

The Electric Power System

- Japan -



Basic facts

- ❑ Area: 377,962km² (source:MIC)
- ❑ Population: 127million(2015/3) (source:MIC)
- ❑ Number of electricity consumers: approx. 77million
(source:FEPC)
- ❑ Number of T&DSOs: 10
(TSO and DSO are integrated per electric power company)
- ❑ Peak load: 159GW(FY2013) (source:FEPC)
- ❑ Average interruption of electricity: 16min(FY2013)
(per customer The influences due to natural disaster such as typhoon are included. source:FEPC)

MIC: Ministry of Internal affairs and Communications
FEPC: The Federation of Electric Power Companies of Japan



Global map of interconnections

- No interconnection to any other countries (Island country)



Grid facts and characteristics

- The electricity grid in Japan is sub-divided into transmission grids(basically higher than medium voltage) and distribution grids(basically 6.6kV and lower).

	Voltage Level	Total Length(approx.)	Responsibility
Transmission Grid	500kV	7,900km	TSO
Transmission Grid	187kV,220kV,275kV	13,500km	TSO
High Voltage	66kV to 154kV	62,000km	TSO
Medium Voltage	6.6kV to 66kV	19,300km	TSO (Partially DSO)
Medium Voltage	6.6kV	734,000km	DSO
Low Voltage	100 or 200V	573,000km	DSO

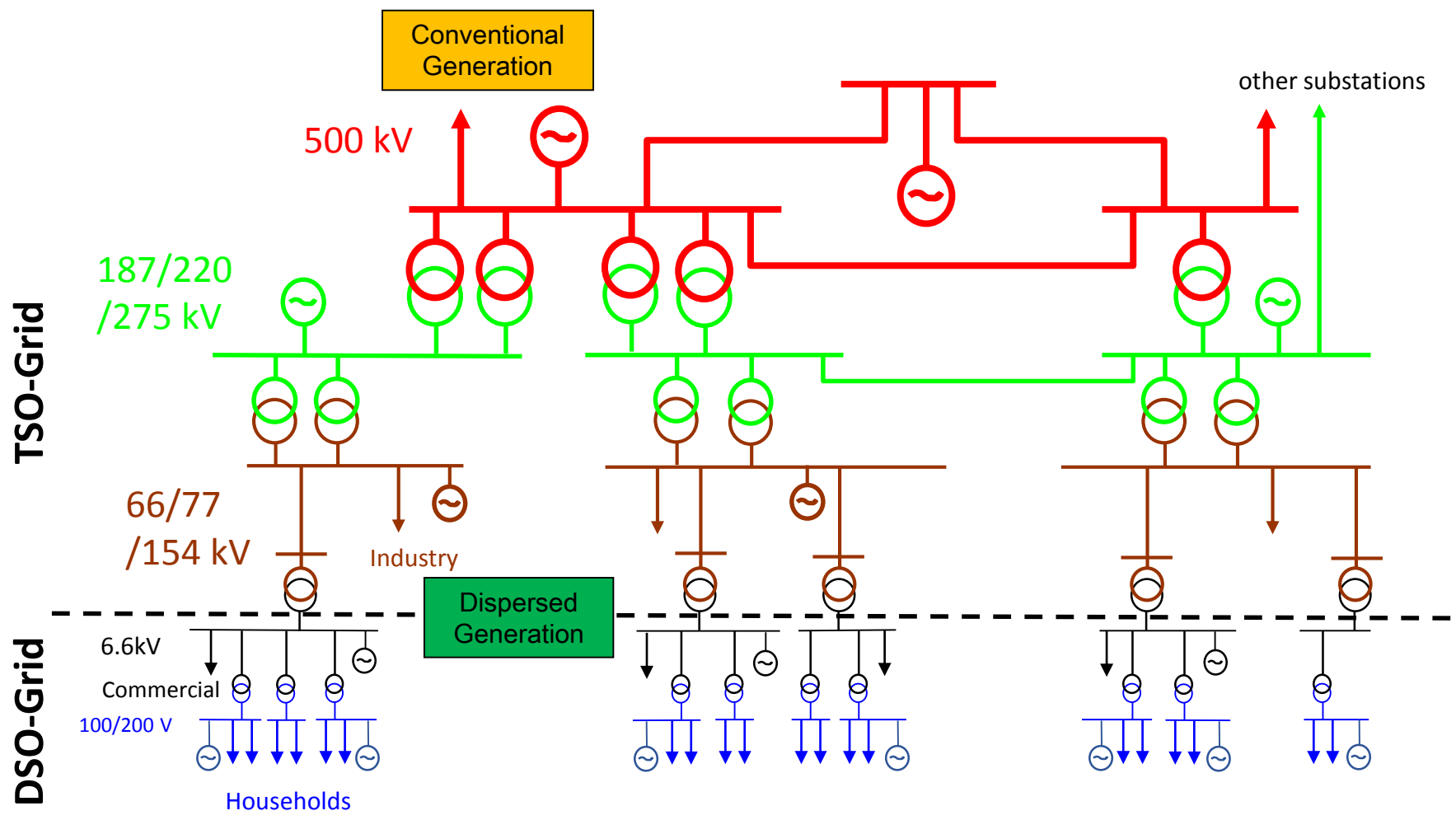
(source:FEPC)





Structure of electrical power system

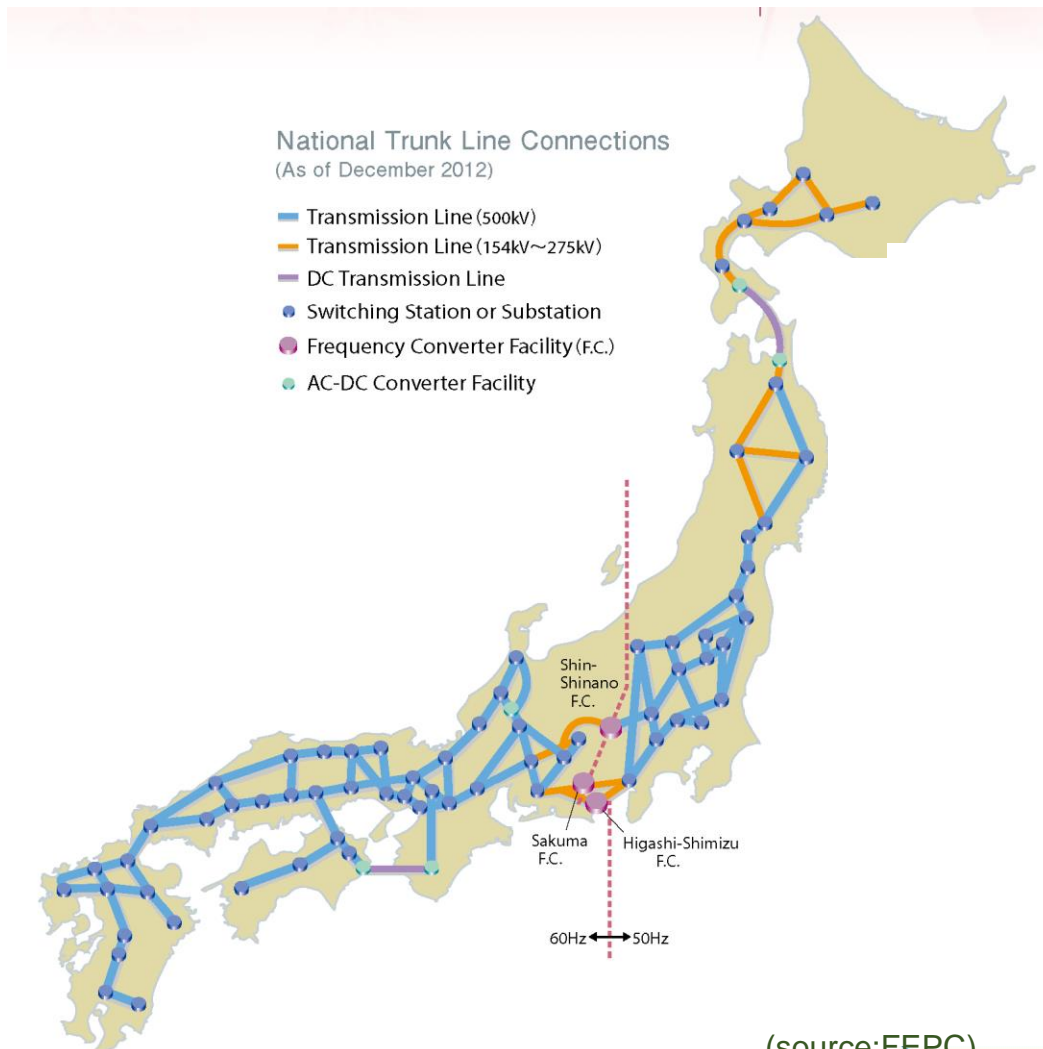
Trunk(EHV) system: Loop, Sub-transmission(HV,MV): Radial



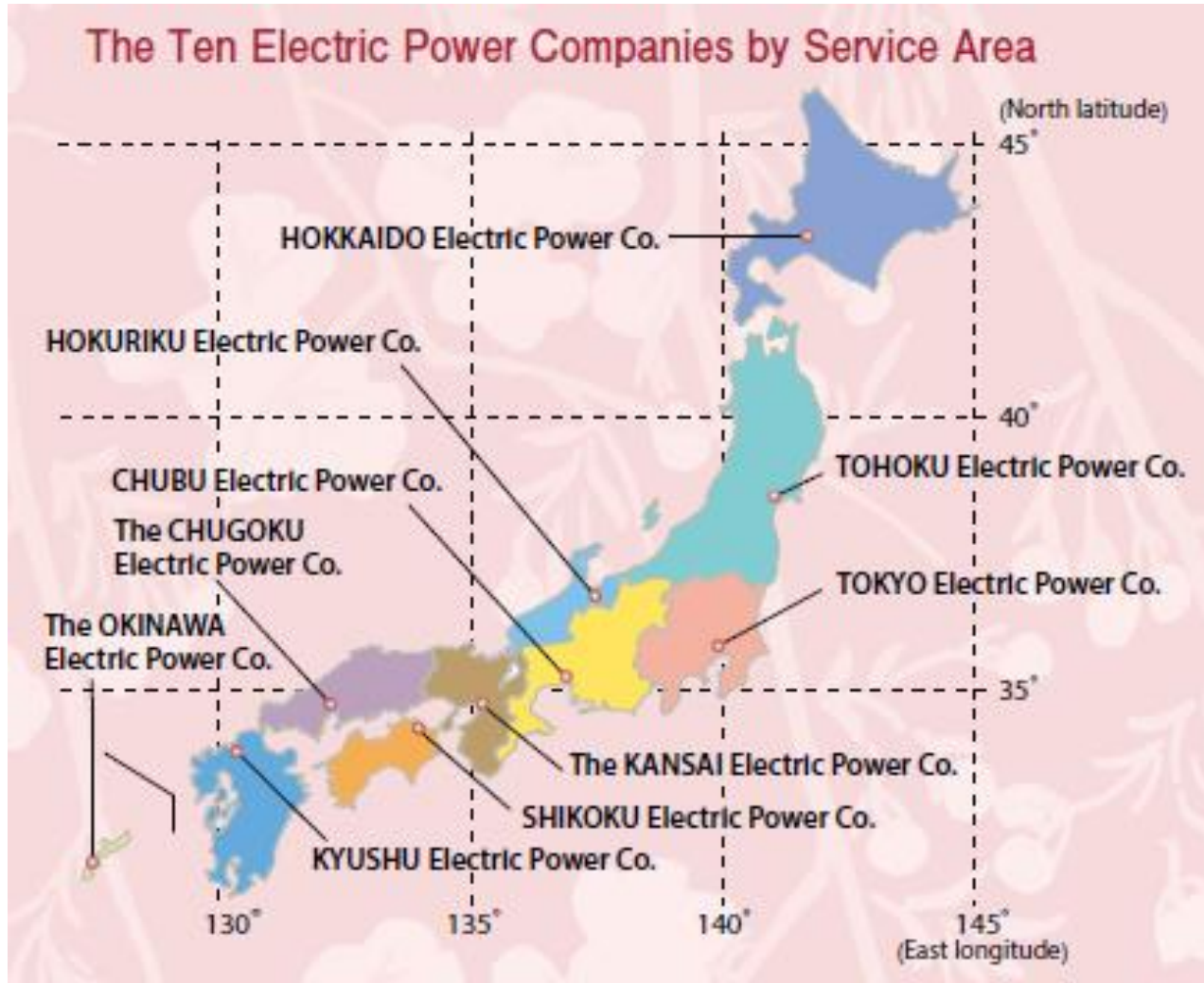
Map of the extra high voltage grid

2 Frequencies

- 50Hz at Eastern
- 60Hz at Western
- DC linked interconnections by Frequency Converter



Map on 10 Japanese TSOs



(source:FEPC)



Information on 10 Japanese TSOs

TSOs	Network Length [km](500kV)	Network Length [km](187-275kV)	Served area[km ²]	Annual Transmitted Energy[TWh]	Shared load[%]
Hokkaido	0	2,450	78,400	31	4
Tohoku	552	2,173	79,500	77	9
Tokyo	2,493	1,611	39,500	267	31
Chubu	890	1,511	40,300	127	15
Hokuriku	234	241	12,600	28	3
Kansai	1,682	1,854	27,300	140	17
Chugoku	828	1,006	31,900	59	7
Shikoku	279	983	18,800	27	3
Kyushu	942	1,708	42,200	84	10
Okinawa	0	0	2,300	7	1

(source:FEPC)





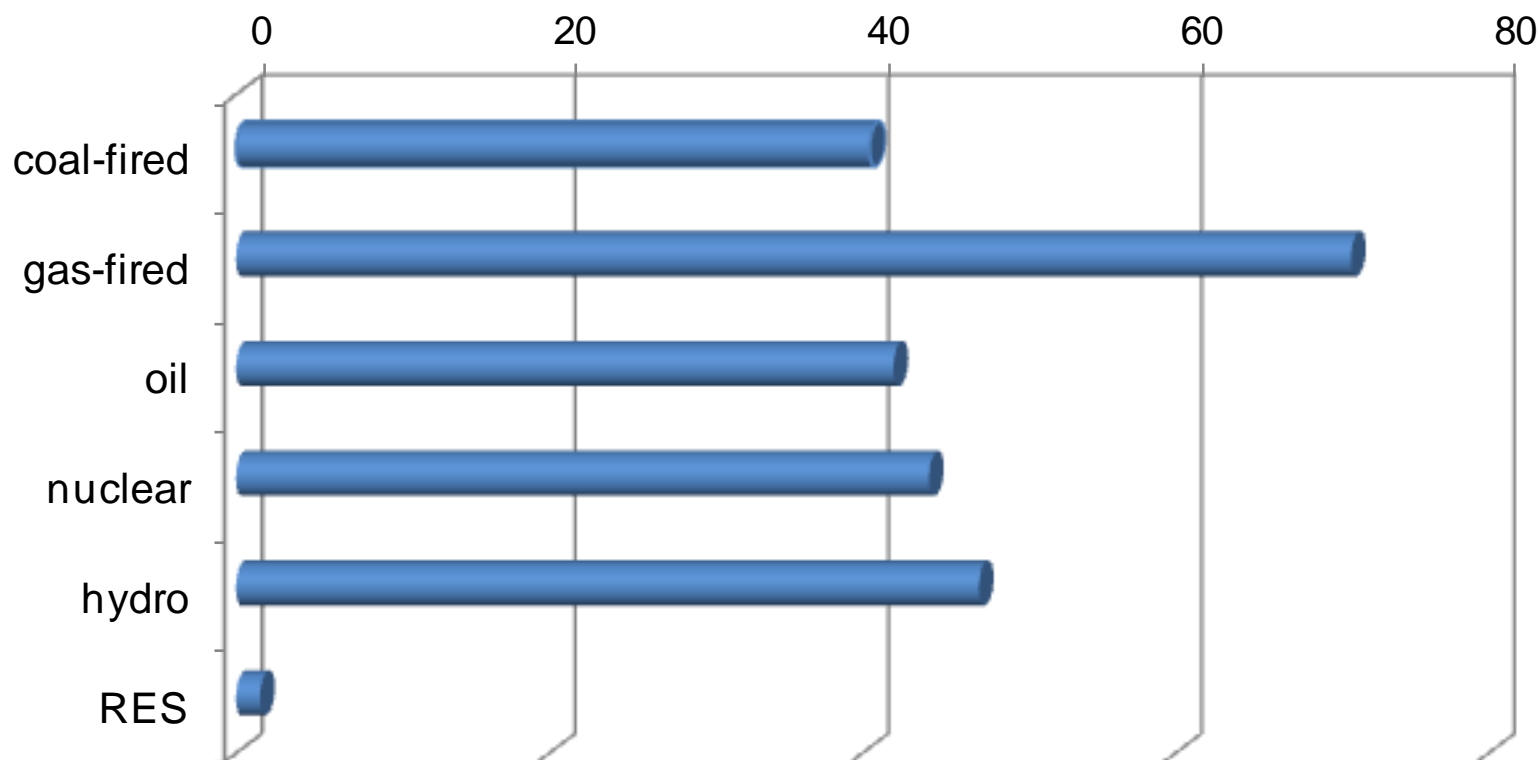
Japanese TSO's Web site

TSOs	Web site URL
Hokkaido	http://www.hepco.co.jp/english/index.html
Tohoku	http://www.tohoku-epco.co.jp/english/index.html
Tokyo	http://www.tepco.co.jp/en/index-e.html
Chubu	http://www.chuden.co.jp/english/index.html
Hokuriku	http://www.rikuden.co.jp/english/index.html
Kansai	http://www.kepco.co.jp/english/
Chugoku	http://www.energia.co.jp/e/index.html
Shikoku	http://www.yonden.co.jp/english/index.html
Kyushu	http://www.kyuden.co.jp/en_index.html
Okinawa	http://www.okiden.co.jp/english/index.html



Installed capacity with reference to primary resources

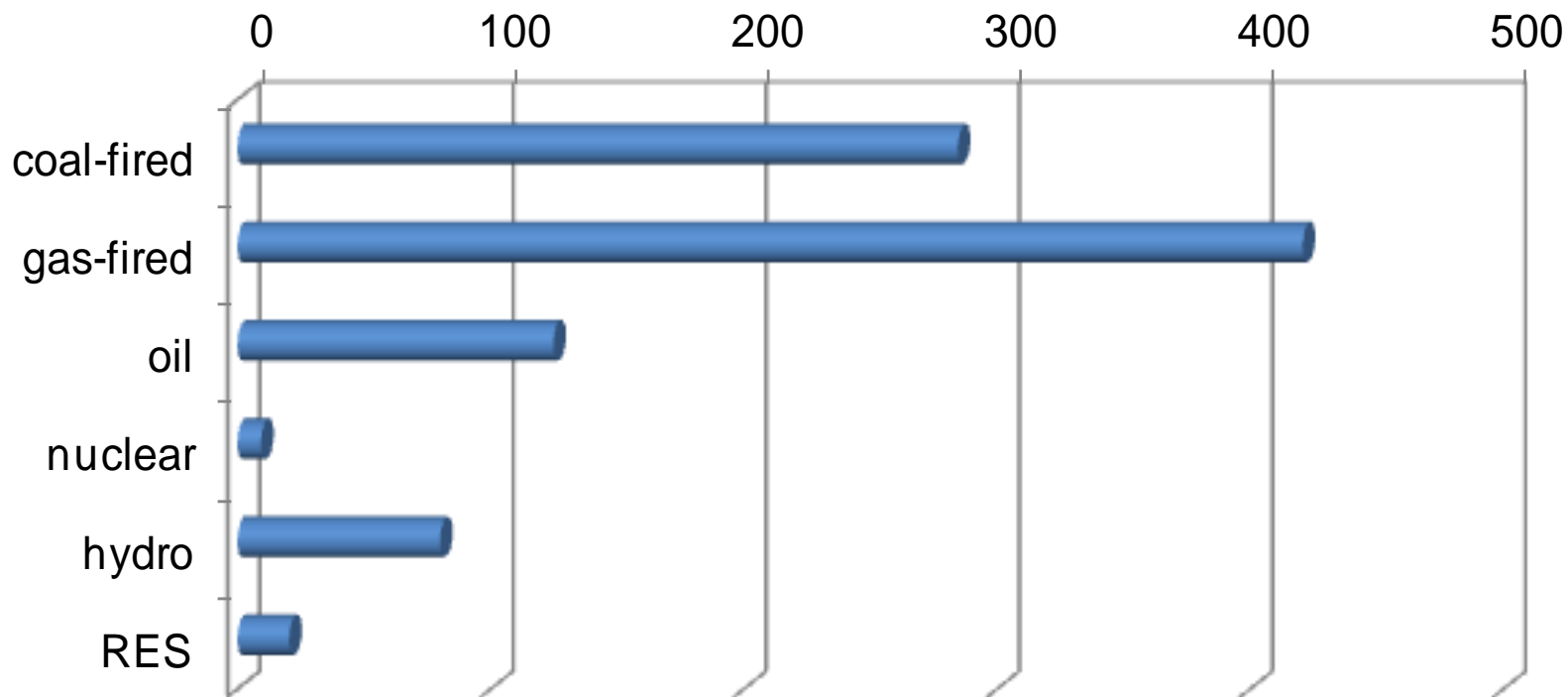
Installed capacities [GW] (FY2013)



(source:FEPC)

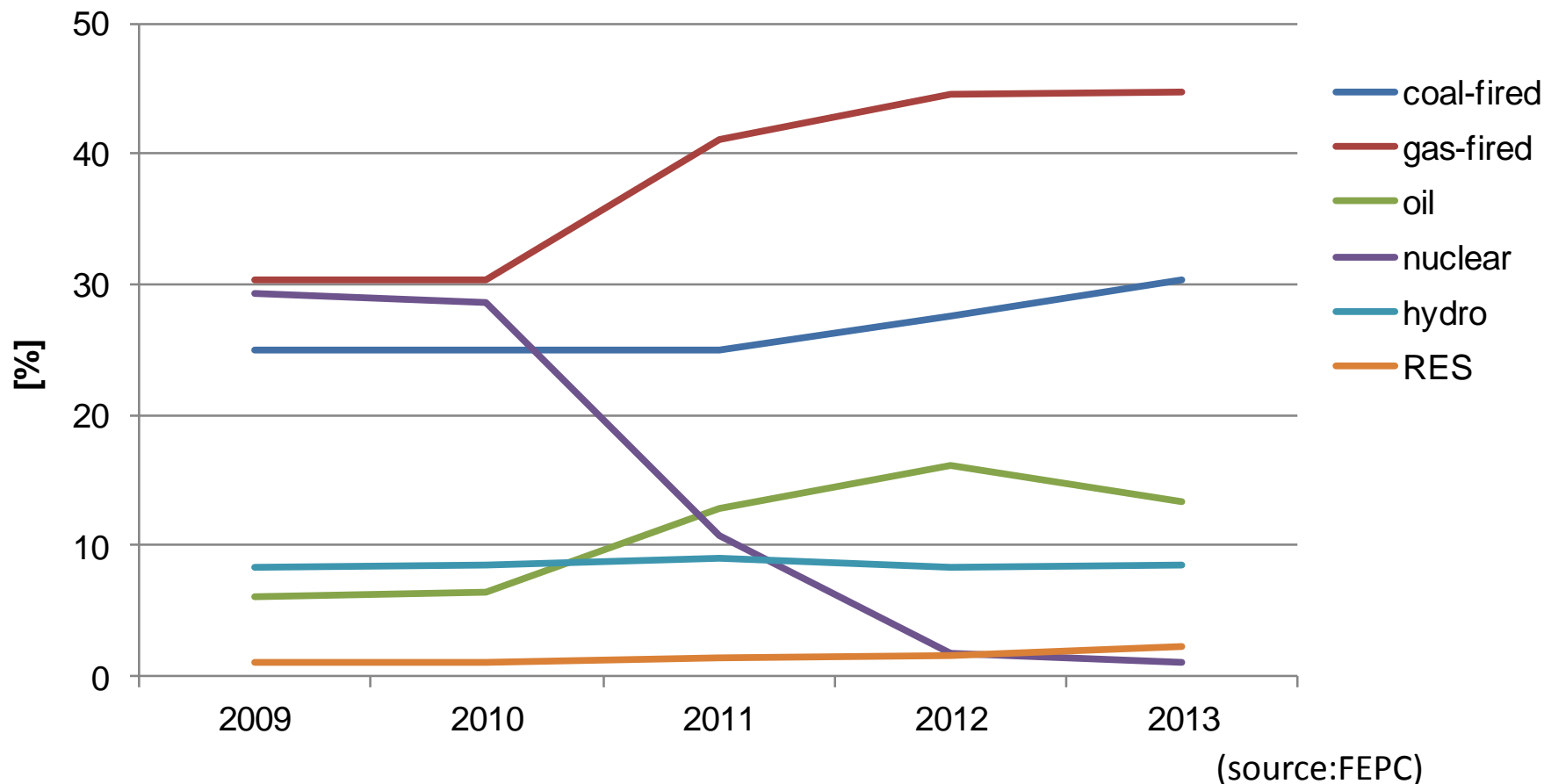
Energy production with reference to primary resources

Electricity Generation[TWh](FY2013)

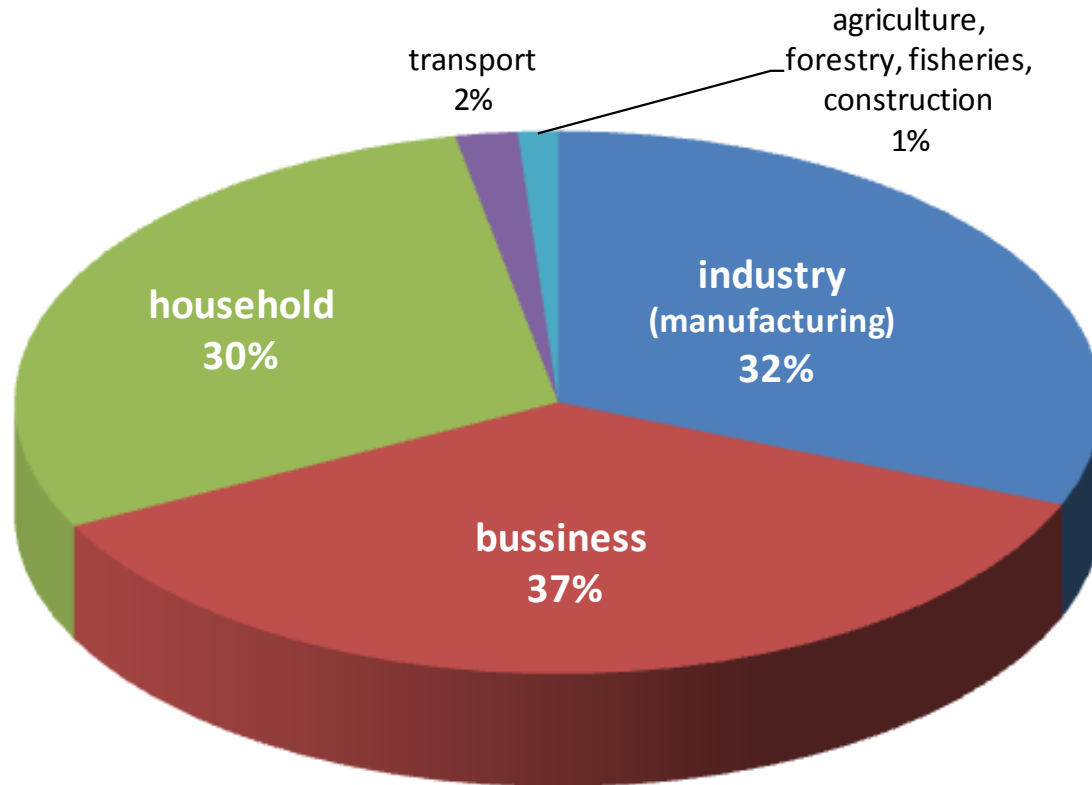


(source:FEPC)

Development of generation capacity since 2009



Consumption per customer groups (FY2013)



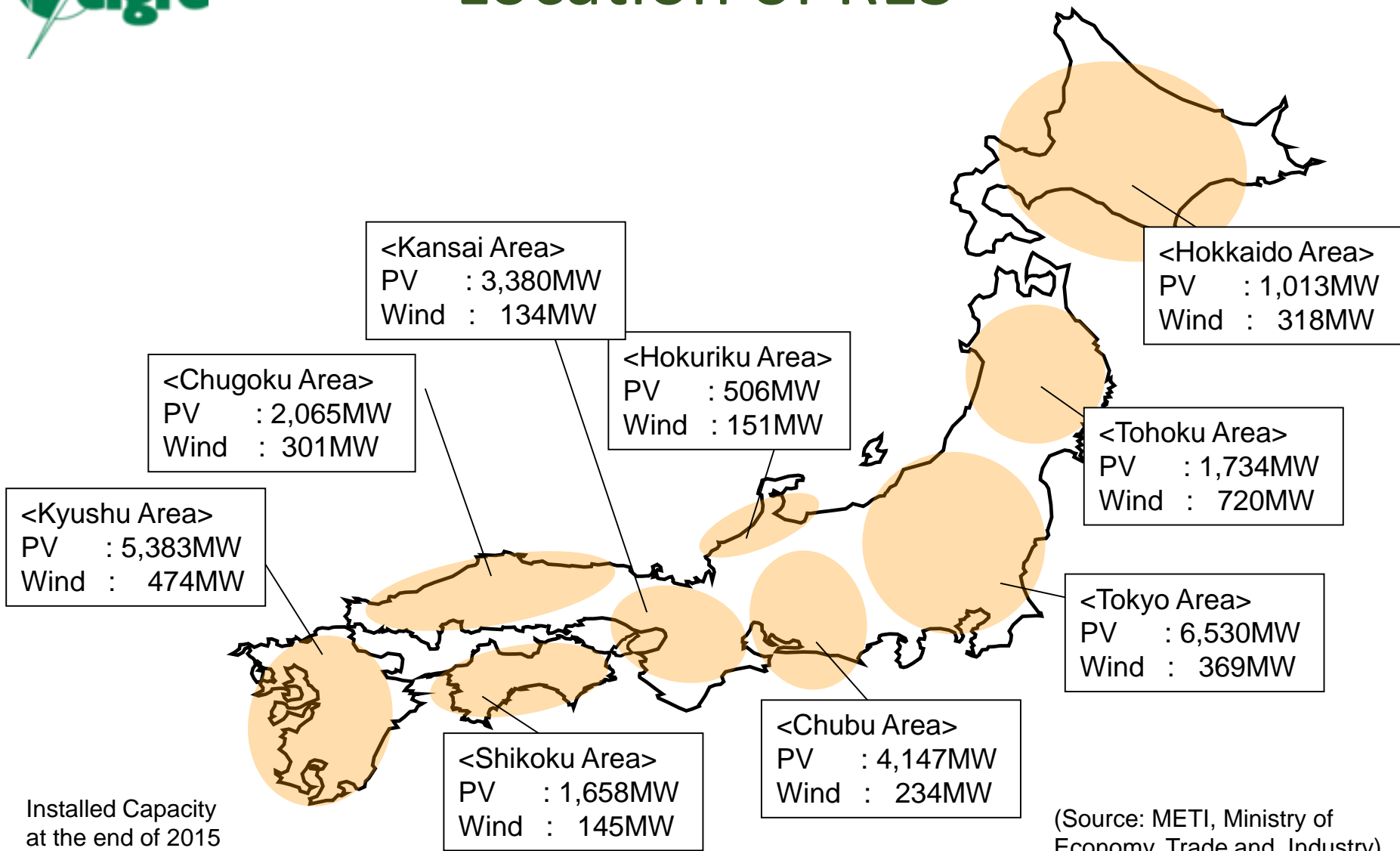
(source: Agency for Natural Resource and Energy, Japan)



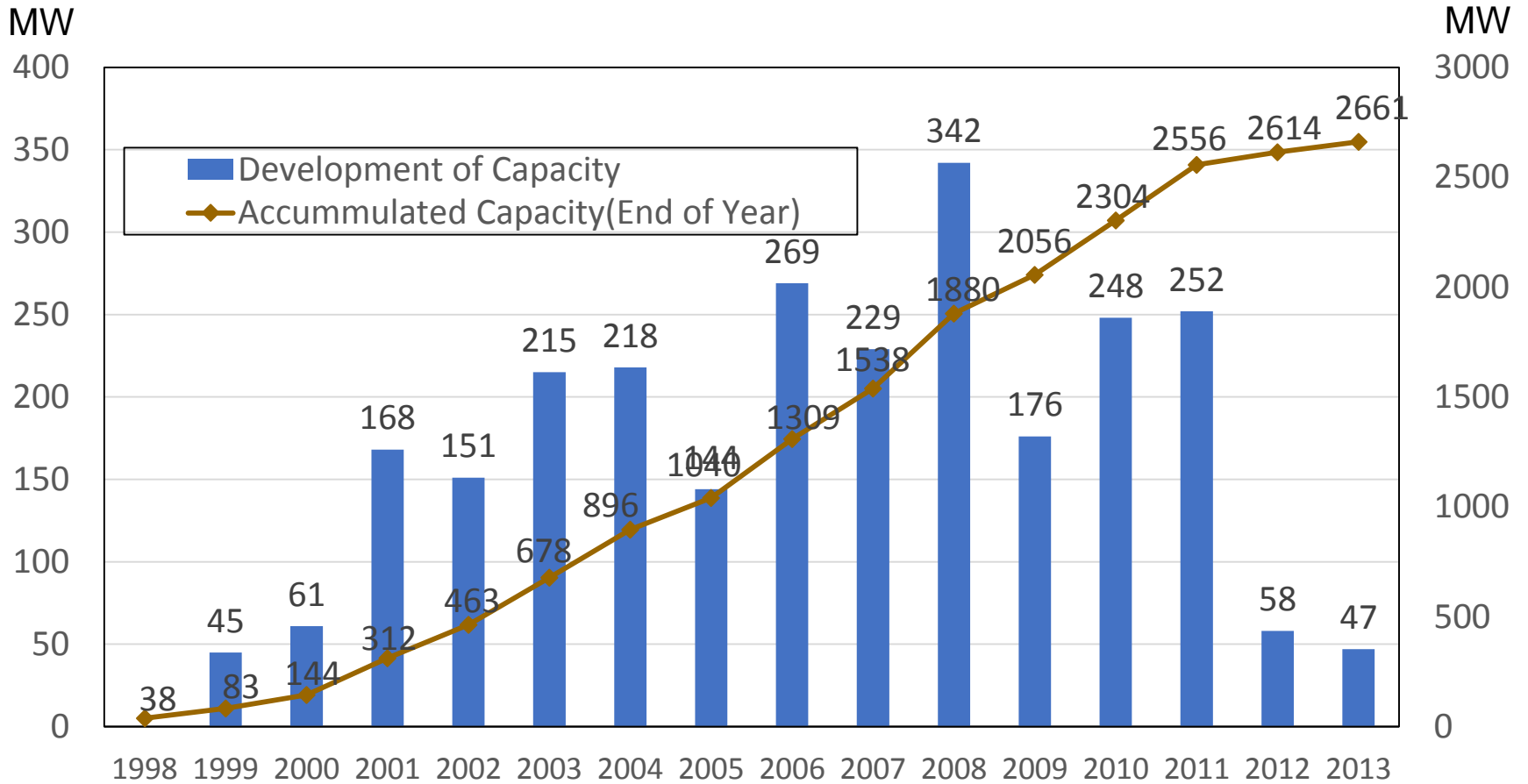
Renewables



Location of RES



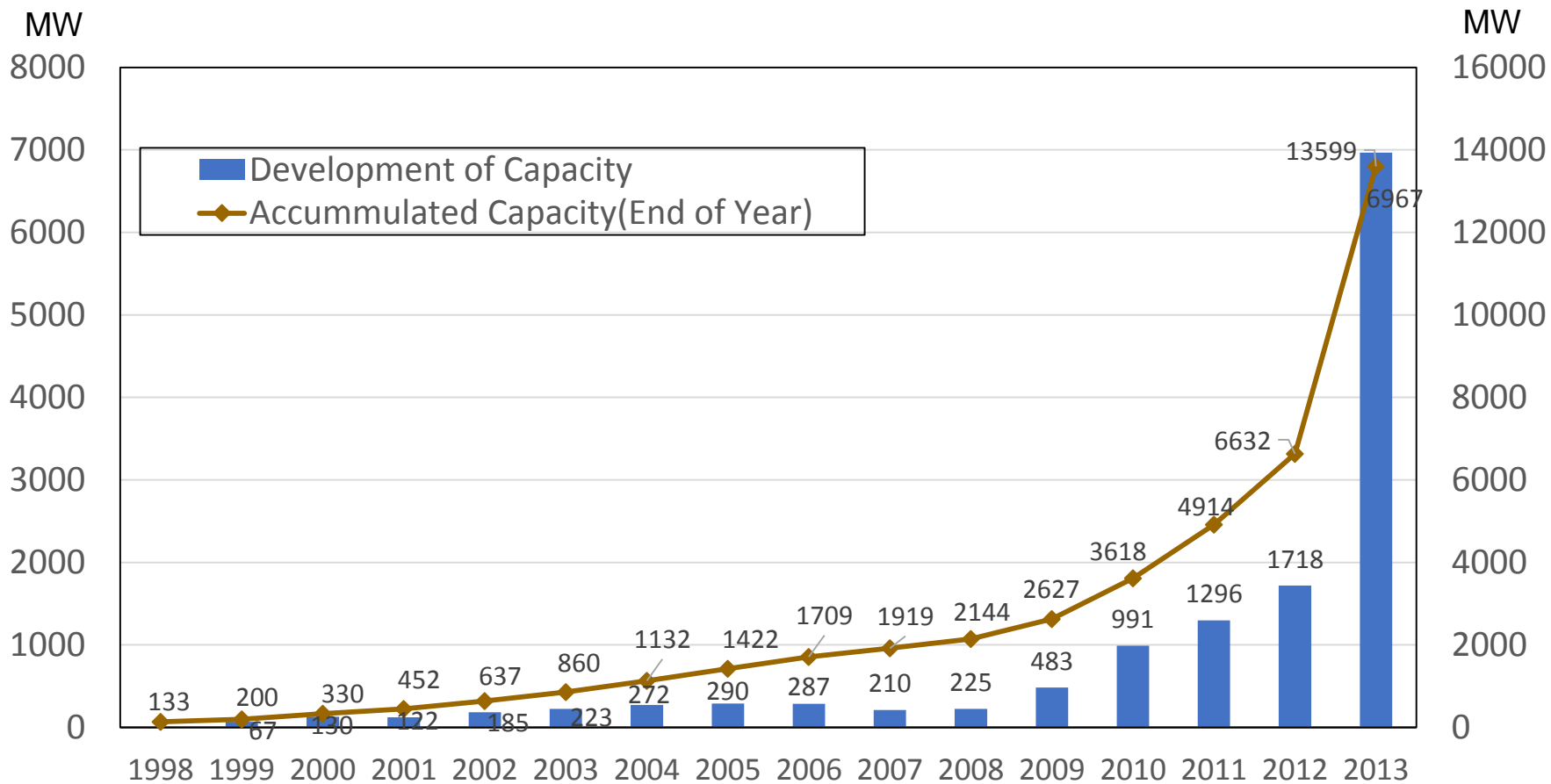
Development of wind power



(Source: FEPC)



Development of PV power



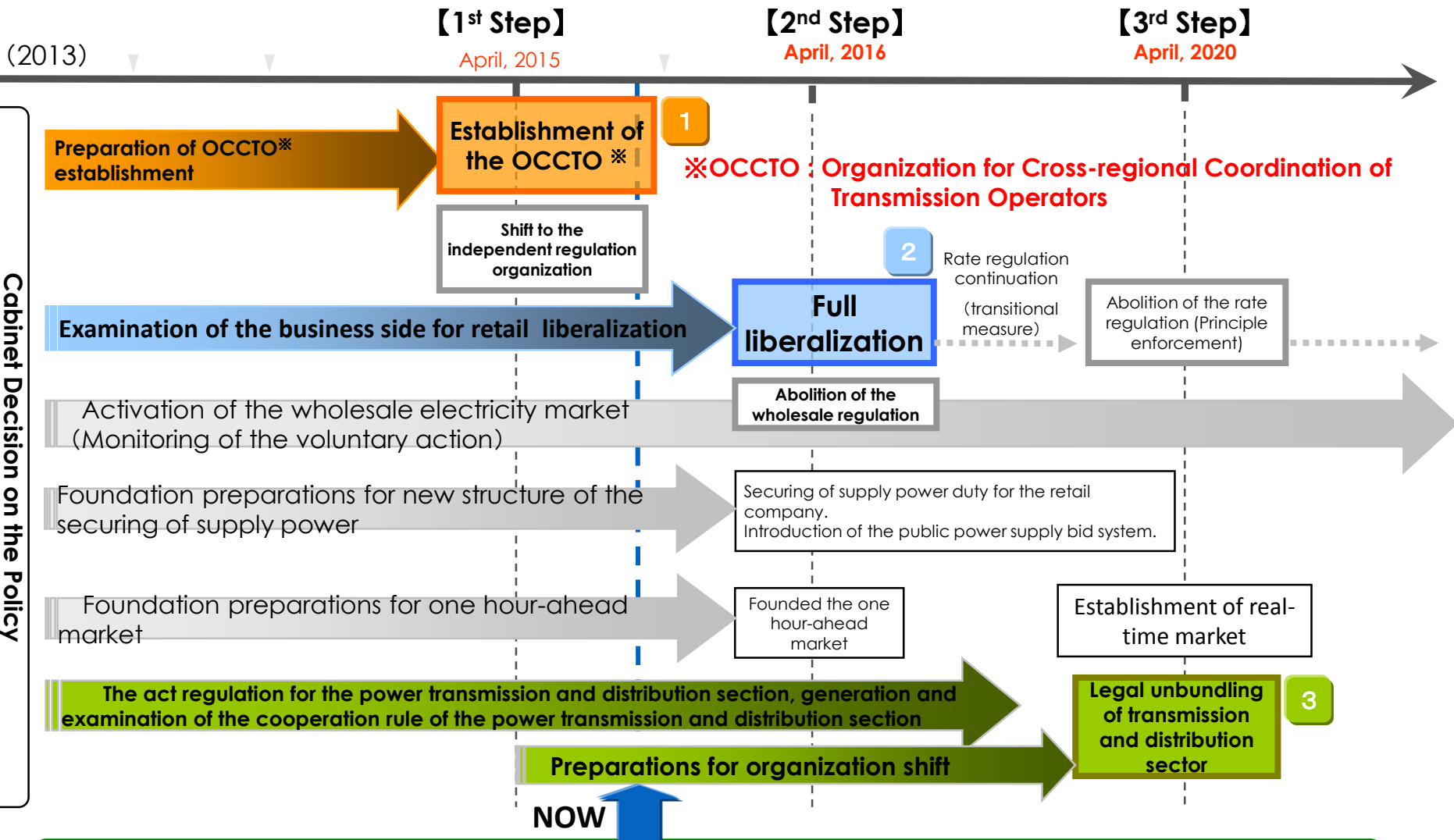
(Source: FEPC)



Market



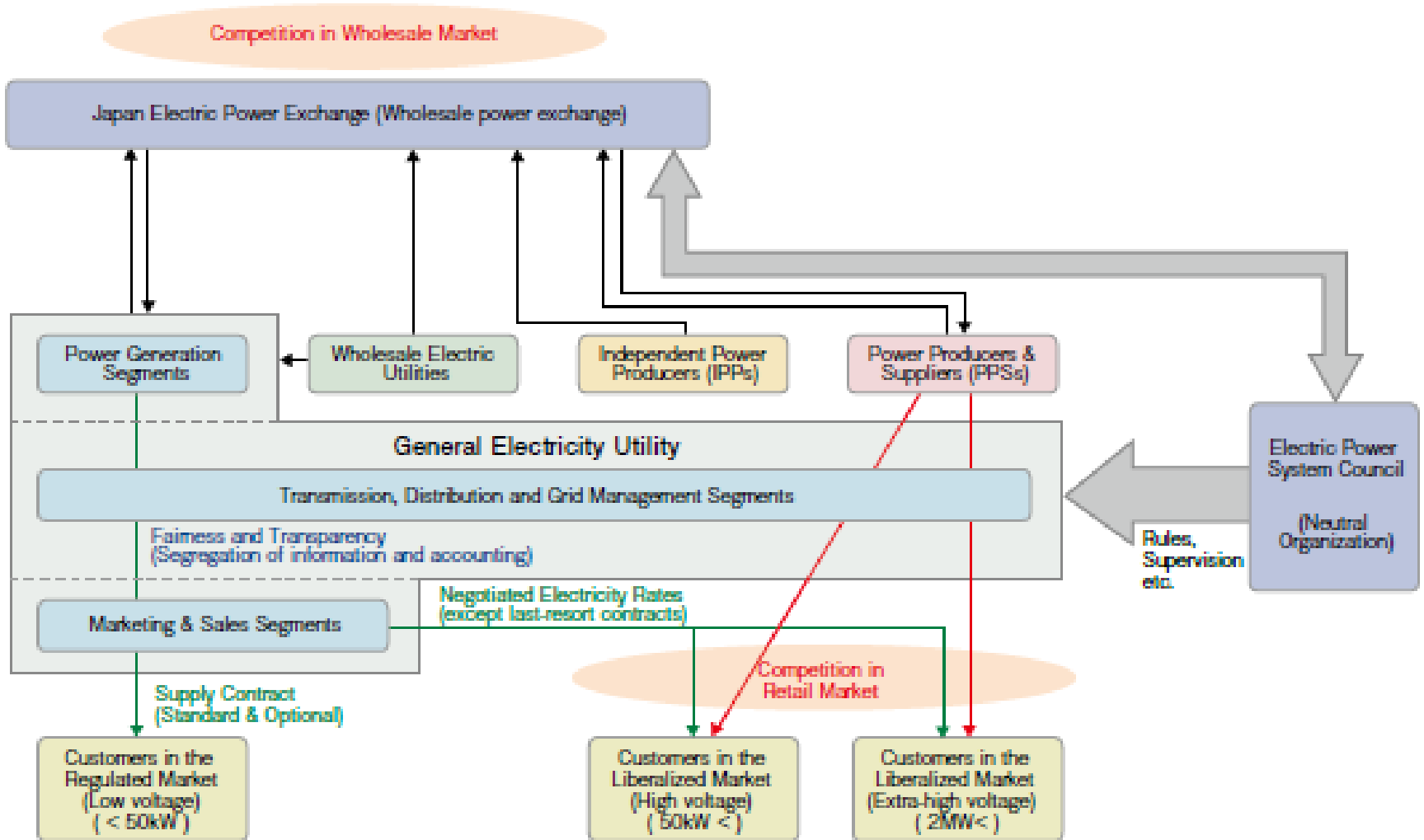
Reform program based on step by step schedule



Cabinet Decision on the Policy on Electricity System Reform



Electricity market structure



(Source: FEPC)



Power balance in FY2013

- ❑ Generation 922.9(TWh)
- ❑ Consumption 848.5(TWh)
- ❑ Imports 0(TWh)*
- ❑ Exports 0(TWh) *
- ❑ Losses 74.4(TWh)

* Japanese power system is isolated from other countries' system.

(source FEPC)

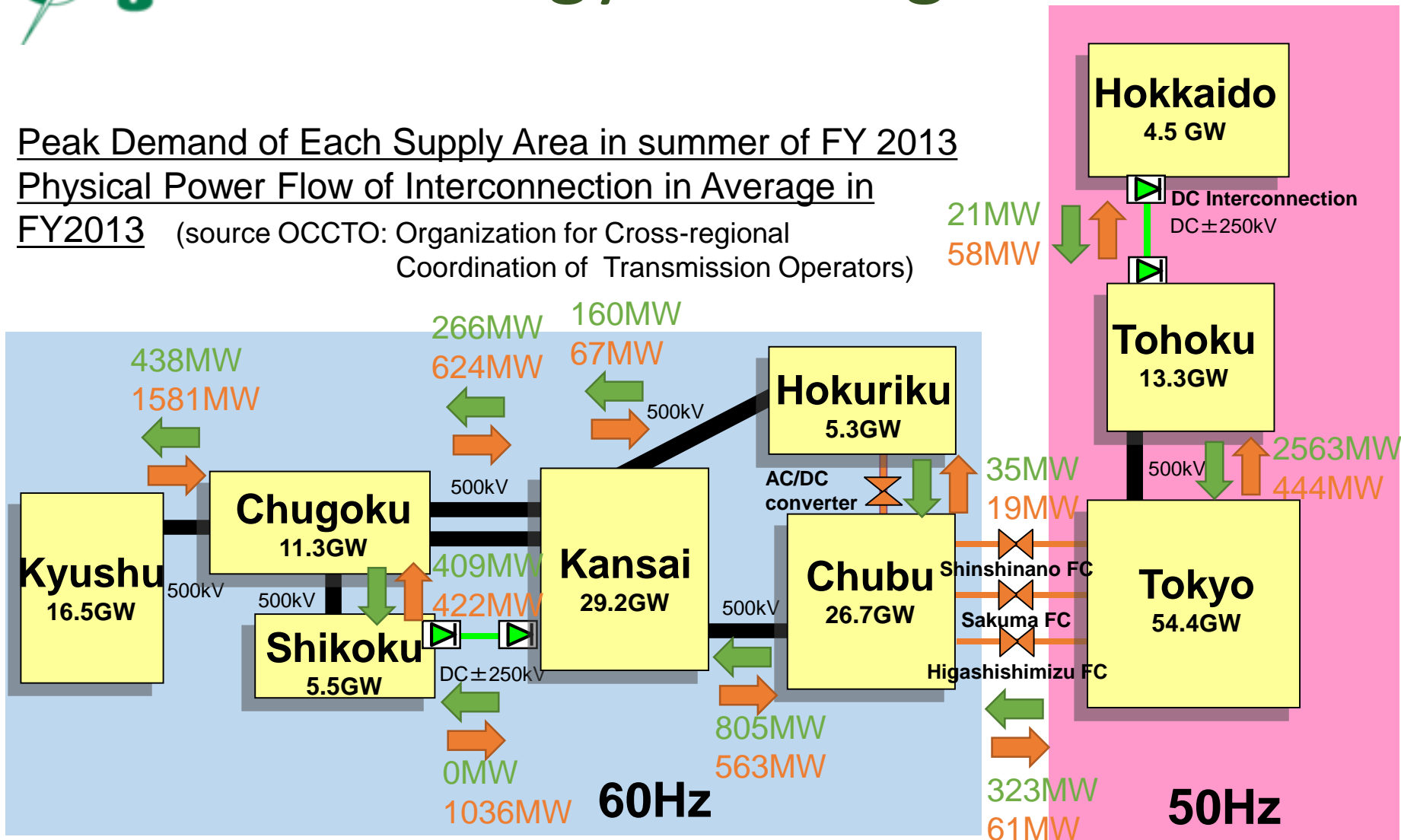


Energy exchanges

Peak Demand of Each Supply Area in summer of FY 2013

Physical Power Flow of Interconnection in Average in

FY2013 (source OCCTO: Organization for Cross-regional Coordination of Transmission Operators)



※FC: Frequency Converter



Specific aspects of the electricity market

□ Market type

- Spot market
 - ❖ Day-ahead market
 - ❖ 4hours-ahead market
- Forward market
 - ❖ Fixed-form products
 - ❖ Bulletin board products

□ Features

- Day-ahead market, 4hour-ahead market
 - ❖ Single price auction system
 - ❖ Market split when transaction exceeds interconnection capacity
- Fixed-form products
 - ❖ Continuous session system
 - ❖ Monthly products, weekly products
 - ❖ 24-hour type, daily hour type