

Lesson learn from other countries and hints for Thailand

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- 1. Megatrend and role of VPP**
- 2. Lesson learn from other countries**
- 3. Hints for Thailand**

Megatrend of Energy Sector and VPP

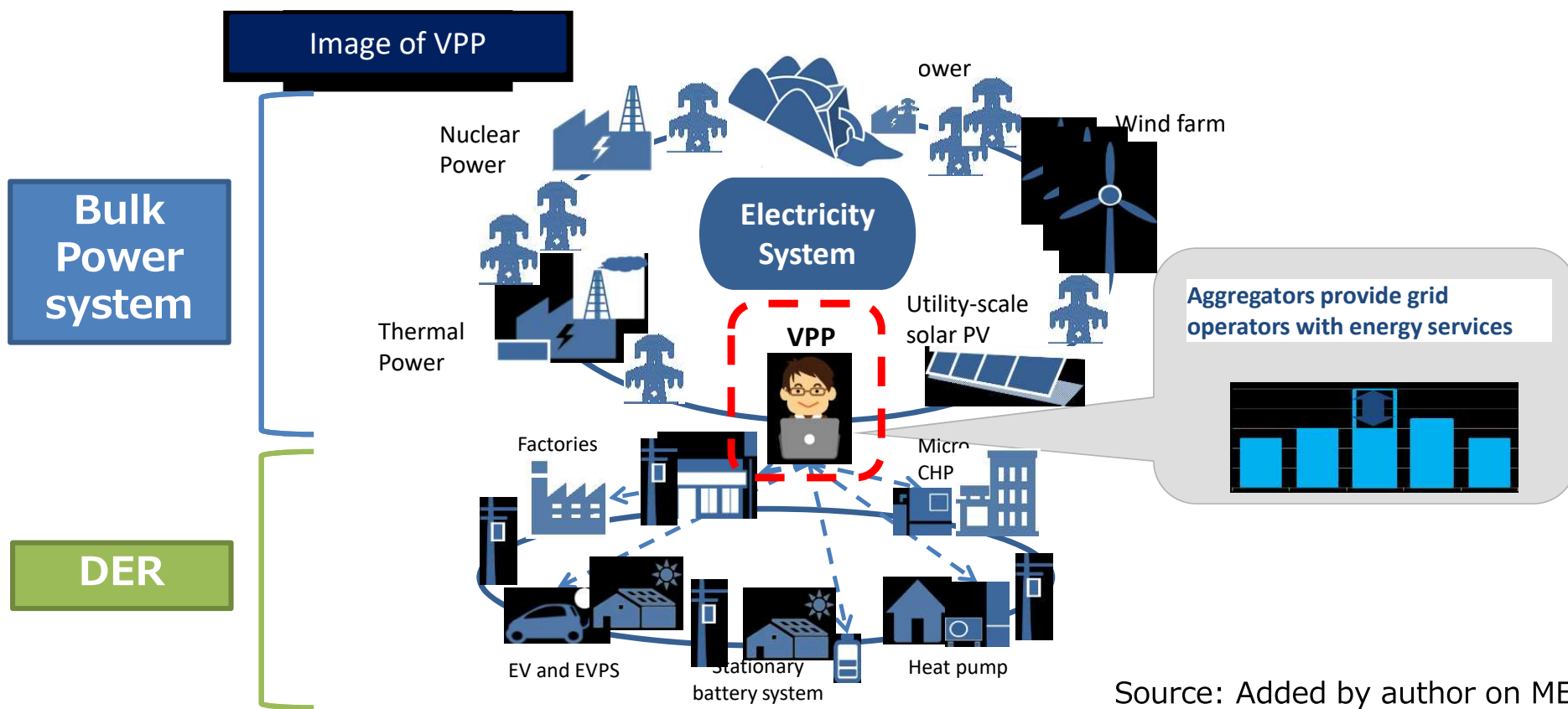
- **Megatrend of Energy Sector : 4Ds**

- ✓ **D**igitalization, **D**eregulation, **D**ecentralization, **D**ecarbonization



- **VPP (Virtual Power Plant) :**

- ✓ VPP is a system that provides the same functionality as a power plant by controlling distributed energy resources (DERs).



Source: Added by author on METI

VPP and its Services at a Glance

- **VPP is expected to provide some services.**

- ✓ **Services** : Balancing service, Wholesale power supply and Energy management
- ✓ **For** : Network operator, Retailer, and Consumer

		Utilities	Others		
		Retailer	Aggregator		Resource Aggregator
			With Resources	Without Resources	
General		Controlling resources of consumer	Aggregating DERs including its own resources.	Aggregating DERs (sharing merit with third parties)	Bundling aggregators without directly aggregating DERs
Resources		Demand side	installed by company	owned by third parties	-
Services	Balancing (for network)	○	○	○	○
	Wholesale (for retailer)	○	○	○	○
	Energy Management (for consumer)	○	△	○	X
Examples		SCE, PG&E	AES ES	NextKraftwerke, Stem, Sunverge	Olivine

Source: Prepared by author based on Mitsubishi Research Institute(2017)

1. Megatrend and role of VPP

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Electric Power Market and VPP

● Market structure

- ✓ BG / Power pool

● Power generation facilities

- ✓ Power generation mix, Large-scale DER / Small-scale DER

● Renewable energy policy

- ✓ FIT, FIP
- ✓ Tax Incentive, etc.

● Future challenges

- ✓ Flexibility, Ancillary services, Resilience
- ✓ More RE,,,



VPP is expected to solve issues in each country.

Electric Power Market and VPP in Germany

1. The current market in Germany

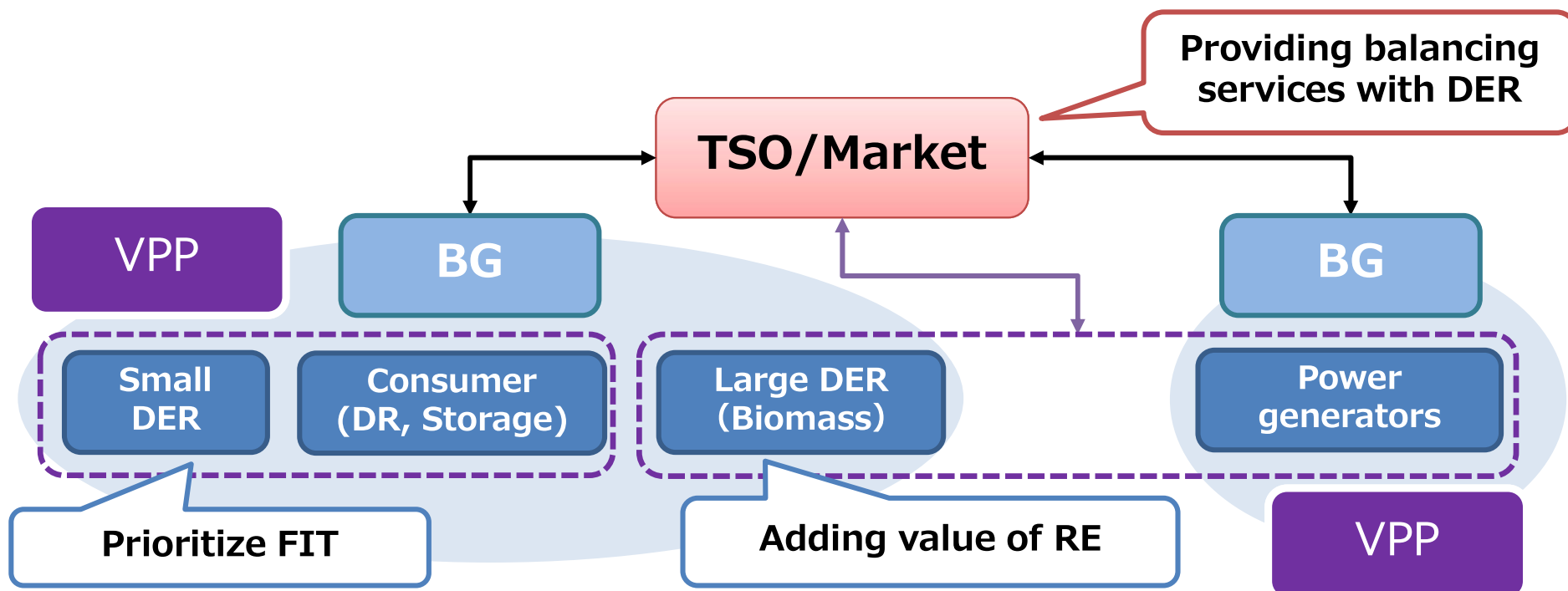
- **BG type**
- **RE** : Wind, PV, Biomass ,etc., **RE Policy** : FIT and FIP

2. In the Future

- Shifting from FIT to FIP and encouraging integration of RE
- Securing flexibility and increasing the value of power sources

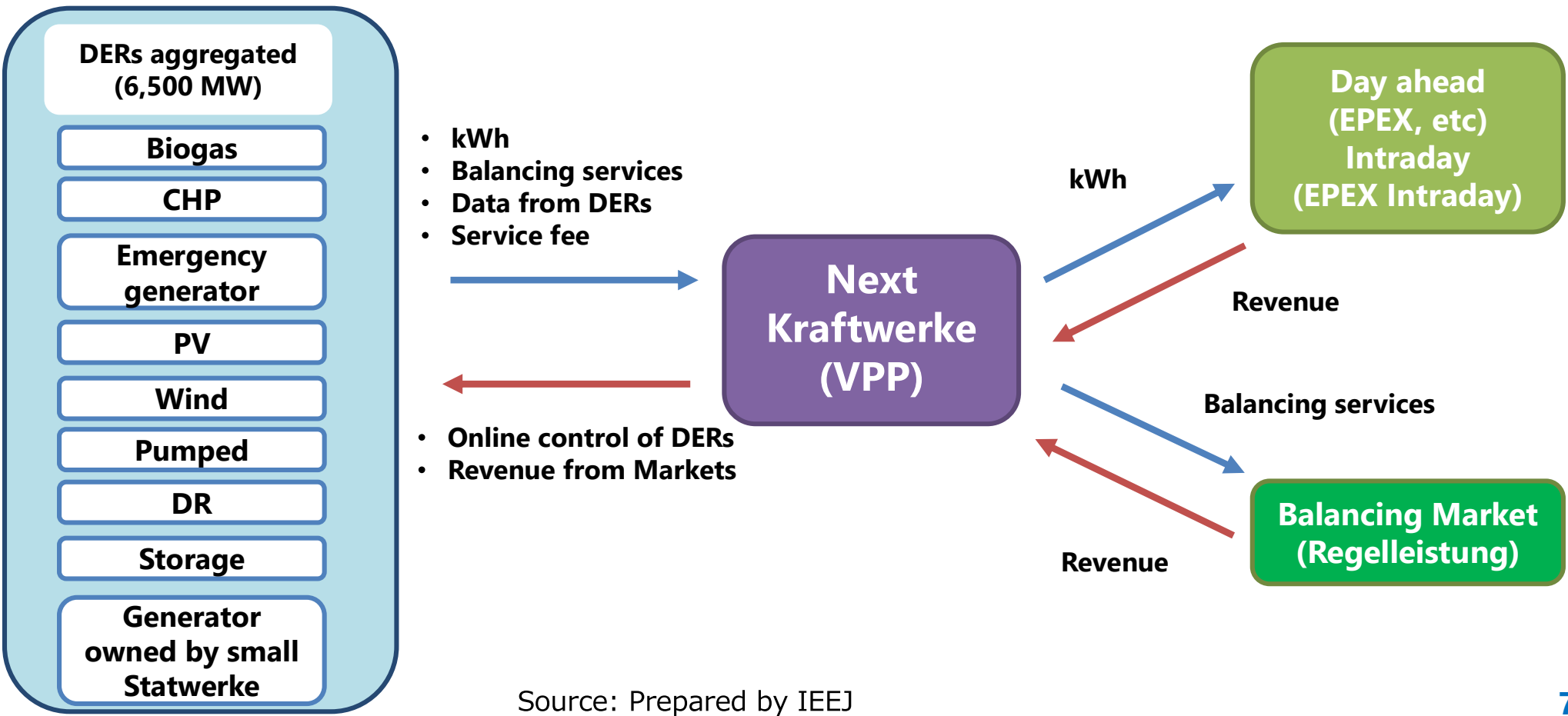
3. Expectations for VPP

- Increasing value of renewable energy
- Improving of BG imbalance and providing balancing services with DER



A Case of Next Kraftwerke in Germany

- DER owner maximizes the generation revenue by participating in the wholesale market and balancing market through VPP.
- VPP receives a service fee from the DER owner the revenue in the market.
- Next Kraftwerke makes the best use of large DERs (biomass, etc).



Source: Prepared by IEEJ

Electric Power Market and VPP in U.S.

1. The current market in U.S.

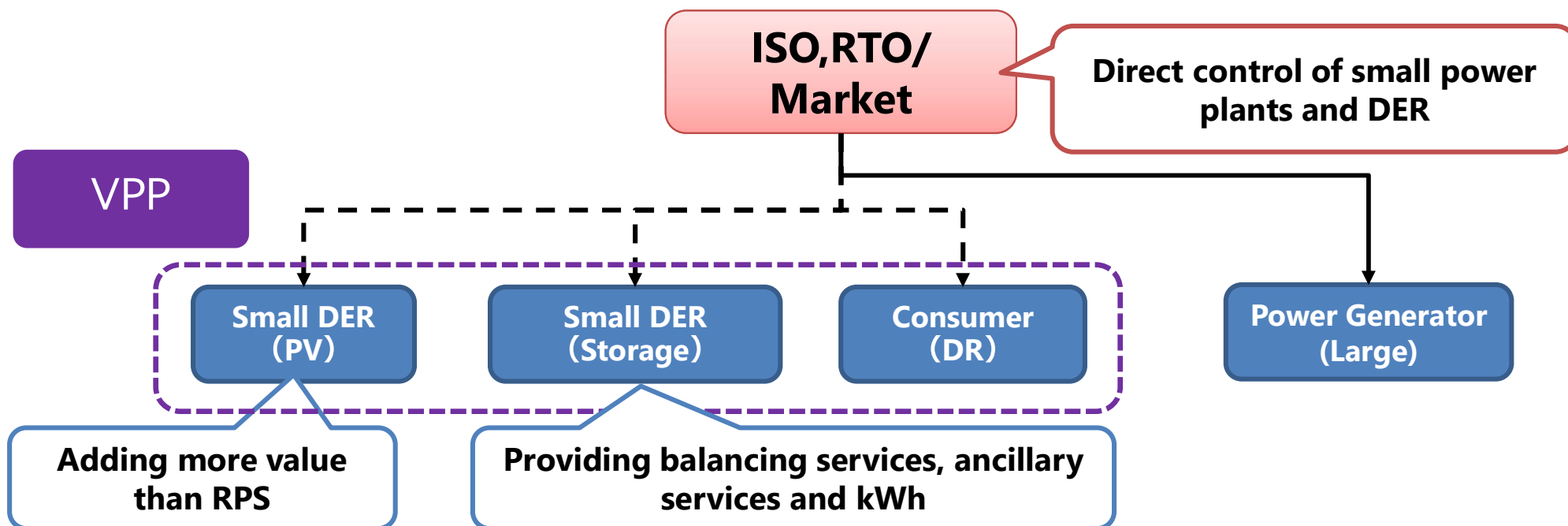
- **Power pool type**
- **RE** : Wind, PV, Hydro, **RE policy** : RPS, PTC, ITC

2. In the Future

- More residential solar, wind, storage batteries, and EVs
- Control of behind-the-meter DERs from grid operators

3. Expectations for VPP

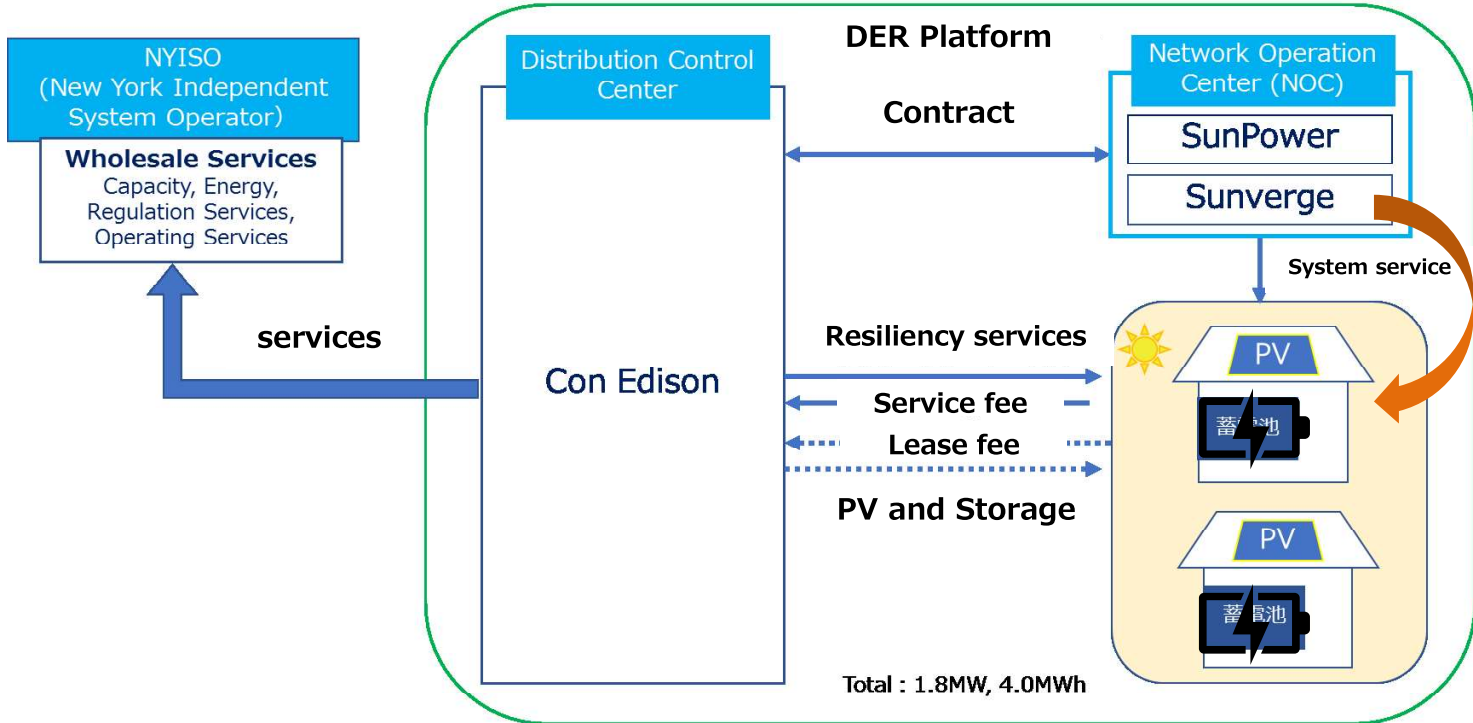
- Improving value of renewable energy
- Providing balancing services and ancillary services with DER



A Case of Con Edison in U.S.

- Con Edison involves an integrated control of a system that combines solar power and storage batteries installed in distribution network.
- Con Edison focuses on the distribution network and behind-the-meter DER.

→ This demonstration project is **Suspended**, because it took longer than expected to obtain permissions and a consensus from the public.



Source: Prepared by IEEJ

Electric Power Market and VPP in Japan

1. The current market in Japan

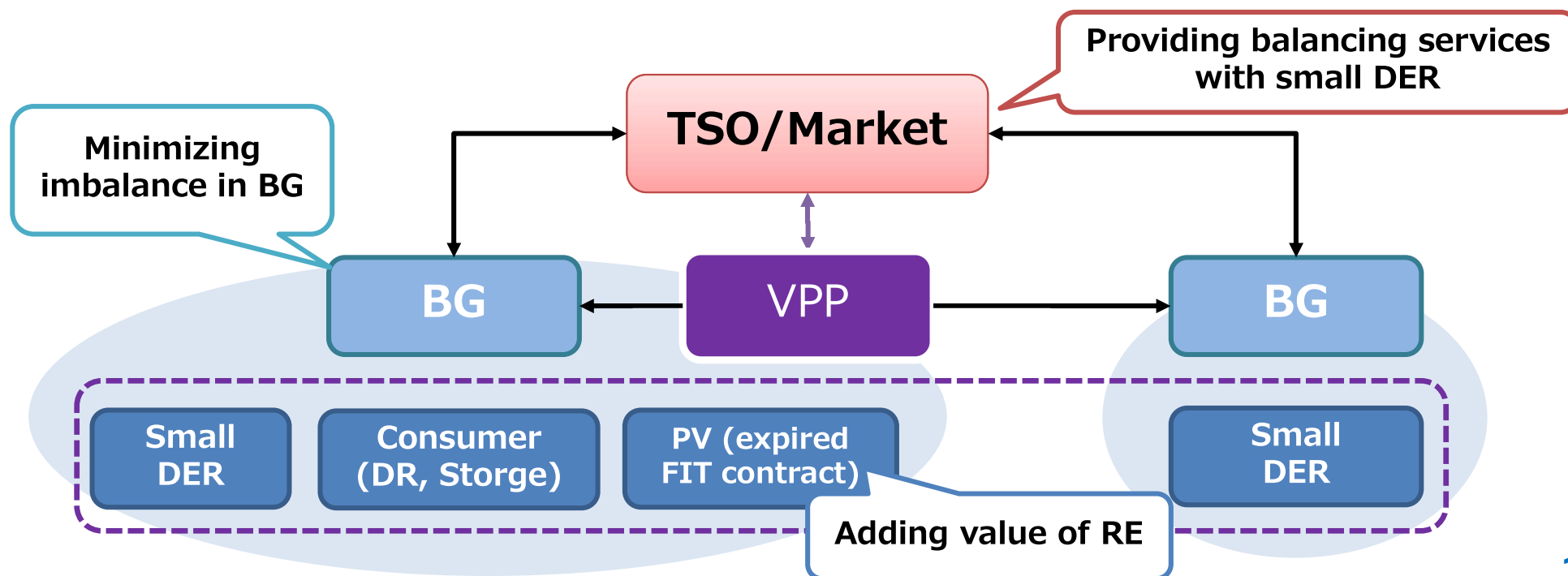
- **BG type,**
- **RE : PV, Hydro, etc., RE policy : FIT (to FIP)**

2. In the Future

- In the short-term, residential solar will expire FIT contract.
- In the long-term, more needs for flexibility with massive RE

3. Expectations for VPP

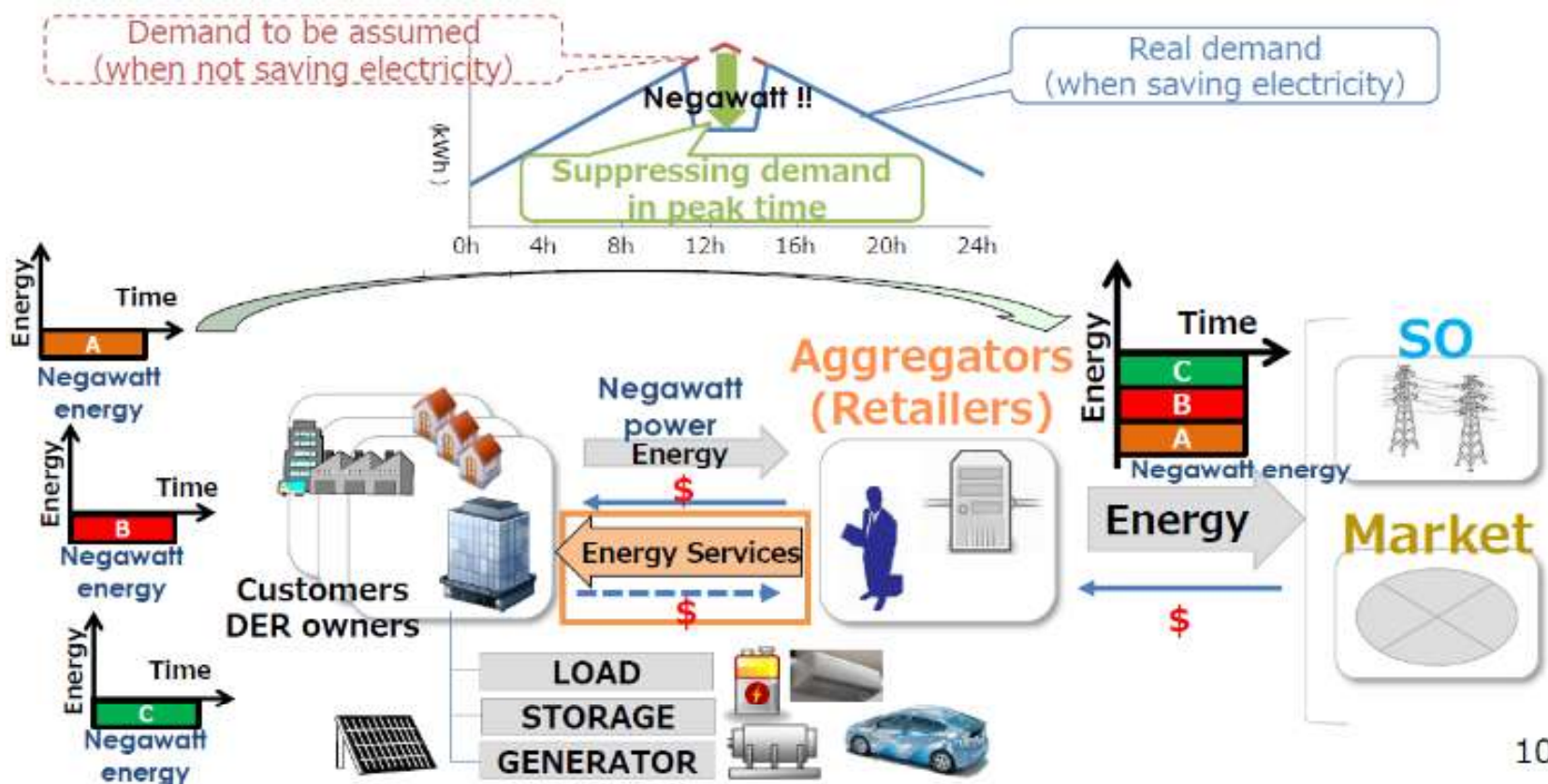
- Controlling small DER(residential solar and home appliances, etc)
- Improving BG imbalance and providing balancing services with DER



Cases of VPP/DR in Japan

- Some companies have already implemented DR in Kyushu and Tokyo.
- TSOs are expected to use DR when the demand-supply is tightened.
- EGC jointly created guidelines with METI to promote a new business scheme.

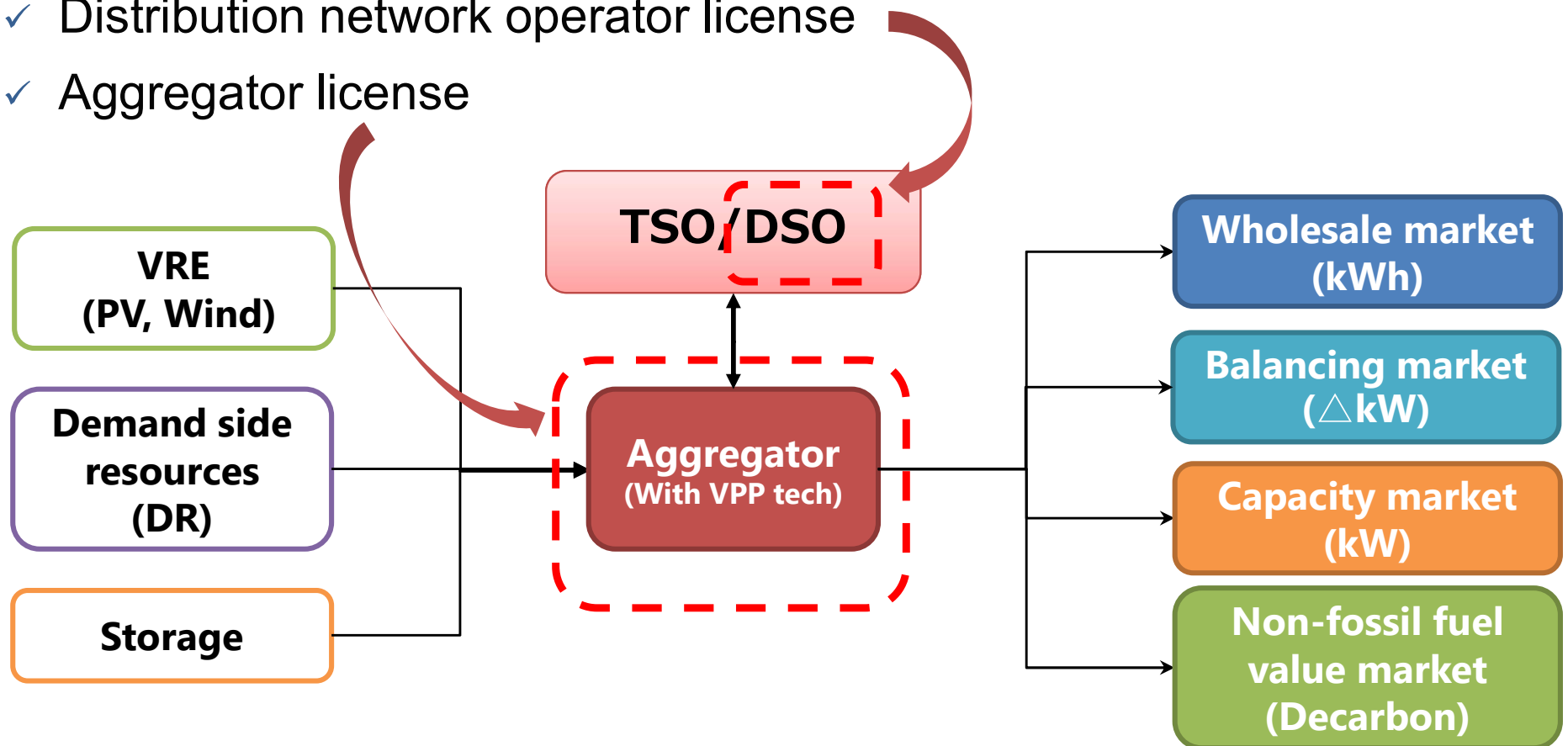
Demonstration of Aggregation Business (VPP/DR)



10

New Policies under the Electric Power Market Reform in Japan

- **New Markets** : to realize the value of power
 - ✓ Capacity market, Balancing market, Non-fossil fuel value trade market
- **New Licenses** : to invite new entrants
 - ✓ Distribution network operator license
 - ✓ Aggregator license

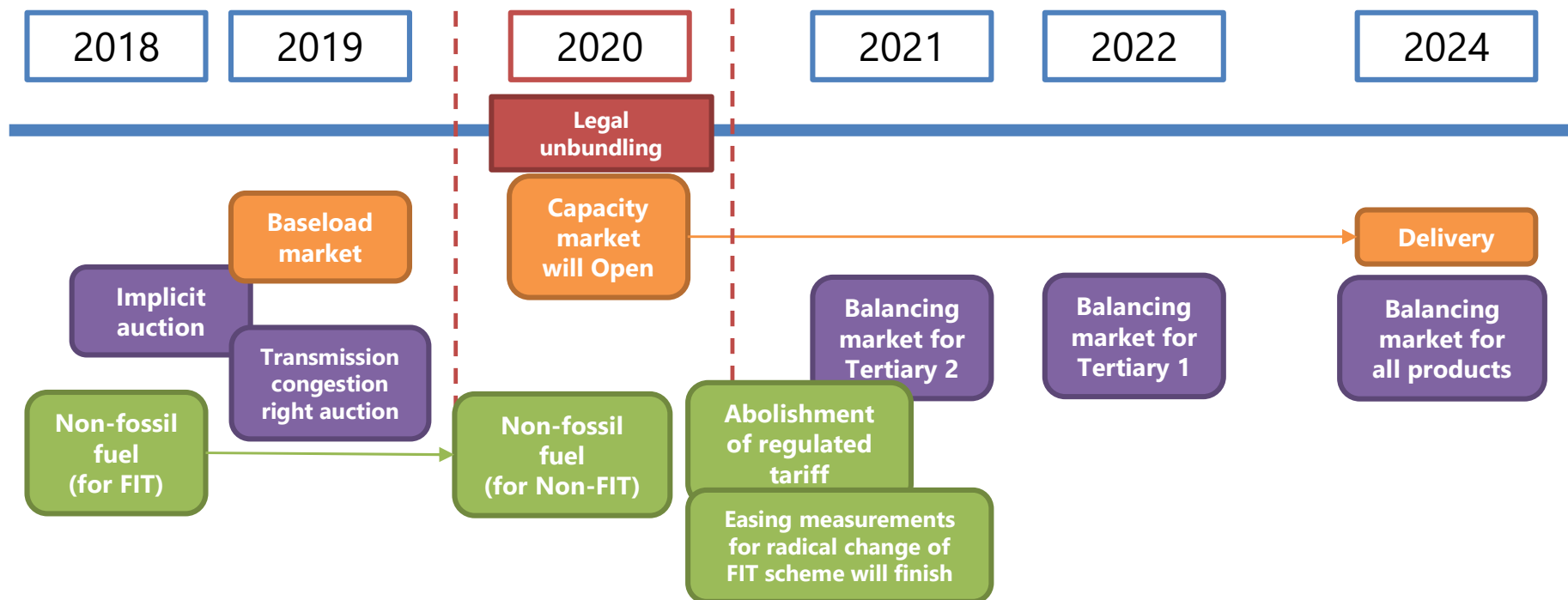


Source: Prepared by author based on METI

[Appendix] Roadmap of New Markets in Japan

● Timeline of New Market

- ✓ Non-fossil fuel value traded market : Open in May 2018
- ✓ Implicit auction for interconnection usage : Open in Oct 2018
- ✓ Transmission congestion right auction : Open in April 2019
- ✓ Base load market : Open in FY2019, Delivery in FY2020
- ✓ Balancing market : Open in April 2021
- ✓ Capacity market : Open in FY 2020, Delivery in FY2024
- ✓ Full liberalization of retail electricity rates : Expected in FY2020



Summary of VPP in Countries

1. Market Structure

- BG : TSO/DSO need more reliable response of DER.
- Power pool : TSO/DSO have issues of controlling behind-the-meter DER.

2. VPP Resources

- Large-scale DER : can be reliable resources
- Small-scale DER : need to ensure their reliability of response to control

3. RE policy

- FIT type : Not necessarily an incentive to participate in VPP
- RPS type : Incentive to participate in VPP to add value to DER
- Others (Tax credit) → smaller benefits for VPP participation

	Germany	U.S. (NYISO)	Japan
Market Model	BG	Power Pool	BG
Balancing	Real-time	Planned	Planned
Who makes short-term Supply and demand plan	Balancing Group Manager	Power generation company, retail company	Balancing Group Manage
Balancing Service Provider	Portfolio Based	Unit-based	Portfolio Based
Resources for VPP	Large-scale DER (biomass, etc.)	Small-scale DER (residential solar, etc.)	Small-scale DER (residential solar, etc)
Renewable Energy Policy	FIT, FIP	RPS	FIT (FIP)

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● Technology trends and needs

- ✓ Decarbonization, Decentralization and Digitalization
→ VPP is one of the keywords. How? and Who?

● Regulatory framework

- ✓ New business models with VPP may create values
→ Deregulation? To re-define the role of stakeholders in the market

● New business model

- ✓ Value of power would be realized by markets or regulatory body
→ New entrants? Start-up? Incumbent?

Thank you for your attention

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https://twitter.com/IEEJ_Japan

[Appendix] VPP and Market in Countries

	Germany	U.S.	Japan
General situation of VPP	Extensive commercialized	Partially commercialized	Demonstration project phase
Objectives of VPP	Commercial business	Demonstration of business models under massive RE	Demonstration of technical aspects
Markets to be traded	Pilot initiatives for day-ahead/day-ahead markets, at regional markets at DSO level	Wholesale market, ancillary market	Wholesale market, supply and balancing market, capacity market
DER capacity being aggregated in case	5,987 MW (Next Kraftwerke)	1.8MW (ConEdison), 162 kW (PG&E)	12.4MW (TEPCO HD demonstration)
Renewable energy policy	From FIT (or FIP) to direct sales to the market	RPS, PTC, ITC, Net metering	FIT, FIP(under discussion)
Electricity market model	Balancing Group Model	Power Pool Model	Balancing Group Model
Electricity supply system	Legal unbundling of transmission sector	It depends on the States.	Legal unbundling of transmission sector
Share of VRE	22.4% (2017)	8.9% (2017)	6.8% (2017)
Expected functions of EMS and IT systems	Optimization of generation schedules, Reliable response of DER	Reliable response of DER	Demand-side optimization function (EMS), Reliable response of DER