



GRID SOLUTIONS

VPP Solutions

Grid Solutions, Inc.



Overview of VPP Solution

Capacity Market /D&S Market

送配電事業者

Scope of our Solution

*We provide one-stop service to PPS and aggregators



Business Logic

Forecast

- Generate Forecast based on AI forecast logic from resource performance and external API (weather information etc.)
- Demand
- PV panel (generation)
- Battery (SoC)
- EV battery (SoC)



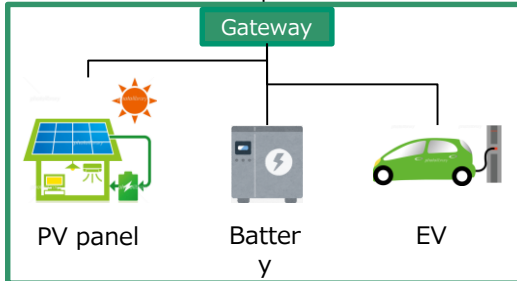
Business Logic

- Create & Distribute Control instruction
- Imbalance check
- Baseline calculation
- Resource management
- Performance management
- System Configuration
- Cognitive Analytics of Demand Response

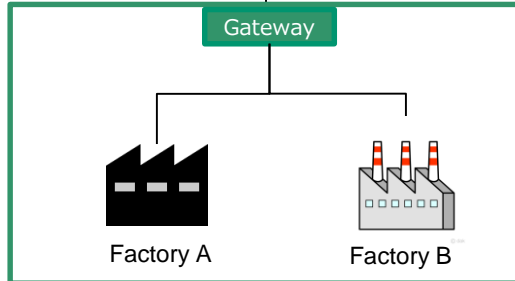
Remote control of individual resources

Renewable Energy/Community Consumption

Household



Factory Facility



ESS





Main functions provided by business logic (1/3)

Forecast

- Because the **controllable amount of resources affects the profit of the aggregator, it is important to improve the forecast accuracy**. Our AI-based forecast engine predicts **demand, PV power generation, storage battery and EV SoC** through external APIs such as weather forecast, and delivers the forecast data to business logic.
- Our Forecast Engine is a tool to automatically perform forecasts, based on time series, using **machine learning algorithms and deep learning**. This algorithm trains a forecasting model, handling outlier and missing data set.
- Our forecast engine provides a **two day forecast with intervals required by customers** of the series (i.e. 30min interval).

Optimization

- Based on the resources' performance data and the forecast data supplied by the forecast engine, our AI-based Optimization Engine generates a Demand & Supply. In doing so, **the Optimization Engine can autonomously create control instructions for the resources independent of the control instructions from the TSO**.
- Based on Demand & Supply Forecast value, our **Optimization Engine will create a 24-hour (48 frames) demand & supply plan**. The schedule is **updated every 30 minutes** as the forecast is updated.



Main functions provided by business logic (2/3)

Event Management / Distribution

- It is a function to distribute control commands to consumer resources that can be controlled according to the schedule created by the optimization engine.
- After creating the control instruction, it responds through the following sequence.
 - 1) (For DR) Calculate the baseline based on the control performance (power usage) of resources.
 - 2) Judge whether to participate in the event from the distribution result, and return a response to VEN.
 - 3) (For Non-DR) **Check the supply-demand imbalance every 30 minutes**, and if imbalance occurs, return a response to the optimization engine, and the **optimization engine recreates the demand-supply plan.**
- You can also check the success rate judgment for each event on the GUI.

Performance Management

- It is a function to acquire and manage the actual information from resources and a function to send it to the power transmission and distribution business operator. It is also used as information for optimal distribution of control instructions in conjunction with the forecast engine.
- Performance management is mainly 1) "Resource performance registration", 2) "Resource performance aggregation", 3) "Send Report" :
 - 1) **"Resource performance registration"**: Receive performance from each resource and register them in the database.
 - 2) **"Resource achievement aggregation"**: resource performance aggregation request (schedule base) is received and the performance is sent to VEN.
 - 3) **"Send report"**: sends the aggregated resource results to VEN.
- Supports three reports: "baseline report", "control performance report", and "controllable amount report".



Main functions provided by business logic (3/3)

Baseline Calculation

- The baseline is an estimate of the amount of power demand without demand restraint. The amount of demand restraint at the DR event. It is calculated as the difference between this baseline and the actual power demand.
- Business logic calculates the baseline based on the results aggregated from each resource, and uses the averaging method (High 4 of 5: data for the 4 days with the highest power consumption in the last 5 days).

System Configuration

- It is a function to manage the load information of the resources owned by each consumer, the baseline, and other information about the consumer.
- You can also check the success rate judgment of the response for each resource on the GUI.



Company Overview

- ❑ Company Grid Solutions, Inc
- ❑ Location Suite 311 5-26-8 Kamata Ota-Ku Tokyo 144-0052
- ❑ Founded April 2012
- ❑ CEO Yohei Takahashi
- ❑ Bank SMBC Kashiwa Branch
- ❑ Business Development of Smart grid, Demand Response, VPP solutions
 - ✓ OpenADR solutions
 - OpenADR2.0b certified (VTN, VEN)
 - ✓ VPP solutions
 - ✓ AI-based forecast engine
 - ✓ Participated in the Capacity Market, and Demand and Supply Adjustment Market