

Electricity Market Reform and its impact on Energy Market in Japan

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The Institute of Energy Economics, Japan (IEEJ)

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1. Objectives of System Reform

❖ Objectives of the system reform:

- ① Creation of new services and businesses
- ② Lower electricity rates & gas rates by enhanced competition
- ③ Protection of customers' benefits and safety assurance
- ④ Reinforcement of industrial competitiveness and development of overseas markets

(Gas system reform has started in response to the electricity system reform)

❖ Characteristics of Electric Power Industry:



- ① Grid established nationwide
- ② Existence of dominant operators in each region
- ③ Universal service vs. competition

❖ Characteristics of Gas Industry :



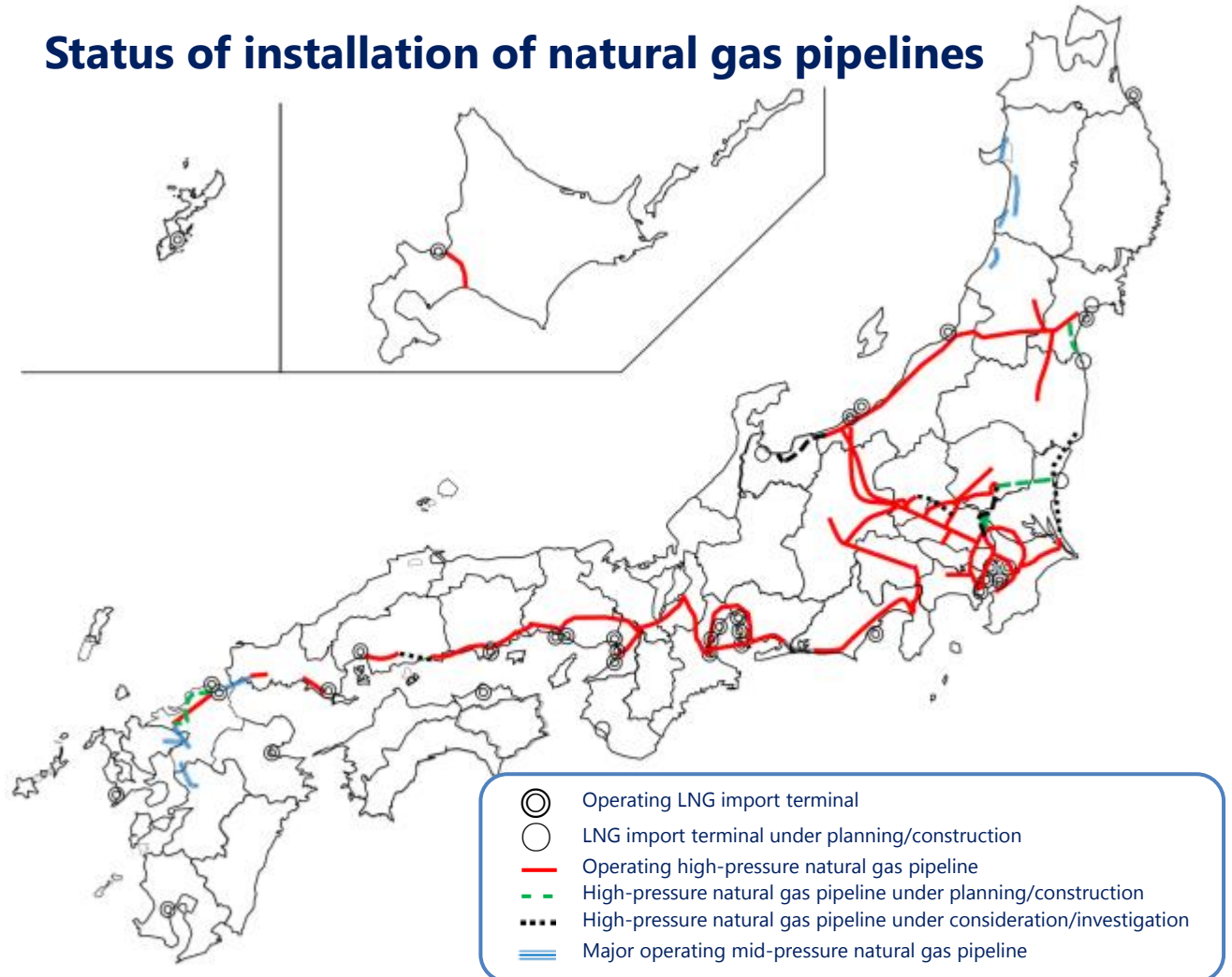
- ① Incomplete nationwide gas pipeline network
- ② Numerous operators ("General Gas Utility")
- ③ Competition with other types of energy (LPG, All-electric housing*, etc.)

Gas Pipeline Network



❖ As the wide-area pipeline network is limited in Japan, new entrants are mainly business operators that own production facilities and LNG terminals.

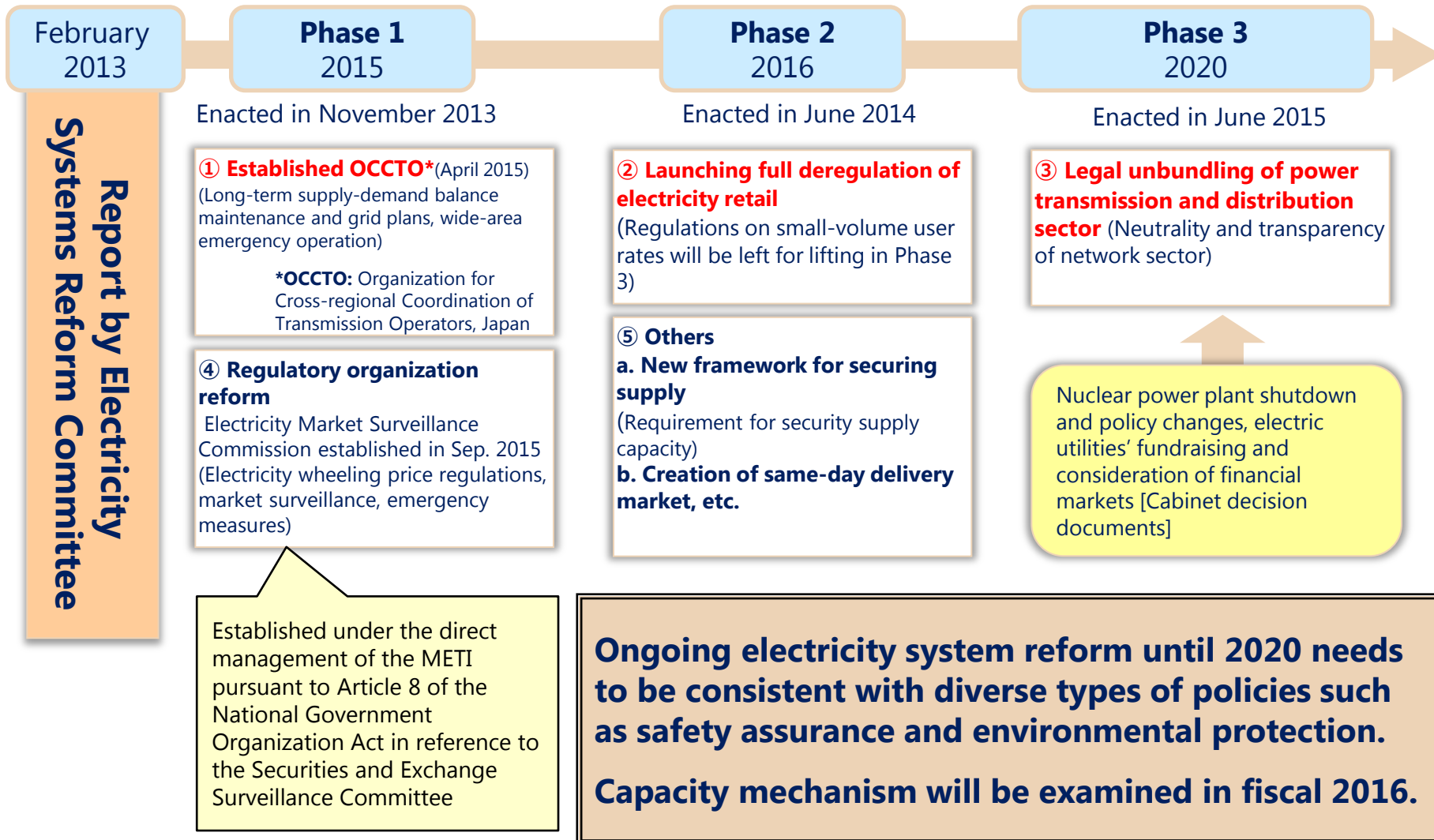
Status of installation of natural gas pipelines



Source: (The 26th) Gas Systems Reform Subcommittee, Basic Policy Section Committee, Advisory Committee for Agency for Natural Resources and Energy (Dec. 15, 2015)
Document 4 "Detailed System Design for the Full Liberalization of Gas Retail Market" p.60.

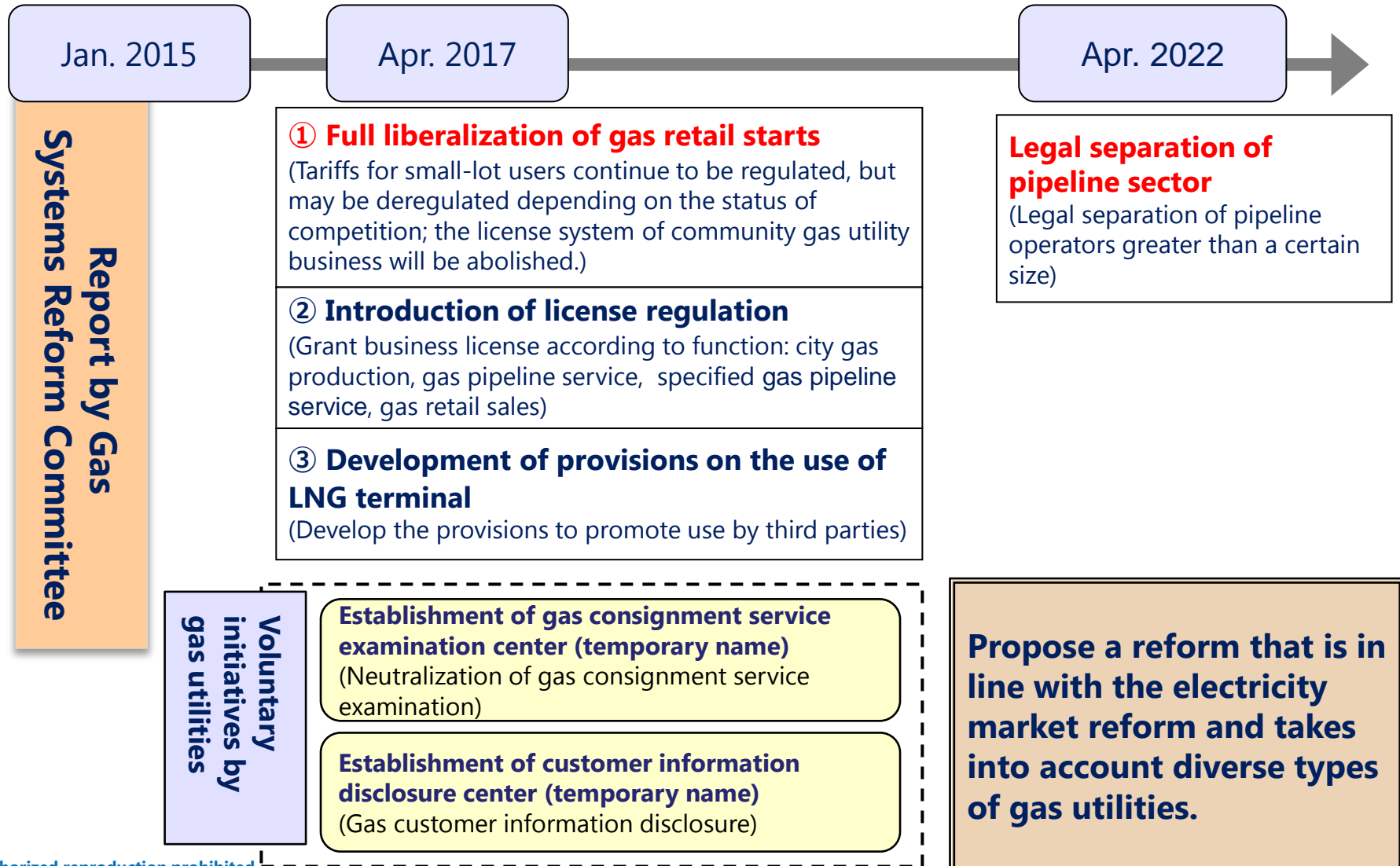
2. Roadmap of System Reform

(1) Electric Power Industry



2. Roadmap of System Reform

(2) Gas Industry



3. Current Status

(1) New Entrants

① Electric power industry



— Announced on Feb. 5, 2016 (Announced by OCCTO*; holders of retail licenses):

Number of new entrants **(About 150)**

From big enterprises such as Tokyo Gas, Osaka Gas, Tokyu Corporation, KDDI to small-scale operators

Note: Existing operators account for 30.

*Organization for Cross-regional Coordination of Transmission Operators, Japan (OCCTO) is established to enhance the function of controlling the supply-demand balance of electricity in both normal and emergency situations on a nationwide basis.

② **Gas industry:** Number of new entrants **(38, Excluding entry by existing gas utilities in areas outside original supply areas)**



INPEX, JAPEX, Tokyo Electric Power Co., Chubu Electric Power Co., JX Energy, Iwatani Corporation, Mitsubishi Corporation, Mitsui & Co., Ltd., etc.

Electricity Retail: Diverse Types of New Entrants (as of Feb. 8, 2016)



Area	New Entrants
Current major PPS* ¹ (22)	F-Power, Erex, les power, e-sell, Ennet, Alpha-power, Eneserve, Nippon Steel & Sumikin Engineering, Marubeni, etc.
LPG, City gas (32)	Tokyo Gas, Osaka Gas, Toho Gas, Saibu Gas, Hokkaido Gas, Keiyo Gas, Isesaki Gas, Mitsuuroko Green Energy, etc.
Oil (8)	Showa Shell Sekiyu, TonenGeneral, Idemitsu Green Power, Premium Green Power, Itochu Enex, JX Energy
Telecommunication, Broadcasting, Railway, etc. (32)	F-bit Communications, Tokyo Power Supply, KDDI, Chukai TV, J-COMC group
Subsidiary of GEU* ² (7)	K-Opti, Diamond Power, Energia Solution and Service, TEPCO Customer Service, Syneria Power, KENES, Cenergy
Renewable energy companies (21)	SE Wings, Next Power Yamato, Looop, Ebara Environmental Plant, Tokyo eco Service, Npower, Green Circle, West Power, New Energy Development, V-Power, Daiwa Energy, Apple Tree, Maniwa Bioenergy, Ecostyle, Kitakyushu Power, S-CORE, Npower Minami Kyushu, Miyama Smart Energy, etc.
Others (47)	MITSUI & Co, Itochu Corporation, Kawasaki Trading, Osaka Izumi Co-operative Society, Kagoshima Power, Mito Power, Nara Power, Hitachi Zosen, Toyota Turbine and System, CO-OP Kobe, Toppan, etc.

*¹ PPS: Power Producer and Supplier

*² GEU: General Electric Utility

Large-Volume Gas Supplier: Diverse Types of New Entrants (Mar. 2015)



Area	New Entrants
Oil related companies (6)	San-Ai Oil, JX Nippon Oil & Energy, INPEX, JAPEX, Kokura Enterprise Energy, Next energy
Electric power related companies (5)	Tokyo Electric Power Company(TEPCO), Kansai Electric Power Company, Chubu Electric Power Company, Shikoku Electric Power Company, Koka Energy*
Gas related companies (13)	Air Water, Tohoku Natural Gas, Enelop, Chikugo Gas Pipeline Service Provider, Minami Enshu Pipeline, Asahi Gas Energy, Iwatani, Tokyo Gas Engineering Solutions(TGES), Sendai Puropan, Tokyo Gas Energy, Nijio, Kumamoto Mirai LNG, Kinki Air Water
Trading companies (6)	MC shiohama energy service, ENEX-LNG Sales, Suzuyo Shoji, MITSUI & Co, Mitsubishi Corporation, Onsite Energy Service Shizuoka
Renewable energy companies (2)	Joetsu Energy Service, Progressive Energy
Others (6)	Godo Shigen, Nippon Steel & Sumitomo Metal Corporation, Yawata Works, Tetsugen, Mitsubishi Chemical, Toyama Green Food Recycle, Suzukoh

*Note: Koka Energy is a gas retail company invested by Iwatani Corporation 56%, Kansai Electric 34% and Kokakyodo Gas 10%,

3. Current Status

(2) Change of Contract

① Electric power industry



— **Share of new entrants in FY2014 (large scale customer): 5.24%**

— Announced on Feb. 5, 2016 (OCCTO)

Number of applications for switching is about 106,000.

99% were made within the supply areas of TEPCO and KEPCO.

Tokyo 74,000, Kansai 29,000, Hokkaido 1,100,

Kyushu/Chubu/Tohoku/Hokuriku/Shikoku 1,800, Chugoku/Okinawa 0

② Gas industry – Share of new entrants in FY2014 (large-vol. customer): 11.7%



(Unit: 1 million m ³)	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014
Total gas sales volume for large-vol. customers (non-regulated area)	20,895	22,699	23,918	23,775	23,502	23,877
Gas sales volume for large-vol. customers by new entrants	2,822	3,641	4,073	3,648	2,844	2,785
Share of new entrants	13.5%	16.0%	17.0%	15.3%	12.1%	11.7%

Business outlook of big new entrants

- In association with full liberalization of the gas retail market in April 2017, **TEPCO aims to sell for 1 million t/year in LNG volume by 2024.** (New Comprehensive Special Business Plan announced in January 2014)
- **INPEX aims to supply 2.5 billion m³ in Japan in 2015**, by reinforcing the domestic pipeline network (Mid- to Long-Term Vision issued in May 2012) Gas sales in FY2014 were 1.79 billion m³. The reduced share of new entrants was due to the increase for gas demand to compensate the shutdown of nuclear plants.

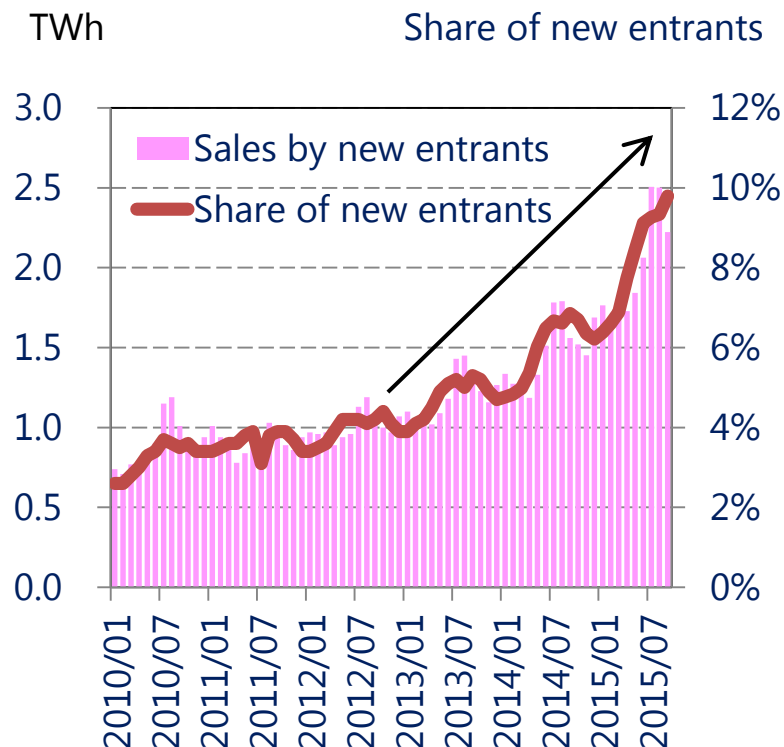
Electricity Retail Market

(Share of New Entrants in TEPCO's Supply Area)

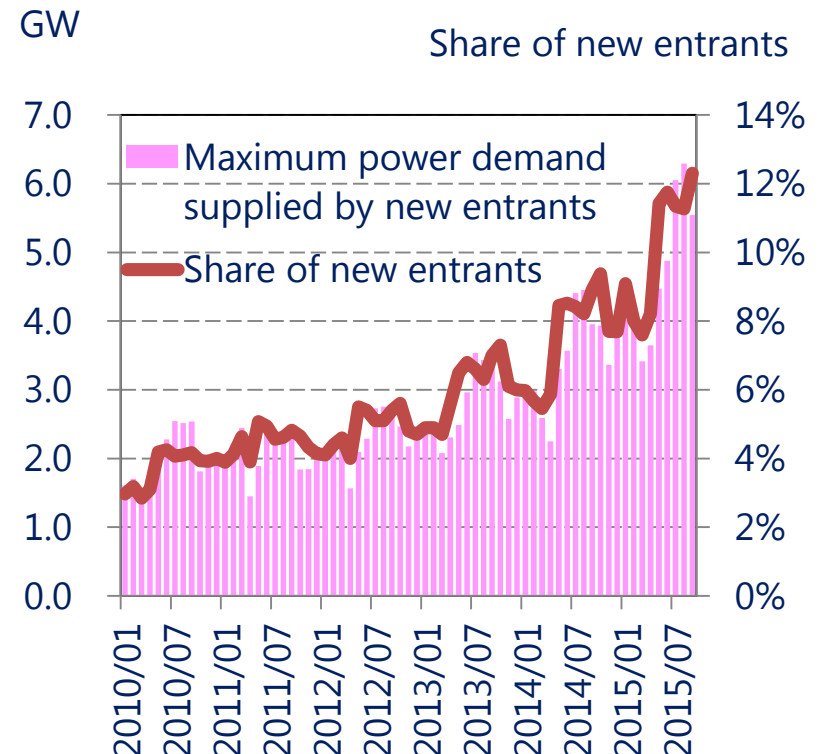


- ❖ About 60% of customer to switching is in the supply area of TEPCO (about 25% is in the supply area of KEPCO).

Sales by new entrants and their share
(Estimates)



Maximum power demand supplied by
new entrants and their share (Estimates)



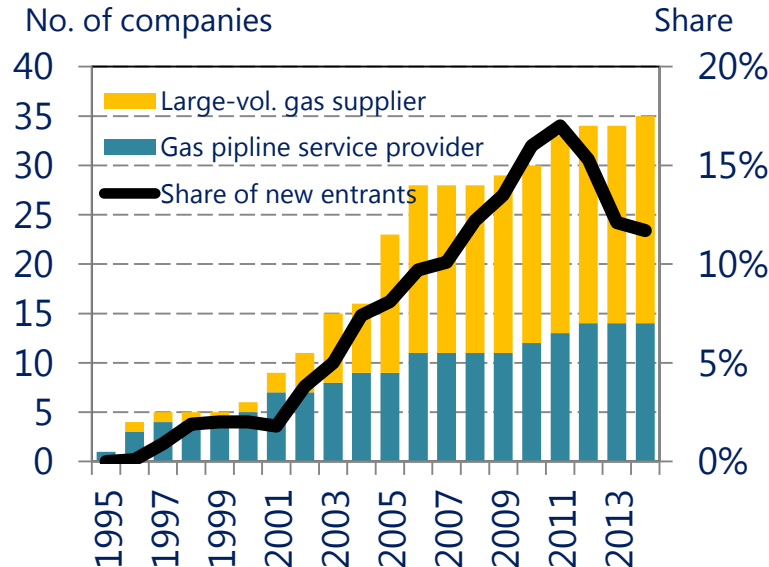
Status of Competition in Gas Industry



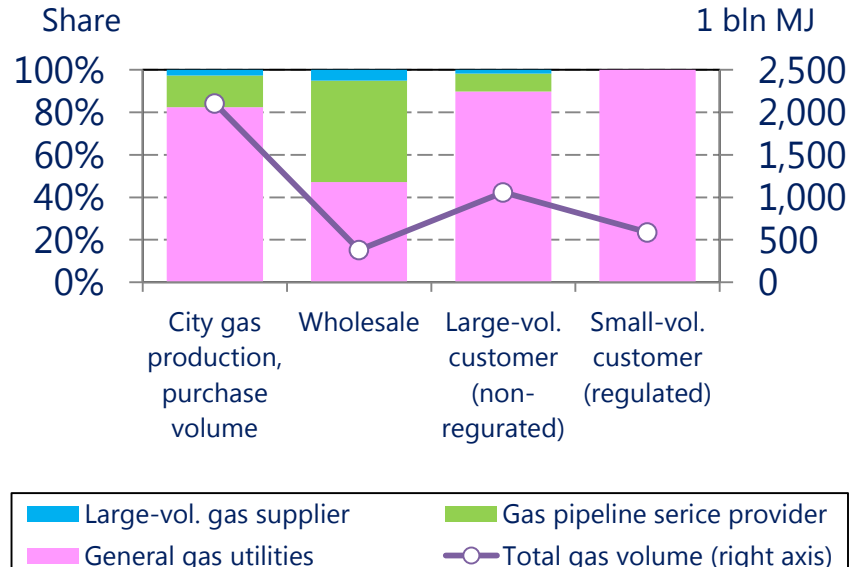
❖ In FY2014, the number of new entrants (gas pipeline service provider or large-vol. gas supplier) was 38, and the share of new entrants accounted for 11.7%. Although the share reached 17% in FY2011, it is considered to have declined due to the tight supply-demand balance in the electric power industry after the Great East Japan Earthquake.

On the other hand, in terms of wholesale supply to small and medium-sized gas utilities, the share of large-vol. gas supplier and gas pipeline service provider reached 53%, showing that competition in the market has successfully made progress in terms of large-vol. supply and wholesale supply.

Status of new entrants



Share according to business process (FY2013)

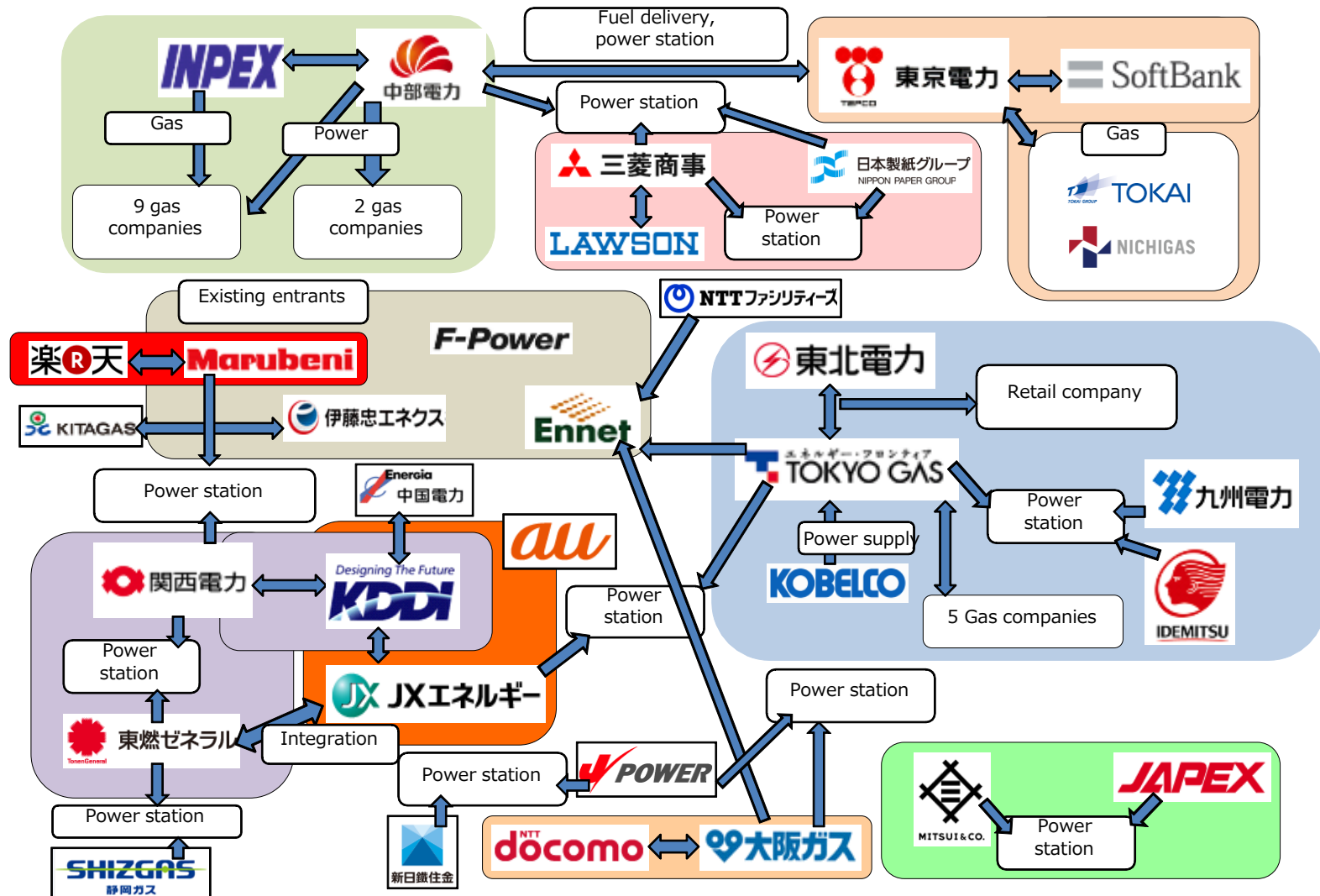


Note: FY2014 results are the total values in the period between Apr. 2014 and Feb. 2015.

Source: Agency for Natural Resources and Energy, "Current Status of Gas Industry," data since 2013 was prepared based on the Current Survey of Production Concerning the Gas Industry.

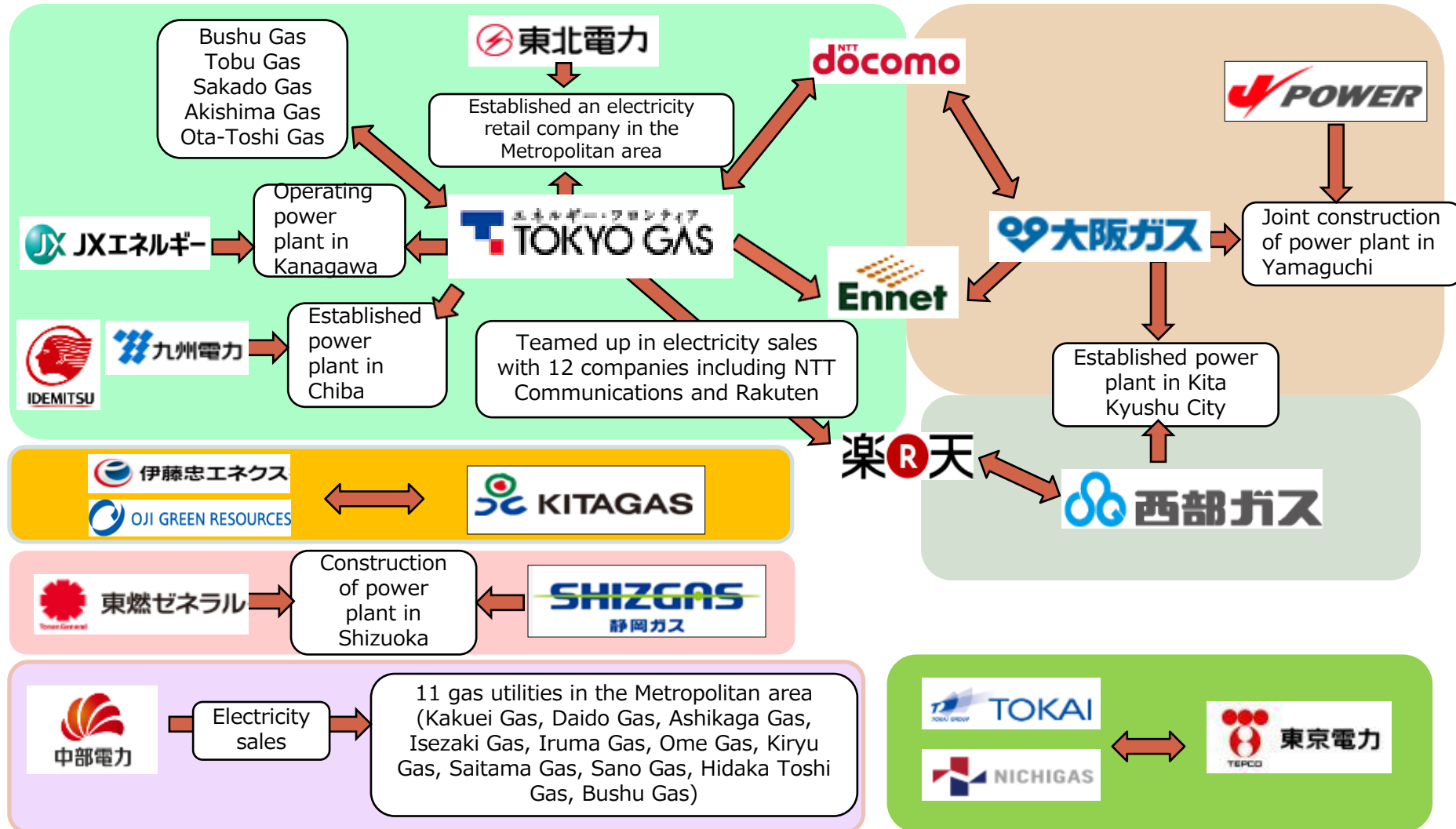
3. Current Status

(3) Business Alliances ① (In the Electric Power Business)



3. Current Status

(3) Business Alliances ② (In the Gas Business)



Status of New Entrants in the Gas Industry by Area



❖ Status of registration of large-vol. gas utilities (As of Mar. 2015)

Hokkaido	
Tohoku	Aomori, Akita, Iwate, Yamagata, <u>Miyagi</u> , Fukushima
Kanto①	Niigata
Kanto②	Gunma, Nagano
Kanto③	Tokyo, Saitama, Ibaraki, Tochigi
Kanto④	Chiba
Kanto⑤	Kanagawa, Shizuoka(Some areas), <u>Yamanashi</u>
Chubu・Hokuriku	Shizuoka(Some areas), Aichi, Gifu, <u>Mie</u> , <u>Tovama</u> , <u>Ishikawa</u>
Kinki	Osaka, Fukui, Kyoto, Hyogo, Shiga, <u>Nara</u> , <u>Wakayama</u>
Chugoku・Shikoku	Okayama, Tottori, Shimane, <u>Hiroshima</u> , <u>Yamaguchi</u> , <u>Ehime</u>
Kyushu・Okinawa	Fukuoka, Nagasaki, Kumamoto, Oita, <u>Miyazaki</u> , <u>Kagoshima</u> , <u>Okinawa</u>

Kanto① (16)

- (7) INPEX Corporation
- (3) NexT energy Co., Ltd
- (3) JAPEX
- (2) Mitsubishi Chemical Corporation
- (1) Joetsu Energy Service Co., Ltd.

Kanto② (13)

- (3) INPEX
- (5) Tokyo Gas Engineering Solutions Corporation (TGES)
- (2) NexT energy
- (1) Iwatani Corporation
- (1) JX Nippon Oil & Energy
- (1) San-Ai Oil Co., Ltd.

Kinki (115)

- (90) The Kansai Electric Power Company, Incorporated
- (17) Koka Energy
- (1) Iwatani
- (5) San-Ai Oil Co., Ltd.
- (2) Kinki Air Water Inc.

Hokkaido (13)

- (7) Air Water Inc.
- (5) Japan Petroleum Exploration Co., Ltd. (Abbreviation: JAPEX)
- (1) Tetsugen Corporation

Tohoku (12)

- (6) Tohoku Natural Gas Co., Ltd.
- (5) JX Nippon Oil & Energy Corporation
- (1) Sendai Puropan Co., Ltd

Kanto③ (53)

- (20) TGES
- (27) Tokyo Electric Power Company, Incorporated (TEPCO)
- (1) JX Nippon Oil & Energy
- (5) INPEX

Kanto④ (13)

- (4) TEPCO
- (2) Mitsubishi Corporation
- (1) TGES
- (1) Godo Shigen Co., Ltd.
- (1) Nijio Co., Ltd
- (1) mitsui & Co., Ltd.
- (3) Tokyo Gas Energy Co., Ltd.

Kyushu・Okinawa (27)

- (1) Kokura Enterprise Energy CO., LTD.
- (15) San-Ai Oil Co., Ltd.
- (6) Nippon Steel & Sumitomo Metal Corporation, Yawata Works
- (1) Mitsubishi Chemical
- (1) Kumamoto Mirai LNG Co., Ltd.
- (2) Chikugo Gas Pipeline Service Provider Co., Ltd.
- (1) Progressive Energy Corporation

Chubu・Hokuriku (54)

- (30) Chubu Electric Power Co., Inc.
- (13) Enelop Inc.
- (4) Mitsubishi Chemical
- (2) mitsui & Co., LTD.
- (2) Asahi Gas Energy Co., Ltd.
- (1) MC shiohama energy service Co., Ltd.
- (1) Toyama Green Food Recycle, INC.
- (1) Suzukoh Co., Ltd.

Chugoku・Shikoku (6)

- (2) JX Nippon Oil & Energy
- (1) ENEX-LNG Sales Co., Ltd.
- (1) San-Ai Oil Co., Ltd.
- (2) Shikoku Electric Power Co., Inc.

Kanto⑤ (49)

- (15) TGES
- (9) Suzuyo Shoji Co., Ltd
- (9) TEPCO
- (5) JX Nippon Oil & Energy
- (2) San-Ai Oil Co., Ltd.
- (2) Onsite Energy Service Shizuoka
- (1) INPEX
- (2) Nijio
- (4) Minami Enshu Pipeline Co., Ltd.

Note: Figures in () show the number of declarations in the area concerned (based on declarations for large-vol. supply as of Mar. 2015). The underlined utilities are confirmed not to have declared for large-vol. supply.

4. Overseas Trends

(1) Change in Industrial Organization

(2) Creation of International Comprehensive Energy Enterprises

(3) Impact on Prices

(4) Securing Adequate Investment





(5) Realization of Adequate Energy Mix

4. Overseas Trends

(1) Change in Industrial Organizations ①


(Electricity) Although the situation differs country by country, energy utilities have been integrated across borders in general terms.



- (Europe)**
- ① **UK**  : 1 originally state-owned utility has become **Big 6**.
 - ② **Germany**  : 8 originally leading utilities integrated into **Big 4**.
 - ③ **France**  : The regime consisting of **1 large state owned utility** and **other small utilities** remains unchanged in both the electricity and gas sectors.
 - ④ **Italy**  : The market originally dominated by state-owned utility (Enel) is now open to **many other companies** triggered by the sale of thermal power plants.

(U.S.) The states that introduced full retail liberalization were limited to **13 states + Washington DC**

Note: Facing liberalization, California electric crisis occurred before other states tried to implement retail liberalization.

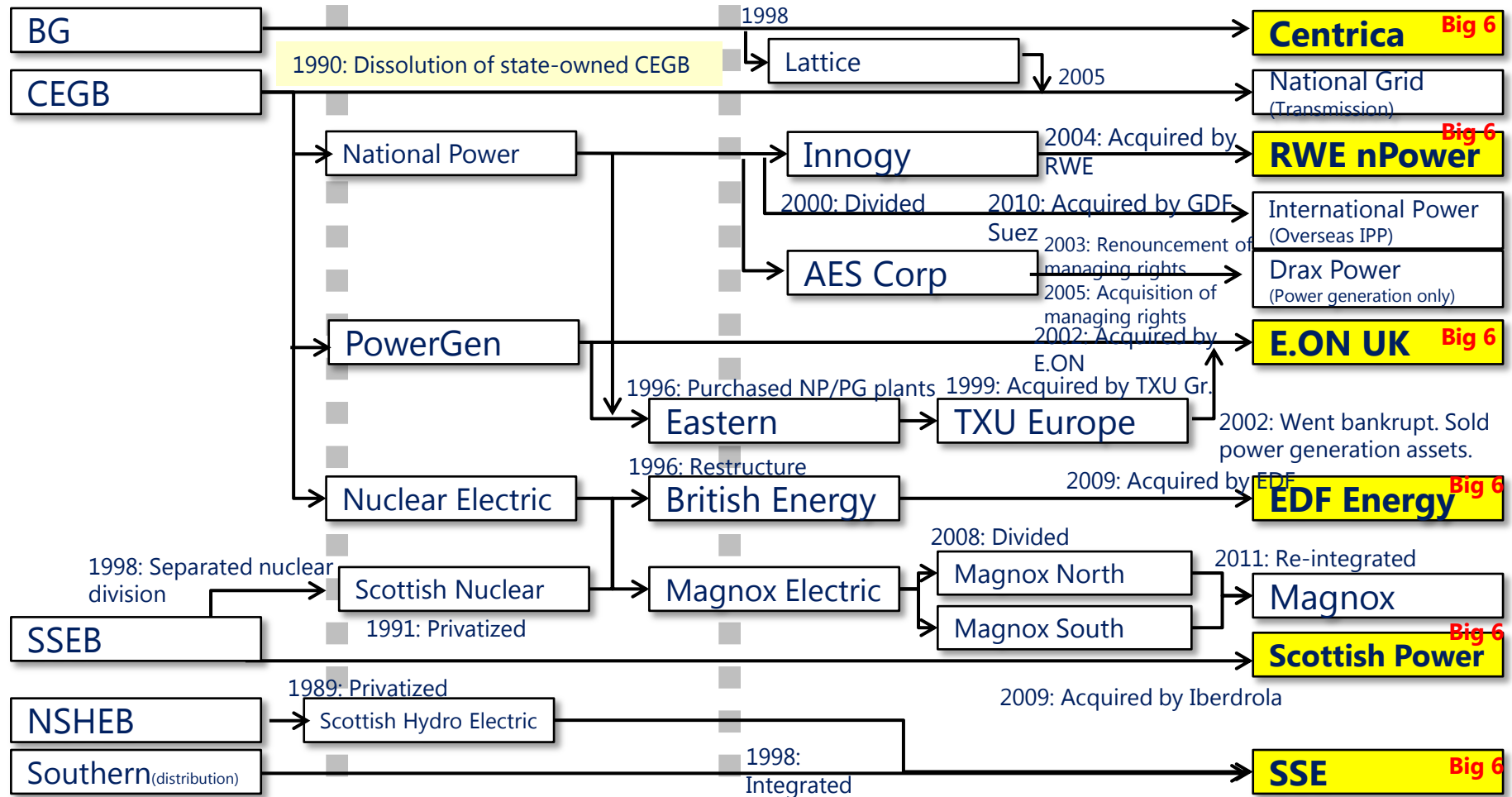
- ⑤ **U.S.**  : Although **the electricity market in states such as NY, Massachusetts, and Texas used to be monopolized by the local utilities**, **many firms** have entered the market.

U.K. Electric/Gas Utilities Reorganization Developments



1982: Partial liberalization of **gas** retail market
1990: Partial liberalization of **electricity** retail market

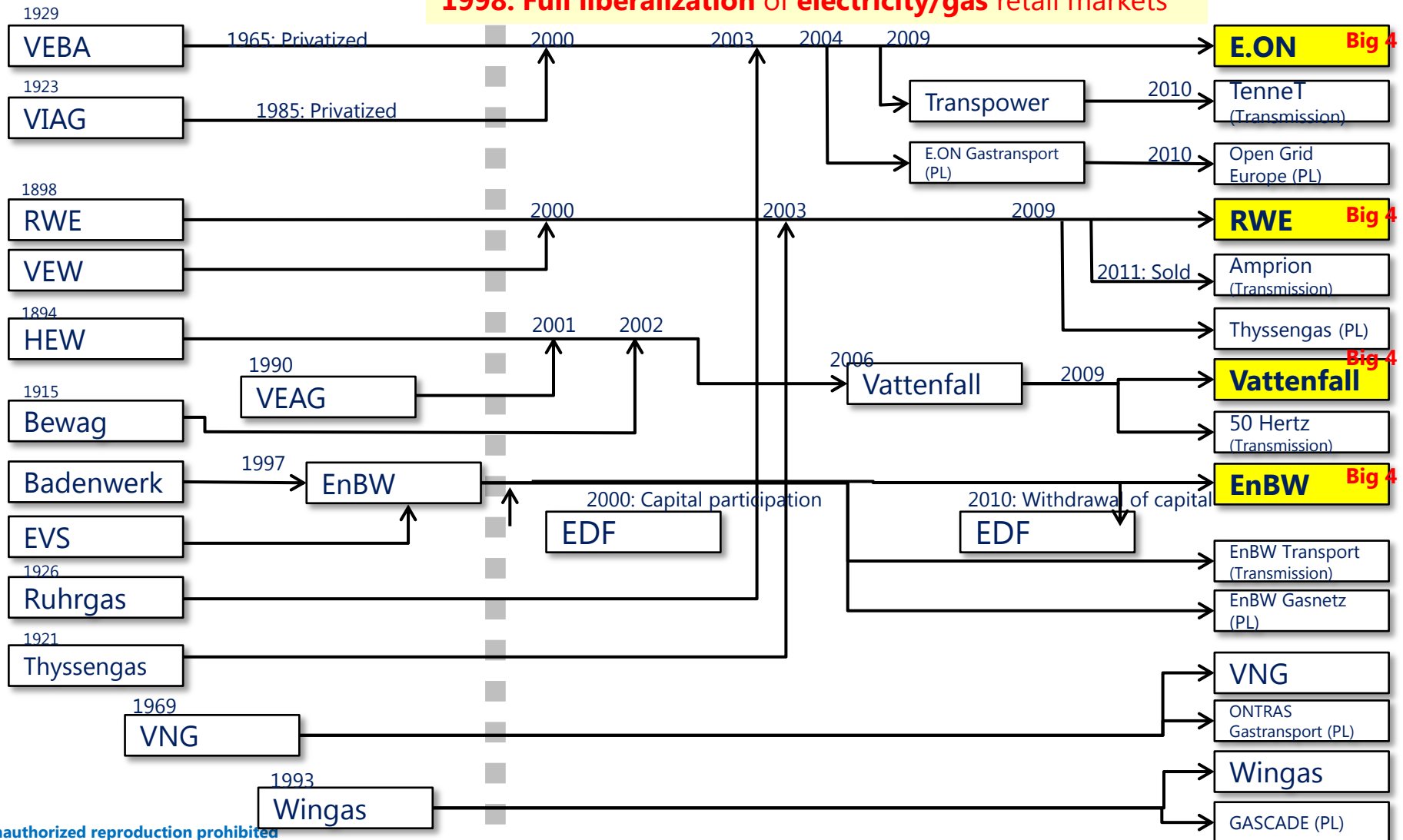
1998: Full liberalization of **gas** retail market
1999: Full liberalization of **electricity** retail market



German Electric/Gas Utilities Reorganization Developments



1998: Full liberalization of electricity/gas retail markets

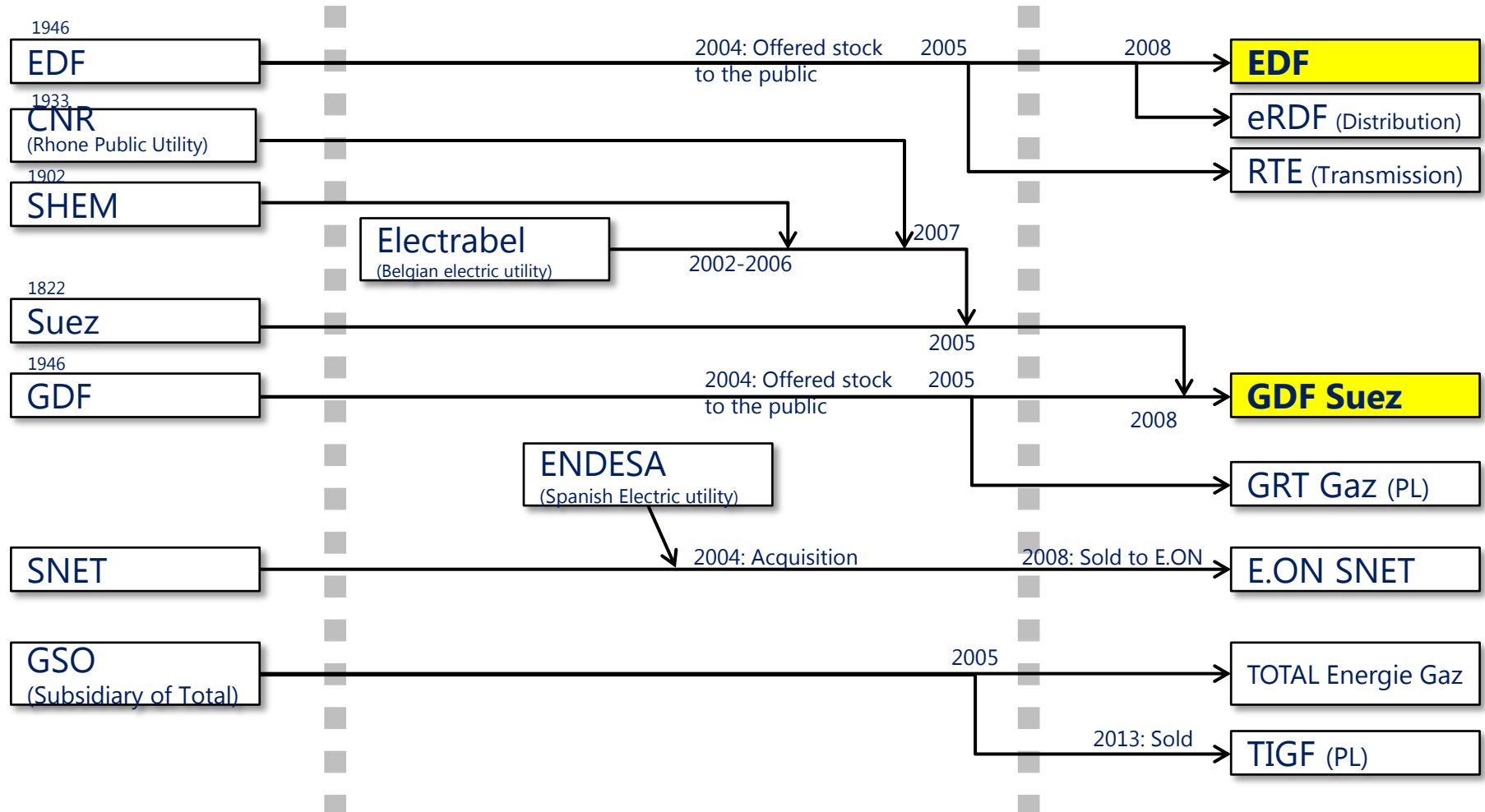


French Electric/Gas Utilities Reorganization Developments



1999: Partial liberalization of **electricity** retail market
2000: Partial liberalization of **gas** retail market

2007: Full liberalization of **electricity/gas** retail markets

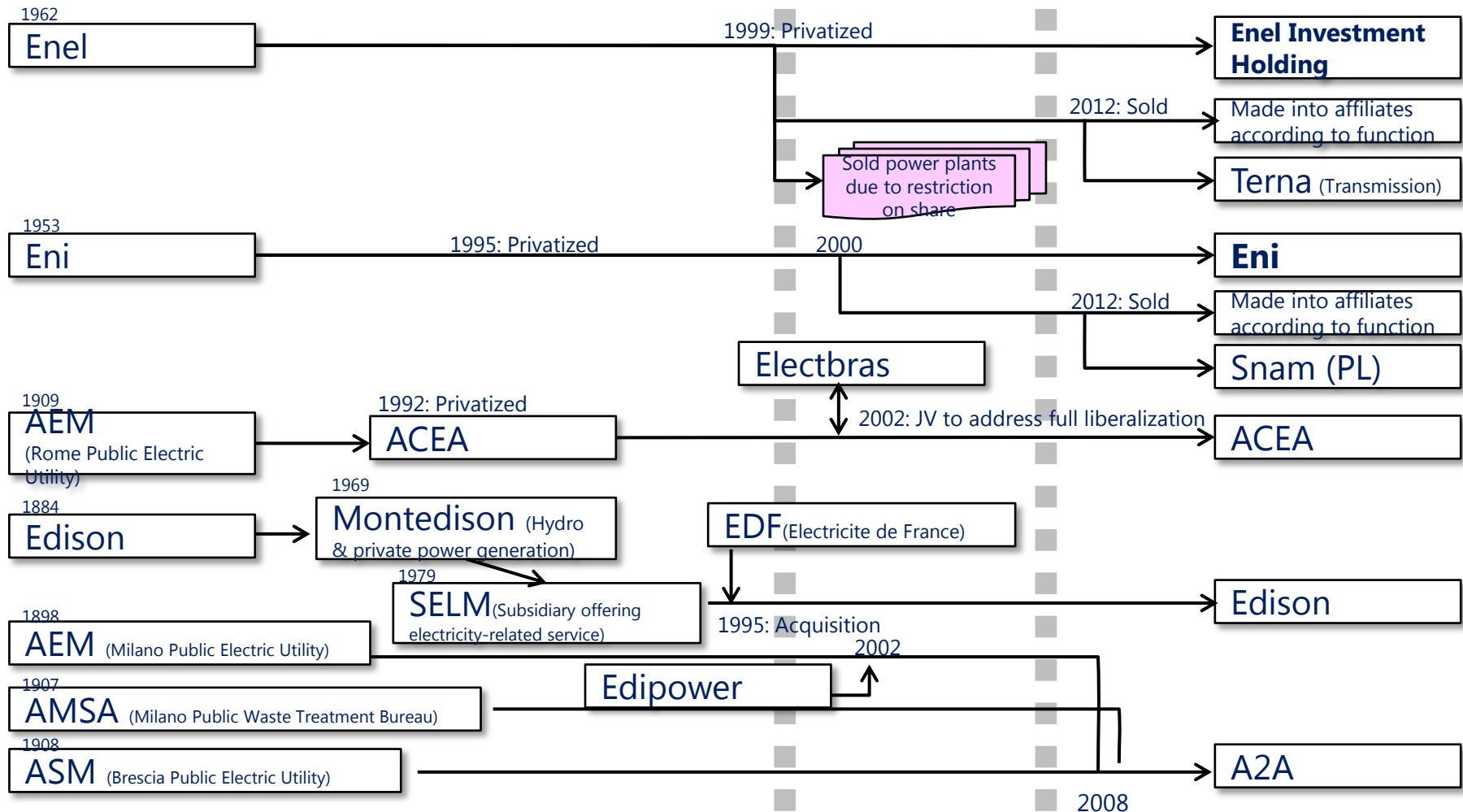


Italian Electric/Gas Utilities Reorganization Developments



1999: Partial liberalization of **electricity** retail market
2000: Partial liberalization of **gas** retail market

2003: Full liberalization of **gas** retail market
2007: Full liberalization of **electricity** retail market

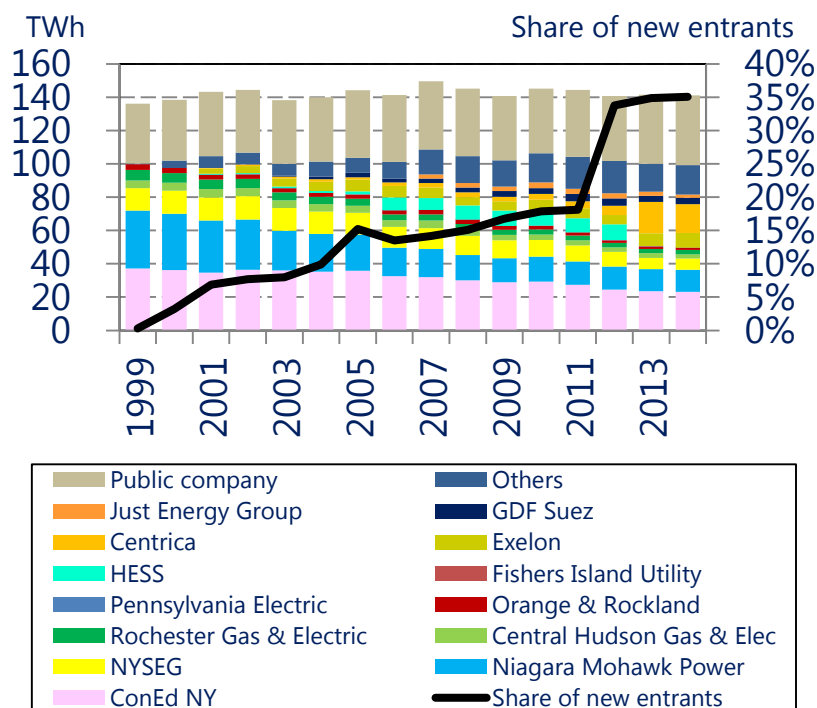


Example of US (Electricity) Retail Sales in New York State

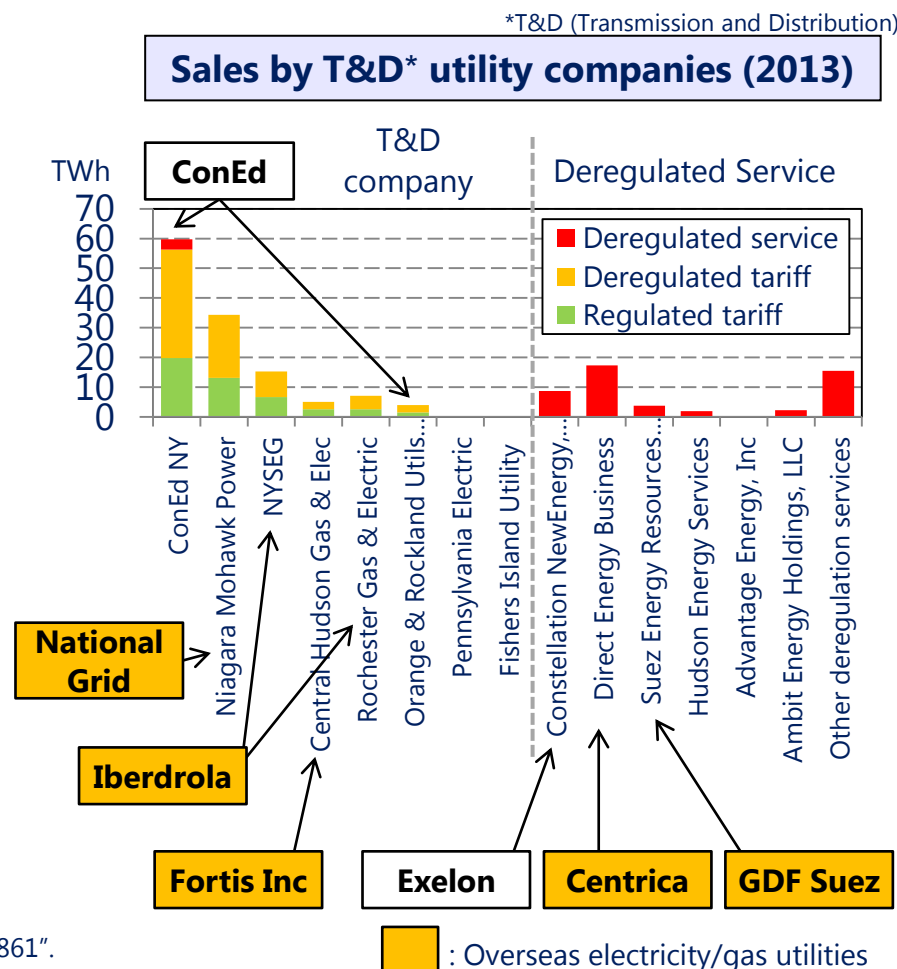


- ❖ Electricity retail market were liberalized in 1999 in New York State. 68 companies (including affiliates of local electric utilities) newly entered the market, and their share rose to as high as 35%. (based on 2014 data)

**Changes in electricity sales
by type of utility in New York State**



Sales by T&D* utility companies (2013)



Example of Europe (Gas)

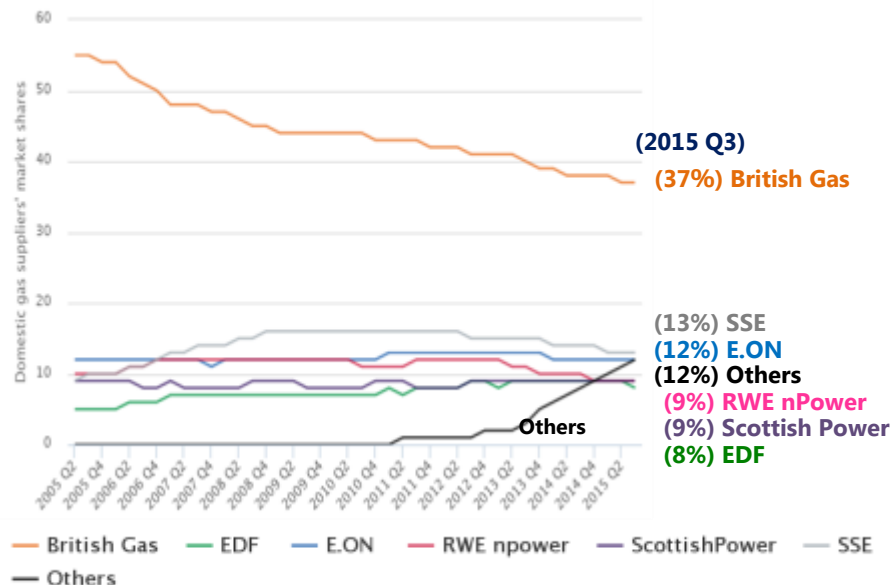
Liberalization of Gas Retail Market in the U.K.



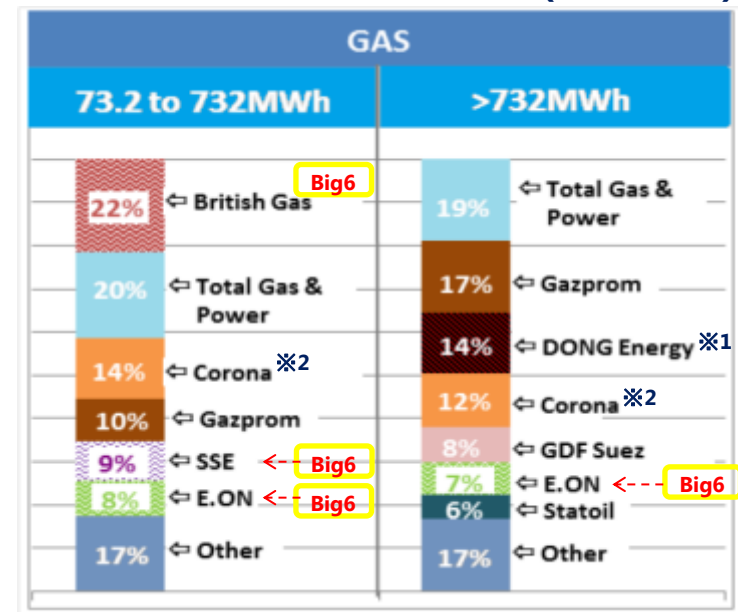
- The liberalization process was completed by the Third Energy Package enforced in 2009. Presently, the focus is on reinforcing coordination within the area, and securing stable supplies (reduction of dependence on gas produced in Russia).
- In the case of the U.K., the oligopoly of the Big 6 (British Gas, EDF, E.ON, RWE nPower, Scottish Power, SSE) is likely to remain almost fixed even when other operators are tending to increase their share.
- Large-lot customers constitute a market for the upstream competitive companies.

Changes in the share of sales in the residential sector

Gas supply market shares by company: Domestic (GB)



Sales share in the non-residential sector (Jun. 2015)



4. Overseas Trends

(1) Change in Industrial Organization ②

(Gas) (Europe)



Although it differs country by country, **electricity and gas businesses were integrated and concentrated in many cases.**

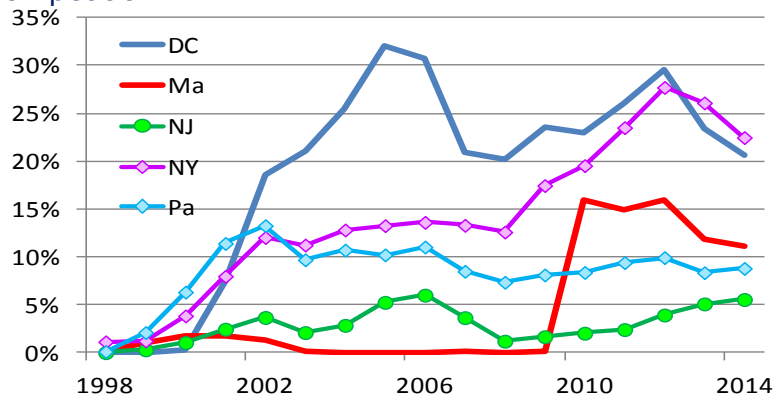
(U.S.)

Retail market is fully liberalized in **7 states + Washington DC.**
Competition is in progress in 4 states and Washington DC.
 (NY, Pennsylvania, Massachusetts, NJ)

Note: No merit as there is no discrepancy between adjusted prices by pipelines.

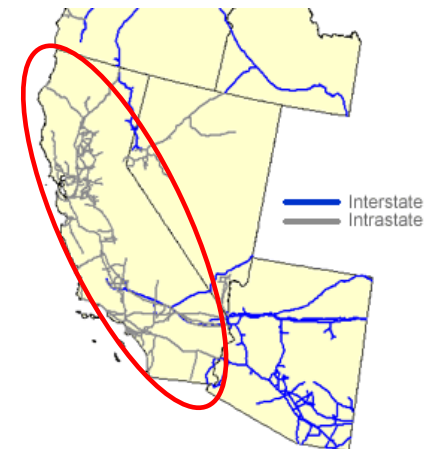
Provider switch rate in residential sector in
 4 states + DC

13-108 companies newly entered the market.
 Monopoly of access to interstate PL by conventional utilities has been recognized as a challenge to promote competition.



States where liberalization is not successfully functioning
 (New Mexico = left, California = right)

Interstate pipelines have not been sufficiently developed.
 Impossible to ensure procurement from diverse sources for competition.



— Interstate
 — Intrastate

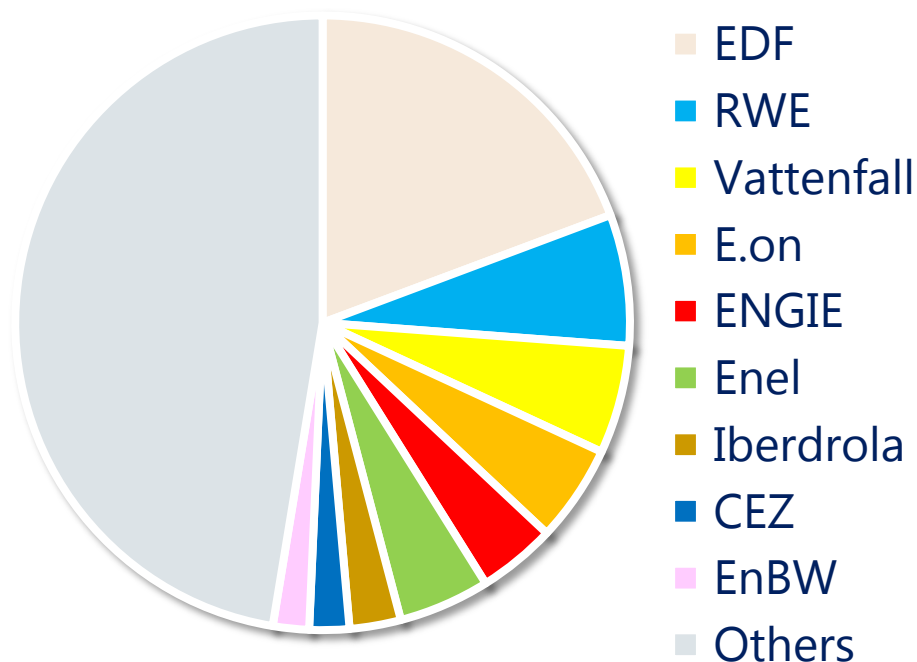
4. Overseas Trends

(2) Creation of International Comprehensive Energy Enterprises

25

- ❖ In Europe, electricity/gas utilities operating worldwide were formed triggered by liberalization of the electricity market.

Share of power generation in
27 EU countries (2014)



- **Expand the quantity and area of wholesale electricity market transactions**
- **Expand the short-term transactions of gas/coal/CO₂**
- **Maintain advantages in fuel procurement**
- **Brand power**
- **Sustain growth**
- **Improve profitability in power generation business associated with fuel price increase** (Especially in nuclear power generation/coal-power generation)

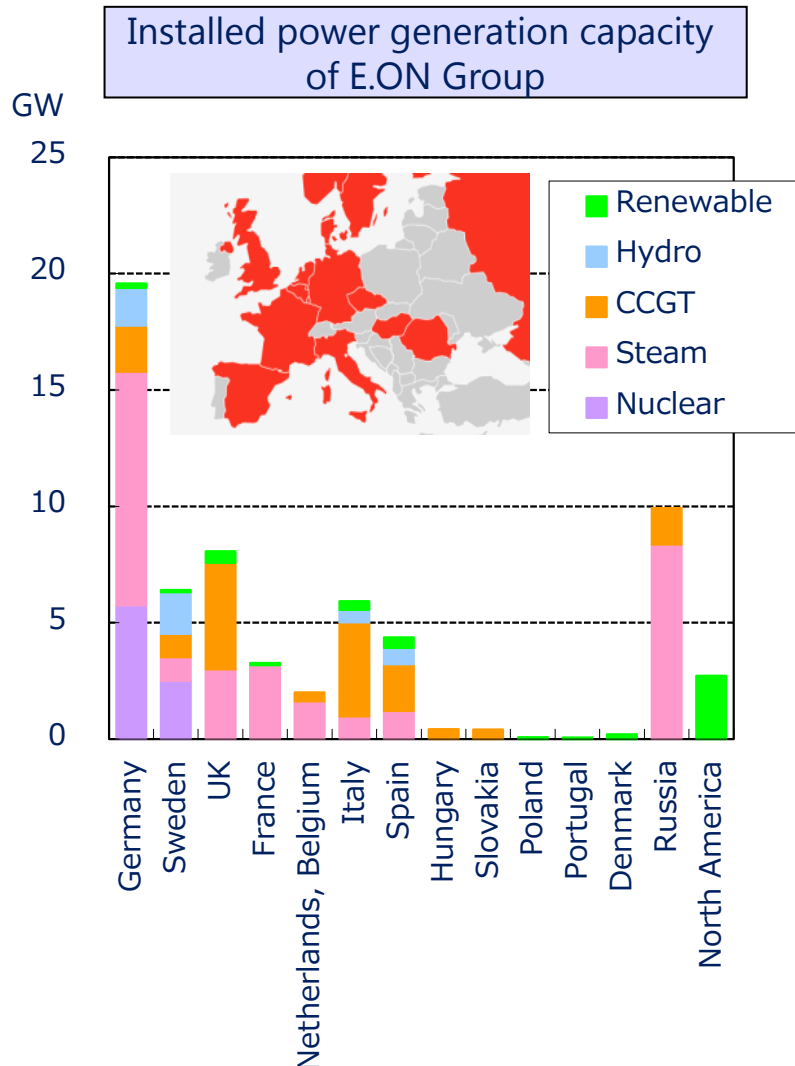
Effects of European and U.S. Electricity System Reforms

- ❖ Among European countries and the United States that have deregulated electricity systems earlier than Japan, companies in Germany, France and Italy have become international integrated energy firms. However, such firms have not emerged from the United Kingdom or the United States. International integrated energy companies emerged in the 2000s when fuel prices soared. Over recent years, many international integrated energy companies have seen their earnings deteriorating on weak wholesale electricity prices that have accompanied renewable energy expansion. Their problem is how to secure investment in power generation equipment.

	Effects of electricity system reforms	Problems
U.S.	<ul style="list-style-type: none"> ● Efficient wide-area operation of wholesale electricity markets (Eastern systems other than those in the Southeast have produced five RTOs), new participants in retail electricity markets ● No U.S. firms have become international integrated energy companies. 	<ul style="list-style-type: none"> ● Switching from coal to gas and renewable energy for electricity generation
Germany	<ul style="list-style-type: none"> ● Four major utilities' oligopoly through mergers (including a foreign company) ● Two have developed into international integrated energy companies 	<ul style="list-style-type: none"> ● Maintaining gas-fired electricity generation ● Reviewing system reforms to expand renewable energy
U.K.	<ul style="list-style-type: none"> ● New electricity market participants increased in the initial phase of deregulation before the Big Six (including four foreign firms) established an oligopoly in the 2000s. ● No U.K. firms have become international integrated energy companies. 	<ul style="list-style-type: none"> ● Reviewing system reforms to promote low-carbon society
France	<ul style="list-style-type: none"> ● EDF has maintained its monopoly and has become an international integrated energy company. 	<ul style="list-style-type: none"> ● Securing consistency with EU-wide regulatory reforms
Italy	<ul style="list-style-type: none"> ● The Great Blackout of 2003 prompted Italy to create a competitive pool electricity market. ● Enel has become an international integrated energy company. 	<ul style="list-style-type: none"> ● Increased dependence on imports, maintaining investment in electricity generation

*RTO: Regional Transmission Organization

International Electricity/Gas Utilities and Integrated Energy Giants



❖ International electricity/gas utilities in Europe

EDF: France, U.K., Italy, Belgium, etc.

E.ON: Germany, Sweden, U.K., Italy, Spain, France, Netherlands, Hungary, Czech, Slovakia, Romania, Russia, Brazil, Turkey, North America, etc.

RWE: Germany, U.K., Netherlands, Belgium, Central and Southern Europe

ENEL: Italy, South America, Slovakia, Russia, Romania, etc.

Iberdrola: Spain, U.K., U.S., Portugal, Germany, France, Canada, Brazil, Mexico, etc.

Integrated energy enterprises are expected to grow in Japan due to demand reduction in the future, improvement in purchasing power in the upstream sector and effective use of information technology.

Source: Prepared on the basis of E.ON, "Facts & Figures".

4. Overseas Trends

(3) Impacts on Prices

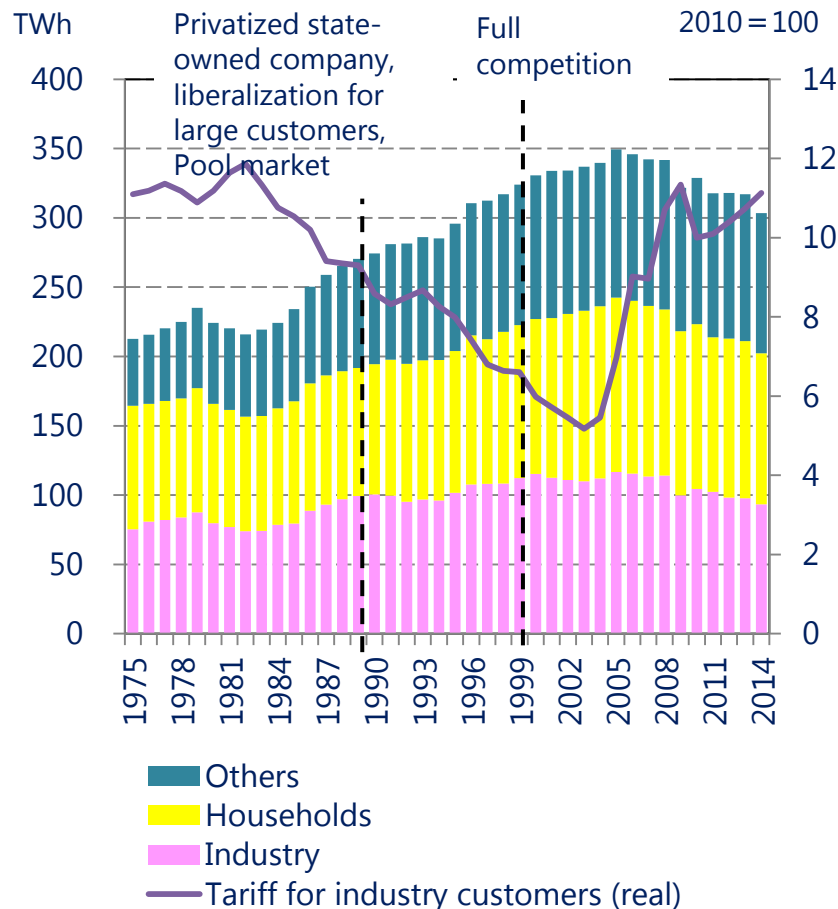
- ❖ Liberalization means exposure to the spot market. As a result, fluctuations in fuel prices are reflected in energy prices in an exaggerated manner.
- ❖ So far, it is viewed that liberalization has not reduced prices because fuel prices have been increasing.

Note: The current situation including lower crude oil prices has not been adequately reviewed yet.

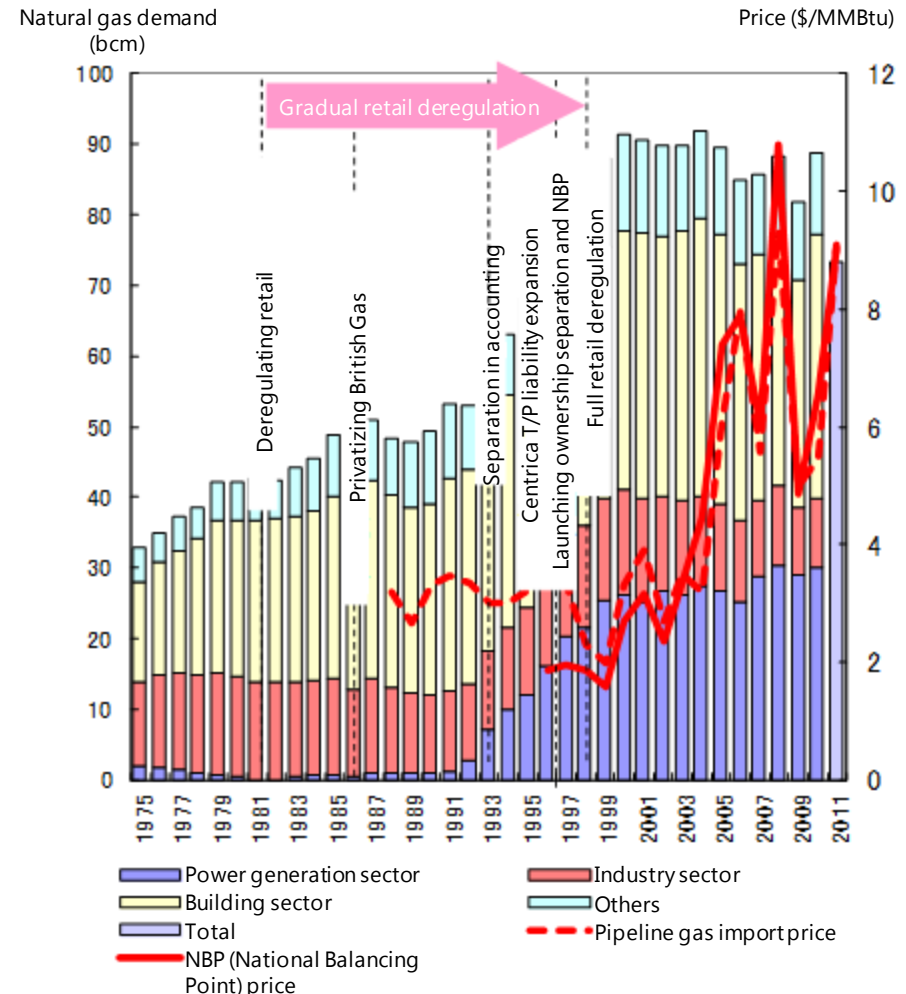
European case (U.K.): Electricity & Gas Trends



U.K. Electricity demand and prices



U.K. gas demand and prices



Source: IEA, BP

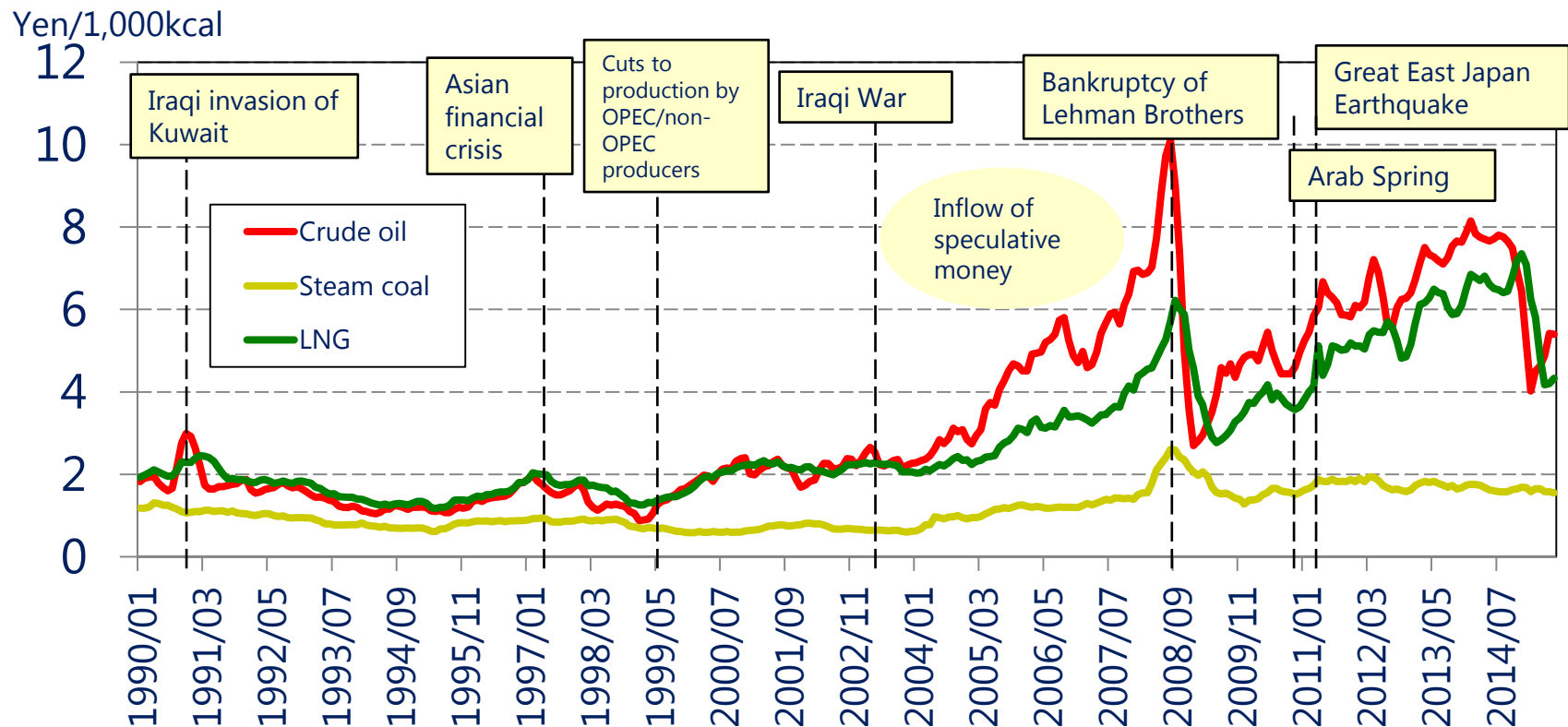
Source: DECC

Changes in Import Prices of Primary Energy

Period when the market was highly reliable

Period when concerns over stable supply increased

Revision of policy after earthquake



2002
**Basic Act on
Energy Policy**

2003
1st, Basic
Energy Plan

2007
2nd, Basic
Energy Plan

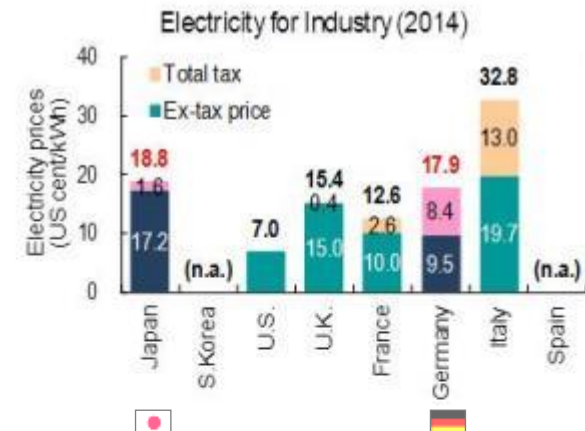
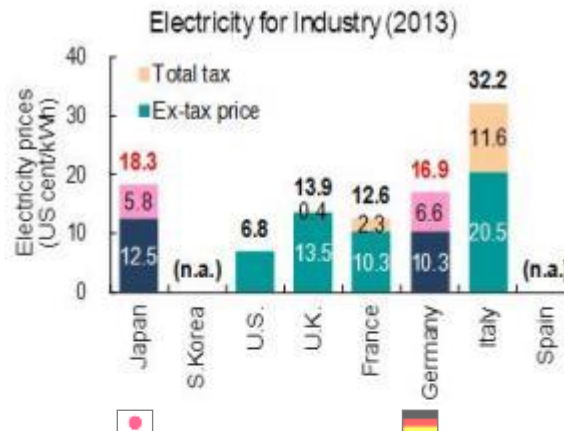
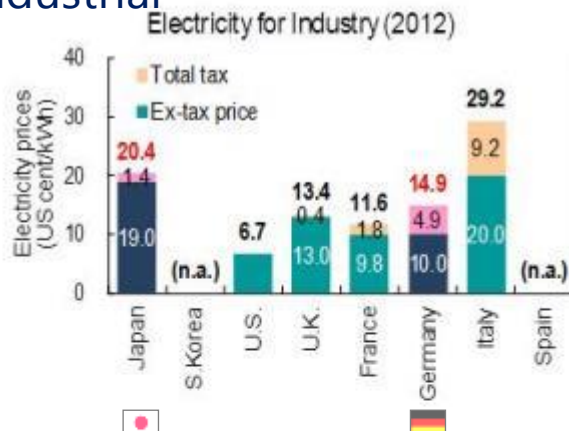
2010
3rd, Basic
Energy Plan

2014
4th, Basic
Energy Plan

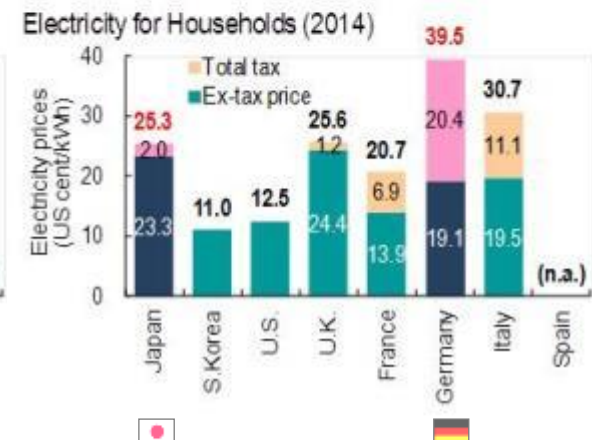
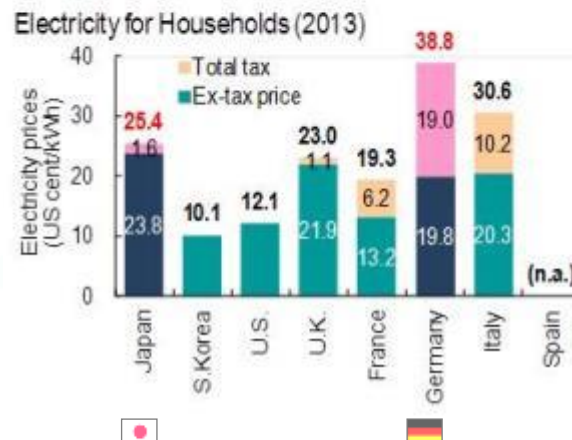
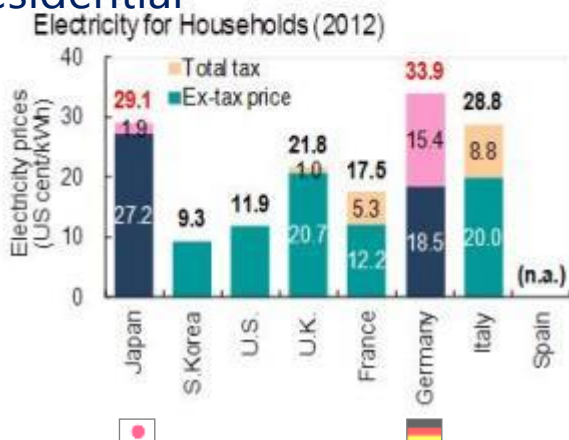
International Comparison of Electricity Prices (2011-14)



Industrial



Residential



(Note 1) n.a. (no data available) for [Industry] S. Korea for 2011-13 and Spain for 2012-13, [Residential] Spain for 2012-13

(Note 2) For S. Korea and the US, data on the ratio of electricity price and tax in the tariffs is not available.

(Note 3) Totals may not match due to rounding.

4. Overseas Trends

(4) Securing Adequate Investment



- ❖ Adequate investment cannot be secured by liberalization alone.

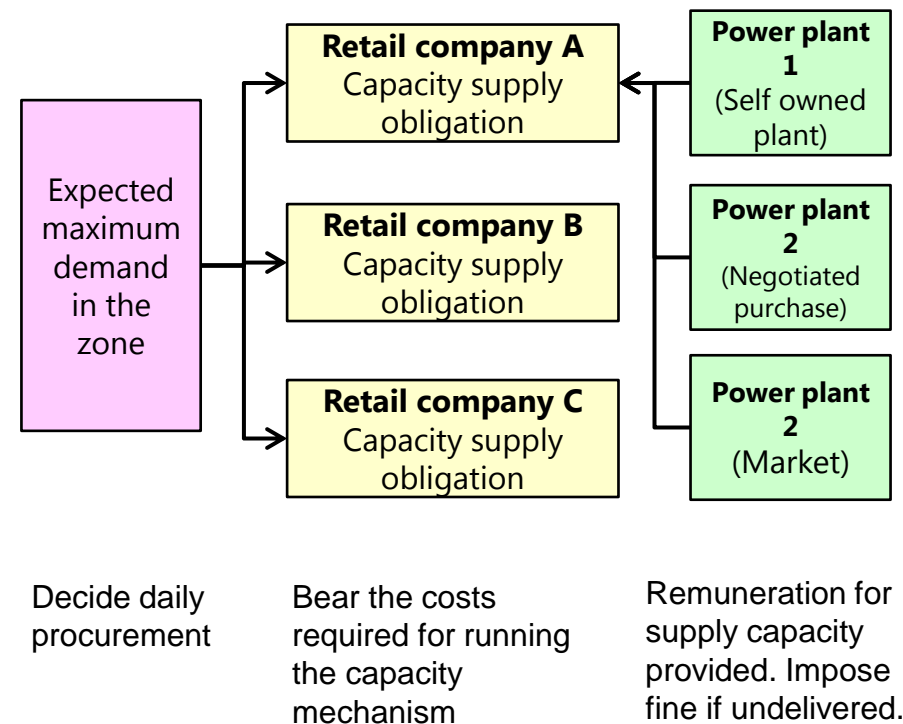
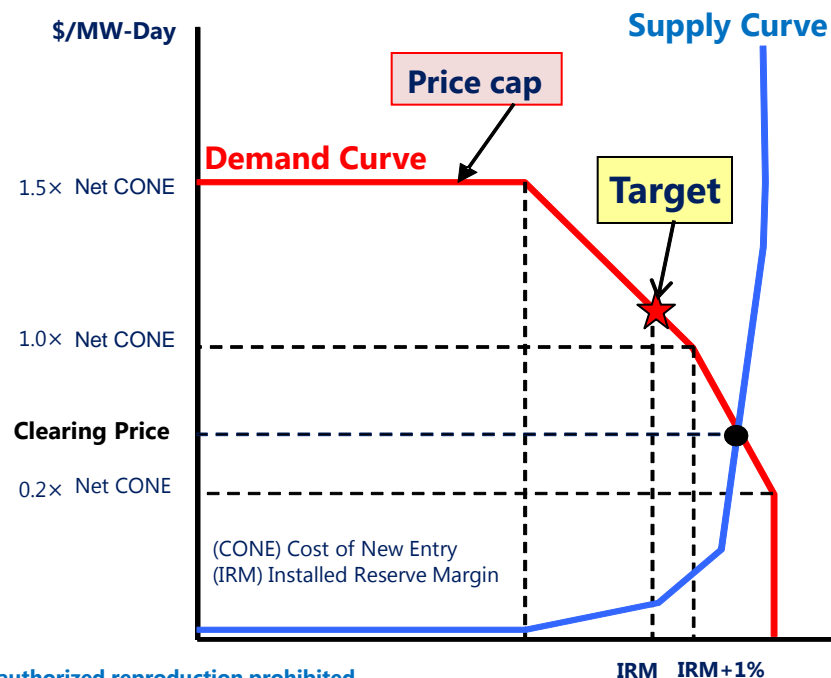
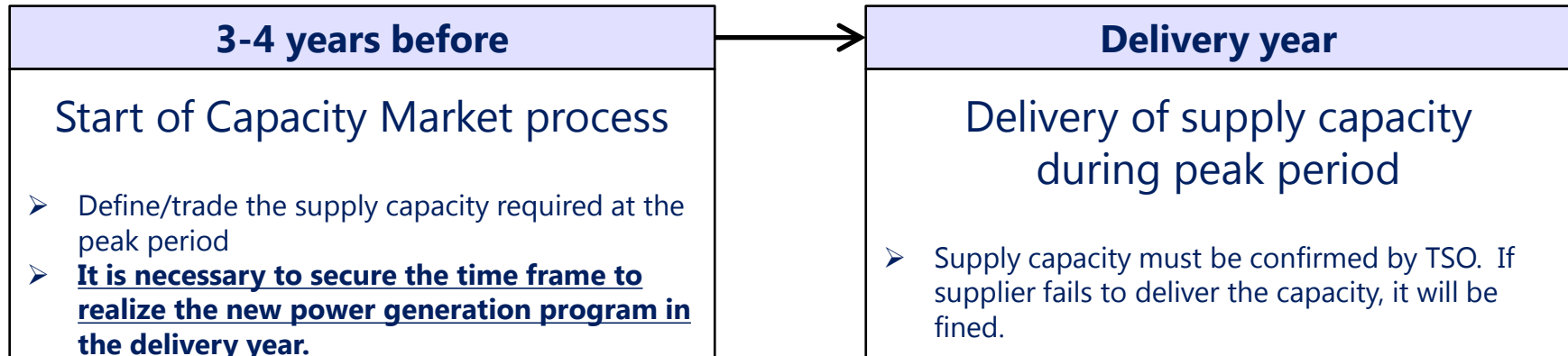
Many countries are addressing the shortage of investment by introducing such means as the **Capacity Market**.

Note: It is difficult to invest in power generation facilities with high fixed costs requiring mid- to long-term recovery of costs, when there is significant uncertainty in both prices and quantities.

The Capacity Market is an initiative to offer a certain level of certainty.

- ❖ However, there are countries which successfully operate the Capacity Market, and those which do not.

Basic Form of Capacity Market



Types of Capacity Market and Current Status



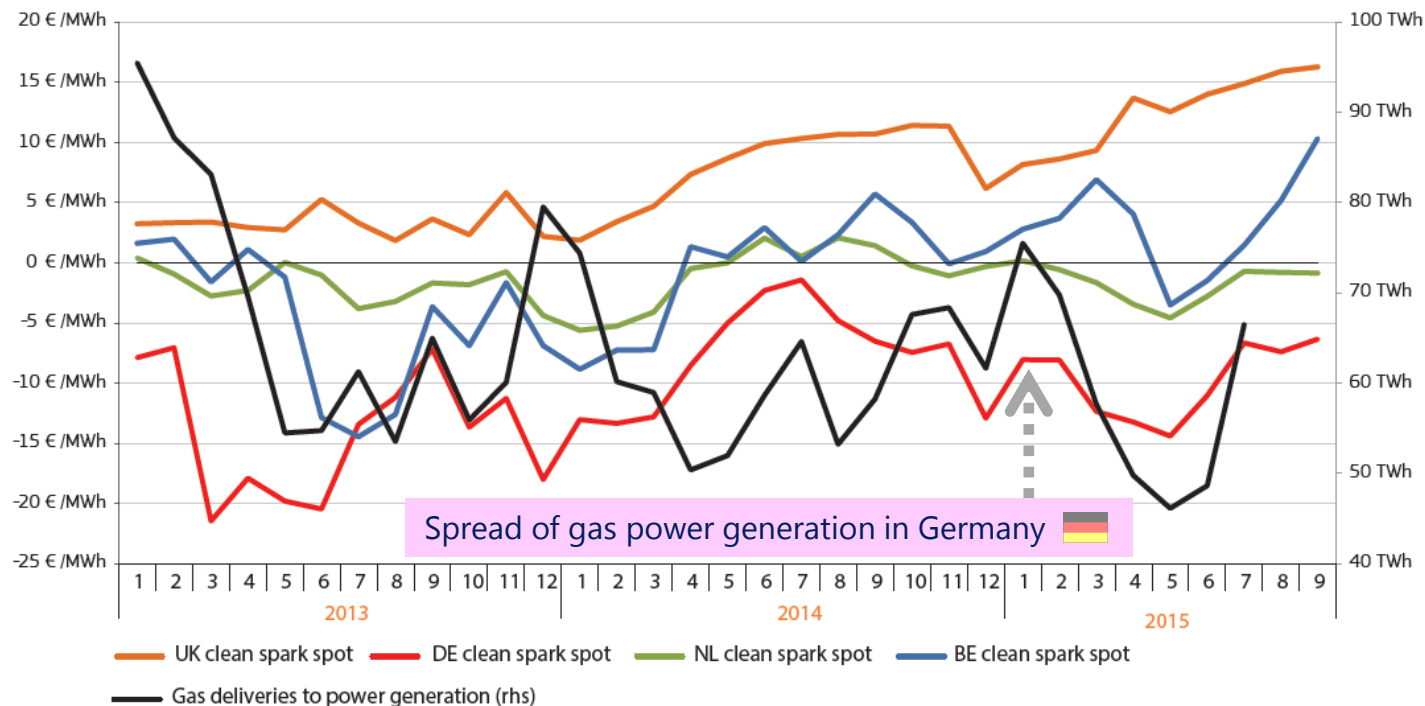
- ❖ **Resolution of classical missing money issue:** Introduce the capacity market because the wholesale price is decided based on the marginal cost principle in the pool market, and the fixed costs of the peak power source cannot be recovered.
- ❖ **Measures against stagnant wholesale prices due to the spread of renewable energy:** Introduce the capacity mechanism as a measure to secure investment for power generation or to avoid shutdown due to stagnant wholesale prices due to the spread of renewable energy and increase in uncertainty of power generation volume.
- ❖ **Enhancement of reliability:** The capacity mechanism may be introduced as a measure to reduce the risk of blackout caused by extreme weather like a heat wave or cold wave in case the electricity demand for air conditioners is high (capacity mechanism is adopted by necessity) and also as a measure to secure high reliability in big cities.

		Resolution of classical missing money issue	Measures against stagnant wholesale prices due to the spread of renewable energy	Enhancement of reliability
Price type	Capacity payment	Old U.K. pool market, Spain, etc.		
Capacity market (Supply capacity obligation)	Centralized capacity market		U.K.	U.S. PJM
	Distributed capacity market			France
Partial capacity market (Strategic reserved capacity)	Controlled type		Germany	
	Effective use of market type			Sweden, Finland
No capacity mechanism		State of Texas, Australia (Allowing for price spike)		

Profitability of Natural Gas Power Generation in Europe



- ❖ The profitability of thermal power generation is analyzed based on the factor called “spread”, which is the difference between electricity wholesale prices and fuel costs (fuel prices ÷ power generation efficiency).
- ❖ The spread of natural gas power generation in Europe is called “Clean Spark Spread”. Recently, the spread became negative in some countries including Germany, causing the difficult situation of not being able to recover even fuel prices. Under these circumstances, applications for terminating gas power generation have increased, and the framework of the wholesale market is being reconsidered even in Germany.

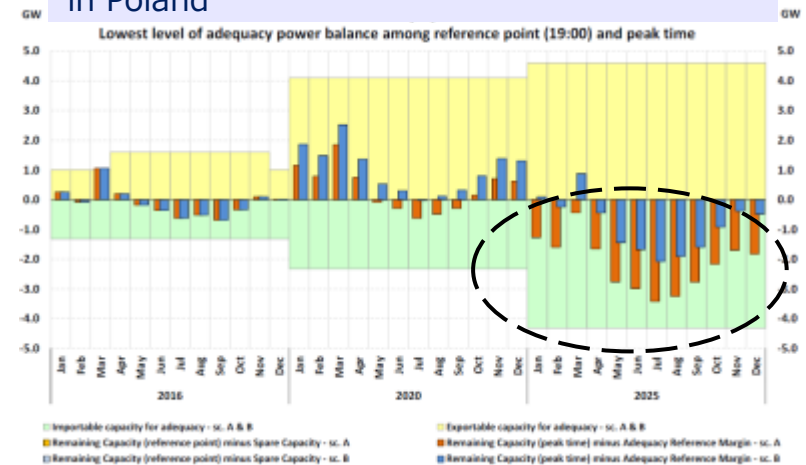


Supply-Demand Balance Outlook in Major European Countries

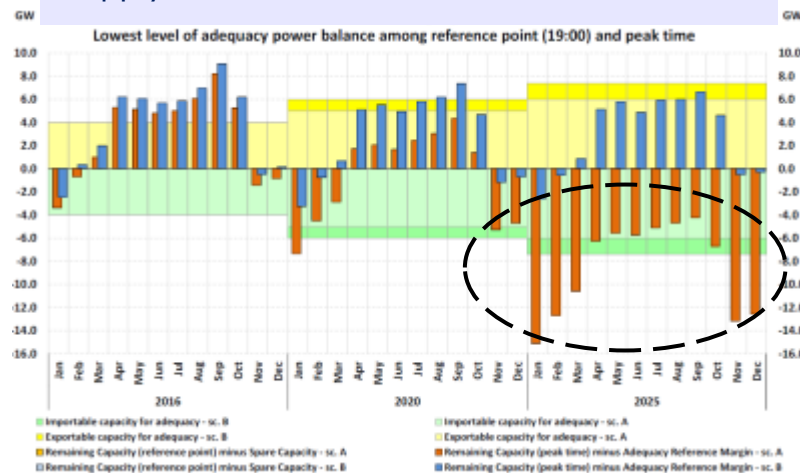


- ❖ Because of the liberalization of investment in power generation, supply-demand balance is still uncertain. According to a scenario based on conservative assumptions on investment in the U.K., supply capacity may become insufficient.
- ❖ There is a concern in Poland of a shortfall in supply capacity due to stagnant wholesale prices in countries especially in Germany.

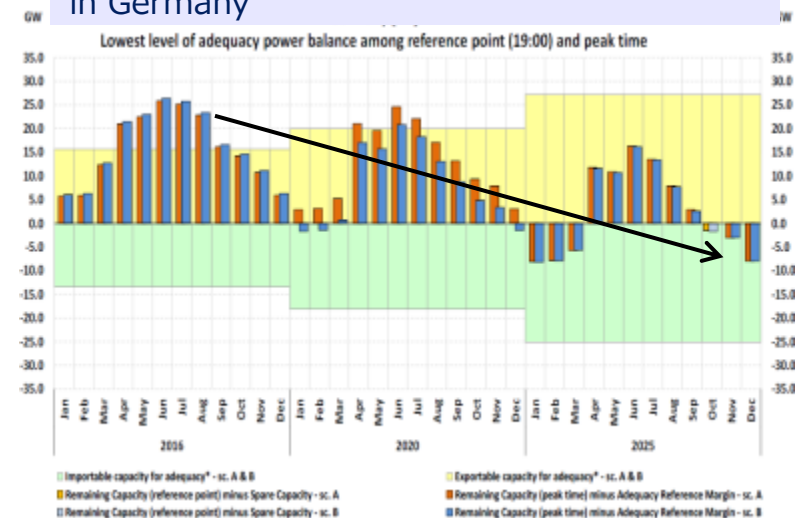
Supply-demand balance outlook in Poland



Supply-demand balance outlook in U.K.



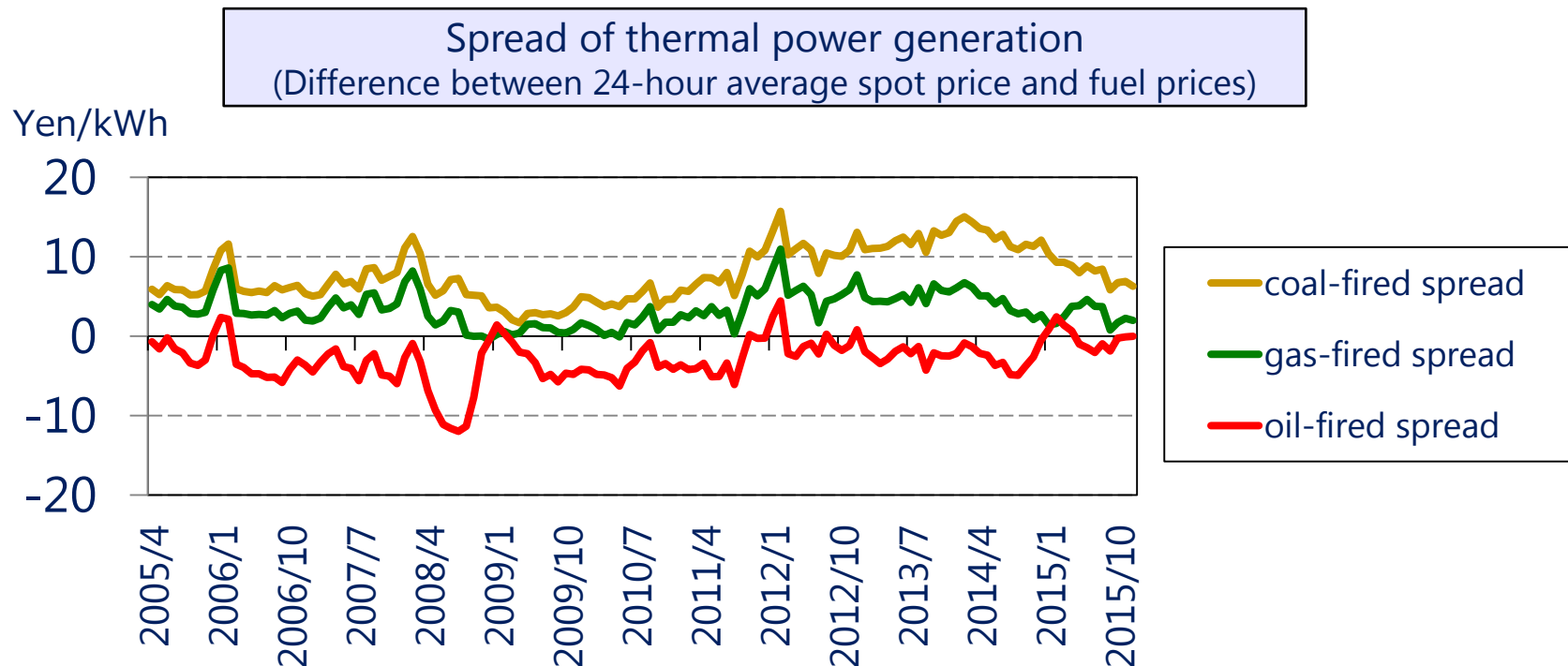
Supply-demand balance outlook in Germany



Spot Price of Japan Electric Power Exchange and Spread of Thermal Power Generation



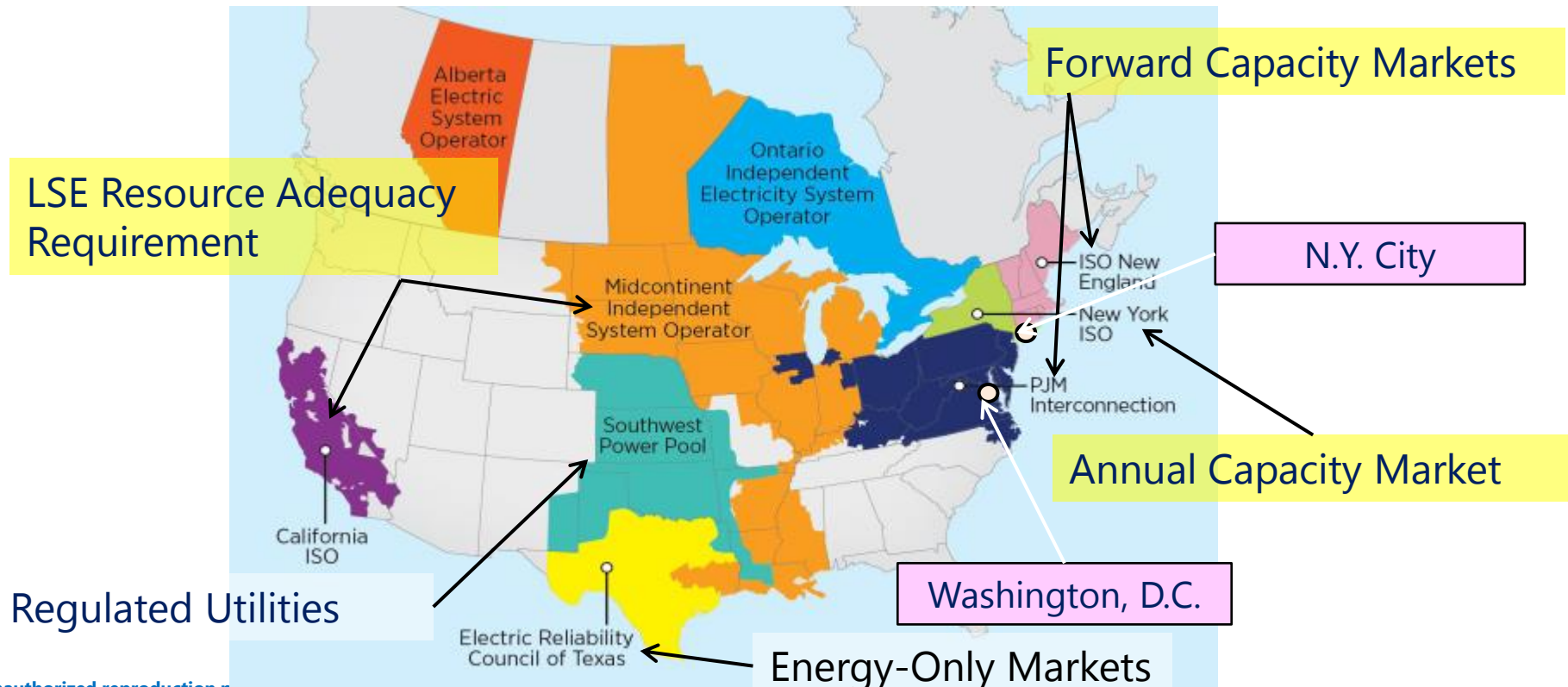
- ❖ There is a strong tendency in Japan that the wholesale spot price is linked with fuel prices of oil thermal power generation. In association with the termination of oil thermal power generation, the spot price is becoming linked with the fuel prices of gas thermal power generation. Productivity of gas thermal power generation is decreasing due to declining fuel prices.
- ❖ FIT electricity will be purchased by distribution / transmission operators. Purchased FIT electricity will be sold in the wholesale market, in principle. That will increase the pressure to lower the spot price.



Securing High Supply Reliability



- ❖ On the East Coast in the U.S. where there are many big cities, initiatives to upgrade supply reliability such as imposing a capacity supply obligation on retail operators have been made since long ago. There is a public power authority in New York State, which used to play a role in installing emergency power sources.
- ❖ Is there any area in Japan where high supply reliability should be secured in the same way? And how do we achieve that?

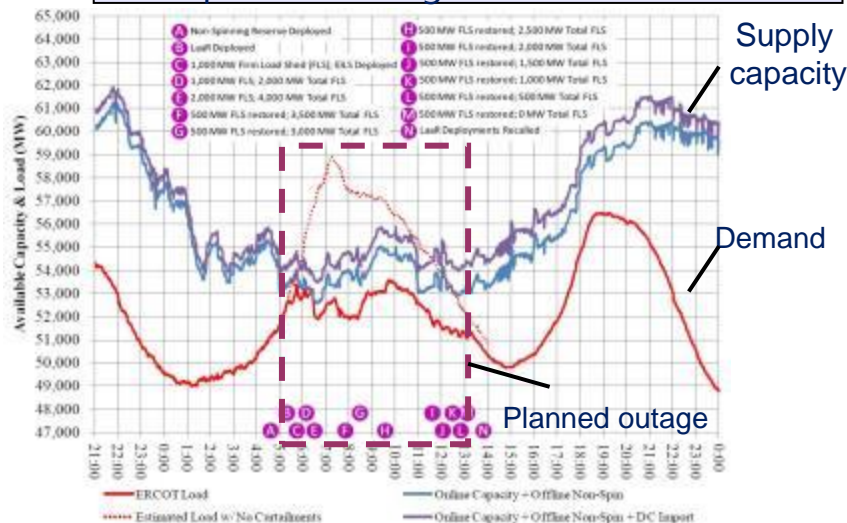


Example of Emphasizing the Market Principle: State of Texas

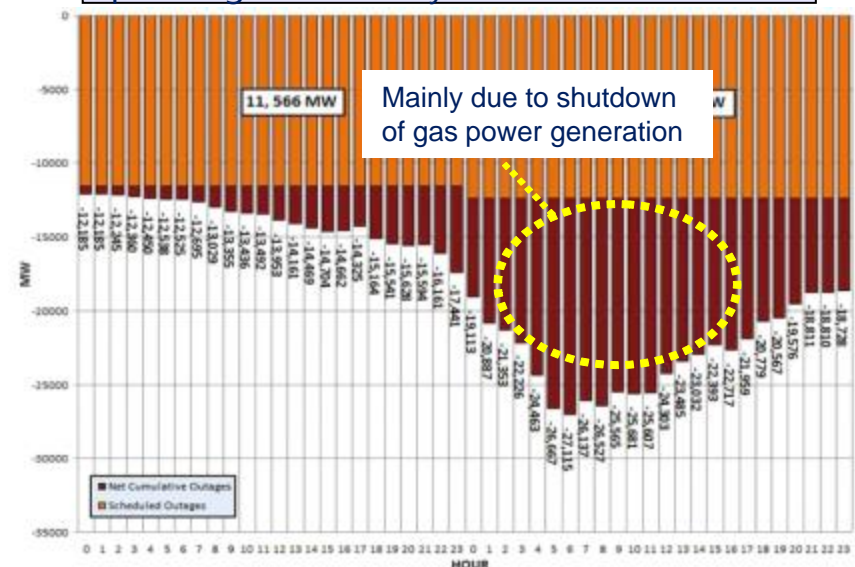


- ❖ A cold wave in early February 2011 had significant effects on the energy supply mainly in the State of Texas. On February 2, a serious unplanned blackout of the generation system occurred due to freezing of equipment and a shutdown of the natural gas supply. The supply capacity became insufficient because the peak demand was expected to increase to almost 60,000 MW on the day. As a result, ERCOT conducted rolling blackouts for a total of 4,000 MW, which affected 3.2 million customers. The energy trade market continued to operate even during this period.
- ❖ If the market principle is emphasized, it is necessary to widely announce that planned outages will be implemented when a certain threshold is exceeded.

Supply-demand status and planned outage on Feb. 2, 2011



Shutdown status of
power generation system on Feb. 2, 2011



4. Overseas Trends

(5) Realization of Adequate Energy Mix



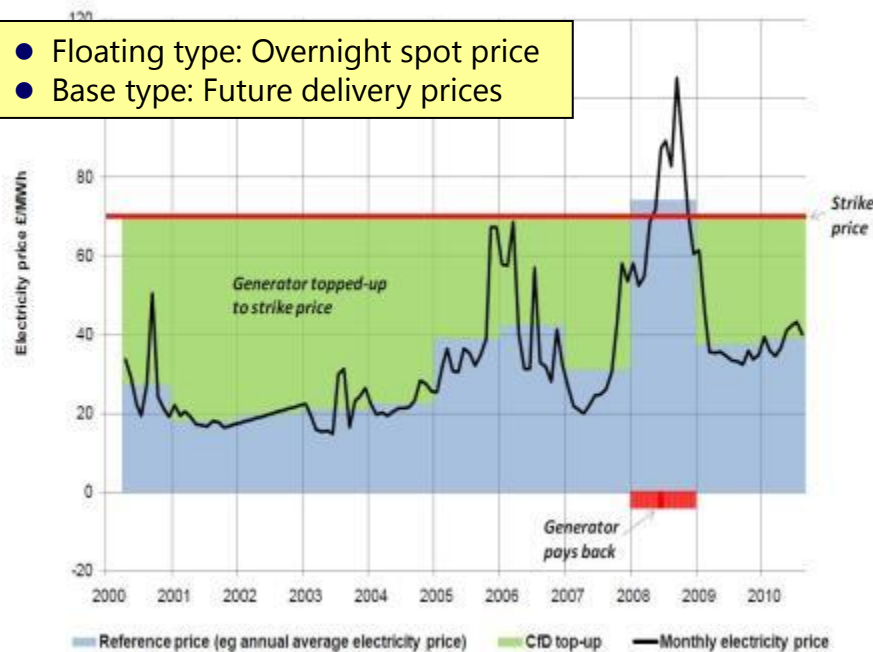
- ❖ In some countries where the degree of liberalization is high, investment in zero-carbon electricity sources is not adequately made , which tend to require stronger involvement by the government.

European case: U.K.'s electricity deregulation, and stable supply and low-carbon electricity source difficulty in securing

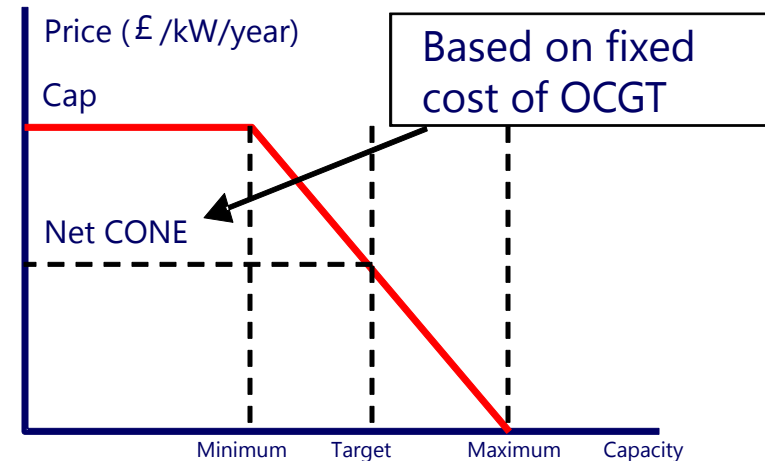


CfD (contract for differences) strike prices and payments

- Floating type: Overnight spot price
- Base type: Future delivery prices



Capacity market pricing

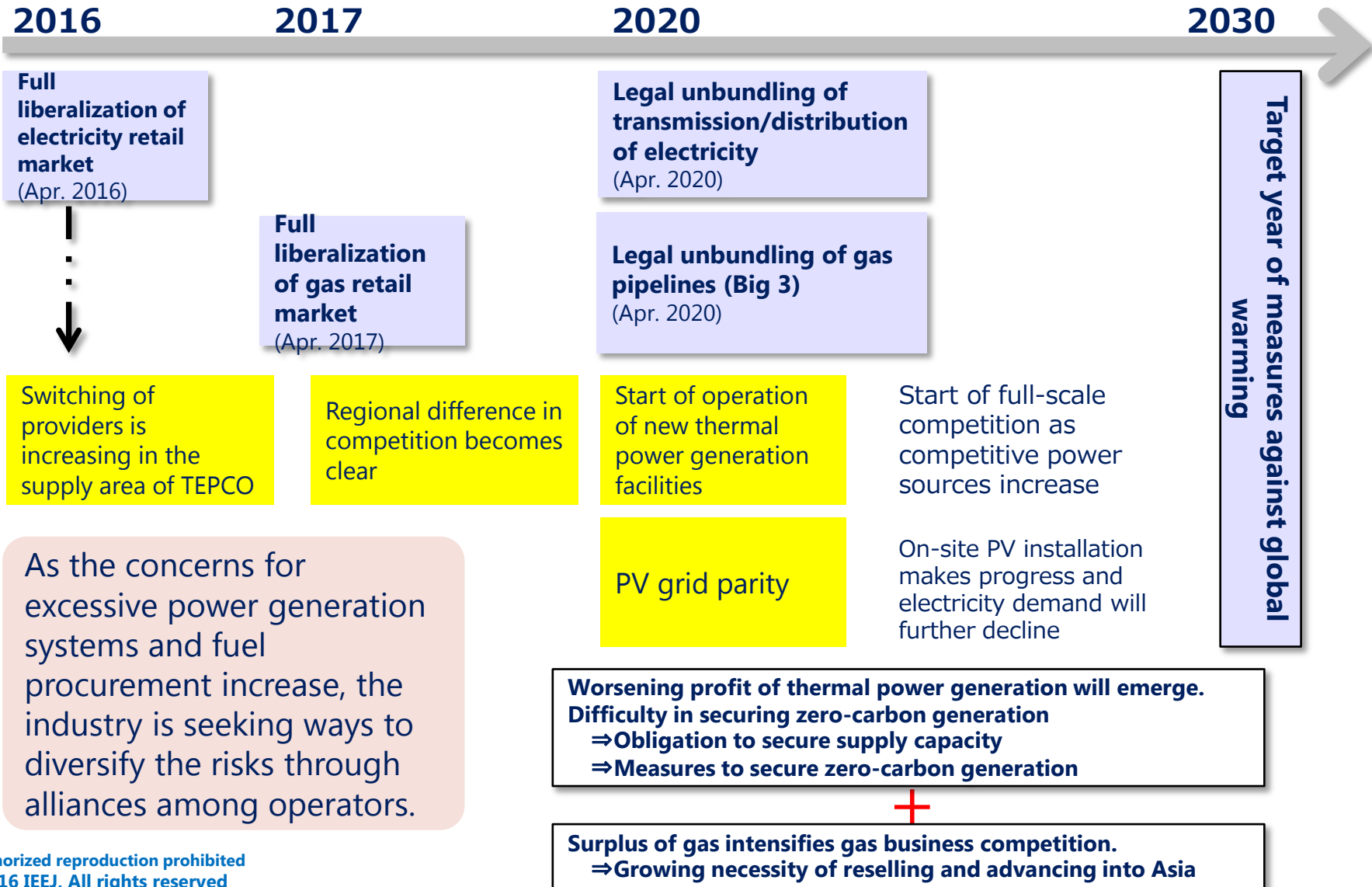


Electricity transmission companies procure capacity for the fourth year from now while retailers shoulder costs.

- The United Kingdom is considering reforming the electricity system to maintain stable supply in response to the planned shutdown of outdated power plants with a total capacity of nearly 20,000 MW over 20 years and to promote de-carbonization of electricity sources.
- The country seeks to take advantage of CfDs (contracts for difference) for increasing low-carbon electricity sources (renewable energy and nuclear) and secure capacity by permitting additional income as capacity credits using a capacity market for fossil fuel power generation.

5. Future Challenge

(1) Overview



Expansion of Renewable Energies and Rising Electricity Tariffs

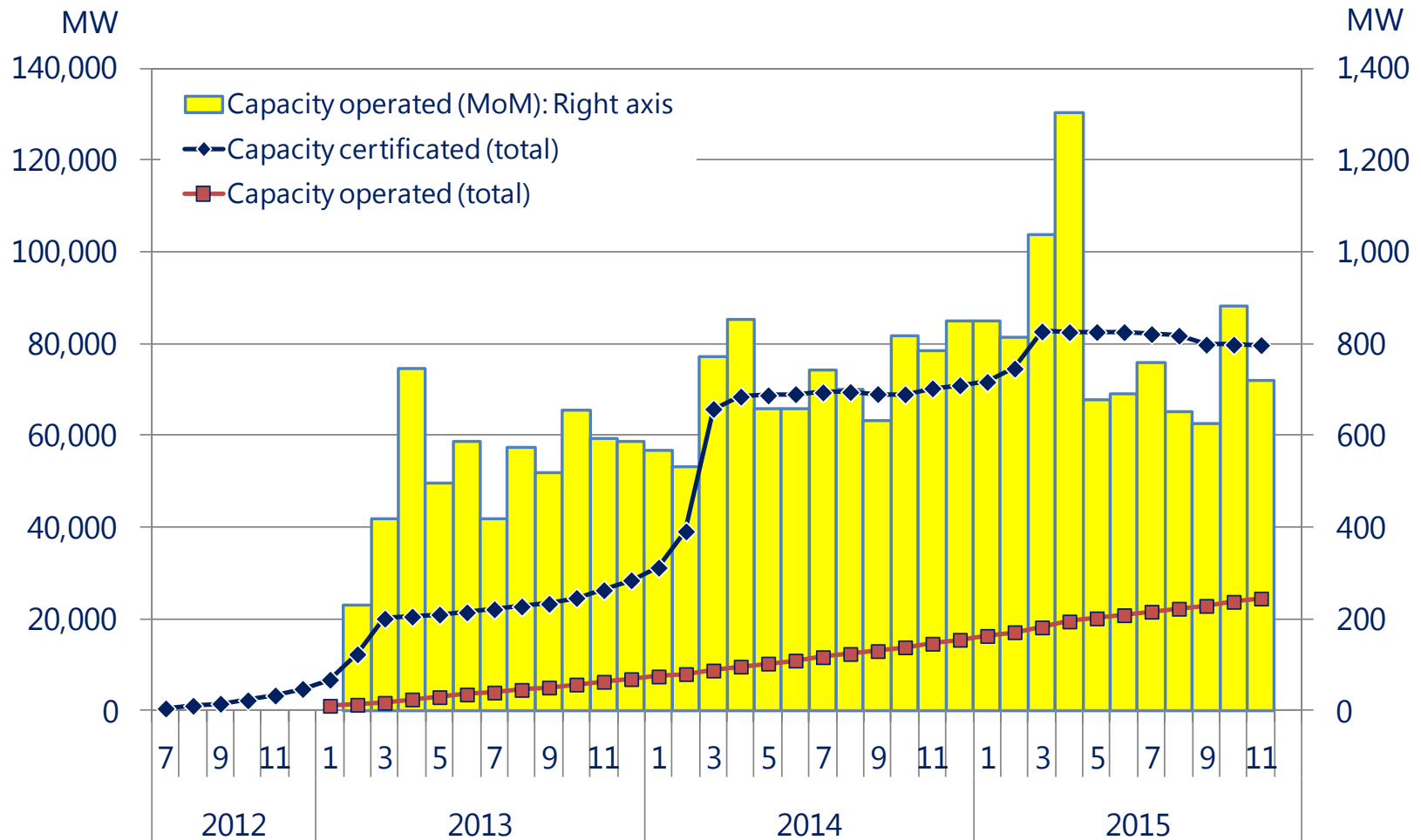


	①Installed Capacity (MW)		②Purchased power (GWh)	③Purchased price (100 million Yen)	④Licensed capacity (MW)
	After the introduction of FIT	Before the introduction of FIT	After the introduction of FIT	After the introduction of FIT	After the introduction of FIT
Solar power(residential)	3670	4700	17788.1	7723	4330
Solar power(non-residential)	20740	260	34812.5	14310	75310
Wind power	380	2530	15456.2	3363	2330
Medium- and small-scale hydraulic power	130	210	3108.8	809	740
Geothermal	10	0	46.2	20	70
Biomass	430	1130	10323.8	2106	2790
Total	25370	8830	81535.5	28329	85580

* The figures for each energy are rounded up, and may not add up to the total.

- Consumer burden related to renewable electricity generation is soaring.
The total consumer burden for the next 20 years will reach **55 trillion yen** by operating just the **86 GW** capacity installed and licensed as of the end of **November 2015**. This inevitable burden is equivalent to a **3.1 yen/kWh** rise in tariffs, **or 19% for industrial and 13% for residential sectors**.
- The rapid increase in solar power with high purchase price is greatly increasing the burden. The burden will grow further as power sources with longer lead times, such as wind power, start operation in addition to solar power.

Solar Power Generation Nationwide



Source: Agency for Natural Resources and Energy, "Status of Introduction of Renewable Electricity Generation Facilities (end of Nov.)", Mar. 2016



5. Future Challenge

(2) Specific issues: Electric Power Industry

❖ Harmonization of power system and renewable energy (intermittency)

- Wholesale of FIT electricity by transmission/distribution operators
⇒ How to use wholesale market
- Enhancement of network and cost sharing

❖ Prevention of shortage of investment

- Whether or not to introduce capacity market (capacity mechanism)
- Revision of FIT to lower tariffs for some renewable energy and renewable energy diversification
- Study of CfD of nuclear power in mid-term

❖ Securing adequate energy mix

- Ensuring ratio of zero-carbon power source
⇒ the law for upgrading energy supply Structures
- Introduction of benchmark for thermal power generation
⇒ Energy Conservation Act

❖ Advancing into overseas markets

- Reinforcing competitiveness and coping with reduced demand

◀ What kind of measures will be taken in light of the experiences in Europe and the U.S.?

5. Future Challenge

(3) Specific issues : Gas Industry



❖ Full liberalization of gas retail market

- Concerning gas supply to households, etc. which is now only permitted for general gas utilities, regional monopoly of the retail market is abolished to allow registered utilities to enter the gas retail market.
⇒ New deployment of gas pipelines and interconnection
- Regulations on the prices are eliminated, in principle. However, the utilities are required to offer regulated price plans in areas where competition is insufficient as a transitional measure in terms of customer protection.

❖ Third-Party Access to LNG Terminal

- It will be legally prohibited for operators who own LNG terminal to refuse the use by a third party without a valid reason.

❖ Safety regulation and accelerated introduction

- Legal obligation for securing safety of pipeline network, inspection of internal piping owned by small-vol. customers, and emergency preparedness will be imposed on gas pipeline operators.

❖ Advancing into overseas markets

- Reinforcing competitiveness and coping with reduced demand

◀ What kind of measures will be taken in light of the experiences in Europe and the U.S.?

Conclusion



1. Market reform is natural development in terms of streamlining the electric power and gas industry.
2. Considering the situation in Europe and the U.S., no obvious positive effects can be seen such as reduction in tariffs, while various challenges are notable such as lack of investment and difficulty in achieving an adequate energy mix.
3. It is critical for Japan to carry out the detailed design of the system reform, taking into account the successes and failures in Europe and the U.S.

Thank you for your attention.



Mapping the Energy Future

IEEJ will celebrate its 50th anniversary in June of this year.



IEEJ was evaluated as the world's number 1 in the **energy sector** of the "**Global Go To Think Tank Index**" (published in Jan. 2016) announced every year by the University of Pennsylvania. IEEJ has been ranked top for two years in a row in Asia.

Since the start of the survey, it is the first time for a non-U.S./European research institute to be chosen as the top in the world ranking, based on research field.
(IEEJ was ranked third in the world, and top in Asia, in the 2014 index.)



"2015 Global Go To Think Tank Index Report" (p.83)

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