



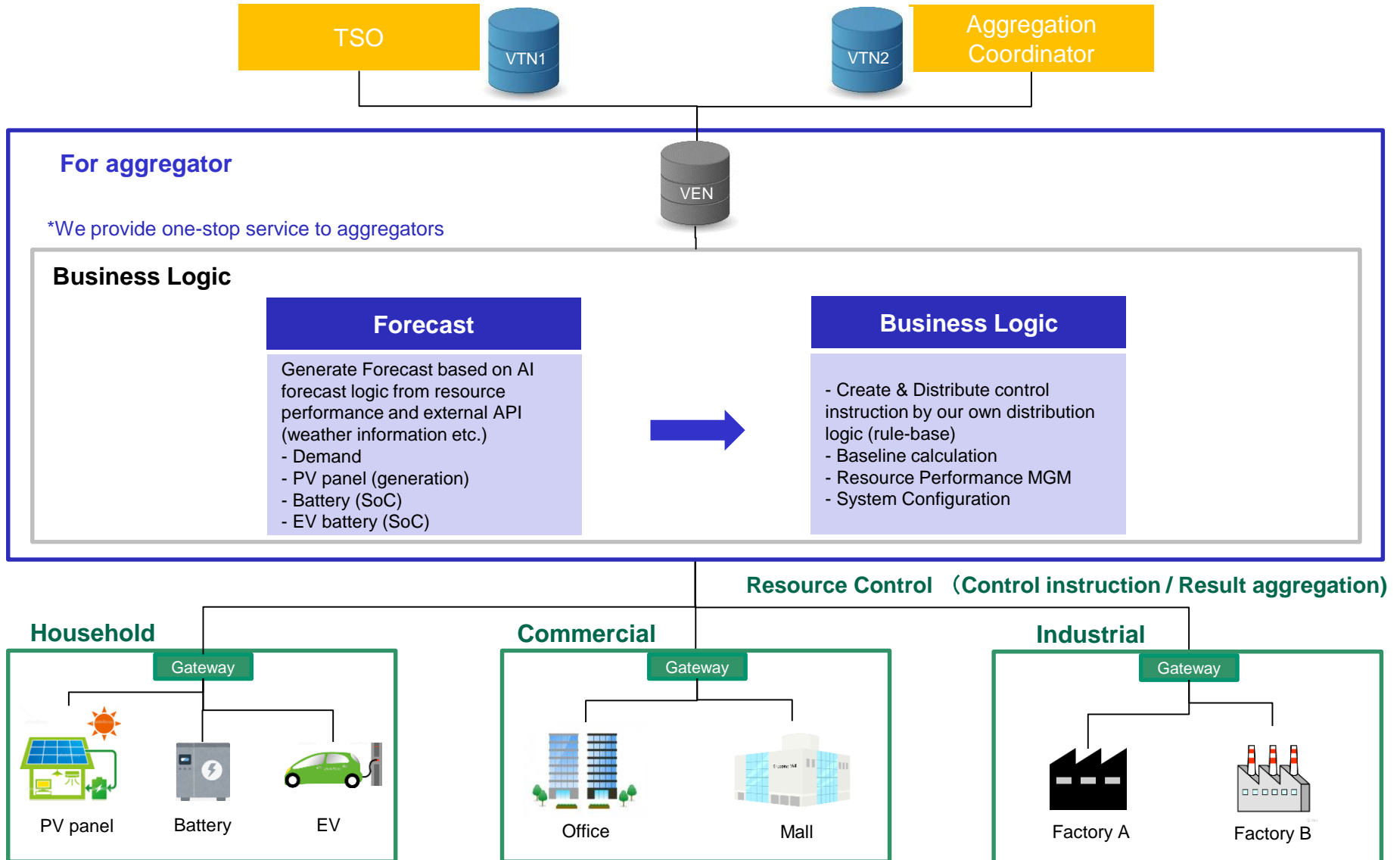
**GRID SOLUTIONS**

# VPP Solutions

Grid Solutions, Inc.



# Overview of VPP Solutions





# Main functions provided by business logic (1/2)

## Forecast

- Resource consumption forecast affects payoff optimization and needs to be more accurate. Our unique AI-based **forecasting engine** predicts **demand, PV panel's power generation, EV and storage battery SoC** through resource performance data, external weather data API, etc.
- Our Forecast Engine is a tool to automatically perform forecasts, based on time series, using **machine learning algorithms and deep learning**.
- Forecasting accurately is key to running an efficient VPP. For this end, we use weather data and solar irradiation data from external data sources to make more accurate predictions.
- Our forecast engine provides a **two day forecast of the series with intervals required by customers** (i.e. 30min interval).
- This algorithm trains a forecasting model, handling outlier and missing data set.

## Event Management/Distribution

- It distributes control instruction resources that can be controlled according to the content of the DR event received from the TSO and from the aggregation coordinator (VTN).
- After receiving the DR event from VEN, it responds through the following sequence.
  - 1) Calculate the baseline based on the controlled performance (power usage) of resources.
  - 2) Create an event schedule and distribute command values based on the "controllable amount" and "control cost" of the resource
  - 3) Judge whether to participate in the event from the distribution result, and return a response to VEN.



# Main functions provided by business logic (2/2)

## Performance Management

- It is a function to acquire and manage performance data from resources, and to send it to a TSO (VTN) via VEN. It is also used as data to efficiently distribute control instructions 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".

## Baseline Calculation

- The baseline is an estimate of the amount of power demand without demand restraint. 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.



# Company Overview

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- ❑ Company      Grid Solutions, Inc
- ❑ Location     4-6-16-1004 Shiba Minato-ku Tokyo 108-0014
- ❑ 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 a number of national projects