TEPCO's decarbonization challenges

Masaaki HANAOKA

Executive General Manager, London Office

Tokyo Electric Power Company Holdings, Inc

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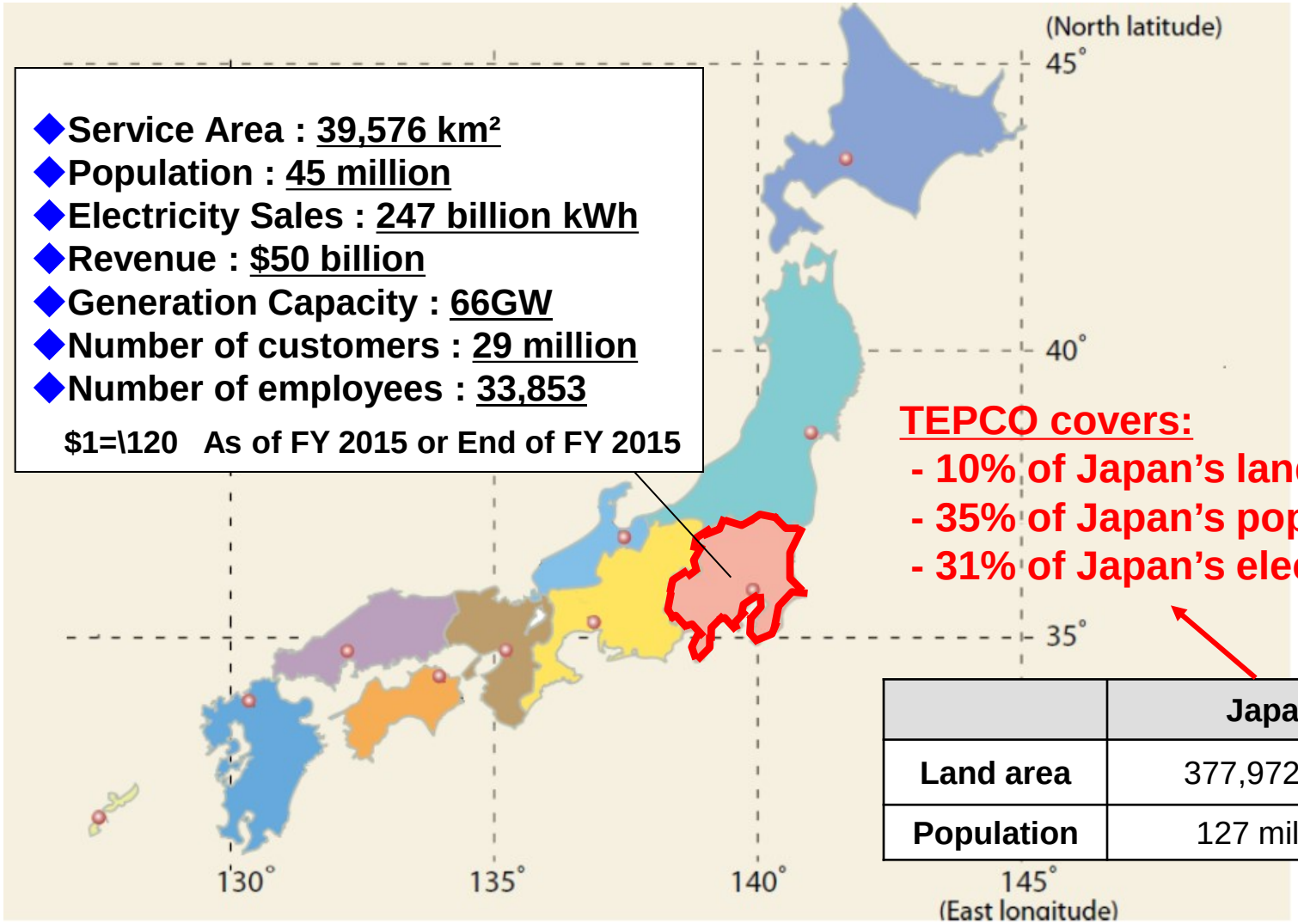
Key Figures of TEPCO



- Service Area : 39,576 km²
- Population : 45 million
- Electricity Sales : 247 billion kWh
- Revenue : $50 billion
- Generation Capacity : 66GW
- Number of customers : 29 million
- Number of employees : 33,853

$1=\120 As of FY 2015 or End of FY 2015

TEPCO covers:
- 10% of Japan's land area
- 35% of Japan's population
- 31% of Japan's electricity sales

	Japan
Land area	377,972 km²
Population	127 million

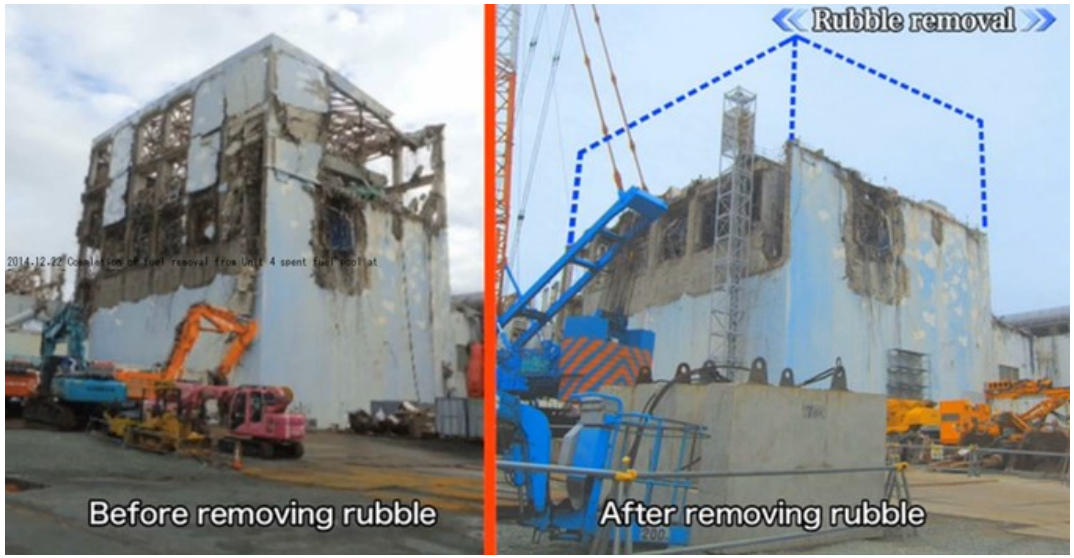
"ELECTRICITY REVIEW JAPAN" (The Federation of Electric Power Companies of Japan)

Fukushima Daiichi Five years Later

Fuel Removal from Unit 4 Spent Fuel Pool Completed on Dec. 22, 2014

Nov. 2011 Apr. 2012 Nov. 2013 Dec. 2014

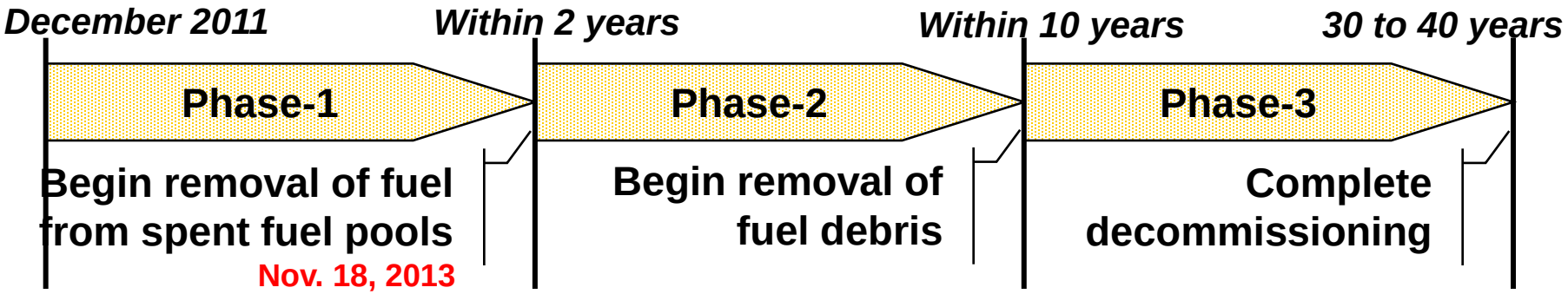
Rubble removal → Cover construction → Fuel removal → Completion



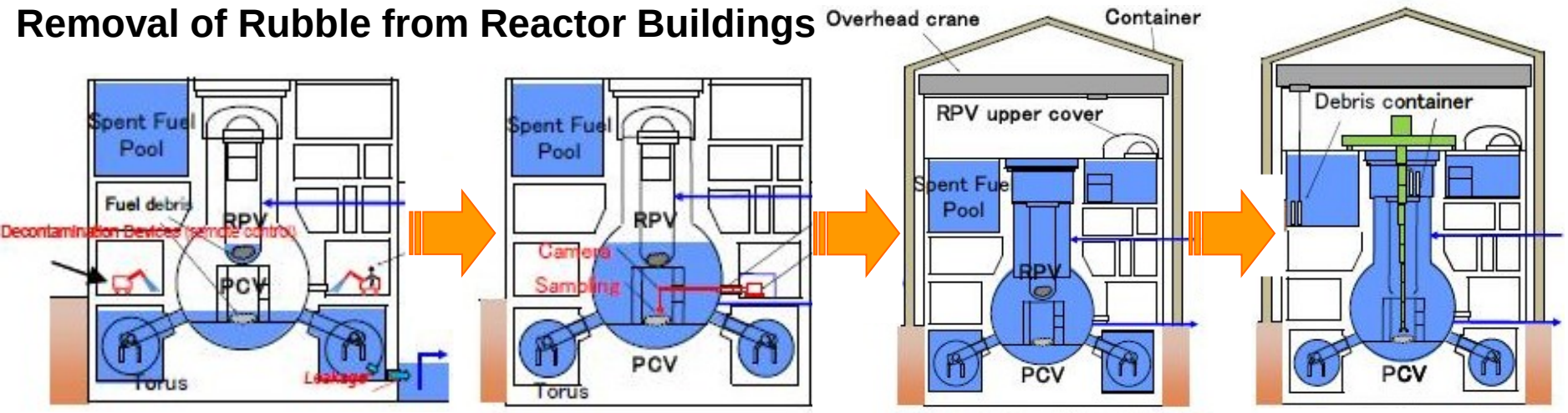
Fuel Handling Machine
to remove fuel from spent fuel pool

Roadmap for Recovery and Decommissioning

- **Global collaboration needed to work on unprecedented R&D efforts.**

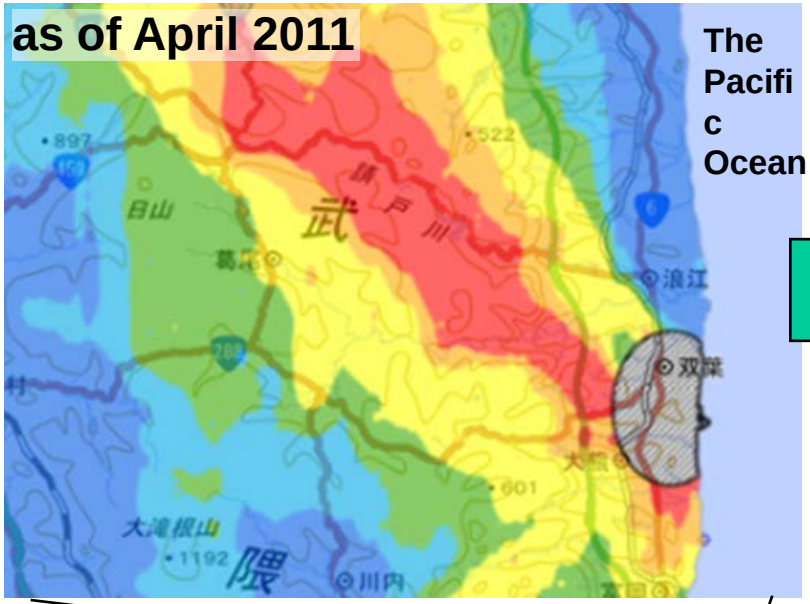


Removal of Rubble from Reactor Buildings

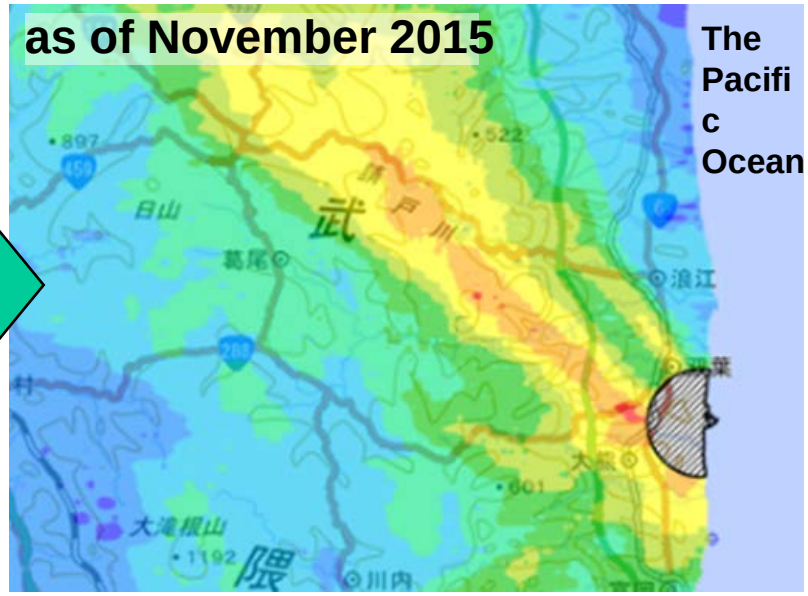


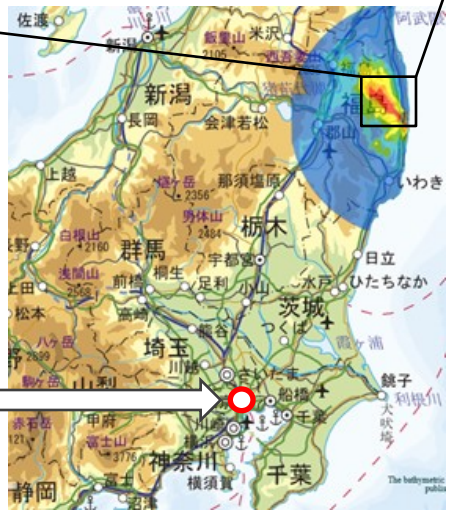
Radiation Dosage Levels around Fukushima Daiichi

Aerial Radiation Dose (μSv/h) at 1 m above ground)



4 years





Tokyo

1 μSv/h = 8.76 mSv/y
2.3 μSv/h = 20 mSv/y

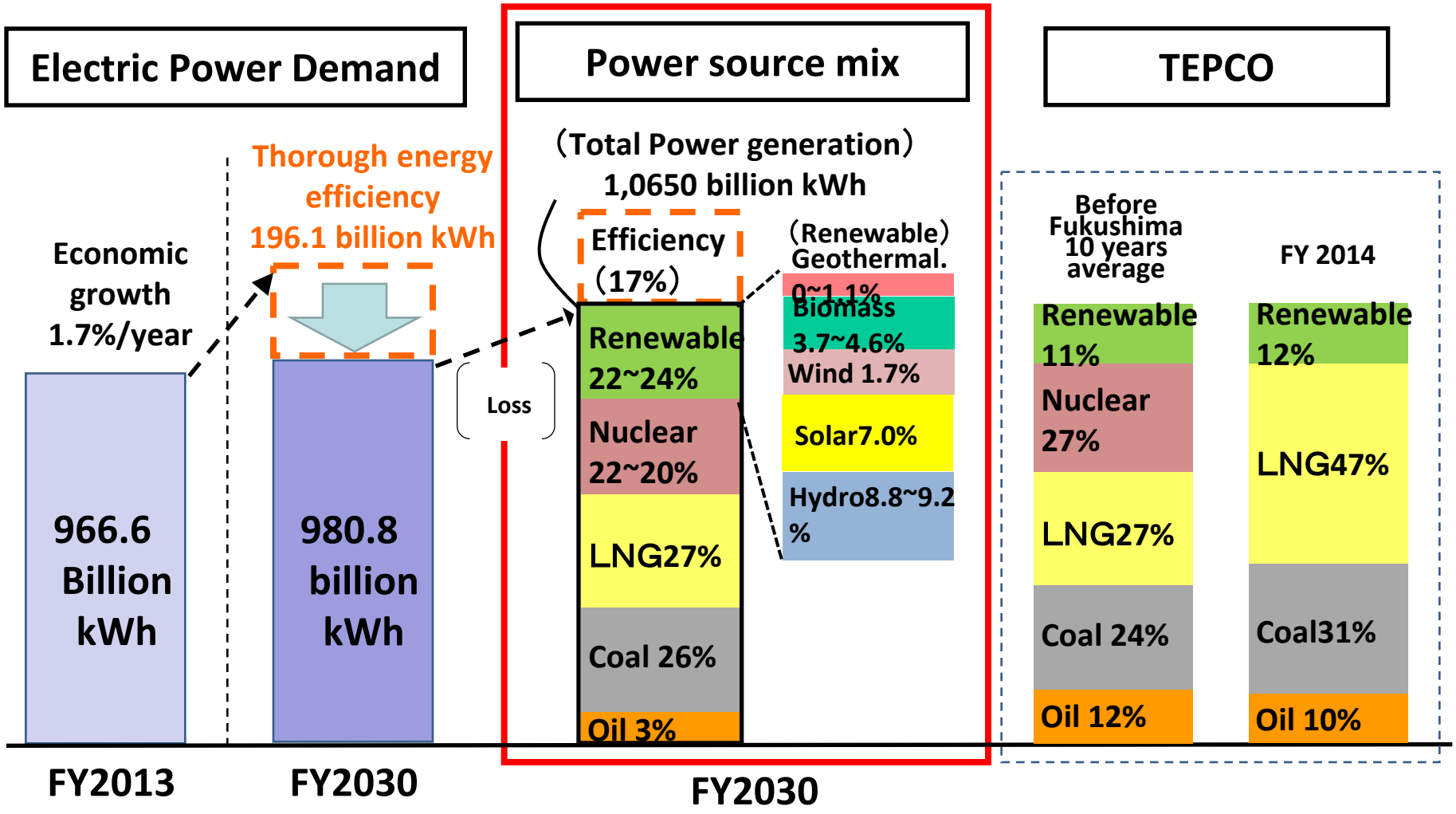
19.0<MV (measured value) (μSv/h)
9.5<MV≦19.0
3.8<MV≦9.5
1.9<MV≦3.8
1.0<MV≦1.9
0.5<MV≦1.0
0.2<MV≦0.5
0.1<MV≦0.2
MV≦0.1

No Data Area

Energy Mix in Japan

Long-term Energy Supply and Demand Outlook

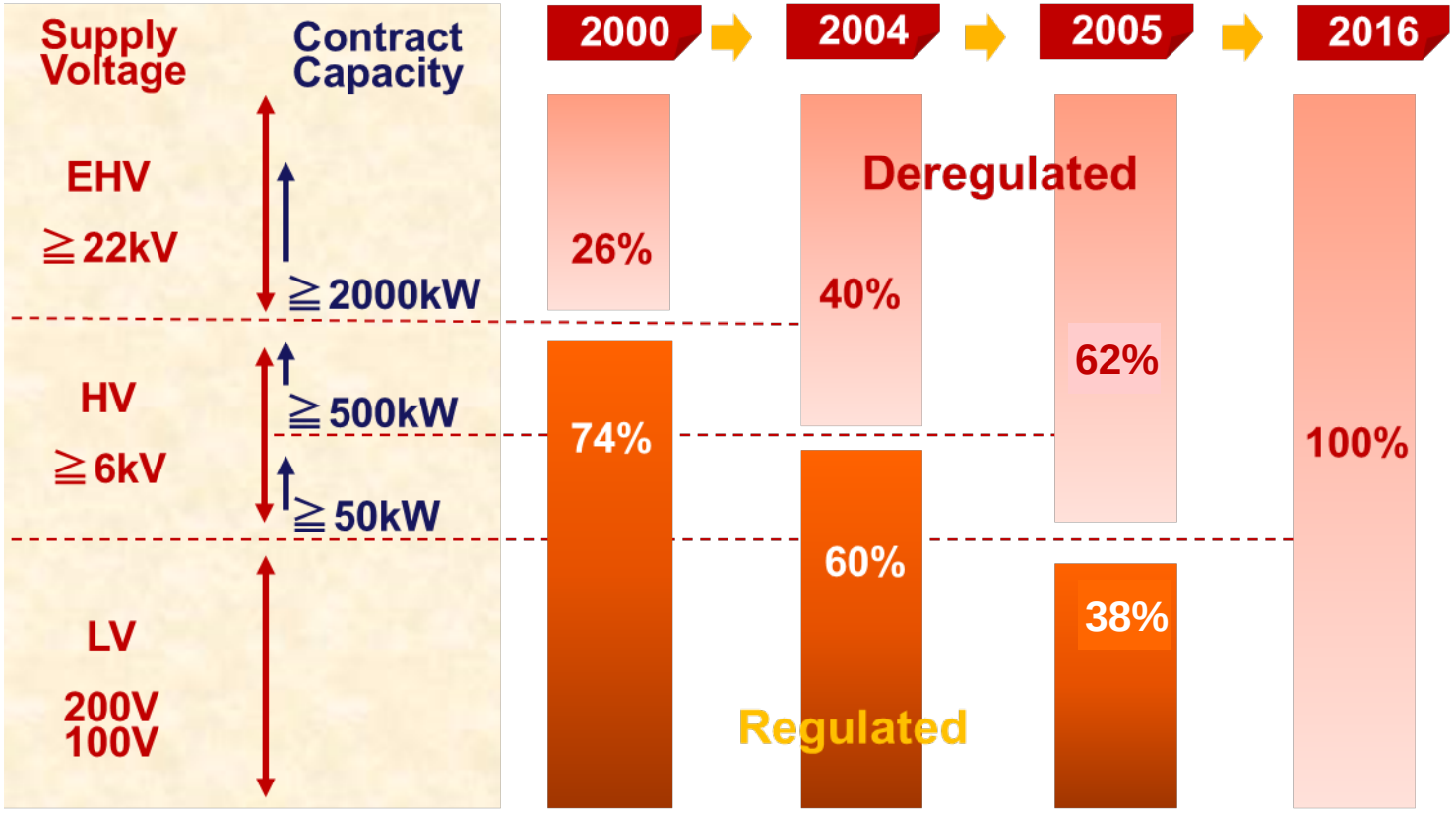
- The goals of energy policy are to be achieved regarding safety, energy security, economic efficiency and environment which are the basic perspectives in the Strategic Energy Plan.



Power Market Reform in Japan

Power market reform in Japan

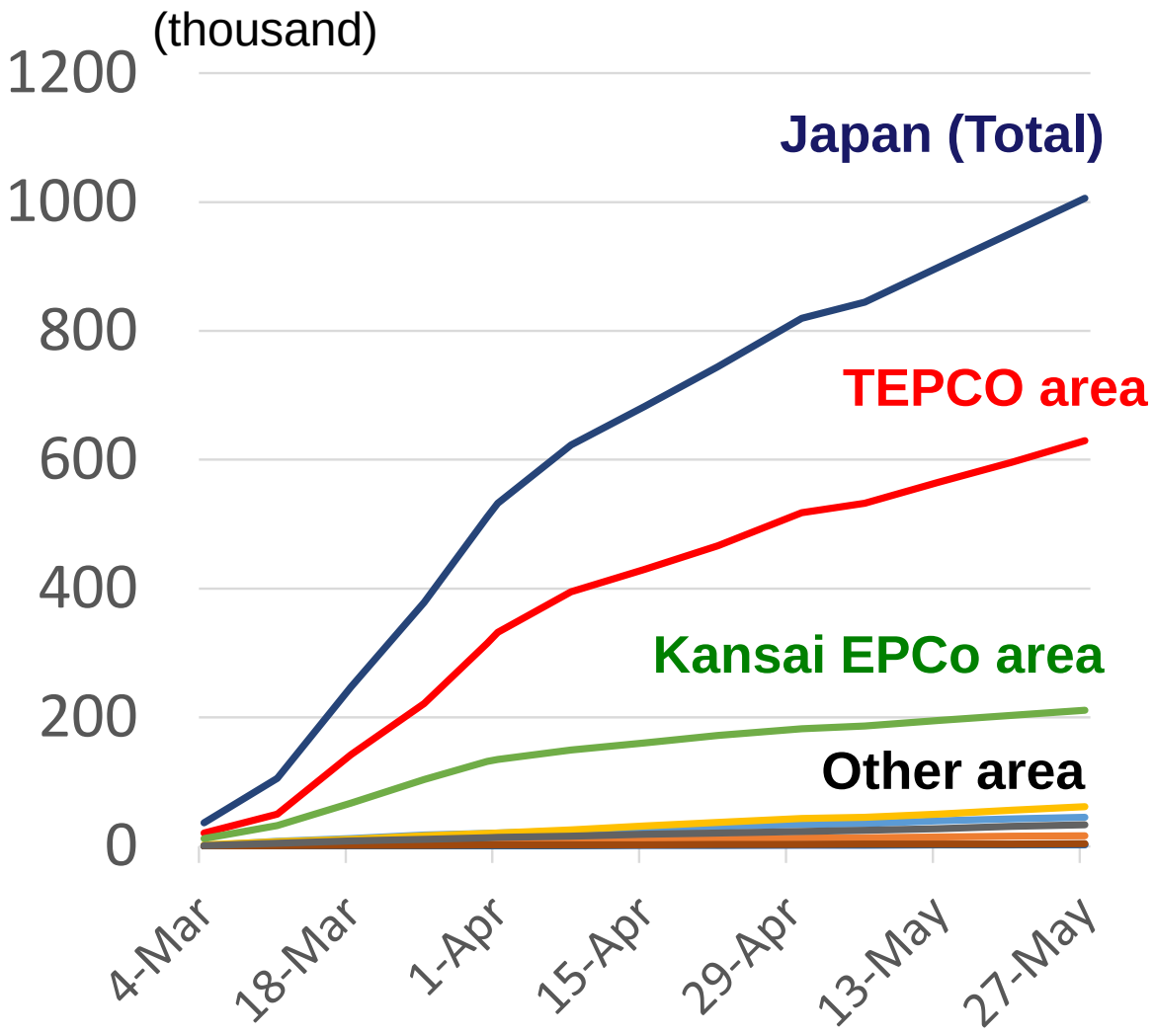
- Japan's power market liberalization started in 2000.
- From April 2016, it is fully opened.



- Gas market will be fully opened in April 2017.

‘Market penetration’ under full liberalization

Accumulated switching application number in Japan

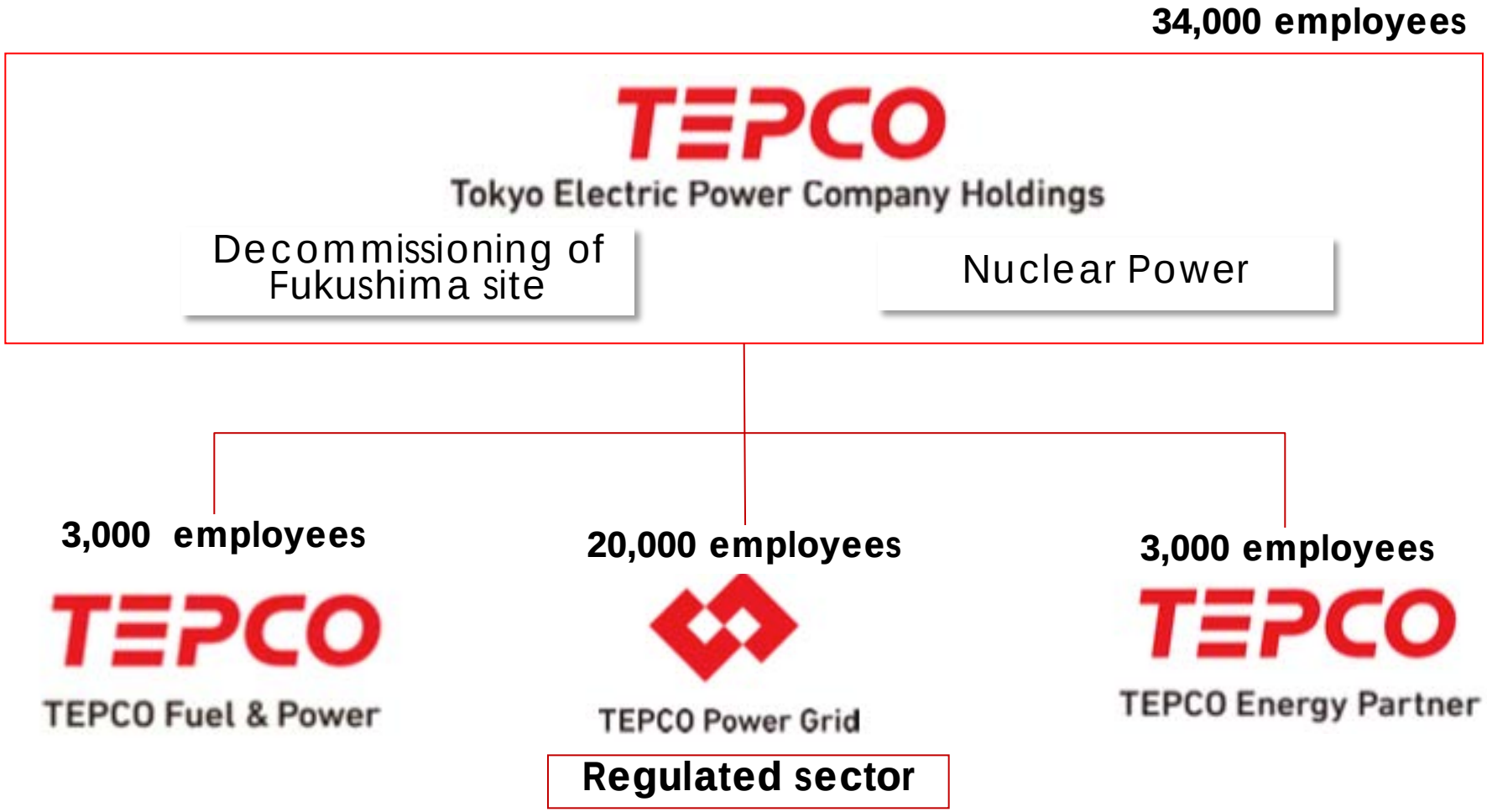


EPCo	No. of application (k)	Rate (%)
Hokkaido	45.9	1.15
Tohoku	17.6	0.23
Tokyo	**647.3**	**2.22**
Chubu	64.0	0.60
Hokuriku	2.3	0.11
Kansai	**216.3**	**1.59**
Chugoku	2.5	0.05
Shikoku	4.2	0.15
Kyushu	35.4	0.41
Okinawa	-	-
Japan	**1036**	**1.22**

※ As of May 31

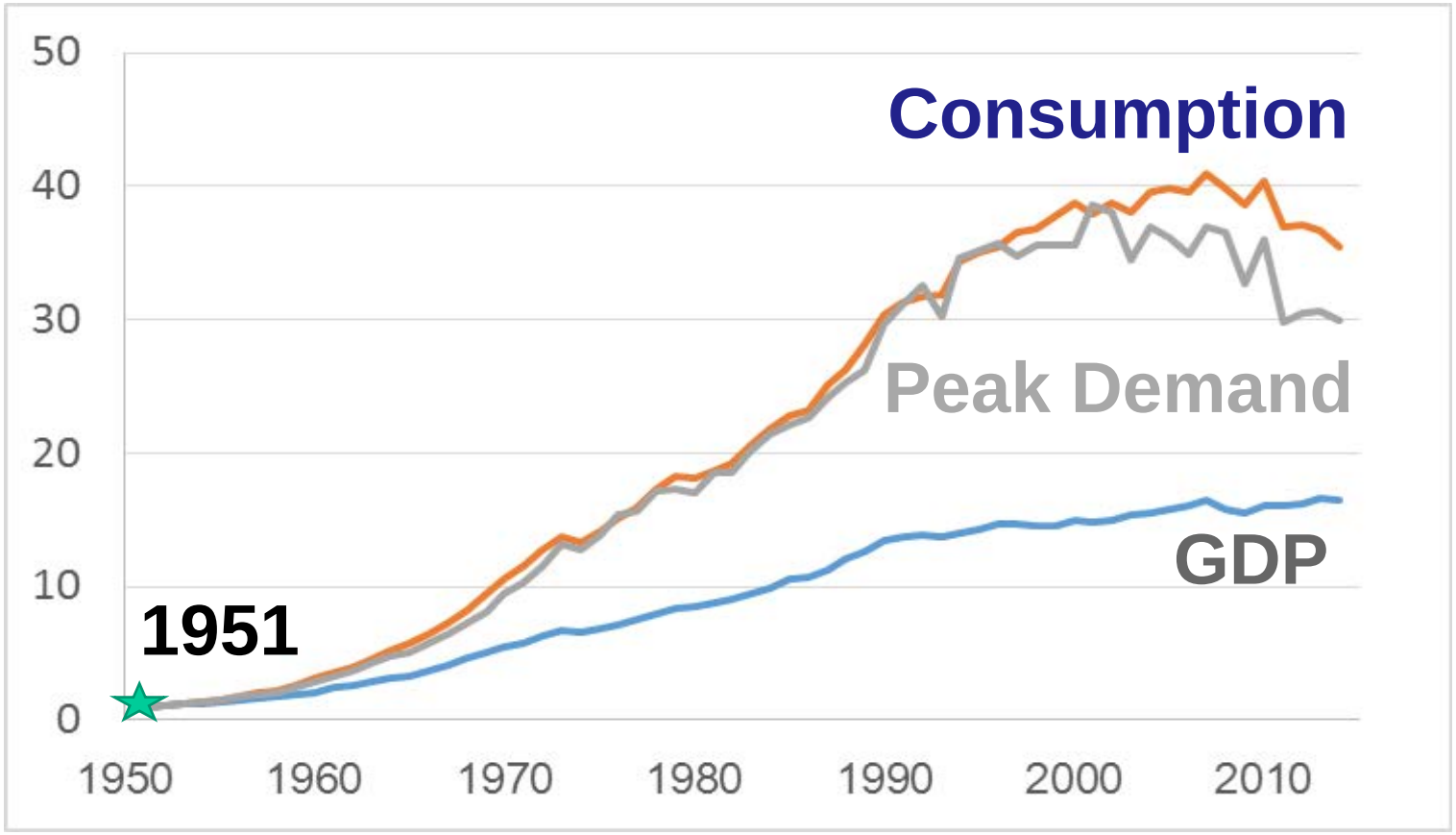
New TEPCO company structure

- TEPCO moved to a holding company structure in April 2016.



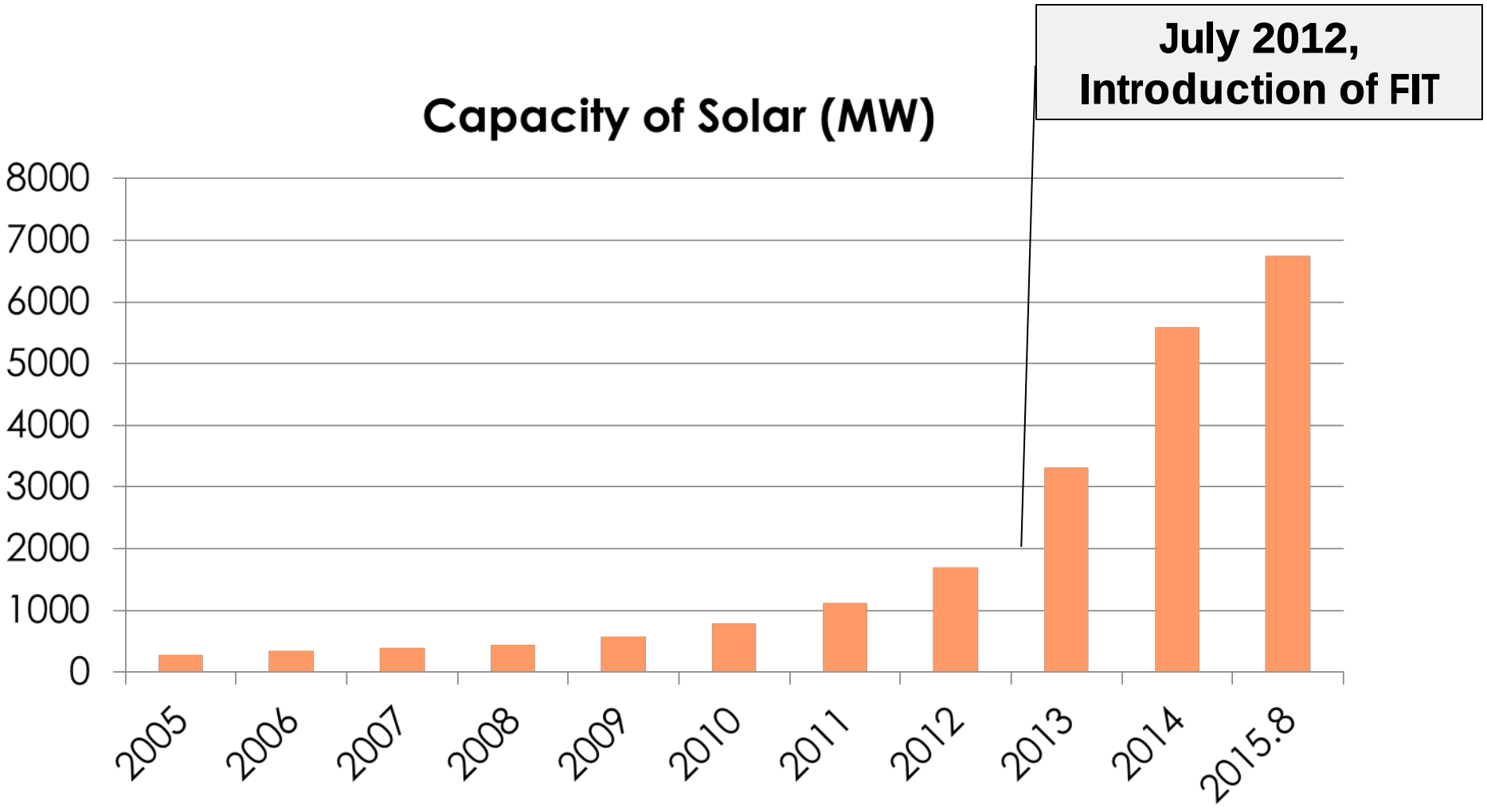
Electricity demand in Japan

- Electricity demand declined after Fukushima nuclear accident.



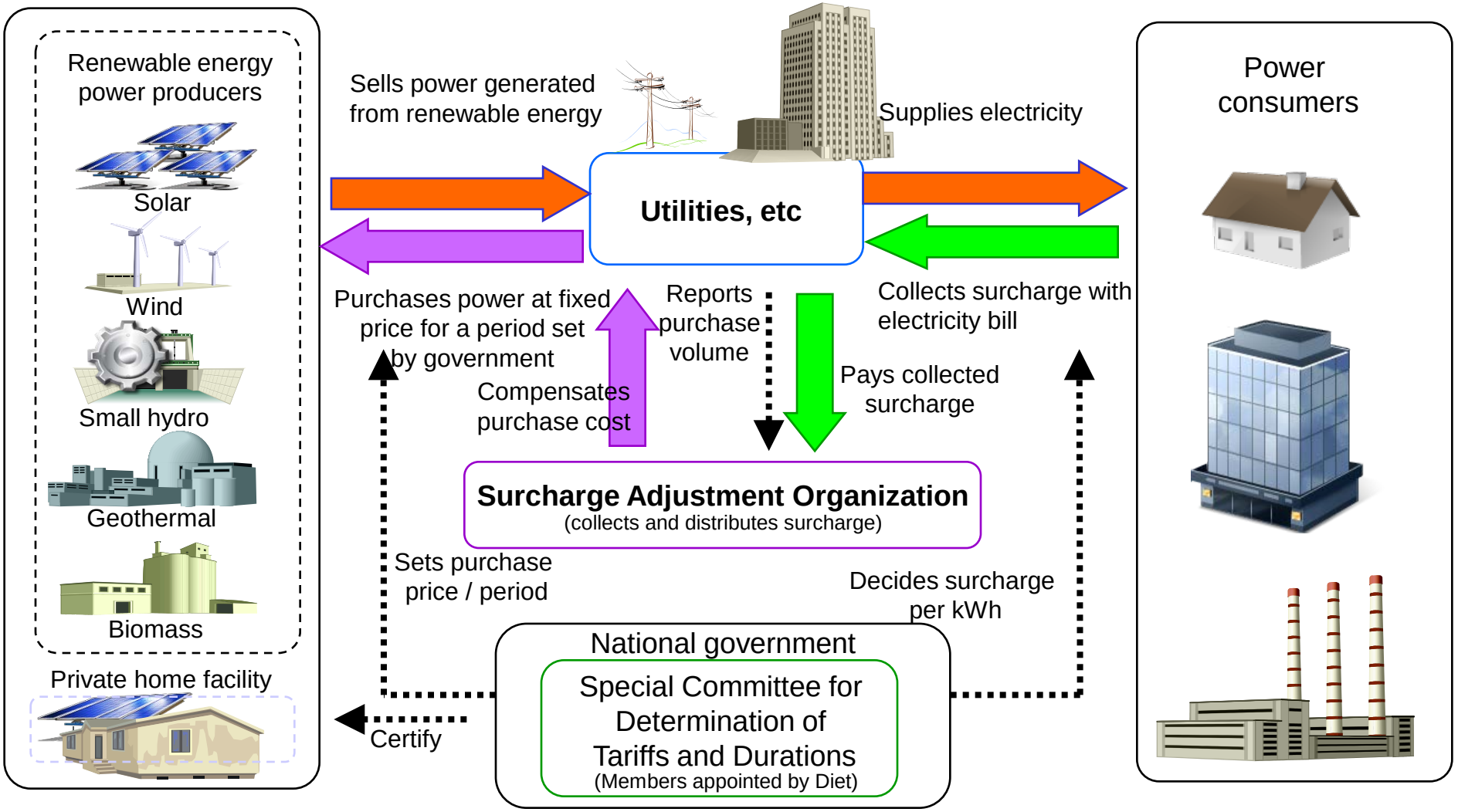
Renewable Energy in Japan

Growing Purchase of Electricity from Solar



Outline of FIT System in Japan (July 2012-)

- Power utilities purchase power generated from renewable energy at fixed price for a certain period of time
- Purchasing cost is surcharged to consumers depending on consumption volume



Purchase Conditions for FY 2012-2015

Energy	Purchase category		Price (JPY/kWh) FY2012	FY2013	FY2014	FY2015 April-June	FY2015 July-Mar	FY2016	Period (yrs)
Solar	Under 10 kW (surplus purchase)		**42**	**38**	**37**	**33**(※1), **35**(※2)		**31**(※1),**33**(※2)	10
	10 kW or more		**40**	**36**	**32**	**29**	**27**	**24**	20
Wind	Under 20 kW		55						20
	20 kW or more		22						
	Offshore		—		36				
Hydro	Newly built	Under 200 kW	34						20
		From 200 kW up to 1MW	29						
		From 1MW up to 30MW	24						
	Existing headrace used	Under 200 kW	—		25				20
		From 200 kW up to 1MW	—		21				
		From 1MW up to 30MW	—		14				
Bio-mass	Wood biomass (recycled wood)		13						20
	Waste (non-wood) biomass		17						
	Wood biomass (imported chips, PKS, etc)		24						
	Wood biomass (unused wood) 2MW or more		32						
	Wood biomass (unused wood) Under 2MW		32			40			
	Methane fermented gasified biomass		39						
Geo-thermal	Under 15MW		40						15
	15MW or more		26						

(※1) When generators are not required to install output control equipment
(※2) When generators are required to install output control equipment

Results of FIT Introduction (Jul 2012-Nov 2015)

- Since FIT system introduction in July 2012, renewable facilities with total output of approximately 94 GW have been granted FIT certifications.
- Solar power is particularly high in certified output.

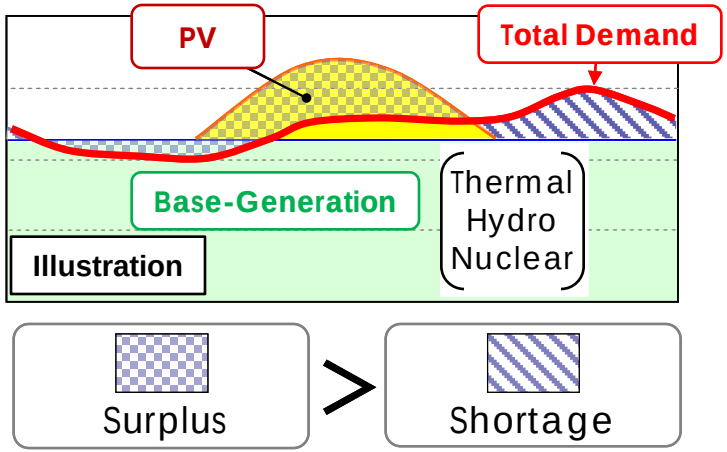
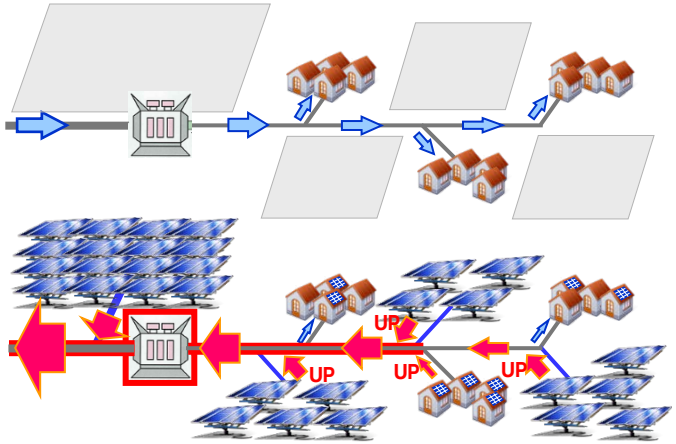
■ Certified output for each energy source (as of end of Nov 2015)

(MW)	Solar		Wind	Small/med hydro	Geo-thermal	Biomass	Total
	Under 10kW	10kW or more					
Certified Output (New)	4,330	**75,310 (88%)**	2,330	740	70	2,790	85,580
Installed Output (New)	3,670	20,740	380	130	10	430	25,370
Installed Output (Existing)	4,700	260	2,530	210	0	1,130	8,830

➢ Caused problems such as shortage of transmission capacity, increase in surcharges, and so on.

Source: METI website

Results of FIT Introduction – Grid Connection Problems

	(1) Demand-supply restriction	(2) Network capacity restriction
Illustration		
Problem and measures	Hokkaido, Tohoku, Shikoku, Kyushu, Okinawa Power Companies announced that they would postpone their replies on the network access applications from renewable developers. (Sep 2014) ➢ Mandatory installation of output control equipment. ➢ Transition to time-based output restriction rule (from 30 d/y to 360 h/y (PV), 720 h/y (wind)). ➢ Utilization of "designated power company scheme".	Surplus of renewable energy output at transmission lines, transformers. ➢ Setting the rule of transmission system information publication. ➢ Launched bidding scheme for renewable developers to share the burden of upgrading the network facilities.

Recent adoption on FIT revision (Date of effect: April 2017)

[Purpose of the revision]

(※) 12.2% in FY2014.

To achieve the target of 22-24%(※) renewables in FY2030 energy mix

Balanced renewable installation	Cost-efficient to limit national burden	Efficient Cross-regional electricity trading & coordination

Combine maximum renewable energy installation and limited national burden

[Revision points]

1. **The establishment of a new certification scheme.**
   - Taking into consideration non-operative projects
2. Installation of scheme for proper operation.
3. **Installation of cost-efficient scheme.**
   - Bidding scheme (target TBD)
   - Showing future purchase prices (target TBD)
4. Promotion of renewable projects with long lead-times.
5. Promotion of renewable projects utilizing the electricity market reforms.
   - Change of purchase obligation party (from retailer to network operator)

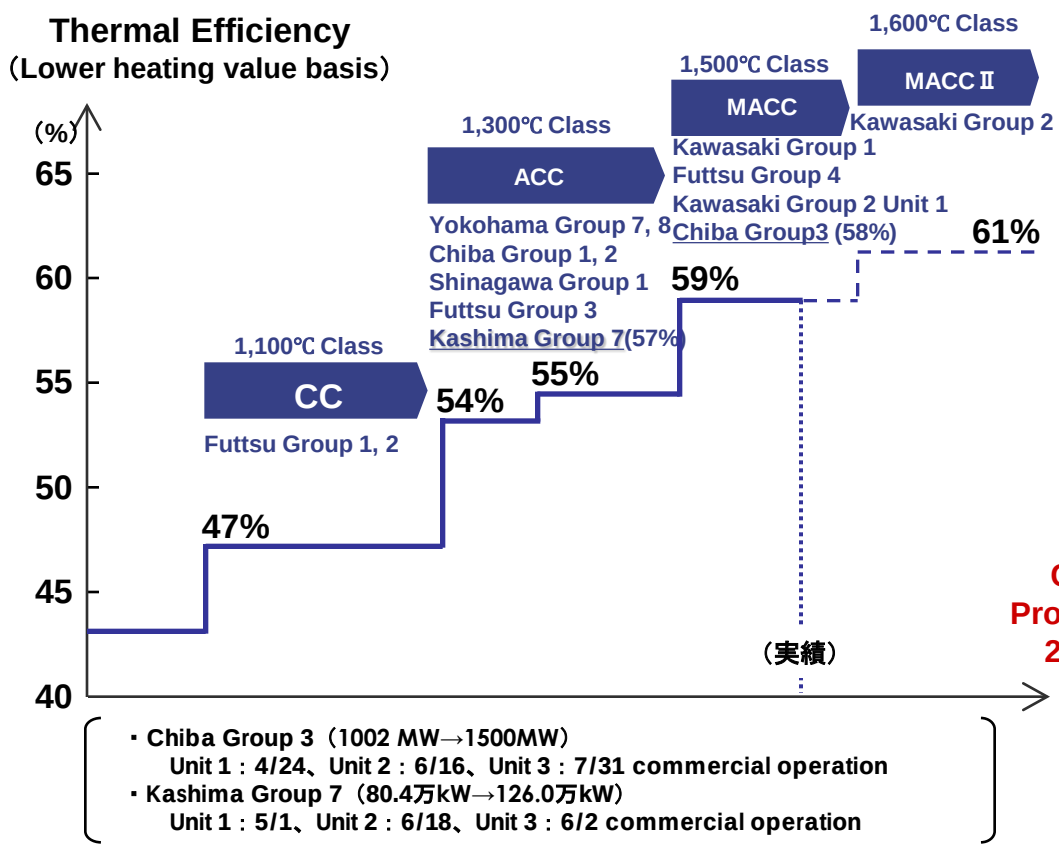
Source: METI document

TEPCO’s challenges

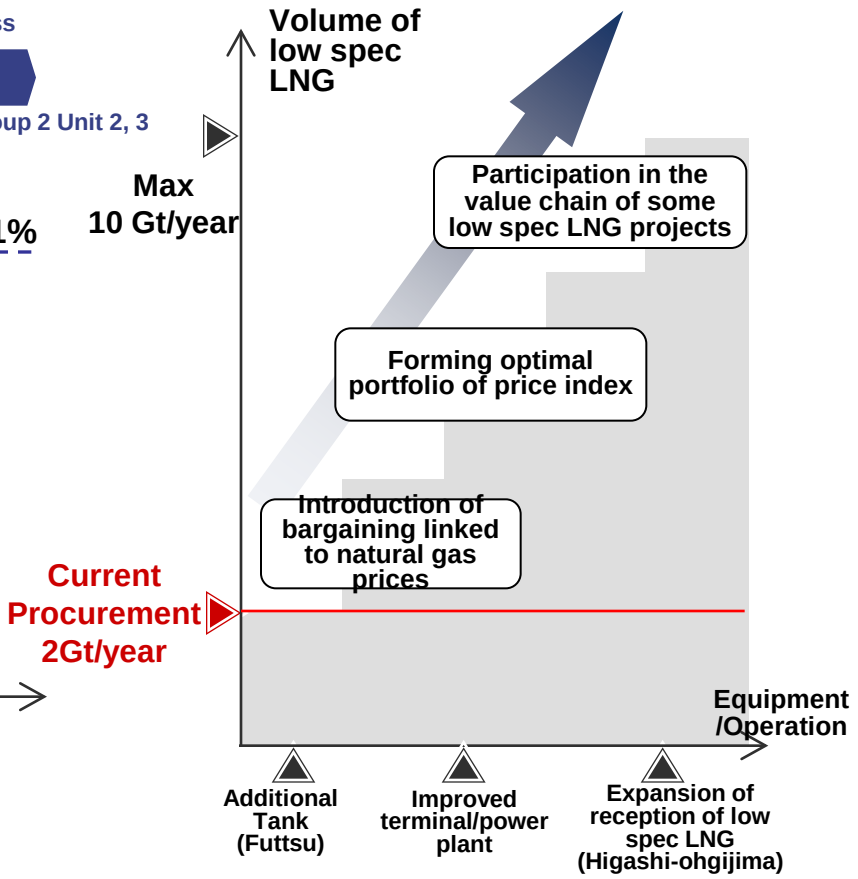
- Reduction of fuel costs and consumption
- Adopting adjustable-speed pumped storage hydro
- Distribution Upgrade & Smart Meter
- Digital Utility

Reduction of fuel costs and consumption

- Chiba Thermal Group 3 and Kashima Thermal Group 7 started operation in series; they were installed immediately after 3.11 and were improved to be combined cycled and highly efficient
- TEPCO will purchase up to 1.20 million tons of LNG per year over 17 years from BPS, starting in April 2017. The supply features the inclusion of lean LNG, of which TEPCO intends to increase its share, and also the inclusion of gas link (Henry Hub link) for price indexation

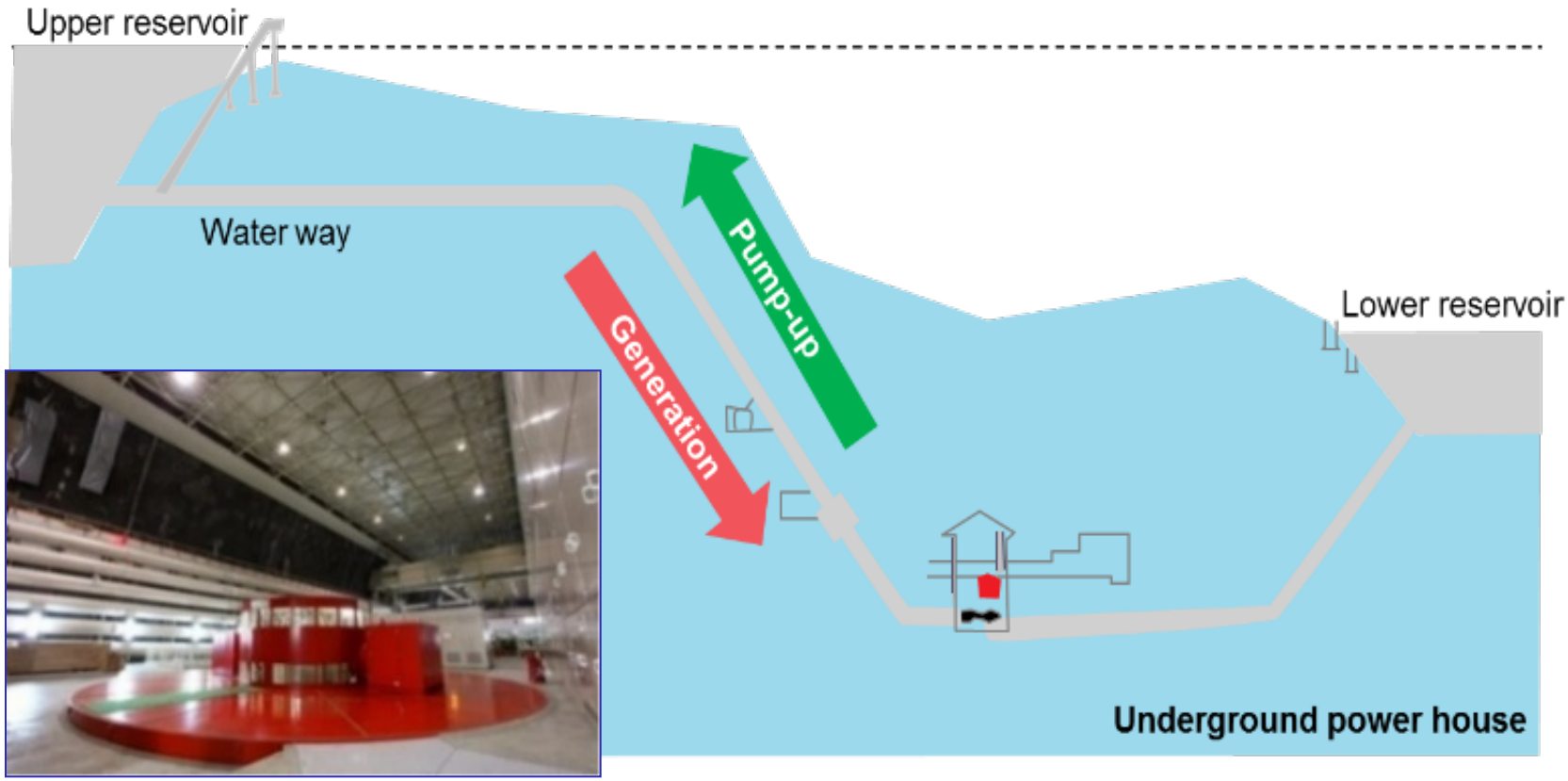


- Chiba Group 3（1002 MW→1500MW）
  Unit 1：4/24、Unit 2：6/16、Unit 3：7/31 commercial operation
- Kashima Group 7（80.4万kW→126.0万kW）
  Unit 1：5/1、Unit 2：6/18、Unit 3：6/2 commercial operation



Advanced technologies of TEPCO

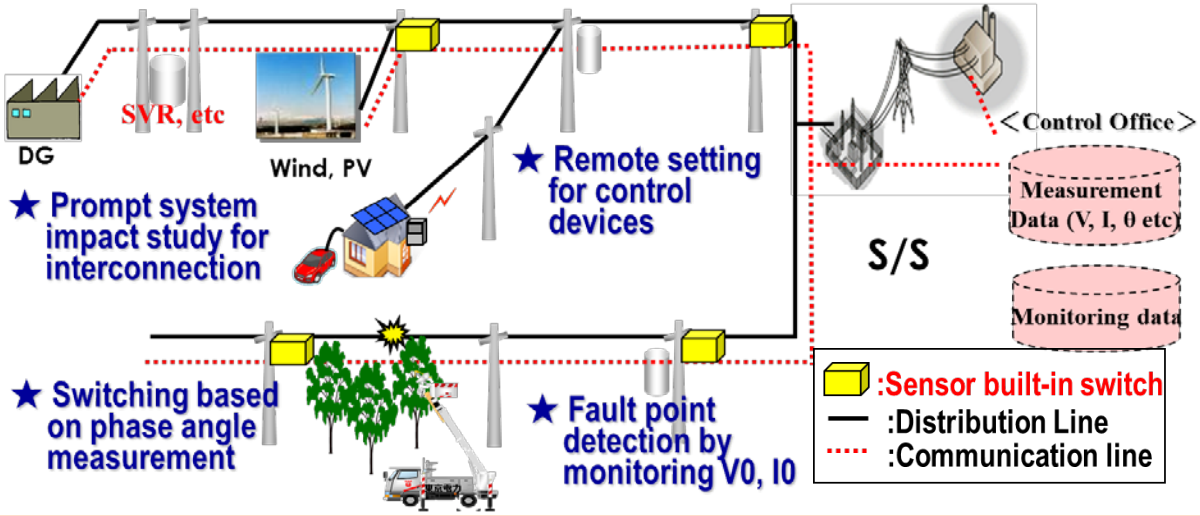
Adopting adjustable-speed pumped storage hydro



- **Adopt a high-volume grid to absorb surplus power from unstable electrical sources (e.g., solar, wind) on light-load days**
- **Provide LFC service even while in pumping operation**

Distribution Upgrade & Smart Meter

- TEPCO will roll out 27 million smart meters by 2020.



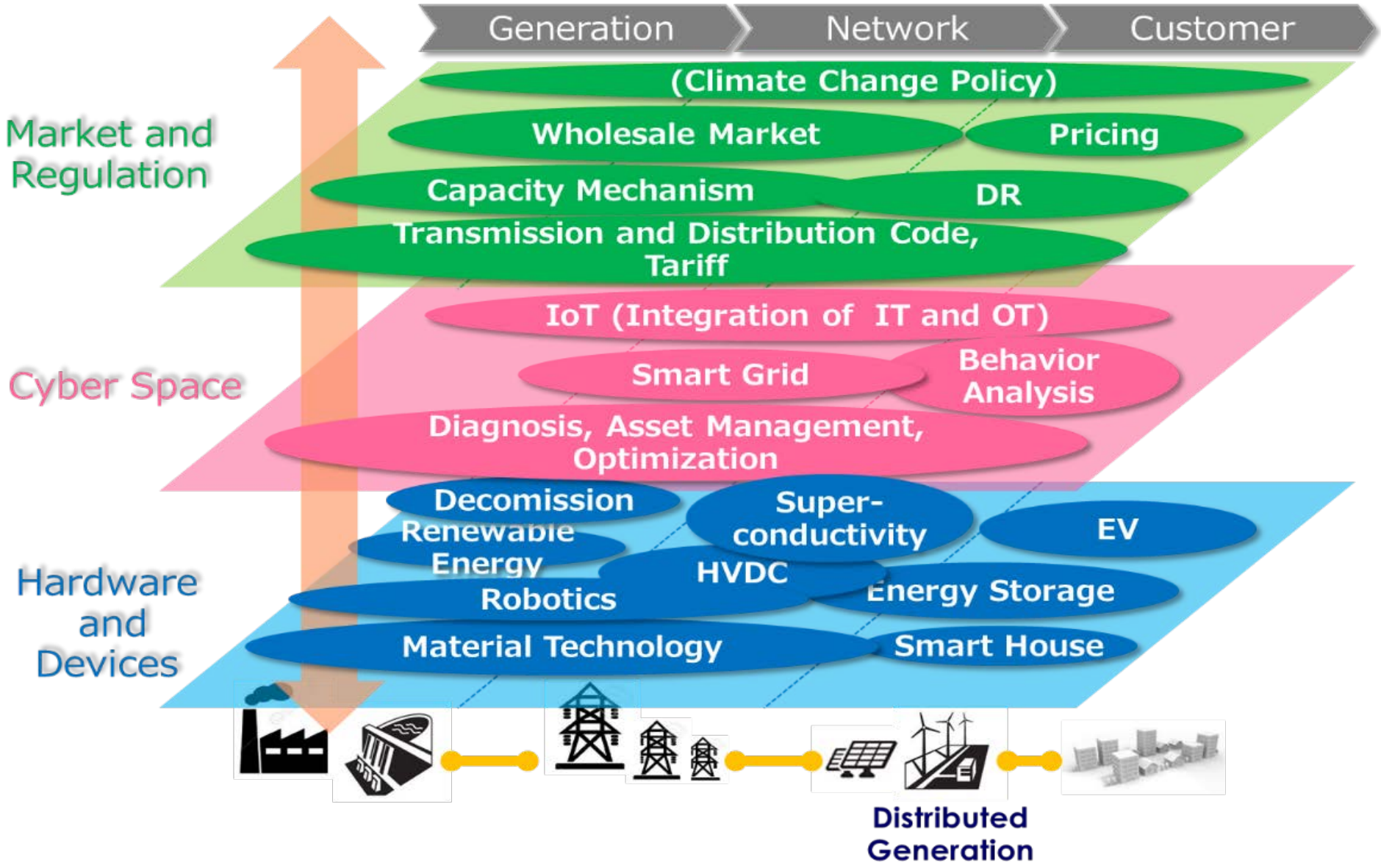
Sensor built-in switch

Smart Meter

- ✓Metering and memorizing every 30 min.
- ✓Measuring currents and power
- ✓Communicative Function, Remote disconnect / reconnect, Demand-limit change, Emergency demand limit, Event memorization, etc.
- ✓Automated meter reading
- ✓Energy management for HEMS

- ✓Possible in various rate plans

Towards a Digital Utility



Brand slogan of TEPCO Group

The Energy for Every Challenge

As expressed in the word "Challenge," TEPCO aims to be the chosen partner in this industry while remaining highly competitive and fulfilling its responsibility. TEPCO will continue to provide a stable supply of electricity and moreover, contribute to improving the lives of our customers. In every business field, we pledge to pursue a higher goal.

The word "Energy" here refers not only to our business domain, but to our passion and power to serve people.