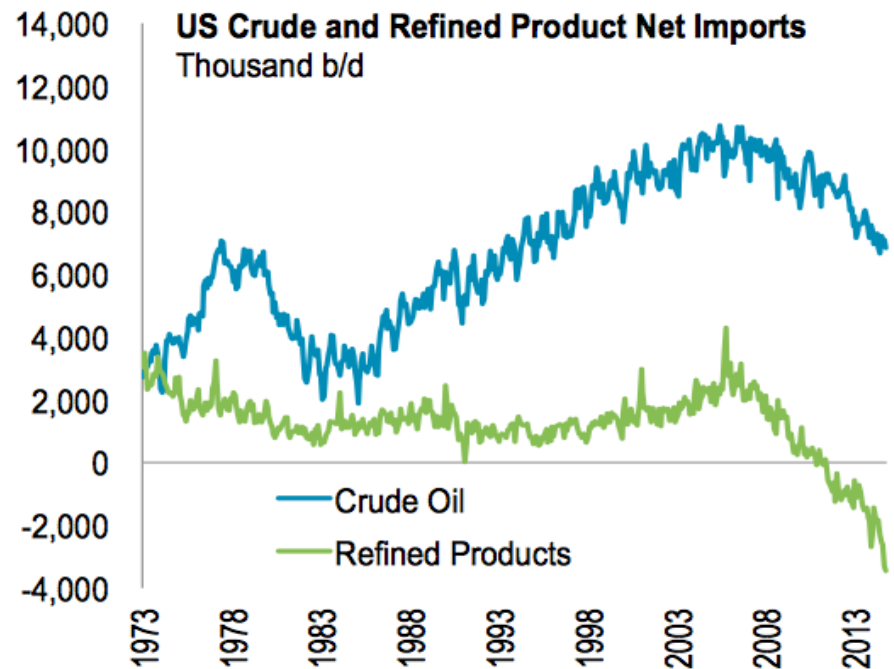
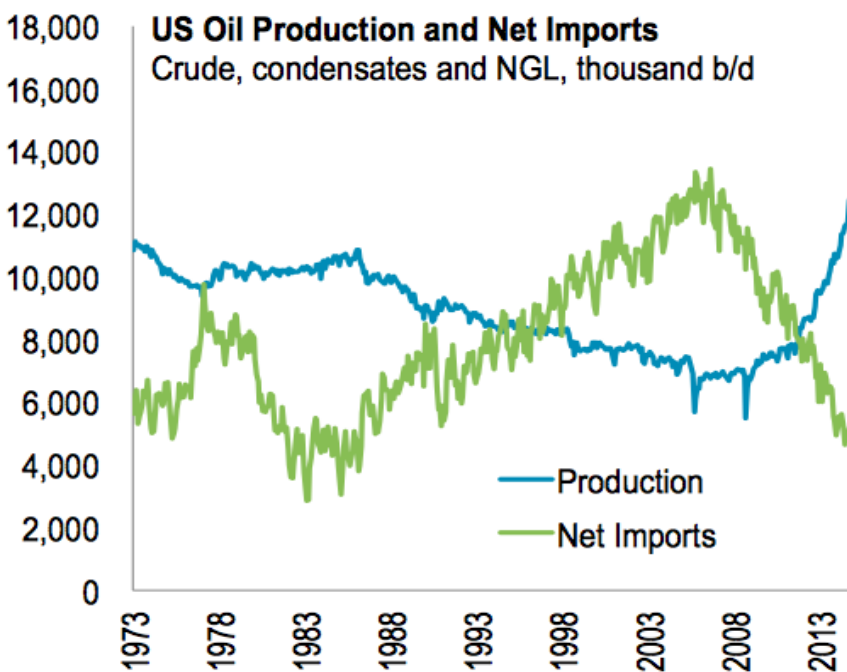


Japan & Global Energy Update February 2015

What is happening in global energy markets now ?

The Shale Boom Has Redrawn the US Energy Landscape

- Rapid domestic production growth and weak demand has sharply reduced the US petroleum trade deficit
- The US has gone from being the world's largest product importer to largest (gross) exporter. Will likely remain a net crude importer for foreseeable future



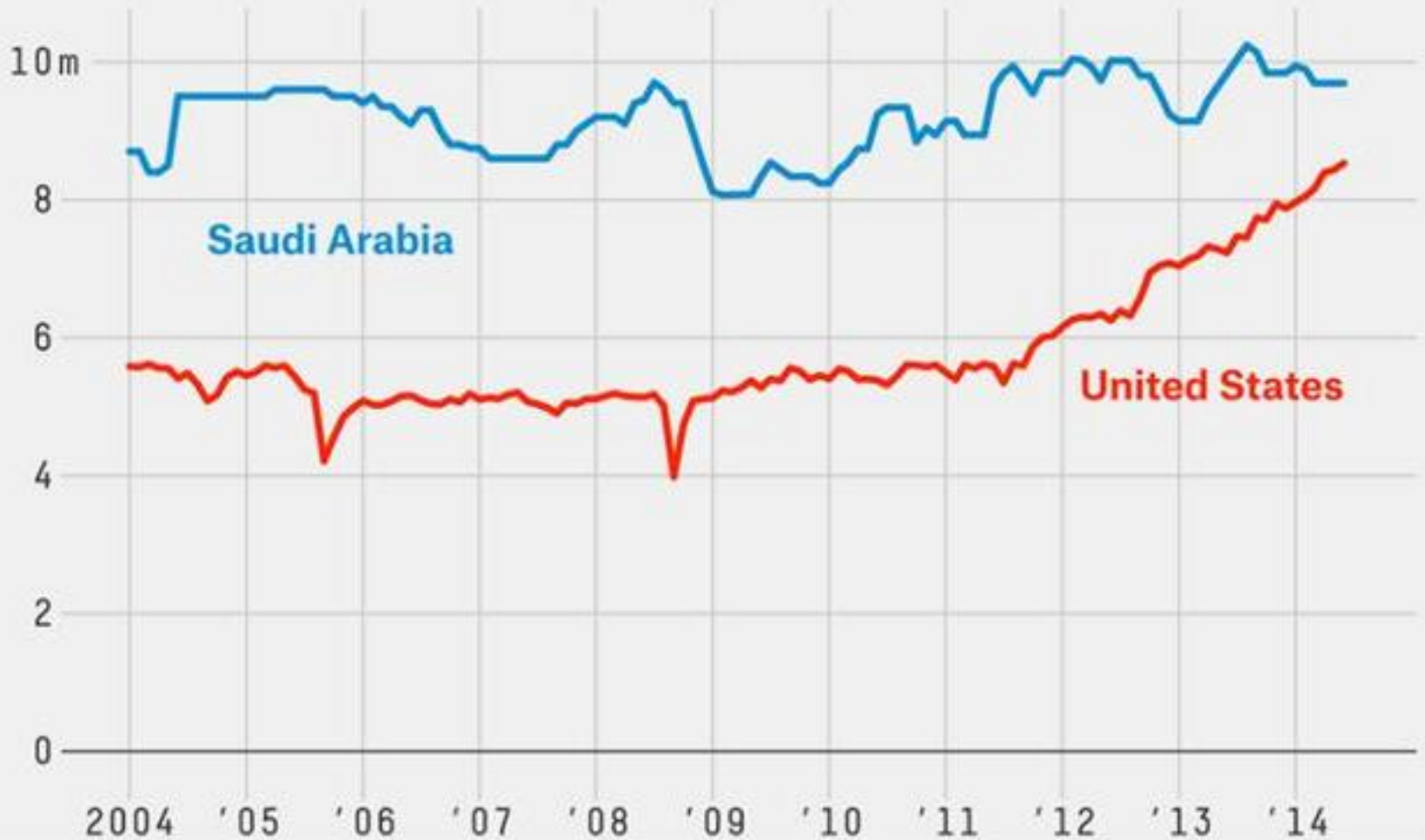
Source: EIA

US\$ vs Oil

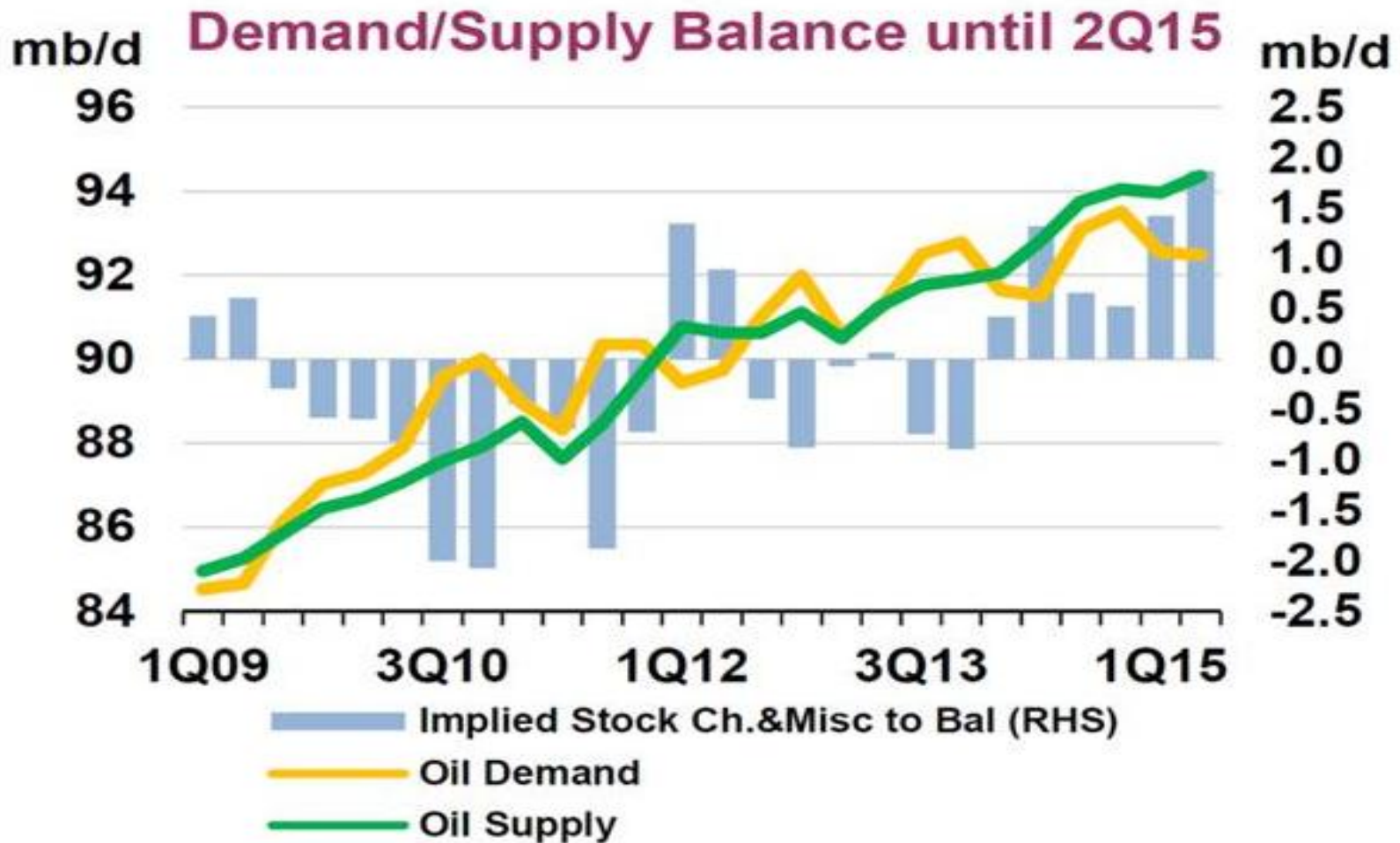


U.S. vs. Saudi Crude Oil Production

Barrels per day, through June 2014



Global Oil Market-Update



Overview of US **Main Logistics Trading Corridors**

Main US Logistics Routes

Figure 2. Top 1 Percent of Trade Corridors Based on Value, Domestic Corridors Only, 2010

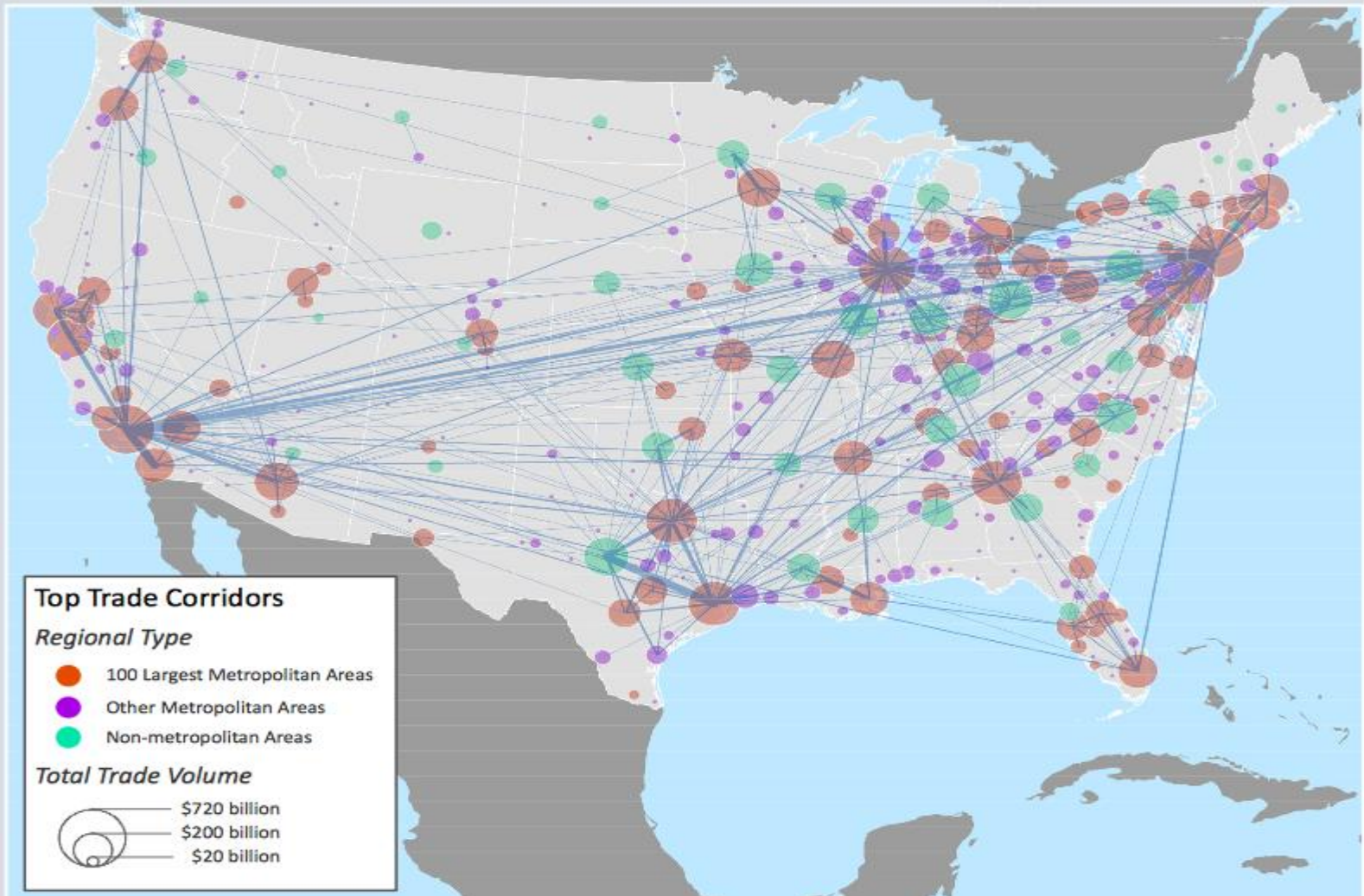


Table 3. Most Valuable National Trade Corridors, 2010 (\$ millions)

Rank	Trader A	Trader B	Total Value	Highest Traded Commodity	Value
1	New York-Northern New Jersey-Long Island, NY-NJ-PA	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	\$55,902.9	Mixed Freight	\$13,812.9
2	Los Angeles-Long Beach-Santa Ana, CA	Riverside-San Bernardino-Ontario, CA	\$50,970.8	Energy Products	\$20,854.1
3	Houston-Sugar Land-Baytown, TX	Rest of Texas	\$47,991.3	Energy Products	\$25,047.4
4	Los Angeles-Long Beach-Santa Ana, CA	San Diego-Carlsbad-San Marcos, CA	\$36,818.0	Mixed Freight	\$5,396.3
5	San Francisco-Oakland-Fremont, CA	San Jose-Sunnyvale-Santa Clara, CA	\$29,786.7	Electronics	\$4,867.9
6	Los Angeles-Long Beach-Santa Ana, CA	Oxnard-Thousand Oaks-Ventura, CA	\$29,548.2	Energy Products	\$10,851.4
7	Baton Rouge, LA	New Orleans-Metairie-Kenner, LA	\$26,474.8	Energy Products	\$18,520.4
8	China	San Jose-Sunnyvale-Santa Clara, CA	\$26,225.2	Electronics	\$20,706.6
9	Dallas-Fort Worth-Arlington, TX	Houston-Sugar Land-Baytown, TX	\$25,167.2	Transportation Equipment	\$5,559.0
10	China	Los Angeles-Long Beach-Santa Ana, CA	\$24,733.3	Electronics	\$8,187.0
11	Los Angeles-Long Beach-Santa Ana, CA	New York-Northern New Jersey-Long Island, NY-NJ-PA	\$24,379.3	Textiles	\$5,792.4
12	China	New York-Northern New Jersey-Long Island, NY-NJ-PA	\$23,925.0	Electronics	\$6,091.4
13	Dallas-Fort Worth-Arlington, TX	Rest of Texas	\$23,156.9	Agricultural Products	\$4,947.8
14	Chicago-Joliet-Naperville, IL-IN-WI	Milwaukee-Waukesha-West Allis, WI	\$22,984.4	Mixed Freight	\$5,464.8
15	Beaumont-Port Arthur, TX	Houston-Sugar Land-Baytown, TX	\$22,034.5	Energy Products	\$10,043.5

Source: Brookings

Table 1. National Goods Trade Network by Origin and Destination Type, 2010 (\$ millions)

		Destination				
		100 Metro Areas	Other Metro Areas	Non-Metro Areas	International	Total
Origin	100 Metro Areas	\$6,345,676.8	\$2,120,203.7	\$1,755,438.9	\$746,583.5	\$10,967,902.9
	Other Metro Areas	\$2,074,231.9	\$824,166.1	\$754,764.3	\$258,508.2	\$3,911,670.6
	Non-Metro Areas	\$1,967,359.5	\$865,213.4	\$526,407.0	\$240,862.9	\$3,599,842.7
	International	\$1,183,735.7	\$363,097.0	\$267,598.8	---	\$1,814,431.4
	Total	\$11,571,003.9	\$4,172,680.2	\$3,304,208.9	\$1,245,954.6	\$20,293,847.6

Source: Brookings analysis of EDR and Census data

Japan: Current Energy Status

Japan's Fuel Consumption / Self Sufficiency Rates/CO2 Emissions

Table 4 | Primary energy supply

	Historical				Projections		Year-to-year changes		
	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2013	FY2014	FY2015
Primary energy supply (Mtoe)	514.2	491.2	484.9	488.2	474.9	479.0	0.7%	-2.7%	0.9%
Coal	119.2	112.8	117.7	126.1	123.1	123.6	7.2%	-2.4%	0.4%
Oil	212.0	218.0	221.6	214.3	202.7	197.5	-3.3%	-5.4%	-2.6%
Natural gas	95.6	111.7	116.4	117.9	118.0	114.4	1.3%	0.1%	-3.0%
Hydro	18.2	18.5	16.7	16.9	17.3	17.7	1.2%	2.3%	2.3%
Nuclear	60.7	21.4	3.4	1.9	0.2	9.2	-42.5%	-88.8%	4148%
Others	8.7	8.8	9.2	11.0	13.6	16.5	19.5%	23.7%	21.5%
Self-sufficiency rate	18%	11%	7%	7%	7%	10%
Energy intensity (FY2005=100)	94.2	89.6	87.6	86.4	84.5	83.7	-1.4%	-2.1%	-0.9%
Energy-related CO ₂ emissions (Mt)	1,123	1,173	1,208	1,224	1,196	1,168	1.4%	-2.3%	-2.3%
(FY2005=100)	93.4	97.6	100.4	101.8	99.4	97.1

Transportation is about 25% of Japan's Total Energy Consumption

Table 5 | Final energy consumption

	Historical				Projections		Year-to-year changes		
	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2013	FY2014	FY2015
Final energy consumption (Mtoe)	339.4	327.2	321.8	321.0	311.7	315.6	-0.2%	-2.9%	1.2%
Industry	158.3	152.2	148.4	150.8	146.0	148.6	1.6%	-3.2%	1.8%
Buildings	98.0	93.7	92.9	91.1	88.8	88.6	-1.9%	-2.5%	-0.3%
Residential	54.6	52.8	51.8	50.5	49.7	49.1	-2.6%	-1.6%	-1.0%
Commercial	43.4	40.9	41.1	40.6	39.2	39.4	-1.2%	-3.6%	0.7%
Transport	83.1	81.4	80.4	79.1	76.4	77.9	-1.7%	-3.4%	1.9%
Coal and coal products	35.9	34.7	34.3	36.3	36.7	37.8	6.0%	1.0%	3.1%
Petroleum products	176.2	169.3	165.7	163.4	156.1	156.9	-1.4%	-4.4%	0.5%
City and natural gases	34.3	35.1	34.7	34.1	33.8	34.8	-1.8%	-0.7%	2.7%
Electricity	89.8	85.5	84.6	84.7	82.4	83.4	0.1%	-2.7%	1.2%
Others	3.2	2.7	2.5	2.6	2.7	2.7	1.1%	3.3%	0.3%

Note: Industry includes non-energy use.

Source : IEEJ

Table 7 | Power generation mix (electric utilities)

	Historical				Projections		Year-to-year changes		
	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2013	FY2014	FY2015
Electricity generated and purchased (TWh)	1,028	976.2	962.7	963.5	935.7	950.2	0.1%	-2.9%	1.6%
Share							Year-to-year changes		
Hydro	(8%)	(9%)	(8%)	8%	9%	9%	-0.0p	+0.4p	+0.0p
Fossil fuel-fired thermal	(60%)	(79%)	(90%)	88%	87%	81%	-1.6p	-1.0p	-5.9p
Coal	(23%)	(24%)	(25%)	30%	30%	30%	+4.9p	-0.1p	-0.2p
Natural and city gases	(32%)	(43%)	(48%)	44%	46%	42%	-4.1p	+1.8p	-3.2p
Oil, etc.	(6%)	(13%)	(17%)	14%	12%	9%	-2.4p	-2.7p	-2.5p
Nuclear	(31%)	(12%)	(2%)	1%	0%	5%	-1.0p	-0.8p	+4.5p
Others	(0%)	(0%)	(0%)	3%	4%	6%	+2.6p	+1.4p	+1.4p

Note: Only for general electric utilities until FY2012.

Source IEEJ

City Gas Consumption Patterns

Table 8 | City gas sales (city gas utilities)

	Historical				Projections		Year-to-year changes		
	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2013	FY2014	FY2015
Total (Billion m ³)	39.28	40.39	40.33	39.82	40.14	41.09	-1.3%	0.8%	2.4%
Residential	9.79	9.79	9.80	9.55	9.66	9.64	-2.5%	1.1%	-0.1%
Commercial	4.75	4.50	4.52	4.49	4.32	4.44	-0.6%	-3.7%	2.7%
Industrial	21.61	23.12	22.92	22.20	22.72	23.49	-3.2%	2.4%	3.4%
For electric utilities	1.43	1.53	1.89	1.94	2.75	2.89	2.6%	41.7%	4.9%
For other users	20.18	21.59	21.03	20.26	19.97	20.61	-3.7%	-1.4%	3.2%
Others	3.13	2.97	3.09	3.58	3.43	3.51	15.6%	-4.0%	2.3%

Notes: Converted at 1 m³ = 41.8605 MJ (10,000 kcal)

Source : IEEJ

Fuel Oils and LPG

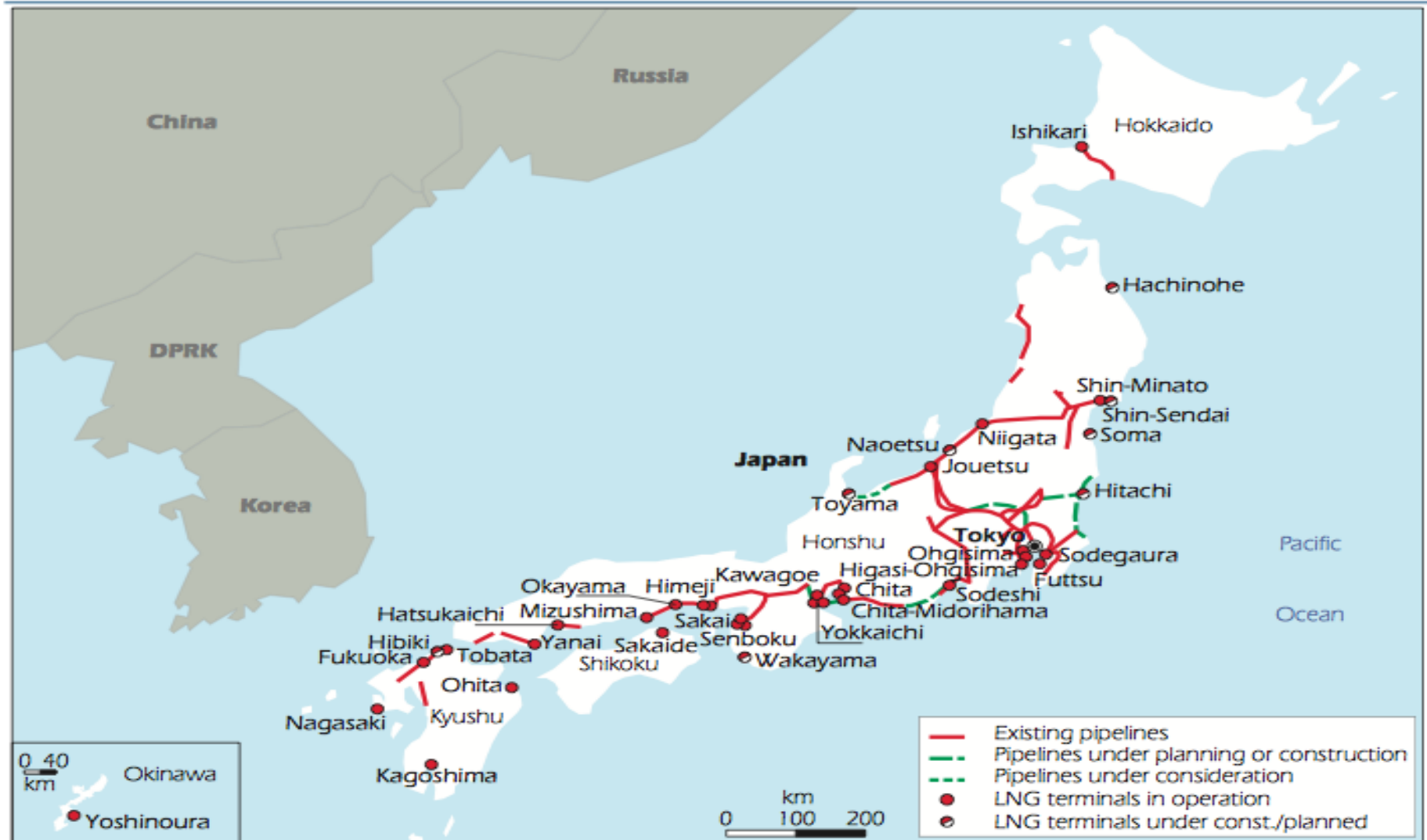
Table 9 | Fuel oils and LPG sales

	Historical				Projections		Year-to-year changes		
	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2013	FY2014	FY2015
Fuel oils (GL)	196.0	196.3	197.8	193.5	184.1	180.5	-2.1%	-4.9%	-2.0%
Gasoline	58.2	57.2	56.2	55.4	53.4	54.2	-1.4%	-3.6%	1.5%
Naphtha	46.7	43.7	43.2	45.7	43.8	44.4	6.0%	-4.3%	1.3%
Jet fuel	5.2	4.2	4.0	5.1	5.1	5.1	27.1%	0.9%	-0.3%
Kerosene	20.4	19.6	18.9	17.9	16.9	16.6	-5.2%	-5.6%	-1.5%
Diesel oil	32.9	32.9	33.4	34.1	33.9	33.9	2.1%	-0.6%	0.2%
Heavy fuel oil A	15.4	14.7	13.8	13.4	12.8	12.1	-2.3%	-4.4%	-5.5%
Heavy fuel oil B and C	17.3	24.0	28.4	21.9	18.1	14.1	-22.9%	-17.1%	-22.3%
For electric utilities	7.7	14.9	19.4	14.4	11.0	7.4	-25.7%	-23.6%	-32.7%
For other users	9.7	9.1	9.0	7.5	7.1	6.7	-16.8%	-4.6%	-6.3%
LPG (Mt)	16.5	16.4	16.6	15.5	15.6	15.4	-6.5%	0.4%	-0.8%

Source: IEEJ

Japan's LNG Infrastructure

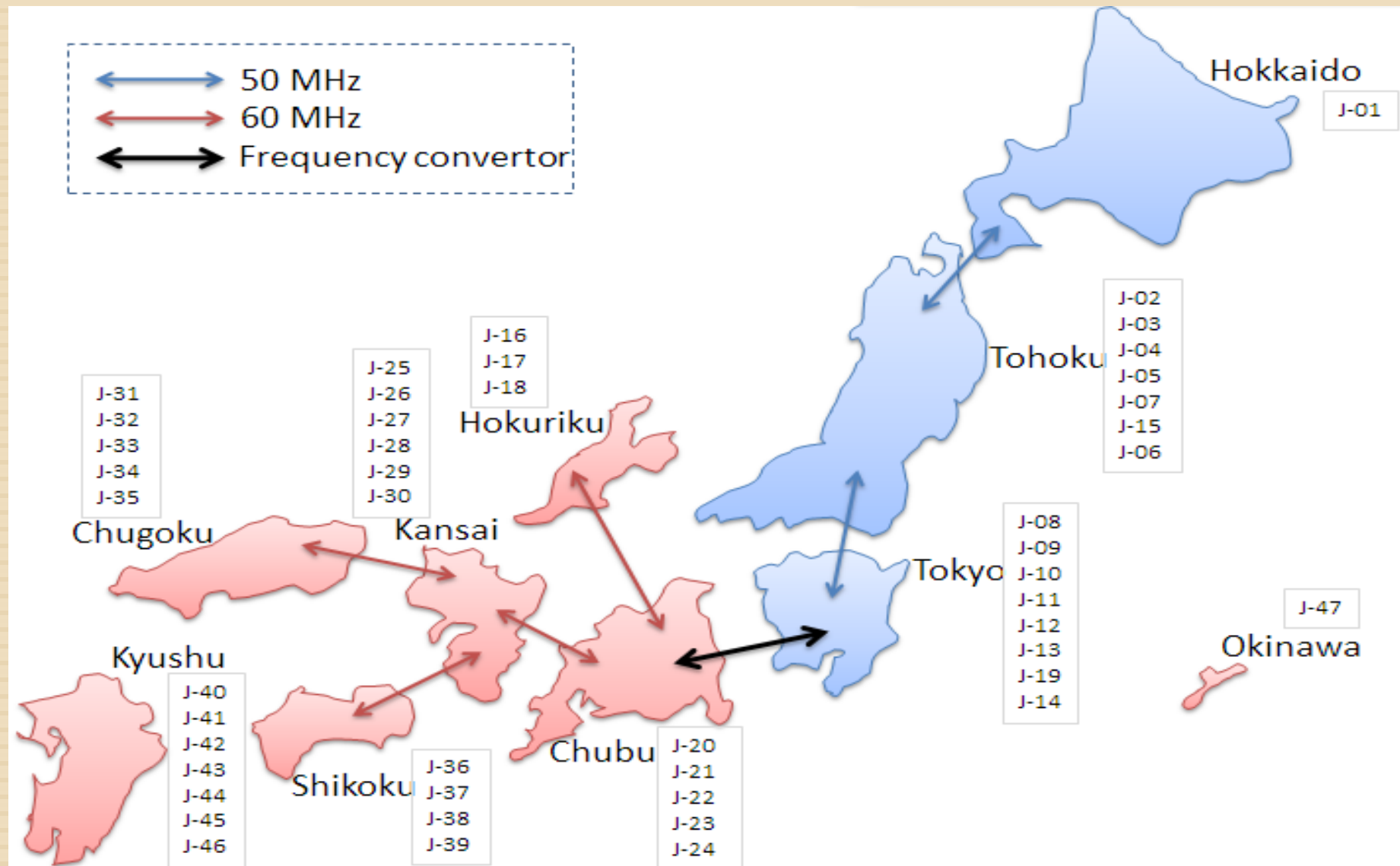
Figure 38 • LNG receiving terminals and main gas pipelines in Japan



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Source: IEA (2014b), *Natural Gas Information 2014*, OECD/IEA, Paris.

Japan's Power Split



Japanese Generation Assets by EPC

Company Data (Fiscal year ending March 31, 2013)

Company	Capital Stock (Million yen)	Total Assets (Million yen)	Generating Capacity (MW)	Electricity Supplied (GWh)	Electricity Sales (GWh)	Revenues from Electricity Sales (Million yen)	Number of Customers (Thousands)	Number of Employees
Hokkaido	114,291	1,607,002	7,549	34,938	31,184	558,860	4,007	5,689
Tohoku	251,441	3,996,559	17,766	85,106	77,833	1,578,135	7,668	12,872
Tokyo	1,400,975	14,619,772	65,581	289,704	269,033	5,660,091	28,869	37,142
Chubu	430,777	5,592,806	34,032	137,140	126,552	2,429,840	10,519	17,277
Hokuriku	117,641	1,366,144	8,061	30,989	28,075	477,750	2,097	4,861
Kansai	489,320	6,757,662	34,958	153,320	141,754	2,439,435	13,560	22,554
Chugoku	185,527	2,715,200	11,989	63,984	58,647	1,089,109	5,223	9,884
Shikoku	145,551	1,318,731	6,963	30,099	27,410	488,195	2,844	6,163
Kyushu	237,304	4,201,704	20,137	90,302	83,787	1,408,339	8,558	13,089
Okinawa	7,586	415,087	2,183	8,313	7,314	158,754	859	1,609
Total	3,380,413	42,590,667	209,219	923,895	851,590	16,288,508	84,204	131,140

Source: Handbook of Electric Power Industry

Source : FEPC

Annual Fuel Usage by the Japanese EPCs-Y2013

- 56 million tons of LNG (\$48.0 billion)
- 150 million barrels of crude and fuel oil - 400,000 bpd or around 10% of Japan's oil imports (\$15.0 billion)
- 100 million tons of thermal coal (\$10.0 billion)
- # Total Fuel Inputs: \$73 billion
- = Y8/ kWh

About 30% of Japan's Fuel Imports are currently consumed by its Power Sector

Japan has very limited gas strategic reserves-16 days vs 90 days for oil

Current Generation Mix of the Japanese EPCs

21

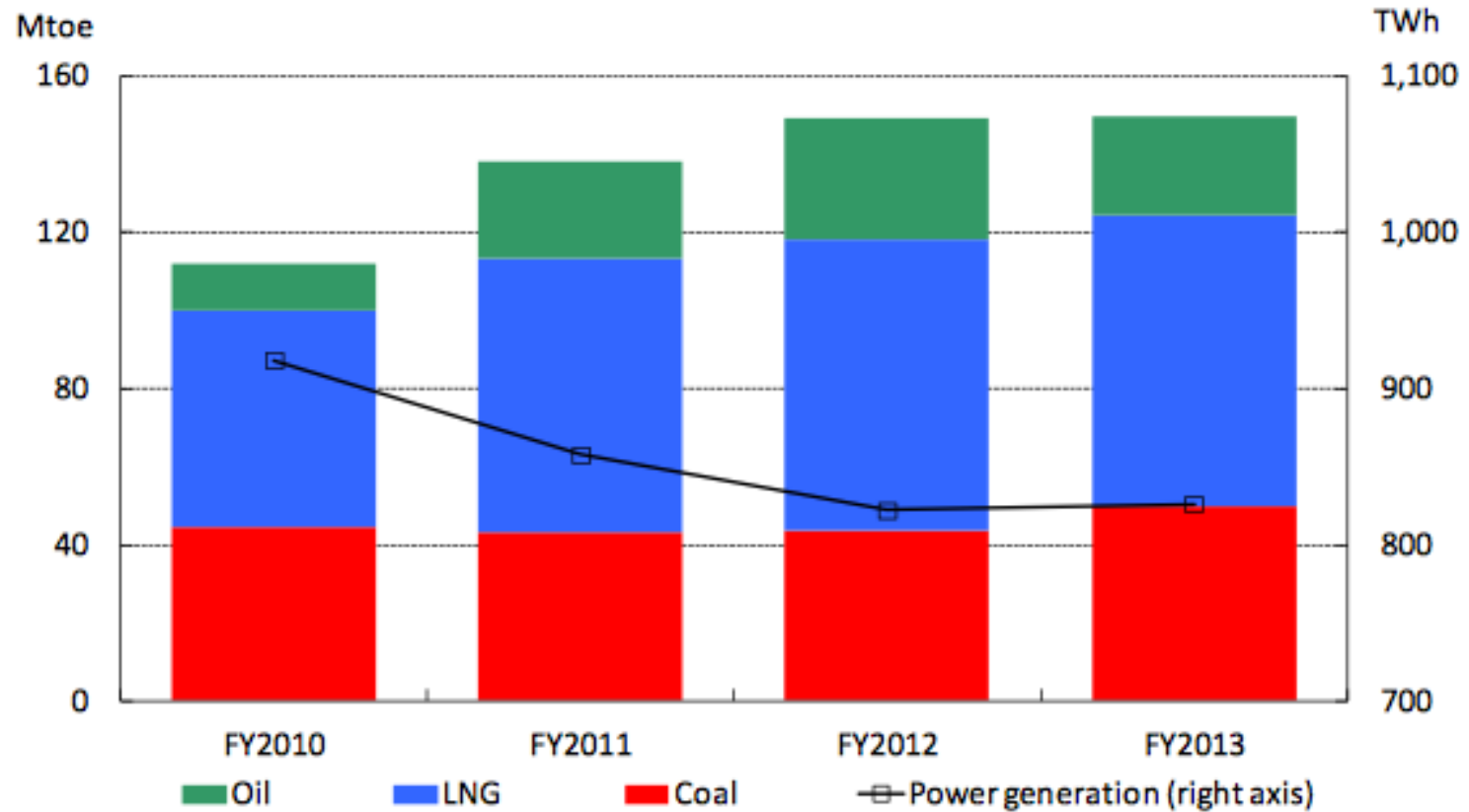
- LNG : 43% - 390 billion kWh
- Coal : 28% - 252 billion kWh
- Oil : 18% - 160 billion kWh
- Hydro : 8% - 72 billion kWh
- Others : 3% - 26 billion kWh

100%-900 billion kWh

Fossil Fuel Usage by Japan EPCs

22

Figure 1 Power Utilities' Fossil Fuel Input



Facts & Figures on the Japan Power Sector

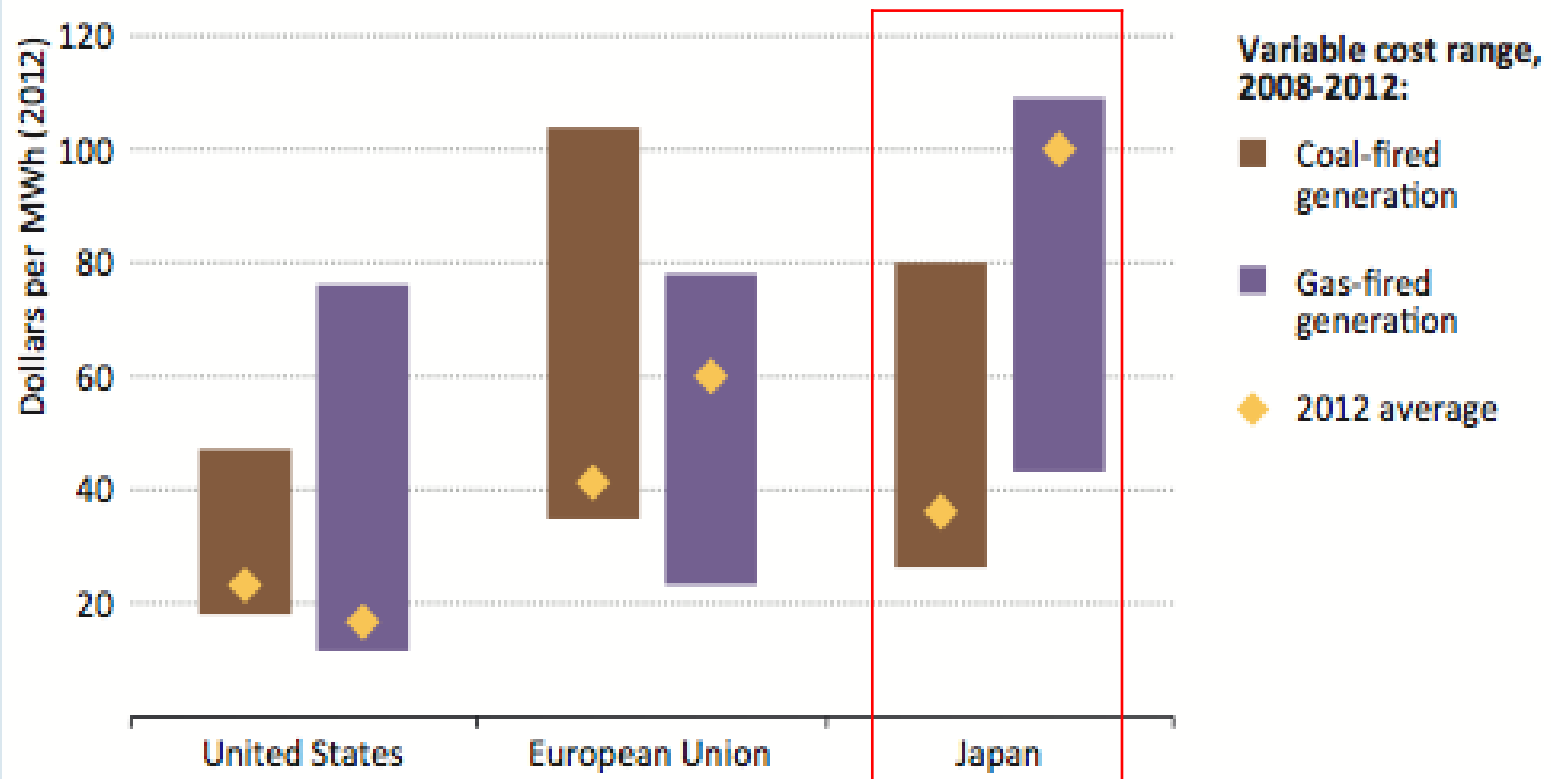
23

- Generation Capacity of EPCs: 220 GW
- Self-generation capacity: 80 GW
- Transmission & Distribution: 18,200 km
- No. of Residential Customers : 54 million
- No. of Commercial/Industrial Customers: 30 million
- Revenue Base : \$150 billion
- Equity/Debt Split of the Industry: 4:1
- Carbon Emissions of the sector: 700 million tons
- CAPEX: FY03/14 : \$24 billion

Coal vs LNG in Japan

24

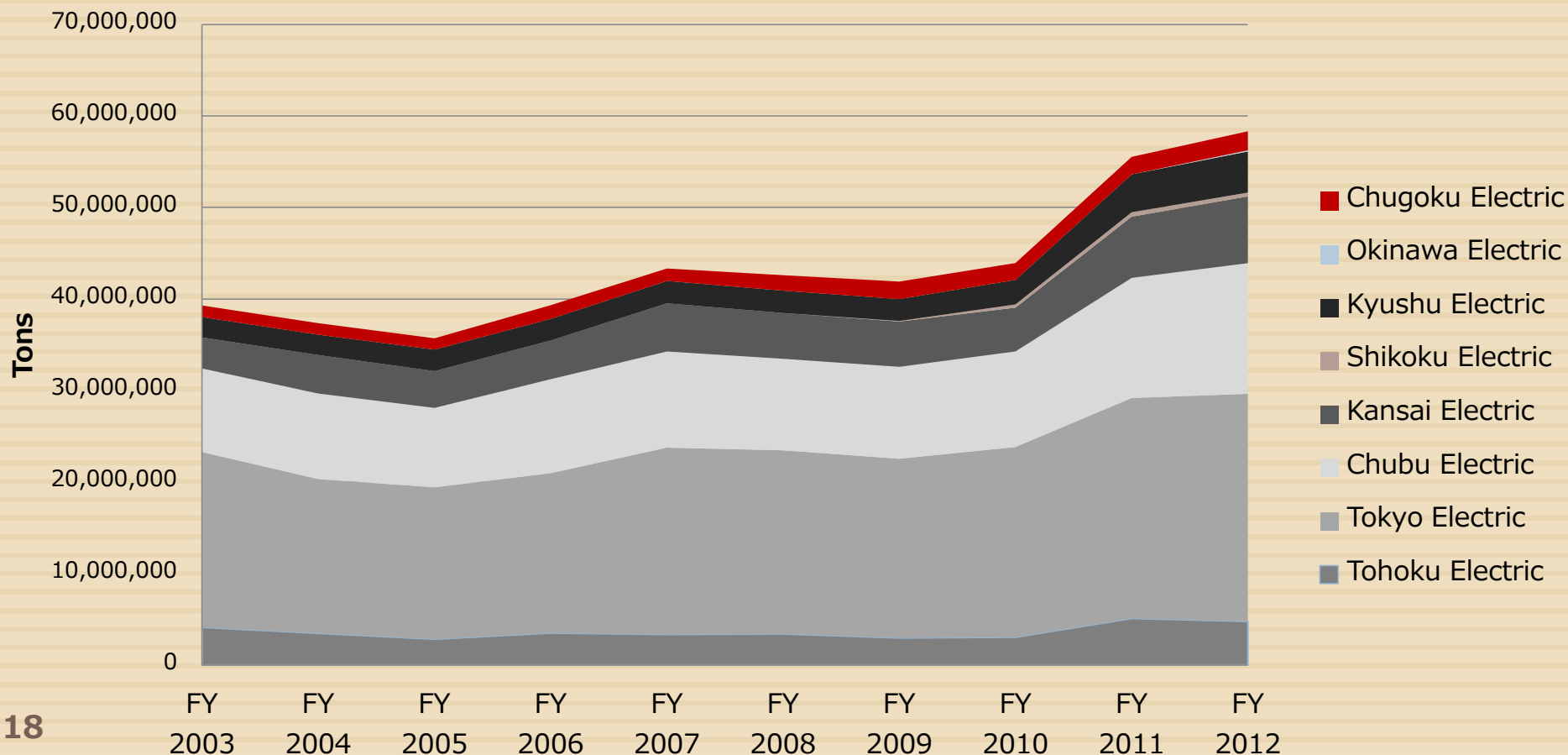
Figure 5.11 ▶ Electricity generating costs for coal and gas by selected region and for 2008-2012 fuel prices



Japan's LNG Imports for Power Generation

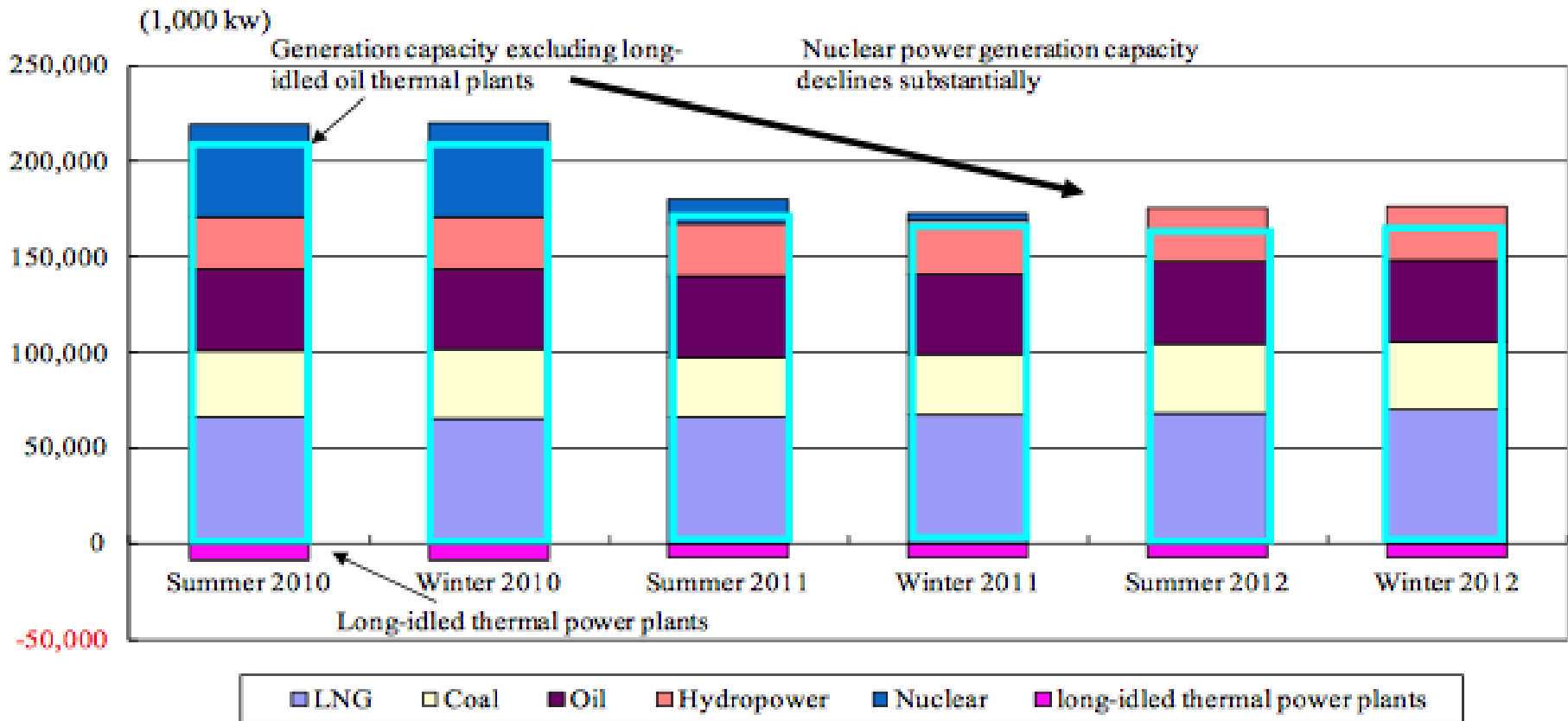
LNG imports by Japan's regional power providers spiked after the Fukushima accident caused the shuttering of the country's 50 nuclear power plants, with 2013 imports closing in on 60 million tons. Limited or no nuclear restarts would mean that Japanese EPCOs would have to secure additional fuel supplies for power generation. New term contracts will have to replace those expiring, and potentially those volumes currently secured on a shorter term or spot basis.

Japan's EPCO LNG Imports



Japan's Generation before/after Fukushima

Figure 2-1 Japan's total power generation capacity



Status of Nuclear Re-Starts

Ohi Reactor shut down on 16 September 2013 and since then no reactor has been activated. FY2014 will be the first year in four decades that no nuclear reactor has been in operation in Japan.

The average numbers of years that Japan's reactors have been non-operational is now 3.5 years or a cumulative 152 years of non-operation or approximately 880 TWh of output has been lost over this period that is almost equivalent to one year of power consumption in Japan or \$150 billion of revenues.

Ten reactors (9.6 GW) may re-start in FY 2015 subject to NRA clearance.

#1 & #2 Sendai: Kyushu EPC

#3 & #4 Genkai: Kyushu EPC

#3 & #4 Takahama : Kansai EPC

#3 Ikata : Shikoku EPC

#3 & #4 Oi: Kansai EPC

#3 Tomari :Hokkaido EPC

Four reactors are now aged over 40 years:-

1 Tsuruga -JAPC

1 & 2 Mihama-Kyushu EPC

#1 Shimane – Chugoku EPC

Three more reactors will reach 40 years by July 2016:-

#1 and #2 Takahama-Kyushu EPC

#1 Genkai – Kyushu EPC

Government efforts now underway to decommission up to 12 reactors starting with #1 and #2 in Mihama.

Y2.2 trillion (\$19 billion) has been the spent so far on upgrading reactors to meet new NRA standards.

TEPCO, Tohoku, Chugoku, Chubu, Hokuriku unlikely to re-start any reactors in FY 2015.

Roadmap for Electricity Market Reform in Japan

Bills

1st Reform: passed in Extraordinary Diet in 2013

- 1) Establishment of the Organization for Cross-regional Coordination of Transmission Operators (OCCTO)
- 2) Action programs for 2nd and 3rd reforms etc.

2nd Reform: Ordinary Diet in 2014

- 1) Full retail competition
- 2) Revision of applicable and regulations associated with the abolishment of General Electricity Utility system

3rd Reform: Ordinary Diet in 2015 (Plan)

- 1) Legal unbundling of transmission/distribution sector
- 2) Code of Conduct

Reforms

Apr. 2, 2013
Cabinet
Decision

Nov. 13, 2013

【1st Stage】
Around 2015

【2nd Stage】
Around 2016

【3rd Stage】
Around 2018 through 2020

Establishment of the
Organization for Cross-
regional Coordination of
Transmission Operators
(OCCTO)

Full retail
competition

Period of
transitional
arrangement for
retail tariff

Abolishment
of retail tariff

Legal unbundling
of transmission /
distribution sector

The 1st Bill was passed.

Cabinet Decision on the Policy
on Electricity System Reform

1st reform

2nd reform

3rd reform

Fuel Sourcing Uncertainties Across Major Economies Asia Pacific

Table 2 • Key long-term uncertainties faced by Asian countries

	China	India	Indonesia	Japan	Korea	Malaysia	Singapore	Chinese Taipei	Thailand	Viet Nam
Production	+++	++	+++	+*		+			+	+
Demand	+++	+++	++							
<i>Coal/gas</i>	+++	+++	+++	+	+	+				
<i>Nuclear</i>	++	+		+++	++			++	+	
Exports			+++			++				
Pipeline imports	+++	++		+	+		+			

Note: +++ = game changer; ++ = significant impact; + = limited impact; " " = no impact/irrelevant.

* Methane hydrates.

Source : IEA

Japan is invested in all LNG regions

Table 3 • Investments of Asian companies in selected regions

	China	India	Indonesia	Japan	Korea	Malaysia	Singapore	Chinese Taipei	Thailand	Viet Nam
North America										
Upstream	✓	✓	X	✓	✓	✓	X	X	X	X
LNG	✓	✓	X	✓	✓	✓	X	X	X	X
Contracts	✓	✓	✓	✓	✓	✓	X	X	X	X
Russia										
Upstream	✓	✓	X	✓	X	X	X	X	X	X
LNG	✓	X	X	✓	X	X	X	X	X	X
Contracts	✓	✓	X	✓	✓	X	X	X	X	✓
Australia										
Upstream	✓	✓	X	✓	✓	✓	X	✓	X	X
LNG	✓	X	X	✓	✓	✓	X	✓	X	X
Contracts	✓	✓	X	✓	✓	✓	✓	✓	X	X
East Africa										
Upstream	✓	✓	X	✓	✓	✓	✓	X	✓	X
LNG	✓	✓	X	✓	✓	X	✓	X	✓	X
Contracts	✓ (?)	✓ (?)	X	✓ (?)	✓ (?)	X	✓ (?)	X	✓	X

Notes: No long-term contract except for PTTEP has been announced for East African LNG, but some key investors are expected to take some of their equity gas back home. Symbols: ✓ = investments have been made; X = investments have not been made; ✓ (?) = investments may have been made but it is currently unclear.

Gas Deregulatory Environment in Asia

Table 12 • Competitive market requirements of Asia's largest LNG importers

Requirement	China	India	Japan	Korea
Hands-off government approach	-	-	-	-
Separation of transport and commercial activities	+/-	-	+/-	-
Wholesale price deregulation	+/-	-	-*	-
Third-party access (TPA)	??	??	-*	-
Sufficient network capacity	-	-	+	-
Competitive number of market participants	-	+	+	-

Notes: + = currently contributing towards a competitive natural gas market; - = currently not contributing towards a competitive natural gas market; +/- = making progress; ?? = currently unclear.

* Japan is undertaking a gas reform which would result in wholesale price deregulation and efficient TPA; it can be considered to be at the very early stages of the process.

Source: IEA

Japanese Gas Importers & Related Companies

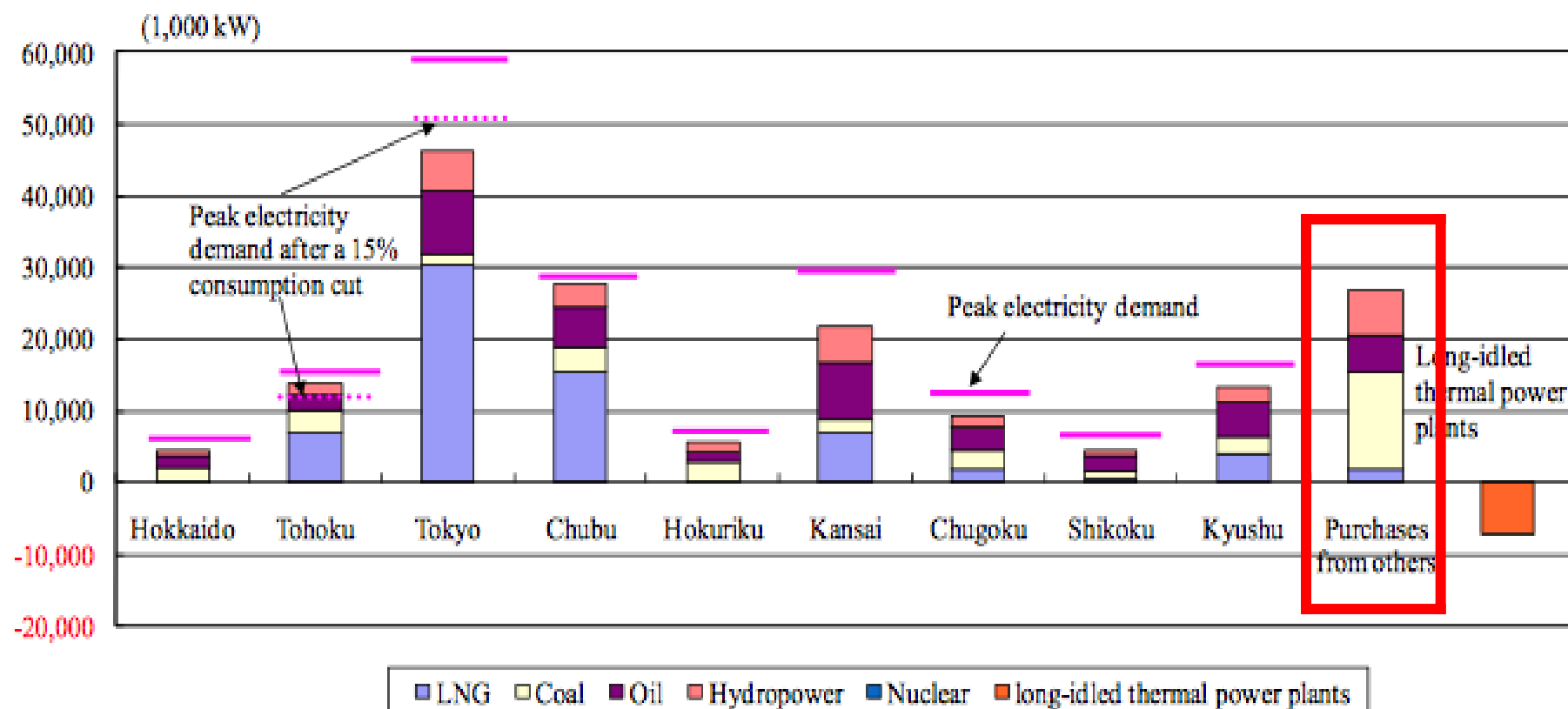
Trading Companies	EPCOs	Gas Utilities	Others
Marubeni	Chubu Electric	Hiroshima Gas	Itochu Corp
Mitsubishi	Chugoku Electric	Nippon Gas	JAPEX
Mitsui	Kansai Electric	Osaka Gas	Gas Bureau, City of Sendai
Itochu	Kyushu Electric	Toho Gas	Nippon Steel
	Shikoku Electric	Tokyo Gas	Idemitsu
	Tokyo Electric	Saibu Gas	
	Tohoku Electric	Shizuoka Gas	

Shipping Companies	Owners of Regasification Installations	Construction of LNG Facilities
Mitsui OSK	EPCs	JGC
NYK	City Gas Cos	Chiyoda
Kawasaki KK		
Tokyo LNG Tankers		
EPCs and City Gas Cos		

Storage Infrastructure	Pipeline & Steel Companies	Road Distribution of Gas
IHI	Nippon Steel	City Gas Cos
EPCs and City Gas Cos	JFE	Niyaku Corp
	Toyota Tsusho	
	Mitsui	
	Mitsubishi	
	E&P Companies	

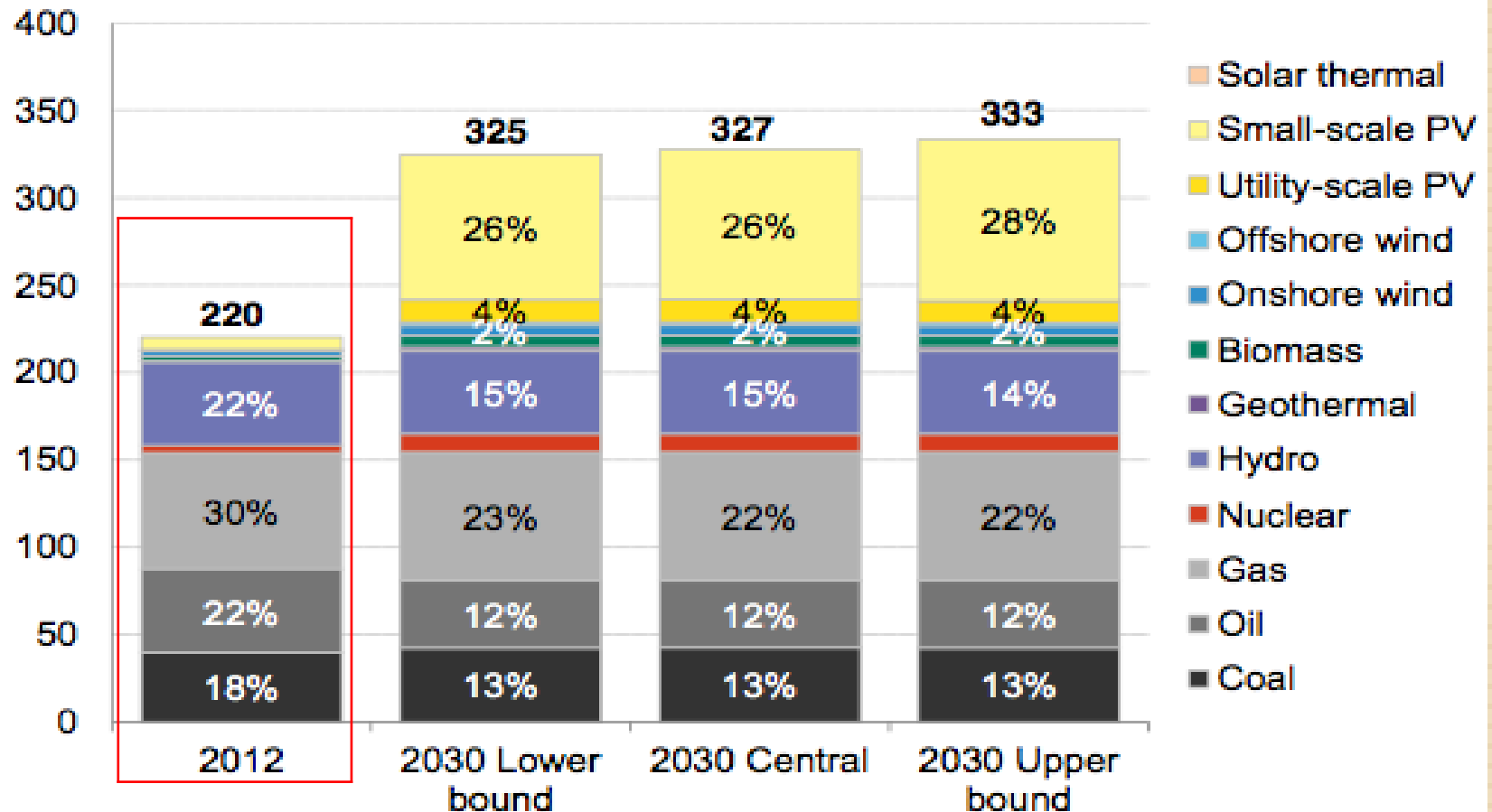
In FY 2014 Reserve Margins deteriorated significantly particularly in Kansai and Kyushu

Figure 3 Each electric power company's generation capacity and local peak demand



Forward Projections Of Japan's Generation Capacity

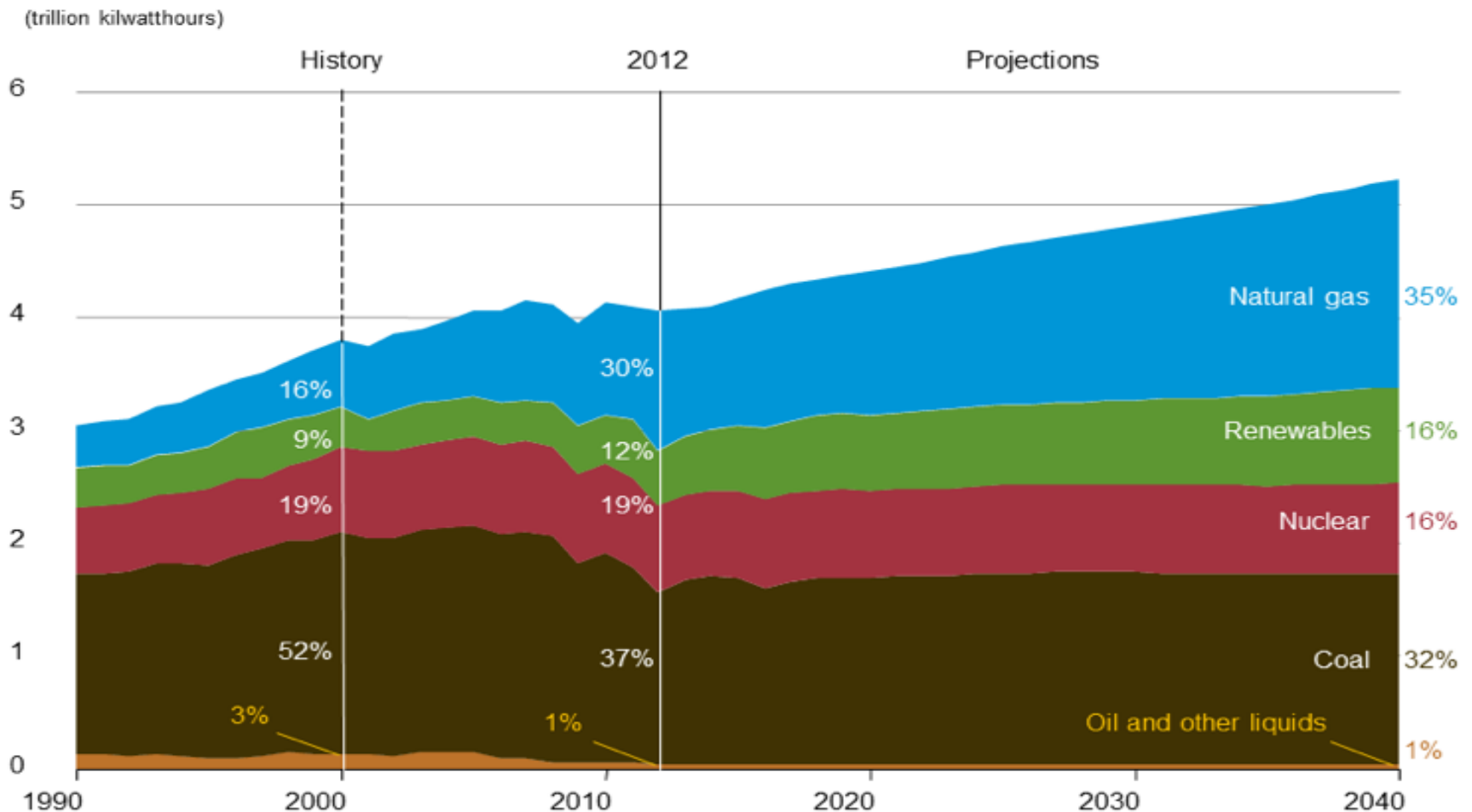
Figure 41: Japan cumulative installed capacity by technology (GW)



Source: Bloomberg New Energy Finance

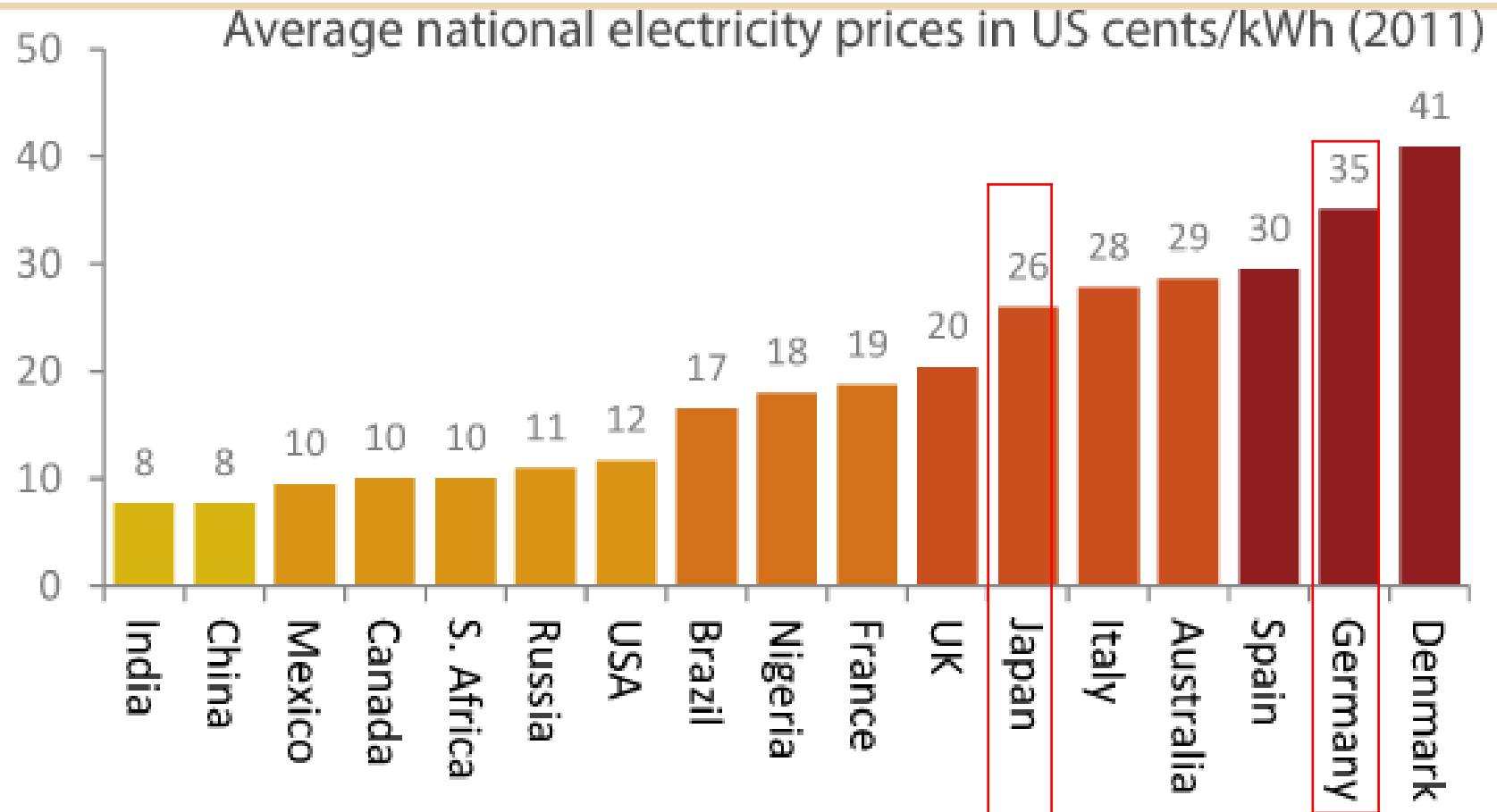
US : Gas & Renewables to assume larger share of US energy mix

Figure 13. Electricity generation by fuel, 1990-2040



Global Electricity Prices

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Data: average prices from 2011 converted at mean exchange rate for that year

End/Out

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