Electricity System and Market in Japan

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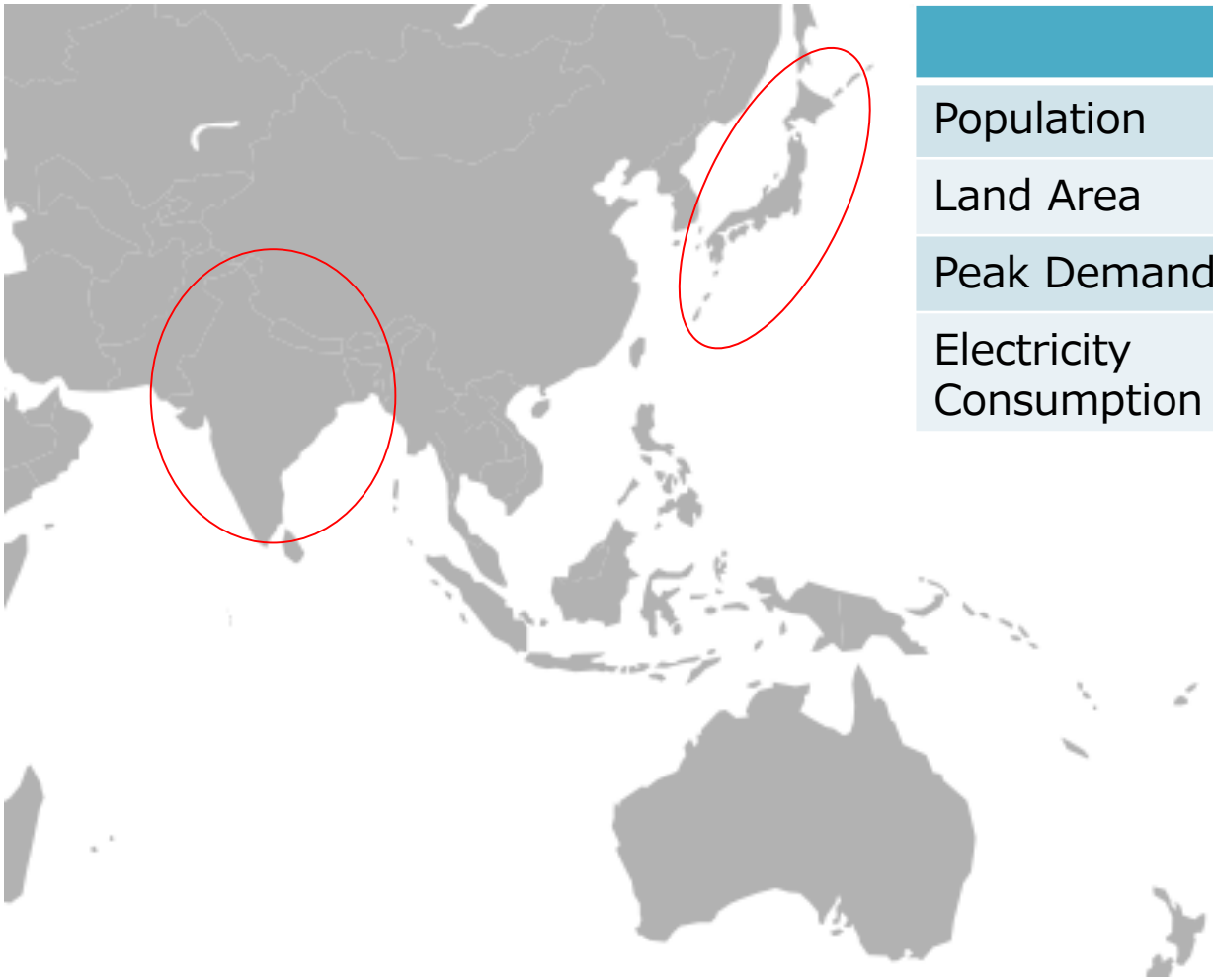
Electricity and Gas Market Surveillance Commission

1. General Information about Japan

- Population and land area of Japan is approximately one-tenth of those of India.

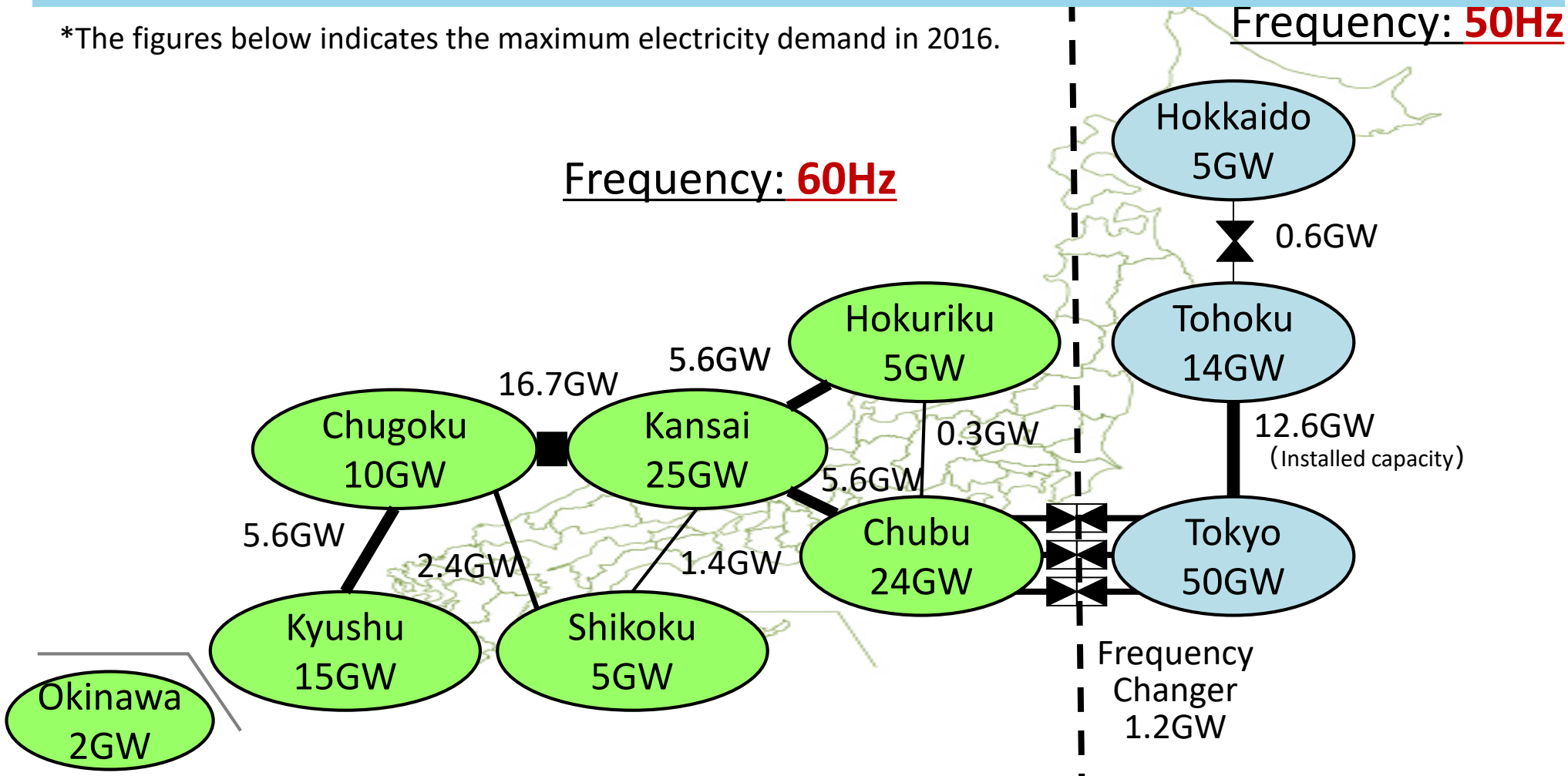


	India	Japan
Population	1,210.5 million	126.7 million
Land Area	3,287,469 km^2	377,971 km^2
Peak Demand	159,542 MW	165,200 MW
Electricity Consumption	1,142,929 GWh (2016-17)	850,500 GWh (FY 2016)

2. Outline of Electricity System in Japan

- Historically, in Japan, the electric utilities are operated by private companies. In 1939, Imperial Japanese Government ordered to Japanese private utilities to integrate 1 Generation and Transmission company and 9 Distribution companies. After WWII, it was reformed to 9 vertical integrated utilities (General Electric Utilities: GEUs) in 1951. (Okinawa returned to Japan in 1972 and since then 10 GEUs are in Japan.)
- In Japan, we have 2 Frequency by historical reason. And Hokkaido is independent 50Hz.

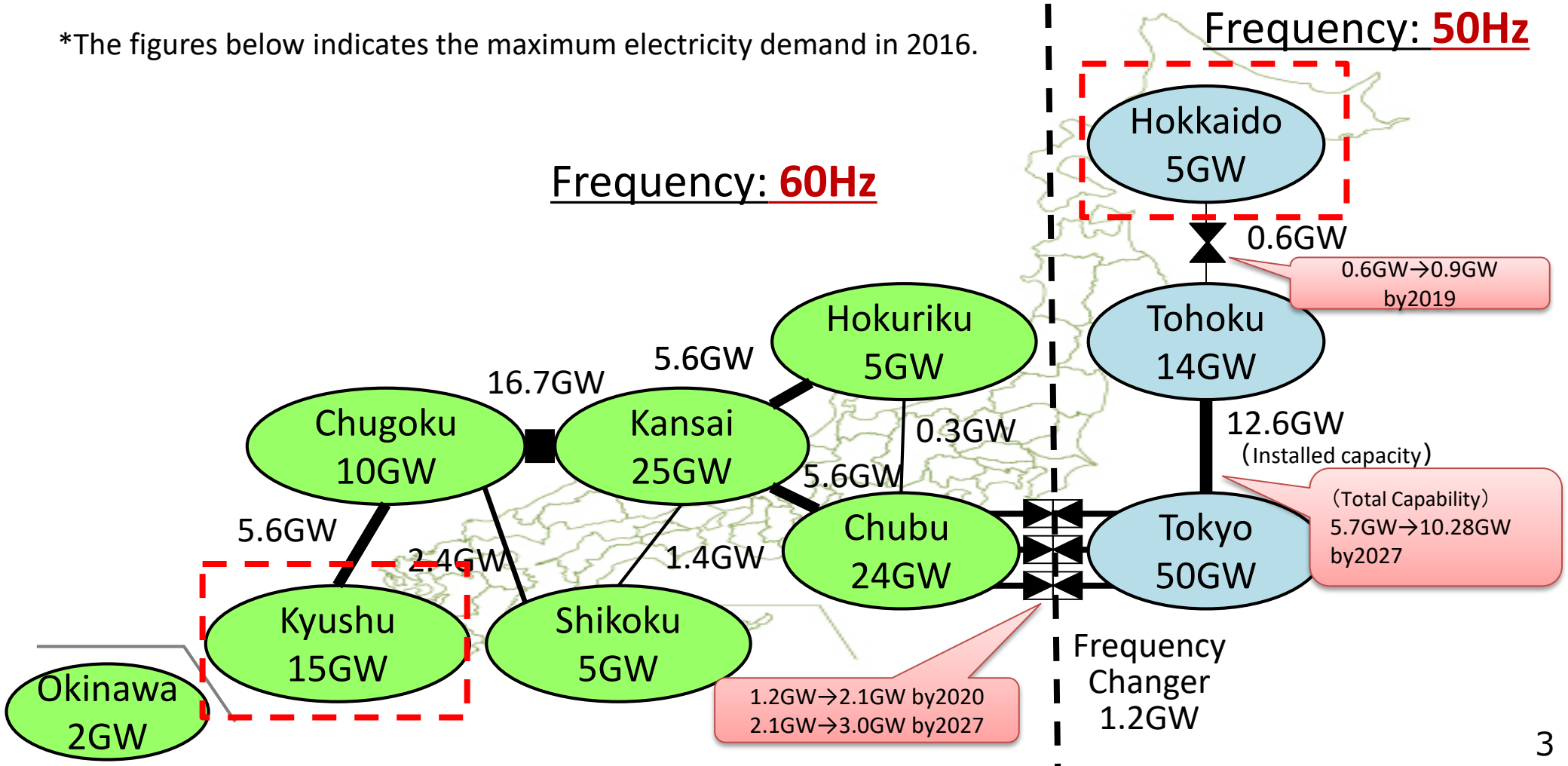
*The figures below indicates the maximum electricity demand in 2016.



3. Power Grid in Japan

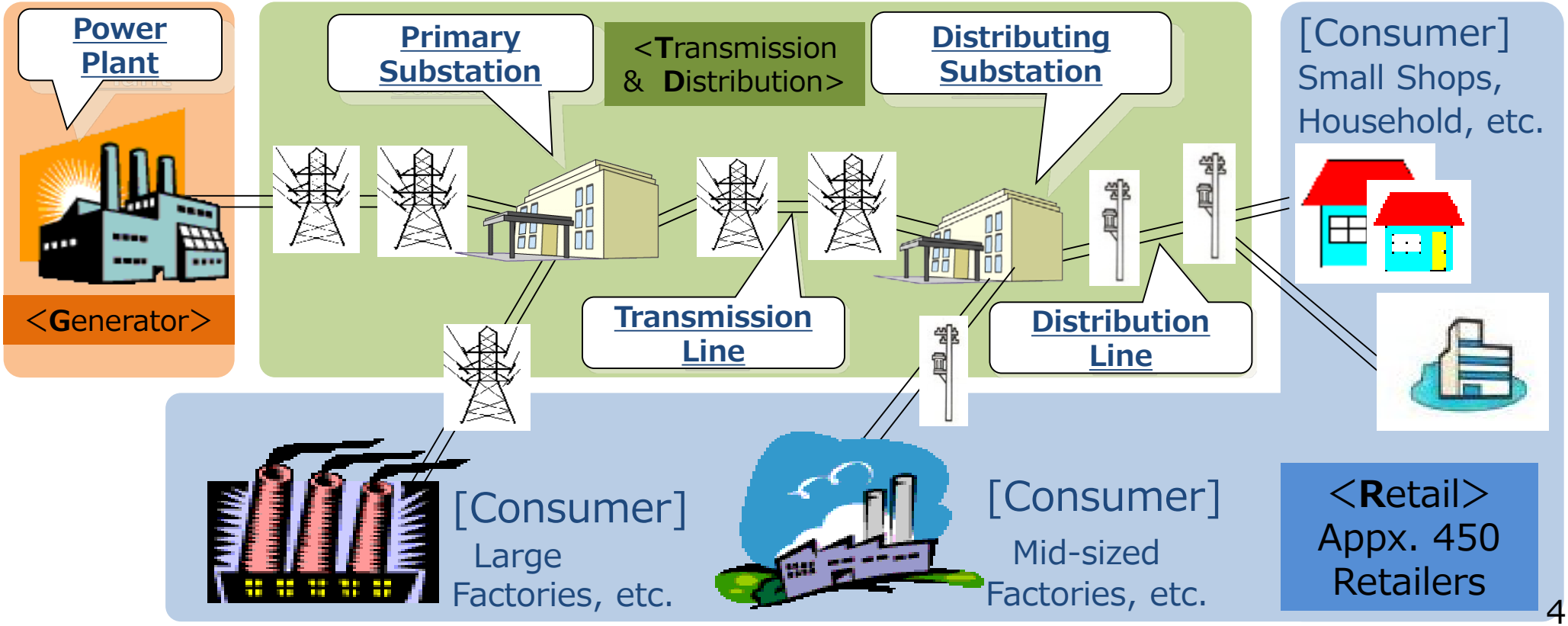
- Transmission network has been developed by 10 GEUs, so interconnection capacities are limited.
- Relatively large demand in Tokyo, Chubu and Kansai. Hokkaido is suitable area for wind power and Kyushu is suitable area for solar power.
- Interconnection grids are still expanding mainly focusing on stable supply and accepting more Renewable Energy.

*The figures below indicates the maximum electricity demand in 2016.



4. Power Supply System in Japan

- Since April 2016, Japan introduced Licensing Unbundling. Now, only TEPCO established TEPCO Power Grid, Inc. From April 2020, all GEUs has to be separated into TDSO and others under legal unbundling.
- Since April 2016, in license, Power Supply System is composed of 3 sectors:
  (i) **G**enerator :Only Notification to METI, Under Competition
  (ii) **T**ransmission & **D**istribution :License, Regional monopoly
  (iii) **R**etail :Registration, Under Competition



5. Recent History of System Reform on Electricity Market in Japan

- METI has been advancing the system reforms on Electricity Market in Japan, such as the introduction of competition to wholesale market and the expansion of retail customer choice, since 1995.

1st System Reform: 1995

- ✓ IPPs and bidding system to General Electric Utilities (GEUs)
- ✓ Customer choice menu in GEUs

2nd System Reform: 1999

- ✓ Retail choice for special high voltage customer (Over 2000 kW)
- ✓ Expansion of flexibility for GEUs' retail menu at reduction

California Electricity Crisis in 2000

3rd System Reform: 2003

- ✓ Expansion of retail choice to high voltage customer (Over 50kW)
- ✓ Establishment of the wholesale market (JEPX) and ESCJ

4th System Reform: 2008

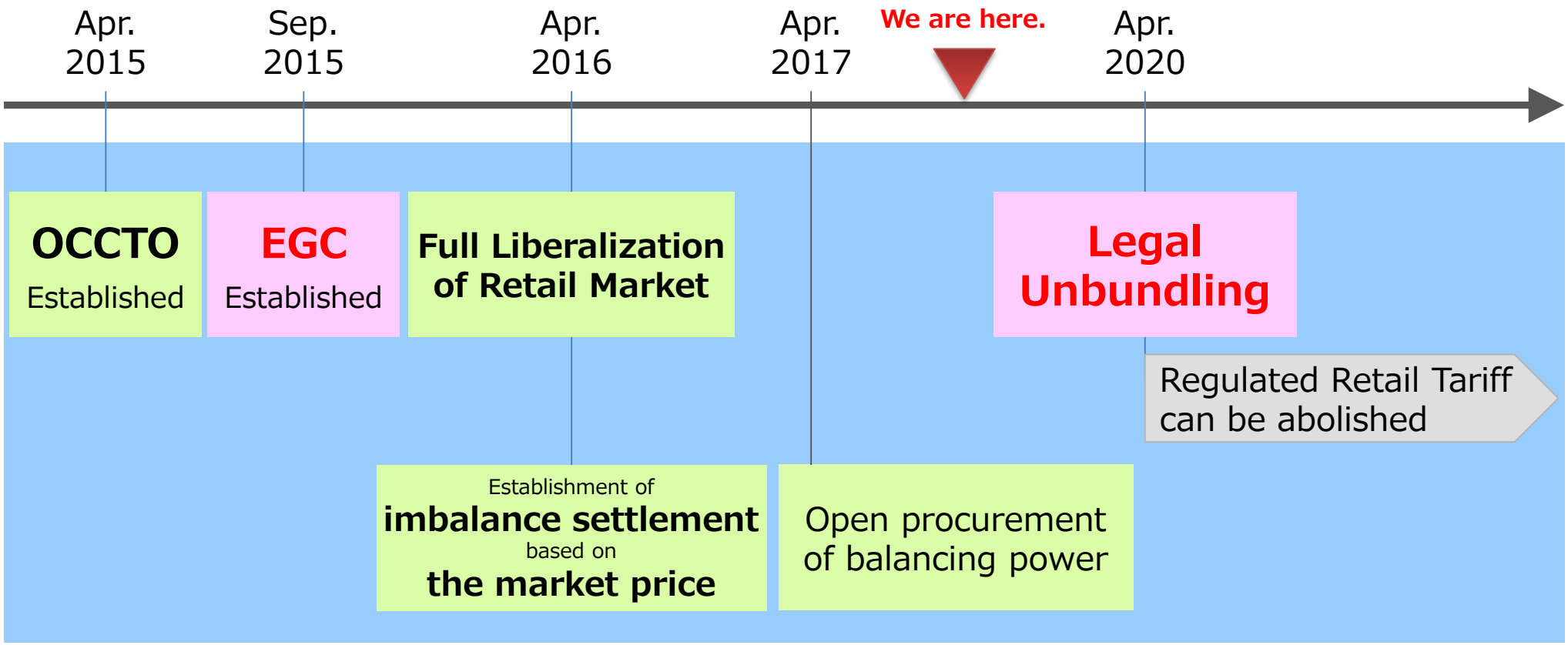
- ✓ Establishment of hourly ahead wholesale market
- ✓ Introduction of stock taking method to Transmission-tariff

East Japan Great Earthquake and Fukushima Daiichi Accident in 2011

5th System Reform: 2015

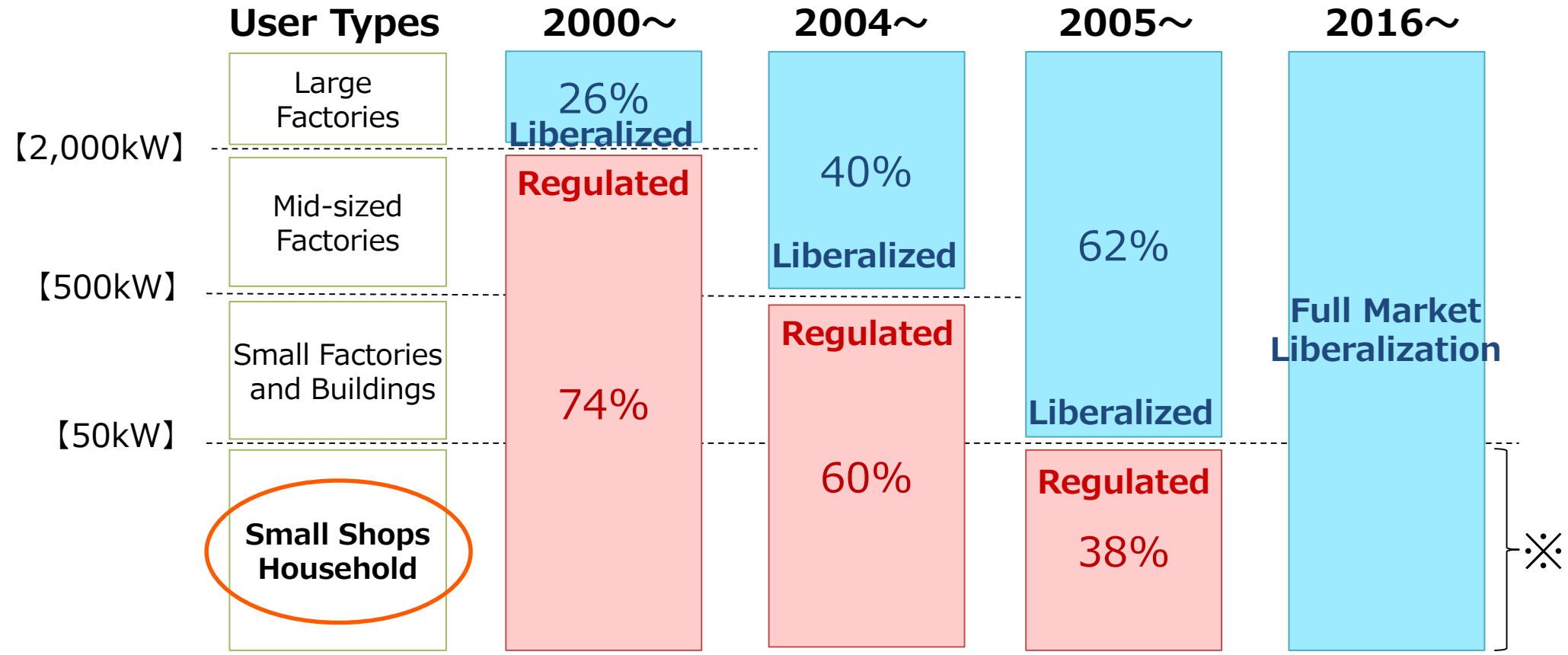
- ✓ Establishment of OCCTO and EGC/METI
- ✓ Full retail choice (From April 2016)
- ✓ Legal Unbundling(From April 2020)

6. Roadmap for Current Electricity Market Reform



7. Gradual Expansion of Electricity Retail Market Liberalization

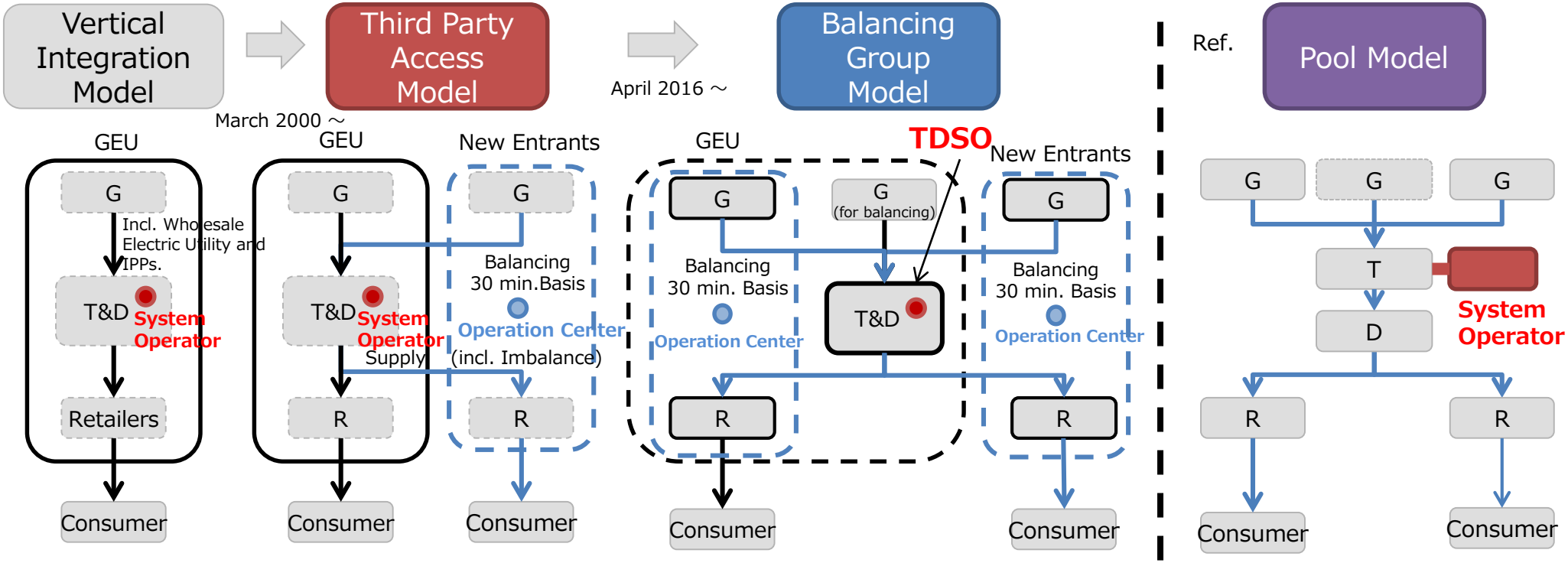
- Retail market had been gradually liberalized since 2000.
- Since April 2016, retail electricity market in Japan has been fully opened up for competition. But regulated tariffs by GEUs are still exist in low voltage consumer for consumer protection.



※Regulated tariffs will be abolished in 2020 or later.

8. Recent Changes in Electricity System in Japan

- Since April 2016, at the same time as the full retail market liberalization, Japan changed electricity system from Third Party Access Model to Balancing Group Model.
- From the viewpoint of system operation, current Electricity System in Japan is basically similar to European countries.



- System Operators of GEUs operate all power plants in general

- A kind of Pooling style under monopoly.

- **New Entrants operate their power plants to keep the balance of demand and supply on 30 min. basis.**
- System Operator of GEUs operate their power plants and settle imbalances.

- **Both New Entrants and GEUs operate their power plants to keep the balance of demand and supply on 30 min. basis.**
- TDSOs operate contracted power plants for balancing
- European Style

- **System Operator operates all power plant in area based on the wholesale market.**
- Effective to merit order and congestion management, but complicated in nodal management
- American Style (Liberalized States)

9. Establishment of OCCTO

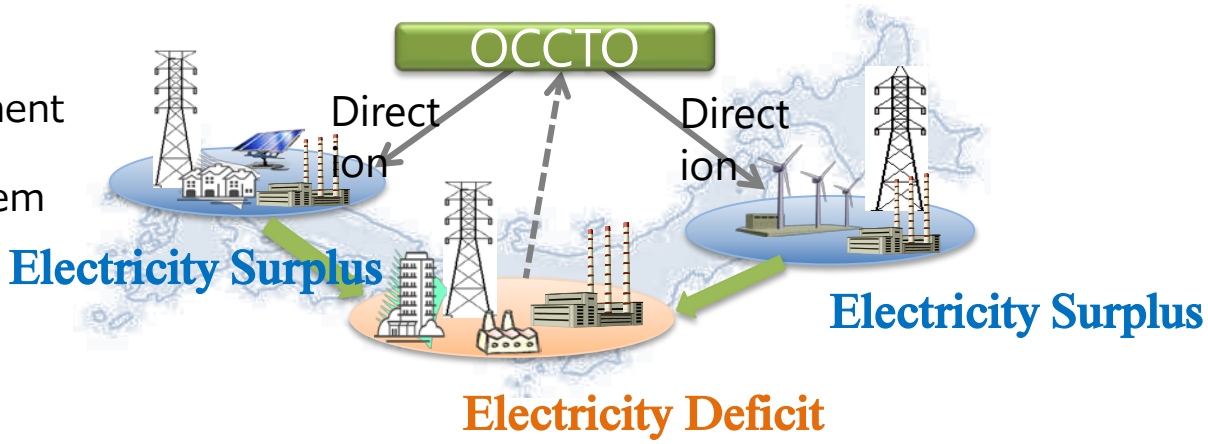
- The Organization for Cross-regional Coordination of Transmission Operators (OCCTO) was established in April 2015.

Missions of OCCTO

1) Promote the development of electricity transmission and distribution networks, which are necessary for cross-regional electricity use.
2) Enhance the nationwide function of maintaining the supply-demand balance of electricity in both normal and emergency situations.

Main Operations of OCCTO

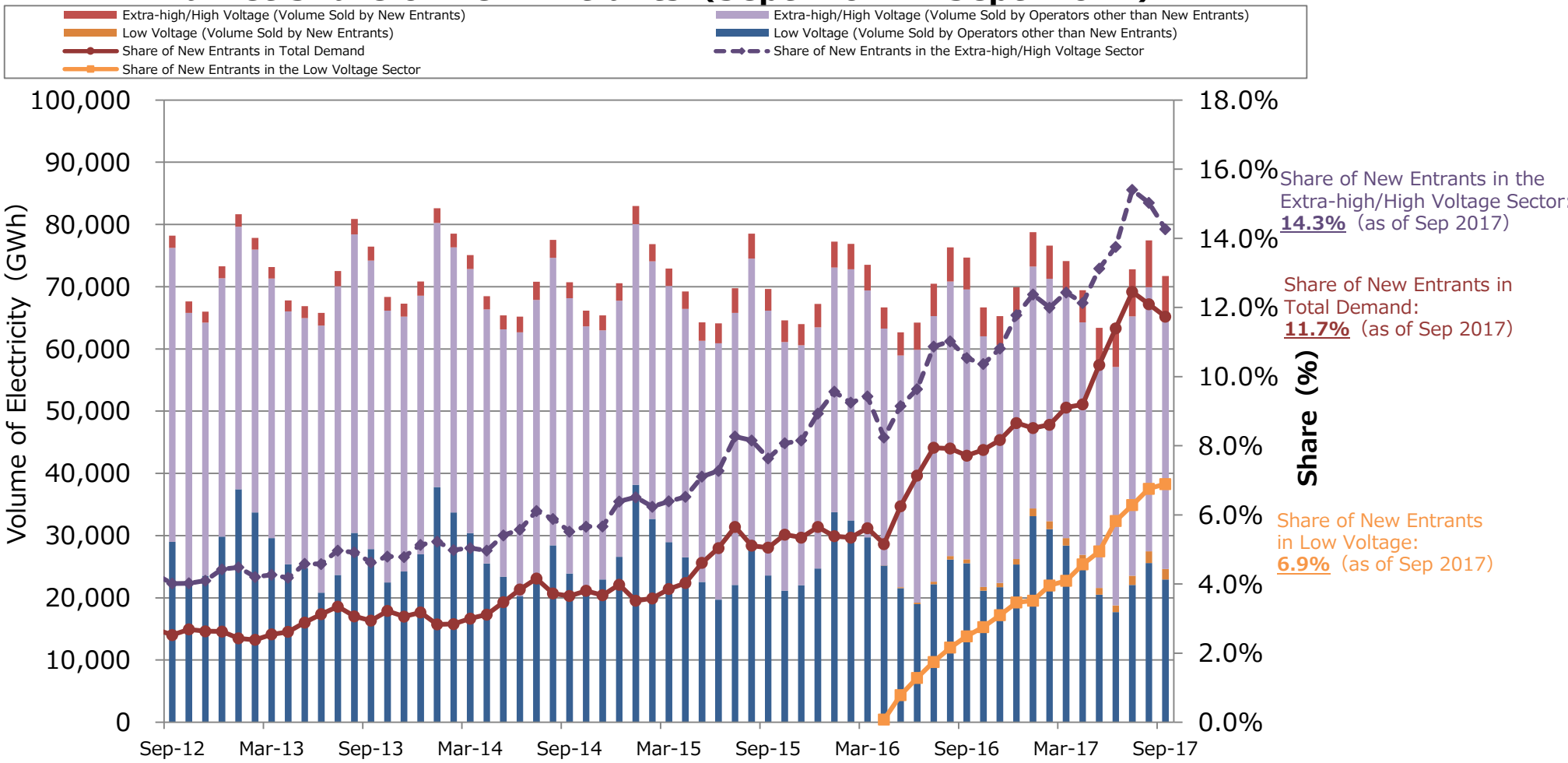
1. Manage Cross-regional Interconnecting Lines
2. Arrange Supply and Demand Balance under Emergency
3. Develop Network Code for Electricity Transmission and Distribution
4. Plan Transmission Network Development
5. Aggregate Supply and Demand Plans
6. Coordinate Network Access and System Impact Study
7. Offer Switching Support Service



10. Changes in Market Share of New Entrants

- The market share of New Entrants based on the volume of electricity sold has been gradually but steadily increasing.
- At present, the market share of New Entrants in total demand reached approximately 11.7%.

Market Share of New Entrants (Sept. 2012 - Sept. 2017)



(Source) "Survey of Electric Power Statistics" and "Electricity Trading Report"

11. Status of Switching Application (As of September 2017)

- As of September 2017, the actual cases of switching the supplier to other companies account for appx. 7.3% (appx. 4.58 million cases), and the cases of switching to other menus within the same GEU account for appx. 5.0% (appx. 3.13 million cases). In total, appx. 12.3%(appx. 7.72 million cases).
- By region, the switching rate is the highest in areas of TEPCO (10.5%), followed by areas of Kansai Electric Power Company (9.8%).

Number of Cases of Switching (External Switching)

	Switching to Other Companies [in thousand]	Percentage [%]
Hokkaido	210.2	7.6
Tohoku	170.4	3.1
Tokyo	2,406.0	10.5
Chubu	380.4	5.0
Hokuriku	27.8	2.3
Kansai	990.9	9.8
Chugoku	59.4	1.7
Shikoku	53.4	2.8
Kyushu	286.8	4.6
Okinawa	0.0	0.0
Nationwide	**4,585.0**	**7.3**

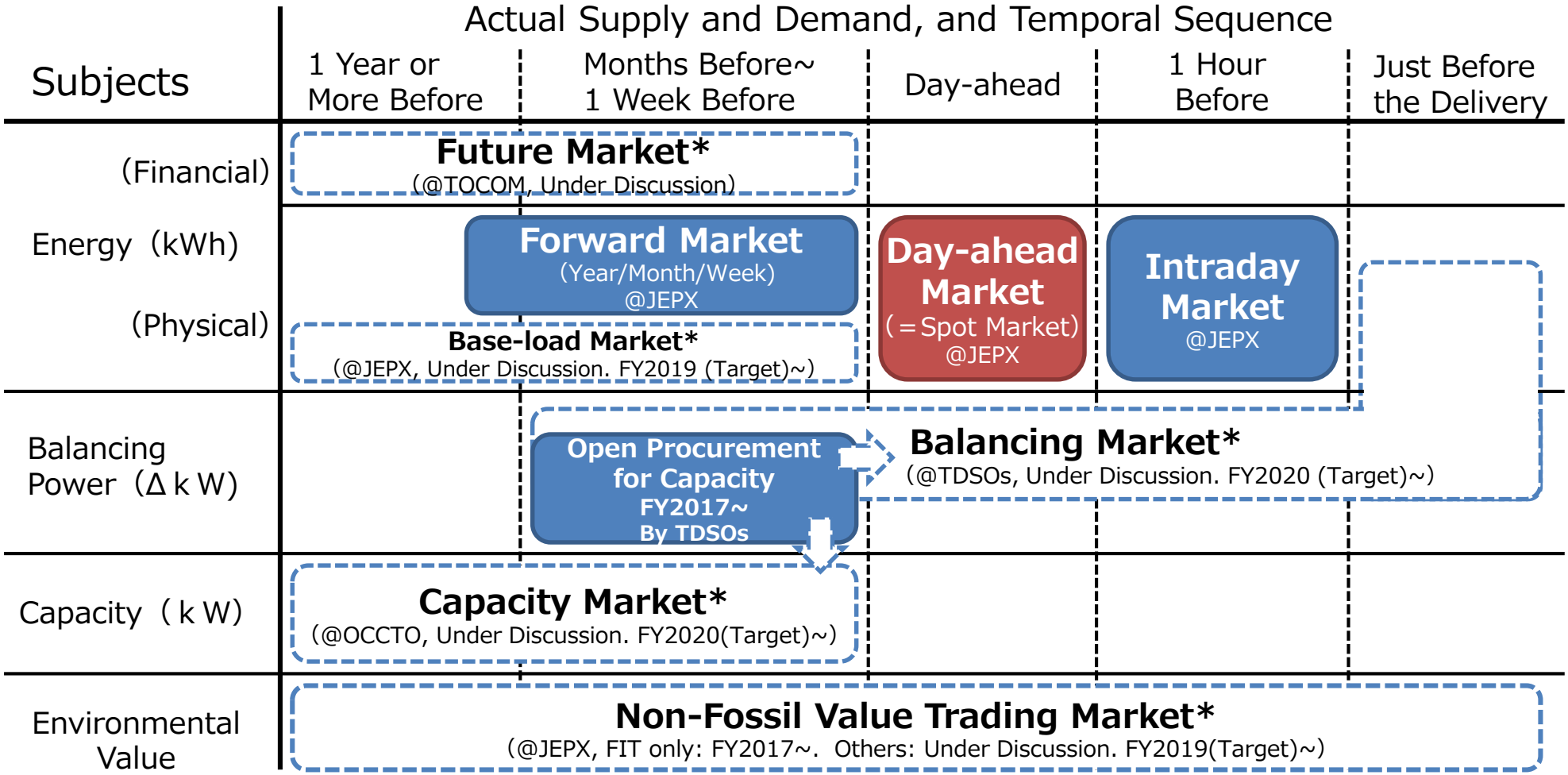
Number of Cases of Switching (Internal Switching in GEUs)

	Internal Switching [in thousand]	Percentage [%]
Hokkaido	11.0	0.4
Tohoku	39.0	0.7
Tokyo	800.0	3.5
Chubu	1,150.0	15.1
Hokuriku	19.0	1.5
Kansai	454.0	4.5
Chugoku	410.0	11.7
Shikoku	85.0	4.4
Kyushu	158.0	2.5
Okinawa	2.0	0.2
Nationwide	**3,127.0**	**5.0**

(Source) Electricity Trading Report (As of September 2017)

12. Current Discussion for New Power Markets in Japan

- Forward Market, Day-ahead Market and Intraday Market are operated by JEPX. In addition, we have started the Procurement of the Balancing Power from April 2017.
- Base-load Market, Balancing Market, Capacity Market and Non-Fossil Value Trading Market, and Future transaction are under discussion for near future establishment.

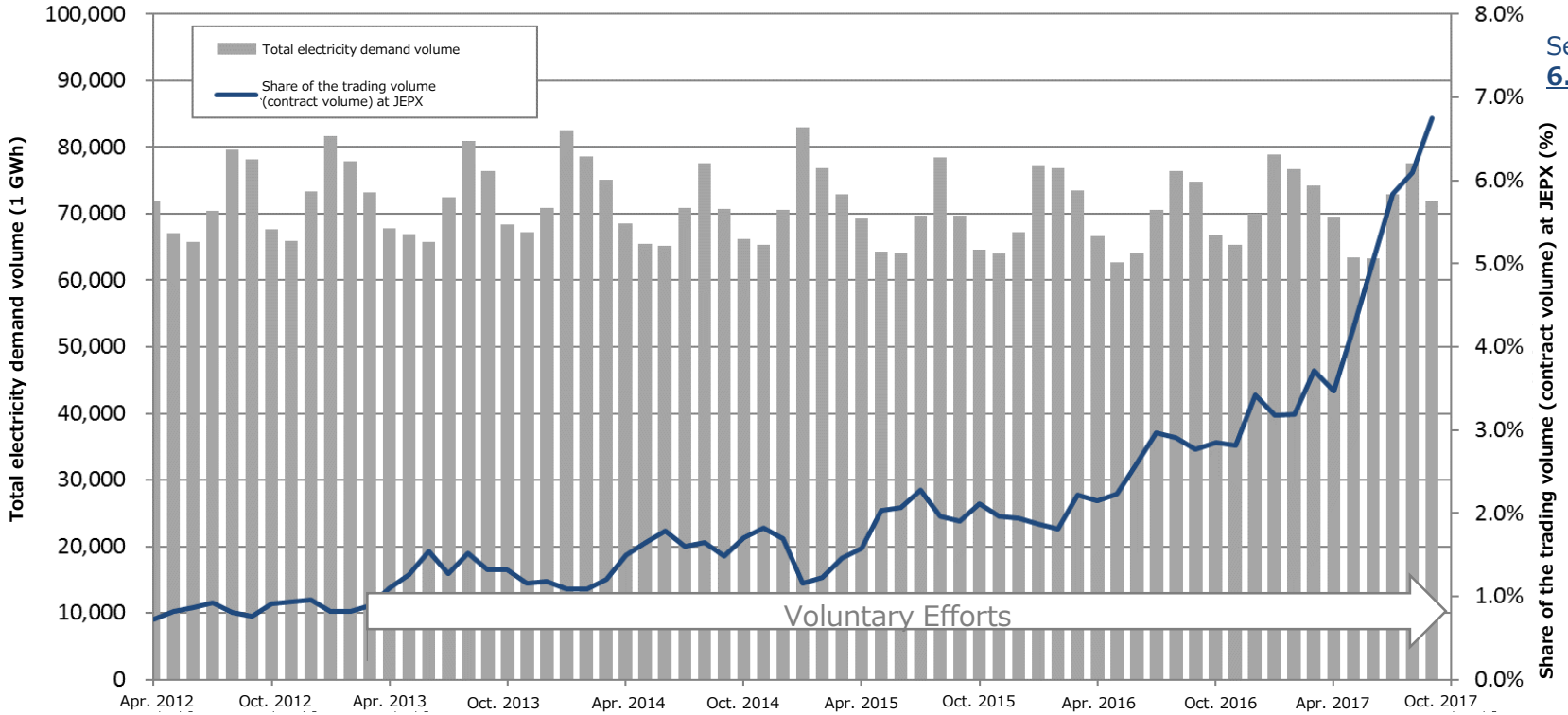


* The timings of the transactions in the Markets may be changed due to discussions.

13. Share of Trading Volume at JEPX in the Electricity Demand

- The share of the trading volume (contract volume) at JEPX in the total electricity demand in Japan as of September 2017 is 6.8% (average of 6.2% for July to September 2017).
- Compared to the same period of the previous year, the share is appx. 2.2 times higher in the period of July – September 2017.

Changes in the share of the trading volume (contract volume) at JEPX
(from April 2012 to September 2017)



September 2017
6.8%

Comparison of the share of the trading volume (contract volume) at JEPX with the same period of the previous year

2016						2017								
July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
x1.3	x1.5	x1.4	x1.4	x1.4	x1.8	x1.7	x1.8	x1.7	x1.6	x1.9	x1.9	x2.0	x2.1	x2.4

14. Spot Market Splitting (July – September 2017)

- Based on the limited capacity of interconnection grids, the wholesale market is sometimes split.
- The average rate of occurrence of market split in the period (July-Sep 2017) was 78.7% in Hokkaido-Honshu Interconnection and 71.6% in Tokyo-Chubu Interconnection (FC).

Monthly Rate of Occurrence of Market Split between Each Region

Hokuriku – Kansai Interconnection

Apr	May	June	July	Aug	Sep	Avg.
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Chubu – Hokuriku Interconnection

Apr	May	June	July	Aug	Sep	Avg.
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Hokkaido – Honshu Interconnection

Apr	May	June	July	Aug	Sep	Avg.
59.2%	86.0%	90.1%	63.9%	83.5%	89.2%	78.7%

Kansai – Chugoku Interconnection

Apr	May	June	July	Aug	Sep	Avg.
5.7%	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%

Tohoku – Tokyo Interconnection

Apr	May	June	July	Aug	Sep	Avg.
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Chugoku – Shikoku Interconnection

Apr	May	June	July	Aug	Sep	Avg.
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Tokyo – Chubu Interconnection (FC)

Apr	May	June	July	Aug	Sep	Avg.
82.7%	91.1%	81.6%	75.9%	64.2%	74.7%	71.6%

Chugoku – Kyushu Interconnection

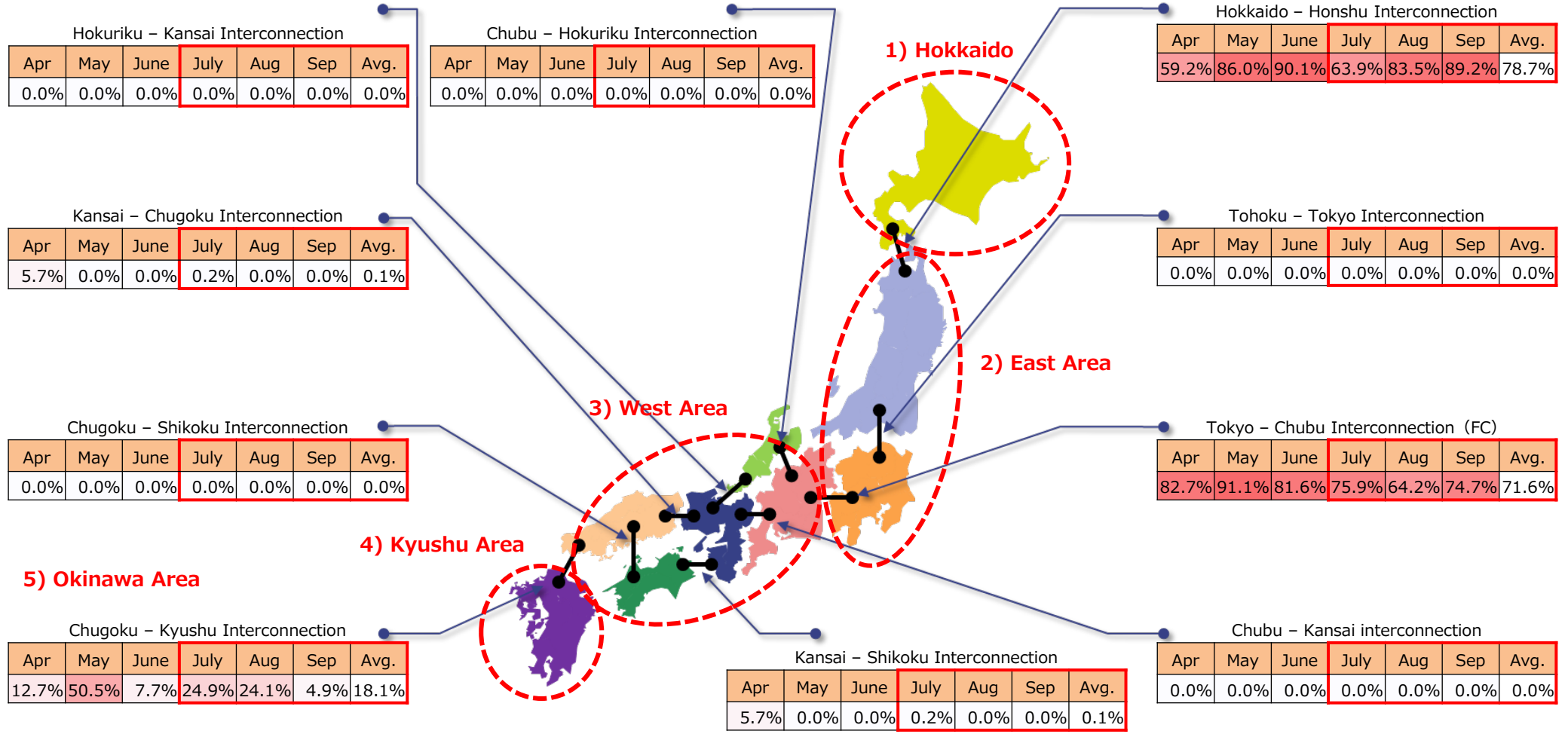
Apr	May	June	July	Aug	Sep	Avg.
12.7%	50.5%	7.7%	24.9%	24.1%	4.9%	18.1%

Kansai – Shikoku Interconnection

Apr	May	June	July	Aug	Sep	Avg.
5.7%	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%

Chubu – Kansai interconnection

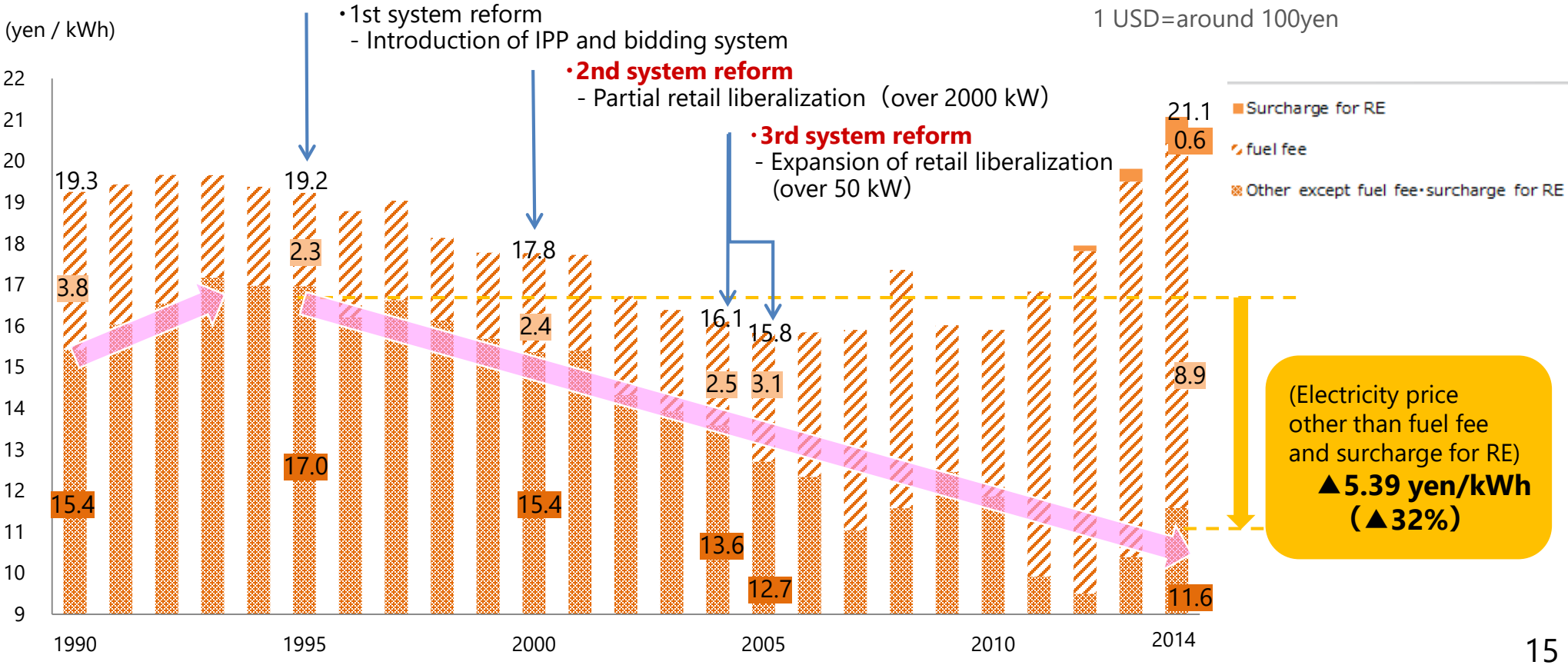
Apr	May	June	July	Aug	Sep	Avg.
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%



15. Reduction of the electricity price

- Electricity price reduced gradually due to the electricity system reform.
- While the electricity price rose due to the increase in fuel fee after the Earthquake 2011, the price other than fuel fee and surcharge for RE declined by 32%.

Transition of electricity price（Yen/kWh）



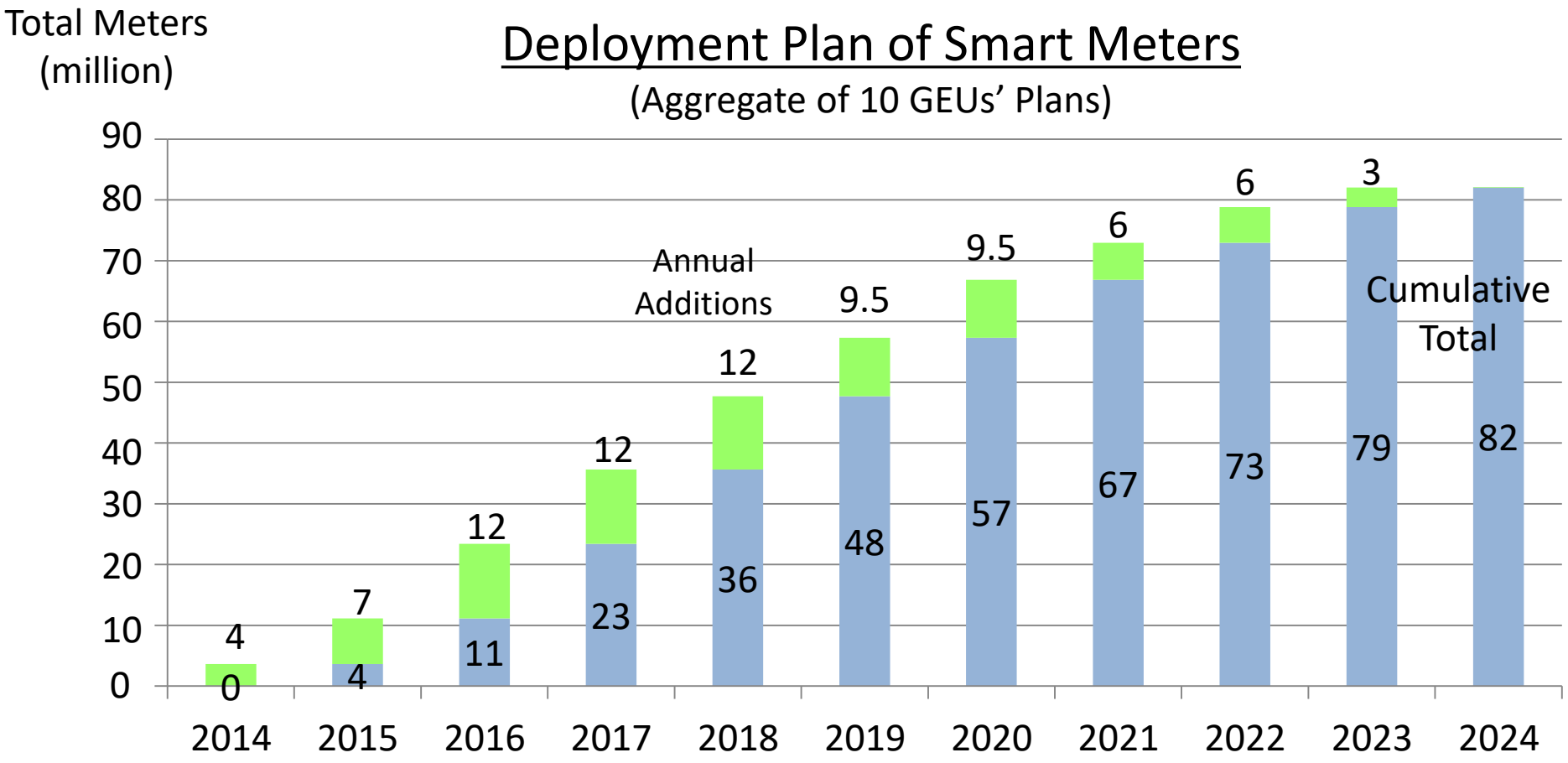
16. Deployment Status of Smart Meters

- Efforts are being made in steady installation of smart meters towards achieving the goal of completing the installation in mid 2020s (35.3 % in average).
- Installation status varies depending on the companies.

Electric Power Companies	Smart Meters to be Installed (in million)	Cumulative Installation Results as of 31 March 2017 (in million)	Percentage of Installation results	Completion of Installation (Scheduled)
Hokkaido	3.7	0.767	20.7%	End of FY2023
Tohoku	6.66	1.48	22.2%	End of FY2023
Tokyo	27.0	10.604	39.3%	End of FY2020
Chubu	9.5	2 .898	30.5%	End of FY2022
Hokuriku	1.82	0.373	20.5%	End of FY2023
Kansai	13.0	7.50	57.5%	End of FY2022
Chugoku	4.95	0.909	18.3%	End of FY2023
Shikoku	2.65	0.435	16.4%	End of FY2023
Kyushu	8.1	2.571	31.7%	End of FY2023
Okinawa	0.85	0.11	12.9%	End of FY2024
Nationwide	**78.23**	**27.6**	**35.3%**	-

17. Massive Deployment of Smart Meters

- In accordance with the full retail market liberalization, a massive number of smart meters are scheduled to be deployed.
- The deployment is beginning to be accelerated this year and as many as 80 million will be deployed by the early 2020s.

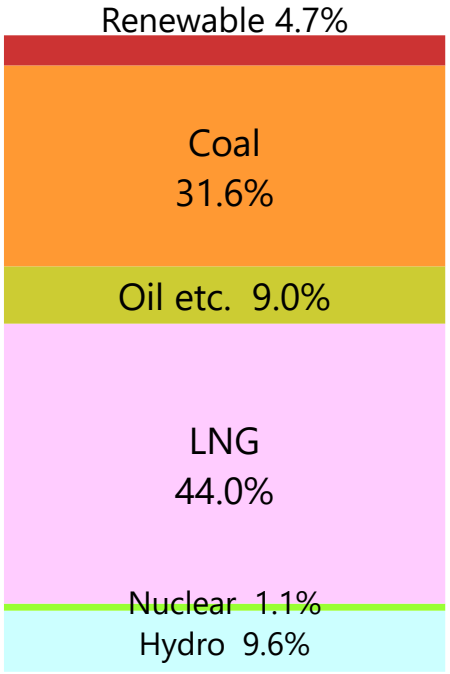


Appendix:

- Appendix 1: Energy Mix Target in 2030
- Appendix 2: Introduction Status of Renewable Energies
- Appendix 3: Nuclear Power Plants in Japan
- Appendix 4. Settlement of Imbalance Power and draft design of wide – area Balancing Market
- Appendix 5: Open Procurement for Capacity of Balancing Power
- Appendix 6: Activation of Power Exchange
- Appendix 7: Transmission Tariff Reform (Under Discussion)
- Appendix 8: About Gas Market
- Appendix 9 : About EGC

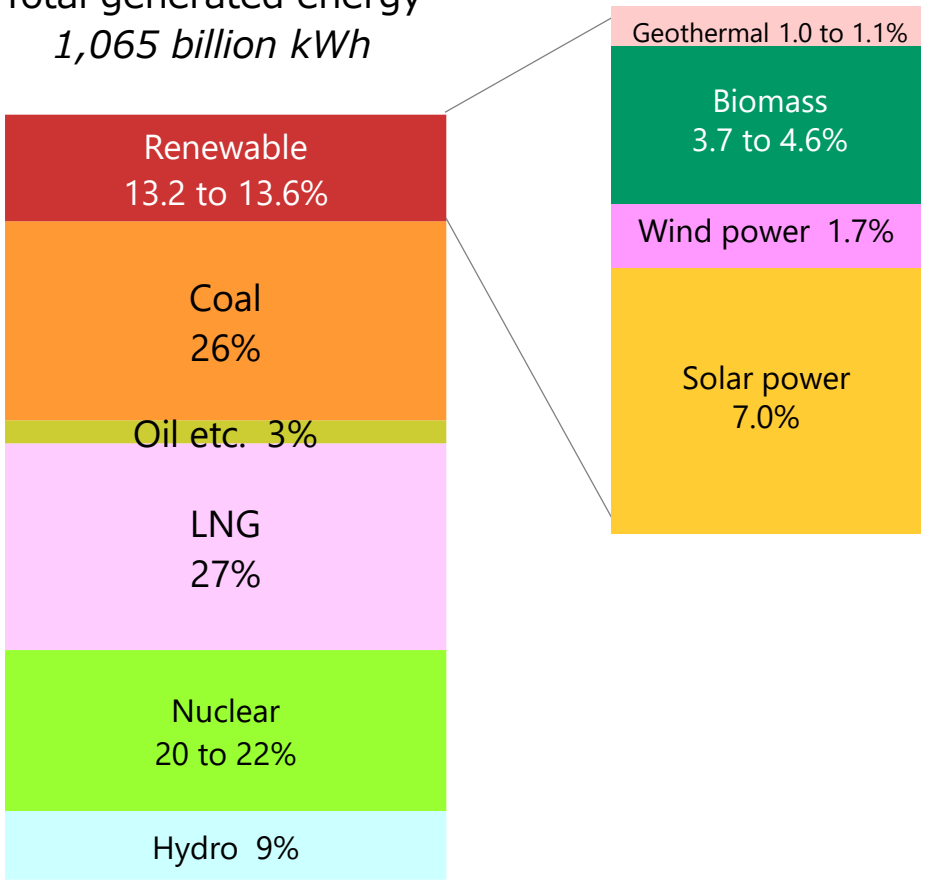
Appendix 1. Energy Mix Target in 2030

Generation
Total generated energy
885.0 billion kWh



2015
(Actual Result)

Generation
Total generated energy
1,065 billion kWh



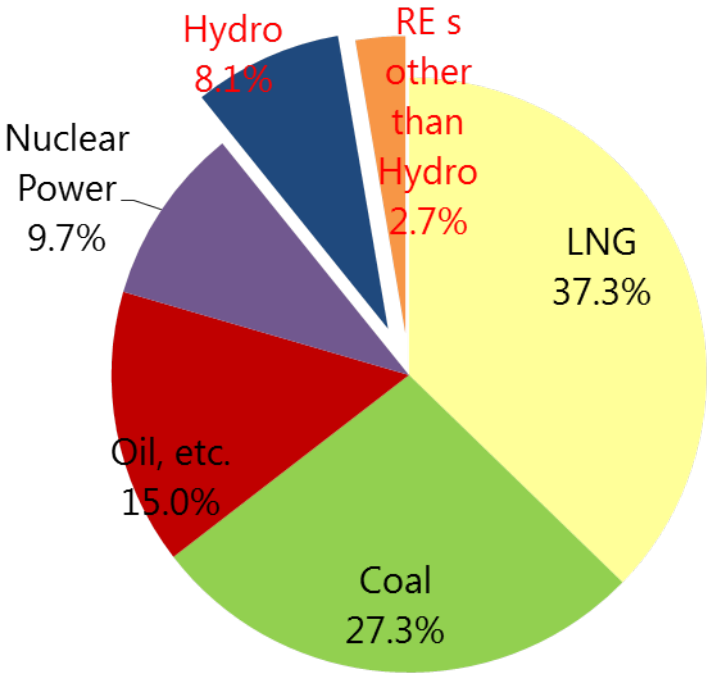
2030
(Target)

Source:
The Strategic energy plan (SEP) in 2014
The Long-term energy supply and demand outlook in 2015

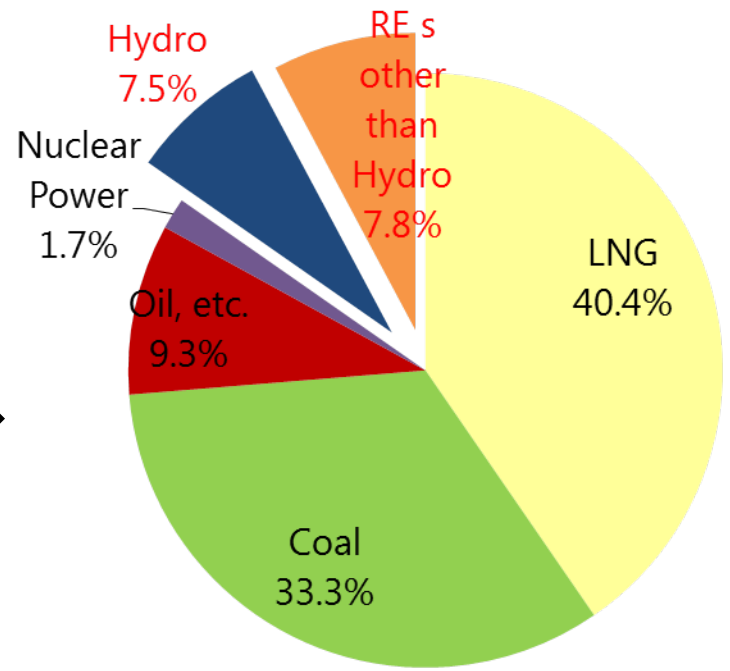
Appendix 2-1. Introduction Status of Renewable Energies

- The ratio of “Renewable Energies other than Hydroelectric” to total generated energy has increased from 2.7% in FY 2011 to 7.8% (or 15.3 % including Hydroelectric) in FY 2016.

【Power Source Composition (FY2011）】

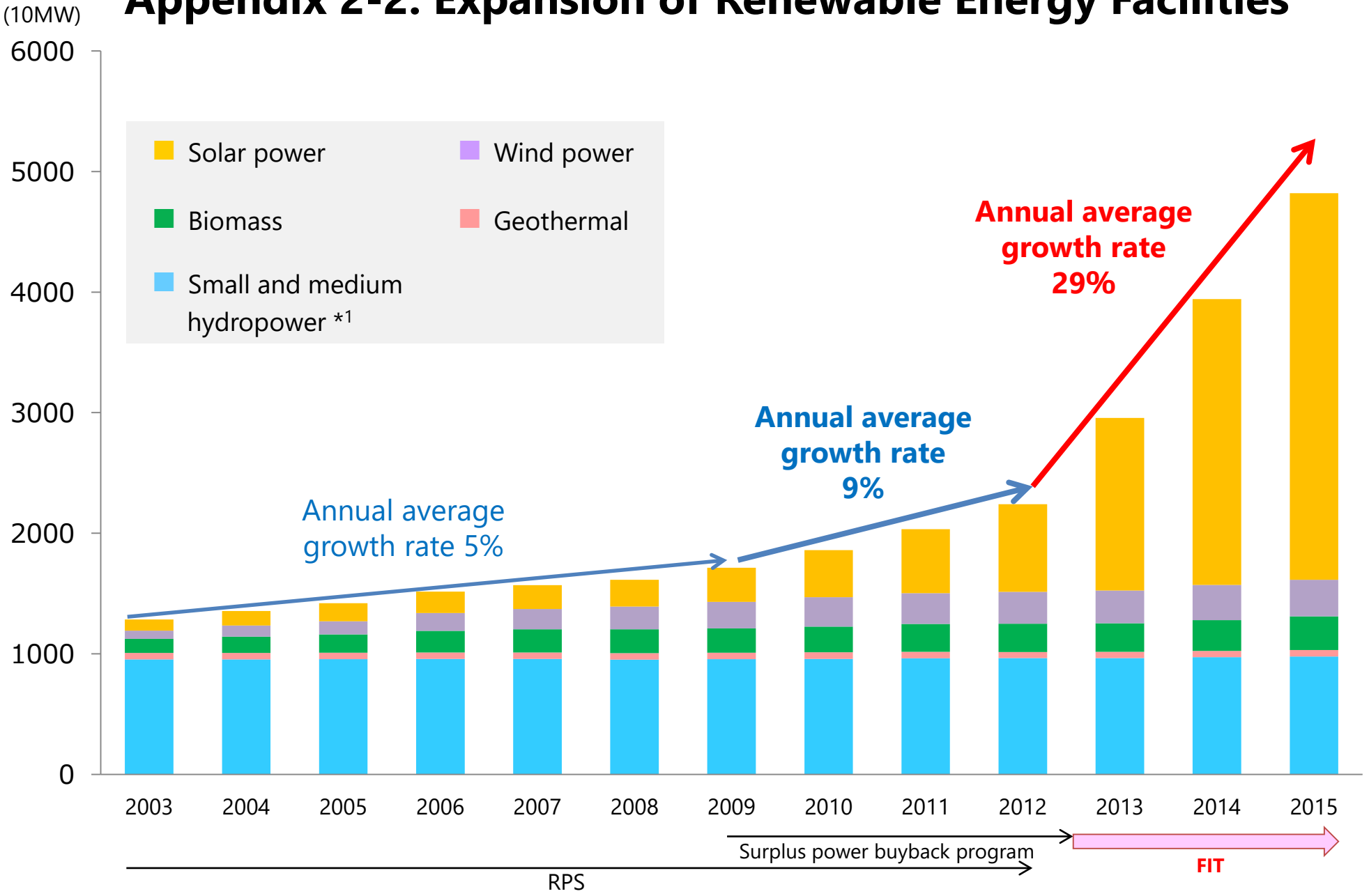


【Power Source Composition (FY2016)】



Source: Survey of Electric Power Statistics

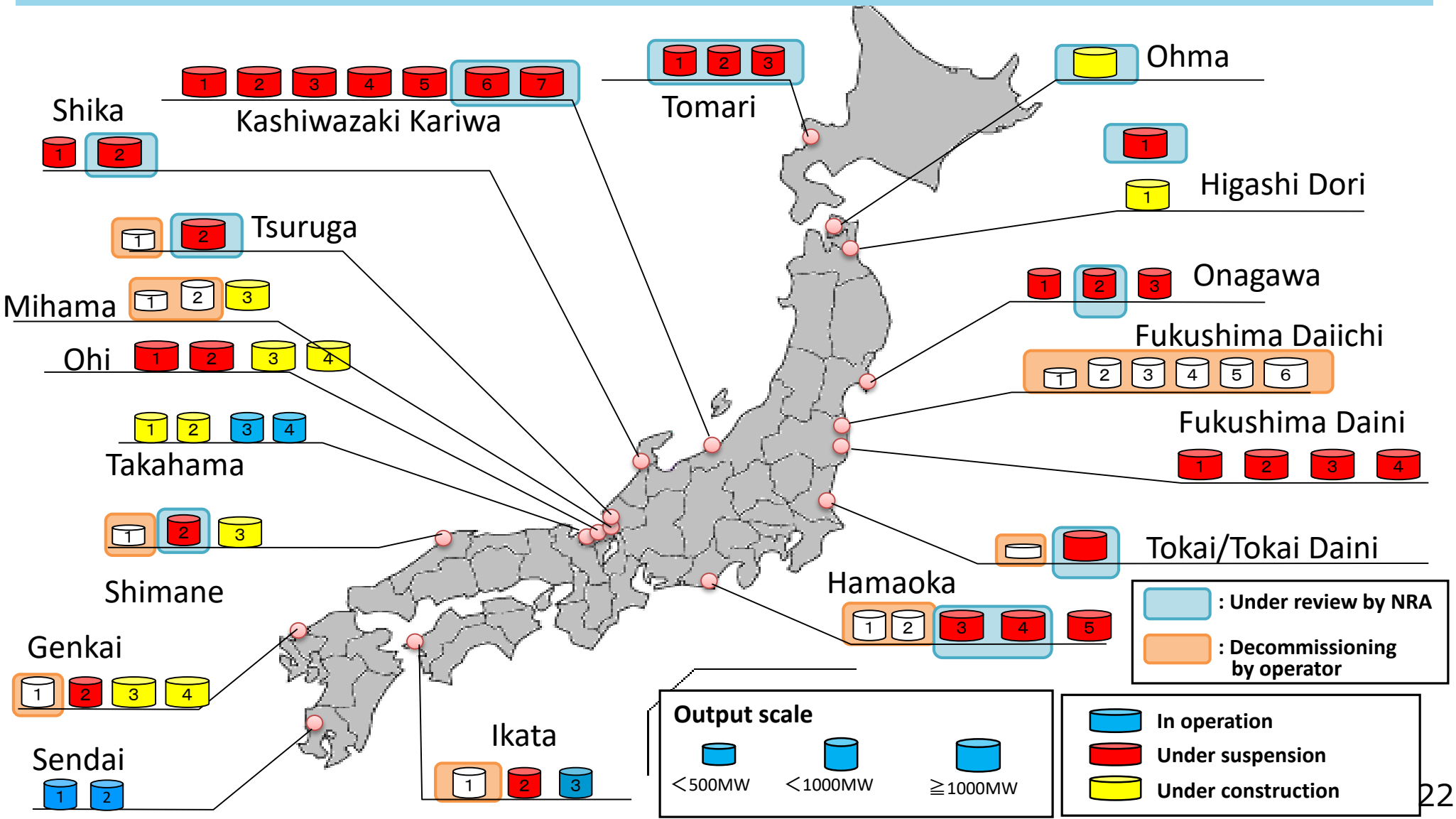
Appendix 2-2. Expansion of Renewable Energy Facilities



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

Appendix 3. Nuclear Power Plants in Japan

- 26 applications have been submitted to the Nuclear Regulation Authority for review but only 5 plants are currently in operation. (As of 12th June 2017.)

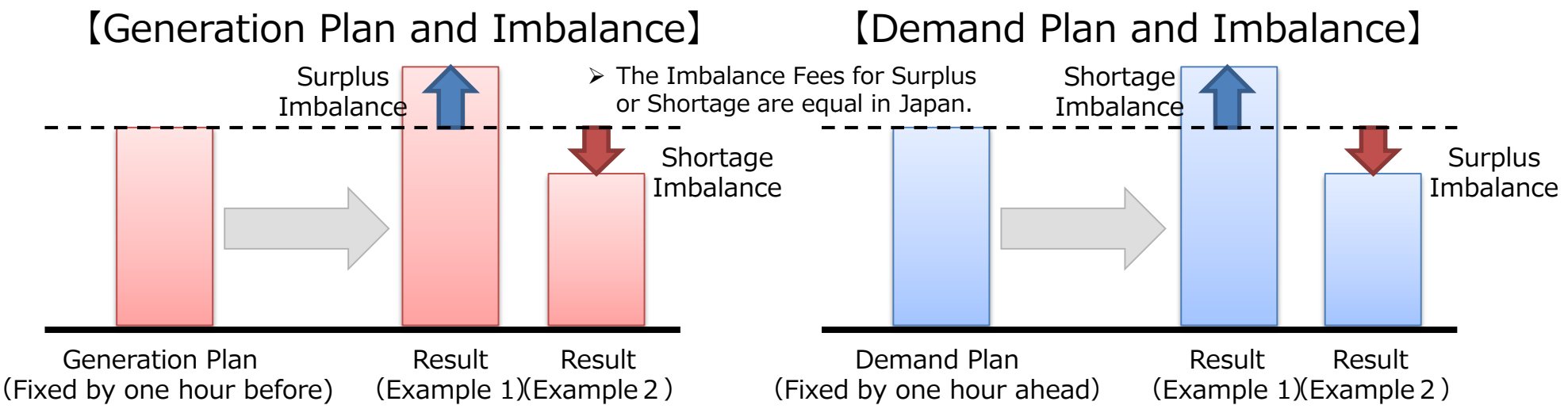


Appendix 4-1. Settlement of Imbalance Power

- The settlement of imbalance power is one of the key factors for (i) equal competition between GEUs and new entrants and (ii) stable supply.
- Japan introduced the Third Party Access (TPA) model in 2000 at its early stage of retail liberalization. Under the TPA model, the equality between GEUs and new entrants and incentive for keeping the balance of demand and supply for new entrants are big subjects for electricity system in Japan.
- Since April 2016, after moving to the Balancing Group (BG) Model, GEUs and new entrants has been standing on the same condition; however, because of the dominance of capacity of balancing power by GEUs, Japan still does not have Balancing Market. Therefore, the imbalance fees are calculated based on the price of Day-ahead Market and Intra-day Market.
- However, the result of the calculation for Imbalance Fee was relatively cheap, and it led the lack of incentive to keep balance of demand and supply for some new entrants. So, in October 2017, the calculation method for Imbalance Fee was tentatively modified. EGC is carefully watching the result of the new calculation for Imbalance Fee.
- Now we are discussing draft design of wide-area Balancing Market in Japan.

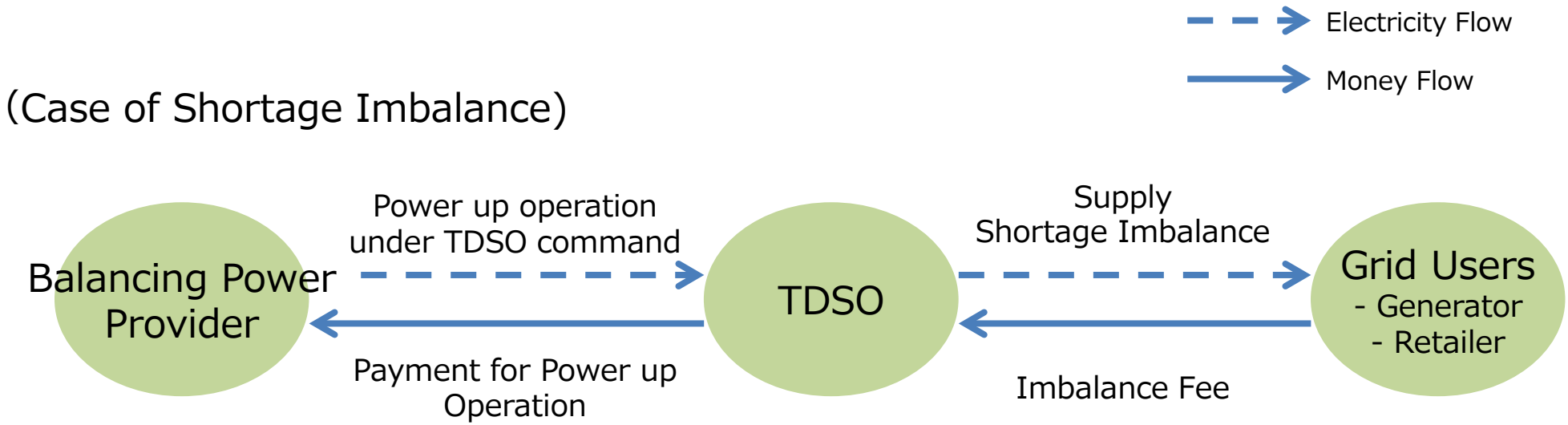
Appendix 4-2. Imbalance Settlement in Balancing Group Model

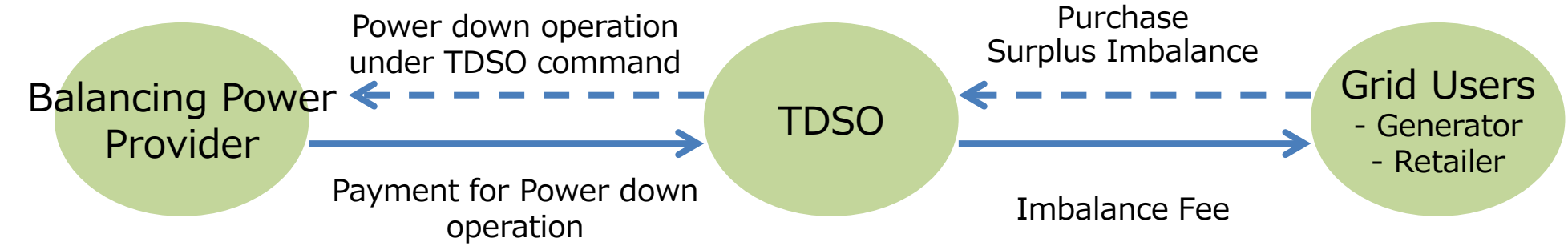
- TDSO should keep the balance between demand and supply including the imbalance of new entrants.
- The fixed cost of imbalance settlement by TDSO may be covered by Transmission Fee. TDSO have contacted some generators for imbalance settlement under “Open Procurement” for capacity of balancing power since April 2017.
- The variable cost for operation of contracted generators may be covered by Imbalance Fee. However, because of the calculation system, the Imbalance Fee is not correctly reflect the actual cost for balancing power in each area.



【Before October 2017】
Imbalance Fee (in each 30 min.)＝(The weighted mean of the price of day - ahead market and intra-day market)×α＋β
α: Adjustment Factor for total system demand and supply
β: Adjustment Factor for reflect area difference of imbalance settlement
（β＝Yearly average imbalance settlement cost in each area－Yearly average imbalance settlement cost in Japan total）

Appendix 4-3. Imbalance Settlement in Balancing Group Model





Appendix 4-4. Accounting Balance of Imbalance in TDSO

- Open Procurement for Capacity of Balancing Power has been started from April 2017. And the calculation method for Imbalance Payment for balancing power was changed.
- As in tentative calculation, all TDSO has operating loss for Imbalance from April 2017.

Tentative Imbalance Accounting form April to August in 2017

	Hokkaido	Tohoku	Tokyo	Chubu	Hokuriku	Kansai	Chugoku	Shikoku	Kyushu	Okinawa
Operating Income /Operating Loss (Million JPY)	-884	-740	-3,788	-1,618	-55	-4,075	-1,437	-856	-769	-41
(Reference) Electricity Demand (TWh)	30.0	77.9	272.4	127.2	28.2	138.5	59.2	26.5	83.8	8.0

(Source) EGC

Appendix 4-5. Imbalance from April to August in 2017

- The surplus imbalance surpassed the shortage imbalance in all area from April to August in 2017.

GWh

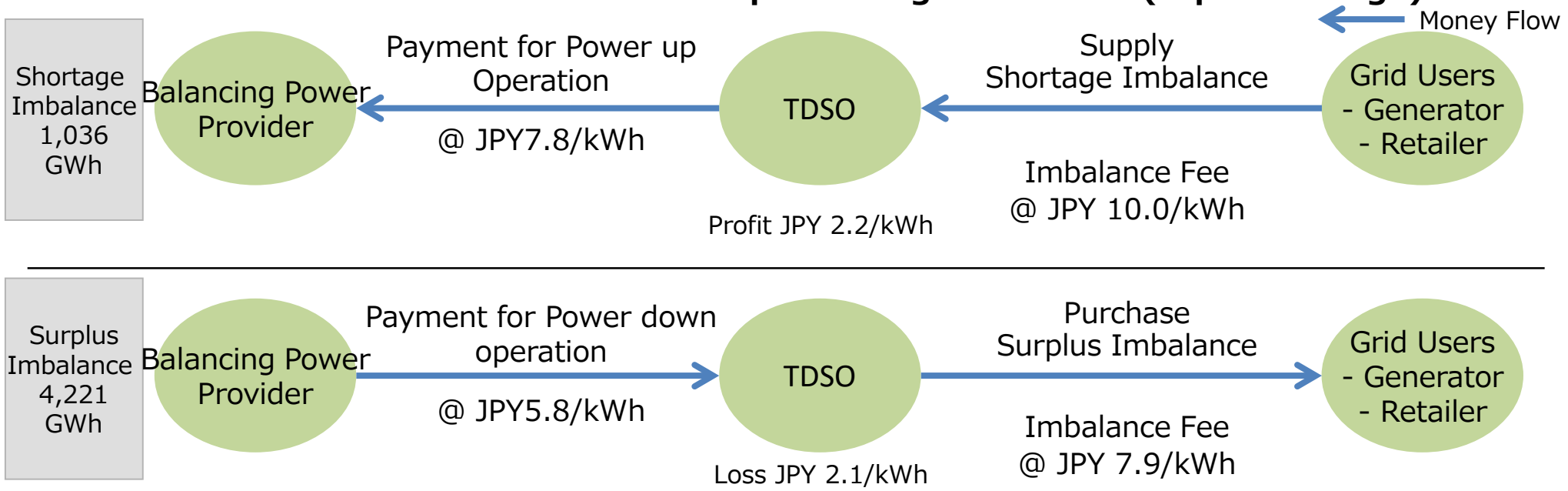
TDSO	Surplus Imbalance (a)	Shortage Imbalance (b)	(a)-(b)	(a)/(b)
Hokkaido	273	120	154	2.3
Tohoku	531	359	172	1.5
Tokyo PG	1,417	937	480	1.5
Chubu	772	510	262	1.5
Hokuriku	152	101	51	1.5
Kansai	1,380	370	1,010	3.7
Chugoku	651	154	497	4.2
Shikoku	298	109	189	2.7
Kyushu	852	482	370	1.8
Okinawa	43	41	2	1.0
Total	4,221	1,036	3,185	4.1

(Source) EGC

Appendix 4-6. 2 Factor for Operating Loss in all TDSO for imbalance

- Factor 1: Price Deference between Imbalance Fee and Payment for Balancing Power
- Factor 2: Amount Deference between Surplus Imbalance and Shortage Imbalance
- Price Deference is important factor to consider how to improve the imbalance fee design.

Price related imbalance settlement from April to August in 2017 (Japan average)



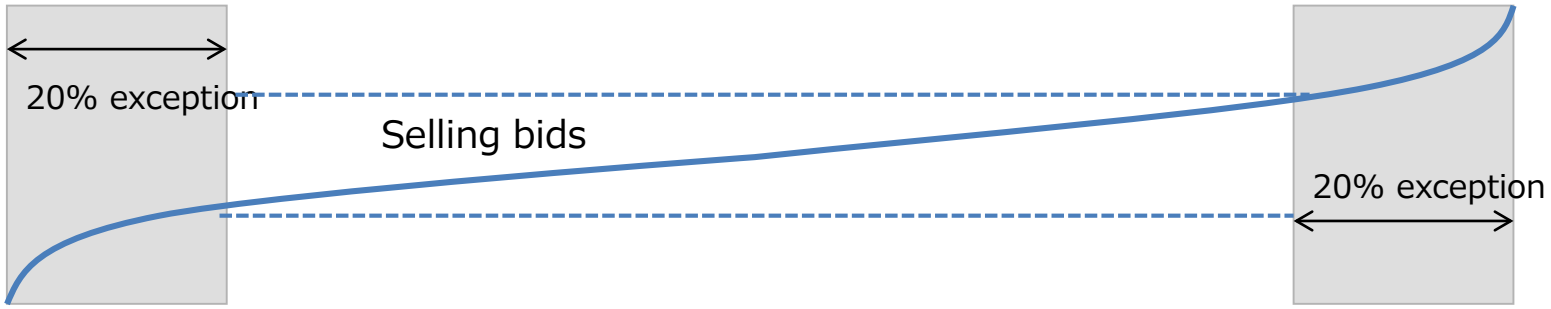
(Source) EGC

Appendix 4-7. Recent Tentative Reform for Imbalance Settlement in Japan

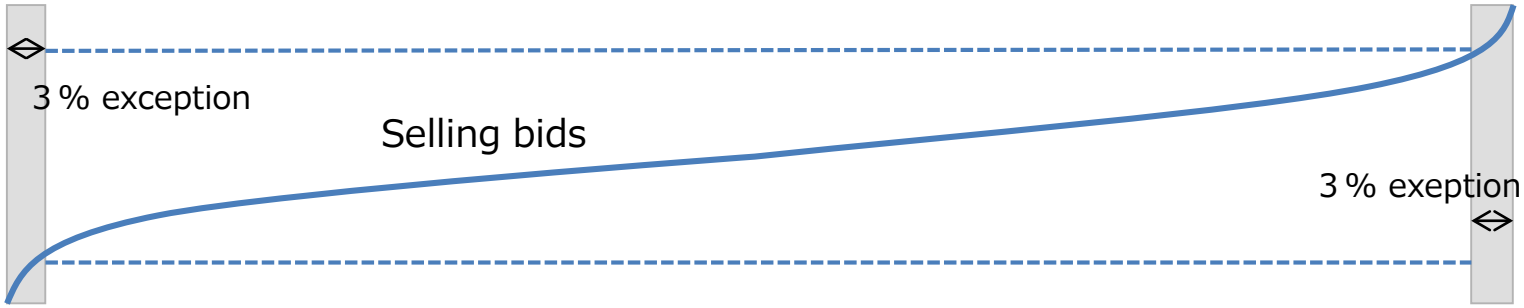
- In October 2017, the calculation method for Imbalance Fee was tentatively modified.

【**After October 2017**】
Imbalance Fee (in each 30 min.)＝(The weighted mean of the price of day - ahead market and intra-day market) × α＋β
α: Adjustment Factor for total system demand and supply **(exception ration change from 20% to 3%)**
β: Adjustment Factor for reflect area difference of **area market price**
（β＝**Median of difference of area price and system price in each month**）

【α: Before October 2017】



【α: After October 2017】



Appendix 4-8. Solar Power and Wind Power under FIT

- Solar Power and Wind Power are increasing under FIT mechanism in Japan.

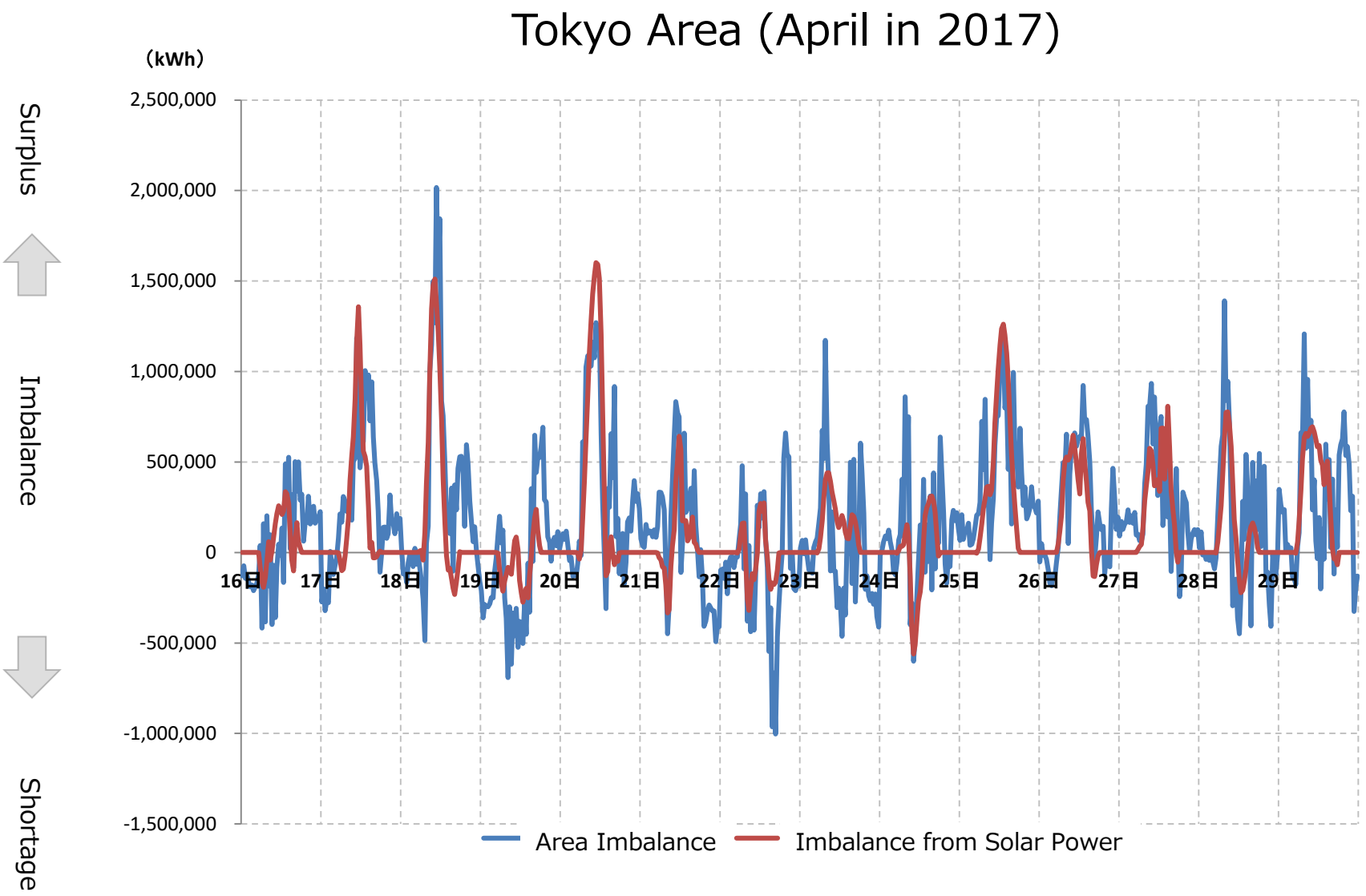
Solar Power and Wind Power under FIT in end of October, 2017

MW	Hokkaido	Tohoku	Tokyo PG	Chubu	Hokuriku	Kansai	Chuguoku	Shikoku	Kyushu	Okinawa
Solar	1,223	3,732	11,715	6,793	738	4,752	3,554	2,083	7,628	313
(% in H3 Demand)	(24.4%)	(27.8%)	(22.3%)	(28.0%)	(14.8%)	(18.6%)	(34.0%)	(41.5%)	(50.5%)	(21.6%)
Wind	348	922	421	319	156	152	347	152	488	14
(% in H3 Demand)	(6.9%)	(6.9%)	(0.8%)	(1.3%)	(3.1%)	(0.6%)	(3.3%)	(3.0%)	(3.2%)	(1.0%)
(Reference) H3 Demand	5,020	13,410	52,530	24,290	4,980	25,480	10,450	5,020	15,110	1,448

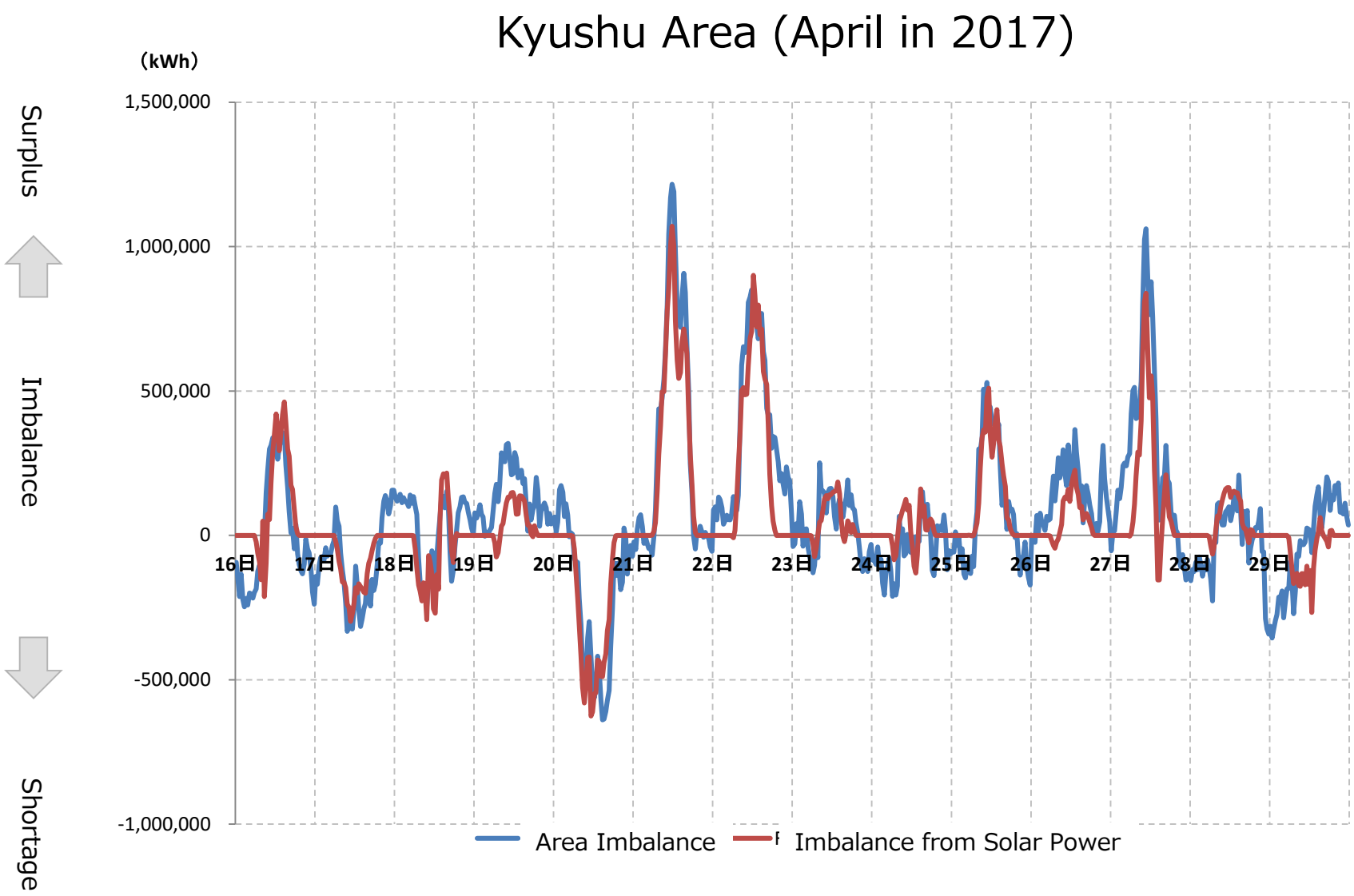
※H3 Demand: Maximum 3 Days Average in Demand in FY 2017 (by OCCTO)

Appendix 4-9. Area Imbalance and Solar Power (Case 1)

- Imbalance from Solar Power is affecting the area imbalance.



Appendix 4-10. Area Imbalance and Solar Power (Case 2)

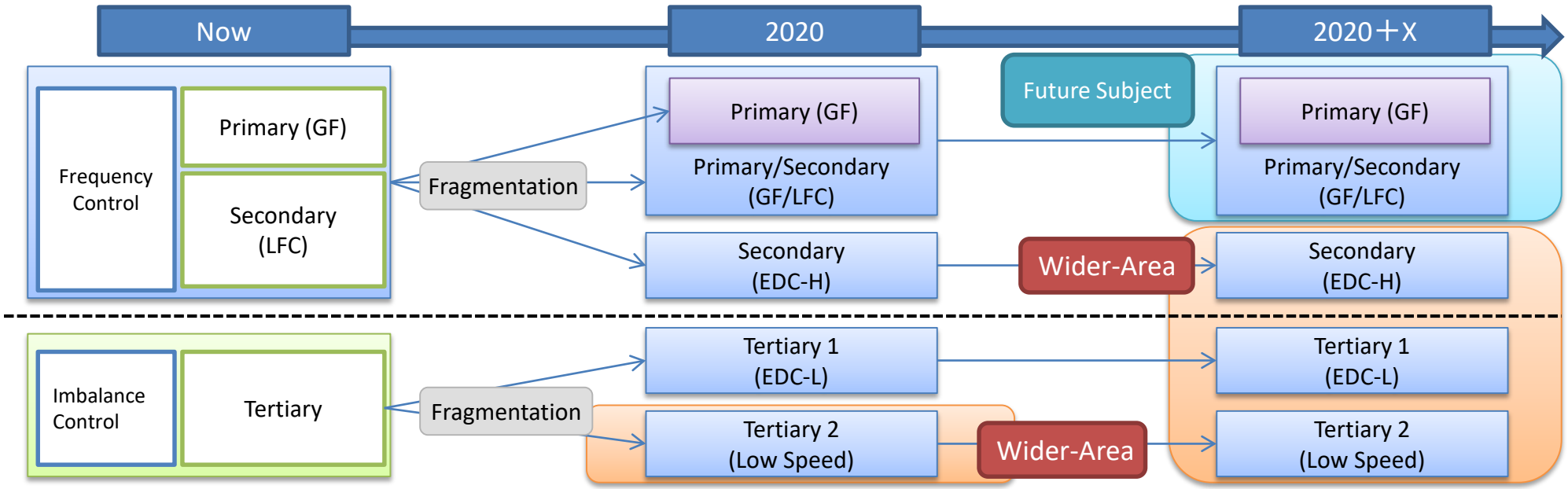


Appendix 4-11. Draft Design of wide-area Balancing Market in Japan

- ANRE/METI started the discussion for the draft design of wide-area Balancing Market in Japan. As same as other countries, the basic design of balancing power is primary, secondary and Tertiary.
- In the draft design, at first, the wide-area Balancing Market for Tertiary 2(Low Speed) will start in FY 2020. Then Tertiary 1 and Secondary will be traded in the market from 2020+x.

Service Category for wide-area Balancing Market in draft design in Japan

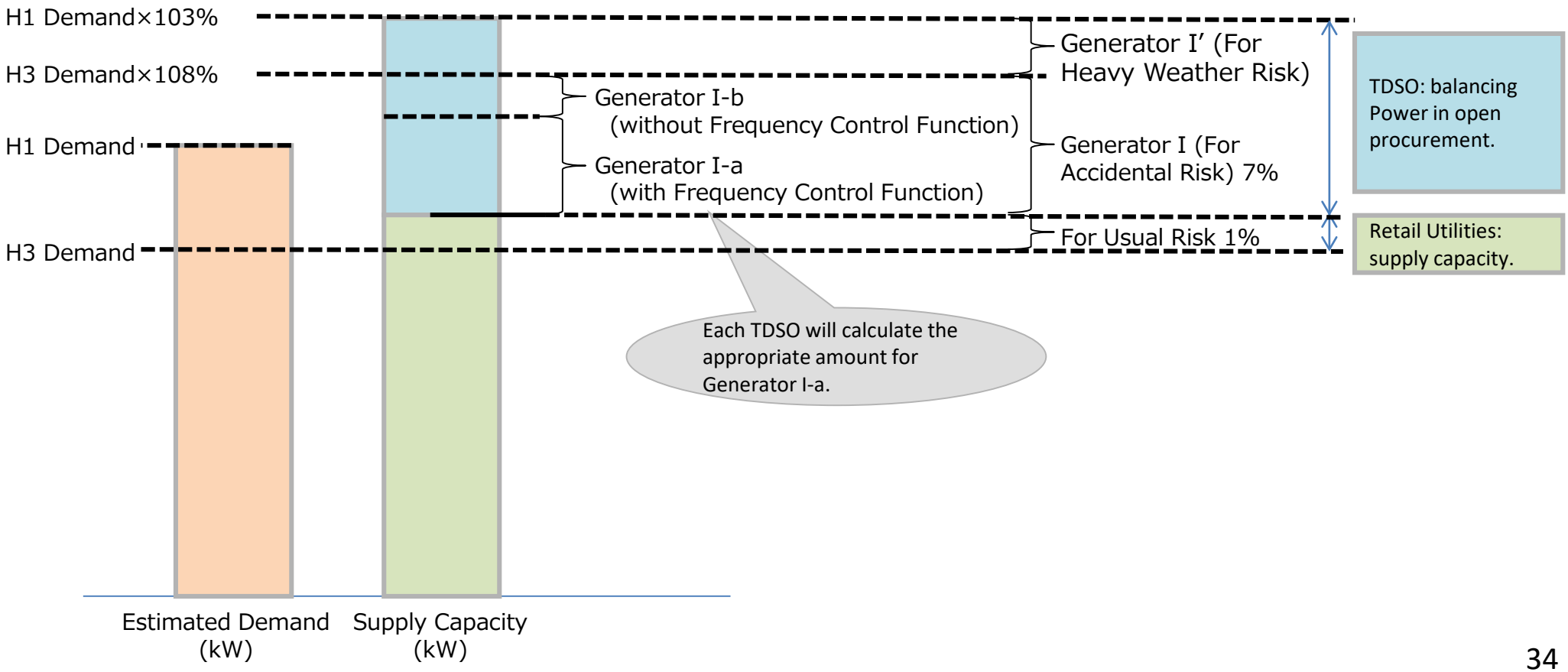
	Primary /Secondary (GF/LFC)		Secondary	Tertiary 1	Tertiary 2 (Low Speed)
	Primary(GF)				
Control Line	—	Exclusive Line, Leased Line	Exclusive Line, Leased Line	Exclusive Line, Leased Line	Including simple operation system
Response Time	Under 10 sec.	Under 240 sec.	Under 5 min.	Under 15 min.	Under 1 hour
Duration	Over 240 sec.	Over 15 min.	Over 7 – 11 hours	Over 7 – 11 hours	Around 3 hours
Service Category	Up/Down	Up/Down	Up/Down	Up/Down	Up/Down



Appendix 5-1. Open Procurement for Capacity of Balancing Power

- In April 2017, TDSOs started “Open Procurement” for capacity of balancing power.
- Based on the METI guideline discussed in EGC, each TDSO categorized the Generator I-a, I-b, I’ and II with spec of generators such as Frequency Control Function. And each TDSO made open procurement for capacity of these generators for balancing power. TDSO will use the Generator II, if these generators are available after gate-close, so Generator II can not get fixed cost as balancing power. GEUs are required to apply in cost base by METI.

Basic concept of Balancing and Category of Balancing Power for 2017FY



Appendix 5-2. Categorized Spec of Generators as Balancing Power

- The categorized specs of Generators as balancing power by TDSOs in FY 2017 are bellow.

	Generator I-a	Generator I-b	Generator I’	Generator II
Online Control	Yes	Yes	Yes in general *1	Yes
Frequency Control Function	Yes	No	No	Yes
Response Time	Under 5 min.	15 – 30 min.	Under 3 hours	- *5
Duration *2	7 – 11 hours	7 – 16 hours	2 – 4 hours	-
Minimum Capacity *3	5MW – 15MW	5MW – 29MW	Over 1MW	- *5
Available Time *4	All Season (April 1, 2017 to March 31, 2018)	All Season (April 1, 2017 to March 31, 2018)	All Season (April 1, 2017 to March 31, 2018), Summer	All Season (April 1, 2017 to March 31, 2018) (Only after gate-close)

*1: Each TDSO offered some off-generators based on their capacity(5 – 10 generators in each).
*2: In case of insufficient generator for duration, the insufficiency reflect to price.
*3: In case DR, TDSO accept the aggregate capacity, not each DR case.
*4: Each TDSO set up with the limit of available days. In case of Generator I’, TDSO set up with the available times per year.
*5: In case of Generator II, each TDSO set up the spec for response speed, such as 10MW under 5min..

Appendix 5-3. Result of Open Procurement for Capacity of Balancing Power in 2017FY

(MW and ¥/kW)

		Hokkaido	Tohoku	Tokyo	Chubu	Hokuriku	Kansai	Chugoku	Shikoku	Kyushu	Okinawa	Total
Generator I-1	Offer MW	360	957	3,210	1,607	330	1,590	745	312	1,060	57	10,228
	Apply MW	543	974	3,262	1,607	330	1,593	745	312	1,060	57	10,483
	Contract MW	360	957	3,237	1,607	330	1,593	745	312	1,060	57	10,258
	Highest Price	¥37,862	¥40,911	¥15,171	¥11,696	¥21,461	¥12,339	¥10,119	¥17,579	¥42,261	¥37,336	-
	Average Price	¥25,047	¥11,531	¥14,575	¥9,260	¥15,359	¥9,740	¥9,785	¥12,328	¥16,291	¥27,878	-
Generator I-b	Offer MW	No Offer	No Offer	470	97	20	260	No Offer	41	No Offer	244	1,132
	Apply MW			478	97	20	260		41		244	1,140
	Contract MW			443	97	20	260		41		244	1,105
	Highest Price			¥15,171	¥5,165	¥18,317	¥12,331		¥17,579		¥9,352	-
	Average Price			¥15,171	¥5,165	¥18,317	¥12,319		¥17,579		¥7,676	-
Generator I'	Offer MW	No Offer	91	590	192	No Offer	170	No Offer	No Offer	284	No Offer	1,327
	Apply MW		93	677	204		366			314		1,654
	Contract MW		74	599	192		170			285		1,320
	Highest Price		¥782	¥4,750	¥1,245		¥5,900			¥32,622		-
	Average Price		¥782	¥4,501	¥1,196		¥3,034			¥8,176		-
Demand Response in Generator I'	Average Price (DR)	No Offer	No DR contract	¥4,690	¥1,196	No Offer	¥3,034	No Offer	No Offer	¥5,250	No Offer	- *1

*1: Total DR Offer 1,112 MW, Total DR Contract 958MW

Appendix 6. Activation of Power Exchange

On Going

1. Improvement of the imbalance settlement system
   - Will promote shift from flexible bilateral contract to fixed volume contract.
2. Improvement of the forward market.
3. Gross bidding.

Under Discussion

1. Procurement of transmission loss by system operators.
2. Establishment of the future market

Appendix 7-1. Transmission Tariff Reform (Under Discussion)

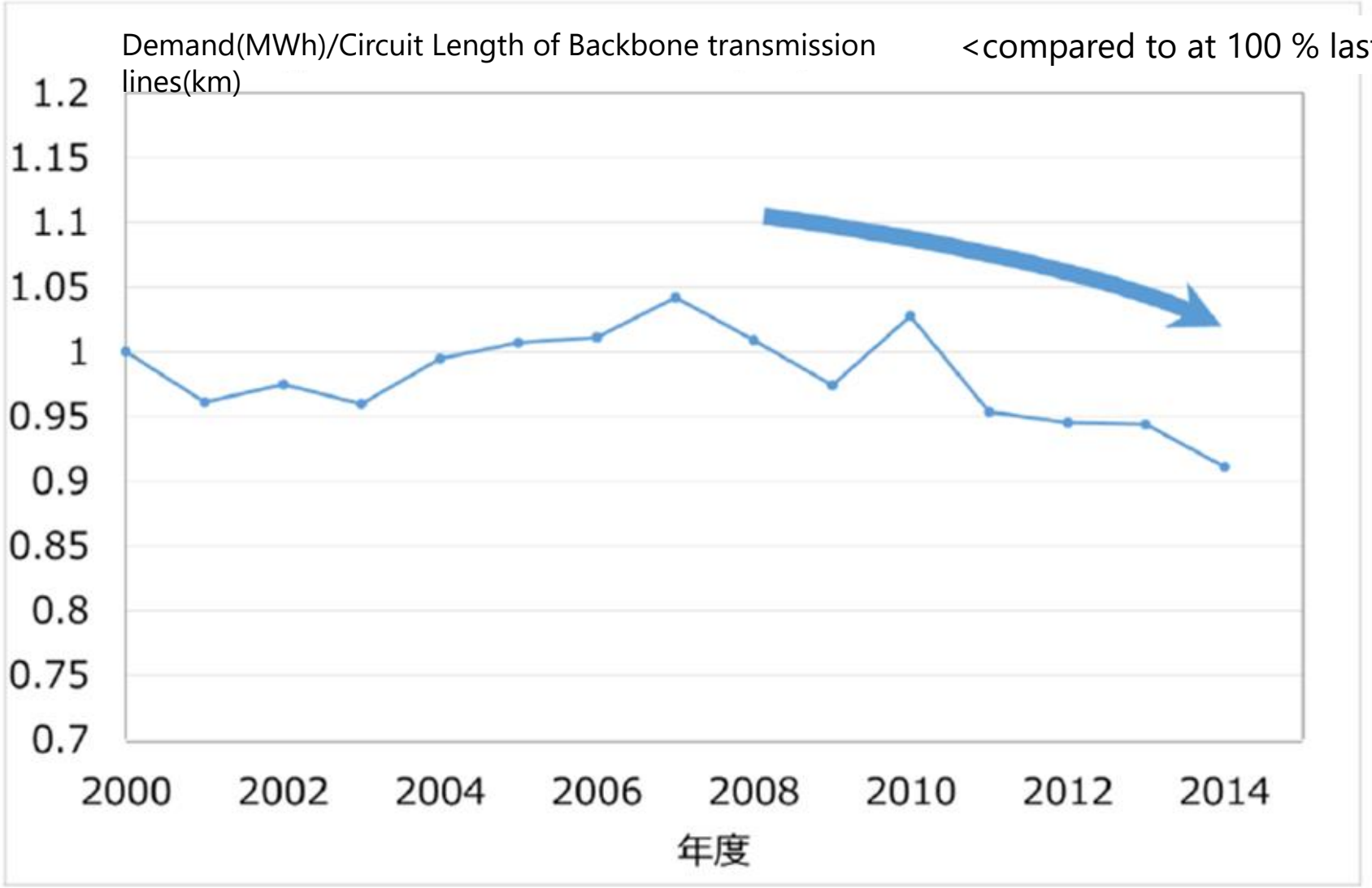
Challenges for Japan's Transmission System

1. Decrease of demand for electricity transmitted through grids
2. Reduction in the utilization efficiency of grids (Increasing REs and decreasing population especially in the rural area)
3. Huge needs for replacement investments of infrastructure

Discussion Items

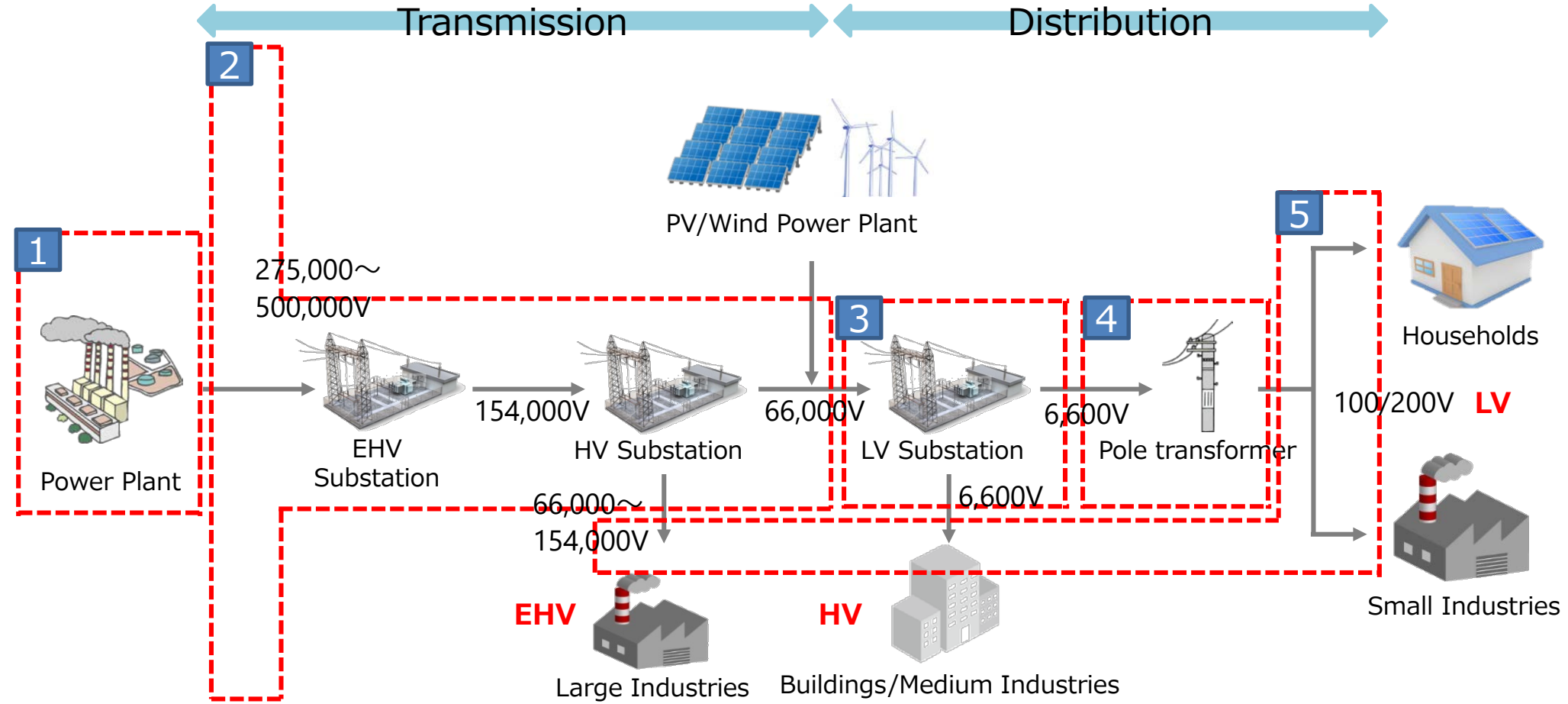
1. Introduction of network charge to generators.
2. Rebalance of Capacity charge (kW) vs Energy charge (kWh)
3. Locational transmission tariff to give locational incentive to generators and load facilities
4. Promoting Transmission Facility Efficiency Increase
   - Interconnecting Grids : First Come First Served→ Implicit Auction (from April 2018)

Appendix 7-2: Utilization of Transmission Facilities



Note: Age as of the end of March 2016

Appendix 7-3. Current Cost Structure : TEPCO



	Supply to Small Is.	1 11% Power Supply	Ancillary Service	2 36% HV Transm.	HV Transf.	3 30% HV Distrib.	LV Transf.	4 9% LV Distrib.	5 13% End-user	Total
Cost (100 mil.yen)	263	174	1,408	4,060	1,119	3,605	717	1,273	1,915	14,541
Unit price(yen/kWh)	0.09	0.06	0.49	1.40	0.39	1.24	0.25	0.44	0.66	5.02

1.

Appendix 7-4. Overview of transmission tariff system in Japan

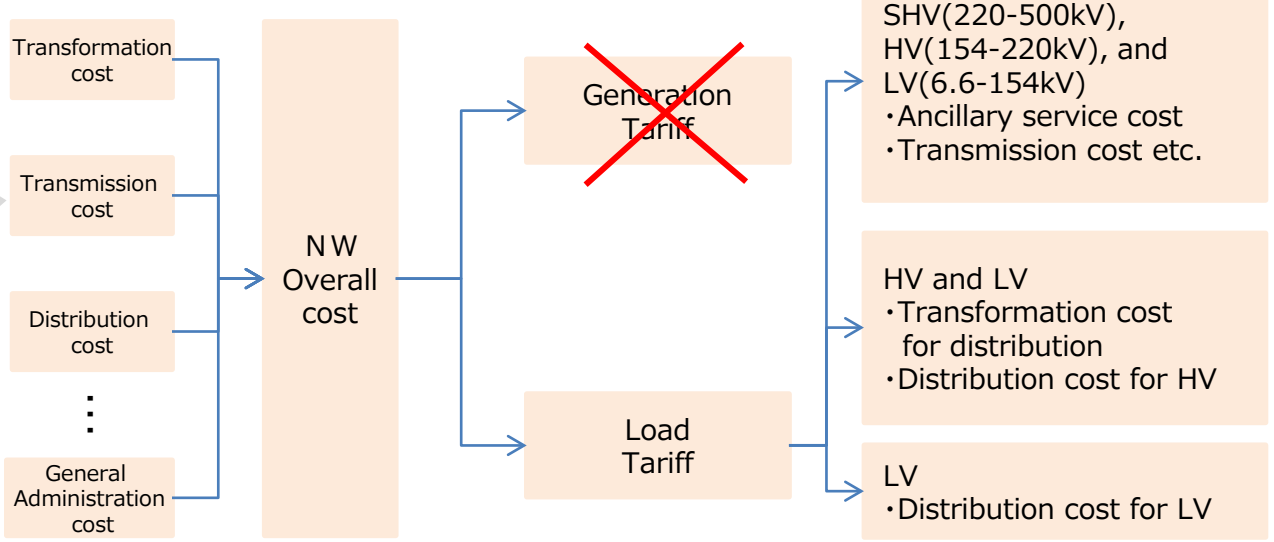
Items under Discussion
- Introducing G-tariff with locational pricing
- Increasing capacity charge

- 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.

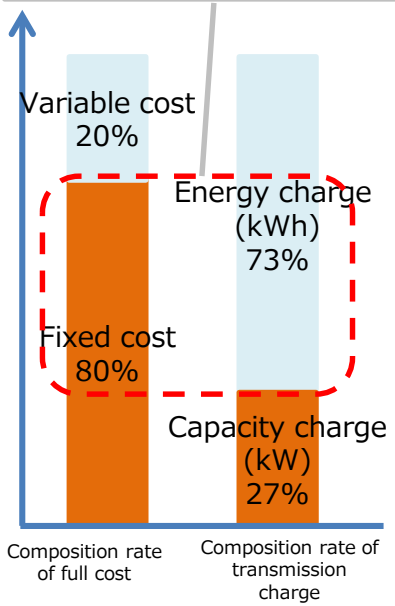
	A :Calculation of full pricing/ First connection charge	B:Allocation of generation-tariff/ Load-tariff	C:Allocation by voltage	D:Transmission tariff planning by service categories
Current system In Japan	• Full pricing system • Shallow[1)]	• Transmission tariff is 100% charged to loads	• Based on the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

Except the First Connection charge

Overview

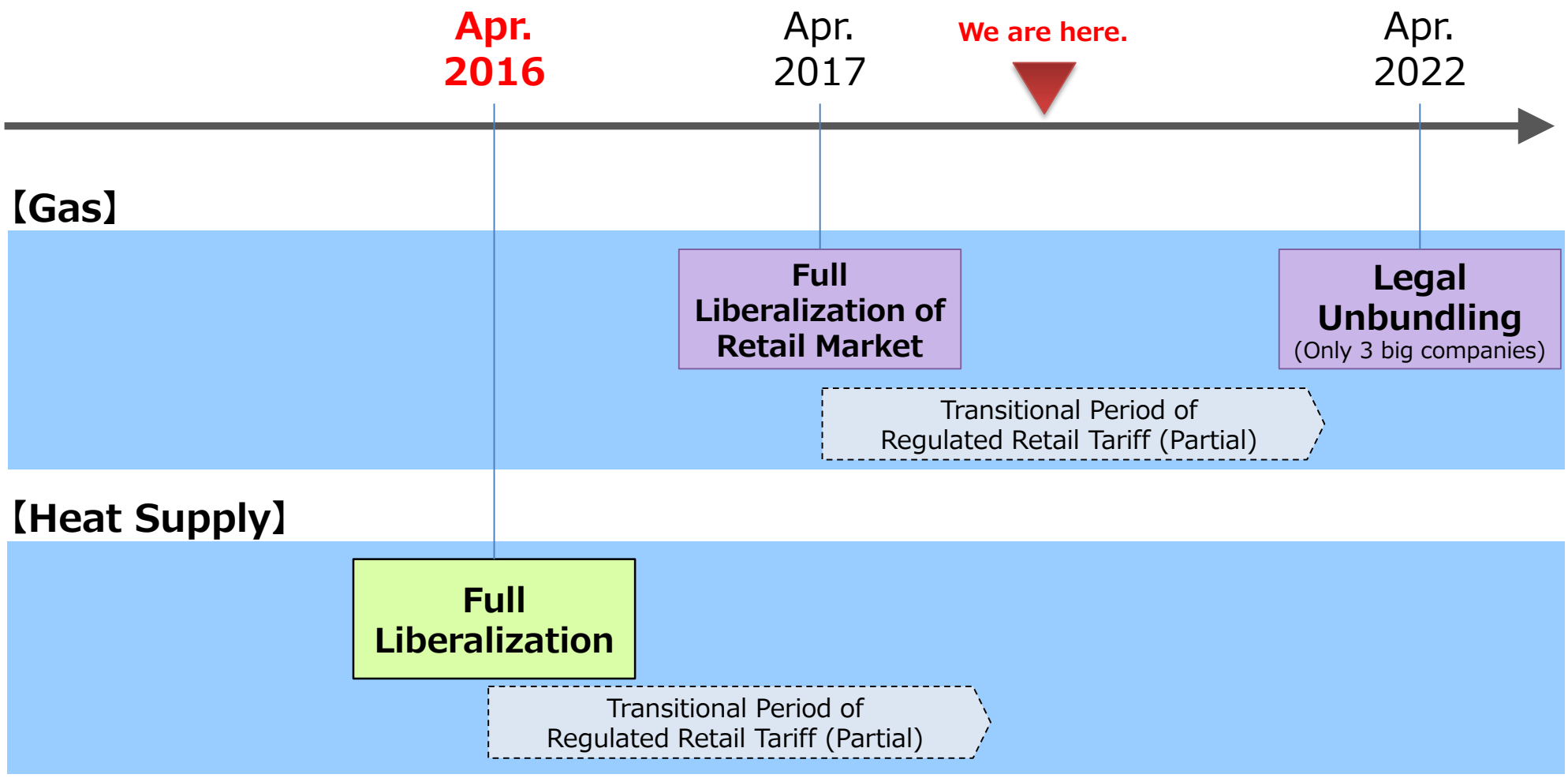


53 % of the total cost is collected through energy charge, while being fixed cost



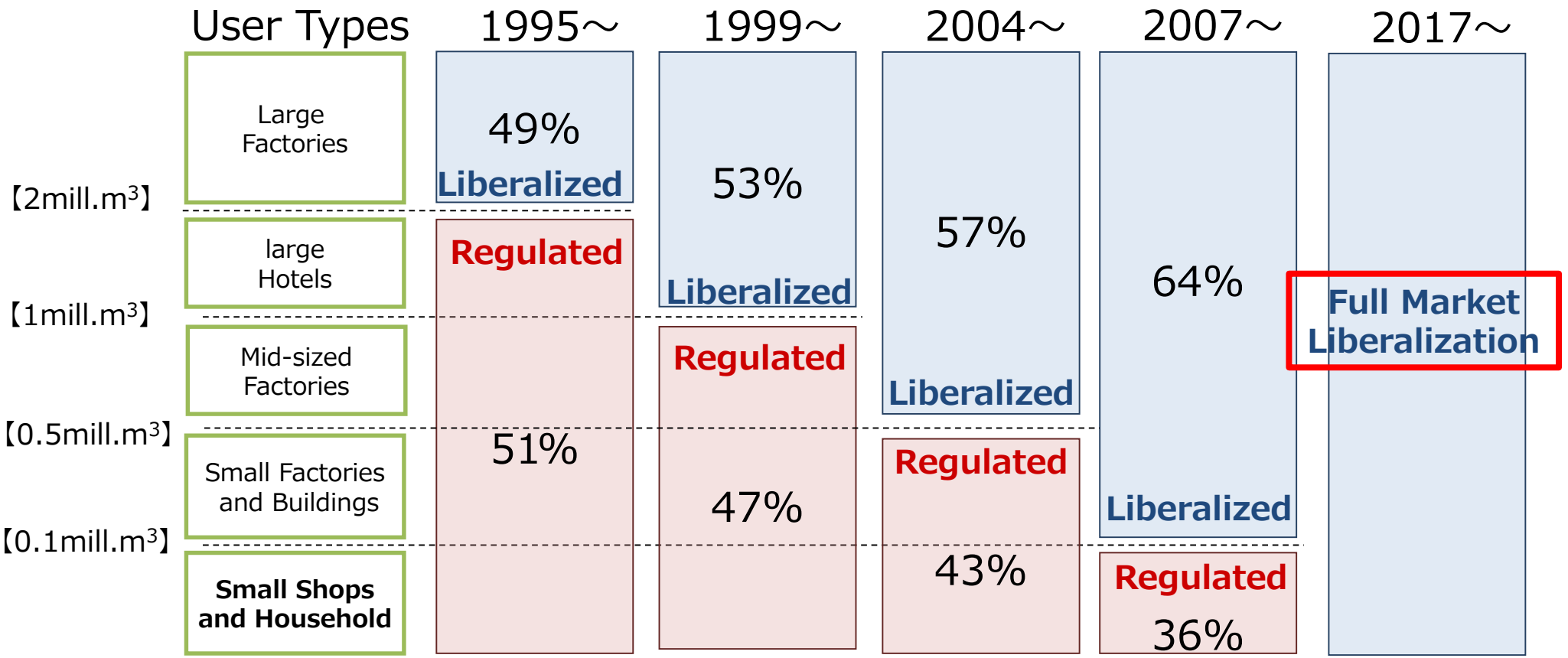
note1. Grid users pay for the infrastructure connecting its installation to the transmission grid (line/cable and other necessary equipment)

Appendix 8-1. Roadmap for Gas and Heat Market Reform

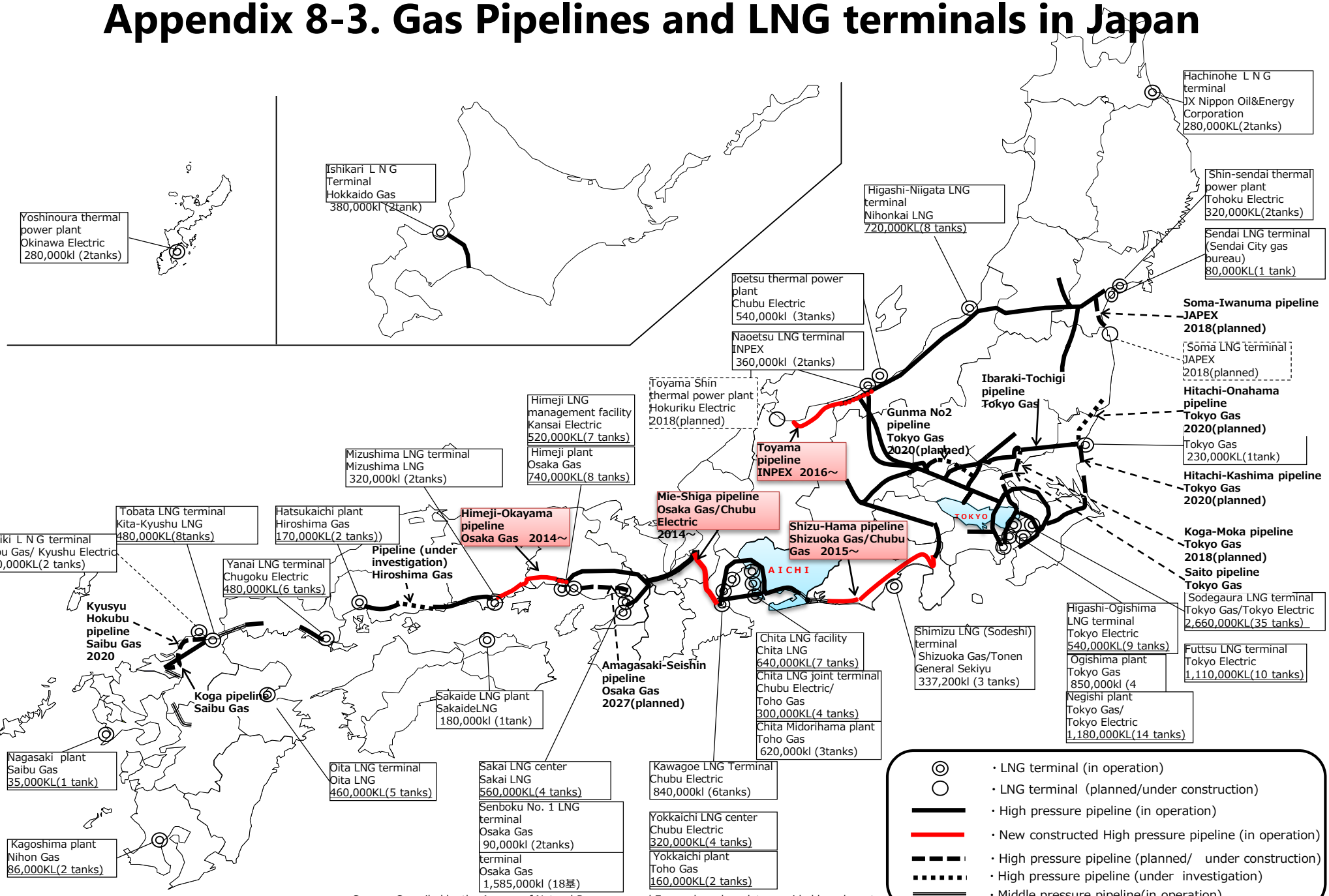


Appendix 8-2. Gradual Expansion of Gas Retail Market Liberalization

1. Around 65% of the gas retail market had been liberalized since 1995. And Since April 2017, the Gas retail market in Japan were fully opened up to competition.
2. The share of new entrants in large sector is around 13%.



Appendix 8-3. Gas Pipelines and LNG terminals in Japan



Source: Compiled by the Agency of Natural Resources and Energy based on data provided by relevant companies

Appendix 9-1. Electricity and Gas Market Surveillance Commission (EGC)

1. EGC was established under the METI in September 2015 in order to urge **sound competition** in the electricity market.

2. Industrial policy, environmental policy, and national security policy are **not** covered.

Appendix 9-2. About EGC - The Chairman and Commissioners

- 5 Commissioners and 130 staffs in the Secretariat

Tatsuo Hatta, Ph.D. (Chairman)	Ryuichi Inagaki Attorney-at-law (Acting chairman)	Yasuhiro Hayashi, Ph.D.	Masanori Maruo	Emiko Minowa
				
【Economics】 President, Asian Growth Research Institute/ Professor Emeritus, Institute of Social and Economic Research, Osaka University	**【Law】** Lawyer Ryuichi Inagaki Law Office	**【Engineering】** Professor, Graduate School of Advanced Science and Engineering, Waseda University	**【Finance】** Managing Director, SMBC Nikko Securities Inc.	**【Accounting】** Certified Public Accountant Partner at Deloitte Touche Tohmatsu LLC.

Appendix 9-3. The Role of EGC

1. Monitoring / Inspection

- **Consumer protection**
  (ex. Demanding extremely high cancellation fee)
- **Prevention of monopolistic power**
  (ex. Setting extremely low retail price to block new entrants)
- **Ensuring neutrality of transmission operators**
  (ex. Leaking the information of other generators/retailers obtained through the transmission operation to the generation/retail sections in the company/group)

2. Recommendation on new market rules

- Rule-makings from the viewpoint of competition as well as consumer protection (* Rule-makings on securing stable supply belongs to ANRE)

◆ EGC also examines (1) transmission tariffs applied by 10 TDSOs, (2) regulated retail tariffs by GEUs and (3)the registration of retailers.