

Natural Gas and LNG Supply/Demand Trends in Asia Pacific and Atlantic Markets* (FY2007)

Tetsuo Morikawa, Senior Researcher
Strategy and Industrial Research Unit – Oil and Gas Strategy Group

Introduction

This paper is a portion of a study undertaken by the Institute of Energy Economics, Japan (IEEJ) on commission from the Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry under the project title of “FY2007 Research for Promotion of Natural Gas Development and Utilization (Study of Natural Gas Supply and Demand Trends in Asia Pacific and Atlantic Markets)”. The scope of the above study included a fixed-point observation survey on the on-going status of countries that are either exporting or importing LNG as well as trends in the LNG markets, which potentially may have an impact on Japan’s natural gas supply and demand situation. In the following sections, an overview will be presented in sequence on the natural gas supply and demand situation, LNG trading, LNG chain, and LNG supply and demand balance.

1. Natural gas supply and demand situation

The world natural gas reserves at the beginning of 2007 stood at 183.1 Trillion Cubic Meters (Tcm), with the Middle East and the former Soviet Union respectively accounting for about 40% and 30% of the total. On the other hand, the reserves in Asia and Oceania were 16.3 Tcm, representing no more than 8.9% of the world total. The world natural gas production in 2006 was 2.89 Tcm, with North America and the former Soviet Union each making up 26.1% and 27.0%, respectively, while Asia and Oceania accounted for 13.1% of the total. In terms of consumption, large volumes are notable in North America and the former Soviet Union, both with vast production capacities, as well as in Europe with considerable natural gas trading activities based on regional supplies or those originating from Africa and the former Soviet Union as supported by well-developed pipeline networks. Natural gas consumption in Asia and Oceania was 426.7 Billion Cubic Meters (Bcm), accounting for 14.8% of the world total (see Chart 1 and Chart 2).

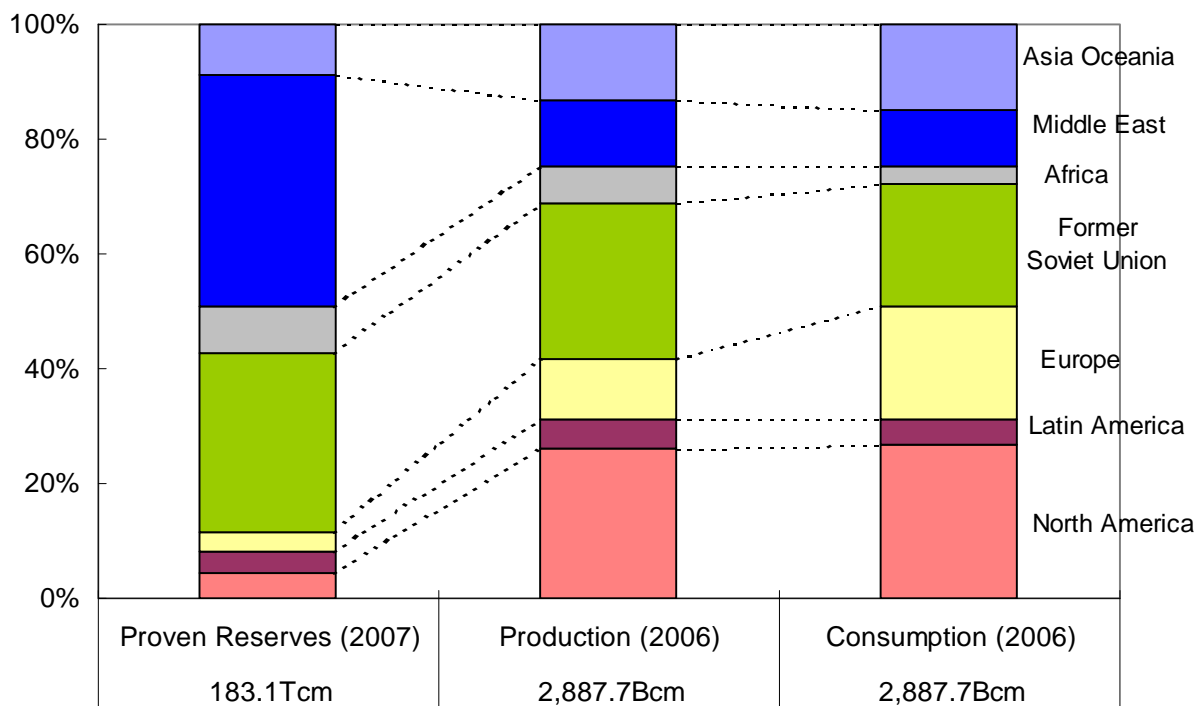
* This paper is an excerpt from a research work commissioned by the Ministry of Economy, Trade and Industry in FY2007, and has been released with the permission of the Ministry. We thank the related parties in the Ministry for their understanding and cooperation. We are also grateful to the Working Group members for their contribution to this research.

[Chart 1] World Natural Gas Reserves, Production and Consumption

	Proven Reserves (2007)		Production (2006)		Consumption (2006)	
	(Tcm)	Share(%)	(Bcm)	Share(%)	(Bcm)	Share(%)
North America	8.0	4.4	753.2	26.1	769.9	26.7
Latin America	6.9	3.8	147.0	5.1	130.8	4.5
Europe	6.3	3.4	305.4	10.6	568.3	19.7
Former Soviet Union	57.2	31.2	778.7	27.0	616.4	21.3
Africa	14.5	7.9	191.7	6.6	88.5	3.1
Middle East	73.9	40.4	334.8	11.6	287.1	9.9
Asia Oceania	16.3	8.9	377.0	13.1	426.7	14.8
Total	183.1	100.0	2,887.7	100.0	2,887.7	100.0

Source: *Natural Gas in the World*, Cedigaz

[Chart 2] World Natural Gas Reserves, Production, and Consumption by Region



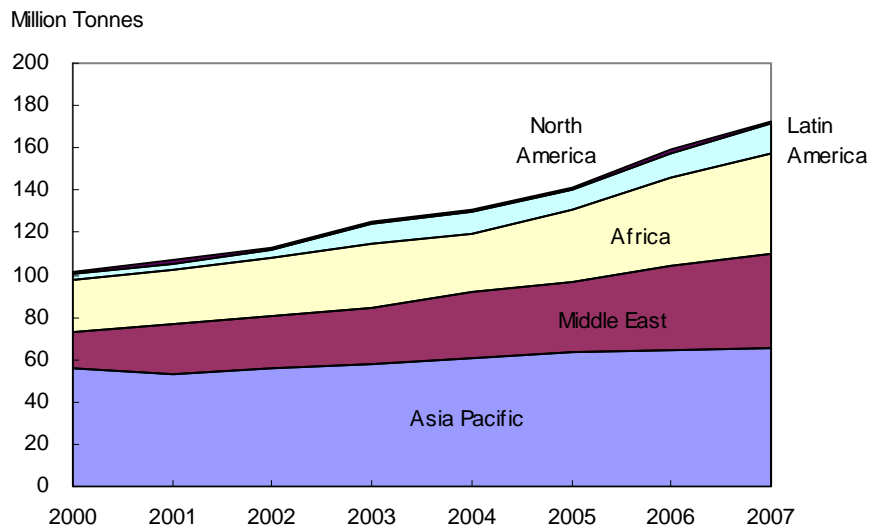
Source: *Natural Gas in the World*, Cedigaz

2. LNG trading

2.1. LNG imports and exports

The worldwide trading volume of LNG in 2007 was 172.6 Million Tonnes (MT). The global LNG trade has expanded at an average annual rate of 8% between 2000 and 2007. During 2007, the total exports increased as much as 13.66 MT as the RasGas II Train 3 in Qatar (in March), the EG LNG plant in Equatorial Guinea (May), Snohvit in Norway (September), and the NLNG Train 6 in Nigeria (December) started their respective operations. In terms of the 2007 export volumes by region, Asia Pacific accounted for 38% of the world total, while 28% was sourced from the Middle East, 27% from Africa, 8% from Latin America, and 1% from North America (see Chart 3).

[Chart 3] LNG Exports by Region



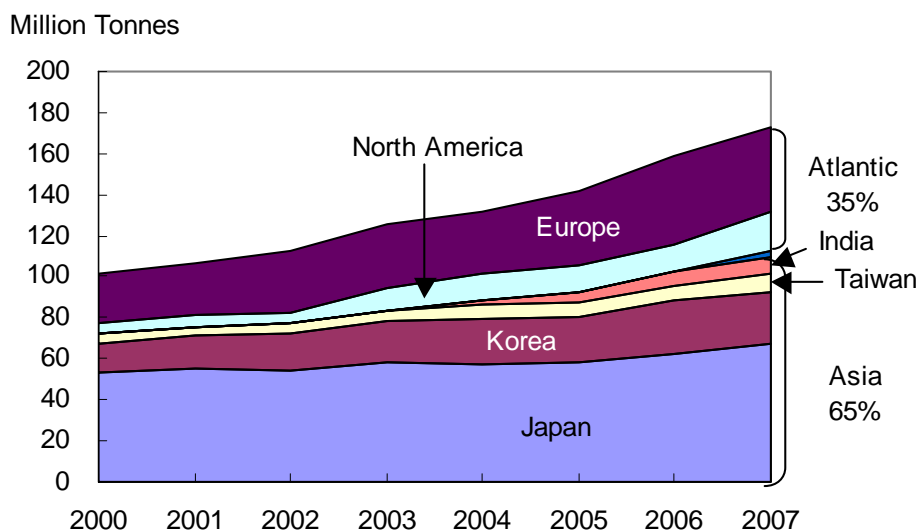
Source: *Natural Gas in the World*, Cedigaz

Concerning imports by region, LNG demand in the Asia Pacific market¹ in 2007 was 112.5 MT, while the Atlantic market² had a demand of 60.1 MT. Over the period from 2000 to 2007, the average annual growth rate for the Asian market demand reached 7%, whereas the Atlantic market grew by an annual rate of 8% for the same period (see Chart 4). For 2007, the total Asian imports grew by 9.64 MT from the previous year as the demand expanded substantially in Japan and India, and the LNG imports by China went into full swing.

¹ Consists of Japan, Korea, Taiwan, India and China as of 2007.

² Consists of the U.S., Puerto Rico, Dominican Republic, Mexico, Belgium, France, Spain, Portugal, Italy, Greece, Turkey, and the UK as of 2007.

[Chart 4] LNG Imports by Region



Source: *Natural Gas in the World*, Cedigaz

2.2. Mid/long-term contracts

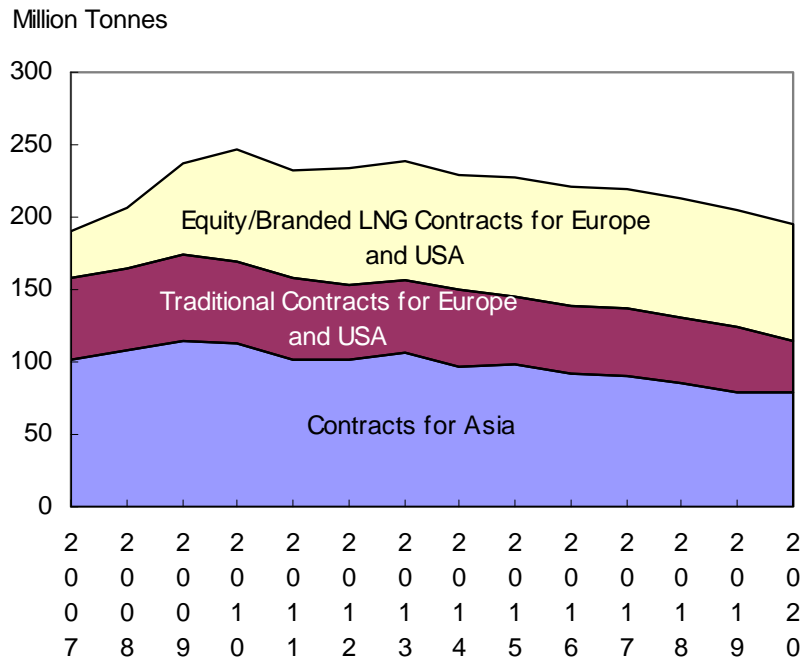
Most LNG trades are based on long-term contracts extending over twenty years, although volumes under short-term contracts or spot deals have also increased in recent years. As of 2007, the total volume on mid/long-term LNG contracts amounted to 190.65 MT. As will be discussed later, a substantial increase in demand is anticipated in the European and the U.S. markets, which are reflected in the contracted volume through 2020 (see Chart 5). A noteworthy fact here is that a considerable portion of volumes in newly concluded contracts for the European/U.S. deliveries takes transaction forms known in the industry as an “Equity LNG”, where a contractual seller lifts the LNG for its own marketing, or a “Branded LNG”, in which a trader purchases LNG for marketing without specifying the supply sources³.

While the volume under the Equity/Branded LNG contracts for the European/U.S. deliveries did not even reach 10% of the world total in 2000, it accounted for 37% (about 33 MT) of the contract volume for the European/U.S. deliveries in 2007 and is expected to grow to as high as 64% by 2015. Since these types of contract often do not specify the cargo destination to one location, it is likely that a certain portion of the contract volume will be diverted in response to the supply-demand and price situations, within the allowance of individual contract terms. There also is a view expressed by an energy consultant that the increased trade volumes are contributing to balance the seasonal demand fluctuations⁴.

³ These terms discussed in this paper follow the definitions provided in “LNG in 2007 – Strong growth but continuing uncertainty over supply”, by Andy Flower in LNG Focus, February-March 2008.

⁴ “LNG in 2007 – Strong growth but continuing uncertainty over supply” by Andy Flower, LNG Focus, February-March 2008.

[Chart 5] Projected Mid/Long Term LNG Contract Volumes by Region



Notes:

1. The figures referred to in this chart are the total of volumes provided in Sale and Purchase Agreements (SPAs) and Heads of Agreements (HOAs), excluding those volumes expressed in Memorandums of Understanding (MOUs) or Letters of Intent (LOIs).
2. Where there is a range in the contractual volume, the lowest value is used for the projection and optional volumes are not included in the data.

Sources: GIIGNL, Press releases by respective project operators.

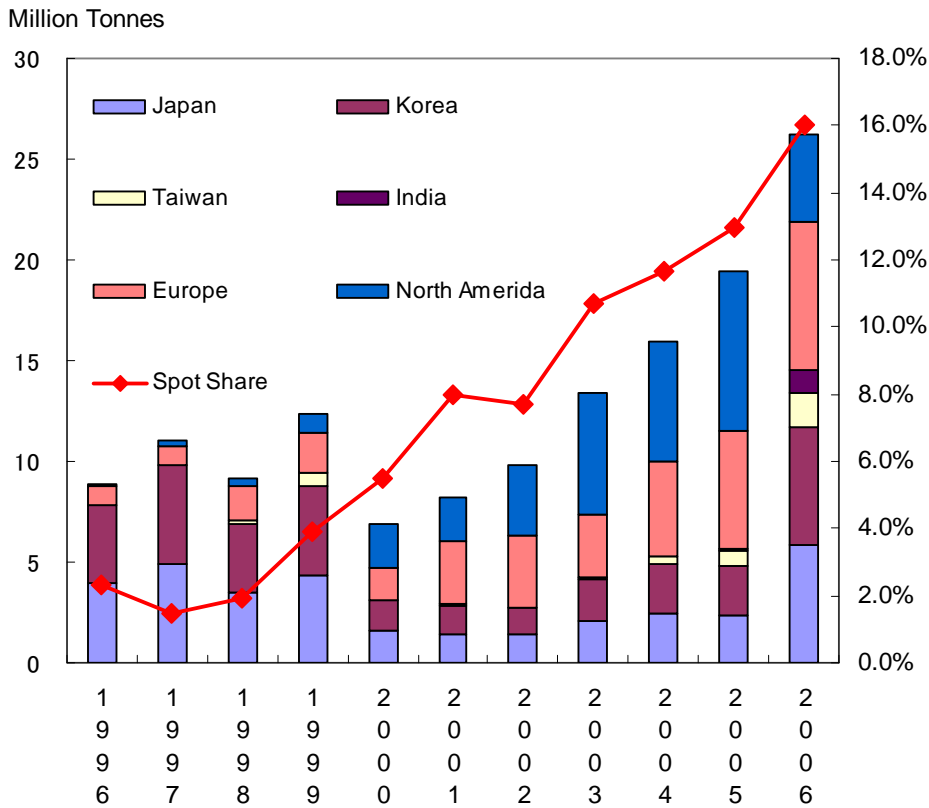
2.3. Spot/short-term trades

The volume of spot or short-term LNG trades in 2006 was 25.47 MT worldwide, of which 4.29 MT was for deliveries into the U.S., 7.40 MT was for Europe, and 13.79 MT was for the Asian market. The above volume represents 16% of the global LNG trades, where a significant growth is notable since 2000 (see Chart 6). It should be noted that the spot or short-term trading discussed here refers to transactions made under contracts with terms of one year or less. It seems the cargo-by-cargo spot transactions remain to be limited in the case of LNG trade⁵. While the liquidity in LNG trading is still low in comparison with crude oil or petroleum products trading, it is also a fact that the volume of spot or short-term trading is rapidly on the rise. In particular, the diverted volumes from

⁵ Although it is generally considered that spot transactions account for 30% or so in the crude oil trades, the percentage share refers to the ratio of cargo based transactions in the overall trade volume. Thus, the definition of "spot trade" differs between crude oil trades and those of LNG.

Equity/Branded LNG contracts would likely be accounted for as spot or short-term transactions in statistical processing. As a consequence, the volumes on spot or short-term deals are envisaged to increase to a certain extent, augmenting the liquidity in LNG trading.

[Chart 6] The Share of Spot Transactions of the World LNG Trades



Sources: GIIGNL, Cedigaz

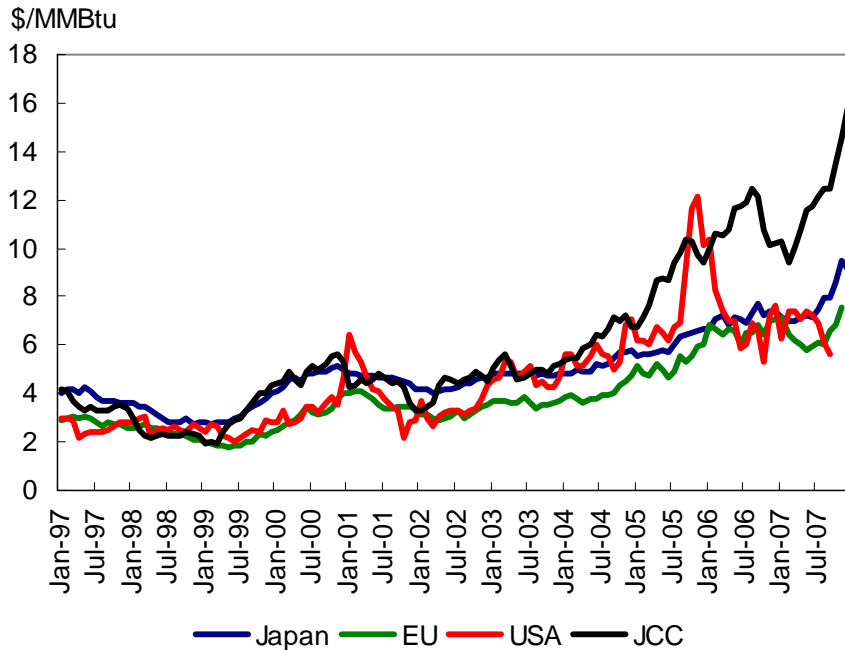
2.4. LNG pricing

LNG pricings vary from region to region. In Asia, LNG prices are generally linked to the so-called JCC (“Japan Crude Cocktail”) price, which is an average CIF price of crude oil imported into Japan, whereas in continental Europe they are linked to petroleum products or Brent crude oil prices. For the U.S. or the U.K. deliveries, LNG prices are determined by supply and demand situations at market places such as Henry Hub in the U.S. or National Balancing Point (NBP) in the U.K.

Chart 7 shows the historical LNG import prices into Japan, the U.S. and the EU. Up until 2000 or so, LNG prices for Japan remained at relatively higher levels in comparison with the U.S. or the EU. While the LNG price for Japan is on the rise in line with the increase in the JCC price, the rate of increase has been restrained at a lower level than that of the JCC thanks to a moderating factor built into the pricing formula. EU price shows similar movements to that of Japan, since both prices are linked to oil prices. LNG price into the U.S. has been on an upward trend since 1999 reflecting the

escalated prices for domestic natural gas and is highly volatile as well.

[Chart 7] Historical LNG Import Prices



Source: *Energy Prices & Taxes*, IEA

As far as the LNG supply for Japan is concerned, it would appear unlikely to see a drastic change in the present oil-linked pricing system. Then the main factors governing the long-term contract price trend should be the level of crude prices and the extent of the linkage with crude prices. For the spot prices, Henry Hub and NBP prices as well as spot prices for other Asian countries may have an impact in addition to the crude oil prices.

3. LNG chain

3.1. Liquefaction plants

The annual LNG production capacity in the world stands at 198 MT at the end of 2007. On a regional basis, Asia Pacific has the largest capacity of 73.6 MT, followed by Africa and the Middle East at 58.0 MT and 46.1 MT respectively; with North and Latin America having 16.1 MT (see Chart 8). LNG supplies for Asian countries are sourced mainly from Asia Pacific, North America and the Middle East, while LNG shipped to the U.S. and European destinations is primarily supplied from Africa and the Latin America.

Qatar, which overtook Indonesia as the world's largest LNG exporter in 2006, presently has a liquefaction capacity of 30.4 MT per year with additional large-scale expansion plans in progress. Although the export facilities at EG LNG in Equatorial Guinea and Snohvit in Norway had initial troubles in their liquefaction facilities after they were both brought on line in 2007, they are now back

in normal operation.

[Chart 8] Existing LNG Production Plants (at the end of 2007)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
Africa	Algeria	Arzew GL4Z (Train 1-3)	1.1	1964	Sonatrach		GdF(2.5): 1976-2019 GdF(3.7): 1982-2019 GdF(1.3): 1992-2019 Duke(3.2): 1989-2009 Botas(3.0): 1994-2014 ENI(1.4): 1997-2014 Enel(1.15): 1999-2022 DEPA(0.50): 2000-2021 Iberdrola(0.73): 2002-2021 Cepsa(0.45): 2002- Endesa(0.75): 2005-2017
		Arzew GL1Z (Train 1-6)	7.8	1978			
		Arzew GL2Z (Train 1-6)	8.0	1980			
		Skikda GL1K II (Train 4-6)	3.0	1980			
	Libya	Marsa el Brega (Train 1-2)	0.6	1970	Sirte Oil		Gas Natural(1.15): 1981-2008
	Nigeria	Nigeria LNG (Train 1, 2)	6.4	1999	NNPC, Shell, Total, ENI	NNPC(49), Shell(25.6), Total(15), ENI(10.4)	GdF(0.36): 1999-2021 Enel(2.5): 1999-2019 Gas Natural(1.17): 1999-2021 Gas Natural(1.99): 2002-2024 Endesa(0.75): 2005-2025 Iberdrola(0.36): 2005-2025 ENI(1.15): 2006-2028 Botas(0.9): 1999-2021 Transgas(1.42): 2002-2023 BG(2.5): 2004-2023 Shell(1.54): 1.54 Total(0.2): 2005-2026
		Nigeria LNG (Train 3)	3.2	2002			
		Nigeria LNG (Train 4, 5)	8.2	2006			
		NLNG (Train 6)	4.1	2007			
	Egypt	Damietta LNG (Train 1)	5.0	2005	EGPC, EGAS, BP, BG, Petronas	Union Fenosa Gas(80), EGAS(10), EGPC(10)	Union Fenosa(3.3): 2005-2029 BP(1.2): 2005-2025 BG(1.7): 2005-2010
		Egyptian LNG (Train 1)	3.6	2005	BG, Petronas	BG(35.5), Petronas(35.5), EGAS(12), EGPC(12), Gaz de France(5)	GdF(3.6): 2005-2025
		Egyptian LNG (Train 2)	3.6	2005		BG(38), Petronas(38), EGAS(12), EGPC(12)	BG(3.6): 2006-2023
	Equatorial Guinea	EG LNG (Train 1)	3.4	May 2007	Marathon, Sonagas	Marathon(60), Sonagas(25), Mitsui(8.5), Marubeni(6.5)	BG(3.4): 2007-
			Sub Total	58.0			
Europe	Norway	Snohvit LNG (Train 1)	4.2	October 2007	Statoil 33.53%, Petoro 30%, Total 18.4%, Gaz de France 12%, Amerada Hess 3.26%, RWE 2.81%		Statoil(1.8): 2007- Iberdrola(1.2): 2007- GdF/Total(1.2): 2007-
			Sub Total	4.2			

[Chart 8] Existing LNG Production Plants (at the end of 2007) (continued)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
Americas	USA	Kenai (Train 1, 2)	1.3	1969	ConocoPhillips(70), Marathon(30)		Tokyo Electric(0.92): 1989-2009 Tokyo Gas(0.31): 1989-2009
	Trinidad and Tobago	Atlantic LNG (Train 1)	3.0	1999	BP, BG, Chevron, Petromin, ENI, PetroCanada	BP(34), BG(26), Repsol-YPF(20), NGC(10), Tractebel(10)	Gas Natural(1.06): 1999-2018 Gas Natural(0.65): 2002-2023 Repsol YPF(1.19): 2006-2023 Suez(1.63): 1999-2018 Suez(0.34): 2000-2020 BP(0.8): 2002-2021 BG(2.2): 2004-2020 Marathon(1.2): 2005-2010 BG(1.5): 2005-2026 NGC(0.58): 2006-2026
		Atlantic LNG (Train 2)	3.3	2002		BP(42.5), BG(32.5), Repsol-YPF(25)	
		Atlantic LNG (Train 3)	3.3	2003			
		Atlantic LNG (Train 4)	5.2	2005		BP(37.78), BG(28.89), Repsol-YPF(22.22), NGC(11.11)	
Sub Total			16.1				
Middle East	Abu Dhabi	ADGAS (Train 1, 2)	3.1	1977	ADNOC(100)	ADNOC(70), Mitsui(15), BP(10), Total(5)	Tokyo Electric(4.3): 1994-2019
		ADGAS (Train 3)	2.3	1994			
	Oman	Oman LNG (Train 1, 2)	6.6	2000	Oman Government(60), Shell(34), Total(4), Partex(2)	Oman Government(51), Shell(30), Total(5.54), Mitsubishi(2.77), Mitsui(2.77), Partex(2), Itochu(0.92), Korea LNG(5)	Osaka Gas(0.66): 2000-2024 KOGAS(4.06): 2000-2024 BP(0.77): 2004-2009 Itochu(0.7): 2006-2026
		Qalhat LNG (Train 3)	3.7	2005		Oman Governmenet(47), Oman LNG(37), Union Fenosa(7), Mitsubishi(3), Itochu(3), Osaka Gas(3)	Mitsubishi(0.8): 2006-2020 Osaka Gas(0.8): 2006-2020 Union Fenosa Gas(1.6): 2006-2026
	Qatar	Qatargas (Train 1-3)	9.7	1997	QP(65), Total(20), ExxonMobil(10), Mitsui(2.5), Marubeni(2.5)	QP(65), Total(10), ExxonMobil(10), Mitsui(7.5), Marubeni(7.5)	Chubu Electric(4.0): 1997-2022 Tokyo Gas(0.35): 1998-2022 Osaka Gas(0.35): 1997-2021 Tohoku Electric(0.52): 1999-2022 Kansai Electric(0.29): 1999-2022 Chugoku Electric(0.12): 1999-2022 Tokyo Electric(0.2): 1999-2022 Toho Gas(0.17): 2000-2022 Gas Natural(0.66): 2001-2012 Gas Natural(0.66): 2002-2012 Gas Natural(0.75): 2005-2025 Gas Natural(0.75): 2006-2025 Iberdrola(0.88): 2003-2022
		RasGas (Train 1, 2)	6.6	1999	QP(63), ExxonMobil(25), KOGAS(5), Itochu(4), LNG Japan(3)		KOGAS(4.92): 1999-2024 Petronet(7.5): 2004-2028 Endesa(0.8): 2005-2025 ENI(0.75): 2004-2023
		RasGas II (Train 3)	4.7	2004	QP, ExxonMobil	QP(70), ExxonMobil(30)	Edison(4.7): 2007-2032 Distrigas(2.05): 2007-2027 CPC(3.0): 2008-2033
		RasGas II (Train 4)	4.7	2005	QP, ExxonMobil	QP(70), ExxonMobil(30)	
		RasGas II (Train 5)	4.7	March 2007	N.A.	Qatar Petroleum(70), ExxonMobil(30)	
	Sub Total			46.1			

[Chart 8] Existing LNG Production Plants (at the end of 2007) (continued)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
Asia Pacific	Brunei	Brunei LNG (Train 1-5)	7.2	1972-1974	Brunei Government(50), Shell(50) Total(37.5), Shell(35), Jasra(22.5), Pg Jaya(5)	Brunei Government(50), Shell(25), Mitsubishi(25)	Tokyo Electric(4.03): 1973-2013 Tokyo Gas(1.24): 1973-2013 Osaka Gas(0.74): 1973-2013 KOGAS(0.70): 1997-2013
	Indonesia	Bontang I (Train A, B)	5.2	1977	VICO, Total, INPEX, Chevron ① Offshore Mahakam Total(50) INPEX(50)② Attaka Unit Chevron(50) INPEX(50)③ Makassar Chevron(90) Pertamina(10)④ Galal Chevron(80) Eni-Ganal(20)⑤ Sanga Sanga VICO(23.13)L ASMO(26.25)BP(26.25)CPC(20)Universal Gas & Oil(4.37)	Pertamina(55), VICO(20), JILCO(15), Total(10)	Osaka Gas(1.27): 1994-2013 Tokyo Gas(0.92): 1994-2013 Toho Gas(0.12): 1994-2014 Hiroshima Gas(0.21): 1996-2015 Osaka Gas(0.1): 1996-2015 Nihon Gas(0.08): 1996-2015 Kansai Electric(2.57): 2000-2010 Chubu Electric(2.15): 2000-2010 Kyushu Electric(1.56): 2000-2010 Osaka Gas(1.30): 2000-2010 Nippon Steel(0.62): 2000-2010 Toho Gas(0.25): 2000-2010 Chubu Electric(1.65): 2003-2011 Kansai Electric(0.88): 2003-2011 Osaka Gas(0.44): 2004-2011 Toho Gas(0.55): 2003-2011
		Bontang II (Train C, D)	5.2	1983			
		Bontang III (Train E)	2.8	1989			
		Bontang IV (Train F)	2.8	1993			
		Bontang V (Train G)	2.8	1997			
		Bontang VI (Train H)	3.0	1999			
	Indonesia	Arun I (Train 1)	1.5	1978	ExxonMobil(100)	Pertamina(55), ExxonMobil(30), JILCO(15)	KOGAS(2.0): 1994-2014 KOGAS(1.0): 1998-2017 CPC(1.57): 1990-2010 CPC(1.84): 1998-2017 Tohoku Electric(0.85): 2005-2009 Tokyo Electric(0.13): 2005-2009 KOGAS(2.3): 1986-2007
		Arun II (Train 4, 5)	3.0	1984			
		Arun III (Train 6)	2.0	1986			
Malaysia	Malaysia LNG I (Satu) (Train 1-3)	8.1	1983	Shell(50), Carigali(50)	Petronas(90), Sarawak Government(5), Mitsubishi(5)	Tokyo Electric(4.8): 2003-2018 Tokyo Gas(2.6): 2003-2018 Saibu Gas(0.2): 1993-2013	
	Malaysia LNG II (Dua) (Train 4-6)	7.8	1995		Petronas(60), Shell(15), Mitsubishi(15), Sarawak Government(10),	Saibu Gas(0.16): 1993-2013 Tokyo Gas(0.8): 1995-2015 Osaka Gas(0.6): 1995-2015 Kansai Electric(0.42): 1995-2015 Toho Gas(0.28): 1995-2015 Tohoku Electric(0.5): 1996-2016 Shizuoka Gas(0.45): 1996-2016 Sendai City Gas(0.15): 1997-2017 KOGAS(2.0): 1995-2015 CPC(2.25): 1995-2015	
	Malaysia LNG III (Tiga) (Train 7, 8)	6.8	2003		Shell(37.5), Nippon Oil(37.5), Carigali(25)	Petronas(60), Shell(15), Nippon Oil(10), Sarawak Government(10), Mitsubishi(5)	JAPEX(0.48): 2003-2023 Tokyo Gas(0.34): 2004-2024 Toho Gas(0.22): 2004-2024 Toho Gas(0.52): 2007-2027 Osaka Gas(0.12): 2006-2024 Hiroshima Gas(0.008-0.016): 2005-2012 Tohoku Electric(0.5): 2005-2025 Toho Gas(0.52): 2007-2027 KOGAS(1.5): 2003-2010 KOGAS(1.5): 2008-2028 CNOOC(3.03): 2009-2034
	Malaysia LNG (Project Unspecified)						Osaka Gas(0.92): 2009-2025 Shikoku Electric(0.42): 2010-2025 Chubu Electric(0.54): 2011-2031 Saibu Gas(0.39): 2013-2028

[Chart 8] Existing LNG Production Plants (at the end of 2007) (continued)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
Asia Pacific	Australia	NWS (Train 1-4)	11.9	1989-2004	Woodside(16.7), Shell(16.7), Chevron(16.7), BHP Billiton(16.7), BP(16.7), MIMI(16.7), CNOOC	Woodside(16.7), Shell(16.7), Chevron(16.7), BHP Billiton(16.7), BP(16.7), MIMI(16.7)	Tokyo Gas(0.79→0.53): 1989-2009→2017 Tokyo Electric(1.18→0.3): 1989-2009→2016 Toho Gas(0.23→0.76): 1989-2009→2019 Osaka Gas(0.79→0.5): 1989-2009→2015 Kyushu Electric(1.05→0.7): 1989-2009→2017 Kansai Electric(1.13→0.4): 1989-2009→2017 Chubu Electric(1.05→0.5): 1989-2009→2016 Chugoku Electric(1.11→1.43): 1989-2009→2021 Kansai Electric(0.50→0.925): 2009-2014→2023 KOGAS(0.50): 2003-2007→2016 Tokyo Gas(1.07): 2004-2028 Toho Gas(0.3): 2004-2028 Osaka Gas(1.0): 2004-2034 Kyushu Electric(0.5): 2004-2026
		Darwin LNG	3.5	2006	ConocoPhillips(56.72), Eni(12.04), Santos(10.63), Inpex(10.53), Tokyo Electric(6.72), Tokyo Gas(3.36)		Tokyo Electric(2.0): 2006-2023 Tokyo Gas(1.0): 2006-2023
	Sub Total		73.6				
Total			198.0				

Source: Prepared by IEEJ based on respective corporate websites, etc.

In addition to the existing capacities described in the above, there are a number of new projects and expansion programs on existing plants. Such new LNG production capacities that are either under construction or with signed SPAs (Sale and Purchase Agreement) or HOAs (Heads of Agreement) total to 117.4 MT at the end of 2007 and are expected to come on line by 2015. In terms of regional distribution, Africa is slated for a total expansion of 18.1 MT, whereas 53.5 MT is planned in the Middle East, 4.4 MT in Latin America, and 41.4 MT in Asia Pacific. (see Chart 9).

[Chart 9] LNG Production Plants with Signed SPAs/HOAs (at the end of 2007)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
Africa	Algeria	Skikda	4.5	2011	Sonatrach		Sonatrach
	Nigeria	NLNG (Train 7)	8.4	2012	NNPC, Shell, Total, ENI	NNPC(49), Shell(25.6), Total(15), ENI(10.4)	BG(2.25): 2012- Total(1.38): 2012- ENI(1.38): 2012-
	Angola	Angola LNG (Train 1)	5.2	2012	Sonagas(22.8%), Chevron(36.4%), Eni(13.6%), Total(13.6%), BP(13.6%)		Chevron(1.9): 2012- Sonangol(1.2): 2012- Total(0.7): 2012- BP(0.7): 2012- ENI(0.7): 2012-
	Sub Total		18.1				

[Chart 9] LNG Production Plants with Signed SPAs/HOAs (at the end of 2007) (continued)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
Middle East	Qatar	RasGas 3 (Train 6)	7.8	End 2008	N.A.	Qatar Petroleum (70), ExxonMobil(30)	ExxonMobil(7.8): 2008–
		RasGas 3 (Train 7)	7.8	End 2009	N.A.	Qatar Petroleum(70), ExxonMobil(30)	ExxonMobil(7.8): 2009–
		Qatargas II (Train 1)	7.8	2008	N.A.	Qatar Petroleum(70), ExxonMobil(30)	ExxonMobil(10.4): 2007–2032 Total(5.2): 2009–2034
		Qatargas II (Train 2)	7.8	2009	N.A.	Qatar Petroleum(65), ExxonMobil(18.3), Total(16.7)	
		Qatargas 3	7.8	2009	N.A.	Qatar Petroleum(68.5), ConocoPhillips(30), Mitsui(1.5)	ConocoPhillips(7.8): 2009–
		Qatargas 4	7.8	End 2009	N.A.	Qatar Petroleum (70), Shell (30)	Shell(4.8): 2009– PetroChina(3.0): 2009–
	Yemen	Yemen LNG (Train 1, 2)	6.7	2009 Q4	Hunt Oil(38.5), ExxonMobil(37), SK(24.5)	Total(42.9), Yemen Gas(23.1), Hunt Oil(18), SK(10), Hyundai(6)	KOGAS(1.3): 2008–2028 Suez(2.5): 2009–2029 Total(1.5): 2009–2029
Sub Total			53.5				
Americas	Peru	Peru LNG	4.4	2010 Q2	Hunt Oil(50), SK(20), Repsol YPF(20), Marubeni(10)		Repsol YPF(3.6): 2010–
	Sub Total		4.4				
Asia Pacific	Australia	NWS (Train 5)	4.4	2008 Q4	Woodside, BHP Billiton, BP, Chevron, Shell, MIMI (1/6 each), CNOOC	Woodside, BHP Billiton, BP, Chevron, Shell, MIMI (1/6 each)	Partially same as the NWS Train 1–4 buyers
		Gorgon (Train 1, 2)	15.0	2014–2015?	Chevron(50), Shell(25), ExxonMobil(25)		Tokyo Gas(1.2): 2010–2035 Chubu Electric(1.5): 2010–2035 Osaka Gas(1.5): 2010–2035 Shell(2.5): 2010– PetroChina(1.0):
		Pluto (Train 1)	4.8	End 2010	Woodside(90), Tokyo Gas(5), Kansai Electric (5)		Tokyo Gas(1.5–1.75): 2010–2025 Kansai Electric(1.75–2.0): 2010–2025
	Indonesia	Tangguh (Train 1, 2)	7.6	2008–2009	BP(37.16), MI Berau BV(16.3), CNOOC(16.96), Nippon Oil(12.23), KG Berau+KG Wiragar(10), LNG Japan(7.35)		POSCO(0.55): 2005–2025 CNOOC(2.6): 2007–2032 Semptra(3.7): 2008–2028 Tohoku Electric(0.12): 2010–2025

[Chart 9] LNG Production Plants with Signed SPAs/HOAs (at the end of 2007) (continued)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
Asia Pacific	Russia	Sakhalin II (Train 1, 2)	9.6	2008	Gazprom(50), Shell(27.5), Mitsui(12.5), Mitsubishi(10)		Tokyo Gas(1.1): 2007-2031 Tokyo Electric(1.5): 2007-2029 Hiroshima Gas(0.21): 2008-2028 Kyushu Electric(0.5): 2009-2031 Toho Gas(0.5): 2009-2033 Tohoku Electric(0.42): 2010-2030 Saibu Gas(0.0085): 2010-2028 Chubu Electric(0.5): 2011-2025 Osaka Gas(0.2): 2008-2028 KOGAS (1.5) : 2008-2028 Shell(1.6) : 2008-2028
			Sub Total	41.4			
Total			117.4				

Source: Prepared by IEEJ based on respective corporate websites, etc.

Furthermore, there are a number of new projects being considered for further commercialization. As shown in Chart 10, the capacity of such projects totals to 194.4 MT. However, there are significant differences among these projects with respect to the possibility of their realization, depending on factors such as LNG demand trends, political stability and environmental restrictions in producing country, and development strategies adopted by investors. Accordingly, there is no guarantee that all of these projects will be implemented, and, even if they are, they may not necessarily start operations in a timely manner.

[Chart 10] LNG Production Plants Under Planning

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors	Destinations
A f r i c a	Algeria	Gassi Touil (Arzew)	4.0	N.A.	Sonatrach	Atlantic
	Nigeria	Olokola LNG (Train1-4)	22.0	2009-2010	NNPC(49.5), Chevron(18.5), Shell(18.5), BG(13.5)	USA
		Brass River LNG (Train 1, 2)	10.0	2013	NNPC(49), Total(17), ConocoPhillips(17), ENI(17)	North America
		Flex LNG	1.0	2011	Flex LNG, Peak Petroleum	N.A.
	Angola	Angola LNG (Train 2)	6.0	N.A.	Sonangol, ENI, Gas Natural, Galp, Exem	Atlantic
	Egypt	Damietta (Train 2)	5.0	N.A.	ENI, BP, EGAS, SEGAS	N.A.
		Egyptian LNG (Train 3)	N.A.	N.A.	BG, RWE	N.A.
		West Damietta	4.0	N.A.	Shell, EGPC	N.A.
	Libya	Marsa el Brega Refurbishment (Train 1-2)	2.5	N.A.	NOC, Shell	N.A.
	Equatorial Guinea	EG LNG (Train 2)	4.4	N.A.	Marathon(60), Sonagas(25), Mitsui(8.5), Marubeni(6.5)	N.A.
Sub Total			58.9			
E u r o p e	Russia	Shtokman LNG	7.0	2014	Gazprom	Atlantic
	Norway	Snohvit LNG (Train 2)	4.2	2012	Petro, Statoil, Total, Gaz de France, Amerada Hess, RWE	Atlantic
	Sub Total			11.2		
M i d d l e E a s t	Iran	Pars LNG (Train 1, 2)	10.0	2013	NIOC(50), Total(40), Petronas(10)	Asia, Europe
		Persian LNG (Train 1, 2)	16.2	2013	NIOC(50), Shell(25), Repsol(25)	Asia, Europe
		North Pars LNG	15.0	2013	CNOOC	China
		Iran LNG	10.0	N.A.	NIOC	Asia
		Qeshm	1.2	2010	LNG Ltd.	N.A.
	Sub Total			52.4		
A m e r i c a s	USA	North Slope	9.0	N.A.	Yukon Pacific	USA
	Venezuela	Mariscal Sucre (Train 1)	4.7	2013	PDVSA, Shell, Mitsubishi	USA
		Delta Caribe	4.5	2015	Chevron	Atlantic
	Trinidad and Tobago	Atlantic LNG (Train 5)	N.A.	N.A.	N.A.	N.A.
Sub Total			18.2			

[Chart 10] LNG Production Plants Under Planning (Continued)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors	Destinations	
Asia Pacific	Australia	Browse	7.0	2013-2015	Woodside, Chevron, BP, BHP Billiton, Shell	Asia Pacific	
		Greater Sunrise	7.0	2013	Woodside(33.44), ConocoPhillips(30), Shell(26.56), Osaka Gas(10)	Asia Pacific	
		Timor Sea LNG (Tassie Shoal)	3.6	N.A.	Methanol Australia	Aisa	
		Pilbara	6.0	N.A.	BHP Billiton, ExxonMobil	USA	
		Pluto (Train 2)	N.A.	2012	Woodside	Asia Pacific	
		Ichthys	6.0	2012	INPEX(76), Total(24)	Asia Pacific	
		Gladstone	3.0	2014	Santos	Asia Pacific	
		Project Sun	0.5	2012	Sojitz, Sunshine Gas	N.A.	
		Gladstone LNG (Train 1)	1.3	2011	LNG Ltd.	N.A.	
		Gladstone LNG (Train 2)	1.3	2013	LNG Ltd.	N.A.	
		N.A.	3.0	2013	BG, Queensland Gas	N.A.	
	Indonesia	Tangguh (Train 3)	N.A.	N.A.	BP, MI Berau, CNOOC, Nippon Oil, KG Berau Wiriagar, LNG JAPAN	Asia Pacific	
	Indonesia	Natuna	N.A.	N.A.	ExxonMobil, Pertamina	Asia Pacific	
		Donggi Senoro LNG	2.0	2010	Mitsubishi(51), Pertamina(29), Medco(20)	Asia Pacific	
		Abadi	3.0	2015	INPEX	Asia Pacific	
	Papua New Guinea	N.A.	5.0	2012	ExxonMobil(42.5), Oil Search(36.6), Santos(13.8), Nippon Oil(2.7), AGL(3.3), MRDC(1.1)	Asia Pacific	
		PNG LNG	4.0	2012	InterOil, Merrill Lynch, Clarion Finaz AG	Asia Pacific	
		N.A.	1.0	2010	LNG Ltd.	Asia Pacific	
	Sub Total			53.7			
	Total			194.4			

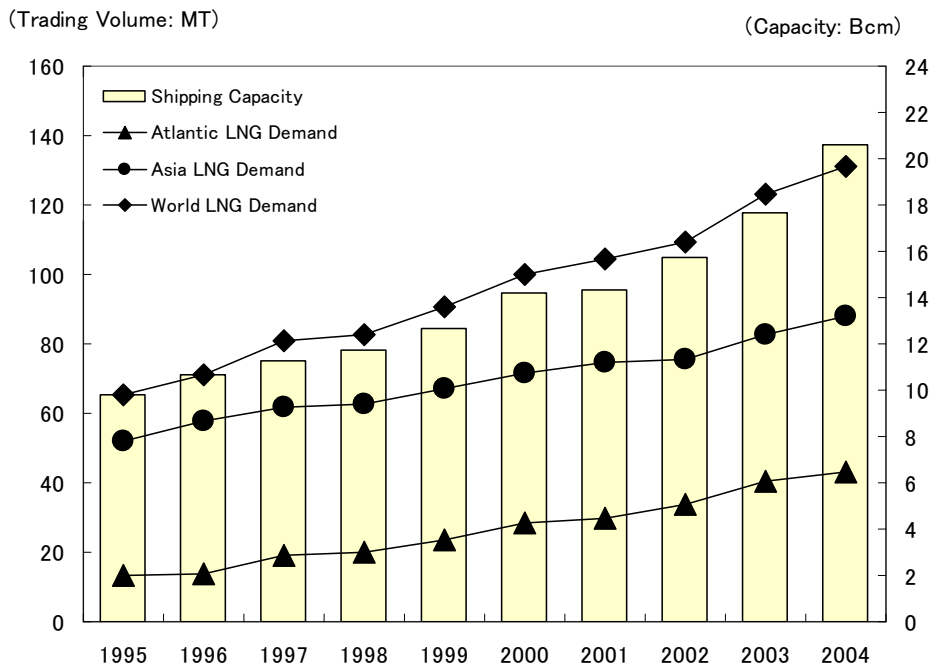
Source: Prepared by IEEJ based on various corporate websites, etc.

3.2. LNG tankers

As of the 2007 year-end, the number of tankers in the world LNG fleet in operation was 254 with

an aggregated shipping capacity of 32 Bcm (see Chart 11). In the face of growing LNG demand, the number of LNG tankers being built has also been on a steep rise in recent years, and the resultant expansion in the shipping capacity has outstripped the growth in LNG demand. As a result, recently there are LNG tankers having only spot or short-term charters, or some of them not even having any charter contract.

[Chart 11] LNG Shipping Capacity Trends



Sources: LNG Japan, IEEJ

3.3. Receiving terminals

As of the 2007 year-end, LNG receiving terminals existed at 58 locations throughout the world, with an aggregated annual storage capacity of 2.6 million KI, with the total send out capability of 519.18 Bcm per year. In terms of regional distribution, Japan has by far the largest number with 27 terminals, followed by Spain with six terminals, the U.S. with five, and South Korea with four (see Chart 12).

[Chart 12] Existing LNG Receiving Terminals (at the end of 2007)

Region	Country	Name	Investor(s)	Storage (1,000kl)	Send Out Capacity (Bcm/y)	Start-up	
A s i a	Japan	Sendai	Sendai City Gas	8.0	0.38	1997	
		Higashi Niigata	Nihonkai LNG	72.0	11.60	1984	
		Futtsu	Tokyo Electric	111.0	26.00	1985	
		Sodegaura	Tokyo Electric, Tokyo Gas	266.0	37.80	1973	
		Higashi Ogishima	Tokyo Electric	54.0	20.00	1984	
		Ogishima	Tokyo Gas	60.0	7.70	1998	
		Negishi	Tokyo Electric, Tokyo Gas	118.0	15.60	1969	
		Sodeshi	Shimizu LNG	17.7	1.10	1996	
		Chita Kyodo	Chubu Electric, Toho Gas	30.0	10.40	1977	
		Chita	Chita LNG	64.0	15.70	1983	
		Chita Midorihama	Toho Gas	20.0	6.90	2001	
		Yokkaichi LNG Center	Chubu Electric	32.0	9.20	1987	
		Yokkaichi	Toho Gas	16.0	0.90	1991	
		Kawagoe	Chubu Electric	48.0	7.10	1997	
		Senboku 1	Osaka Gas	18.0	3.20	1972	
		Senboku 2	Osaka Gas	158.5	16.60	1977	
		Sakai	Sakai LNG	42.0	8.70	2006	
		Himeji	Osaka Gas	74.0	6.40	1984	
		Himeji LNG	Kansai Electric	52.0	11.00	1979	
		Mizushima	Chugoku Electric, Nippon Oil	16.0	1.30	2006	
		Hatsukaichi	Hiroshima Gas	17.0	0.74	1996	
		Yanai	Chugoku Electric	48.0	3.10	1990	
		Oita	Oita LNG	46.0	6.27	1990	
		Tobata	Kitakyushu LNG	48.0	8.80	1977	
		Fukuoka	Saibu Gas	7.0	1.10	1993	
		Nagasaki	Saibu Gas	3.5	0.20	2003	
	Kagoshima	Nihon Gas	8.6	0.30	1996		
	Japan Total				1,455.3	238.09	
	Korea	Pyeong Taek	KOGAS	100.0	27.70	1986	
		Inchon	KOGAS	248.0	35.90	1996	
		Tong Young	KOGAS	70.0	14.50	2002	
		Gwangyang	POSCO	30.0	2.30	2005	
Korea Total				448.0	80.40		
Taiwan	Yung An	CPC	69.0	23.00	1990		
India	Dahej	Petronet	32.0	7.00	2004		
	Hazira	Shell, Total	32.0	3.30	2005		
China	Dapeng	CNOOC, BP etc	32.0	4.90	2006		
Subtotal				2,041.2	356.69		

[Chart 12] Existing LNG Receiving Terminals (at the end of 2007) (continued)

Region	Country	Name	Investor(s)	Storage (1,000kl)	Send Out Capacity (Bcm/y)	Start-up
A m e r i c a s	USA	Everett	Tractebel LNG	15.5	6.90	1971
		Lake Charles	Trunkline LNG	28.5	18.60	1982
		Cove Point	Dominion	38.0	10.74	1978
		Elba Island	Southern LNG (El Paso)	19.1	8.33	1978
		Gulf Stream, (Off-shore), GOM	Excelerate Energy	N.A.	4.60	2005
	Puerto Rico	Penuelas	EcoElectrica	16.0	3.75	2000
	Dominica	Andres	AES	16.0	2.32	2003
	Mexico	Altamira	Shell, Total, Mitsui	30.0	5.30	2006
Subtotal				163.1	60.54	
E u r o p e	Belgium	Zeebrugge	Fluxys	26.1	5.26	1987
	France	Fos-sur-Mer	Gaz de France	15.0	7.00	1972
		Montoir-de-Bretagne	Gaz de France	36.0	10.00	1980
	Italy	Panigaglia	Snam	10.0	3.32	1971
	Spain	Barcelona	Enagas	54.0	14.45	1969
		Cartagena	Enagas	28.7	10.51	1989
		Huelva	Enagas	46.0	10.51	1988
		Bilbao	BP, Respol, Iberdrola, EVE	30.0	7.00	2003
		Sagunto	Union Fenosa, Iberdrola, Endesa	30.0	7.00	2006
		Reganosa	Endesa, Union Fenosa, Tojeiro Group, Caixa Galicia, Xunta de Galicia, Caixanova,	30.0	3.60	2007
	Portugal	Sines	Transgas	12.0	5.20	2003
	UK	Isle of Grain	National Grid	20.0	4.60	2005
		Teesside GasPort	Excelerate Energy	4.0	N.A	2007
	Greece	Revithoussa	DEPA	13.0	1.30	2000
	Turkey	Marmara Ereglisi	Botas	25.5	6.20	1994
Aliaga/Izmir		Eregaz	28.0	6.00	2006	
Subtotal				408.3	101.95	
Total				2,612.6	519.18	

Source: Prepared by IEEJ based on respective corporate websites, etc.

In addition to existing terminals, a number of new projects are currently being considered for commercial operations. (See Chart 13) Such projects are especially numerous in North America and China, where demand for LNG is expected to grow rapidly. However, with regard to the prospect of realization, these projects vary significantly subject to factors such as project economics, environmental and social constraints, and respective countries' policies on infrastructure

development.

[Chart 13] LNG Receiving Terminals Under Planning

Region	Country	Name	Investors	Capacity (MT/y)	Start Up
N o r t h A m e r i c a	USA	Hackberry, LA	Sempra Energy	20.3	2008
		Freeport, TX	Freeport LNG Development	30.7	2008
		Sabine, LA	Cheniere Energy	19.9	2008
		Corpus Christi, TX	Cheniere Energy	19.9	2010
		Corpus Christi, TX	ExxonMobil	8.4	2008-2009
		Fall River, MA	Hess LNG	6.1	2010
		Sabine, TX	ExxonMobil, Qatar Petroleum, ConocoPhillips	15.3	2009
		Corpus Christi, TX	Occidental Energy	7.7	2008
		Logan Township, NJ	BP	9.2	N.A.
		Port Arthur, TX	Sempra Energy	12.3	2010
		Cameron, LA	Cheniere Energy	25.3	2011
		Pascagoula, MS	Gulf LNG	11.5	2009
		Pascagoula, MS	Chevron	10.0	N.A.
		Port Lavaca, TX	Gulf Coast LNG Partners	7.7	2009-2010
		Port Pelican, LA	Chevron	12.3	N.A.
		(Offshore), LA	McMoran	7.7	N.A.
		Boston(Offshore), MA	Suez	3.1	2009
		Boston(Offshore), MA	Excelerate Energy	6.1	N.A.
		Long Island Sound, NY	TransCanada, Shell	7.7	2010
		Pleasant Point, ME	Quoddy Bay	15.3	N.A.
		Robbinston, ME	Kestrel Energy	3.8	N.A.
		(Offshore), NY	ASIC	15.3	N.A.
		Baltimore, MD	AES	11.5	N.A.
		(Offshore), GOM	TORP	10.7	N.A.
		(Offshore), FL	Suez	14.6	N.A.
		(Offshore), FL	Port Dolphin Energy	9.2	N.A.
		Long Beach, CA	Sound Energy Solutions	5.4	N.A.
		Bradwood, OR	Northern Star	7.7	N.A.
		Coos Bay, OR	Jordan Cove Energy Project	7.7	N.A.
		(Offshore), CA	BHP Billiton	11.5	N.A.
		(Offshore), CA	Northern Star	3.8	N.A.
		(Offshore), CA	Woodside	9.2	N.A.
		(Off-shore), CA	Chevron	5.8	N.A.
		St. Helens, OR	Port Westward LNG	5.4	N.A.
Philladelphia, PA	PGW	4.6	N.A.		
Calais, ME	BP Consulting	N.A.	N.A.		
(Offshore), CA	Excelerate Energy	4.6	N.A.		
(Offshore), CA	Tidelands	N.A.	N.A.		

[Chart 13] LNG Receiving Terminals Under Planning (continued)

Region	Country	Name	Investors	Capacity (MT/y)	Start Up
North America	Canada	St. John, NB	Canaport LNG	7.7	2008
		Point Tupper, NS	Venture Energy	7.7	2008
		Quebec City, QC	Enbridge, Gaz Met, Gaz de France	3.8	2010
		Riviere-du-Loup, QC	TransCanada, PetroCanada	3.8	2010
		Kitimat, BC	Galveston LNG	7.7	2010
		Prince Rupert, BC	WestPac LNG	3.8	2011
		Goldboro, NS	Keltin Petrochemichals, Petroplus	7.7	2010
	Energie Grande-Anse	N.A.	8	N.A.	
	Mexico	Costa Azul, Baja California	Shell, Semptra	7.7	2008
		GNL Mar Adentro, Baja California	Chevron	10.7	2008
		Lazaro Cardenas	Tractebel, Repsol-YPF	3.8	2008
		Puerto Libertad, Sonora	DKRW Energy	10.0	2011
		Gulf of Mexico(Offshore)	Tidelands	7.7	2008
		Manzanillo	CFE, PEMEX, Mitsui, KOGAS	3.8	2011
		Topolobampo	TransCanada	3.8	N.A.
Bahama	Bahamas	Suez, El Paso	6.4	N.A.	
	Bahamas	AES Ocean Express	6.4	N.A.	
Latin America	Brazil	Pecem	Petrobras	1.6	2008-2009
		Guanabara Bay	Petrobras	3.7	2008
	Chile	Quintero Bay	BG, ENAP, Endesa, Metrogas	2.5	2009
		GNL Mejillones	Suez, Codelco	2.5	2009
	Uruguay	Montevideo	N.A.	2.6	2012
Europe	France	Fos-Cavaou	Gaz de France, Total	6.0	2008
		Fos-Cavaou	ExxonMobil	N.A.	2009
		Bordeaux	4Gas	N.A.	2011
		Le Havre	N.A.	N.A.	N.A.
		Dunkirk	Electricite de France	4.4	2011
	Italy	Isola di Porto Levante	ExxonMobil, Qatar Petroleum, Edison	5.8	2008
		Brindisi	BG	5.8	N.A.
		Livorno	Endesa, Amga, CrossGas	2.9	N.A.
		Syracuse	Shell, ERG	5.8	N.A.
		Rosignano	Edison, Solvay, BP	5.8	N.A.
		Gioia Tauro	CrossGas	8.8	N.A.
		Trieste	Gas Natural	5.8	N.A.
		Taranto	Gas Natural	5.8	N.A.
		(Offshore), Trieste	Endesa	5.8	N.A.
		Porto Empedocle	Nouve Energie	8.8	N.A.
		Rada di Augusta	ERG, Shell	5.8	N.A.
		Sicily	Enel	5.8	N.A.
		Ravenna	Enel	5.8	N.A.
	Spain	Gran Canaria	Endesa	N.A.	2008
		El Musel	Enagas	5.1	2012

[Chart 13] LNG Receiving Terminals Under Planning (continued)

Region	Country	Name	Investors	Capacity (MT/y)	Start Up
Europe	UK	South Hook	ExxonMobil, Qatar Petroleum	14.0	2008
		Canvey	Caor Gas, LNG Japan, Osaka Gas	4.0	2012
		Teesside	ConocoPhillips	N.A.	N.A.
		Gateway	Stag Energy	N.A.	N.A.
	Ireland	Shannon LNG	Hess LNG	N.A.	2011
	Netherlands	Rotterdam	Gasunie/Vopak	4.4	2010
		Eemshaven	ConocoPhillips	7.3	2010
	Germany	Wilhelmshaven	E.On Ruhrgas	4.4-7.3	2010
	Turkey	Ceyhan	N.A.	N.A.	N.A.
	Cyprus	Vasilikos	State Electricity Authority	0.7	2010
	Poland	Swinoujscie	PGNiG	2.2-3.7	2010
	Croatia	Krk	E.ON, Total, OMV, RWE, Geoplin	7.3	2012
Latvia	Baltic Coast	Itera Latvija	0.4	N.A.	
Middle East	Kuwait		KPC	1.3-1.7	2009
Asia Oceania	China	Putian, Fujian	CNOOC, Fujian Investment and Development	2.6	2008
		Qingdao, Shangdong	SINOPEC	3.0	2008
		Shanghai	Shanghai LNG (CNOOC, Shenergy)	3.0	2009
		Ningbo, Zhejiang	CNOOC, Zhejiang Energy Group, Ningbo Electric	3.0	2008
		Rudong, Jiangsu	PetroChina	3.0	2008
		Darlian, Liaoning	PetroChina	2.0	2011
		Tangshan, Hebei	PetroChina, Beijing Enterprises Group, Hebei Construction Investment	6.0	2010
		Tiangjing	CNOOC	2.5	2010
		Haikou, Hainan	CNOOC, Hainan Government	2.0	2009
		Swatou, Guangdong	CNOOC	2.5	2010
		Zhuhai, Guangdong	CNOOC	3.0	2010
		Guangxi	PetroChina	3.0	2010
		Hong Kong	CLP	3.0	2011
		Yingkou, Liaoning	CNOOC	3.0	N.A.
		Binghai, Jiangsu	CNOOC	3.0	N.A.
	Wenzhou, Zhejiang	CNOOC, Yancheng Government	N.A.	N.A.	
	India	Kochi	Petronet	2.5	2011
		Dabhol	Petronet, NTPC, Gail	5.0	2008
		Ennore	IOC, Petronas	5.0	N.A.
		Mangalore	HPCL, Petronet, MRPL	2.5	2012
Pakistan	Karachi	SSGC	2.5	2009	

[Chart 13] LNG Receiving Terminals Under Planning (continued)

Region	Country	Name	Investors	Capacity (MT/y)	Start Up
Asia Oceania Indonesia	Japan	Wakayama	Kansai Electric	N.A.	N.A.
		Joetsu	Chubu Electric	N.A.	N.A.
		Omaezaki	Chubu Gas, Tokai Gas, Suzuyo	N.A.	2010
		Sakaide	Shikoku Electric	0.4	2010
		Kumamoto	Saibu Gas	N.A.	N.A.
		Nakagusuku	Okinawa Electric	0.7	2010
		Naoetsu	INPEX	N.A.	2013
	Korea	Gunsan	GS Caltex	1.5	N.A.
		Samcheok	KOGAS	N.A.	N.A.
	Taiwan	Taichung	CPC	1.7	2008
	Phillipines	Bataan	GN Power	N.A.	N.A.
	Indonesia	Cilegon	PLN, Pertamina	3.0	N.A.
	Singapore	Singapore	Gas Supply Pte, PowerGas	N.A.	N.A.
	Thailand	Map Ta Phut	PTT, EGAT, EGCO	5.0	2011
	New Zealand	N.A.	Contact Energy, Genesis Energy	0.9-1.08	2011

Source: Prepared by IEEJ based on respective corporate websites, etc.

4. LNG supply demand balance

4.1. LNG demand forecasts

Summarized in Chart 14 is the world LNG demand forecast by IEEJ. This has been produced by an econometric model using certain assumptions factored into parameters such as the rate of economic growth and demographic trends. The assumptions used for the demand forecast were established in reference to a study made by IEEJ entitled "Asia/World Energy Outlook 2007."⁶ It should be noted here that a number of uncertainties exist over factors such as the projected economic growth rate and inter-fuel substitution.

According to the model case computation results exhibited below, the global LNG demand is projected to grow from 176.2 MT in 2007 at an annual rate between 4.1 and 4.9% to reach a level between 435 MT and 517 MT by 2030. In terms of regional pictures, the Asian demand would expand from 112.58 MT in 2007 at an annual rate between 2.1 and 3.0% to a level between 182 MT and 223 MT by 2030.

The LNG demands in Europe and the Americas are projected to grow much faster than the Asian market to surpass Asia around the mid 2010s. In particular, the projected growth in the U.S. demand is so brisk that the country is expected to become the world's largest LNG importer by 2030.

⁶ "Asia/World Energy Outlook 2007 – Focusing on China and India", by K. Ito, Y. Morita, Z.Y. Shen, A. Yanagisawa, S. Suehiro, IEEJ, October 2007, <http://eneken.ieej.or.jp/en/data/pdf/405.pdf>

[Chart 14] World LNG Demand Forecasts

(Million Tonnes)

		2007	2010	2020	2030
O c e a n i a	Japan	66.87	66.0 – 70.0	68.0 – 74.0	70.0 – 78.0
	Korea	26.05	31.0 – 33.0	38.0 – 41.0	42.0 – 45.0
	Taiwan	8.22	9.5 – 11.5	14.0 – 17.0	17.0 – 22.0
	India	8.42	9.0 – 11.0	10.0 – 12.0	13.0 – 20.0
	China	3.02	8.0 – 10.0	20.0 – 25.0	25.0 – 36.0
	Others	–	–	12.0 – 17.0	15.0 – 22.0
	Subtotal	112.58	123.5 – 135.5	162.0 – 186.0	182.0 – 223.0
E u r o p e	France	9.74	12.0 – 14.0	17.0 – 20.0	21.0 – 24.0
	Italy	2.13	6.0 – 8.0	13.0 – 16.0	17.0 – 20.0
	Spain	18.91	20.0 – 22.0	23.0 – 28.0	25.0 – 32.0
	UK	1.13	7.0 – 9.0	17.0 – 19.0	28.0 – 31.0
	Others	9.15	14.0 – 16.0	17.0 – 22.0	26.0 – 31.0
	Subtotal	41.06	59.0 – 69.0	87.0 – 105.0	117.0 – 138.0
A m e r i c a	USA	15.84	22.0 – 28.0	65.0 – 73.0	102.0 – 111.0
	Canada	–	0.0 – 1.0	4.0 – 6.0	7.0 – 12.0
	Mexico	1.99	4.0 – 6.0	8.0 – 10.0	16.0 – 19.0
	Others	1.15	1.0 – 2.0	6.0 – 8.0	11.0 – 14.0
	Subtotal	18.98	27.0 – 37.0	83.0 – 97.0	136.0 – 156.0
Total		172.62	209.5 – 241.5	332.0 – 388.0	435.0 – 517.0

Source: IEEJ

4.2. LNG supply potentials

As presented in Chart 8 earlier, the global LNG production capacity existing at the end of 2007 was 198.0 MT. Of that figure the production capacity existing in Asia Pacific, North America, and the Middle East for an aggregated total of 121.0 MT was directed mainly toward the Asian market, although some 6 MT was diverted to the Atlantic market in 2007⁷. Adjusting the production capacity of 4.7 MT at the RasGas II Train 5⁸ and regarding the actual export volume of 20.9 MT as the capacity for Indonesia, which is suffering from a substantial production decline, it can be estimated that a production capacity of 104.4 MT was available for the Asian market in 2007.

As for the future outlook, new liquefaction capacities with signed SPAs or HOAs are expected to become operational to bring the production capacity available for the Asian market to a total of 135.5 MT by 2015 (see Chart 15). For the period after 2011, some of the other projects currently under planning are anticipated to come on stream as well. Additionally, there is a high probability that some new projects that are presently unknown will add to the capacity. As far as this study could identify, a

⁷ Calculated based on the data shown in LNG Focus February – March 2008. Total exported volume of 111.0 MT from Asia-Oceania and the Middle Eastern producers plus 7.7 MT diverted to Asia from African and Latin American exporters minus the demand in the Asian markets at 112.7 MT equals to 6.0 MT.

⁸ This train started production in March 2007. For this study, we regarded that this train operated for 9 months (April to December) in 2007 and that produced 3.53 MT of LNG.

supply capacity up to some 98 MT out of such projects as discussed above could become available for supplying the Asian market by 2020. Thus the potential supply availability for Asia in 2020 is estimated at 233.5 MT. Further, those volumes under the Equity/Branded LNG contracts for European or U.S. deliveries are expected to play an important role of adjusting the Asian demand for the medium term.

It should be kept in mind that the numeric data shown here as the supply capacity is a total of liquefaction capacity for which a degree of uncertainty exists as to whether feed gas could be secured in sufficient quantity throughout the period. On the other hand, some new projects that are currently unknown are likely to come into operation in addition to the capacity listed in Chart 15.

[Chart 15] LNG Supply Potential for Asian Market

(Million Tonnes)

	Existing & HOA/SPA signed	Planning	Supply Potential for Asia	Equity/Branded LNG for Europe and USA
2007	104.4		104.4	33.4
2008	106.6		106.6	41.2
2009	111.5		111.5	62.2
2010	126.2		126.2	77.4
2011	123.7	5.5	129.2	75.0
2012	123.0	12.9	135.9	80.0
2013	123.0	58.4	181.4	81.7
2014	138.0	61.4	199.4	80.0
2015	135.5	61.4	196.9	82.5
2020	135.5	98.0	233.5	80.9
2025	135.5	98.0	233.5	65.7
2030	135.5	98.0	233.5	49.8

Source: Prepared by IEEJ based on respective corporate websites, etc.

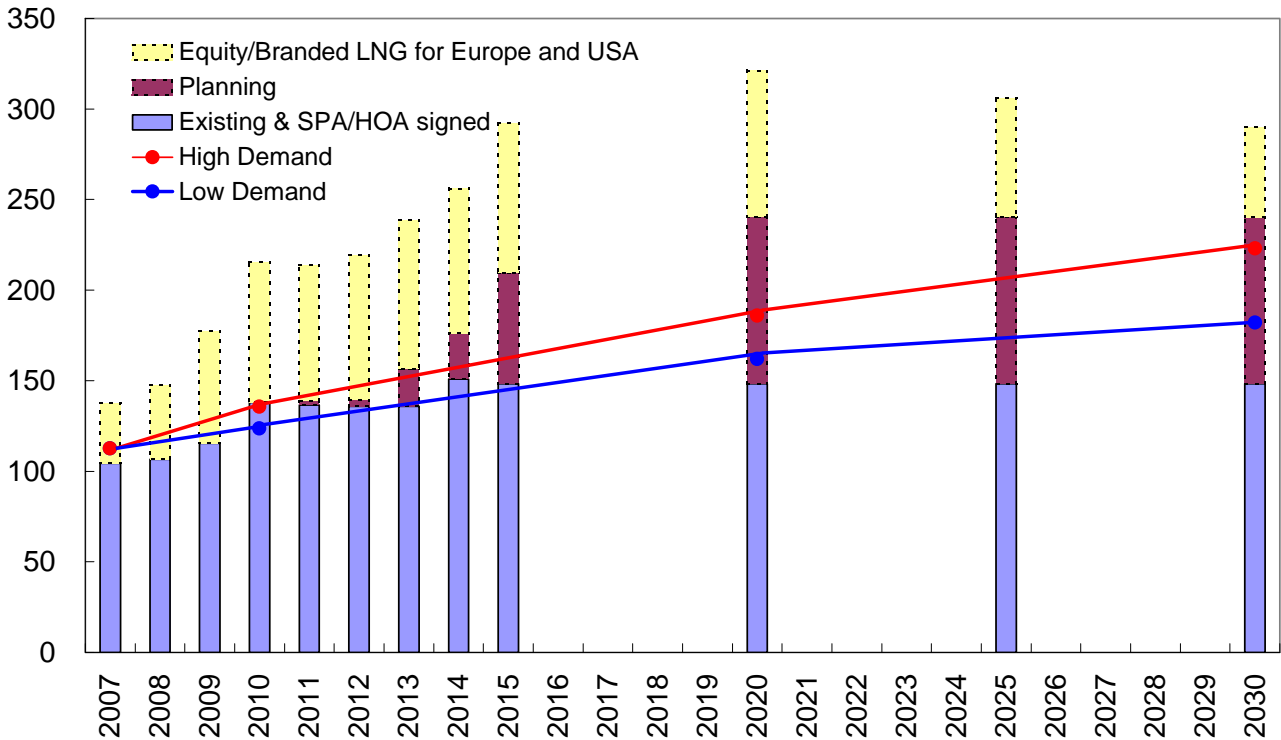
4.3. LNG supply demand balance for Asia

Based on the LNG demand forecast and supply potentials discussed in the foregoing, the outlook of LNG supply demand balance for Asia can be summarized as in Chart 16. The line graphs in the chart represent the projected demand for Asia as given in Chart 14, and the bar graphs refer to the supply potentials discussed in Chart 15. Again, as mentioned earlier, some new projects that are currently unknown could be added. The demand up to 2030 could be covered if those projects currently under planning are smoothly brought to operation. For the period after 2030, a similar scenario would apply where the demand could be satisfied with the smooth realization of those projects currently under planning. As discussed before, 7.7 MT of LNG flowed from Africa and Latin America into Asia in 2007, a substantial portion of which could be attributed to have come from the Equity/Branded LNG contracts originally intended for European or U.S. deliveries. Thus, a part of supply for Atlantic is already built in the supply portfolio for Asia. This trend is likely to last for the medium-term unless future projects targeted at Asian markets are brought into commercial operation

quicker than expected.

[Chart 16] LNG Supply Demand Outlook for Asia

(Million Tonnes)



Source: IEEJ

In our study in FY 2006⁹, we pointed out the following seven factors as key issues for the future LNG supply and demand situation for Asia: namely, energy consumption trends linked to the economic growth; heating/cooling degree days; operating conditions of nuclear power plants; developments on renewal negotiations for Indonesian LNG supply agreements; cost inflation of LNG projects; demand growth in the North American markets; and Qatar's LNG supply strategy. While the importance of factors mentioned above has not changed substantially, the following points seem to require close watch.

Firstly, stemming originally from the subprime mortgage and credit crisis in the U.S., economic slow-down is becoming a real possibility especially in Europe and the U.S. Although the economy in the OECD member countries that include main LNG importers has expanded steadily in the last three to four years, these countries are now making downward revisions to their real GDP growth projection for the short-term. Even though the LNG demand is significantly capacity driven and contractually

⁹ "Natural Gas and LNG Supply/Demand Trends in Asia Pacific and Atlantic Markets (for FY2006)" by T. Morikawa, IEEJ, <http://eneken.ieej.or.jp/en/data/pdf/401.pdf>

constrained, the impact of the economic slow down on the natural gas consumption in these countries should be closely monitored.

Secondly, in relation to the first point, attention should be paid to the price level in the U.S. market, where almost all supplies are based on Equity/Branded LNG contracts, and its impact on the extent of reselling volume for the Asian market. Owing to the soaring prices since 2000, natural gas development in the U.S. has been in brisk progress especially for non-conventional gas reserves, and the annual production in recent years has stayed roughly at about 19 Tcf. On the other hand, since the demand growth has been sluggish, the LNG demand outlook published by EIA¹⁰ was continuously revised downward for the last several years¹¹. How the Henry Hub price will behave in the 2008 - 2010 period, when various LNG projects aimed at the U.S. market will start operations, should be important as it is one of the key elements determining the LNG supply potential for Asian deliveries.

Thirdly, there is the issue of the Kashiwazaki-Kariwa Nuclear Power Station and its timing of service restoration from the current shutdown due to the earthquake in Niigata Prefecture in July 2007. According to estimates by IEEJ¹², an additional LNG demand of between 3.37 MT and 3.84 MT per year would be generated as a result of this unplanned shutdown. While resuming plant operation would largely depend on decision by the local autonomous body, its timing will substantially impact on the short-term LNG demand of Japan.

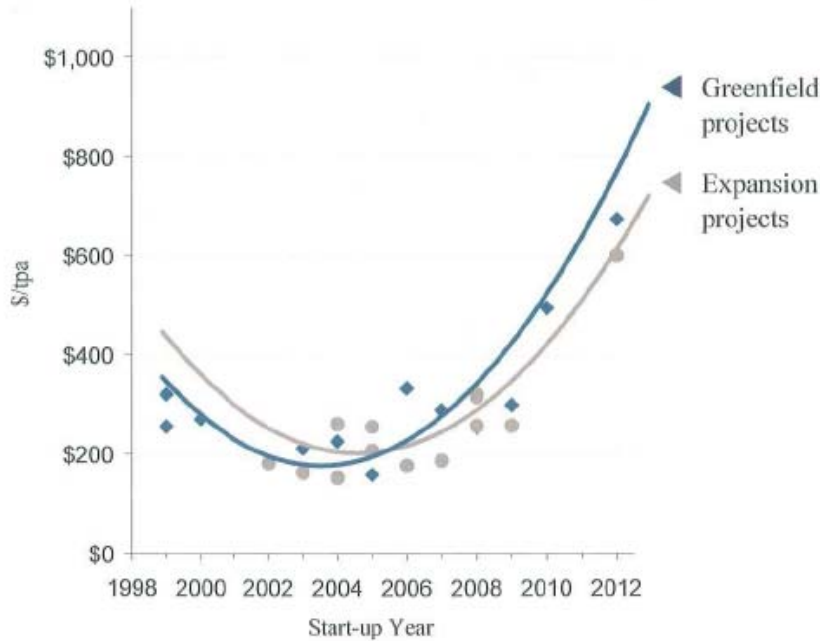
The fourth element to watch is concerned with a deteriorating investment climate for LNG projects. Behind this trend are cost inflation of LNG projects and resource nationalism. As illustrated in Chart 17, the EPC (i.e. engineering, procurement and construction) cost for LNG project used to be about \$200 per tonne during 2003 - 2004, but increases sharply to \$700 - \$900 per tonne for projects that will come on stream around 2012.

¹⁰ Energy Information Administration, the U.S. Department of Energy

¹¹ In the *Annual Energy Outlook 2005* by IEA, the LNG demand for 2010 was projected at 2.5 Tcf (52.5 MT), whereas the *Annual Energy Outlook 2007* puts it at 1.81 Tcf (38.0 MT).

¹² "Impacts on International Energy Market of Unplanned Shutdown of the Kashiwazaki-Kariwa Nuclear Power Station", by T. Murakami, M. Watanabe, S. Sato, K. Shida, April 2008, <http://eneken.ieej.or.jp/en/data/pdf/434.pdf>

[Chart 17] EPC Cost for LNG Projects



Source: Poten & Partners

Furthermore, gas-producing countries are strengthening control over their domestic resource and create risk for LNG investments. The speculated creation of a gas cartel did not materialize in the GECF¹³ meeting in Doha in April 2007. Differences between oil and gas businesses with respect to the market structure or transaction, and the difficulty to form a unified decision among the member countries seem to present a high hurdle for organizing an effective gas cartel. However, if gas producing countries like Russia, Iran or Algeria would start to either take coordinated actions or hold regular meetings on investment for future development or pricing policy, international oil companies or LNG buyers might be pressured at least psychologically, which could prevent timely investment decisions from being taken. The EU is heavily dependent on natural gas from Russia and Algeria and therefore is taking the situation quite seriously. Since Japan also is preparing for importing LNG from Russia in the near future, it would be necessary to pay sufficient attention on the so-called “Gas-OPEC” idea.

The fifth factor of note is that non-conventional LNG projects are being brought to realization. In the area of gas field development, a number of new gas projects based on coal-seam gas reserves are announced one after another in Queensland, Australia. Meanwhile, the project currently pursued by LNG Ltd. of Australia is said to employ a unique liquefaction technology and, despite its small scale, have cost competitiveness approaching a commercial level. Furthermore, Flex LNG of the U.K. is

¹³ Gas Exporting Countries Forum. Established in 2001, the forum did not have a fixed membership structure in the past six meetings; however Algeria, Bolivia, Brunei, Egypt, Equatorial Guinea, Indonesia, Iran, Malaysia, Nigeria, Qatar, Russia, Trinidad & Tobago, the UAE and Venezuela could be identified as current members.

planning an LNG project in Nigeria based on a floating liquefaction plant. Elsewhere, continued efforts are paid to developing off-shore liquefaction technologies as well. Although these non-conventional projects appear to face numerous obstacles in terms of technology or economics, they also demonstrate that technological advancement is being achieved in the face of rapidly expanding LNG demand. It is therefore believed that the speed of technological innovation will become one of the factors influencing the LNG supplies on a medium-term basis.

Contact: report@tky.ieej.or.jp