May 23, 2019

Strategic Partnership with Next Kraftwerke in a Virtual Power Plant (VPP) Demonstration Project

~ Tohoku Electric Power will become the first power utility which concludes a basic agreement with one of the world's largest VPP operators~

Tohoku Electric Power Co., Inc. (hereafter "Tohoku EPCO") agreed to enter into a basic agreement today on a strategic partnership in a VPP demonstration project with the German virtual power plant (VPP) operator Next Kraftwerke*1 (head office: Cologne, Germany; Chief Executive Officers: Hendrik Sämisch and Jochen Schwill).

The partnership marks the first time that a Japanese power utility has concluded a basic agreement with Next Kraftwerke.

Tohoku EPCO launched the VPP demonstration project in April 2018, and has been working on to remotely control and aggregate power-producing assets distributed throughout the regions, and make them function as if they were a single power plant, by utilizing IoT and other new information technologies. The energy resources include generators and batteries owned by local governments, companies, households of customers, and others.

Through the demonstration project, Tohoku EPCO aims to commercialize VPP and to develop new services in the future. In order to realize this, Tohoku EPCO believes that it is important to further enhance our VPP-related knowledge and technology, such as the ability to control energy resources accurately and precisely.

Next Kraftwerke is one of the largest VPP operators in the world developing its large-scale VPP from Germany to most of central Europe. The company possesses extensive expertise and experience in the field of VPP, including technology for accurately controlling various energy resources.

Tohoku EPCO entered into this agreement, expecting to accelerate the commercialization of VPP and development of new services in the future by leveraging Next Kraftwerke's knowledge and technology.

The partnership based on this agreement is planned for about two years until 2020.

As the first step, from around August 2019, Tohoku EPCO will verify the basic functions of VPP system through remotely monitoring and controlling energy storage devices in Tohoku EPCO's research and development center located in Sendai City, utilizing Next Kraftwerke's "NEMOCS*2", a VPP controlling system, and its "NEXT BOX*3", a device with communication functions.

As the second step, from around February 2020, Tohoku EPCO will verify and evaluate the system functions to remotely monitor and control multiple devices by gradually expanding the number of energy resources.

Then, as the third step, from around August 2020, Tohoku EPCO will verify the feasibility of commercializing VPP and developing new services leveraging Next Kraftwerke's systems. At the same time, we will seek for the possibility of a further strategic alliances with Next Kraftwerke, including power trading and ancillary services.

Taking into account the change in business environment like the advancement of information technologies, Tohoku EPCO will endeavor to develop new business models and meet expectations of customers and communities by providing a value-added services as a leading integrated energy company.

*1 Next Kraftwerke :
Established in 2009, Next Kraftwerke has a capacity of around 7,000MW with over 7,600 aggregated assets. Leveraging its unique VPP control system which optimizes the generation as well as consumption of various VPP resources, Next Kraftwerke develops services to create value through power trading and ancillary services.

*2 NEMOCS (Next Monitoring and Control System):
A unique VPP system, developed by Next Kraftwerke that collectively manages multiple VPP resources, and measures and predicts power levels in each device.

*3 NEXT BOX:
A transmission and control device that controls VPP resources installed in customer equipment such as generators and batteries.

Attachment

Strategic Partnership with Next Kraftwerke in a Virtual Power Plant (VPP) Demonstration Project

NEXT KRAFTWERKE

より、そう、ちから。東北電力

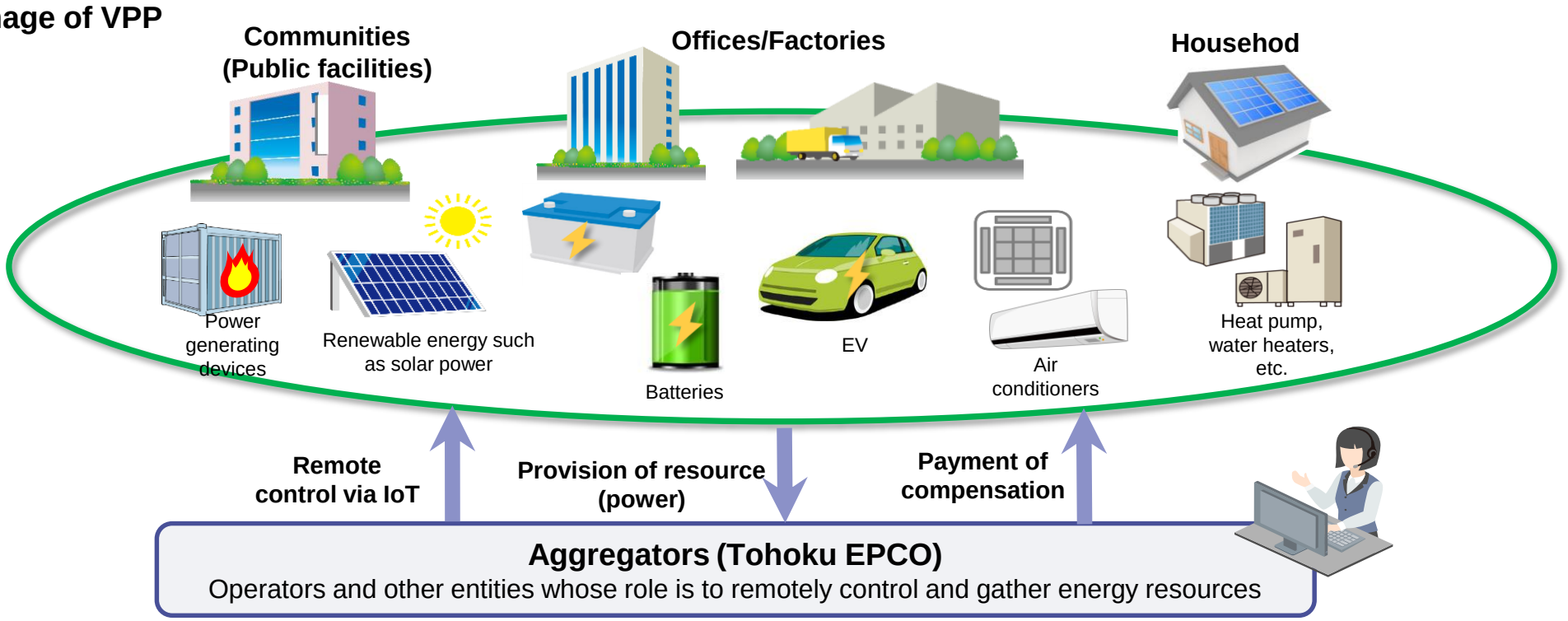
May, 23, 2019

Tohoku Electric Power Co., Inc.

Introduction: What is a Virtual Power Plant (VPP)?

- VPP aggregates the capacity of distributed energy resources throughout the regions, and make them function as if they were a single power plant, by utilizing IoT and other information technologies. The energy resources include generators, batteries, and electric vehicles (EV) owned by communities, companies, and households.
- Tohoku EPCO launched the VPP demonstration project in April 2018, and has been working on to utilize distributed energy resources including solar power and other renewable energy as VPP resources.
- The VPP demonstration project aims to commercialize VPP and develop new services in the future. In order to realize this, we believe that it is important to further enhance our VPP-related knowledge and technology, such as the ability to control energy resources accurately and precisely.

Image of VPP



Purpose of concluding basic agreement with Next Kraftwerke

- Next Kraftwerke is one of the largest VPP operators in the world developing its large-scale VPP from Germany to most of central Europe. The company possesses extensive expertise and experience in the field of VPP, including technology for accurately controlling various energy resources.
- Tohoku EPCO aims to accelerate the commercialization of VPP and development of new services in the future by leveraging Next Kraftwerke's knowledge and technology.
- Next Kraftwerke aims to develop service solutions for the Japanese electricity system/market.

NEXT KRAFTWERKE

NEMOCS

- VPP system that collectively manages multiple energy resources, and measures and predicts power levels in each device
- Automatically control energy resources via Next Box

NEXT BOX

- A transmission and control device that controls VPP resources installed in customer equipment such as generators and batteries.

Conclusion of basic agreement

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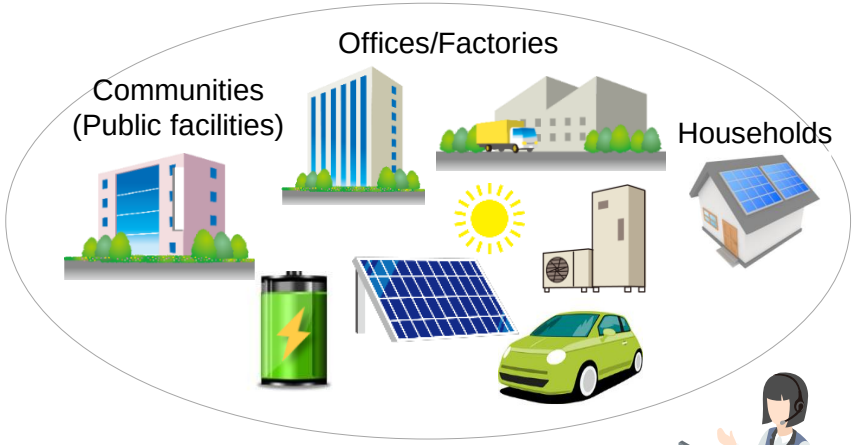

Aggregator

Demonstration schedule based on basic agreement

- Step 1 (from around August 2019): To verify the basic functions of VPP system through remotely monitoring and controlling energy storage devices in Tohoku EPCO's Research and Development Center, utilizing "NEMOCS" and "NEXT BOX".
- Step 2 (from around February 2020): To verify and evaluate the system functions to remotely monitor and control multiple devices by gradually expanding the number of energy resources.
- Step 3 (from around August 2020): To verify the feasibility of commercializing VPP and developing new services leveraging Next Kraftwerke's systems. At the same time, we will seek for the possibility of a further strategic alliances, including power trading and ancillary services.

May 23, 2019 — March 31, 2021

Verification period will last for approximately 2 years

	Step1	Step2	Step3
Schedule	From around August 2019	From around February 2020	From around August 2020
Details	Verify basic functions • Utilize systems including "NEMOCS" to control energy storage devices (2 to 3 devices) in Tohoku EPCO's Research and Development Center • Establish technical methods to control resources	Expand energy resources • Expand applicable energy and verify/evaluate functions to control multiple energy resources	Consider business opportunities • Verify response in Japan's ancillary/balancing market. • Consider potential business opportunities to increase revenue

Objectives of strategic partnership with Next Kraftwerke

- In addition to the knowledge accumulated through the VPP demonstration until now, Tohoku EPCO aims to leverage Next Kraftwerke's extensive VPP-related knowledge and technology to expand future business domains, such as commercialization of VPP and development of new services.
- Tohoku EPCO also aims to meet the expectations of the customers and communities by creating win-win solutions for companies, households, communities, and us through energy and cost saving and utilizing renewable energy.

Customers
Offer energy/cost saving service as well as compensation opportunities by incorporating customers' assets into Tohoku EPCO's VPP

Local communities & society
Effectively utilize renewable energy in the Tohoku/Niigata region, stabilize the power system, and improve the community's disaster resilience

Tohoku EPCO
Expand business domains in the future through developing a new, mid- to long-term business model

Aggregators

より、そう、ちから。 東北電力

VPP demonstration (started March 29, 2018)

Companies
Utilization of large scale resources

Remotely control power generators to an extent that doesn't hinder business operations

- ✓ Officially launched the service of Tohoku EPCO's unique energy management system called "exEMS" (Oct. 31, 2018)

Households
Utilization of resources for households

Consider new services that combine the use of solar power and energy storages

- ✓ Concluded a contract to perform joint research with Toshiba Energy Systems and Solutions Corporation regarding direct power transactions (P2P power transactions) (Apr 26, 2019)

Communities
Utilization of resources for communities

Collaborate demonstrations with Sendai, Koriyama, and Niigata City

- ✓ Basic agreement with Sendai City (Apr. 27, 2018)
- ✓ Basic agreement with Koriyama City (Feb. 18, 2019)
- ✓ Basic agreement with Niigata City (Apr. 17, 2019)

V2G (Vehicle to Grid)
Utilization of EV (batteries)

Verify the possibility of using EVs through nationally subsidized projects

- ✓ Started a selection and collaboration project subsidized by the Agency for Natural Resources and Energy (May 30, 2018 and Oct. 4, 2018)

Next Kraftwerke

Basic agreement regarding strategic partnership (May 23, 2019)

One of the world's largest VPP operators who controls roughly 7,000MW of energy resources.

Possesses abundant knowledge and technology regarding VPP.