METI

Ministry of Economy, Trade and Industry
Agency for Natural Resources and Energy

# Renewable Energy Policy in Japan

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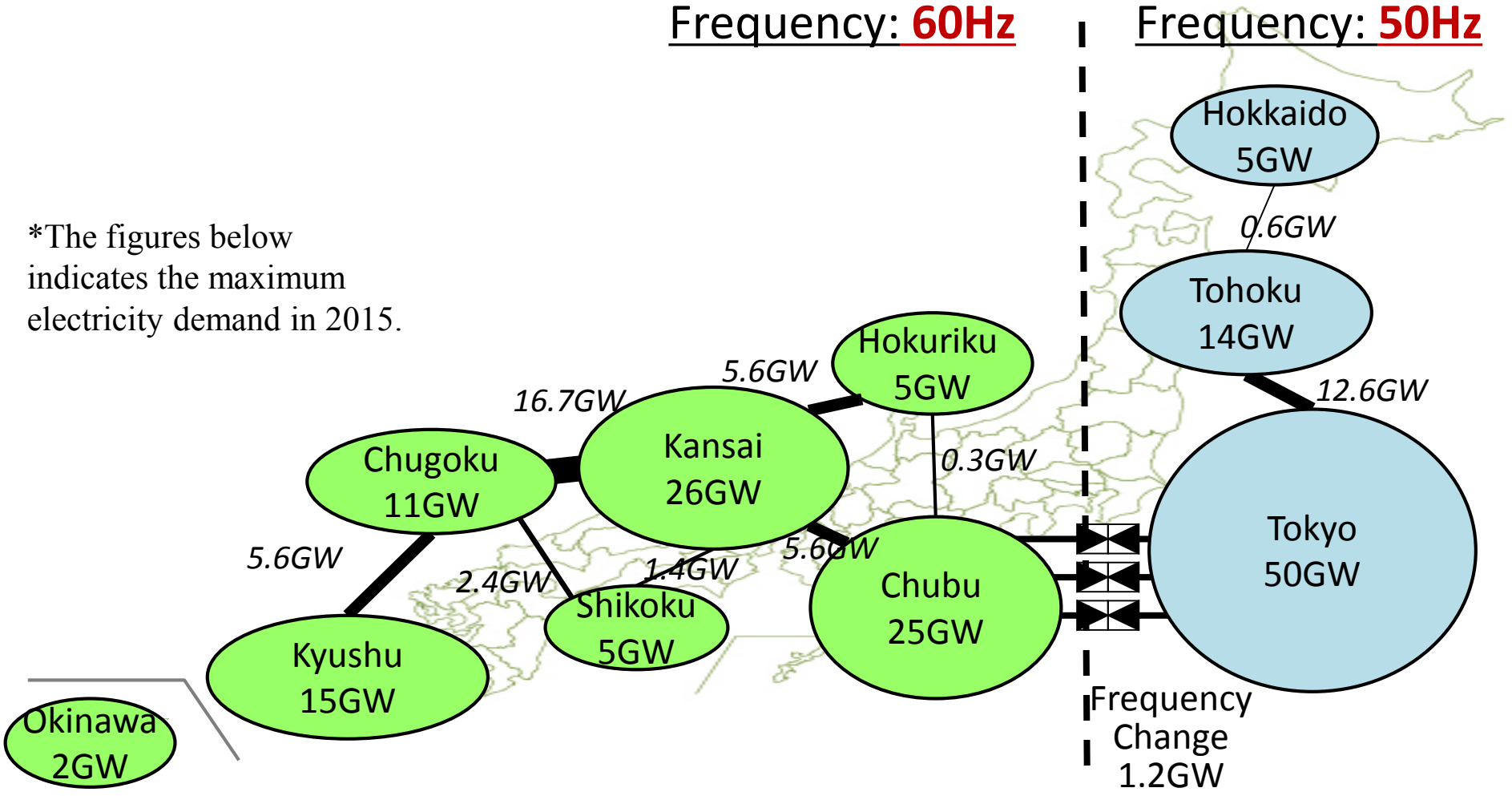
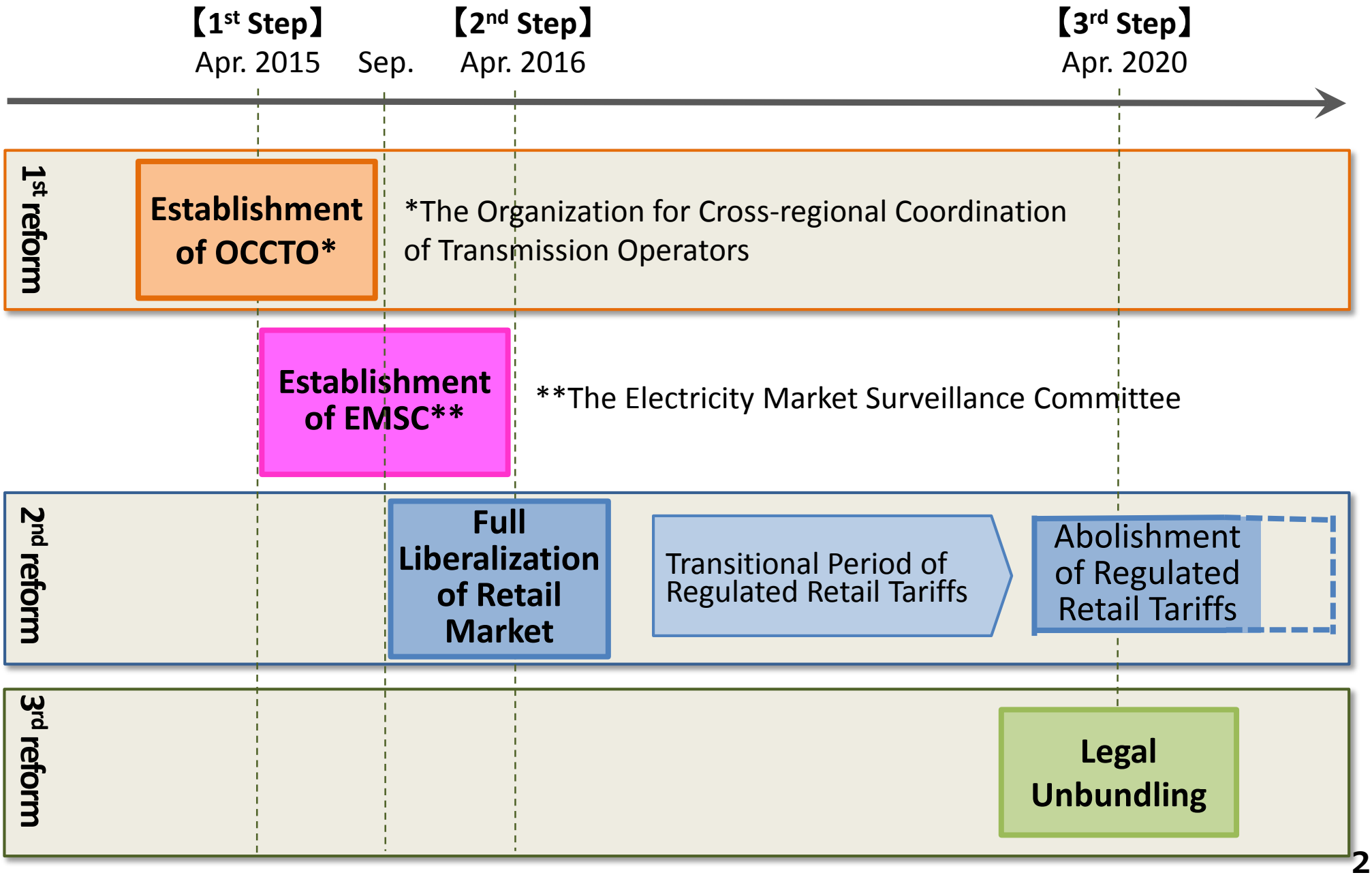
# Power grid in Japan

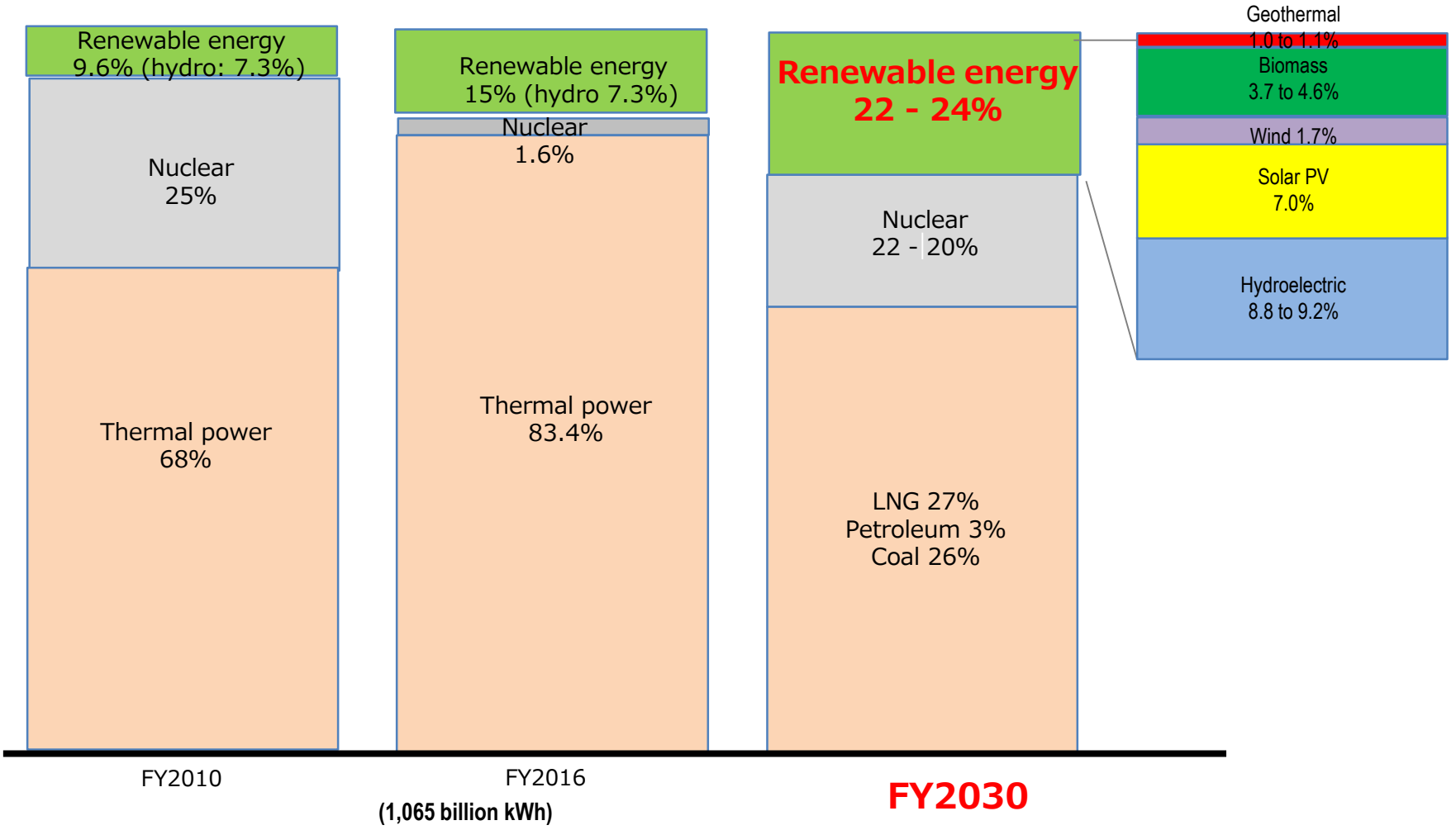
- Grid network has been historically developed by 10 general utilities whereas capacity of interconnecting grids are limited. This leads to difficulty in electric power interchange in Japan.
- Expansion of interconnection grids are under discussion for introducing more REs.



# Electricity Market Reform Roadmap



# Generation mix



# Support measures for renewable energy

(1) Support with subsidies (1997-)

(2) Support by imposing the use of a certain amount of renewable energy on power companies **(the RPS system)** (2003-2012)

(3) Support by setting fixed prices for purchase of renewable electricity (2009-)

- 2009: **Excess Electricity Purchasing scheme** was launched
- July 2012: **Feed-in Tariff (FIT) scheme** was launched
  (Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities)
- April 2017: **the FIT scheme was revised**

# Tariffs

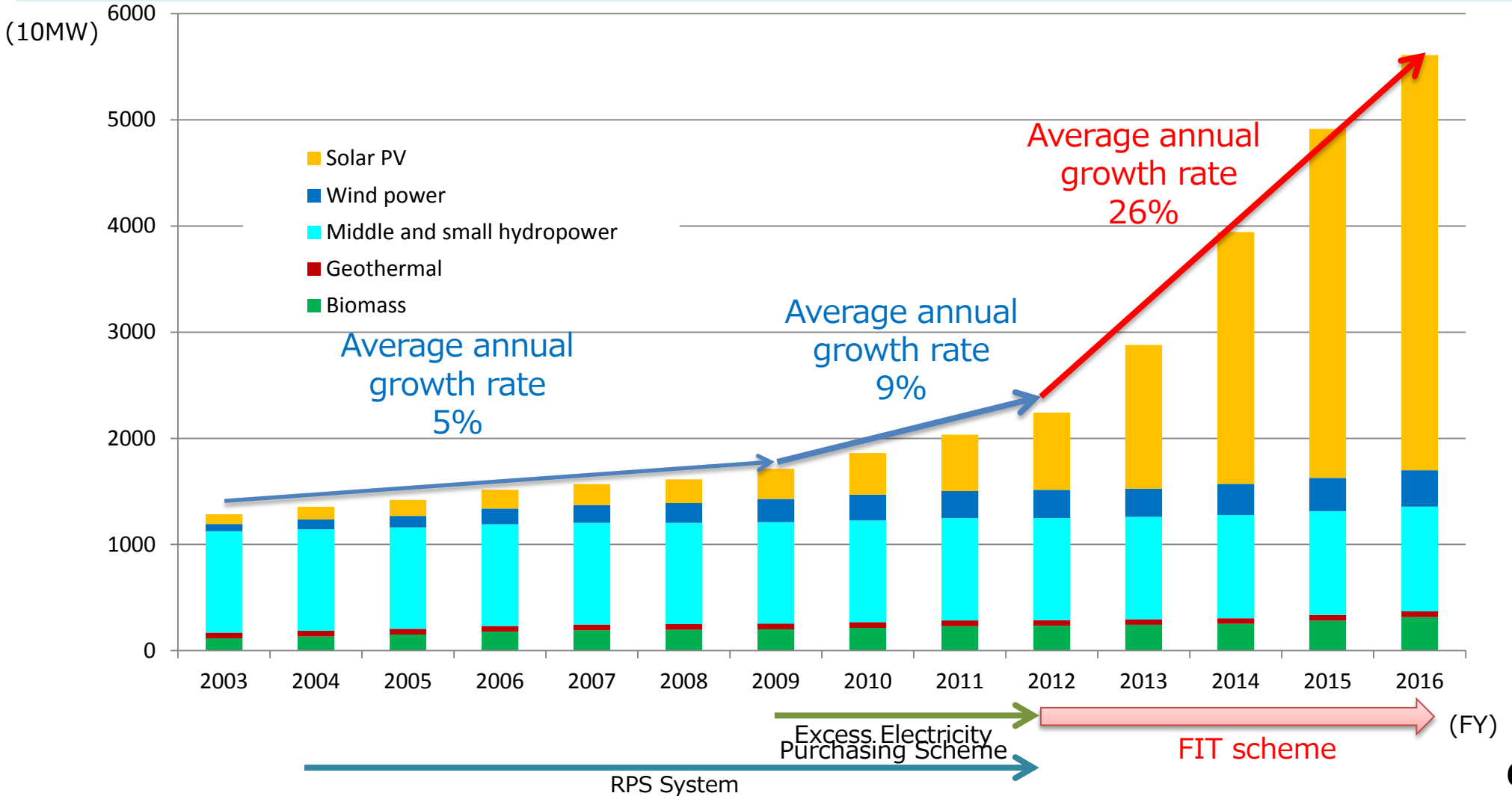
| (JPY/kWh) | FY2012 | FY2013 | FY2014 | FY2015 | Fy2016 | FY2017 | FY2018 | FY2019 |
|---|---|---|---|---|---|---|---|---|
| Solar PV (10kW or more) | 40 | 36 | 32 | 29<br>27 | 24 | **21** ※3 | TBD | TBD |
| Solar PV (Less than 10kW) | 42 | 38 | 37 | 33<br>35 ※2 | 31<br>33 ※2 | **28**<br>30 ※2 | **26**<br>28 ※2 | **24**<br>26 ※2 |
| Wind | 22 (20kW or more) | | | | | **22** **21** | **20** | **19** |
| | 55 (less than 20kW) | | | | | 55 | TBD | TBD |
| | | | | 36 (Offshore) | | 36 | | |
| Geothermal | 26 (15000kW or more) | | | | | 26 (15000kW or more) | | |
| | 40 (less than 15000kW) | | | | | 40 (less than 15000kW) | | |
| Hydraulic Power | 24 (1000kW or more but less than 30000kW) | | | | | 24 **20 (5000kW or more but less than 30000kW)**<br>**27 (1000kW or more but less than 5000kW)** | | |
| | 29 (200kW or more but less than 1000kW) | | | | | 29 | | |
| | 34 (less than 200kW) | | | | | 34 | | |
| Biomass | 39 (Biogas) | | | | | 39 | | |
| | 32 (Wood fired power plant (Timber from forest thinning)) | | | 40 (less than 2000kW)<br>32 (2000kW or more) ((Wood fired power plant (Timber from forest thinning)) | | 40 (less than 2000kW)<br>32 (2000kW or more) | | |
| | 24 (Wood fired power plant (Other wood materials)) | | | | | 24 **21 (20000kW or more)**<br>24 (less than 20000kW) | | |
| | 13 (Wood fired power plant (Recycled wood)) | | | | | 13 | | |
| | 17 (Wastes (excluding woody wastes)) | | | | | 17 | | |

※3 Auction (2MW or more), starting from Oct. 2017

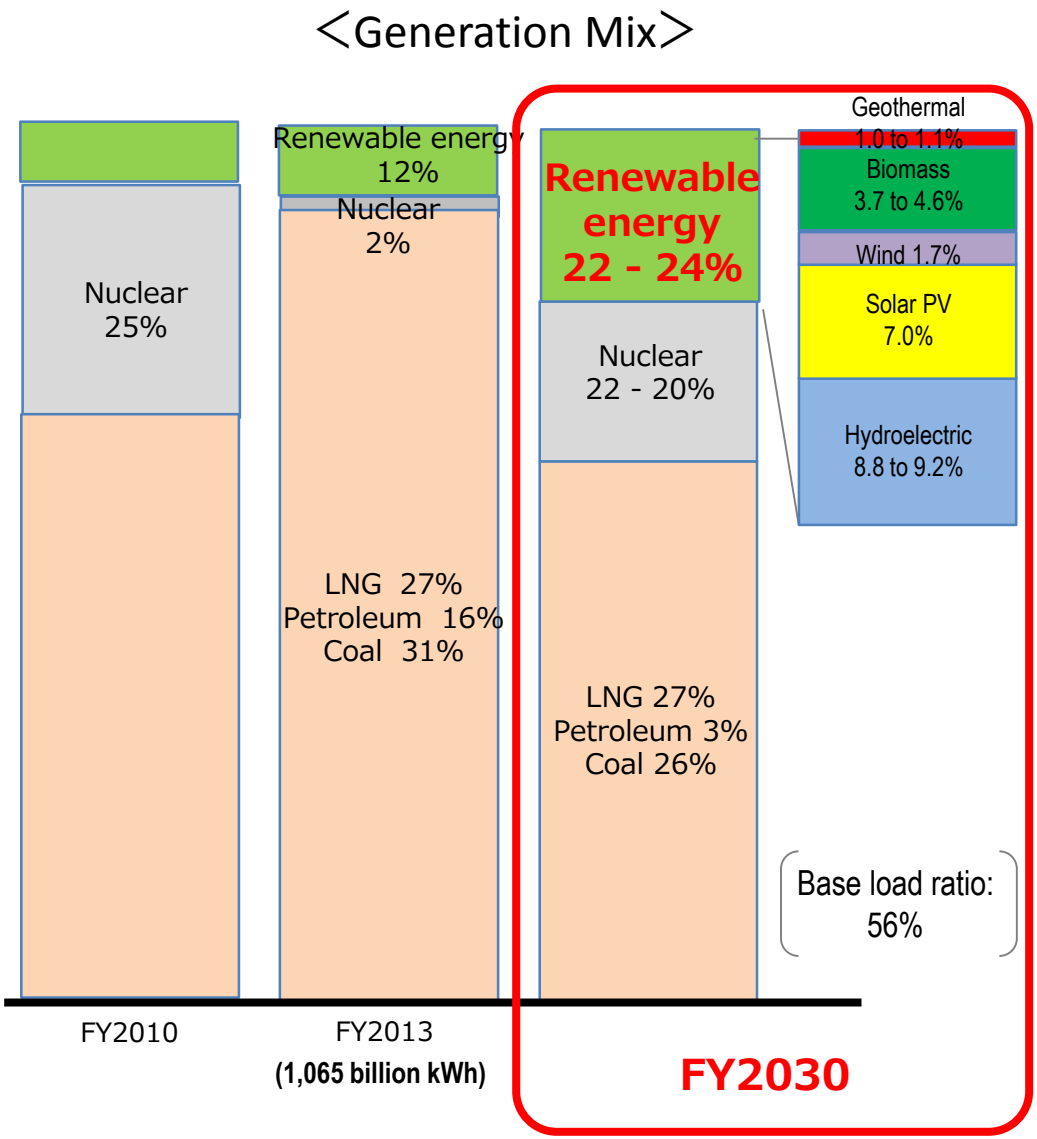
※2 With real-time power control system

# History of renewable energy introduction

- The main driver shifted to RPS in 2003, Residential Surplus Electricity Purchasing Scheme in 2009 and then, to FIT in 2012.
- After introduction of Feed-in-Tariff in 2012, deployment of solar PV increased dramatically **(170% increase since 2012)**.



# Renewable energy introduction and 2030 Energy Mix



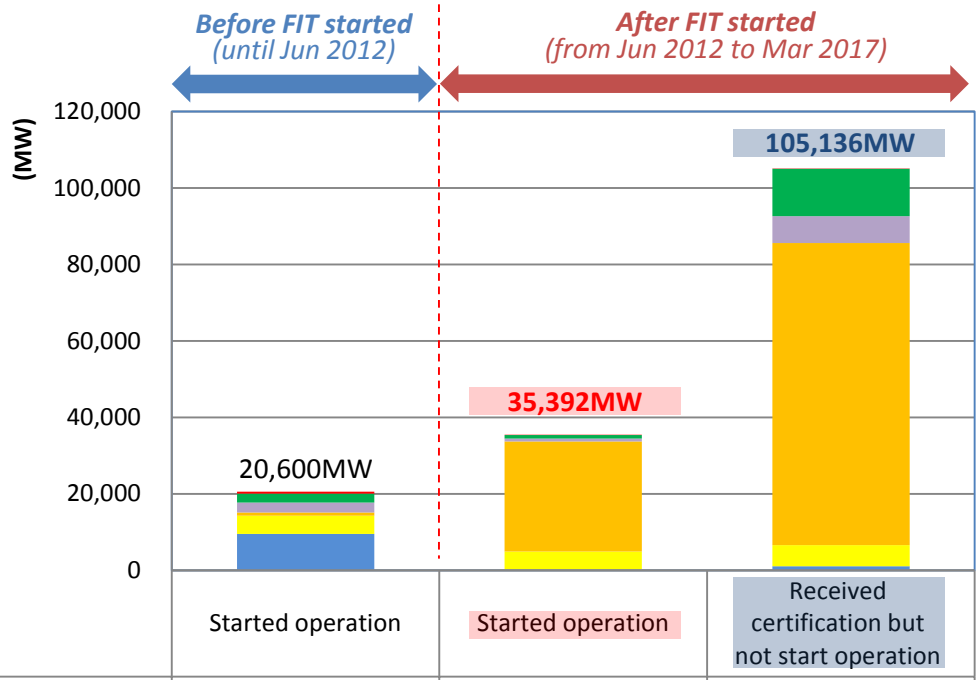

| | Current [A] (March2017) | Target[B] (FY2030) | [B]/[A] (maximum case) |
|---|---|---|---|
| Geothermal | 0.5GW | 1.4 - 1.6GW | 2.9 |
| Biomass | 3.1GW | 6.0 - 7.3GW | 2.1 |
| Wind | 3.4GW | 10GW | 3.0 |
| Solar PV | 38.5 GW | 64GW | 1.7 |
| Hydro | 48.1GW | 48.5 - 49.3GW | 1.0 |

* Values are approximate.

# Renewable energy introduction after FIT started

- **35,392 MW of renewable energy capacity** has been newly deployed from July 2012 (when FIT started) to the end of March 2017.
- **Solar PV accounts for more than 95% of capacity of renewable energy** facilities that certified and started operation, after FIT started.

<Deployment of renewable energy (as of the end of March 2017)>




| | Started operation | Started operation | Received certification but not start operation |
|---|---|---|---|
| Geothermal | 500 | 15 | 88 |
| Biomass | 2,300 | 851 | 12,417 |
| Wind | 2,600 | 789 | 6,972 |
| Solar PV (non-residential) | 900 | 28,753 | 79,047 |
| Solar PV (residential) | 4,700 | 4,745 | 5,493 |
| Mid to small sized Hydro (less than 30MW) | 9,600 | 239 | 1,118 |

<Public burden>

| | Transition of Surcharge | Surcharge unit price per kWh |
|---|---|---|
| 2012 | 131 billion yen | 0.22yen/kWh (57yen/mon) |
| 2013 | 329 billion yen | 0.35yen/kWh (91yen/mon) |
| 2014 | 652 billion yen | 0.75yen/kWh (195yen/mon) |
| 2015 | 1,322 billion yen | 1.58yen/kWh (410yen/mon) |
| 2016 | 1,803 billion yen | 2.25yen/kWh (585yen/mon) |
| 2017 | **2,140 billion yen** | **2.64yen/kWh** (686yen/mon) |

# Challenges for renewable energy to be a major power source

## Cost competitiveness

✓ **Higher tariff**

(e.g. Non-residential solar PV 21 JPY/kWh ( 190 USD/MWh))

→ *Introduction of auction scheme for solar PV above 2MW*

# Challenges for renewable energy to be a major power source

## Unbalanced introduction of solar PV

- ✓ **Solar PV accounts for more than 95%** that started operation
- ✓ Hundred thousands of **uncommissioned solar PV projects**

→ *Further foreseeability on coordination of regional stakeholders and adaptation of regulation*

→ *Stricter rule for authorization to solve uncommissioned solar PV projects*

→ *Three-year tariff setting for wind, geothermal, biomass and hydro*

# Challenges for renewable energy to be a major power source

## Grid constraint

- ✓ **Local grid constraint**

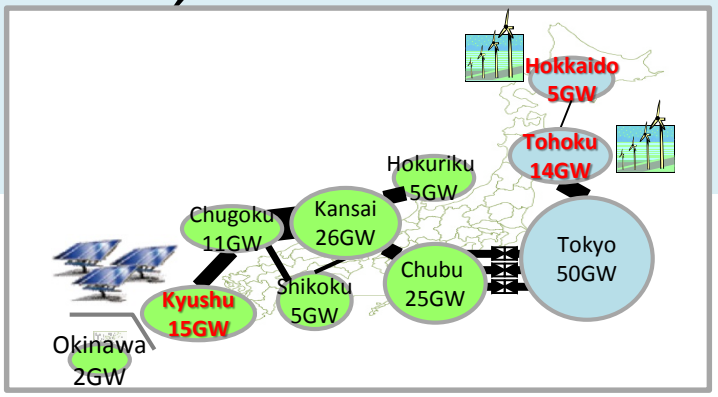
  **(**e.g. suitable for variable renewable energy but limited regional demand/interconnection capacity)

- ✓ **Grid connection on a first-come-first-served basis**

→ *Establish organization for cross-regional coordination of transmission (OCCTO)*

→ *Further discussion on the implicit auction for inter-connections, Connect & Manage scheme, etc.*

→ *Transmission enhancements*



# Reference

# Basic mechanism of FIT scheme

- Under the FIT scheme, if a renewable energy producer requests an electric utility to sign a contract to purchase electricity at a fixed price and for a long-term period guaranteed by the government, the electric utility is obligated to accept this request.

Those engaged in the power generation business using renewable energy sources

Solar PV

Small- and medium-scale hydraulic power

Wind power

Biomass

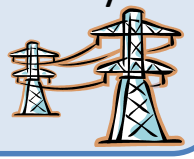
Geothermal power

Those who generate power at home

Sale of electricity produced from renewable energy sources

Purchase of electricity at a fixed price for a government guaranteed period

Electric utility



Payment for the purchase cost

Submission of the collected surcharge

Surcharge adjustment organization (organization to collect and distribute the surcharge)

Electricity supply

Collection of surcharge together with the electricity charge

Electricity customers

Deciding tariffs and durations, respecting the opinion of the special committee (every fiscal year)

Decision of surcharge unit price per kWh (every fiscal year)

Minister of Economy, Trade and Industry

・Approval of facilities
(Government confirms whether the facility can generate electricity stably and efficiently. The approval is cancelled when the facility no longer satisfies the requirements.)

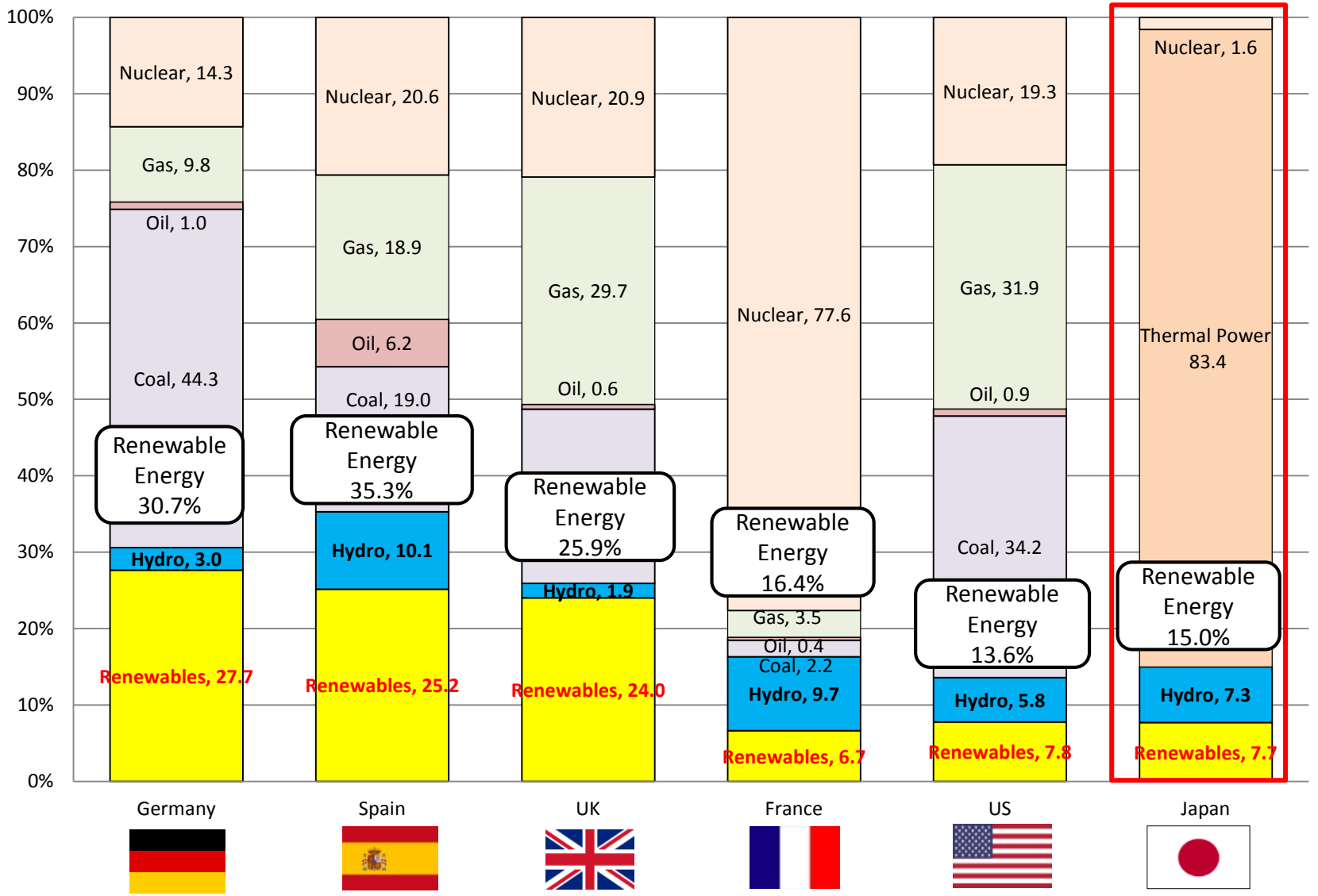
Opinion on tariffs and duration

Special committee for determination of tariff s and durations

Government

# Ratio of renewable energy

- Ratio of electricity generation by **renewable energy in Japan is 15.0 % (FY2016)**.
- On the other hands, ratio of electricity generation by **renewable energy except hydro is only 7.7%.**




Source: Japan:(FY2016Data, Estimates)。
Except Japan: FY2015Data. IEA Energy Balance of OECD Countries (2017edition)

# Renewable Energy Policy in the next decade

## Long-term Energy Supply and Demand Outlook (July 2015)

4. Major Approaches in Each Field

2) Renewable energy

Ensure compatibility between maximum introduction and expansion according to the individuality of each power source, and inhibition of public burden.

To this end, expand positively utilization of geothermal, hydroelectric and biomass powers stably operable independent of the natural conditions, thereby securing base load power sources and reducing dependence on the nuclear power plants.

For solar and wind powers which fluctuate greatly in output depending on the natural conditions, introduce and expand them to a maximum extent through utilization of large-scale wind power, and so on, while reducing costs and considering inhibition of public burden.

From these viewpoints, improve the environment so that renewable energy can be introduced at low cost, through measures to various regulations and restrictions, support for geothermal power generation accompanied by high development risk, improvement of electric system and expansion area of electric system operation, technological development for higher efficiency, lower cost and advanced system operation technology, and the like.

The feed-in tariff serves as the driving force for promoting introduction of renewable energy. On the other hand, considering one-sided introduction of solar power generation, concerns about increased public burden, progress of the electric power system reform, and the like, and based on the characteristics and reality of renewable energy, review the system so as to allow well-balanced introduction between renewable energies, and compatibility between maximum introduction and expansion, and inhibition of public burden.

# FIT Reform (2016)

## 1. New authorization system

**(to solve uncommissioned PV projects*)**

- Includes the procedure to check the project feasibility (eg. Requirement for a grid connection contract).
- Applies for previously accredited projects (transitional measures for commissioned projects).

* 340 thousand projects of 2012-2013 not commissioned (30%)

## 2. Project validity scheme

- Requires
  - ✓ maintenance & inspection during the project,
  - ✓ compliance of removal & disposal after the project.
- enables an administrational order to improve & rescission of accreditation for violations.

## 3. Cost effective FIT tariff for PV

- Establishes the mid & long term price targets to improve foreseeability.
- Introduces tendering system for larger scale PV.
- Modifies an exemption rate for electricity-intensive business depending on their energy-saving efforts.

## 4. Longer period FIT tariff

- Determines 3 years FIT tariffs for wind, geothermal, biomass, small & mid scale of hydro to secure longer foreseeability.

## 5. Electricity system reform

- Changes the obliged FIT power purchaser from retailors to TSO/DSO to enable cross-regional coordination.

# Cost Reduction of PV Generation System (Example)

- Currently, PV systems in Japan cost about twice those in Europe.
- Target is the market level = independent industry:
  Non-residential: JPY100k/kW by 2030; Residential: JPY200k/kW by as early as 2020

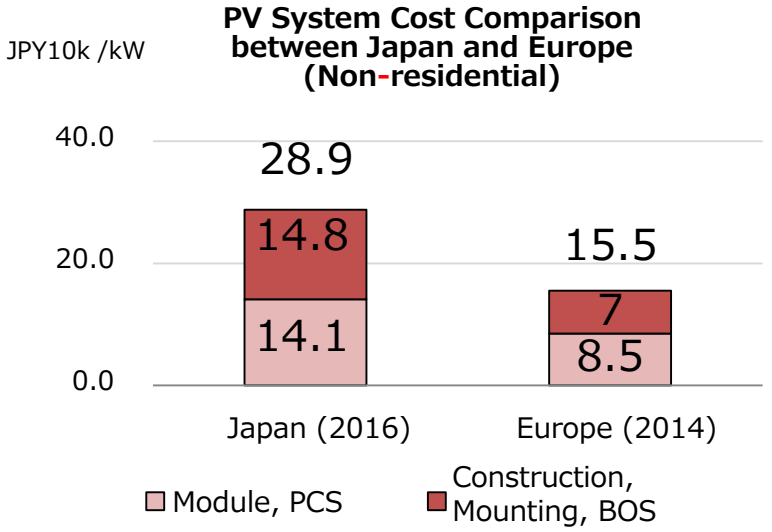
**Current:** JPY300k/kW (twice European price)

**Module, PCS :** 1.7 times
- Cost difference between domestic and foreign prices of international distribution products
- Residential PV system cost is 3 times as high as that in Europe due to the distribution structure for residential systems

**Construction, Mounting, etc. :** 2.1 times
- Few PV-specific installers, the methods are not most efficient
- Additional cost due to Japan's specific disaster response, site environment

Converge with the international price through competitiveness and technology development

Reduce the costs by optimizing methods and technology development




**Target**

**For non-residential**
- JPY200k/kW by 2020
  (≒Generation cost: JPY14/kWh*)
- JPY100k/kW by 2030
  (≒Generation cost: JPY7/kWh*)

**For residential**
- JPY300k/kW by 2019
  (≒Sales price: residential electricity bills JPY24/kWh)
- JPY200k/kW ASAP
  (≒Sales price: residential electricity bills JPY11/kWh)

*Target of NEDO's technology development strategy

# Outlook of Wind Generation Cost Reduction

- Our target is to reduce generation cost to JPY 8-9 /kWh by 2030 so that wind power energy will be self-sustaining (without the support by FIT)

**【Status】**

JPY 13.9 /kWh (the world average is JPY 8.8/kWh)

**Turbine : JPY 160k**
**(1.4 times the world average)**
- hover at high level due to high tariff and uncertainty of grid connection, EIA, etc.

Promotion of Competition
Stronger wind power industry

**Construction :JPY 122k**
**(1.6 times the world average)**
- Geological limit, smaller-scale generation

Larger-scale Wind Farms
Larger Turbines

**O & M : JPY 9k /kW/year**
**(twice the world average)**
**Duration : 20 years**
- Monopoly/Oligopoly by turbine makers and O&M companies
- Not efficient O&M

Promotion of Competition
More efficient O&M

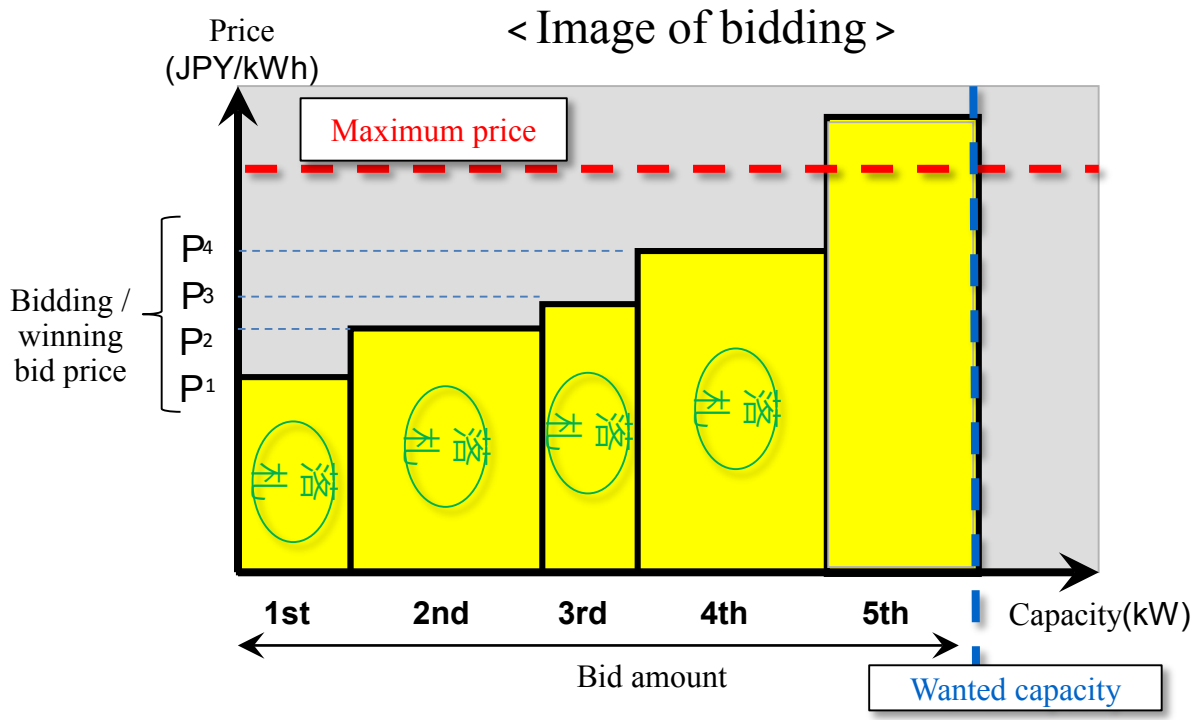
**【2030 Target】**
**JPY 8-9 /kWh by 2030 and Self-sustaining wind power energy**

**Turbine & Construction : JPY 239～253k/kW**

**O&M : JPY 4.1～4.6k/kW/year**
**Duration : 25 years**

# Auction scheme

· Target for bidding for the moment: solar power generation for business of 2 MW or more.
· Implementation time: The first round will be held in October, 2017
※Trial period: FY2017 and FY2018 (three times in total for 2 years).
· Bid amount: Total 1 to 1.5 GW in 1st to 3rd times. The first round is 500 MW.
· Maximum price: 21 yen / kWh for the first time. The 2 nd and 3 rd times are set by verifying the results of the 1 st time.
· Procurement price etc. of the winning bidder: Bid price is adopted as procurement price in 1st ~ 3rd times (Pay as bid method). Procurement period is 20 years.



# Accelerating Environmental Impact Assessment

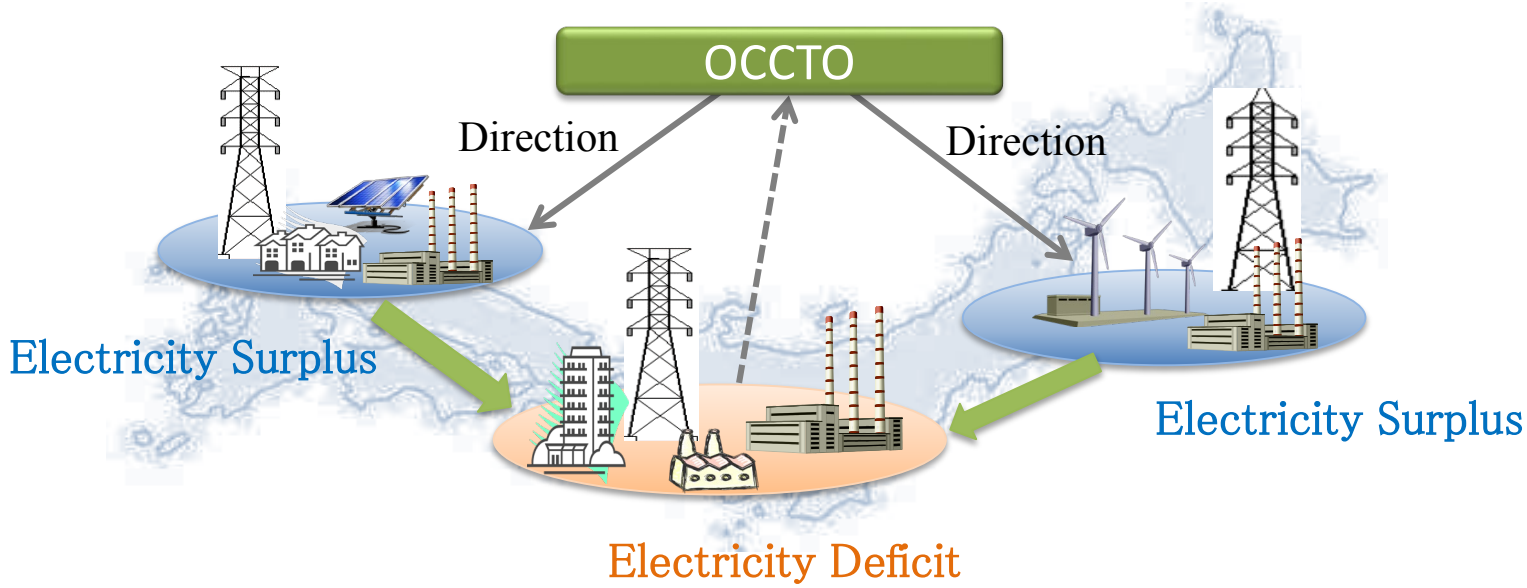
- Environmental Impact Assessment (EIA) typically takes between 3 and 4 years, so it takes a long until the project scale and site are determined. This is a concern for the development of the business.
- Results of demonstration projects (from time of Letter of Consideration to Minister's recommendation)
  - Typical process: 36.8 months
  - Accelerated process: 22.4 months (for those completed by 2015)

**Capacity of Wind Projects under EIA**

| Power Co. | Capacity (MW) | Power Co. | Capacity (MW) |
|---|---|---|---|
| Hokkaido | 2,200 | Kansai | 80 |
| Tohoku | 5,330 | Chugoku | 100 |
| Tokyo | 80 | Shikoku | 190 |
| Hokuriku | 20 | Kyushu | 240 |
| Chubu | 140 | Total | 8,350 |

# 1st Step: Establishment of OCCTO

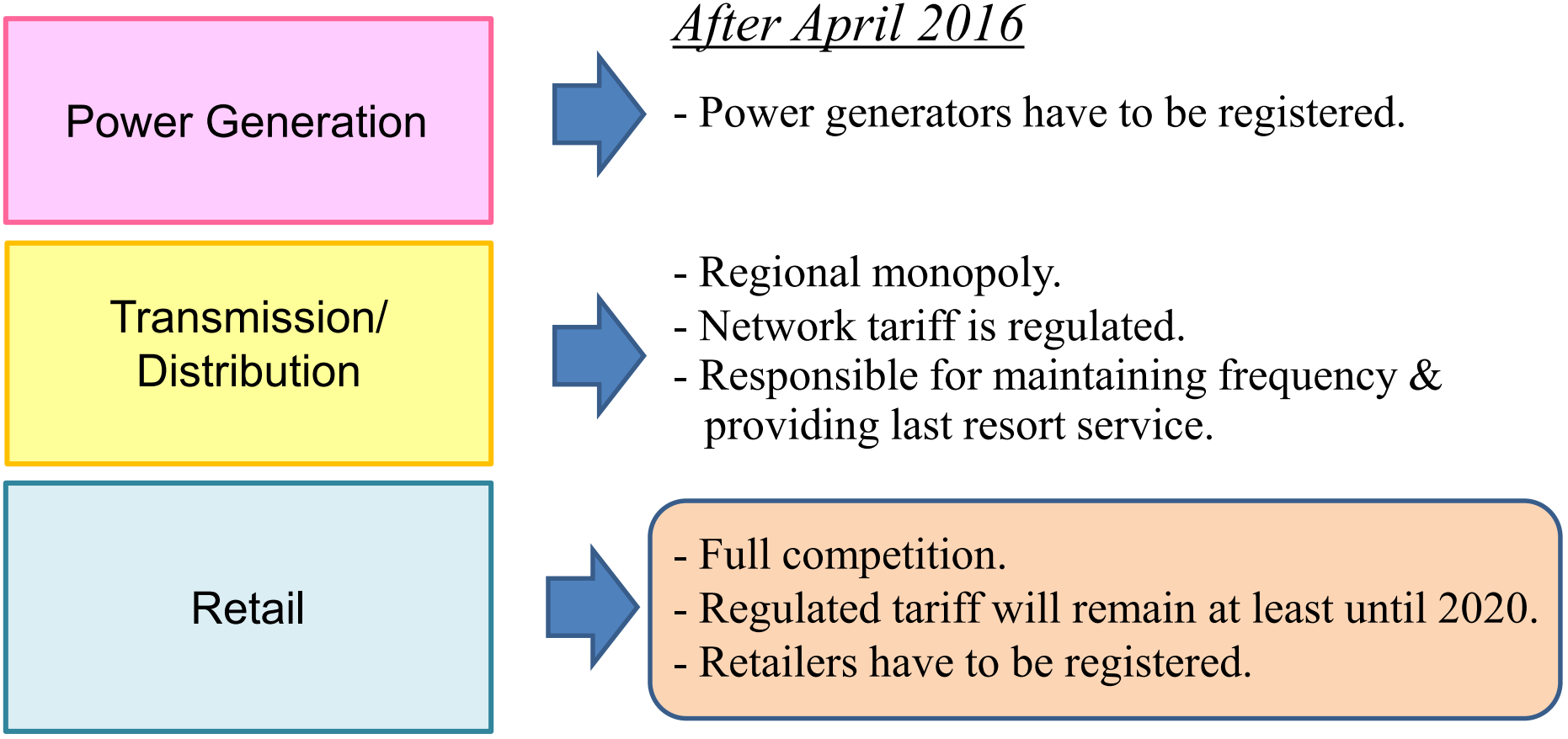
- In order to facilitate power interchange between regions, the Organization for Cross-regional Coordination of Transmission Operators (OCCTO) was established in April 2015.




OCCTO's main functions include:
- prescribing utilities to increase power generation and interchange when needed.
- reviewing utilities' power supply and demand plans.
- constructing transmission lines between regions in response to an increase in demand.

# 2nd Step: Full Retail Competition

- The residential sector was opened up to competition on April 1st this year.
- In the meantime, consumers can stay with the regulated tariffs at least until 2020 if they wish.



# 3rd Step: Unbundle Transmission/Distribution Sector

- In order to enhance neutrality and transparency, transmission/ distribution sector has to be unbundled from other sectors in 2020.
- Either a holding company or an affiliated company format will be chosen.