

Japan's Electricity Market Reform and Beyond

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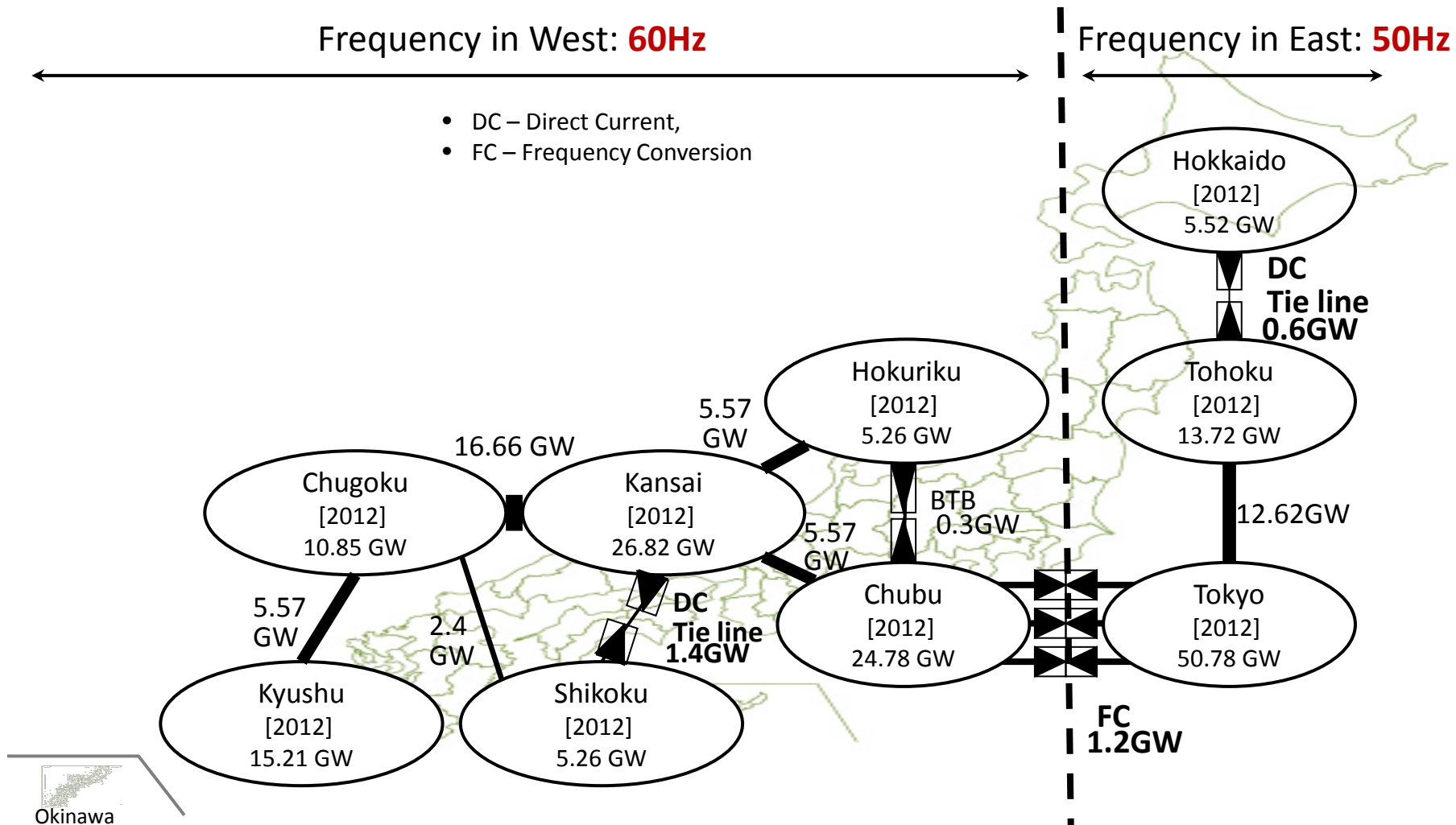
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OVERVIEW OF JAPAN'S ELECTRICITY MARKET

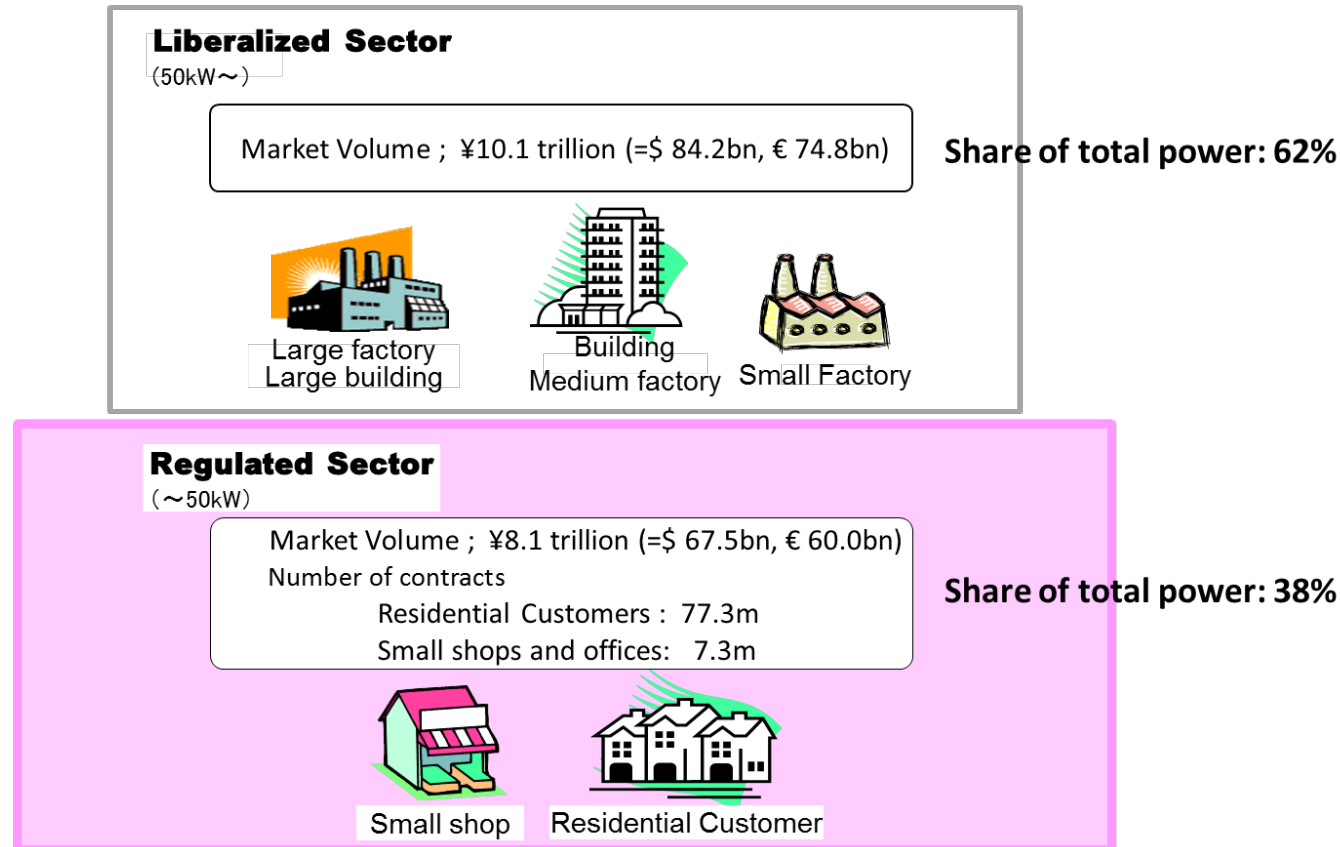
Electricity Market Overview

- 10 Vertically Integrated Electricity Power Companies (EPCOs)
- 2 types of frequency, 50Hz and 60Hz



Partially Liberalized But Still Very Low Competition

- While Japan's electricity market has been partially liberalized since 2000, still big 10 EPCOs dominates the market.
 - 10 big EPCOs: 848.5TWh / 209GW = JPY 18.2 trillion (\$ 151.7bn, € 134.8bn) (2013)
 - Share of non- big EPCOs for over 50kW retail market = 4.2%
 - Only 1.3% is transacted at Japan Electric Power Exchange (JEPX)



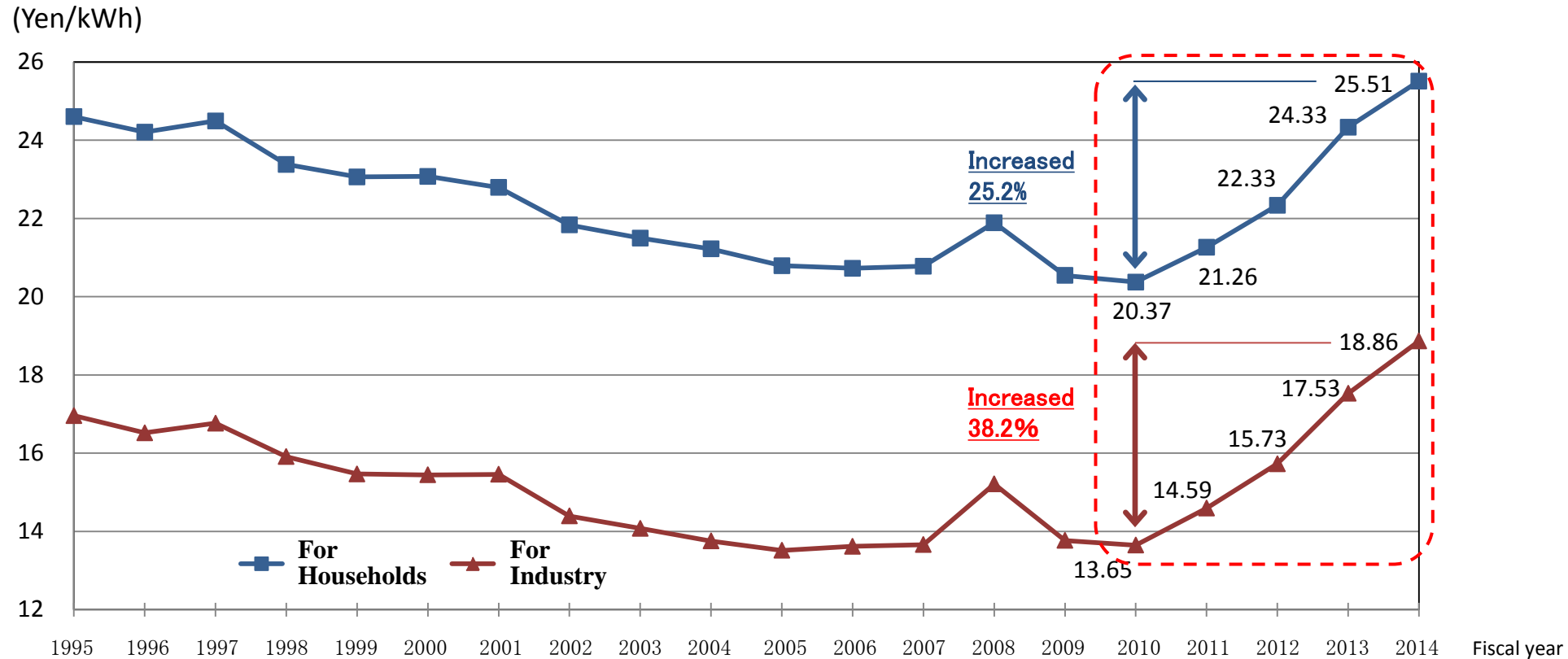
Total market volume: 982.4TWh/289GW

Problems Revealed by 3.11

The Great East Japan Earthquake on March 11 2011 revealed negative aspects of regional monopoly system with 10 big and vertically integrated EPCOs.

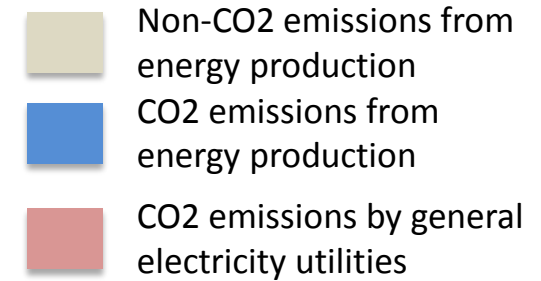
1. Lack of system which transmits electricity beyond regions
2. Little competition and strong price control
3. Little flexibility in changing the existing energy mix; hard to increase the ratio of renewable energy

Electricity Price Goes Up After 3.11

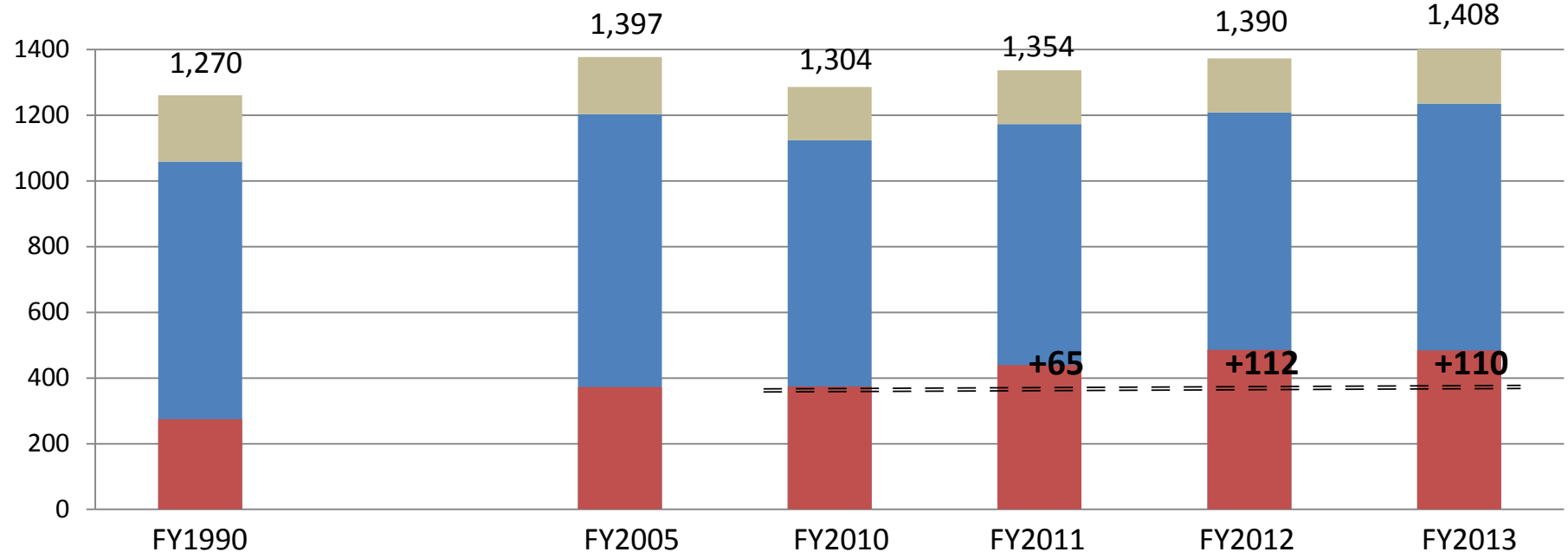


[Source] Created based on the "Electricity Demand Report" (Federation of Electric Power Companies in Japan) and the materials concerning the power companies' final settlement reports, etc.

CO2 Emissions Also Goes Up After 3.11



(Million ton-CO2)

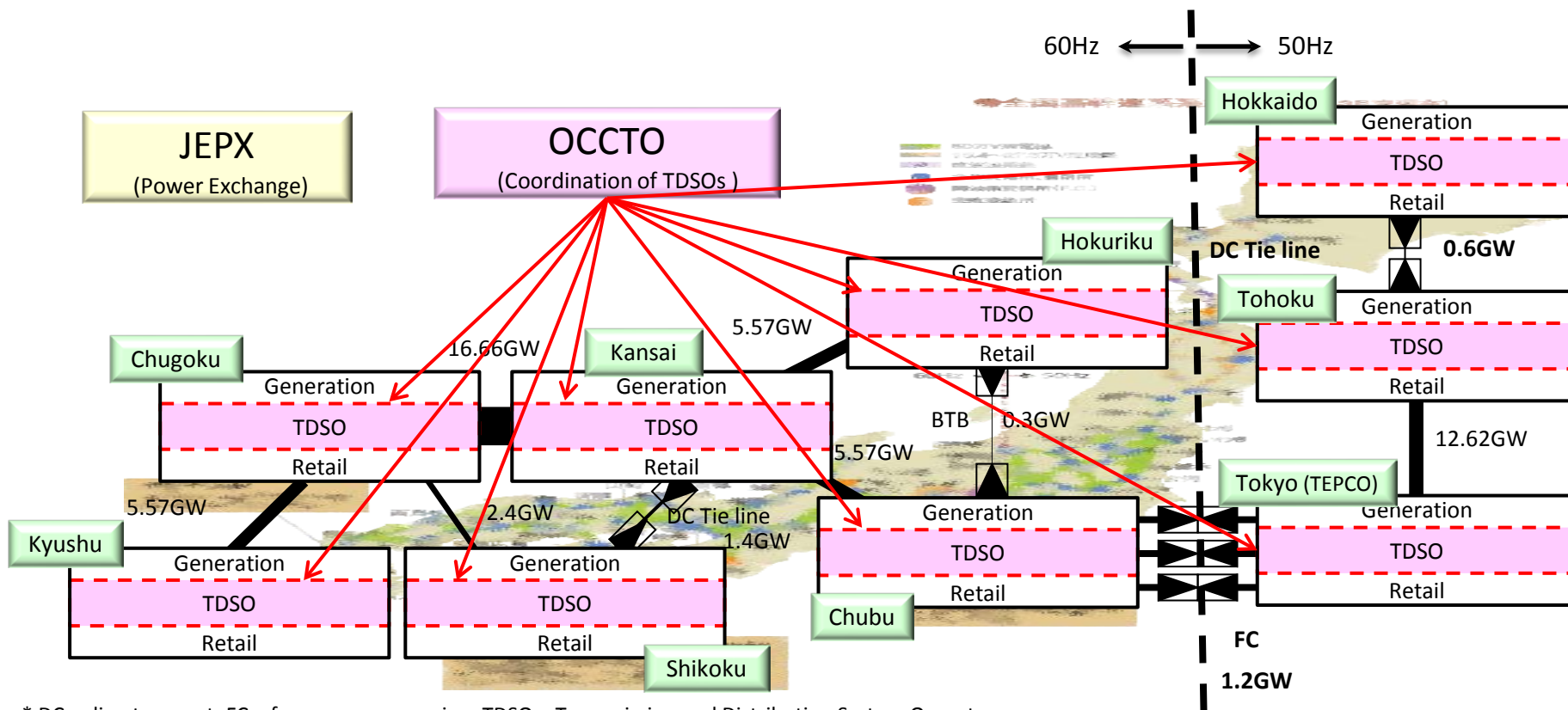


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ELECTRICITY MARKET REFORM ROADMAP

1st step: Establish the OCCTO

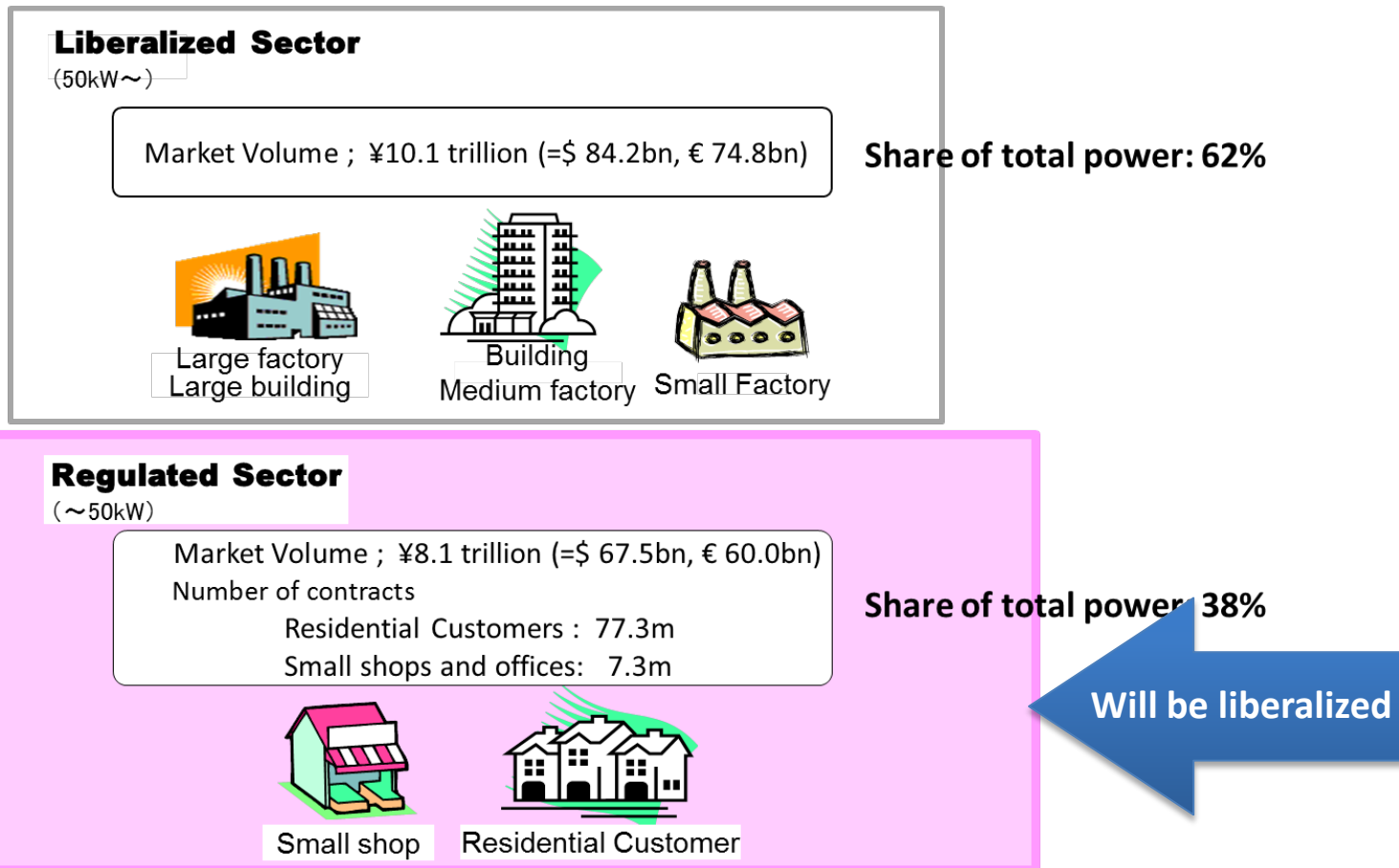
- Established the Organization for Cross-regional Coordination of Transmission Operators (OCCTO) in Apr. 2015
- OCCTO's main functions include:
 1. Review the EPCOs' supply-demand and grid plans for changes in the plans (e.g. tie line construction) if needed.
 2. Order EPCOs to increase power generation and interchange if supply gets tight.



* DC – direct current, FC – frequency conversion, TDSO – Transmission and Distribution System Operator

2nd step: Full Retail Competition

- Expand retail competition to the residential sector in 2016
- Maintain regulation on retail tariff for under 50kW users to incumbent 10 big EPCOs at least until 2020



3rd step: Unbundle Transmission/Distribution Sector

- Unbundle the big EPCOs' transmission/distribution (T/D) sector by “legal unbundling” in 2020 to enhance neutrality and transparency of T/D sector.
- EPCO can choose either a holding company or an affiliated company format

Holding company format

Holding company

Generation company

Competitive

Transmission/Distribution company

(System operation)

(Transmission/distribution facilities)

Regulated

Retail company

Competitive

Affiliated company format

Generation company

Competitive

Retail company

Competitive

Transmission/Distribution company

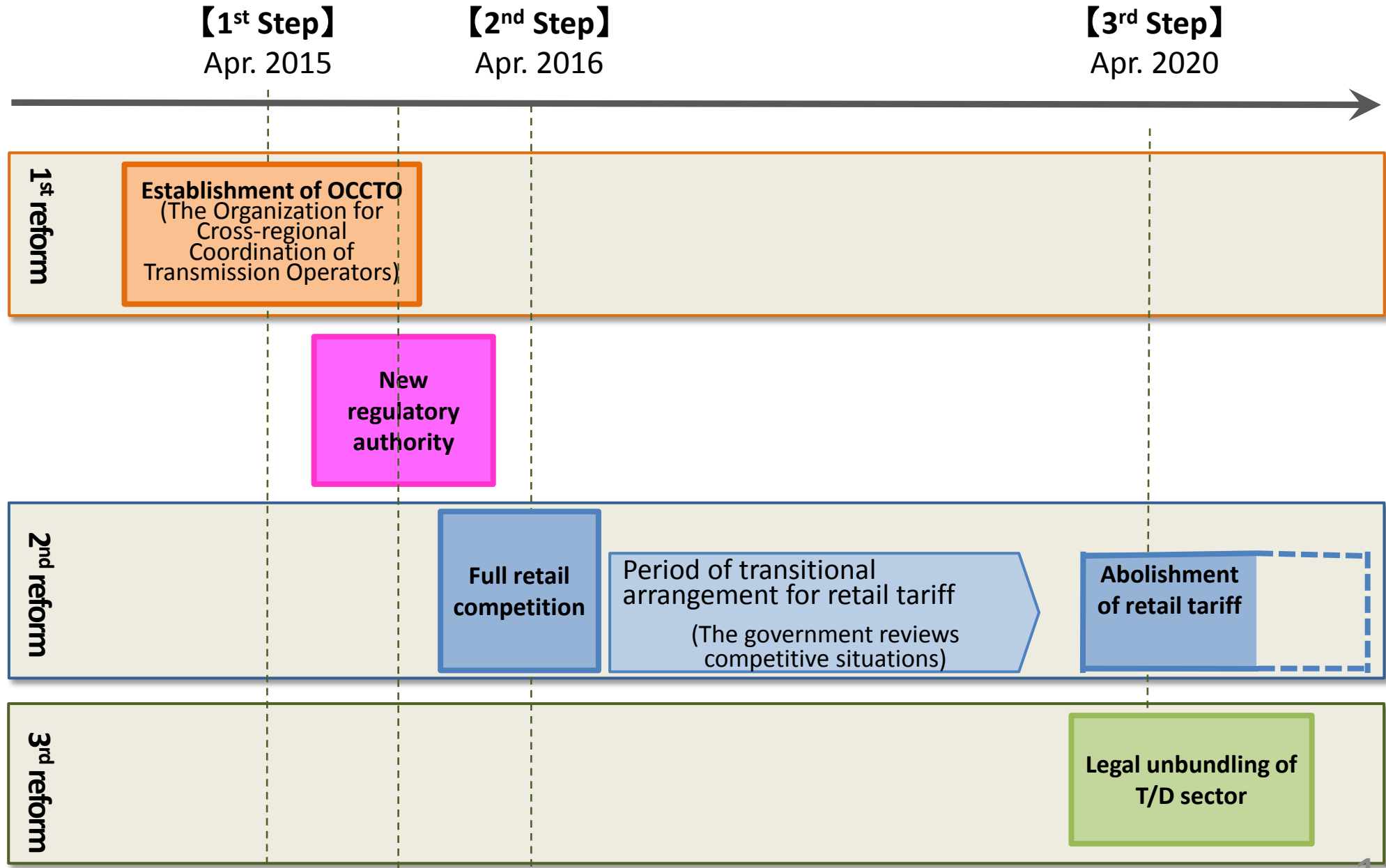
(System operation)

(Transmission/distribution facilities)

Regulated

- Regional monopoly
- Regulation on network tariff
- Responsibility for maintaining frequency & providing LR service
- Code of conduct for securing neutrality

Japan's Electricity Market Reform: Roadmap



Positive Signs of More Competition

- Non-EPCO companies s announce to enter the power retail market after 2016
 - Gas company : electricity + gas,
 - Telecom company : telecom + electricity, etc.
- Big EPCOs announce to start preparing for offering power retail business in other EPCOs' regions.
- Non-EPCO Companies start making new investments in power generation
 - KOBELCO: 1.4GW (2019-2020), Saibu Gas: 1.6GW (2020), Ohgishima Power: 0.4GW (2016), etc.
- EPCOs promote partnership
 - Tokyo EPCO and Chubu EPCO contracted to form comprehensive partnership to jointly procure fuel, operate related businesses (upstream investment, transportation and trading), construct and replace thermal power plants, etc.

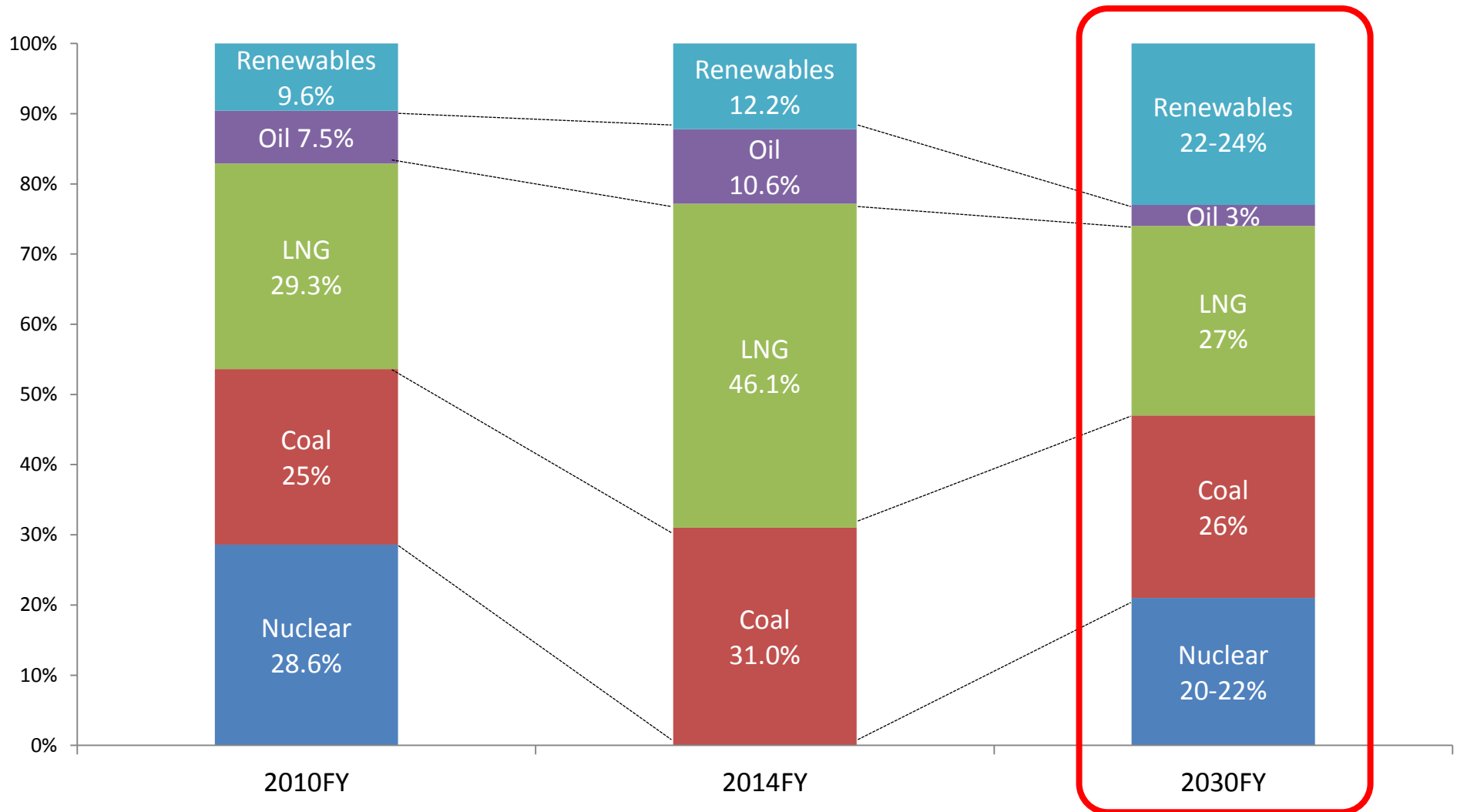
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ROAD AHEAD

Challenge

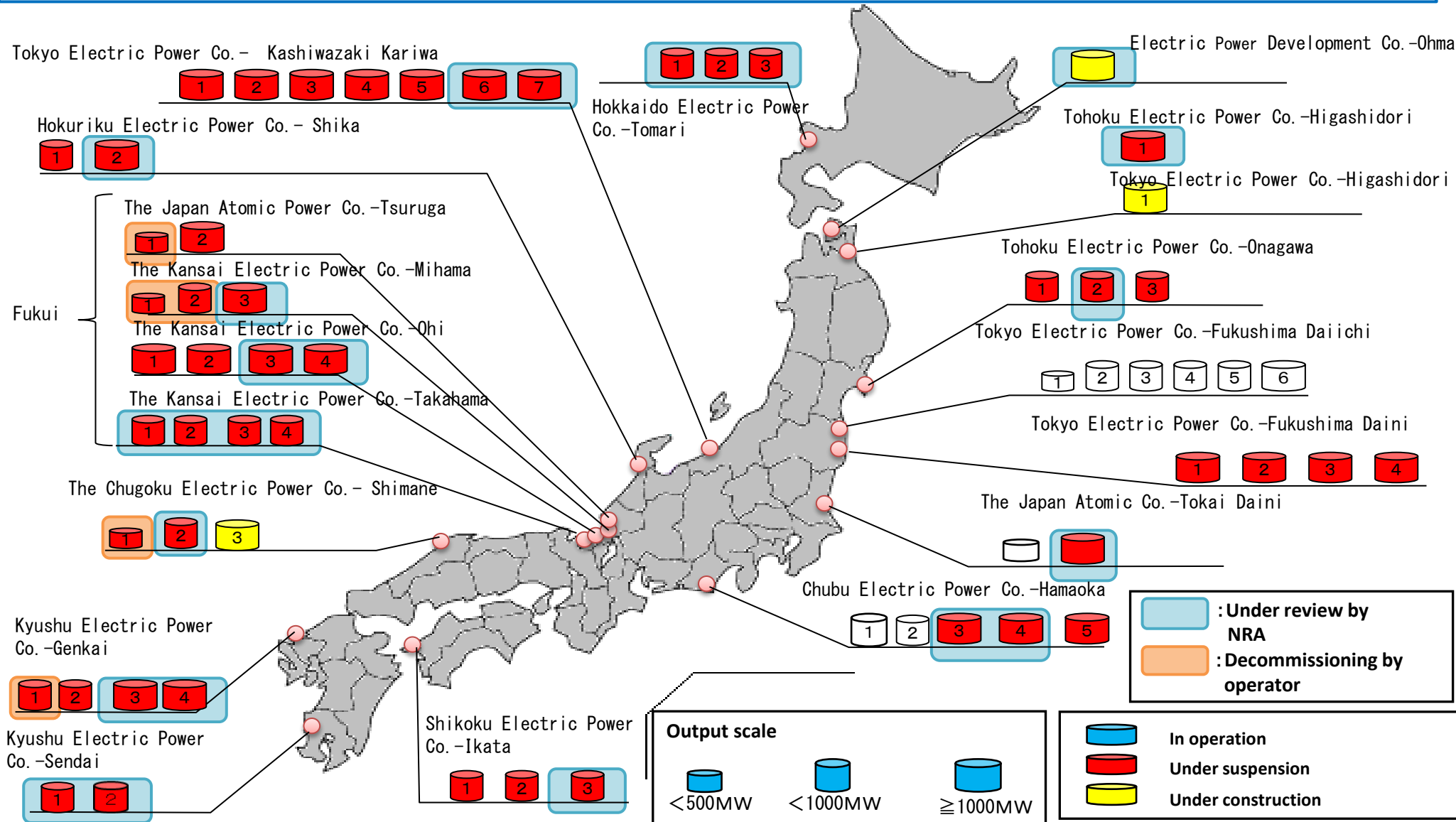
How can we secure stable supply and achieve desirable low-carbon energy mix while facilitating competition?

Japan's Generation Mix Target (Preliminary)



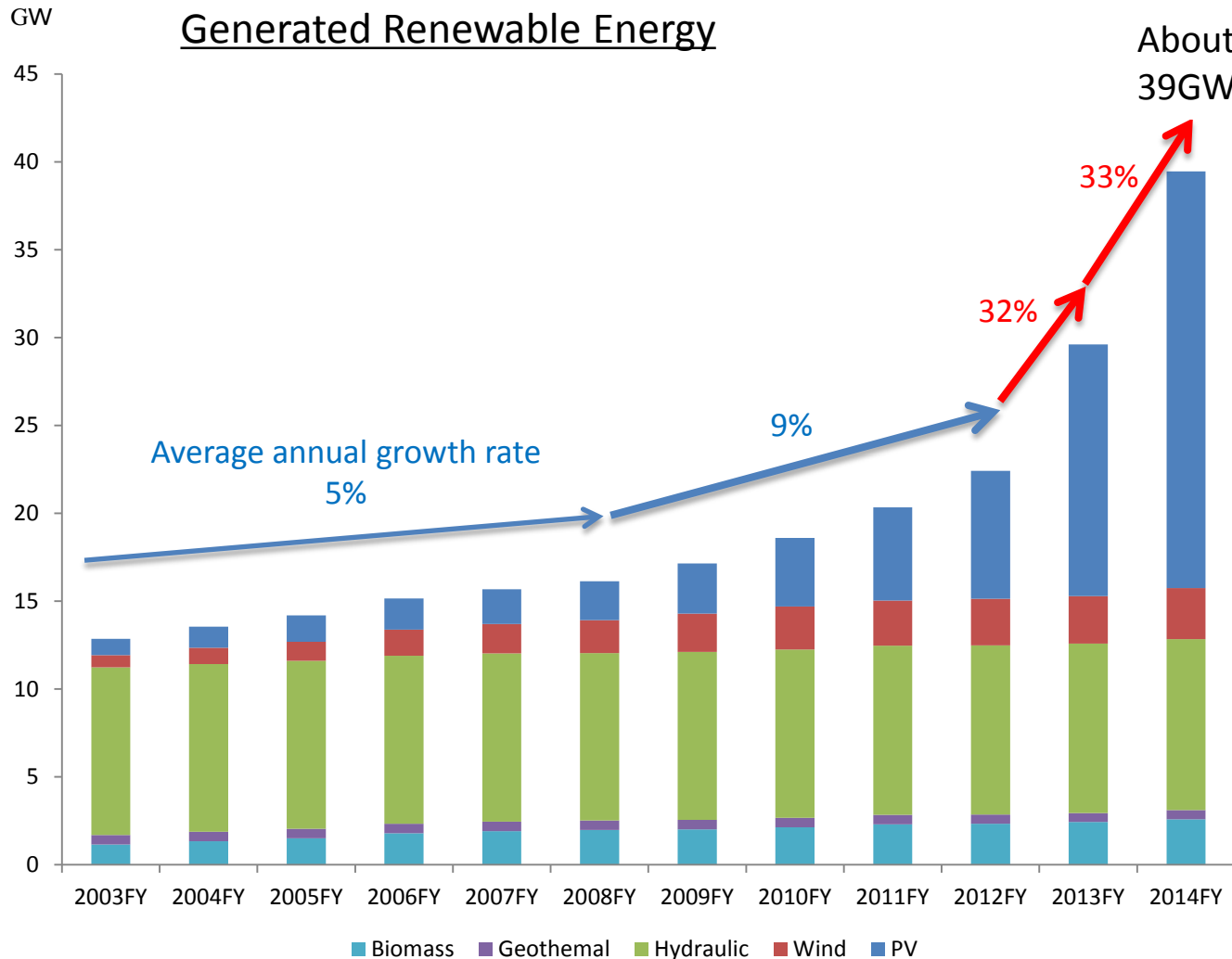
Nuclear Electric Power Plants in Japan (As of June 23rd, 2015)

- 25 units in 15 NRPs are under NRA'S assessment and inspections for resuming operation: NRA has decided to decommission 5 units in 3NRPs.
- These 25 units account for 25GW out of total nuclear capacity of 46GW.



RES integration

Generated Renewable Energy



	Authorized (up to the end of 2014FY)	Already installed before 2014FY
PV (residential)	3.79GW	3.1GW
PV (non-residential)	78.84GW	15.01GW
Wind	2.29GW	0.33GW
Hydraulic	0.66GW	0.09GW
Geothermal	0.07GW	0.01GW
Biomass	2.03GW	0.22GW
Total	87.68GW	18.76GW

→ FIT(only for surplus residential PV)

FIT

RPS

Policy Under Consideration

How can we secure stable supply and achieve desirable low-carbon generation mix while facilitating competition?

Challenges

- Maintain nuclear power generation in competitive environments.
- Promote cross-regional electricity supply.
- Set up a scheme to recover investments in grid reinforcement for RES integration.

Policy Plan

- Strengthen OCCTO's influence over 9 TSOs to promote risk/cost sharing and coordination for more cross-regional transmission and grid reinforcement.
- Prepare the scheme for neutralizing risks of nuclear investments
- Review FIT system.
- Introduce "Capacity Mechanism"

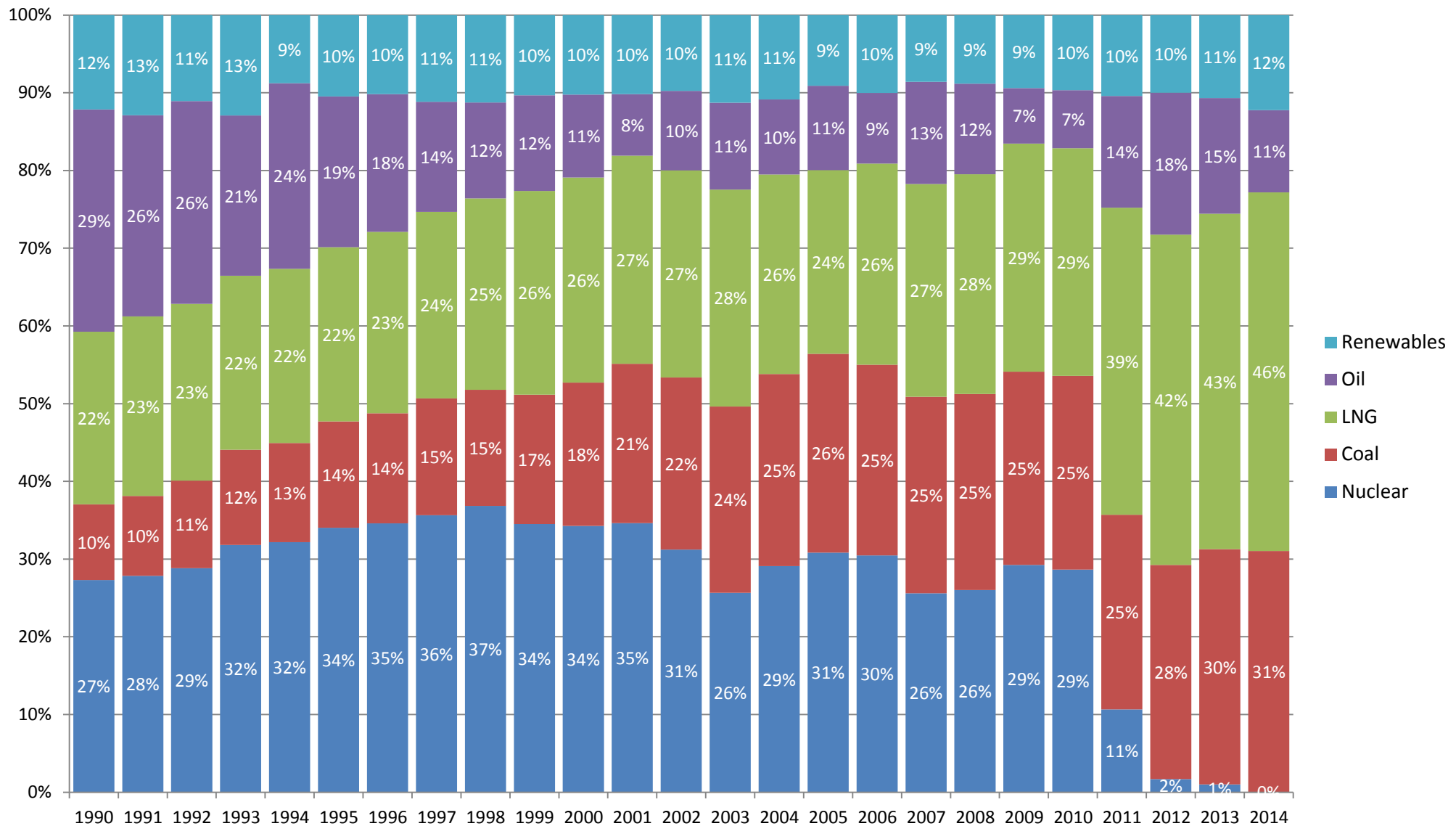
Thank you!



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APPENDIX

Transition of Japan's Generation Mix



History of Electricity Market Reforms in Japan

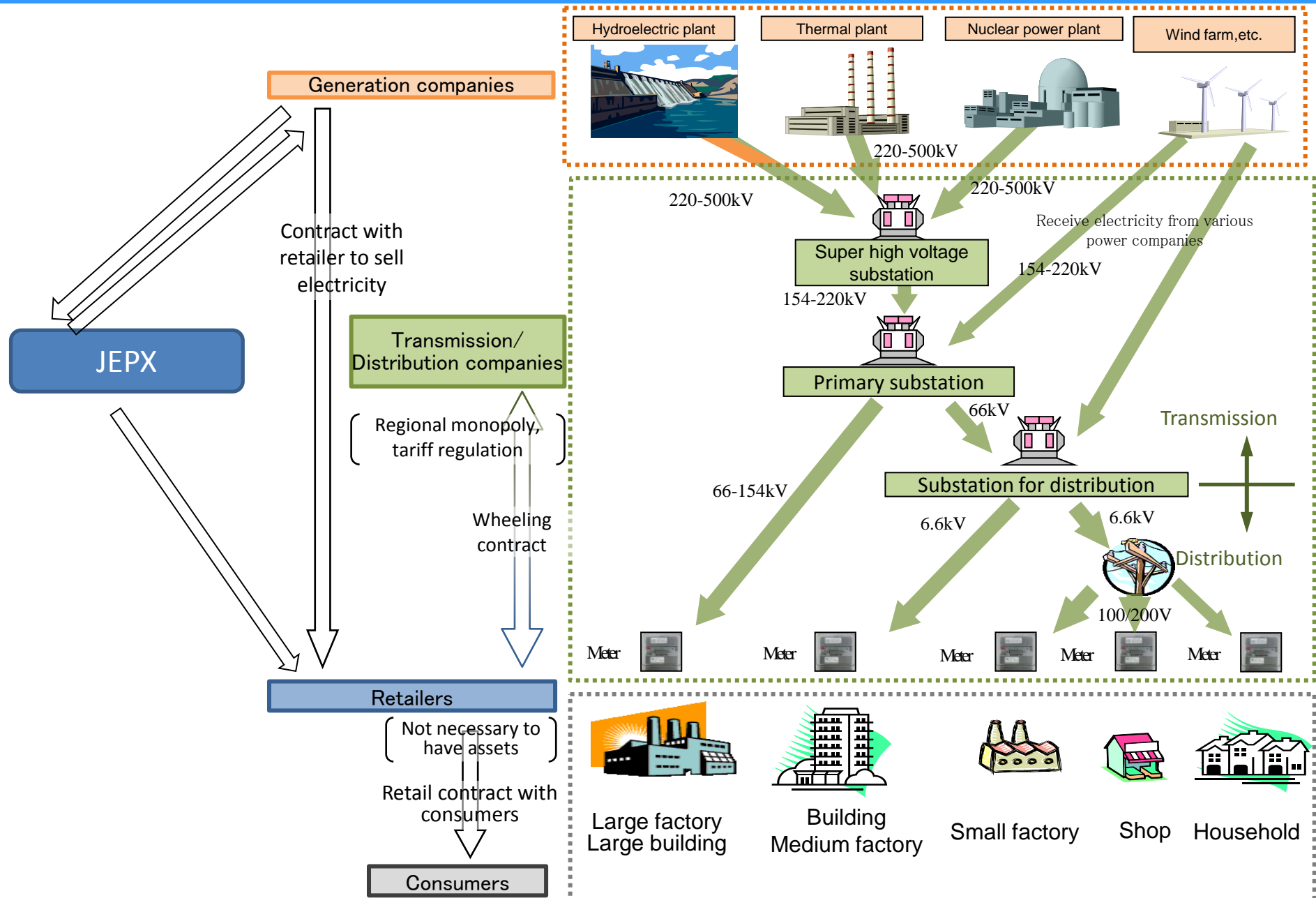
No competition in the electricity market before 1995:
10 vertically integrated EPCOs dominated and controlled the market.



METI embarked on a series of reforms...

No.	Year enforced	Overview
1	1995	<ul style="list-style-type: none">• Opened the IPP (Independent Power Producer) market• Allowed specified-scaled and vertically integrated power generators
2	2000	<ul style="list-style-type: none">• Introduced partial retail competition (over 2,000kW in 2000 [26%], over 500kW in 2004 [40%])• Introduced regulation of third party access to grid lines
3	2005	<ul style="list-style-type: none">• Expanded retail competition (over 50kW [62%])• Established the wholesale power exchange (JEPX) and its supporting body for transmission in wider areas• Improved regulation of third party access to grid lines, and introduced accounting separation of transmission/distribution sector
4	2008	<ul style="list-style-type: none">• Modified the rule of wheeling rates

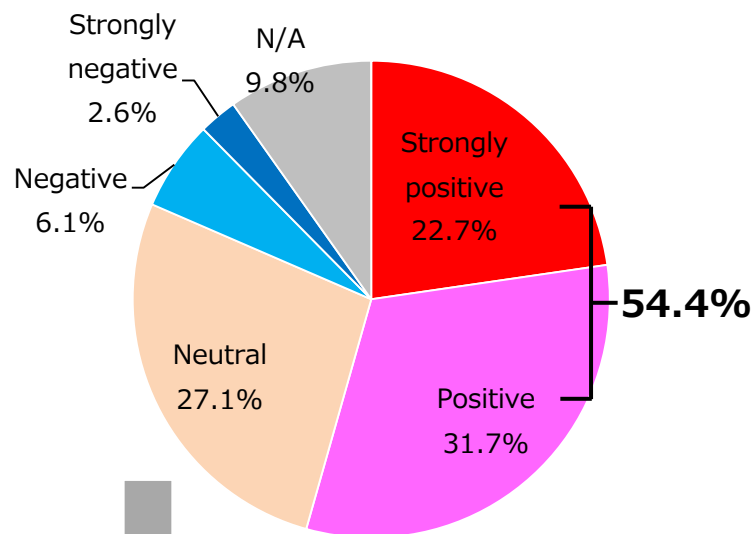
Future Design of Japan's Electricity Market



People Want Reform

- 54% people want to switch their electricity retailer if retail power sales is fully deregulated.
- And even among those who do not think about switching, only 1% say they like the current retailer.

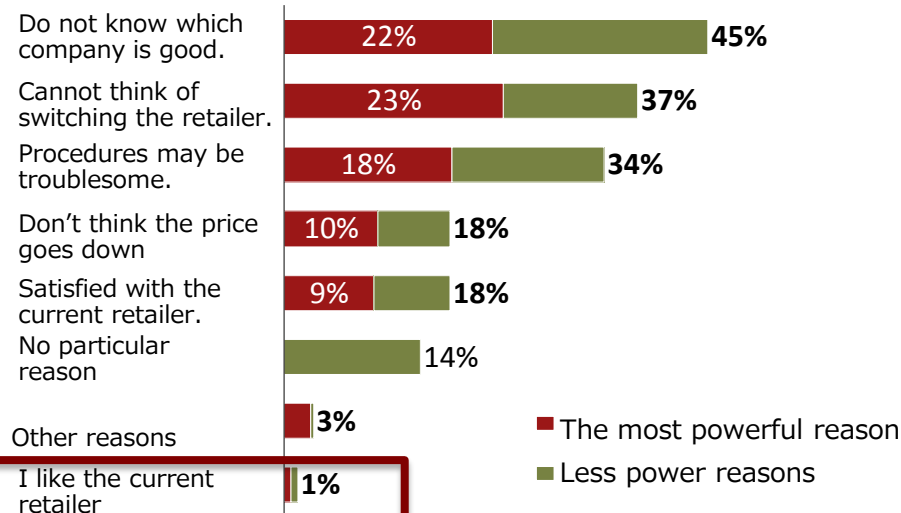
Do you want to switch your retailer?



Ask to people (36%) who answered as follows

- Neutral
- Negative
- Strongly negative

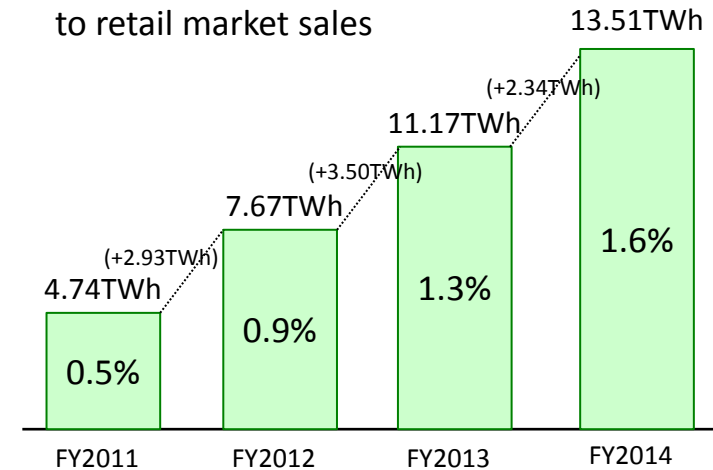
Reasons why you are negative or neutral to switch your retailer?



Improve liquidity in the wholesale market

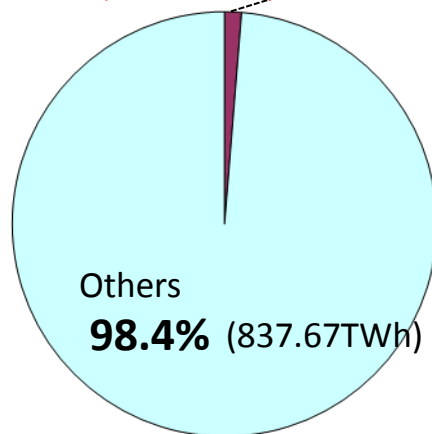
- Current rule (from March 2013):
 - Self commitment by 10 big EPCOs to provide all capacity except for adequate reserve margin into JEPX
 - Market monitoring by the regulator
- Further discussion including introduction of VPP scheme etc. will be needed depending on the result of market monitoring

Trend of share of trading in JEPX to retail market sales

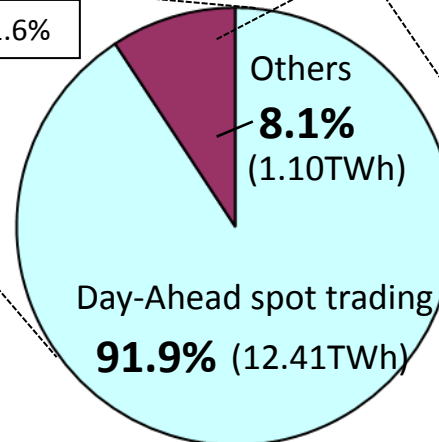


Share of trading in JEPX to retail market sales (FY2014)

Trading in JEPX
1.6% (13.51TWh)

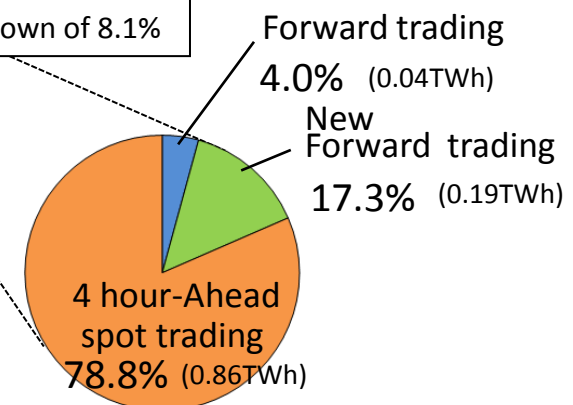


Breakdown of 1.6%



Breakdown of trading in JEPX (FY2014)

Breakdown of 8.1%

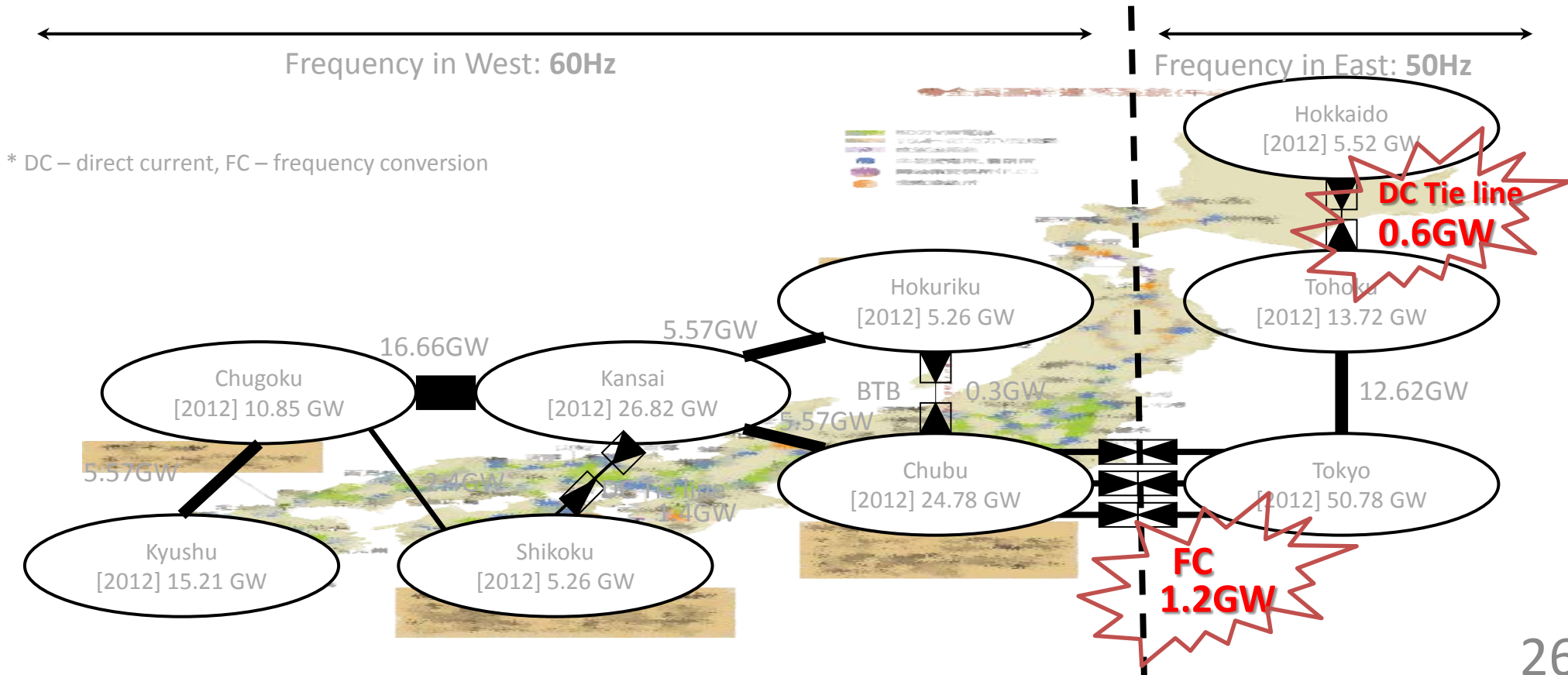


Cross-regional competition

- Avoid market separation and congestion of tie lines through OCCTO's function for reinforcing their capacities.

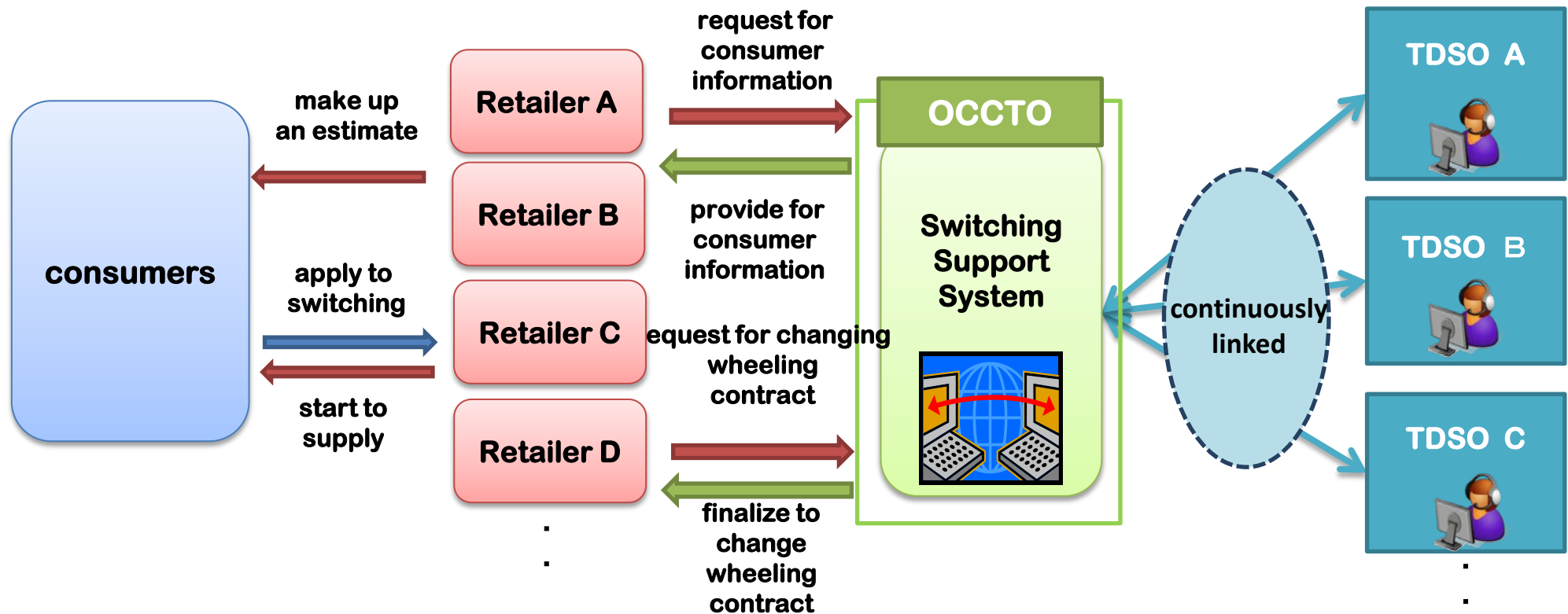
Eg. Frequency conversion b/w Tokyo and Chubu : 1.2GW → 2.1GW → 3.0GW
DC tie line b/w Hokkaido and Tohoku: 0.6GW → 0.9GW → ? ?

- Maintain the “postage stamp” cost allocation scheme for network fee, even after introducing full retail competition.



Switching support system

- Establish an one-stop system for switching support until 2016.
 - New retailer X can obtain necessary customers' information for the switching, which are standardized, from TDSOs through the system.
 - New retailer X can complete a switching process including changing a wheeling contract b/w retailer X and TDSOs through the system.
 - Time line: “automatically and instantly”



※ Information interchanged through this system will be standardized and provided for retailer instantly.

Ensuring electricity security in Japan's EMR project

1. Regulation for T/D companies to secure frequencies and to maintain investment on the grid
2. Obligation for all retailers to secure adequate capacity <2016>
 - Ensure procurement of enough quantity in the electricity market
3. Auction for the long-run generation capacity by OCCTO <2016>
 - Prepare for the possible shortage of long-run capacity as a safety net for the electricity market
4. Further discussion on capacity mechanism (capacity market etc.)
 - Enhance the incentive to establish and maintain generation plant

Obligation for all retailers to secure adequate capacity <2016>

- All retailers are legally obliged to ensure adequate capacity (incl. reserve margin) to match their demand.
- Government checks all retailers' plans at both points of registering to enter the market and of submitting 10-year supply and demand plan each year
- TDSO will balance the gap b/w actual supply and actual demand in the imbalance mechanism.

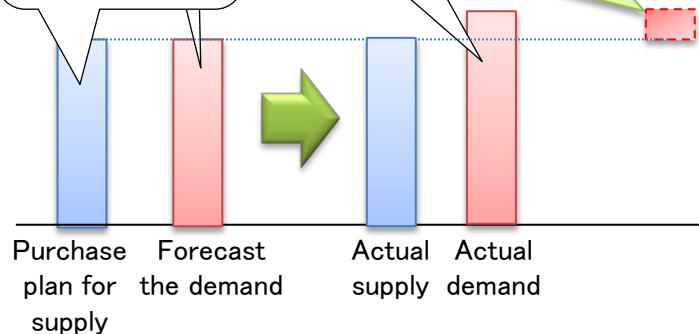
Retailer A

Forecast the demand as '100'

Purchase the supply same as forecasted demand (= '100')

The demand increases to '110', when accident happens.

Reserve margin which retailer A should have secured for upward demand (additional supply necessary for fulfilling the obligation)



Some years or months ahead

At the actual supply and demand

TDSO

Compensate the **shortage**

Buy the **surplus**

Compensate the **shortage**

Actual supply Actual demand The gap (shortage)

Actual supply Actual demand The gap (surplus)

Actual supply Actual demand The gap (shortage)

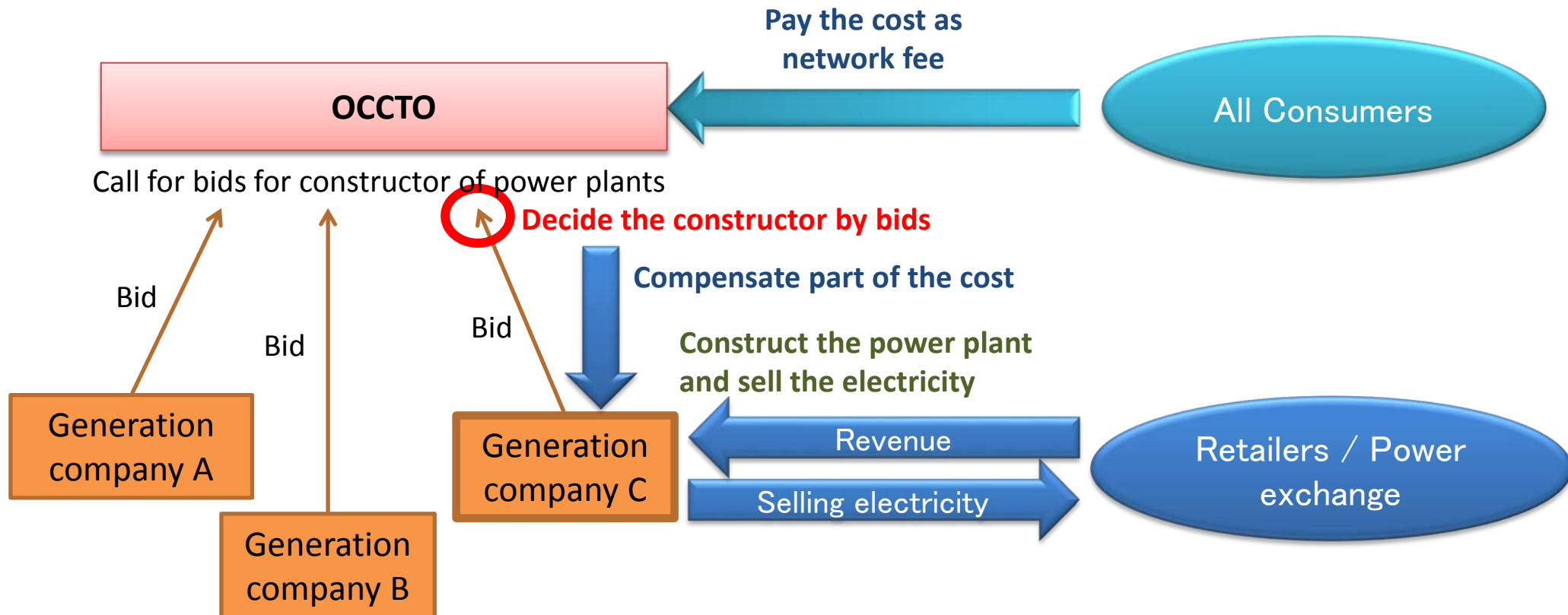
Retailer A

Retailer B

Retailer X

Auction for the long-run capacity by OCCTO <2016>

- OCCTO will call for bids when supply power shortage is likely to occur because of insufficient investment.
- OCTTO will pay for their capacity (MW), through recovering from network fee.
- The detailed design is under discussion.

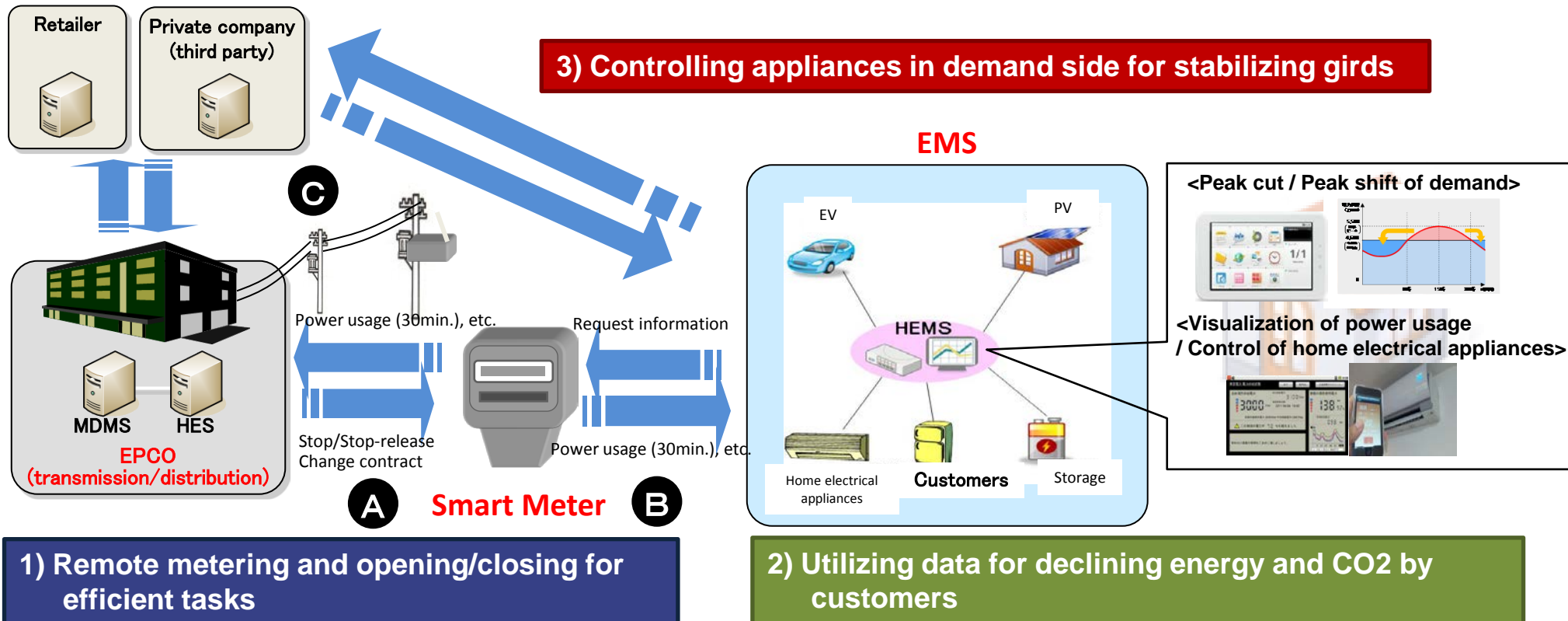


Smart Meter and the effects

Smart meter

- Reducing measurement cost and the future capital investment by launching Demand Response menus, visualization of the electricity use, control of appliances and so on
- Creating future various services and businesses by utilizing 'Big Data' such as energy usage

Total image and the effects of Smart Meter and the related system



(Note) EMS: Energy Management System
MDMS: Meter Data Management System

HES: Head End System
HEMS: Home Energy Management System

Introduction schedule of Smart Meters

- ✓ The demand of each “Small and Medium-sized Enterprise” and “Low Voltage Consumer” is small. However, the number is large.
- ✓ Based on the perspective of efficiency of Smart Meters as a supply and demand measure, a transition to Smart Meters for commercial-scale utility customers will be initiated first.
- ✓ Smart Meters in high voltage sector (factories, etc.) are planned to complete installing in Japan until FY2016.
- ✓ Smart Meters in low voltage sector (household, etc.) are planned to complete installing in Tokyo until the end of FY2020 and in Japan until the end of FY2024.
- ✓ All EPCOs announced to exchange the current meters to smart meters promptly for consumers who want to install according to the introduction of HEMS, etc. or switch their retailers.

Introduction schedule

		Hokkaido	Tohoku	Tokyo	Chubu	Kansai	Hokuriku	Chugoku	Shikoku	Kyushu	Okinawa
High voltage	Installation will be completed in	2016	Completed	Completed	2016	2016	Completed	2016	2016	Completed	2016
Low voltage	Installation will be started in	2015	Started	Started	2015	Started	2015	2016	Started	2016	2016
	Installation will be completed in	2023	2023	2020	2022	2022	2023	2023	2023	2023	2024

EPCOs Plan to Introduce Smart Meters

The estimated number of smart meters introduced as of the end of each fiscal year

(Thousand)

	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	Total
Hokkaido		← 380	530	480	490	510	510	520	560	570 →		4,550
Tohoku	← 120	650	840	820	810	800	780	730	730	720 →		7,000
Tokyo	← 1,900	3,200	5,700	5,700	5,700	3,300	3,300 →					28,800
Chubu	← 10	1,020	1,460	1,440	1,420	1,390	1,390	1,420	1,390 →			10,940
Hokuriku		← 150	250	250	230	230	220	190	190	160 →		1,870
Kansai	← 1,600	1,700	1,700	1,700	1,500(Note)	1,300(Note)	1,300(Note)	1,200(Note)	1,100(Note) →			15,600
Chugoku		← 240	560	610	610	610	610	610	610	610 →		5,070
Shikoku	← 30	150	310	310	310	310	310	310	310	300 →		2,650
Kyusyu			← 800	850	850	1,090	1,010(Note)	1,000(Note)	890(Note)	790(Note) →		7,280
Okinawa		← 10	100	100	100	100	100	100	90	90 →	90	850
Total	3,660	7,500	12,250	12,260	12,020	9,640	9,530	6,080	5,870	3,240	90	84,610

(Note) Except the number in the table, some smart meters will be exchanged new smart meters because of reaching maturity of the verification