Study on Calculation of Storage Battery Capacity in Photovoltaic Power Generation Installation System

Shunya Shibata[1], Kazuo Yukita[1], Takuya Goto[1]
[1]Aichi Institute of Technology,
v25713vv@aitech.ac.jp

Introduction

To efficiently utilize renewable energy, the adoption of storage batteries is advancing [1]. However, the appropriate selection of storage battery capacity is crucial in this process. This paper simulates both a centralized system, where a single storage battery is shared among solar power generation facilities and multiple consumers under the condition of reverse power flow suppression, and a distributed system, where storage batteries are deployed for each consumer. It compares the storage battery capacities required for both approaches.

Simulation Conditions

In this study, demand data was constructed using a model for introducing solar power generation facilities at three university facilities. Conceptual model of the centralized is shown in Figure 1, and Conceptual model of the distributed is shown in Figure 2. The solar power generation capacity was assumed to be 80 kW, and the inverter capacity was also set to 80 kW. A sustained load curve was created from the demand and generation data, and the storage battery capacity was selected based on this curve [2]. Furthermore, the maximum absolute value of the difference between demand and generation output was adopted.

Simulation Results

Based on the calculated battery storage capacity, a one-year battery operation simulation was conducted for evaluation purposes, sampling at one-hour intervals. As an example, Figure 3 shows the load power curve for a centralized system with a storage capacity of 500 kWh. Figure 4 shows the load power curve for a distributed system with a total storage capacity of 500 kWh (Storage Capacity 1 and 2: 100 kWh each; Storage Capacity 3: 200 kWh).

Summary

This study calculated battery storage capacity in centralized and distributed systems and evaluated battery operation through simulation.

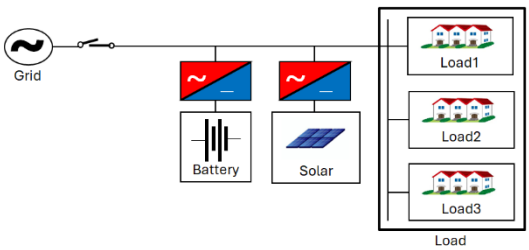

Figure1 Conceptual model of the centralized

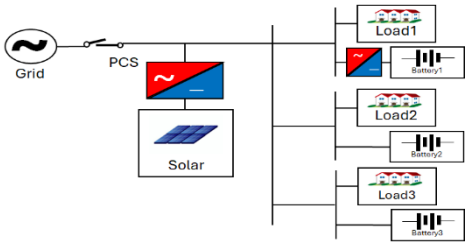

Figure2 Conceptual model of the distributed

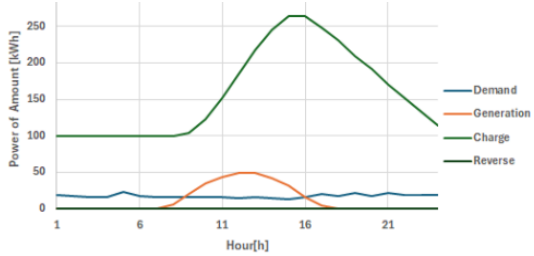

Figure 3 Centralized -type load power characteristics

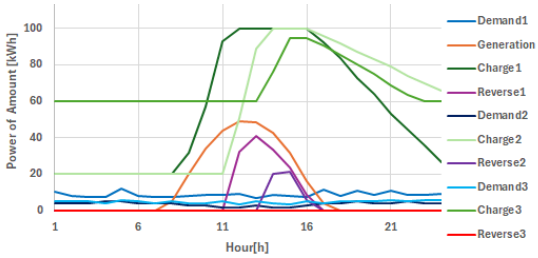

Figure 4 Distributed Type Load Power Characteristics

References

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https://www.meti.go.jp/shingikai/enecho/denryoku_gas/saisei_kano/pdf/062_05_00.pdf?utm_source=chatgpt.com
[2] Ogawa, Sakai et al Research Study on Self-Consumption PV Systems Controlled by Storage Batteries (2025)