

# The Cost effective technology of PV+ESS+EMS for islands in Maldives

Dr. YT, KIM ([ytkim@battery.or.kr](mailto:ytkim@battery.or.kr))

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**KORBA** Battery R&D  
Association of Korea

**KBIA** Korea Battery  
Industry Association





## Foundation

- Established on Nov. 1 2011 under the MOTIE (Ministry of Trade, Industry & Energy)

※ Having operated as Battery R&D Association of Korea since 1997

## Main Mission

- To support the government to make plans and policies for battery industry
- To spread government policies to battery companies
- To establish the infrastructure needed for the growth of national battery business
- To induce foreign investment on battery industry and promote international cooperation
- To research and analyze information of battery

# Korea Battery Industry Association

About KBIA



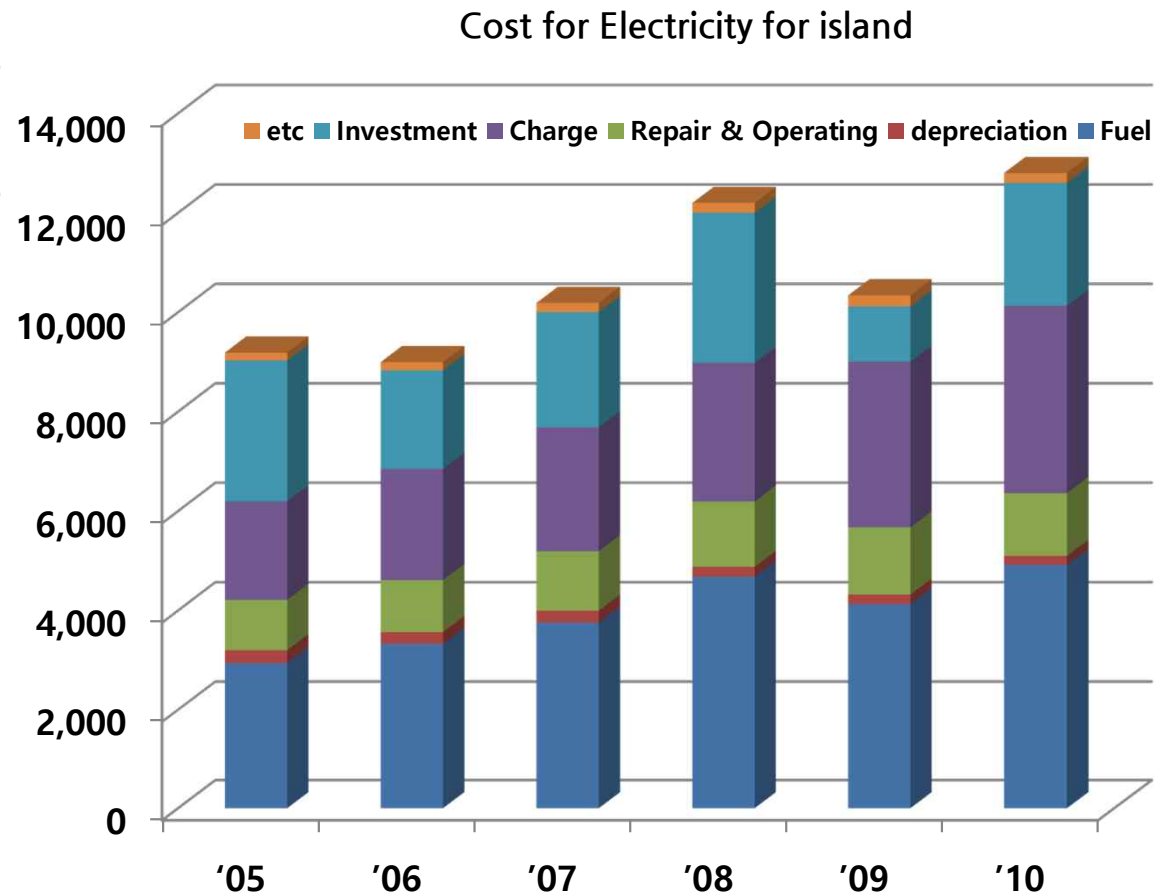
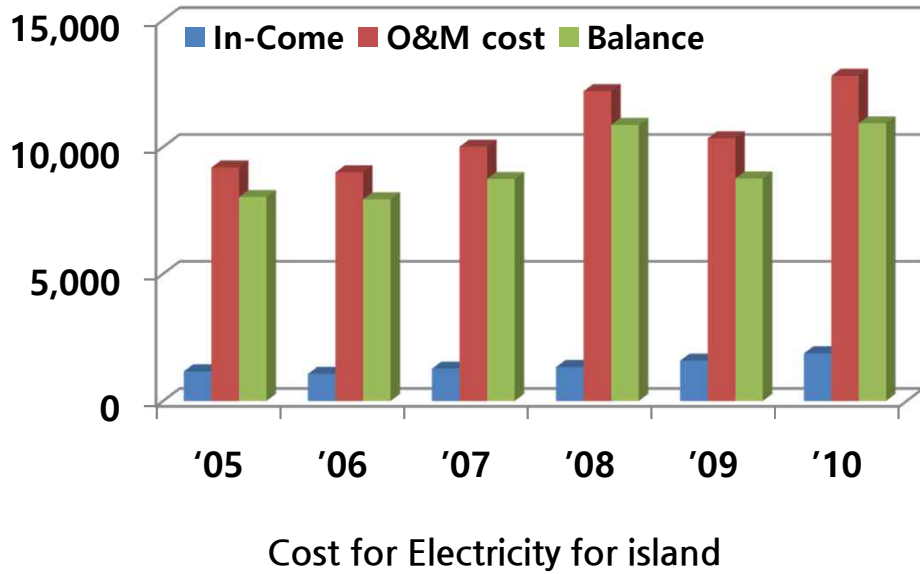
## Members of KBIA

Battery manufacturers (12)	SAMSUNG SDI, LG Chem, SK Innovation, Kokam, Sebang etc.
Parts & materials companies (31)	GS Energy, POSCO Energy, Ecopro, Panaxetec etc.
Equipment/ system companies (13)	Hyundai MOBIS, PNE Solution, Woojin, Hanwha etc.
Others (3)	KETI, KIER, KERI





## 64 Islands in Korea





## Remote Micro-grid Systems in Woojin





Configuration of Remote Micro-grid Systems



10kW Wind Power



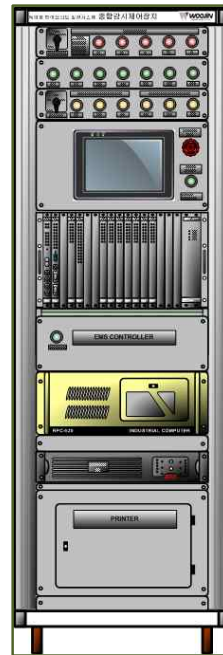
10kW Wind Power



3kW Wind Power



10kW PV Power X2



EMS



50kW Diesel Generator



60kW Diesel Generator



94kWh Energy Storage System



'13 Energy Storage Technologies and Applications (ADB)



Mini Grid



A kind of Smart grid project (Yunicos)



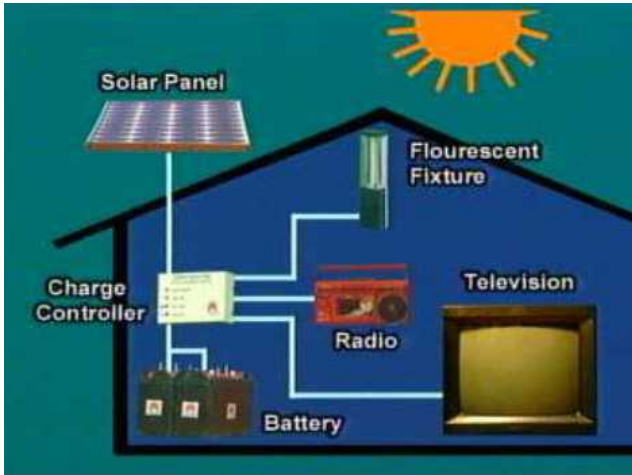
Sanyo LIB system



Italy



'Energy Storage for the bottom of pyramid in India' from SELCO



Solar Home Lighting systems



Central charging models- Street hawkers, education



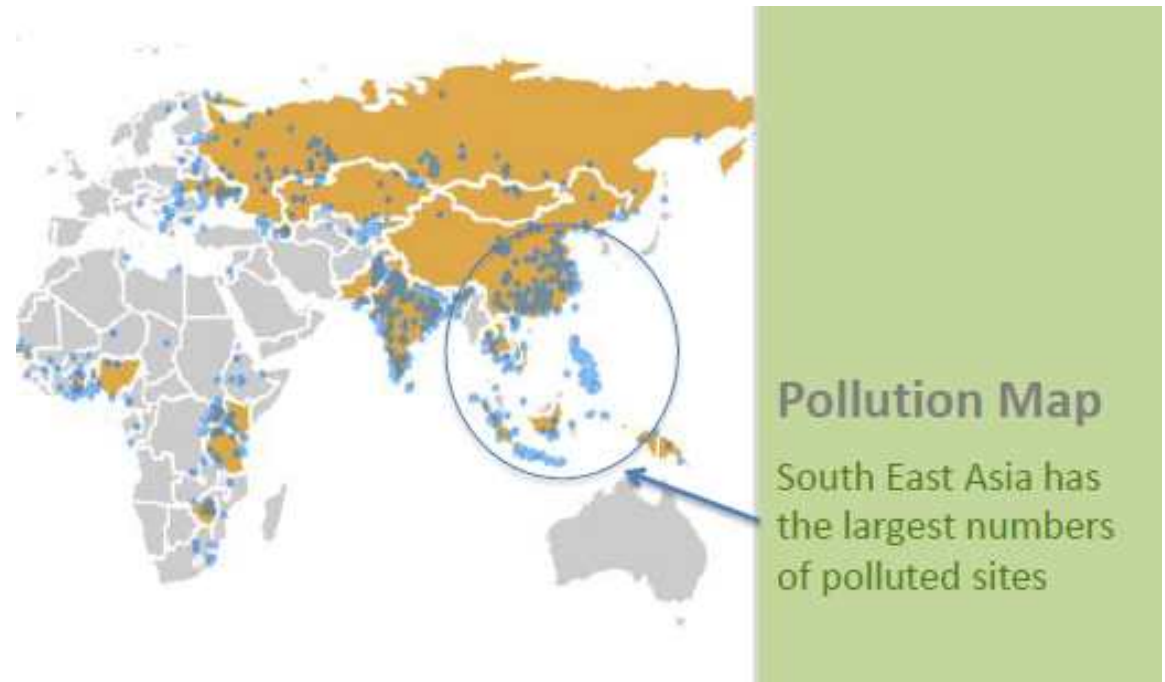




'The World's worst pollution problems from Ecoglobal Inc.



Lead waste and Lead smelting



South East Asia has the largest numbers of polluted sites



Interested in Lithium Battery for Energy Storage system, Sustainable and Maintenance free system



# 1<sup>ST</sup> INTERNATIONAL RENEWABLE ENERGY INVESTORS CONFERENCE

INVESTING IN RENEWABLE IN THE MALDIVES

JUNE 15-17, 2013, BANDOS ISLAND RESORT, REPUBLIC OF MALDIVES

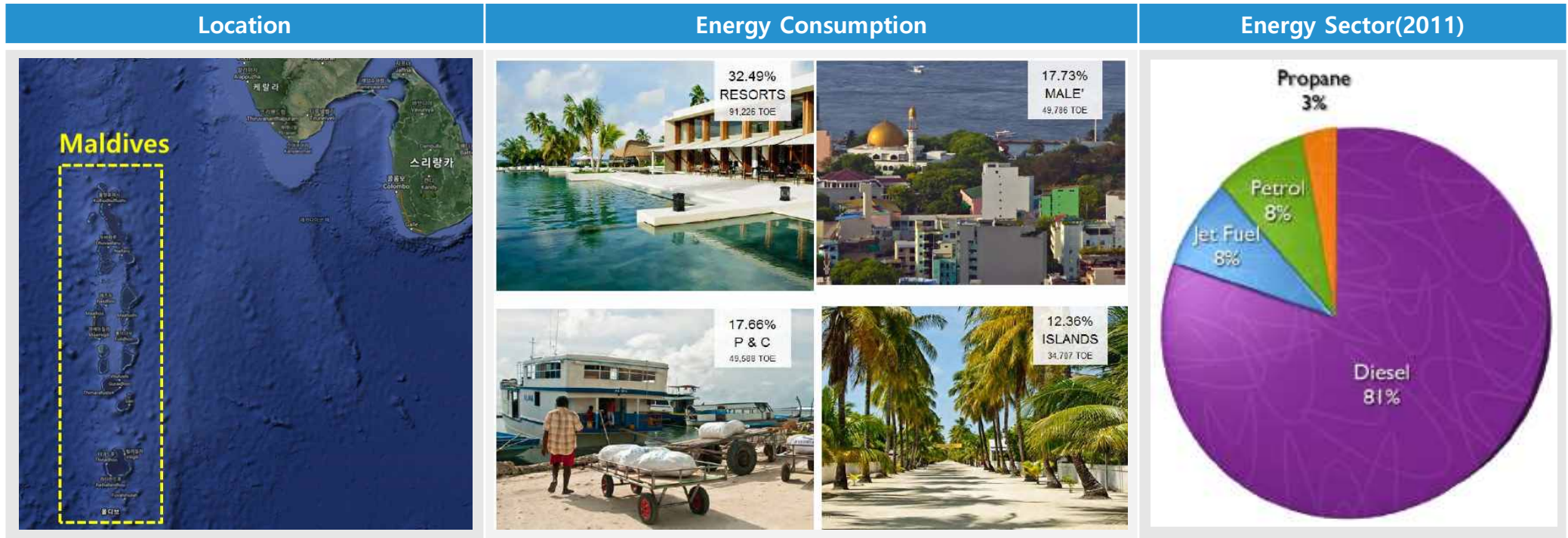


THE WORLD BANK





## “ The best environment condition for PV+ESS System ”

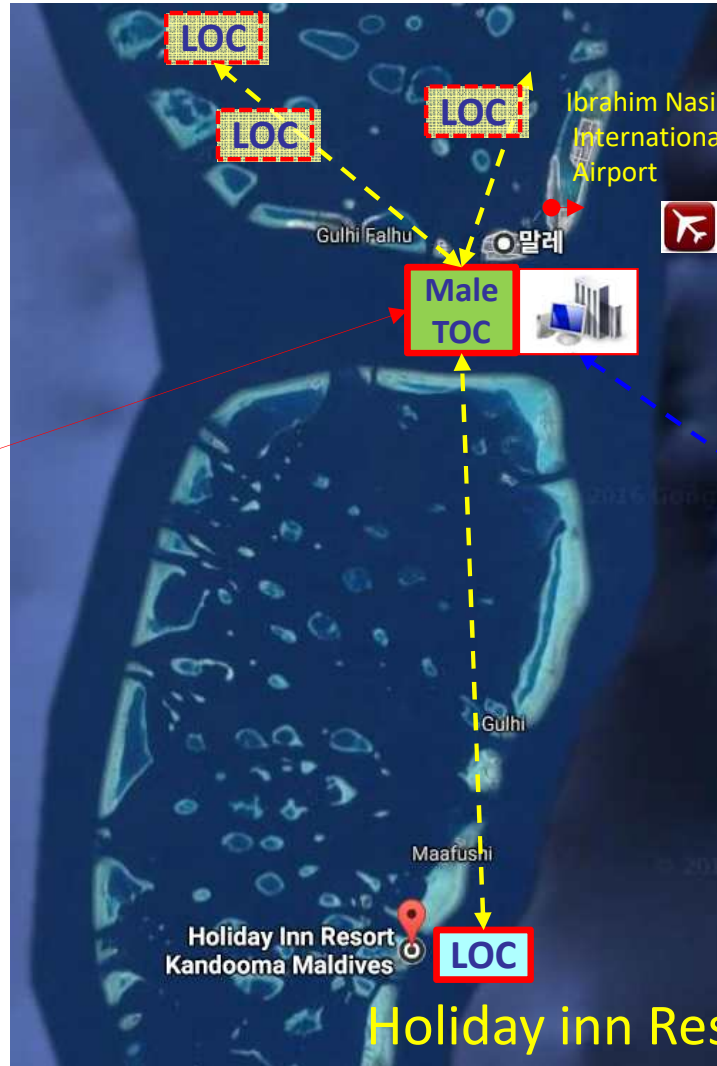


Island, Fuel transportation Cost, Diesel generator, Energy consumption

US\$ 0.45/kW



TOC(Total Operating Center)

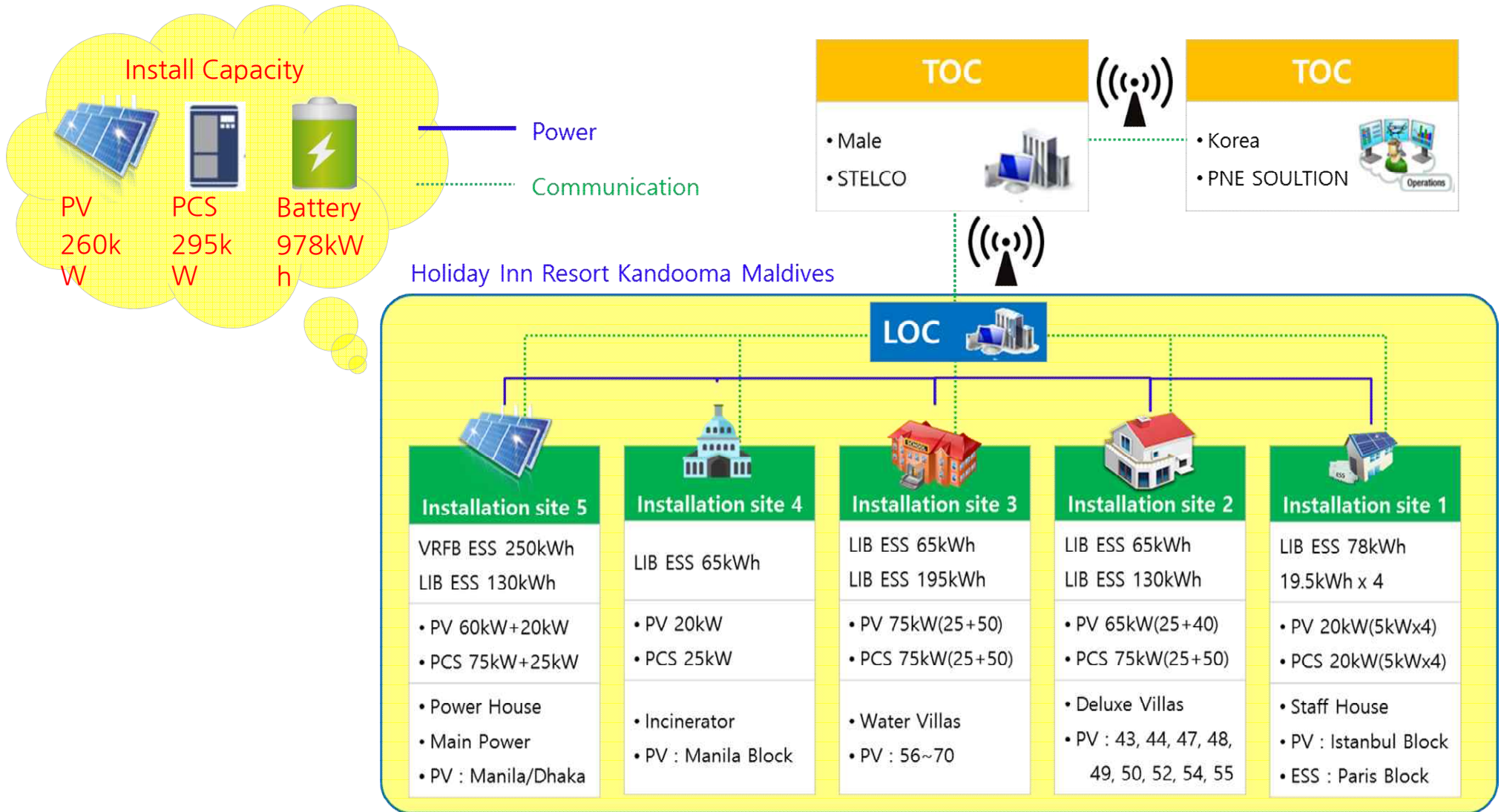


Holiday inn Resort





# Demonstration Project of Multi-site PV-ESS System





Company	PNE SOLUTION Co., 	Wonkwang Electric Power Co., 	H2 Co, LTD 
Task	System Design & Integration Power Conditioning System(PCS) Development of Energy Management System Total Operation Center	Analysis of Load Profile Environmental Analysis Construction of PV Power Grid	VRFB System Development 250kWh Module
Company	Korea Battery Association 	Korea Institute of Energy Research 	Yonsei University 
Task	Local Business Environment Research Establish Integrated ESS Standard (Domestic, Overseas) Strategy for expanding importation business	Performance Environment Test Develop Evaluation Method Establish VRFB Test Platform	Economic Analysis Develop Biz-Model Build ODA Cooperation Method



\* By the end 2018

- Operation and maintenance with PNE consortium
- Run TOC (Total Operation Center) at STELCO office

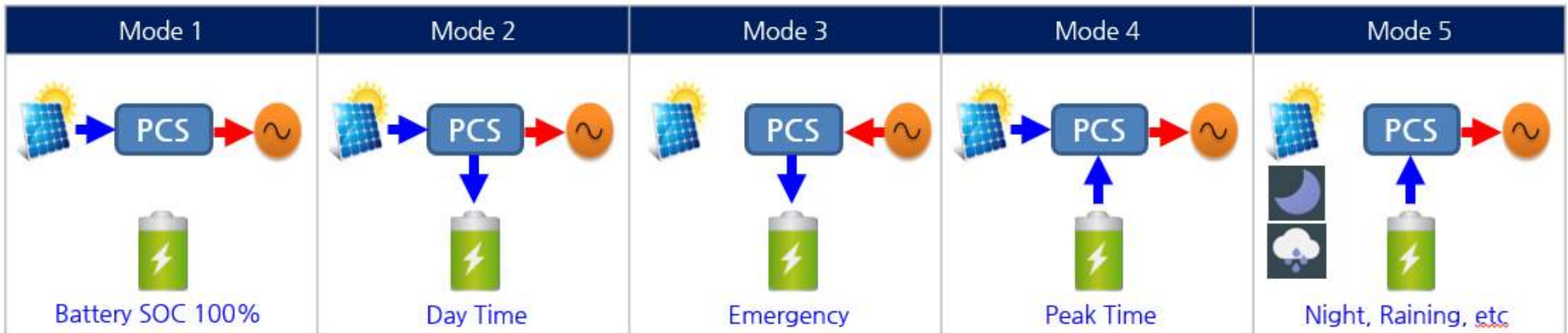
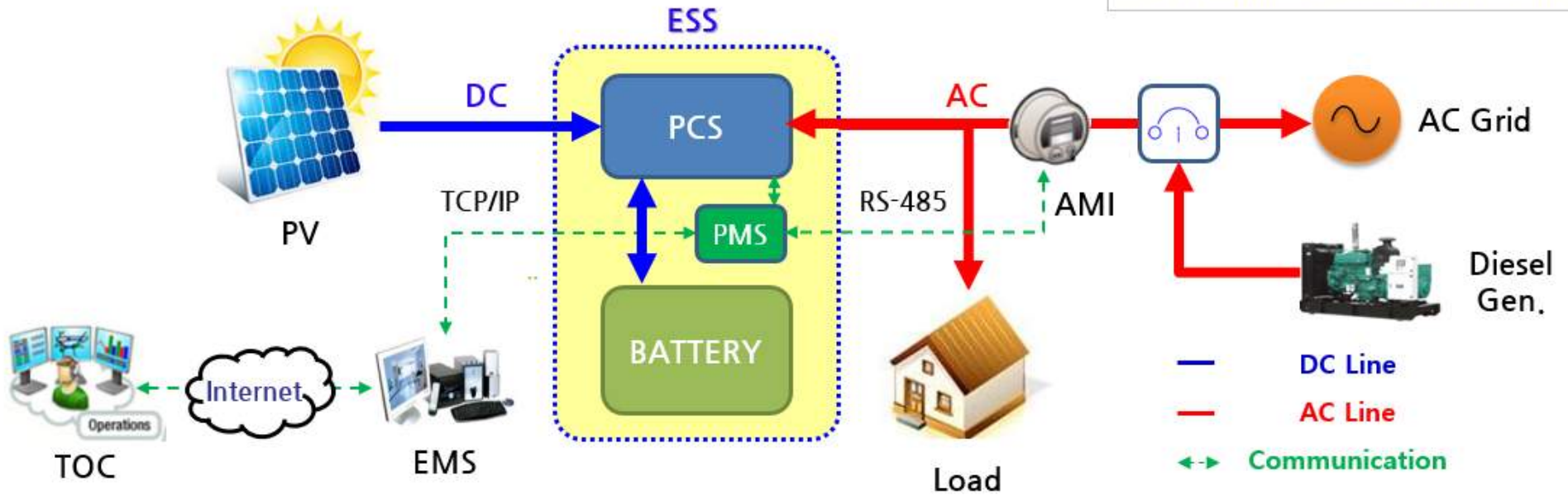
\* From 2019

- Operation and maintenance without PNE consortium
- Run TOC at STELCO office



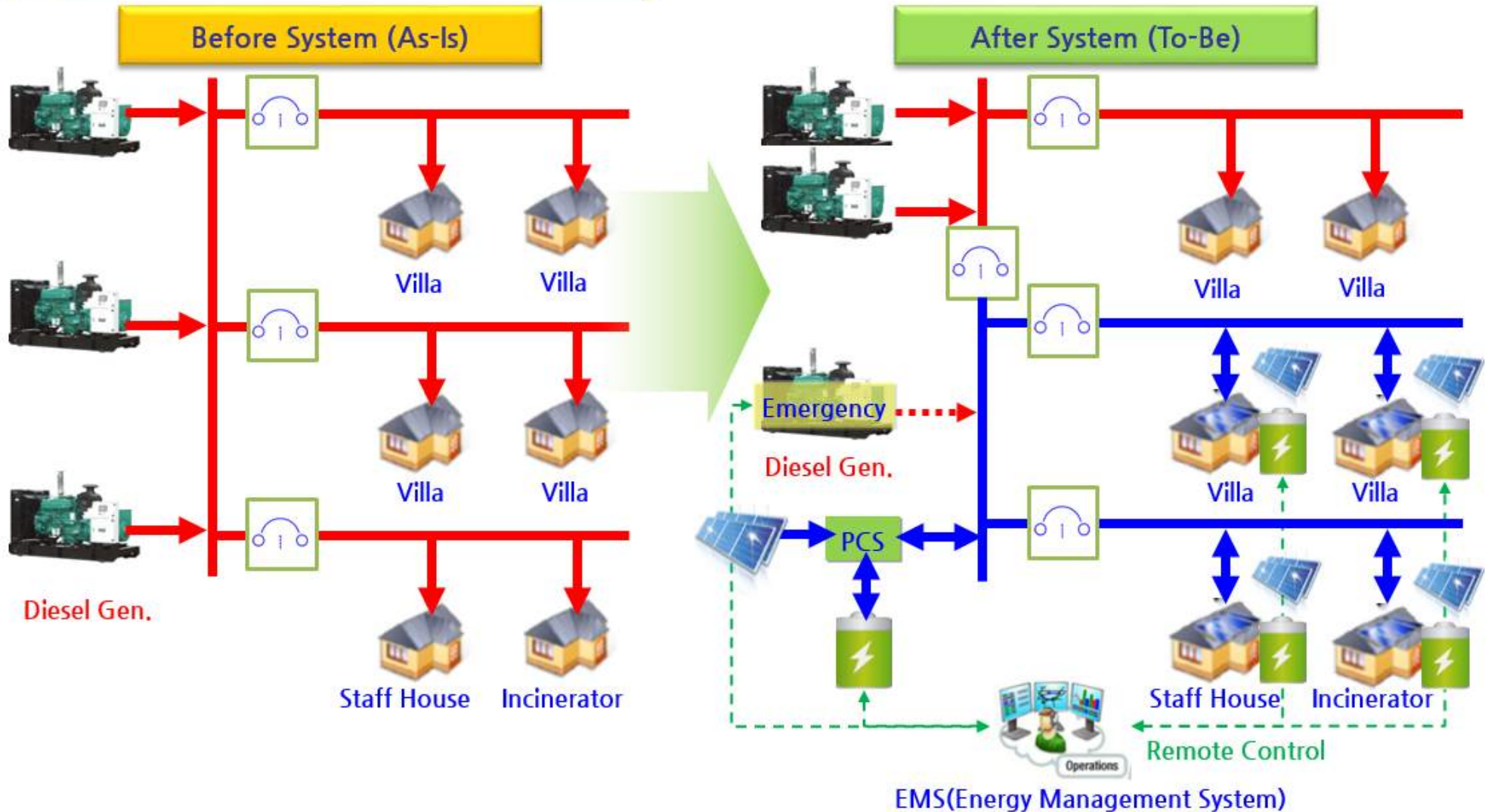
Energy Storage System

- \* TOC : Total Operating Center
- \* EMS : Energy Management System
- \* PCS : Power Conditioning System
- \* AMI : Advanced Metering Infrastructure





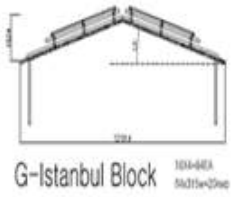
Concept Diagram of System







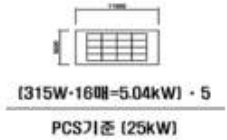
PV Installation site



G-Istanbul Block 1004-40A 5x21m-22m



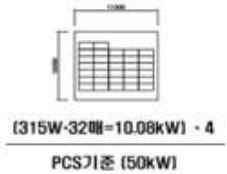
Istanbul Block : 20 kW



[315W-16매=5.04kW] · 5 PCS기준 (25kW)



Deluxe villa : 65 kW  
Room : 43, 44, 47, 48, 49, 50, 52, 54, 55



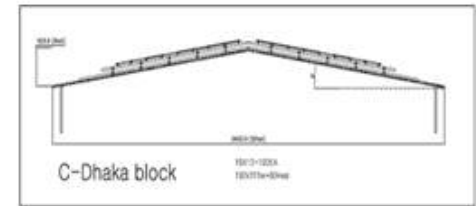
[315W-32매=10.08kW] · 4 PCS기준 (50kW)



Water villa : 75 kW  
Room: 56~70



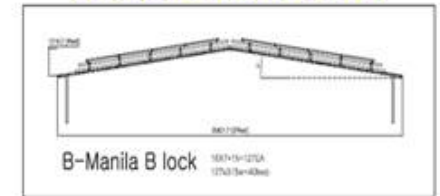
Dhaka Block : 60 kW



C-Dhaka block 1003-1004 10x17m-18m



Manila Block : 40 kW



B-Manila B lock 1003-1010A 12x13.5m-13m



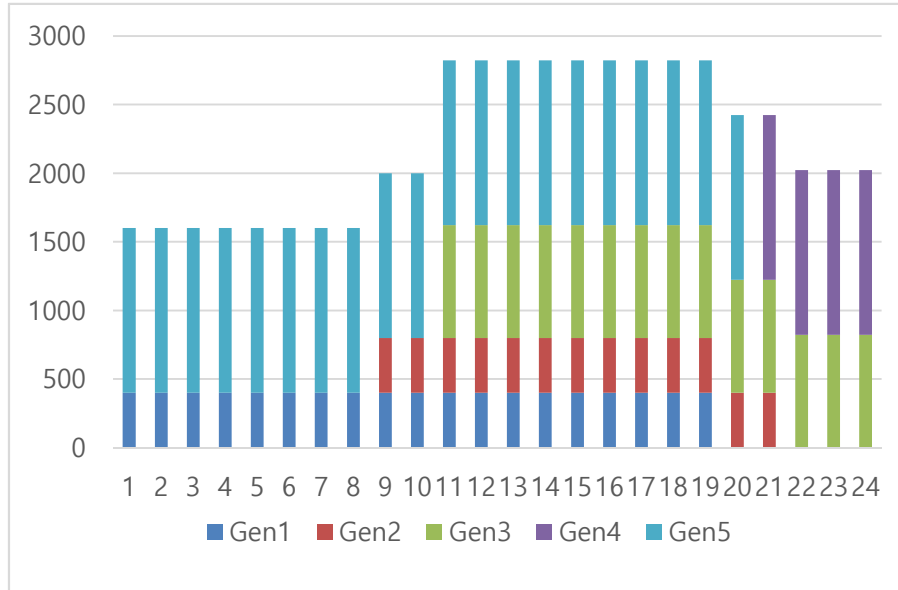
## Benefit



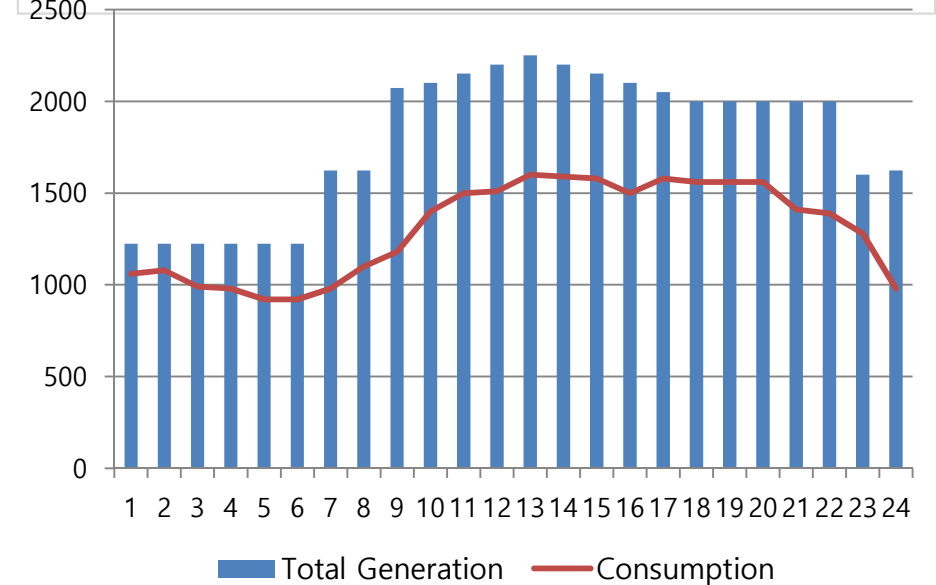
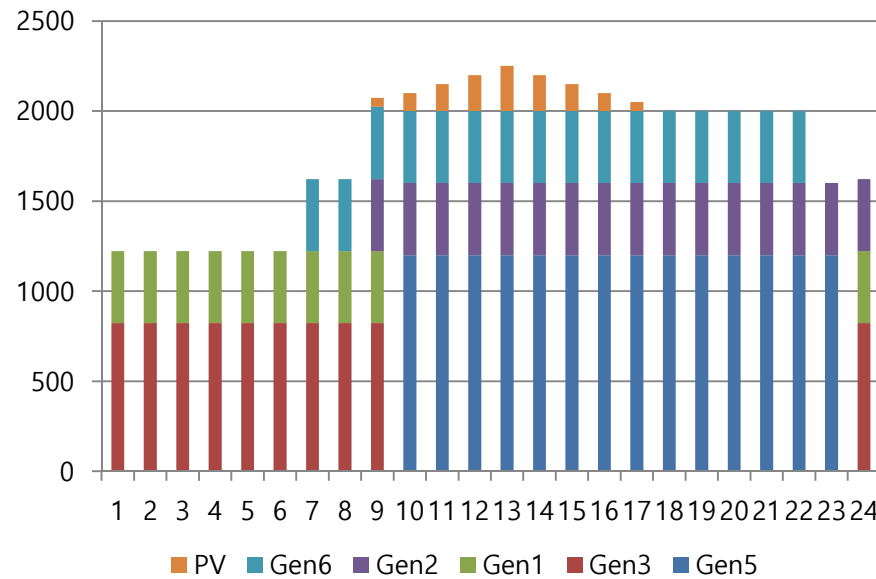
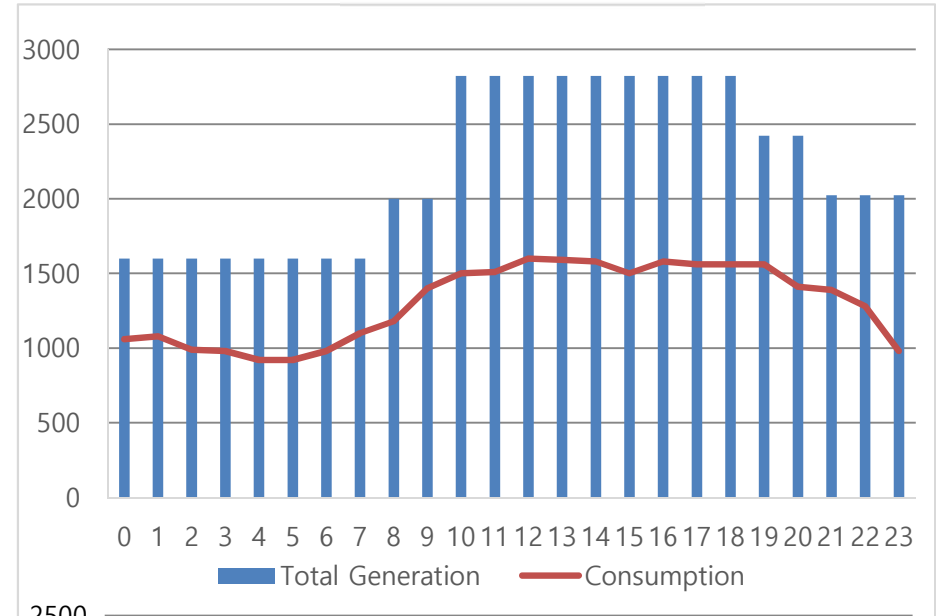
Item		Day	Month	Year
AS-IS	Fuel Efficiency of Holiday inn Resort (1)	3.75kWh/L	3.75kWh/L	3.75kWh/L
	Fuel Consumption (2)	4,500L/day	4,500L x 30days (135,000L/Month)	4,500L x 365days (1,642,600L/Year)
	Total Energy Consumption of Holiday inn Resort (1) x (2) = (3)	16,875kWh (16MWh)	506,250kWh (506MWh)	6,159,375kWh (6,159MWh)
TO-BE	Demand Response and Diesel Generation reduction 30% → 25%, Energy Consumption Saving <sup>1)</sup> (5% ↓) (3) x 5% = (4)	833kWh	25,000kWh	304,167kWh
	ESS use for Frequency Regulation and Reserve Capacity Energy Consumption Saving <sup>2)</sup> (10% ↓) (3) x 10% = (5)	1,667kWh	50,000kWh	608,333kWh
	<b>Total Energy Consumption Saving (4) + (5)</b>	<b>2,500kWh (15% ↓)</b>	<b>75,000kWh (15% ↓)</b>	<b>912,500kWh (15% ↓)</b>



Generator running schedule



Power reserve rate





'Remote Micro-Grid(Renewable Energy +ESS+EMS) System'

