2006-2009 Triennium Work Report

October 2009

PROGRAMME COMMITTEE D: LIQUEFIED NATURAL GAS
The World Wide LNG Industry at the End of 2008

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Japan

Abstract

As is customary for the Committee in charge of LNG within the International Gas Union, presently named « Program Committee D », a report has been prepared during each triennium to show the evolution of the LNG industry as a whole during the triennium 2007 to 2009. The Vice Chairman of the Committee, held by Mr. Alaa Abujbara from the State of Qatar for the triennium 2007-2009, customarily has been engaged in the preparation of this report. This report, based on various related data from different sources, referenced in the report, provides information and trends of the global LNG industry. It covers all segments of the LNG chain namely LNG plants, LNG carriers and LNG receiving terminals in terms of capacity and number of units, type of processes or technology as well as the imports and exports trade statistics for the period between 2004 and 2008.

Résumé

Ce rapport, émis par le « Program Committee D », le comité responsable du GNL au sein de l'Union Internationale de l'Industrie du Gaz, présente l'évolution de la chaine industrielle du GNL entre 2007 et 2009. Comme de coutume, c'est au Vice Président du Comité, Mr Alaa Abu Jbara représentant de l'Etat du Qatar, qu'il revient de rédiger ce rapport. Ce rapport, élaboré sur la base de données émanant de plusieurs sources d'information, présente les évolutions et les tendances de l'industrie mondiale du GNL. Tous les segments de la chaîne GNL, des unités de liquéfaction aux méthaniers et terminaux de GNL, sont étudiés. Le rapport souligne notamment les évolutions technologiques en terme de procédés et capacités, mais aussi présente des statistiques sur le négoce du GNL entre 2004 et 2008.

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1. Foreword

Forty-five years have passed since the first commercial export of LNG in the world from the Arzew LNG plant in Algeria. Utilization of LNG has been rapidly spreading in recent years owing to the growing energy needs of the world. Compiled from various data, this report presents the status of the LNG industry at the end of 2008 in all its segments, LNG liquefaction plants, receiving terminals, LNG and LNG carriers and provides import and export statistics to demonstrate the growing importance of this form of energy. The committee of the IGU in charge of LNG, presently named « Program Committee D », has traditionally prepared this report, and the one for the preceding term, namely 2003 to 2006, profiled the LNG industry as of 2004. The latest edition, which details the status of the industry in 2008, includes comparisons with 2004. Finally, the report would not be complete without some comments on the outlook for LNG liquefaction and receiving terminals and LNG carriers.

2. Key Facts

The key facts for the LNG industry between the years 2004 and 2008 were as follows:

1. The volume of LNG trade reached 173.6 million tons per annum in 2008 and increased by 42.1 million tons per annum, or 32% from 2004.
2. The share of spot trade in LNG has increased to 29 million tons per annum in 2008, which is equal to 17% of total LNG trade volumes.
3. 82 liquefaction trains are in operation in 15 countries on 5 different continents by the end of 2008.
4. Global LNG liquefaction capacity totaled 208.4 million tons per annum in 2008 and increased by 59.4 millions tons or 40% since 2004. It is expected to reach 297.6 million tons in 2012 after the successful completion of projects currently under construction.
5. The number of LNG receiving terminals in operation around the world reached 64 at the end of 2008. These terminals are located in 18 countries on four continents.
6. Global LNG regasification capacity totaled 449.2 million tons per annum in 2008 and has increased by 78.4 millions tons per annum or 21% since 2004. It is expected to reach 620.9 million tons in 2012 after the completion of projects currently under construction.
7. 296 LNG carriers were in operations at the end of 2008. The combined capacity of these ships has increased by 19.7 million cubic meters, or 97% from 2004, to 40.1 million cubic meters, for an average of 135,605 cubic meters per carrier.
8. Producers, importers & shipping operators have significantly invested in liquefaction and shipping capacity to deliver LNG to customers all over the world. As a result the ratio between liquefaction and receiving terminal capacity has increased dramatically from only 10% in 1968 to 46% at the end of 2008.

Les faits principaux qui ont marqués l'industrie du GNL entre 2004 et 2008 sont les suivants :

1. Le volume de GNL échangé a atteint 173,6 millions de tonnes par an en 2008, et a augmenté de 42,1 millions de tonnes par an par rapport à 2004, soit une augmentation de 32%.
2. La part du marché Spot GNL s'est élevée à 29 millions de tonnes en 2008, soit 17% du marché total du GNL.
3. A fin 2008, 82 trains de liquéfactions sont en opération dans 15 pays sur 5 continents.
4. La capacité de production totale de GNL atteint 208.4 millions de tonnes par an en 2008. Depuis 2004, cette capacité a cru de 59,4 millions de tonnes, soit une augmentation de 40%. Il est prévu que la capacité mondiale atteigne 297.6 millions de tonnes par an fin 2012, grâce à la mise en production de projets en cours de réalisation.
5. A fin 2008, 64 terminaux GNL sont opérationnels dans le monde. Ces terminaux se situent dans 18 pays sur 4 continents.
6. La capacité globale de regazéification de GNL s'élève à 449,2 millions de tonnes par an en 2008. Par rapport à 2004, c'est une augmentation de 78.4 millions de tonnes, soit 21%. Il est prévu que cette capacité atteigne 620.9 millions de tonnes en 2012 après prise en compte des projets actuellement en cours de réalisation.
7. A fin 2008, 296 méthaniers sont en opération. La capacité de transport totale de ces navires est de 40.1 millions de mètres cubes. Par rapport à 2004, cette capacité a cru de 19.7 millions de mètres cubes, soit une augmentation de 97%. En 2008, le volume moyen de GNL transporté par méthanier est de 135,605 mètres cubes.
8. Les producteurs de GNL ont de manière significative investi dans la construction de trains de liquéfaction et dans la mise en service de méthaniers, afin de satisfaire leurs clients à travers le monde. En conséquence, le rapport entre les capacités de liquéfaction et les capacités de regazéification a fortement augmenté, passant de seulement 10% en 1968 à 46% en 2008.

3. LNG Import and Export

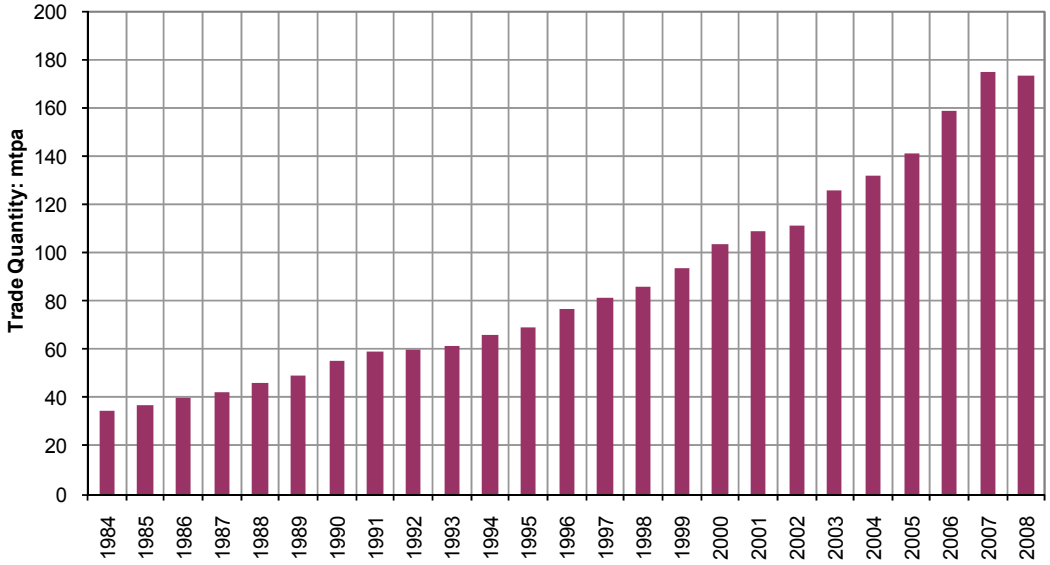
3.1. Overview

In 2008, the volume of LNG traded reached 173.6 million tons per annum. Countries exporting LNG numbered 12 in 2004, namely Algeria, Australia, Brunei, Indonesia, Libya, Malaysia, Nigeria, Oman, Qatar, Trinidad and Tobago, United Arab Emirates and the United States. During the past four years, four additional countries have also started to export LNG, namely Belgium, Egypt, Equatorial Guinea and Norway, bringing the total of exporting countries to 16 at the end of 2008. Over the same period the countries importing LNG increased by four countries, namely Argentina, China, Mexico and the United Kingdom to 18, the other 14 being Belgium[1], Dominican Republic, France, Greece, India, Italy, Japan, Portugal, Puerto Rico[2], South Korea, Spain, Taiwan, Turkey and the United States.

3.2. LNG Trade Volumes

Between 2004 and 2008, liquefaction capacity increased due to the construction of new, and expansion of existing plants and trains. With the increase in liquefaction capacity globally, LNG trade volumes have increased by 42.1 million tons per annum, or 32%. The LNG trade volume is expected to continue to increase in the near term with the addition of new liquefaction capacity in Algeria, Angola, Australia, Equatorial Guinea, Indonesia, Libya, Nigeria, Papua New Guinea, Peru, Russia, and Yemen. In addition, Qatar alone will increase liquefaction capacity by 47 million tons per annum from 2008 to a total of 77 million tons per annum as six new mega-trains are commissioned.

Figure 1: LNG Trade Volumes from 1984 to 2008, mtpa[3]



Sources: 1984 – 2001: BP Statistical Review of World Energy June 2005
2002 – 2007: Poten and Partners
2008: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Industry Sources

1 LNG previously delivered into the tanks at Zeebrugge was reloaded onto a LNG vessel for redelivery

2 Puerto Rico is listed separately, although it is part of the United States of America.

3 mtpa is defined as million tons per annum

3.3. LNG Exports by Country

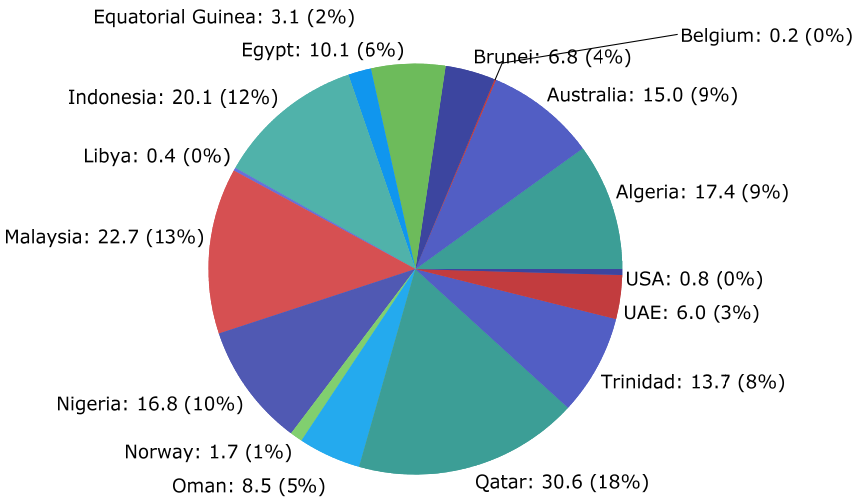
At the end of 2008, 16 countries exported LNG. Qatar is the largest exporter of LNG followed by Malaysia, the second largest producer, and Indonesia is the third largest producer.

Table 1: LNG Exports by Country in 2008, mtpa

Exporter	mtpa
Algeria	17.4
Australia	15.0
Belgium	0.2
Brunei	6.8
Egypt	10.1
Equatorial Guinea	3.1
Indonesia	20.1
Libya	0.4
Malaysia	22.7
Nigeria	16.8
Norway	1.7
Oman	8.5
Qatar	30.6
Trinidad	13.7
UAE	6.0
USA	0.8
Total Exports	**173.6**

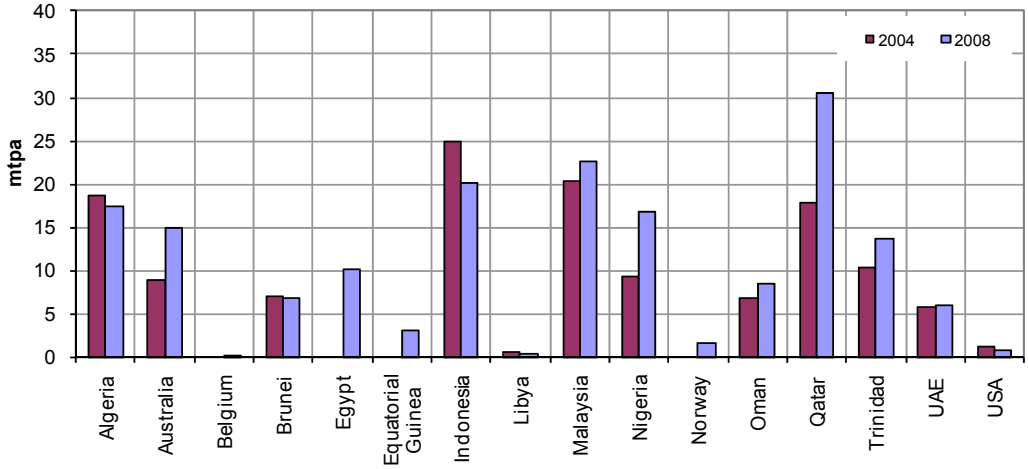
Sources: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Wood Mackenzie
Industry Sources

Figure 2: LNG Exports by Country in 2008



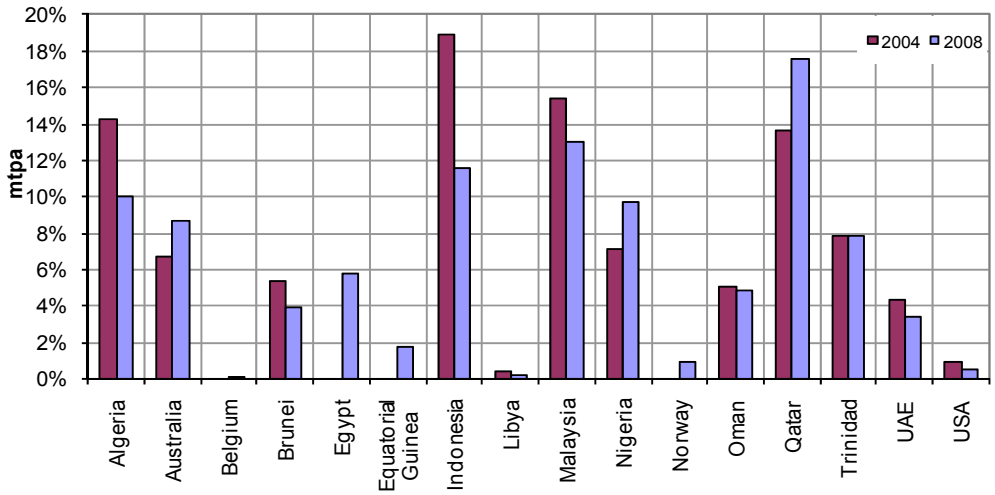
Four countries started to export LNG after 2004, namely Belgium, Egypt, Equatorial Guinea, and Norway, while Australia, Nigeria, Oman, Qatar and Trinidad and Tobago increased LNG exports. In 2004, Indonesia was the biggest exporter of LNG, accounting for some 25 million tons per annum, equal to 19% of global volumes. At the end of 2008, Qatar has taken over from Indonesia as largest exporter with over 30 million tons, equal to 18% of global trade, followed by Malaysia with 23 millions tons, which is equal to 13% of global traded volumes of LNG.

Figure 3: LNG Exports by Country in 2004 and 2008, mtpa



Sources: Poten and Partners
The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Wood Mackenzie
Industry Sources

Figure 4: LNG Exports by Country in 2004 and 2008, % of total



Sources: Poten and Partners
The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Wood Mackenzie
Industry Sources

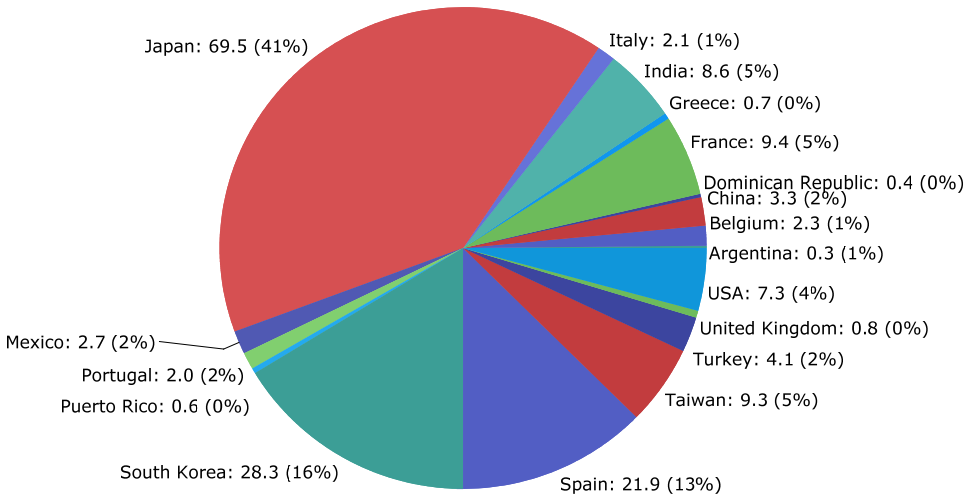
3.4. LNG Imports by Country

Japan has historically been the biggest consumer of LNG and remains so at the end of 2008, with an annual consumption of almost 70 million tons of LNG, followed by South Korea with 28 million tons. These two countries combined contribute to more than half of the world's LNG consumption.

Table 2: LNG Imports by Country in 2008, mtpa

Importer	mtpa
Argentina	0.3
Belgium	2.3
China	3.3
Dominican Republic	0.4
France	9.4
Greece	0.7
India	8.6
Italy	2.1
Japan	69.5
Mexico	2.7
Portugal	2.0
Puerto Rico	0.6
South Korea	28.3
Spain	21.9
Taiwan	9.3
Turkey	4.1
United Kingdom	0.8
USA	7.3
Total Imports	**173.6**

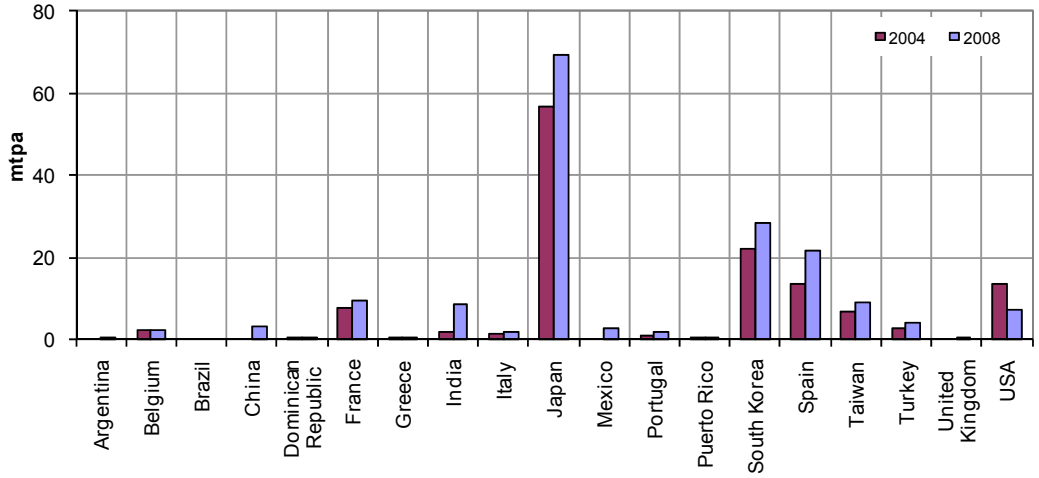
Figure 5: LNG Imports by Country in 2008



Sources: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Wood Mackenzie
Industry Sources

Argentina, China, Mexico and the United Kingdom[4], started to import LNG after the end of 2004. All countries have increased imports of LNG in absolute terms except the USA. The United States have decreased imports of LNG, partly because of the additional supply from unconventional gas plays, such as shale drilling.

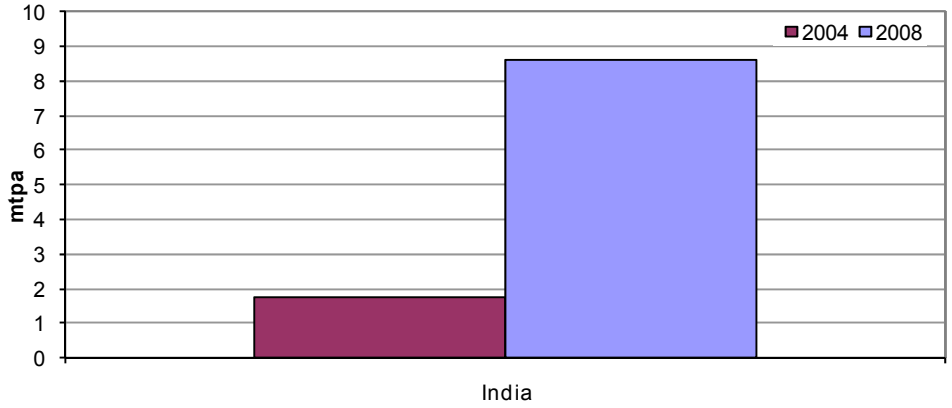
Figure 6: LNG Imports by Country in 2004 and 2008, mtpa



Sources: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Wood Mackenzie
Industry Sources

India has significantly increased imports of LNG from a volume of less than 2 million tons to more than 8 million tons in 2004 and 2008 respectively. The country has traditionally relied on naphtha as a feedstock for its power generation, but is increasingly shifting towards procuring LNG as an alternative fuel.

Figure 7: LNG Imports by India in 2004 and 2008, mtpa



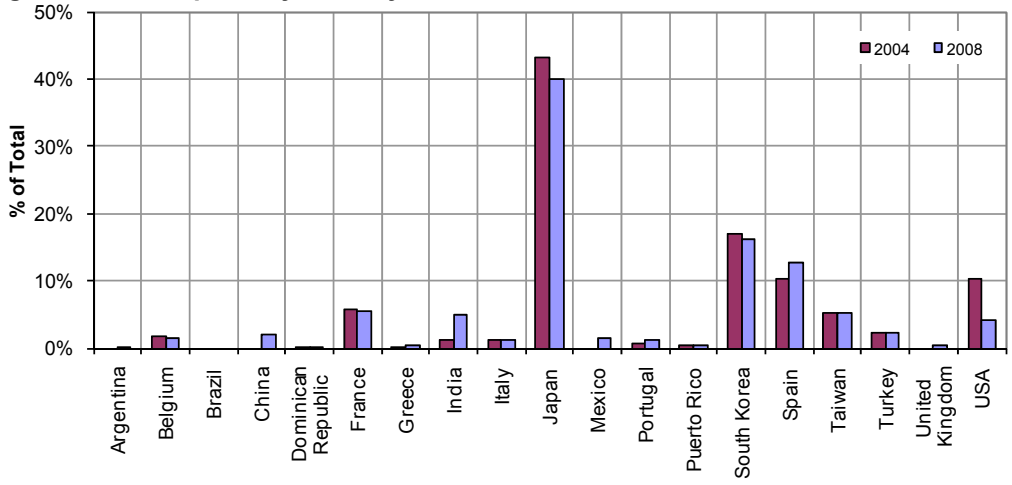
Sources: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Wood Mackenzie
Industry Sources

Japan has increased imports of LNG by 12.7 million tons per annum, or 22% from 2004 to 69.5 million tons per annum at the end of 2008. An earthquake in the summer of 2007, leading to the shut down of reactors at the 8.9 GW Kashiwazaki-Kariwa nuclear power station, has created significant additional LNG demand in Japan. It remains the biggest buyer of LNG, but the emergence of new buyers (Argentina, China, Mexico and the United

4 The Canvey Island gas storage terminal was built in the 1960's for the import of LNG. However, in the 1990's the terminal was closed as a gas terminal and only used for the storage of LPG.

Kingdom) and an increasing pull from other traditional buyers have decreased its share of global imports from 43% to 41%.

Figure 8: LNG Imports by Country in 2004 and 2008, % of total



Sources: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Poten and Partners
Wood Mackenzie
Industry Sources

3.5. LNG Interregional Trade

Almost 70% of the world's LNG is consumed in the Asia Pacific[5] region. Asian countries consumed 119 million tons of LNG in 2008, of which 43% was produced within the region and 57% of demand was met by imports from other regions. Middle Eastern countries provide the Asia Pacific region with 57% of its import requirements. During 2008, some of Asia's imports came from as far away as Norway and Trinidad and Tobago, which are located more than 12,000 and 13,000 nautical miles respectively from Japan. In 2004 the most distant supplier to Asia was Trinidad and Tobago. In fact during 2008 Japan imported LNG from every producing country in the world except Libya, whose entire production goes to Spain. Europe has started to produce LNG from the Snohvit project in Norway, whereas Argentina in the South & Central American region[6] has started to import LNG.

Table 3: LNG Trade between Continents in 2008, mtpa

Export / Import	Africa	North America	Asia Pacific	Australia	Europe	Middle East	Total
North America	3.0	6.4			0.5	0.2	10.0
South & Central America		1.3					1.3
Asia Pacific	12.9	2.5	49.6	15.0	0.3	38.7	119.0
Europe	31.9	4.3			1.0	6.1	43.3
Total	**47.7**	**14.5**	**49.6**	**15.0**	**1.8**	**45.0**	**173.6**

Sources: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Wood Mackenzie
Industry Sources

5 Australia is listed separately instead of being part of the Asia Pacific region.

6 Brazil received its first cargo in January 2009.

Table 4: LNG Trade Volumes between Countries in 2005, in million mtpa

Import \ Export	Algeria	Australia	Brunei	Egypt	Indonesia	Libya	Malaysia	Nigeria	Oman	Qatar	Spain	Trinidad	UAE	USA	Totals
Belgium	2.0														2.0
France	5.8			0.3				2.9	0.1						9.1
Greece	0.3			0.1											0.4
India		0.1							0.1	3.9					4.1
Italy	1.9										0.2				2.0
Japan	0.1	10.2	6.3		14.3		13.6		1.0	6.3			5.1	1.3	58.0
Portugal	0.1							1.1							1.2
Puerto Rico												0.5			0.5
South Korea		0.8	0.6	0.3	5.6		4.7		4.4	6.2			0.1		22.6
Spain	4.1			2.7		0.6	0.1	3.7	1.5	3.5		0.4	0.2		16.8
Taiwan		0.3			3.6		3.0		0.2						7.1
Turkey	3.1							0.8							3.9
United Kingdom	0.4														0.4
USA	2.0			1.5			0.2	0.2	0.1	0.1		9.2			13.1
Totals	**19.8**	**11.4**	**6.9**	**4.8**	**23.4**	**0.6**	**21.6**	**8.6**	**7.2**	**20.0**	**0.2**	**10.1**	**5.4**	**1.3**	**141.2**

Source: Poten and Partners
Wood Mackenzie
Industry Sources

Table 5: LNG Trade Volumes between Countries in 2006, mtpa

Import \ Export	Algeria	Australia	Brunei	Egypt	Indonesia	Libya	Malaysia	Nigeria	Oman	Qatar	Spain	Trinidad	UAE	USA	Totals
Belgium	2.3			0.3				0.1		0.3		0.2			3.2
China		0.7													0.7
France	6.3			0.3				3.0		0.3	0.0				9.9
Greece	0.4														0.4
India	0.2	0.1		0.4			0.1		0.2	5.2					6.0
Italy	2.0					0.0				0.0	0.0				2.0
Japan	0.2	12.2	6.5	0.5	14.4		12.0	0.2	2.4	7.5		0.3	5.2	1.2	62.5
Mexico				0.1				0.3		0.1		0.2			0.6
Portugal	0.1							1.1							1.2
Puerto Rico												0.3			0.3
South Korea	0.2	0.6	0.8	0.9	5.1		5.6	0.1	5.3	6.7		0.1			25.5
Spain	2.6			3.6		0.7		5.8	0.4	4.7		2.8			20.6
Taiwan	0.2	0.2		0.1	3.2		3.3		0.3	0.4		0.1			7.8
Turkey	2.5							0.7							3.1
United Kingdom	1.6			0.8						0.1		0.3			2.9
USA	0.4			2.1				1.2				8.3			11.8
Totals	**18.7**	**13.7**	**7.4**	**9.1**	**22.7**	**0.7**	**21.0**	**12.4**	**8.6**	**25.3**	**0.0**	**12.5**	**5.2**	**1.2**	**158.6**

Source: Poten and Partners
Wood Mackenzie
Industry Sources

Table 6: LNG Trade Volumes between Countries in 2007, mtpa

Import \ Export	Algeria	Australia	Brunei	Egypt	Equatorial Guinea	Indonesia	Libya	Malaysia	Nigeria	Norway	Oman	Qatar	Spain	Trinidad	UAE	USA	Totals
Belgium	0.4											1.7					2.1
China	0.2	2.5							0.1		0.1						2.9
Dominican Republic									0.1					0.4			0.5
France	6.0			0.9					3.0	0.1				0.1			10.2
Greece	0.4			0.2													0.6
India	0.4							0.1	0.4		0.2	6.3		0.3	0.1		7.8
Italy	2.2												0.0				2.3
Japan	0.6	12.1	6.4	1.2	0.3	13.6		13.3	0.7		3.6	8.2		0.4	5.6	0.9	66.8
Mexico	0.1			0.9					0.5					0.6			2.1
Portugal									2.0								2.0
Puerto Rico									0.1					0.6			0.6
South Korea	0.2	0.4	0.6	1.1		3.8		6.1	0.2		5.1	8.1		0.2	0.1		25.9
Spain	3.8			3.6			0.6		7.0			4.1		1.9			21.1
Taiwan	0.2	0.1		0.6	0.3	3.7		3.2	0.2		0.2	0.4		0.1			9.1
Turkey	2.2			0.1					1.1								3.4
United Kingdom	0.4			0.1								0.2		0.3			1.0
USA	1.4			2.3	0.4				2.0			0.4		9.7			16.2
Totals	**18.6**	**15.2**	**7.0**	**11.1**	**1.0**	**21.2**	**0.6**	**22.6**	**17.4**	**0.1**	**9.1**	**29.5**	**0.0**	**14.5**	**5.7**	**0.9**	**174.5**

Source: Poten and Partners
Wood Mackenzie
Industry Sources

Table 7: LNG Trade Volumes between Countries in 2008, mtpa

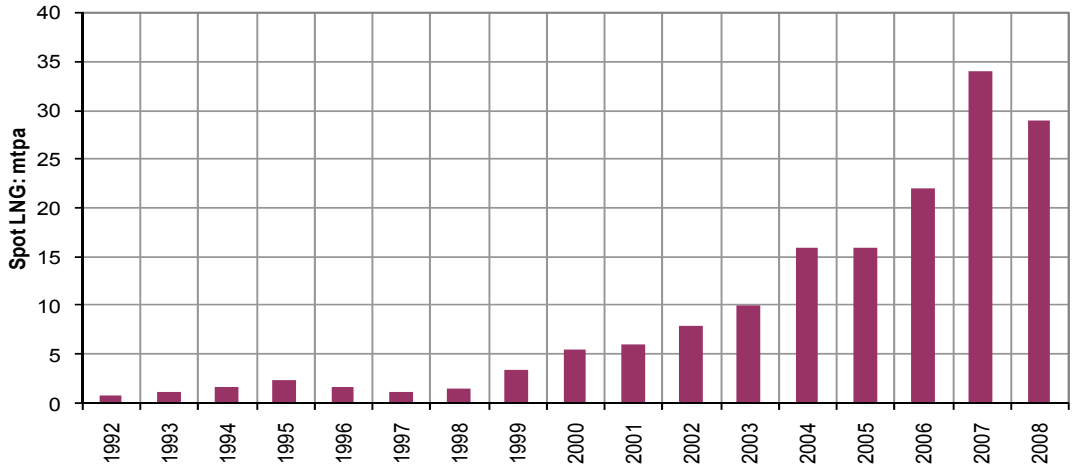
Export / Import	Algeria	Australia	Belgium	Brunei	Egypt	Equatorial Guinea	Indonesia	Libya	Malaysia	Nigeria	Norway	Oman	Qatar	Trinidad	UAE	USA	Totals
Argentina														0.3			0.3
Belgium					0.1						0.1		2.2	0.1			2.3
Brazil																	
China	0.1	2.7			0.2	0.2			0.0	0.1							3.3
Dominican Republic														0.4			0.4
France	5.6				0.9					2.7	0.2						9.4
Greece	0.5				0.1									0.1			0.7
India	0.5	0.1	0.1		0.2	0.3				0.4	0.1	0.3	6.2	0.2	0.3		8.6
Italy	2.1																2.1
Japan	0.8	11.6		6.1	1.5	1.1	14.2		13.6	1.9	0.1	3.3	8.4	0.5	5.6	0.8	69.5
Mexico	0.1				0.8					0.8	0.1		0.1	0.9			2.7
Portugal			0.0							1.9							2.0
Puerto Rico														0.6			0.6
South Korea	0.4	0.5	0.1	0.7	1.7	0.9	3.0		6.2	0.3		4.8	9.0	0.8	0.1		28.3
Spain	3.6		0.0		3.4			0.4		6.1	0.7	0.1	3.8	3.8			21.9
Taiwan	0.1	0.1			0.1	0.6	2.9		2.9	1.7		0.1	0.8	0.2			9.3
Turkey	3.3				0.1					0.8							4.1
United Kingdom	0.3				0.1								0.1	0.4			0.8
USA					1.1					0.2	0.4		0.1	5.5			7.3
Totals	**17.4**	**15.0**	**0.2**	**6.8**	**10.1**	**3.1**	**20.1**	**0.4**	**22.7**	**16.8**	**1.7**	**8.5**	**30.6**	**13.7**	**6.0**	**0.8**	**173.6**

Sources: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Wood Mackenzie
Industry Sources

3.6. LNG Spot Market

Traditionally LNG has been delivered under long term arrangements between buyers and sellers and LNG was only marginally traded on a spot basis. From the beginning of this decade, spot LNG trading has grown steadily over the years at an average of 24% per annum, from 5% in 2000 to around 17% of total LNG trade at the end of 2008[7]. The total volume of spot trade was 29 million tons per annum in 2008.

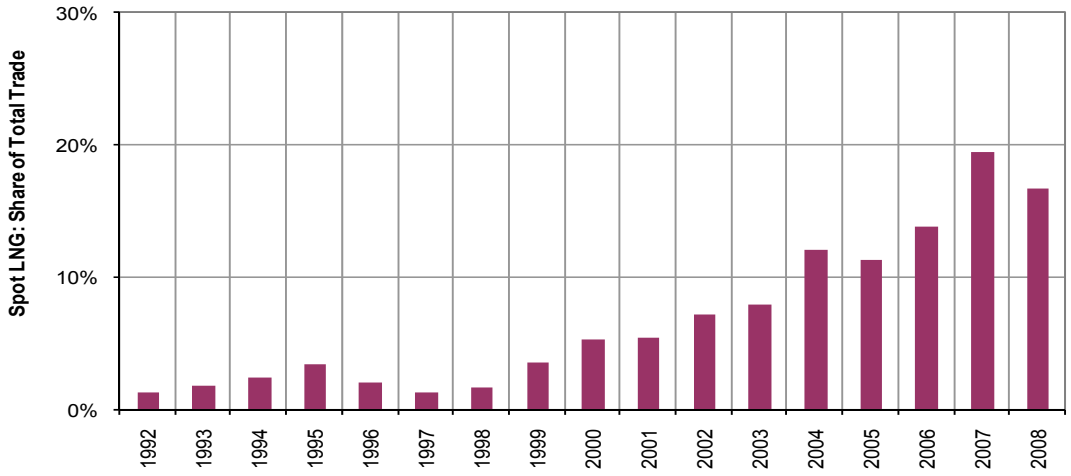
Figure 9: Spot LNG Trade from 1992 to 2008, mtpa



Source: 1992 – 2001: PetroStrategies
2002 – 2007: Poten and Partners
2008: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Wood Mackenzie
Industry Sources

7 Spot trade peaked at 34 mtpa in 2007.

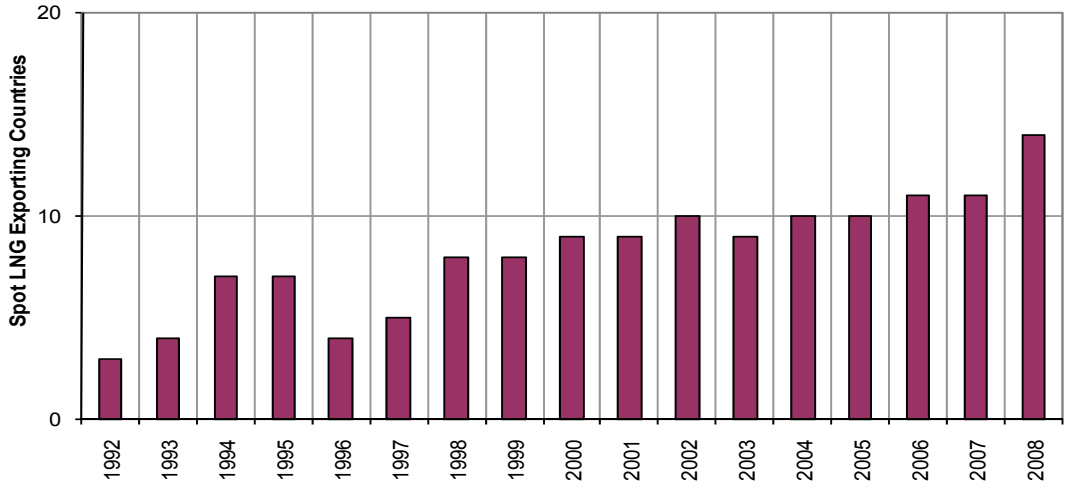
Figure 10: Share of Spot Contracts in LNG Trade from 1992 to 2008, % of total



Source: 1992 – 2001: PetroStrategies
2002 – 2007: Poten and Partners
2008: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Industry Sources

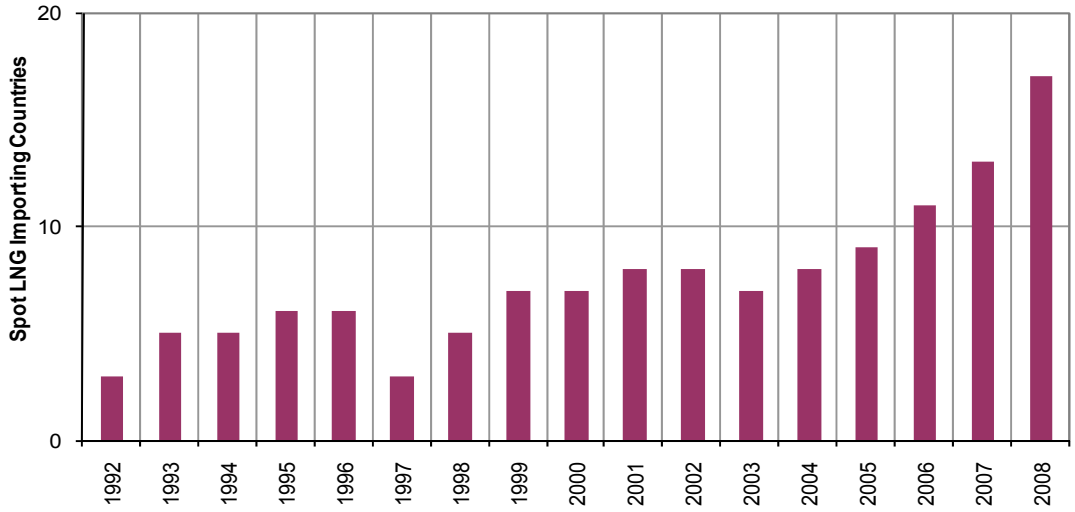
In 2004, 10 countries were active spot LNG exporters and 8 countries were spot cargo importers. These numbers have risen to 14 and 17 respectively at the end of 2008. The appetite to buy LNG on a spot basis has increased significantly as the list of spot buyers has almost doubled, whereas the list of spot sellers has increased also, albeit considerably less.

Figure 11: Number of Exporters of Spot LNG from 1992 to 2008



Source: 1992 – 2001: PetroStrategies
2002 – 2007: Poten and Partners
2008: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Industry Sources

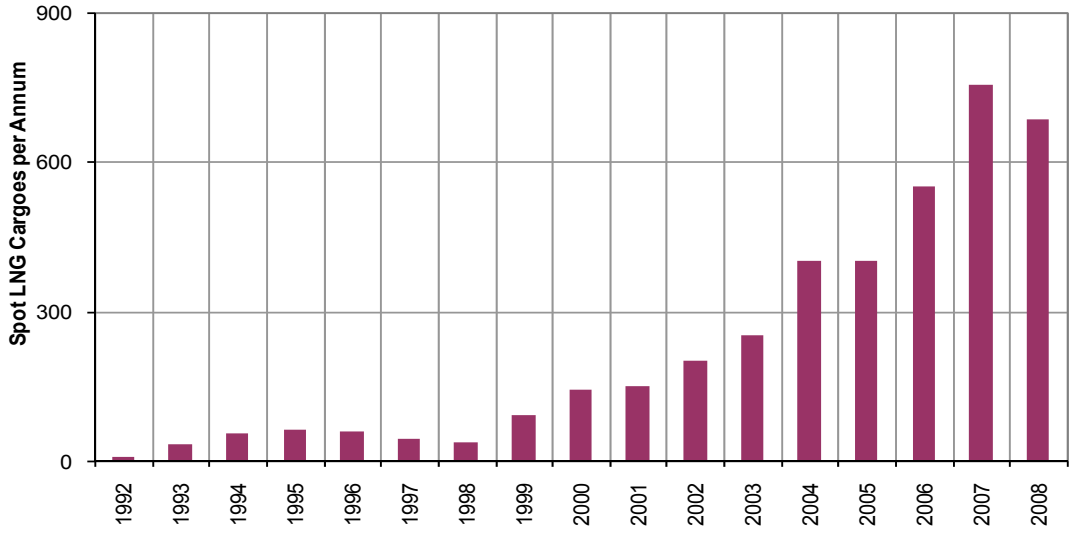
Figure 12: Number of Importers of Spot LNG from 1992 to 2008



Source: 1992 – 2001: PetroStrategies
2002 – 2007: Poten and Partners
2008: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Industry Sources

In 2004 around 400 cargoes were traded on a spot basis. At the end of 2008, the number of spot cargoes was around 700.

Figure 13: Number of Spot LNG Cargoes from 1992 to 2008



Source: 1992 – 2001: PetroStrategies
2002 – 2007: Poten and Partners
2008: The Asian Waterborne LNG Reports
The European Waterborne LNG Reports
The U.S. Waterborne LNG Reports
Industry Sources

4. LNG Liquefaction Plants

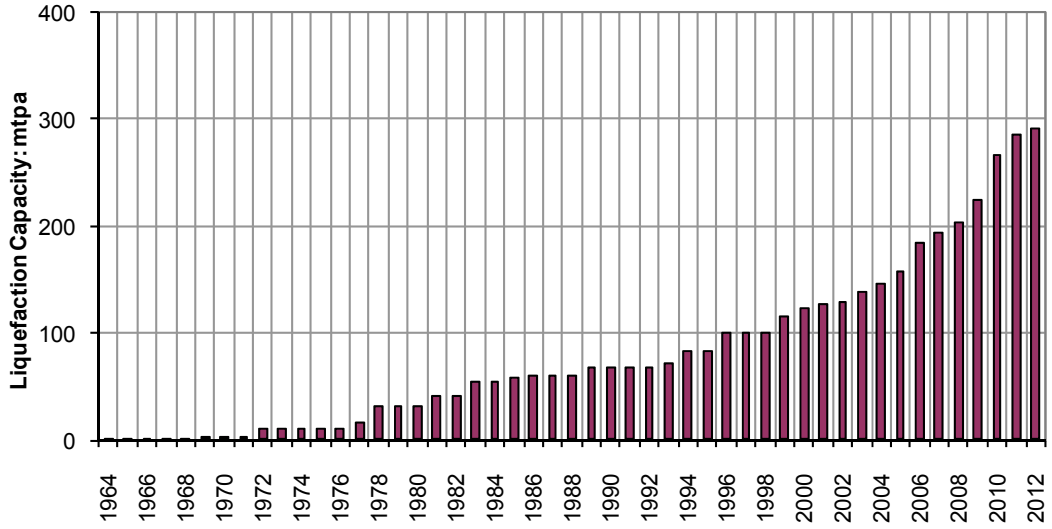
4.1. Overview

As per the end of 2008, 82 trains are in operation on five different continents. Global liquefaction capacity has reached 208.4 million tons per annum. The first plant, located in Arzew, Algeria has been in operations for 45 years. Between the end of 2004 and 2008, three countries have commissioned greenfield liquefaction facilities, namely Egypt, Equatorial Guinea and Norway and another six countries have expanded their liquefaction capacity, namely Australia, Malaysia, Nigeria, Oman, Qatar and Trinidad and Tobago.

4.2. Liquefaction Capacity[8] Globally

The installed liquefaction capacity at the end of 2008 is 208.4 million tons per annum, an increase of 59.6 million tons per annum, or 40% relative to the capacity at the end of 2004. Indonesia, Qatar, Russia and Yemen will commission new liquefaction plants, increasing capacity by 55.3 million tons per annum in the year 2009. By the year 2012, global liquefaction capacity is expected to reach 297.8 million tons per annum based on the completion of projects currently under construction. It should be noted that production does not equal liquefaction capacity, for instance because of feed gas constraints. Average utilization factors[9] for the installed LNG train capacity globally have been between 80% and 90% since the beginning of this decade.

Figure 14: Liquefaction Capacity from 1964 to 2012, mtpa

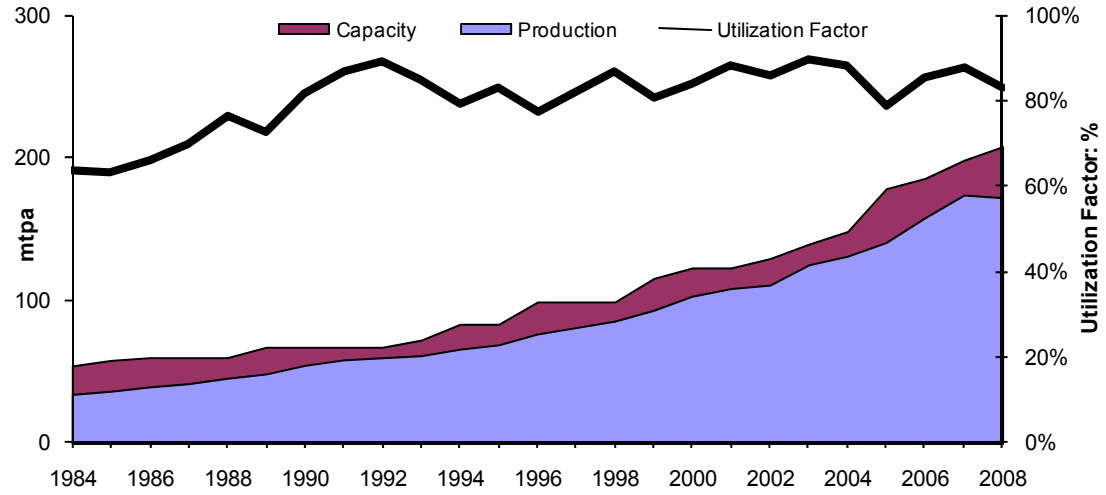


Source: Poten and Partners
CERA
Wood Mackenzie
Industry Sources

8 Liquefaction capacity is defined as the installed liquefaction capacity. Liquefaction capacity for Skikda trains 20, 30 and 40 are zero.

9 Service factor is defined as the ratio between actual train output and liquefaction capacity.

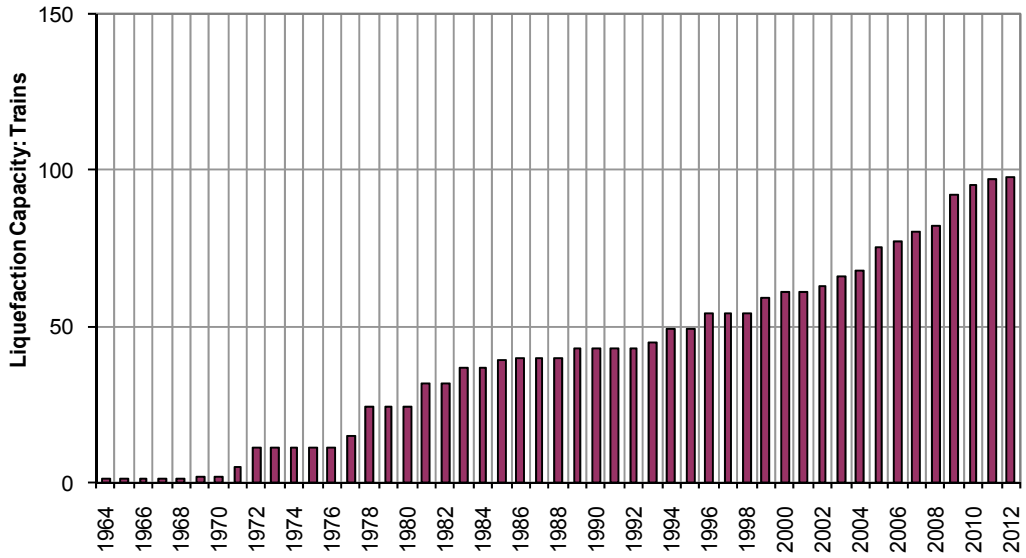
Figure 15: Utilization Factors



Source: Poten and Partners
CERA
Industry Sources

Since the end of 2004, 14 trains have been added, bringing the total number of liquefaction trains in operation to 82 at the end of 2008. Between the end of 2008 and 2012, 16 trains currently under construction as per the end of 2008 are expected to be commissioned in Algeria, Angola, Australia, Indonesia, Peru, Qatar, Russia and Yemen, bringing the total to 100 trains in operation at the end of 2012. If all the trains are commissioned in 2009 as expected there will be a step change in operating trains not seen since 1981.

Figure 16: Number of Liquefaction Trains from 1964 to 2012

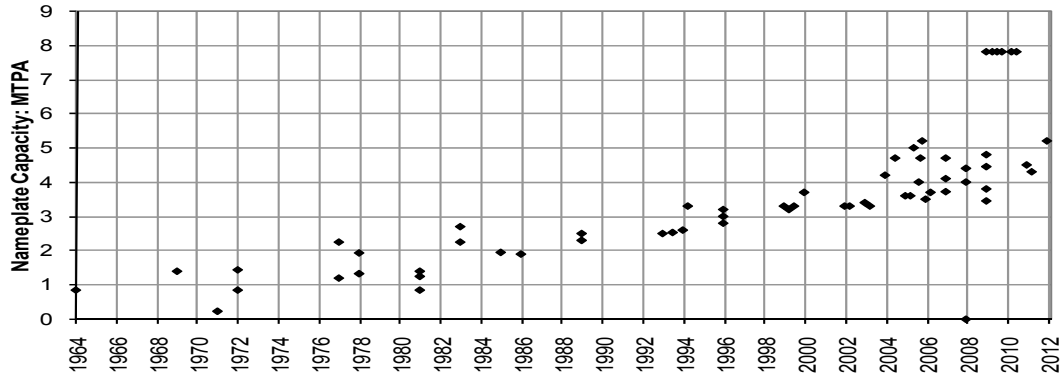


Source: Poten and Partners
CERA
Industry Sources

The first liquefaction plant in Arzew, Algeria had a nameplate capacity of 0.85 million tons in 1964. Train capacities have been steadily increasing over the years. Qatar's new trains under construction, which utilize the APCI AP-X liquefaction process, namely Qatargas' trains 4, 5, 6 and 7 and Rasgas' trains 6 and 7, have a nameplate design capacity of 7.8 million tons per annum. These "mega-trains" represent a step-out in technology as they break from the relatively constant trend of train capacity growth. The chart below shows the

liquefaction capacity for trains commissioned between the years of 1964 and 2008 and for those trains that are currently under construction and will be completed before the end of 2012.

Figure 17: Liquefaction Capacity per Train from 1964 to 2012, mtpa



Source: *Poten and Partners*
CERA
Industry Sources

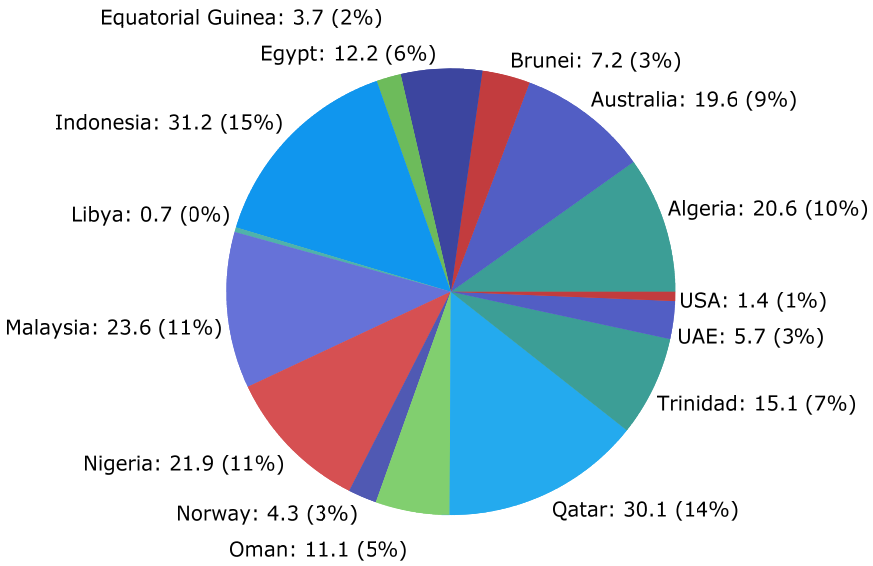
4.3. Liquefaction Capacity by Country

A total of 15 countries produced LNG at the end of 2008. Indonesia has the biggest nameplate liquefaction capacity globally, totaling 31.2 million tons per annum, and is closely followed by Qatar. However, Indonesia has been experiencing decline in the natural gas supply and has therefore not been able to produce LNG up to its trains' nameplate capacities.

Table 8: Liquefaction Capacity by Country in 2008, mtpa

Country	mtpa
Algeria	20.6
Australia	19.6
Brunei	7.2
Egypt	12.2
Equatorial Guinea	3.7
Indonesia	31.2
Libya	0.7
Malaysia	23.6
Nigeria	21.9
Norway	4.3
Oman	11.1
Qatar	30.1
Trinidad	15.1
UAE	5.7
USA	1.4
Total	**208.4**

Figure 18: Capacity by Country in 2008

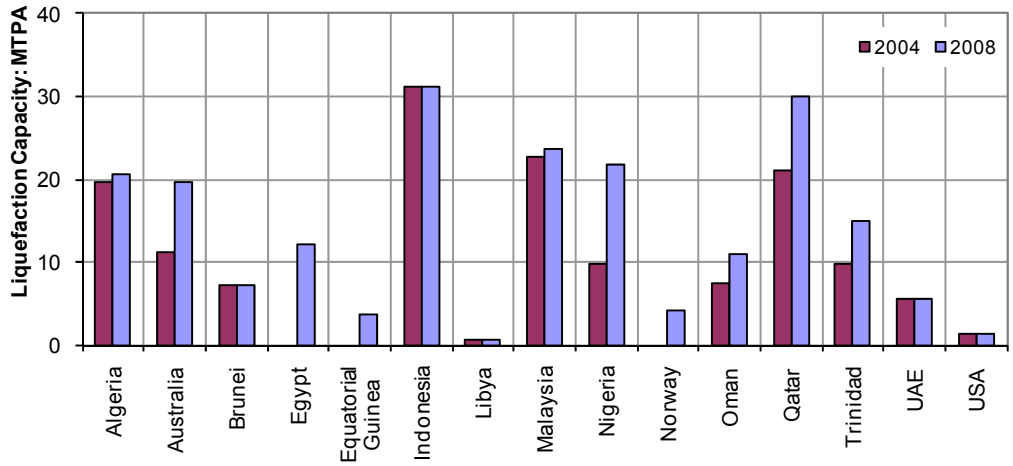


Source: *CERA*
Poten and Partners
Wood Mackenzie
Industry Sources

Australia, Malaysia, Nigeria, Oman, Qatar and Trinidad and Tobago have increased the existing liquefaction base[10], while Egypt, Equatorial Guinea and Norway have started to produce LNG between the end of 2004 and 2008.

[10] Algeria had greater production in 2008 than at the end of 2004 but that has been due to the restarting of Train 10 at Skikda after the fire.

Figure 19: Liquefaction Capacity by Country in 2004 and 2008, mtpa



Source: *Poten and Partners*
CERA
Wood Mackenzie
Industry Sources

4.4. Liquefaction Capacity by Region

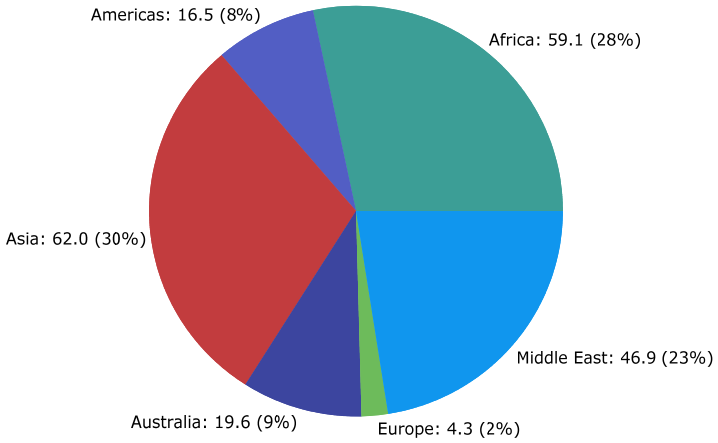
In 2008, liquefaction facilities were found in six major regions around the world. The aggregated nameplate capacities of these facilities in each region were as follows:

Table 9: Liquefaction Capacity by Region in 2008, mtpa

Region	mtpa
Africa	59.1
Americas	16.5
Asia	62.0
Australia	19.6
Europe	4.3
Middle East	46.9
Total	**208.4**

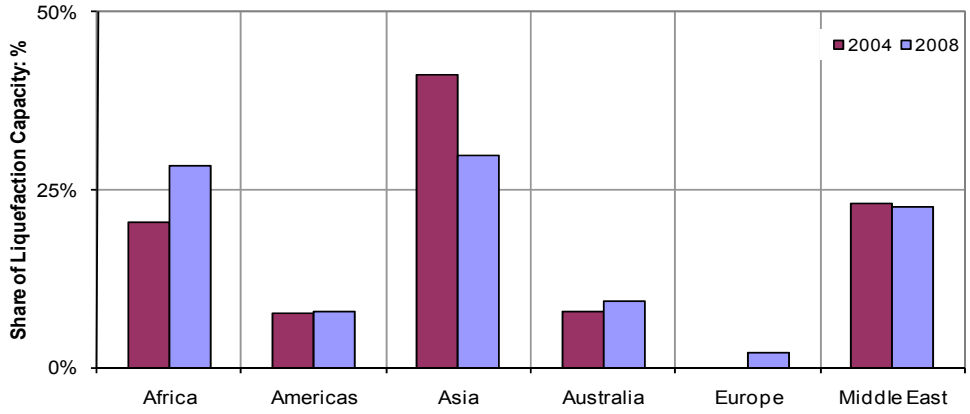
Source: *Poten and Partners*
CERA
Wood Mackenzie
Industry Sources

Figure 20: Capacity by Region in 2008



Asia has the biggest share (30%) of the global liquefaction capacity with an annual nameplate capacity of 62 million tons, closely followed by Africa (28%) at the end of 2008. At the end of 2004, the Asia Pacific region accounted for 40% of the world's liquefaction capacity. As of the end of 2008, the Asia region has not commissioned any new liquefaction trains, nor has it expanded capacity of its existing trains significantly, whereas in the other regions liquefaction capacity has been added to the existing base or in greenfield locations, causing its loss of market share to other regions.

Figure 21: Liquefaction Capacity by Region in 2004 and 2008

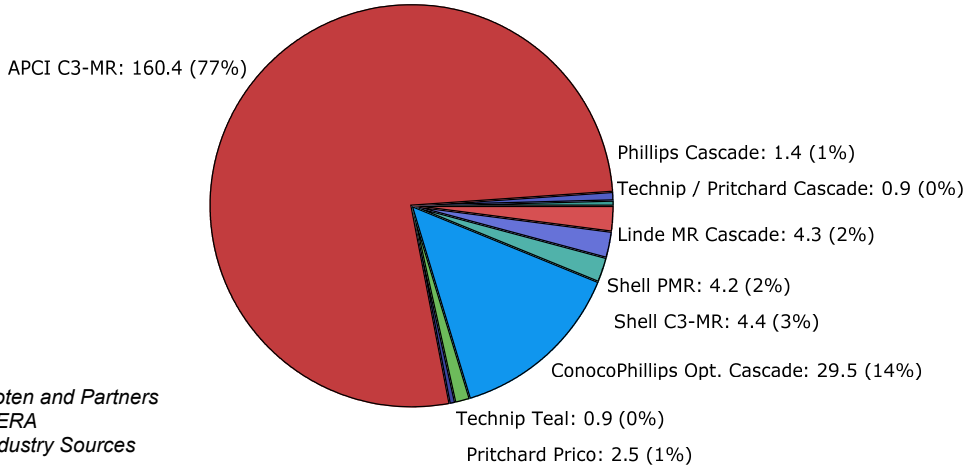


Source: *Poten and Partners*
CERA
Industry Sources

4.5. Liquefaction Processes

There were 8 types of liquefaction processes in use at liquefaction plants in 2008. The most extensively used process was APCI C3-MR, which accounted for liquefaction of 160.4 million tons in 2008, or the vast majority (77%) of the global nameplate liquefaction capacity.

Figure 22: Liquefaction Process at the end of 2008



Source: *Poten and Partners*
CERA
Industry Sources

The Snohvit LNG plant started up 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 deep seawater for cooling. Carbon dioxide present in the feedgas is removed and re-injected underground.

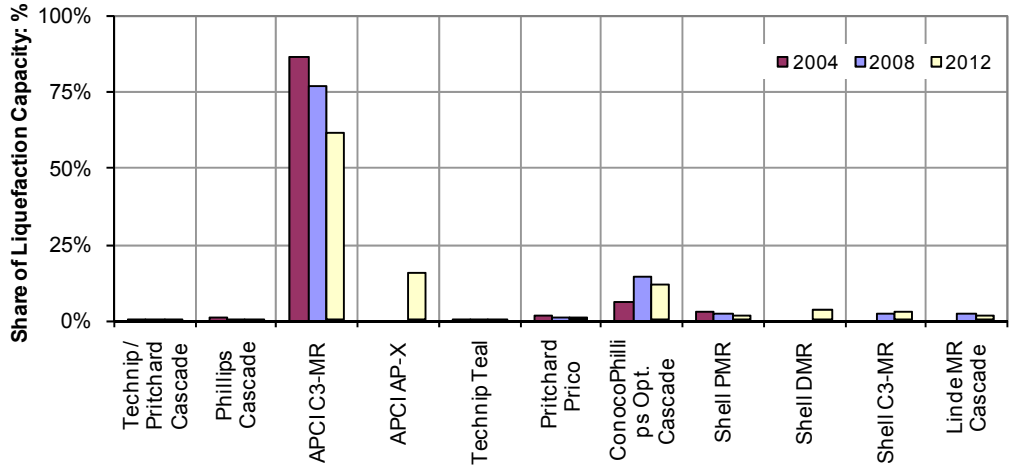
Some of the new trains currently under construction or in commissioning will use new processes, such as APCI AP-X in Qatar and Shell's DMR process at Sakhalin LNG in Russia.

ExxonMobil and Qatar Petroleum developed a mega-train design of 7.8 mtpa capacity for the Qatargas II project. The same design was repeated for all the expansion projects in Qatar: RasGas trains 7 and 8 and Qatargas trains 4 through 7. This application is the first for APCI's AP-X liquefaction technology. A nitrogen sub-cooling loop is added to the C3/MR process to increase capacity for the same sized MCHE. It is also the first application of a GE Frame 9 gas turbine as a mechanical driver for the refrigerant compressors.

The Shell Dual Mixed Refrigerant (DMR) process is used for the Sakhalin project in Russia. This novel process uses two Mixed Refrigerant cycles in series and the process is air cooled for process and environmental

reasons. It is sufficiently flexible to support the wide range of ambient temperatures experienced in the sub arctic environment. Train capacity is 4.8 mtpa.

Figure 23: Liquefaction Process in 2004, 2008 and 2012



Source: Poten and Partners
CERA
Industry Sources

4.6. Liquefaction Plants and Trains Recently Commissioned

New trains have been commissioned in Australia, Egypt, Equatorial Guinea, Nigeria, Norway, Oman, Qatar and Trinidad and Tobago between 2005 and the end of 2008. The main bulk of new-build trains, namely seven out of 14, have made use of APCI C3-MR, closely followed by ConocoPhillips' Optimized Cascade process with five trains utilizing its process.

Table 10: Newly Commissioned LNG Liquefaction Trains between 2005 and 2008

Country	Project	Location	Start Year	Nameplate Capacity: mtpa	Trains	Train Size: mtpa	Sponsors	Liquefaction Process
Egypt	Egyptian LNG T1	Idku	2005	3.6	1	3.6	BG, EGAS, EGPC, GdF, Petronas	Opt. Cascade
Egypt	Egyptian LNG T2	Idku	2005	3.6	1	3.6	BG, Petronas, EGAS, EGPC	Opt. Cascade
Egypt	SEGAS LNG T1	Damietta	2005	5.0	1	5.0	EGPC, EGAS, Union Fenosa Gas	C3-MR
Nigeria	NLNG-Plus	Bonny Island	2005	8.0	2	4.0	NNPC, Shell, Total, Eni	C3-MR
Qatar	RasGas 2 T4	Ras Laffan	2005	4.7	1	4.7	QP, ExxonMobil	C3-MR
Trinidad	Atlantic LNG T4	Point Fortin	2005	5.2	1	5.2	BP, BG, Repsol, NGC	Opt. Cascade
Australia	Darwin LNG	Wickham Point	2006	3.5	1	3.5	ConocoPhillips, Eni, Inpex, Santos, Tepco/Tokyo Gas	Opt. Cascade
Oman	Qalhat LNG	Qalhat, Sur	2006	3.7	1	3.7	Itochu, Mitsubishi, Oman Govt., Oman LNG, Osaka Gas, Union Fenosa Gas	C3-MR
Equatorial Guinea	Equatorial Guinea LNG	Bioko Island	2007	3.7	1	3.7	Marathon, Marubeni, Mitsui & Co, Sonagas	Opt. Cascade
Norway	Snohvit	Melkoya Island	2007	4.3	1	4.3	StatoilHydro, Petoro, Total, GdF,Hess RWE Dea	MR Cascade
Qatar	RasGas 2 T5	Ras Laffan	2007	4.7	1	4.7	QP, ExxonMobil	C3-MR
Australia	North West Shelf T5	Burrup Peninsula	2008	4.4	1	4.4	Woodside, BP, BHP Billiton, MIMI, Chevron, Shell	Shell C3-MR
Nigeria	NLNG 6	Bonny Island	2008	4.0	1	4.0	NNPC, Shell, Total, Eni	C3-MR

Source: Poten and Partners
CERA
Industry Sources

4.7. Liquefaction Terminals and Trains under Construction or in Planning

In Africa, Australia, Asia, the Americas and the Middle East plans have been made for the replacement or rejuvenation of trains, the addition of trains to already existing projects or sites or for greenfield LNG liquefaction projects. Qatar will add significant LNG liquefaction capacity to the world as Qatargas' Trains 4, 5, 6 and 7 and Rasgas' Trains 6 and 7, each with an annual liquefaction capacity of 7.8 million tons, are under construction and slated to be completed before the end of 2010. In addition to the trains under construction, many liquefaction trains are on the drawing board or awaiting regulatory approval.

Table 11: Planned LNG Liquefaction Trains

Country	Project	Location	Start Year	Nameplate Capacity: mtpa	Trains	Train Size: mtpa	Sponsors	Liquefaction Process	End of 2008 Status
Africa									
Algeria	Skikda 20, 30, 40 replacement	Skikda	2011	4.5	1	4.5	Sonatrach	C3-MR	Under Construction
Algeria	Gassi Touil GL3Z	Arzew	2013	4.7	1	4.7	Sonatrach	C3-MR	Planned
Angola	Angola LNG	Soyo	2012	5.2	1	5.2	BP, Chevron, Eni, Sonangol, Total	Opt. Cascade	Under Construction
Equatorial Guinea	Equatorial Guinea LNG T2	Bioko Island	2014	4.4	1	4.4	E.ON Ruhrgas, Marathon, Marubeni, Mitsui & Co, Sonagas, TBD, Union Fenosa Gas	Opt. Cascade	Planned
Libya	Marsa el Brega rejuvenation	Marsa el Brega	2013	3.0	3	1.0	NOC, Shell		Planned
Libya	Mellitah LNG	Mellitah	2015	5.0	1	5.0	NOC, Eni		Planned
Nigeria	Brass LNG	Brass River, Bayesla State	2013	10.0	2	5.0	ConocoPhillips, Eni, NNPC, TBD, Total	Opt Cascade	Planned
Nigeria	NLNG 7	Bonny Island	2014	8.5	1	8.5	Eni, NNPC, Shell, Total	PMR	Planned
Australia									
Australia	Pluto LNG	Burrup Peninsula	2011	4.3	1	4.3	Kansai Electric, Tokyo Gas, Woodside	DMR	Under Construction
Australia	Curtis LNG	Gladstone, Queensland	2014		1		BG, QGC	Opt. Cascade	Planned
Australia	Gorgon LNG	Barrow Island	2014	15.5	3	5.2	Chevron, ExxonMobil, Shell	C3-MR	Planned
Australia	Browse	TBD	2014	15.0	2	7.5	BHP Billiton, BP, Chevron, Shell, Woodside		Planned
Australia	Pilbara	Onslow	2014	6.0	1	6.0	BHP Billiton	C3-MR	Planned
Australia	Gladstone LNG	Gladstone, Queensland	2014	3.0	1	3.0	Petronas, Santos		Planned
Asia									
Indonesia	Tangguh LNG	Berau Bay	2009	7.6	2	3.8	BP, CNOOC, Inpex, JNOC, LNG Japan, Mitsubishi, Mitsui & Co, Nippon Oil, Talisman	C3-MR	Under Construction
Indonesia	Donggi Senoro	Central Sulawesi	2012	2.0	1	2.0	Mitsubishi, Pertamina, PT Medco Energi Intl.	C3-MR	Planned
Papua New Guinea	Liquid Niugini Gas	Napa Napa	2013	5.0	1	5.0	InterOil, Merrill Lynch, Pacific LNG	Opt. Cascade	Planned
Papua New Guinea	PNG LNG	Port Moresby	2014	6.3	2	3.2	AGL Energy, Eda Oil, ExxonMobil, Landowners, Nippon Oil, Oil Search, Santos		Planned
Russia	Sakhalin-2 T1,2	Prigorodnoye	2009	9.6	2	4.8	Gazprom, Mitsubishi, Mitsui & Co, Shell	DMR	Under Construction
Russia	Sakhalin-2 T3	Prigorodnoye	2014	4.8	1	4.8			Planned
Americas									
Peru	Peru LNG	Pampa Melchorita	2010	4.5	1	4.5	Hunt Oil, Marubeni, Repsol, SK Corp	C3-MR	Under Construction
Middle East									
Qatar	Qatargas 2 T4	Ras Laffan	2009	7.8	1	7.8	QP, ExxonMobil	AP-X	Under Construction
Qatar	Qatargas 2 T5	Ras Laffan	2009	7.8	1	7.8	ExxonMobil, QP, Total	AP-X	Under Construction
Qatar	RasGas 3 T6	Ras Laffan	2009	7.8	1	7.8	QP, ExxonMobil	AP-X	Under Construction
Qatar	RasGas 3 T7	Ras Laffan	2009	7.8	1	7.8	ExxonMobil, QP	AP-X	Under Construction
Qatar	Qatargas 3 T6	Ras Laffan	2010	7.8	1	7.8	ConocoPhillips, Mitsui & Co, QP	AP-X	Under Construction
Qatar	Qatargas 4 T7	Ras Laffan	2010	7.8	1	7.8	QP, Shell	AP-X	Under Construction
Yemen	Yemen LNG	Balhaf	2009	6.9	2	3.5	GASSP, Hunt Oil, Hyundai, KOGAS, SK Corp, Total, Yemen Gas Co.	C3-MR	Under Construction

Source: Poten and Partners
CERA
Industry Sources
Wood Mackenzie

5. LNG Receiving Terminals

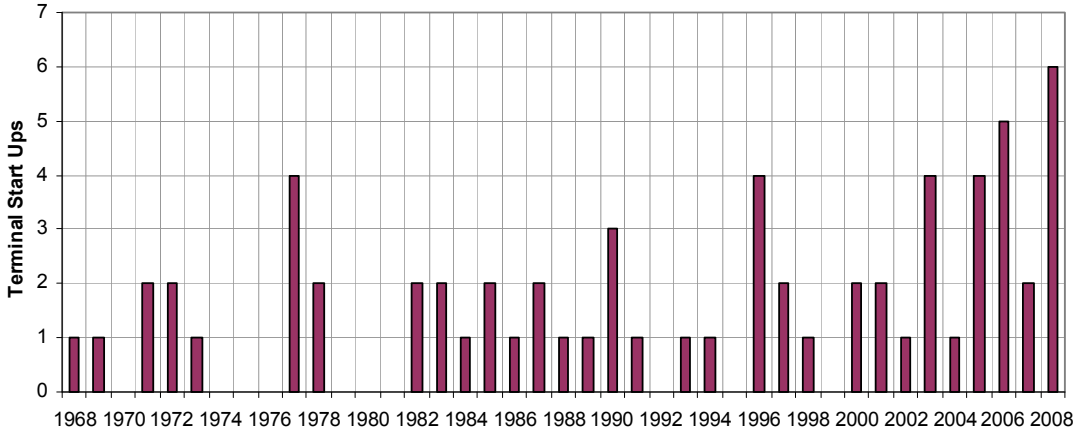
5.1. Overview

At the end of 2008, a total of 64 receiving terminals were in operation in 18 countries on four continents, namely North America, South and Central America, Asia and Europe. Between the end of 2004 and 2008, four countries have started to import LNG, namely Argentina, China, Mexico and the United Kingdom from 14 countries (Belgium, Dominican Republic, France, Greece, India, Italy, Japan, Portugal, Puerto Rico, South Korea, Spain, Taiwan, Turkey and the United States) in 2004.

5.2. Receiving Terminal Capacity Globally

From the beginning of this decade, 27 terminals have been commissioned. The year 2008 has seen 6 terminals start operations.

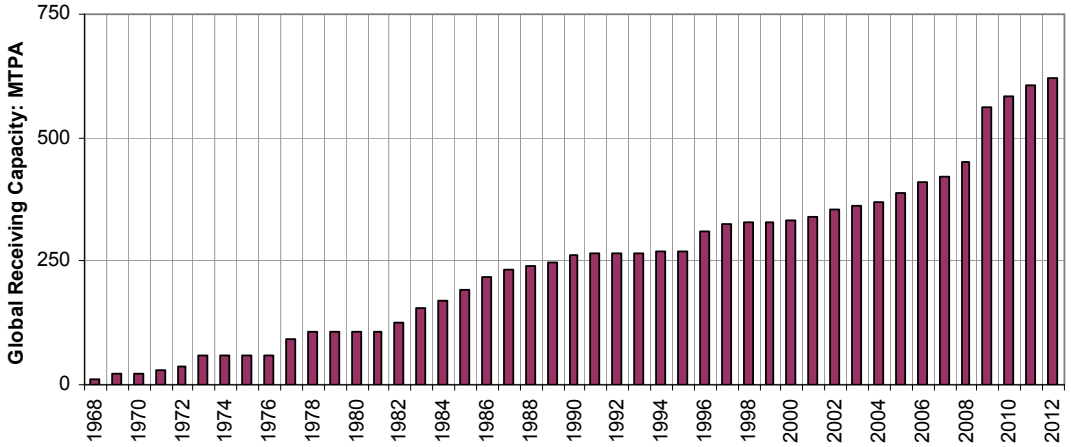
Figure 24: Start-ups of LNG Receiving Terminals from 1969 to 2008



Source: Poten and Partners
CERA
Industry Sources

Since 2004, global send out capacity has increased by 78.4 million tons per annum to 449.2 million tons per annum at the end of 2008. An additional 171.7 million tons is under construction and is slated to be completed before the end of 2012, bringing the expected send out capacity to 620.9 million tons by 2012.

Figure 25: Receiving Terminal Capacity globally, mtpa



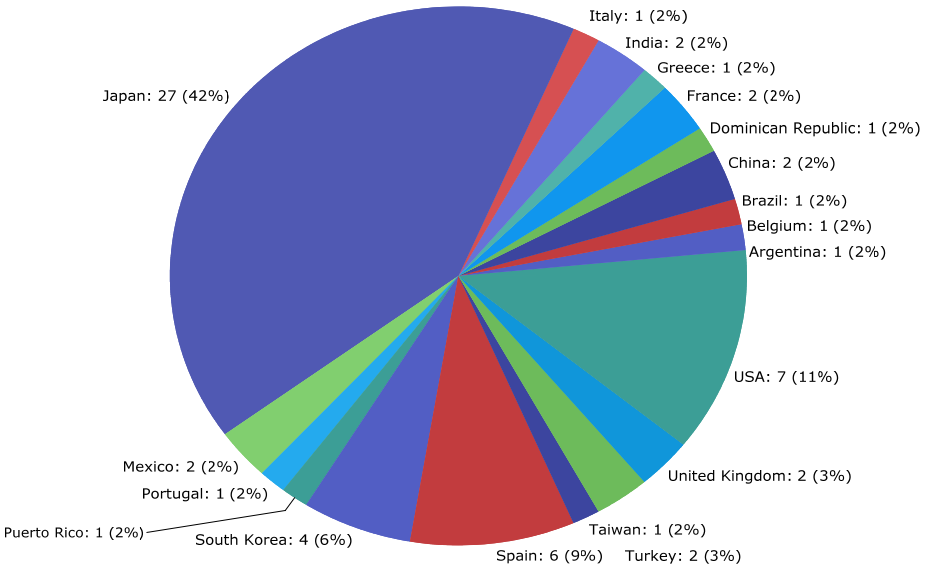
Source: Poten and Partners
CERA

Industry Sources

5.3. Receiving Terminals by Country

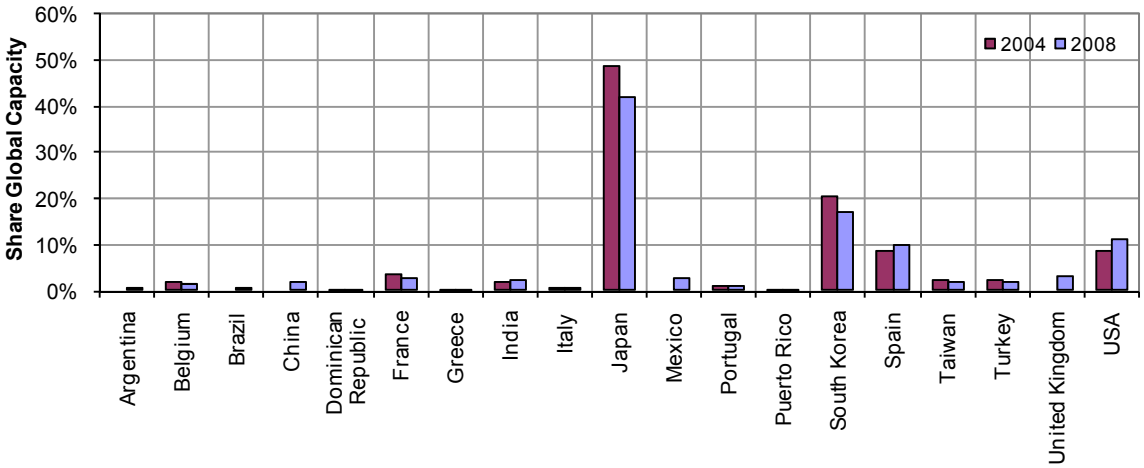
Japan has by far the most receiving terminals in the world, with 27 terminals in operation at the end of 2008, followed by the United States with 7 terminals. Japan's terminals have a combined send out capacity of 187.3 million tons per annum, which is equal to 42% of global capacity[11].

Figure 26: Receiving Terminals by Country 2008



Source: Poten and Partners
CERA
Industry Sources

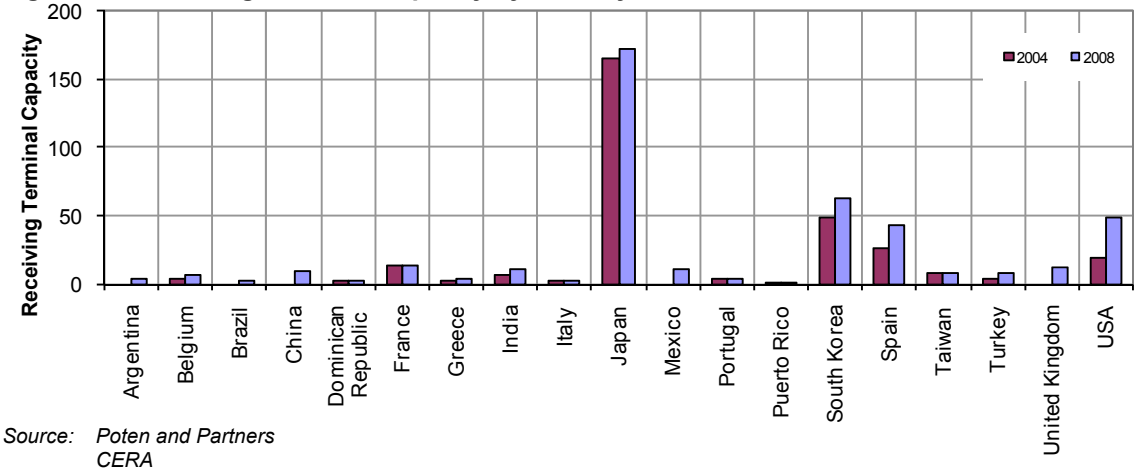
Figure 27: Capacity by Country in 2004 and 2008, mtpa



Source: Poten and Partners
CERA
Industry Sources

[11] Brazil's receiving terminal was completed in 2008 but received its first cargo in 2009; it is included in the diagrams.

Figure 28: Receiving Terminal Capacity by Country in 2004 and 2008



Source: *Poten and Partners*
CERA
Industry Sources

5.4. Receiving Terminals by Region

Asia is the region with the most terminals at the end of 2008, as was the case in 2004. In total, 36 terminals are in operation in Asia, which is equal to 55% of all terminals worldwide. Also, in terms of regasification capacity Asia holds the most capacity at 289.5 million tons per annum, or 64% of the global total, followed by Europe with 20%.

Figure 29: LNG Receiving Terminals by Region 2008

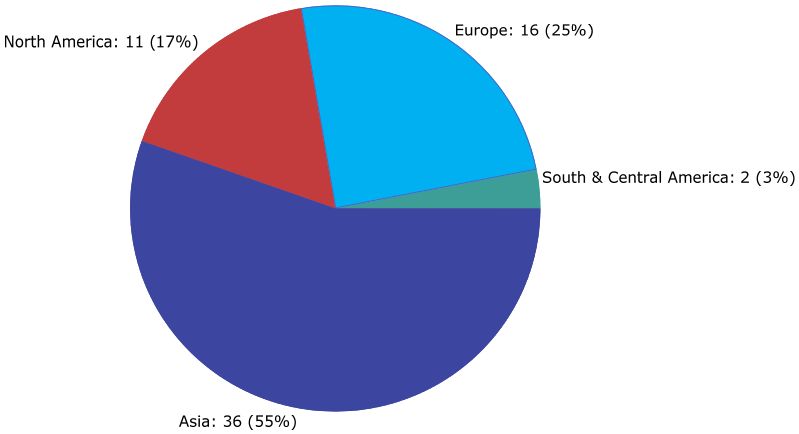
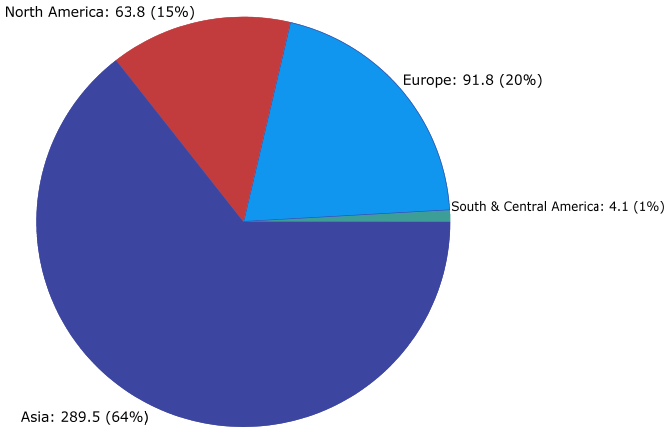


Figure 30: Capacity by Region 2008, mtpa



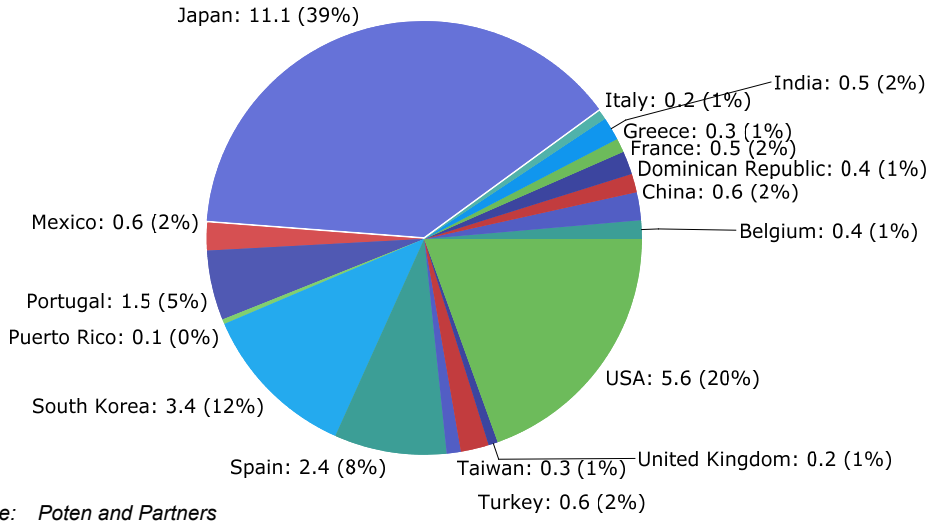
Source: *Poten and Partners*
CERA
Industry Sources

5.5. Receiving Terminals LNG Storage Capacity

Japan has the biggest storage capacities[12] with LNG storage of 11.1 million cubic meters, or 37% of the global LNG storage capacity, followed by the USA with 5.6 million cubic meters, or 19% of global capacity.

12 The storage capacity is the combined capacity of the LNG storage tanks.

Figure 31: LNG Storage Capacity by Country at the end of 2008, million m3

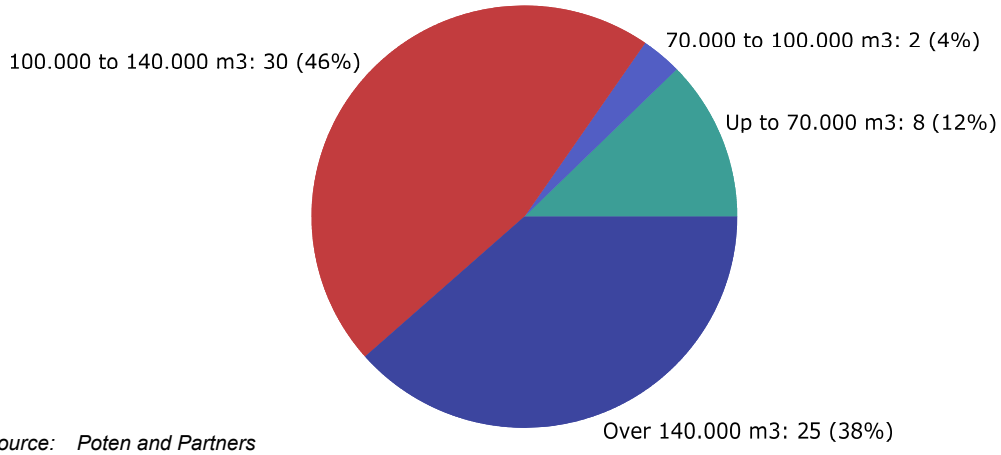


Source: Poten and Partners
CERA
Industry Sources

5.6. Receiving Terminals Maximum Berthing Capacity and Gas Send-out Capacity

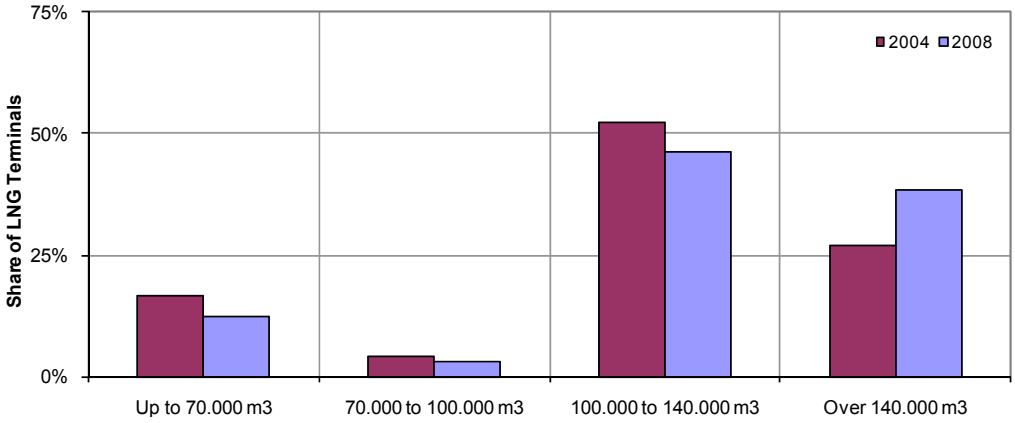
More than a third of the receiving terminals, namely 38%, can accommodate vessels with an LNG carrying capacity of over 140,000 cubic meters from only 27% of receiving terminals in 2004.

Figure 32: Maximum Berthing Capacity in 2008



Source: Poten and Partners
CERA
Industry Sources

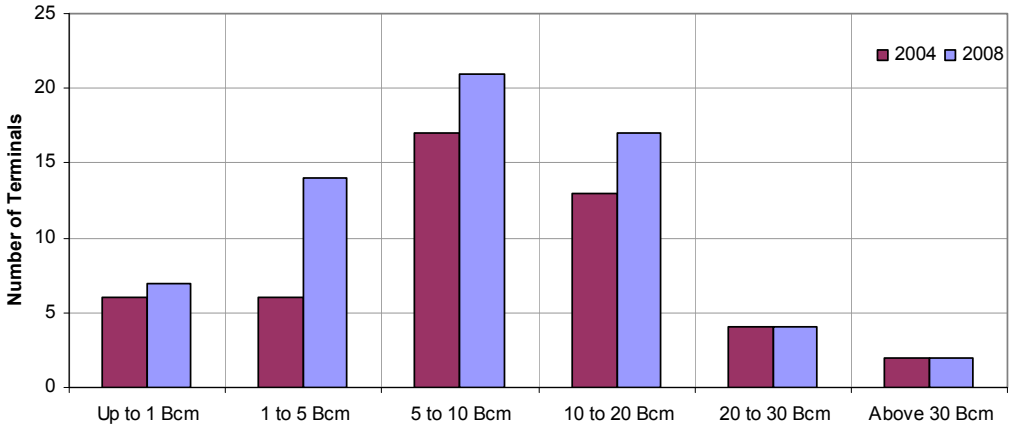
Figure 33: Maximum Berthing Capacity in 2004 and 2008



Source: Poten and Partners
CERA
Industry Sources

All send-out brackets have experienced growth between the end of 2004 and 2008, except terminals with a send-out greater than 20 billion cubic meters per annum. The majority of receiving terminals have a send-out between 5 to 10 billion cubic meters per annum at the end of 2008, as was also the case in 2004.

Figure 34: Gas Send-Out Capacity of LNG Terminals at the end of 2004 and 2008

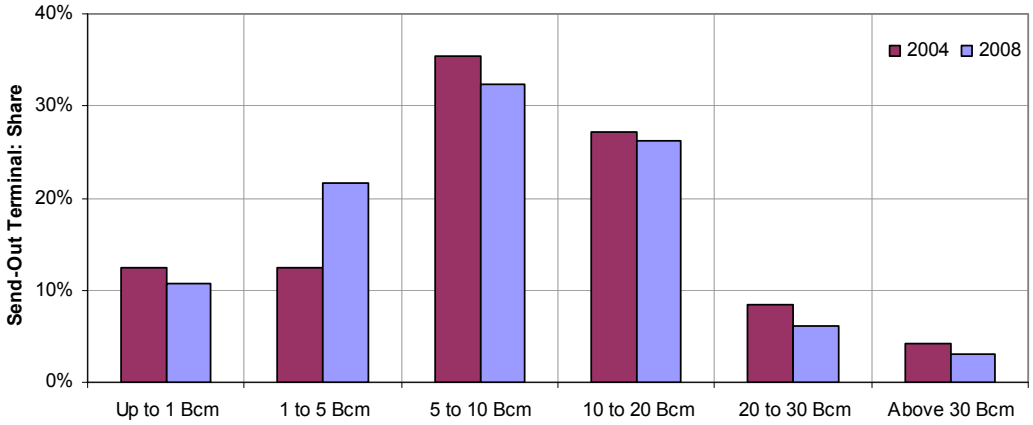


Source: Poten and Partners
CERA
Industry Sources

The biggest growth has taken place in the construction of terminals with a send-out between 1 and 5 billion cubic meters per annum from 6 terminals in 2004 to 14 terminals at the end of 2008. A large part of the increase stems from the commissioning of floating receiving terminals, such as Bahia Blanca in Argentina, Pecem in Brazil[13] and Excelerate's Teesside GasPort, Gulf Gateway and Northeast Gateway.

13 Terminal completed but no cargo received in 2008, 1st cargo delivered in Jan 2009.

Figure 35: Gas Send Out Capacity of LNG Terminals at the end of 2004 and 2008



Source: Poten and Partners
CERA
Industry Sources

5.7. Regasification Terminals' Technologies

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

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

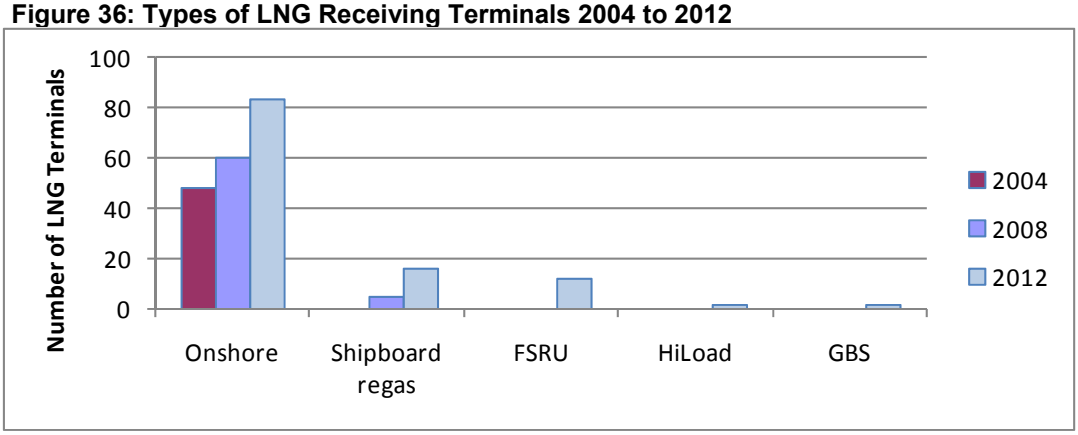
An LNG Regasification Vessel (LNGRV) is a carrier with re-gasification equipment onboard. The carrier docks at a floating buoy and exports its gas to the shore via a sub sea pipeline. Shipboard regasification can take 5-7 days before the carrier is depleted and can sail to its next destination.

A Gravity Based Structure (GBS) is a submersible structure that permanently rests on the sea floor and contains integral LNG storage tanks and re-gasification equipment on the topside. It is a robust, but also rather costly solution and currently there are no proposals for further 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 re-gasified offshore and exported to shore via a sub sea pipeline. Onshore re-gasification terminals have also seen innovation including use of air vaporizers 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 sea-water 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.

Figure 36: Types of LNG Receiving Terminals 2004 to 2012



Source: Poten and Partners
Industry Sources

5.8. Receiving Terminals recently commissioned

Argentina, China, Mexico and the United Kingdom[14] have commissioned greenfield LNG receiving terminals. In the case of India, Japan, South Korea, Spain, and the United States terminals were added to the existing base.

Table 12: Newly Commissioned LNG Receiving Terminals & Expansions between 2005 and 2008

Country	Project	Startup	Sponsor	MTPA
Argentina	Bahia Blanca	2008	Excelerate	2.3
Belgium	Zeebrugge (Phase II)	2008	Fluxys	3.2
Brazil	Pecem (Northeast)	2008	Petrobras	1.9
China	Guangdong Dapeng LNG	2006	BP, CNOOC, Other small shareholders	3.5
China	Guangdong Dapeng LNG expansion	2007	BP, CNOOC, Other small shareholders	3.5
China	Fujian	2008	CNOOC , Fujian Investment and Development Co	2.7
China	Wuhaogou LNG Emergency Supply Station	2008	Shenerg	0.0
India	Hazira	2005	Shell ,Total	4.0
Japan	Mizushima	2006	Mizushima LNG	0.6
Japan	Sakai LNG	2006	Cosmo Oil, Iwatani, Kansai Electric, Ube Industries	7.1
Mexico	Terminal De LNG De Altamira	2006	Mitsui & Co, Shell, Total	4.9
Mexico	Energia Costa Azul	2008	Sempra	7.5
South Korea	POSCO	2005	POSCO	1.7
Spain	Sagunto Harbor	2005	Endesa, Iberdrola, Oman Govt, Union Fenosa Gas	5.1
Spain	Regasificadora del Noroeste, SA (REGANOSA)	2006	Banco Pastor, Caixa Galicia, Caixanova, Endesa, Sonatrach, Tojeiro Group, Union Fenosa Gas, Xunta de Galicia	2.6
United Kingdom	Grain LNG	2005	National Grid Transco	3.2
United Kingdom	Teesside GasPort	2007	Excelerate	3.2
United Kingdom	Grain 2 Expansion	2008	National Grid Transco	6.6
USA	Gulf Gateway	2005	Excelerate	3.0
USA	Elba Island Expansion II	2006	Southern LNG	2.7
USA	Lake Charles Expansion	2006	Southern Union	4.5
USA	Excelerate Energy Northeast Gateway	2008	Excelerate	3.0
USA	Freeport LNG	2008	Cheniere, Dow Chemical, Freeport LNG, Osaka Gas	11.3
USA	Sabine Pass LNG	2008	Cheniere	19.6

Source: Poten and Partners
CERA
Industry Sources

5.9. Receiving Terminals under Construction

A significant number of terminals are either under construction, under regulatory review or still in the planning stages, as is shown in the tables below. Traditional importing regions all have plans to increase the number of

14 The United Kingdom has a mothballed LNG terminal at Canvey Island that was built in the 1960's but taken out of operation in the 1990's.

terminals, expanding the list of countries that will potentially import LNG. The Middle East, traditionally an exporting region, will be importing LNG in the near future as a terminal in Kuwait is currently under construction and plans are developed for a receiving terminal in Dubai.

Table 13: LNG Receiving Terminals, Under Construction

Country	Project	Startup	Sponsor	MTPA
Brazil	Guanabara Bay, Rio de Janeiro State	2009	Petrobras	3.8
Canada	Canaport LNG	2009	Irving Oil, Repsol	7.5
Chile	GNL Quintero	2009	GNL Quintero SA	2.7
Chile	GNL Mejillones	2010	Codelco, GdF Suez	1.4
China	Shanghai	2009	CNOOC,Shenergy	3.1
China	Dalian	2011	PetroChina	3.1
China	Fujian Expansion	2011	CNOOC,Fujian Investment and Development Co	3.5
China	Jiangsu	2011	Petro China Jiangsu Guoxin Investment Group, Raja Garuda Mas International Group	3.0
France	Fos Cavaou (Fos II)	2009	GdF Suez, Total	6.0
India	Dabhol	2009	Gail,IDBI-led institutions ,Maharashtra State Electricy Board ,NTPC	5.0
India	Dahej Expansion	2009	Petronet LNG	5.0
Italy	Isola di Porto Levante (Terminale GNL Adriatico SRL)	2009	Edison, ExxonMobil, QP	5.8
Italy	Offshore Floating LNG Terminal Toscana (OLT)	2011	Endesa, Golar LNG, IRIDE, OLT energy Toscana	2.7
Japan	Sakaide LNG	2010	Cosmo Oil,Shikoku Electric,Shikoku Electric	0.0
Kuwait	Mina Al-Ahmadi GasPort	2009	Excelerate	3.0
Mexico	Terminal KMS de GNL S. de R.L. de C.V	2011	KOGAS, Mitsui & Co, Samsung	3.8
Netherlands	GATE LNG Terminal	2012	DONG, E.ON Ruhrgas, Essent Energie, GasunieOMV, Vopak	6.8
Spain	El Musel	2010	Enagas	5.1
Taiwan	Taichung	2009	CPC	5.0
United Kingdom	South Hook LNG	2009	ExxonMobil, QP, Total	7.7
United Kingdom	South Hook LNG Phase II	2009	ExxonMobil, QP, Total	7.7
United Kingdom	Dragon LNG	2009	4Gas, BG, Petronas	4.2
United Kingdom	Grain 3 Expansion	2010	National Grid Transco	5.3
USA	Cameron LNG	2009	Sempra	13.5
USA	Neptune LNG	2009	GdF Suez	3.8
USA	Sabine Pass LNG Expansion	2009	Cheniere	10.5
USA	Golden Pass	2010	ExxonMobil, ConocoPhillips, QP	15.0
USA	Gulf LNG Clean Energy Project	2011	El Paso, Sonangol, The Crest Group	11.3

Source: Poten and Partners
CERA
Industry Sources

Table 14: LNG Receiving Terminals, Under Regulatory Review

Country	Project	Startup	Sponsor	MTPA
Belgium	Zeebrugge FSRU (TBD)	TBD	Exmar	3.7
Canada	Grande-Anse LNG	2012	Énergie Grande-Anse	7.5
Chile	Chile	TBD	Oxiquim	1.4
China	Qingdao	2017	Sinopec, Shandong Shihua Natural Gas Corp, Shandong Natural Gas & Pipeline Co	3.0
China	Zhejiang	2013	CNOOC, Zhejiang Provincial, Ningbo Electric Power	5.0
China	Zhuhai LNG (Guangdong II)	2015	Guangdong Yudean Group, CNOOC, Guangzhou Enterprises, Other small shareholders	1.0
France	Dunkerque LNG	2014	EDF	10.5
France	Pegaz LNG	2013	4Gas	6.5
Italy	Alpi Adriatico	2011	Endesa, Friulia	5.8
Italy	Brindisi	2012	BG	5.8
Italy	LNG Jonio Terminal	2011	ERG Power & Gas,Shell	5.8
Italy	LNG Med Gas Terminal	2013	CrossGas, Iride SpA and Sorgenia SpA	8.7
Italy	Porto Empedocle (Agrigento)	2012	Nuove Energie	5.8
Italy	Taranto	2012	Gas Natural	5.8
Italy	Vada LNG	TBD	BP, Edison, Solvay	5.8
Italy	Zaule	2012	Gas Natural	5.8
Mexico	Sonora Pacific LNG	2011	Sonora Pacific LNG	7.5
Mexico	Terminales y Almacenes Maritimos de Mexico (TAMMSA)	TBD	CEMSA, Moss Maritime	0.1
Netherlands	Eemshaven	2014	Essent Energie, Gasunie, Vopak	8.7
South Africa	Coega Integrated LNG-to-Power Project	TBD	iGas	1.7
United Kingdom	Norsea	2011	Norsea	0.0
United Kingdom	Port Meridian	2012	Hoegh LNG	5.8
USA	Clearwater Port	TBD	Northern Star	4.1
USA	Downeast LNG	TBD	Dean Girdis, Kestrel Energy Partners	3.8
USA	Jordan Cove Energy	TBD	Energy Projects Development, Fort Chicago Energy Partners	7.5
USA	Port Dolphin Energy	2011	Hoegh LNG	6.0
USA	Safe Harbor Energy	2014	Atlantic Sea Island Group, LLC	7.5
USA	Weavers Cove Energy	2013	Hess LNG	3.0
USA	Broadwater Energy	TBD	TransCanada, Shell	7.8

Source: Poten and Partners
CERA
Industry Sources
Wood Mackenzie

Table 15: LNG Receiving Terminals, Planned

Country	Project	Startup	Sponsor	MTPA
Albania	Albania	2014	ASG Power SA	7.3
Bahamas	AES Ocean LNG	2012	AES	6.3
Brazil	Bahia	TBD		TBD
Brazil	Pernambuco	TBD		TBD
Brazil	Santa Catarina state	2009	Petrobras	3.8
Brazil	Sao Luis	TBD		TBD
Canada	Grassy Point LNG	TBD	LNG Partners LLC, North Atlantic Pipeline Partnership	TBD
Canada	Texada Island Terminal	2013	Westpac Terminal	3.8
China	Hainan	TBD	CNOOC,Hainan Development Holding Co	3.0
China	Hebei	TBD	CNOOC	3.0
China	Shenzhen	2015	PetroChina	TBD
China	Tianjin	TBD	CNOOC	4.8
China	Zhuhai	TBD	Macau Natural Gas Co, Sinopec	3.0
Croatia	Adria LNG	2014	E.ON Ruhrgas, Geoplin, OMV, RWE Transgas, Total	7.3
Cyprus	Cyprus	2013	Government of Cyprus, Electricity Authority Cyprus	0.7
Dubai	DUSUP	2010	Golar LNG	3.6
France	Montoir de Bretagne Expansion	2011	GdF Suez	1.7
Germany	German GasPort	2010	Excelerate, Nord-West Oelleitung, RWE	3.8
India	Mangalore	TBD	Hindustan Petroleum Corporation	TBD
India	Mundra	TBD	Hindustan Petroleum	TBD
Indonesia	East Java	2011	PT Gas Negara	1.6
Indonesia	West Java	2012	PT Gas Negara	1.6
Italy	Civitavecchia	2014	Enel, Gavio Group, Italpetroli	8.7
Italy	Italy ENI (TBD)	TBD	Eni, Third parties	2.3
Italy	Panigaglia	2010	Snam	3.2
Italy	Triton	2012	GdF Suez, Hoegh LNG	3.6
Italy	Undetermined	2014	Sorgenia	10.5
Japan	Ishikari	2013	Hokkaido Gas	TBD
Japan	Jyoetsu Kyodo	2012	Chubu Electric, Tohoku Electric	TBD
Japan	Naoetsu LNG	2014	Inpex	TBD
Japan	Sendai	2018	Tohoku Electric	TBD
Japan	Wakayama	2013	Kansai Electric	TBD
Mexico	Dorado HiLoad	TBD	Teranova Energia	10.9
Mexico	Excelerate Energy Pacific Gateway	TBD	Excelerate	4.5
Mexico	Topolobampo	2011	TBD	3.8
Mexico	Yucatan Peninsula LNG project	2011		2.3
Morocco	Morocco (TBD)	TBD	Afriquia Gaz s.	3.6
Netherlands Antilles	Transhippment and Strorage (Curacao)	TBD	Newfoundland LNG	TBD
New Zealand	Port Taranaki (TBD)	2012	Contact Energy, Genesis	1.2
Pakistan	Mashal	2011	4Gas	3.0
Philippines	Philippines - First Gas (TBD)	2012	First Gas Holdings	1.0
Poland	Swinoujscie	2014	PGNiG	1.8
Romania	Romania (TBD)	TBD	TBD	TBD
Singapore	Singapore Expansion (TBD)	2018	PowerGas	3.0
Singapore	Singapore Jurong Island	2012	GdF Suez, PowerGas	3.0
South Africa	South Africa (TBD)	2010	PetroSA	2.1
South Korea	GS CALTEX	2013	GS Caltex	9.8
South Korea	Pyongtaek II	TBD	KOGAS	6.3
South Korea	Samchuk	2013	KOGAS	TBD
South Korea	Unspecified	TBD	KOGAS	9.8
Spain	Gran Canaria	2013	Compania Transportista de Gas Canarias	1.4
Spain	Tenerife	2013	Compania Transportista de Gas Canarias	1.4
Sweden	OXELOSUND	TBD	Sydkraft	TBD
Thailand	Rayong (TBD)	2011	PTT	4.0
United Kingdom	Canvey Island	2012	Calor Gas, Centrica, LNG Japan, Osaka Gas	3.9
United Kingdom	Gateway LNG	2012	Stag Energy	TBD
Uruguay	Uruguay (TBD)	2012	AncapEnarsa	2.6
USA	BlueOcean Energy	2014	ExxonMobil	9.0
USA	Calais LNG	TBD	North East Energy Development LLC of Maine and Texas	7.5
USA	Crown Landing LNG	2013	BP	9.0
USA	Esperanza Energy	TBD	Tidelands	TBD
USA	Excelerate Energy Golden Gateway	TBD	Excelerate	4.5
USA	Excelerate Energy Liberty Gateway	TBD	Excelerate	3.0
USA	Excelerate Energy Southeast Gateway	TBD	Excelerate	3.8
USA	Freedom LNG	TBD	HNG Storage	22.6
USA	Liberty Natural Gas	2011	Excalibur Energy (USA) Inc	18.0
USA	Oregon LNG Project	2014	Oregon LNG	7.5
USA	Port Westward LNG	TBD	Port Westward LNG	5.6
USA	Tansy Point	TBD	Warrenton Fiber	TBD

Source: Poten and Partners
CERA
Industry Sources

6. LNG Carriers

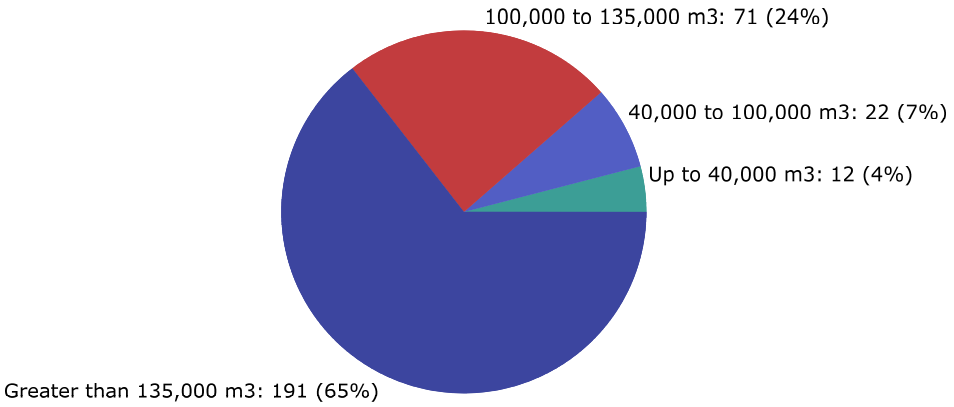
6.1. Overview

At the end of 2008, a total of 296 LNG carriers were delivered. Taken together, they had a combined capacity of 40.1 million cubic meters, for an average of 135,605 cubic meters per carrier. Between the end of 2004 and 2008, 126 of those carriers were placed into service, with a capacity of 19.7 million cubic meters, or nearly 50% of the total LNG fleet tonnage. Due to the commissioning of large carriers, the average capacity at the end of 2008 is 15,504 cubic meters higher than in 2004.

6.2. LNG Carriers' Capacity

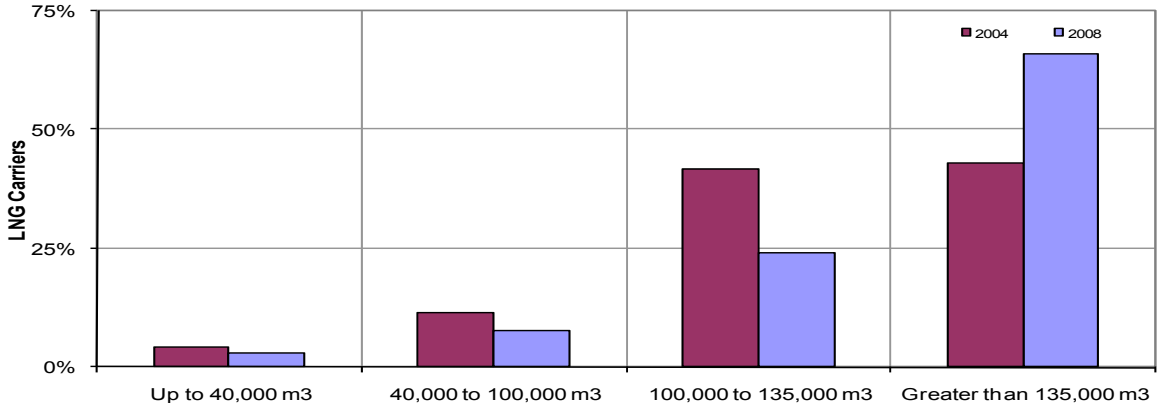
The share occupied by large carriers with a capacity of more than 135,000 m^3 has increased to an overall share of 65%.

Figure 37: Capacity of LNG Carriers, number and share of total



Source: *Poten and Partners*
CERA
Industry Sources

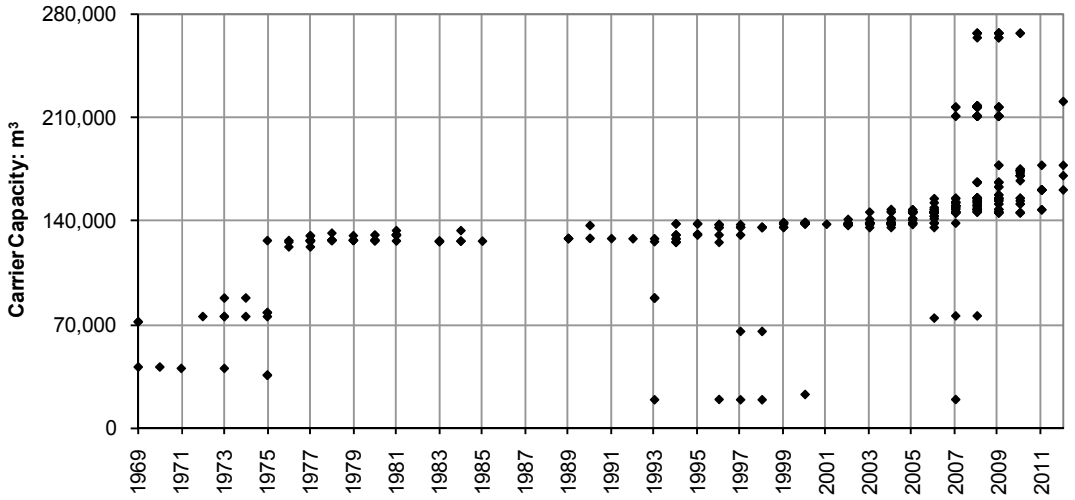
Figure 38: Capacity of LNG Carriers, number and share of total



Source: *Poten and Partners*
CERA
Industry Sources

The size of new build LNG carriers is diverse, some carriers have a very small capacity to facilitate delivery of LNG to remote areas, such as the North Pioneer (2,500 m^3) and the Pioneer Knutsen (1,100 m^3), whereas Qatar operates a fleet of large ships with a capacity of between 210,000 and 266,000 m^3.

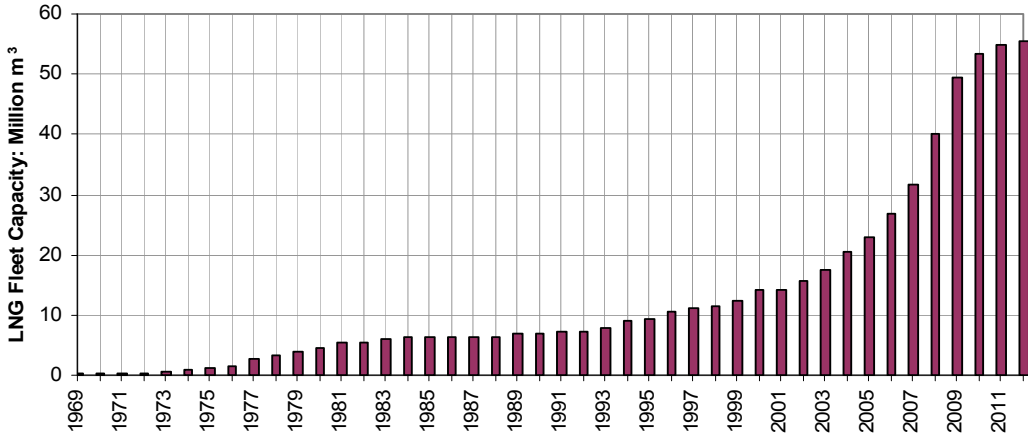
Figure 39: Capacity of LNG Carriers from 1969 to 2012, m3



Source: Poten and Partners
CERA
Industry Sources

The 2008 year-end ship capacity of 40.1 million cubic meters is expected to rise to 56.4 million cubic meters by the end of 2012.

Figure 40: Combined Global LNG Carrier Capacity, m3

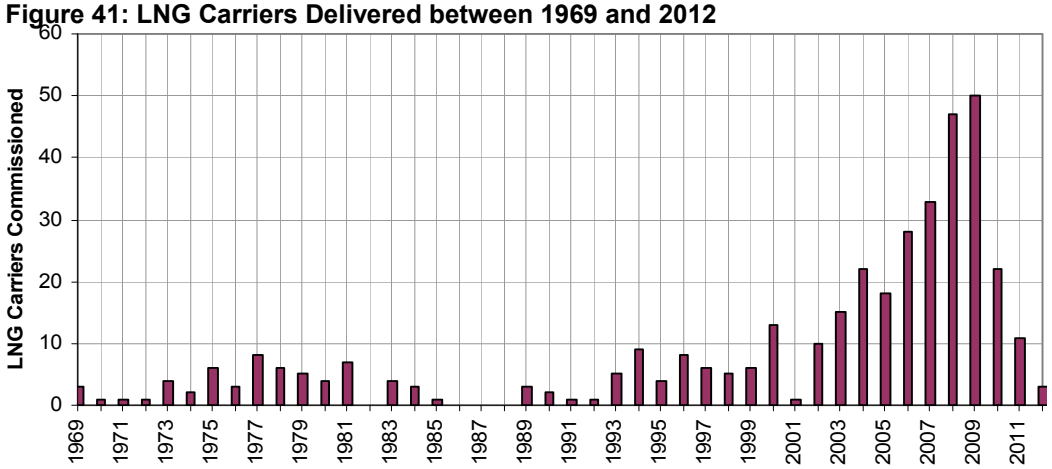


Source: Poten and Partners
CERA
Industry Sources

6.3. LNG Carriers' Commissions

The year 2008 alone saw the commissioning of 49 LNG vessels. A large share of the new builds in that year was delivered to Qatar. It took delivery of 16 Q-Flex size vessels and 4 Q-Max size vessels, each with a capacity of around 216,000 and 265,000 cubic meters respectively.

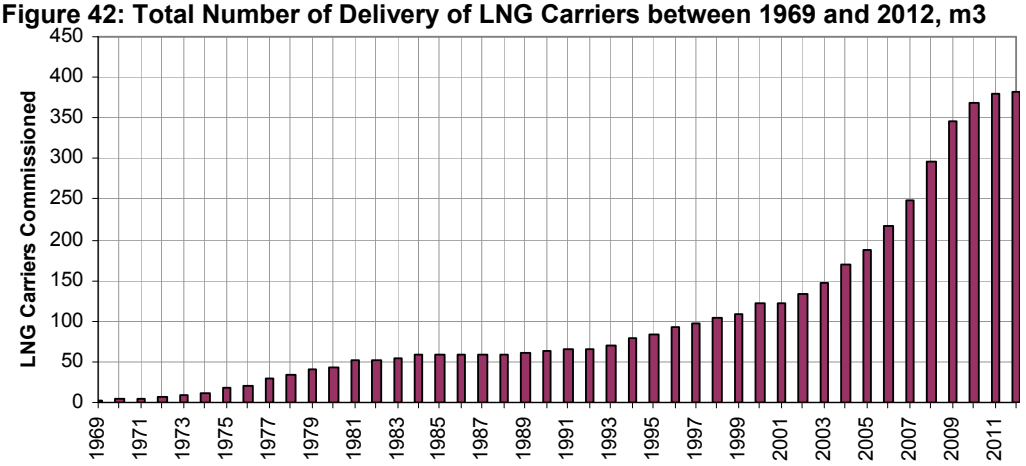
Figure 41: LNG Carriers Delivered between 1969 and 2012



Source: Poten and Partners
CERA
Industry Sources

At the end of 2004, the global LNG carrier fleet consisted of 170 vessels. From 2005 through 2008, 126 ships have been added, and the total fleet consists of 296 vessels.

Figure 42: Total Number of Delivery of LNG Carriers between 1969 and 2012, m3



Source: Poten and Partners
CERA
Industry Sources

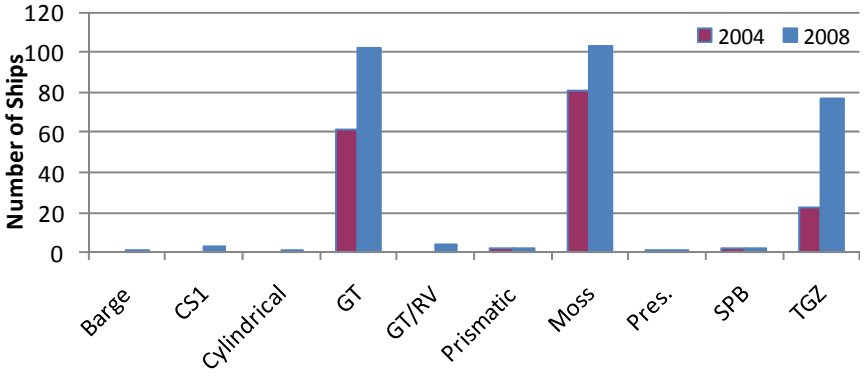
6.4. LNG Carriers' Types

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

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

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

Figure 43: Types of LNG Carriers 2004 to 2012

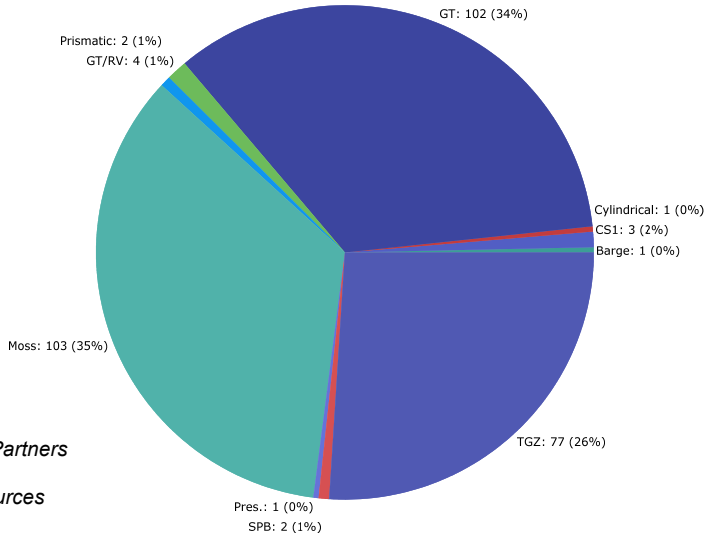


Source: Poten and Partners
CERA
Industry Sources

6.5. LNG Carriers' Tank Type

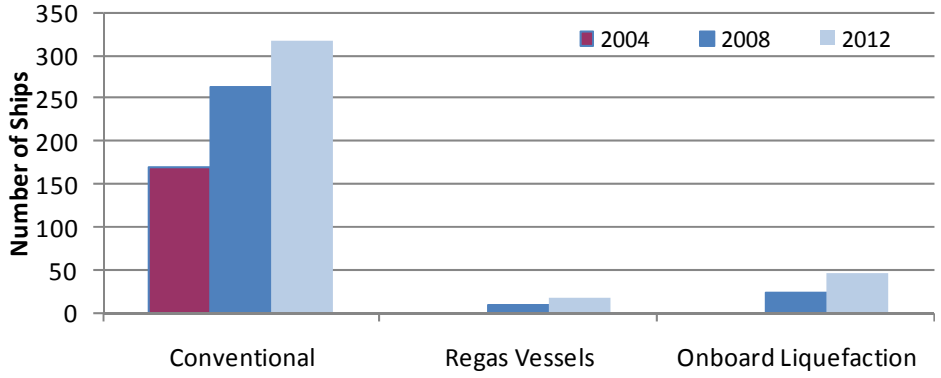
The three major tank types in LNG carriers are Moss, Gaz Transport (GT) and Technigaz (TGZ). The GT and TGZ are a membrane tank configuration rather than spherical Moss containers widely associated with the public image of an LNG ship.

Figure 44: Tank Type of LNG Carriers at the end of 2008



Source: Poten and Partners
CERA
Industry Sources

Figure 45: LNG Tank types in 2004 and 2008

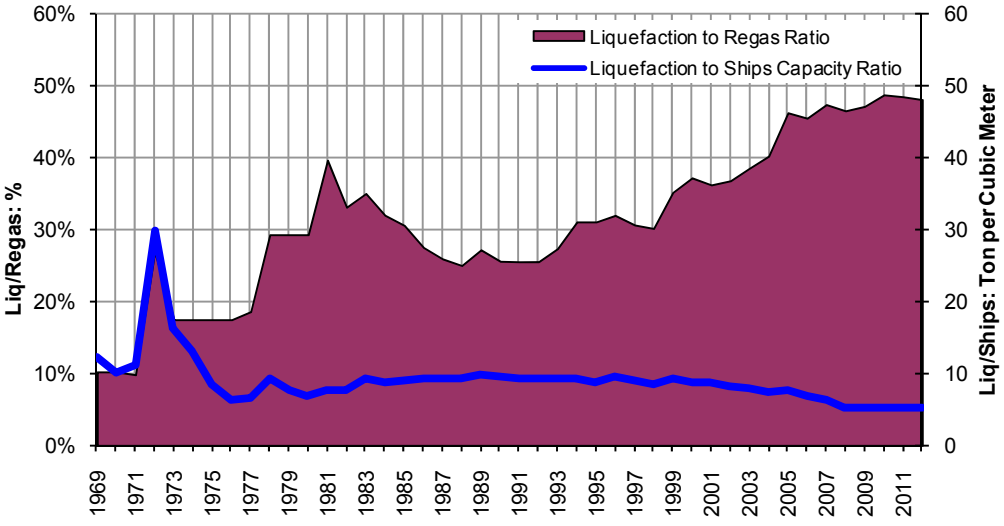


Sources: Poten and Partners
CERA
Industry Sources

6.6. LNG Carriers, Liquefaction and Regasification

Regasification and liquefaction capacities have increased significantly since the 1960's as a result of the increased appetite for LNG. An interesting development has been the steep increase in global shipping capacity expressed in million cubic meters of carrying capacity as shown in the chart below. It has outpaced the growth in both regasification and liquefaction. Increased inter-regional trading activity, whereby producers sell one or more cargoes not only to buyers in their own respective region but deliver LNG in other regions, has increased the need for additional ship carrying capacity. An example has been the influx of LNG from the Atlantic Basin into the Asia Pacific region in 2007 and 2008, whereby the producer and the buyer have been sometimes more than 13,000 nautical miles apart.

Figure 46: LNG Ships, Regasification and Liquefaction

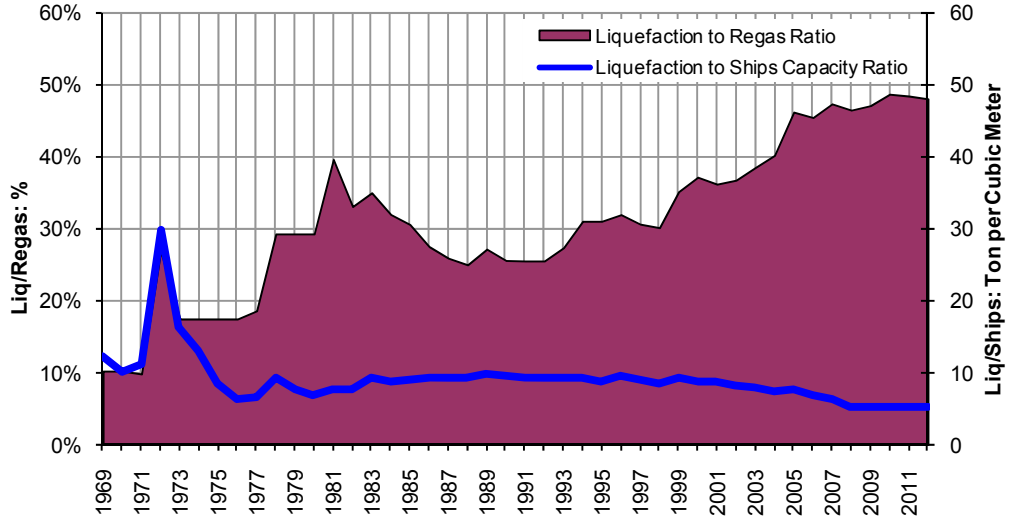


Source: Poten and Partners
CERA
Industry Sources

In 1969 there was relatively small production of LNG compared to the global receiving terminal capacity. Liquefaction capacity stood at 2.25 million tons per annum and the regasification capacity at 22.1 million tons per annum and thus the liquefaction to regasification ratio was only near 10%. Over the years, this ratio has increased steadily, meaning that production capability has increased relatively more than receiving terminal capacities worldwide. At the end of 2008, the ratio is 46%. With regards to shipping, parties have made significant investments in shipping capacity to be able to deliver LNG to buyers all over the world, sometimes far from the producing area, and as a result the average LNG delivered per cubic meter of shipping capacity has

decreased over time. Acceptability of large ships at discharge as well as loading terminals will facilitate global trade of LNG and will be beneficial to producers and buyers of LNG.

Figure 47: Trend of Capacities



Source: Poten and Partners
CERA
Industry Sources

7. Conclusion

The key facts for the LNG industry between the years 2004 and 2008 were as follows:

1. The volume of LNG trade reached 173.6 million tons per annum in 2008 and increased by 42.1 million tons per annum, or 32% from 2004.
2. The share of spot trade in LNG has increased to 29 million tons per annum in 2008, which is equal to 17% of total LNG trade volumes.
3. 82 liquefaction trains are in operation in 15 countries on 5 different continents by the end of 2008.
4. Global LNG liquefaction capacity totaled 208.4 million tons per annum in 2008 and increased by 59.4 millions tons or 40% since 2004. It is expected to reach 297.6 million tons in 2012 after the successful completion of projects currently under construction.
5. The number of LNG receiving terminals in operation around the world reached 64 at the end of 2008. These terminals are located in 18 countries on four continents.
6. Global LNG regasification capacity totaled 449.2 million tons per annum in 2008 and has increased by 78.4 millions tons per annum or 21% since 2004. It is expected to reach 620.9 million tons in 2012 after the completion of projects currently under construction.
7. 296 LNG carriers were in operations at the end of 2008. The combined capacity of these ships has increased by 19.7 million cubic meters, or 97% from 2004, to 40.1 million cubic meters, for an average of 135,605 cubic meters per carrier.
8. Producers, importers & shipping operators have significantly invested in liquefaction and shipping capacity to deliver LNG to customers all over the world. As a result the ratio between liquefaction and receiving terminal capacity has increased dramatically from only 10% in 1968 to 46% at the end of 2008.

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9. *Paper Log*

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