

# Electric power and renewable energy outlook and challenges for 2015

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Jyunichi OGASAWARA

The Institute of Energy Economics, Japan (IEEJ)

Fossil Fuels & Electric Power Industry Unit

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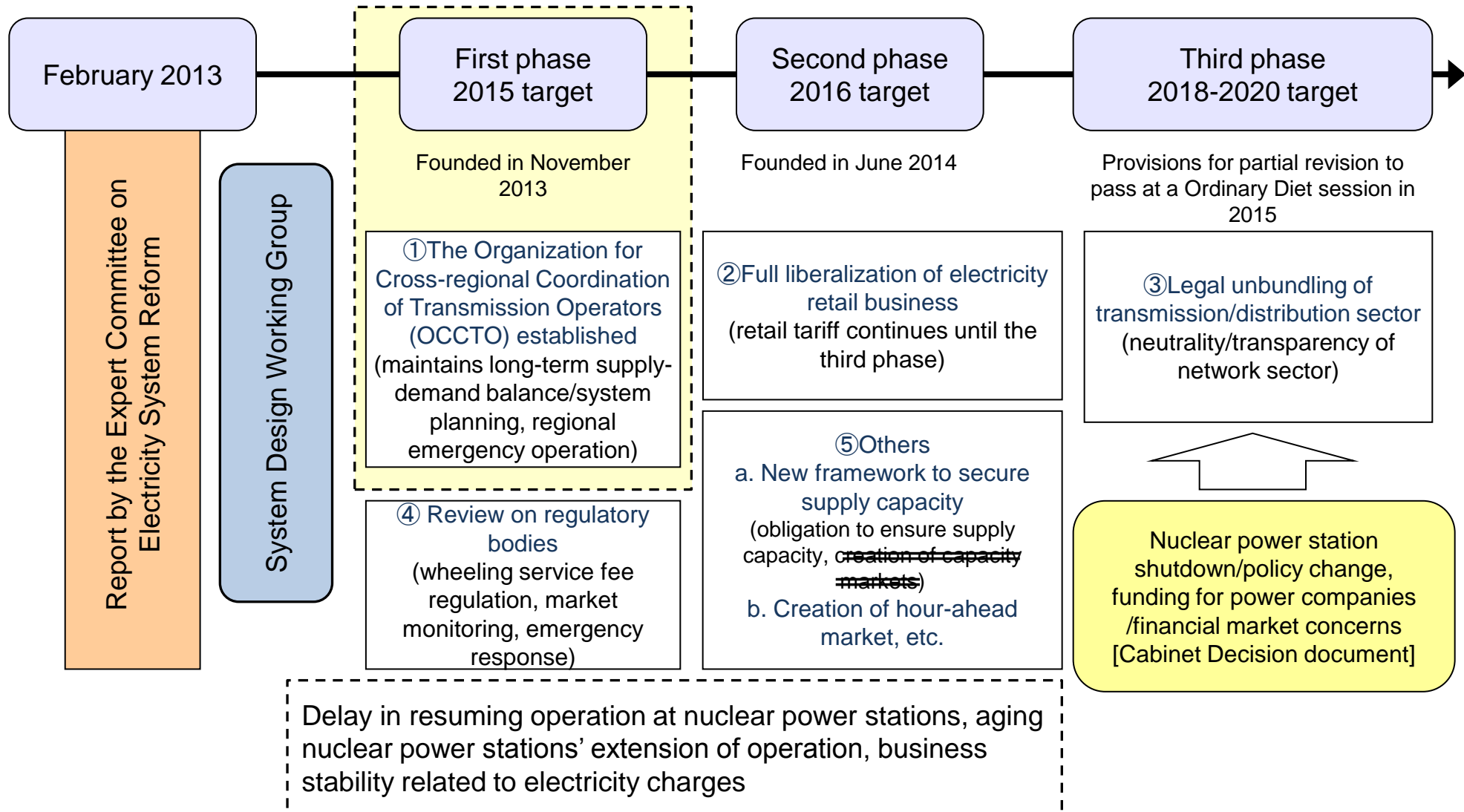
# This report covers:

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1. Electric power system reform and tight supply-demand ratio
2. Energy feed-in tariff system
3. Future Work

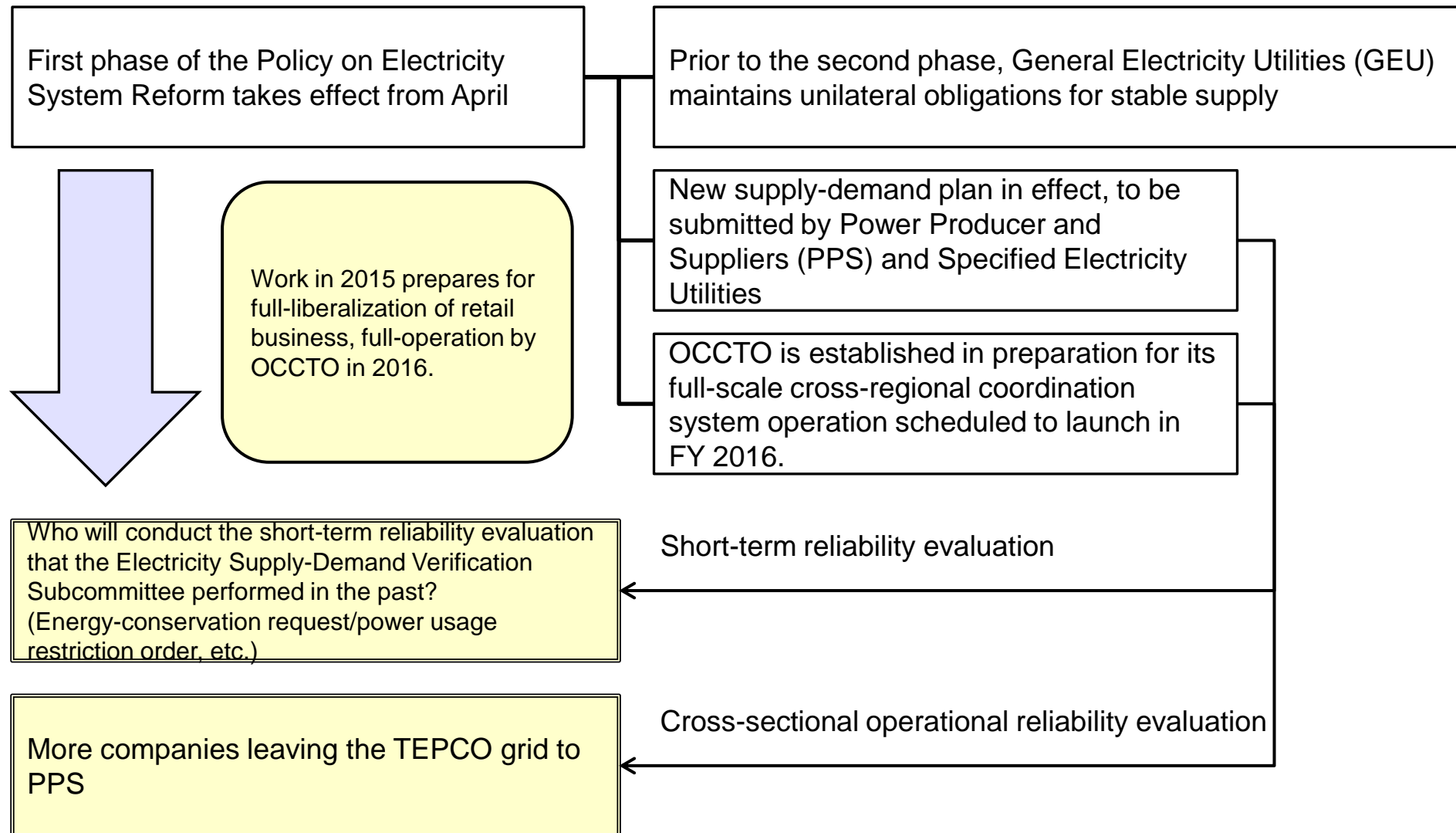
# 1. Electric power system reform and tight supply-demand ratio

## (1) Current status



# 1. Electric power system reform and tight supply-demand ratio

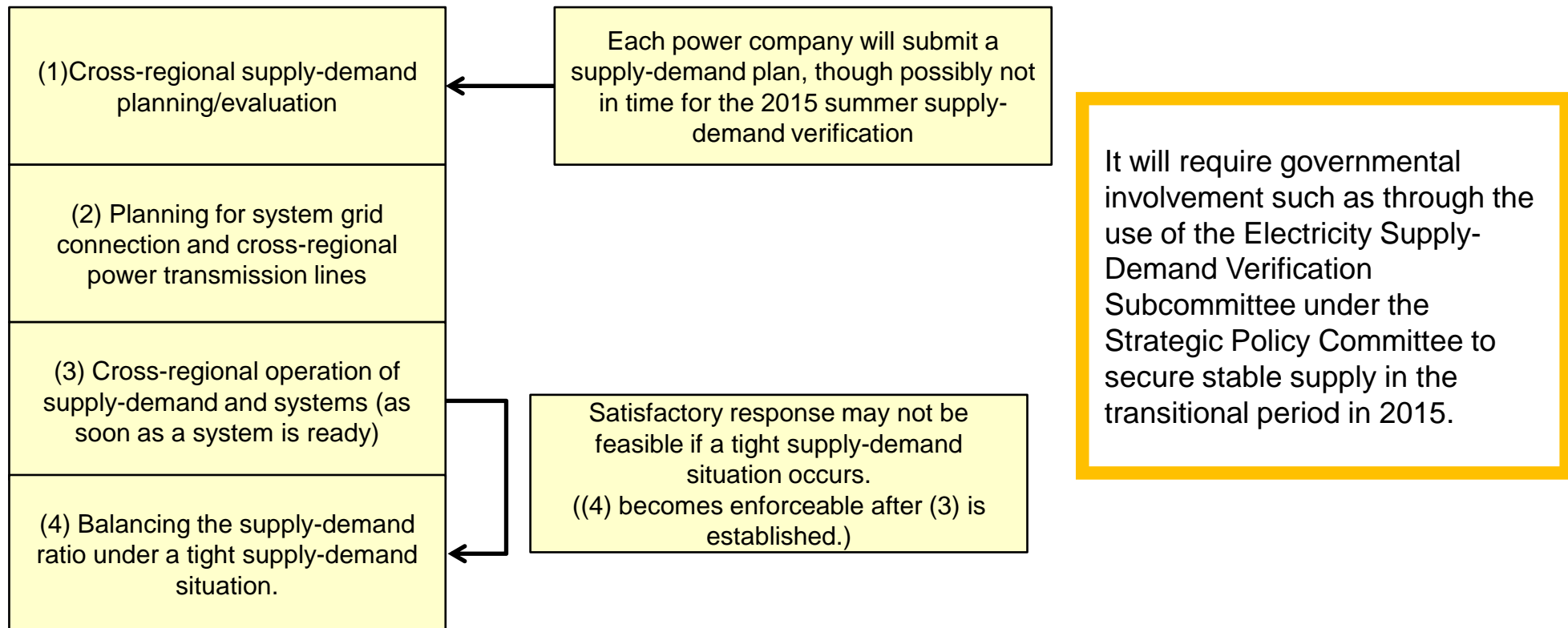
## (2) Agenda for FY 2015



# 1. Electric power system reform and tight supply-demand ratio

## (3) Responsibility of OCCTO

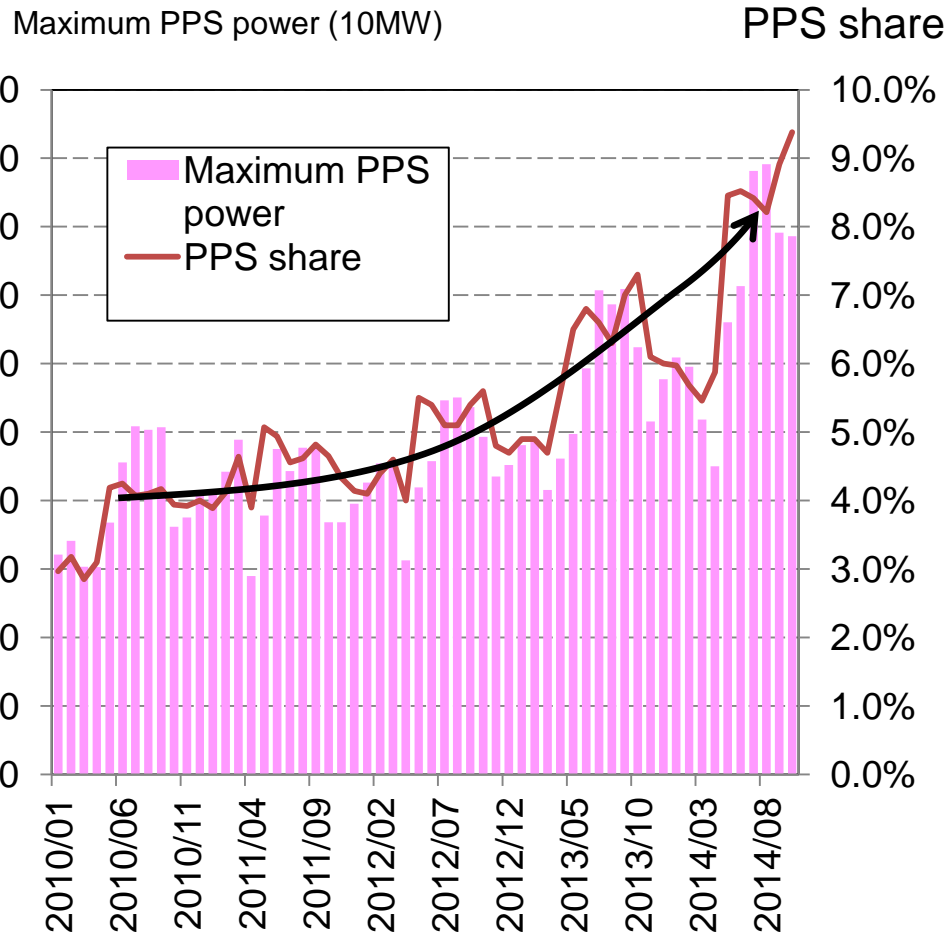
The Organization for Cross-regional Coordination of Transmission Operators (OCCTO), which is scheduled to launch in April 2015, will handle the following: (1) cross-regional supply-demand planning/evaluation, (2) planning for system grid connection and cross-regional power transmission lines, (3) cross-regional operation of supply-demand and systems (as soon as a system is ready), and (4) balancing the supply-demand ratio under a tight supply-demand situation. Incorporating the working mechanism of the current Electric Power System Council of Japan (ESCJ), which will establish an organizational structure to accomplish the above-mentioned responsibilities. It will also handle rule-making on a) how to utilize interconnecting grids, b) best formation of grid connecting facilities, c) best way to connect systems, d) procedures necessary for emergency response under disaster. A new management system for system grid connection will also be constructed.



# 1. Electric power system reform and tight supply-demand ratio

## (4) PPS demand and reserve capacity within the TEPCO grid

Maximum PPS power and estimated withdrawal rate

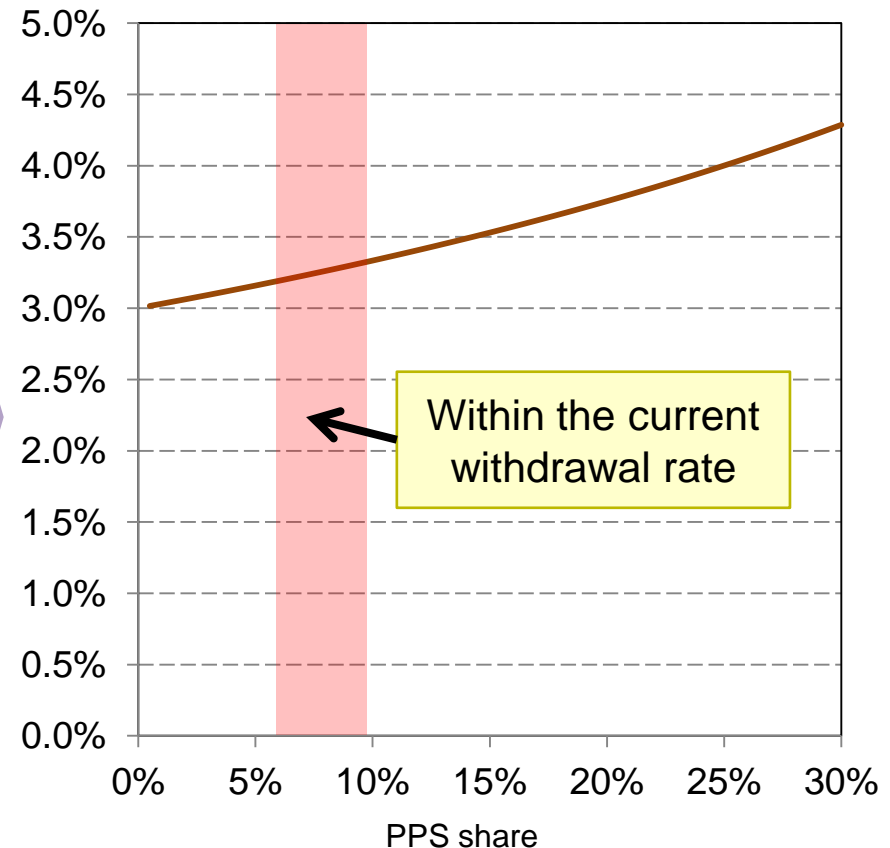


Note) Max PPS power is determined from the difference between ESCJ's regional max power and the daily max power in TEPCO's "Electricity Forecast," represented as the maximum value for the relevant months.

Source) ESCJ *Electricity Supply-Demand Review* and TEPCO *Electricity Forecast*

PPS share and TEPCO's reserve margins

TEPCO reserve margins required to maintain 3% system reserve capacity



Note) PPS power supply capacity is set based on TEPCO's reserve margins at zero.

# 1. Electric power system reform and tight supply-demand ratio

## (5) Post-disaster countermeasures for summer/winter months

While an unplanned shutdown of thermal power stations in the summer of 2014 led to concern that the reserve margins would dip below 3%, a cool summer avoided a supply shortage. Ongoing situations that are susceptible to a tighter supply-demand ratio if an unplanned interruption occurs at thermal power stations need to be noted, along with concerns regarding lower consumer awareness of energy-saving, since main the measures recently focus on suppliers meeting the demand rather than on energy conservation efforts by consumers.

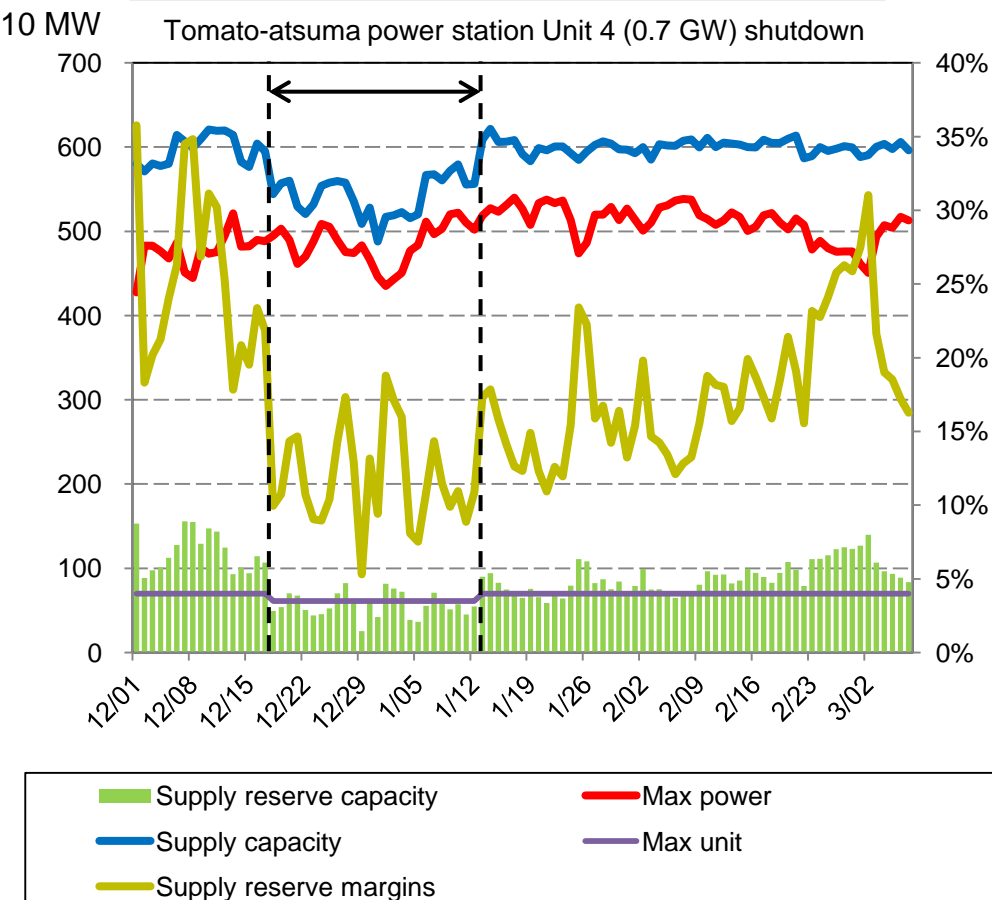
	Coverage area	Energy-conservation request	Events
Summer 2011	Tokyo Electric Power, Tohoku Electric Power	Electricity usage restriction	Tohoku Electric Power experienced a tight supply-demand ratio due to the operation shutdown of hydropower which generated 1 GW, after heavy rainfall in Niigata and Fukushima on 8/8.
Winter 2011	Kansai Electric Power, Kyushu Electric Power	Energy-conservation request with a target figure	Kyushu Electric Power experienced a tight supply-demand ratio due to a 2.295 GW interruption from the Shin-oita thermal power station accident on 2/3. Shikoku Electric Power experienced a tight supply-demand ratio due to a record-breaking cold wave on 2/2.
Summer 2012	Hokkaido Electric Power, mid-western Japan	Energy-conservation request with a target figure	Hokkaido Electric Power experienced a tight supply-demand ratio due to a record-breaking late-summer heat waves on 9/17 and 9/18.
Winter 2012	Hokkaido Electric Power	Energy-conservation request with a target figure	Unplanned thermal station shutdown at Hokkaido Electric Power reduced its reserve margins.
Summer 2013	Whole area	General energy-conservation request	Reserve margins decline due to heat wave at Kyushu Electric Power
Winter 2013	Hokkaido Electric Power	General energy-conservation request	Tomato-atsuma power station Unit 4 shutdown at Hokkaido Electric Power reduced its reserve margins.
Summer 2014	Whole area	General energy-conservation request (target figure was not established while there was concern that the reserve margin in mid-western Japan would be under 3%)	(Mid-western Japan saved from a tight supply-demand ratio thanks to cold summer.)
Winter 2014	Hokkaido Electric Power	General energy-conservation request	

# 1. Electric power system reform and tight supply-demand ratio

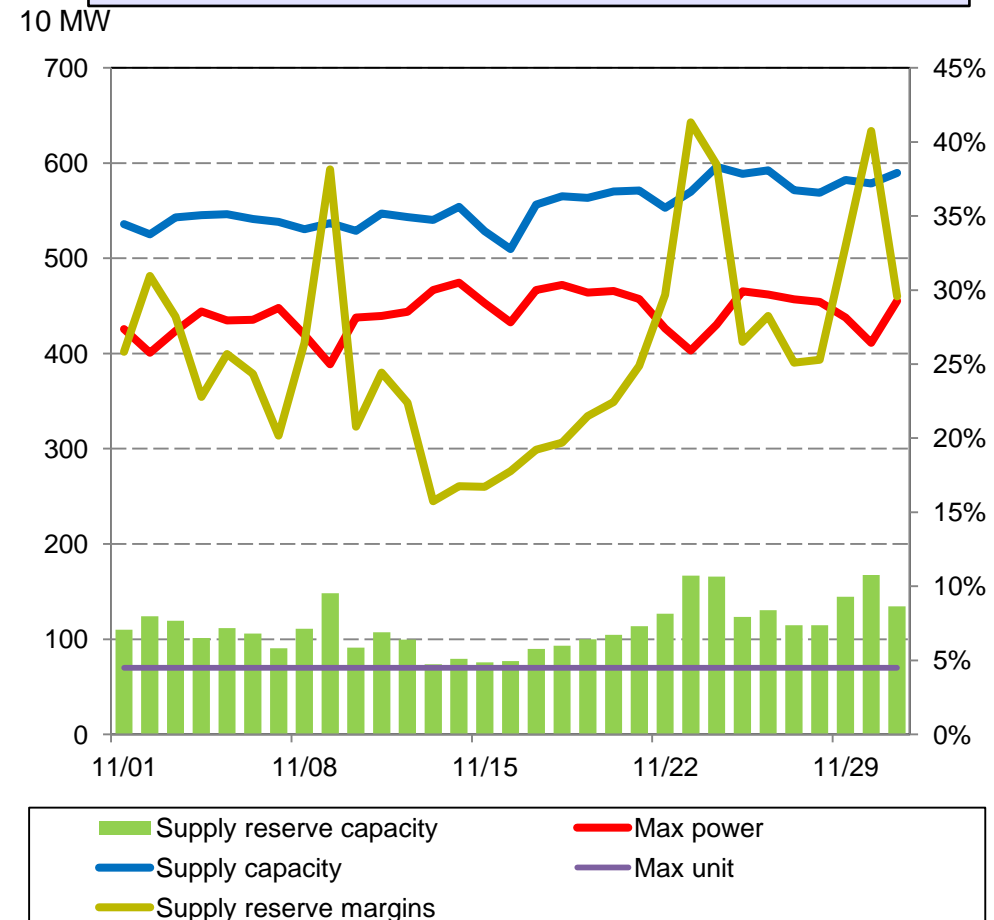
## (6) Supply-demand ratio of Hokkaido Electric Power

Its 0.7 GW thermal power station shutdown in winter 2013 brought a challenging supply-demand balance. There are concerns that a similar challenge would arise if any unexpected shutdown of large-scale thermal power facilities occur during the 2014 winter season.

Supply-demand in winter 2013



Up-to-date supply-demand in winter 2014



Source) Hokkaido Electric Power *Electricity Forecast*



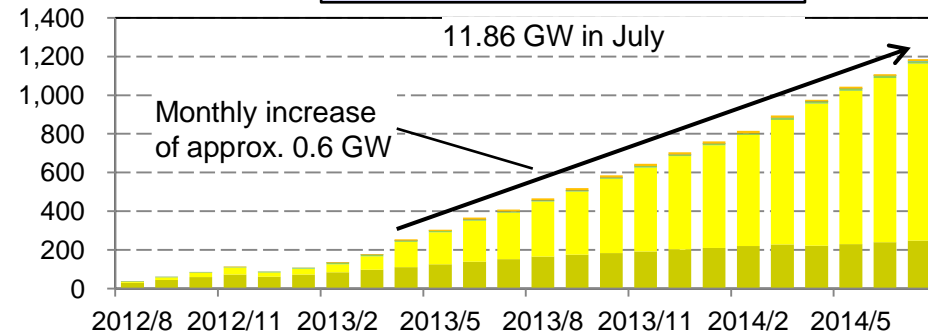
## 2. Energy feed-in tariff system

### (1) Changes in FIT facility approval/operation startup capacity

As of July 2014, including the amount switched from the previous RPS system, the FIT power source in operation totals 20.66 GW, with an approved capacity of 81.01 GW. Especially, approved capacity reached close to the total maximum daily power from 9 power companies during the Golden Week holiday (88.25 GW on 5/4/2014)

Operation startup capacity (10MW)

Newly-operating capacity



Biomass

Geothermal

Hydropower

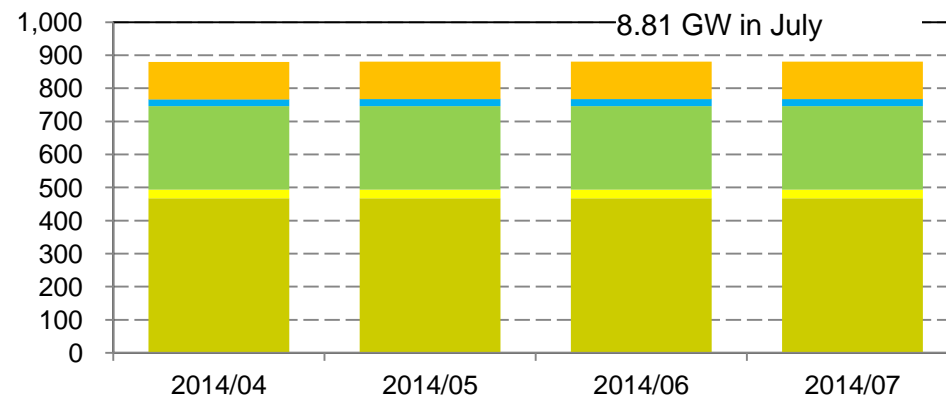
Windpower

Solar power (10kW or higher)

Solar power (10kW or less)

Transferred capacity (10 MW)

Capacity of approved-transfers



Biomass

Geothermal

Hydropower

Windpower

Solar power (10kW or higher)

Solar power (10kW or less)

Biomass

Geothermal

Hydropower

Windpower

Solar power (10kW or higher)

Solar power (10kW or less)

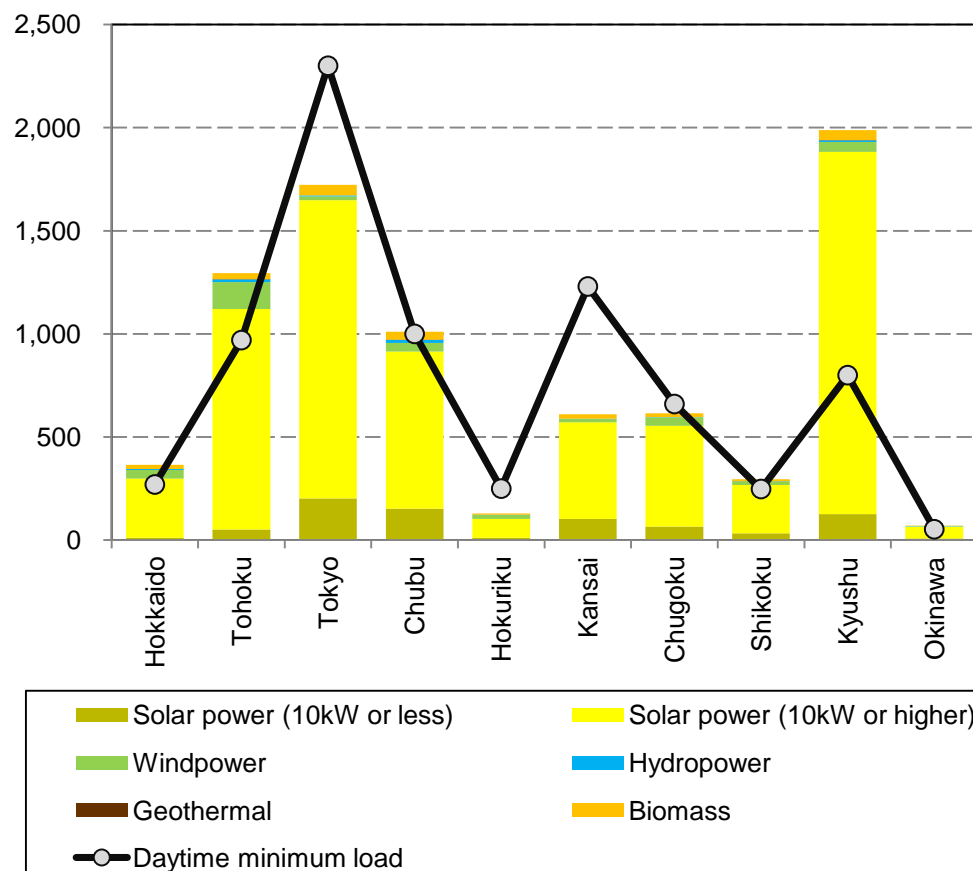
# 2. Energy feed-in tariff system

## (2)Approved/in-operation capacity by region (as of July 2014)

Both capacities for approved and in-operation facilities show significant regional disparities. Kyushu Electric Power reported approvals that substantially exceed minimum daytime load.

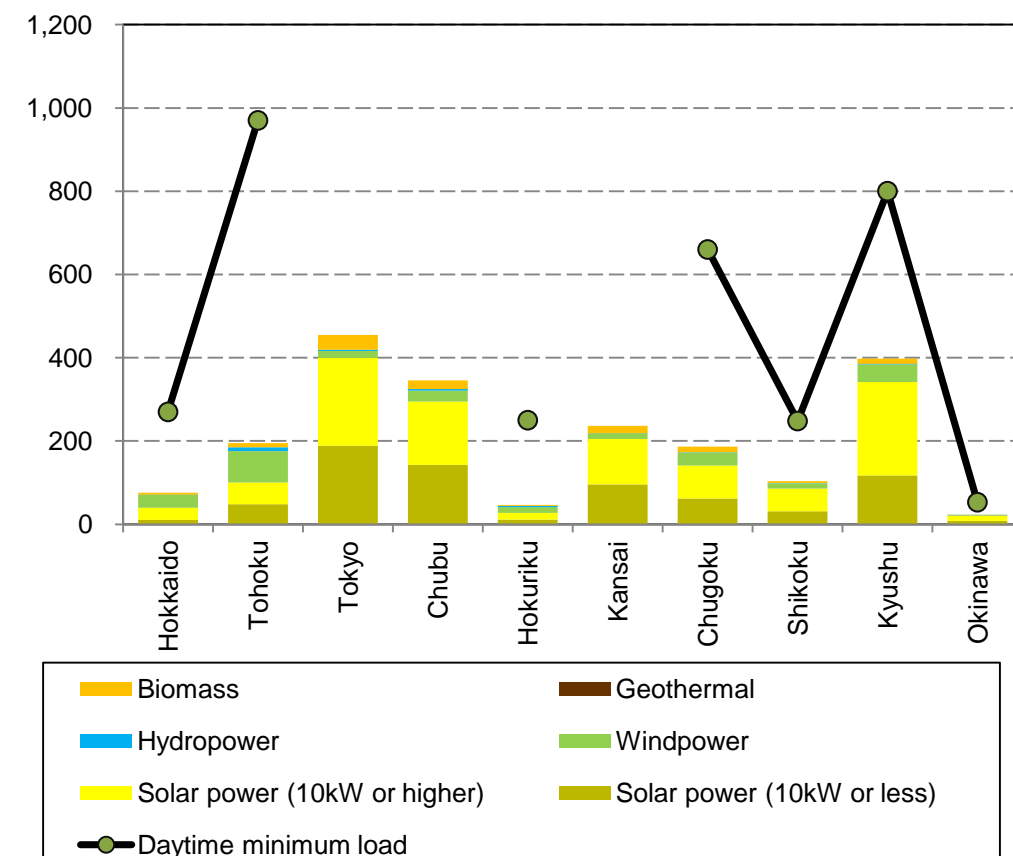
Approved capacity

Approved capacity (10 MW)



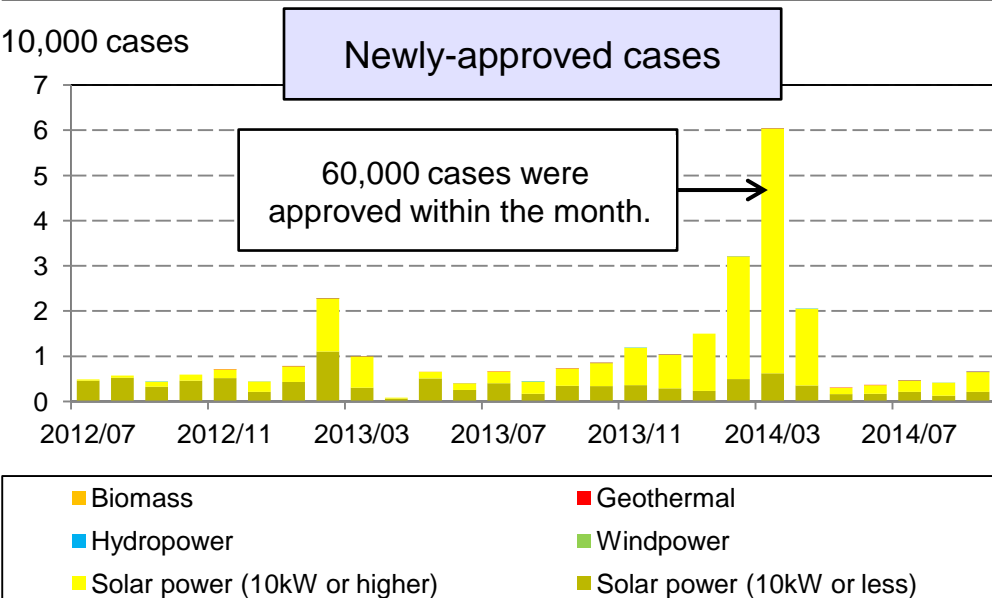
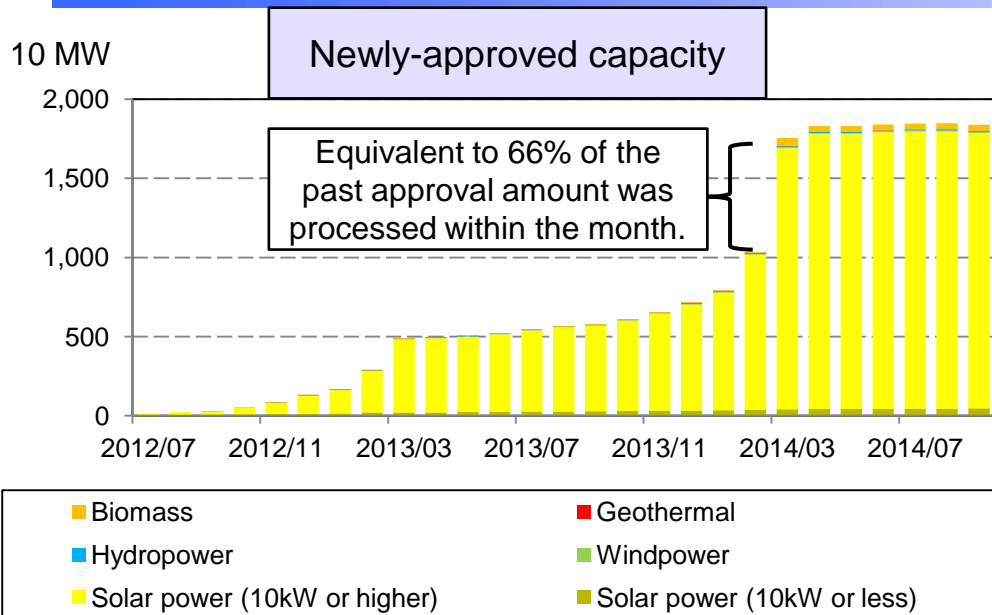
Operating capacity

Operating capacity (10 MW)

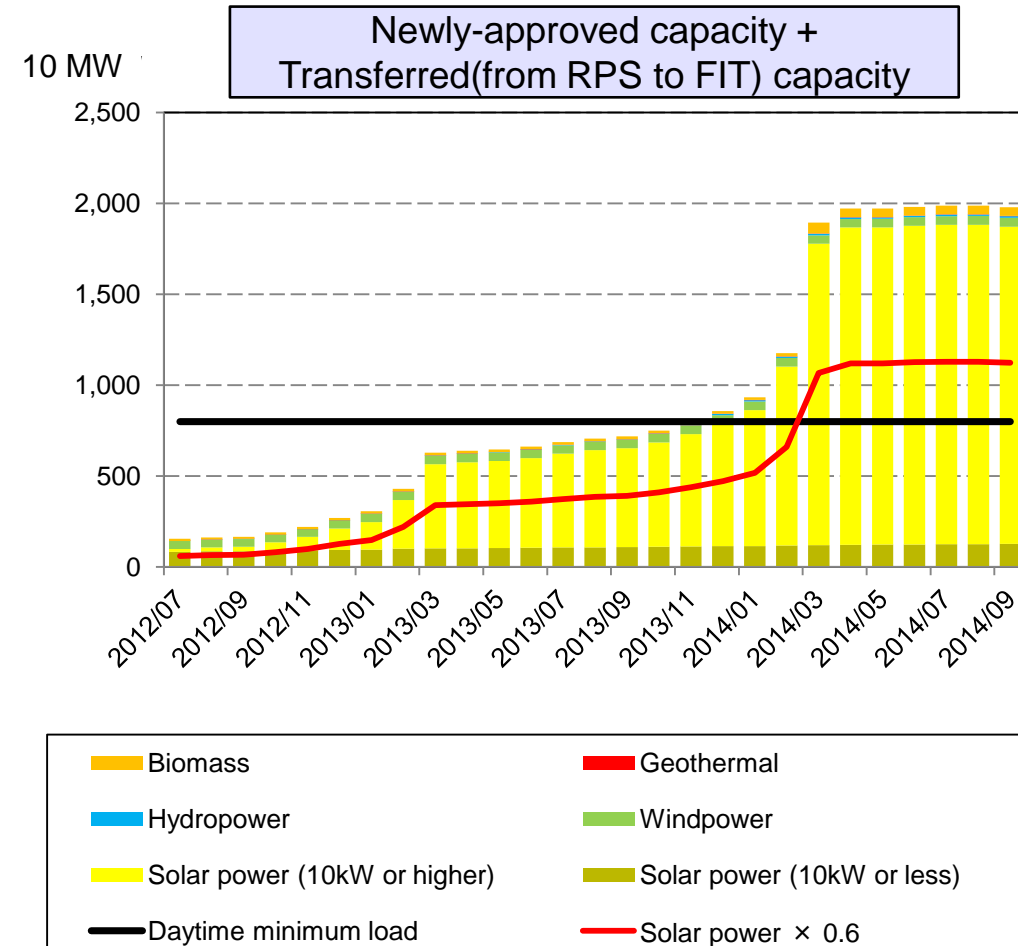


## 2. Energy feed-in tariff system

### (3) Changes in approved FIT capacity in the Kyushu Electric Power grid



A massive amount of last-minute approval applications were submitted before the purchase price change in March 2014.



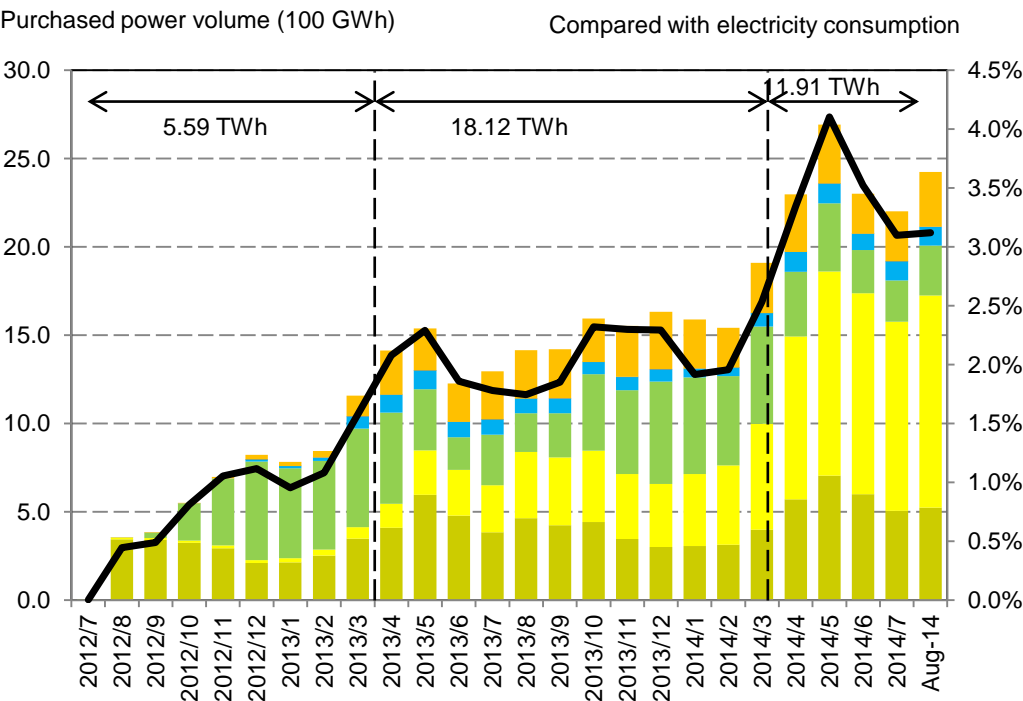
Source) Information disclosure website on Energy FIT system, Agency for Natural Resources and Energy

## 2. Energy feed-in tariff system

### (4) Changes in FIT purchase power volume and price

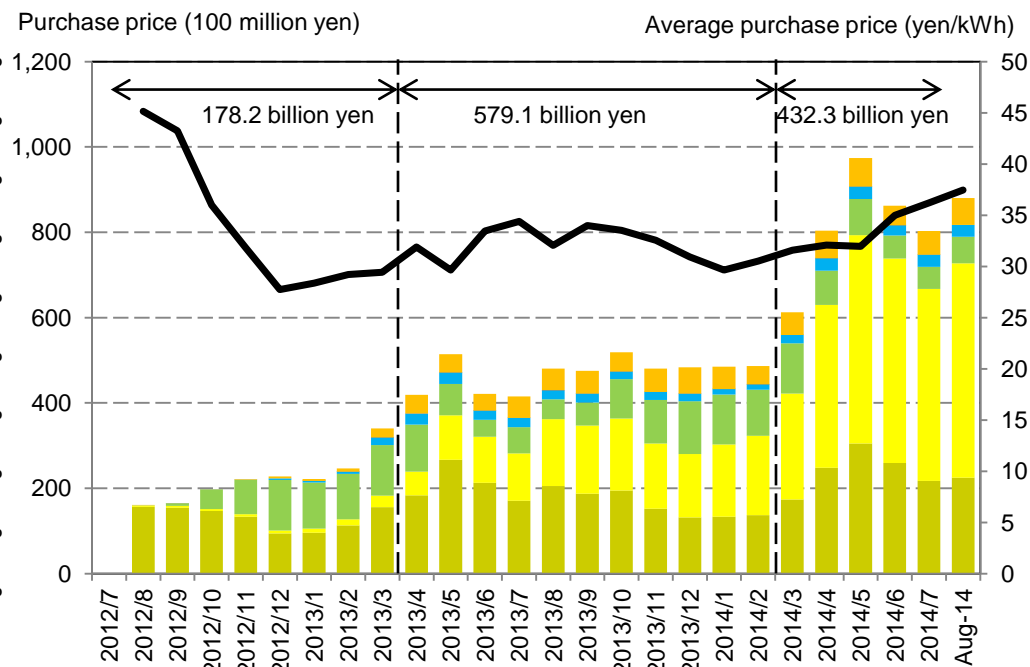
Following the start of the new program, FIT-purchased power drastically increased. The total purchase price in fiscal 2013 was 579.1 billion yen, with a projected total for 2014 that is almost certainly to exceed 1 trillion yen.

#### Changes in FIT-purchase power volume



- Biomass power generation
- Geothermal power generation facility
- Hydropower generation facility
- Windpower generation facility
- Solar power generation (10kW or higher)
- Solar power generation (10kW or less)
- Compared with the electricity consumption

#### Changes in FIT-purchase power price



- Biomass power generation
- Geothermal power generation facility
- Hydropower generation facility
- Windpower generation facility
- Solar power generation (10kW or higher)
- Solar power generation (10kW or less)
- Average purchase price

# 3. Future Work

## (1) Immediate challenges related to an energy FIT system

### [Future challenges]

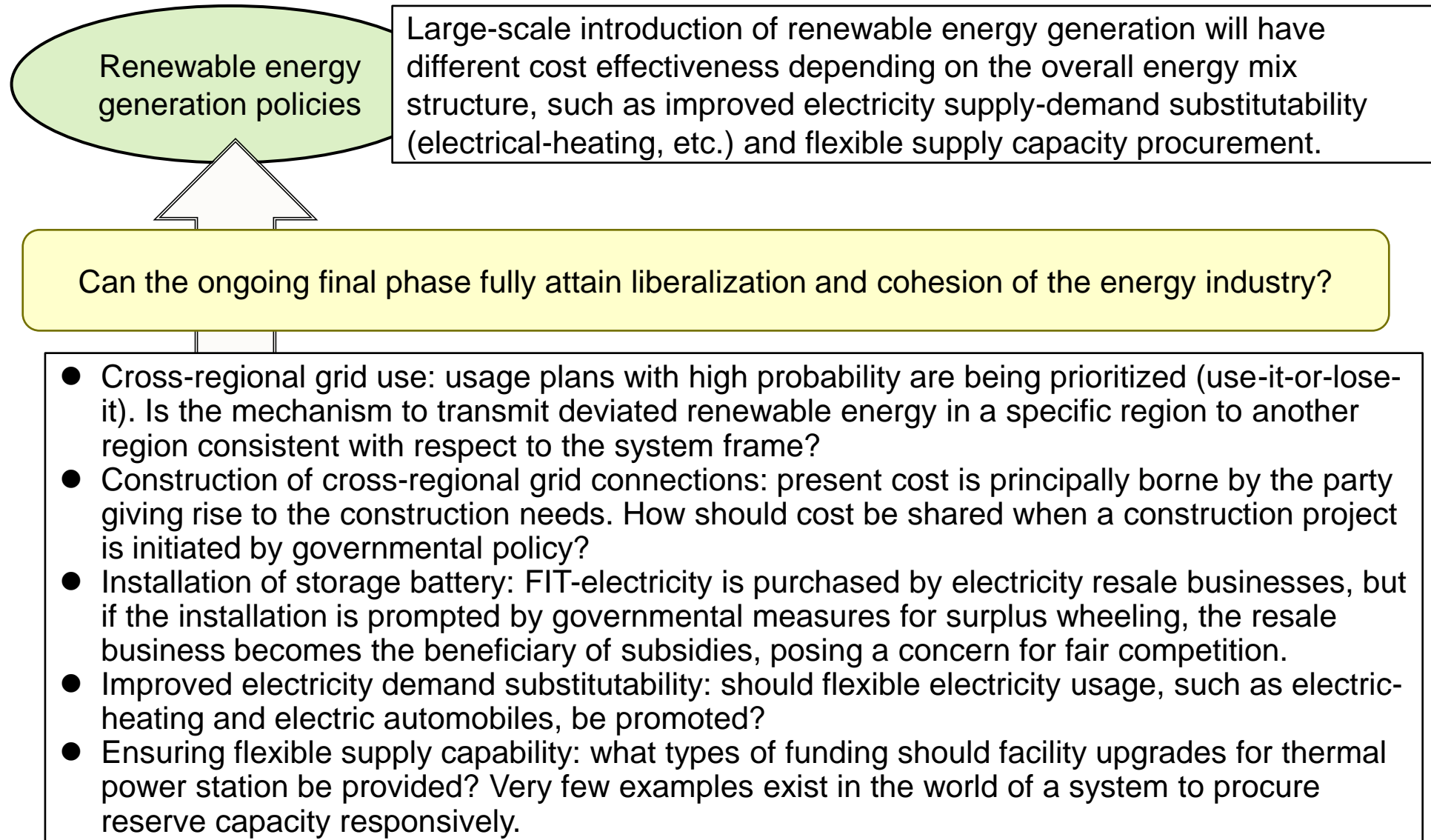
- Verification of renewable energy power generation connectible volume (WG on Grid Connection of Renewable Energy)
- Positioning a FIT-power source in the electric system reform (WG on System Design)
- FIT system operation review (New and Renewable Energy Subcommittee)
- Best mix search for 2030 (connectible volume + additional measures) (Strategic Policy Committee)

New and Renewable Energy Subcommittee	WG on Grid Connection of Renewable Energy	WG on System Design
<ul style="list-style-type: none"> <li>• Improving FIT system operation</li> <li>• Bidding system adopted for enhancing electricity transmission/distribution facilities</li> <li>• Understanding procurement and avoidable costs</li> <li>• Promotional policy based on each renewable energy feature</li> </ul>	<ul style="list-style-type: none"> <li>• Basic concept in calculating connectible volume (short-term)</li> <li>• Basic concept in calculating connectible volume (mid-to-long term)</li> </ul>	<ul style="list-style-type: none"> <li>• Special provisions in the transition to an electricity balancing program with full liberalization of the electricity retail market</li> <li>• Review of reserve capacity with an expanding FIT power source</li> </ul>
<ul style="list-style-type: none"> <li>• Suppression/control of output (advancement)</li> <li>• Cross-regional grid connection use</li> </ul>		

- \* Best cost sharing methods and priority on enforcing upper-connection for cross-regional grid links and applying cross-regional grid connection, should be discussed.

### 3. Future Work

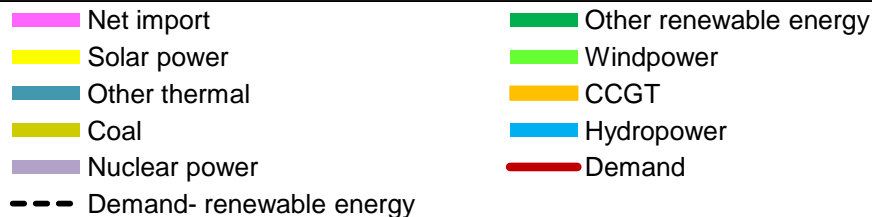
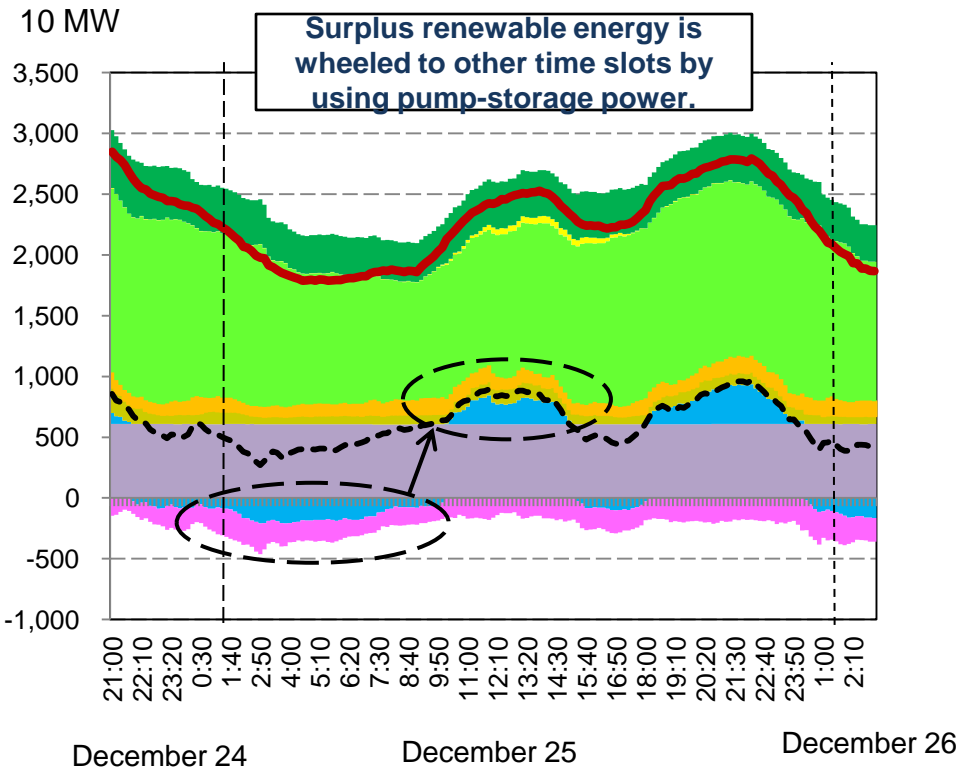
#### (2) Remaining issues



\* While time limitations exist due to meeting the climate change target, thorough discussions must be conducted.

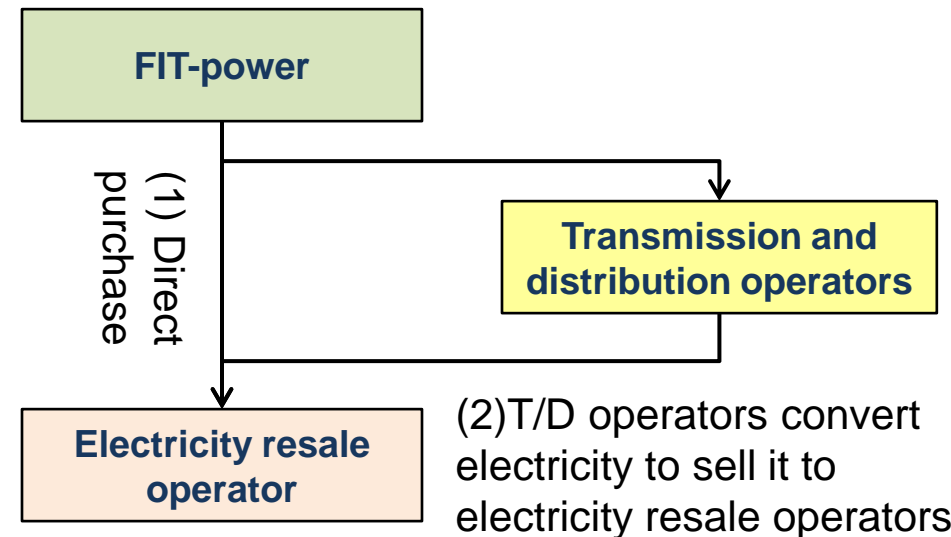
# [Reference] Surplus wheeling of FIT electricity

Supply-demand operation in Spain on December 25, 2013



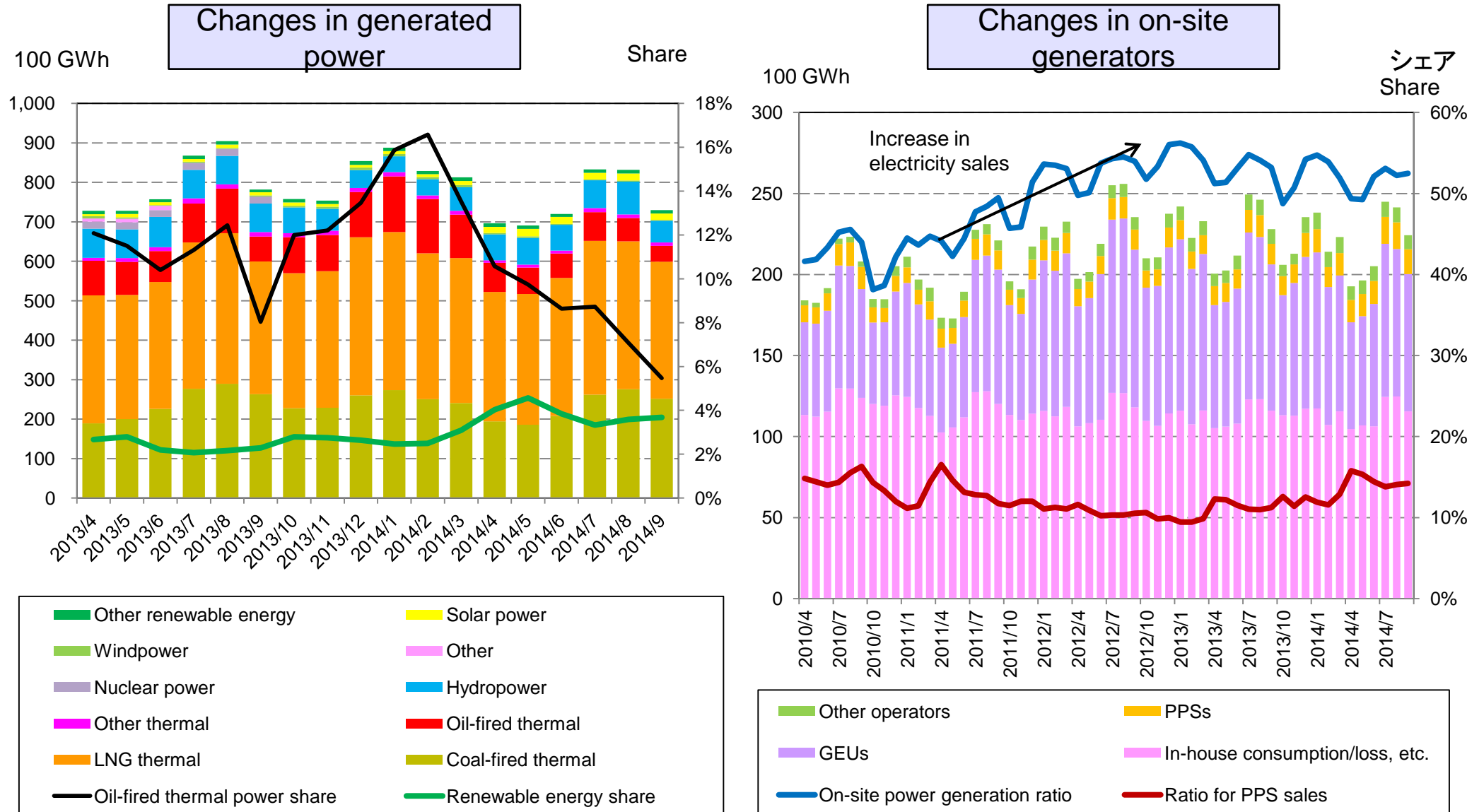
As solar power generation expands, surplus supply may restrict FIT-power introduction especially during the low-load period, such as GW. While energy storage, such as pump-storage power generation and storage batteries, are often viewed as a promising solution, in terms of electricity system reform, care has to be taken since the electricity resale business may heavily represent such operations.

FIT power purchase methods in Japan



Source) REE

# [Reference] Generated power/on-site generation

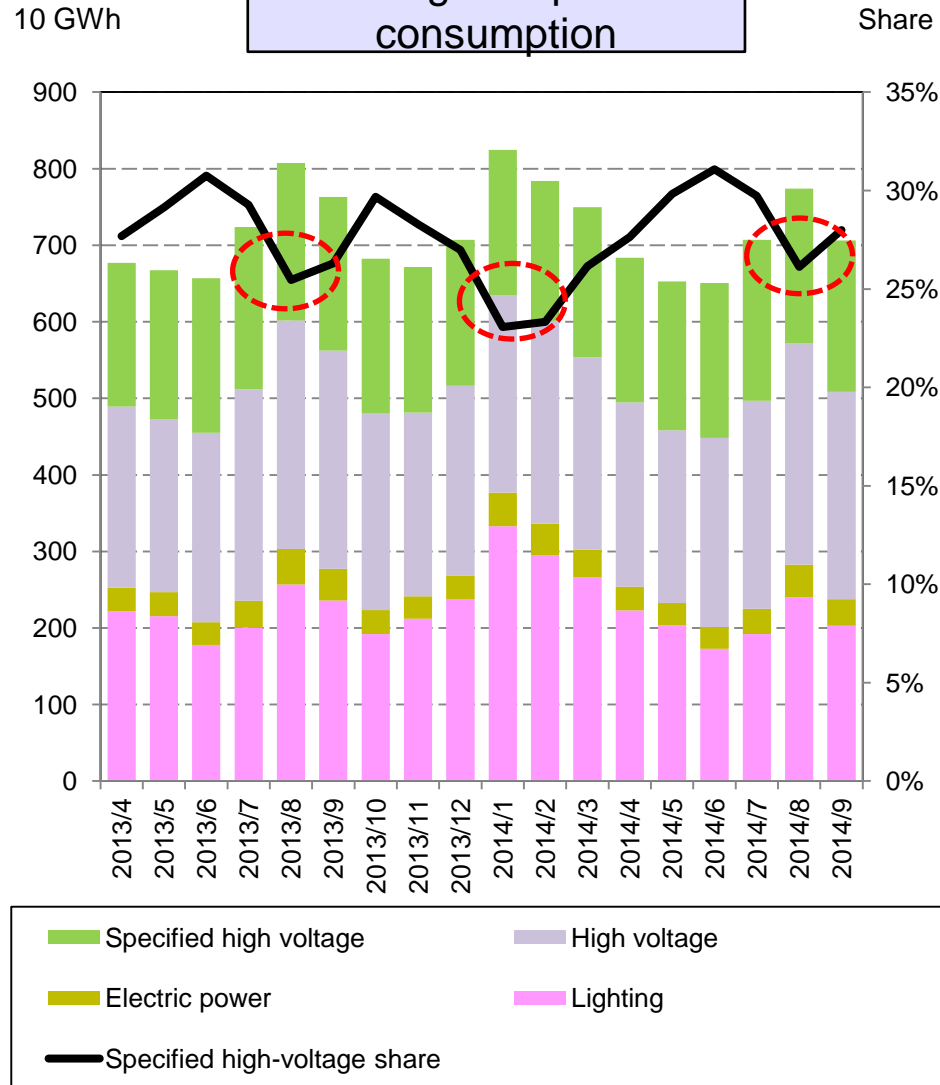


Source) compiled based on *Electric Power Investigation Statistics*, Agency for Natural Resources and Energy



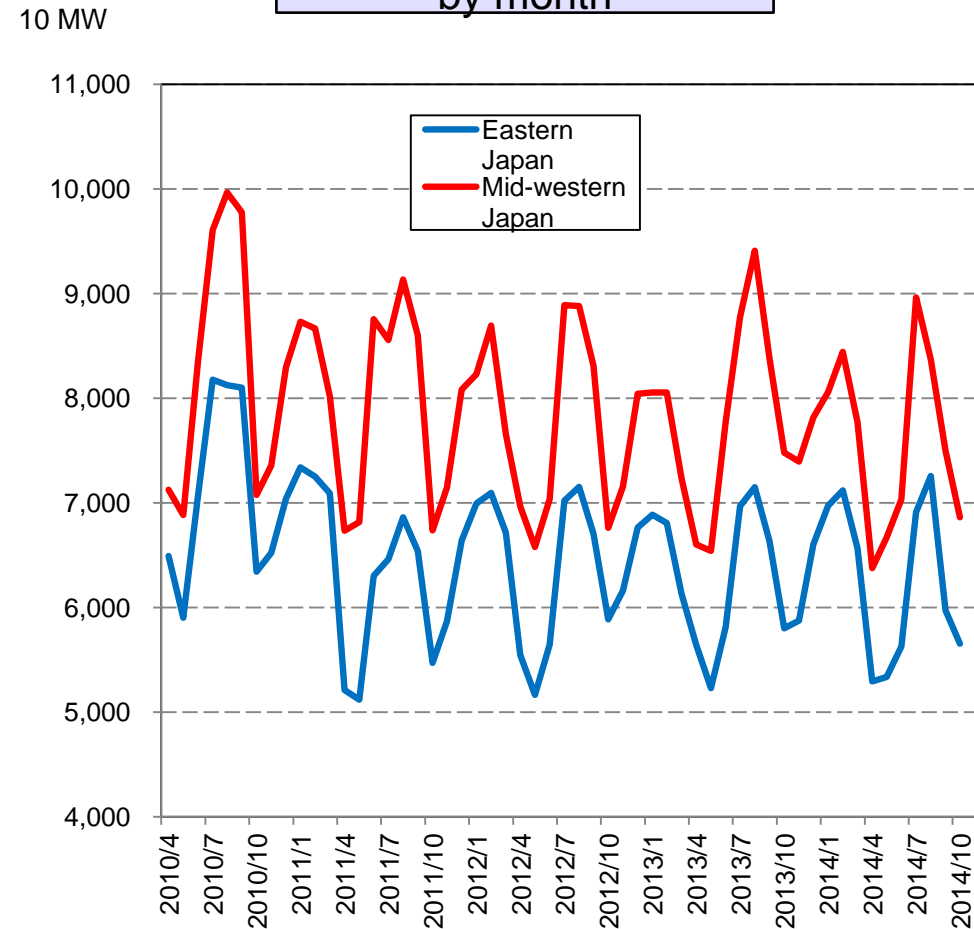
# [Reference] Power consumption/Max power

## Changes in power consumption



Source) compiled based on *Electric Power Investigation Statistics*, Agency for Natural Resources and Energy

## Changes in max power by month

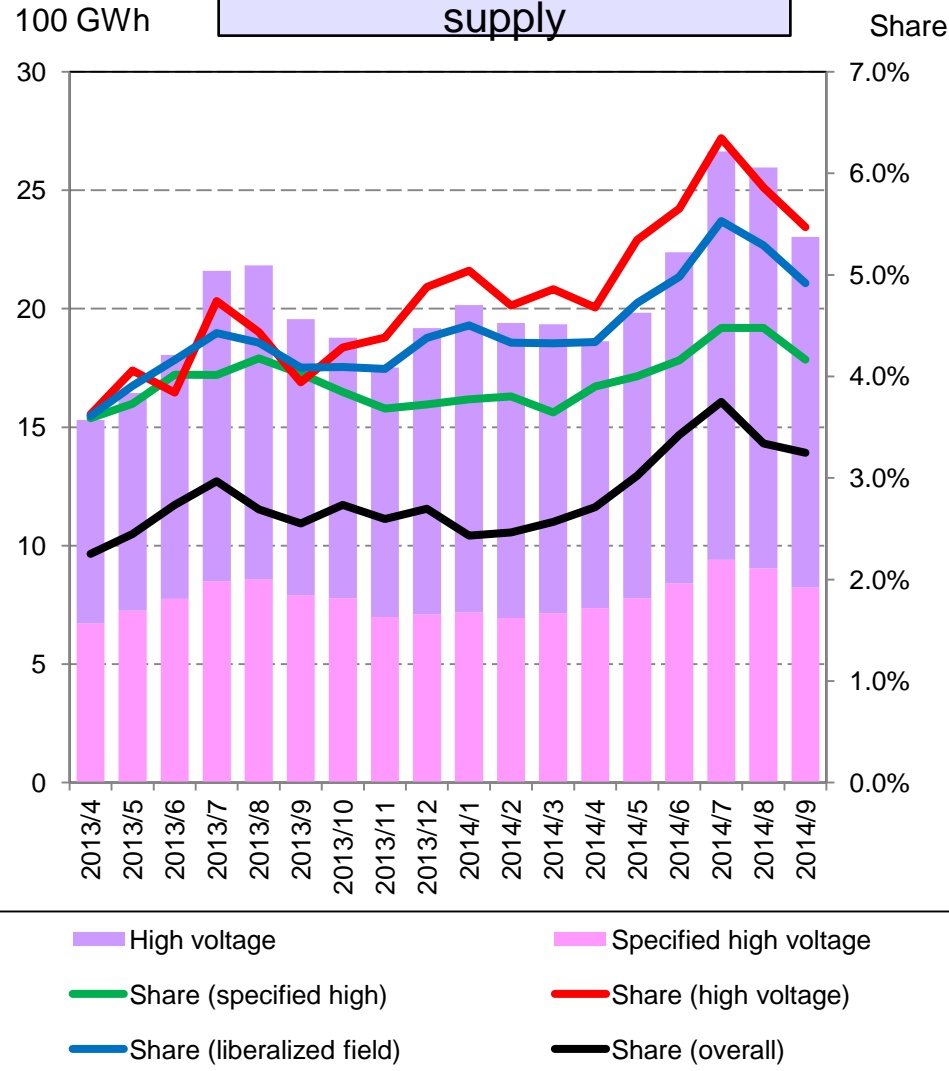


Note) Maximum monthly figure from the total daily max power from companies

Source) compiled based on *Electricity Supply-Demand Review*, Electric Power System Council of Japan

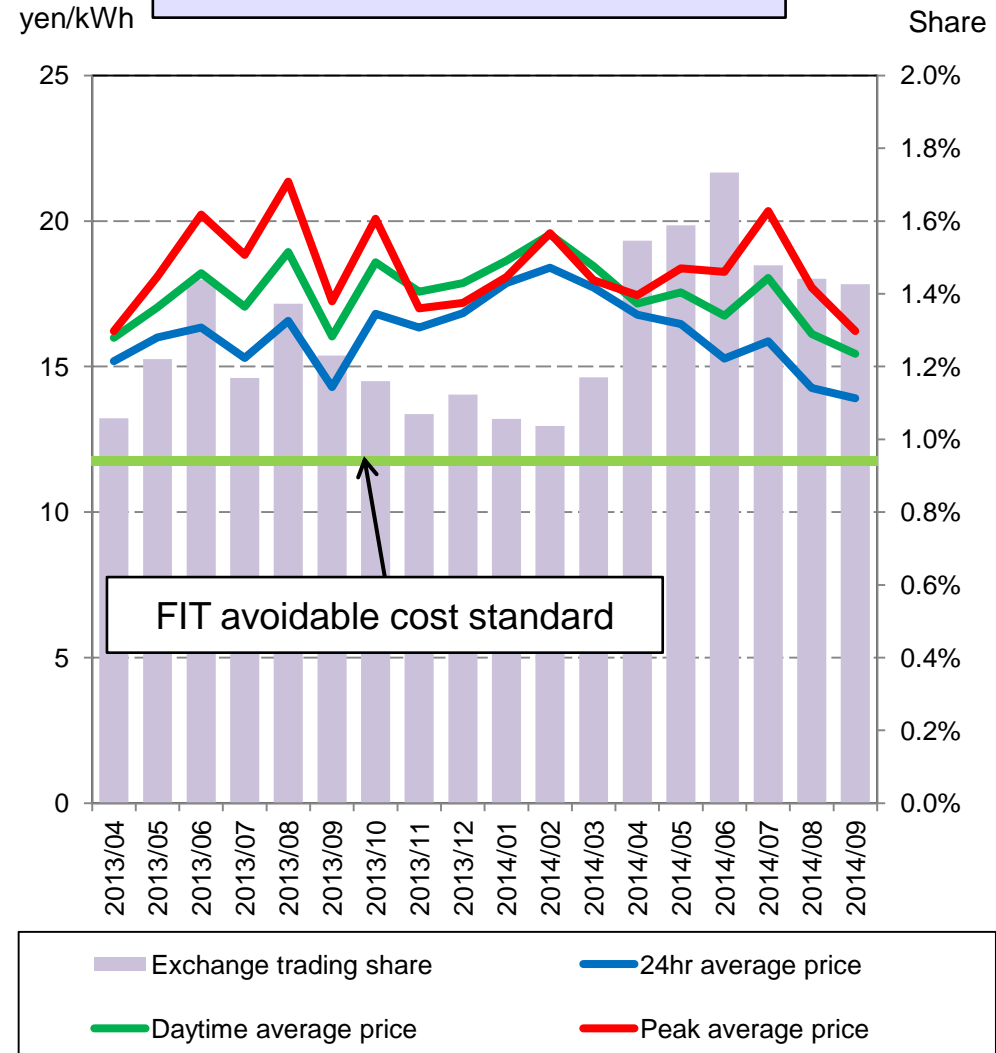
# [Reference] PPS/Spot trading

## Changes in PPS power supply



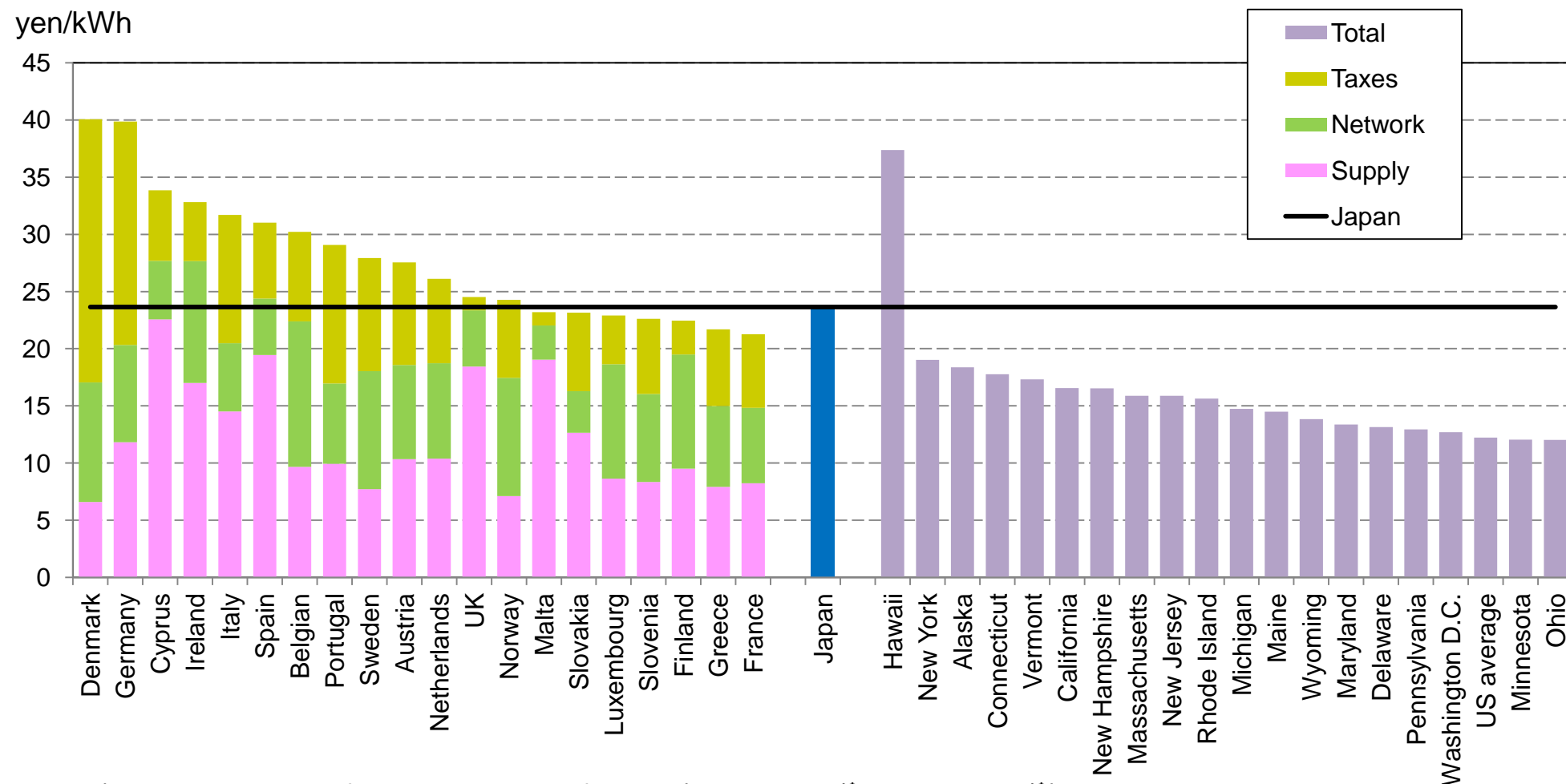
Source) compiled based on *Electric Power Investigation Statistics*, Agency for Natural Resources and Energy

## Changes in spot trading price



Source) Japan Electric Power Exchange (JEPX)

# [Reference] Japan/US/Europe electricity price comparison (2013)



Note 1) exchange rate of December 2013 figures (101.02 yen/\$, 136.46 yen/\$)

Note 2) European taxes include renewable energy generation fees

Source) Eurostat (power consumption 2,500kWh to 5,000kWh) in Europe, EIA "Electric Power Annual" (average electric fee income) in US, and IEA "Energy Prices and Taxes" in Japan.