LNG Supply and Demand in Asia Pacific and Atlantic Markets* (2004)

Industrial Research Unit – Oil and Gas Group
Senior Research Coordinator: Takeo Suzuki
Researcher: Tetsuo Morikawa

The world LNG trading started when the UK imported LNG from Algeria in 1964. After this event, the LNG trading expanded in terms of both geography and quantity, although the extent varies significantly between regions and countries. In 1970, 2.69Bcm of LNG was traded between 3 exporters and 5 importers. In 2003, trading volume reached 168.84Bcm, and there are 12 exporting and 13 importing countries. Diversification of energy sources, overall energy demand increase backed by economic growth and air pollution regulations contributed this amazing growth. In addition, increasing popularity of natural gas for power generation, LNG cost reduction and relative environmental advantage against oil and coal accelerate the growth rate of LNG demand. Within this market Japan has been playing the significant role as the largest LNG importer.. As will be discussed later, Japan's LNG demand is expected to increase relatively slowly. However, considering its huge import volume, Japan will continue to be the main LNG player.

Expansion of LNG market will be even accelerated in the foreseeable future. Within the next 5 years, countries like Russia, Norway and Equatorial Guinea are to start exporting LNG, while countries like China, Mexico and the UK are expected to start or restart importing.

Geographical and volume expansion of LNG trading is contributing to increase the liquidity of the market . The LNG market can be broadly divided into the Asia Pacific market, to which Japan belongs, and the Atlantic market using the Suez Canal as a divider line. Cross market trading is expected to increase to a significant extent, which could accelerate the changing of the world LNG market.

Based on this understanding, this report examines LNG demand/supply and current market characteristics not only of Asia Pacific market, as we did last year, but also of Atlantic market[1].

1. Natural Gas Supply and Demand

World natural gas reserves at the beginning of 2004 was 179.6 Tcm with 40% in the Middle East and 30% in the former Soviet Union. On the other hand, there is roughly 16.3 Tcm in Asia Oceania or just under 10% of the world's total. Natural gas production in 2003 was 2.69 Tcm and North America and the former Soviet Union each make up 30%, while 11.8% for Asia Oceania Major demand regions are North America and the former Soviet Union, each with large amount of production and pipeline network, and Europe which imports large amount of natural gas from Africa and the former Soviet Union. Demand in Asia Oceania is 351.1 Bcm and this accounts for 13.1% of the world total. (Table 1, Fig. 1)

* This report was prepared as a part of a research funded by the Ministry of Economy, Trade and Industry in FY 2004. This report was released under the permission of the Ministry of Economy, Trade and Industry. We express our gratitude for the help of the METI officials and working group members who participated to this research.

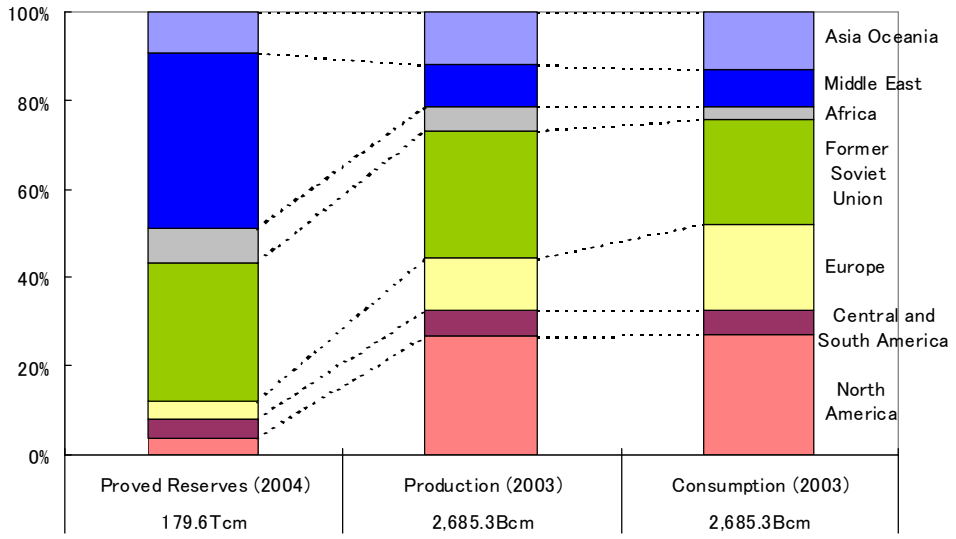
[1] Takeo Suzuki, Tetsuo Morikawa, LNG Demand-Supply and Trends in Natural Gas in the Asia-Pacific Region, July 2004, http://eneken.ieej.or.jp/data/pdf/909.pdf

Table 1 World Natural Gas Reserves, Production and Consumption

	Proved Reserves (2004)		Production (2003)		Consumption (2003)	
	(Tcm)	Share(%)	(Bcm)	Share(%)	(Bcm)	Share(%)
North America	7.0	3.9	721.5	26.9	726.2	27
Central and South America	7.8	4.3	155.4	5.8	152.5	5.7
Europe	6.7	3.7	314.8	11.7	521.2	19.4
Former Soviet Union	56.3	31.4	772.6	28.8	635.5	23.7
Africa	13.8	7.7	143.6	5.3	72.3	2.7
Middle East	71.6	39.9	260.6	9.7	226.5	8.4
Asia Oceania	16.3	9.1	316.8	11.8	351.1	13.1
Total	179.6	100.0	2,685.3	100.0	2,685.3	100.0

(Note) Concerning reserves and production within the Asia Oceania region, the amount shown is the total for 17 countries, Afghanistan, Australia, Bangladesh, Brunei, China, India, Indonesia, Japan, Malaysia, Myanmar, New Zealand, Pakistan, Papua New Guinea, Philippines, Taiwan, Thailand, and Vietnam, and for consumption, the amount shown is the total of 19 countries, these 17 countries plus Singapore and South Korea.
(Source) Natural Gas in the World 2004, Cedigaz

Fig. 1 World Natural Gas Reserves, Production and Consumption by Region



(Source) Natural Gas in the World 2004, Cedigaz

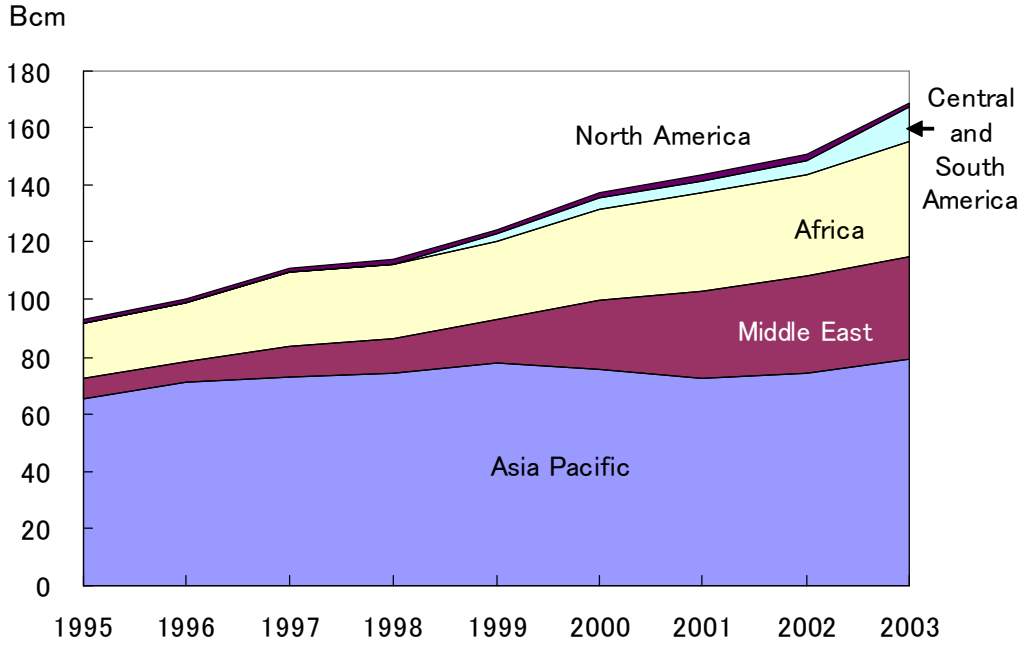
2. LNG Trade

(1) LNG Imports and Exports

The total trading volume of natural gas was 634.516 Bcm in 2003 and of this 168.84 Bcm (roughly 123MT), or 26.6%, was traded in the form of LNG. The world LNG trading grew 7.7% per year from 1995 to 2003.

As for exports, Asia Pacific provided 47%, Middle East 21%, Africa 24%, Central and South America 7% and North America 1% in the year 2003. The share for the Middle East has significantly increased by entry of Qatar and Oman into the market.

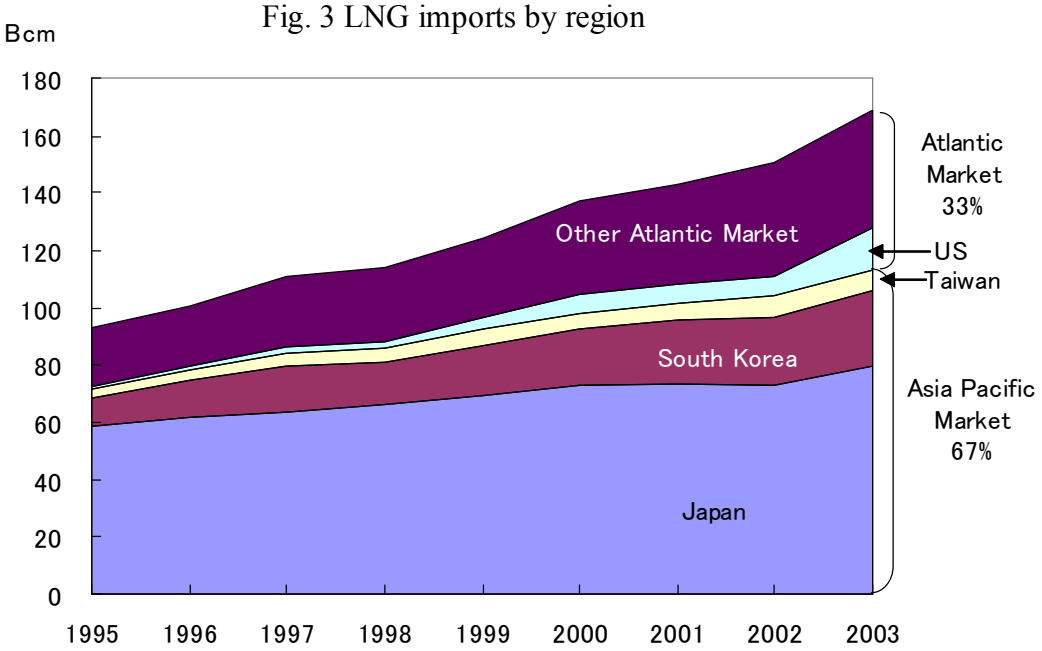
(Fig. 2)



(Source) Natural Gas in the World 1996-2004, Cedigaz

Concerning importing regions, LNG demand in the Asia Pacific market[2] was 113 Bcm and the Atlantic market[3] had a demand of 55 Bcm in 2003. Over the period of 1995 to 2003 the growth rate is 4.9% per year while that of the Atlantic market is 12.5% per year. (Fig. 3) The U.S.'s large increase in imports is a significant contributing factor.

Fig. 3 LNG imports by region



(Source) Natural Gas in the World 1996-2004, Cedigaz

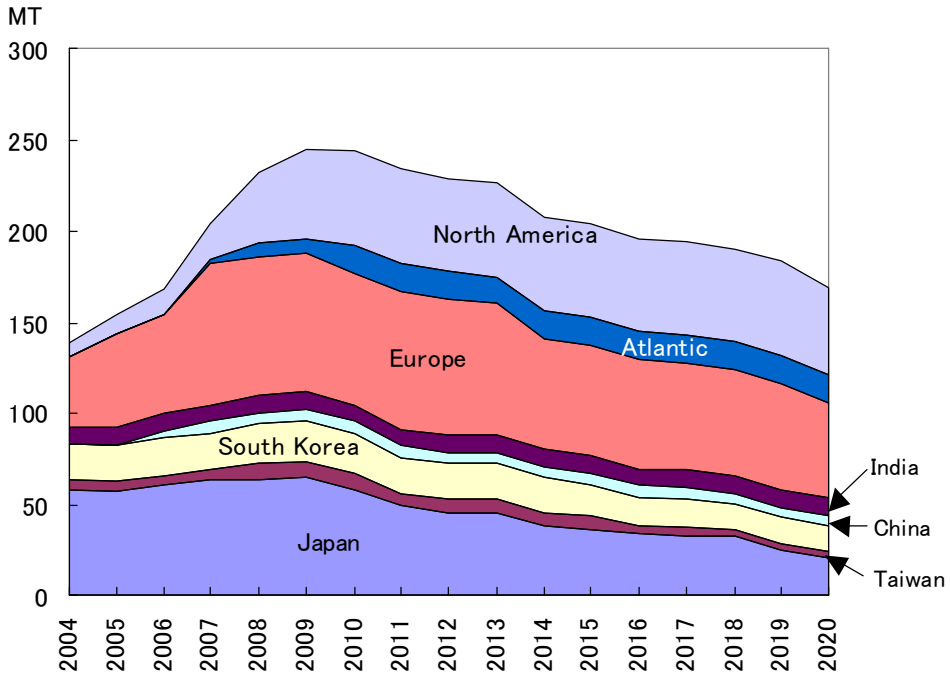
[2] This is for LNG importing and exporting countries east of the Suez Canal. Currently, in 2004, there are 8 exporting countries (Abu Dhabi, Oman, Qatar, Australia, Brunei, Indonesia, Malaysia, US), and 4 importing countries (Japan, South Korea, Taiwan, and India). US exports LNG from its Alaska pacific cost; therefore, this is included in the Asia Pacific Market.

[3] This is for LNG importing and exporting countries west of the Suez Canal. Currently, in 2004 there are 4 exporting countries (Algeria, Libya, Nigeria, Trinidad and Tobago), and 9 importing countries (US, Dominica Republic, Belgium, France, Spain, Portugal, Italy, Greece, Turkey) and the US territory Puerto Rico. Currently, because US is receiving LNG on its east coast and in the Gulf of Mexico, it is included in the Atlantic Market. Note, in January of 2005 Egypt has started exporting and in July the UK has restarted importing LNG.

(2) Mid and Long Term Contracts

Most of LNG trading is based on long term contracts of 20 years or more; however, recently mid-term contracts of 3 to 10 years have also been established. In 2004, these LNG mid to long term contracts volume reached 138.79MT. As will be discussed later, a large demand increase in the Atlantic market is anticipated and this is reflected in the contracted amounts through the year 2020. (Fig. 4) Many Indonesian and Australian contracts for Japan will expire after 2010. Currently, negotiations for extending these contracts and for new contracts are taking place.

Fig. 4 World mid and long term LNG contracts volume



(Note) 1. The values noted on this graph are the total of SPAs and HOAs, MOUs and LOIs values are not included.
2. If there is a range in the contracted amount, the lowest value is used for the summation. Also, option volumes are not included.
3. These values are the total of mid and long term contracts and actual supply may not match these contract values. Especially, amount supplied at the beginning of a project generally is less than the amount contracted. In addition, amount supplied goes up and down depending on gas demand trends in the importing country as well as operating conditions of the liquification plant.

(Source) LNG Trade and Infrastructures, Cedigaz, and company press releases etc.

(3) Spot Trading[4]

The world LNG spot trade amount in 2003 was 14.8 Bcm (10.8MT). Of this 11.7 Bcm (8.54MT) in the Atlantic market and 3.1 Bcm (2.26MT) in the Asia Pacific market. While this is only 8.7% of total LNG trading, the growth rate from the second half of the 1990s is significant. (Fig. 5) With production capacity expansion and effective

[4] This refers to contracts that are less than 1 year.

utilization of depreciated capacity, while the market will be based on long term contracts, there is the possibility that spot trading may continue to expand.

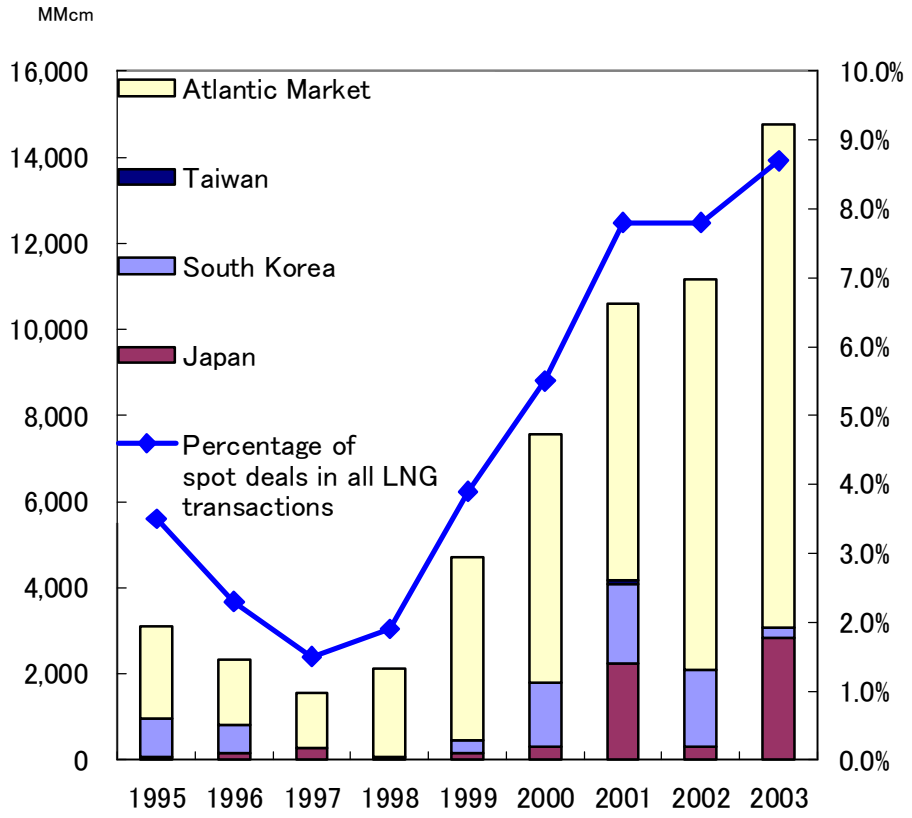


Fig. 5 World LNG spot deals

(Note) It is uncertain whether or on the above diagram includes swaps
(Source) Petrostrategies, July 26, 2004, BP Statistical Review of World Energy 2004

In 2003 Japan and South Korean imported 2.8 Bcm (2.04MT) and 0.23 Bcm (0.17MT) of spot LNG respectively. (Table 2) Japan's spot LNG imports are largely emergency measures in order to meet shortfalls in demand caused by such things as closing of the Arun liquification plants in Indonesia (2001) and closing of the Tokyo Electric's nuclear power generation plant (2002-2003). On the other hand, South Korea's spot LNG imports are primarily to cover high demands during the winter season.

Table 2 Spot LNG imports

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Japan	75	150	280		150	320	2,230	315	2,835
South Korea	900	675		75	305	1,470	1,870	1,790	225
Taiwan							75		
Total Asia Pacific	**975**	**825**	**280**	**75**	**455**	**1,790**	**4,175**	**2,105**	**3,060**
Spain	1,050	980	985	825	1,685	1,430	2,290	4,155	2,755
France	865	225			75	75	525	1,170	75
Italy				115	540	480	375	275	450
Puerto Rico								50	
Portugal						75			
Turkey	225	75		575	300				75
U.S.		225	300	525	1,660	3,725	3,235	3,420	8,340
Total Atlantic Market	**2,140**	**1,505**	**1,285**	**2,040**	**4,260**	**5,785**	**6,425**	**9,070**	**11,695**
Total	**3,115**	**2,330**	**1,565**	**2,115**	**4,715**	**7,575**	**10,600**	**11,175**	**14,755**

(Note) It is uncertain whether or on the above diagram includes swaps
(Source) Petrostrategies, July 26, 2004, BP Statistical Review of World Energy 2004

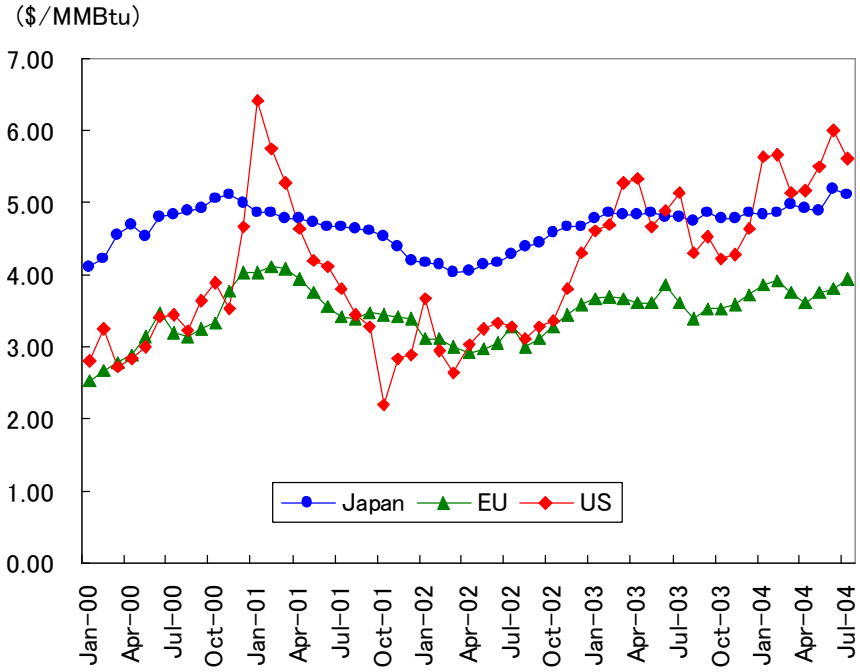
Several years back, a lack of LNG shipping capacity was an impediment to spot LNG orders. Recently, however, demand for spot LNG has increased and has exceeded production capacity. Therefore the balance of supply and demand is temporary tight.

(4) LNG Imports Pricing

LNG pricing differs by region; in Asia, the price is generally linked to the JCC (Japan Crude Cocktail), which is the average CIF price of crude oil for Japan. In the EU it is generally linked to petroleum products and to the Brent crude oil price. In the US, the price is determined by supply and demand based on natural gas trading at various hubs such as Henry Hub.

Fig. 6 shows LNG import prices for Japan, the US and the EU. From 2000 to 2003 LNG price for Japan was in the range of 4 to 5 dollars. EU price was roughly 1 dollar less than that for Japan. As both prices are linked to crude oil and petroleum product prices, there are similarities in how they move. On the other hand, US price over this same period has been more volatile. Reflecting the high increase the domestic gas price, LNG price for US rose to 6.41 dollars in January 2001. While the price plummeted afterwards, it began to rise in the latter part of 2002. Eventually, in the first half of 2004 US LNG price exceeded the price of LNG being sold to Japan.

Fig. 6 LNG import prices for Japan, EU and the US



(Source) Energy Prices & Taxes 2004 Fourth Quarter、IEA

3. LNG Chain

(1) Liquefaction Plants

The annual world production capacity of LNG in 2004, reached 147.2MT. On a regional basis, the Asia Pacific has the highest at 70.4MT, Africa and the Middle East 33.6MT and 32.5MT respectively; and North and Central America 10.7MT. (Table 3) LNG being shipped to Asia is primarily supplied by Asia Pacific, North America and the Middle East exporters while LNG being shipped to the US and EU is primarily supplied by Africa and the Middle East exporters. In 2004, LNG production capacity for Asian market is 104MT per year.

Table 3: Existing LNG production plants

Region	Country	Project name (Train)	Liquification capacity (MT/year)	Start of production	Investor(s)	Main destination(s)
Africa	Algeria	Arzew GL4Z (Train 1-3)	1.1	1964	Sonatrach	Europe, America
		Arzew GL1Z (Train 1-6)	7.8	1978		
		Arzew GL2Z (Train 1-6)	8.0	1980		
		Skikda GL1K (Train 1-3)	2.8	1972		

		Skikda GL2K (Train 4-6)	3.0	1980		
	Libya	Mara el Brega	1.3	1980	Serte Oil	Spain
	Nigeria	Nigeria LNG (Train 1, 2)	6.4	1999	Nigeria LNG (NNPC, Shell, Total, ENI)	Spain, Italy, France, Turkey, Portugal
		Nigeria LNG (Train 3)	3.2	2002		
	Subtotal		33.6			
Middle East	Abu Dhabi	ADGAS (Train 1, 2)	3.1	1977	ADGAS (ADNOC, Mitsui, BP, Total)	Japan, Spain
		ADGAS (Train 3)	2.3	1994		
	Oman	Oman LNG (Train 1, 2)	6.6	2000	Oman LNG (Omani government, Shell, Total, Mitsubishi, Mitsui, Partex, Itochu, Korea LNG	Japan, South Korea, Spain
	Qatar	Qatargas (Train 1-3)	9.2	1997	Qatargas (Qatar Petroleum, ExxonMobil, Total, Marubeni , Mitsui)	Japan, Spain
		RasGas (Train 1, 2)	6.6	1999	Ras Laffan LNG Company Limited (Qatar Petroleum, ExxonMobil, KOGAS, Itochu, LNG Japan)	South Korea
		RasGas (Train 3)	4.7	2004	Ras Laffan LNG Company Limited II (Qatar Petroleum, ExxonMobil)	India
	Subtotal		32.5			
North America	Alaska	Kenai (Train 1, 2)	1.1	1969	ConocoPhillips, Marathon	Japan
	Trinidad, Tobago	Atlantic LNG (train 1)	3.0	1999	Atlantic LNG (BP, BG, Repsol, NGC, Tractebel)	U.S., Spain, Puerto Rico
		Atlantic LNG (Train 2)	3.3	2002	Atlantic LNG (BP, BG, Repsol)	U.S., Spain
		Atlantic LNG (Train 3)	3.3	2003	Atlantic LNG (BP, BG, Repsol)	U.S., Spain
	Subtotal		10.7			

Table 3: Existing LNG production plants (continued)

Region	Country	Project name (Train)	Liquification capacity (MT/year)	Start of production	Investor(s)	Main destinations (s)
Asia Pacific	Brunei	Brunei LNG (Train 1-5)	7.2	1972-1974	Brunei LNG (Brunei government, Shell, Mitsubishi)	Japan, South Korea
	Indonesia	Bontang I (Train A, B)	5.2	1977	PT Badak NGL	Japan
		Bontang II (Train C, D	5.2	1983		Japan
		Bontang III (Train E)	2.8	1990		Taiwan
		Bontang IV (Train F)	2.8	1994		Japan
		Bontang V	3.1	1997		South Korea
		Bontang VI	3.2	1999		Taiwan
		Arun I (Train 1)	1.5	1978	PT Arun NGL	Japan
		Arun II (Train 4, 5)	3.0	1984		Japan
		Arun III (Train 6)	2.0	1987		South Korea
	Malaysia	Malaysia LNG I (Satu) (Train 1-3)	8.1	1983	Malaysia LNG (Petronas, Sarawak government, Mitsubishi)	Japan
		Malaysia LNG II (Dua) (Train 4-6)	7.8	1995	Malyasia LNG Dua (Petronas, Shell, Mitsubishi, Sarawak government	Japan, South Korea, Taiwan
		Malaysia LNG III (Tiga) (Train 7,8)	6.8	2003	Malaysia LNG Tiga (Petronas, Shell, Nippon Oil, Sarawak government, Mitsubishi)	Japan, South Korea
	Australia	NWS (Train 1-3)	7.5	1989-1992	Woodside, Shell, Chevron, BHP Billiton, BP, MMI	Japan
		NWS expansion (Train 4)	4.2	2004	Woodside, BHP Billiton, BP Chevron, Shell, MMI	Japan
	Subtotal		70.4			
Total			147.2			

(Source) LNG Trade and Infrastructures, Cedigaz and from company websites

In addition to these existing plants, there are a number of new and expansion projects. LNG production capacities with SPAs or HOAs signed amount to 119.6 MT. It is likely that these capacities will be realized around 2010. (Table 4)

Table 4 LNG production plants with SPA/HOA singed

Region	Country	Project name (Train)	Liquification capacity (MT/year)	Start of production	Investor(s)	Main destination(s)
Africa	Nigeria	NLNG (Train 4, 5)	8.2	2005	NLNG (NNPC, Shell, Total, ENI	Spain, Portugal, U.S., Italy
		NLNG (Train 6)	4.1	2007	NLNG (NNPC, Shell, Total, ENI	U.S., Europe, Mexico
	Egypt	Damietta LNG	5.5	2005	SEGAS (Union Fenosa Gas, EGAS, EGPC)	Spain
		Egyptian LNG (Train 1)	3.6	2005	BG, Petronas, EGAS, EGPC, Gaz de France	France, Europe
		Egyptian LNG (Train 2)	3.6	2006	BG, Petronas, EGAS, EGPC	U.S., Italy
	Subtotal	28.4				
Middle East	Oman	Qalhat LNG (Train 3)	3.7	2006	Omani government, Oman LNG, Union Fenosa	Europe, Asia
	Qatar	RasGas (Train 4)	4.7	2005	Ras Laffan LNG Company Limited II (Qatar Petroleum, ExxonMobil)	Europe
		RasGas (Train 5)	4.7	2007	Ras Laffan LNG Company Limited II (Qatar Petroleum, ExxonMobil)	Europe
		TasGas (Train 6, 7)	15.6	2008	Ras Laffan LNG Company Limited II (Qatar Petroleum, ExxonMobil)	U.S.
		Qatargas II (Train 1, 2)	15.6	2007	Qatar Petroleum, ExxonMobil, Total	UK, France, U.S.
		Qatargas 3	7.5	2008-2009	Qatar Petroleum, ConocoPhillips	U.S.
		Qatargas 4	7.8	2010-2012	Qatar Petroleum, Shell	Europe
	Yemen	Yemen LNG (Train 1, 2)	6.7	2008	Total, Yemen Gas Corp. Hunt, SK	Asia, Europe
	Subtotal	66.3				

Continued on next page

Table 4: SPA, HOA contracted LNG production plants (continued)

Region	Country	Project name (Train name)	Liquification capability (MT/year)	Start of production	Capital Investor(s)	Main destination(s)
Asia Pacific	Australia	Darwin LNG	3.5	2006	ConocoPhillips, Eni, Santos, Inpex, Tokyo Electric, Tokyo Gas	Asia
	Indonesia	Tangguh (Train 1, 2)	7.6	2008	BP, MI Berau, CNOOC, Nisseki Berau, KG Berau Wiriagar, LNG Japan	Asia Pacific
	Russia	Sakhalin II (Train 1, 2)	9.6	2007	Shell, Mitsui, Mitsubishi	Asia Pacific
	Subtotal		20.7			
Europe	Norway	Snohvit LNG	4.2	2007	Petro, Statoil, Total, Gaz de France, Amerada Hess, RWE	U.S., Europe
	Subtotal		4.2			
Total			119.6			

(Source) LNG Trade and Infrastructures, Cedigaz and from company websites

On a regional basis, the Middle East shows 66.3 MT, Africa 28.4 million MT, Asia Pacific 20.7 MT and Europe 4.2 MT. It is clear that most of the new projects in the Middle East and Africa are for the Atlantic market.

We should pay attention to the trend of enlarging of liquefaction capacity in order to reduce the cost. In addition, there are examples of downstream players such as power and gas companies participating in liquefaction projects. Examples include Union Fenosa which invests on Egypt Damietta project and Gaz de France invests Egyptian LNG and the Snohvit project in Norway. Also, in Japan, Tokyo Electric and Tokyo Gas invest on Darwin project in Australia. This can be viewed as a measure by downstream players for liberalizing energy markets.

Furthermore, there are many projects that are currently planned for commercialization. As shown in Table 5, there is a total of 179.6 MT of LNG production under planning. However, with respect to these projects, there is a significant difference in the feasibility depending on LNG demand growth, political stability, environmental restrictions and project development strategies. Therefore, it is possible that these projects may not be implemented. Even if they are implemented, there may be considerable delay.

Table 5: LNG production plants under planning

Region	Country	Project name (Train)	Liquification capability (MT/year)	Forecasted Start of production	Investor(s)	Main destination(s)
Africa	Algeria	Skikda	4.0	N.A.	Sonatrach	U.S., Europe
		GassiTouil (Arzew)	4.0	2010	Sonatrach	U.S., Europe

	Nigeria	West Niger Δ LNG	9.0	N.A.	ChevronTexaco, ConocoPhillips, ExxonMobil	N.A.
		Brass River LNG	10.0	2008-2009	NNPC, ConocoPhillips, Chevron, ENI	U.S., Mexico
	Angola	Angola LNG (Train 1)	4.0	2007	Chevron, Sonangol, BP, Total, ExxonMobil, Norsk Hydro	U.S., Europe
		Angola LNG (Train 2)	6.0	N.A.	Chevron, Sonangol	U.S., Europe
	Egypt	West Dmietta	4.0	N.A.	Shell, EGPC	N.A.
		Port of Damietta (Train 1, 2)	6.0	N.A.	BP, ENI	U.S., Europe
	Subtotal		47.0			
Europe	Russia	Shtokman LNG	14.00	2013	Gazprom	U.S.
	Subtotal		14.00			
Middle East	Iran	LNG 1: Iran LNG (Train 1, 2)	8.0	N.A.	NIOC, Reliance	India, Europe
		LNG 2: Pars LNG (Train 1, 2)	10.0	N.A.	NIOC, Total, Petronas	India, Europe
		LNG 3: Persian LNG (Train 1, 2)	14.0	2010	NIOC, Shell, Repsol	Asia, Europe
		LNG 4: NIOC LNG	10.0	N.A.	NIOC	Asia, Europe
	Subtotal		42.0			
North, Central, South America	U.S.	North Slope (Train 1-4)	9.0	N.A.	Yukon Pacific	U.S.
	Venezuela	Mariscal Sucre (Train 1)	4.7	N.A.	PDVSA, Shell, Mitsubishi	U.S.
	Peru	Peru LNG	4.4	2008	Hunt Oil, SK	U.S.
	Bolivia	Pacific LNG	6.6	N.A.	Repsol-YPF, BG, BP	U.S.
	Trinidad, Tobago	Atlantic LNG (Train 4)	5.2	2006	Atlantic LNG (BP, BG, Repsol, NGC, Tractebel	U.S., Europe
	Subtotal		29.9			

Continued on next page

Table 5: LNG production plants being investigated (continued)

Region	Country	Project name (Train)	Liquification capability (MT/year)	Forecasted Start of production	Investor(s)	Main destination(s)
Asia Oceania	Australia	Greater Sunrise	4.0	N.A.	Shell, ConocoPhillips, Osaka Gas, Woodside	Asia Pacific
		NWS (Train 5)	4.2	2008	Woodside, BHP Billiton, BP, Chevron, Shell, MIMI	China, Asia Pacific
		Gorgon (Train 1, 2)	10.0	2008	Cevron, Shell, ExxonMobil	U.S., China
		Tassie Shoal	2.5	2010	Methanol Australia	Asia
		Browse	10.0	2011	Woodside, Chevron, BP, BHP Billiton, Shell	Asia Pacific
		Scarborough	6.0	2008	BHP Billiton, ExxonMobil	U.S.
	Indonesia	Bongtang (Train I)	3.0	N.A	Pertamina	Asia Pacific
		Bongtang (Train J)	3.0	N.A.	Pertamina	Asia Pacific
		Sulawesi	N.A.	N.A.	Pertamina, Medco	Asia Pacific
		Natuna	N.A.	N.A.	ExxonMobil, Pertamina	Asia Pacific
	Brunei	Brunei LNG expansion	4.0	N.A.	Brunei LNG (Brunei government, Shell, Mitsubishi)	Asia Pacific
	Subtotal		46.0			
Total			179.6			

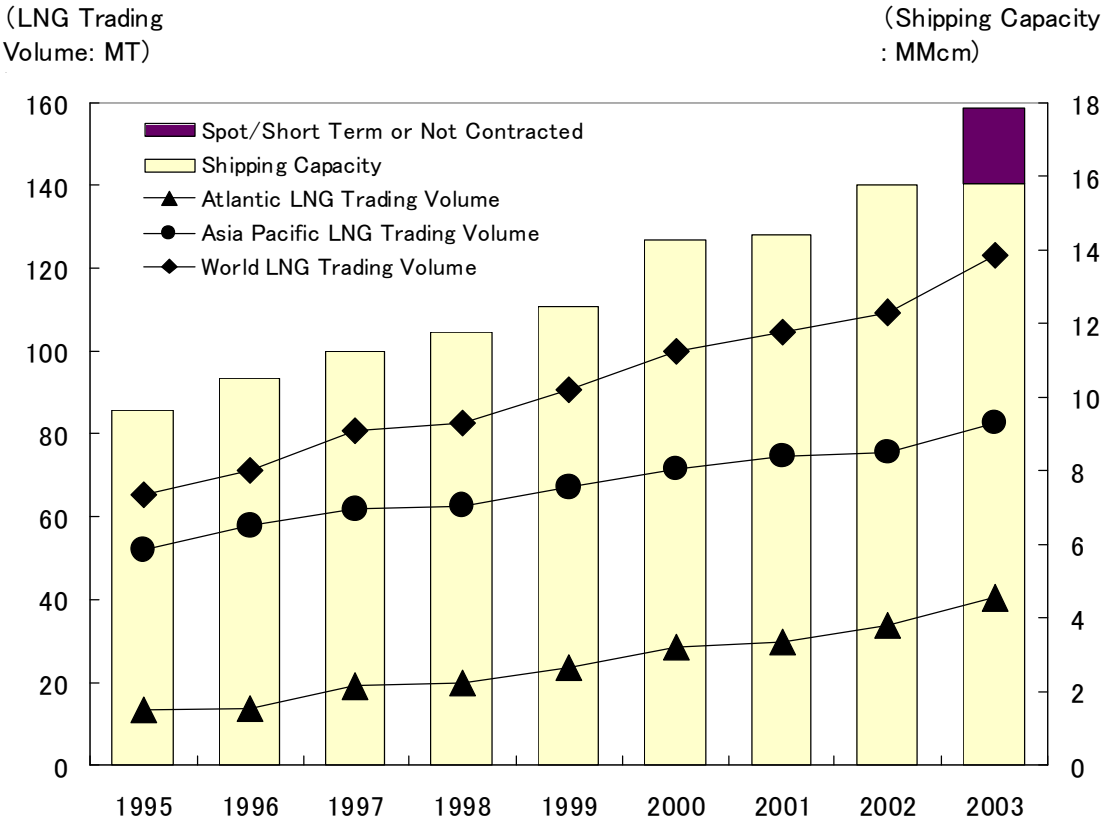
(Source) LNG Trade and Infrastructures, Cedigaz and from company websites

(2) LNG Ships

In 2003, the number of LNG ships was 153 with a total capacity of 15.8 Bcm. Due to increase in LNG demand, recently a large number of LNG ships are built. In 2003 alone, 15 ships were placed into service. The number of LNG ships may reach 300 by the year 2015.

Conventionally, LNG ships were generally constructed for specific long term contracts; however, in recent years there are LNG ships being built for short contracts and even some that have not entered into a charter contract. According to Cedigaz, 11% of the LNG shipping capacity in 2003 was used for either spot trading or short term contracts or was not contracted. (Fig. 7) In addition, both upstream players such as the Majors and trading houses and downstream players such as power and gas utilities own LNG ships to enter into the LNG shipping. Of the utilities in Japan, Tokyo Electric, Tokyo Gas, and Osaka Gas contracted their own LNG ships.

Fig. 7 LNG shipping capacity



(Source) LNG Trade and Infrastructures, Cedigaz

(3) Receiving Terminals

In 2004, there are 46 LNG receiving terminals in the world. Receiving capacities of these terminals reach 157.55 MT. On a regional basis, Japan has as much as 25 terminals and the US and Spain have 4 each. (Table 6)

Table 6, Existing LNG receiving terminals

Region	Country	Name	Investor(s)	Receiving capacity (MT/year)	Storage capacity (1000 kL)	Start up
	U.S.	Everett	Tractebel LNG	5.4	155	1971
		Lake Charles	Trunkline LNG (Southern Union Panhandle	7.67	285	1982
		Cove Point	Dominion	7.7	373	1978
		Elba Island	Southern LNG (El Paso)	3.4	189	1978
	Puerto Rico	Penualas	EcoElectrica	1.3	160	2000
	Dominica Republic	Andres	AES	0.6	160	2003
	Subtotal			25.47	1322	

Continued on next page

Table 6: Existing LNG receiving terminals (continued)

Region	Country	Name	Investor(s)	Receiving capacity (MT/year)	Storage capacity (1,000 kL)	Start up
Asia	Japan	Sendai	Sendai City Gas	0.15	80	1997
		Higashi Niigata	Nihonkan LNG	4.0	720	1984
		Futtsu	Tokyo Electric	7.0	860	1985
		Sodegaura	Tokyo Electric, Tokyo Gas	9.5	2660	1973
		Higashi Ogishima	Tokyo Electric	6.0	540	1984
		Ogishima	Tokyo Gas	1.5	600	1998
		Negishi	Tokyo Electric, Tokyo Gas	3.5	1180	1969
		Sodeshi	Shimizu LNG	0.34	177	1996
		Chita Kyodo	Chubu Electric, Toho Gas	1.4	300	1977
		Chita	Chita LNG	3.1	640	1983
		Chita Midorihama	Toho Gas	0.8	200	2001
		Yokkaichi LNG Center	Chubu Electric	3.0	200	2001
		Yokkaichi	Toho Gas	0.33	160	1991
		Kawagoe	Chubu Electric	4.0	480	1997
		Senboku 1	Osaka Gas	0.8	180	1972
		Senboku 2	Osaka Gas	7.7	1585	1977
		Himeji	Osaka Gas	2.6	740	1984
		Himeji LNG	Kansai Electric	2.6	520	1979
		Hatsukaichi	Hiroshima Gas	0.2	85	1996
		Yanai	Chugoku Electric	1.3	480	1990
		Oita	Oita LNG	2.6	460	1990
		Tobata	Kitakyushu LNG	1.3	480	1977
		Fukuoka	Saibu Gas	0.23	70	1993
		Nagasaki	Saibu Gas	0.11	35	2003
		Kagoshima	Nihon Gas	0.08	36	1996
		Japan total		64.14	13,588	
	South Korea	Pyeongtaek	KOGAS	7.2	1,000	1986
		Inchon	KOGAS	7.2	1,680	1996
		Tongyoung	KOGAS	3.0	420	2002
		South Korea Total		17.4	3,100	
	Taiwan	Yung An	CPC	7.44	690	1990
	India	Daheji	Petronet	5.0	320	2004
	Subtotal			88.98	17,378	
Europe	Belgium	Zeebrugge	Fluxys	4.8	261	1987
	France	Fos-sur-Mer	Gaz de France	5.8	150	1972
		Montoir-de-Bretagne	Gaz de France	8.2	360	1980
	Italy	Panigalia	Nam	2.6	100	1971
	Spain	Barcelona	Enagas	6.2	240	1969
		Cartagena	Enagas	0.9	55	1989
		Huelva	Enagas	2.7	165	1988

		Bilbao	BP, Respol, Iberdola, EVE	2.0	160	2003
	Portugal	Sines	Transgas	3.8	120	2003
	Greece	Revythoussa	DEPA	1.5	130	2000
	Turkey	Marmara Ereglisi	Botas	4.6	255	1994
	Subtotal			43.1	1,996	
Total				157.55	20,696	

(Source) LNG Trade and Infrastructures, Cedigaz and company websites

In addition to existing terminals, there are a number of projects that are currently being planned., especially in North America and China where demand for LNG is expected to grow rapidly. However, feasibility varies significantly between these projects, depending on project economics, environmental and social restrictions, national infrastructure policy and other factors.

We already mentioned that some downstream players invest on liquification plants. For receiving terminals, it is often the case with upstream players investing on receiving terminals so that they can market their own LNG. Thus it can be seen that mutual participation of the players in the LNG chain is accelerating.

Table 7, LNG receiving terminal under planning

Region	Country	Name	Investor(s)	Receiving capacity (MT/year)	Start up
North America	U.S.	Cameron, LA	Sempra Energy	11.5	2008
		Port Pelican (Offshore), LA	Chevron	12.26	2007
		Freeport, TX	Cheniere Energy, ConocoPhillips	11.5	2007
		West Cameron, (Offshore), Gulf of Mexico	El Paso Excelerate	3.83	2005
		Sabine, LA	Cheniere Energy	N.A.	N.A.
		Fall River, MA	Hess LNG	6.13	2007
		Logan Township, NJ	Crown Landing LNG	9.2	2009
		Providence, RI	BG, Keyspan	3.83	N.A.
		LI Sound, NY	TransCanada, Shell	7.67	2006
		Corpus Christi, TX	Cheniere Energy	19,93	2007
		Corpus Christi, TX	ExxonMobil	7.67	2008-2009
		Corpus Christi, Tx	Ingleside Energy	7.67	N.A.
		Sabine, LA	ExxonMobil	7.67	N.A.
		Port Arthur, TX	Sempra Energy	11.50	N.A.
		Pascagoula, MS	Gulf LNG	7.67	2009
		(Off-shore) LA	Shell	7.67	N.A.
		(Off-shore), LA	McMoran	7.67	N.A.
		(Off-shore), Gulf of Mexico	Compass Port-ConocoPhillips	7.67	N.A.
		(Off-shore), Gulf of Mexico	Beacon Port-ConocoPhillips	11.5	N.A.

		(Off-shore), Gulf of Mexico	Pearl Crossing-ExxonMobil	21.46	N.A.
		Long Beach, CA	Mitsubishi Corporation, ConocoPhillips	5.37	2007-2008
		Cabrillo Port (Off-shore), CA	BHP Billiton	11.5	2008
		(Off-shore), CA	Crystal Energy	3.83	N.A.
		Somerset, MA	Somerset LNG	4.98	N.A.
		Peasent, ME	Quoddy Bay	3.83	N.A.
		(Off-sore) Boston, MA	Excelerate Energy	6.13	N.A.
		Philadelphia, PA	Freedom Energy Center-PGW	4.6	N.A.
		Cameron, LA	Creole Trail LNG-Cheniere Energy	25.29	N.A.
		Galveston, TX	BP	9.2	2009
		Port Lavaca, TX	Calhoun LNG- Gulf Coast LNG Partners	7.67	N.A.
		Coos Bay, OR	Energy Projects Development	1.0	N.A.
		St. Helens, OR	Port Westward LNG	5.37	N.A.
		Astoria, OR	Skipanon LNG-Calpine	7.67	N.A.
		(Off-shore), CA	ChevronTexaco	5.75	N.A.

Continued on Next Page

Table 7, LNG receiving terminals under planning (continued)

Region	Country	Name	Investor(s)	Receiving capacity (MT/year)	Start up
North America	Canada	St. John, NB	Irving Oil	7.67	N.A.
		Point Tupper, NS	Bear Head LNG – Anadarko	7.67	2007
		Quebec City, QC	Project Rabaska- Enbridge, Gaz Met, Gaz de France	3.83	N.A.
		Riviere-du-Loup, QC	Cacouna Energy- TransCanada, PetroCanada	3.83	N.A.
		Goldboro, NS	Keltic Petrochemicals	7.67	N.A.
		Kitimat, BC	Galveston LNG	2.61	N.A.
		Price Rupert, BC	WestPac Terminals	2.3	N.A.
	Mexico	Altamira, Tamulipas	Shell, Total, Mitsui & Co. Ltd.	8.58	N.A.
		Cost Azul, Baja California	Shell, Sempra	7.67	2007
		Coronado Island (Off-shore), Baja California	Chevron	10.73	2007
		Puerto Libertad, Sonora	DKRW Energy	9.96	2008
		Lazaro Cardenas	Tractebel	3.83	2007-2008
Central America	Honduras	Puerto Cortes	AES	1.9	2005
	Bahamas	Bahama	FPL Resources, Tractebel, El Paso	6.44	N.A.
		Bahama	AES Ocean Express	6.44	2006-2007
	Brazil	Suape	Shell	1.6	N.A.
	Chile	Quintero Bay	ENAP	0.4	2009
Europe	France	Fos-sur-Mer 2	Gaz de France, Total	6.0	2007
	Italy	Rovigo	ExxonMobil, Edison	3.7	2008
		Brindisi	BG, Enel	6.0	2008
		Tranto	Enel	3.5	N.A.
		Vado Ligure	Enel	3.5	N.A.
		Muggia	Enel	3.5	N.A.
		Livorno	OLT, Falck	2.2	N.A.
		Rosignano	Edison, Solvay, BP	2.2	N.A.
		Trieste	Gas Natural	5.84	N.A.
		Taranto	Gas Natural	5.84	N.A.
		Syracuse	Shell, ERG	5.84	2010
	Spain	Sagunto	Union Fenosa, Iberdrola, Endesa	3.7	2006
		Reganosa	Endesa, Union Fenosa, Sonatrach	2.1	2007
		Gran Canaria	Endessa	N.A.	2008
	UK	Isle of Grain	National Grid Transco	3.3	2005
		Milford Haven	Petroplus, BG, Petronas	8.76	2007
		Milford Haven	ExxonMobil, Qatar Petroleum	14.0	2007

Continued on next page

Table 7 LNG receiving terminals under planning (continued)

Region	Country	Name	Investor(s)	Receiving capacity (MT/year)	Start up
Asia Oceania	China	Shenzhen, Guangdong	CNOOC, BP etc	3.7-6.7	2006
		Putian, Fujian	CNOOC, Fujian Investment and Development	2.6-5.0	2007
		Qingdao, Shangdong	Sinopec	3.0-5.0	2008
		Shanghai	CNOOC, Shenergy	3.0-6.0	2008
		Ningbo, Zhejiang	CNOOC, [Chinese]	3.0-6.0	2008
		Rudong, Jiangsu	PetroChina	3.0-4.0	2008
		Darlian, Liaoning	PetroChina	2.0-4.0	2008
		Tiangjing	CNOOC	3.0	2010
		Zhuhai, Guangdong	CNOOC	3.0	2010
		Swatou, Guangdong	CNOOC	2.5	2010
		Guangxi	PetroChina	3.0	2010
		Hong Kong	CLP	3.0	2011
		Yingkou, Liaoning	CNOOC	3.0	N.A
		Binhai, Jiangsu	CNOOC	3.0	N.A.
	India	Kochi	Petronet	2.5	2007
		Hazira	Shell, Total	2.5	2005
		Dabhol	Petronet, NTPC, Gail	5.0	N.A.
		Ennore	IOC, Petronas	2.5-3.0	2007-2008
		Mangabre	HPCL, Petronet, MRPL	2.5	N.A.
	Japan	Sakai	Sakai LNG	2.7	2005
		Mizushima	Chugoku Electric, Nippon Oil Corporation	3.0	2006
		Wakayama	Kansai Electric	N.A.	N.A.
		Joetsu	Chubu Electric, Tohoku Electric	N.A.	N.A.
		Sakaide	Shikoku Electric	N.A.	2010
		Okinawa	Okinawa Electric	N.A.	2010
	South Korea	[Korean]	POSCO	1.7	2005
		[Korean]	LG-Caltex Oil	1.5	2008
	Taiwan	Taichung	CPC	4.5	2008
	Philippines	Bataan	GN Power	N.A.	N.A.
	Indonesia	Cilegon	PLN	3.0	2007
	Singapore	Singapore	Gas Supply Pte, PowerGas	N.A.	N.A.
	Thailand	N.A.	PTT	3.0-5.0	2010
	New Zealand	N.A.	Contact Energy, Genesis Energy	0.9-1.08	2011

(Source) LNG Trade and Infrastructures, Cedigaz and company websites

4. LNG Balance of Supply and Demand

(1) LNG Demand Forecast

Table 8 shows world LNG demand forecast by research institution, consultancy and gas company. With respect to LNG demand of 125.04 MT, the forecasted demand in 2010 and 2020 is respectively 201.2 MT to 245.4 MT and 320.1 MT to 393.4 MT. On a regional basis demand in Asia is expected to rise from 84.05 MT in 2003 to 109 MT to 132 MT in 2010 and to 147 MT to 184 MT in 2020. In Europe, the demand is expected to reach 56-74.4 MT in 2010 and 86.5-113.4 MT in 2020 and the growth in the UK will be especially high. Reflecting rapid LNG demand growth in the US, it is anticipated that North American demand will be 35-46 MT in 2010 and 81-107 MT in 2020. Thus, according to these forecasts, demand in Europe, North and Latin America may exceed that of Asia, and in 2020 US may be the largest LNG importer.

Table 8 LNG Demand Forecasts

2010 (MT)

		2003 demand	Cedigaz	Gas Strategies	Tokyo Gas
Asia	Japan	59.0	63-64	60	64-70
	South Korea	19.5	22.5-23.5	30	25-28
	Taiwan	5.55	8.5-9.5	11	10-12
	India	-	9-11	12	5-10
	China	-	6-8	10	7-10
	Other	-	0-1	0	0-2
	Subtotal	84.05	109-117	123	111-132
Europe	Belgium	2.3	3.5-4.2	6	
	France	7.3	10.5-11.5	16	
	Greece	0.39	0.5-0.6	0.4	
	Italy	4.1	11-13	11	
	Portugal	0.63	3-3.5	10	
	Spain	11.2	18.5-20.5	19	
	Turkey	3.7	4-4.5	40	
	UK	-	5-10	17	
	Others	-	-	-	
	Subtotal	29.62	56-67.8	74.4	
North America	U.S.	10.6	35-40	35	
	Canada		0-3	-	
	Mexico	-	0-3	40	
	Others	-	-	0.7	
	Subtotal	10.6	35-46	46	
Central and South America	Brazil	-	-	-	
	Chile	-	0-2	-	
	Others	0.77	1.2-1.4	2	
	Subtotal	0.77	1.2-3.4	2	
Total		125.04	201.2-234.2	245.4	-

Continued on next page

Table 8 LNG Demand Forecasts (continued)

2020

		Cedigaz	Gas Strategies	Tokyo Gas
Asia	Japan	73-75	67	
	South Korea	30-33	46	
	Taiwan	12-13.5	19	
	India	15-20	17	
	China	13.5-15.5	30	
	Other	3.5-7	5	
	Subtotal	147-164	184	
Europe	Belgium	5-5.5	7	
	France	12.5-14.5	21	
	Greece	0.5-0.6	0.4	
	Italy	16-18	18	
	Portugal	4-4.5	3	
	Spain	24-26	24	
	Turkey	4.5-5.5	5	
	UK	20-25	35	
	Others	0-1	-	
	Subtotal	86.5-100.6	113.4	
North America	U.S.	66-85	61	
	Canada	7.5-12	-	
	Mexico	7.5-10	10	
	Others	-	20	
	Subtotal	81-107	91	
Central and South America	Brazil	1-2	-	
	Chile	3-5	-	
	Others	1.6-1.8	5	
	Subtotal	5.6-8.8	5	
Total		320.1-380.4	393.4	-

(Source) Amount imported in 2003: Cedigaz, demand forecast: Cedigaz (December, 2004), Gas Strategies (December, 2004), Tokyo Gas (February, 2005)

(2) LNG Supply Potential

This section refers to the LNG production capacity figures for the year 2003 to match the latest demand data, not to Table 6 above that shows the figures for 2004. LNG production capacity at the end of 2003 was 137.1 MT/year. The production capacity in Africa and Central and South America (43.2 MT) is mainly for the Atlantic market. The production capacity in Asia Pacific, North America, and the Middle East (93.9 MT) is mainly for the Asian Market; however, 2.54 MT was supplied to the Atlantic market in 2003. Therefore, there was 91.36 MT LNG capacity for the Asian Market in 2003.

New liquefaction capacity with SPA or HOA signed is a total of 129.7 MT. As these projects are likely to be realized, total capacity around 2010 can be 266.8 MT/year. Subtracting the total liquification capacity in Africa and Europe (existing 43.2 MT, SPA/HOA signed 32.6 MT) and Middle Eastern supply for the Atlantic market (current amount of 2.54 MT and SPA/HOA signed 72.38 MT), LNG supply potential for Asia can be estimated to be 116.08 MT in 2010.

In addition, as shown in Table 8, many other LNG projects, with capacity total 6MT,

are under planning. After subtracting the total capacity of Africa, North, Central, and South America (90.9 MT) and the 10 MT capacity of the Middle East and Asia Pacific capacity for Europe and North America it is possible that an additional 78.7 MT will be available for the Asian market. Therefore, the total of existing, SPA/HOA signed and planned, there is the possibility that capacity may reach 194.78 MT.

Table 9 LNG supply capability for the Asian Market

		Liquifaction Capacity (MT/year)
Current, 2003	Asia Pacific	66.2
	North America	1.1
	Middle East	26.6
	Subtotal	93.9
	Supply for US and Europe	-2.54
	Capacity for Asia	91.36
SPA/HOA signed	Asia Pacific	24.9
	Middle East	72.2
	Subtotal	97.1
	Supply for US and Europe	-72.38
	Capacity for Asia	24.72
Under planning	Asia Pacific	46.7
	Middle East	42
	Subtotal	88.7
	Supplied for US and Europe	-10
	Capacity for Asia	78.70
Total capacity for Asia		194.78

(Source) LNG Trade and Infrastructures, Cedigaz and from company websites

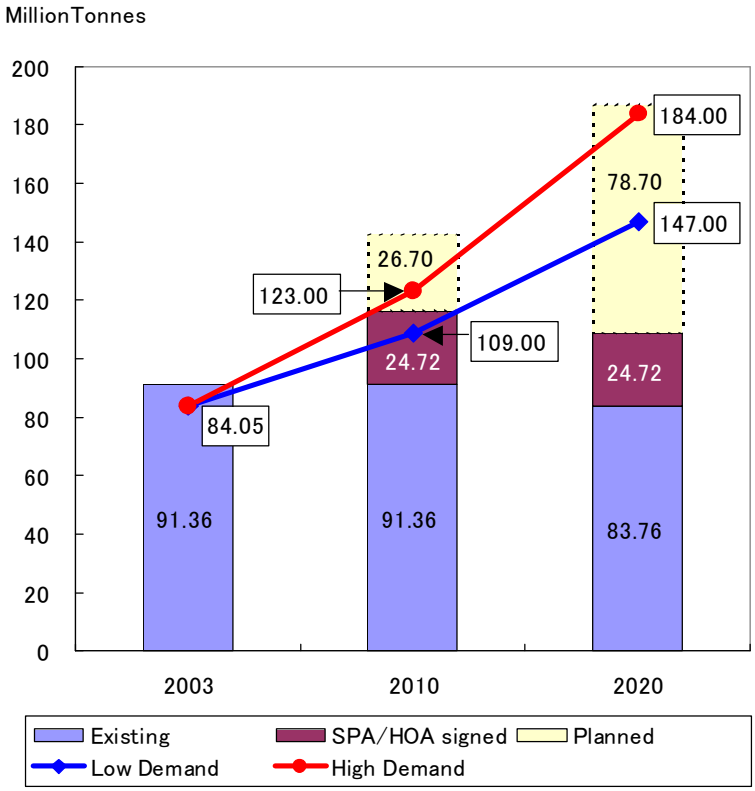
(3) LNG demand supply balance for Asia

Based on the LNG demand forecasts and supply potential above, the demand-supply balance is outlined here for 2010 and 2020.The demand in the year 2003 was 84.05 MT and the forecast demand in 2010 is 109-132 MT and in 2020 147-184 MT.

On the other hand, LNG production capacity for Asia is currently 91.36 MT, 24.72 MT for SPA/ HOA signed,78.7MT for projects under planning. Of the projects under planning, production capacity of 26.70 MT is expected to start operation by 2010, and thus is included in the capacity for 2010. In addition the production capacity of 78.70 MT is scheduled to start operation after 2010. Therefore, those are included in the capacity for 2020. As for the year 2020, 7.6MT capacity of Indonesia's Arun and Alaska's Kenai is excluded since these already show signs of depletion.

Existing and SPA/HOA signed capacity can supply the low demand forecast for 2010. In order to balance with the high demand for 2010, 15.92 MT production capacity of those projects under planning is needed. As for 2020, it is necessary to develop all the SPA/HOA signed projects as well as 38.52 to 75.52 MT capacity of those projects under planning. (Fig. 8)

Fig. 8. LNG demand balance for Asia



(Source) Cedigaz, Gas Strategies, Tokyo Gas

However, the LNG projects mentioned above will compete more or less with one another; therefore, it is unlikely that all of them will be implemented. Moreover, in order to realize, even partially, the potential supply capacities shown here, it will be necessary to overcome economic, political, social and ecological constraints so that each LNG developer can make investment decision. In addition, the above capacity may be utilized for Europe and North America. However, it appears that it will be relatively easy to achieve sufficient supply to meet demand for the year 2010.

5. LNG chain: scale up and new technology

(1) Emergence of larger liquefaction plants.

Currently, the Damietta project in Egypt (started production in 2005) has the largest liquefaction capacity per train (5.5 MT); however, capacity of Qatargas II will be 7.8 MT per year (equivalent to over a 40% scale increase). Perusing economics of scale in relation to liquefaction as well as shipping is g the size of liquification facilities is entering a new phase. Therefore, further cost reductions for LNG can be anticipated.

Note a new AP-X^{TM} process from Air Products is being adopted for this Qatargas II

project[5]. We need to watch closely whether Air Products' technology will be used also for other larger liquefaction plants.

(2) Emergence of larger LNG ships.

Currently, the largest LNG ships in service have a capacity of 145,000 m^3 and there is currently a ship being built with a capacity of 155,000 m^3. An announcement has been made concerning a LNG ship related to the Qatargas II project. A scale that significantly surpasses these capacities with a capacity of 216,200 m^3 (equivalent to greater than 40% scale increase) will be ordered and is scheduled to go into service for the Atlantic market in 2007-2008.

Note, these huge LNG ships cannot necessarily serve existing receiving terminals without checking suitability for entering port, reaching the dock, and equipment for unloading.

(3) Implementation of Receiving and Re-vaporization Facility[6] on the Surface

1) Onboard regasification ship (Energy Bridge)

West Cameron project of Excelerate Energy in the US is using a system called "Energy Bridge". This is a system where LNG is regasified onboard and sent the gas to the shore. Energy Bridge will be installed in the Gulf of Mexico 116 miles (187 km) off the shore of Louisiana. Energy Bridge is a technology developed by El Paso in order to avoid regulational restriction[7] and community opposition[8] towards receiving terminal construction receiving. However, as a result of worsening of financial conditions at El Paso, Excelerate Energy[9] purchased the technology in December of 2003. Two Energy Bridge ships with 0.5Bcfd regasification capacity have been built by Daewoo Shipping and Marine Engineering of South Korea. These were placed into service in January 2005, and after loading LNG in Malaysia, the first ship arrived in the Gulf of Mexico in March.

From the perspective of ship operating efficiency, there is the demerit of having to remain anchored for a longer period of time. However, off-shore terminal projects are likely fact less opposition and construction approval can be easier to obtain. Therefore, this is gaining attention as an element in a new form of LNG supply chain.

2) Gravity Based Structure for Off-shore Receiving Facility[10]

Port Pelican project by Chevron in Louisiana has obtained approval for construction of an offshore gravity based receiving terminal from the Maritime Administration, which is a subsidiary organization within the Department of Transportation, in November of 2003[11]. For this project, the berth to receive LNG, re-gasification equipment, and storage tanks will be constructed 40 miles off Louisiana coast and

[5] Air Products press release, January 24, 2005

[6] Review by Kojima, Masanori, LNG Receiving at Sea – Technology and Project Status, Japan Institute of Energy Journal vol. 84, 1, January, 2005

[7] Prior to dismissing of the TPA that was being carried by the LNG receiving facility owners, this equipment placement was used to escape from this TPA.

[8] This has been termed NIMBY (Not In My Backyard) and BANANA (Build Absolutely Nothing Anywhere Near Anything).

[9] Excelerate Energy Press Release, December 17, 2003

[10] ExxonMobil / Qatar Petroleum・Edison are the implementing agencies and the Rovigo location planned in Italy will also use this method.

[11] ChevronTexaco Press Release, November 17, 2003

installed as gravity based structure LNG storage tank on the ocean floor. Land and the receiving location are linked by a pipeline and re-gasification capacity is 1.6 Bcfd (12.26 MT).

Although this project is likely to be postponed due to high equipment costs and delays in progress of the liquification facility by Chevron[12]; this is gaining attention similar to Energy Bridge as a method of resolving selecting receiving location for the same reasons described previously.

6. Indonesia's Supply Reliability

Due to insufficient gas supply and production facility failure at the Indonesia Bontang liquification plant, deliveries of long term contracted amounts to Japan and South Korea were delayed all around. In order to make up for the insufficiency in production and delivery, 1 cargo shipment order was placed with Nigeria in December, 2003 and another cargo shipment order was placed with Oman in March, 2004. In addition 1 cargo shipment each from Abu Dhabi and Nigeria were reportedly ordered in June, 2004[13]. Furthermore, lack of feed gas supply for Bontang plants resulted in 7 cargo-non-delivery and 6 cargo procurement from other sources[14].

In December 2004, because of reduced production caused by these issues at the Bontang liquification facility and declining of reserves at the Arun gas field, Indonesia requested buyers for reduction of supply in 2005[15]. It has been reported that Indonesia will fulfill contracts with Japanese buyers, and that even in the case of supply reduction, it will be done with the agreement of the buyers, and that while supply will be reduced Japanese buyers have already secured replacement[16].

In the end, as buyers were able to secure replacements from other projects. However, since recovering sufficient supply is not certain in the short term, we cannot deny Indonesia's supply credibility has been damaged. In addition, this issue is the cause of the tightening of the LNG supply and demand balance and a speedy recovery of supply capability will be beneficial to both buyers and sellers.

7. Trends Affecting the LNG Market

(1) LNG Pricing and Indicators

East Asian LNG importers such as Japan, Korea, and Taiwan, generally lack natural gas resource, and depend on LNG imports for their natural gas supply. Therefore, this is a market where stable supply is extremely important. Capital intensive LNG projects needed long term contracts for financial purpose. Therefore, LNG market has characteristics of limited surplus capacity, lower liquidity and potential market control by limited number of suppliers.

In this type of market, long term contracts with take or pay clause will continue to be essential to secure stable supply. Higher liquidity like in the US and some European countries is not likely to be reality in Asia for the time being.

In the Asia Pacific market, LNG trading has conventionally been based on a price

[12] Natural Gas Week, October 18, 2004
[13] TEX Report, June 18, 2004
[14] International Gas Report, September 24, 2004
[15] Gas Matters Today, December 8, 2004, Nihon Keizai Shimbun, December 8, 2004, Platts Commodity News, December 8, 2004
[16] Platts Commodity News, December 8, 2004、Gas Matters Today, December 16, 2004, Gas Energy News, December 15, 2004, International Gas Report, January 14, 2005

formula linked to the JCC[17]. However, in recent negotiations for extensions of long term contracts for Japan, the possibility of non-JCC link price formulae was reported.[18]. This is to introduce diversity such as taking highly transparent indicators other than JCC such as Brent and giving consideration to link petroleum products and coal prices. There can be considered a part of changes that are starting to emerge for new LNG pricing.

However, it is unlikely that significant changes in terms of LNG pricing will take place. For example, introduction of Henry Hub pricing would most likely lead to higher price volatility, which Asian buyers will not accept. In general, it can be said that JCC linkage pricing gains certain popularity, although some buyer may prefer Henry Hub linkage to pursue trading liquidity.

It is arguable that JCC can be replaced by WTI (West Texas Intermediate) or Brent as reference crude mainly because of easier price-hedging and acceptability by exporters who also export crude oil. As for Indonesia's ICP (Indonesia Crude Price) linkage, JCC, WTI or Brent can be a replacement. For Indian and Chinese markets, floor/ceiling and lower oil linkage were already introduced. We expect these variation, rather than uniform JCC linkage, can be sustained in the future.

(2) New LNG flows and Qatar's presence

Existing LNG production capacity at the end of 2004, when reviewed on a per country basis is Indonesia with 28.8 MT/year, Malaysia and Algeria with 22.7 MT/year and next Qatar with 20.5 MT/year. As for capacity with SPA/HOA signed, Indonesia has 7.6 MT/year, Malaysia and Algeria do not have plans for the foreseeable future while Qatar has 55.9 MT per year. As a result, if production capacity proceeds according to plan, Qatar will have nearly 76 MT production capacity in 2012 to be the largest LNG exporter in the world.

Currently Qatar's main destinations are 11 MT/year to Japan and South Korea and 5 MT/year to India. Of the additional production capacity, while 3 MT/year is designated for Taiwan and 2.5 MT/year is designated for India, the rest of the capacity (more than 40MT/year) will serve the Atlantic market. When implemented, Qatar will supply a large share of the Atlantic market and their presence and influence will be huge not only in the Asia Pacific market but also in the Atlantic market.

Recently, Sakhalin II (37 MT over 20 years, 2008 onward) and Tangguh (3.7 MT /year, 2008 onward) projects contracted to supply LNG to North American market. The LNG price for the latter will be determined by Socal price, which is the average price of three Hubs in Southern California.

We should note that these are new LNG flows, crossing the Pacific ocean to the west coast of North America However, from a volume perspective, compared to the 84 MT traded in Asia Pacific, this is only an additional 5 MT and does not even amount to 10% of the current level of trading. Taking into consideration the conditions for the foreseeable future and the Asian Market characteristics as described in (7.(1)), if a price differential develops between JCC and Socal, arbitrage can take place. However, it is considered that the effect of introduction of a new trading mechanism will be limited for the foreseeable future.

---

[17] Petroleum Commission Development and Natural Gas Committee (Third), November 9, 2000

[18] TEX Report, January 18, 2005

[19] Dispute that because petroleum is higher priced in Asia, using this as an indicator for LNG price determination has the result of a higher price for LNG as well.

(3) Players with new function

Conventionally, LNG importers were mostly power and gas companies. However, recently sellers, international oil companies (IOCs) and trading houses frequently become also buyers to market their own LNG. Shell's Sakhalin II and BP's Tangguh are the typical examples. In addition, in June, 2004, Mitsubishi and Itochu who are participating in the Oman Qalhat LNG project are the first Japanese trading houses to enter long term LNG contracts. The share of the total of SPAs and HOAs by IOCs, trading companies, which do not necessarily consume LNG themselves, is anticipated to increase from the current 6% in 2004 to 30% by the year 2010.

From interpretation of this phenomenon the following points can be suggested. First, IOCs are advancing into the downstream market to monetilize their upstream assets.

Second, in liberalized market, LNG importers such as power and gas companies need various flexibilities in their contract, while there are limits to the ability of sellers providing this on their own. IOCs and trading houses see a new business opportunity to offer volume risk hedging function.

Third, liquid markets such as the US and the UK, exporters are exposed to relatively higher price risk, but volume risk is relatively low. Therefore, IOCs and trading houses can sell their LNG relatively easily if price volatility is not considered. With the increase of these contracts, it is possible that LNG will be delivered from multiple liquefaction facilities to multiple destinations within the range set by the SPA in order to maximize profit. As a result, it can be said that these contracts will contribute to increasing liquidity of the LNG market.

(4) Conclusion

World LNG exporting countries and importing countries are increasing and the LNG market will continue to expand both on a volume and geographical basis. In the Atlantic market, especially the US and the UK markets can be the main drivers to create new major LNG flows. New flows will emerge also in Asia Pacific market. There are changes found in market players and trading, too. LNG buyers now include not only power and gas utilities but also IOCs and trading houses. Some traditional upstream players invest on receiving terminal, and some downstream players enter into upstream business. Concluding FOB contracts are becoming common for buyers to reduce transportation cost and increase supply flexibility. In addition, more liquefaction and receiving facilities can contribute to increase liquidity of the market. Traditional LNG buyers of LNG are exposed to energy market liberalization and have difficulties in forecasting their demand growth. Therefore, even in conventional LNG trading, there are strong needs to reduce LNG cost and increase supply flexibility. It is necessary that new LNG projects will be realized timely to secure adequate supply. We hope that a proper amount of attention and cooperation will be held between market players for sound development of world LNG market.

For more information contact: report@tky.ieej.or.jp