

**Osaka Gas to Start a Virtual Power Plant Demonstration Project Using Household Use Fuel Cells, ENE-FARM Type S, Aiming to Further Improve Accuracy
—Joining a Demonstration Project For Further Utilization of Distributed Energy Resources—**

June 26, 2023

Osaka Gas Co., Ltd.

Osaka Gas Co., Ltd. (President and Representative Director: Masataka Fujiwara) will take part in one of the “FY2023 Demonstration Projects for Further Utilization of Distributed Energy Resources”^{*1} publicly offered by the Ministry of Economy, Trade and Industry. This project will be implemented by a consortium led by ENERES Co., Ltd. (President and Representative Director: Sanehiro Tsuzuki) to verify the performance of virtual power plants^{*2} (“VPPs”) as a means to adjust supply and demand in the grid. Osaka Gas takes part in the consortium as a resource aggregator,^{*3} who will build VPPs that will use “ENE-FARM Type S” (“ENE-FARM”), household fuel cells installed at customers’ homes, as distributed energy resources “DERs”.^{*4}

The output power of renewable energies, such as solar and wind power, fluctuates depending on the amount of solar radiation and wind strength. ENE-FARM has high energy efficiency, which can realize reduced CO₂ emissions, as well as the free adjustability of output power, thereby attracting attention as a resource that can contribute to the adjustment of grid supply and demand in a society in which renewable energy plays a major role.^{*5}

Since FY2020, Osaka Gas has been working on a VPP demonstration project that uses ENE-FARM as energy resources. In FY2021, the company remotely controlled over 3,600 ENE-FARM units and supplied over 1 MW of balancing capacity.^{*6} In FY2022, the company remotely controlled over 500 ENE-FARM units and carried out both verification of a newly adopted control method and technical verification that aimed for even faster supply of balancing capacity, achieving favorable results.^{*7} This fiscal year, while utilizing the expertise it has accumulated until last fiscal year, Osaka Gas will increase the number of ENE-FARM units to about 2,000 and aim for even more accurate remote control of ENE-FARM in accordance with supply and demand in the grid.

The Daigas Group will utilize low-voltage resources such as ENE-FARM to promote the spread and expansion of energy networks combined with DERs, contribute to the realization of a low-carbon society and a decarbonized society, and become a corporate group useful in the “further evolution” of life and business.

^{*1}: Demonstration projects that are intended to improve the environment for expanded use of DERs and effective use of renewable energy and to contribute to the achievement of carbon neutrality through the development of aggregation-related business. For these purposes, these projects focus on the further utilization of DERs and demonstrate DER control technologies, which are required to be further sophisticated, in electricity markets, including the balancing market and the capacity market.

^{*2}: A virtual power plant (VPP) is implemented by a business operator known as an “aggregator” who, using information and communication technologies, systematically controls distributed power supply

so that they seem to function as a single generation facility.

- *3: A business operator that controls resources by directly concluding VPP service contracts with consumers
- *4: Distributed energy resources (DERs) are a general term for generation facilities and power storage facilities that are directly interconnected with a network, in addition to other energy resources on the consumer side.
- *5: Source: Document 7 “Efforts to promote the use of distributed energy resources” presented at the 11th Energy Resource Aggregation Business Review Meeting held by the Agency for Natural Resources and Energy in the Ministry of Economy, Trade and Industry(https://www.meti.go.jp/shingikai/energy_environment/energy_resource/pdf/011_07_00.pdf) (in Japanese)
- *6: Article (in Japanese) released on July 21, 2021 (“Osaka Gas to Start a VPP Demonstration Project Using 3,600 units of ENE-FARM type S as part of the ‘Demonstration Projects to Establish Next-Generation Technologies Using Distributed Energy Resources Such as Storage Batteries’”)
https://www.osakagas.co.jp/company/press/pr2021/1296779_46443.html(in Japanese)
- *7: “Osaka Gas to Start a Virtual Power Plant Demonstration Project Using Household Use Fuel Cells, ENE-FARM Type S—Joining the Demonstration Project to Establish Next-generation Technologies Using Distributed Energy Resources—” (Released on May 30, 2022)
https://www.osakagas.co.jp/en/whatsnew/_icsFiles/afieldfile/2022/06/14/220530_3.pdf

(Appendix)

1. Outline of the demonstration project

Project period	July 2023 to February 2024 (planned)
Energy resource	Household fuel cell, ENE-FARM Type S: approximately 2,000 units
Major objectives of demonstration	To conduct the following technical verification by remotely controlling a large number of ENE-FARM units: (1) Technical verification to ensure an accurate supply of balancing capacity to keep the grid stable (2) Technical verification to control power output in accordance with supply and demand in the grid

2. Major objectives of demonstration

(1) Technical verification to ensure an accurate supply of balancing capacity to keep the grid stable

Osaka Gas will verify the performance of technologies to control the output of ENE-FARM units in accordance with commands from the aggregation coordinator^{*8} and supply balancing capacity (verification of accuracy in supplying balancing capacity in accordance with commands).

Continuing from last fiscal year, this fiscal year, the company will focus on the reverse power flow^{*9} and demonstrate the supply of balancing capacity^{*10} using a method of controlling the reverse power flow from ENE-FARM units that ensures that the power generated will exceed the power consumed by a certain margin. The demonstration will be centered on a faster supply of balancing capacity (tertiary balancing power ①^{*11}), which had room for improvement in control accuracy in last year's demonstration.

Image of the VPP demonstration project using ENE-FARM

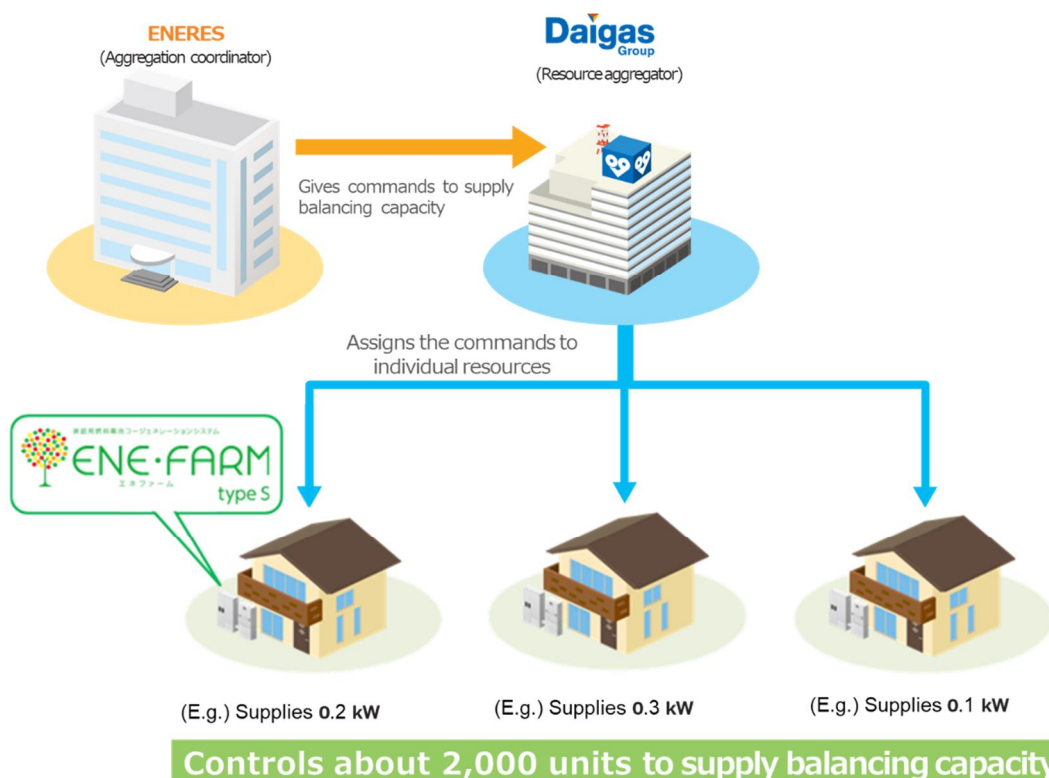
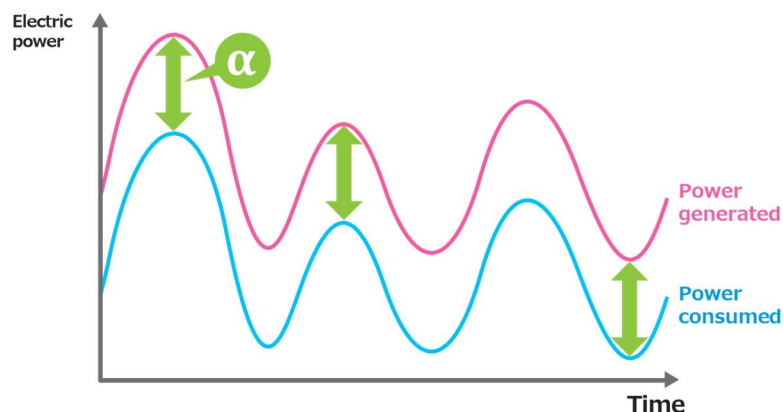


Image of control that ensures that the power generated will exceed the power consumed by a certain margin

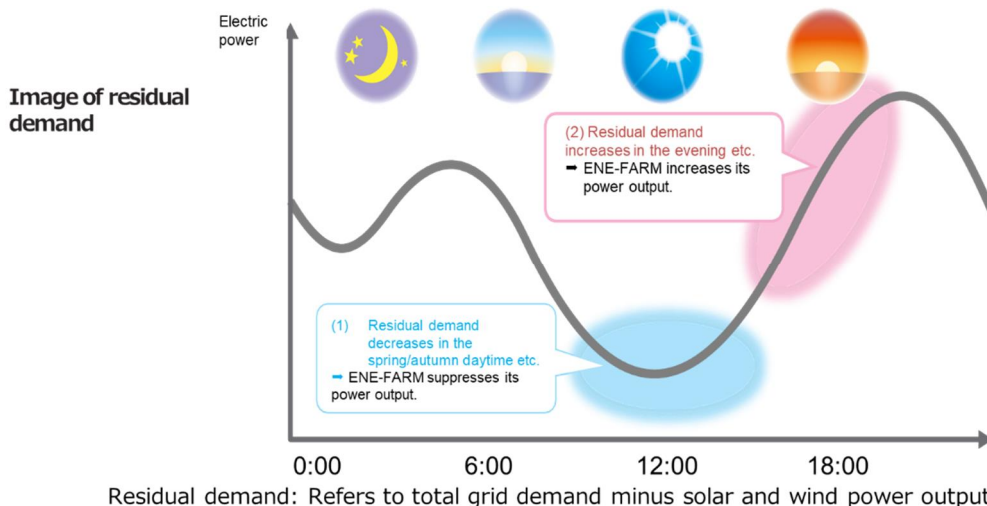


If a certain margin is specified in remote control, ENE-FARM automatically controls the reverse power flow in response to fluctuations in the power consumed, ensuring that the margin is maintained.

- *8: A business operator who aggregates the electric power controlled by resource aggregators and trades electricity directly with general transmission and distribution companies and retail companies
- *9: Power flow from a self-generating business operator to the side of an electric power company's power line. When more power is generated than consumed, the surplus is sent in this reverse power flow. (Power flow for sale of electricity to a generation company)
- *10: Called "posiwatt aggregation," this method supplies Δ kW only by reverse power flow.
- *11: Balancing capacity to respond to supply-demand differences caused by demand forecast errors, renewable energy output forecast errors, and the disconnection of generation facilities from the grid. Response time is within 15 minutes.

(2) Technical verification to control power output in accordance with supply and demand in the grid
 Osaka Gas will verify the performance of technologies to remotely control a large number of ENE-FARM units in accordance with supply and demand in the grid (verification of how appropriately supply capacity can be supplied in terms of its contribution to balancing supply and demand).
 Continuing from last fiscal year, this fiscal year, the company will aim for further optimal control, including simultaneous pursuit of control that restrains electricity purchase and high-accuracy control.

Operational image



Residual demand: Refers to total grid demand minus solar and wind power output

3. Last year's demonstration results

(1) Technical verification to ensure an accurate supply of balancing capacity to keep the grid stable

Regarding the responsiveness of tertiary balancing power ②,^{*12} Osaka Gas confirmed that, by controlling over 500 ENE-FARM units, it was able to supply balancing capacity at high accuracy in relation to the control objective. As for the responsiveness of tertiary balancing power ①, some improvement proved to be necessary in terms of control accuracy, and the company will further consider how to optimize the accuracy this fiscal year as well.

^{*12}: Balancing capacity to respond to supply-demand differences caused, for example, by renewable energy output forecast errors.

Response time is within 45 minutes.

(2) Technical verification to control power output in accordance with supply and demand in the grid

Since there is a certain correlation between the supply and demand situation in the grid and the market price, power output from ENE-FARM was remotely controlled based on the market price to contribute to the adjustment of supply and demand in the grid. As a result, accuracy above a certain level was confirmed.