Campus Microgrid Project in Korea: Development and Demonstration of IoT based Campus Microgrid

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Campus Microgrid Demonstration Project Overview

Completion	Buildings
1970s(1st)	46
1970s(2nd)	35
1980s	27
1990s	33
2000s	43
2010s	32

- **Site:** SEOUL NATIONAL UNIVERSITY(SNU), KOREA
- **Project Budget:** 15.7 million USD (Government 10.3M, Private 5.4M)
- **Project Period:** 2015. 06 ~ 2019. 05 (for 4 years)
- **Project Goal**

  Development of a customized SNU Campus MG model to provide

  1) 4 hours islanding operation to critical loads

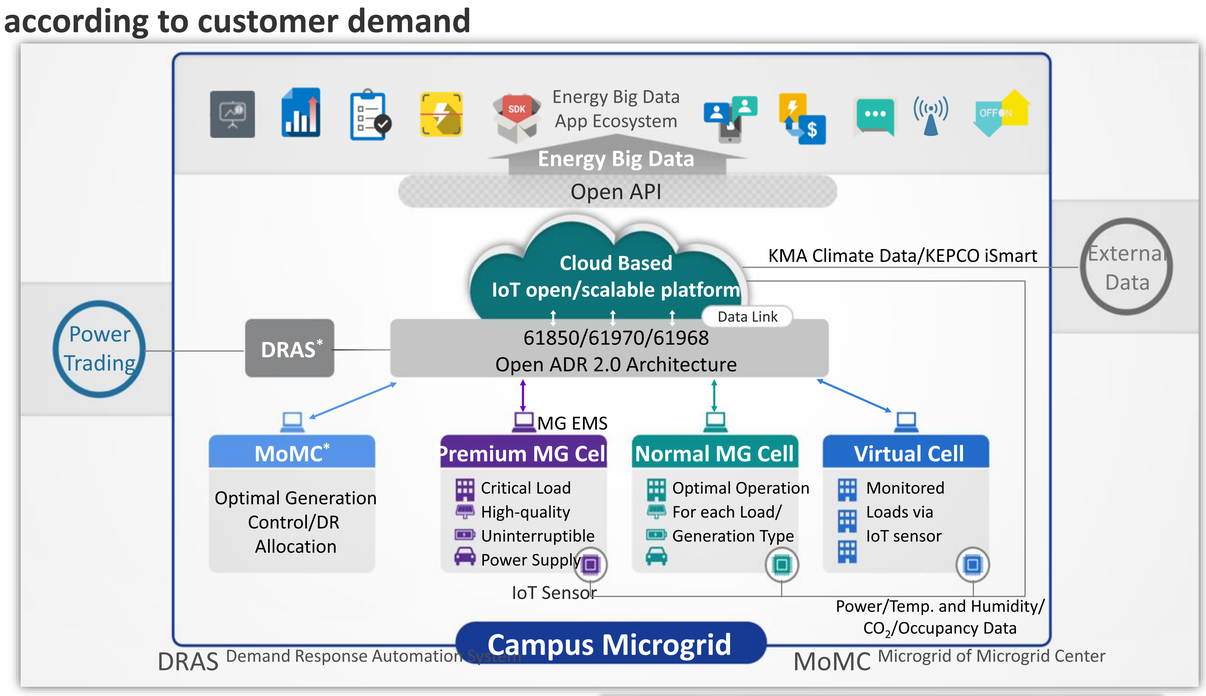
  2) 20% peak load reduction and energy cost saving based on campus operating model

  3) Consumer participative energy-saving services by employing Big Data platform

SNU Campus MG Conceptual Model

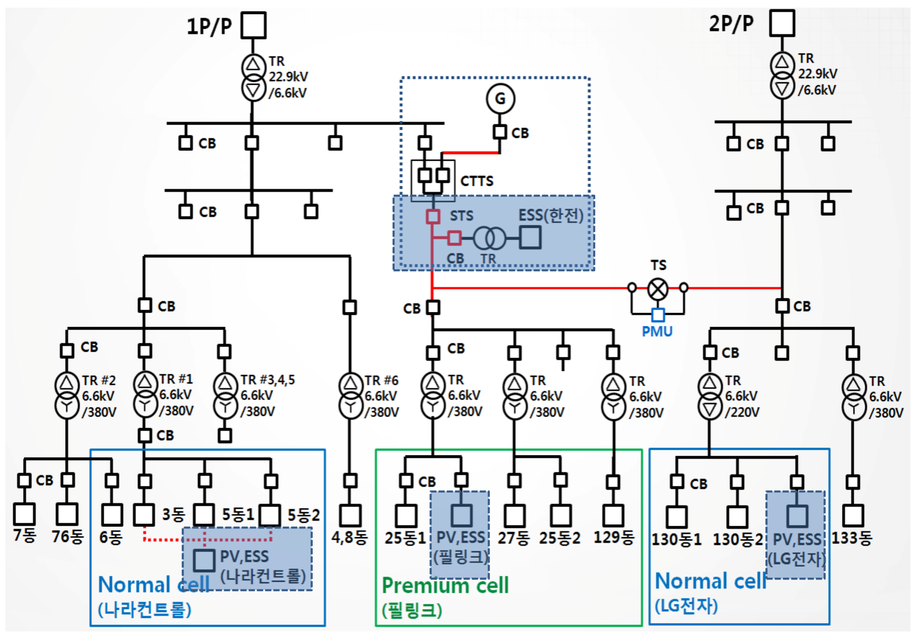
- **Cell region:** Efficient energy operation
- **Cloud region:** Providing variety of IoT based services

Lego style Campus MG Customized Model enabling flexible configuration change according to customer demand



Generation focused Microgrid → Fusion of generation and consumption in Microgrid; IoT convergence based Microgrid

System Configuration for the Demonstration



[DERs of this project]

1) for seamless transfer islanding operation
- ESS : 1MW/1MWh

2) for islanding operation
- Diesel Generator : 2MVA

3) for energy savings
- ESS, PV

Premium MG Cell

- Cell targeting critical loads (research buildings, hospitals, etc.) requiring uninterruptible power supply and quality
- 4 hours uniterruptible operation and 20% energy savings

Normal MG Cell

- Cells with DGs and targeting general loads (lecture halls, dormitories etc.) that require energy efficiency
- 20% savings in energy costs and peak load

Virtual Cell

- Cell consisting of general loads without DGs that provides energy-saving services based on the analysis of information from IoT sensors
- 10% energy savings through IoT based user participatory energy service platform

Test Results

Premium MG Cell

Seamless transfer islanding operation test

1) Best-condition Case

- condition : standby mode without charging or discharging
- results : seamless transfer islanding operation within 85% of voltage magnitude and within 10ms of transient state

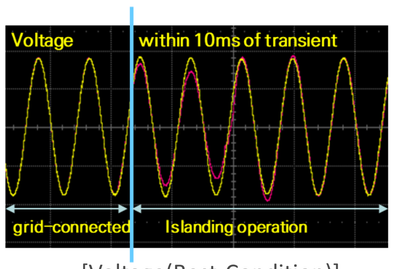
➔ Confirmed that it is possible to uninterruptible islanding operation.

2) Worst-condition Case

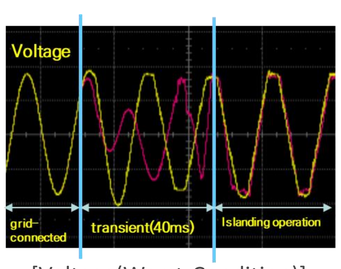
- condition : 1MW charging state
- results : transfer to islanding operation within 40ms of transient state

➔ There is a voltage drop(30%) when transfer to islanding operation, but uninterruptible islanding operation for normal load* is possible.

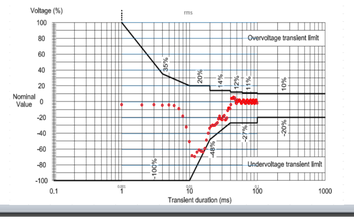
(* IEC62040-3 class 3 : standard of office equipment)



[Voltage(Best-Condition)]



[Voltage(Worst-Condition)]



[IEC62040-3 class 3 satisfaction (Worst-Condition)]

Normal MG Cell

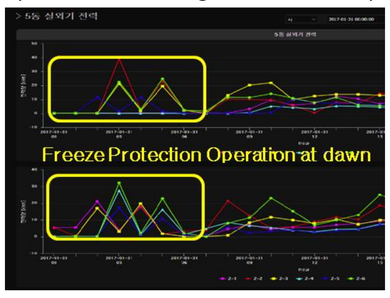
20% reduction of energy cost and peak load by energy efficiency technology

1) Identify energy wastage factors with IoT data analysis

- As a result of analyzing the internal temperature, it is confirmed that there is almost no change in the internal temperature with respect to the outside temperature change.

2) Efficient operation through EHP control

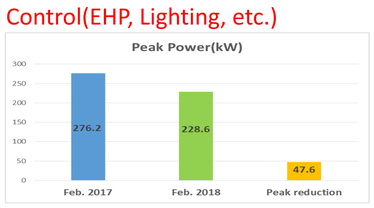
- 2.8% cost saving based on the test period(winter) by efficient operation according to internal temperature.

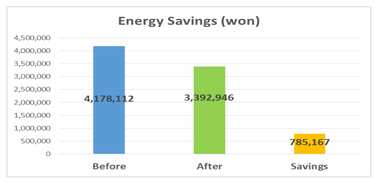


[EHP Outdoor Unit Power – Before]

[EHP Outdoor Unit Power – After energy savings operation]

3) Peak reduction 17.25%, Energy savings 18.8% by ESS, PV, Equipment Control(EHP, Lighting, etc.)





	Feb. 2017	Feb. 2018	Reduction	
Peak Load(kW)	276.2	228.6	47.6	17.2 %

	Before	After	Savings	
Energy Savings(Won)	4,178,112	3,392,946	785,167	18.8 %

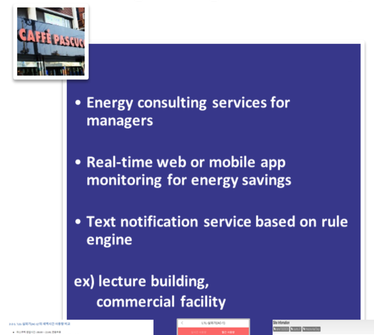
Virtual Cell

10% Energy savings by energy consumption analysis and user participation

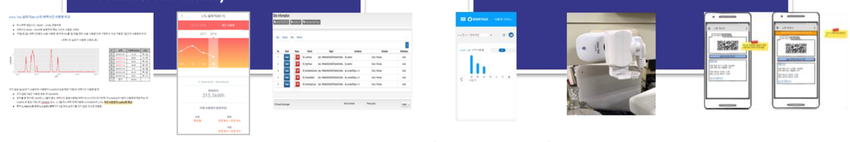
1) Big data platform implementation for energy analysis and energy pattern analysis at each buildings

2) Develop a special saving program classified as manager-centered savings and member-participant savings programs

[Building manager-centered]

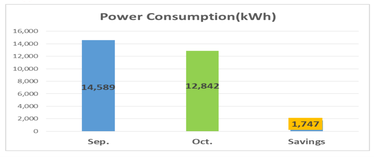


[Member-participant savings]



[monthly report] [mobile app] [text notification] [energy monitoring] [smart plug] [energy savings]

3) User participation program reduced power consumption by 11% per month



	Sep. 2017	Oct. 2017	Savings	
Power Consumption(kWh)	14,589	12,842	1,747	11 %