북미 셰일가스 수출과 동북아 LNG 시장의 변화

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Global Natural Gas Structure

- 전 세계가 급증하는 에너지수요를 충당하기 위한 안정적이고 경제적인 미래 에너지원을 모색하기 위해 안간힘.

- 신재생에너지와 원자력에너지가 주춤하는 사이 천연가스가 대안적 에너지로 급부상.

- 천연가스가 “셰일혁명”을 통해 지속적인 황금기를 구가하려면 국제천연가스 무역도 지각변동이 불가피하며 이러한 국제가스거래 변화의 핵심은 LNG의 확대이며 더 중요한 것은 가격체계의 변화.

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Global Natural Gas Structure

- 불과 20년전만 하더라도 천연가스는 프리미엄 에너지로 보편화된 에너지가 아니었기 때문에 세계적인 시장이 형성되어 있지 않고 무역관행과 가격체계도 지역에 국한되어 있고 시장가격이 형성되어져 있지 않다.
- 2011년 현재 전 세계적으로 25억톤의 천연가스가 생산되었는데 이 가운데 약 70%가 생산국에서 자체 소비되고 30%인 7억톤 가량이 국제적으로 수출·수입을 통해 거래.
- 7억톤 가운데 70%는 아직도 소위 가스관(PNG)을 통해 거래되며 30%인 2.4억톤 정도만이 액화천연가스(LNG) 형태로 거래.
- 10년전과 비교해 LNG의 비중이 급격히 증가

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Global Natural Gas Structure

1. Global LNG Supply and Demand Structure

– 8% Increase in LNG Trade (2011): Total Turnover of 241.5 MT

2006-2011 LNG Trade Trends	
* [Total Turnover]	(2006) 159.1 MT → (2011) 241.5 MT (52% ↑)
[Export Countries]	(2006) 13 → (2011) 18
[Import Countries]	(2006) 15 → (2011) 24

– Largest Exporter → Qatar 75.5 MT (31% of total supply)

- Malaysia + Indonesia+ Australia = 27 % of total supply

– Largest Importer → Japan + S. Korea (48% of total demand)

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Global Natural Gas Structure

2. LNG Spot Market

- ❖ LNG is traditionally traded through Long-term deal contracts
- ❖ Spot Market Share

2006 — 11.7 % 2004 / 19.0 % 2010

2011 → 25% (62 MT)

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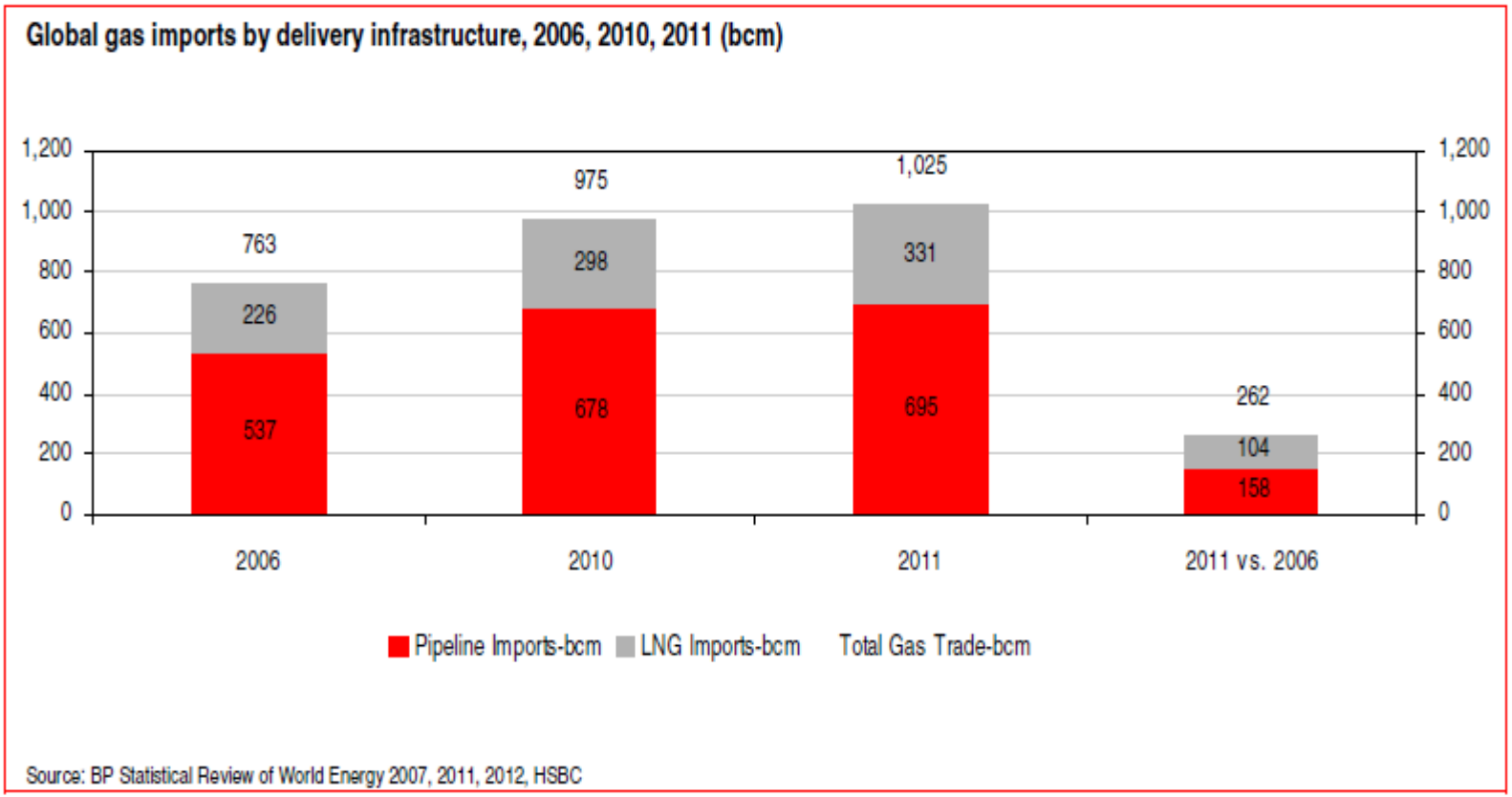
Global Natural Gas Structure

Global gas trade growth – Pipelines, LNG and AP LNG



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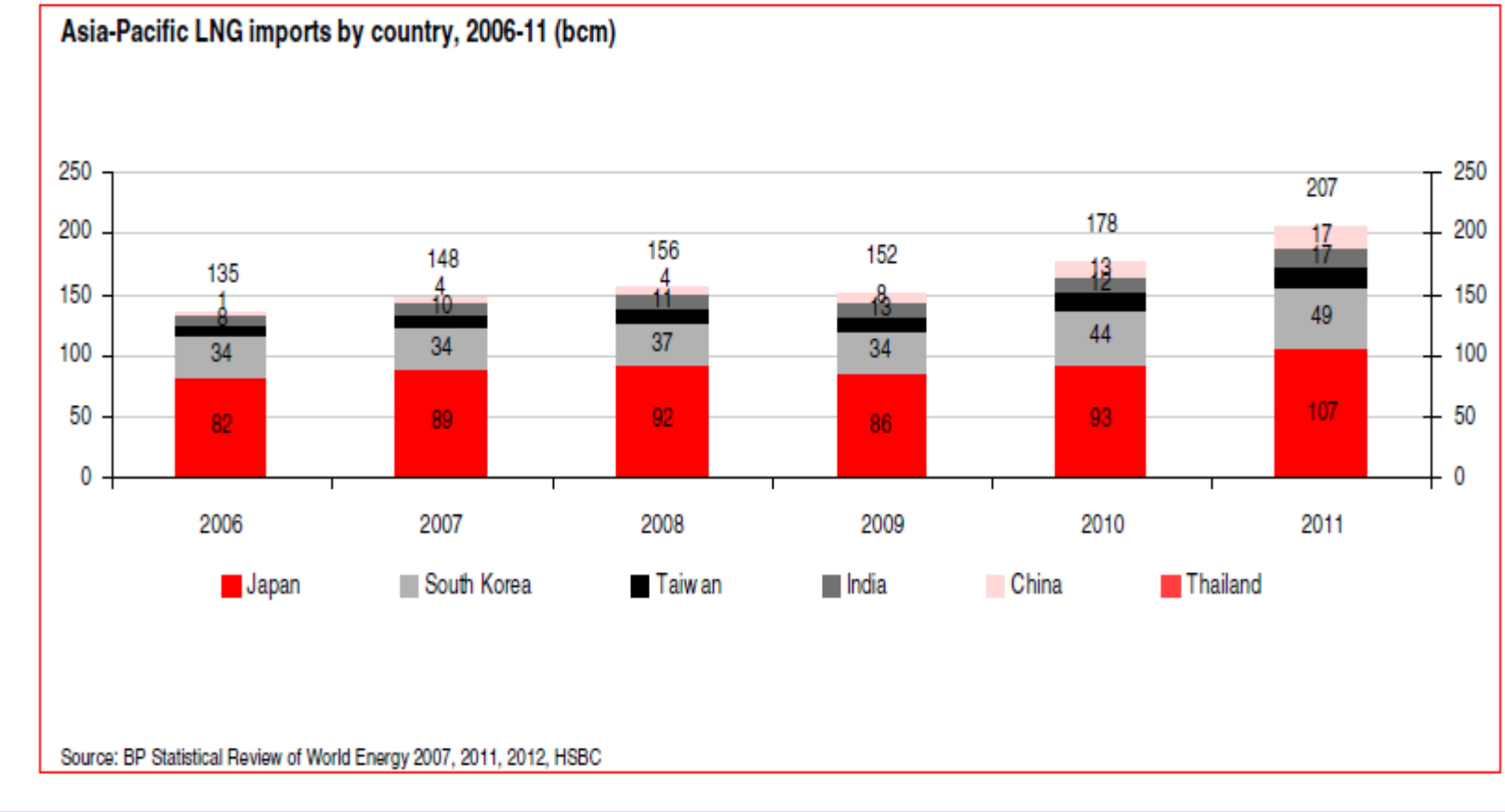
Asian Natural Gas Market

- Asia-Pacific annual natural gas demand jumped 283 bcm from 2001 to 2011 and domestic production has been unable to keep pace.



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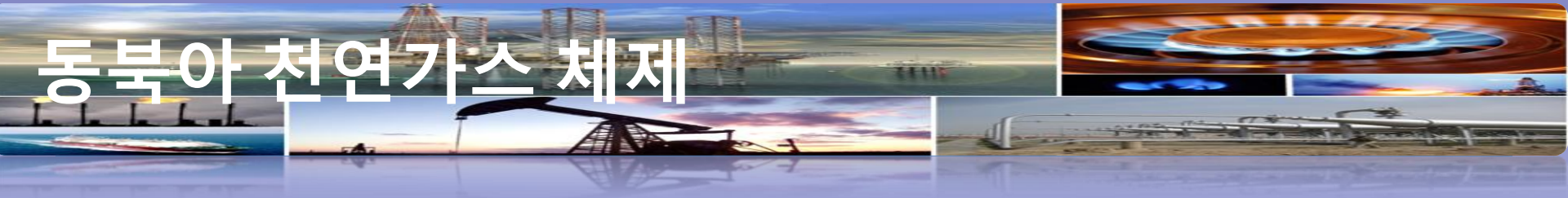
동북아 천연가스 체제



- 향후 국제천연가스 무역에 있어 가장 관심을 끄는 지역이 동북아 지역
- 동북아 지역에는 세계 최대 LNG 수요국들이 집중
- 한국, 중국, 일본, 대만 4개국이 세계 LNG 수입의 61%를 차지
- 막대한 수요에도 불구하고 동북아의 가스가격은 유럽 및 북미지역에 비해 아시아프리미엄이라 하여 항상 비싼 가격이 유지
- 이는 지역내 가스시장이 존재하지 않고 또한 이를 뒷받침해 줄 자국내 가스 생산이 미약하고 천연가스 인프라망이 지역내에 구축되지 않았기 때문

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Asian Natural Gas Market

Asia-Pacific natural gas consumption, 2001, 2006, 2011 (bcm)

	2001	2006	2011	5Yr CAGR-% 2006/2001	5Yr CAGR-% 2011/2006
China	**27**	**56**	**131**	**15%**	**18%**
Japan	74	84	106	2%	5%
India	**26**	**37**	**61**	**7%**	**10%**
Thailand	**25**	**33**	**47**	**6%**	**7%**
South Korea	21	32	47	9%	8%
Pakistan	23	36	39	10%	2%
Indonesia	31	33	38	1%	3%
Malaysia	25	34	29	6%	-3%
Australia	22	24	26	2%	1%
Bangladesh	11	15	20	7%	6%
Taiwan	7	11	16	9%	7%
Singapore	1	7	9	51%	4%
Vietnam	2	7	9	28%	4%
Other AP	13	15	16	3%	2%
Total Asia Pacific	**308**	**425**	**591**	**7%**	**7%**
Increment bcm		**116**	**166**		
Imp require-bcm	**26**	**442**	**112**		
Imp require %	**8.4%**	**10%**	**18.9%**		

Source: BP Statistical Review of World Energy 2012, HSBC

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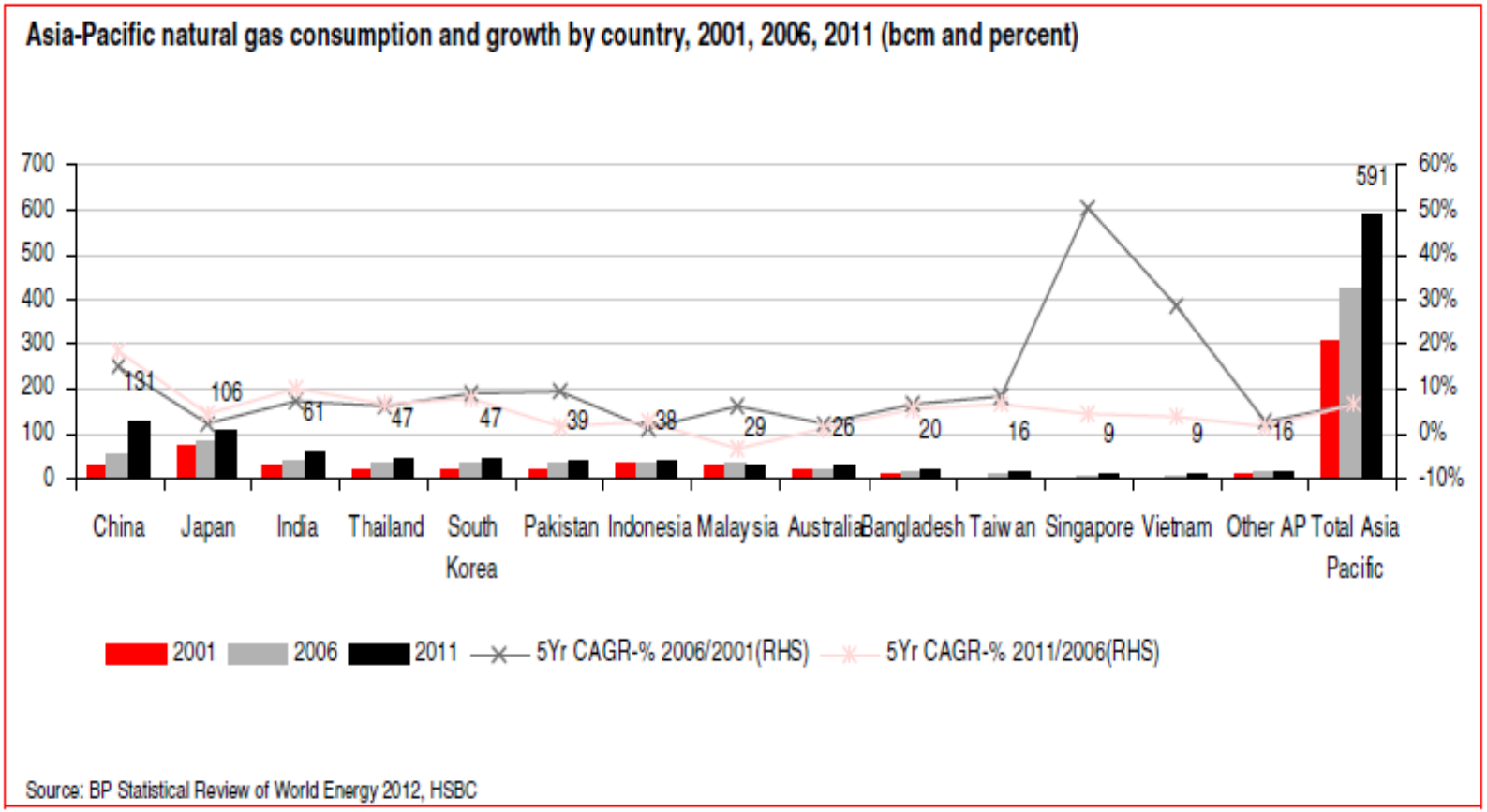
LNG import by country, 2006-11, bcm

	2006	2007	2008	2009	2010	2011
China	1	4	4	8	13	17
India	8	10	11	13	12	17
Japan	82	89	92	86	93	107
South Korea	34	34	37	34	44	49
Taiwan	10	11	12	12	15	16
Thailand						1
AP Consumption	135	148	156	152	178	207
ROW Consumption	76	78	71	91	120	124
Global LNG Consumption	211	226	227	243	298	331
China y-o-y%		287%	15%	72%	68%	30%
India y-o-y%	32%	25%	8%	17%	-4%	41%
Japan y-o-y %	7%	9%	4%	-7%	9%	14%
South Korea y-o-y%	12%	1%	6%	-6%	29%	11%
Taiwan y-o-y%	6%	7%	11%	-2%	26%	9%
Thailand y-o-y%						NA
AP y-o-y %	10%	9%	5%	-2%	17%	17%
AP 3Yr CAGR (%)	6.0%	7.7%	8.4%	4.0%	6.3%	9.9%

Source: BP Statistical Review of World Energy June 2012, HSBC

Asian Natural Gas Market

Asia-Pacific natural gas consumption by country, import %



Source: BP Statistical Review of World Energy 2012, HSBC

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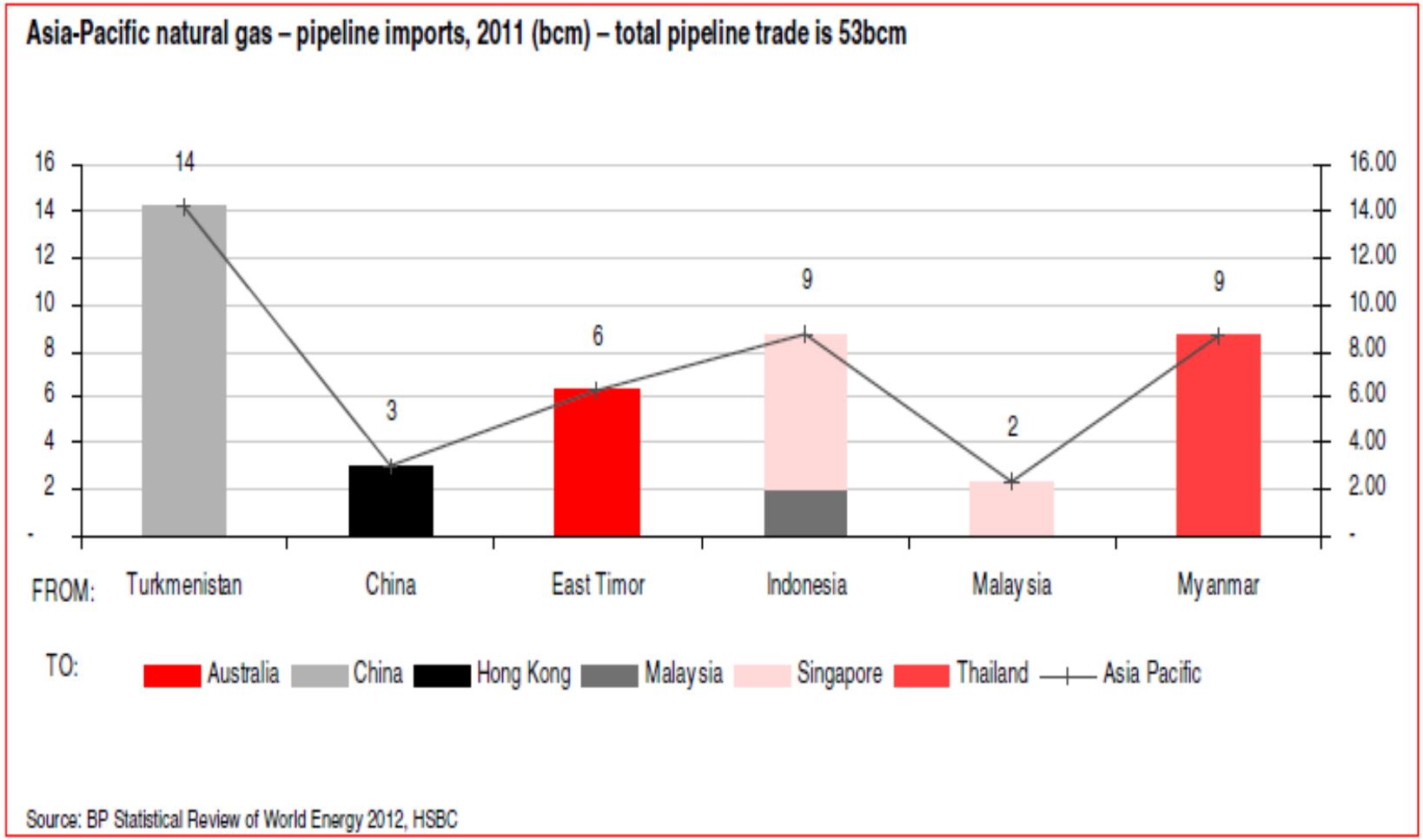
Asian Natural Gas Market



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Asian Natural Gas Market

China, India and Thailand natural gas production, imports and consumption and growth, 2001, 2011 (bcm and percent)

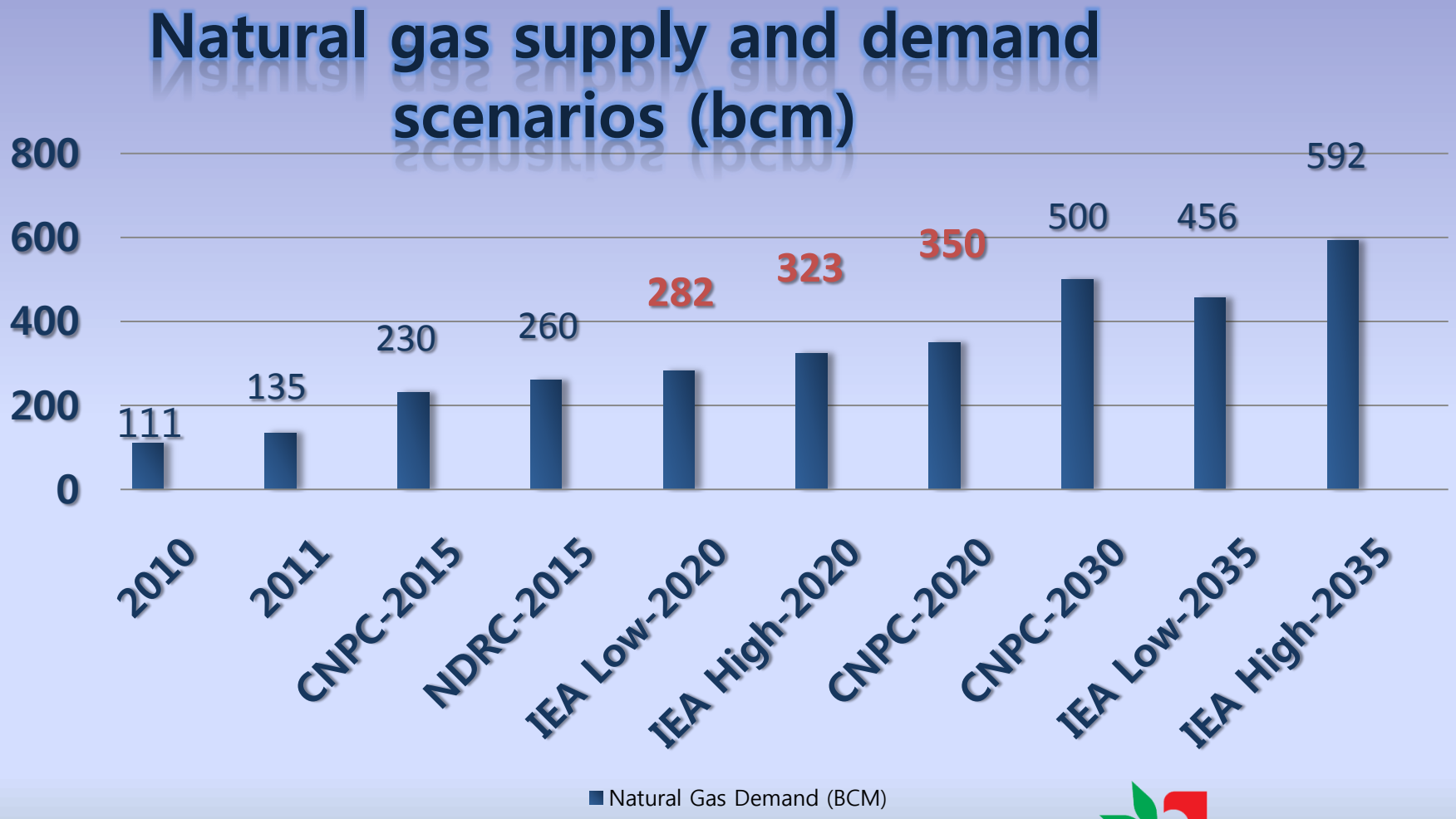
	2001-Production (bcm)	2011-Production (bcm)	Change (bcm)	CAGR %
China	30	103	72	13%
India	26	46	20	6%
Thailand	20	37	17	7%
CH IN TH -Prod	**76**	**186**	**109**	**9%**
AP	282	479	197	
CH IN TH /AP (%)	27%	39%	56%	

	2001-Import (bcm)	2011-Import (bcm)	Change (bcm)	CAGR %
China	-3	28	31	NA
India	0	15	15	NA
Thailand	5	10	4	6%
CH IN TH-Import	**2**	**53**	**51**	**37%**
AP	26	112	86	
CH IN TH /AP (%)	9%	47%	59%	

	2001-Consumption (bcm)	2011-Consumption (bcm)	Change (bcm)	CAGR %
China	27	131	103	17%
India	26	61	35	9%
Thailand	25	47	22	7%
CH IN TH-Cons	**79**	**238**	**160**	**12%**
AP Cons	308	591	282	
CH IN TH /AP (%)	25%	40%	57%	
Import requirement (%)	**3%**	**22%**		

Source: BP Statistical Review of World Energy 2012, HSBC

China's Natural Gas Landscape



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China's Natural Gas Landscape

Table 10: China Natural Gas Supply and Demand (2011-2020) (Unit: Bcm)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Demand	127,3	150,7	178,4	211,2	250,0	274,6	301,7	331,4	364,1	400,0
Growth rate	18 %	18 %	18 %	18 %	18 %	10 %	10 %	10 %	10 %	10 %
Conventional Production*	103,6	113,7	124,7	136,8	150,0	161,9	174,8	188,8	203,8	220,0
CBM	2,1	3,1	4,5	6,6	10,0	12,5	15,5	19,3	24,1	30,0
Shale Gas	-	0,1	0,2	0,5	1,0	1,5	2,3	3,4	5,1	10,0
Domestic Supply	105,8	116,9	129,4	143,9	161,0	175,9	192,6	211,5	232,9	260,0
Turkmenistan	12,0	15,0	22,0	25,0	30,0	30,0	35,0	35,0	40,0	40,0
Mynmar	-	-	-	5,0	9,0	10,0	10,0	10,0	10,0	10,0
Russia	-	-	-	-	-	-	5,0	10,0	12,0	15,0
Pipeline Imports	12,0	15,0	22,0	30,0	39,0	40,0	50,0	55,0	62,0	65,0
LNG imports	16,9	22,2	29,1	38,1	50,0	54,2	58,8	63,8	69,2	75,0
Total Imports	28,9	37,2	51,1	68,1	89,0	94,2	108,8	118,8	131,2	140,0
Supply	134,7	154,1	180,5	212,0	250,0	270,1	301,4	330,2	364,1	400,0

舊 동북아 LNG 체제

- 과거 동북아에 LNG를 공급하기 위해 개발 되던 LNG프로젝트의 패러다임:

유가와 연동된 고가의 가격구조 및 하역항 변경금지로 인한 시장성의 결여라고 말할 수 있다.

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舊 동북아 LNG 체제

- 동북아시아에 LNG가 처음 도입된 것은 일본 도쿄전력 및 도쿄가스가 미국의 알라스카 키나이 LNG 프로젝트로부터 1969년에 수입한 것이 시발점.
- 그 당시 년간 도입 물량은 약 1백만 톤이었으나 한국, 대만, 중국에서 LNG를 도입하면서 2011년 동북아 4개국의 LNG도입량은 전세계 LNG 거래량의 약 57%인 1억 4천만톤.

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舊 동북아 LNG 체제

- LNG 국제거래는 가스전개발, 액화기지건설, LNG수송선 건조, 인수기지건설 등 소위 “LNG 프로젝트 체인” 전과정이 판매자와 구매자가 장기계약에 의해 상호 구속이 이루어질 때 가능해지며 신규프로젝트의 경우 LNG 프로젝트 체인의 건설은 대규모의 초기자본 투자를 필요로 하므로 LNG매매계약은 투자비 회수를 보증하기 위하여 통상 20년 이상 장기 계약으로 이루어지며 구매자의 계약물량 인수보증(Take or Pay)이 필요한 것으로 인식

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舊 동북아 LNG 체제

❖과거 동북아의 가스가격은 유럽 및 북미지역에 비해 아시아프리미엄이라 하여 항상 비싼 가격이 유지. 이는 지역내 가스시장이 존재하지 않고 또한 이를 뒷받침해 줄 자국내 가스 생산이 미약하고 천연가스 인프라망이 지역내에 구축되지 않은 것도 한몫 했다. 가스 거래량 규모 자체도 유럽과 북미처럼 독자적으로 시장을 형성할 정도로 미성숙.

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新 동북아 LNG 체제

❖최근 미국에서의 셰일가스 개발붐으로 미국의 헨리허브 가스가격은 10년내 최저 수준으로 떨어졌고 가스의 공급 과잉으로 과거 LNG 수입을 위해 건설 되었던 터미널을 중심으로 LNG를 수출하는 프로젝트로 급격히 전환되어 감에 따라 동북아 기존 LNG구매자는 유가에 연동되어 있는 고가의 LNG보다는 핸리허브가격에 연결되어 있는 저렴한 LNG구매에 보다 적극적이다.

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新 동북아 LNG 체제

- Low gas prices in the US create arbitrage opportunities
- But construction of LNG export facilities require a long lead time
- Therefore we do not see US gas as a near-term game changer

新 동북아 LNG 체제

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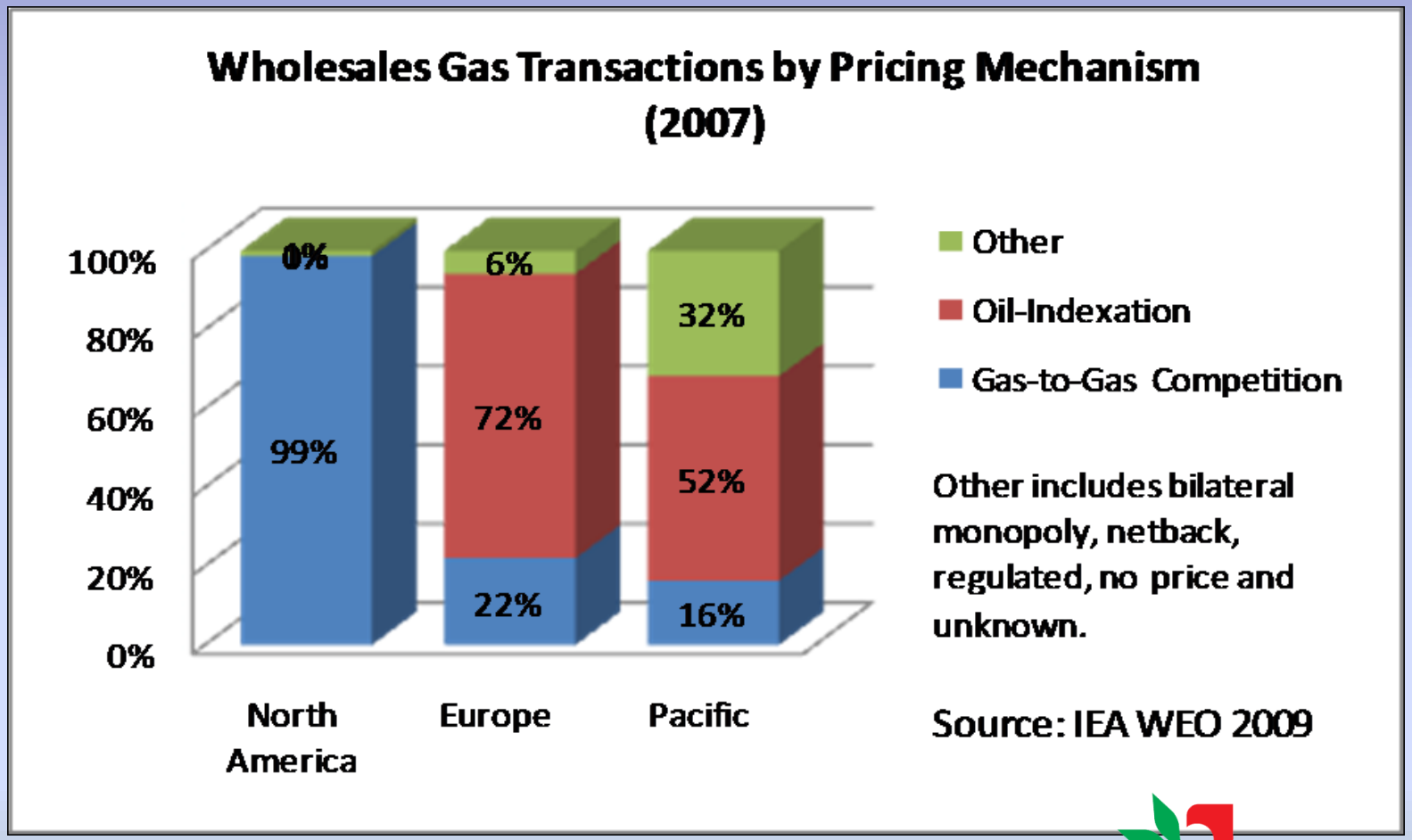
Global Natural Gas Structure

LNG Pricing Mechanism



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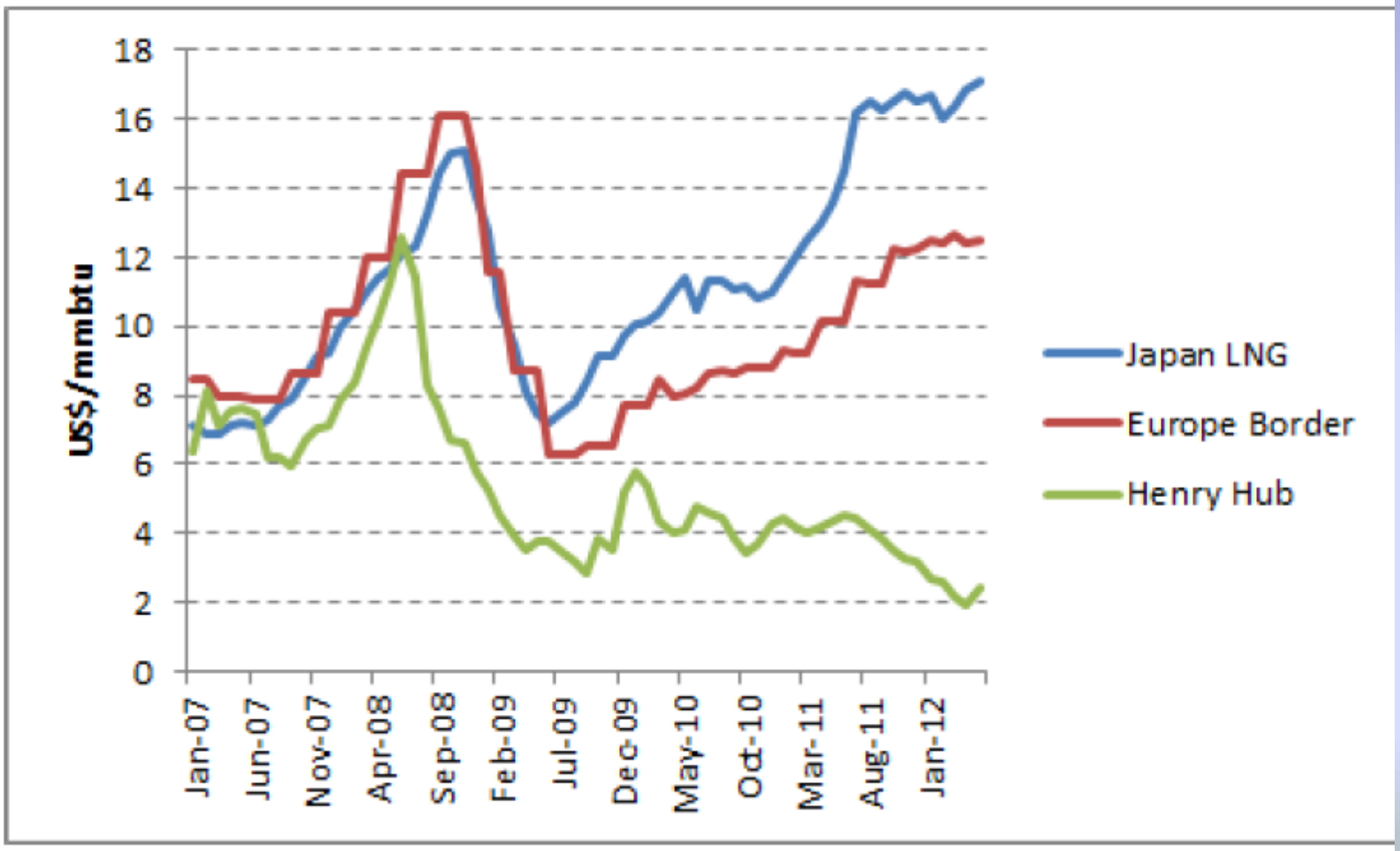
Natural Gas Pricing

Figure 2: Gas Prices in the US, Japan and Europe since 2007



新 동북아 LNG 체제

❖최근 한국가스공사는 미국의 핸리허브와 연계된 가격으로 LNG장기계약에 성공함으로써 동북아의 기존 다수의 LNG구매자들로 하여금 경쟁적으로 북미의 천연가스 시장과 연계된 가격으로 LNG를 도입하고자 하는 욕구를 한층 북돋았다.

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新 동북아 LNG 체제

- 중국이 세계 최대의 셰일가스를 보유하고 있고 이를 본격적으로 개발하기 시작할 경우 동북아 LNG 시장에 주는 파급효과는 무시할 수 없을 것을 보인다.
- 과거 동북아에 LNG를 공급하기 위해 개발되던 LNG프로젝트의 페러다임 즉, 유가와 연동된 고가의 가격구조 및 하역항 변경금지로 인한 시장성 결여의 LNG거래는 북미천연가스시장과 연계된 가격과 하역항 변경금지의 해소에 따른 자유로운 물류의 이동으로 인해 보다 시장성 있는 상품으로의 전환이 되는 과정.

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新 동북아 LNG 체제

- ❖동북아시아에서 공급자와 구매자간에 일대일 협상으로 이루어져 온 LNG거래가 다수가 참여하는 시장 형태의 거래로 변하고 있는 현상은 크게 두가지로 나누어 찾아볼 수 있는데
- ❖첫째는 하역항 금지변경 조항이 폐지되고 둘째는 천연가스 시장과 연계된 가격으로 LNG거래가 발생하기 시작한 것이다.

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新 동북아 LNG 체제

- 동북아에 LNG를 공급하는 프로젝트는 그동안 LNG개발자들이 안정적인 현금흐름을 보장받기 위해 판매자 물량이 동북아의 다른 구매자에게 넘겨져서 시장의 마켓쉐어 변동 및 가격교란이 발생하는 것을 극도로 꺼려해서 하역항 변경금지 조항을 요구해 왔으며 구매자는 재판매 목적이 아닌 자기 관할지역의 LNG소비용으로 도입해 왔으므로 하역항변경 금지에 대한 커다란 거부감이 없었다.
- 최근 동북아시아의 시장 규모가 커지고 또한 LNG소비국 내에서의 가스 전력시장의 규제완화에 따른 도입경쟁 및 Spot시장의 규모가 커지면서 하역항 변경 금지조항이 LNG구매자에게는 수급문제를 야기하고 시장의 변화에 유연하게 대처하지 못하게 하여 최근에 이루어지고 있는 장기계약에서는 하역항 변경금지 조항이 상당부분 완화.
- 동북아시아 도입 LNG에서 하역항 변경 금지 조항이 폐지된다는 것은 지역내 LNG 수급에 따라 LNG의 교역이 보다 활발하게 이루어지는 계기가 만들어져 그동안 동북아 국가간 또는 구매자간 폐쇄된 시장에서 동북아권역내에서 오픈된 시장으로의 이전이 가능하게 됨을 의미.

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Asian LNG: Japan

- **Japan is paying a higher premium for LNG imports.** The March 2011 earthquake substantially increased the LNG import requirement, and was a key factor in LNG price inflation; average import costs rose from USD12/mmbtu in February 2011 to USD17/mmbtu recently. As of May 2012, the premium of Japan's average LNG import price over the US Henry Hub spot price was at a historic high of USD14.7/mmbtu, while the premium of China's average import price over the US spot was just USD8.3/mmbtu due to historical, low cost contracts.
- **Pending supply contract renegotiations.** Many of Japan's LNG supply contracts are expiring over 2018-20. Japan needs to renegotiate mid to long-term supply contracts or find shorter-term supply.

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Asian LNG: Japan

- Bloomberg quoted Mitsunori Torihara, Chairman of Japan Gas Association, on 7 June 2012, as saying that Japan should contain LNG purchase costs by:
- Breaking the current LNG / crude oil price links and pegging imports to other price benchmarks, such as the US Henry Hub and the UK National Balancing Point (NBP), and
- Looking beyond the Asia-Pacific region for LNG sources.

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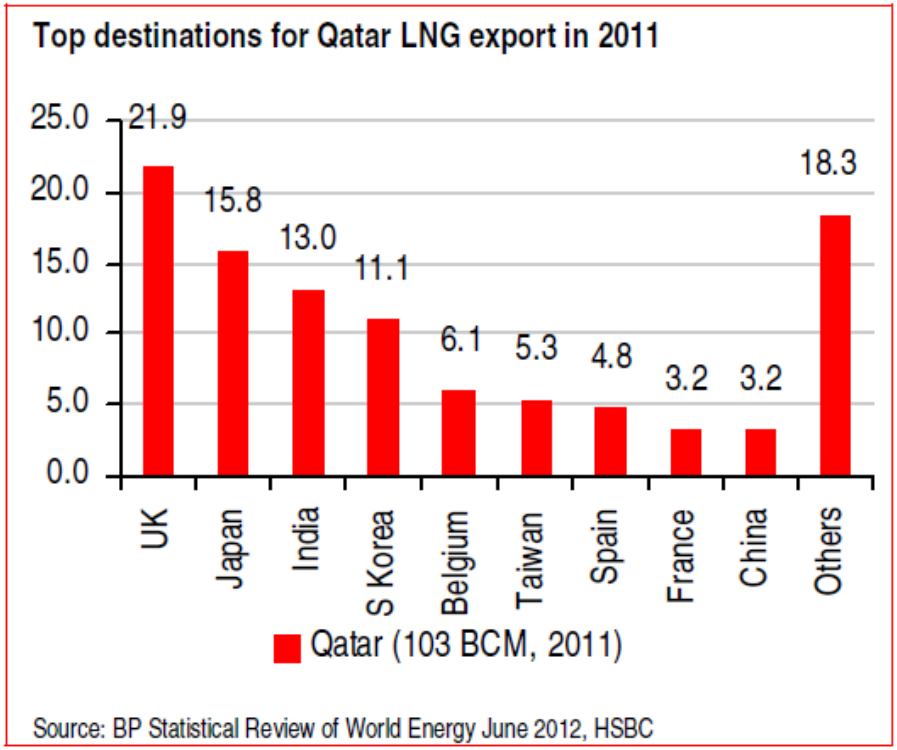
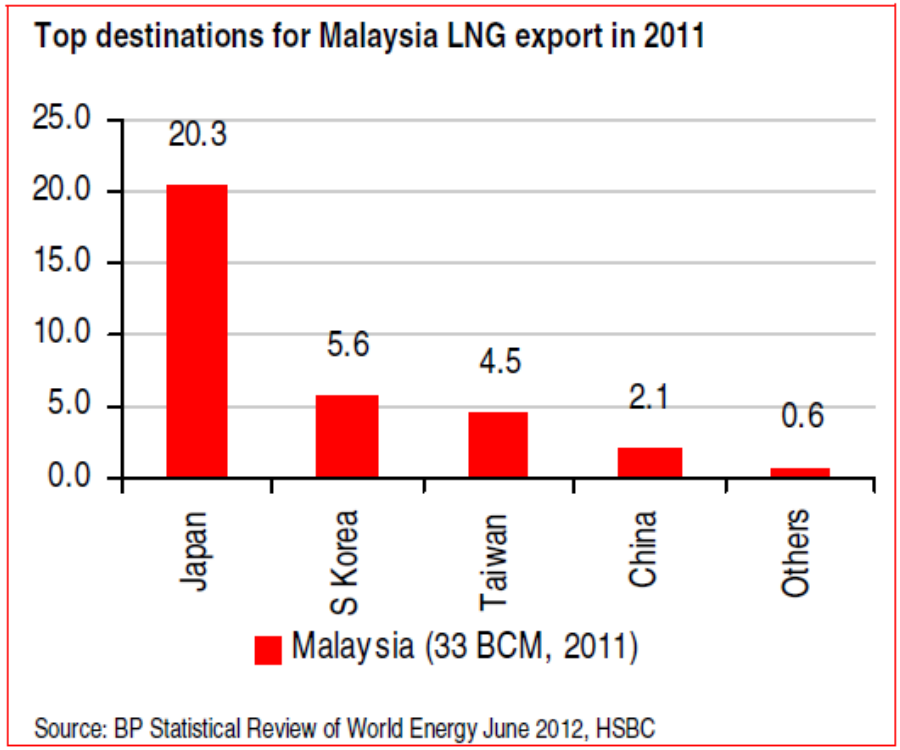
Natural Gas Conditions and Implications After the Financial Crisis and Fukushima

Top destinations of key LNG exporters, 2011





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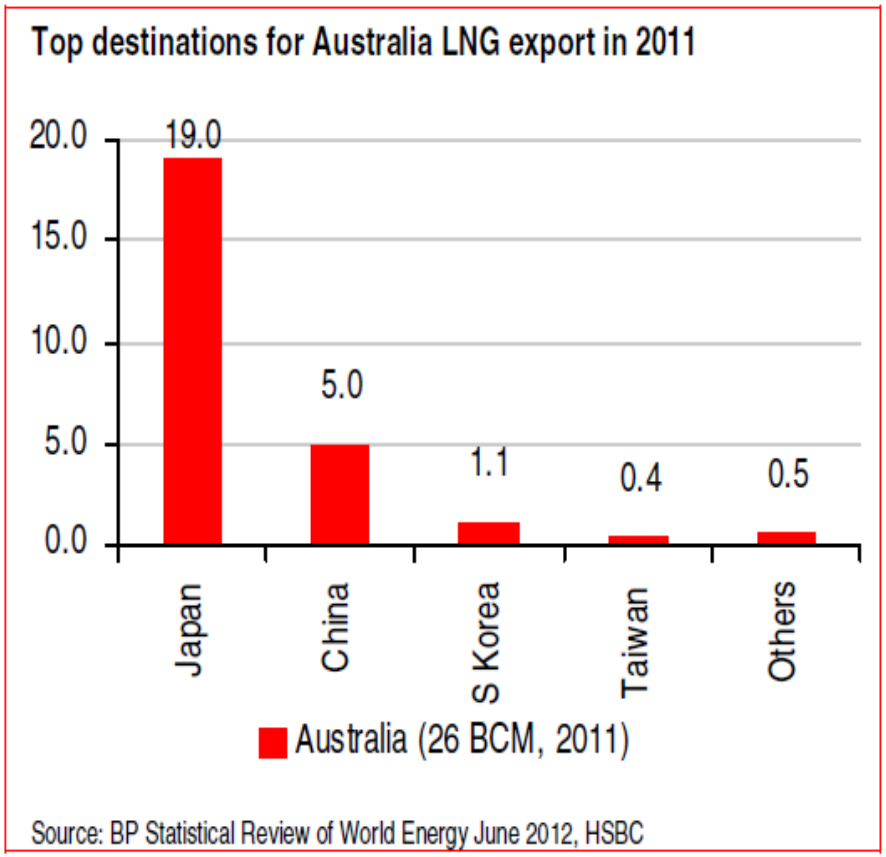

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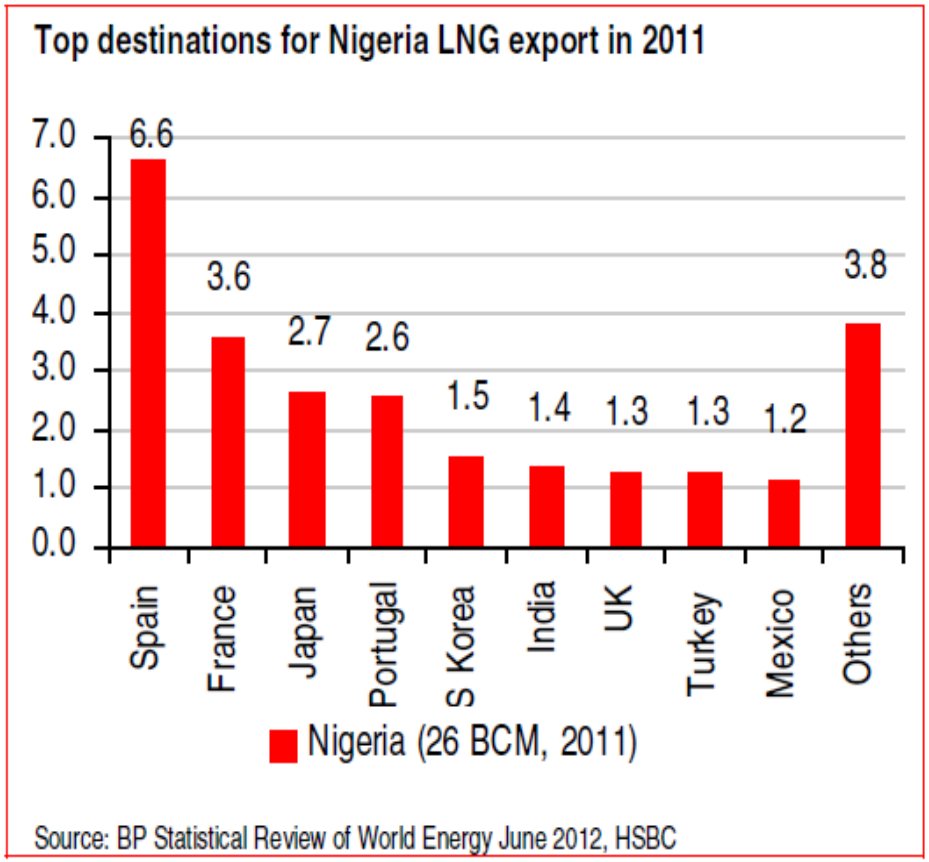

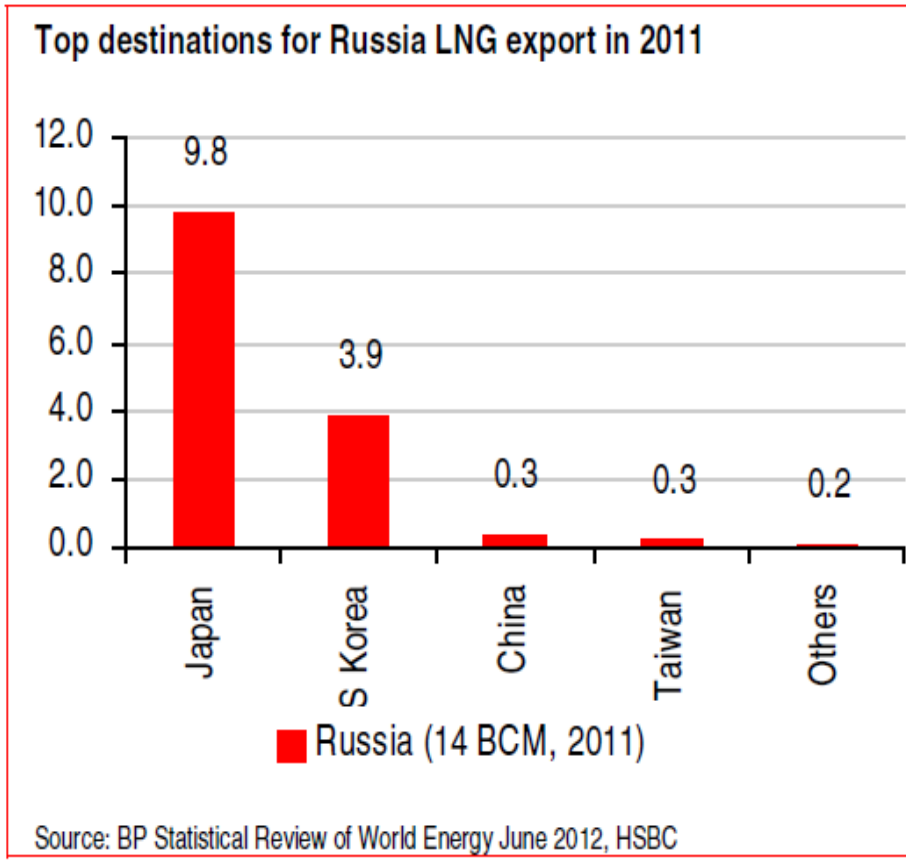

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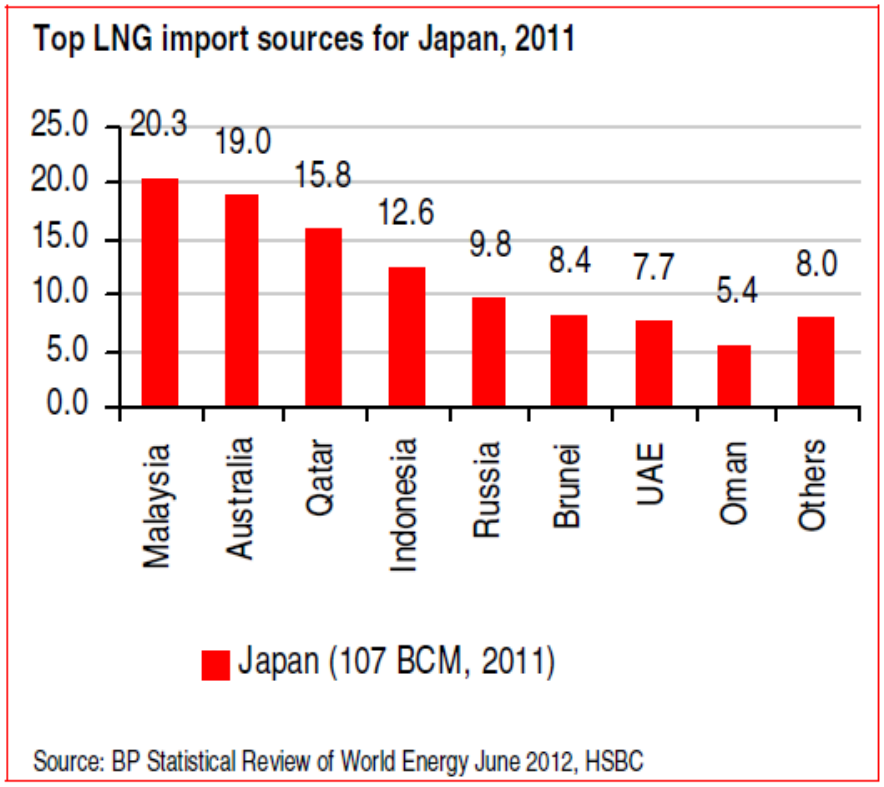
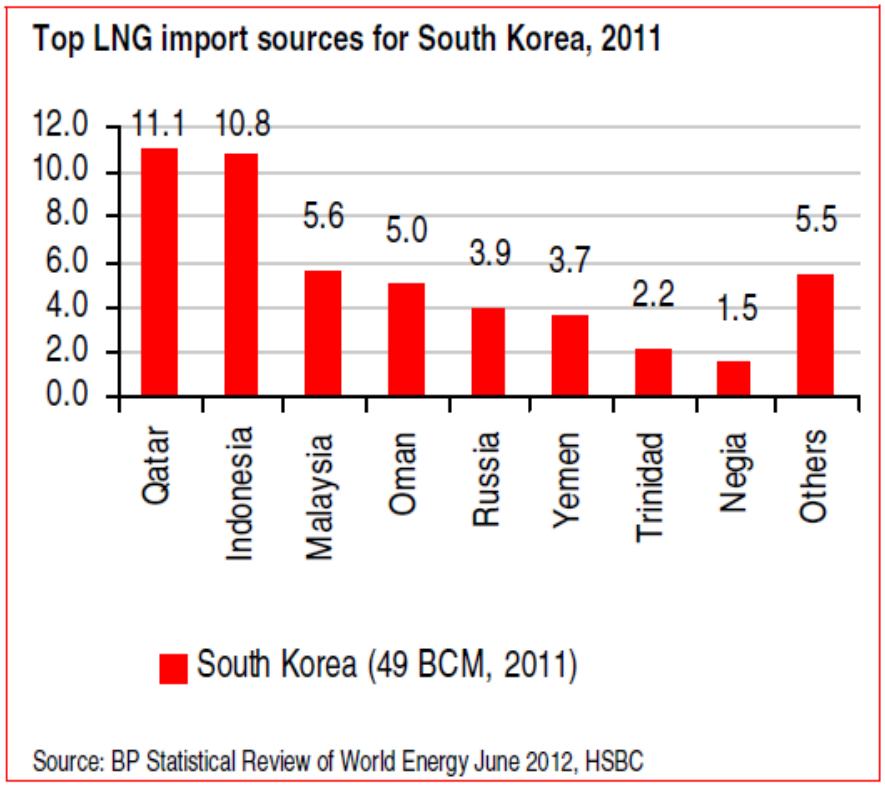
Sources for Asia's top LNG importers





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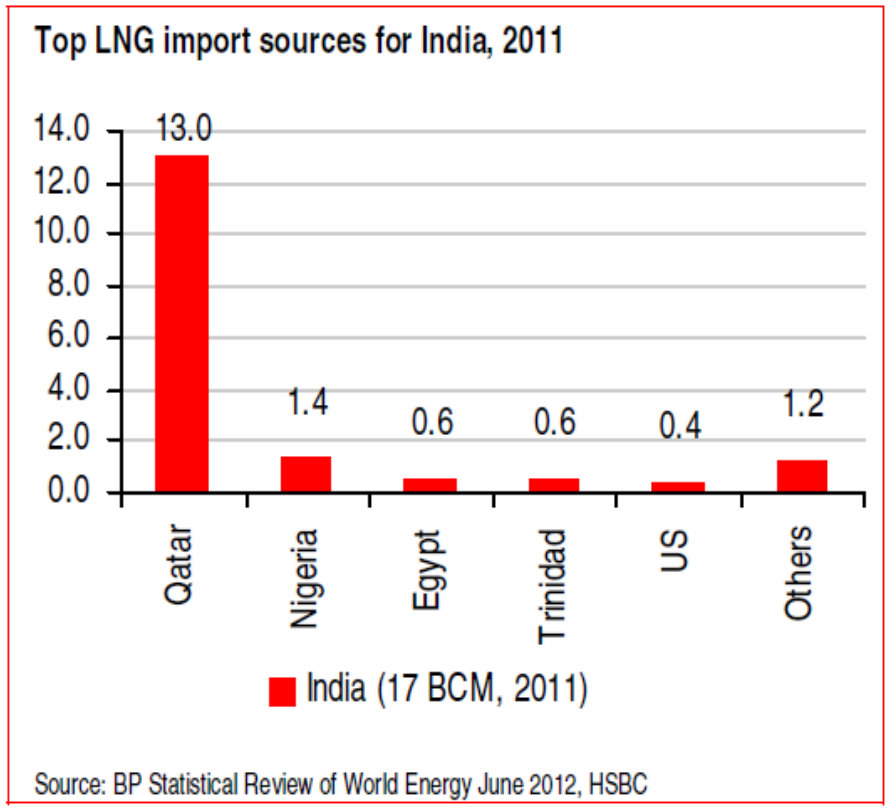

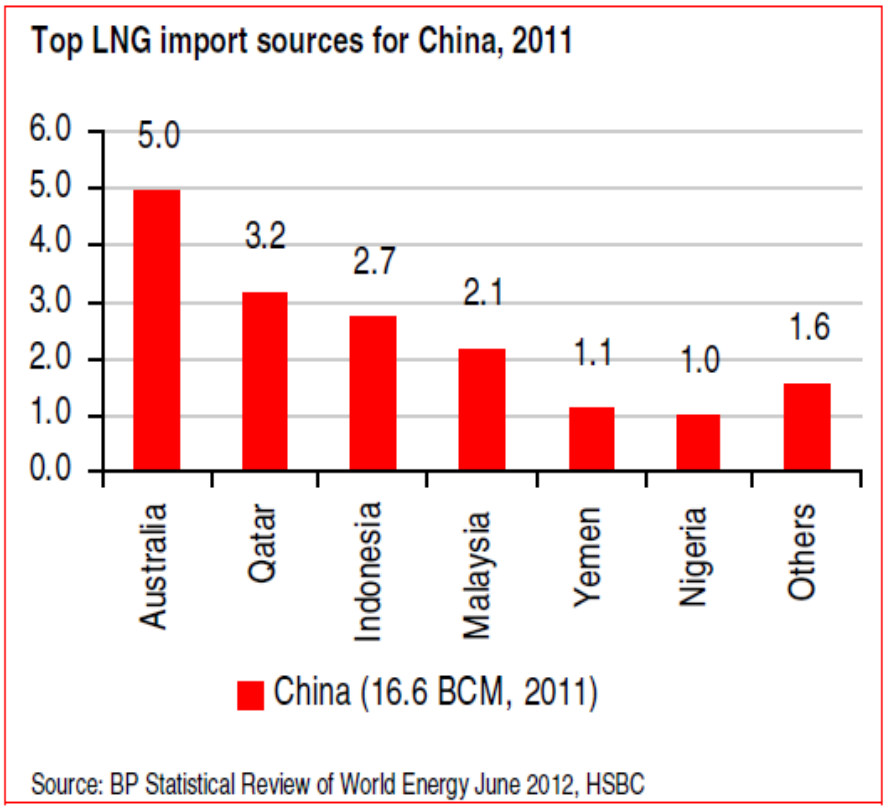

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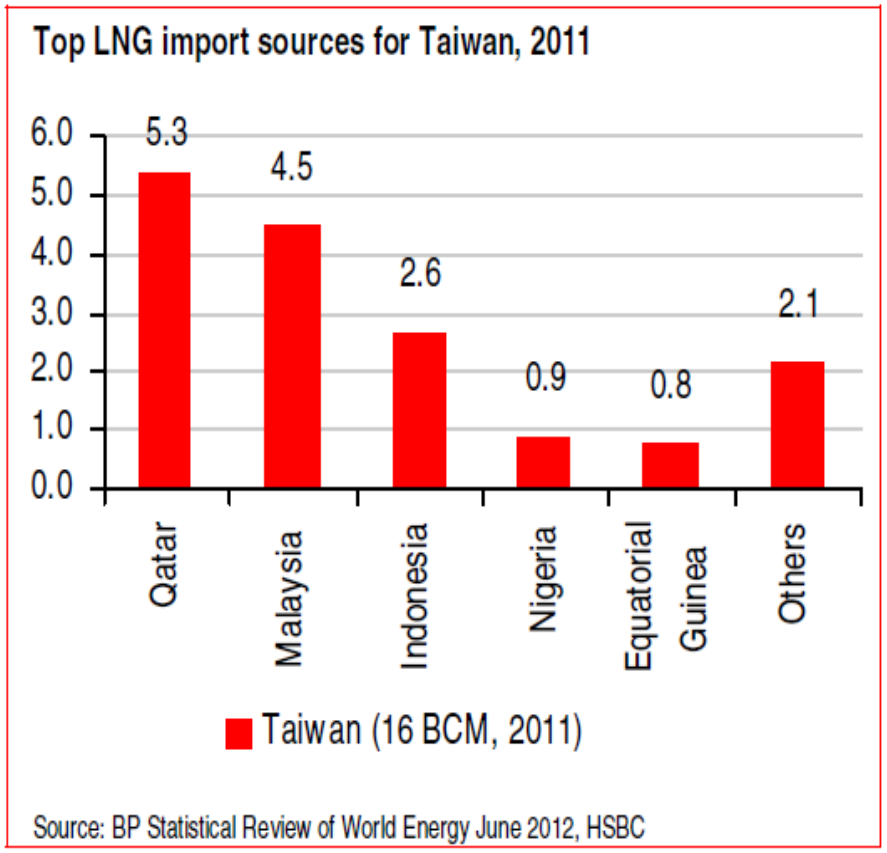

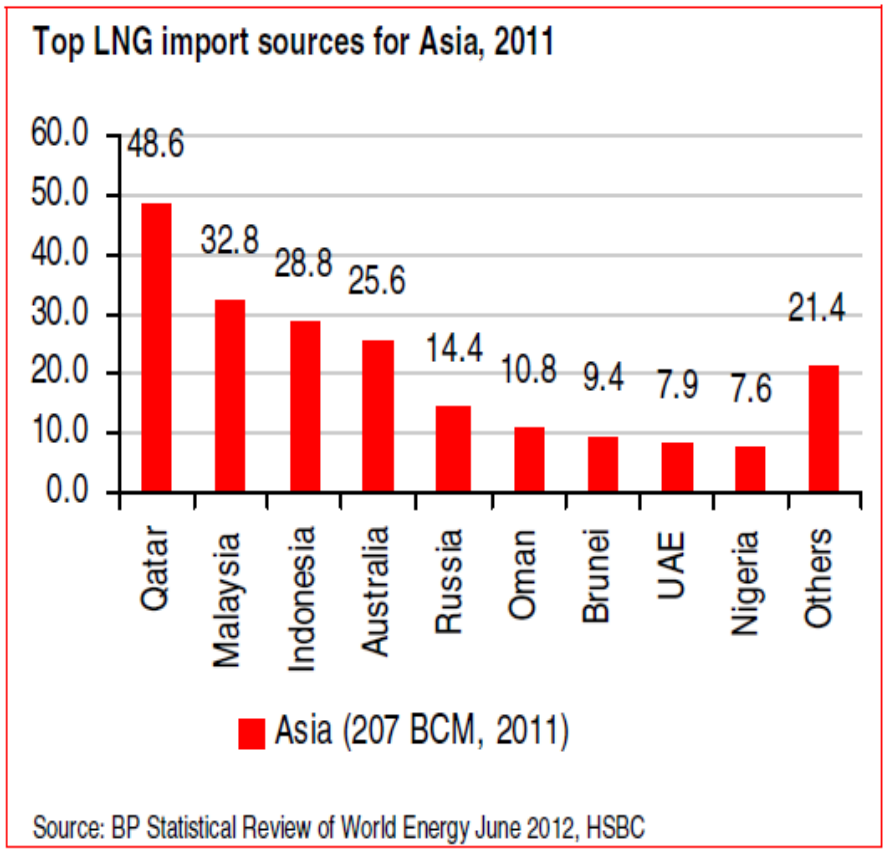

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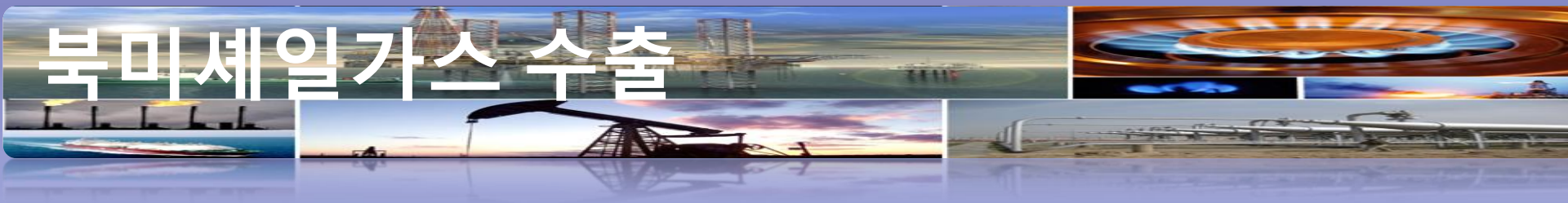
북미셰일가스 수출



- 북미 셰일가스 수출은 이러한 동북아LNG 트레이딩 추세를 더욱 가속화할 것.

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North American LNG Exports:

Table 1: Canadian Gas Resources by Province

	Conventional		Unconventional		Total	
	Tcf	*Bcm*	*Tcf*	*Bcm*	*Tcf*	*Bcm*
Alberta	78	2210	0	0	78	2210
Saskatchewan	4	113	0	0	4	113
British Columbia	31	878	78	2210	109	3088
Southern Territories	6	170	0	0	6	170
Total	**119**	**3371**	**78**	**2210**	**197**	**5581**

Source: Canadian National Energy Board

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North American LNG Exports:

Map 1: North American LNG Projects

NORTH AMERICAN LNG IMPORT / EXPORT TERMINALS

AS OF APRIL 26, 2012

APPROVED SITES

IMPORT TERMINALS UNDER CONSTRUCTION

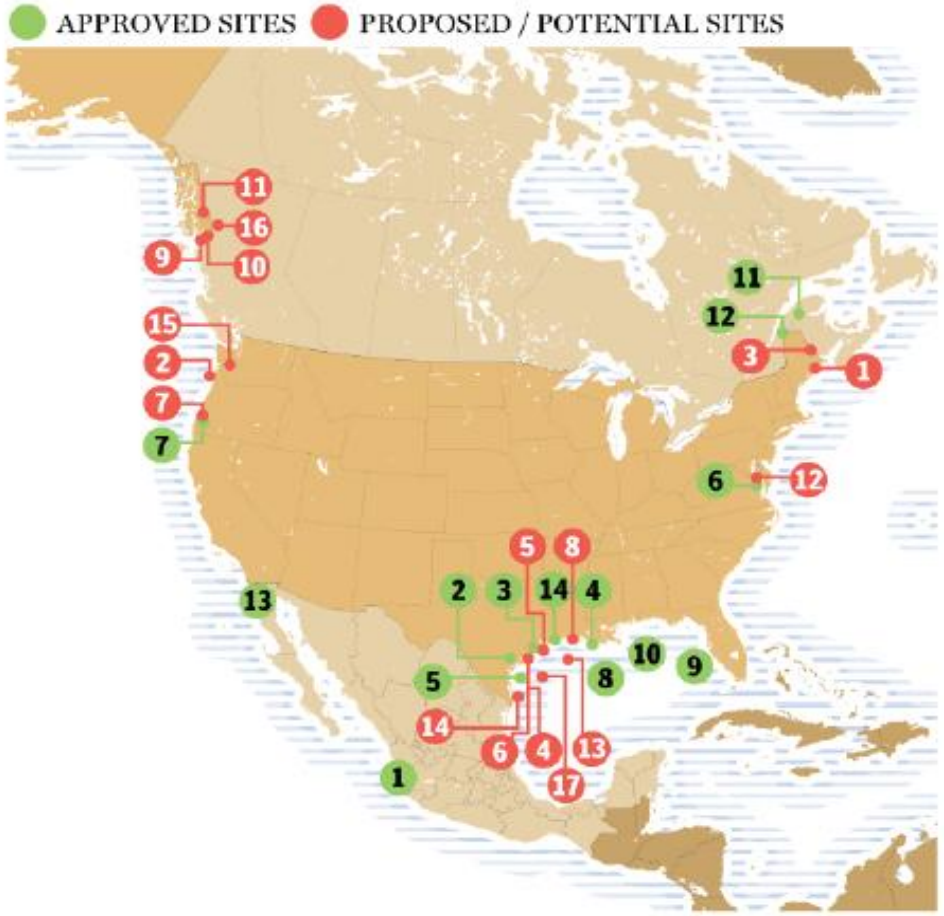
1. Manzanillo, Mexico

IMPORT TERMINALS NOT UNDER CONSTRUCTION

2. Corpus Christi, TX
3. Freeport, TX
4. Hackberry, LA
5. Port Lavaca, TX
6. Baltimore, MD
7. Coos Bay, OR
8. Gulf of Mexico
9. Offshore Florida
10. Gulf of Mexico
11. Rivière-du-Loup, Que.
12. Quebec City, Que.
13. Baja California, Mexico

EXPORT TERMINAL NOT UNDER CONSTRUCTION

14. Sabine, LA



PROPOSED / POTENTIAL SITES

IMPORT TERMINAL

1. Robbinston, ME
2. Astoria, OR
3. Calais, ME
4. Corpus Christi, TX

EXPORT TERMINAL

5. Freeport, TX
6. Corpus Christi, TX
7. Coos Bay, OR
8. Lake Charles, LA
9. Kitimat, B.C.
10. Kitimat, B.C.
11. Douglas Island, B.C.
12. Cove Point, MD
13. Hackberry, LA
14. Brownsville, TX
15. Astoria, OR
16. Prince Rupert Island, B.C.
17. Gulf of Mexico

SOURCE: U.S. DEPARTMENT OF ENERGY

ANDREW BARR / NATIONAL POST

Table 2: Proposed and Potential LNG Export Projects in North America

	Location	Capacity			Target Start-Up*	Current Export Licence Status	Owners
United States		*Bcf/d*	*bcma*	*Mtpa*			
Approved							
Sabine Pass	Louisiana	2.1	21.6	16.0	2015	Unrestricted	Cheniere Energy, Sabine Pass LNG
Proposed to FERC							
Freeport	Texas	1.7	17.8	13.2	2017/18	FTA only	ConocoPhillips and multiple partners
Corpus Christi	Texas	1.8	18.2	13.5	2018	Filed with FERC	Cheniere Energy, Corpus Christi LNG
Coos Bay	Oregon	0.8	8.1	6.0	2018	FTA only	Jordan Cove Energy Project
Lake Charles	Louisiana	2.4	24.3	18.0	2018	FTA only	Southern Union, Trunkline LNG (BGF)
Cameron	Louisiana	1.6	16.2	12.0	2017/18	FTA only	Sempra, Cameron LNG
Cove Point	Maryland	0.8	8.1	6.0	2017	FTA only	Dominion
Astoria	Oregon	1.3	13.5	10.0	2017	Filed with FERC	Oregon LNG
Approved & Proposed		***12.4***	***127.9***	***94.7***			
Other Potential Projects							
Brownsville	Texas	2.8	29.0	21.4	na		Gulf Coast LNG Export
Pascaguola	Mississippi	1.5	15.5	11.5	na		Gulf LNG Liquefaction
Lavaca Bay	Texas	1.0	10.8	8.0	2017		Excelerate Liquefaction
Elba Island	Georgia	0.5	5.4	4.0	na		Southern LNG Company
Golden Pass	Texas	2.0	21.1	15.6	na		Exxon, Qatar Petroleum
Potential		***7.9***	***81.8***	***60.5***			
Total USA		**20.3**	**209.7**	**155.2**			

North American LNG Exports:

Canada							
Proposed							
Kitimat	British Colombia	1.3	13.5	10.0	2017	Secured NEB	Apache, EOG, Encana
LNG Canada	British Colombia	1.6	16.2	12.0	2019	Applied to NEB	Shell Canada, KOGAS, Mitsubishi, PetroChina
Lelu Island	British Colombia	1.0	10.0	7.4	2018	Proposed	Petronas, Progress Energy
Douglas Island	British Colombia	0.1	1.2	0.9	2014	Applied to NEB	BC LNG
Sub-Total		***4.0***	***40.9***	***30.3***			
Total Canada		**4.0**	**40.9**	**30.3**			
Total North America		**24.2**	**250.7**	**185.5**			

Source: FERC as of July 2012, Company data

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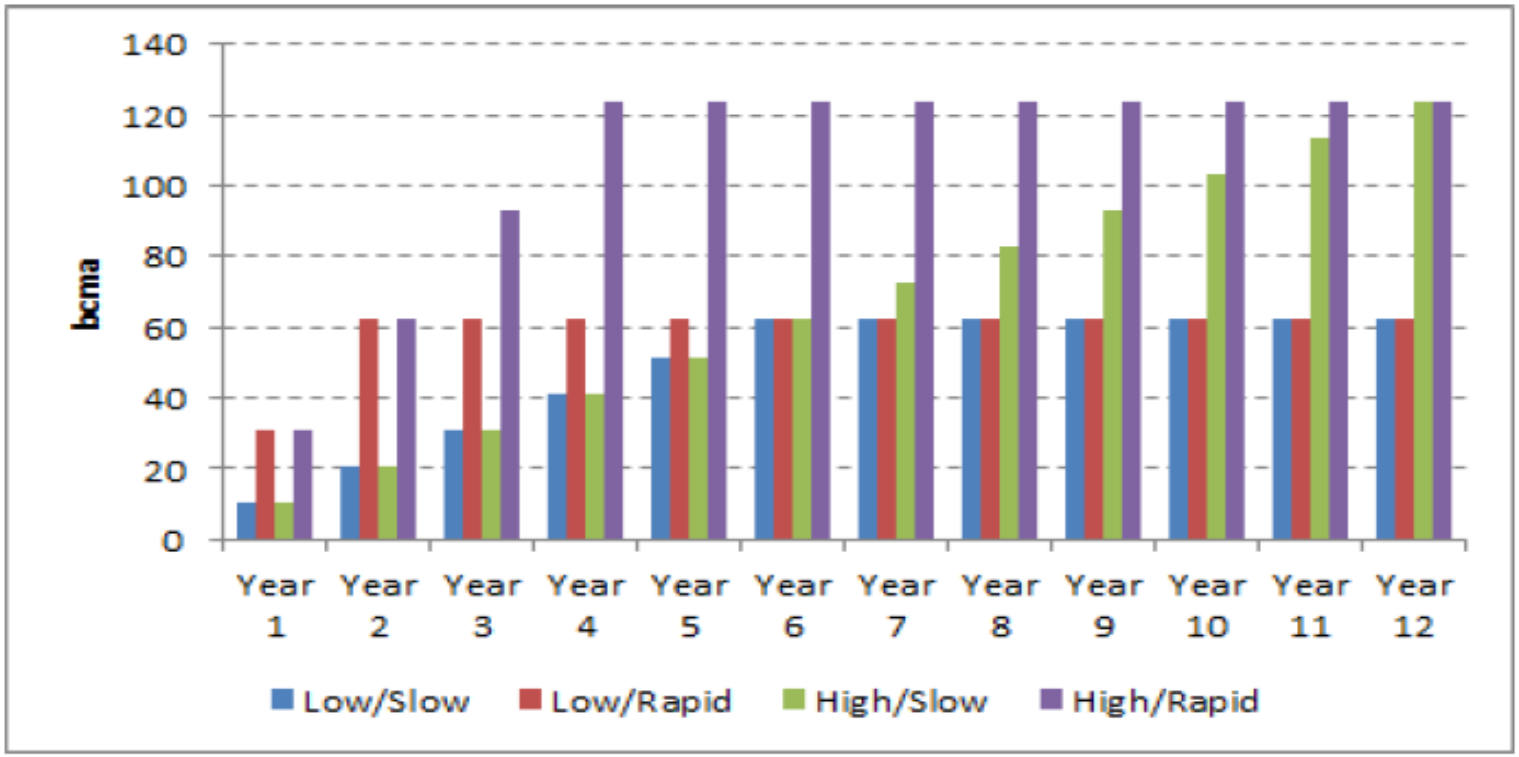
North American LNG Exports:

Figure 5: EIA Scenarios for US Gas Exports



Source: EIA (2012)

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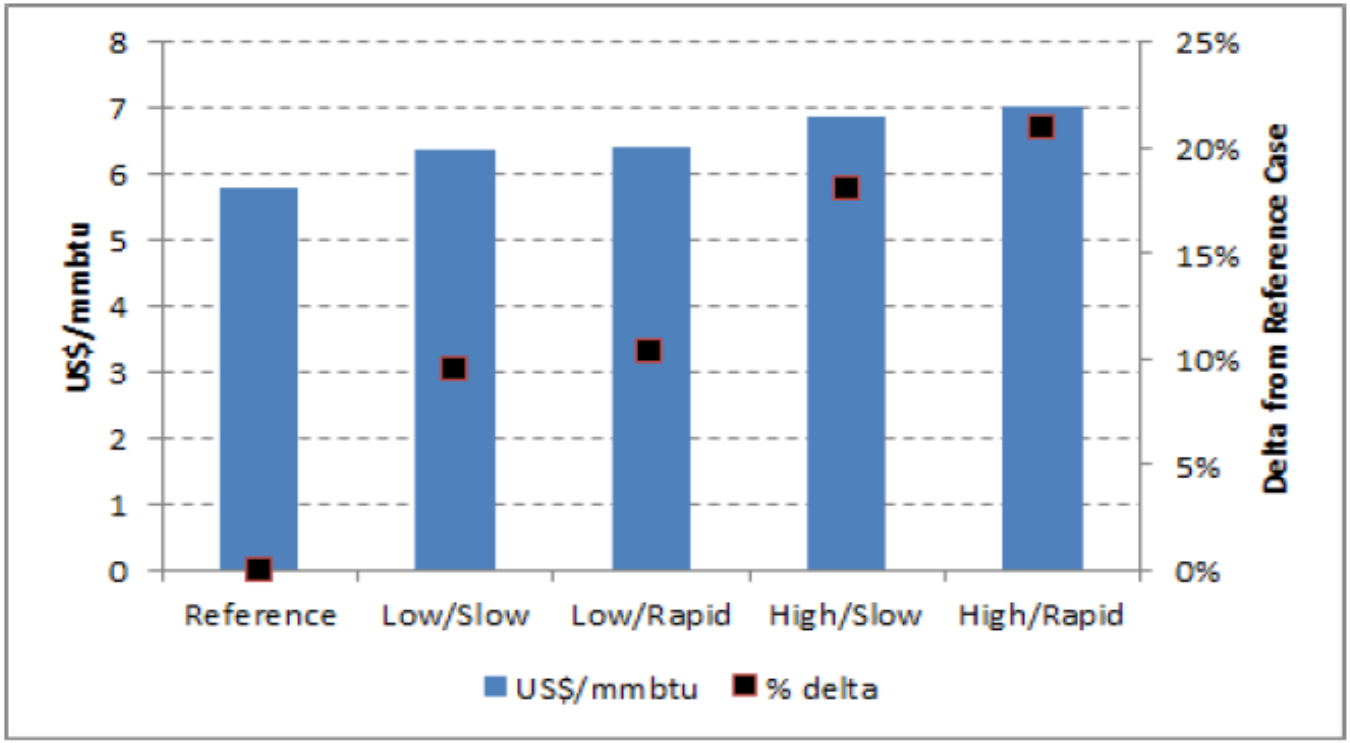
North American LNG Exports:

Figure 6: Price Impact of Exports on EIA Reference Case Gas Price



Source: EIA (2012)

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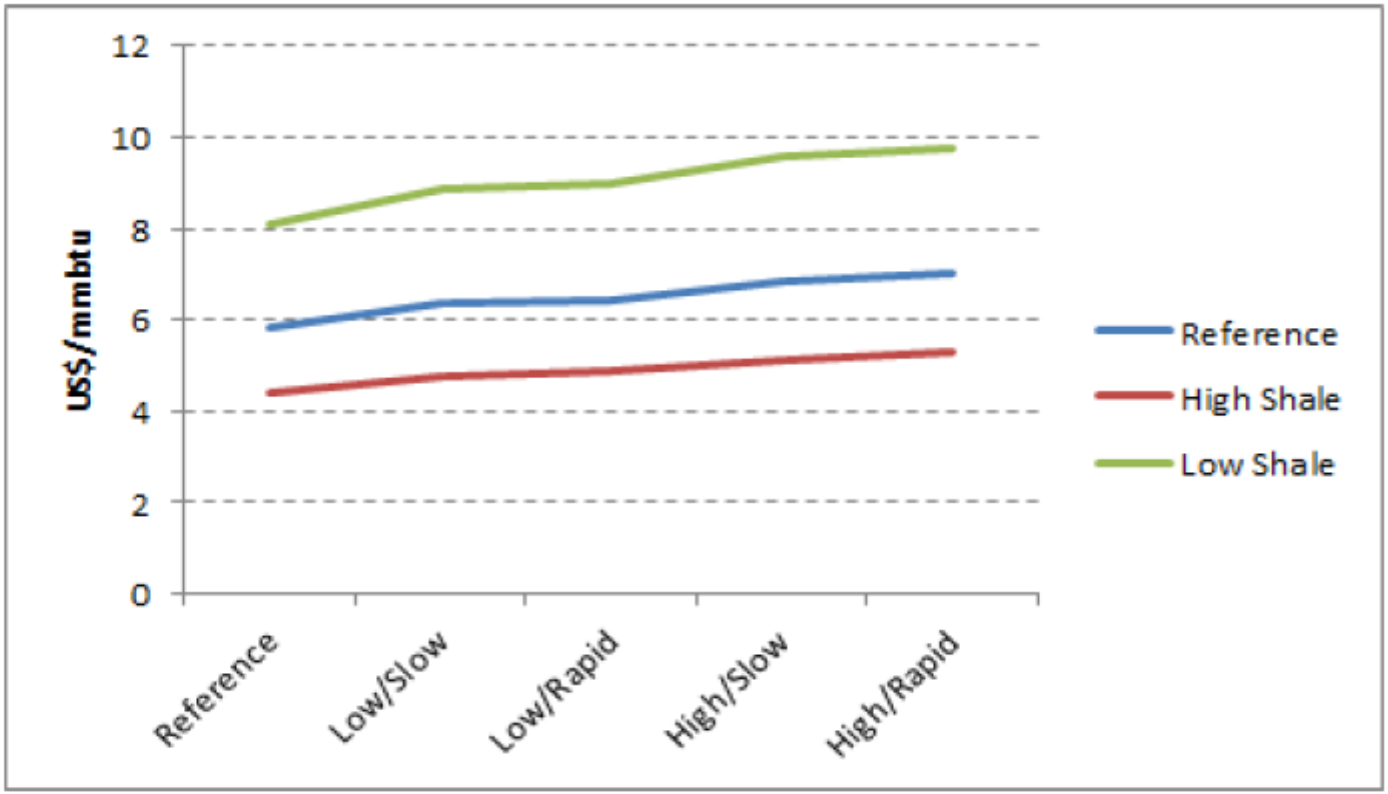
North American LNG Exports:

Figure 8: The Impact of Different Shale Gas Production Scenarios on US gas prices



Source: EIA (2012)

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North American LNG Exports:

Table 3: The Delivered Cost of US LNG Exports to Europe and Asia ($/mmbtu)

Henry Hub Price	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**10.0**
Liquefaction	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Transport to Europe	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Transport to Asia	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Regasification	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Full Cost Europe	**6.6**	**7.6**	**8.6**	**9.6**	**10.6**	**11.6**	**12.6**	**13.6**	**14.6**
Full Cost Asia	**8.4**	**9.4**	**10.4**	**11.4**	**12.4**	**13.4**	**14.4**	**15.4**	**16.4**

Source: Author's calculations based on Cheniere Energy data

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Table 5: Existing agreements for the export of North American gas

Terminal	Buyers	Country	Volume *Mt*	Term *Years*	Start	Comment
Canada						
Kitimat	Kogas	South Korea	2.0	20	2016/17	MoU signed in 2009
	Gas Natural	Portfolio	1.6	20	2016/18	MoU signed in 2010
LNG Canada	Shell	Portfolio	4.8	na	2019	Partner with 40% interest in the project
	Kogas	South Korea	2.4	na	2019	Partner with 20% interest in the project
	Mitsubishi	Japan	2.4	na	2019	Partner with 20% interest in the project
	PetroChina	China	2.4	na	2019	Partner with 20% interest in the project
Total Canada			**15.6**			
United States						
Sabine Pass	BG	Portfolio	6.0	20	2015-18	Confirmed contract
	Gas Natural	Portfolio	3.8	20	2015/16	Confirmed contract
	Kogas	South Korea	3.8	20	2017/18	Confirmed contract
	Gail	India	3.8	20	2017/18	Confirmed contract
Hackberry (Cameron LNG)	Mitsubishi	Japan	4.0	20	2017	Binding commitment to negotiate a tolling agreement
	Mitsui	Japan	4.0	20	2017	Binding commitment to negotiate a tolling agreement
	GDF Suez	France	4.0	20	2017	Binding commitment to negotiate a tolling agreement
Freeport	Osaka Gas	Japan	2.2	20	2018	Tolling contract, gas to be sourced by toller
	Chubu Electric	Japan	2.2	20	2018	Tolling contract, gas to be sourced by toller
Cove Point	Sumitomo	Japan	1.15	20	2017	Tolling contract, gas to be sourced by toller
	Tokyo Gas	Japan	1.15	20	2017	Tolling contract, gas to be sourced by toller
Total US			**36.2**			
Total US & Canada			**51.8**			

Table 6: Asian owners of North American gas assets

Foreign Participant	Asset Location	Asset	Description
PetroChina	Canada	Groundbirch Shale	20% interest in shale gas assets in partnership with Shell
Sinopec	Canada	Daylight Energy	Acquisition of Canadian refiner with shale oil and gas assets in 2011
	US	Devon Energy fields	33% of five fields in Ohio, Michigan and Oklahoma
CNOOC	US	Eagle Ford Shale	Purchase of 33% stake in Chesapeake assets for $1.1bn
	US	Colorado & Wyoming shale	Purchase of 33% stake in oil-rich Chesapeake assets for $1.3bn
	Canada	Nexen Energy	Bid to purchase company with significant shale assets made in July 2012
Sumitomo	US	Marcellus Shale	30% of assets owned by Rex Energy
	US	Barnett Shale (Texas)	30% of oil and gas shale assets owned by Devon Energy
Mitsubishi	Canada	Cutbank Ridge	40% interest in Encana shale gas assets
	Canada	Cordova Basin	30% of JV with Penn West Exploration, Kogas and a Japanese consortium
Mitsui	US	Eagle Ford Shale	12.5% interest in SM Energy gas assets in Texas
	US	Marcellus Shale	32.5% interest in Anadarko gas assets in Pennsylvania
Marubeni	US	Eagle Ford Shale	35% interest in Hunt Oil shale oil and gas assets
	US	DJ Basin	30% interest in Marathon shale oil assets in Wyoming
Itochu	US	Samson Resources	25% interest in US shale gas explorer and producer in partnership with KKR
Inpex	Canada	Horn River, Cordova & Liard Basins	JV with Nexen Energy to develop shale gas assets (Inpex to have 40% stake)
Osaka Gas	US	Pearsall Shale	35% of Cabot Oil & Gas Corp assets in Texas
KNOC	US	Eagle Ford Shale	33% of Anadarko assets in Texas
Kogas	Canada	Cordova Basin	5% of JV with Penn West Exploration, Mitsubishi and a Japanese consortium
GAIL	US	Eagle Ford Shale	20% interest in Carrizo assets in Texas
Reliance	US	Marcellus	40% interest in Atlas Energy gas assets
Japan Consortium	Canada	Cordova Basin	JOGMEC, Tokyo Gas, Chubu Electric and Osaka Gas each have 3.75% of project with Mitsubishi and PWE

North American LNG Exports:

- So far, only the Houston-based Cheniere Energy has received permits to build a natural gas export terminal in Sabine, Louisiana, where it already has a LNG import terminal. According to Bloomberg News, on 30 January 2012, it signed a contract to sell 3.5 mtpa of LNG to KOGAS by as early as 2017. The price will be linked to monthly levels at Henry Hub, the US gas benchmark.
- the US will limit LNG exports to maintain domestic natural gas at the lowest possible level. US exports will not change the linking of LNG prices to oil in Asia in the near term.

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North American LNG Exports:

- As of July 2012, the Freeport LNG, Cameron LNG and Cove Point LNG had signed contracts to provide 16.4 mtpa of LNG to Japanese utilities companies for the period 2017-38.

Japan LNG import contracts with US exporters, as of July 2012

US Export Venture	Japanese Buyer	Term	Start Year	End Year	Volume
Cameron LNG	Mitsubishi Corp	FOB	2017	2037	4.00
Cove Point	Tokyo Gas	FOB	2017	2037	4.00
Freeport LNG	Chubu Electric	FOB	2018	2038	2.20
Cameron LNG	Mitsui & Co	FOB	2018	2038	4.00
Freeport LNG	Osaka Gas	FOB	2018	2038	2.20

Source: Bloomberg, HSBC

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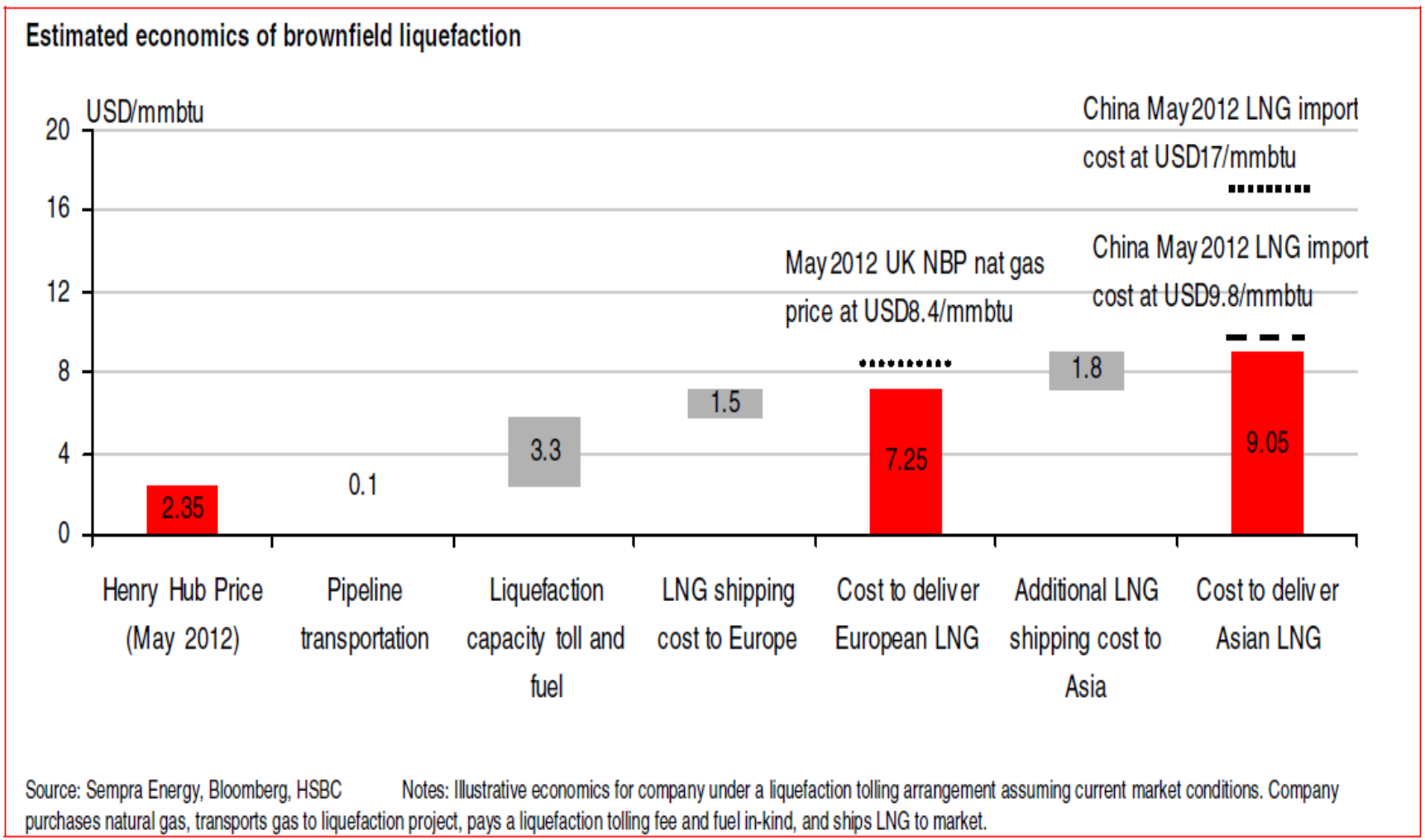
North American LNG Exports:

- Economics of liquefaction
- In an analyst conference on 29 March 2012, Usbased Sempra Energy, which is constructing some of the largest LNG associated capital projects in North America, evaluated the economics of exporting US-produced LNG to Europe and Asia.
- Wheeling, liquefaction and LNG shipping add a total of USD4.9/mmbtu to export to Europe, and USD6.7/mmbtu to Asia. Yet, it still has good economics to export to Europe and Asia.

North American LNG Exports:



Source: Sempra Energy, Bloomberg, HSBC Notes: Illustrative economics for company under a liquefaction tolling arrangement assuming current market conditions. Company purchases natural gas, transports gas to liquefaction project, pays a liquefaction tolling fee and fuel in-kind, and ships LNG to market.

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