International Gas Union (IGU)

News, views and knowledge on gas – worldwide

World LNG Report 2011

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1. Message from the President of International Gas Union

Dear IGU members

I am indeed honoured to present to you the second IGU World LNG Report for 2011.

Last year, the world experienced some very interesting events, which led to some very intriguing outcomes. After experiencing a very strong growth in demand of 22% in 2010, the LNG market was poised to experience a glut situation in 2011 with Qatar producing at its maximum capacity of 77 MTPA whilst the United States, which used to be a significant importer of LNG, continuing to turn away more cargoes and increasingly rely on domestic unconventional gas to meet its energy needs. Moreover, Europe was expected to consume less LNG because several economies were experiencing sluggish growth. However, Mother Nature again proved us wrong, and as the saying goes "nature works in mysterious ways"!

Datuk (Dr) Abdul Rahim Hashim

The tragic earthquake which hit Japan in March 2011 could be considered a "game changer" for the LNG industry. The consequence which caused the Japanese municipalities/local authorities to temporarily shutdown all the 54 nuclear powered power plants which led to the country having to rely on LNG to fill its energy vacuum. As a result, Japan's demand for LNG jumped by almost 12% to about 79 MT.

Meanwhile, the growing concern for the environment and a move seen to avert any serious impact from another oil price hike, coupled with the need to enhance energy security, had led to several countries to enter the league of LNG importers, as well as increase their consumption of LNG.

The large incremental demand across the globe practically mopped up all the increased cargoes churned by Qatar, as well as those turned away by the United States. It is therefore not surprising that the world's LNG spot trade increased by 32% to reach 62 MT, or 26% of the world's total LNG trade, and with 25 countries actively involved. The unexpected tight LNG market led to its prices shooting up to between $16 and $17/mmBtu towards the end of 2011.

In tandem with the growth in the world's LNG trade, tanker charter rates, which were sluggish in 2009 and 2010, also experienced a sharp rise, and vessel availability became a major concern in the latter part of 2011. This is further exacerbated by the need for more of the conventional sized ships instead of the Qmax/Qflex to serve more widespread LNG markets.

On the supply side, 2011 saw a large number of new LNG project sanctions, mostly in Australia. But as these projects start moving forward, the industry was also beginning to get a glimpse of the new frontiers. Eastern Africa and the Eastern Mediterranean buttressed their position as possible LNG exporters as recent discoveries reflect the regions' export potential. North America started to move forward more aggressively, aided by several Sales Purchase Agreements signed by the Sabine Pass LNG project.

As Australia's LNG projects move forward, the industry is already turning to the next wave. And within this change came also Shell's Final Investment Decision (FID) on Prelude LNG, aiming to become the world's largest floating liquefaction (FLNG) project. Interestingly, work on the PETRONAS FLNG project for offshore Sarawak, is also underway after obtaining FID.

Moving forward, demand for LNG for the next 5 years is expected to remain strong as evidenced by several countries advancing plans to begin to import LNG. In Latin America, Southeast Asia and the Middle East, importers are emerging quickly, as floating regasification terminals allow them to shorten the time required to receive cargoes. It is becoming obvious now that there are more countries looking to import LNG than to export it, and this change will have major implications for the LNG market. The desire of several countries to limit the use of nuclear power further bolster the demand potential for natural gas.

The LNG business remains an immensely exciting industry and one whose complexities and surprises will surely grow. The fundamentals of the industry are strong – driven by economic growth and concern for the environment. There is a massive demand challenge ahead and meeting this will require that the industry deploys large capital outlay on E&P, liquefaction, shipping, regasification and distribution. It is also an industry that will become increasingly complicated and interwoven as developments between the basins affect prices and flows globally.

Finally, I would like to thank PFC Energy for preparing this report. I also wish to thank PETRONAS for again sponsoring the publication of this report. My sincere appreciation also to members of the IGU Task Force who had been entrusted to oversee the publication of this report, as well as their respective organisations.

This IGU World LNG Report 2011 will be the second and final report to be published under the Malaysian Presidency.

Thank you.

2. State of the LNG Industry at the End of 2011

During 2011:

- *The world's LNG trade in 2011 grew by 8%, or 17.7 MT, to reach a new high of 241.5 MT, primarily due to the sharp increase in demand from Japan (by 8.2 MT) arising from the severe earthquake and tsunami which hit the country in March 2011, as well as the tragedy which struck the Fukushima nuclear power plant. Increased demand from the United Kingdom (by 4.4 MT), India (by 3.4 MT) and China (by 3.3 MT), more than offset the 3.4 MT decline from Spain, and 2.6 MT for the United States, which continues to increase consumption of domestic unconventional gas.*

- *The LNG spot market grew by almost 32%, or 15 MT, to reach 62 MT – just over a quarter of the LNG trade, with a majority of transactions coming from the Atlantic Basin. By comparison, the spot market made up only 16% of LNG trade in 2006.*

- *On the supply side, global liquefaction capacity increased by only 2.9%, or 7.8 MTPA, to reach 278.7 MTPA, with only one liquefaction train coming onstream, the 7.8 MTPA Qatargas IV. The project was the world's 96th liquefaction train to enter commercial operations, and was Qatar's last development under its current plan. No new country joined the club of LNG exporters in 2011 since Peru became the 18th LNG exporter in 2010.*

- *A slew of projects – representing 26.8 MTPA in liquefaction capacity – took final investment decision (FID) in 2011, including Donggi-Senoro LNG, Australia Pacific LNG T1, GLNG T1-2, Wheatstone LNG T1-2 and Prelude LNG (the first floating liquefaction (FLNG) project to reach FID). Except for Indonesia's Donggi-Senoro, the other projects are located in Australia. Another Australian project, the two train, 8.4 MTPA Ichthys LNG T1, reached FID in January 2012.*

- *15 new regasification terminals came onstream in 2011, including new facilities in the Netherlands, Norway, Sweden and Thailand, marking those countries' first regasification capacity. With these nations' new capacity, 27 countries now have the ability to import LNG.*

- *Global regasification capacity stands at 608 MTPA – a 64% increase over capacity in 2006.*

- *At the end of 2011, the global LNG fleet consisted of 360 vessels - more than one and a half times the fleet size at end of 2006. Short-term, spot charter rates doubled in 2011 to an average of $78,000/day, and by Q1 2012, had exceeded $130,000 for newer, more efficient vessels.*

- *Unconventional gas production in the United States continued to rise, leaving LNG volumes previously destined for the US market redirected elsewhere. The widening disparity in prices between Henry Hub and elsewhere around the world – especially in the Asia Pacific – led several companies to propose liquefaction plants in the US Gulf of Mexico. To date, 101.3 MTPA of liquefaction capacity has been proposed there.*

Key:

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

3. LNG Imports, Exports and Prices

LNG trade grew stronger than anticipated in 2011. Since 2006, five new countries started LNG exports and ten new markets began importing LNG. At the same time, the price differential between oil-linked, spot and Henry Hub prices for LNG has created new opportunities and challenges for the industry.

Demand for LNG reached new heights in 2011, primarily due to sharp increase in demand from Japan in the wake of that country's March 2011 natural catastrophe and the ensuing nuclear disaster at the Fukushima nuclear power plant. Strong demand in the UK, China and India, augmented by increased volumes from emerging new markets, further tightened the world's LNG market. Though the unconventional gas boom in the United States was thought to prove detrimental for an industry that had spent the previous decade building liquefaction capacity, growing demand elsewhere and high oil prices saw LNG prices reaching record highs.

3.1. OVERVIEW

The world LNG trade grew by 8% in 2011 to a new high of 241.5 MT. The LNG trade has not only grown in volume, but in geographic reach as well. In 2006, only 13 countries exported LNG: Algeria, Australia, Brunei, Egypt, Indonesia, Libya, Malaysia, Nigeria, Oman, Qatar, Trinidad & Tobago, the United Arab Emirates and the United States.

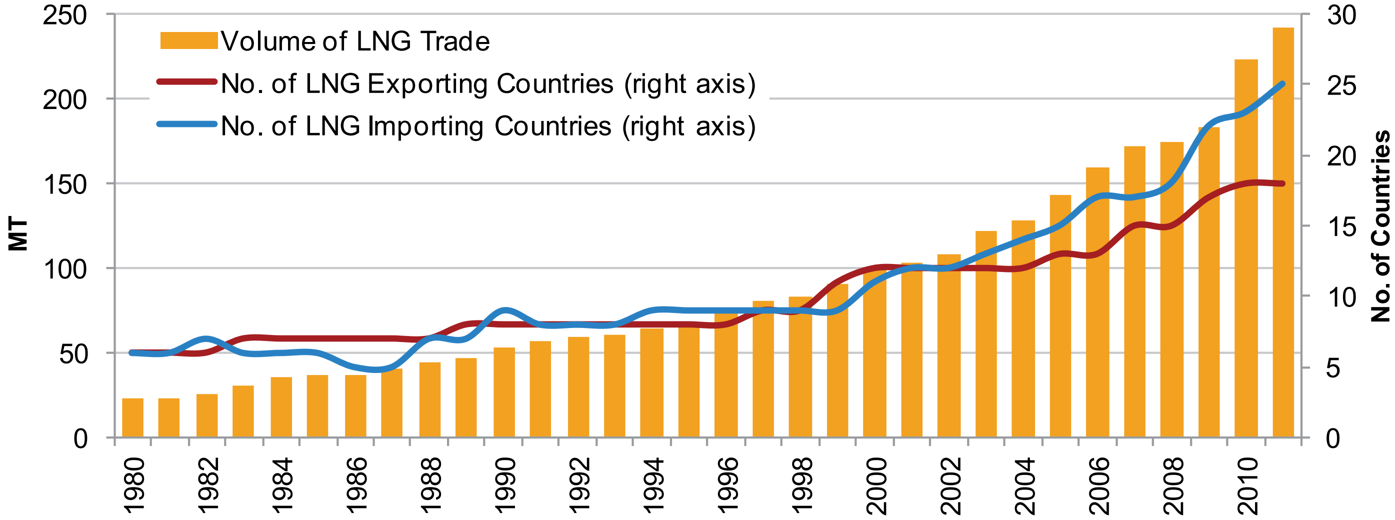
Global liquefaction capacity however rose by only 7.8 MTPA in 2011, much less than the 20.4 MTPA added in 2010. Since 2006, another five countries brought liquefaction capacity onstream: Equatorial Guinea, Norway, Peru, Russia and Yemen. Angola is expected to join this list of exporters in 2012 with the start of its Angola LNG T1 development. Further, another five countries have re-exported LNG during this period: Belgium, Brazil, Mexico, Spain and the United States.

Perhaps even more remarkable is the number and geographic reach of countries that have started *importing* LNG during this period. Argentina, Brazil, Canada, Chile, China, Kuwait, Mexico, and the United Arab Emirates have begun importing LNG since 2006, joining the existing 15 importers which include Belgium, the Dominican Republic, France, Greece, India, Italy, Japan, Portugal, Puerto Rico, the Republic of Korea (Korea), Spain, Taiwan, Turkey, the United Kingdom and the United States. Many of these countries were not considered to be potential LNG importers a decade ago – and the United States, which was then expected to be the largest LNG import market by now, has seen imports slow to a trickle. These changes reflect the dynamic nature of the market.

In spite of increased interregional trade, there is still no "global" gas market. Value continues to be set by micro factors – such as location, contract structure and timing – more than the global balances. Prices even vary within markets, with multiple sources of supply contracted at distinct price levels. This is not expected to change in the near term, especially given the long-term nature of many existing contracts.

3.2. LNG TRADE VOLUMES

FIGURE 1: LNG TRADE VOLUMES, 1980-2011



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

From 2006 to 2011, the volume of LNG traded grew from 159.1 MT to 241.5 MT reflecting growth of about 52%. Some 66% of this incremental LNG came from countries that had historically been LNG exporters (largely from the growth in supplies from Qatar) with the remainder originating from countries that had previously not exported LNG. The majority of the growth in demand – 82% – came from existing LNG importers, dominated by the increase of volumes into Japan and higher imports to the United Kingdom, India and China.

3.3. LNG EXPORTS BY COUNTRY

By the end of 2011, 18 countries were exporting their gas resources as LNG. In addition, five countries, namely Belgium, Brazil, Mexico, Spain and the United States, were re-exporting LNG previously imported from another source.

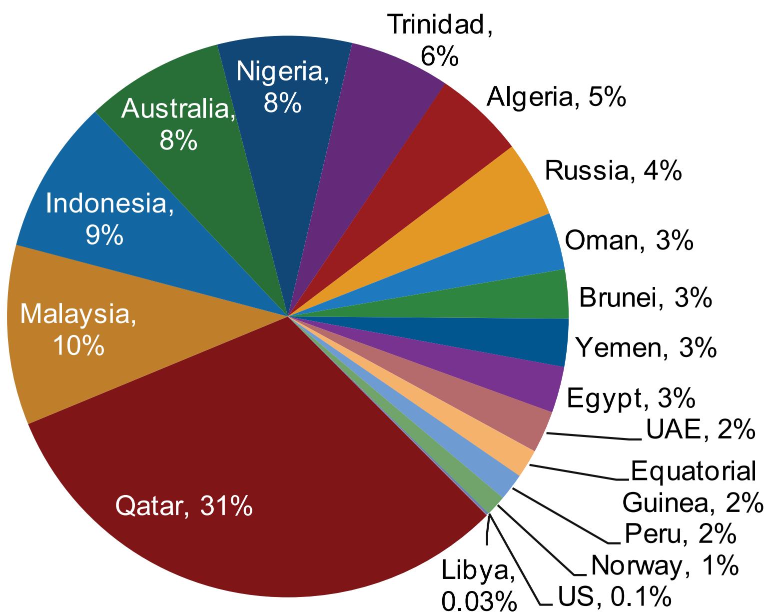
Qatar is by far the largest LNG exporter. In 2011, the country supplied 75.5 MT of LNG to the market – nearly one third (31%) of global supply. Malaysia overtook Indonesia as the second largest LNG exporter in 2011 as the MLNG Dua debottleneck saw its first year of full production and Indonesia's Arun and Bontang facilities produced below capacity. Together with Australia, these three Pacific Basin exporters accounted for about 27% of the world's LNG supply.

TABLE 1: LNG EXPORTS BY COUNTRY, 2011

Exporter	MT
Qatar	75.5
Malaysia	25.0
Indonesia	21.4
Australia	19.2
Nigeria	18.7
Trinidad	13.9
Algeria	12.6
Russia	10.5
Oman	7.9
Brunei	6.8
Yemen	6.7
Egypt	6.4
UAE	5.9
Equatorial Guinea	4.0
Peru	3.8
Norway	2.9
US	0.3
Libya	0.1
Total Exports	**241.5**

Sources: Waterborne LNG Reports, US DOE, PFC Energy

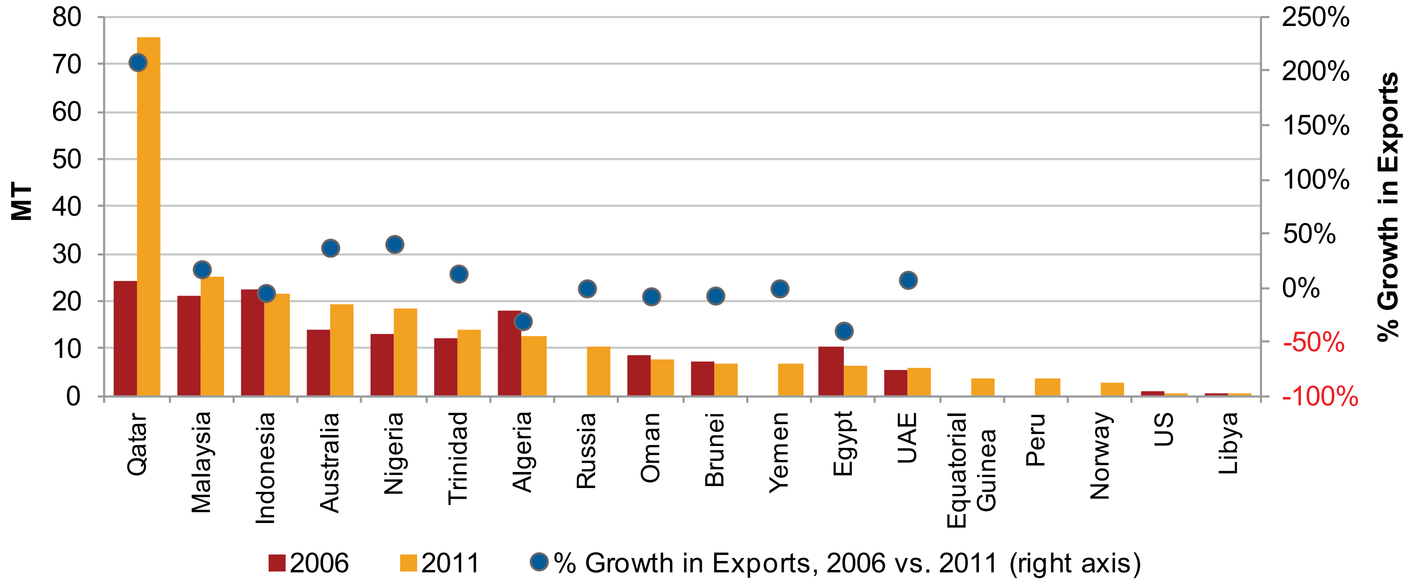
FIGURE 2: LNG EXPORTS BY COUNTRY, 2011



Sources: Waterborne LNG Reports, US DOE, PFC Energy

Qatar reached its planned nameplate capacity of 77 MTPA, ensuring that country's dominance as the world's largest LNG exporter. Though Australia has plans to eventually build liquefaction capacity to eclipse Qatari capacity, it remained the world's fourth largest LNG producer in 2011.

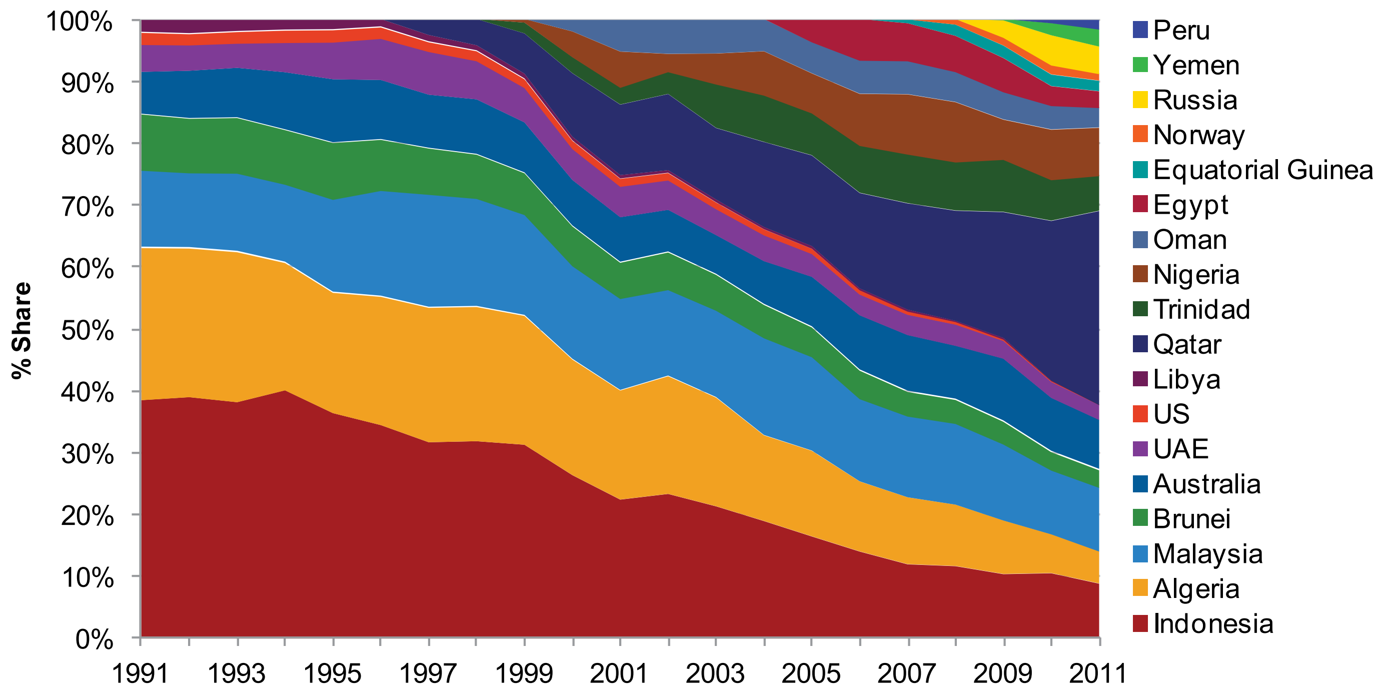
FIGURE 3: LNG EXPORTS BY COUNTRY IN 2006 AND 2011



Sources: Waterborne LNG Reports, US DOE, PFC Energy

Beyond the dramatic rise in LNG exports from Qatar in the last decade, it is also important to note the increased diversity in exporters – and growth from other existing players. The graph below indicates how each country's share of LNG global exports has developed as new players have entered the market.

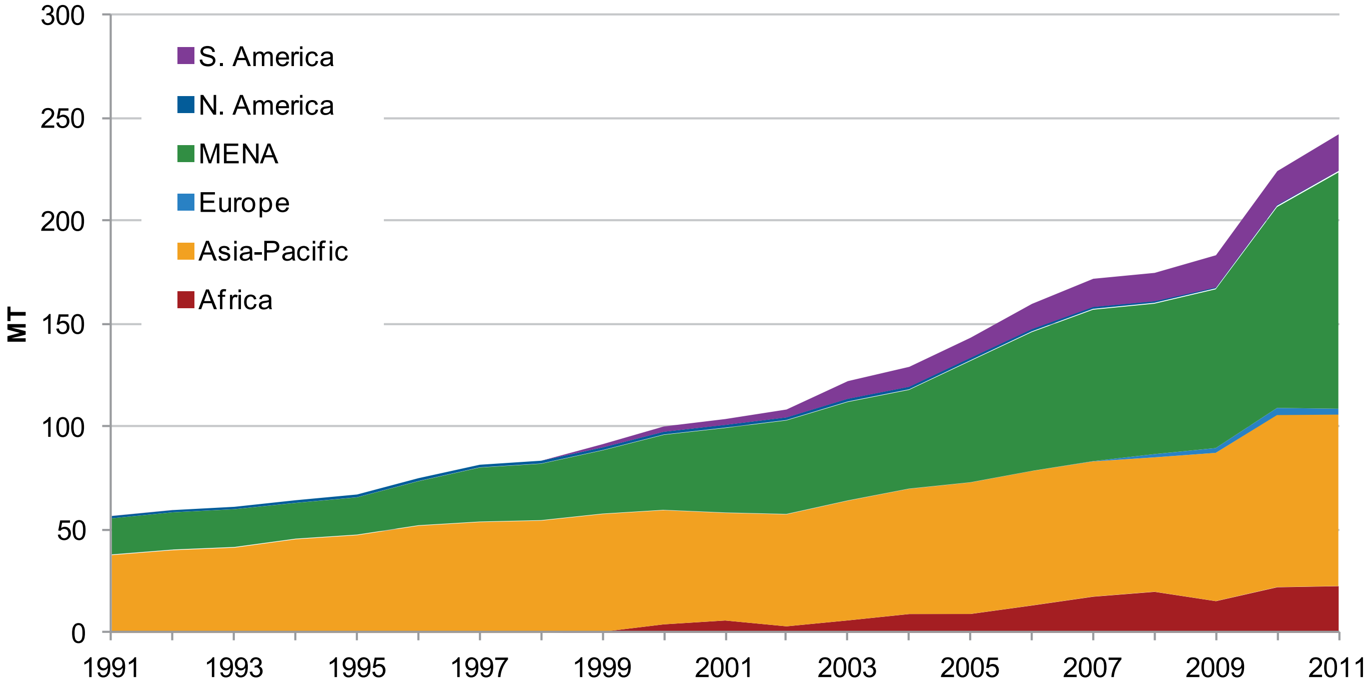
FIGURE 4: SHARE OF GLOBAL LNG EXPORTS BY COUNTRY, 1991-2011



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

Regionally, Middle Eastern exporters outpaced Asia-Pacific exporters in total volumes exported in 2006 and have continued to supply more volumes to the market in the intervening years. This trend is likely to reverse in the coming decade as new Australian projects come onstream, the moratorium on new gas export projects in Qatar remains in effect and prospects for growth in LNG exports elsewhere in the Middle East and North Africa are limited. The Middle East and North Africa region faces several issues which impact development from country to country; these include rising domestic demand, regulatory or energy policy clarity, economic and political stability, sanctions (in the case of Iran), and reserves which are more difficult to recover.

FIGURE 5: LNG EXPORTS BY REGION, 1991-2011



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

3.4. LNG IMPORTS BY COUNTRY

Japan and Korea are the world's dominant LNG importers, consuming 48% of LNG supplied to the market in 2011. This figure was marginally 1% higher than 2010 volumes due to higher demand for Japan due to the Fukushima disaster that saw the country's nuclear power fleet being replaced with gas-fired power. A second important and growing feature of global LNG imports was the emergence of smaller LNG importers. While individually minor, the twelve markets that each imported less than 3.0 MT of LNG collectively accounted for 18.1 MT, or about 7% of total demand during the year.

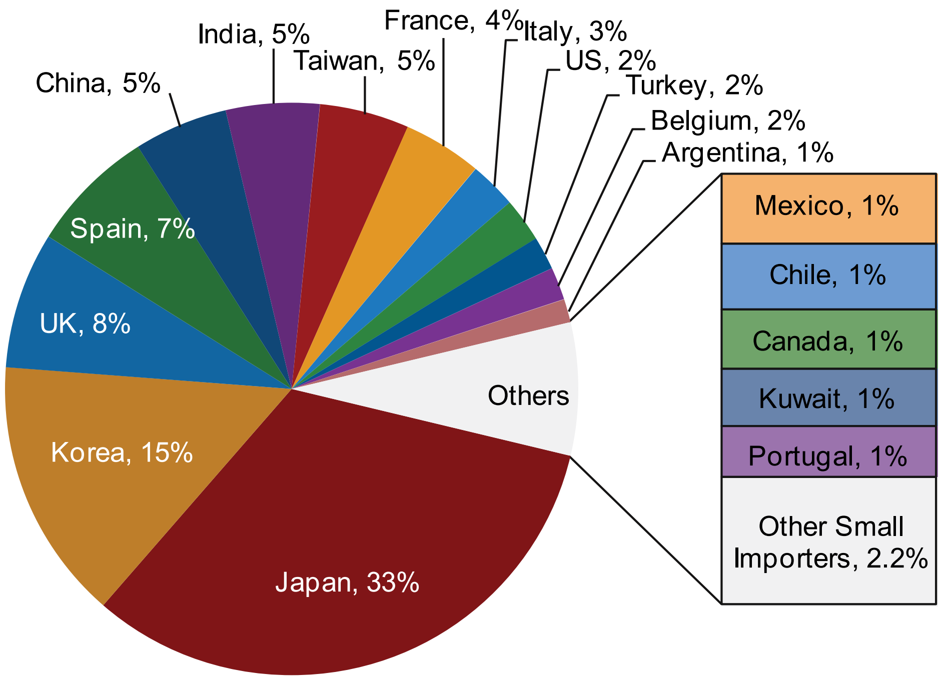
Courtesy: Vopak, The Netherlands

TABLE 2: LNG IMPORTS BY COUNTRY, 2011

Sources: Waterborne LNG Reports, US DOE, PFC Energy

Importer	MT
Japan	78.8
Korea	35.8
UK	18.6
Spain	17.1
China	12.8
India	12.7
Taiwan	12.2
France	10.7
Italy	6.4
US	5.9
Turkey	4.6
Belgium	4.5
Argentina	3.2
Mexico	2.9
Chile	2.8
Canada	2.4
Kuwait	2.4
Portugal	2.2
UAE	1.2
Greece	1.0
Dom. Rep.	0.7
Thailand	0.7
Brazil	0.6
Netherlands	0.6
Puerto Rico	0.5
Total Imports	**241.5**

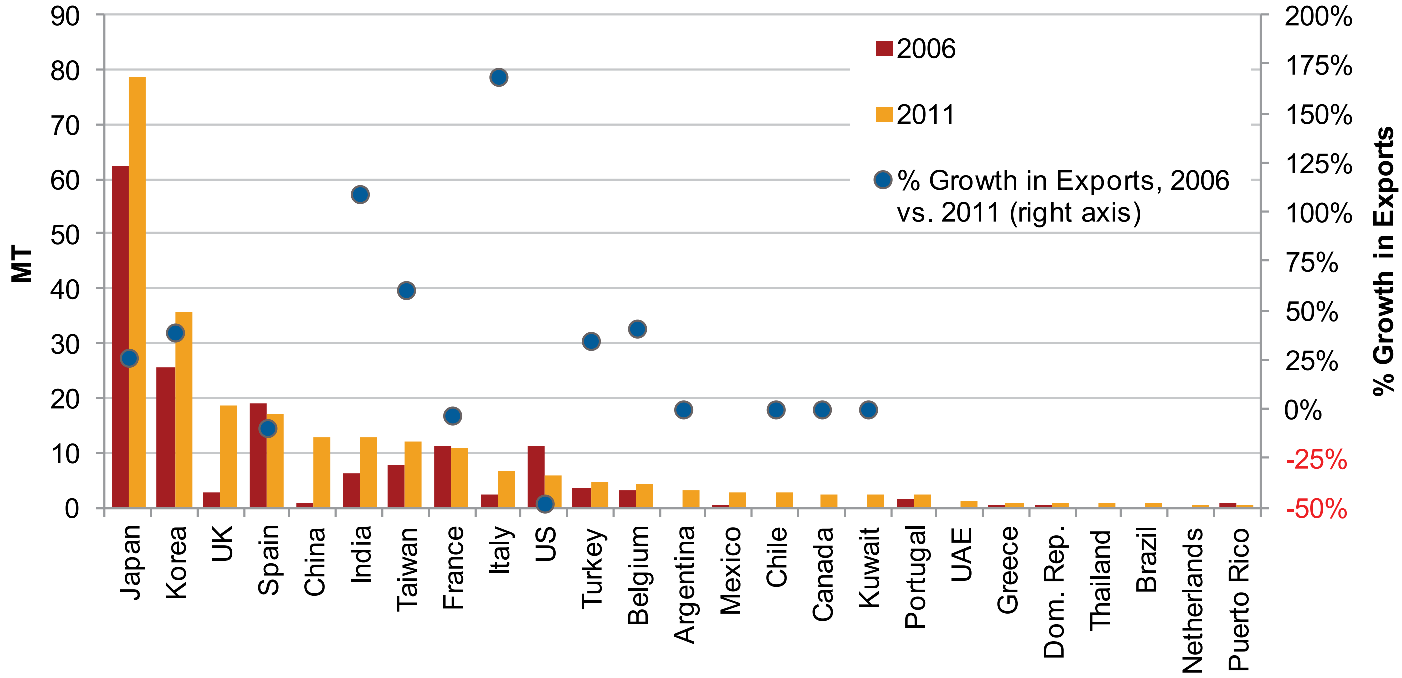
FIGURE 6: LNG IMPORTS BY COUNTRY, 2011



**"Small Importers" includes imports to the United Arab Emirates (Dubai), Greece, the Dominican Republic, Thailand, Brazil, the Netherlands and Puerto Rico. Each of these countries imported less than 1% of global LNG volumes in 2011.*

Sources: Waterborne LNG Reports, US DOE, PFC Energy

FIGURE 7: LNG IMPORTS BY COUNTRY IN 2006 AND 2011

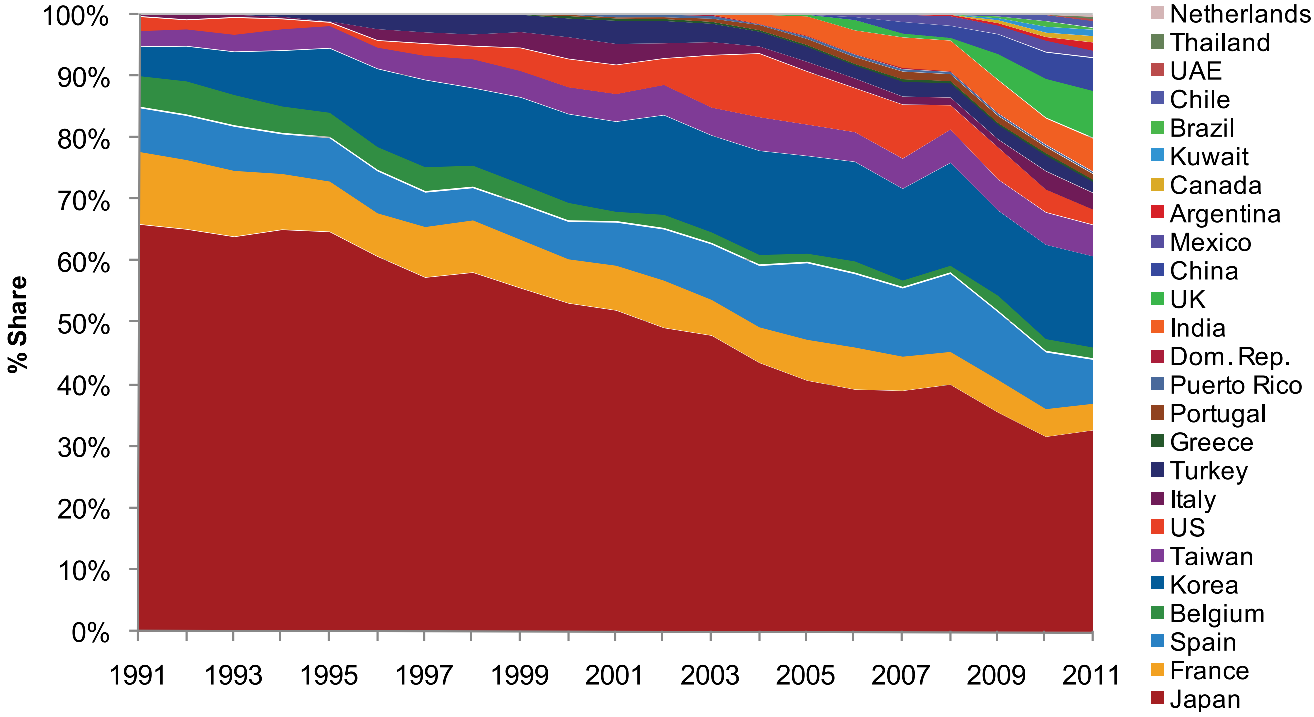


Sources: Waterborne LNG Reports, US DOE, PFC Energy

Though some LNG importers saw import volumes grow substantially from 2006 to 2011, the United States, Spain and France all saw declining import volumes over that period. Slackening demand for LNG imports was largely a function of energy needs being met from other sources. In Europe, Spanish demand fell because of the country's increased reliance on renewable energy and domestically produced coal, whilst in France, the marginal 3% decline reflects rather flat LNG imports over the period. In the United States, rising unconventional gas supply kept gas prices low and made LNG unattractive.

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, 10 new countries started to import LNG, namely: Argentina, Brazil, Canada, Chile, China, Kuwait, Mexico, the Netherlands, Thailand, and the United Arab Emirates. Notably, three of the eight countries are located in South America and two in the Middle East – two regions that had not previously imported LNG and were not expected to be potential LNG markets even six years ago. By the end of 2012 another two countries are expected to join the list of countries heretofore not ever expected to import LNG: Indonesia and Malaysia. Both of the LNG exporting countries seek to use LNG to bring gas to otherwise distant potential demand centres. Three additional markets that do not currently import LNG are also building regasification capacity to satisfy growing demand in the face of uncertain piped supplies: Singapore and Israel expect to bring their terminals onstream by 2013; and Poland expects to bring its terminal onstream in 2014.

FIGURE 8: SHARE OF GLOBAL LNG IMPORTS BY COUNTRY, 1990-2011



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

3.5. LNG INTERREGIONAL TRADE

The majority – 63% – of the world's LNG is consumed in the Asia-Pacific region. Asian countries consumed 153 MT of LNG in 2011, with 91% of supplies primarily coming from within the region or from the Middle East (providing 54% of Asia's supplies) and North Africa (providing 37% of the region's supplies). Though Qatari volumes dominate this trade by supplying roughly two thirds of volumes sent from the region to Asia, nearly all of the LNG producers in the Middle East and North Africa sent LNG to Asia in 2011, lending a diverse picture to trade between the two regions.

TABLE 3: LNG TRADE BETWEEN REGIONS, 2011, MT

Importing Region / *Exporting Region* [1]	Europe	Asia-Pacific	Middle East	N. America	S. America	Total
Africa	11.2	8.5	0.7	0.9	1.3	***22.6***
Asia-Pacific	-	82.5	0.6	0.7	-	***83.8***
Europe	1.5	1.1	0.1	0.3	0.2	***3.2***
MENA	48.4	55.9	2.0	6.8	1.6	***114.7***
North America	0.3	1.0	-	-1.2	0.3	***0.3***
South America	4.3	4.0	0.3	4.4	3.9	***16.9***
Total	***65.7***	***153.0***	***3.6***	***11.8***	***7.3***	***241.5***

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

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

TABLE 4: LNG TRADE VOLUMES BETWEEN COUNTRIES, 2010, MT

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			4.68	0.71		1.20	0.06					3.54		2.78		0.95		14.1
Australia						3.89				0.06		13.35	0.98	0.06				0.83					19.2
Belgium			0.06									0.06	0.07	0.07			0.06		0.07				0.4
Brunei												5.93	0.72										6.7
Egypt		0.13			0.36			0.46	0.06	0.06	0.44	0.43	0.80	0.21	0.12		2.10	0.13	0.19		0.12	1.46	7.1
Eq. Guinea			0.02		1.17	0.07			0.06	0.12	0.06	0.54	1.44	0.19				0.39					4.1
Indonesia						1.94						12.75	5.57		1.38			1.97					23.6
Libya																	0.25						0.2
Malaysia						1.19						13.89	5.02	0.13				2.96					23.2
Nigeria		0.06	0.62			0.21		2.82		0.25		0.58	0.88	0.06	1.76	2.06	5.71	0.81	1.08		0.31	0.86	18.1
Norway		0.06		0.06				0.33			0.12		0.13				1.33	0.05	0.12		0.70	0.54	3.5
Oman												2.86	4.65	0.71			0.12	0.38					8.7
Peru		0.08	0.12	0.12									0.07		0.18		0.49					0.34	1.4
Qatar	0.18	4.51	0.38	0.18	0.12	1.27		1.77	0.03	8.05	4.56	7.91	7.58		0.72	0.06	4.20	2.88	1.46	0.12	10.57	0.94	57.5
Russia						0.38						6.29	3.39	0.07				0.51					10.6
Trinidad	1.10	0.06	0.68	1.18	0.37	0.05	0.59	0.24	0.06	0.48	0.24	0.11	0.66	0.29		0.13	2.50	0.37	0.18		1.29	4.45	15.0
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	0.48		0.07		0.28		0.12	1.88	0.14	0.13		0.13				0.20	0.80	4.3
Re-exports		-0.39																				-0.60	-1.0
Total	**1.28**	**4.51**	**1.98**	**1.54**	**2.26**	**9.47**	**0.59**	**10.35**	**0.92**	**9.30**	**6.63**	**70.61**	**34.28**	**2.09**	**4.29**	**2.25**	**20.52**	**11.63**	**5.87**	**0.12**	**14.28**	**8.79**	**223.6**

*Includes Puerto Rico

Sources: Waterborne LNG Reports, US DOE, PFC Energy

Courtesy: Photographic Services Shell International Ltd.

TABLE 5: LNG TRADE VOLUMES BETWEEN COUNTRIES, 2011, MT

Importer / Exporter	Argentina	Belgium	Brazil	Canada	Chile	China	Dom Rep	France	Greece	India	Italy	Japan	Korea	Kuwait	Mexico	Netherlands	Portugal	Spain	Taiwan	Thailand	Turkey	UAE	UK	US*	**Total**
Algeria	-	0.06	-	-	-	-	-	4.23	0.72	0.18	1.16	0.06	-	-	-	0.06	0.06	2.94	-	-	2.96	-	0.18	-	12.6
Australia	-	-	-	-	-	3.71	-	-	-	0.04	-	13.69	1.16	0.19	-	-	-	-	0.34	-	-	0.06	-	-	19.2
Belgium	-	-	-	-	-	-	-	-	-	-	-	0.19	0.06	-	-	0.06	-	0.20	-	-	-	-	-	-	0.5
Brazil	0.04	-	-	-	-	-	-	-	-	-	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	0.1
Brunei	-	-	-	-	-	-	-	-	-	-	-	6.15	0.70	-	-	-	-	-	-	-	-	-	-	-	6.8
Egypt	0.06	-	-	-	0.06	0.21	-	0.65	0.06	0.51	0.38	0.67	0.50	0.05	-	-	0.06	1.73	0.44	-	0.26	-	0.06	0.73	6.4
Eq. Guinea	-	-	-	-	0.91	0.13	-	-	-	-	-	1.56	0.78	-	-	-	-	-	0.57	-	-	-	-	-	4.0
Indonesia	-	-	-	-	-	2.40	-	-	-	-	-	9.26	7.57	-	0.19	-	-	-	1.95	0.07	-	-	-	-	21.4
Libya	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.06	-	-	-	-	-	-	0.1
Malaysia	-	-	-	-	-	1.72	-	-	-	0.13	-	15.45	3.91	0.32	-	-	-	-	3.40	-	-	0.06	-	-	25.0
Mexico	-	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
Nigeria	0.30	0.06	0.05	-	-	0.67	-	2.66	0.06	1.00	-	1.90	1.13	0.59	0.86	0.05	1.91	4.74	0.67	0.12	0.92	0.06	0.88	0.05	18.7
Norway	-	-	-	-	-	-	0.06	0.39		0.06	0.12	0.18	0.30	-	-	0.06	0.06	0.93	0.12	-	-	-	0.26	0.31	2.9
Oman	-	-	-	-	-	-	-	-	-	0.13	-	3.98	3.55	-	-	-	-	0.13	0.13	-	-	-	-	-	7.9
Peru	-	-	-	-	-	0.15	-	-	-	-	-	0.34	0.74	-	0.49	-	-	1.43	0.06	0.22	-	-	-	0.34	3.8
Qatar	0.43	4.59	0.29	1.57	0.45	2.31	-	2.38	0.12	9.70	4.48	11.58	7.85	1.12	1.31	0.27	0.12	3.52	4.00	0.25	0.43	0.78	16.15	1.79	75.5
Russia	-	-	-	-	-	0.24	-	-	-	-	-	7.18	2.82	-	-	-	-	-	0.18	0.06	-	-	-	-	10.5
Spain	0.15	-	-	-	-	-	-	-	-	-	0.17	0.11	-	0.06	-	-	-	-	0.05	-	-	-	-	-	0.5
Trinidad	2.22	0.06	0.18	0.86	0.94	0.35	0.66	0.30	-	0.42	0.12	0.38	1.63	-	-	0.06	-	1.87	0.05	-	-	0.22	0.42	3.20	13.9
UAE	-	-	-	-	-	-	-	-	-	0.12	-	5.63	-	0.04	-	-	-	-	0.06	-	-	-	-	-	5.9
US	-	-	0.19	-	0.06	0.13	-	-	-	0.33	-	0.36	0.18	-	-	-	-	0.12	-	-	-	-	0.13	-	1.5
Yemen	-	0.21	-	-	0.31	0.75	-	0.13	-	0.13	-	0.13	2.94	-	0.13	-	-	-	0.14	-	-	-	0.54	1.24	6.7
Re-exports	-	-0.52	-0.09	-	-	-	-	-	-	-	-	-	-	-	-0.06	-	-	-0.55	-	-	-	-	-	-1.18	-2.4
Total	**3.19**	**4.45**	**0.62**	**2.42**	**2.80**	**12.8**	**0.72**	**10.7**	**0.95**	**12.7**	**6.43**	**78.9**	**35.8**	**2.42**	**2.92**	**0.56**	**2.21**	**17.1**	**12.2**	**0.72**	**4.58**	**1.18**	**18.6**	**6.48**	**241.5**

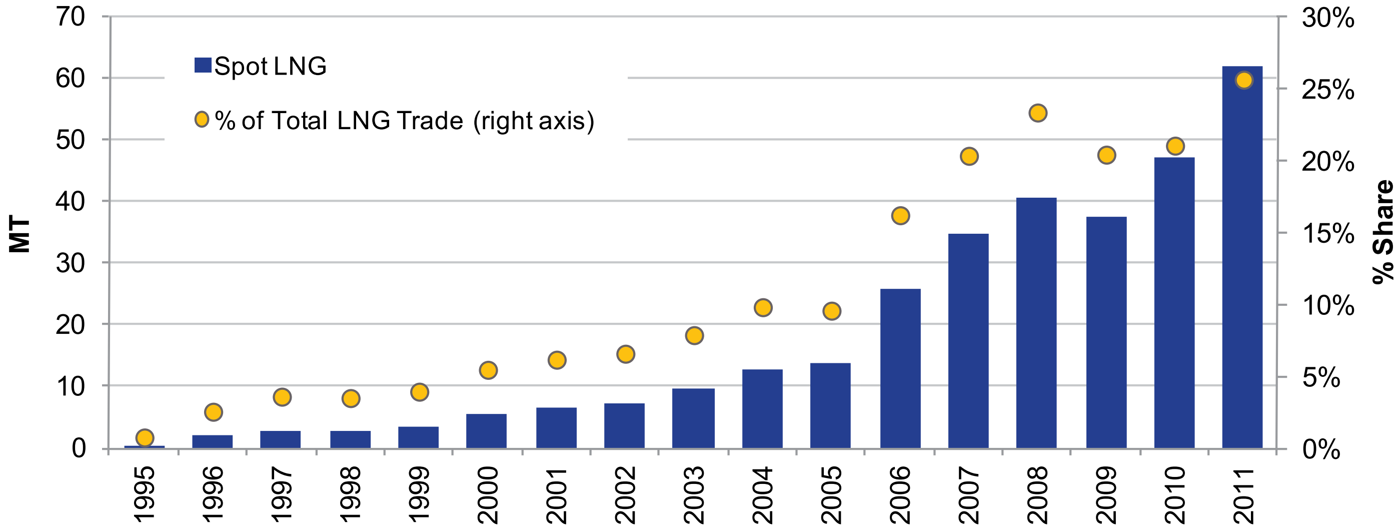
**Includes Puerto Rico*

Sources: Waterborne LNG Reports, US DOE, PFC Energy

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. Prior to 2004-2005, the spot trade accounted for about 10% of total LNG traded; by 2006, spot trades accounted for 16% of the LNG traded (26 MT) and by 2011, this was more than 25% of global trade, or 62 MT.

Figure 9: Volume of Spot LNG Trade and Share of Total LNG Trade, 1995-2011



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

In 2006, nine countries were active spot LNG exporters and 13 countries were spot cargo importers. These numbers rose to 21 and 25, respectively, by the end of 2011. The appetite to buy LNG on a spot basis has increased significantly as the list of spot buyers has nearly doubled with a variety of countries looking to import spot cargoes as changes in nuclear policies around the world and the seasonality of demand for gas require additional supplies. While the list of spot sellers has increased, this has occurred at a much slower pace.

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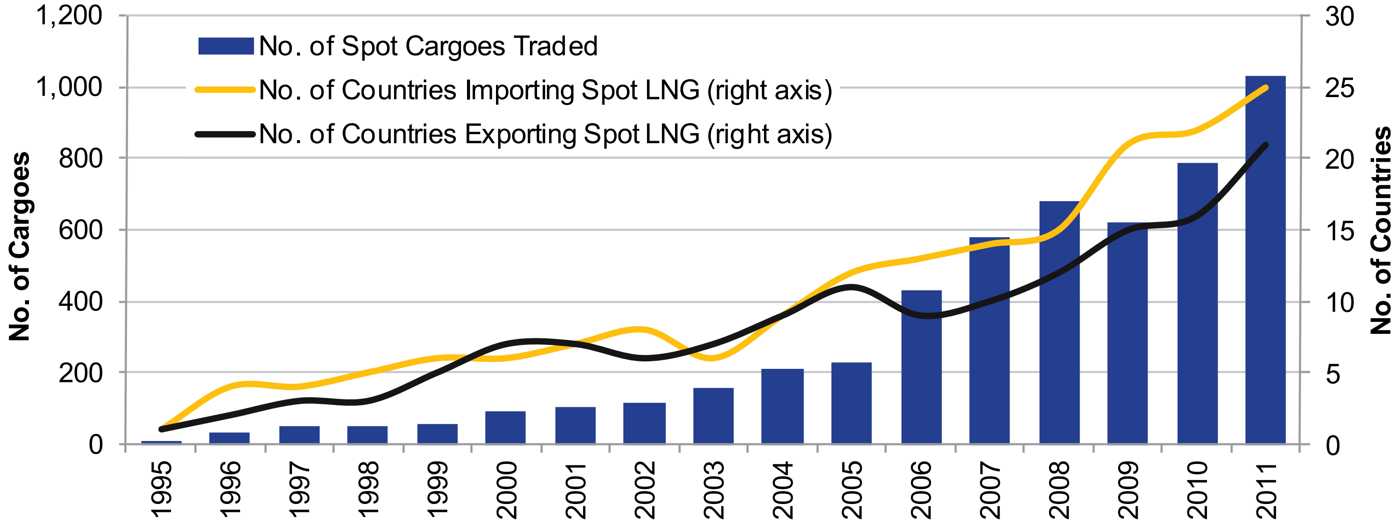
[2] *Spot and short-term trade (hereafter referred to as spot) is defined as any transaction that is not supported by a contract with a duration of more than four years. Spot trade figures also include cargoes that are over and above contracted volumes. For example, if a company has a 5 MTPA long-term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

Courtesy: Vopak, The Netherlands

FIGURE 10: NUMBER SPOT CARGOES TRADED AND EXPORTERS AND IMPORTERS OF SPOT LNG, 1995-2011

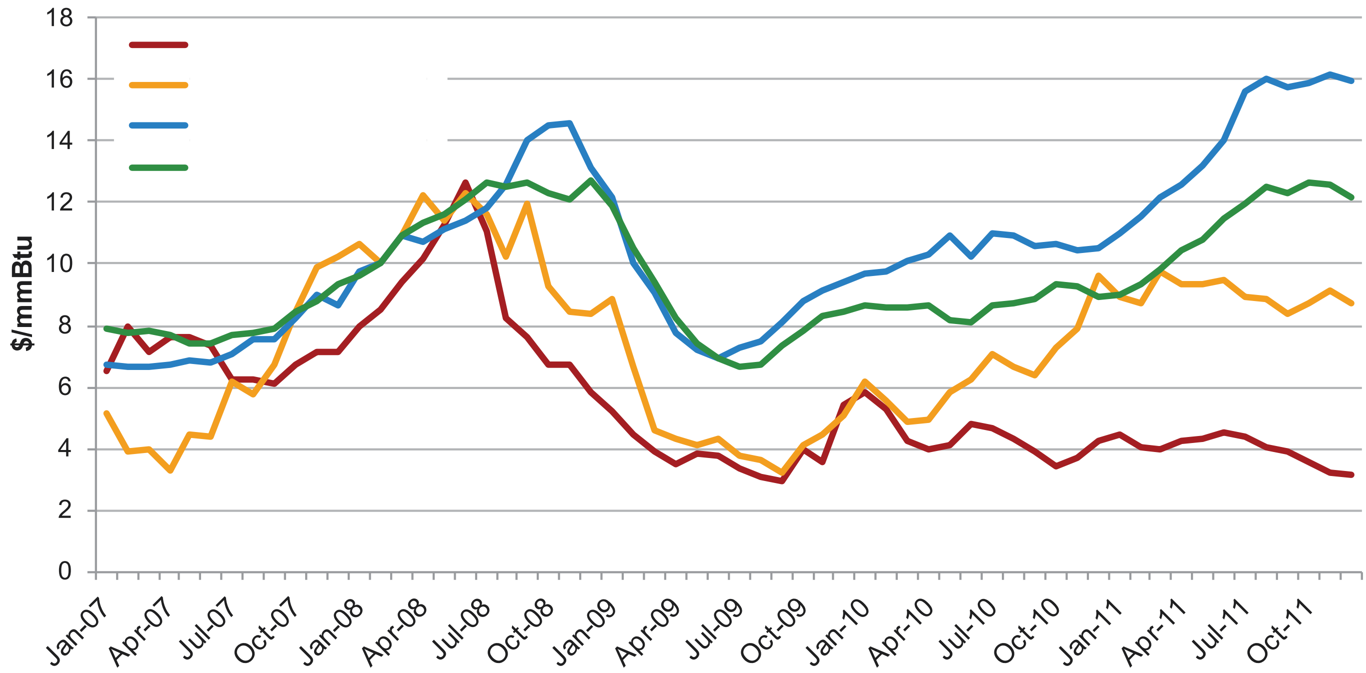


Sources: Waterborne LNG Reports, US DOE, PFC Energy

3.7. LNG PRICING OVERVIEW

Although gas is an increasingly global commodity, there is still no "global" gas market. Value is set by micro rather than macro factors. In particular, location, contract structure and timing are more influential in determining value than the global balances. In fact, gas prices widely diverge across and even within markets. Gas importing markets with multiple supply contracts, each source at distinct price levels, which are determined by the pricing formula governing each contract. In a given year, the prices paid in a typical importing market will vary according to the market's collection of supply contracts.

FIGURE 11: NUMBER OF SPOT CARGOES TRADED AND EXPORTERS AND IMPORTERS OF SPOT LNG, 1995-2011



Sources: Bloomberg, EIA, German Federal Office of Economics and Export Control (BAFA), Japanese Ministry of Finance, PFC Energy

Gas pricing systems can be organised into four main categories:

Hub-based systems. Supply and demand set prices at liquid hubs. In North America, the most important price marker is Henry Hub (Louisiana), with a spot and futures market trading on the New York Mercantile Exchange (NYMEX). In Europe, the most important hub is the National Balancing Point (NBP) in the United Kingdom, which is a virtual trading point for the Intercontinental Exchange (ICE). It contains both a spot and a futures market, although prices fall sharply after the first few months of future delivery.

Oil-linked systems. Most of the gas traded in Europe and Asia, and specifically long-term LNG contracts, falls in this category. Gas contract formulas vary in a number of ways based on the following factors: Indexation, Slope/Coefficients of the indexation, presence of S-curves, Lag and Averaging Mechanisms.

Regulated systems. In many parts of the world, prices are regulated. In this case the government sets wellhead, transportation and end-user prices.

Subsidised systems. In most countries in the Middle East and North Africa, gas prices barely suffice to cover production costs. In Latin America, the former Soviet Union and in much of Africa, gas prices are similarly set with no linkage to oil or costs.

Spot prices for LNG rose substantially around the world over the last two years as the market shifted from having a demand problem during the initial period of the Global Economic Crisis to having a supply problem. The earthquake/tsunami-induced nuclear outages in Japan starting in March 2011 contributed significant tightness there. Factors in various markets have created alternate views on the market balance, depending on geography, alternately between a global tightening in demand and loosening in some markets. The Fukushima nuclear power plant disaster accelerated an existing tightening trend in Asia, which was expected due to the structural growth in power generation and changes in environmental policy.

Oil-linked prices – whether in Asia or Europe – moved much higher in 2011 in line with the increase in oil. In early 2011, a relative convergence emerged between Japan, the European oil-linked price and NBP. However, this convergence dissipated by the third and fourth quarters of the year. NBP was relatively flat in 2011, averaging $9/mmBtu. This strength came despite a 14% drop in demand (which should have depressed prices), an even higher 21% drop in supply and a 3.2% increase in net imports (with LNG growing but pipeline gas falling). In other words, there were many contradictory pulls on NBP and, as a result, the price ended up relatively stable.

What used to be a strict split between the oil-linked markets and the hub-based markets morphed over the last months of 2010 into a “Henry Hub and the rest” reality. As NBP stayed firm in 2011 around the $9/mmBtu level, Henry Hub continued to weaken due to increased production of unconventional gas in North America.

Looking Ahead:

- ***How tight will the LNG market get over the next five years?*** *The demand shock from Japan, the continued and sustained growth in LNG demand from emerging market, and the very modest growth in supply before 2014, all ensure that tightness in the LNG market is unlikely to be alleviated before 2014 or 2015. But how tight will the market get and what are the pricing implications of this tightness?*

- ***Can the value chain sustain this period of high demand?*** *Charter rates for modern vessels are reaching record highs and the ability to secure tonnage is increasingly limited. In such price environment, the arbitrage window between Europe and Asia is shrinking and companies' ability to ensure the logistics for delivery of LNG cargoes is diminishing? When will the investments in new vessel capacity alleviate this pressure and how much of a correction will the market see?*

- ***Could the spot market actually shrink over the next five years?*** *The rapid growth in LNG consumption and a period of sustained high prices have prompted companies with flexible supplies to secure several short, medium and long-term contracts at attractive rates. As a result, the volume of gas that are available at the spot market may shrink. What implications will this development have for pricing and for supply security?*

- ***What is the ability to pay in emerging markets****? The past five years have seen a dramatic transformation in the LNG market as new countries began to import LNG. Yet, as prices have continued to rise, the price attractiveness of LNG is slowly diminishing. Will this price spike impact demand in emerging markets? What is the market for $15 or $18/mmBtu gas in Latin America, the Middle East and Southeast Asia? Is there a price at which emerging markets will opt to stop importing****?***

- ***Will supply grow in tandem with the projected increase in demand?*** *With Qatar already reaching maximum production capacity, all hope is now on the 6 projects that have obtained FID to be completed on time. With a few projects in Australia now facing cost overrun, labour shortage, and regulation issues, can these projects be completed on schedule? What options do buyers have in the face of such industry scenario?*

4. Liquefaction Plants

Now that Qatar has achieved its targeted 77 MTPA of liquefaction capacity, growth in liquefaction capacity is expected to shift to Australia.

Qatar drove liquefaction capacity growth in recent years, reaching its target of 77 MTPA in February 2011. Yet with the moratorium on new export projects from Qatar and little movement elsewhere, the Middle East has very little opportunity for growing liquefaction capacity. Conversely, Australia's liquefaction capacity is set to grow significantly over the next decade. Of the projects currently under construction, 73% – representing 61 MTPA of capacity – are in Australia. This growth has been driven by both conventional reserves and by coal bed methane (CBM) to LNG projects.

4.1. Overview

At the end of 2011, global liquefaction capacity stood at 278.7 MTPA from 96 trains in 18 countries. Two more liquefaction projects are expected onstream in 2012: the 4.3 MTPA Pluto LNG in Australia and the 5.2 MTPA Angola LNG T1 in Angola. The Angolan project, which is the country's first, will bring the number of countries with liquefaction capacity to 19. Five countries have commissioned greenfield LNG projects since 2006: Equatorial Guinea, Norway, Peru, Russia and Yemen; whilst another six countries have expanded existing liquefaction capacity, namely: Australia, Indonesia, Malaysia, Nigeria, Oman and Qatar. Though net liquefaction capacity continues to grow, several plants have been decommissioned or discussed decommissioning in recent years, though this has only a marginal impact on global liquefaction capacity: the Arun LNG in Indonesia, and Arzew/Skikda LNG project in Algeria. Meanwhile, although ConocoPhillips and Marathon are considering decommissioning Kenai LNG in Alaska, the project remains onstream and, as ConocoPhillips bought Marathon's stake, could seek to extend its export license after it expires in 2013.

Table 6: Liquefaction Capacity by Status, 2011, MTPA

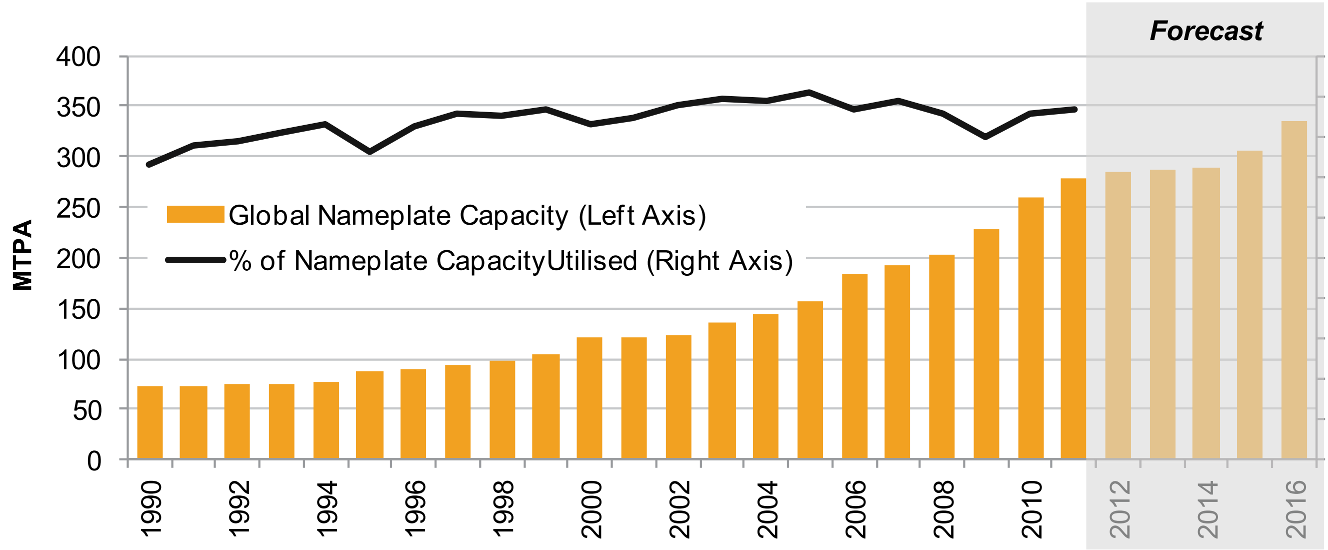
Country	Atlantic-Mediterranean	Middle East	Pacific	Global Total
Decommissioned	0.9		8.3	**9.2**
Existing	77.8	100.3	100.6	**278.7**
Under Construction*	14.4		69.6	**84.0**
Pre-FEED	12.3	3.2	29.4	**44.9**
In FEED	20.9		38.0	**58.9**
FEED Completed	55.6		13.1	**68.7**
Proposed without Announced Progress	101.8	7.0	160.4	**269.1**
Total	**283.6**	**110.5**	**419.4**	**813.5**

*Note: "Under Construction" does not include the 10.8 MTPA announced to be under construction in Iran.
Sources: PFC Energy, Company Announcements

4.2. Global Liquefaction Capacity

Global liquefaction capacity of 278.7 MTPA at the end of 2011 marks 52% growth in capacity since 2006. With 84 MTPA of liquefaction capacity under construction, global capacity is expected to increase to 334.9 MTPA by 2016 (however, not all of the capacity under construction are expected to come onstream by 2016). The speed of growth accelerated over the five year period from 2006 to 2010 (when CAGR was 10.7%) as compared to the five year period from 2001 to 2006 (when CAGR was 5.6%). This trend slowed in 2011, with growth at only 2.9%, as the last of the Qatari projects came onstream. Very few projects are announced to come onstream in 2012-2014, leaving expectations for a continued slowing in the growth rate before many of the Australian projects now under construction come onstream in the middle of the decade.

FIGURE 12: GLOBAL LIQUEFACTION CAPACITY BUILD-OUT, 1990 - 2016[3]

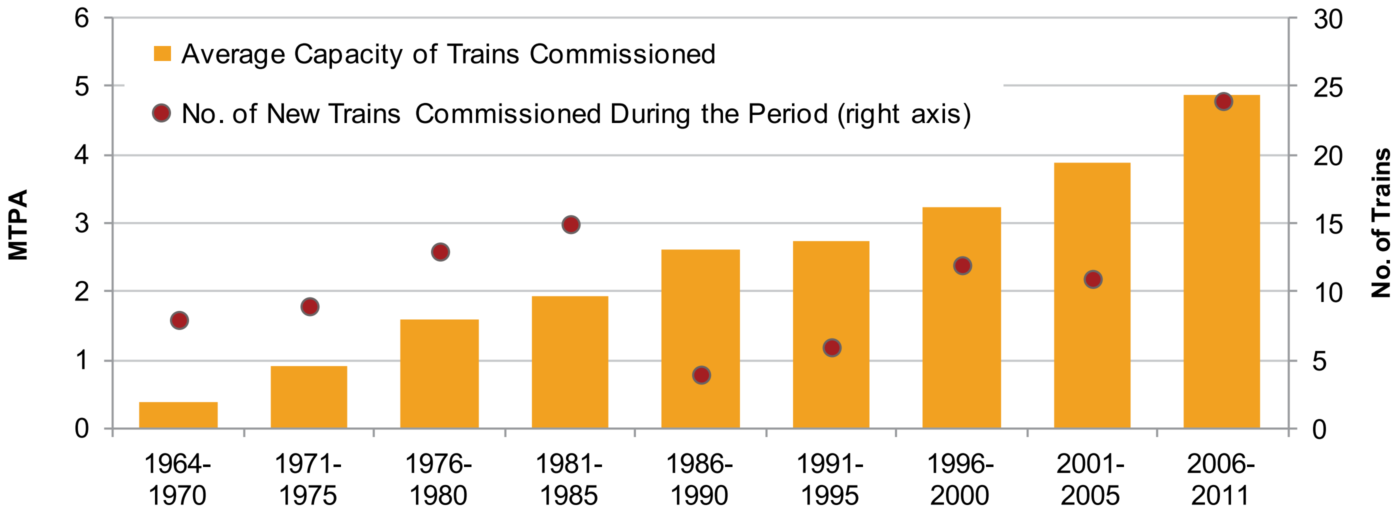


Sources: PFC Energy, Company Announcements

Liquefaction technology has evolved over time, allowing for larger trains: the world's first liquefaction plant in Arzew, Algeria (since decommissioned) was brought onstream in 1964 with a nameplate capacity of 0.85 MTPA. In contrast, the six Qatari mega trains (the last of which came onstream in February 2012) employ Air Products APCI AP-X liquefaction technology, giving them each a nameplate capacity of 7.8 MTPA. Though this technology has not been used elsewhere, the average nameplate capacity of trains brought onstream from 2006-2011 has grown tremendously when compared to the world's earliest projects. Average train size in the last five years was 4.9 MTPA, which includes the large-scale AP-X technology and its smaller sister technology, Air Product's C_3MR/SplitMR™ technology.

[3] *Forecast for LNG capacity to 2016 are calculated based on company-announced start dates for sanctioned projects only. As of April 2012, all sanctioned liquefaction project had already begin construction. Planned decommissioning of plants in Algeria and Indonesia are also included.*

FIGURE 13: NUMBER OF TRAINS COMMISSIONED VS. AVERAGE TRAIN CAPACITY, 1964-2011



Source: PFC Energy

4.3. LIQUEFACTION CAPACITY BY COUNTRY

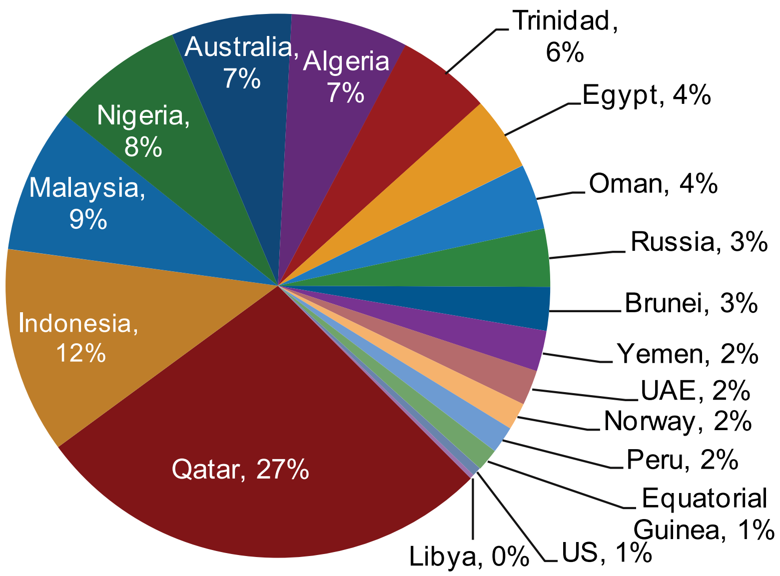
At the end of 2011, 18 countries had liquefaction capacity for exporting LNG. Three countries hold 48% of that capacity: Qatar, Malaysia and Indonesia. With the exception of Algeria, liquefaction capacity has remained constant or grown in each of the 18 countries since 2006 (Algeria decommissioned 0.9 MTPA of its capacity in 2010, representing 4.5% of its capacity at that time). Since 2006, five countries brought on greenfield liquefaction projects (Equatorial Guinea LNG T1, Snøhvit LNG in Norway, Yemen LNG, Sakhalin 2 T1-2 in Russia and Peru LNG).

TABLE 7: LIQUEFACTION CAPACITY BY COUNTRY, 2011

Country	MTPA
Qatar	77.0
Indonesia	34.1
Malaysia	25.0
Nigeria	21.9
Australia	19.9
Algeria	18.4
Trinidad	15.5
Egypt	12.2
Oman	10.8
Russia	9.6
Brunei	7.2
Yemen	6.7
UAE	5.8
Norway	4.5
Peru	4.5
Equatorial Guinea	3.7
US	1.3
Libya	0.7
Total Capacity	**278.7**

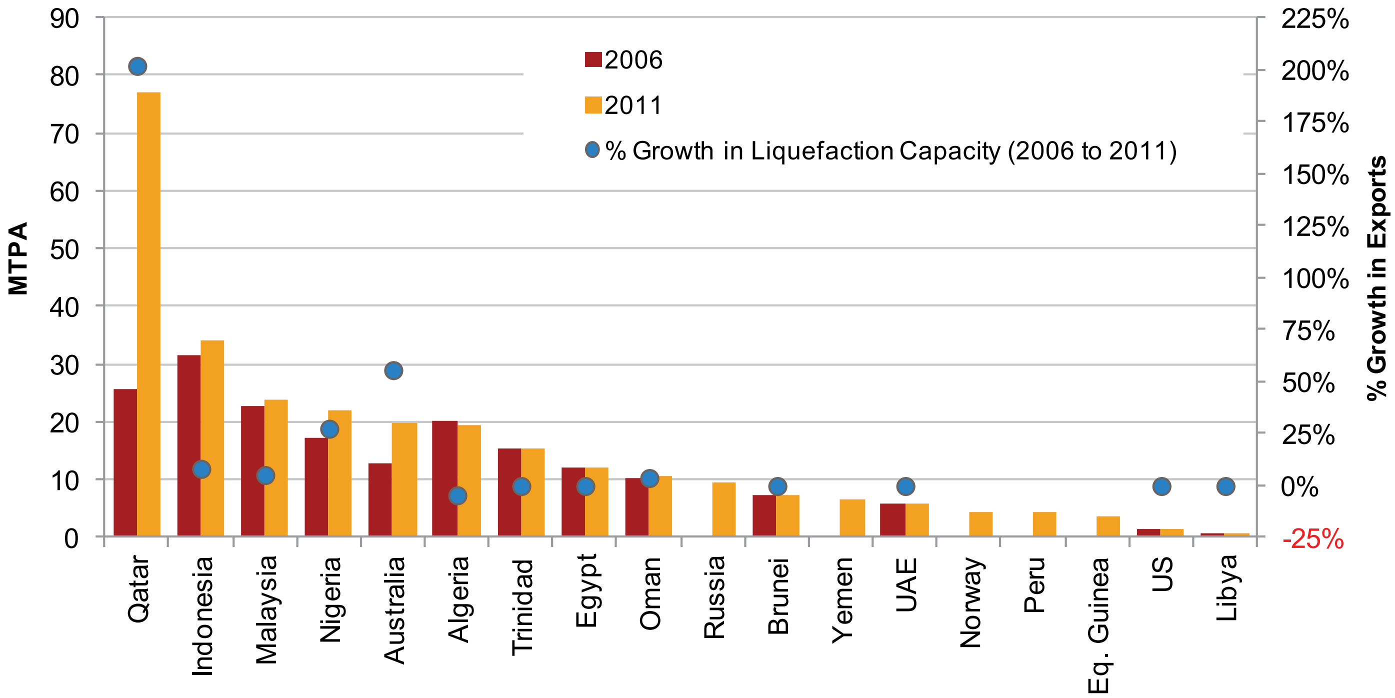
Source: PFC Energy

FIGURE 14: LIQUEFACTION CAPACITY BY COUNTRY, 2011



Source: PFC Energy

FIGURE 15: LIQUEFACTION CAPACITY BY COUNTRY IN 2006 AND 2011



Source: PFC Energy

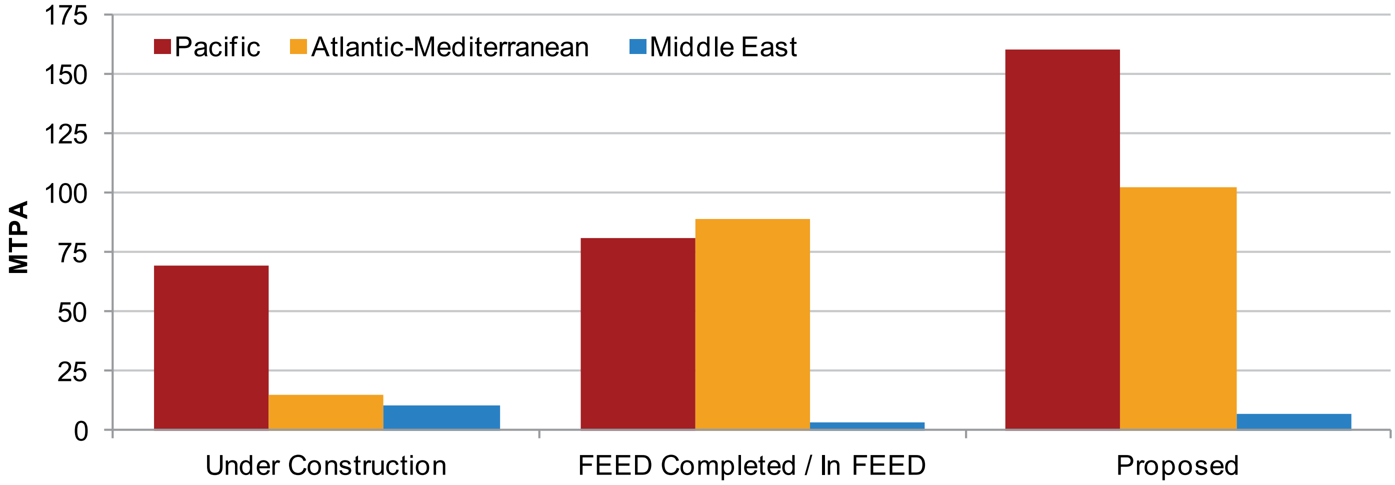
Several LNG trains are scheduled to be decommissioned in the coming five years. Kenai LNG, originally due offline in 2011, is now expected to be decommissioned in 2012, though ConocoPhillips (and former partner Marathon) backed off from previous firm plans to do so in the past. If the train is taken offline, the United States will not have commercial liquefaction capacity until the planned Sabine Pass LNG plants come onstream in the U.S. Gulf of Mexico. Indonesia's Arun LNG continued decommissioning trains and Arzew/Skikda took its oldest three trains offline in late 2010 due to the age of the plants.

Qatar's six mega trains (each with liquefaction capacity of 7.8 MTPA) have all come onstream between 2006 and 2011 - marking the largest growth over a five year period for any LNG producer. The country achieved its liquefaction capacity target of 77 MTPA with the start of Qatargas IV in February 2011, but has few opportunities for domestic expansion, given the ongoing moratorium on new developments from the North Field as the Qataris study the effects of development on the North Field. Qatar has mentioned debottlenecking the existing mega trains, but this remains uncertain at this stage.

As Qatari capacity has reached its target, Australia is expected to be the source of new liquefaction capacity. A total of 61 MTPA of liquefaction capacity is currently under construction there with an additional of about 93 MTPA being proposed or in some stage of FEED (Front End Engineering and Design). Beyond Australia, a number of new large-scale projects were proposed in 2011 that are expected to add significantly to global liquefaction capacity, including LNG projects in the United States, Western Canada and Mozambique. Although 28.3 MTPA of liquefaction capacity had been proposed in Nigeria, none of the partners in those projects have taken a final investment decision and have not announced plans to move most of these projects forward in the near term (Brass LNG is the one exception that appears to be moving forward, however slowly).

Beyond the 84 MTPA of liquefaction capacity currently under construction around the world, an additional 172.5 MTPA of liquefaction capacity has either completed FEED or is currently undergoing FEED, and a further 269 MTPA of capacity has been proposed. A number of projects were in some form of FEED in Russia and the United States in 2011, with those two countries accounting for almost 38% of the total during the year. Australia, Canada and Nigeria rounded out this group.

FIGURE 16: FUTURE LIQUEFACTION CAPACITY BY STATUS AS OF Q1 2012



Source: PFC Energy

4.4. LIQUEFACTION CAPACITY BY REGION

The Pacific Basin continues to dominate the LNG export business, with 38% of 2011 liquefaction capacity located there and the majority of capacity expected onstream by 2016. The Qatari projects have led to a significant rise in liquefaction capacity in the Middle East, but with little room for growth, capacity in the region is expected to remain flat in the medium term. Though the Atlantic Basin has seen slow growth, 101.3 MTPA of capacity has been proposed or is in some stage of FEED in the US Gulf of Mexico. Still, it is unlikely all of these projects will move forward.

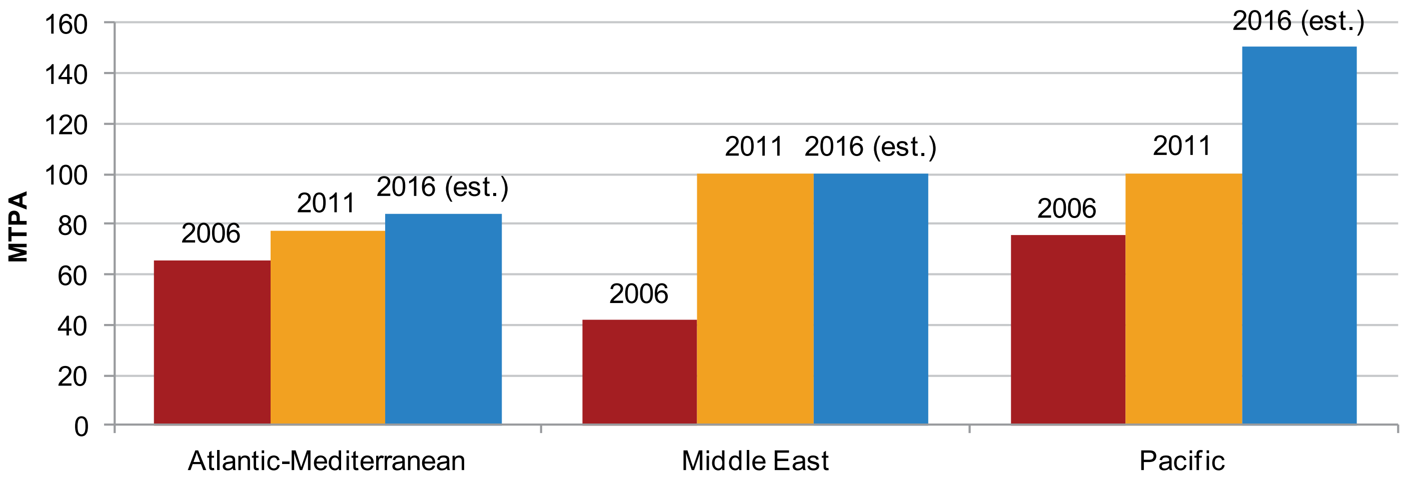
Though Australian capacity is expected to eclipse the rest of the world in the medium term, a number of other Pacific Basin projects – including those in Canada, Russia and Mozambique – have the potential to add significant liquefaction capacity in the Asia-Pacific region in the long term as well.

TABLE 8: LIQUEFACTION CAPACITY BY BASIN IN 2006, 2011 AND 2016, MTPA

Basin	2006	2011	2016 (Anticipated)	% Growth 2006-2011 (Actual)	% Growth 2011-2016 (Anticipated)
Atlantic-Mediterranean	65.8	77.8	84.3	18%	8.4%
Middle East	41.7	100.3	100.3	140%	0%
Pacific	75.6	100.6	150.3	33%	49%
Total Capacity	***183.1***	***278.7***	***334.9***	***52%***	***20%***

Source: PFC Energy

FIGURE 17: LIQUEFACTION CAPACITY BY BASIN IN 2006, 2011 AND 2016



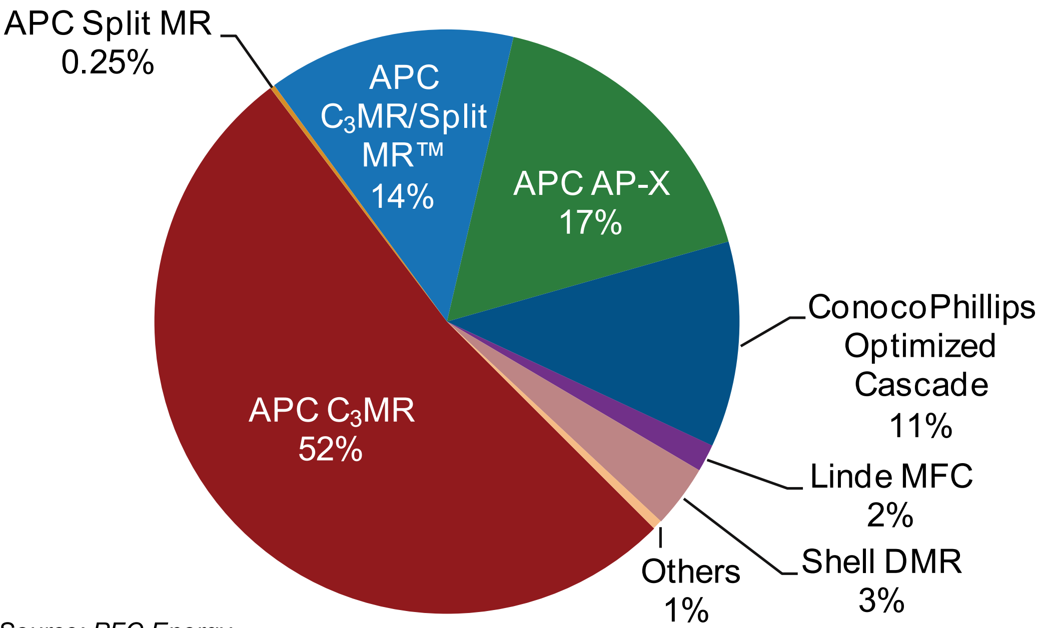
Sources: PFC Energy, Company Announcements

4.5. LIQUEFACTION PROCESSES

Seven primary liquefaction technologies were employed at the end of 2011 with a few other technologies used sporadically on a project by project basis. Air Products' four LNG processes and ConocoPhillips' Optimized Cascade® technology are the most widely used technologies, present on 94% of global LNG nameplate capacity.

Air Products' APC C_3MR technology was the most heavily used, accounting for 66% of global nameplate liquefaction capacity. Its sister technology, APC AP-X was used in another 17% of capacity - all of which is located in Qatar. Given the nature of the APC C_3MR technology as a reliable and large-scale, but not massive liquefaction technology, new projects continue to announce plans to use the technology. No project partners have announced plans to use the APC AP-X mega train technology outside Qatar.

FIGURE 18: LIQUEFACTION CAPACITY BY TYPE OF TECHNOLOGY, 2011



Source: PFC Energy

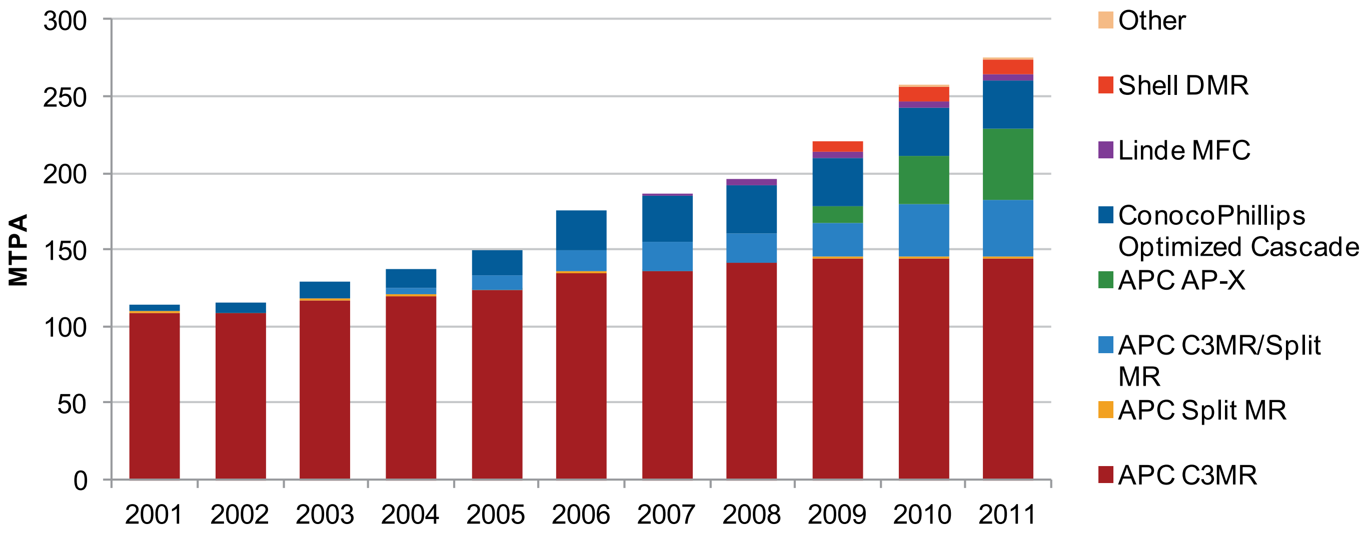
New processes are being employed at several projects. Shell's Dual Mixed Refrigerant (DMR) process is being used at Sakhalin LNG in Russia, APCI's AP-X technology is used for the Qatari mega-trains, and the Linde Mixed Fluid Cascade (MFC) process is in use at Snøhvit LNG in Norway.

The Snøhvit LNG plant, which came onstream 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 MTPA Qatargas II project. The same design was repeated for all the 7.8 MTPA mega-trains in Qatar: RasGas III, Trains 2 and 3 and Qatargas III and IV. A nitrogen sub-cooling loop is added to the C_3MR 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 in 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 temperatures experienced in the sub-arctic environment. Train capacity is 4.8 MTPA.

FIGURE 19: LIQUEFACTION CAPACITY BY TYPE OF TECHNOLOGY, 2001-2011



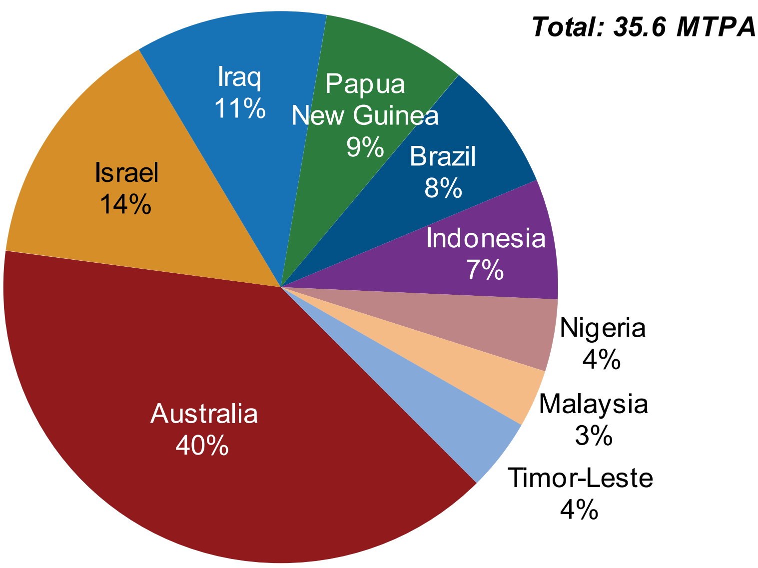
Source: PFC Energy

4.6. FLOATING LIQUEFACTION

Floating liquefaction moved forward in May 2011 with Shell taking a final investment decision on its Prelude LNG project (INPEX joined the project in March 2012). The 3.6 MTPA plant, proposed to be sited over the Prelude field off the coast of Western Australia, is the first floating liquefaction (FLNG) project to reach a final investment decision (FID). Meanwhile, PETRONAS has also reached FID for its proposed FLNG project off Sarawak, Malaysia and is now considering a second floating liquefaction train; the Santos Basin project in Brazil awarded a FEED contract; and the Tamar LNG (Israel) and Bonaparte LNG (Australia) partners awarded pre-FEED contracts in 2011.

Floating liquefaction is also being discussed as the development concept for 14 other projects.

FIGURE 20: FLOATING LIQUEFACTION CAPACITY (PROPOSED AND UNDER CONSTRUCTION), BY COUNTRY



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 capacity has been proposed, but how much and how fast that proposed capacity comes on-stream will be critical to meeting projected demand growth.*

- ***Where will the new wave of projects come from****? As Australia's LNG development gets underway, the industry is looking ahead at the next source of LNG growth. There are several areas with promising export potential, including North America (United States and Canada), East Africa (Mozambique and Tanzania), Eastern Mediterranean (Israel and Cyprus), and Latin America (chiefly Brazil). Can LNG projects materialise in those locations, at what cost, and at what pace? How soon can the LNG market depend on volumes from these countries?*

- ***Will floating liquefaction technology unlock a new generation of stranded gas?*** *As Shell and PETRONAS took Final Investment Decision on their respective FLNG project, the world is eagerly anticipating other companies that will do the same, while also paying close attention to the progress that these two companies are making. How will floating liquefaction play out? Will it be competitive? What kind of reserves will it unlock and how soon?*

5. Special Report: Emerging LNG Markets

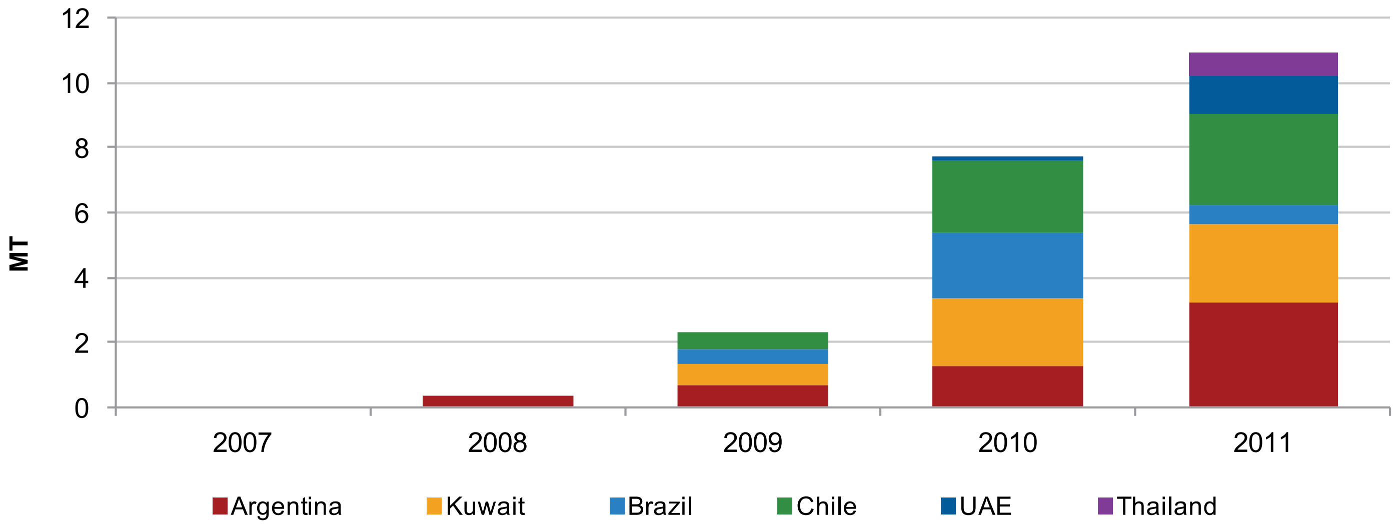
When taken in aggregate, emerging LNG markets have grown into a sizeable demand centre – importing some 11 MT in 2011. This is expected to grow in the coming decade, in spite of the fact that even five years ago many of these countries were not considered to be future LNG importers.

The current list of emerging LNG importers includes: Argentina, Brazil, Chile, Thailand, Kuwait and Dubai (United Arab Emirates). Malaysia and Indonesia are building capacity that is announced to come onstream in 2012; Singapore and Israel have announced capacity coming onstream in 2013 and Poland in 2014. Beyond these countries where terminals are already under construction, another 30 markets have proposed plans to build import terminals for a proposed regasification capacity of about 85 MTPA by the end of the decade – which would nearly double current global *regasification capacity to over 1,000 MTPA if all of these were to be built.*

5.1. INTRODUCTION

Emerging LNG markets accounted for 10.9 MT, or about 4.5% of the world LNG trade in 2011. This volume is expected to grow further as these countries acquire more volumes and new emerging markets start to import LNG. The markets represent a large and growing part of LNG import demand and are a diverse set of both regulated and deregulated gas markets. Some of these countries will have a greater ability to pay increasingly high prices than others. Where LNG replaces other sources of more expensive energy, this will be less of a problem; but where LNG is expected to replace falling production from inexpensive domestic sources, these players may have a difficult time paying.

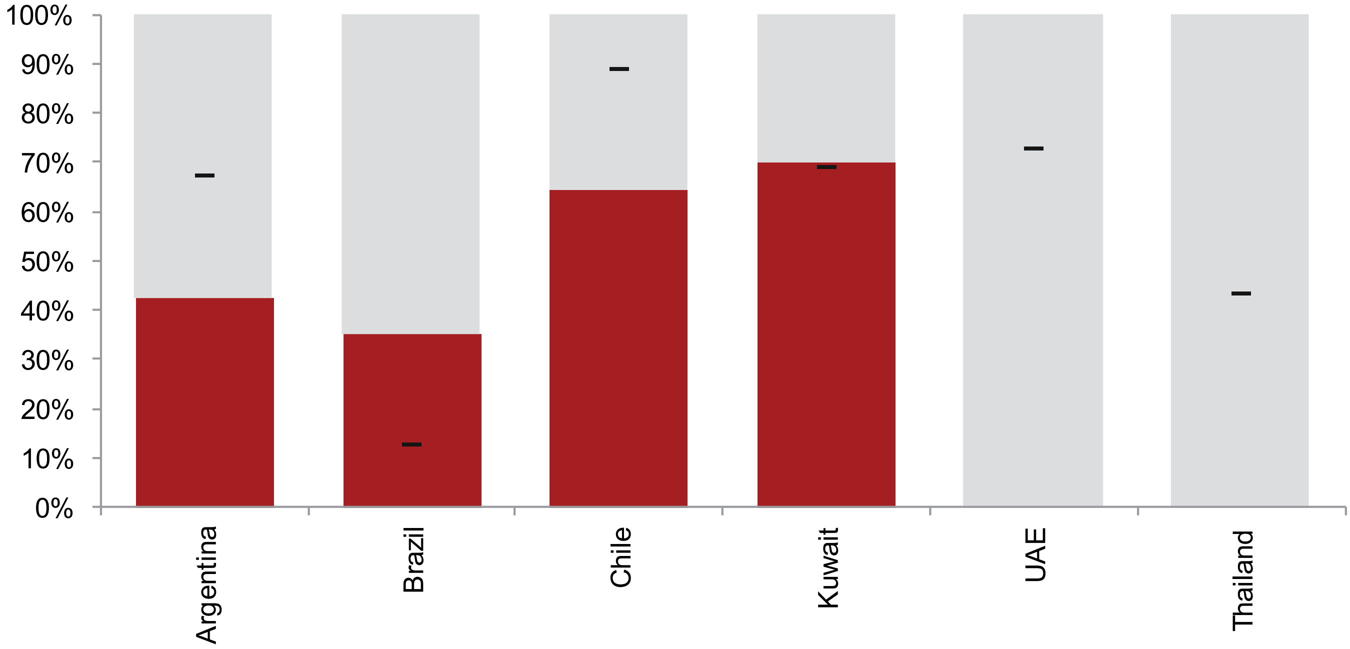
FIGURE 21: LNG IMPORTED TO EMERGING MARKETS, 2007-2011



Sources: Cedigaz, Waterborne LNG Reports, PFC Energy

The wave of emerging LNG importers continues to grow for a number of reasons. In some markets (e.g. Malaysia and Indonesia), countries look to match geographically diverse reserves with demand centres as basins near demand centres mature. For markets such as Argentina and Chile, which are facing insufficient production – and oftentimes reserves, imports are needed to satisfy domestic gas demand. Finally, other markets (e.g. Thailand, Poland) have embraced LNG imports as a method to diversify gas supply originations. As the first wave of these countries has begun importing LNG, most have maintained or increased utilisation rates of their terminals, importing more volumes year over year.

FIGURE 22: TERMINAL UTILISATION RATES, BY COUNTRY 2010 AND 2011



2010 denoted by the bar in red
2011 denoted by dash

Sources: Cedigaz, Waterborne LNG Reports, PFC Energy

Another 22 MTPA of regasification capacity is currently under construction, with a further 165 MTPA proposed to be built before the end of the decade. Even though some of these projects will not move forward, the potential for growth is significant. In the last five years, existing small-scale importers have seen average utilisation rates of 41%.

5.2. GAS RESERVES AND PRODUCTION LOCATED DISTANT FROM MARKETS

A number of markets currently import or plan to import LNG because the country's gas reserves are located far from demand centres that have historically been served by nearby producing gas fields which are now maturing. While both Indonesia and Malaysia are LNG exporters and have remaining domestic reserve potential, gas reserves lie in remote locations with a share allocated to exports via LNG – and each is now considering importing LNG (or, in the case of Indonesia, shipping domestically produced LNG to domestic terminals). Major demand centres would require a pipeline, or as is planned, import terminals that can satisfy local demand.

5.3. INSUFFICIENT GAS PRODUCTION

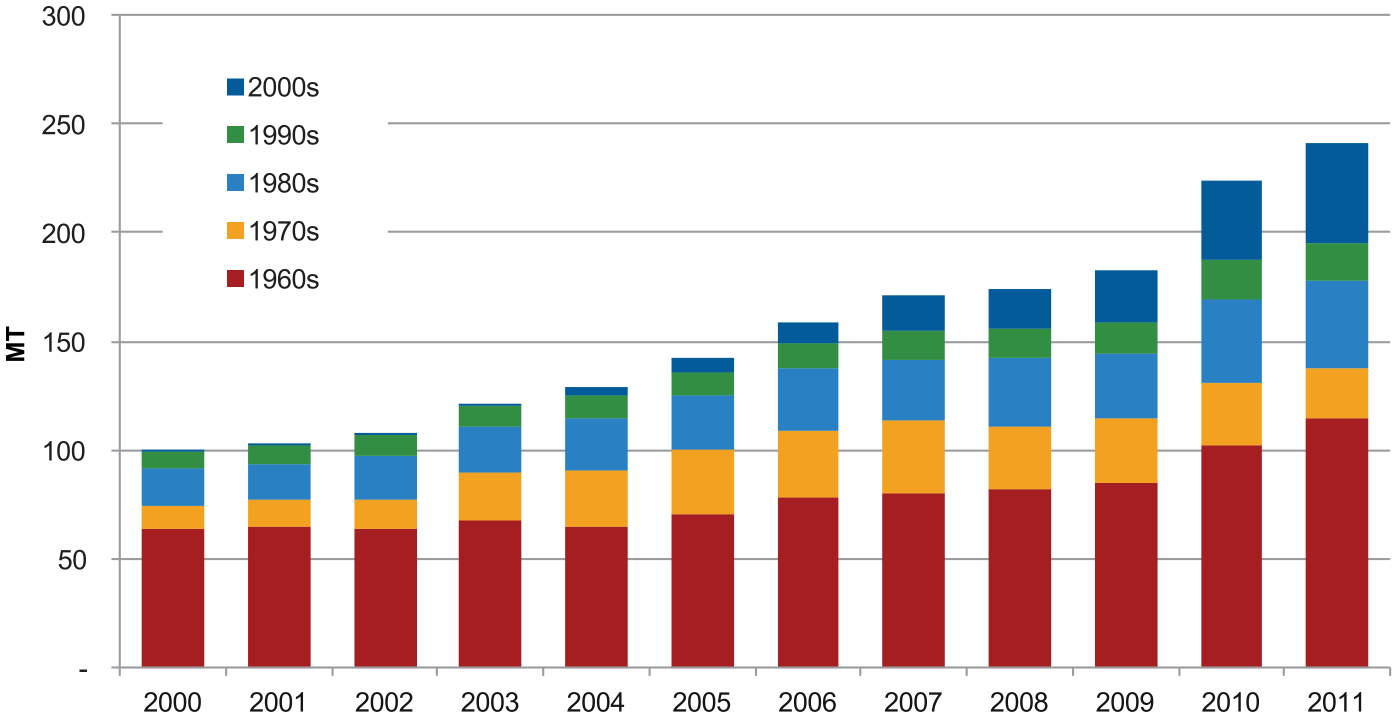
A second set of importers are looking to increase gas imports to compensate for the decline in domestic gas production, or to substitute imported gas for imported oil and coal. Many countries that had previously produced sufficient gas sold volumes inexpensively domestically, but with waning production and buoyed demand from cheap prices, many of these markets are turning to LNG imports.

The Philippines, Thailand and Vietnam face a country-wide decline in reserves and/or limited investment in exploration. Moreover, access to easy, cheap gas is increasingly a thing of the past in Indonesia, Thailand, Malaysia and Vietnam. In these countries, remaining reserves are smaller in size, in more difficult environment (high CO_2, deepwater, high temperature, etc), and to develop and produce the gas will require much bigger capital and much longer time. Imports are either a bridge, or a contingency in case the development of such gas reserves does not materialise.

Latin American markets have historically been marginal players in the global gas market. Besides exports from Trinidad, the region mostly boasted a limited trade between Brazil, Bolivia, Argentina, and Chile. But a whole new market has opened up in Latin America: Chile, Argentina, and Brazil have all opened six regasification terminals between them with more planned. More importantly, in Chile and Argentina, gas is used to replace oil, and so the ability to pay is very high. In Brazil, Petrobras has a number of associated gas fields coming onstream that should boost both supply and demand; even so, the demand trajectory is so strong that Petrobras postponed its plans to build a floating liquefaction facility that could export gas and is advancing its plans to build another import terminal in the country.

Underlying LNG import ambitions in many of these markets is strong economic growth. Together, the three traditional Asian exporters (Indonesia, Malaysia and Brunei) as well as Thailand and Singapore are home to more than 400 million people, and their combined GDP neared $1.47 trillion in 2010, on par with India's economy. As a gas consumer, these markets used 13.4 bcf/d in 2010, more than China, India or Japan consumed individually. Over the last five years, gas demand growth was a respectable 4.6% against a global average of 2.3% a year.

FIGURE 23: LNG IMPORTS BY YEAR OF ENTRY INTO LNG MARKET



Source: PFC Energy

5.4. Energy Security

The second major reason countries look to build regasification capacity and sign LNG import contracts is to ensure supply security. While various delivery threats – perceived or real – exist in each region, this has led to proposals to build terminals in nearly every corner of the world (with the notable exception of the United States).

Above-ground risk spurred a number of countries to look to build or propose building terminal capacity, even if it remains unused. Poland and the Baltic countries launched their plans to develop LNG imports as Gazprom looked to build alternate supply routes to Europe. The undersea Nord Stream pipeline bypasses the region altogether and leaves the markets susceptible to additional influence from the Russians. While Poland's terminal is under construction (expected onstream in 2014) and LNG contracts in place with Qatar, the Baltic nations have yet to decide on a definitive plan, though two options are moving forward. Likewise, above-ground risk in the Middle East brought Israel, Lebanon and Jordan to propose building LNG import capacity. Supply routes from North Africa have been threatened with unrest in the last year, raising concern in each country. Israel is the furthest ahead, with its offshore terminal currently under construction and expected onstream in 2013 in spite of recent discoveries and discussion of building either a pipeline to send domestically produced gas to the home market or even an LNG export project.

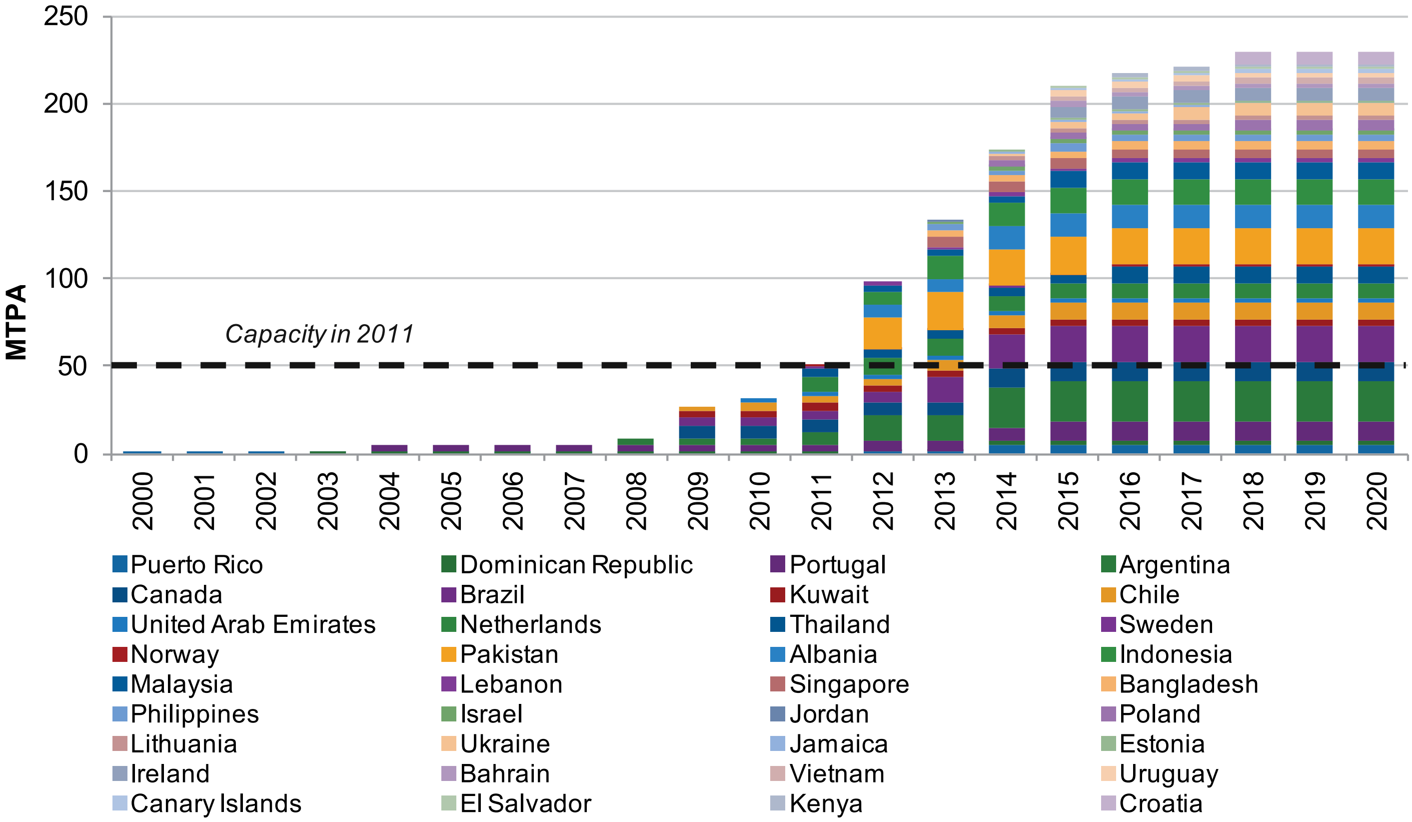
In Southeast Asia, Thailand and Singapore look to supplement existing imports and boost energy security through diversification away from an exclusive reliance on pipeline imports. Singapore has been in discussions with current pipeline gas suppliers Malaysia and Indonesia; but if incremental piped supply is insufficient, the city-state has already indicated it is prepared to contract more LNG to supplement its existing 3 MTPA LNG contract with BG. In Thailand, PTT relies solely on pipeline imports from Myanmar. Although it agreed to take additional gas from Myanmar starting in 2013, it has always been uncomfortable with its reliance on only one source of gas supply.

5.5. Potential Growth

Along with the 32 countries that have existing regasification capacity or terminals under construction, another 30 emerging LNG import markets have announced plans to build capacity. If all of these terminals are built, these countries will have a combined capacity of 246 MTPA by 2018 – nearly half the total global regasification capacity of 608 MTPA in 2012.

This is clearly ambitious: some of the projects proposed to start in 2012 have yet to start construction and some authorised terminals may never be built, but the desire to build the capacity is indicative of the optimism that these countries can import LNG to alleviate fuel concerns. Technological innovation means that a terminal can be built in less than a year: Argentina proposed its floating terminal in 2007 and started importing LNG in 2008. Though 13% of the projects currently under construction are dependent on floating regasification terminals, 35% of the remaining proposed or authorised terminals expect to use a floating concept. The technology provides tremendous flexibility and an option to bring capacity onstream more quickly than historically possible. This has also facilitated counter seasonal LNG trade, with demand centres in the Middle East and Latin America dependent on gas for cooling and heating, respectively, from May to August – when Japan and Korea have historically required fewer LNG imports for heating.

FIGURE 24: POTENTIAL CAPACITY GROWTH BY COUNTRY (ANNOUNCED START DATES)



5.6. IMPACT OF TECHNOLOGICAL DEVELOPMENTS

Technology is creating more demand for LNG. Recent developments in floating regasification have opened new markets to LNG imports and accelerated the time frame on which each of these countries can begin importing LNG. Argentina was the first example of the speed with which a country could start importing LNG, given a floating option: it took just under a year to build its Bahia Blanca terminal and start importing volumes – incredibly quick when compared to the length of time an onshore terminal would have taken to complete.

Further, in addition to new markets employing floating regasification to import new volumes, new technologies are creating new demand centres. Companies and governments are looking for new ways to utilize gas in sectors where gas use has historically been limited. LNG for transportation - for fuelling shipping vessels, car and truck fleets - and potentially LNG-fired power plants are examples of future markets for LNG.

Looking Ahead:

- ***How many more emerging markets will start to import LNG?*** *Over the past years, a large number of countries have proposed to import LNG – but a much smaller number has actually done so. How many countries will be able to overcome the commercial and logistical complexities of developing LNG import capacity?*

- ***How will the addition of emerging markets impact LNG flows?*** *As more markets import LNG, there is a wider "floor" that is created beneath LNG prices as there are more destinations where LNG can go and as there are more potential buyers that can come into the market when prices are low. Will emerging markets indeed put a floor under LNG prices? How will that floor be determined? And what does it mean for project development, for profitability, and for companies' marketing strategy?*

- ***Will LNG contracting trends begin to more accurately reflect this growth in markets?*** *Though some of the newest LNG importers have signed long-term contracts, some have not signed long-term contracts, requiring a continual return to the spot market. Though tightening demand might lend credence to these new importers looking for long-term agreements, exporters with trading ambitions may view this as an excellent opportunity to leave volumes available for increased spot sales.*

- ***Can the markets expect to fully – or even partially – utilise this growing regasification capacity?*** *Many of the most recent terminals to come onstream or start construction have identified some form of supply that allow them to utilise their growing capacity, but many companies that have proposed terminals lack LNG supplies and will either move forward only with firm supply contracts or with the hope that building a terminal will bring suppliers calling.*

- ***Can technology innovation lead to sharply increased consumption and create huge demand for LNG?*** *More and more countries are turning to gas – and LNG – as an alternative to other energy sources. Just as the current price environment has incentivised this switch, technological innovation has made the move that much more viable. Floating regasification has proven a driving force in speedy growth in the number of countries that can import LNG. Likewise, industrial uses for LNG without regasification – directly in use in power generation and in transportation, such as ships and fleet vehicles, could create even more demand centres.*

6. LNG Receiving Terminals

Gas is the fuel of choice to meet growing demand for energy and replace existing fuels in both developed and emerging markets. This is clearly reflected in both the number of countries building regasification capacity and those actually using that capacity to import LNG.

Global regasification capacity continued to grow in 2011 – to 608 MTPA – reflecting the increased demand for gas (and LNG) in an ever-larger number of markets. Many of these new LNG importing markets were not expected to be LNG importing markets as recently as five years ago, but have collectively built 32.7 MTPA of regasification capacity and have increasingly used that capacity. Floating regasification capacity has added a measure of flexibility to these markets that was previously unknown, providing relatively inexpensive capacity that can be built over a short time. In spite of growing capacity in new regions, capacity in some markets - notably the United States and Spain - is increasingly underutilised.

6.1. Overview

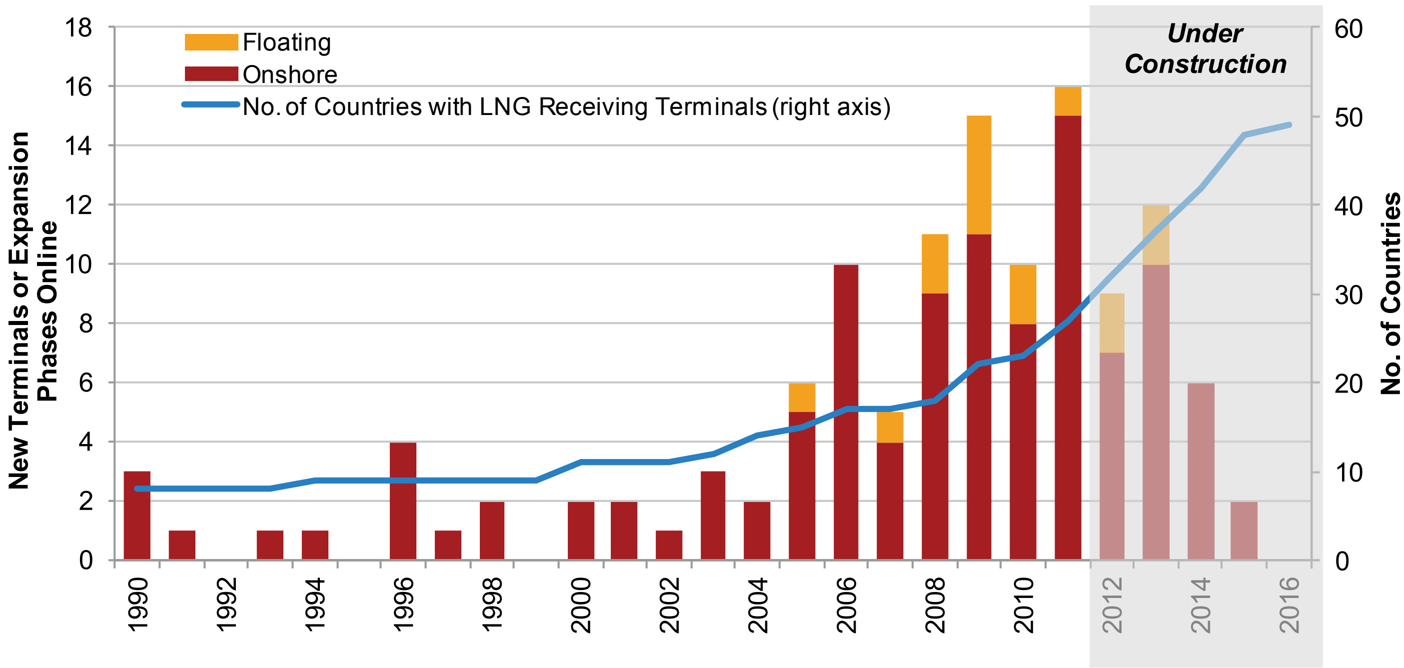
The number of markets turning to LNG to meet gas demand has grown considerably over the past decade with more than double the number of countries having regasification capacity in 2011 than in 2001. Since 2006, eight countries started to import LNG: Argentina, Brazil, Canada, Chile, Kuwait, the Netherlands, Thailand and Dubai in the United Arab Emirates. Notably, five out of these eight 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, the Dominican Republic, France, Greece, India, Italy, Japan, Mexico, Portugal, Puerto Rico, Korea, Spain, Taiwan, Turkey, the United Kingdom and the United States.

6.2. Receiving Terminal Capacity Globally

There were 89 regasification terminals around the world at the end of 2011, representing 608 MTPA in regasification capacity. Out of the 89 terminals, 29 started commercial operations between 2006 and 2011, totalling 245 MTPA in new capacity. Ten of these terminals are offshore facilities: nine of those use floating regasification technology and one (Adriatic LNG in Italy) employs a gravity-based structure. One terminal, the floating Gulf Gateway regasification terminal in the US Gulf of Mexico, was decommissioned in 2011.


Courtesy: Photographic Services Shell International Ltd.

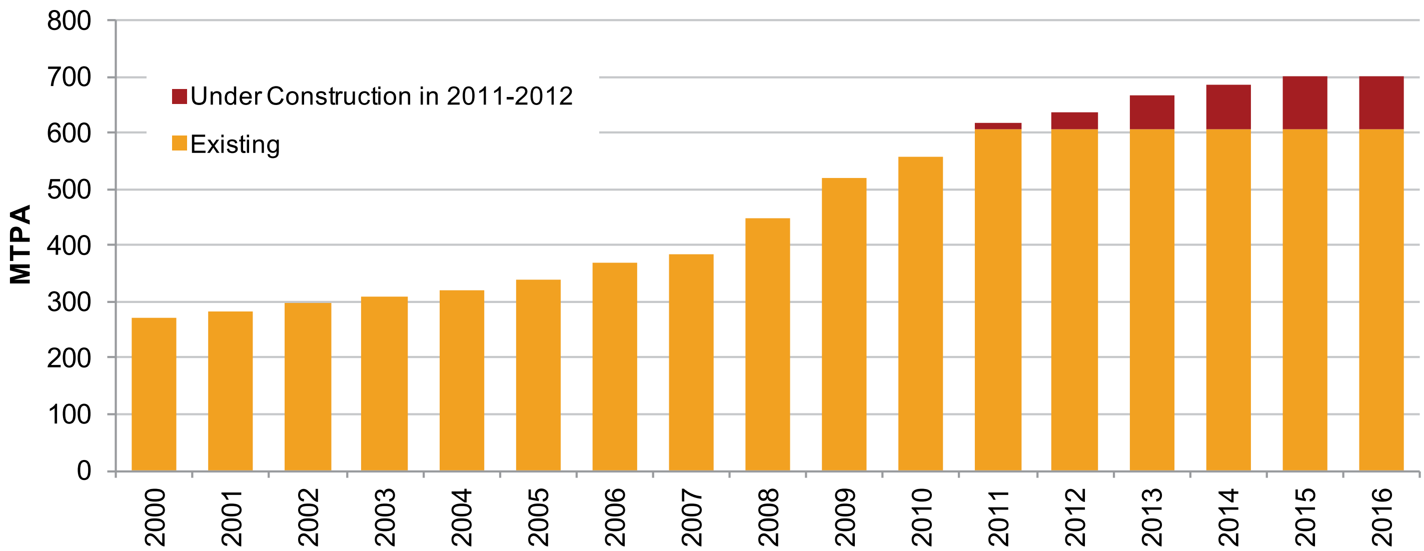
FIGURE 25: START-UPS OF LNG RECEIVING TERMINALS, 1980-2016[4]



Source: PFC Energy

Regasification capacity continues to grow, especially in new markets. Out of the 24 projects currently under construction (including new terminals and terminal expansions), 18 are completely new terminals. Once these are completed, five new countries will have LNG import capacity: Indonesia, Israel, Malaysia, Poland and Singapore. These will join the countries that have only brought terminals onstream in the last five years and were not considered potential LNG importers a decade ago. The fact that Middle Eastern countries such as Kuwait and the United Arab Emirates are importing LNG is a sign of how much the structure of the market has changed in recent years.

FIGURE 26: GLOBAL RECEIVING TERMINAL CAPACITY, 2000-2016



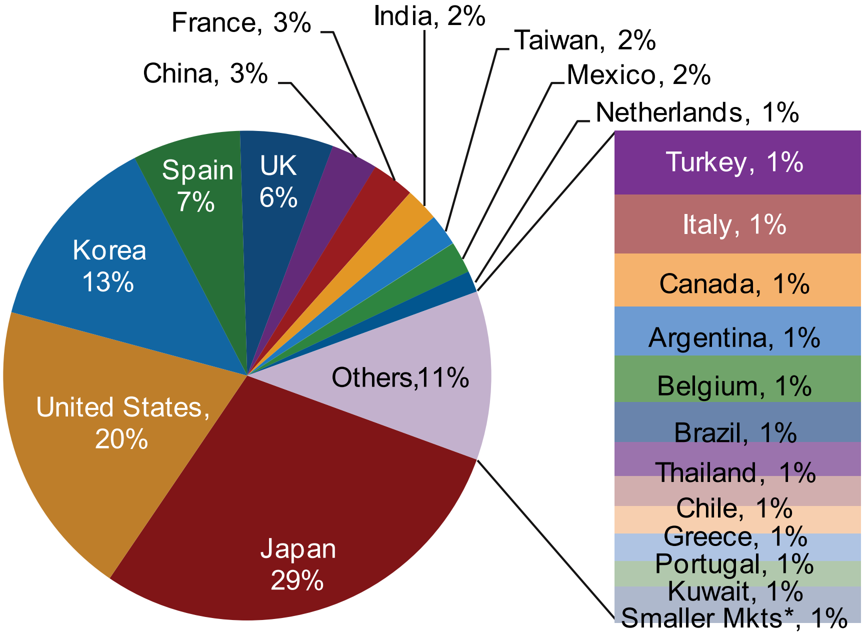
Sources: GIIGNL, PFC Energy

[4] *Forecast through 2016 based on company-announced start dates for regasification capacity currently under construction.*

6.3. Receiving Terminals by Country

Japan, the United States and Korea held 62% of global regasification capacity at the end of 2011. While Japan and Korea have increased LNG imports, capacity in the United States has been left underutilised. Including the United Kingdom and Spain, the top five regasification capacity markets held 75% of global capacity at the end of 2011 with the remaining 25% located in the 22 other LNG importing countries. Japan continues to hold the world's largest portion of regasification capacity, with 29% of global capacity located there via 28 terminals. This capacity was particularly useful in 2011 after the Fukushima disaster, when the country increased imports by 8.2 MT, or about 12%.

Figure 27: LNG Regasification Capacity by Country, 2011

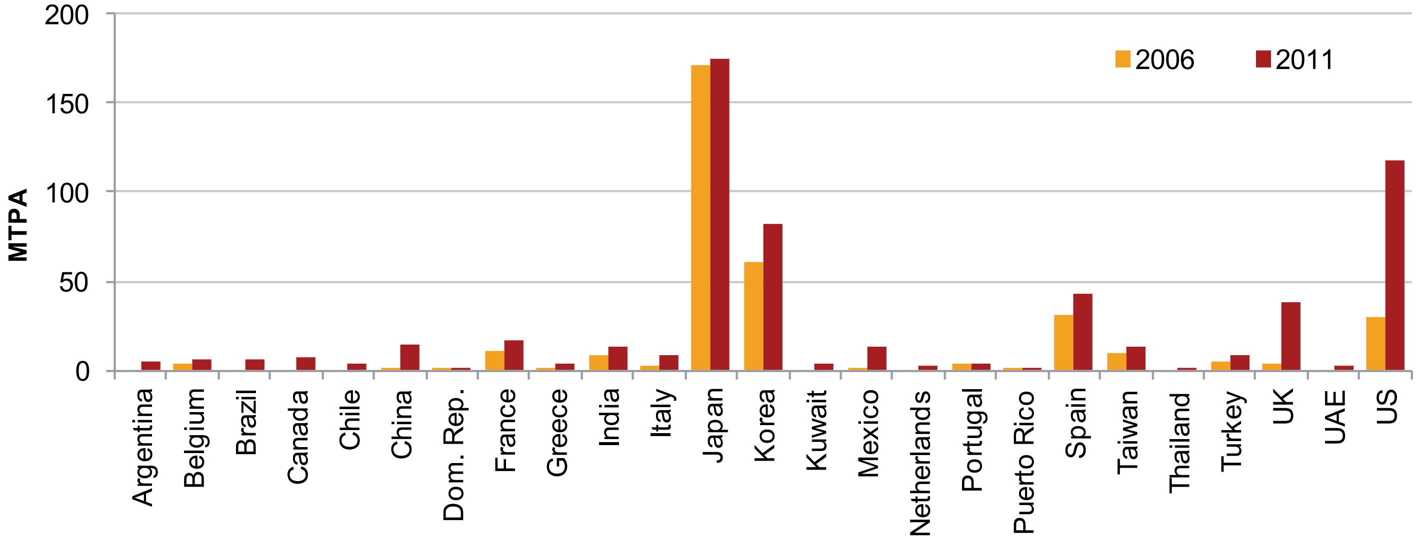


**"Smaller Markets" includes capacity in the United Arab Emirates, Puerto Rico, Sweden and Norway. Each of these countries has less than 1% of global regasification capacity.*

Sources: GIIGNL, PFC Energy

Courtesy: Photographic Services Shell International Ltd.

FIGURE 28: RECEIVING TERMINAL CAPACITY BY COUNTRY IN 2006 AND 2011

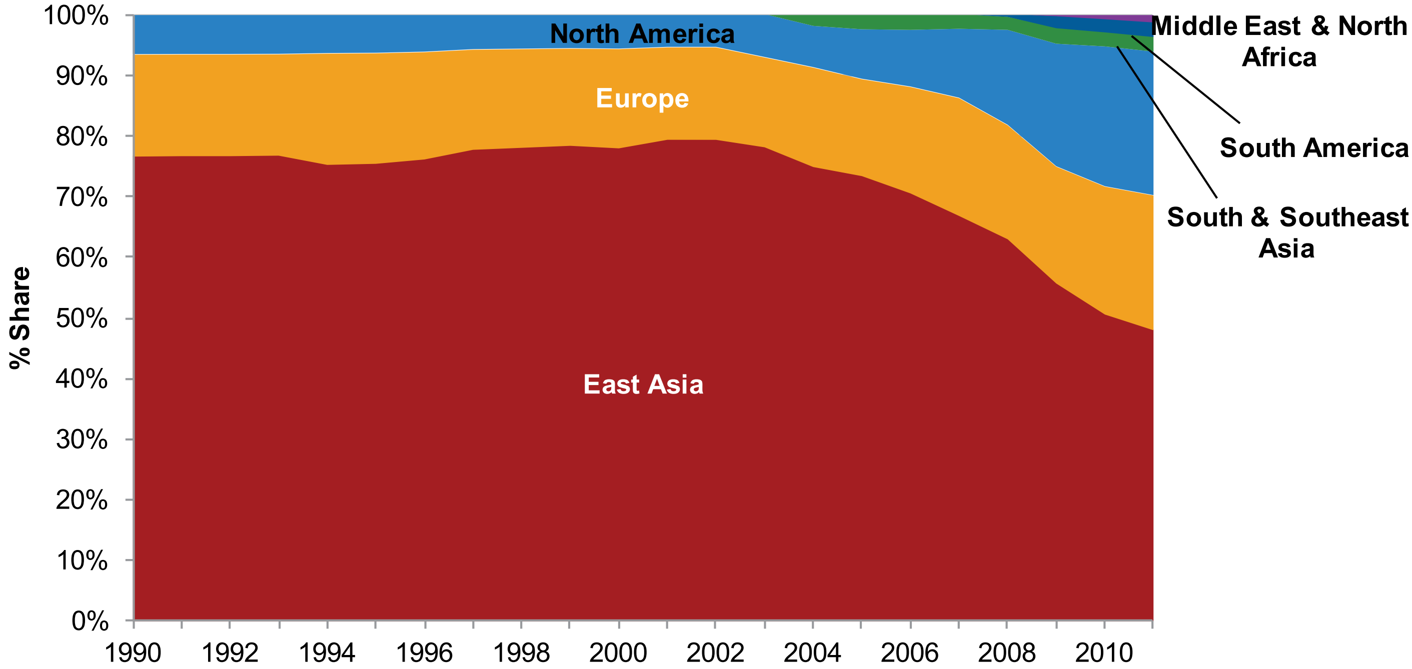


Sources: GIIGNL, PFC Energy

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 (48% or 289 MTPA) of the world's regasification capacity at the end of 2011. East Asia has historically accounted for a larger share of global regasification capacity, (about 70% 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 and Southeast Asia, South America and the Middle East.

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

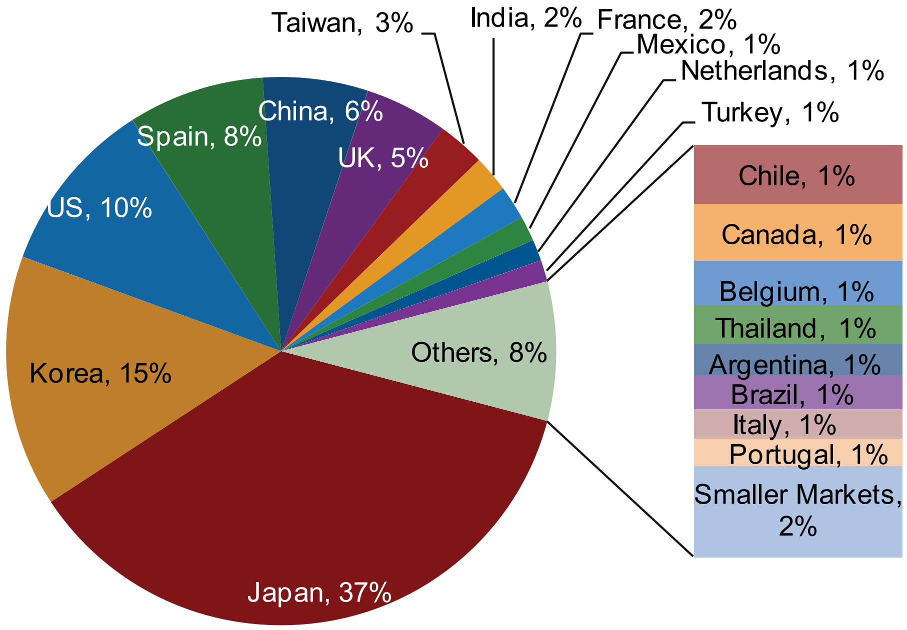


Sources: GIIGNL, PFC Energy

6.5. Receiving Terminal LNG Storage Capacity

At the end of Q1 2012, the world's regasification terminals had over 42 million cubic metres (mmcm) of combined LNG storage capacity[5]. The top six countries with the largest storage capacities together accounted for 80% of global LNG storage capacity: Japan and Korea alone accounted for the majority (51.5%), Japan with 15.5 mmcm of capacity and Korea with 6.3 mmcm, followed by the United States (10.3%), Spain (8%), China (6.2%) and the United Kingdom (4.9%). 20 countries together make up the remaining 19.1% of global LNG storage capacity. Important to note is the growth of China: in 2011, the country brought 0.74 mmcm of LNG storage capacity onstream, propelling it into the top tier.

Figure 30: LNG Storage Tank Capacity by Country as of Q1 2012



"Smaller Markets" includes storage capacity in the Dominican Republic, Greece, Kuwait, Norway, Puerto Rico, the United Arab Emirates and Sweden. Each of these countries has less than 0.5% of global LNG storage capacity.

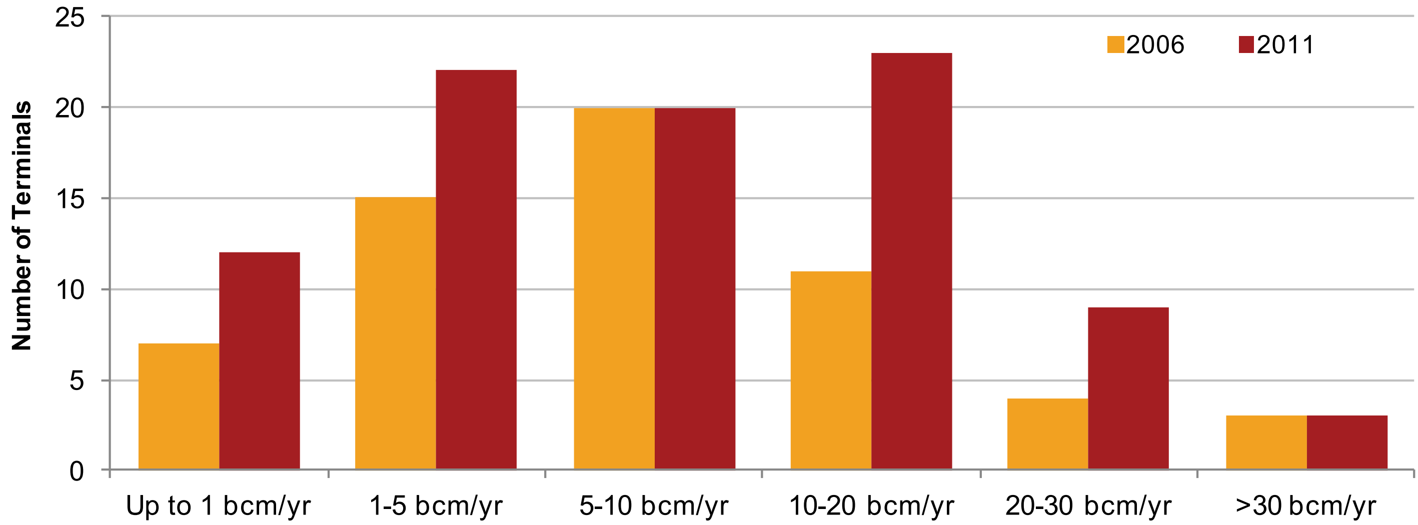
Source: PFC Energy

6.6. Receiving Terminal Maximum Berthing Capacity and Gas Send-out Capacity

A majority (slightly more than 50%) of LNG terminals can accommodate vessels with a LNG carrying capacity of over 150,000 cm, a share which has doubled since 2005 as new terminals have come onstream with berthing capacities over 150,000 cm and a growing number of existing terminals are upgrading facilities to accommodate larger ships.

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

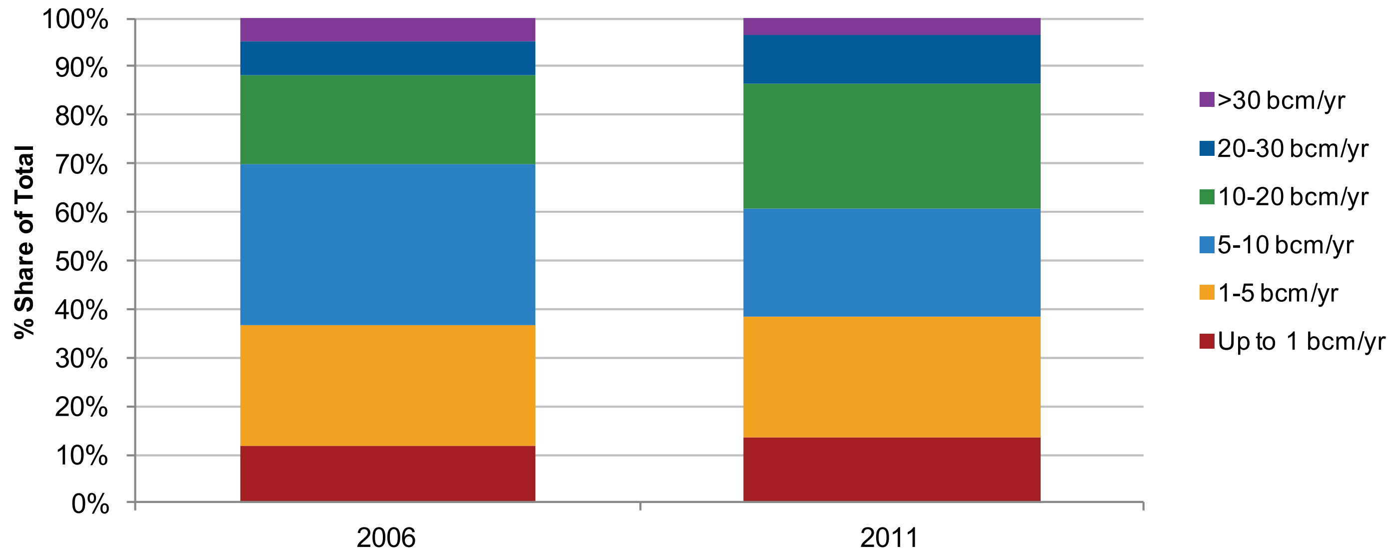
FIGURE 31: ANNUAL SEND-OUT CAPACITY OF LNG TERMINALS IN 2006 AND 2011



Source: PFC Energy

A large part of the increase in smaller-sized terminals stems from the commissioning of floating terminals, including the Bahía Blanca and Puerto Escobar terminals in Argentina; Pecém and Guanabara in Brazil; Dubai in the UAE; the Teesside GasPort in the UK; the Northeast Gateway and Neptune LNG off the US coast; and the Mina Al-Ahmadi GasPort in Kuwait. Contracts were also signed for floating terminals in Indonesia (West Java), Lithuania (Klaipeda LNG) and Israel (Israel LNG), all of which are announced to come onstream in the medium term, with many more countries and developers studying or planning offshore terminal developments.

FIGURE 32: SHARE OF ANNUAL SEND-OUT CAPACITY OF LNG TERMINALS IN 2006 AND 2011



Source: PFC Energy

6.7. REGASIFICATION TERMINAL TECHNOLOGY

The long lead time and high investment cost for land-based terminals, together with safety concerns and environmental considerations have recently resulted in an increased interest in offshore re-

- 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, regasified on demand and exported to shore by a subsea pipeline.

- An ***LNG Storage and Regasification Vessel (LNG SRV)*** 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 5-7 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 use of air vaporisers in hot and wet climates, and cold integration with neighbouring 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 and prices long term?*** *Several traditional LNG exporters are already building or are planning to build LNG receiving capacity. Indonesia is channelling some volume from its LNG plant for use in the domestic market, and a few others may also follow. To what extent would such imported LNG impact on the prices of the local gas market? .*

- ***Will new LNG capacity lead to extreme demands on LNG supply?*** *In addition to the 32 countries with existing regasification capacity or capacity under construction, another 29 countries around the world are studying or planning LNG imports to meet domestic gas needs. Would the high number of proposed regasification capacity be a good indicator of the future LNG market?*

- ***Will new technology continue to impact the number of LNG importers?*** *Many of the latest markets that have begun importing LNG have been able to do so more quickly than was previously possible due to technological developments. As more countries seek to address supply security or energy cost concerns, this is likely to grow even more.*

7. LNG Carriers

The LNG trade hit an all time high of 241.5 MT, mainly arising from the Fukushima crisis in March 2011, contributed to charter rates reaching historic highs, and resulted in a boom in orders for newbuild vessels.

The charter market for LNG vessels initially began to tighten in Q4 2010 and Q1 2011 as the price differential for LNG in the Atlantic and Pacific basins widened, resulting in greater interest in sending cargoes from the Atlantic Basin and Middle East into Asian markets. This arbitrage opportunity increased journey lengths, placed a premium on non Q-Class, conventional-sized vessels able to serve all terminals, and ultimately increased demand for spot shipping charters. The surge in LNG demand in the Japanese market, as a result of the Fukushima crisis, as well as higher demand in the United Kingdom, India and China, and the emerging markets, added even greater momentum to this situation.

7.1. Overview

At the end of 2011, the global LNG fleet consisted of 360 vessels of all types, with a combined capacity of 53 mmcm, which was 150% higher than in 2006. Growth was largely the result of deliveries associated with the last cyclical boom in orders for newbuild LNG vessels, which occurred most prominently in 2004 when 68 orders for all vessel types were placed in a single year.

The average size of LNG carriers has also increased in recent years partly due to the commissioning of larger Q-Series vessels associated with Qatar. Deliveries of Q-Series vessels were completed in 2010, resulting in the addition of 31 Q-Flex (210,000-217,000 cm) and 14 Q-Max (261,700-266,000 cm) vessels to the global fleet. In 2011, the average capacity global fleet was 147,951 cm. By contrast, the average size of vessels in the newbuild order book at the end of 2011 was 162,132 cm, reflecting the trend toward larger capacities for conventional vessels.

There is also growing demand for alternative uses of LNG vessels, which consists mainly of Floating Storage and Regasification Unit (FSRU) vessels. Many companies have also looked to develop Floating Production, Storage and Offloading (FPSO) vessels, which facilitate floating liquefaction. This technology remains unproven, though Shell in cooperation with Technip sanctioned the world's largest floating liquefaction plant in May 2011.

7.2. Vessel Types

The term "conventional LNG vessels" refers to the Moss-type or membrane vessels, which are greater than 125,000 cm and less than 180,000 cm. Non-conventional vessels include Q-Series types, which offer the largest capacities between currently available, in addition to FSRUs.

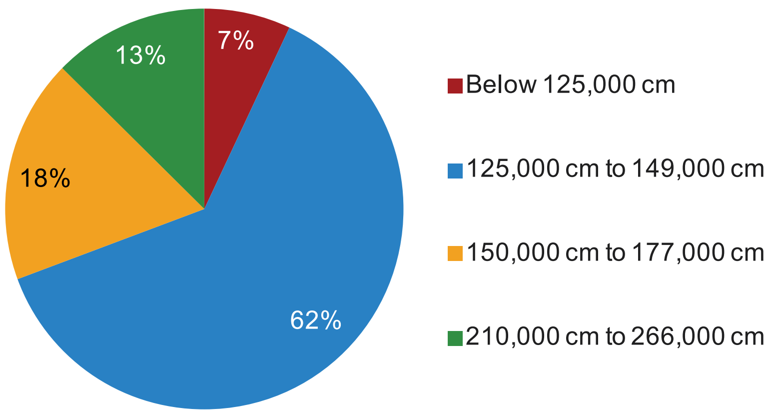
FSRUs are typically capable of both transporting LNG like traditional LNG carriers, and additionally offer the onboard functionality of regasifying LNG, which is delivered to land usually via a buoy-connected pipeline. This onboard regasification capability eliminates the need for a traditional onshore regasification terminal, allowing the FSRU to function as a floating terminal for other conventional vessels and to deliver its own LNG cargo directly to land. Some FSRUs are permanently moored as floating regasification terminals, but the majority of the vessel type alternate as a floating terminal or LNG carrier at different points in a year.

Shell and Technip's FPSO vessel, which took FID in conjunction with the Prelude LNG project in 2011, will be the world's largest vessel, estimated at about 600,000 tonnes. Given the unprecedented and technically challenging nature of the project, Shell has stipulated that it will privilege execution over its announced timeline. Several other players are interested in pursuing FPSO newbuilds, but none have thus far made as much progress as the Shell-Technip duo, except Malaysia's FLNG project offshore Sarawak.

7.3. Vessel Capacity and Age

The size of LNG carriers ranges significantly, but more recent additions to the fleet demonstrate a bias toward vessels with larger capacities. The smallest cross-border LNG vessels, typically 14,000 cm to 40,000 cm, are mostly used to transport LNG from Southeast Asia to smaller terminals in Japan. 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. The most common class of LNG carrier has a capacity between 125,000-149,000 cm, representing 62% of the global fleet. The vast majority of newbuild orders over the past decade in the next capacity category, 150,000 cm to 177,000 cm. Existing vessels of this size represent 18% of the current fleet. Finally, the largest category of LNG vessel is the Q-Series, which is composed by Q-Flex (210,000-217,000 cm) and Q-Max (261,700-266,000 cm) types.

Figure 33: Global LNG Fleet by Capacity, 2011 (Number of Carriers, % of Total)

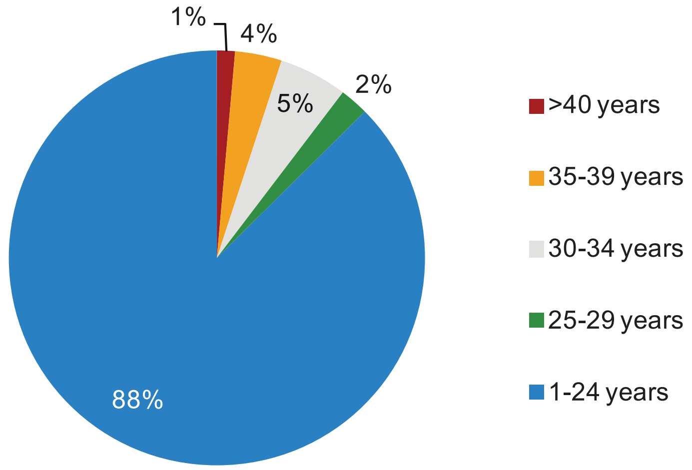


Source: PFC Energy

The average age of the global LNG fleet at the end of 2011 was approximately 11 years, largely due to deliveries from the last cyclical newbuild order boom in 2004. 88% 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 more than 40 years.

At the end of 2011, approximately 10% of the global fleet was over 30 years. But the tightening of the charter market in 2011 and the anticipated strength of LNG charter rates for the next couple of years has encouraged vessel owners to postpone retirements. It also suggests the high level of difficulty in anticipating the decision-making process, which vessel owners will undertake for as long as the charter market remains at historic highs.

FIGURE 34: GLOBAL LNG FLEET BY AGE, 2011 (NUMBER OF CARRIERS, % OF TOTAL)

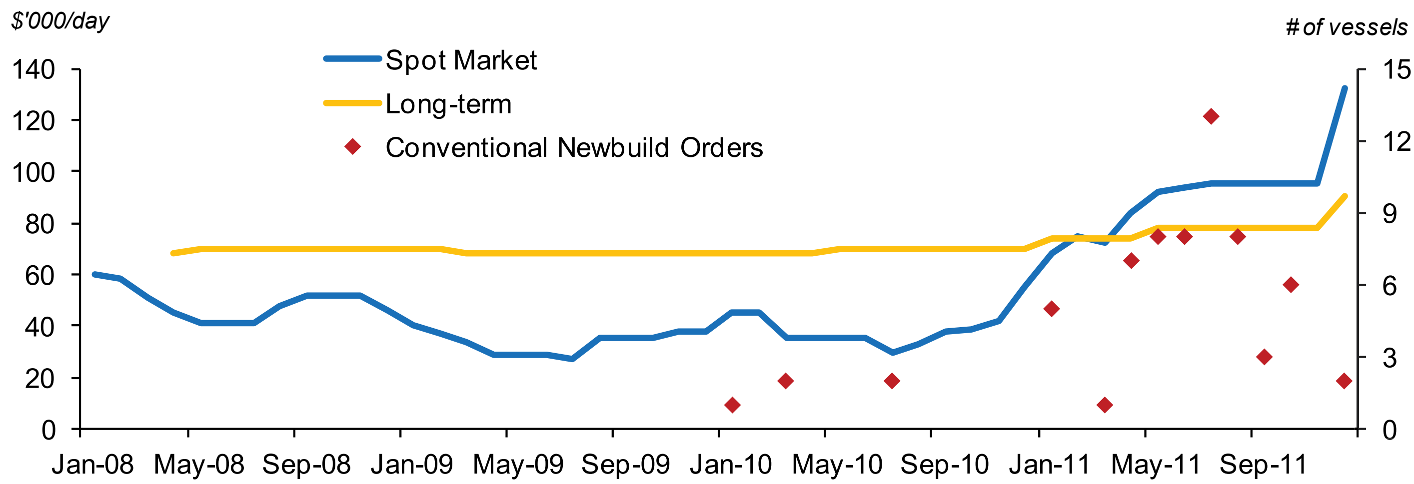


Source: PFC Energy

7.4. CHARTER MARKET

A major driver for the flurry of newbuild order activity in the LNG shipping market in 2011 was the tightening of short-term charter rates. The charter market for LNG vessels initially began to tighten in Q4 2010 and Q1 2011 as the price differential for LNG in the Atlantic and Pacific basins widened, resulting in greater arbitrage opportunities from the Atlantic Basin and Middle East to Asian markets. This preference to sell into the Pacific Basin increased journey lengths, placed a premium on conventional vessels capable of serving all Asian markets, and generally led to an increase in demand for short-term, spot charters.[6] The surge in demand from Japan, which occurred as a direct result of the Fukushima crisis, added even greater momentum to this trend as LNG suppliers rushed to divert cargoes to the Japanese market.

FIGURE 35: ESTIMATED LNG CHARTER RATES & NEWBUILD ORDERS



Sources: Argus, PFC Energy

Short-term, spot charter rates doubled in 2011 to an average of $78,000/day. By Q1 2012, spot charter rates exceeded $130,000 for newer, more efficient vessels. Long-term charter rates rose12%

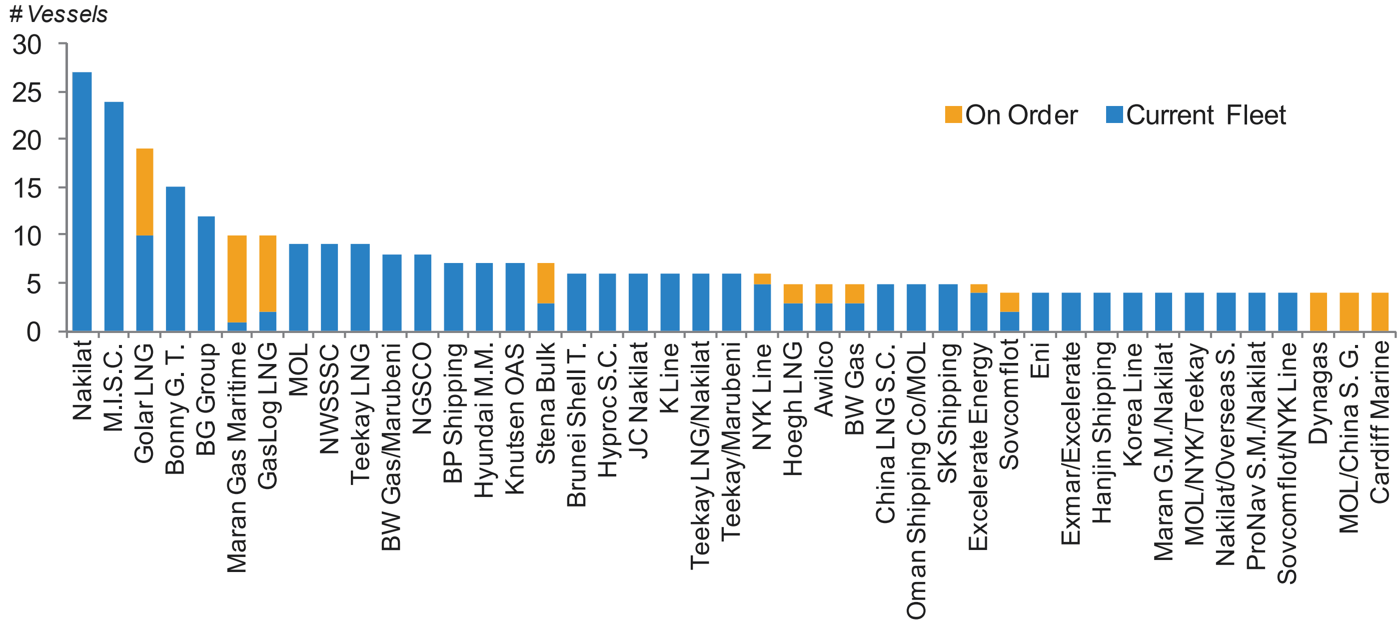
[6] *Q-Series vessels are able to deliver LNG to a finite number of terminals, which have the capacity to receive such large-capacity vessels.*

in 2011 to $78,000/day. Those interested in chartering a vessel were generally reluctant to sign long-term deals in such a strong charter market, as long-term rates crept close to the breakeven between chartering and ordering newbuild vessels.

7.5. Newbuild Orders

2011 proved to be a very strong year for newbuild vessel orders, especially following the Fukushima crisis in March 2011. During the period between March and December, 55 orders were placed for newbuild conventional and FSRU vessels. In total, 57 newbuild orders were placed for these types in 2011, second only to the last cyclical order boom for LNG in 2004 when 68 vessels, including Q-Series vessels, were ordered in a single year.[7] The cumulative number of outstanding orders in the order book stood at 67 at the end of 2011.

Figure 36: LNG Fleet and Order Book, 2011



Source: PFC Energy

The largest players in the market have traditionally been NOC-affiliated shipping companies such as Nakilat, MISC Berhad, and Bonny Gas Transport, in addition to large Japanese shipping players such as Mitsui O.S.K. Lines (MOL) and Teekay. In 2011, other players made a push into the ranks of the elite. In particular, independent shipping companies Golar LNG, Maran Gas Maritime and GasLog LNG have been quite aggressive in making orders during the post-Fukushima period. As charter markets for other forms of shipping such as dry bulk and VLCC continue to experience cyclical downturns, shipping companies are privileging the counter-cyclical opportunity offered by the tightening LNG charter market. Based on these conditions, 44 orders placed during the post-Fukushima period were "speculative" or "non-associated", meaning they are not known to be associated with a liquefaction project charter or a general charter at the time the order was placed.

The order book at the end of 2011 included five orders for FSRU vessels, which were placed by three companies Excelerate Energy, Golar LNG and Höegh LNG.

[7] *All orders for Q-Series vessels were made from 2004 through 2007.*

The market for floating liquefaction vessels was limited to a single firm newbuild order associated with Shell's Prelude LNG project.

Looking Ahead:

- ***Would the 57 newbuild vessels scheduled to be completed sometime in 2015, lead to weakening of charter rates?*** *The order boom in 2011 for newbuild LNG vessels, which are scheduled to be delivered toward the middle of the decade, could lead to an increase in capacity that overshoots demand for charters.*

- ***Considering that the charter rates for LNG vessels are now very high, what strategy should owners of new LNG plants adopt?*** *Unprecedentedly high charter rates are prompting LNG offtake customers of liquefaction projects currently under construction to consider ordering their own vessels rather than contracting speculative newbuild orders.*

- ***Would the delay experienced by some of the ongoing LNG projects lead to excess capacity sometime in 2015/16?*** *Delays to liquefaction projects currently under construction could result in vessels chartered to those projects temporarily entering the spot market in search of work. This would in turn lead to downward pressure on short-term charter rates.*

- ***Should owners of older LNG vessels (around 30 years) take the risk of extending the charter of such vessels in view of very high charter rates?*** *The decisions made by shipping companies regarding the timing of retirements for older vessels will play an important role in determining the tightness of the charter market over the next few years.*

8. Impact of Unconventional Gas on the LNG Industry

The rapid transformation of the US gas market following the shale gas boom has already had an impact on the global 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 be able to replicate the success of the US?

8.1. Introduction

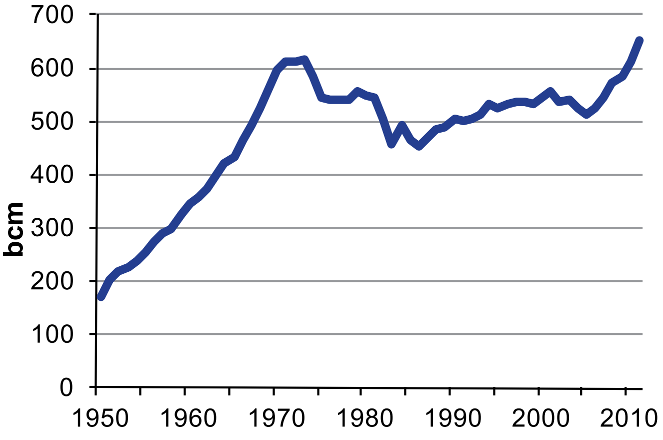
The following report discusses the factors that led to the unconventional gas boom in the US, the impact it has already had on regional gas markets, the potential for material shale gas production to be replicated elsewhere, and the resulting impact on LNG demand. It also addresses the potential for the US to export shale gas as LNG, another impact from the shale gas boom that will affect the LNG market over the next decade and beyond.

8.2. US Shale Gas Boom and Impact on US LNG Gas 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 2011, output surpassed the 1973 peak.

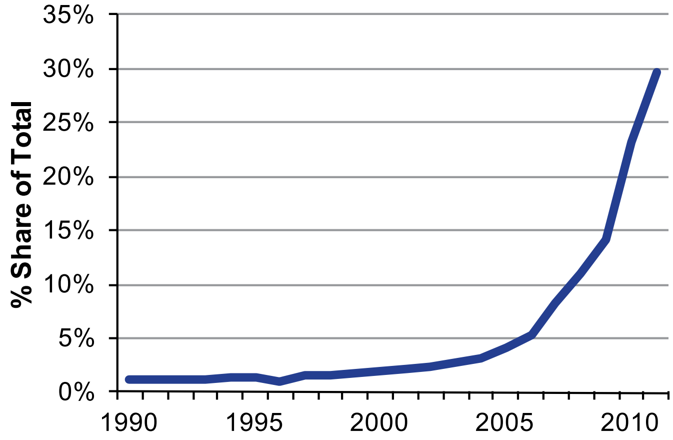
The growth in gas production has been driven chiefly by the ability to produce unconventional resources at ever cheaper rates. Unconventional gas includes shale, coal bed methane and tight gas which are all characterised by low natural permeability in the reservoir (commercial gas volumes do not "flow" naturally). Using horizontal drilling and hydraulic fracturing, combined with tighter well spacing and a higher rate of drilling versus conventional gas fields, companies have been able to create sufficient permeability to extract ever increasing commercial volumes from these reservoirs.

FIGURE 37: US NATURAL GAS PRODUCTION



Sources: EIA, PFC Energy

FIGURE 38: SHARE OF SHALE GAS IN US GAS PRODUCTION



Source: EIA

This growth in shale gas production has emerged as a shock to the LNG system for two reasons: first, it has made clear that the US will not import significant volumes of LNG over the next decade (at least), and furthermore has already altered the dynamics of both the Canadian and Mexican gas markets as well; 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.

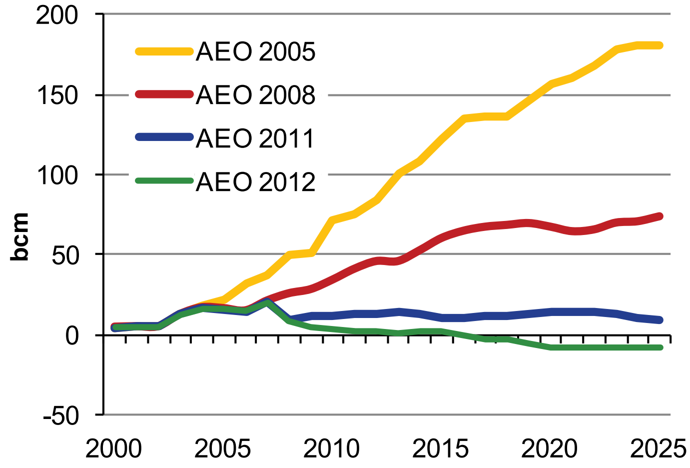
8.3. IMPLICATIONS OF US SHALE GAS BOOM ON LNG TRADE FLOWS AND PRICES

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 significantly downgraded its LNG import expectations, and in 2012 it has gone even further, projecting that the US will become a net LNG exporter by 2016, after the start up of Cheniere Energy's Sabine Pass liquefaction project, the first train of which is announced to come onstream in 2015.

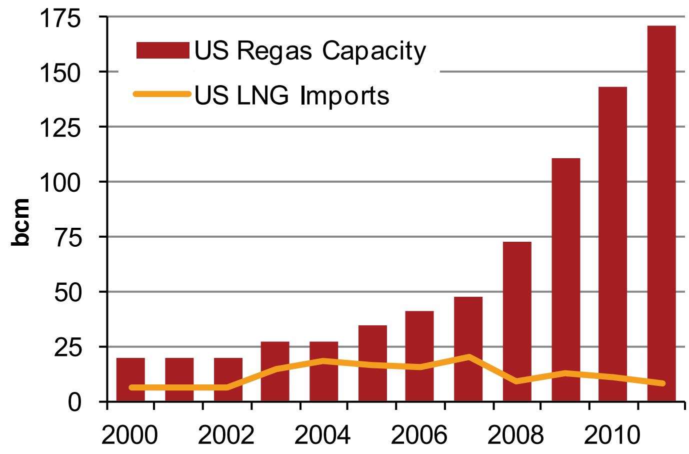
In addition to Sabine Pass, there are now seven other proposed liquefaction projects in the continental US (excluding Alaska). However, Sabine Pass is the only one to have secured contracts for any of its proposed capacity. Three other projects have announced start-up dates: Cove Point LNG in 2016, Freeport LNG in 2016, and Corpus Christi LNG in 2017.

FIGURE 39: EIA FORECASTS FOR US LNG IMPORTS



Source: EIA

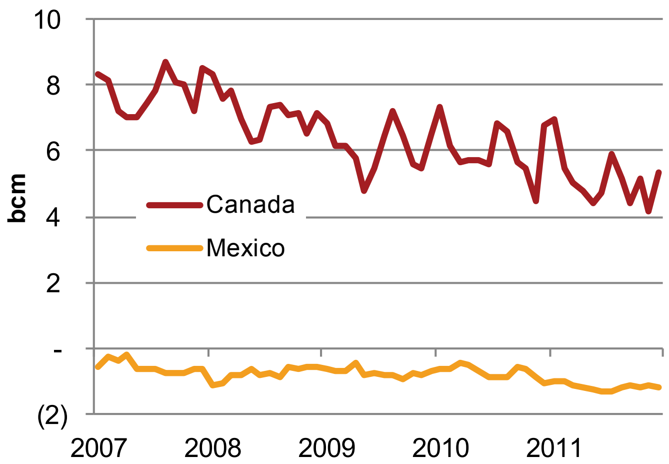
FIGURE 40: US REGASIFCATION CAPACITY VS. IMPORTS



Source: PFC Energy

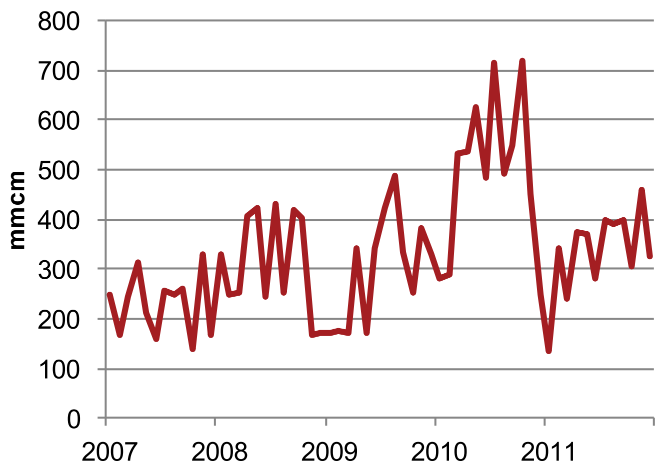
This means that not only has a significant source of demand for global LNG supplies has disappeared, but in fact the US is likely to add to global LNG supply by the middle of the current decade. This will have a significant impact on LNG markets over the next decade, but it has already transformed regional dynamics in North America. In particular, US net imports from Canada have declined steadily since 2007, while net exports to Mexico have grown. Lower demand for Canadian gas in the US has coincided with declining Canadian conventional gas production, but an important implication of lower demand for Canadian gas in the US is that new shale gas being developed in western Canada is now more likely to be exported as LNG. There are several projects proposed, and these are likely to add to LNG supply in the Pacific Basin over the next decade, including Kitimat LNG, BC LNG, LNG Canada and the PETRONAS/Progress LNG project in Canada's Pacific Northwest. In Mexico, greater availability of pipeline gas from the US has already led to lower LNG imports in 2011, and this trend is likely to continue:

FIGURE 41: US NET TRADE WITH CANADA AND MEXICO



Source: PFC Energy

FIGURE 42: MEXICAN LNG IMPORTS

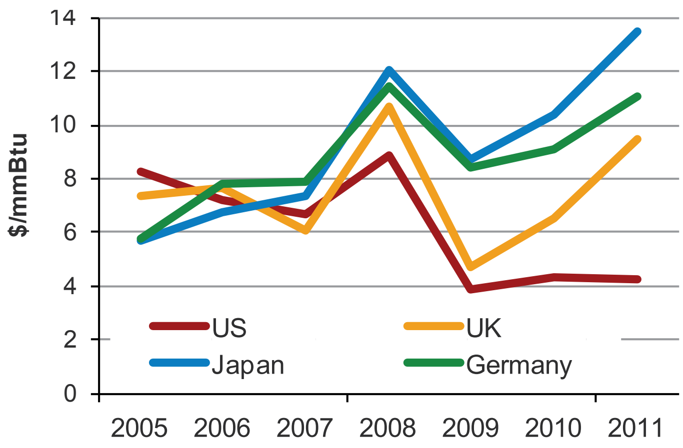


Source: PFC Energy

Given that LNG investments have a long-lead time, there has been a significant amount of LNG capacity that has come onstream between 2009 and 2012 that 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). In 2011, following the Fukushima disaster, Japan absorbed most of the incremental LNG as its nuclear reactors were taken offline. Thus, while the lack of more imports needed from the US produced a glut in gas supplies, new supply has been effectively absorbed by the market, minimising any downward pressure on prices outside of North America. Specifically, this has two implications for gas pricing.

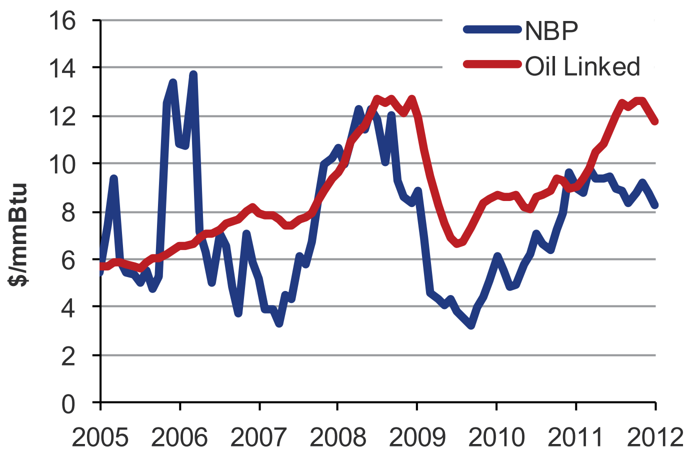
First, the US market has become effectively disconnected from the broader global market, and remained so even as prices elsewhere moved towards convergence in 2011. While Henry Hub has never correlated perfectly with prices in either Europe or Asia, the disparity between Henry Hub and prices elsewhere has been magnified since 2008. In 2011, US gas prices were more than 68% lower than prices in Japan, while they also traded at a growing discount to UK gas prices (-33% in 2010, and -55% in 2011). As a result of this disparity, several companies that own regasification terminals which are idle have proposed to start exporting LNG from North America.

FIGURE 43: GAS PRICES IN SELECT MARKETS



Source: PFC Energy

FIGURE 44: EUROPEAN GAS PRICES, OIL-LINKED VS. SPOT



Source: PFC Energy

Second, increased supply into Europe put temporary pressure on the linkage between oil-linked and spot prices there. In 2009, the average oil-linked contract price exceeded the spot price at NBP by about $3.5/mmBtu. However, by the end of 2010 the gap had disappeared as buyers were in some cases able to renegotiate terms with sellers. Buyers succeeded in linking some of the volumes they purchase to spot prices rather than oil; they also achieved a relaxation of take-or-pay (TOP) provisions. In 2011, however, this trend proved temporary: NBP fell slightly as the UK absorbed a greatly increased volume of LNG from Qatar, while rising oil prices pulled oil linked prices higher.

Thinking about the importance of US shale gas from a more structural perspective, there are three questions to consider:

- First, is the US shale gas revolution sustainable, and at what price is shale gas viable? And what risks are associated with its production? In 2011, the answers to these questions became somewhat clearer. First, the shale gas revolution is looking increasingly robust, as persistent low prices, and a massive shift in drilling to target oil rather than gas has yet to slow rising gas production in the US. While there are cyclical factors contributing to this, such as portfolio high-grading (companies drilling only on their best acreage), and JVs in which the operator's drilling costs are carried by its partners for a set time period, it nonetheless appears that structural trends support sustainability. That is, the cost of producing shale gas has been driven down to a level at which production can be sustained long term even in a relatively low price environment, though eventually growth is likely to slow or even temporarily reverse as the cyclical trends cited above play out. And though restrictions on hydraulic fracturing due to its perceived or real environmental impacts could have a material impact on production potential in some areas, the actual impact remains highly uncertain. Current policy trends mostly support continued expansion of drilling, but this could change over time if environmental impacts prove significant.

- Second is the question of whether the absence of US LNG import demand has produced a short or long-term glut in supplies. From a global perspective, the glut seen in 2009-2010 has proven short-lived, though much of that has been driven by increased Japanese demand post-Fukushima, and this could change depending on the evolution of nuclear power policy there. In the near-term, very little incremental LNG capacity is set to come onstream, meaning markets are likely to remain tight so long as Japanese demand remains high. As the next wave of LNG capacity is added over the coming decade, demand growth in China, India and other emerging markets now appears likely to prevent another major glut, but this could change if economic trends reverse. Over the long term, the most significant question remains whether other countries will be able to replicate the boom in shale gas seen in the US.

- And third, what is the potential impact of US LNG exports on global markets? The total amount of proposed LNG capacity in the US is now over 100 MTPA (137 bcm), but much of this capacity is highly speculative and very unlikely to move forward. Sabine Pass LNG, the project with the greatest momentum and a relatively high likelihood of being built, has a total of 18 MTPA (four 4.5 MTPA trains) proposed. While it now appears likely that some LNG export capacity will be built in the US, there remains great uncertainty over how much is possible, and thus the impact on LNG markets is likewise uncertain. At the low end, 18 MTPA represents about 6% of current global capacity, not insignificant but also not likely to transform global trade patterns or market dynamics.

8.4. Growth in unconventional gas production outside North America

The success of the US in boosting shale gas has generated interest in unconventional gas around the world. In Asia, Europe, Latin America and Africa, companies want to apply the knowledge and expertise gained in North America to other reservoirs globally. Interest is growing rapidly, but to-date, development 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 the US EIA in 2011 to be as high as 6,623 tcf (188 tcm) – but this is a geological estimate of resources in place that could possibly be produced, and does not reflect economic or other considerations that will prevent much of this gas from ever being produced. There is much more activity needed before we know exactly how much unconventional gas exists and, more importantly, how much can be produced economically.

- The shale gas revolution in North America was the result of a number of factors coming together: a prime resource base, large service sector capacity, favourable 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. To date, a limited number of horizontal wells with hydraulic fracturing have been drilled with mixed results in Argentina, Poland, China and Australia. Of these, the most promising in terms of reported production rates have been in China and Australia. In China, with activity dominated by the incumbent NOCs, who have brought in IOC majors as partners, it may be several more years before activity builds to a level where material shale gas production is seen, and many uncertainties remain over the quality of plays and whether they will be economic to drill. In Australia, activity has been somewhat more widespread, but commercial production likewise remains at least several years away.

Therefore, while there is certainly the potential for unconventional gas to transform the global market in the same way that it transformed the North American market, it is clear that the level of activity globally is not at that point yet. In some countries such as Australia and China there are early indicators that look promising; other countries such as Argentina and Poland are also moving quickly. But in several others – for example, France and South Africa, the political constraints are already delaying drilling for shale gas. Development will be thus slow and uneven around the world.

Looking Ahead:

- ***Is the shale gas boom in the US sustainable?*** *Portfolio high-grading and the expiration of drilling JV carries are pointing towards a slowing of growth. However, the overall continuation of shale gas production at a high level now appears structurally sound, as producers have been able to improve drilling economics to the point of making shale gas production possible even in a relatively low price environment.*

- ***Can the success of the shale gas sector 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 and China. 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 North America emerging as a substantial LNG exporter?*** *Over the past two years, eight existing and proposed regasification terminals in the US meant to import LNG into British Columbia, Canada have been replaced with four proposed LNG export projects. The potential impact of LNG exports from North America is yet to be determined, though it will likely depend heavily on the long-term oil-gas price environment, and government policy. Some LNG exports now appear inevitable, but the final scale remains highly uncertain.*

9. The LNG Industry in the Years Ahead

- ***Will Japan's nuclear outage continue to affect global LNG demand?*** *The future of nuclear power continues with uncertainty after the accident in Japan in 2011. While it is still too early to tell how much LNG demand will be impacted by the shut in of nuclear plants and an overall policy shift away from nuclear in select countries, the potential upside for gas is significant.*

- ***How high will the tally of countries turning to LNG imports to meet domestic needs rise?*** *Just as the Middle Eastern, South American, and Southeast Asian countries began importing LNG in the last five years, more countries in these regions, and potentially Africa, have plans to begin importing LNG in the next few years. How significant will the additional demand impact on the market?*

- ***How long will the shale gas boom in the United States affect LNG prices?*** *The LNG market tightened as a result of robust demand growth in 2011 and the demand shock from Japan in the aftermath of the Fukushima Daiichi tragedy. In that market environment, the overhang generated by shale gas in the United States is slated to last less than many market analysts had anticipated.*

- ***Is the pace of growth in liquefaction capacity set to continue?*** *Incremental LNG supply into the market is expected to slow in 2012-2014 as all of Qatar's trains have come onstream and Australia's liquefaction capacity is not expected onstream until later in the decade. Only three liquefaction plants are scheduled to come onstream in 2012: the Skikda-GL1K Rebuild project in Algeria, Angola LNG T1 in Angola and Pluto LNG in Australia. Arzew-GL3Z (Gassi Touil) is announced to come onstream in 2013.*

- ***Will all the announced liquefaction capacity come online as scheduled?*** *84 MTPA in liquefaction capacity is under construction, though another 92.1 MTPA has been announced to come onstream by 2016, bringing global liquefaction capacity to 454 MTPA in that year, as opposed to 278.7 MTPA in 2011. Still, some of these plants may not come onstream on schedule and decommissioning of older plants is expected to offset a minor share of this growth.*

- ***What nations will drive future growth in liquefaction capacity?*** *Though Qatar has been the source of much of the world's new liquefaction capacity over the last decade, the country has completed its last currently planned train – the 7.8 MTPA Qatargas IV. Australia is projected to surpass Qatar as the largest LNG exporter by the end of the decade, given its 61 MTPA of capacity currently under construction.*

- ***Will global LNG receiving capacity continue on a strong growth trajectory?*** *Roughly 94 MTPA of regasification capacity is currently under construction and announced to be onstream by the end of 2016. Once completed, global regasification capacity will stand at about 709 MTPA. Commissioning of new floating regasification vessels (which have shorter development lead times) could further increase LNG receiving capacity within this time frame.*

- ***Will the LNG shipping market continue to tighten in 2012?*** *LNG shipping will be 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 United States) adding to miles travelled even though volumes may not grow. Together, these three factors have helped push up spot charter rates in 2011 and led to a dramatic number of LNG ship orders, with 55 ships ordered between March and December 2011.*

APPENDIX I: Table of Recently Commissioned Liquefaction Plants

Country	*Project Name*	*Start Year*	*Nameplate Capacity (MTPA)*	*Project Partners**	*Liquefaction Technology*
Trinidad	ALNG T4	2006	5.2	BP, BG, Repsol, NGC Trinidad	ConocoPhillips Optimized Cascade®
Nigeria	NLNG T4	2006	4.1	NNPC, Shell, TOTAL, Eni	APC C_3*MR*
Nigeria	NLNG T5	2006	4.1	NNPC, Shell, TOTAL, Eni	APC C_3*MR*
Oman	Qalhat LNG	2006	3.7	Omani Govt, Petroleum Development Oman (PDO), Shell, Union Fenosa Gas, Itochu, Mitsubishi, Osaka Gas, TOTAL, Korea LNG, Mitsui, Partex, Itochu	APC C_3*MR*
Australia	Darwin LNG T1	2006	3.6	ConocoPhillips, Santos, INPEX, Eni, TEPCO, Tokyo Gas	ConocoPhillips Optimized Cascade®
Equatorial Guinea	EG LNG T1	2007	3.7	Marathon, GE Petrol, Mitsui, Marubeni	ConocoPhillips Optimized Cascade®
Norway	Snøhvit LNG T1	2007	4.2	Statoil, Petoro, TOTAL, GDF SUEZ, RWE **	Linde MFC
Qatar	RasGas II (T3)	2007	4.7	Qatar Petroleum, ExxonMobil	APC C_3*MR*/ Split MR™
Nigeria	NLNG T6	2008	4.1	NNPC, Shell, TOTAL, Eni	APC C_3*MR*
Australia	North West Shelf T5	2008	4.4	BHP Billiton, BP, Chevron, Shell, Woodside, Mitsubishi, Mitsui	APC C_3*MR*
Qatar	Qatargas II (T1)	2009	7.8	Qatar Petroleum, ExxonMobil	APC AP-X
Qatar	Qatargas II (T2)	2009	7.8	Qatar Petroleum, ExxonMobil, TOTAL	APC AP-X
Qatar	RasGas III (T1)	2009	7.8	Qatar Petroleum, ExxonMobil	APC AP-X
Yemen	Yemen LNG T1	2009	3.4	TOTAL, Hunt Oil, Yemen Gas Co., SK Corp, KOGAS, Hyundai, GASSP	APC C_3*MR*/ Split MR™
Indonesia	Tangguh LNG T1	2009	3.8	BP, CNOOC, JX Nippon Oil & Energy, Mitsubishi, INPEX, LNG Japan, KG Berau, Talisman, Mitsui	APC C_3*MR*/ Split MR™
Indonesia	Tangguh LNG T2	2009	3.8	BP, CNOOC, JX Nippon Oil & Energy, Mitsubishi, INPEX, LNG Japan, KG Berau, Talisman, Mitsui	APC C_3*MR*/ Split MR™
Russia	Sakhalin 2 (T1)	2009	4.8	Gazprom, Shell, Mitsui, Mitsubishi	Shell DMR
Russia	Sakhalin 2 (T2)	2009	4.8	Gazprom, Shell, Mitsui, Mitsubishi	Shell DMR
Qatar	Qatargas III	2010	7.8	Qatar Petroleum, ConocoPhillips, Mitsui	APC AP-X
Qatar	RasGas III (T2)	2010	7.8	Qatar Petroleum, ExxonMobil	APC AP-X
Yemen	Yemen LNG T2	2010	3.4	TOTAL, Hunt Oil, Yemen Gas Co., SK Corp, KOGAS, Hyundai, GASSP	APC C_3*MR*/ Split MR™
Peru	Peru LNG	2010	4.5	Hunt Oil, Repsol, SK Corp, Marubeni	APC C_3*MR*/ Split MR™
Qatar	Qatargas IV	2011	7.8	Qatar Petroleum, Shell	APC AP-X

Source: PFC Energy
** Companies are listed by size of ownership stake, starting with the largest stake*
*** Hess sold its stake in Snøhvit LNG in November 2011*

APPENDIX II: Table of Liquefaction Plants Under Construction

Country	Project	Announced Start Year	Nameplate Capacity (MTPA)	Project Partners*
Algeria	Skikda - GL1K Rebuild	2012	4.5	Sonatrach
Angola	Angola LNG T1	2012	5.2	Chevron, Sonangol, BP, Eni, TOTAL
Australia	Pluto LNG T1	2012	4.3	Woodside, Kansai Electric, Tokyo Gas
Algeria	Arzew - GL3Z (Gassi Touil)	2013	4.7	Sonatrach
Australia	Gorgon LNG T1	2014	5.0	Chevron, ExxonMobil, Shell, Osaka Gas, Tokyo Gas, Chubu Electric
Indonesia	Donggi-Senoro LNG	2014	2.0	Mitsubishi, Pertamina, KOGAS, Medco
Papua New Guinea	PNG LNG T1	2014	3.3	ExxonMobil, Oil Search, Government of Papua New Guinea, Santos, JX Nippon Oil & Energy, MRDC, Marubeni, Petromin PNG
Papua New Guinea	PNG LNG T2	2014	3.3	ExxonMobil, Oil Search, Government of Papua New Guinea, Santos, JX Nippon Oil & Energy, MRDC, Marubeni, Petromin PNG
Australia	Queensland Curtis LNG T1	2014	4.3	BG, CNOOC
Australia	Australia Pacific LNG T1	2015	4.5	ConocoPhillips, Origin Energy, Sinopec
Australia	Gladstone LNG T1	2015	3.9	Santos, PETRONAS, TOTAL, KOGAS
Australia	Gorgon LNG T2	2015	5.0	Chevron, ExxonMobil, Shell, Osaka Gas, Tokyo Gas, Chubu Electric
Australia	Gorgon LNG T3	2015	5.0	Chevron, ExxonMobil, Shell, Osaka Gas, Tokyo Gas, Chubu Electric
Australia	Queensland Curtis LNG T2	2015	4.3	BG, Tokyo Gas
Australia	Gladstone LNG T2	2016	3.9	Santos, PETRONAS, TOTAL, KOGAS
Australia	Wheatstone LNG T1	2016	4.5	Chevron, Apache, TEPCO, KUFPEC, Shell, Kyushu Electric
Australia	Wheatstone LNG T2	2016	4.5	Chevron, Apache, TEPCO, KUFPEC, Shell, Kyushu Electric
Australia	Ichthys LNG T1	2017	4.2	INPEX, TOTAL, Tokyo Gas, Osaka Gas, Toho Gas
Australia	Ichthys LNG T2	2017	4.2	INPEX, TOTAL, Tokyo Gas, Osaka Gas, Toho Gas
Australia	Prelude LNG (Floating)	2017	3.6	Shell, INPEX

Source: PFC Energy
** Companies are listed by size of ownership stake, starting with the largest stake*

APPENDIX III: Table of Liquefaction Plants Which Have Completed FEED

Country	Project	Announced Start Year	Nameplate Capacity (mmtpa)	Project Partners*
US	Sabine Pass LNG (Liq.) T1	2015	4.5	Cheniere Energy
Australia	Pluto LNG T2	2015	4.3	Woodside
Australia	Pluto LNG T3	2015	4.3	Woodside
US	Sabine Pass LNG (Liq.) T2	2016	4.5	Cheniere Energy
Australia	Australia Pacific LNG T2	2016	4.5	ConocoPhillips, Origin Energy, Sinopec
Nigeria	Brass LNG T1	2016	5	NNPC, ConocoPhillips, Eni, TOTAL, Itochu, LNG Japan, Sempra
Nigeria	Brass LNG T2	2016	5	NNPC, ConocoPhillips, Eni, TOTAL, Itochu, LNG Japan, Sempra
Eq. Guinea	EG LNG T2	2016	3.25	Marathon, GE Petrol, Mitsui, Marubeni
US	Sabine Pass LNG (Liq.) T3	2017	4.5	Cheniere Energy
US	Sabine Pass LNG (Liq.) T4	2017	4.5	Cheniere Energy
Russia	Shtokman LNG	2017	7.5	Gazprom, TOTAL, Statoil
Nigeria	NLNG T7	N/A	8.4	NNPC, Shell, TOTAL, Eni
Nigeria	NLNG T8	N/A	8.4	NNPC, Shell, TOTAL, Eni

Source: PFC Energy, status as of March 2012
** Companies are listed by size of ownership stake, starting with the largest stake*

APPENDIX IV: Table of Recently Commissioned LNG Receiving Terminals

Country	Project*	Announced Start Year	Nameplate Capacity (MTPA)	Project Partners**	Concept
Japan	Sodegaura (Expansion)	2008	1.6	TEPCO, Tokyo Gas	Onshore
China	Fujian LNG	2008	2.6	CNOOC, Fujian Investment & Development Co.	Onshore
China	Mengtougou	2008	0.1	Shanghai Gas Group	Onshore
India	Hazira LNG (Debottlenecking)	2008	1.1	Shell, TOTAL	Onshore
Belgium	Zeebrugge (Expansion)	2008	3.3	Publigas, Fluxys	Onshore
UK	Grain LNG (Phase 2)	2008	6.4	National Grid Transco	Onshore
US	Northeast Gateway (OS)	2008	3.0	Excelerate Energy	Floating
US	Sabine Pass	2008	19.5	Cheniere Energy	Onshore
US	Freeport LNG	2008	11.2	Michael S. Smith Co., ZHA FLNG Purchaser, Dow Chemical, Osaka Gas	Onshore
Mexico	Costa Azul	2008	7.5	Sempra	Onshore
Argentina	Bahia Blanca GasPort (OS)	2008	3.0	Enarsa, Repsol, YPF	Floating
Taiwan	Taichung LNG	2009	3.0	CPC	Onshore
China	Dapeng LNG (Guangdong, Expansion)	2009	3.0	CNOOC, BP	Onshore
China	Shanghai LNG	2009	3.0	Shenergy Group, CNOOC	Onshore
India	Dahej LNG (Expansion)	2009	3.5	Petronet LNG	Onshore
Kuwait	Mina Al-Ahmadi GasPort (OS)	2009	3.7	Excelerate Energy	Floating
Spain	Sagunto (Expansion)	2009	1.5	RREEF Infrastructure, Eni, Gas Natural Fenosa, Osaka Gas, Oman Oil	Onshore
Italy	Adriatic LNG/Rovigo (OS)	2009	5.8	ExxonMobil, Qatar Petroleum, Edison	Floating

UK	South Hook (Phase 1)	2009	7.7	Qatar Petroleum, ExxonMobil, TOTAL	Onshore
UK	Dragon LNG	2009	4.3	BG Group, PETRONAS, 4Gas	Onshore
US	Cove Point (Expansion)	2009	5.4	Dominion	Onshore
US	Cameron LNG	2009	11.2	Sempra	Onshore
Canada	Canaport	2009	7.5	Repsol, Irving Oil	Onshore
Brazil	Pecém (OS)	2009	1.8	Petrobras	Floating
Brazil	Guanabara LNG/Rio de Janeiro (OS)	2009	3.7	Petrobras	Floating
Chile	Quintero LNG	2009	2.5	BG Group, ENAP, ENDESA, Metrogas	Onshore
Japan	Sakaide	2010	0.7	Shikoku Electric, Cosmo Gas, Shikoku Gas	Onshore
UAE	Dubai (OS)	2010	3.0	Golar	Floating
Spain	Barcelona (Expansion)	2010	4.7	ENAGAS	Onshore
France	FosMax LNG (formerly Fos Cavaou)	2010	6.0	GDF SUEZ, TOTAL	Onshore
UK	Grain LNG (Phase 3)	2010	5.2	National Grid Transco	Onshore
UK	South Hook (Phase 2)	2010	7.7	Qatar Petroleum, ExxonMobil, TOTAL	Onshore
US	Elba Island III (Phase 1)	2010	3.5	El Paso	Onshore
US	Lake Charles (IEP)	2010	3.9	Southern Union, AIG Highstar	Onshore
US	Neptune LNG (OS)	2010	3.0	GDF SUEZ	Floating
Chile	Mejillones LNG (Phase 1)	2010	1.5	GDF SUEZ, Codelco	Onshore
Japan	Mizushima LNG (Expansion)	2011	0.9	Mizushima LNG (Chugoku Electric, JX Nippon Oil & Energy)	Onshore
Japan	Yufutsu	2011	0.0	Japex	Onshore
Japan	Ohgishima (Expansion)	2011	1.6	Tokyo Gas	Onshore
China	Rudong/Jiangsu LNG	2011	3.5	PetroChina, Pacific Oil, Jiangsu Guoxin	Onshore
China	Dalian	2011	3.0	PetroChina, Dalian Port, Dalian Construction Investment Corp	Onshore
Thailand	Rayong (Map Ta Phut)	2011	4.9	PTT, EGAT, EGC	Onshore
Spain	Huelva (Storage Expansion)	2011	0.0	ENAGAS	Onshore
Spain	Sagunto (Expansion 2)	2011	1.2	RREEF Infrastructure, Eni, Gas Natural Fenosa, Osaka Gas, Oman Oil	Onshore
Sweden	Nynashamn LNG	2011	0.3	AGA Gas AB	Onshore
Norway	Fredrikstad	2011	0.0	Skangass LNG	Onshore
Netherlands	GATE LNG	2011	8.7	Gasunie, Vopak, Dong, EconGas, E.ON, RWE	Onshore
US	Golden Pass Phase 1	2011	7.5	Qatar Petroleum, ExxonMobil, ConocoPhillips	Onshore
US	Golden Pass Phase 2	2011	8.1	Qatar Petroleum, ExxonMobil, ConocoPhillips	Onshore
US	Gulf LNG (formerly Clean Energy Terminal)	2011	11.2	El Paso, GE Energy Financial Services, Sonangol	Onshore
Argentina	Puerto Escobar (OS)	2011	3.7	Enarsa	Floating

Source: PFC Energy
** (OS) refers to offshore terminals*
***Companies are listed by size of ownership stake, starting with the largest stake*

APPENDIX V: Table of LNG Receiving Terminals Under Construction

Country	Project*	Announced Start Year	Nameplate Capacity (MTPA)	Project Partners**
India	Dabhol LNG	2012	2.0	GAIL, NTPC
Indonesia	Nusantara (OS)	2012	3.0	Pertamina, PGN
Malaysia	Lekas LNG (Malacca)	2012	4.0	PETRONAS
Portugal	Sines LNG (Expansion Phase 1)	2012	2.0	REN
Mexico	Manzanillo	2012	3.7	Mitsui, Samsung, KOGAS
Argentina	Bahia Blanca (OS) (Expansion)	2012	3.7	Enarsa
China	Shanghai LNG (Expansion)	2012	0.0	Shenergy Group, CNOOC
India	Kochi LNG	2012	2.5	Petronet LNG
Japan	Ishikari LNG	2013	1.4	Hokkaido Gas
China	Tianjin FSRU (OS)	2013	2.2	CNOOC
China	Ningbo, Zhejiang	2013	3.0	CNOOC
India	Hazira LNG (Expansion)	2013	1.4	Shell, TOTAL
India	Kochi LNG Phase 2	2013	2.5	Petronet LNG
Singapore	Jurong Island LNG Phase 1	2013	3.5	Singapore Energy Market Authority
Israel	Israel LNG	2013	1.8	Israel Natural Gas Lines
Spain	El Musel (Gijon)	2013	5.8	ENAGAS
Italy	Livorno (OS)	2013	2.7	E.ON, IREN, OLT Energy, Golar
China	Zhuhai (CNOOC)	2013	3.5	CNOOC
India	Dahej LNG (Second Expansion Phase 1)	2013	2.5	GSPC, Petronet LNG
Singapore	Jurong Island LNG Phase 2	2013	2.5	Singapore Energy Market Authority
Japan	Naoetsu	2014	1.5	INPEX
Japan	Hibiki LNG	2014	3.5	Saibu Gas, Kyushu Electric
Spain	Bilbao (Expansion)	2014	2.5	ENAGAS, EVE, RREEF Infrastructure
China	Hainan LNG	2014	2.0	CNOOC, Hainan Development Holding Co.
China	Qingdao	2014	3.0	Sinopec
Poland	Swinoujscie	2014	3.6	GAZ-SYSTEM SA
Korea	Samcheok	2015	6.8	KOGAS
France	Dunkirk	2015	9.4	EDF, Fluxys, TOTAL

Source: PFC Energy
** (OS) refers to offshore terminals*
*** Companies are listed by size of ownership stake, starting with the largest stake*

APPENDIX VI: Table of Emerging Market Import Capacity

Country	Number of Exiting Terminals in 2011	Number of Terminals Proposed or Under Constr. in 2011	Existing Capacity in 2011 (MTPA)	Capacity Under Construction or Proposed in 2011 (MTPA)	First Year as LNG Importer (by announced start date)
Argentina	2	3	7.5	12.8	2008
Brazil	2	5	5.5	17.2	2009
Chile	2	3	3.9	6.2	2009
Kuwait	1	0	3.7	0.0	2009
United Arab Emirates	1	1	3.0	4.5	2010
Norway	1	0	0.0	0.0	2011
Sweden	1	0	0.3	0.0	2011
Thailand	1	0	4.9	4.9	2011
Albania	0	3	0.0	16.8	2012
Indonesia	1	14	0.0	18.7	2012
Malaysia	0	6	0.0	9.7	2012
Pakistan	0	4	0.0	21.7	2012
Bangladesh	0	1	0.0	3.7	2013
Colombia	0	3	0.0	Unspecified	2013
Ghana	0	1	0.0	Unspecified	2013
Israel	0	1	0.0	1.8	2013
Jordan	0	1	0.0	0.7	2013
Philippines	0	3	0.0	4.5	2013
Singapore	0	1	0.0	6.0	2013
Estonia	0	2	0.0	0.7	2014
Jamaica	0	1	0.0	1.2	2014
Lithuania	0	2	0.0	4.0	2014
Panama	0	1	0.0	Unspecified	2014
Poland	0	1	0.0	5.4	2014
South Africa	0	1	0.0	Unspecified	2014
Ukraine	0	1	0.0	7.3	2014
Bahrain	0	1	0.0	5.9	2015
Canary Islands	0	2	0.0	1.9	2015
Croatia	0	2	0.0	10.9	2015
Denmark	0	1	0.0	Unspecified	2015
El Salvador	0	1	0.0	1.3	2015
Ireland	0	1	0.0	7.2	2015
Lebanon	0	1	0.0	2.0	2015
Uruguay	0	1	0.0	2.7	2015
Vietnam	0	2	0.0	3.0	2015
Kenya	0	1	0.0	2.0	2016
Aruba	0	1	0.0	3.6	N/A
Bulgaria	0	1	0.0	Unspecified	N/A
Cuba	0	1	0.0	2.0	N/A
Germany	0	1	0.0	2.9	N/A
Morocco	0	1	0.0	3.6	N/A
Romania	0	1	0.0	Unspecified	N/A
Sri Lanka	0	2	0.0	0.3	N/A

Source: PFC Energy
** (OS) refers to offshore terminals*
Note: Capacity proposed or under construction in 2011 includes expansion phases, which are not included in the tally of terminals proposed or under construction.

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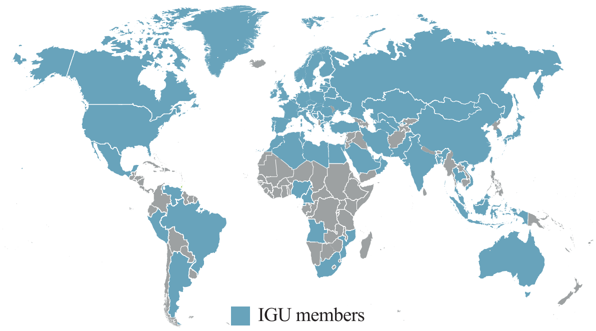

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