stranded or non-commercial gas reserves.*

5. Special Report: Impact of Unconventional Gas on the LNG Industry

The rapid transformation of the US natural gas market following the shale gas boom has already had an impact on the LNG industry, but this impact could grow if the US exports shale gas as LNG or if unconventional gas can have the same transformative impact on other markets.

The shale gas boom in the US and its dampening impact on the country's LNG demand has amplified the supply and demand balance in the market in 2009 and 2010. Yet the absence of the US as a significant LNG importer merely pushes back the time at which the LNG market tightens by a couple of years. The bigger question is whether other countries will replicate the success of the US – this could happen in some places, but in general the process will be a long one.

5.1. Introduction

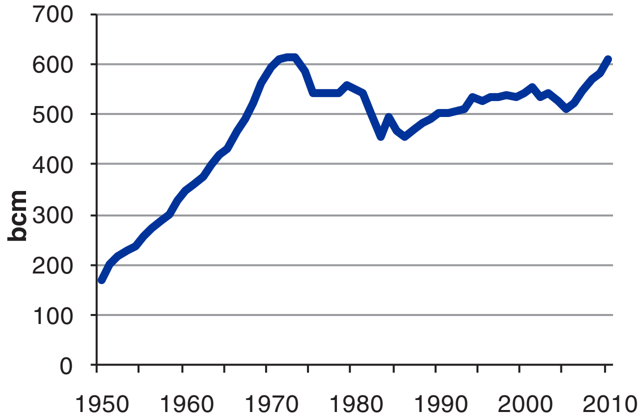
The following special report discusses the factors that led to the unconventional gas boom in the US, the potential for that to be replicated elsewhere and the resulting impact on LNG demand. It also addresses the potential for the US to export shale gas as LNG, another possible impact from the shale gas boom on the LNG market.

5.2. US Shale Gas Boom and Impact on US LNG Demand

Since 1950, the US gas system has gone through five phases. First, production grew by an average 6% per annum from 1950 until it peaked in 1973. Second, production started to fall in 1974 until it bottomed out in 1986 – in that period, production declined by over 25%. Third, from 1987 to 2000, US production increased by a sustained 1.3% annually, leading to a significant recovery in output, but still below the 1973 peak. Fourth, production hit another peak in 2000 and started to decline by 1.2% per annum until 2005. From 2006 onward, production experienced its most dramatic growth in the last 40 years, growing by an average 3.6% per annum. In 2010, output was almost equal to the 1973 peak.

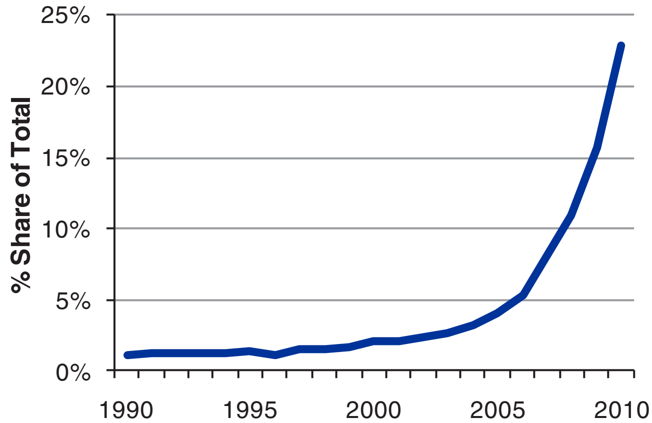
The growth in gas production has been driven primarily by the ability to produce unconventional resources at ever cheaper rates. Unconventional gas includes shale, coal bed methane and tight gas which are all characterized by low natural permeability in the reservoir (commercial gas volumes do not "flow" naturally). Using horizontal drilling and hydraulic fracturing, companies have been able to create sufficient permeability to extract ever increasing commercial volumes from these reservoirs.

Figure 19: US Natural Gas Production



Source: EIA, PFC Energy

Figure 20: Share of Shale Gas in US Gas Production



Source: EIA

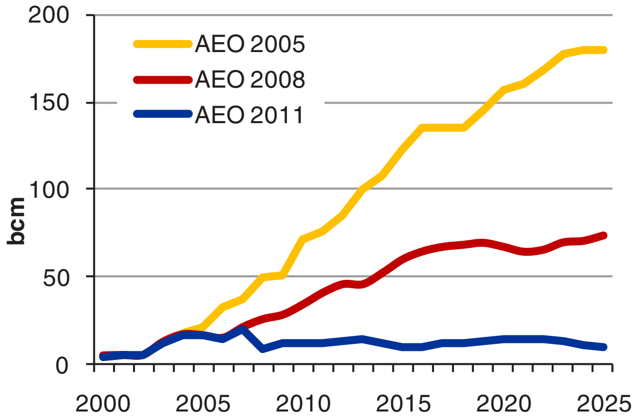
This growth in unconventional gas production has emerged as a shock to the LNG system for two reasons: first, it has made clear that the US will not need to import significant volumes of LNG over the next decade (at least); and second, there is growing uncertainty over whether other countries will be able to replicate the experience of the US and hence, reduce their own needs for imports. Together, these two prospects could reshape the LNG industry.

5.3. Implications of US Shale Gas Boom on LNG Trade Flows and Prices

Perhaps the most important global implication of this "shale gas revolution" is that the US no longer needs as much LNG as previously forecasted. One useful way to think about the importance of US LNG is to re-examine the forecasts done by the Energy Information Administration (EIA) at the US Department of Energy. In its 2005 Annual Energy Outlook (AEO 2005), the EIA was forecasting that the US would need to import as much as 70 bcm in 2010 to meet demand and offset the drop in indigenous production. Given actual LNG production in 2010, this would have amounted to a global market share of 23%, making the US the world's second largest LNG market after Japan. To meet this projected rise in imports, there was a boom in US regasification capacity which increased sevenfold between 2002 and 2010.

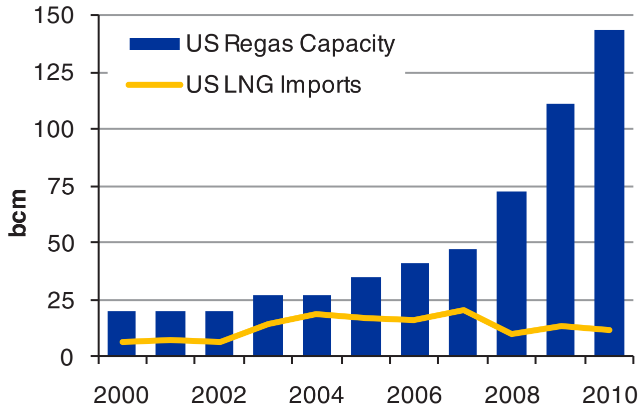
As the production growth story proved to be sustainable, those expectations shifted: by 2008, the EIA thought that by 2010, the US would only need 34 bcm. However, even those numbers turned out to be optimistic. In the 2011 AEO, the EIA has significantly downgraded its LNG import expectations and it effectively foresees no growth through 2025.

Figure 21: EIA Forecasts for US LNG Imports



Source: EIA

Figure 22: US Regasifcation Capacity vs. Imports

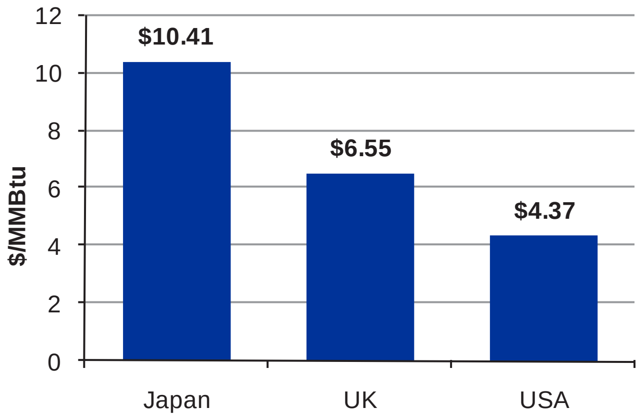


Source: PFC Energy

This means that a significant source of demand for global LNG supplies has disappeared. Given that LNG investments have a long-lead time, there is a significant amount of LNG capacity that is coming online between 2009 and 2012 which was constructed based on the market expectations of 2005, whereby the US would become a major import market. This LNG had to find a new place to go – and in 2010, it found a home mostly in Europe as well as in emerging markets (Middle East and Latin America). Combined with a recession-induced drop in gas demand in 2009, the lack of more imports needed from the US produced a longer-than-expected glut in gas supplies. This glut has had two implications for gas pricing:

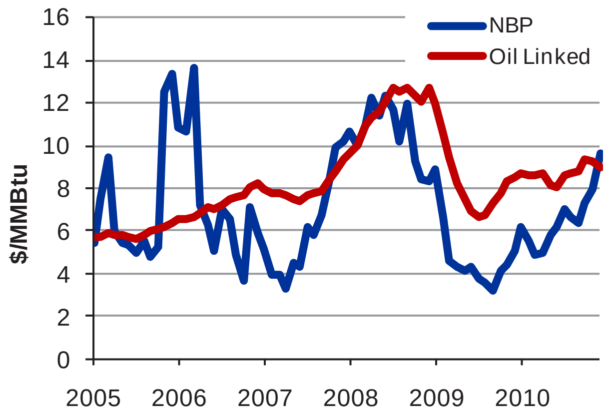
First, the US market has become effectively disconnected from the broader global market. While Henry Hub has never correlated perfectly with prices in either Europe or Asia, the disparity between Henry Hub and prices elsewhere has been magnified in 2008, 2009 and 2010. Of particular interest is in 2010, where US gas prices were more than 50% lower than prices in Japan, while they are also being traded at a significant discount vis-à-vis UK gas prices (-33%). As a result of this disparity, a number of companies that own regasification terminals which are currently idle, are now proposing instead to start exporting LNG from North America.

FIGURE 23: GAS PRICES, 2010



Source: PFC Energy

FIGURE 24: EUROPEAN GAS PRICES, OIL-LINKED VS. SPOT



Source: PFC Energy

Second, there has been growing pressure on the linkage between oil-linked and spot prices in Europe. In 2009, the average oil-linked contract price exceeded the spot price at NBP by ~$3.5/MMBtu. In 2010, the gap narrowed only slightly, reaching $2.16/MMBtu. In 2010, the gap narrowed and by the end of 2010 it had disappeared at least in the short term – but there have been two distinct byproducts of this resulting disparity. First, buyers have sought to renegotiate terms with sellers. In general, buyers have succeeded in linking some of the volumes they purchase to spot prices rather than oil; they have also achieved a relaxation of take-or-pay (TOP) provisions. Second, several new entrants have sought to procure gas directly from the spot market (pipeline or LNG). Combined with the existence of TOP clauses, this competitive pressure has further squeezed incumbent importers who are usually saddled with higher-priced gas that they cannot market.

Thinking about the importance of US shale gas from a more structural perspective, there are two questions to consider. First, is the US shale gas revolution sustainable? If so, at what price is shale gas viable and what risks are associated with its production? If it is indeed both abundant and cheap to produce, then the US could easily emerge as a major exporter of LNG within the next decade.

Second is the question of whether the absence of US LNG import demand has produced a short or long-term glut in supply. This is the controversial subject in the gas world today with two camps – those who think the glut is cyclical, and those who think it is structural – having several data points to support their argument. The important question to ask is: even if one excludes the US as an importing country, does the global supply and demand balance tighten sooner or later?

5.4. GROWTH IN UNCONVENTIONAL GAS PRODUCTION OUTSIDE NORTH AMERICA

The success in boosting shale gas in the US has generated strong interest in unconventional gas across the globe. In Asia, Europe, Latin America and Africa, companies strive to acquire the knowledge and expertise gained in North America and to apply them elsewhere. Although this development is taking place rapidly, it is still at a very early stage. At this point, several observations can be made:

- The global resource base is thought to be significant – estimated by Rogner in 1997 to be as high as 32,000 tcf (906 tcm) – but this is an order of magnitude geological estimate at best. There is much more activity needed to ascertain accurately how much unconventional gas exists and, more importantly, how much can be produced economically.

- The unconventional gas revolution in North America was the result of a number of factors coming together: a prime resource base, large service sector capacity, favorable pricing, easy to market gas, clear property rights, a supportive government, etc. These conditions are largely absent in most other places – and even when some conditions are present (for example, high prices), others are not (availability of rigs, people, services or easy access to pipelines or clear sub-surface mineral rights, etc.).

- Every play is different. Even in the US, productivity (and hence profitability) is highly variable with good wells being as much as 30-40 times better than the worst wells. There are also enormous productivity gains over time as companies learn how to produce optimally from specific reservoirs. In that sense, the industry's challenge is to "adapt" not merely "adopt" the best practices from America.

- There is an industry consensus that the production outlook for unconventional gas is very uncertain. Most likely, unconventional gas production may grow in certain niche markets such as Australia, China and a few others in Europe and Latin America.

Therefore, while there is still potential for unconventional gas to transform the global market in the same manner it had transformed the North American market, it is obvious that the level of activity globally has yet to reach the requisite point. While the prospects for some countries, such as Australia and China, look promising; others such as Argentina and Poland, are merely trying to move quickly. But in several others – for example, France and South Africa, the political constraints are already delaying drilling for unconventional gas. Development will be thus slow and uneven around the world.

Looking Ahead. . .

- ***Can the success of shale gas in North America be replicated in other countries with significant unconventional gas reserves?*** *A few countries outside North America are already on their way to tapping shale and CBM gas reserves, namely Australia. Many more countries across Asia, Europe and South America have also proposed developing unconventional gas, but significant quantities of production remain far off.*

- ***Will the US shale gas revolution result in LNG exports from the continental US?*** *Over the past year, at least three regasification terminals in the US have proposed developing bi-directional capacity, which would allow partners to either import LNG or liquefy US shale gas for export. The potential impact of LNG exports from the continental US is yet to be determined, though it will likely depend heavily on the long-term oil-gas price environment.*

6. LNG Receiving Terminals

In developed and emerging markets, gas is a fuel of choice to meet domestic needs and both the volume of new LNG receiving capacity and the number of countries importing LNG has increased significantly in recent years.

The growth in global regasification capacity in 2008 and 2009 continued in 2010 as a significant number of new LNG receiving terminals were commissioned. Several of these terminals were located in regions that are not only new LNG importers, but regions that ten years ago were not considered markets for significant LNG demand. Several terminals, however, came online in the US, where as a result of that country's shale gas revolution, they are largely unutilised.

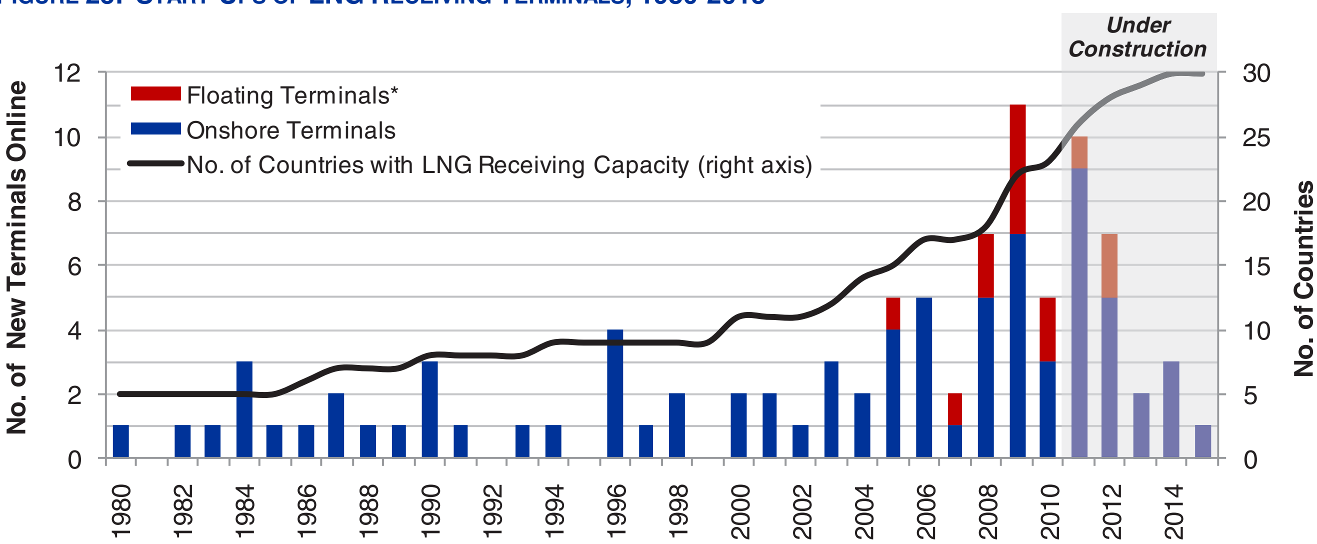
6.1. Overview

The number of markets turning to LNG to meet natural gas demand has grown considerably over the past decade, with the number of countries with LNG receiving capacity more than doubling between 2000 and 2010. Since 2005, six countries started to import LNG: Argentina, Brazil, Canada, Chile, Kuwait, and the UAE. Notably, five out of these six countries are located in South America and the Middle East, two non-traditional and emerging LNG importing regions. The world's other 17 LNG importers are Belgium, China, Dominican Republic, France, Greece, India, Italy, Japan, Mexico, Portugal, Puerto Rico, South Korea, Spain, Taiwan, Turkey, the UK and the US.

6.2. Receiving Terminal Capacity Globally

Over the last five years (2006-2010), 30 terminals started operation, bringing the total number to 83 terminals at the end of 2010. Ten of the world's 83 terminals are floating terminals, nine of which utilise floating regasification vessels (one floating terminal, Gulf Gateway in the US, is announced to be decommissioned in 2011), and one that is a gravity-based structure.

Figure 25: Start-Ups of LNG Receiving Terminals, 1980-2015[4]



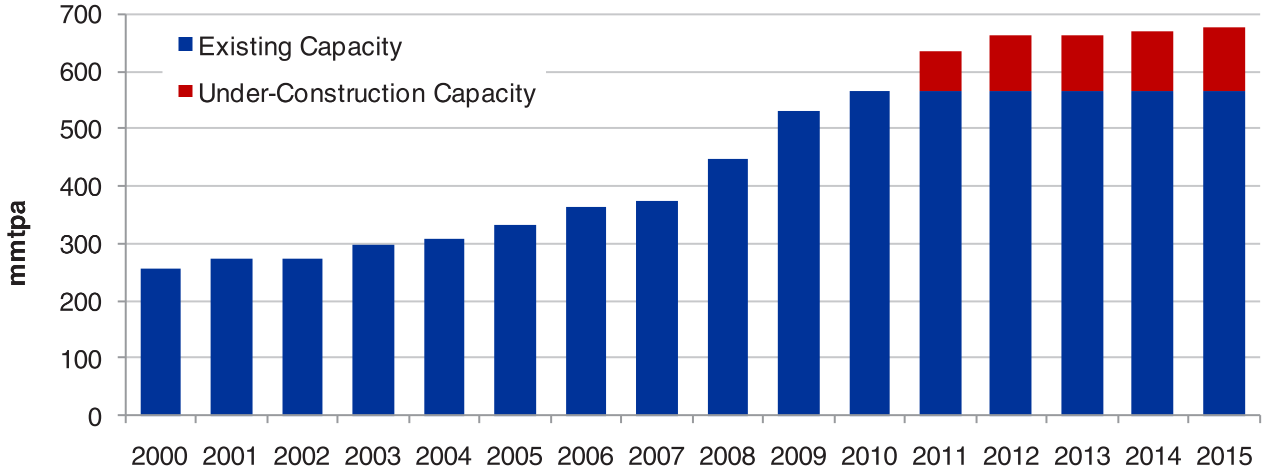
* *Includes offshore floating regasification vessels and the one gravity-based structure.*
Source: PFC Energy

[4] *Forecast through 2015 based on company-announced start dates for under-construction regasification capacity.*

Since 2005, annual send-out capacity has increased by 70%, reaching over 572 MMtpa at the end of 2010. An additional 110 MMtpa is under construction at existing terminals and greenfield sites and is due online by 2015. When the under-construction terminals are completed, the global regasification capacity would be increased to 680 MMtpa.

Several under-construction terminals are in countries with no existing regasification capacity, namely: Indonesia, Malaysia, the Netherlands, Poland, Singapore, Sweden and Thailand. Their addition to the list of countries with LNG receiving capacity will bring the total to 30 countries by 2015.

FIGURE 26: GLOBAL RECEIVING TERMINAL CAPACITY, 2000-2015

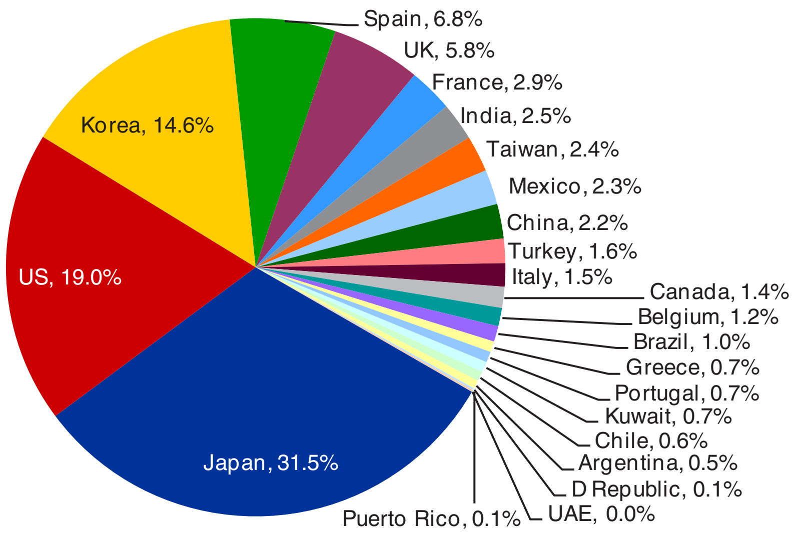


Source: PFC Energy

6.3. RECEIVING TERMINALS BY COUNTRY

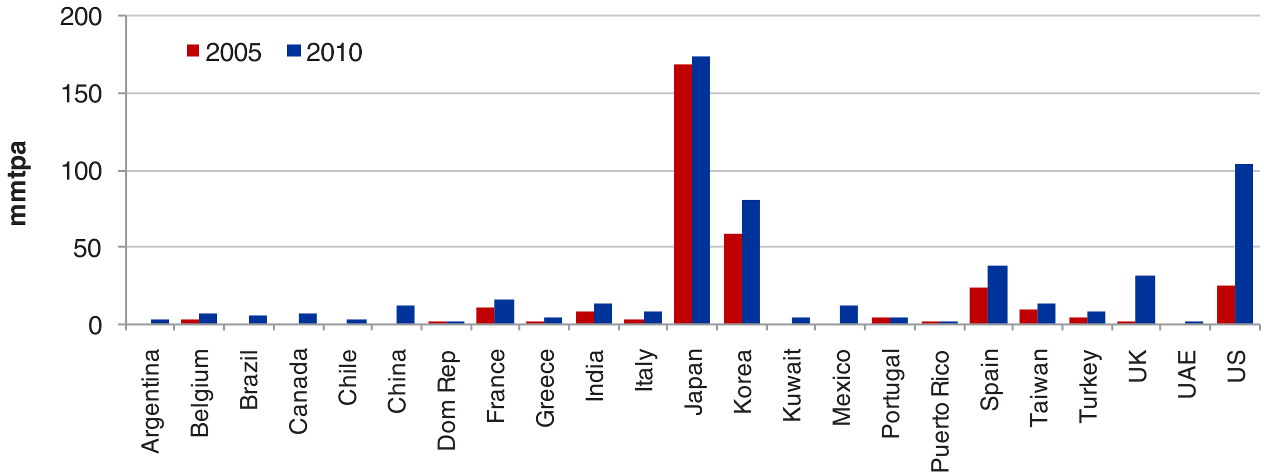
Japan has by far the most receiving terminals in the world, with 28 terminals in operation at the end of 2010, followed by the US with ten terminals (an eleventh terminal, Golden Pass, came online in 2011, while the Gulf Gateway terminal is expected to be decommissioned during the year). Japan is home to a third of global regasification capacity, followed by the US with 19% and South Korea with 15%.

FIGURE 27: LNG REGASIFICATION CAPACITY BY COUNTRY, 2010



Source: PFC Energy

FIGURE 28: RECEIVING TERMINAL CAPACITY BY COUNTRY IN 2005 AND 2010

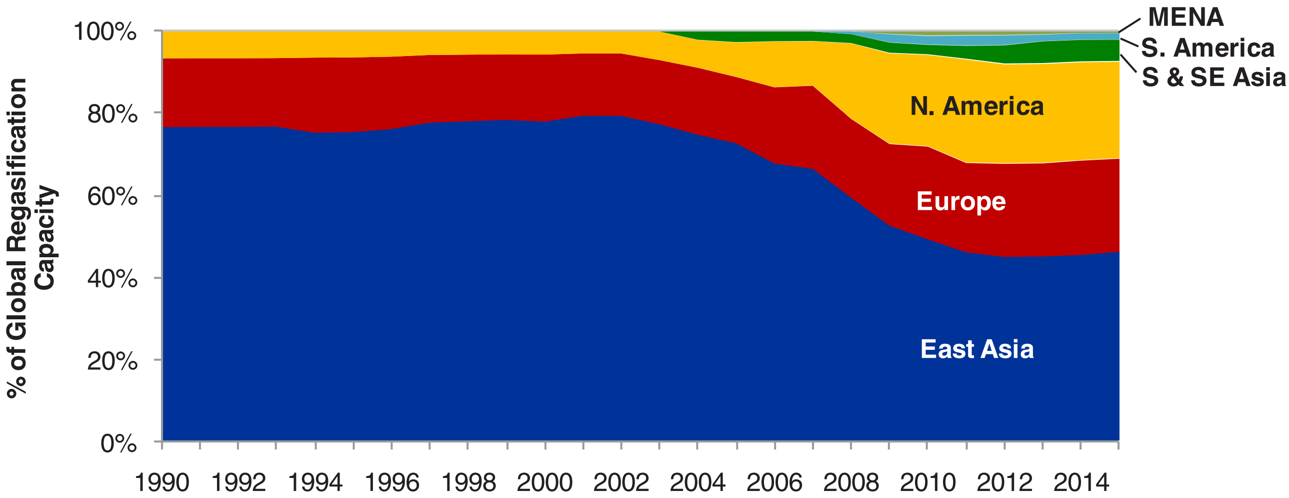


Source: PFC Energy

6.4. RECEIVING TERMINALS BY REGION

East Asia, which includes traditional LNG importers Japan, Korea and Taiwan, as well as fast-growing China, held the majority (51% or 280 MMtpa) of the world's regasification capacity at the end of 2010. East Asia has historically accounted for a larger share of global regasification capacity, (~75-80% throughout the 1990s and early 2000s), but its share has been declining dramatically since the mid-2000s due to capacity additions in North America, and to a lesser extent Europe, and the emergence of LNG importing markets: South Asia, South America and the Middle East.

FIGURE 29: REGASIFICATION CAPACITY BY REGION, % SHARE OF TOTAL



Source: PFC Energy

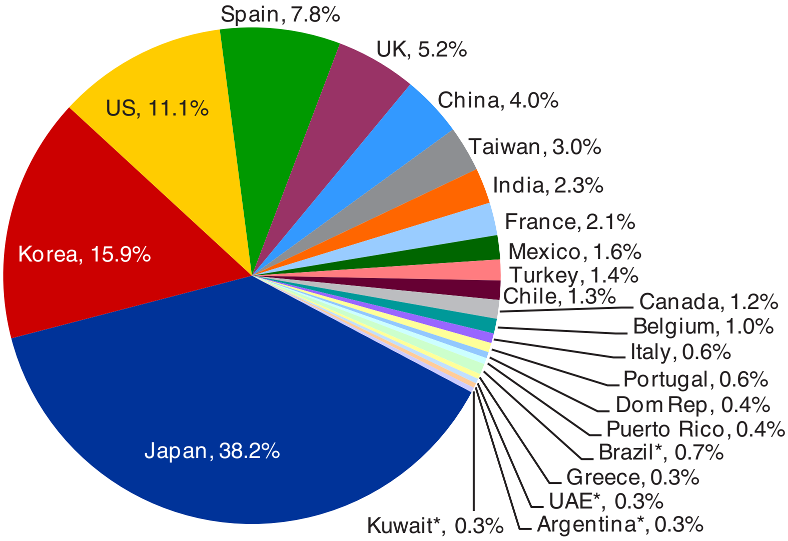
6.5. RECEIVING TERMINALS' LNG STORAGE CAPACITY

At the end of Q1 2011, the world's regasification terminals had over 39 million cubic metres (MMcm) of combined LNG storage capacity[5]. The top five countries with the largest storage capacities together

[5] *The storage capacity is the combined capacity of the LNG storage tanks. Data and graphs include onshore and offshore/floating LNG storage tanks.*

claimed 78% of global LNG storage capacity: Japan and Korea alone accounting for 54% (Japan with 15.1 MMcm of capacity and Korea with 6.3 MMcm), followed by the US (11.6%), Spain (6.8%) and the UK (5.5%). Eighteen countries together make up the remaining 22% of global LNG storage capacity.

FIGURE 30: LNG STORAGE TANK CAPACITY BY COUNTRY AS OF Q1 2011



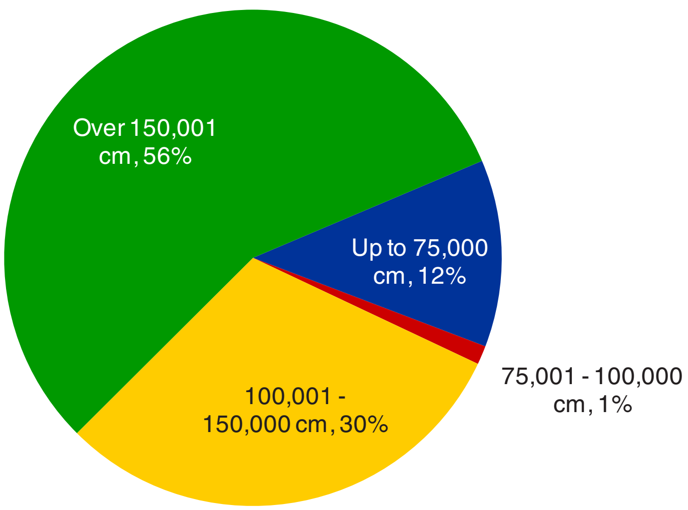
*Country's entire LNG storage capacity consists only of storage tanks on offshore regasification vessels

Source: PFC Energy

6.6. RECEIVING TERMINALS' MAXIMUM BERTHING CAPACITY AND GAS SEND-OUT CAPACITY

A majority (56%) of LNG terminals can accommodate vessels with a LNG carrying capacity of over 150,000 cubic metres, a share which has doubled since 2005 as new terminals have come online with berthing capacities over 150,000 cm, and a growing number of existing terminals are upgrading facilities to accommodate larger ships.

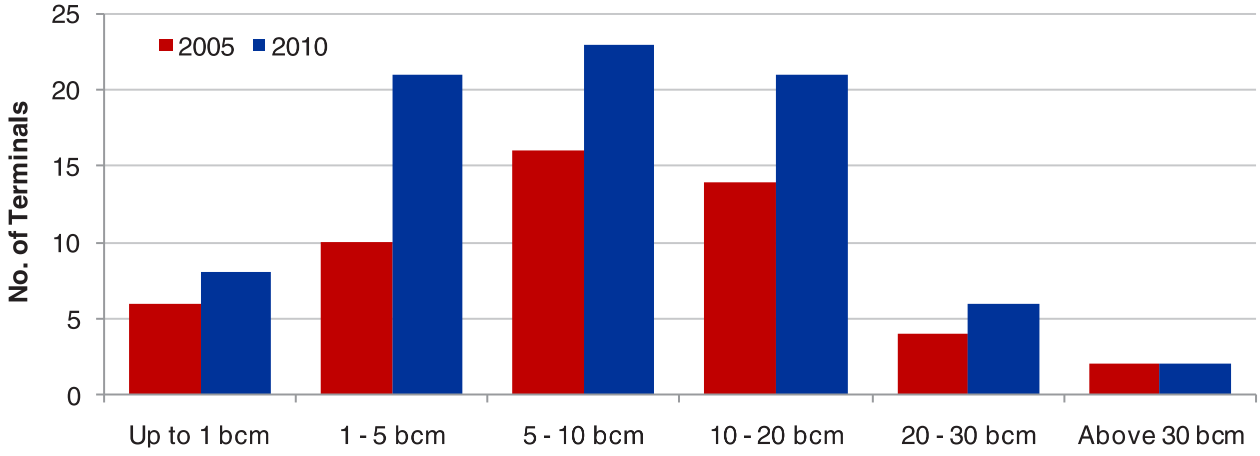
FIGURE 31: MAXIMUM BERTHING CAPACITY AS OF Q1 2011



Source: PFC Energy

All send-out brackets have experienced growth between the end of 2005 and 2010, except terminals with a send-out greater than 20 billion cubic metres per annum (bcm). The majority of receiving terminals had a send-out between 5 and 10 bcm at the end of 2008, as was also the case in 2005.

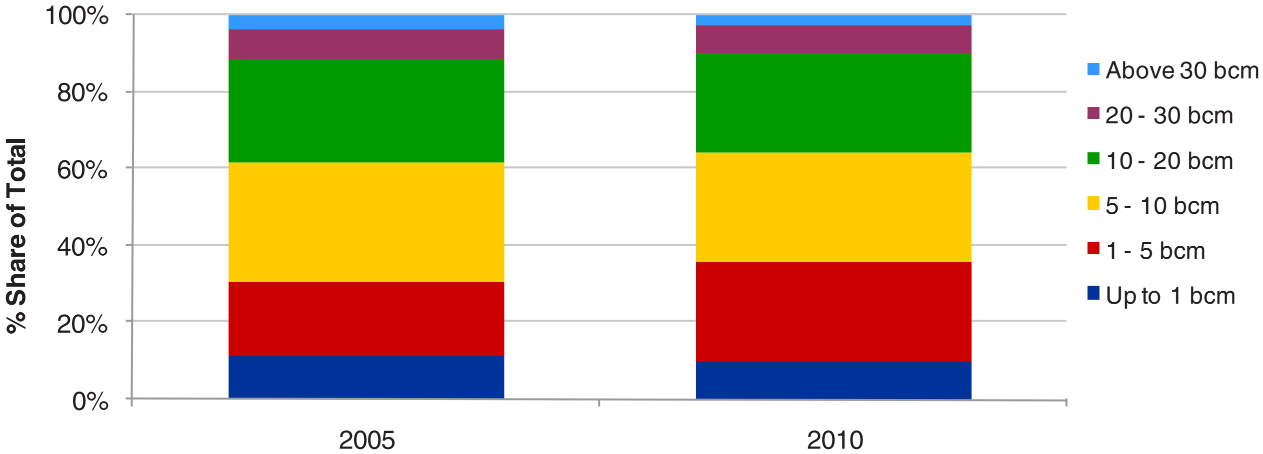
FIGURE 32: ANNUAL SEND-OUT CAPACITY OF LNG TERMINALS IN 2005 AND 2010



Source: PFC Energy

The biggest growth has taken place in the construction of terminals with a send-out of 1 bcm – 5 bcm from 10 terminals in 2005 to 21 terminals at the end of 2010. A large part of the increase stems from the commissioning of floating receiving terminals, including Golar Energy's Bahía Blanca in Argentina, Pecem and Guanabara in Brazil and Dubai in the UAE, and Excelerate Energy's Teesside GasPort in the UK, Gulf Gateway, Northeast Gateway, and Neptune in the US and Mina Al-Ahmadi GasPort in Kuwait. Contracts have also been signed for two more floating terminals (Puerto Escobar in Argentina and West Java in Indonesia) announced to come online in the medium-term, with many more countries and developers studying or planning offshore terminal developments.

FIGURE 33: SHARE OF ANNUAL SEND-OUT CAPACITY OF LNG TERMINALS IN 2005 AND 2010



Source: PFC Energy

6.7. Regasification Terminals' Technologies

The long lead time and high investment costs for land-based terminals, together with safety concerns and environmental considerations have recently resulted in an increased interest in offshore re-gasification terminals. A variety of offshore concepts have been developed:

- A ***Floating Storage and Regasification Unit (FSRU)*** is an LNG carrier with on-board regasification capability. It either can be a conversion of an existing carrier or purpose built. It remains attached to a single point mooring system offshore and receives LNG from other carriers by ship-to-ship transfer. The LNG is stored, re-gasified on demand and exported to shore by a subsea pipeline.

- An ***LNG Regasification Vessel (LNGRV)*** is a carrier with regasification equipment onboard. The carrier docks at a floating buoy and exports its gas to the shore via a subsea pipeline. Shipboard regasification can take 5 days - 7 days before the carrier is depleted and can sail to its next destination.

- A ***Gravity-Based Structure (GBS)*** is a submersible structure that permanently rests on the sea floor and contains integral LNG storage tanks and regasification equipment on the topside. It is a robust, but also rather costly solution and currently there are no proposals for additional GBS projects.

- Other concepts are at a conceptual stage such as Hiload. It is a floating docking station to which an LNG carrier is able to dock via a friction-based attachment system. The LNG is regasified offshore and exported to shore via a subsea pipeline. Onshore regasification terminals have also seen innovation including the use of air vaporisers in hot and wet climates, and cold integration with neighboring industry to improve overall efficiency.

LNG receiving terminals convert imported LNG back to its gaseous state by using either an open loop or closed loop heating system. An open loop system uses a continuous stream of seawater as the heat source for regasification and can pump up to 200 million gallons of sea-water per day in the process. In a closed loop system, a portion of the gas cargo, about 1% - 2%, is burnt in order to provide the heat source for regasification. This system has higher emissions from gas combustion than an open loop system but has minimal impact on marine life and is the system used by most terminals.

Looking Ahead. . .

- ***By how much will rising domestic gas demand, especially in LNG exporting countries, impact LNG supply long term?*** *Several traditional LNG exporters are already building or are planning to build LNG receiving capacity.*

- *In addition to the 30 countries with existing or under-construction LNG receiving capacity, at least 11 countries in Europe, seven in South America & the Caribbean, five in South & Southeast Asia, four in MENA and two in Africa are studying or planning LNG imports to meet domestic gas needs. However, absorbing costly LNG into some local gas markets will be challenging.*

7. LNG Carriers

The global LNG fleet has grown at a rapid pace in recent years and new orders will bring more growth in the medium term.

The LNG fleet has expanded faster than that of the global LNG trade, a situation exacerbated by the global recession. As demand recovered in 2010, that disparity narrowed and will continue to narrow in 2011. Interregional trading will also lead to higher utilisation of this additional ship carrying capacity.

7.1. Overview

At the end of 2010, the world LNG fleet consisted of 360 ships[6], with a combined capacity of 53 MMcm, up from 195 ships at end-2005. Over the last decade the fleet has been growing at a rapid pace: during the 1980s and 1990s, the LNG shipping industry delivered an average of four new LNG carriers each year. By contrast, the industry delivered an average of 35 new LNG carriers over the past five years (2006-2010), hitting an all-time high of 47 LNG ships delivered in 2008.

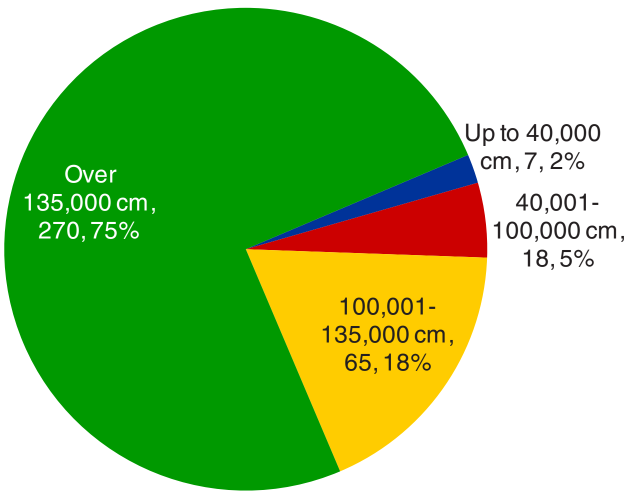
The average size of LNG carriers has also increased in recent years due to the commissioning of large carriers. In 2010, the global fleet averaged 146,686 cm of capacity per carrier. As of the end of 2010, the fleet included 31 Q-Flex (210,000-217,000 cm each) and 14 Q-Max (>260,000 cm) vessels.

There is also growing demand for alternative uses of LNG ships, which consists mainly of floating regasification and/or LNG storage vessels. Many companies and countries are also investing in developing floating liquefaction technology, which would also utilise LNG carriers. This technology remains unproven, though Shell sanctioned the world's first floating liquefaction plant in May 2011.

7.2. LNG Carriers' Capacity

The size of LNG carriers ranges significantly. The smallest cross-border LNG vessels, typically ~18,000 cm - 40,000 cm, are mostly used to transport LNG from Southeast Asia to smaller terminals in Japan, whereas Qatar operates a fleet of large ships with capacities of 210,000 cm to 266,000 cm.

Figure 34: Capacity of LNG Carriers, 2010 (Number of Carriers, % of Total)



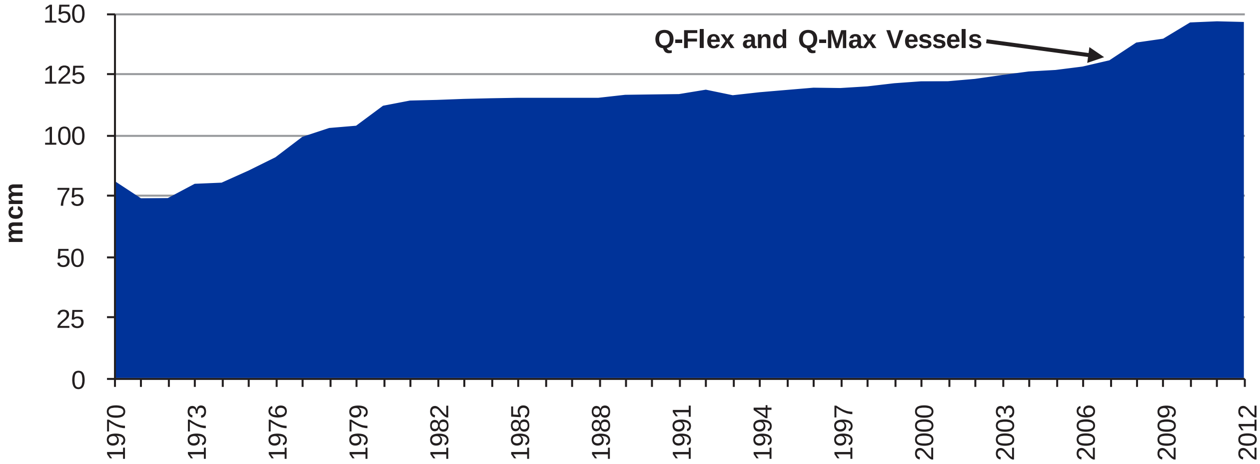
Source: PFC Energy

[6] *Data and graphs in this section exclude coastal tankers not used for cross-border LNG trade.*

There are also much smaller carriers – 7,500 cm and below – which are used in domestic and coastal trades, facilitating delivery of LNG to remote areas. LNG carriers with a capacity larger than 135,000 cm accounted for 75% (270 carriers) of the global fleet by the end of 2010, a share which has continued to rise.

Since 1969, the average capacity of the world's LNG fleet has more than doubled; between 2000 and 2010, total average capacity increased by ~22%. As of end 2010, the average capacity per vessel was ~146,700 cm; the average capacity of all vessels on order was 157,654 cm[7]. The average vessel size increased by less than 5,000 cm during the first half of the last decade (2000-2004), but by ~20,000 cm during the second half of the decade (2005-2010). The more recent increase in both total and average capacity is largely linked to the completion of 45 Q-series vessels, which accounted for 20% of the fleet's capacity in 2010.

FIGURE 35: GROWTH IN AVERAGE FLEET CAPACITY, 1964-2012



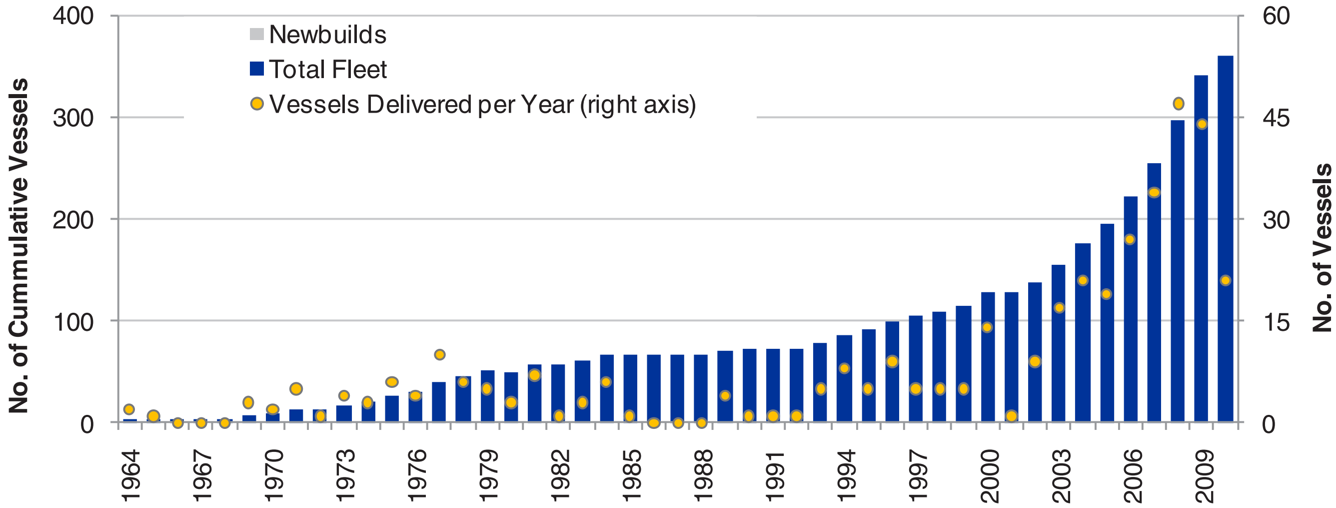
Source: PFC Energy

[7] *Excludes floating liquefaction vessels on order*

7.3. LNG CARRIERS COMMISSIONED

Over the past five years (2006-2010), 173 new LNG vessels were commissioned; a record number of 47 new vessels was delivered in 2008, most of which went to Qatar.

FIGURE 36: LNG FLEET GROWTH, 1964-2010



Source: PFC Energy

At the end of 2010, over 30 vessels remain on the order book, the bulk of vessels on order are between 160 mcm and 180 mcm. Also on order are four 220 mcm FPSOs owned by Flex LNG and a single FPSO owned by Shell (these are not shown in the graph).

7.4. LNG CARRIERS' TYPES

The term "conventional LNG carriers" usually refers to the Moss-type or membrane vessels which are widely used. As with the increase in variety of regasification terminals, there has been a surge in the different types of LNG carriers used in transporting LNG. These include LNG Regasification Vessels (LNGRVs) and carriers with onboard liquefaction.

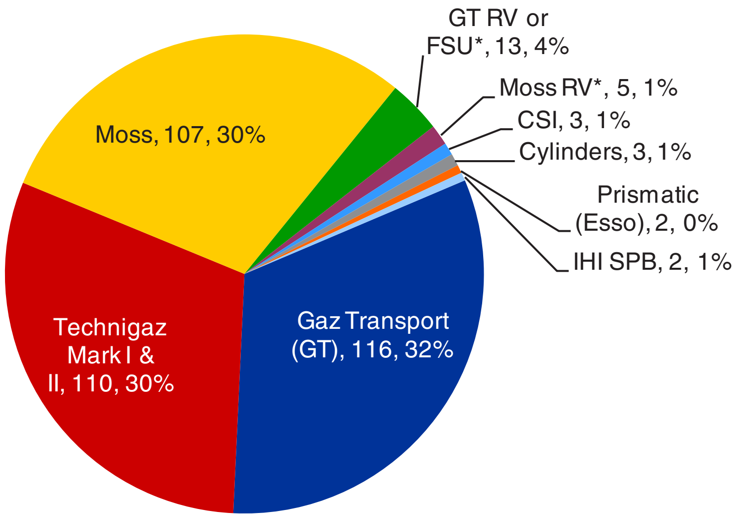
An LNGRV is similar to conventional LNG carriers in size except the regasification function and related facilities. The LNGRV is a new innovation combining conventional LNG carrier and FSRU designs. It is a LNG carrier equipped with onboard LNG regasification facilities and an internal turret for the subsea pipe connection. Therefore, the LNGRV can be operated as a conventional LNG vessel during the voyage and at the same time it can function as an offshore regasification terminal when connected to a buoy.

Carriers with on-board re-liquefaction systems handle boil-off gas, liquefy it and return the LNG to the cargo tanks, thereby reducing LNG losses and producing economic and environmental benefits. Carriers with these capabilities include the Q-Flex and Q-Max, which are each propelled by two slow speed diesel engines.

7.5. LNG Carriers' Tank Type

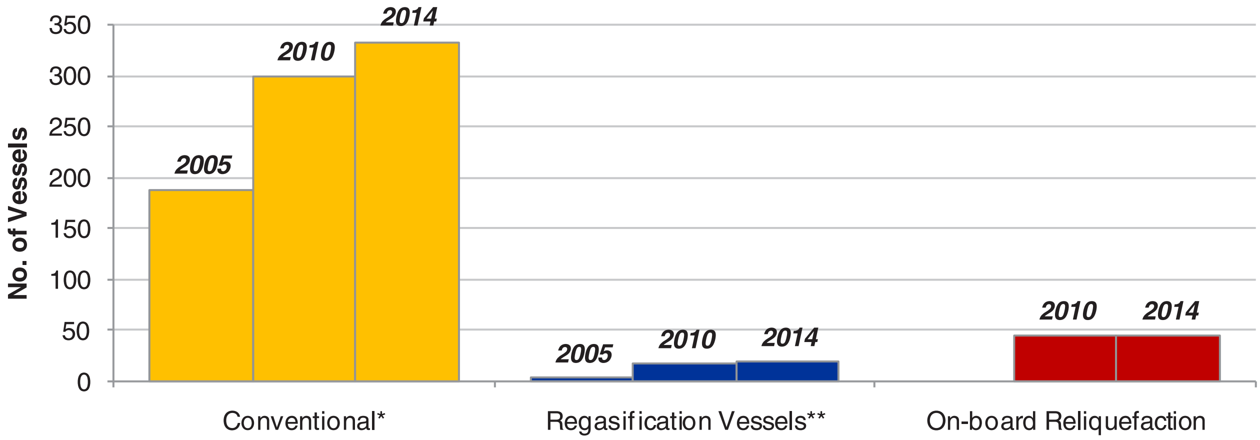
The three major tank types in LNG carriers are Moss, Gaz Transport (GT) and Technigaz (TGZ). The GT and TGZ are a membrane tank configuration rather than spherical Moss containers widely associated with the public image of an LNG ship.

Figure 37: LNG Carriers by Cargo Containment System, 2010 (Number of Carriers and % of Total)



**RV = Regasification Vessel; FSU = Floating Storage Unit. Includes converted and newbuild RVs and FSUs.*
Source: PFC Energy

Figure 38: LNG Tank Types in 2005, 2010 and 2014[8]



** Includes vessels used as Floating Storage Units (FSU) at regasification terminals.*
*** Includes Shuttle Regasification Vessels (SRVs).*
Source: PFC Energy

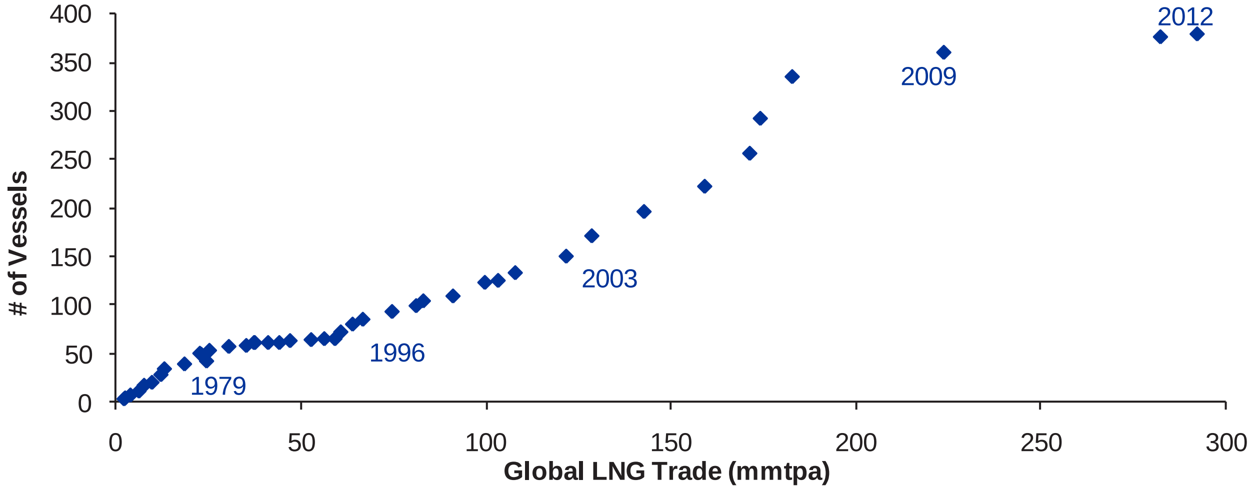
7.6. LNG Carriers and the LNG Trade

The LNG fleet has expanded faster than that of the global LNG trade, a situation exacerbated by the global recession. Vessels ordered prior to the crisis were completed even as demand for LNG cargoes dropped considerably. But as demand recovers, the trade in LNG is expected to grow into

[8] *2012 data includes existing fleet plus ships on order due to be delivered by end-2012.*

this larger fleet. Also, leading to higher demand for LNG ships is the increase in interregional trading activity, whereby producers sell one or more cargoes not only to buyers in their own respective region but deliver LNG in other regions, which has increased the need for additional ship carrying capacity. An example has been the influx of LNG from the Atlantic Basin into the Pacific Basin, whereby the producer and the buyer have been sometimes more than 13,000 nautical miles apart. Looking forward, fewer vessels are on order to be completed between 2011 and 2012, as compared with the delivery schedules in recent years, which will also increase utilisation rates of the existing fleet.

FIGURE 39: LNG FLEET EXPANSION VS. GLOBAL LNG TRADE



** Figures beyond 2010 are based on PFC Energy estimates for LNG fleet size and global liquefaction capacity*
Source: PFC Energy

Looking Ahead. . .

- *The supply and demand shock delivered to the LNG system has already led to a significant tightening in shipping capacity alongside a rapid growth in charter rates.*
- *Low charter rates have enabled a series of new entrants to enter the LNG market as they chartered ships to do spot and short-term trades. As charter rates rise, the barriers to entry will rise.*
- *New orders have slowed down after the boom in liquefaction capacity – but as new projects reach FID, that situation will be reversed.*

8. The LNG Industry in the Years Ahead

Going forward. . .

- *The LNG market is already showing signs of tightening as a result of robust demand growth in 2010 and the demand shock from Japan in the aftermath of the Fukushima Daiichi tragedy. In such market environment, the overhang generated by shale gas in the US is slated to last less than many market analysts had anticipated.*
- *Implications of the Fukushima Daiichi nuclear crisis on public opinion, nuclear policies and power markets around the world will continue to play out long term. While it is still too early to tell how much LNG demand will be impacted by the shut-in of select nuclear plants and an overall policy shift away from nuclear in select countries, the potential upside is indeed significant.*
- *Incremental LNG supply into the market is expected to grow significantly in 2011, albeit less than in 2010. This will be driven by new liquefaction capacity commissioned in 2011 (Pluto LNG and Qatargas IV) and trains brought online in 2010, including two mega-trains in Qatar realizing full-year production.*
- *There will be a temporary slow-down in liquefaction capacity brought online in the medium-term (end-2011 to 2013). This is due to the limited number of LNG projects sanctioned during and around 2008. Angola LNG was the only project that reached FID in 2008 and is announced to be completed in 2012. No capacity is announced to come online in 2013.*
- *Driven by an increase in LNG projects sanctioned in 2009 and 2010, there is currently 64.9 MMtpa of under-construction liquefaction capacity that is expected to come online by the end of 2015. This will bring liquefaction capacity to 343.9 MMtpa by end-2015 from 283.5 MMtpa at end-2011. Decommissioning of older plants is expected to offset a minor share of this growth.*
- *Qatar, which is the largest LNG exporter, is expected to further increase its LNG exports in 2011 as the mega-trains realise full-year production. But in the longer term, Australia is projected to surpass Qatar as the largest LNG exporter. Australia has a significant volume of capacity under construction, with even more nearing FID or being proposed. By contrast, there is no liquefaction capacity under construction or in FEED in Qatar or the Middle East region (except for Iran).*
- *Growth of global LNG receiving capacity is expected to continue on a strong path. About 110 MMtpa of regasification capacity is currently under construction and due online by the end of 2015. Once completed, global regasification capacity will stand at nearly 680 MMtpa. Commissioning of new floating regasification vessels, which have shorter development lead-times, could further increase LNG receiving capacity within this time frame.*
- *The tally of countries turning to LNG imports to meet domestic needs will also continue to rise. Moreover, just as the Middle East and South America became LNG importing regions during the last decade, Southeast Asia and possibly Africa, will begin importing LNG this decade.*
- *The LNG shipping market will continue to tighten in 2011, driven by three main factors: first, a slowdown in new vessel deliveries; second, Qatar has chartered a number of smaller vessels to increase the flexibility of its fleet; and third, an increase in players looking to do long-haul trade (including re-exporting from the US) adding to miles traveled even though volumes may not grow. Together, these three factors have helped to push up spot charter rates thus far in 2011.*

APPENDIX I: Table of Recently Commissioned Liquefaction Plants

Country	*Project Name*	*Start Year*	*Nameplate Capacity (MMtpa)*	*Project Partners*	*Liquefaction Technology*
Trinidad	ALNG T4	2006	5.2	BG, BP, NGC Trinidad, Repsol	Optimized Cascade
Nigeria	NLNG T4	2006	4.1	Eni, NNPC, Shell, TOTAL	APC C3MR
Nigeria	NLNG T5	2006	4.1	Eni, NNPC, Shell, TOTAL	APC C3MR
Oman	Qalhat LNG	2006	3.7	Shell, TOTAL, Itochu, Korea LNG, Mitsubishi, Mitsui, Omani Government, Osaka Gas, Partex, Petroleum Development Oman (PDO), Union Fenosa Gas	APC C3MR
Australia	Darwin LNG T1	2006	3.6	ConocoPhillips, Eni, INPEX, Santos, TEPCO, Tokyo Gas,	Optimized Cascade
Equatorial Guinea	EG LNG T1	2007	3.7	GE Petrol, Marathon, Marubeni, Mistui,	Optimized Cascade
Norway	Snøhvit LNG T1	2007	4.2	TOTAL, GDF SUEZ, Hess, Petoro, RWE, Statoil	Linde MFC
Qatar	RasGas II (T3)	2007	4.7	ExxonMobil, Qatar Petroleum	APC C3MR/ Split MR
Nigeria	NLNG T6	2008	4.1	Eni, NNPC, Shell, TOTAL	APC C3MR
Australia	North West Shelf T5	2008	4.4	BP, Chevron, Shell, BHP Billiton, Mitsubishi, Mitsui, Woodside	APC C3MR
Qatar	Qatargas II (T1)	2009	7.8	ExxonMobil, Qatar Petroleum	APC AP-X
Qatar	Qatargas II (T2)	2009	7.8	ExxonMobil, Qatar Petroleum, TOTAL	APC AP-X
Qatar	RasGas III (T1)	2009	7.8	ExxonMobil, Qatar Petroleum	APC AP-X
Yemen	Yemen LNG T1	2009	3.4	TOTAL, GASSP, Hunt Oil, Hyundai, KOGAS, SK Corp, Yemen Gas	APC C3MR/ Split MR
Indonesia	Tangguh LNG T1	2009	3.8	BP, CNOOC, INPEX, JX Nippon Oil & Energy, KG Berau, LNG Japan, Mitsubishi, Mitsui, Talisman	APC C3MR/ Split MR
Indonesia	Tangguh LNG T2	2009	3.8	BP, CNOOC, INPEX, JX Nippon Oil & Energy, KG Berau, LNG Japan, Mitsubishi, Mitsui, Talisman	APC C3MR/ Split MR
Russia	Sakhalin 2 (T1)	2009	4.8	Shell, Gazprom, Mitsubishi, Mitsui	Shell DMR
Russia	Sakhalin 2 (T2)	2009	4.8	Shell, Gazprom, Mitsubishi, Mitsui	Shell DMR
Qatar	Qatargas III	2010	7.8	ConocoPhillips, Qatar Petroleum, Mitsui	APC AP-X
Qatar	RasGas III (T2)	2010	7.8	ExxonMobil, Qatar Petroleum	APC AP-X
Yemen	Yemen LNG T2	2010	3.4	TOTAL, GASSP, Hunt Oil, Hyundai, KOGAS, SK Corp, Yemen Gas	APC C3MR/ Split MR
Peru	Peru LNG	2010	4.5	Hunt Oil, Marubeni, SK Corp, Repsol	APC C3MR/ Split MR
Qatar	Qatargas IV	2011	7.8	Qatar Petroleum, Shell	APC AP-X

Source: PFC Energy

APPENDIX II: Table of Under Construction Liquefaction Plants

Country	Project	Announced Start Year	Nameplate Capacity (MMtpa)	Project Partners
Australia	Pluto LNG T1	2011	4.8	Kansai Electric, Tokyo Gas, Woodside
Algeria	Arzew GL3Z (Gassi Touil)	2012	4.7	Sonatrach
Angola	Angola LNG T1	2012	5.2	BP, Chevron, Eni, Sonangol, TOTAL
Algeria	Skikda GL1K Rebuild	2013	4.5	Sonatrach
Australia	Queensland Curtis LNG T1	2014	4.25	BG, CNOOC
Australia	Gorgon LNG T1	2014	5	Chevron, Chubu Electric, ExxonMobil, Osaka Gas, Shell, Tokyo Gas
Australia	Gorgon LNG T2	2014	5	Chevron, Chubu Electric, ExxonMobil, Osaka Gas, Shell, Tokyo Gas
Indonesia	Donggi-Senoro LNG	2014	2	KOGAS, Medco, Mitsubishi, Pertamina
Papua New Guinea	PNG LNG T1	2014	3.3	ExxonMobil, JX Nippon Oil & Energy, Mitsubishi, MRDC, Oil Search, Petromin, PNG Government, Santos
Papua New Guinea	PNG LNG T2	2014	3.3	ExxonMobil, JX Nippon Oil & Energy, Mitsubishi, MRDC, Oil Search, Petromin, PNG Government, Santos
Australia	Gladstone LNG T1	2015	3.9	KOGAS, Santos, PETRONAS, TOTAL
Australia	Gladstone LNG T2	2015	3.9	KOGAS, Santos, PETRONAS, TOTAL
Australia	Queensland Curtis LNG T2	2015	4.25	BG, Tokyo Gas
Australia	Gorgon LNG T3	2015	5	Chevron, Chubu Electric, ExxonMobil, Osaka Gas, Shell, Tokyo Gas

Source: PFC Energy

APPENDIX III: Table of Recently Commissioned LNG Receiving Terminals

Country	Project*	Announced Start Year	Nameplate Capacity (MMtpa)	Project Partners
Argentina	Bahía Blanca GasPort (OS)	2008	3.0	Excelerate
Belgium	Zeebrugge (Expansion)	2008	3.3	Fluxys
Brazil	Guanabara LNG (Rio de Janeiro) (OS)	2009	3.7	Petrobras
Brazil	Pecem (OS)	2009	1.9	Petrobras
Canada	Canaport	2009	7.5	Irving Oil, Repsol YPF
Chile	Quintero LNG	2009	2.5	BG, Enap, Endesa, Metrogas
Chile	Mejillones LNG (Phase 1)	2010	1.5	Codelco, GDF SUEZ
China	Dapeng LNG	2006	3.7	CNOOC, BP
China	Fujian LNG	2008	2.6	CNOOC, Fujian Investment & Development Co
China	Mengtougou Peak Shaving Terminal	2008	0.1	Shanghai Gas Group
China	Dapeng LNG (Expansion)	2009	3.0	CNOOC
China	Shanghai LNG (Yangshan)	2009	3.0	CNOOC
France	Fos Cavaou	2010	6.0	GDF SUEZ, TOTAL
Greece	Revithoussa (Expansion)	2007	2.7	DEPA
India	Hazira LNG (Debottlenecking)	2008	1.1	Shell, TOTAL
India	Dahej LNG (Expansion)	2009	3.5	Petronet LNG
Italy	Adriatic LNG/Rovigo (OS)	2009	5.8	Edison, ExxonMobil, Qatar Petroleum
Japan	Mizushima LNG	2006	0.6	Mizushima LNG (Chugoku Electric, JX Nippon Oil & Energy)
Japan	Sodegaura (Expansion)	2008	1.6	Tokyo Gas, TEPCO
Japan	Sakaide	2010	0.7	Cosmo Gas, Shikoku Electric, Shikoku Gas
Kuwait	Mina Al-Ahmadi GasPort (OS)	2009	3.8	Excelerate
Mexico	Altamira LNG	2006	4.9	Mitsui & Co, Shell, Total
Mexico	Costa Azul	2008	7.5	Sempra
Spain	Cartagena (Expansion)	2006	1.9	ENAGAS
Spain	Huelva (Expansion)	2006	2.7	ENAGAS
Spain	Sagunto	2006	4.8	Banco Pastor, Caixa Galicia, Caixanova, Gas Natural Fenosa, Sonatrach, Tojeiro Group, Union Fenosa Gas, Xunta de Galicia
Spain	Mugardos LNG (El Ferrol)	2007	2.6	ENAGAS
Spain	Sagunto (Expansion)	2009	1.5	Banco Pastor, Caixa Galicia, Caixanova, Gas Natural Fenosa, Sonatrach, Tojeiro Group, Union Fenosa Gas, Xunta de Galicia
Spain	Barcelona (Expansion)	2010	4.7	ENAGAS
Taiwan	Taichung LNG	2009	3.0	CPC
Turkey	Aliaga LNG	2006	4.4	Egegaz
UAE	Dubai (OS)	2010	3.0	Golar LNG
UK	Teesside GasPort	2007	3.0	Excelerate
UK	Grain LNG (Phase 2)	2008	6.5	National Grid Transco
UK	Dragon LNG	2009	4.4	4Gas, BG, PETRONAS
UK	South Hook (Phase 1)	2009	7.8	ExxonMobil, Qatar Petroleum, TOTAL
UK	Grain LNG (Phase 3)	2010	5.2	National Grid Transco
UK	South Hook (Phase 2)	2010	7.8	ExxonMobil, Qatar Petroleum, TOTAL
US	Elba Island II	2006	3.3	El Paso
US	Lake Charles (Expansion Ph. 2)	2006	4.4	AIG Highstar, Southern Union

US	Freeport LNG	2008	11.3	Dow Chemical, Michael S Smith Cos, Osaka Gas, ZHA FLNG Purchaser
US	Northeast Gateway (OS)	2008	3.0	Excelerate
US	Sabine Pass	2008	19.6	Cheniere Energy
US	Cameron LNG	2009	11.3	Sempra
US	Cove Point (Expansion)	2009	5.5	Dominion
US	Sabine Pass (Expansion)	2009	10.6	Cheniere Energy
US	Elba Island III (Phase 1)	2010	3.5	El Paso
US	Lake Charles (IEP)	2010	3.9	AIG Highstar, Southern Union
US	Neptune LNG (OS)	2010	3.0	GDF SUEZ

** (OS) refers to offshore terminals.*
Source: PFC Energy

APPENDIX IV: Table of Under Construction LNG Receiving Terminals

Country	Project*	Announced Start Year	Nameplate Capacity (MMtpa)	Project Partners
Argentina	Puerto Escobar (OS)	2011	3.8	Excelerate
China	Dalian	2011	3.0	Dalian Construction Investment Corp, Dalian Port, Kunlun Energy
China	Fujian LNG (Expansion)	2011	2.6	CNOOC, Fujian Investment & Development Co
China	Rudong/Jiangsu LNG	2011	3.5	Jiangsu Guoxin, Pacific Oil, Kunlun Energy
China	Zhuhai	2012	3.5	CNOOC, Guangdong Yuedian Group
China	Ningbo, Zhejiang	2013	3.0	CNOOC, Ningbo Power Development Co Ltd, Zhejiang Energy Group Co Ltd
India	Dabhol LNG	2011	2.0	GAIL, NTPC
India	Kochi LNG	2012	3.0	Petronet LNG
Indonesia	Khannur FSRU (West Java) (OS)	2012	3.0	Nusantara Regas (Pertamina, PGN)
Italy	Livorno (OS)	2012	2.7	EON, Golar LNG, IRIDE, OLT Energy
Japan	Ohgishima (Expansion)	2011	1.6	Tokyo Gas
Japan	Ishikari LNG	2012	1.4	Hokkaido Gas
Japan	Mizushima LNG (Expansion)	2012	0.9	Mizushima LNG (Chugoku Electric, JX Nippon Oil & Energy)
Japan	Hibiki LNG	2014	3.5	Kyushu Electric, Saibu Gas
Japan	Naoetsu	2014	1.5	Inpex Corp
Korea	Samcheok	2015	6.8	KOGAS
Malaysia	Lekas LNG (Malacca)	2012	3.8	PETRONAS
Mexico	Manzanillo	2011	3.8	KOGAS, Mitsui, Samsung
Netherlands	Gate LNG	2011	8.8	Dong, EconGas OMV, EON, Gasunie, RWE, Vopak
Poland	Swinoujscie	2014	3.6	GAZ-SYSTEM SA
Portugal	Sines LNG (Expansion Phase 1)	2012	3.4	REN
Singapore	Jurong Island LNG	2013/2014	3.5/6.0	Singapore Energy Market Authority
Spain	El Musel (Gijon)	2012	5.8	ENAGAS
Sweden	Nynashamn LNG	2011	0.3	AGA Gas AB
Thailand	Rayong	2011	5.0	Electricity Generating Authority of Thailand. Electricity Generating Company, PTT
US	Clean Energy Terminal	2011	11.3	El Paso, GE Energy Financial Services, Sonagol
US	Golden Pass (Phase 2)	2011	12.8	ConocoPhillips, ExxonMobil, Qatar Petroleum

** (OS) refers to offshore terminals.*
Source: PFC Energy

Sources

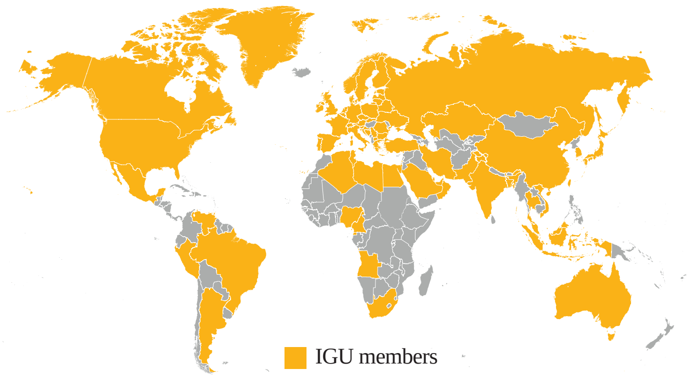
1. Cedigaz
2. Waterborne LNG Reports
3. United States Energy Information Agency (EIA)
4. United States Department of Energy (DOE)
5. Company reports and announcements
6. PFC Energy (including PFC Energy's Global LNG Service Databases)
7. IGU PGC D's "The World Wide LNG Industry at the End of 2008", October 2009

Paper Log

1. *Paper Title:* IGU World Report - 2010
2. *Author:* PFC Energy
3. *Word Processing Software:* Microsoft Word 2007
4. *Number of Pages:* 42 pages
5. *File Size:* 1.1 MB
6. *List of Keywords:*
   LNG, liquefied natural gas, spot trade, liquefaction terminal, receiving terminal, LNG carrier, LNG imports, LNG exports, LNG regasification capacity, unconventional gas

IGU

The International Gas Union is a worldwide non-profit organisation aimed at promoting the technical and economic progress of the gas industry. The Union has more than 100 members worldwide on all continents. The members of IGU are national associations and corporations of the gas industry. IGU's working organisation covers all aspects of the gas industry, including exploration and production, storage, LNG, distribution and natural gas utilisation in all market segments. IGU promotes technical and economic progress of the gas industry emphasising environmental performance worldwide. For more information, please visit www.igu.org



International Gas Union

Office of the Secretary General
c/o Statoil ASA
0246 Oslo
Norway

Telephone: + 47 51 99 00 00
Fax: + 47 22 53 43 40
Email: secrigu@statoil.com
Website: www.igu.org

100467 IGU 2010, Photo: xxxxx