Natural Gas and LNG Supply/Demand Trends in Asia Pacific and Atlantic Markets* (2006)

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Introduction

This paper discusses a portion of the outcome 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 "FY2006 Investigative 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 type survey on the on-going status of countries that are either exporting or importing LNG as well as trends in the LNG markets, which will have an impact on Japan's natural gas supply and demand situation. In the following sections, an overview on the natural gas supply and demand, natural gas trading, the LNG chain, and LNG supply and demand balance will be presented in this order.

1. Natural gas supply and demand

The world natural gas reserves at the beginning of 2006 stood at 180.5 Tcm[1], 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 14.7 Tcm, representing only 8.1% of the world total. The world natural gas production in 2005 was 2.78 Tcm, with North America and the former Soviet Union each making up 27.1% and 28.5%, respectively, while Asia and Oceania accounted for 12.2% of the total. In terms of consumption, large volumes are notable in North America and the former Soviet Union, both of which having vast production capacities, as well as Europe with robust trading based on regional or inter-regional supplies supported by well-developed pipeline networks. Natural gas demand in Asia and Oceania was 374.7 Bcm[2], accounting for 13.5% of the world total (see Chart 1 and Chart 2).

* This paper is an excerpt from a research commissioned by the Ministry of Economy, Trade and Industry in FY2006, and has been released under the permission of the Ministry. We thank the related parties in the Ministry for their understanding and cooperation. We are also grateful and indebted to the Working Group members for their contribution to this research.

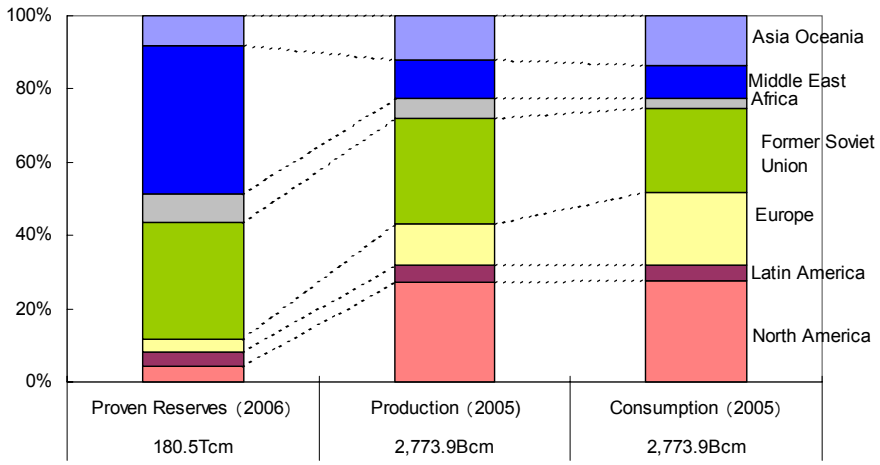
[1] Trillion cubic meters
[2] Billion cubic meters

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

	Proven Reserves (2006)		Production (2005)		Consumption (2005)	
	(Tcm)	Share (%)	(Bcm)	Share (%)	(Bcm)	Share (%)
North America	7.6	4.2%	752.1	27.1	769.5	27.7
Latin America	7.0	3.9%	128.3	4.6	114.3	4.1
Europe	6.6	3.7%	322.3	11.6	552.1	19.9
Former Soviet Union	57.2	31.8%	791.3	28.5	633.1	22.8
Africa	14.4	8.0%	152.7	5.5	79.6	2.9
Middle East	73.0	40.6%	288.8	10.4	250.8	9.0
Asia Oceania	14.7	8.1%	338.4	12.2	374.4	13.5
Total	180.5	100.3%	2,773.9	100.0	2,773.9	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

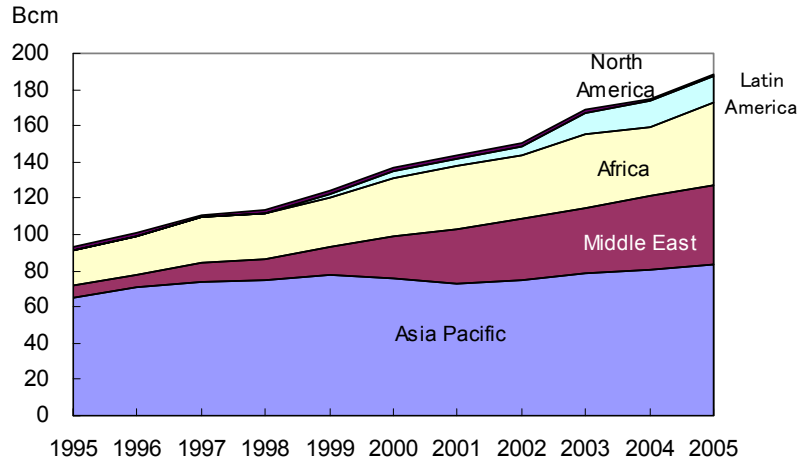
2.1. LNG imports and exports

The worldwide trading volume of natural gas in 2005 was 731.22 Bcm, of which 188.81 Bcm or about 138 MT (million tonnes) representing 26% of the total was traded in the form of LNG. World LNG trading has expanded at an average annual growth rate of 7.3% between 1995 and 2005.

As for the 2005 export volumes by region, Asia Pacific accounted for 44% of the world

total, while 23% was sourced from the Middle East, 24% from Africa, 7% from Latin America, and 1% from North America (see Chart 3).

[Chart 3] LNG Exports by Region



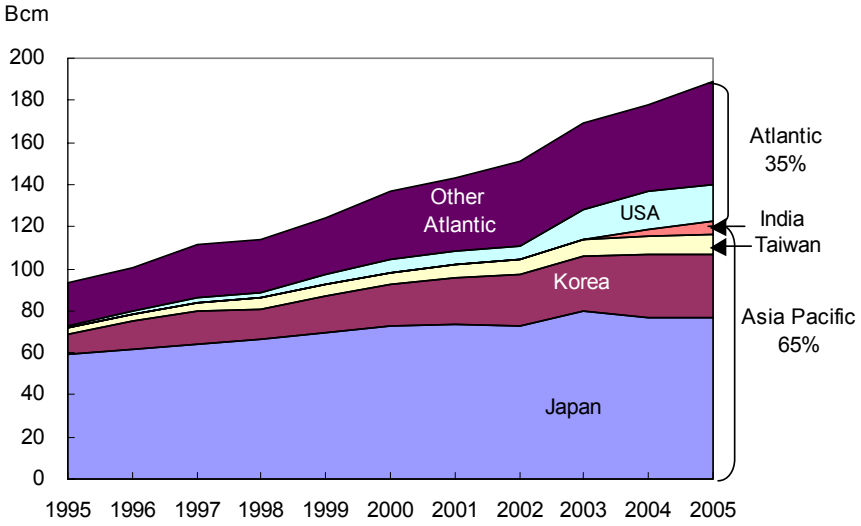
(Source) *Natural Gas in the World*, Cedigaz

Concerning imports by region, LNG demand in the Asia Pacific market[3] in 2005 was 122.42 Bcm, while the Atlantic market[4] had a demand of 66.39 Bcm. Over the period from 1995 to 2005, the average annual growth rate for the Asia Pacific market demand was 5.5%, whereas the Atlantic market grew by an annual rate as high as 12.0% for the same period (see Chart 4). The main contributor for such a remarkable growth was a sharp increase in imports by the USA.

[3] The Asia Pacific market comprises LNG importing and exporting countries east of the Suez Canal. As of 2006, there are eight exporting countries (Abu Dhabi, Oman, Qatar, Australia, Brunei, Indonesia, Malaysia, and the USA), and five importing countries (Japan, South Korea, Taiwan, India and China). Since the USA exports LNG from its Alaskan Pacific Coast, its export is included in the Asia Pacific market in this discussion.

[4] The Atlantic market comprises LNG importing and exporting countries west of the Suez Canal. As of 2006, there are five exporting countries (Algeria, Libya, Nigeria, Egypt, and Trinidad and Tobago), and eleven importing countries (the USA, Mexico, Dominican Republic, Belgium, France, Spain, Portugal, Italy, Greece, Turkey, and the UK) plus Puerto Rico, a Commonwealth of the USA. Since the USA is receiving imported LNG on its East Coast and the Gulf of Mexico, its import is included in the Atlantic market in this discussion.

[Chart 4] LNG Imports by Region

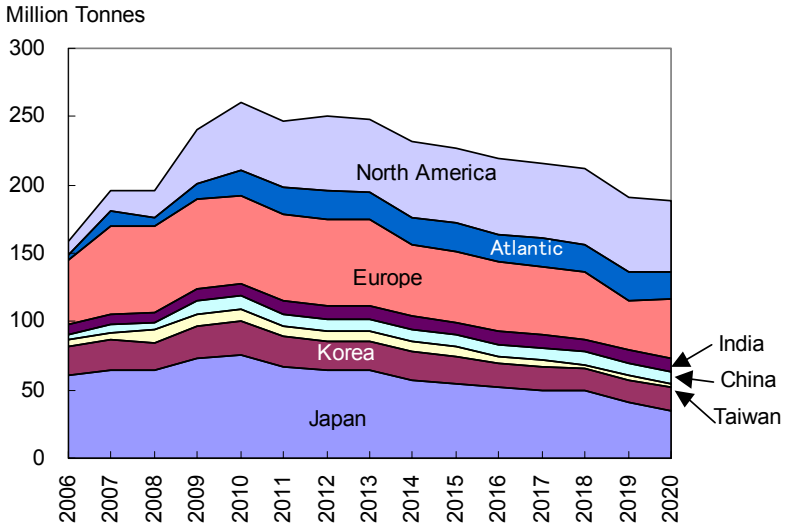


(Source) *Natural Gas in the World*, Cedigaz

2.2. Mid and long term contracts

Most LNG trades are based on long term contracts extending over twenty years; although mid-term contracts ranging from three to ten years have also been concluded in recent years. As of 2006, the total volume on mid and long term LNG contracts has amounted to 166.56 MT. As will be discussed later, a substantial increase in demand is anticipated in the European and the USA market and is reflected in the contracted volume through 2020 (see Chart 5). A noteworthy fact here is that, in newly concluded contracts for the Atlantic market, a contractual seller often appoints its own representative as a contractual buyer for the majority of the contract volume. Such a contracting practice differs from traditional LNG contracts, the difference being that the end user in the former type of transaction is not always the actual importer.

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



Notes:

1. The figures referred to in this graph 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. Moreover, optional volumes are not included in the data.
3. While the graph is based on the total volume on mid and long term contracts, actual supplies may not match the contracted volumes. In particular, volumes supplied at an early stage of a project usually are less than the contracted values. In addition, the volumes supplied could fluctuate depending on gas demand trends in the importing country or operating conditions of the liquefaction plant.

Sources: Press releases by respective project operators, etc.

2.3. Spot trading

The volume of spot LNG trades in 2005 was 22.86 Bcm (16.69 MT) worldwide, of which 9.9 Bcm (7.22 MT) was for deliveries into the USA, 7.3 Bcm (5.33 MT) was for Europe, and 5.6 Bcm (4.09 MT) was for Asia. While the above volume represents only 12.1% of the global LNG trades, its growth since the late 1990s has been significant[5] (see Chart 6).

For the 2006-2007 winter season, Asian buyers completed the procurement of

[5] The spot trading discussed here refers to transactions made under contracts with terms of four years or less. The cargo-by-cargo spot transaction in the usual sense seems to be very rare in the case of LNG trade.

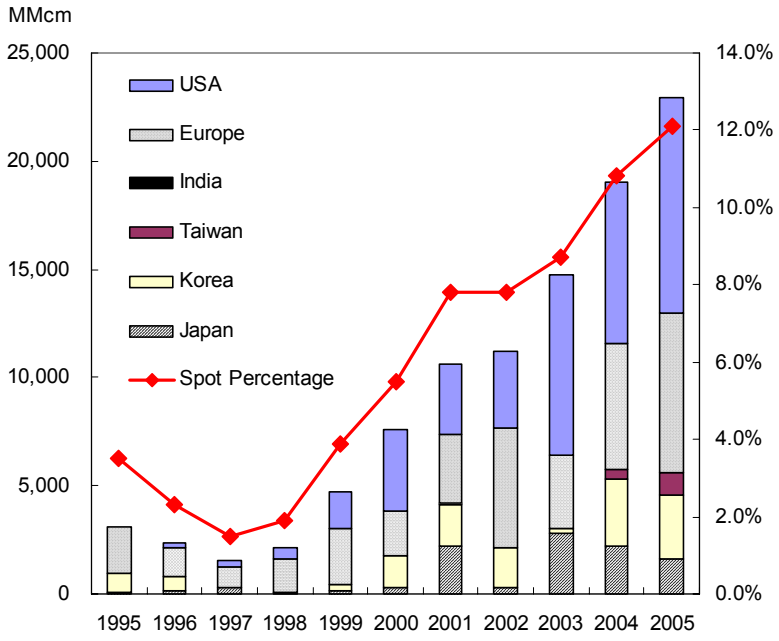
necessary spot cargoes much earlier than the average year, having learned from the hard experience of the 2005-2006 winter season that brought unusually cold weather across the world. It is also becoming commonplace to secure spot cargoes not just from the Middle East, the major supply source of spot cargoes, but also from countries such as Egypt, Algeria, Nigeria, or Trinidad and Tobago, which traditionally are the sources for Europe and North America. Additionally, prices at Henry Hub or NBP stayed lower than the 2005-2006 winter, and also there had been sufficient shipping capacity. Those factors contributed to more cargoes diversion for Asia.

In relation to spot market, in June 2006, LNG Impel of Canada and the Dubai Multi Commodities Centre signed an MOU to jointly construct an LNG Storage Hub in Dubai, which is the first of its kind in the world. The hub plans to offer customers the storage, trading, blending different quality of LNG as well as financial derivatives. Although the eventual viability of the project is uncertain at present due to the fact that LNG transactions mainly comprise long term contracts with specific cargo destinations, and that changes in cargo properties are likely to occur when the storage extends over a long period of time, this project is worthy of continued attention as a new LNG-related business eying at an expansion of the spot market.

Additionally, in the 2nd half of 2006, an unprecedented type of operations was observed, in which a fully loaded LNG tanker was moored at an off-shore anchorage waiting for a higher and thus more opportune spot price[6]. Dubbed as a “Floating LNG Storage”, however, this type of operation did not appear to have made much of a success as the USA or UK markets remained weak in comparison with the previous 2005-2006 winter.

[6] According to an industry report, some 16 cargoes were put on the Floating LNG Storage operations in the 2nd half of 2006. (“2006 Review – An Overview of the LNG Year Past” by Andy Flower, *LNG Focus*, February 2007)

[Chart 6] Spot LNG Transactions of the World



Sources: Petrostrategies, GIIGNL, Cedigaz

2.4. LNG pricing

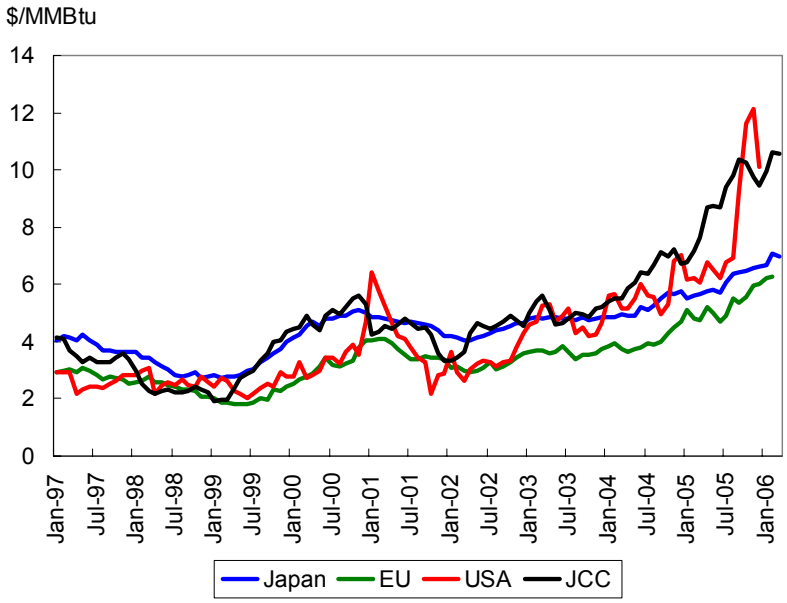
LNG pricing varies from region to region. In Asia, LNG prices are generally linked to the so-called JCC ("Japan Crude Cocktail"), which is an average CIF price of crude oil imported into Japan, whereas in continental Europe they are linked to prices of petroleum products or the Brent crude. In the USA or the UK, LNG prices are determined by supply and demand situations at Henry Hub in the USA or National Balancing Point (NBP) in the UK.

Chart 7 shows the historical LNG import prices into Japan, the USA and the EU. Until around 2000, LNG prices for Japan remained at relatively higher levels in comparison with the USA or the EU. While the LNG prices for Japan is on the rise in line with the increase in the JCC prices, 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. The EU price shows similar movements to that of Japan, since both prices are linked to oil prices. LNG price into the USA have been on an upward trend since 1999, reflecting the escalated prices for domestic natural gas, which are highly volatile as well.

Concerning prices for Japan deliveries, since the structure of a typical pricing formula is such that it allows LNG a greater price advantage over competing petroleum products in an inflated crude oil market, the soaring crude prices in recent years are causing a

considerable increase in LNG demand particularly by industrial users. By contrast, in countries such as India or China, the soaring prices are likely to work as a factor to discourage the growth in LNG demand due to a widening price gap with coal as the main competing fuel.

[Chart 7] LNG Import Prices for Japan, EU and the U.S.A.



Source: *Energy Prices & Taxes*, IEA

3. The LNG chain

3.1. Liquefaction plants

The annual LNG production capacity currently available in the world stands at 181.7 MT as of 2006. On a regional basis, Asia Pacific has the largest capacity of 73.6 MT, followed by Africa and the Middle East at 50.6 MT and 41.4 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 USA and European destinations is primarily supplied from Africa and Latin America.

At the end of 2006, Indonesia had the largest liquefaction capacity in the world with a nameplate capacity reportedly being 28.3 MT per year. However, the actual export volume was much smaller at 23.49 MT for the year 2005, due to depletion or production troubles at the gas fields feeding the liquefaction plants. As a result of this, Qatar with its newly added RasGas II Train No.4 became the world's largest LNG exporting nation

replacing Indonesia in 2006[7].

[Chart 8] Existing LNG Production Plants (at the end of 2006)

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(2.52): 1976-2013 GdF(3.7): 1982-2013 GdF(1.3): 1992-2013 Distrigas(0.95): 1978-2008 Duke(0.59): 1989-2009 Statoil(0.51): 2003-2006 Sempra(1.9): 2008-2028 Distrigas(3.24): 1982-2006 Botas(2.88): 1994-2013 ENI(1.33): 1997-2014 DEPA(0.49): 2000-2021 Iberdrola(0.75): 2002-2017 Endesa(0.75): 2005-2020
		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)	0.7	1970	Sirte Oil		Gas Natural(1.1): 1991-2011
	Nigeria	Nigeria LNG (Train 1, 2)	6.4	1999	NNPC, Shell, Total, ENI	NNPC(49), Shell(25.6), Total(15), ENI(10.4)	ENEL(2.59): 1999-2019 Botas(0.89): 1999-2021 GdF(0.36): 1999-2021 Gas Natural(1.19): 2002-2024 Iberdrola(0.36): 2005-2025 Endesa(0.75): 2006-2016 Transgas(0.31): 2000-2019 Transgas(1.5): 2005-2025 Shell(1.1): 2005-2025 BG(2.2): 2004-2023 Total(0.9): 2005-2026 Shell(1.4): 2007-2027
		Nigeria LNG (Train 3)	3.2	2002			
		Nigeria LNG (Train 4, 5)	8.2	2006			
	Egypt	Damietta LNG (Train 1)	5.0	2005	EGPC, EGAS, BP, BG, Petronas	Union Fenosa Gas(80), EGAS(10), EGPC(10)	Union Fenosa(3.2): 2005-2030 BG(1.7): 2005-2010 BP(2.38): 2005-
		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
	Sub Total		50.6				

[7] With RasGas II Train 5 on stream in March 2007, Qatar has the largest liquefaction capacity in the world.

[Chart 8] Existing LNG Production Plants (at the end of 2006) (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	ConocoPhilips(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(1.19): NA Suez(1.63): 1999-2018 AES(0.75): 2003-2023 BG(2.2): 2004-2020 Marathon(1.2): 2005-2010 Gas Natural(0.65): 2002-2023 Suez(0.34): 2000-2020 BP(0.8): 2002-2021
		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	2006		BP(37.78), BG(28.89), Repsol-YPF(22.22), NGC(11.11)	
	Sub Total		16.1				
Middle East	Dhabi Abu	ADGAS (Train 1, 2)	3.1	1977	ADNOC(100)	ADNOC(70), Mitsui(15), BP(10), Total(5)	Tokyo Electric(4.39): 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 Shell(0.7): 2002-2007 BP(0.6): 2004-2010
		Qalhat LNG (Train 3)	3.7	2005		Oman Government(47), Oman LNG(37), Union Fenosa(7), Mitsubishi(3), Itochu(3), Osaka Gas(3)	Itochu(0.7): 2006-2025 Mitsubishi(0.8): 2009-2025 Osaka Gas(0.8): 2009-2025 Union Fenosa(1.6): 2006-2025
	Qatar	Qatargas (Train 1-3)	9.7	1997	QP(65), Total(20), ExxonMobil(10), Mitsui(2.5), Marubeni(2.5)		Chubu Electric(4): 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 Iberdrola(0.88): 2003-2022

[Chart 8] Existing LNG Production Plants (at the end of 2006) (continued)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
Middle East	Qatar	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): 2005-2025 Edison(4.7): 2007-2032 Distrigas(2.05): 2007-2027 CPC(3): 2008-2033
		RasGas II (Train 3)	4.7	2004	QP, ExxonMobil	QP(70), ExxonMobil(30)	
		RasGas II (Train 4)	4.7	2005	QP, ExxonMobil	QP(70), ExxonMobil(30)	
	Sub Total		41.4				
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(0.7): 1997-2013
	Indonesia	Bontang I (Train A, B)	5.2	1977	VICO, Total, INPEX, Chevron ①Offshore Mahakam Total(50) INPEX(50) ②Attaka Unit Chevron(50) INPEX(50) ③Makassar Chevron(90) Pertamina(10) ④Ganal Chevron(80) Eni-Ganal(20) ⑤Sanga Sanga VICO(23.13)LASMO(26.25)BP(26.25)CPC(20)Universal Gas & Oil(4.37)	Pertamina(55), VICO(20), JILCO(15), Total(10)	Osaka Gas(1.265): 1994-2013 Tokyo Gas(0.92): 1994-2013 Toho Gas(1.15): 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(1.68): 2003-2011 Kansai Electric(0.88): 2003-2011 Osaka Gas(0.44): 2004-2011 Toho Gas(0.56): 2003-2011 KOGAS(2): 1994-2014 KOGAS(1): 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
		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			
		Arun I (Train 1)	1.5	1978	ExxonMobil(100)	Pertamina(55),. ExxonMobil(30), JILCO(15)	
		Arun II (Train 4, 5)	3.0	1984			
		Arun III (Train 6)	2.0	1986			

[Chart 8] Existing LNG Production Plants (at the end of 2006) (continued)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
Asia Pacific	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): 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 Osaka Gas(0.12)2006-2024 Tohoku Electric(0.5): 2005-2025 Toho Gas(0.52): 2007-2027 KOGAS(1.5): 2003-2010 KOGAS(1.5): 2008-2028
		Malaysia LNG (Project Unspecified)					Hiroshima Gas(0.008-0.016): 2005-2012 Osaka Gas(0.92): 2009-2025 Shikoku Electric(0.42): 2010-2025 Chubu Electric(0.54): 2011-2031 Saibu Gas(0.39):2013-2028
	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 Kansain 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(0.5): 2003-2007→2016 Tokyo Gas(1.07): 2004-2029 Toho Gas(0.3): 2004-2029 Osaka Gas(1): 2004-2034 Kyushu Electric(0.5): 2004-2026 Shizuoka Gas(0.14): 2005-2029 Tohoku Electric(0.4): 2005-2019 Chubu Electric(0.6): 2009-2024 CNOOC(3.3): 2006-2031 Shell(up to 3.7):2004-2009 Tohoku Electric(0.6):2010-2019
		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): 2006-2023 Tokyo Gas(1): 2006-2023
	Sub Total		73.6				
Total			181.7				

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

In addition to existing capacities described in the above, there are a number of new projects and expansion projects on existing plants. Such new LNG production capacities that are either under construction or signed SPAs (Sale and Purchase Agreements) or HOAs (Heads of Agreements) total to 116.9 MT at the end of 2006, which are expected to come on line by 2012 (see Chart 9).

[Chart 9] LNG Production Plants with Signed SPAs/HOAs

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
Africa	Nigeria	NLNG (Train 6)	4.1	2007 Q4	NNPC, Shell, Total, ENI	NNPC(49), Shell(25.6), Total(15), ENI(10.4)	Shell(1.4): 2007-2027 Endesa(0.75): 2006-2016 Total(N.A.)
		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(1.375): 2012- ENI(1.375): 2012-
	Equatorial Guinea	Bioko LNG (Train 1)	3.4	2007 Q4	Marathon, Sonagas	Marathon, Sonagas, Mitsui, Marubeni	BG(3.4): 2007-
	Sub Total		15.9				
Europe	Norway	Snohvit LNG (Train 1)	4.2	2007 December	Statoil 33.53%, Petoro 30%, Total 18.4%, Gaz de France 12%, Amerada Hess 3.26%, RWE 2.81%		Statoil(1.75): 2007- Iberdrola(1.17): 2007- GdF/Total(1.24): 2007-
	Sub Total		4.2				
Middle East	Qatar	RasGas II (Train 5)	4.7	2007 March	N.A.	Qatar Petroleum(70), ExxonMobil(30)	Partially same as the RasGas II Train 1-4 buyers
		RasGas 3 (Train 6)	7.8	2008 Q4	N.A.	Qatar Petroleum (70), ExxonMobil(30)	ExxonMobil(7.8): 2008-
		RasGas 3 (Train 7)	7.8	2009 Q4	N.A.	Qatar Petroleum(70), ExxonMobil(30)	ExxonMobil(7.8): 2009-
		Qatargas II (Train 1)	7.8	End 2007	N.A.	Qatar Petroleum(70), ExxonMobil(30)	ExxonMobil(10.4): 2007-2032 Total(5.2): 2009-2034
		Qatargas II (Train 2)	7.8	End 2008	N.A.	Qatar Petroleum(65), ExxonMobil(18.3), Total(16.7)	
		Qatargas 3	7.8	2009 Q1	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(7.8): 2009-
	Yemen	Yemen LNG (Train 1, 2)	6.7	2009 Q2	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(2.5): 2009-2029
	Sub Total		58.2				

[Chart 9] LNG Production Plants with Signed SPAs/HOAs (continued)

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors		Buyer (Quantity): Contract Duration
					Gas Field	Liquefaction Plant	
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)	10.0	End 2011	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-
		Pluto (Train 1, 2)	7.0	End 2010	Woodside		Tokyo Gas(1.5-1.7): 2010-2025 Kansai Electric(1.75): 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 Wiriagar(10), LNG Japan(7.35)		K-Power(0.6): 2006-2026 POSCO(0.55): 2005-2025 CNOOC(2.6): 2007-2032 Sempra(3.7): 2008-2028 Tohoku Electric(0.12): 2010-2025
	Russia	Sakhalin II (Train 1, 2)	9.6	2008 Summer	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): 2010-2033 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		38.6				
Total			116.9				

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

In terms of regional figures for expansion, the Middle East is slated for a total expansion of 58.2 MT, whereas 15.9 MT is planned in Africa, 38.6 MT in Asia Pacific and 4.2 MT in Europe. It is clear that most of the new projects in the Middle East and Africa have the Atlantic market in mind as their main outlets. Additionally, countries such as Equatorial Guinea, Yemen, Norway and Russia are expected to newly join the ranks of LNG exporting countries. Among the existing exporters, Qatar's brisk pace of production increase is notable where its LNG capacity expected to treble from 25.7 MT in 2006 to 77.2 MT by 2010.

In seeking further cost reduction, sizes of liquefaction plants are also becoming increasingly large. While the Damietta project in Egypt currently boasts the world's largest single train production capacity of 5 MT/year, Qatar's RasGas 3, Qatargas II, Qatargas 3, and Qatargas 4 projects will have a single train capacity as high as 7.8 MT/year.

Additionally, there are a number of new projects being planned for commercial

operation. As shown in Chart 10, the known new LNG production capacities currently under review for commercialization total to 163.35 MT. However, there are significant differences among these projects with respect to the possibility of their materialization, depending on LNG demand prospects, political stability and environmental restrictions in the host countries and development strategies by project developers. Accordingly, there is no guarantee that all of these projects will be implemented, and, even if they will, they may not necessarily start production at the indicated schedule.

[Chart 10] LNG Production Plants Under Planning

Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors	Destinations
Africa	Algeria	Skikda	4.5	N.A.	Sonatrach	Atlantic
		Gassi Touil (Arzew)	4.0	N.A.	Sonatrach	Atlantic
	Nigeria	Olokola LNG (Train1-4)	20.0	2009-2010	NNPC(49.5), Chevron(18.5), Shell(18.5), BG(13.5)	Atlantic
		Brass River LNG (Train 1, 2)	10.0	2011	NNPC(49), Total(17), ConocoPhillips(17), ENI(17)	USA, Mexico
	Angola	Angola LNG (Train 1)	4.0	2010-2011	Chevron(36.4), Sonangol(36.4), BP(13.6), Total(13.6)	Atlantic
		Angola LNG (Train 2)	6.0	N.A.	Chevron, Sonangol	Atlantic
	Egypt	Damietta (Train 2)	5.0	2011	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	Bioko LNG (Train 2)	4.4	N.A.	Marathon(60), Sonagas(25), Mitsui(8.5), Marubeni(6.5)	N.A.
	Sub Total		64.4			
Europe	Russia	Shtokman LNG	N.A.	N.A.	Gazprom	Atlantic
		Baltic LNG	5.0	2010	Gazprom	Canada
	Norway	Snohvit LNG (Train 2)	4.2	2012	Petro, Statoil, Total, Gaz de France, Amerada Hess, RWE	Atlantic
	Sub Total		9.2			

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

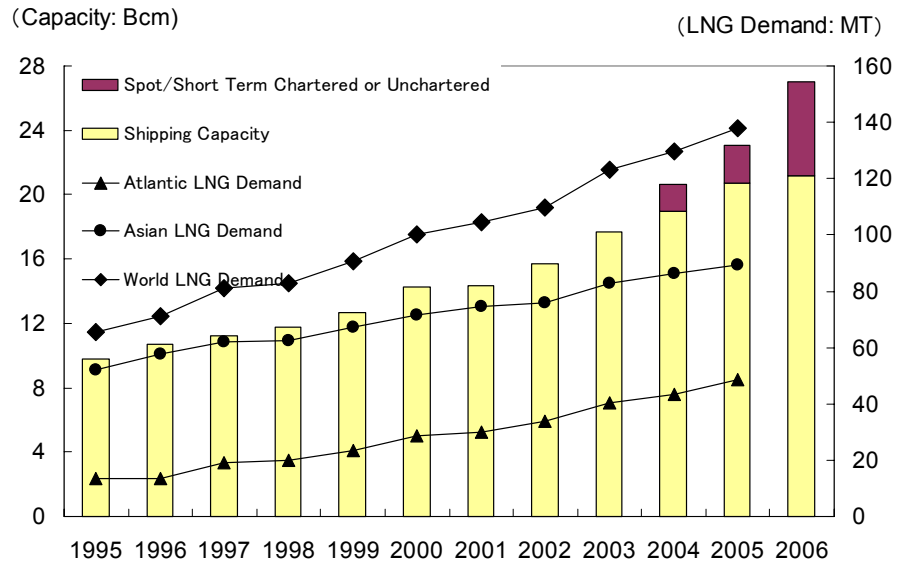
Region	Country	Project (Train)	Capacity (MT/y)	Start Up	Investors	Destinations
East Middle	Iran	Pars LNG (Train 1, 2)	10.0	2011	NIOC(50), Total(40), Petronas(10)	Atlantic
		Persian LNG (Train 1, 2)	16.2	2011	NIOC(50), Shell(25), Repsol(25)	Asia, Europe
		NIOC LNG	10.0	N.A.	NIOC	Asia
	Sub Total		36.2			
Americas	USA	North Slope (Train 1-4)	9.0	N.A.	Yukon Pacific	USA
	Venezuela	Mariscal Sucre (Train 1)	4.7	N.A.	PDVSA, Shell, Mitsubishi	USA
	Peru	Peru LNG	4.4	2008	Hunt Oil(50), SK(30), Repsol-YPF(20)	USA, Mexico
	Trinidad and Tobago	Atlantic LNG (Train 5)	N.A.	N.A.	N.A.	N.A.
	Sub Total		18.1			
Asia Pacific	Australia	Greater Sunrise	7.0	N.A.	Woodside(33.44), ConocoPhillips(30), Shell(26.56), Osaka Gas(10)	Asia Pacific
		Tassie Shoal	3.6	2011	Methanol Australia	Asia Pacific
		Browse	7.0	2012-2014	Woodside, Chevron, BP, BHP Billiton, Shell	Asia Pacific
		Pilbara	6.0	End 2011	BHP Billiton, ExxonMobil	USA
		Ichthys	6.0	2012	INPEX(76), Total(24)	Asia Pacific
	Indonesia	Tangguh (Train 3)	N.A.	N.A.	BP, MI Berau, CNOOC, Nippon Oil, KG Berau Wiriagar, LNG JAPAN	Asia Pacific
		Senoro	0.85	N.A.	LNG Ltd, Medco	Asia Pacific
	Indonesia	Natuna	N.A.	N.A.	ExxonMobil, Pertamina	Asia Pacific
		Matindo LNG	2.0	2009	Pertamina, Medco, Mitsubishi	Asia Pacific
		Abadi	3.0	2015	INPEX	Asia Pacific
	Papua New Guinea	N.A.	N.A.	2012/2013	Oil Search, BG	Asia Pacific
	Sub Total		35.5			
Total			163.35			

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

3.2. LNG tankers

As of the 2006 year-end, the number of LNG tankers in operation was 218 with an aggregated loading capacity of 27 Bcm. 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 transport capacity has outstripped the growth in LNG demand (see Chart 11). As a result, there recently are LNG tankers having only spot or short-term charters or some of them even without any charter contract. In the backdrop of the Floating LNG Storage operation described earlier are the reduced charter rates caused by the increased number of freelance vessels.

[Chart 11] LNG Shipping Capacity



Sources: LNG Japan, IEEJ

As with the case of liquefaction plants, the jumboizing trend is also prevalent in newly built LNG tankers. While most LNG tankers today have capacities of 135,000 to 145,000m^3 at the maximum, larger vessels having capacities of 200,000 to 270,000 m^3 or so-called Q-Flex or Q-Max vessels, will be built and employed for the new projects in Qatar. Although the Q-Flex or Q-Max vessels are originally designed for a particular range of import terminals in the Atlantic markets, some of the Asian terminals are also undergoing modifications to receive such extra-large vessels.

3.3. Receiving terminals

As of the 2006 year-end, LNG receiving terminals exist at 56 locations throughout the

world, with an aggregated annual receiving capacity of 203.5 MT. In terms of regional distribution, Japan has an unparalleled 27 terminals, followed by the USA and Spain with five terminals each, and South Korea with four (see Chart 12).

[Chart 12] Existing LNG Receiving Terminals (2006 Year-end)

Region	Country	Name	Investor(s)	Capacity (MT/y)	Storage (1,000kl)	Start-up
Asia	Japan	Sendai	Sendai City Gas	0.15	80	1997
		Higashi Niigata	Nihonkai LNG	4.0	720	1984
		Futtsu	Tokyo Electric	9.0	1,110	1985
		Sodegaura	Tokyo Electric, Tokyo Gas	9.5	2,660	1973
		Higashi Ogishima	Tokyo Electric	6.0	540	1984
		Ogishima	Tokyo Gas	2.0	600	1998
		Negishi	Tokyo Electric, Tokyo Gas	3.5	1,180	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	320	1987
		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	1,585	1977
		Sakai	Sakai LNG	2.7	420	2006
		Himeji	Osaka Gas	2.6	740	1984
		Himeji LNG	Kansai Electric	2.6	520	1979
		Mizushima	Chugoku Electric, Nippon Oil	0.8	160	2006
		Hatsukaichi	Hiroshima Gas	0.5	170	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	86	1996
		Japan total		70.44	14,553	
	South Korea	Pyeongtaek	KOGAS	7.2	1,000	1986
		Inchon	KOGAS	7.2	2,480	1996
		Tongyoung	KOGAS	3.0	980	2002
		Gwangyang	POSCO	1.7	200	2005
		South Korea Total		19.10	4,660	
	Taiwan	Yungan	CPC	7.44	690	1990
	India	Dahej	Petronet	5.0	320	2004
		Hazira	Shell, Total	2.5	320	2005
	China	Shenzhen, Guangdong	CNOOC, BP etc	3.7	320	2006
	Subtotal			108.18	20,863	

[Chart 12] Existing LNG Receiving Terminals (2006 Year-end) (continued)

Region	Country	Name	Investor(s)	Capacity (MT/y)	Storage (1,000kl)	Start-up
Americas	U.S.A.	Everett	Tractebel LNG	7.93	155	1971
		Lake Charles	Trunkline LNG	9.20	285	1982
		Cove Point	Dominion	7.67	380	1978
		Elba Island	Southern LNG (El Paso)	9.36	191	1978
		West Cameron, (Off-shore), Gulf of Mexico	Excelerate Energy	3.83	N.A.	2005
	Puerto Rico	Penuelas	EcoElectrica	1.30	160	2000
	Dominica	Andres	AES	0.60	160	2003
	Mexico	Altamira	Shell, Total, Mitsui	5.37	300	2006
	Subtotal			45.26	1,631	
Europe	Belgium	Zeebrugge	Fluxys	4.80	261	1987
	France	Fos-sur-Mer	Gaz de France	5.80	150	1972
		Montoir-de-Bretagne	Gaz de France	8.20	360	1980
	Italy	Panigaglia	Snam	2.60	100	1971
	Spain	Barcelona	Enagas	6.20	240	1969
		Cartagena	Enagas	0.90	55	1989
		Huelva	Enagas	2.70	165	1988
		Bilbao	BP, Respol, Iberdola, EVE	2.00	160	2003
		Sagunto	Union Fenosa, Iberdrola, Endesa	3.70	300	2006
	Portugal	Sines	Transgas	3.80	120	2003
	U.K.	Isle of Grain	National Grid	3.30	200	2005
	Greece	Revithoussa	DEPA	1.50	130	2000
	Turkey	Marmara Ereglisi	Botas	4.60	255	1994
	Subtotal			50.10	2,496	
Total				203.54	24,990	

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 projected to grow rapidly from now on. However, on the matter of possibility for materialization, the projects vary significantly among them in terms of factors such as project economics, environmental and social constraints, national policies on infrastructure development, and so forth.

[Chart 13] LNG Receiving Terminals under planning

Region	Country	Name	Investor(s)	Capacity (MT/y)	Start Up
Americas	U.S.A.	Hackberry, LA	Sempra Energy	11.50	2008
		Freeport, TX	Freeport LNG Development	30.66	2008
		Sabine, LA	Cheniere Energy	19.93	2008
		Corpus Christi, TX	Cheniere Energy	19.93	2010
		Corpus Christi, TX	ExxonMobil	7.67	2008-2009
		Fall River, MA	Hess LNG	6.13	2010
		Sabine, TX	ExxonMobil	7.67	2009
		Corpus Christi, TX	Occidental Energy	7.67	2008
		Logan Township, NJ	BP	9.20	N.A.
		Port Arthur, TX	Sempra Energy	12.26	2010
		Cameron, LA	Cheniere Energy	25.29	2011
		Port Pelican, LA	Chevron	12.26	N.A.
		(Offshore), LA	Shell	7.67	N.A.
		(Offshore), LA	McMoran	7.67	N.A.
		Long Island Sound, NY	TransCanada, Shell	7.67	N.A.
		Pleasant Point, ME	Quoddy Bay	15.33	N.A.
		Robbinston, ME	Kestrel Energy	3.83	N.A.
		Boston(Offshore), MA	Suez	3.07	2009
		Boston(Offshore), MA	Excelerate Energy	6.13	N.A.
		Baltimore, MD	AES	11.50	N.A.
		Pascagoula, MS	Gulf LNG	11.50	2009
		Pascagoula, MS	Chevron	9.96	N.A.
		Port Lavaca, TX	Gulf Coast LNG Partners	7.67	2009-2010
		(Offshore), GOM	TORP	10.73	N.A.
		(Offshore), FL	Suez	14.56	N.A.
		Long Beach, CA	Sound Energy Solutions	5.37	N.A.
		Bradwood, OR	Northern Star	7.67	N.A.
		Coos Bay, OR	Jordan Cove Energy Project	7.67	N.A.
		(Offshore), CA	BHP Billiton	11.50	N.A.
		(Offshore), CA	Northern Star	3.83	N.A.
		(Off-shore), CA	Woodside	9.20	N.A.
		(Off-shore), CA	Chevron	5.75	N.A.
		St. Helens, OR	Port Westward LNG	5.37	N.A.
		Philladelphia, PA	PGW	4.60	N.A.
		Astoria, OR	Calpine	7.67	N.A.
		Boston, MA	AES	6.13	N.A.
		Calais, ME	BP Consulting	N.A.	N.A.
		(Offshore), NY	ASIC	15.33	N.A.
		(Offshore), CA	Excelerate Energy	4.60	N.A.
		(Offshore), CA	Tidelands	N.A.	N.A.
	Canada	St. John, NB	Canaport LNG	7.67	2008
		Point Tupper, NS	Venture Energy	7.67	2008
		Quebec City, QC	Enbridge, Gaz Met, Gaz de France	3.83	2010
		Riviere-du-Loup, QC	TransCanada, PetroCanada	3.83	2010
		Kitimat, BC	Galveston LNG	7.67	2010
		Prince Rupert, BC	WestPac LNG	3.83	2011
		Goldboro, NS	Keltic Petrochemicals, Petroplus	7.67	N.A.
		Energie Grande-Anse	N.A.	7.67	N.A.

[Chart 13] LNG Receiving Terminals under planning (continued)

Region	Country	Name	Investor(s)	Capacity (MT/y)	Start Up
Americas	Mexico	Costa Azul, Baja California	Shell, Sempra	7.67	2008
		GNL Mar Adentro, Baja California	Chevron	10.73	2007
		Lazaro Cardenas	Suez, Repsol-YPF	3.83	2008
		Puerto Libertad, Sonora	DKRW Energy	9.96	2011
		Manzanillo	CFE, PEMEX	3.83	2009
		Topolobampo	TransCanada	3.83	N.A.
	Bahama	Bahamas	Suez, El Paso	6.44	N.A.
		Bahamas	AES Ocean Express	6.44	N.A.
	Honduras	Puerto Cortes	AES	1.90	N.A.
	Brazil	Suape	Shell	1.60	N.A.
	Chile	Quintero Bay	ENAP	2.70	2009
Europe	France	Fos-Cavou	Gaz de France, Total	6.00	2007
		Fos-Cavou	ExxonMobil	N.A.	2009
		Bordeaux	4Gas	N.A.	2011
		Le Havre	N.A.	N.A.	N.A.
		Dunkirk	Electricite de France	4.40	2011
	Italy	Isola di Porto Levante	ExxonMobil, Qatar Petroleum, Edison	5.80	2007
		Brindisi	BG	5.80	2009
		Livorno	Endesa, Amga, CrossGas	2.90	N.A.
		Syracuse	Shell, ERG	5.80	N.A.
		Rosignano	Edison, Solvay, BP	5.80	N.A.
		Gioia Tauro	CrossGas	8.76	N.A.
		Trieste	Gas Natural	5.80	N.A.
		Taranto	Gas Natural	5.80	N.A.
		(Offshore) Triests	Endesa	5.80	N.A.
		Porto Empedocle	Nouve Energie	8.76	N.A.
		Rada di Augusta	ERG, Shell	5.80	N.A.
		Sicily	Enel	5.80	N.A.
		Ravvena	Enel	5.80	N.A.
	Spain	Reganosa	Endesa, Union Fenosa, Sonatrach	2.10	2007
		Gran Canaria	Endessa	N.A.	2008
		El Mussel	Enagas	5.12	2012
	U.K.	Teesside GasPort	Excelerate Energy	3.00	2007
		Dragon	4Gas, BG, Petronas	8.76	2007
		South Hook	ExxonMobil, Qatar Petroleum	14.00	2007
		Canvey	Calor Gas, LNG Japan, Centrica, Osaka Gas	4.00	2010
		Teesside	ConocoPhillips	N.A.	N.A.
		Gateway	Stag Energy	N.A.	N.A.
	Netherlands	Rotterdam	4Gas	4.40	2009
		Rotterdam	Gasunie/Vopak	4.40	2010
		Eemshaven	ConocoPhillips	N.A.	2010
	Germany	Wilhelmshaven	E.On Ruhrgas	4.40-7.30	2010
	Turkey	Izmir	Colakoglu	4.40	N.A.
		Ceyhan	N.A.	N.A.	N.A.
	Cyprus	Vasilikos	State Electricity Authority	0.73	2010
	Poland	Swinoujscie	PGNiG	2.20-3.70	2010
	Croatia	Krk	E.On Ruhrgas	N.A.	N.A.
	Latvia	(Baltic Coast)	Itera Latvija	0.365	N.A.

[Chart 13] LNG Receiving Terminals under planning (continued)

Region	Country	Name	Investor(s)	Capacity (MT/y)	Start Up
Asia Oceania	China	Putian, Fujian	CNOOC, Fujian Investment and Development	2.60	2007
		Qingdao, Shangdong	SINOPEC	3.00	N.A.
		Shanghai	CNOOC、Shenergy	3.00	2009
		Ningbo, Zhejiang	CNOOC、Zhejiang Energy Group, Ningbo Electric	3.00	N.A.
		Rudong, Jiangsu	PetroChina	3.00	N.A.
		Darlian, Liaoning	PetroChina	2.00	N.A.
		Tiangjing	CNOOC	3.00	N.A.
		Zhuhai, Guangdong	CNOOC	3.00	N.A.
		Swatou, Guangdong	CNOOC	2.50	N.A.
		Guangxi	PetroChina	3.00	N.A.
		Hong Kong	CLP	3.00	N.A.
		Yingkou, Liaoning	CNOOC	3.00	N.A.
		Binhai, Jiangsu	CNOOC	3.00	N.A.
	India	Kochi	Petronet	2.50	2009
		Dabhol	Petronet, NTPC, Gail	5.00	2009
		Ennore	IOC, Petronas	5.00	N.A.
		Mangalore	HPCL, Petronet, MRPL	2.50	N.A.
	Pakistan	Karachi	SSGC	2.50	2009
	Japan	Wakayama	Kansai Electric	N.A.	N.A.
		Joetsu	Chubu Electric, Tohoku Electric	N.A.	N.A.
		Omaezaki	Chubu Gas, Tokai Gas, Suzuyo	N.A.	2010
		Sakaide	Shikoku Electric	0.40	2010
		Kumamoto	Saibu Gas	N.A.	N.A.
		Nakagusuku	Okinawa Electric	0.70	2010
	South Korea	Gunsan	GS Caltex	1.5	N.A.
		Cheju	KOGAS	N.A.	2012
		(4th Terminal)	KOGAS	N.A.	2013
		(5th Terminal)	KOGAS	N.A.	N.A.
	Taiwan	Taichung	CPC	1.68	2007
	Phillipines	Bataan	GN Power	N.A.	N.A.
	Indonesia	Cilegon	PLN, Pertamina	3.00	N.A.
	Singapore	Singapore	Gas Supply Pte, PowerGas	N.A.	N.A.
	Thailand	Map Ta Phut	PTT, EGAT, EGCO	5.00	2010
	New Zealand	N.A.	Contact Energy, Genesis Energy	0.90-1.08	2011

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

4. LNG supply demand balance

4.1. LNG demand forecasts

Shown in Chart 14 is a summary of IEEJ's LNG demand forecasts. The global LNG demand is projected to grow from 141.74 MT[8] in 2005 to between 198.0-226.5 MT by 2010, 350.0-376.0 MT by 2020, and 379.0-502.0 MT by 2030. In terms of regional pictures, the

[8] Some disagreement with the figure mentioned in Chapter 2.1 is caused due to different data sources and conversion used.

Asian demand would expand from 92.4 MT in 2005 to 111.0-124.0 MT by 2010, 141.0-170.0 MT by 2020, and 165.0-216.0 MT by 2030. For Europe, the forecast demand levels for 2010, 2020, and 2030 are 52.0-61.0 MT, 73.0-90.0 MT, and 93.0-123.0 MT, respectively. For the Americas, demand ranges of 35.0-41.5 MT, 91.0-116.0 MT, and 121.0-163.0 MT are forecast for 2010, 2020, and 2030, respectively, reflecting the sharp increase in LNG imports by the USA. From these pictures, it can be suggested that USA LNG demand could overtake that of Japan by 2020 to replace the position of the world's largest LNG importer.

[Chart 14] World LNG Demand Forecasts

(Million Tonnes)

		2005	2010		2020		2030	
			Low Demand	High Demand	Low Demand	High Demand	Low Demand	High Demand
Oceania Asia	Japan	58.1	60.0	64.0	63.0	73.0	64.0	76.0
	Korea	22.5	27.0	29.0	34.0	40.0	38.0	46.0
	Taiwan	7.2	10.0	12.0	14.0	16.0	15.0	18.0
	India	4.6	8.0	10.0	12.0	15.0	18.0	28.0
	China	-	6.0	9.0	10.0	16.0	20.0	33.0
	Others	-	-	-	8.0	10.0	10.0	15.0
	Sub-toal	92.4	111.0	124.0	141.0	170.0	165.0	216.0
Europe	France	9.7	12.0	14.0	14.0	16.0	15.0	20.0
	Italy	1.8	6.0	8.0	9.0	13.0	12.0	18.0
	Spain	17.0	20.0	22.0	24.0	28.0	28.0	35.0
	U.K	0.4	5.0	6.0	13.0	18.0	22.0	30.0
	Others	7.1	9.0	11.0	13.0	15.0	16.0	20.0
	Sub-toal	36.0	52.0	61.0	73.0	90.0	93.0	123.0
Americas	U.S.	12.7	29.0	34.0	70.0	84.0	90.0	120.0
	Canada	-	0.5	1.0	10.0	12.0	13.0	16.0
	Mexico	-	3.5	4.5	8.0	11.0	10.0	14.0
	Others	0.7	2.0	2.0	3.0	9.0	8.0	13.0
	Sub-toal	13.4	35.0	41.5	91.0	116.0	121.0	163.0
Total		141.7	198.0	226.5	305.0	376.0	379.0	502.0

Source: IEEJ

4.2. LNG supply potentials

While Chart 8 earlier presented the LNG production capacities as of 2006, for the purpose of the exercise in this section to examine LNG supply potentials in 2005, the latest available data for production capacity for 2005 is referenced. The world LNG production capacity at the end of 2005 stood at 173.0 MT[9]. Capacity in Africa and Latin America for a total of 60.2 MT was directed mainly to the Atlantic market. The remaining capacity

[9] Obtained by subtracting the combined production capacity of Atlantic LNG Train 4 and Darwin LNG which came on line during 2006, i.e. 8.7 MT, from the total global production capacity indicated in Chart 8, i.e. 181.7 MT for 2006.

existing in Asia Pacific, North America, and the Middle East for an aggregated total of 105.88 MT[10] is directed mainly to the Asian market, although 5.85 MT was shipped to the Atlantic market in 2005. Regarding Indonesian export amount (23.49MT) as its capacity since Indonesia decreases LNG export significantly, it can be concluded that a production capacity of 94.92 MT was available for the Asian market in 2005.

Concerning the future outlook, new liquefaction capacities with signed SPAs or HOAs are expected to become operational in succession to bring the production capacity available for the Asian market to a total of 131.34 MT by 2012. For the period after 2011, some of the other projects indicated in Chart 10 are anticipated to come on stream. Current assumptions are that, out of such projects, 57.55 MT could become available for Asia. Therefore, the potential supply availability for Asia around 2020 could be estimated at 188.83 MT (see Chart 15).

[Chart 15] LNG Supply Availability for Asian Market

		Capacity (MT/y)			Capacity (MT/y)
2005	Asia Pacific	65.29	2009	Asia Pacific	90.07
	North America	1.30		North America	1.30
	Middle East	34.18		Middle East	80.65
	Sub Total	100.77		Sub Total	172.02
	For the Atlantic	-5.85		For the Atlantic	-48.46
	For Asia	94.92		For Asia	123.56
2006	Asia Pacific	68.79	2010	Asia Pacific	85.18
	North America	1.30		Middle East	99.60
	Middle East	41.40		Sub Total	184.78
	Sub Total	111.49		For the Atlantic	-65.13
	For the Atlantic	-2.97		For Asia	119.65
	For Asia	108.52	2011	Asia Pacific	89.81
2007	Asia Pacific	68.79		Middle East	99.60
	North America	1.30		Sub Total	189.41
	Middle East	44.93		For the Atlantic	-65.13
	Sub Total	115.02		For Asia	124.28
	For the Atlantic	-5.02	2012	Asia Pacific	99.37
	For Asia	110.00		Middle East	99.60
2008	Asia Pacific	70.79		Sub Total	198.97
	North America	1.30		For the Atlantic	-67.63
	Middle East	55.85		For Asia	131.34
	Sub Total	127.94	Planning	Asia Pacific	35.45
	For the Atlantic	-19.61		Middle East	36.20
	For Asia	108.33		Sub Total	71.65
				For the Atlantic	-14.10
				For Asia	57.55
			Supply Potential for Asia in 2020 (Existing+SPA・HOA Signed+Planning)		188.83

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

From Chart 15 above, it can be seen that a sharp increase is forecast for the supplies

[10] For RasGas II Train 4 (4.7 MT/Year) which was completed in September 2005, 1.18 MT was given for the 2005 capacity contribution assuming the plant came on line in October 2005. Further, the 2005 capacity does not count the Qalhat LNG plant, which started export operations in December 2005.

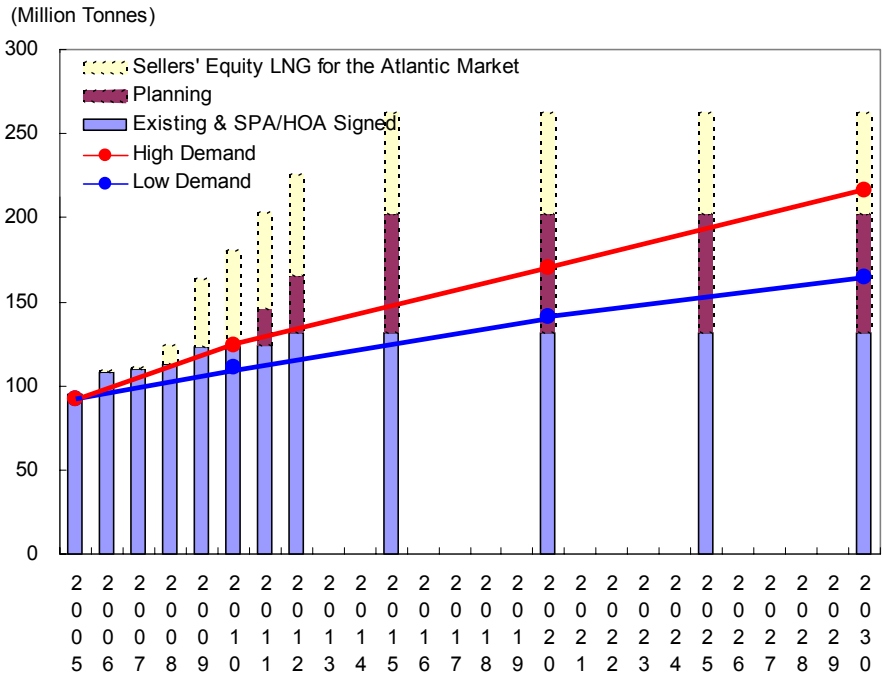
to the Atlantic market originating from the Asia-Pacific and the Middle East which traditionally have shipped LNG to the Asian market. While the volume supplied to the Atlantic market from the Asia-Pacific and the Middle East was no more than 5.85 MT in 2005, such supply is expected to leap and reach 67.63 MT on a 2012 contractual basis. Such a substantial increase means that a new LNG flow will be generated from the Asia-Pacific and the Middle East into the Atlantic. However, for most of these contracts, often both exporter and importer are the affiliates of the same entity. Typically being upstream companies themselves, those projects do not necessarily secure the supply agreement with end users. It is therefore likely that, depending on the prices difference between the Atlantic and Asia, portion of the contracted volume in the above will flow into the Asian market.

4.3. LNG supply demand balance for Asia

Based on the LNG demand forecasts and supply potentials discussed above, we will look at supply demand balance for Asia. To reiterate the figures shown in Chart 14, the actual Asian import demand in 2005 was 92.4 MT, and the forecast demands are in the ranges 111.0-124.0 MT for 2010, 141.0-170.0 MT for 2020, and 165.0-216.0 MT for 2030.

Meanwhile, LNG production capacity available for Asia, which is estimated at 94.92 MT as of 2005, is projected to increase to 131.34 MT by 2012, which is a total of existing projects and those with signed SPAs or HOAs and therefore having high likelihood of materialization. In addition to the base capacity above, as discussed already, there are extra volumes to become available from some of the projects that are currently under study for commercialization, along with the potential supply for Asia from the seller's own LNG marketing for the Atlantic. A summarized LNG supply demand outlook for Asia is given in Chart 16.

[Chart 16] LNG Supply Demand Outlook for Asia



Source: IEEJ

Since most of LNG for Asia is supplied under long-term contracts, it is usually the case where the contract volume and the production capacity balance each other to a large degree. The above chart indicates that in some years up to 2010, swing supplies from the Atlantic may be needed to meet the high demand. As long as those projects under planning are to come on stream smoothly, there seems to be ample supply availability after 2011.

In examining the future LNG supply and demand situation for Asia, the following six points are considered to become key issues in addition to the main energy consumption trends linked to the economic growth:

Firstly, the weather and temperature behavior, as a matter of course, will have a significant impact on the demand picture. The peak gas demand in LNG importing countries tends to occur during the winter months as it is propelled by the heating needs. A significant contrast, especially in the spot LNG supply and demand, was evident during the 2005-2006 winter with harsh coldness and a warmer-than-usual 2006-2007 winter.

Secondly, the operating conditions of nuclear power plants are important. Since 2002, the load factor of nuclear power plants in Japan has remained lower for a variety of reasons, leading to a substantial increase in the LNG requirement. Nuclear power

supplying 30% of Japan's power demand, its load factor fluctuation will result in significant impact on LNG demand.

Thirdly, there is the issue of renewal on Indonesian LNG supply agreements. While there currently exist LNG supply contracts between Indonesia and Japanese businesses covering more than 15 MT of annual supplies, the so-called 1973 Contract and the Badak Expansion Contract will expire in 2010 and 2011 respectively to affect the fate of some 12 MT of annual supply quantity combined. The Indonesian government has already made it clear that it will substantially reduce the contract volume upon renewal in favor of its domestic gas supplies. Further, Indonesia will also cut down on the contract volume for Korea or Taiwan, or could even turn down the contract renewal. As Indonesia is the single largest supplier of LNG for Asian countries, its future supply trends will have a significant impact on the supply demand pictures for the region.

The fourth element concerns with the soaring cost of equipment, materials, and workforce required for LNG projects. Because of the worldwide economic growth in general and the proliferation of energy related projects in particular, prices are soaring for requirements such as drilling rigs, steel, or manpower, with potentially serious effect on some of the projects with borderline economics. As a result, the increased cost could become one of the obstacles for a project start up.

The fifth factor is the demand growth in the North American markets. In the USA, there currently is a multitude of receiving terminal projects, where the total regasification capacity will exceed 120 MT by 2010. Although the natural gas demand for the last several years have been flat and prices also were relatively stable during the 2006-2007 winter season, such a large capacity could siphon up a significant quantity of LNG depending on the price level.

Finally, Qatar's supply strategy should be watched. With a huge supply capacity of 77 MT envisioned for 2010, Qatar in recent years has endeavored to construct new projects eyeing at the Atlantic market. However, there are some signs of cargoes diversion to the Asian markets. The state-owned Qatar Petroleum has announced its policy of arbitraging LNG between Asia and Atlantic markets for highest return.

As discussed, each of the six points above could have a significant impact on the LNG supply and demand situation in Asia. The magnitude of such impacts may also amplify depending on the timing, scope, and combinations of respective events.

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