METI

EGC
Electricity and Gas Market Surveillance Commission

JAPAN'S ENERGY OUTLOOK AND NEW CHALLENGES (IEA ESAP SESSION 1)

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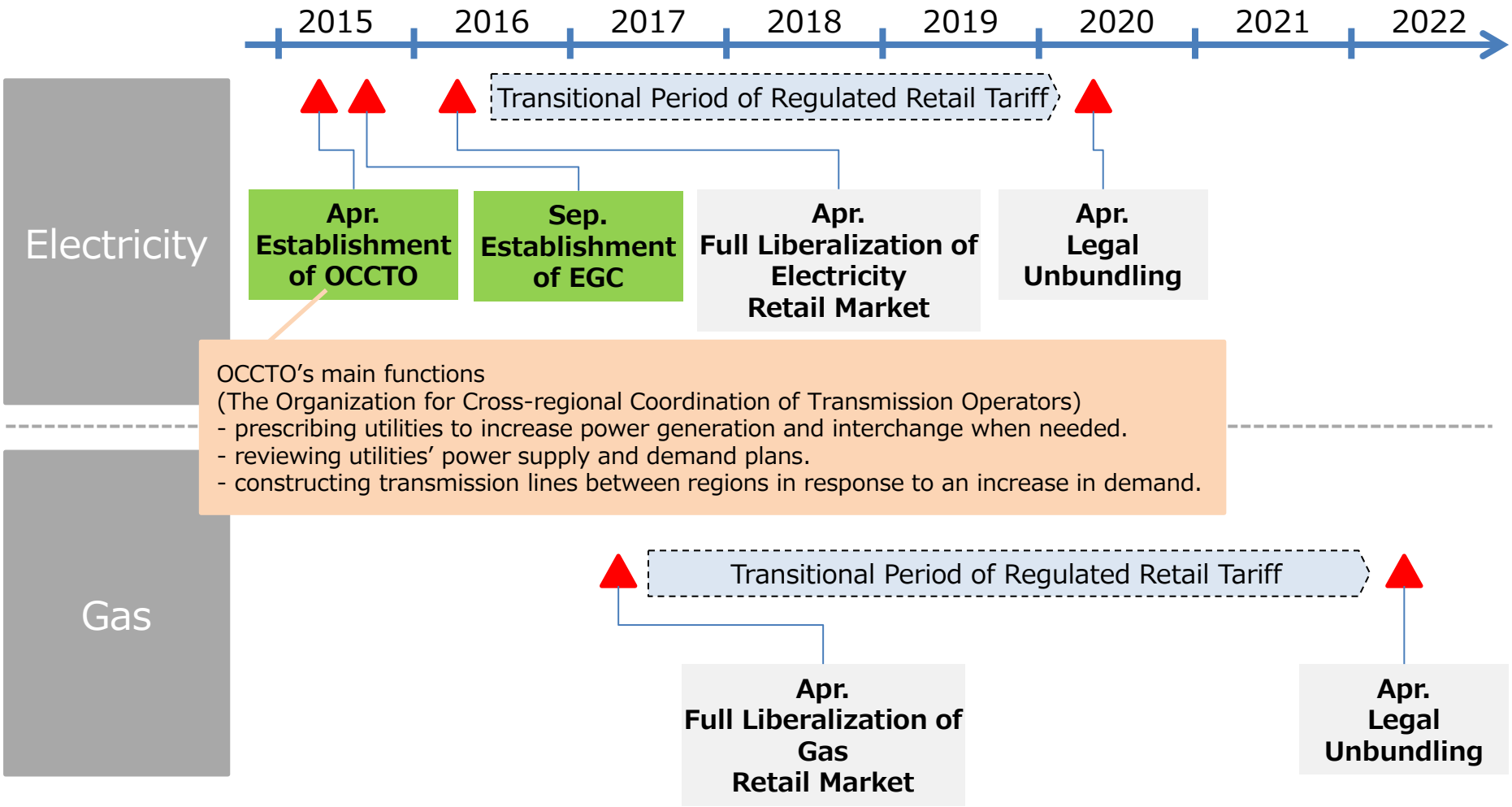
Roadmap for Energy Market Reform

- Electricity retail market has been fully liberalized from this April and legal unbundling is scheduled in 2020.
- OCCTO and EGC was established to advance the energy system reform.



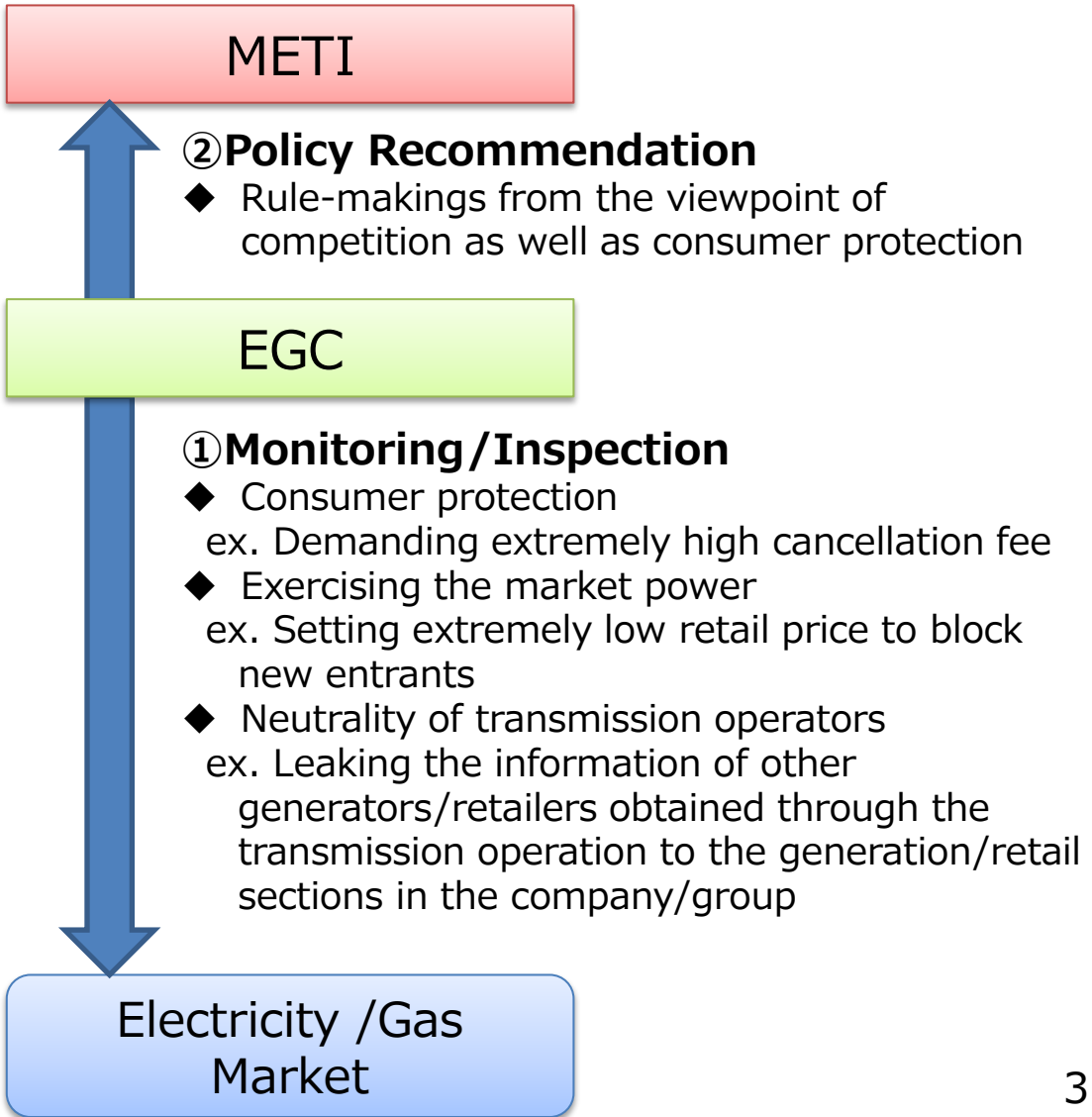
About EGC

EGC
Electricity and Gas Market Surveillance Commission

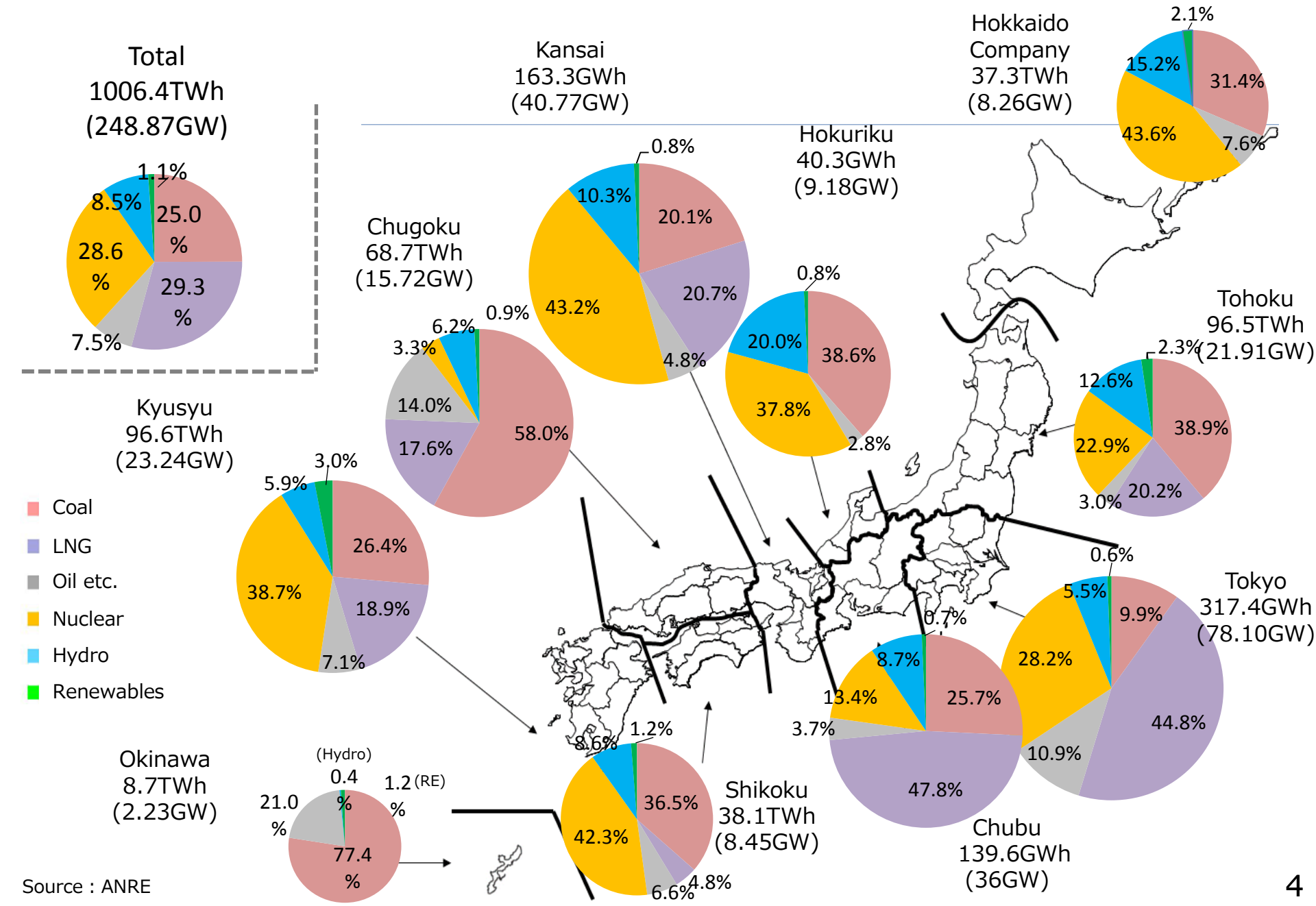
Mission

- The Commission is aimed to urge sound competition in the electricity and gas market.
- Besides strictly monitoring transactions in the market, EGC makes policy recommendations on necessary rule-makings to the Minister.

Role

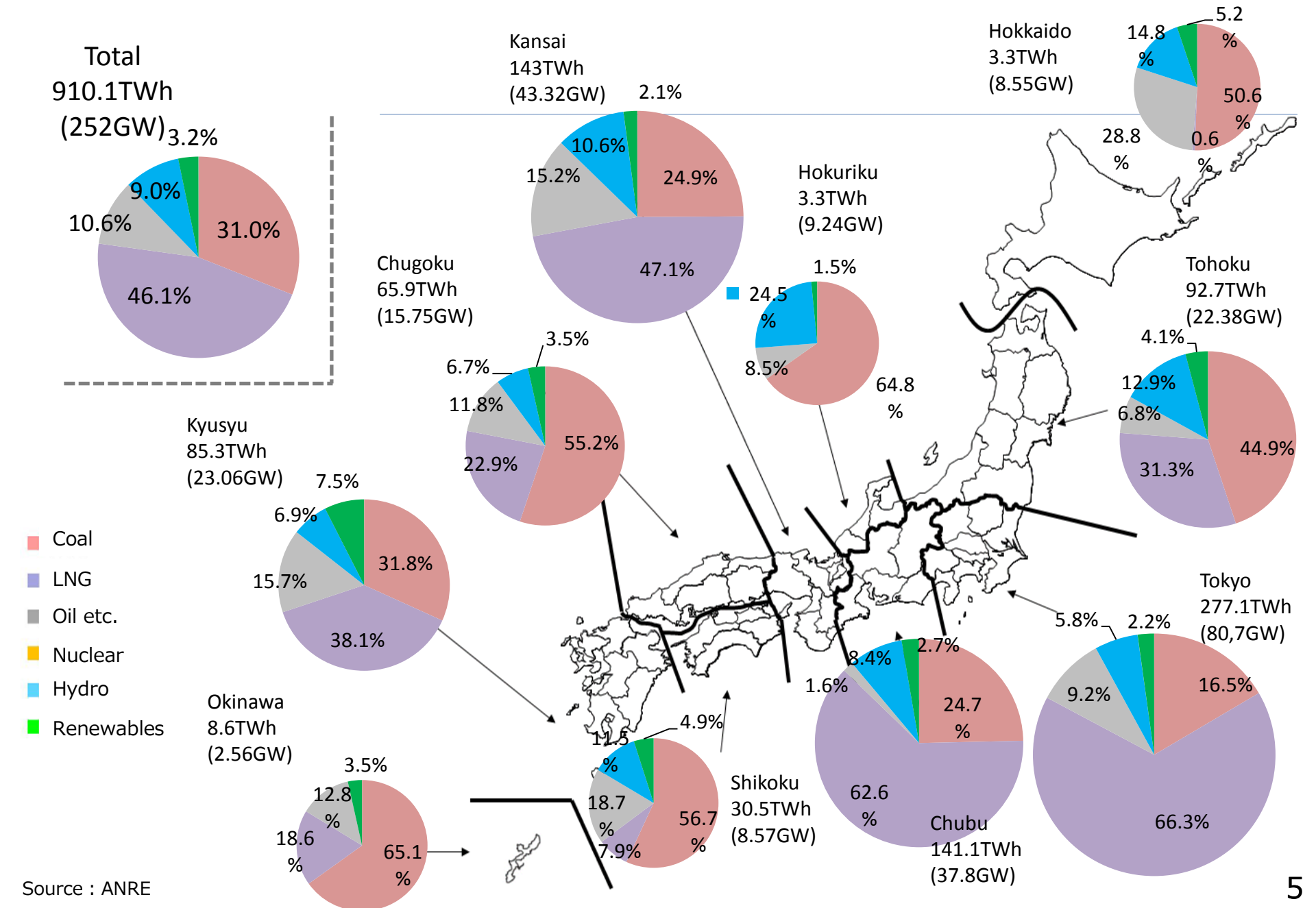


Generation by energy source by company（2010）



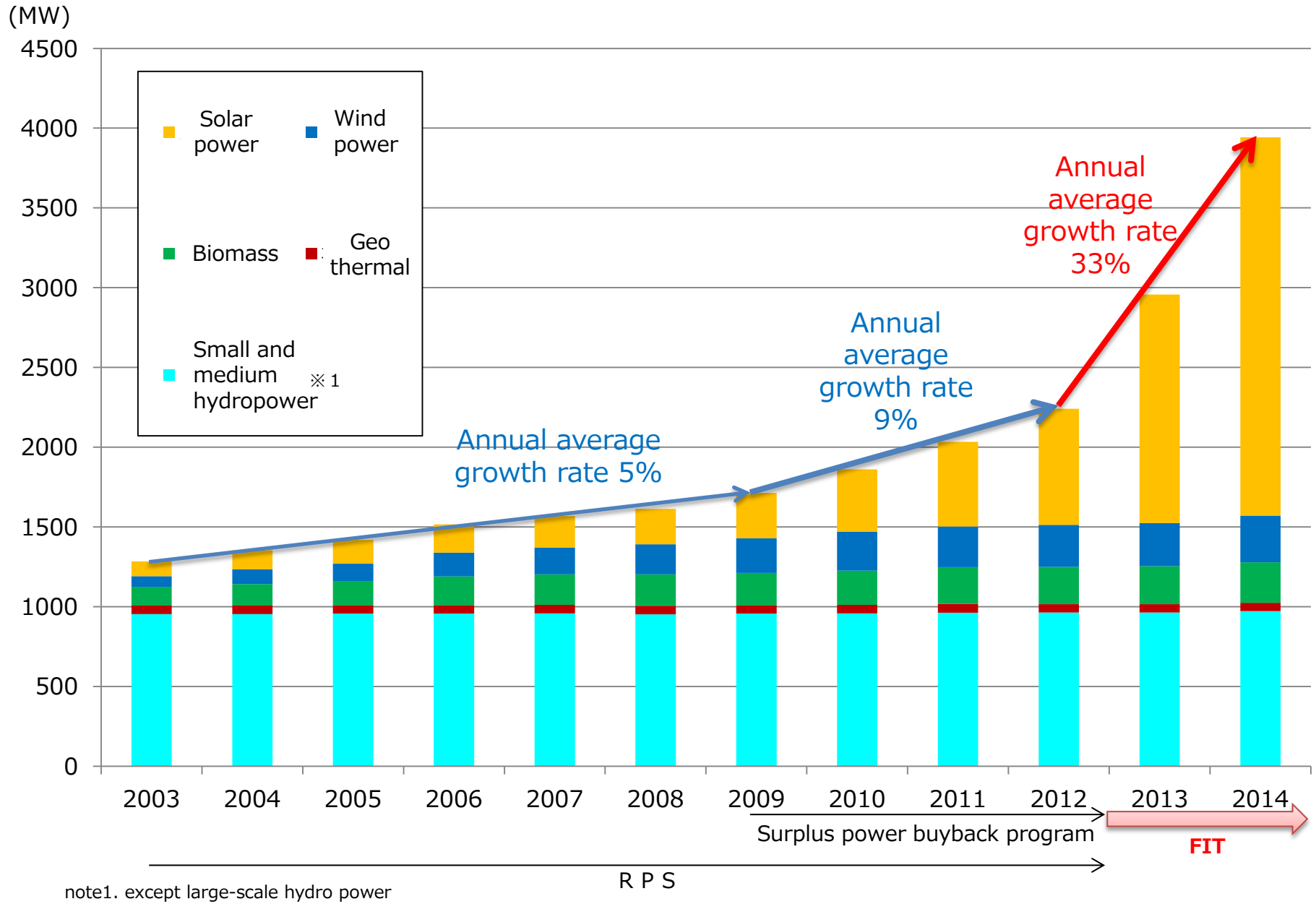
Source : ANRE

Generation by energy source by company（2014）



Source : ANRE

Expansion of renewable energy facilities

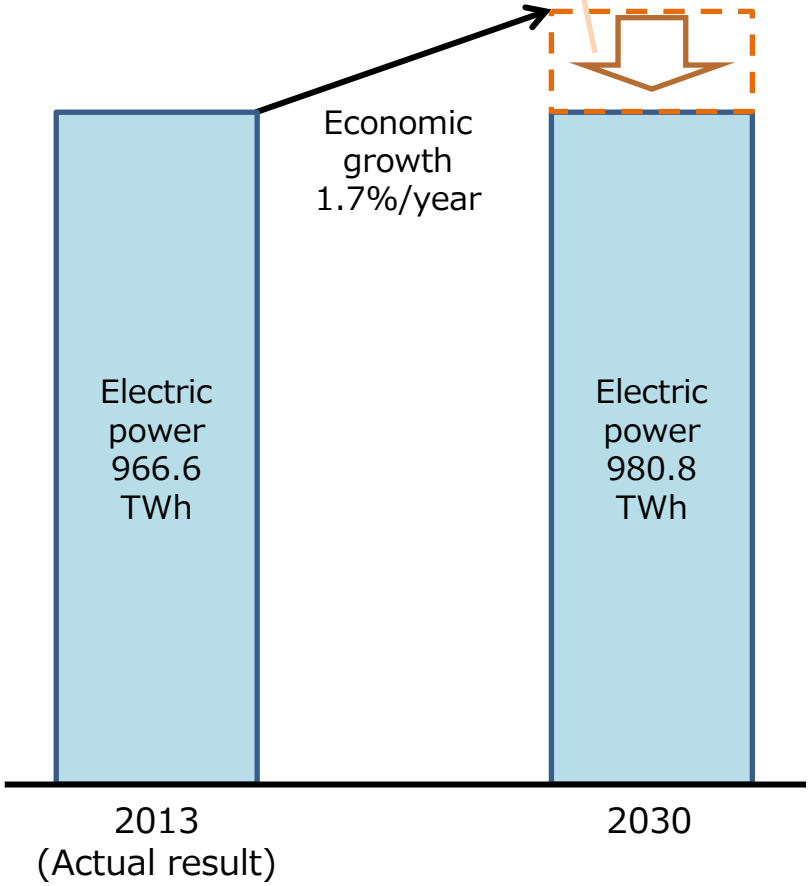


note1. except large-scale hydro power
Source: ANRE calculation based on several statistics such as JPEA ,NEDO etc.

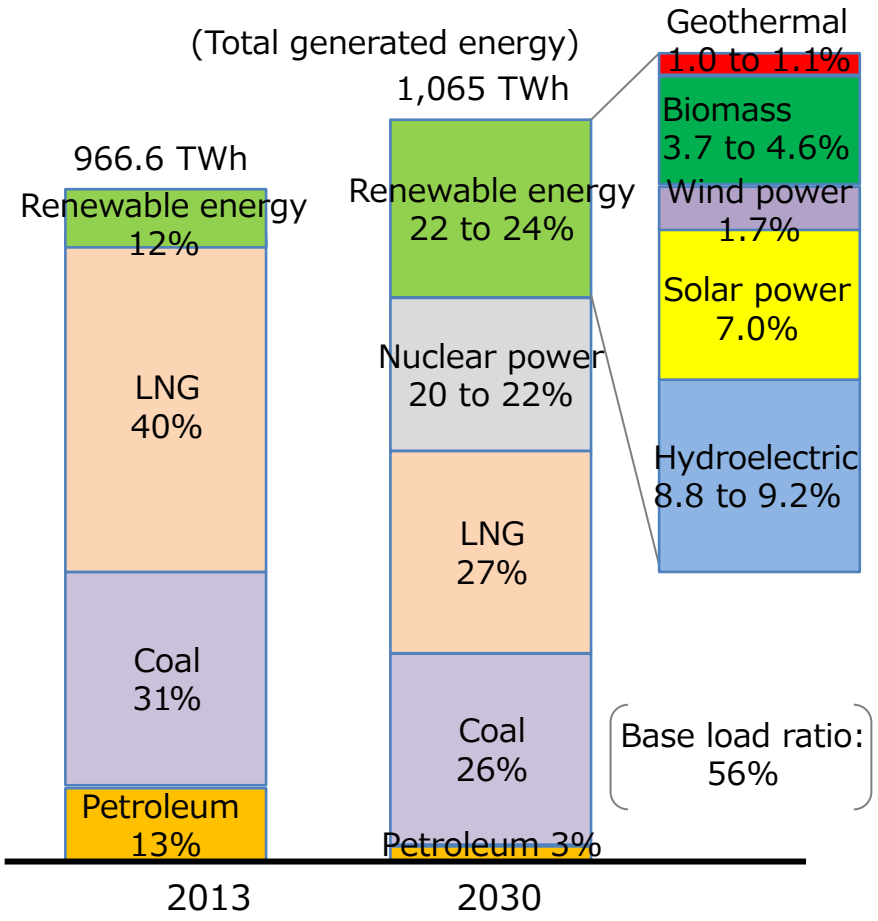
Electricity Supply and Demand Outlook for 2030

Power demand

Thorough energy efficiency and conservation 196.1 billion kWh (17% lower than before the implementation of the energy conservation measures)



Generation by energy source



Source: ANRE calculation based on several statistics such as JPEA ,NEDO etc.

* Values are approximate.

Three challenges to further introduction of REs

Challenge① : fixed cost of conventional power plants	• As more renewable electricity, whose variable cost is almost zero, come into the market, how can the fixed cost of conventional power plants, which are essential for ancillary service, be secured?
Challenge② : interregional transmission lines	• How can new inter-regional lines, which is necessary for REs' further instruction, be smoothly constructed? How can utilization of existing lines be expanded?
Challenge③ : transmission tariff system	• While electricity demand is not expected to grow, how should transmission tariff system be reformed, in order to make the grid-related investment, required by newly introduced renewables, efficient and appropriate?

Overview of transmission tariff system in Japan

- Japan adopts the full pricing system.
- Transmission tariffs consist of capacity charge(kW) and energy charge (kWh), and are charged 100% to loads on the premise that electricity flows from upper to lower grid.

	Calculation of full pricing/ First connection charge	Allocation of generation-tariff/ Load-tariff	Allocation by voltage	Transmission tariff planning by service categories
Current system In Japan	• Full pricing system • Shallow[1)]	• Transmission tariff is 100% charged to loads	• Based on the premise that electricity flows from upper to lower	• Combination of capacity and energy charges, but…

53 % of the total cost is collected through energy charge, while being fixed cost

Overview

Except the First Connection charge

Transformation cost

Transmission cost

Distribution cost

⋮

General Administration cost

NW Overall cost

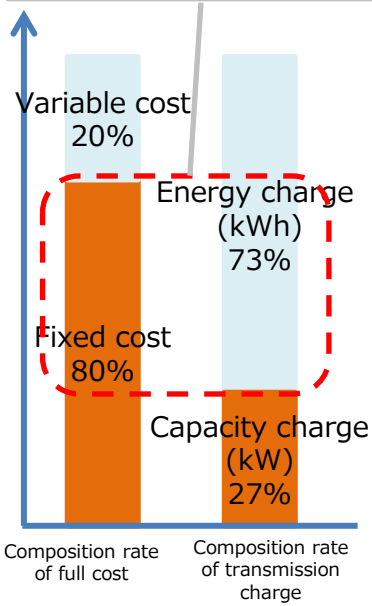
Generation Tariff

Load Tariff

SHV(220-500kV), HV(154-220kV), and LV(6.6-154kV)
・Ancillary service cost
・Transmission cost etc.

HV and LV
・Transformation cost for distribution
・Distribution cost for HV

LV
・Distribution cost for LV



note1. Grid users pay for the infrastructure connecting its installation to the transmission grid (line/cable and other necessary equipment)

Challenge① : Charge to generators

- Charging 100% to load would diminish generators' incentive to construct and operate grid system more efficiently.

Efficient development and maintenance of grid

- Depending on the locations of RE, the cost of grid might be extremely high.
- However, generators don't need to consider the additional cost for the grid because load pays 100% of the cost.

Additional cost	Hokkaido	Tohoku	Total
	2.7GW (4.7TWh/ year)	3.2GW (5.6TWh/ year)	5.9TkW (10.3TWh/ year)
Internal grid cost	1.47 billion Euro	0.5 billion Euro	1.99 billion Euro
Interconnection between regions/ Internal main transmission lines etc.	5.01 billion Euro	1.61 billion Euro	6.63 billion Euro
Total construction cost	6.48 billion Euro(11.1 cent/kWh)	2.14 billion Euro(2.95 cent/kWh)	8.61 billion Euro (6.63 cent/kWh)

Source:ANRE

Efficient use of grid

- It is necessary to consider the maximum flow from the generation facilities when transmission facilities are developed.
- If the generation capacity is the same, the necessary cost is also the same regardless of the utilization rate of the facilities.

Ex) : Utilization rate of the facilities
Thermal power plant : 80%
Wind power plant: 20%

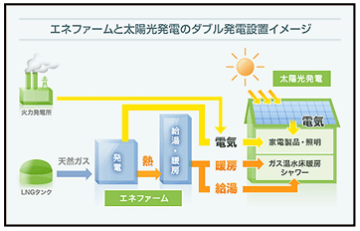
【Areas in the left side chart】

Challenge② : Charge to consumers

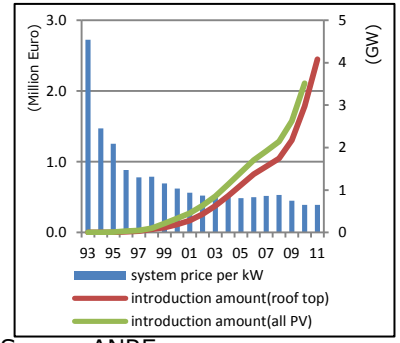
- The fairness of the burdens of fixed cost and the risk of being unable to recover fixed cost could become more serious problems in the future depending on the extent of expansion of RE.

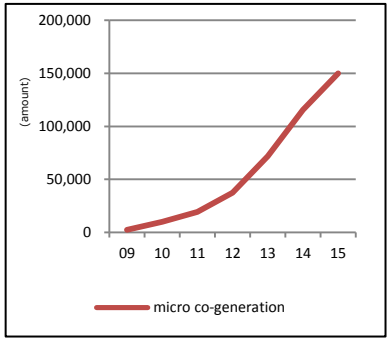
Increasing off-grid power system

- Increase in the number of consumers with off-grid power system accelerates free-rider problem regarding the payment of fixed cost.
- In Japan, this problem gets more serious because roof-top PV and micro-cogeneration are often installed together.



- 9GW of roof-top PV for residence and 5.3 million micro-cogeneration(around 10% of all households) are expected to be installed in 2030.





Source:ANRE

Problem of the fairness of the burdens

- Since fixed cost is recovered by energy charge, the users of off-grid power system don't pay sufficient fixed cost in transmission tariff.

【Preliminary calculation roof-top PV】
<Premise>
・Contracted capacity :50A,6,000kWh/year
・Utilization of facility:14%, self consumption:30%

unit: euro/year	w Roof top PV	w/o Roof top PV
Capacity Charge (kW)	Around 18	Around 18
Energy Charge (kWh)	Around 243 (fixed cost: around **161**)	Around 338 (fixed cost: around **235**)

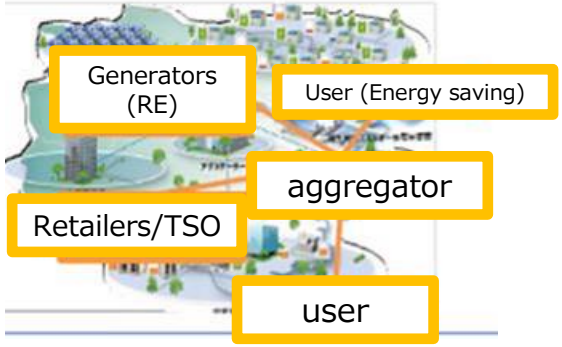
1/3 of fixed cost(74euro) which originally should be paid decreases.
*Toward 2030, this difference will be expanded.

Challenge③ : Value of the grid

- Given the increase in the number of off-grid generation users and the increase in reverse flow from lower to upper grid system in the future, how should we evaluate the value of the grid?

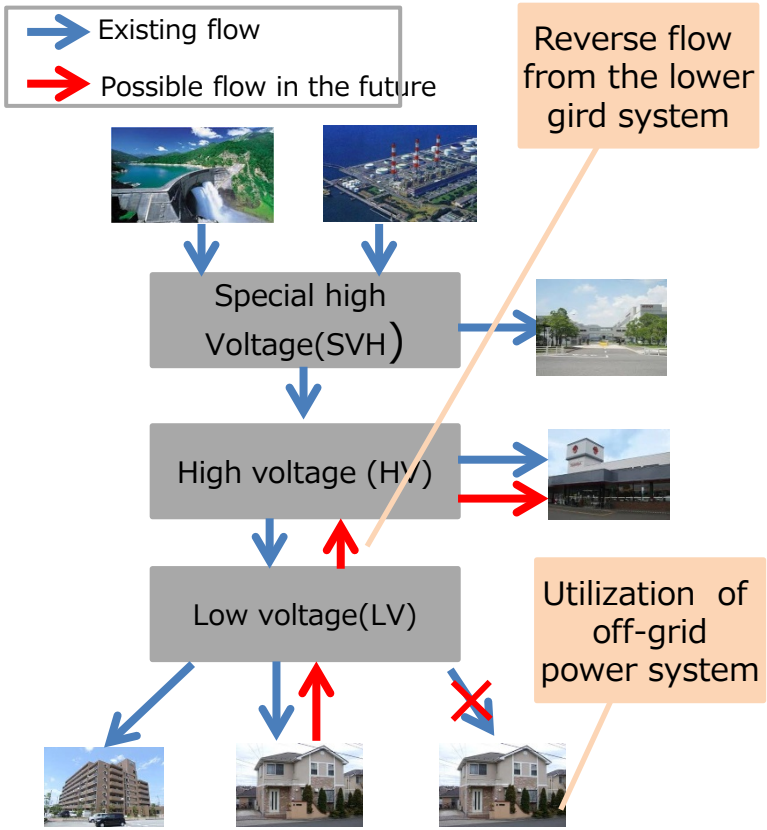
In the future

- In the low voltage area, new services like VPPs including DR are emerging together with introduction of roof top PV and micro-cogeneration.



- Smart meters will be fully deployed by early 2020s.
  - For high voltage users (ex. factories), smart meters will be installed by 2016.
  - For low voltage users (ex. residences etc.), smart meters will be installed by 2020 in Tokyo area and by 2024 in all the areas in Japan.

Change of the electricity flow



Source:ANRE

Measures to be considered

	Challenges	Measures to be considered	
Generation	• Generators might locate power plants without taking into account the transmission and distribution cost since the cost is 100% charged to loads. • The utilization rate of network facilities might be low because they are constructed based on the maximum flow.	• Introduction of network charge to generators • Locational transmission tariff system	Rebalance of fixed cost ・Transmission charge depending on the capacity (kW charging) ・Reviewing capacity charge ・Charging the fixed cost to the users of off-grid power system
Load	• Due to the imbalance between the ratio of fixed cost and ratio of capacity charge, heavy power users bear more burden. • Acceleration of distributed power systems makes the problem more serious, further damaging the fairness of burdens.	• Locational transmission tariff system (Demand side) • New transmission tariff system considering the flow within the lower gird	
Others	• How should we evaluate the value of the grid in case reverse flow to the upper grid occurs due to the introduction of roof-top PV and micro co-generation?	Further discussion is needed considering that electricity flow has been changing. Charges for ancillary service and transport service should be considered differently?	