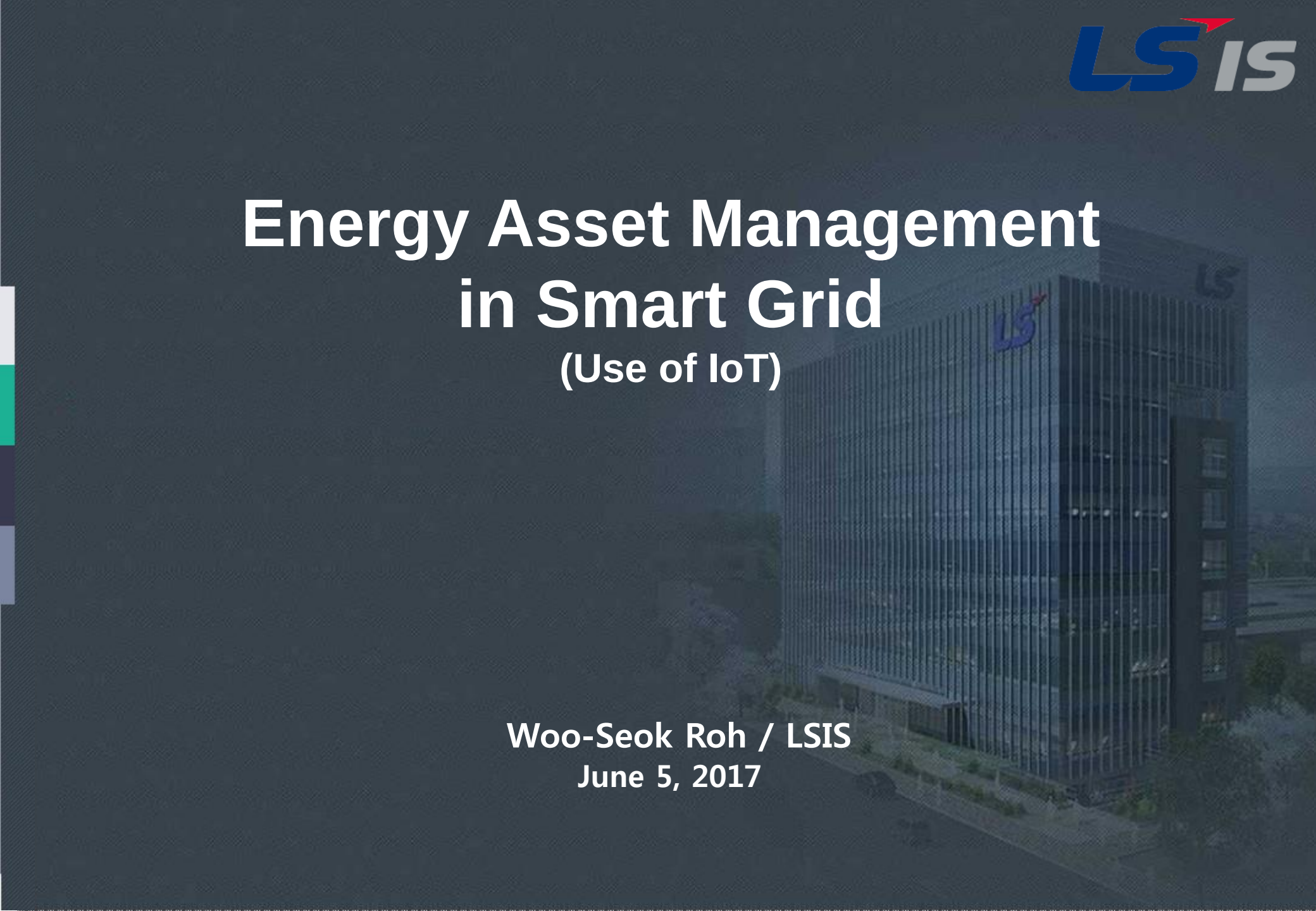
Energy Asset Management in Smart Grid

(Use of IoT)



Woo-Seok Roh / LSIS

June 5, 2017

LS Group and LSIS

Growing into a top global company in the industrial electric, electronics, materials and energy fields

(Foundation Year)

- LS Cable & Systems (1962)
- LSIS (1974)
- LS Nikko (1936)
- Gaon Cable (1947)
- E1 (1984)
- Yesco (1981)

→
- *Power Grid Biz.*
- *Power Distribution Biz.*
- *Smart Grid Biz*
- *Automation & Drive Biz.*

- LG Electronics
- LG Chemical
- LG Display
- LG U Plus

- GS Caltex
- GS Retail
- GS E&C
- GS SHOP

About R&D Campus of LSIS

Building Name	LSIS R&D Campus
Category	R&D Center
Address	LS-ro 116 beongil 40, Dongan-gu, Anyang-si, Gyeonggi-do, 14118, Korea
Intelligent/Green Building Certification	Building Energy Efficiency Rating Grade : 2nd Grade
Site area	**5,056 m^2**
Construction Floor Area (CFA)	**28,691 m^2**
BCR(Building Coverage Ratio)	42.7 % CFA / Site area
Construction commencement date	2013.07 (Building use permit issued date : 2014.12)
Number of floors	**Above ground: 9** **Basement levels: 3**
Remarks	**. The 1st APIGBA award (Gold Prize)** **. The 1ST Certification on ESS for Emergency Operation**

System Architecture _ Design Concept

Heat Source


Refrigerator


Boiler

Field Device: Temp. Pressure Power. Flow Gas

- **Cooling Equipment performance evaluation** (COP/Load Factor)
- **Energy Consumption Analysis & Simulation.**
- **Indoor environmental assessment** (Temp./Humid, CO_2)

Electrical


Distribution Panel


Peak Demand Controller


ESS

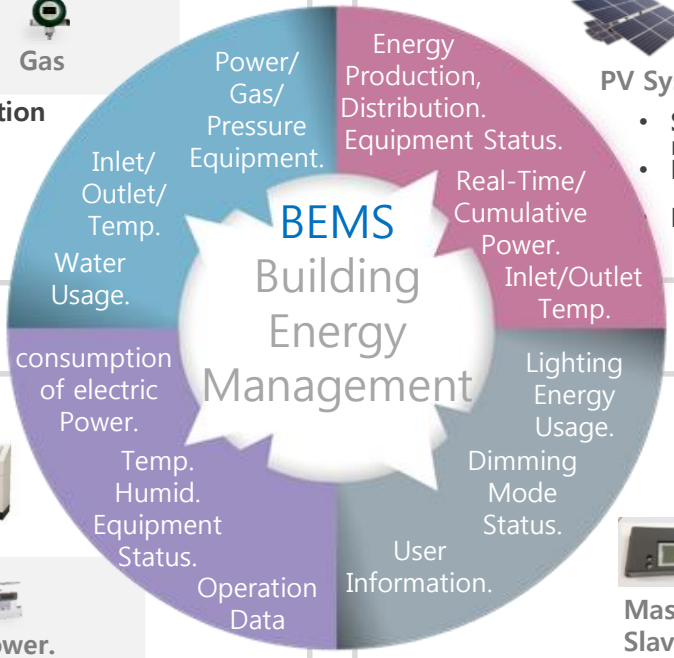

PV System


Geothermal System


Power meter


EV Charge spot

- **Surveillance total electrical power by monitoring each zone**
- **Peak shaving & load management** (using ESS & Peak Demand Controller)
- **Energy analysis in each system** (using Geothermal System & PV System & EV System)



HVAC

Equipment


Air Handling Unit


FCU

Field Device: Temp. Humid Pressure. Power.

- **Energy Consumption Analysis**
- **Heating and cooling capacity of the air**
- **FAN efficiency(Evaluate the Efficiency of Supply fan and Ventilation fan)**
- **Indoor environmental assessment**(Temp./Humid, CO_2)
- **EMS interlocking control I/F for maximum energy savings**

Lighting


Master Slave


Micro Wave Sensor (Dimming Controller)

- **LED Lighting System**
- **Automatic dimming by lighting level**
- **Schedule/Zone/Pattern controls(ON/OFF)**

System Architecture _ Hierarchy Design

Management

SI 주 Server

SI 예비 Server

Duplexing

FMS Server

2 X 6 Display

BEMS/ BIM Server

DB Server

Smart Phone

Ethernet / BACnet IP, Modbus TCP, OPC, SQL

Operation

Device/ Electrical

Lighting/ Dimming

Remote Meter

Fire

ELEV.

Parking Control

Access Control

CCTV

PV

Geothermal

ESS

LON

Monitoring & Control

DDC

PLC

WDC

Dimmer

LCP

R-type Receiver

ACU

NVR

Invert

Geothermal

PCS

Automatic Blinder

Field Device

Temp.

Humid

Pressure

Valve

Actuator

Prog. SW.

LED

Panel Boards

Watt-hour Meters

Electrical Measuring

Relay

Area Alarm

Sensor

Elevator

Elevator

Recognizer

Breaker

Reader

Entry Button

Door Lock

Card Reader

Dome Camera

Fixed Camera

Module

Monitoring

Heater Pump

Cold&Hot Water Circulation Pump

Underground Circulation Pump

GIMAC-i

Section Controller

BATTERY

Distribution Panel

Parking Guider Light

Cooling Tower

Cold & Hot Water Dispenser

Boiler

FCU

Air Handling Unit

FAN

BACnet/IP

Modbus TCP

TCP/IP

RS - 485

CAN

Hardwire

Application at the each Floor

Energy Grid

Photovoltaic(50kW)

roof

9F · · · 2F

Smart Meter

LED Lighting(8F) (Illumination Sensor)

Smart Plug (8F)

Automatic Blind (8F)

Office Space

Common Space

1F

Smart Meter

Saving sensor

LED Lighting

KIOSK

Energy Information Screen

PV Status board

EV & Charging infrastructure

B1 · · B3

Measuring & Metering

Geothermal

Inverter

Demand Controller

DG

Switchboard

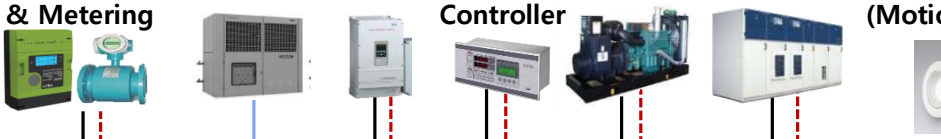
LED Lighting (Motion Sensor)

(B2F)

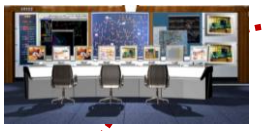
PCS(1MW)

Battery (1MWh)

ESS(B3F)



Operation center



Outside Interface

Power

D/R

HVAC

BEMS

Lighting

ESS

AMI

Operation center

Power Grid

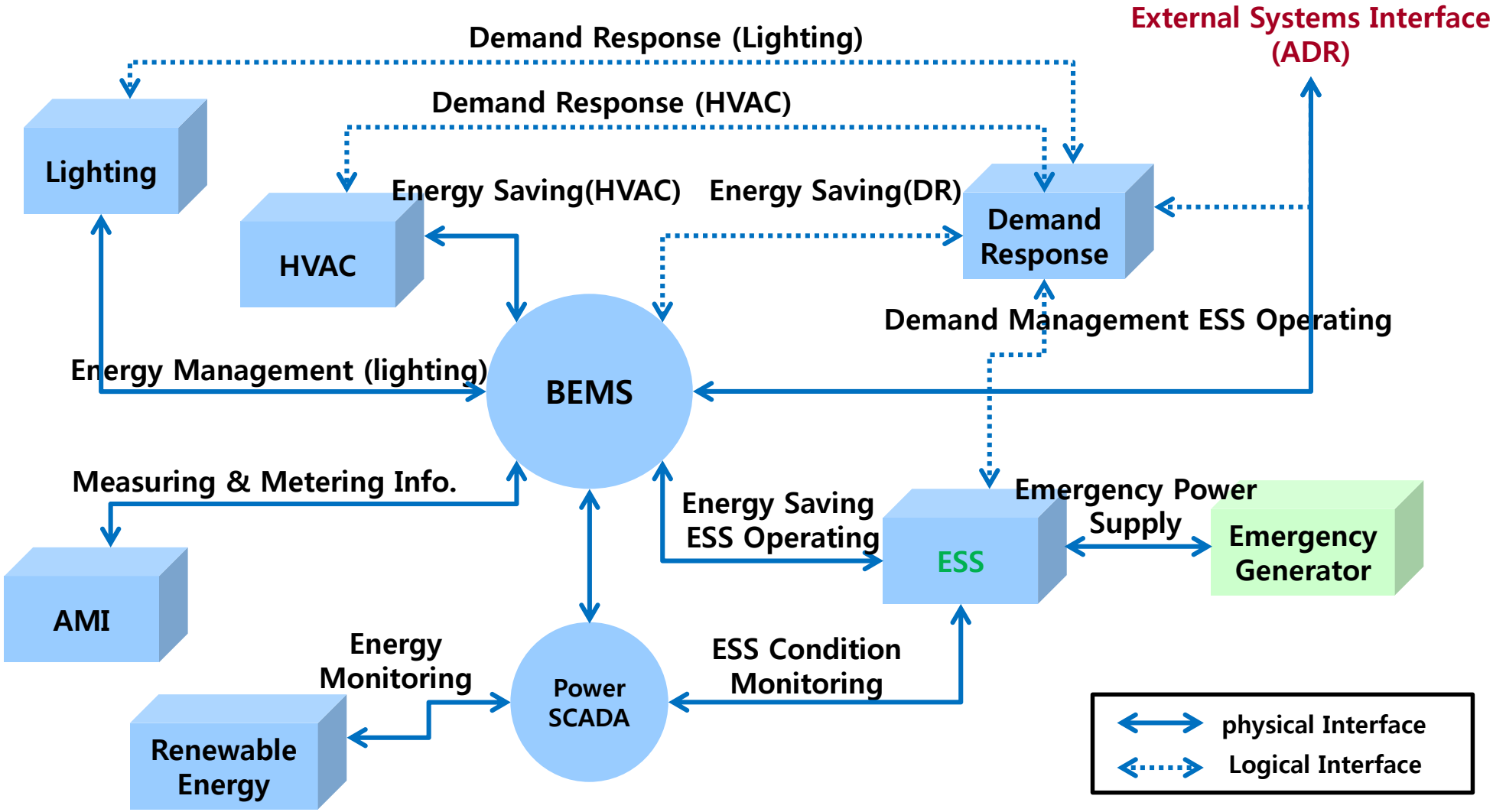
Heat Grid

ESS : Energy Storage System

PCS : Power Conditioning System

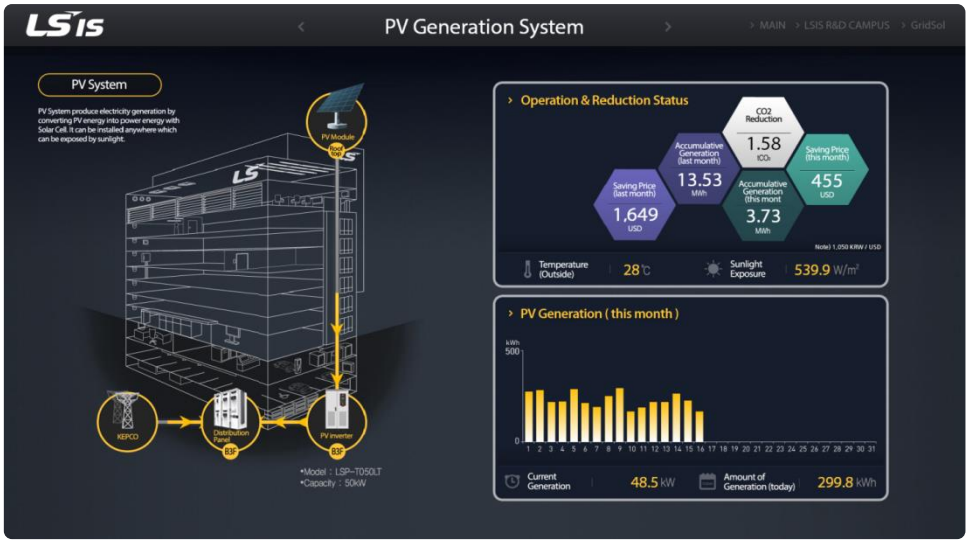
Communication

Quality, Amount, Processing, Storage of Data

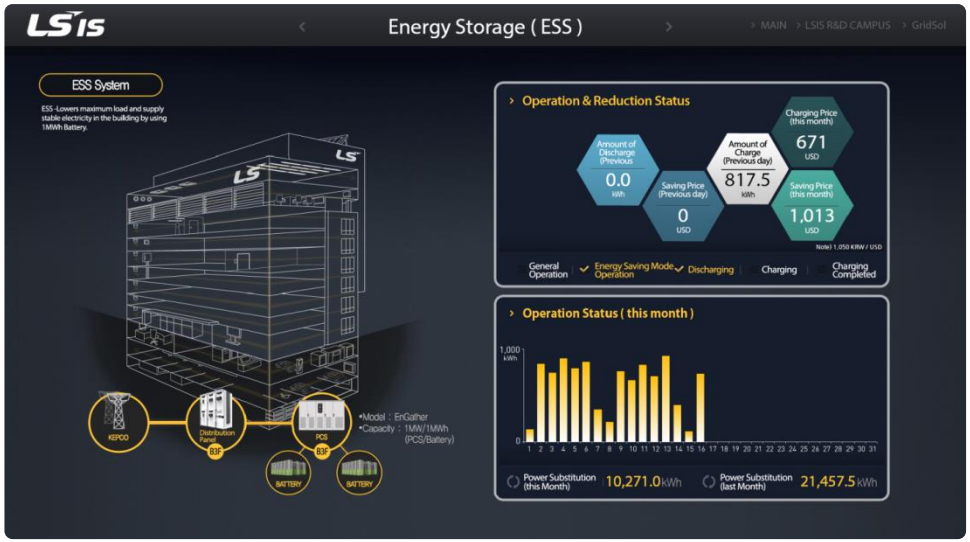


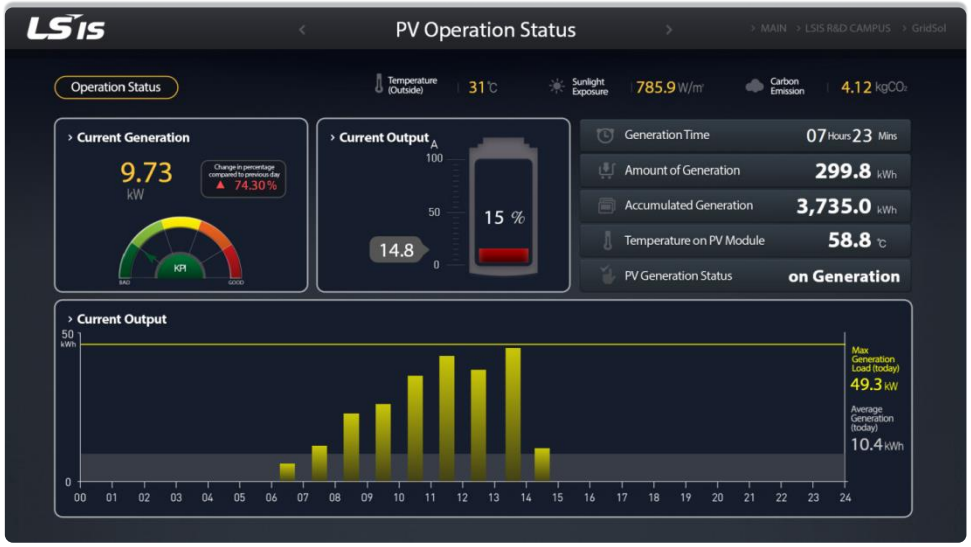
Monitoring, Analytics, Management

< PV Generation >

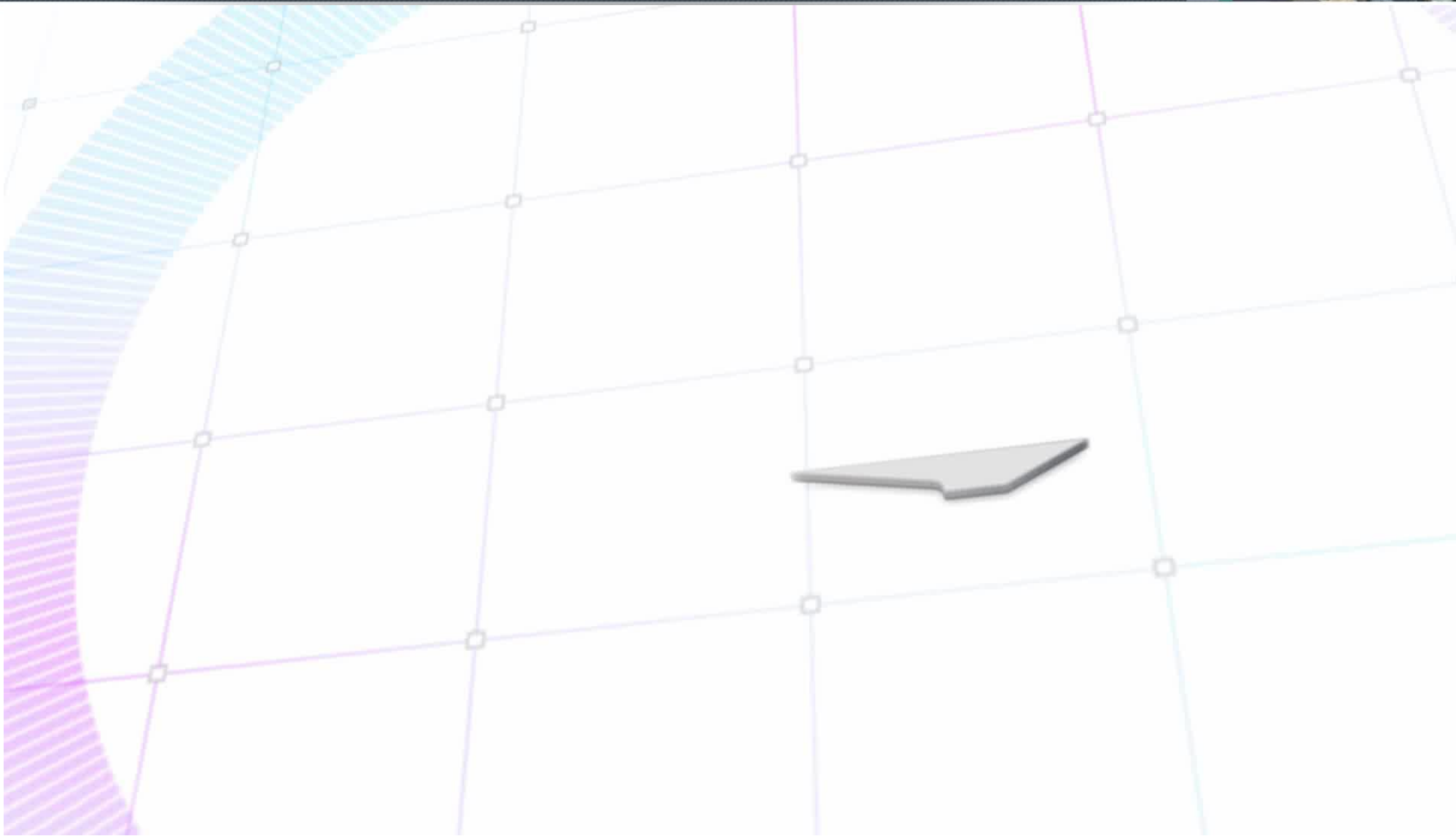


< Energy Storage System >



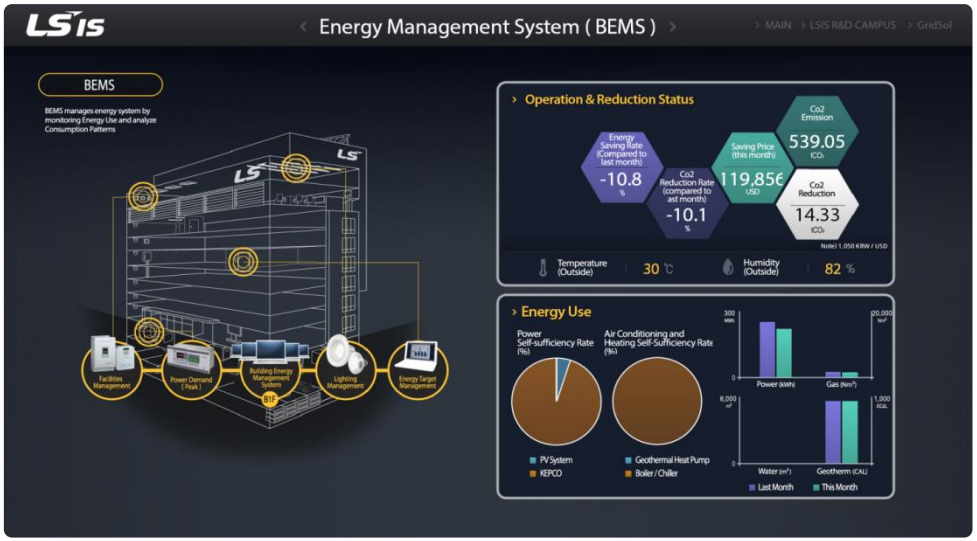


Others(Emergency Operation of ESS)



Monitoring, Analytics, Management

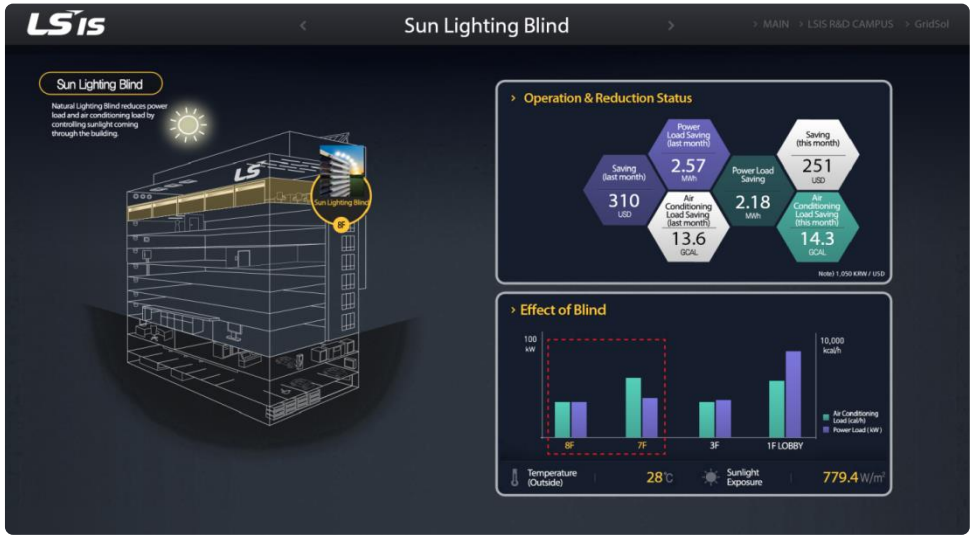
< BEMS >



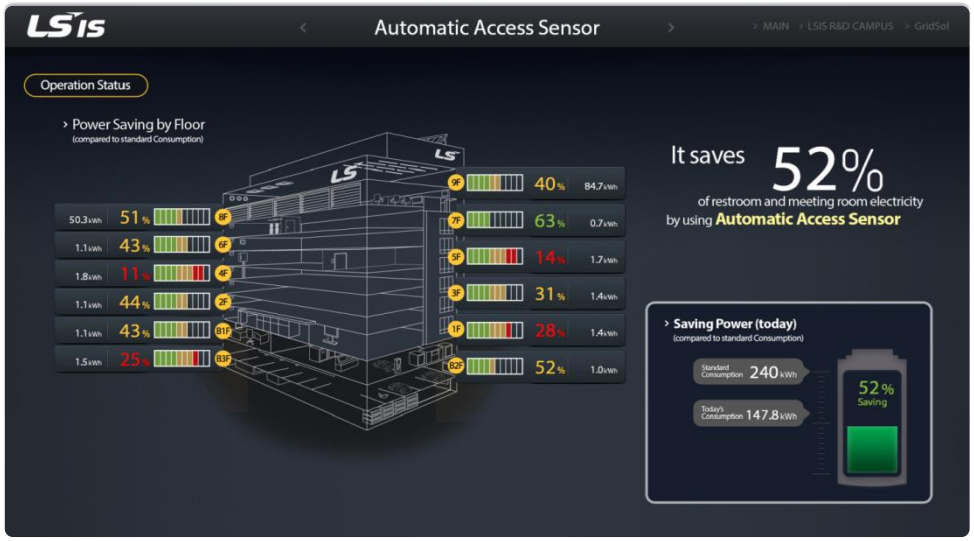
< LED & Diming >

Monitoring, Analytics, Management

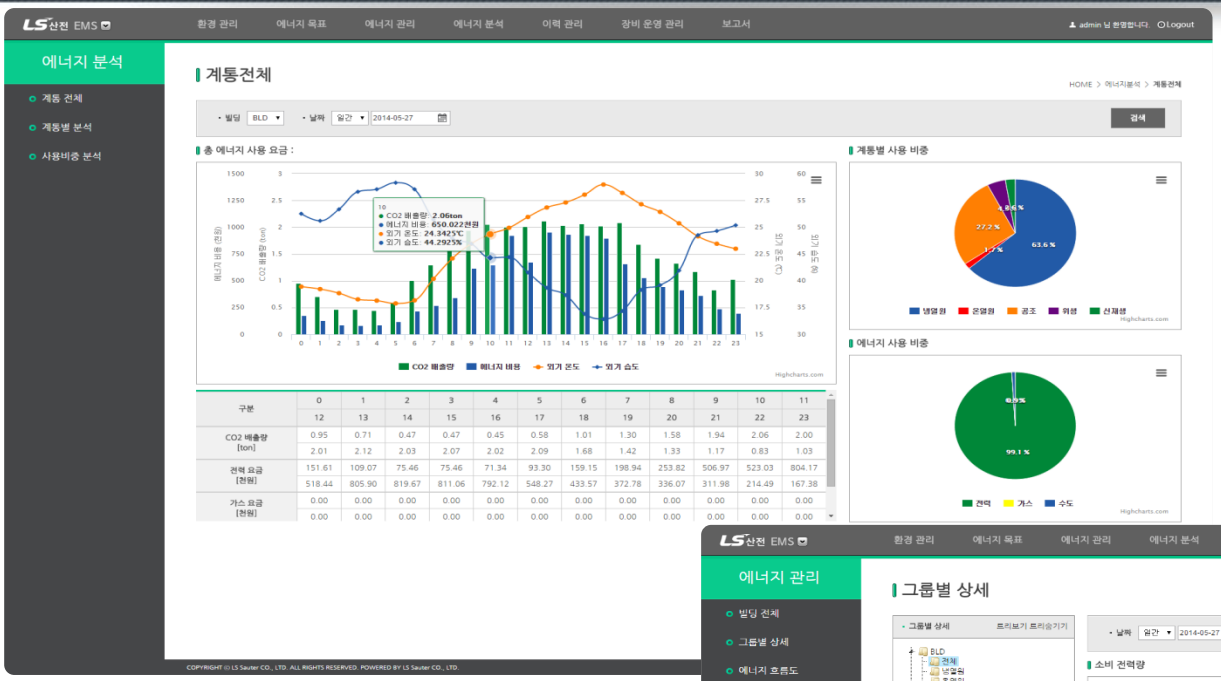
< Automatic Blinding >



< Automatic Access Sensor >

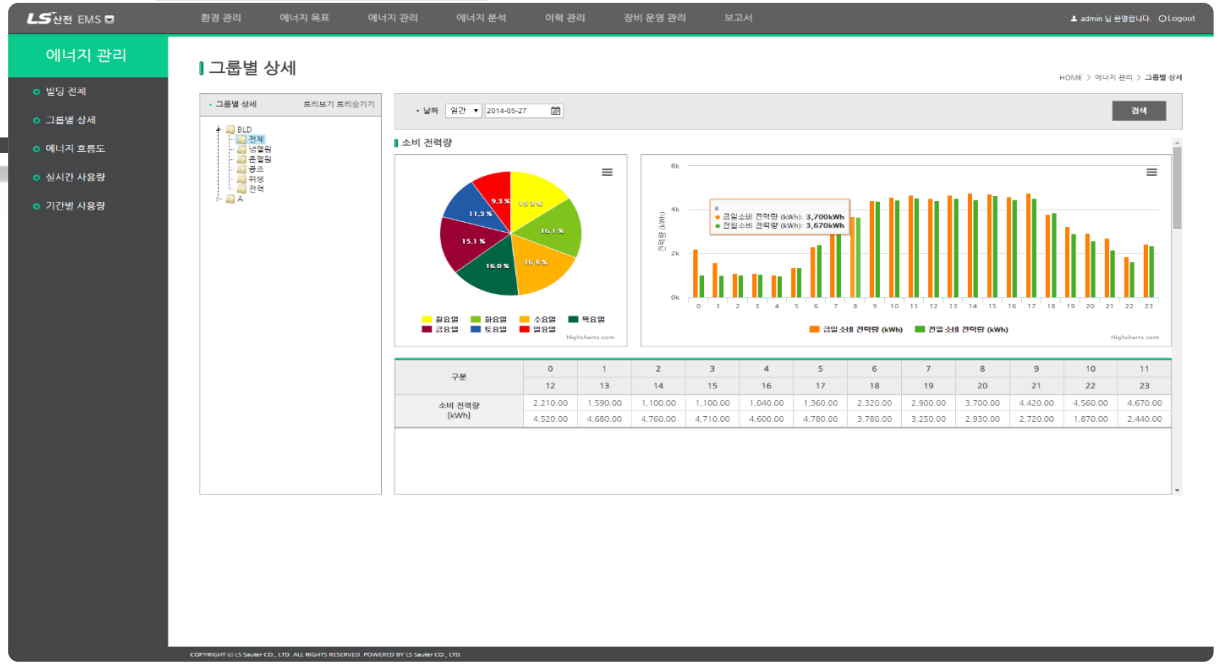


Monitoring, Analytics, Management



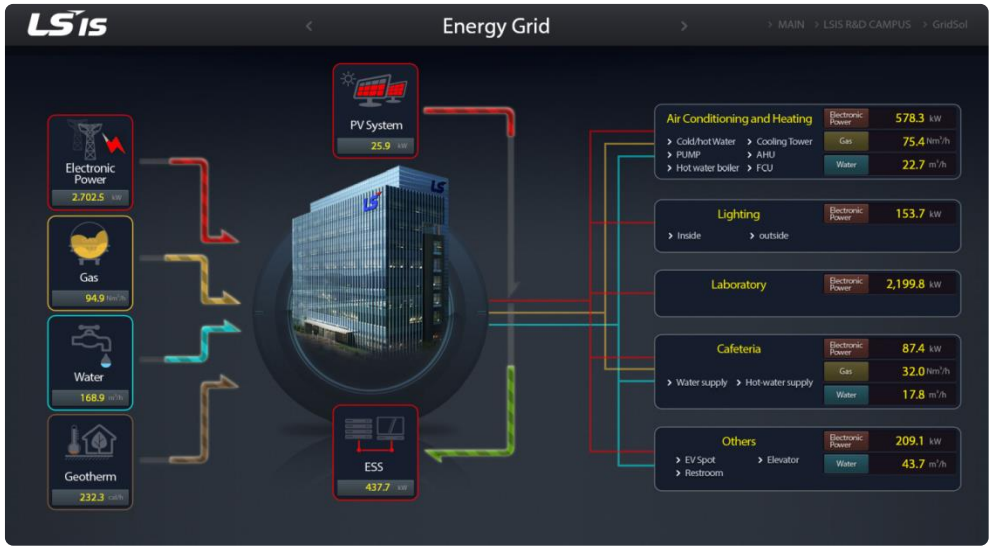
< Energy Analytics >

< Energy Management >

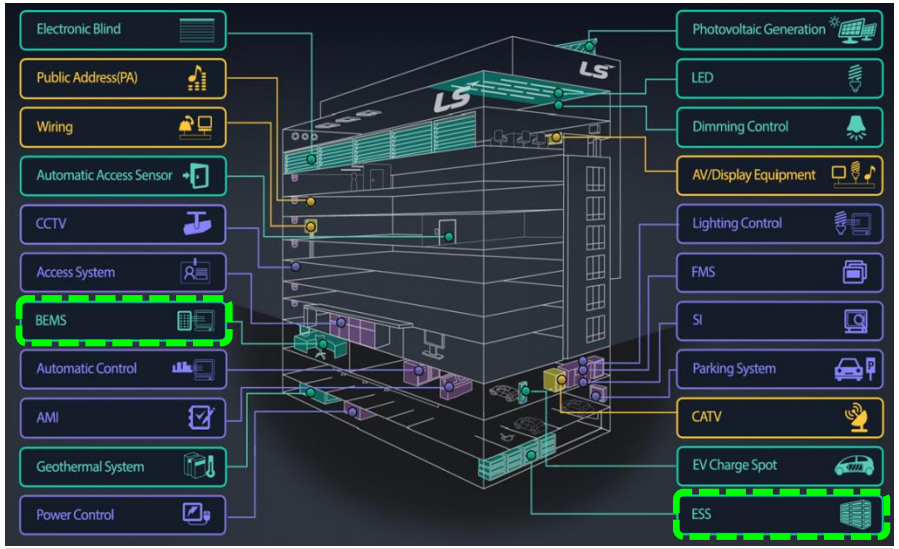


Monitoring, Analytics, Management

< Energy Flow & Energy Saving >



< BEMS & ESS Station >



■=Smart Grid, ■=Building Automation, ■=Office Automation / Tele-Communication

➢ **BEMS Station (B1F)**

➢ **ESS Station (B3F)**

Benefits

PV

- Capacity : 50kW
- Module : 265WX190EA

64,605kWh ↓

$ 8 k

ESS

- PCS Capacity : 1MW
- Battery : 1MWh

* Emergency : 300kWh

$ 37 k

LED

- 22WX2X309EA(8F)
- 16/22WX322EA(B2F)

38,762kWh ↓

$ 4 k

Dimming control

- Illumination Sensor(8F)
- Motion Sensor (B2F)

54,995kWh ↓

$ 6 k

Automatic Blind

- 8F application
- Automatic Blind

✓ Unused : 800W/m²
✓ Use : 200W/m²

80,180,807kCal ↓

$ 10 k

Access sensor

- Meeting rooms
- Toilets
- hallway

10,787kWh ↓

$ 1 k

EV

- EV 1 ea
- Slow charger 2 ea

Gasoline 2.4k Liter ↓

$ 4 k

Geothermal

- Capacity : 50RT

✓ **LNG : 64,273Nm³ ↓**
✓ **Elec : 127,903kWh ↑**

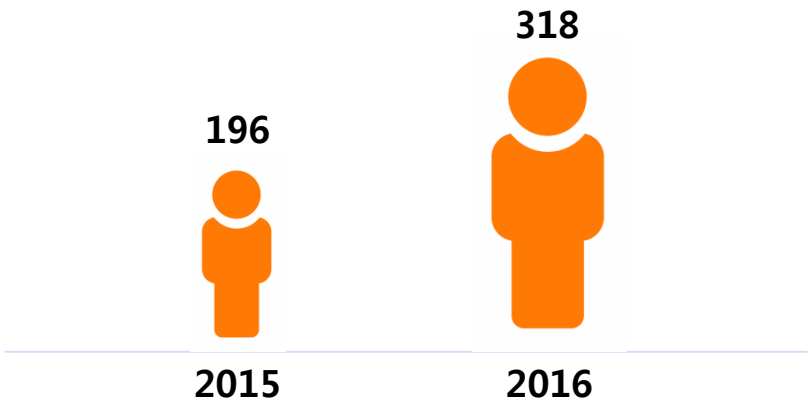
$ 44 k

Peak Demand 10~14% ↓ | **Energy Saving 9~11% ↓** | **Energy Cost $114 k ↓**

☞ Reminding Energy Management

☞ Promotion & Education of BEMS

< Trend of Visitors >



< BEMS Station(B1F) >

Challenges, Solution, Next Steps

▶ Challenges

- Monitoring vs Control : Focus on Monitoring
- Renewable Energy System Item : Adding BIPV, Fuel-cell

▶ Solution

- According to Government Initiative
  - “Zero Energy Building”
  - “ESS Installation in Public Building”

▶ Next Steps

- Analytic Performance upgrade with Big-Data
- Application of Demand Response
- Development of ESS with UPS Function

Thank you!

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