# EIPGRID INTRODUCTION

References and Insights

**EIPGRID**

September, 2023

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# INTRODUCTION

# EIPGRID global business status

EIPGRID provides DERs operation & monitoring services to overseas power companies and utilities through VPP platform 'EIP'. Since 2016, we have been providing services mainly for the Japanese and Southeast Asian markets, and we are preparing to enter the European market following our recent entry into the US market. Based on our stable & durable services to global customers, we are preparing to commercialize AI-based EaaS* targeting the domestic market. (EaaS : Energy-as-a-Service)



EIPGRID

## SECURE VPP
ENERGY EFFICIENCY WITH VIRTUAL POWER PLANTS

関西電力　北陸電力　東北電力
東邦ガス　TOKYO GAS　MEDIOTEC
MEA　PEA　TENAGA NASIONAL　GRID SYSTEM OPERATOR
SK E&S　kt korea telecom　GS Caltex　한화에너지 Hanwha Energy　POSCO ICT　KPX 한국전력거래소 KOREA POWER EXCHANGE


intertrust
**Secure Virtual Power Plant for Telecom industry**


SK E&S  SK innovation  LG Chem  SAMSUNG SDI
**Battery cell-level data collection and monitoring**


TIS
TIS INTEC Group
**Customization for the Japanese energy market**


GRID SYSTEM OPERATOR  TNB RESEARCH
**EIPGRID Virtual Power Plant is Malaysia's Grid System Operator's choice**


rainforest automation
**Scalable EV Charge-management Solution in North America**


Read
การไฟฟ้านครหลวง  PEA
**Thailand's Metropolitan and Provincial energy providers chose EIPGRID technology**

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# THE PARTNERSHIP

## EIP BUSINESS STRENGTH AND CAPABILITIES

- **In the Energy Business since 2010**
- **Developed Korea's first Automated Demand Response Management System**
- **Extended areas of application**
  - Distributed Energy Resources Management, Battery ESS Management, Micro-Grid, Virtual Power Plant, Vehicle to Grid, all combined into a single platform
- **Overseas footprint**
  - Reaching Japan, Southeast Asia, Europe, North America
- **Carbon Credits (Soon)**
- **Carbon Credit trading (Carbon Metering)**

Business Track Record

Global Standard Protocol

Machine Learning Forecasting

High-volume Data Processing

Utility Partnership

HW Interfacing

Cybersecurity

**AI-FORECASTING**

**AUTOMATED ASSETS CONTROL**

**AI SCHEDULING & OPTIMIZATION**

**PREVENTIVE MAINTENANCE**

**CUSTOMIZATION**

**STABILITY**

**CERTAINTY**

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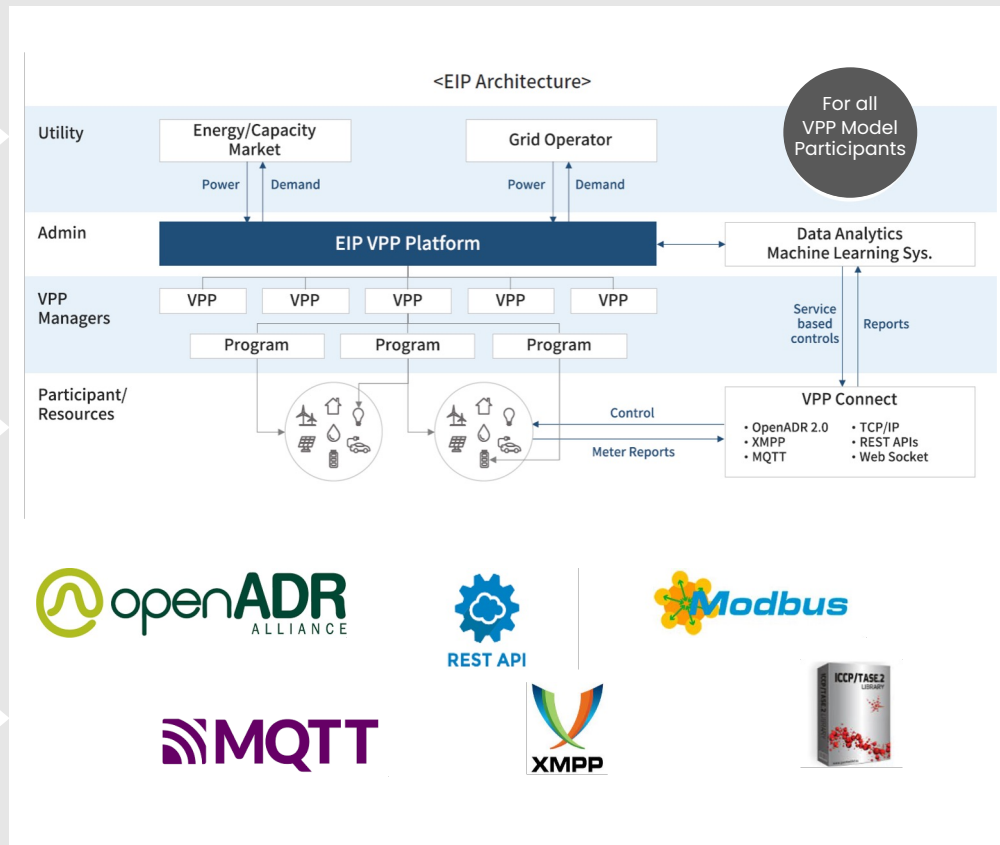# EIP Virtual Power Plant Platform
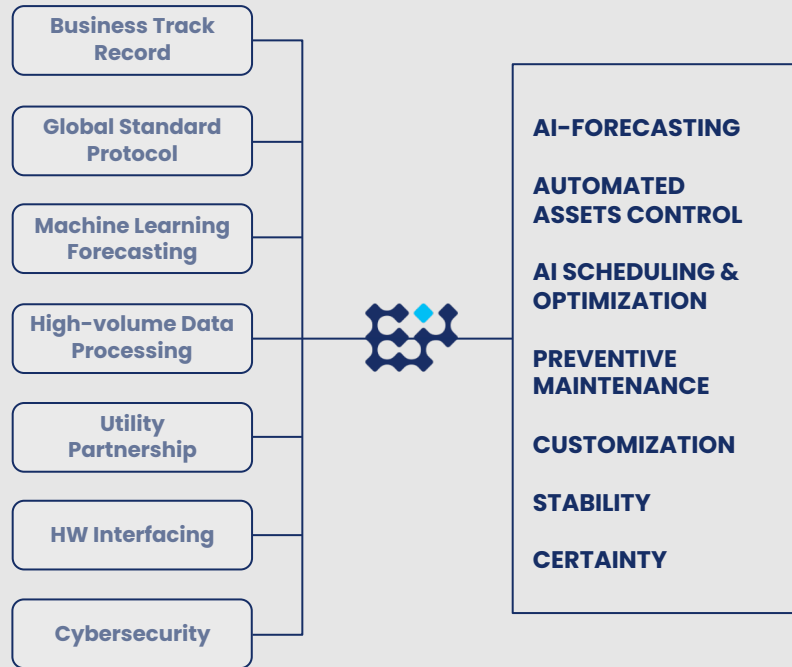
## UTILITIES

- Stabilize the grid 24/7 by leveraging data collection and AI to offset the variability of renewables
- Offer incentive programs to users who help balancing the grid through load curtailing or capacity supply

## AGGREGATORS

- Help communities monetize their energy assets and participate in their local energy market
- Act as a gateway between the grid and the communities and support end-users earning incentives

## COMMUNITY MANAGERS

- Monitor, operate and manage renewable energy assets in one or multiple communities
- Promote generation and use of affordable and low carbon electricity to households, commercials and industrials



<EIP Architecture>

For all VPP Model Participants

Utility — Energy/Capacity Market | Grid Operator

Power | Demand | Power | Demand

Admin — EIP VPP Platform — Data Analytics Machine Learning Sys.

VPP Managers — VPP | VPP | VPP | VPP | VPP

Program | Program | Program

Service based controls | Reports

Participant/ Resources

VPP Connect
- OpenADR 2.0
- XMPP
- MQTT
- TCP/IP
- REST APIs
- Web Socket

Control | Meter Reports

openADR ALLIANCE · REST API · Modbus · MQTT · XMPP · ICCP/TASE.2

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# Interfacing and Communication





**EIP Client BOX**

Interfacing & communicating between the EIP platform and on-site edge devices. Collects & controls data from edge devices using various and heterogeneous protocols, and can be provided as hardware or software

**IoT - Telenor Connexion**

Partnership with one of the world's top telecommunication and IoT companies for smooth communication between the devices and system anywhere in the world

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## DEMAND RESPONSE

- **Grid Balance**
  - Utilities maintain stable power grid, and LA/resource owners earn incentives by participating in DR programs

- **DER Management**
  - Operation and management of diverse energy resources with real-time monitoring

- **AI Portfolio**
  - Automated forecast and scheduling based on user's energy consumption pattern and grid status

- **Automated DRMS**
  - DR Management System fully customized and tailored to local market rules
  - User friendly design : utilities and LA can directly manage participants joining their DR programs

# EIP Platform Business Applications



COMMUNITY SELF-CONSUMPTION

COMMUNITY ENERGY STORAGE

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ESS ESS

ENERGY MARKET

SPOT   FIT   REC
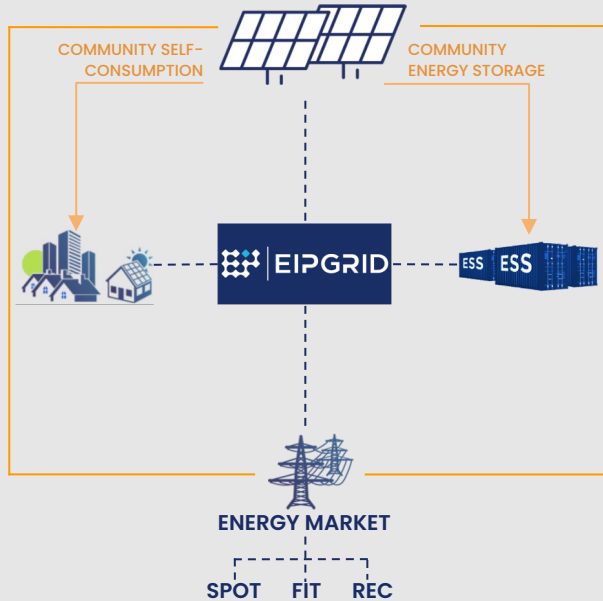
## PV MANAGEMENT

Precise Load & Gen Forecasting, Curtailment, Defect Detection, Interoperating Energy Storage

- **Smart Control**
  - Control over community energy usage with efficient management of PVs scattered across the community area

- **Defect Detection**
  - Defect detection feature scans and detects any possible issue on any of the PV in the PV farm and alerts the operator if any abnormality is found

- **Energy Storage**
  - Energy generated through the PVs can be stored and managed with our market-leading ESS management system for smarter energy storage and consumption.

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# EIP Platform Business Applications
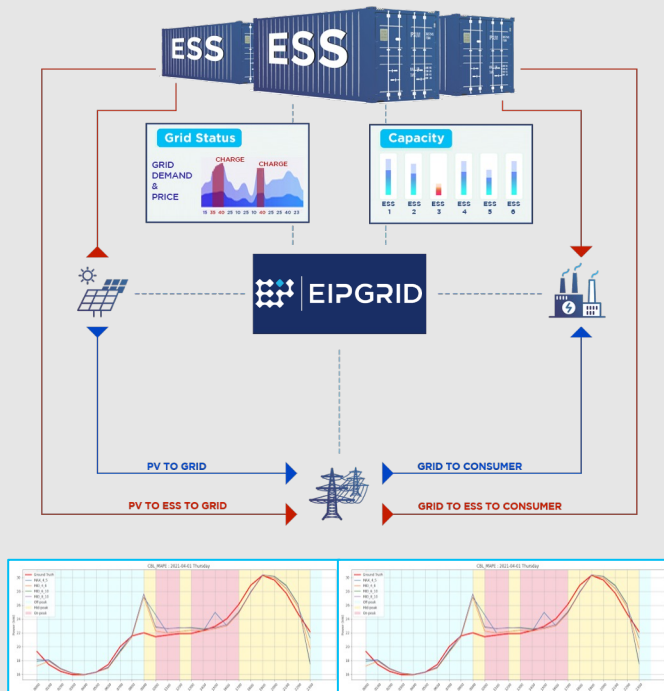


## ESS MANAGEMENT

- **Scheduling**
  - Schedule charging according to the market grid status, their own electricity usage pattern, and load capacity.

- **Anomaly Detection**
  - Detect changes in the battery cell's temperature, voltage, current, etc. as well as any unusual access to the system

- **TSDP – Time Series Database Technology**
  - Real-time unstructured big data is collected, curated and structured for efficient and precise analysis and performance tracking
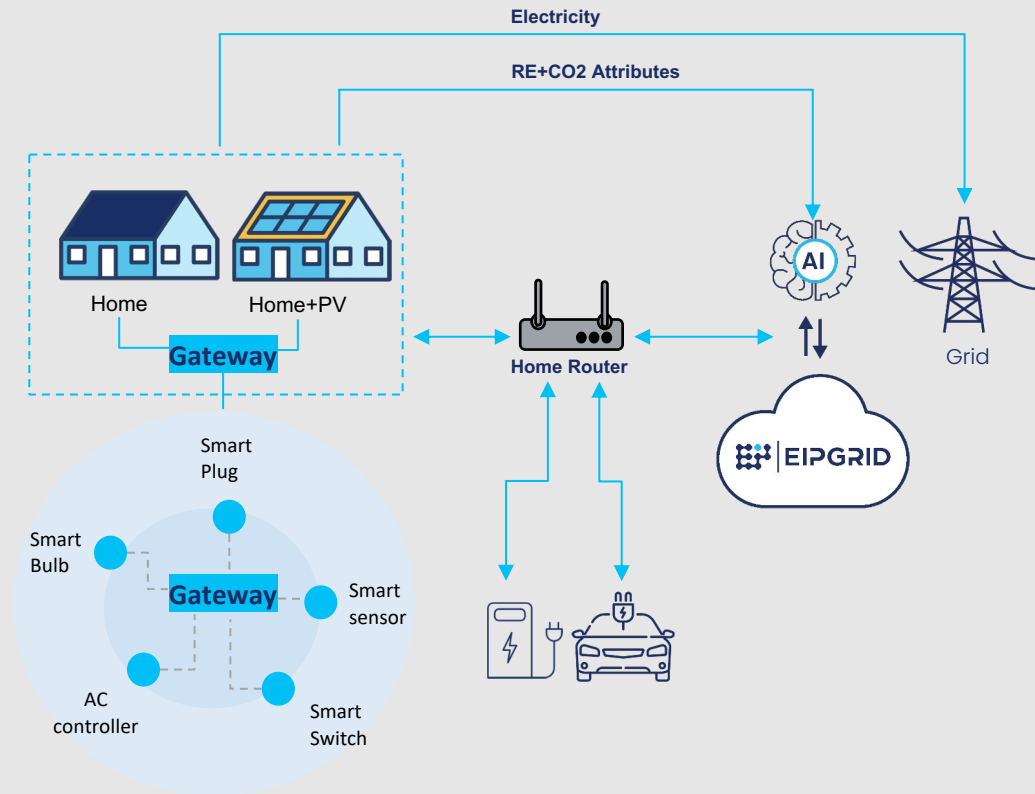
- **System Integration**
  - Long track-record of projects with the world's top battery and ESS manufacturers (SK Innovation, SAMSUNG SDI, LG Chem)
  - ESS coupling with PV solar and/or consumption site

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# EIP Platform Business Applications
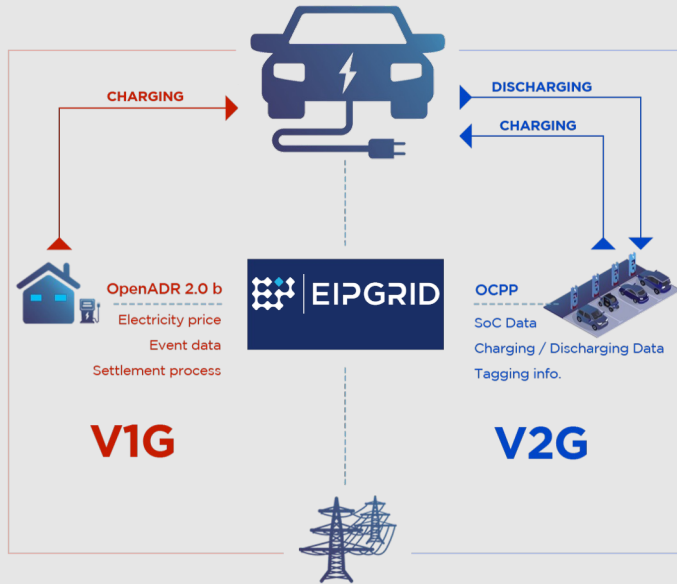


**EV MANAGEMENT**

- Charging according to the grid's demand
  - Earn incentives by charging according to the grid
- V1G - Smart Charging
  - Remote EV charging time and speed control
- V2G - Connect to the EV charging station
  - Participate in DR program and earn incentives by charging according to the grid demand and electricity rate
- V2G Energy Flexibility Verification through Gamification Incentive Model
  - Integrated operation technology to support DR and auxiliary service complex market using DR resources including Gamification-based V2G resources
  - Validation of commercialization and operation of platform, operating system, and consumer participation technology

# EIP Platform Business Applications



**Electricity**

**RE+CO2 Attributes**

Home

Home+PV

**Gateway**

Smart Plug

Smart Bulb

**Gateway**

AC controller

Smart sensor

Smart Switch

**Home Router**

AI

Grid

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## HOME/BUILDING ENERGY MANAGEMENT

- **HEMS/BEMS Control System**
  - Energy Management
  - Monitoring & Control
  - Participation in energy programs
  - Reduction of electricity bills
  - Data Aggregation
  - Logging
  - Alarm Control

- **Smart Devices & Appliances**
  - Smart plugs & cables
  - Temperature Controller
  - Smart AC or AC Controller
  - EV Charging Point
  - Alarm Control

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# Big Data Aggregation Capabilities



PV GENERATION BM

GRID-OPERATION BM

V2G BM

## 100K-CLASS BIG DATA SMART CITY PROJECT

AMI on
**3M** industrial sites + **300k** households

Transmission / Distribution / Substation  Data
Environment  / Life / Internet service Data

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VPP API REFERENCE    HTTPS ⌄    Swagger

GET   /rest/v1/events/{eventId}

GET   /rest/v1/programs/{programId}/control/live

GET   /sp/inverter/{inverter_id}/history

GET   /sp/{id}/predict/day2

## LARGE OPEN API LIBRARY

**100** Plant/Gov. Open APIs

**730** Platform based Open APIs

Public Open APIs target
Swagger-based document

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## EIPGRID DARE Data Services



- **D 1 Data Analysis Server**
  - Quick & Accurate Energy Data Analysis
  - CBL and RRMSE

- **D 2 Decision Dynamics**
  - Time Series Forecasting
  - Advanced Predictive AI
  - Optimal and Profitable Energy Decisions

- **D 3 Data Discovery Den**
  - Dynamic Visualization
  - Actionable Time Series Energy Insights
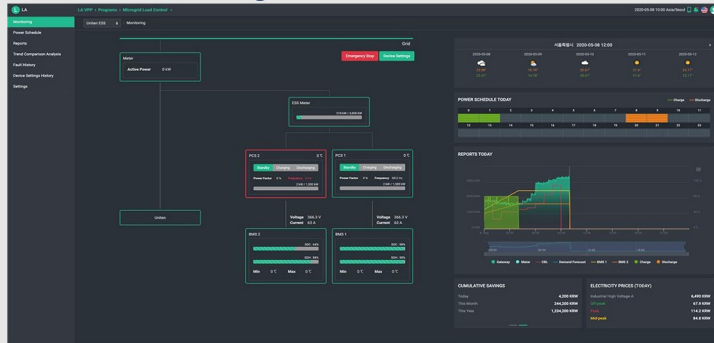  - Time Series Chart Editor and Interactive Report

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# EIP Platform User Interface

## EIP Platform Dashboard
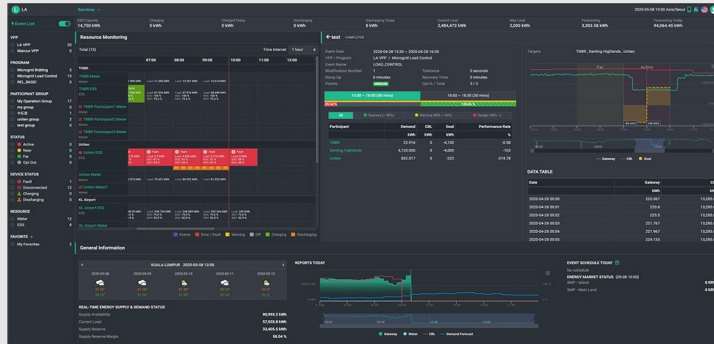


## Forecasting
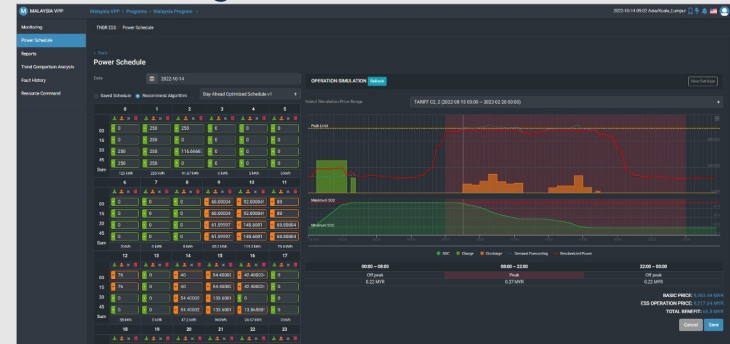


## ESS Monitoring



## Smart Scheduling

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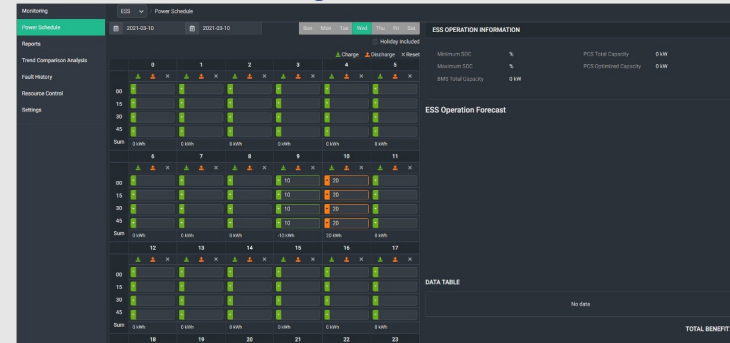
# DATA AGGREGATION & REFERENCES

# Resource Agnostic Platform

**20** sites

**ESS**
740 MWh

**3** battery providers
**6** PMS providers

**718** sites
incl. VPP participation

**PV**
650 MWp

**4** power generators

**700** sites

**DR**
2.1 GW

**1000** participants
**7** Aggregators / utilities

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# Domestic and Overseas References

**SOUTH KOREA**

**650 MWh** capacity

**16** sites

Cell level monitoring for fault detection and prevention

**MALAYSIA**

**4.38 MWh** capacity

**4** sites

Peak cut / DR / Frequency Regulation

**SOUTH KOREA**

**92 MWh** capacity

**170** sites

Monitoring, operation & aggregation remotely

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# Domestic and Overseas References

**THAILAND**

**3,000** participants

**45 MW** capacity

Automated DR Operating System development

**SOUTH KOREA**

**1,000** participants

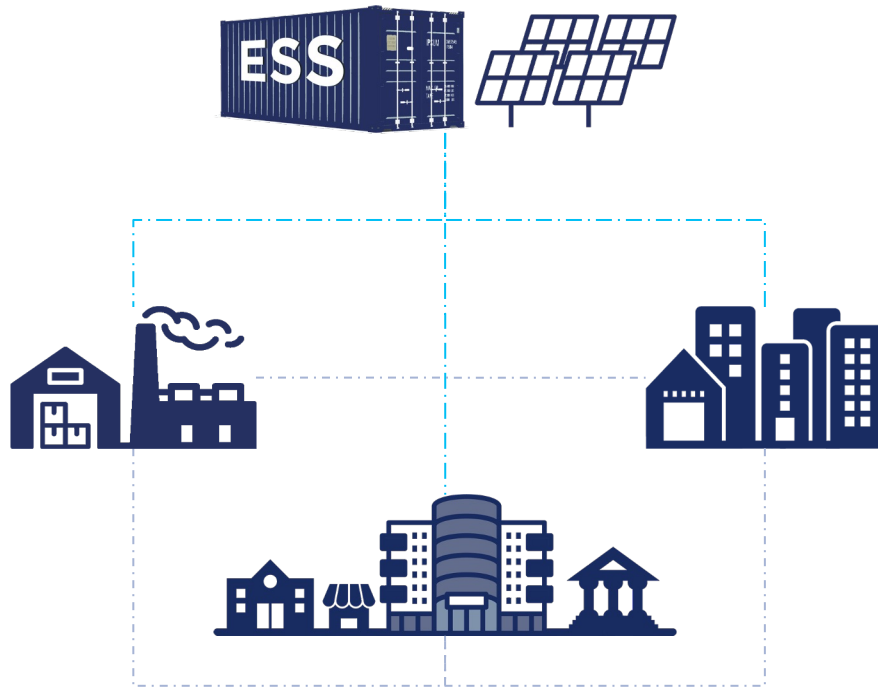**2.1 GW** capacity

DR program

**JAPAN** *confidential

**1,200** participants

**4** utilities

Customized DR Management System development

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# VIETNAM
## MICROGRID FOR ENERGY MANAGEMENT AT AN INDUSTRIAL COMPLEX



## Participants and resources

Manufacturing plants

Households

Commercial buildings

Solar PV + Battery ESS

## Real-time Energy Management

Real time power demand monitoring

On-site energy production, storage and consumption

Demand balancing and energy trading between sites

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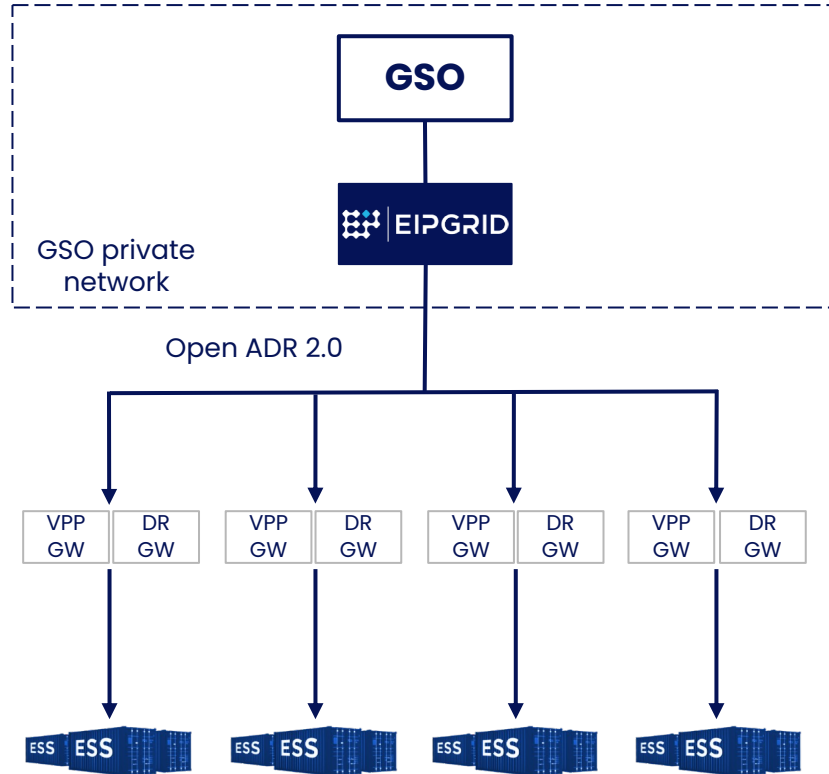
## MALAYSIA – BATTERY ESS OPERATION & MONITORING

**24/7** operation with

**Real-time** monitoring with Data backup

**AI-powered** daily forecast & load scheduling

**Automated** Peak-cut, energy arbitrage, demand-response

Emergency reaction time **<2 sec**

### Smooth operations
In difficult environments

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# Business Tools: Neural-Symbolic AI Tech

## STAKEHOLDERS

ENERGY CONSUMER

ENERGY PRODUCER

ENERGY DISTRIBUTOR

ENERGY PROSUMER

## ESS SCHEDULER & ANOMALY DETECTION

### INPUT

Load Power

Peak Load

State Of Charge

Electricity Cost

Cell Voltage

Module Temperature

### PROCESS

AI

AI TECHNOLOGY

EMS

EIP

BMS

KNOWLEDGE BASE

### OUTPUT

Time-of-use Profile

Cost Reduction

Peak Shaved Load Power

Predicted Load Power

ESS Scheduled

Anomalous Status

## SERVICES

MONITORING

ESS SCHEDULING

ANOMALY DETECTION

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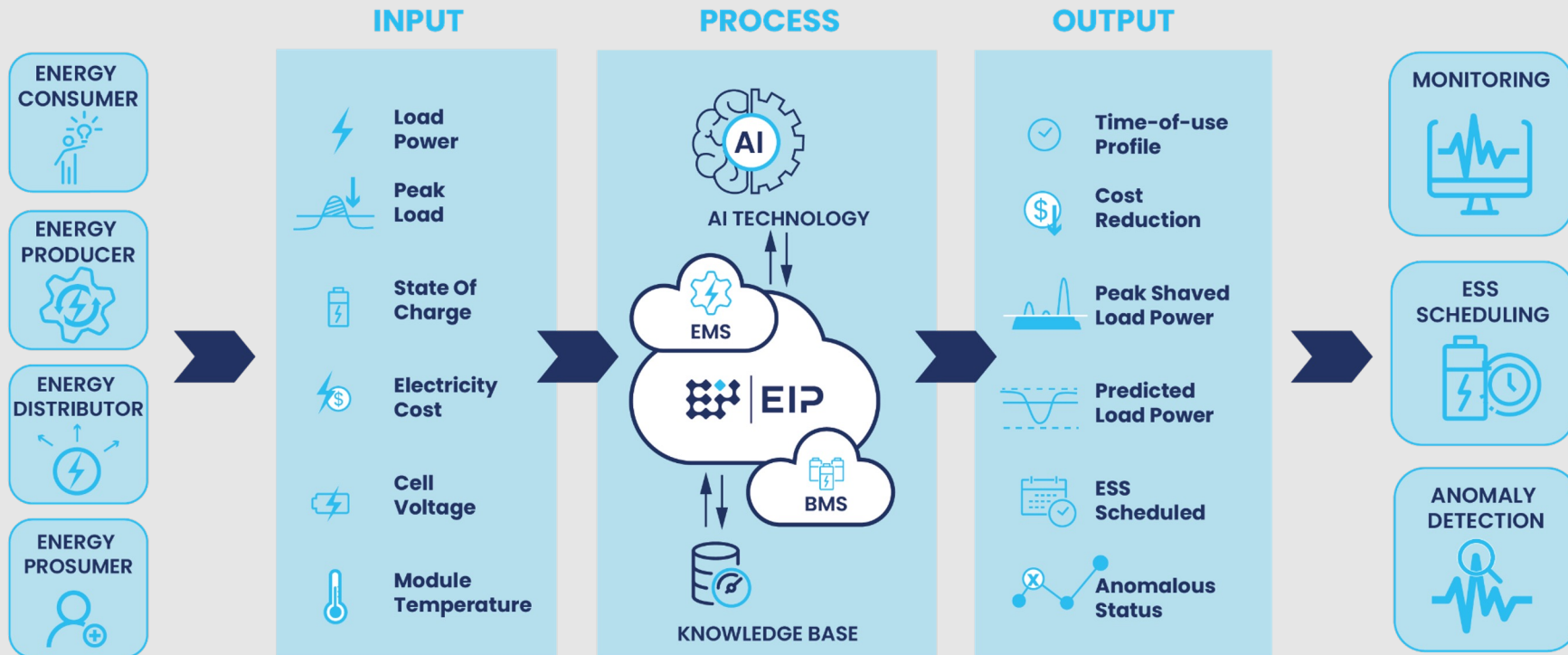
## JEJU ISLAND - VEHICLE-TO-GRID

**91** electric vehicles

**527** chargers

- VIG / V2G operation
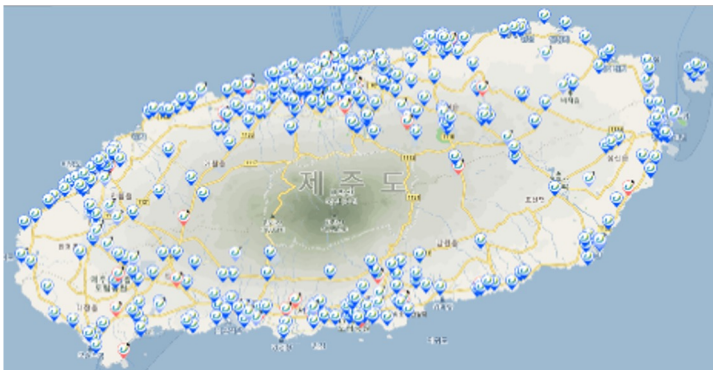- Real time grid balancing

- Push notification System
- Gamification model + participant reward



## Infrastructure for real-time monitoring & management

- Grid status : power load and generation
- EV : Real-time location & battery SOC
- Charging station : Real-time usage status

## Focus on user experience and user retention

- Event dispatch to user through mobile notification
- Gamification model based on event participation : point reward system, quiz, loto, user ranking
- User behavior analysis + user satisfaction survey

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# V2G Operation

## INPUT

Real-time grid status

Real-time EV location

Real-time State of Charge

Real-time charger usage

## MONITORING / PROCESSING

Administrator : real-time monitoring with tailored interface

Automated processing & analysis

## EVENT MANAGEMENT

Event dispatch & mobile notification

Real-time event participation monitoring

Settlement, user reward and user ranking

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# EIP MONETIZATION TOOLS

# Business Tools: Monetization

| EIP KEY MODULES | | | | | BIZ APPS | BIZ LOGIC |
|---|---|---|---|---|---|---|
| Resource Management | VPP Group Management | Program Management | Event Management | Component Management | Demand Response | Settlement Rule-setting |
| Settlement Management | Notifications Management | Device Management | Library Management | Schedule Management | Peak-Cut | |
| | | | | | Energy Prosumer | |
| Account Management | Log & History Management | Network Management | Report Management | Forecasting & Scheduling Management | Frequency Regulation | |
| | | | | | V1G, V2G | |

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## RESOURCE MANAGEMENT WITH PROFIT MAXIMIZATION

- Efficient resource management through different operation simulations
- Select customized plans just for your platform

## CUSTOMIZE YOUR BUSINESS UTILIZING EIP CORE MODULES

- Add modules to the platform as your business portfolio develops
- Development costs lowered substantially

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| CLIENTS | | | PARTNERS |
|---|---|---|---|
| **Private** | GS Caltex / Rockwell Automation | kt / SK E&S | posco 포스코DX / **& Others (confidential)** | intertrust / rainforest automation / KTGCC |
| **SI & Engineering** | TIS TIS INTEC Group | GUNKUL not only the energy, we care | DOOSAN | NECTEC a member of NSTDA |
| **Utilities & energy operators** | Busan city gas SK E&S / GRID SYSTEM OPERATOR / KPX 전력거래소 KOREA POWER EXCHANGE / TENAGA NASIONAL | eMotorWerks An Enel Group Company / 한국전력공사 KOREA ELECTRIC POWER CORPORATION / PEA PROVINCIAL ELECTRICITY AUTHORITY / TNB RESEARCH | FULL ADVANTAGE Sustainable Energy and Environment Solutions / KEPCO KDN / การไฟฟ้านครหลวง Metropolitan Electricity Authority | BlackRidge TECHNOLOGY / telenor connexion / SGtech School of Renewable Energy and Smart Grid Technology Naresuan University / kx amazon web services / 경희대학교 KYUNG HEE UNIVERSITY |

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# LET'S CONNECT!

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