

Gasado MicroGrid Project

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KEPCO Research Institute





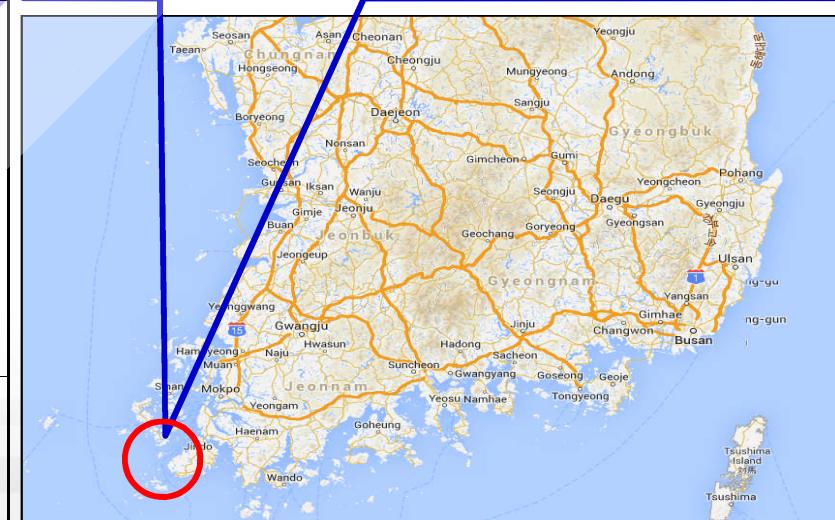
Video of Gasado



Overview of Gasado

Test Island : Gasado(southern side of Korea)

	Contents
Location	<ul style="list-style-type: none">Southern part of South KoreaDistance from main land : 6kmArea : 6.4km²
Electrical System	<ul style="list-style-type: none">Genset : 100kW×3 (1992)D/L : 2 line(total length : 8km)
Load	<ul style="list-style-type: none">Customer : 168house(286person)Average Load : 96kW (Peak : 173kW, Min : 61kW)Main Load : Radar, Lighting house Water supply
Site	<ul style="list-style-type: none">50% : Owned by local government50% : Private owned

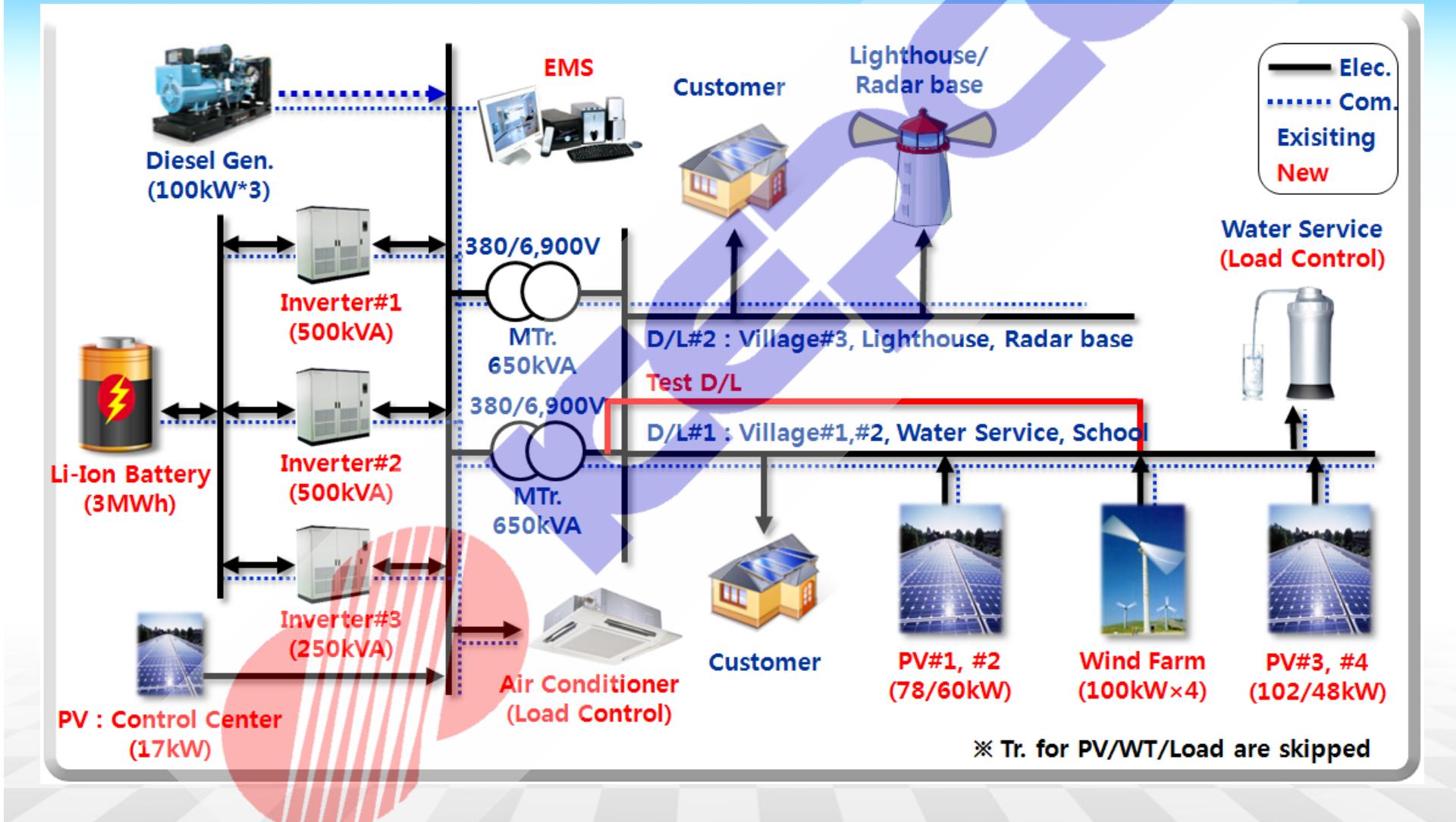


Design Target

- MicroGrid system supplied with 99% renewable energy

Classification	Contents	Note
Energy	99% renewable energy	Energy independent
No Wind/Sun	1 day	Battery size, Economical
Emergency	Using diesel generator	WT/PV fault No wind/sun
For field test	Renewable mix test No outage at the village	Capacity divide Exclusive line for test
EMS	Automatic control	System efficiency
Plug & Play	No communication for small PV	Economical
Site for WT/PV	Building roof, idle site	Idle site, Roof, Reservoir

System Architecture



Feature of Gasado MicroGrid

❖ Inverter based small power system

- ✓ Usually, just one Grid Forming Inverter(GFI) 'control the system voltage(V) and frequency(f).
- ✓ #2 PCS(or #1) is for the backup(fault at #1) and #3 is for the shortage of the rated power of GFI.
- ✓ If the output power from WTs/PVs is bigger than the amount of load, GFI will charge the battery to maintain V&f. Contrary, GFI will discharge the electrical power from the battery to the load.
- ✓ If the surplus power is bigger than GFI's rated power(500kVA), #3 PCS(250kVA) will be operated automatically.
- ✓ Sometimes, the diesel gensets are interconnected to GFI to charge the battery or to supply the power to the loads.
- ✓ WTs & PVs don't run without GFI. Because genset cannot control the frequency if there is too much power from WTs & PVs.
- ✓ Test D/L is for the initial system test using GFI, WTs, PVs and load simulator. So Test D/L is not charged in this time.

Feature of Gasado MicroGrid

- ❖ EMS
 - ✓ Forecast of renewable energy production and load
 - ✓ Load control and management of battery SOC
- ❖ Automatic direct load control
 - ✓ Air conditioner of Battery and inverter room
 - ✓ Water pumping motor for water tank
- ❖ Real test-bed for isolated MicroGrid
 - ✓ Two isolated power system can be made using 'test D/L '
 - ✓ Four wind turbines and 4 Photovoltaic generators.
 - ✓ 250kW & +- 150kVar Load simulator
 - ✓ Bellows can be tested
 - Capacity combination of renewable energy
 - Newly developed grid forming inverter '
 - Some operation algorithm for EMS

Main Equipment

	Specification	Function & Feature
EMS	SCADA + Application	Battery SOC management, Forecasting of load & renewable energy, Direct load control, Automation
GFI (Grid Forming Inverter)	500kVA*2, 250kVA*1	Frequency & voltage control, P/Q control 500kVA #2 : Backup, 250kVA : for shortage of rating
Battery	3MWh, Li-ion	Electrical energy storage, 1C-rate, NMC type 3 GFIs are connected to 3MWh in parallel.
WT	100kW*4	PMSG+Full converter, Power limitation, Power factor & Voltage control, Slew rate, LVRT, FRT
PV	314kW(8ea)	Power limitation, Monitoring of each module, Water floating PV system for limited site
Diesel Gen.	100kW*3	Droop control, Remote on/off
Load	Water pump Air conditioner	Water tank is used to energy storage. Battery room temp. control using surplus energy.

Tape cutting ceremony at Gasado



[Wind & Solar Farm]



Equipment of Gasado



[EMS(Energy Management System)]



[Water Floating PV system : 48kW]



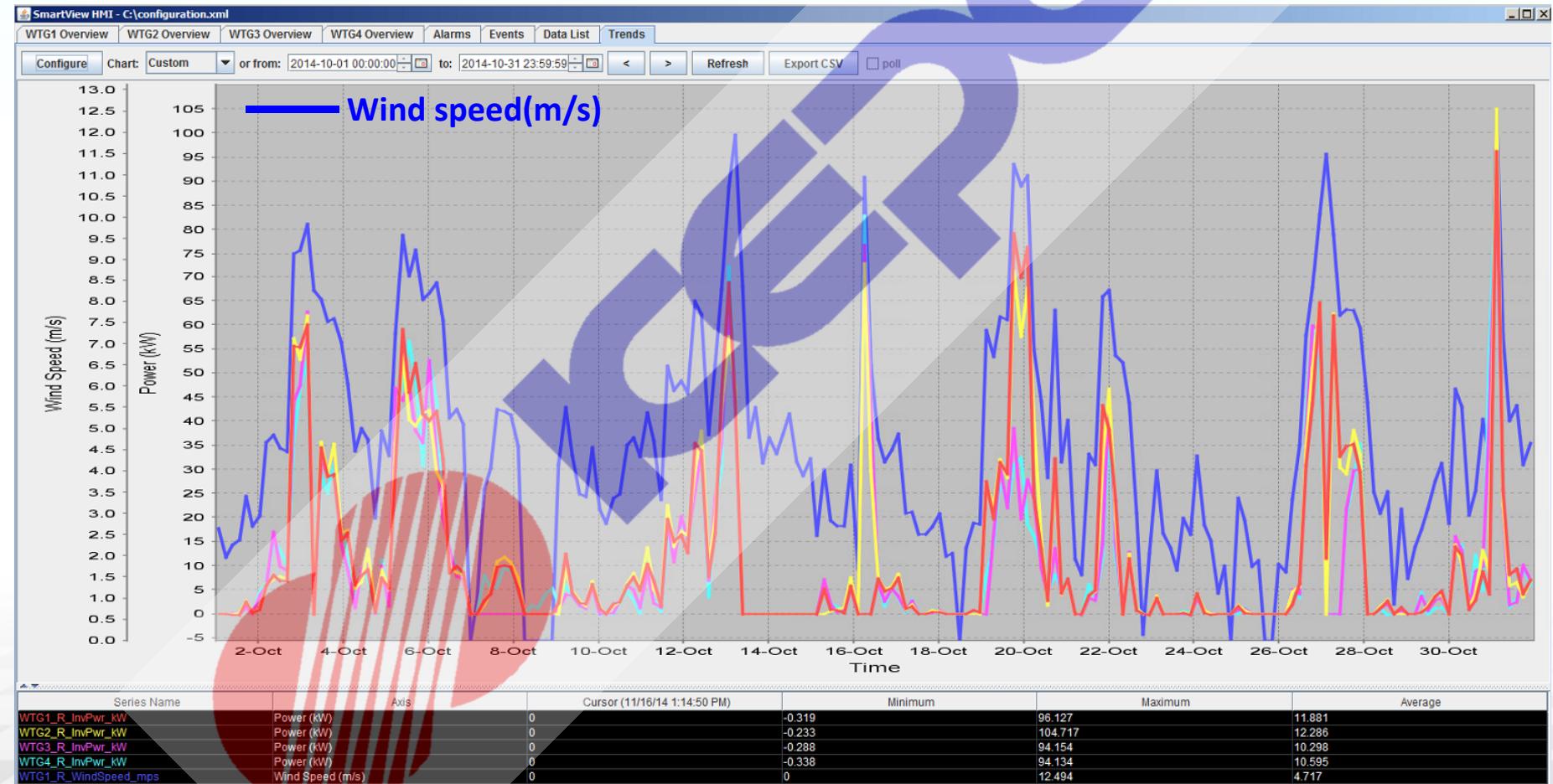
[Grid Forming Inverter : 500kVA*2, 250kVA*1]



[Li-ion Battery : 3MWh]

Operation Results

- ❖ Wind turbine : Oct. 1st~ Oct. 31th
 - ✓ Automatic operation following wind



[Operation Results of Wind Turbines(Oct. 1st~ Oct. 31th)]