Demonstration of Regional Energy Management

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1. Background

- **One of the solutions is to promote "local production for local consumption," which utilizes locally generated renewable energy for local electricity consumption and reduce the load on the power grid.**

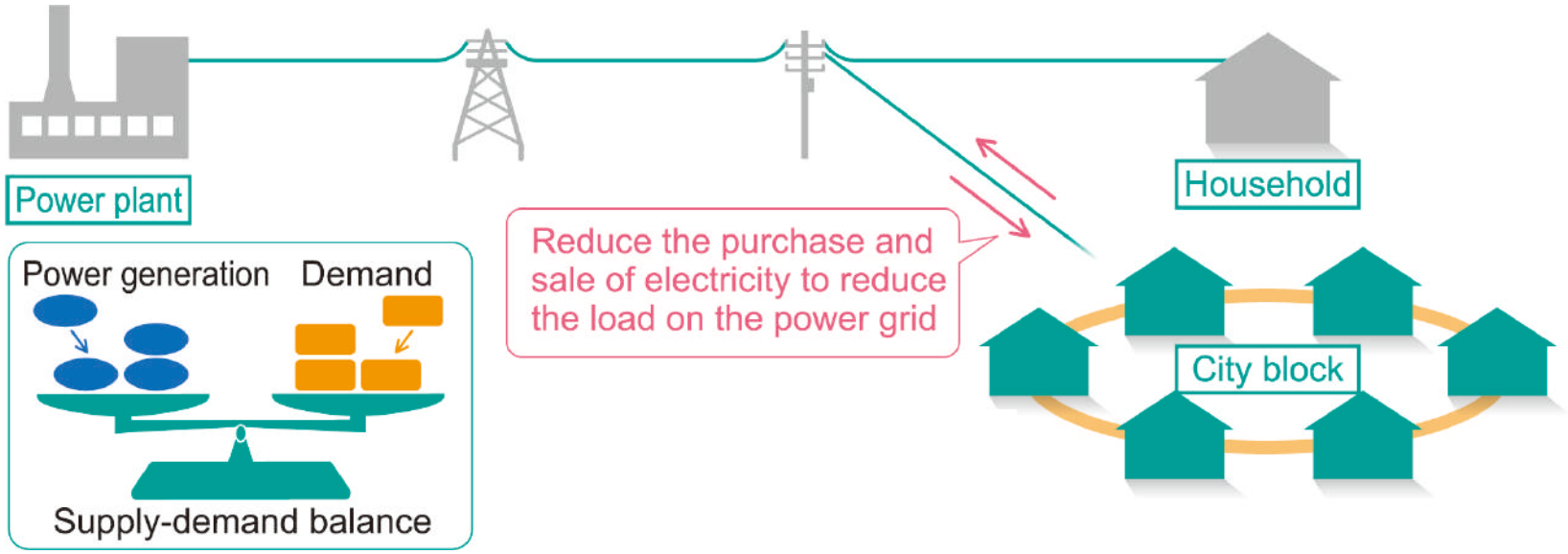


Figure 1 Image of the energy management demonstration

2. Purpose of the demonstration

- We conducted a demonstration project with the City of Kobe.
- Through energy management, electricity generated within the block was effectively utilized within the block to maximize local production for local consumption.

Maximize local production for local consumption of electricity

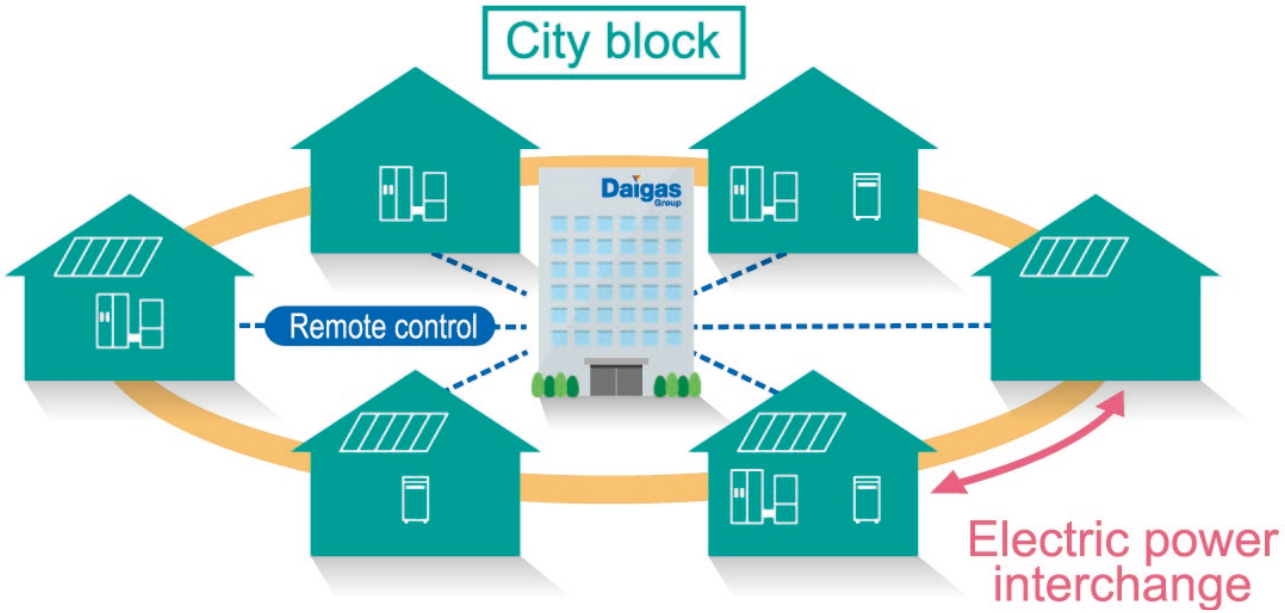


Figure 2 Image of the city block

3.1 Demonstration target

- Participants were solicited from residents in Kobe City who used residential distributed energy resources at home.
- The virtual city block consisted of the participants' houses, and it was assumed that an electric power interchange was enabled within the city block.

Table 1 Participants in the demonstration

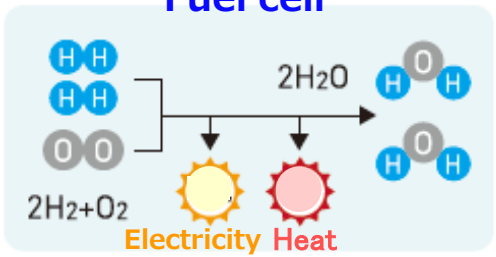
Participating households	118
(1)Ene-Farm cogeneration systems	93
(2)Solar photovoltaic systems	72
(3)Storage battery systems	65

3.2 Residential distributed energy resources

- Targets of residential distributed energy resources were three types.

Ene-Farm cogeneration system

Fuel cell



Solar photovoltaic system

Storage battery system

Main Equipment specifications

Power output	50 ～700W
Heat output	114～428W

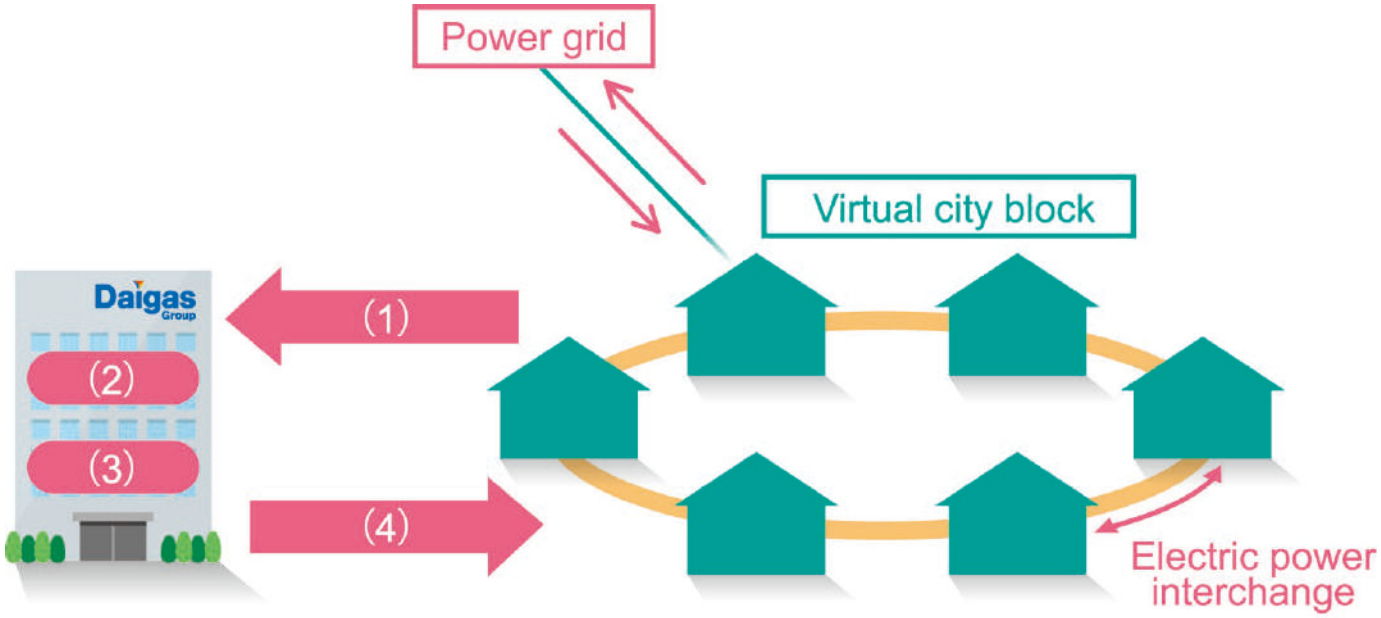
Solar panel capacity	4kW

Storage capacity	6.5kWh
Rated Power output	2.5kW

Figure 3 Three types of residential distributed energy resources

3.3 Energy management flow

- **Energy management of the city block was performed based on the flow.**



(1) Data collection
(2) Demand forecast
(3) Control plan
(4) Implementation of control

Figure 4 Energy management flow

3.4 Image of electricity control in the city block

- **The Ene-Farm cogeneration systems and storage battery systems were remotely controlled to meet the demand of the entire virtual city block.**
- **Remote control was implemented, mainly during the peak hours, to level out electricity demand in the city block.**

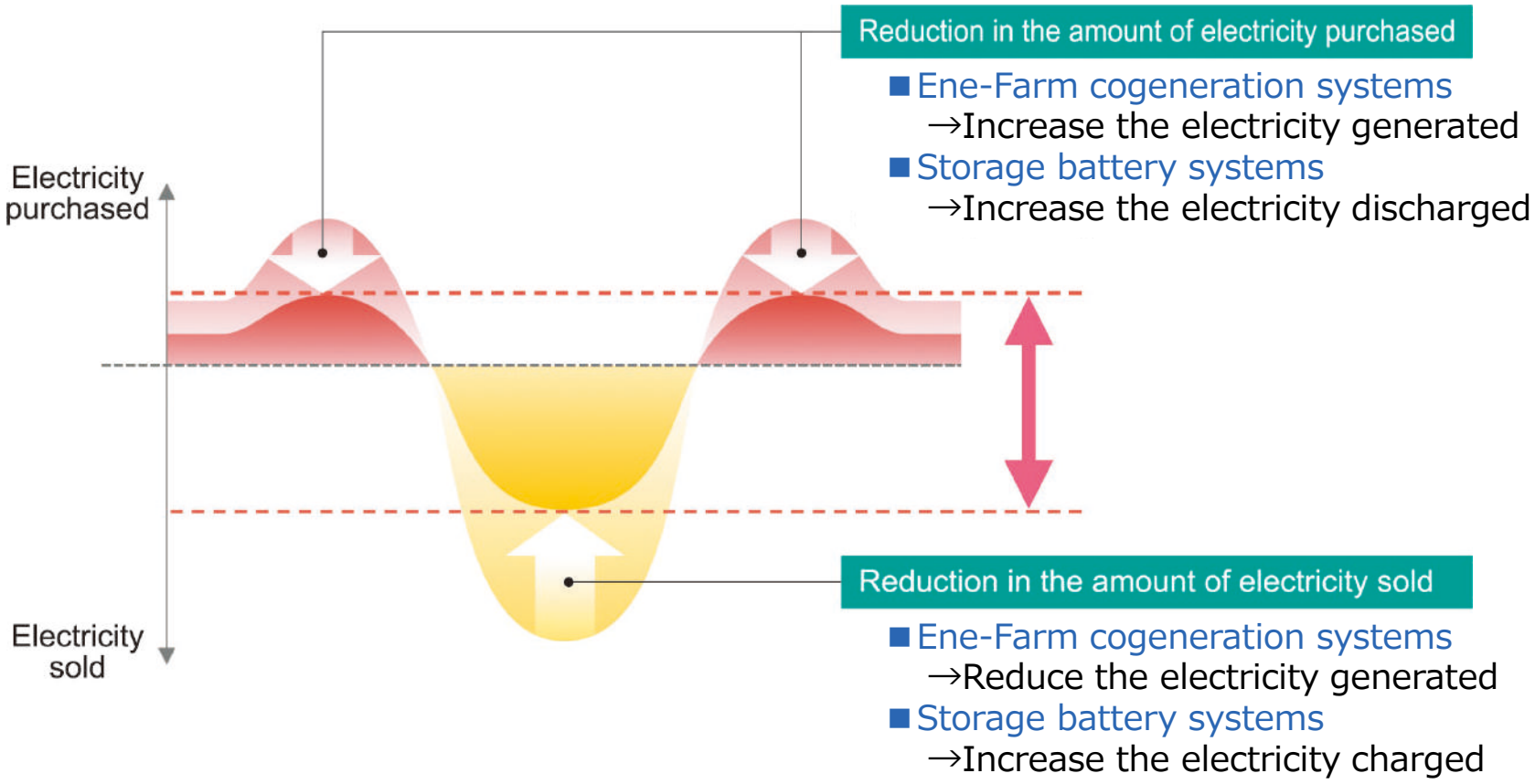


Figure 5 Image of electricity control in the city block

3.5 Method of controlling equipment

- **The Ene-Farm cogeneration systems and storage battery systems in the respective houses were subject to remote control in combination with local control to meet electricity demand in the city block.**

Local control in homes	Remote control in the city block
Automatic operation based on the product specifications	Remote control
In homes	In the virtual city block through electric power interchange

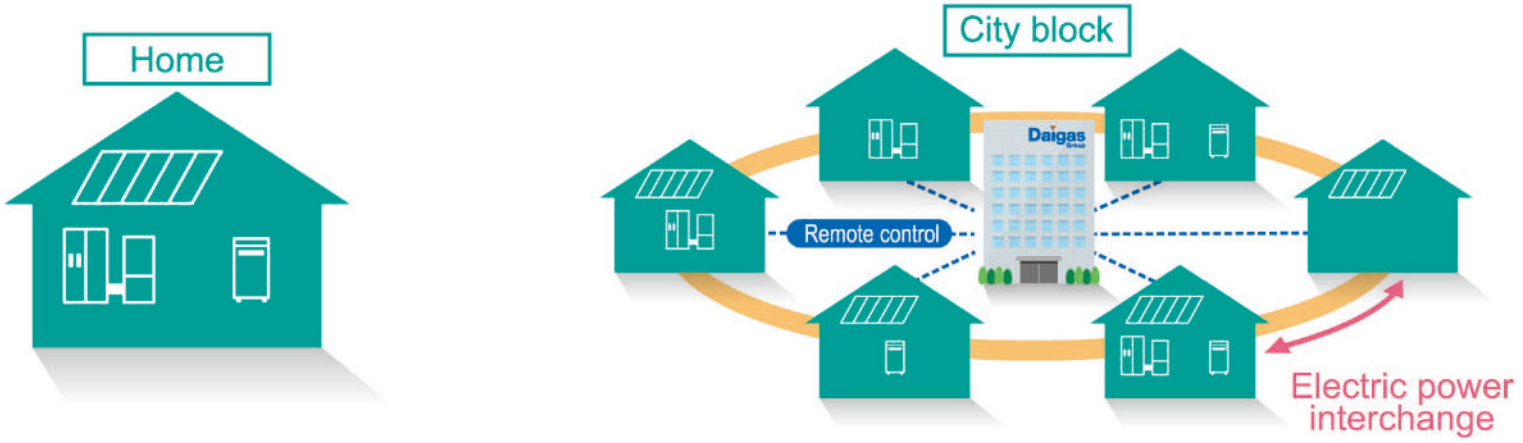


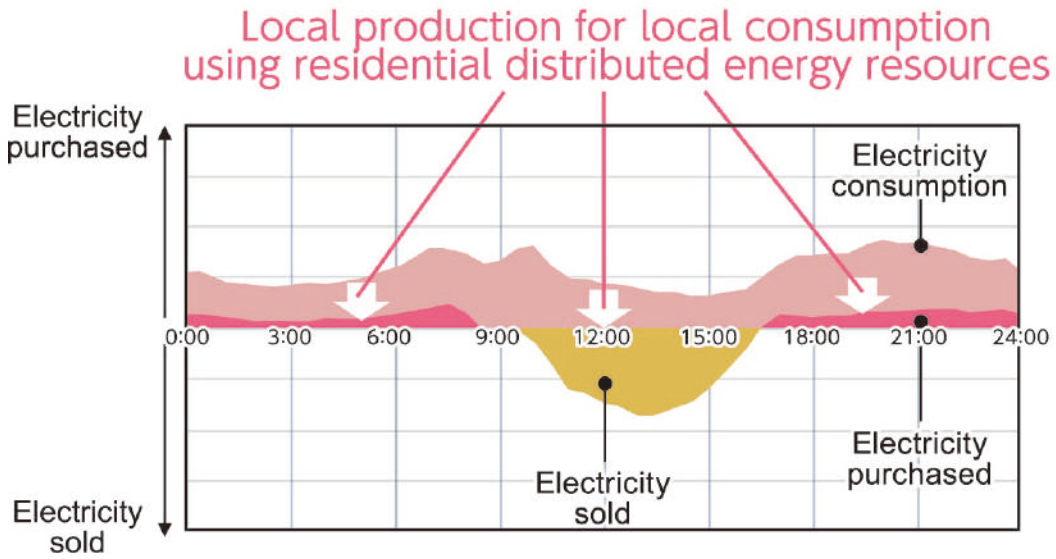
Figure 6 Method of controlling Ene-Farm cogeneration systems and storage battery systems

4.1 Results: Status of electricity by season

- The electricity consumption was low during the intermediate season.
- The electricity coverage rate in the city block was 83% by local production for local consumption.

Intermediate season

Monday, November 28, 2022
Weather:Sunny and sometimes cloudy



Peak value of the electricity consumption		Using residential distributed energy resources	Peak value reduction effect
20:00-20:30	84kW	16kW	▲68kW (▲81%)

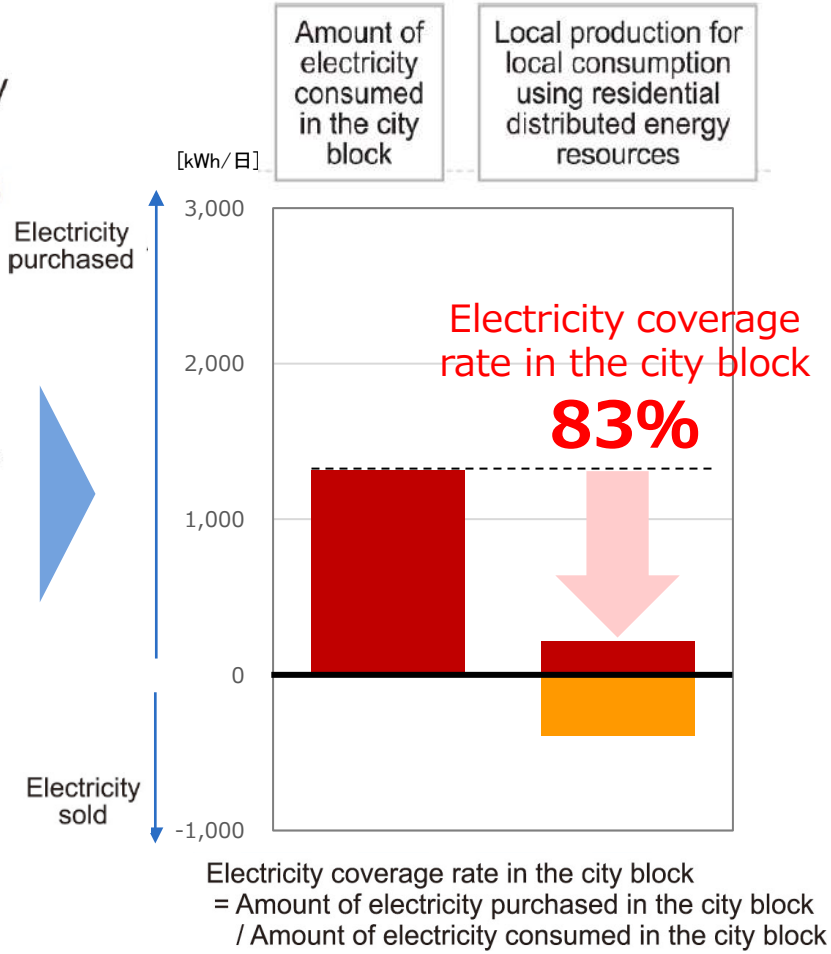


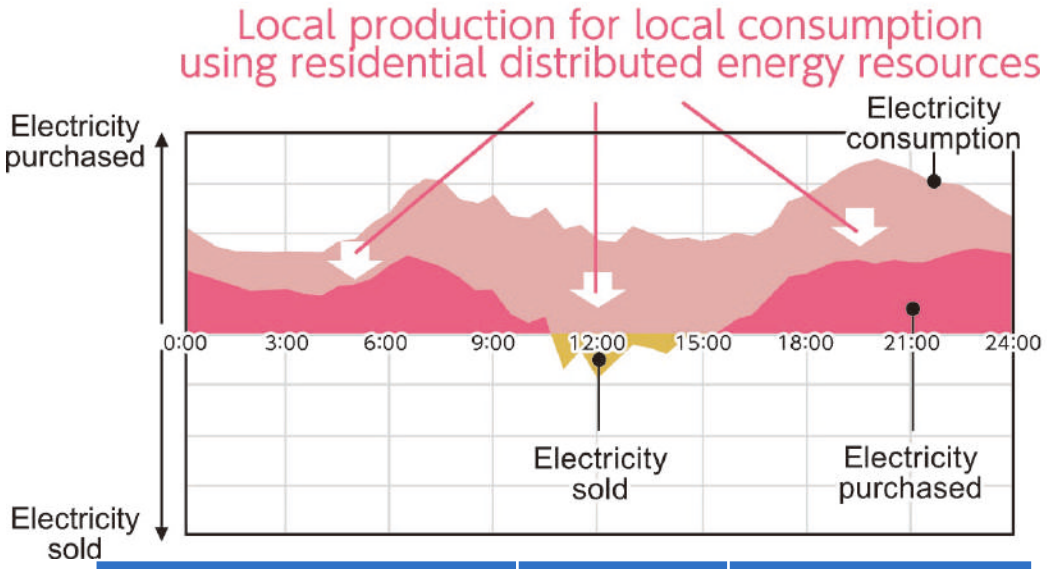
Figure 7 Status of electricity during intermediate season

4.2 Results: Status of electricity by season

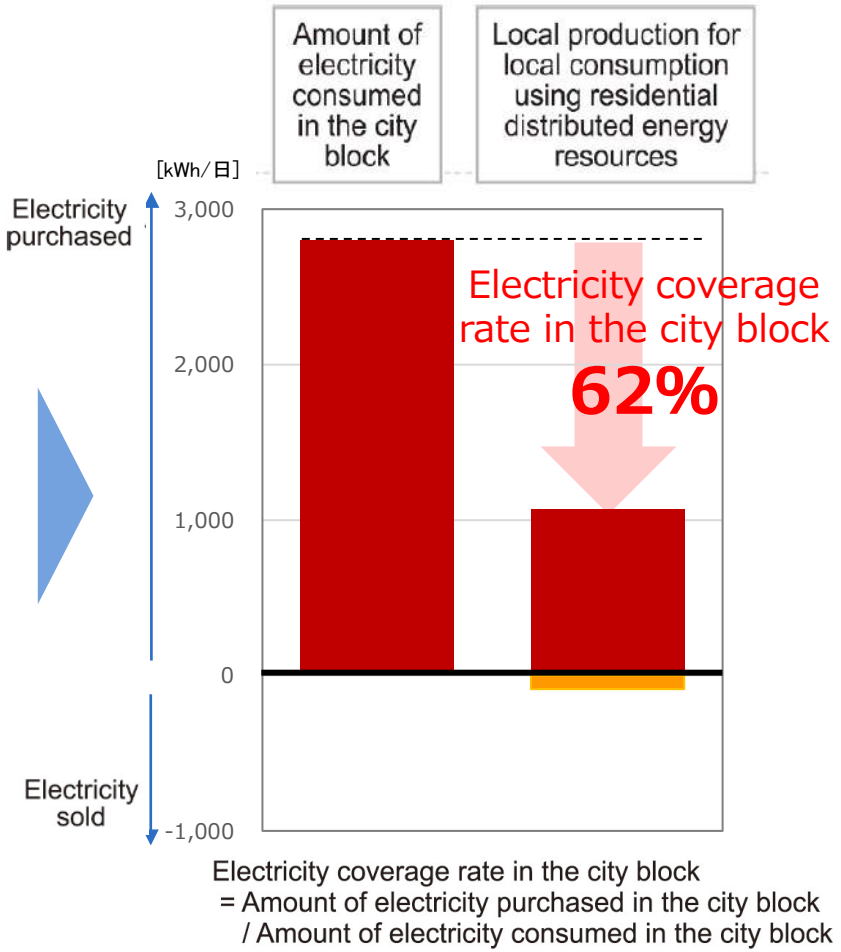
- The electricity consumption doubled due to the use heating in winter.
- We also demonstrated the capability to reduce the peak value and level out electricity demand in the city block.

Winter

Wednesday, February 15, 2023
Weather:Cloudy and sometimes sunny with occasional snow and sleet



Peak value of the electricity consumption		Using residential distributed energy resources	Peak value reduction effect
20:00-20:30	172kW	72kW	▲100kW (▲58%)



Electricity coverage rate in the city block
= Amount of electricity purchased in the city block
/ Amount of electricity consumed in the city block

Figure 8 Status of electricity during winter

4.3 Results: Total during the period

- **During the control period, 70% of the electricity consumption was covered by residential distributed energy resources, reducing the amount of electricity purchased in the block.**

Total during the period

(2022/11/22～2023/3/30)

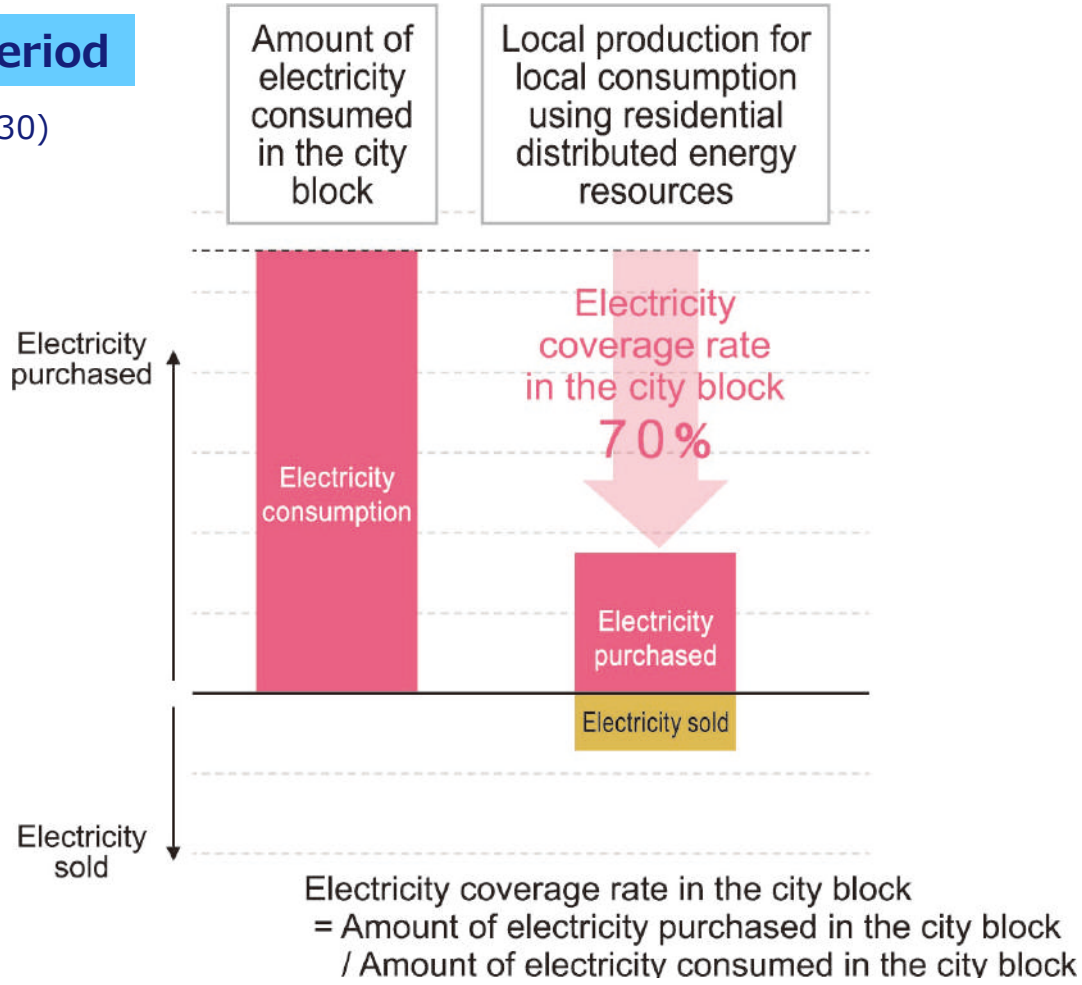


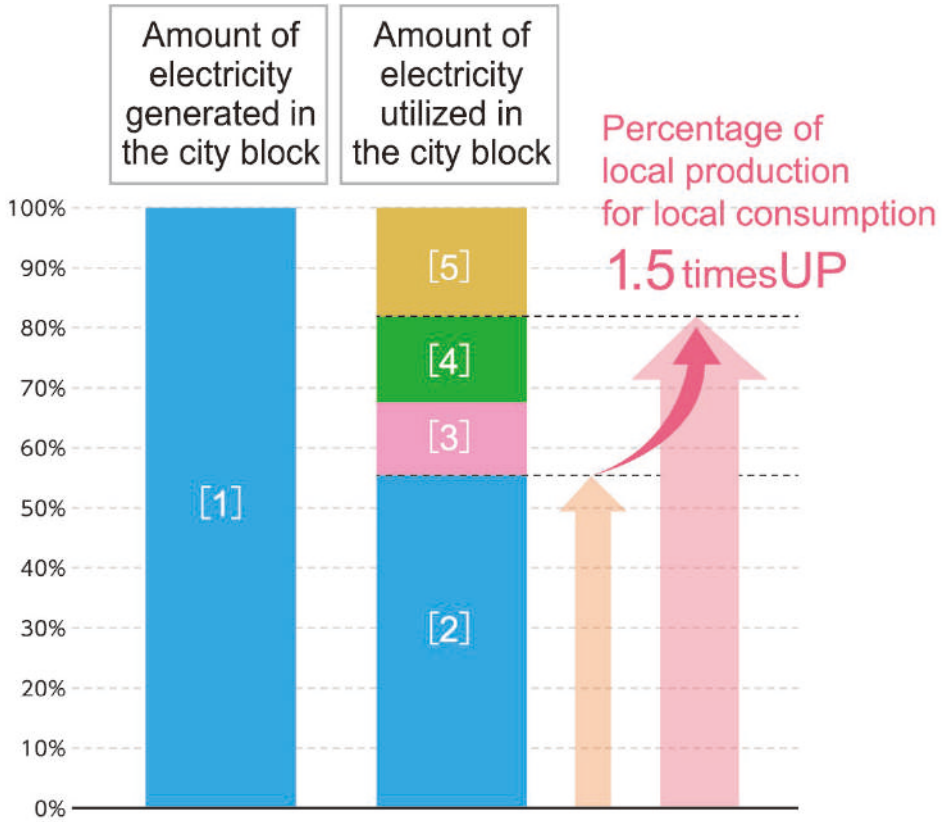
Figure 9 Total electricity coverage rate in the city block during the period

4.4 Results: Total during the period

- **The percentage of local production for local consumption increased by 1.5 times to 80% during the period.**

Total during the period

(2022/11/22～2023/3/30)



[1] Electricity generated by the Ene-Farm cogeneration systems and solar photovoltaic systems

[2] Self-consumption of electricity generated by the Ene-Farm cogeneration systems and solar photovoltaic systems

[3] Charging of storage battery systems

[4] Electric power interchange in the city block

[5] Sale of electricity outside the city block

Percentage of local production for local consumption
= Amount of electricity utilized in the city block
/ Amount of electricity generated in the city block

Fig. 10 Total percentage of local production for local consumption during the period

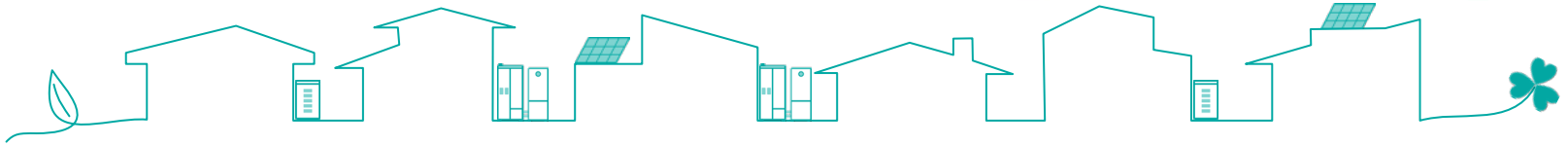
5. Conclusion

The demonstration of energy management using three types of residential distributed energy resources in a virtual city block was resulted to:

◆Increase the percentage of local production for local consumption and level out electricity demand in the city block.

◆The effectiveness of energy management that combined solar photovoltaic systems and storage battery systems with Ene-Farm cogeneration systems capable of generating electricity regardless of the season, weather, or time of the day.

This regional energy management will contribute to expanding the introduction of renewable energy and realizing a low carbon emissions city.



Thank you for your attention !