

Upcoming Era of ESS

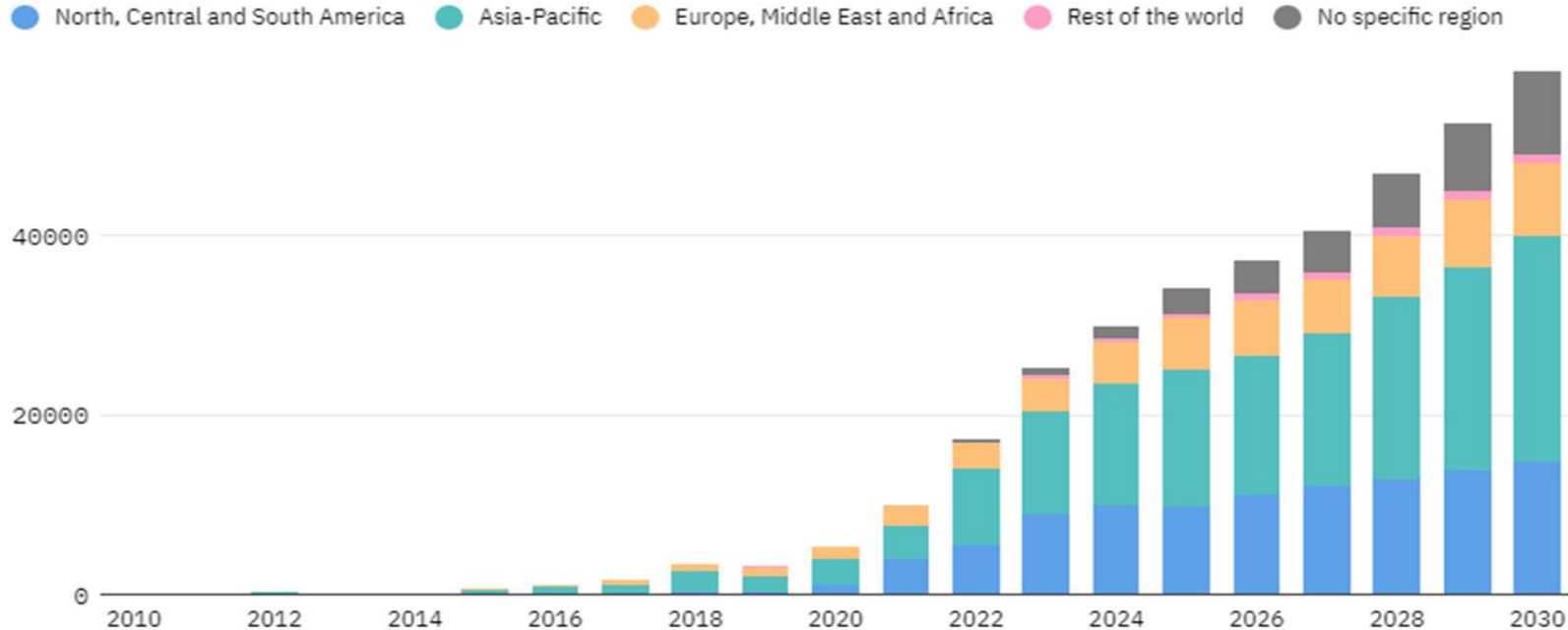
(Energy Storage System)



- Annual : 10GW/22GWh(2021) → 58GW/178GWh(2030) [x8]
- Accumulated : 27GW/56GWh(~2021) → 365GW/912GWh(~2030)

Asia-Pacific is set to lead in annual energy storage installations by 2030

Global annual storage installations by region based on power output, MW, 2010–30



The forecast data is for energy storage technologies excluding pumped hydro. No specific region is an estimate/headroom that is not explicitly allocated to any specific application.

Source: BloombergNEF

ENERGY MONITOR

Grid Stabilization (Frequency Regulation)



Renewable Energy (PV/WP) (Ramp Rate Control / Time Shifting)



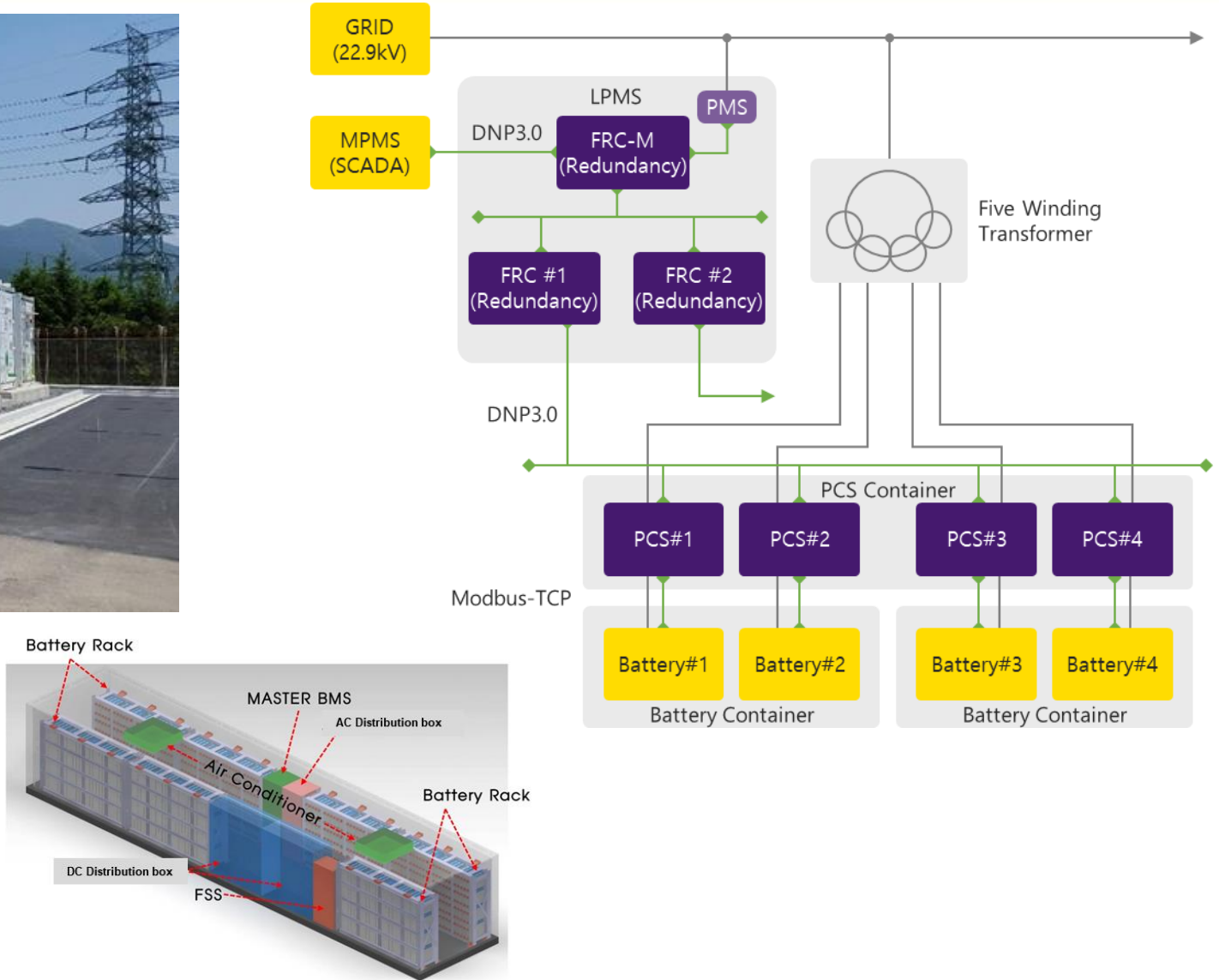
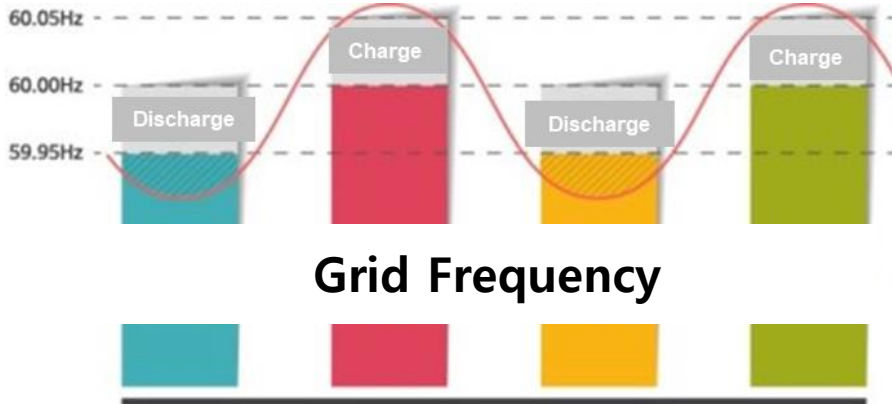
Building/Factory Peak Cut (Demand Charge Reduction)



Microgrid/ Island/Rural Electrification



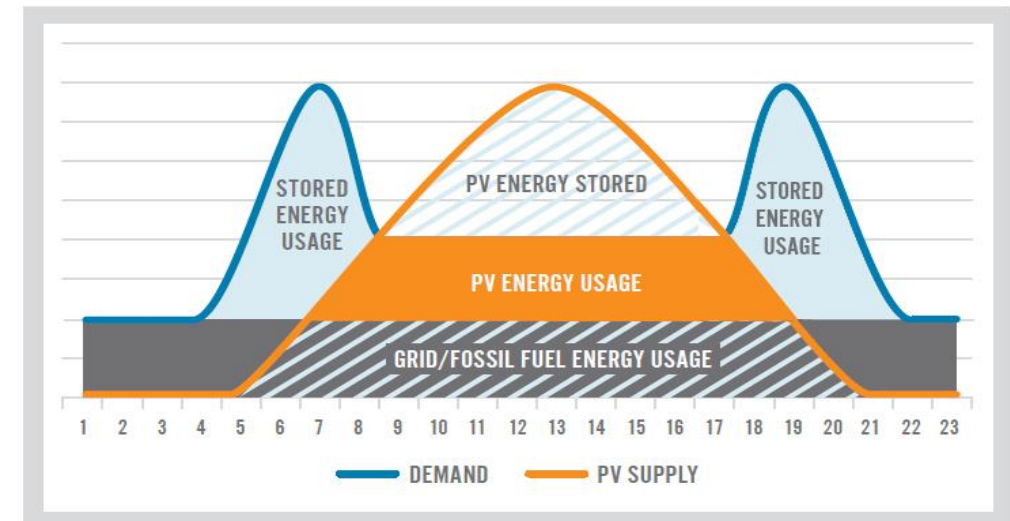
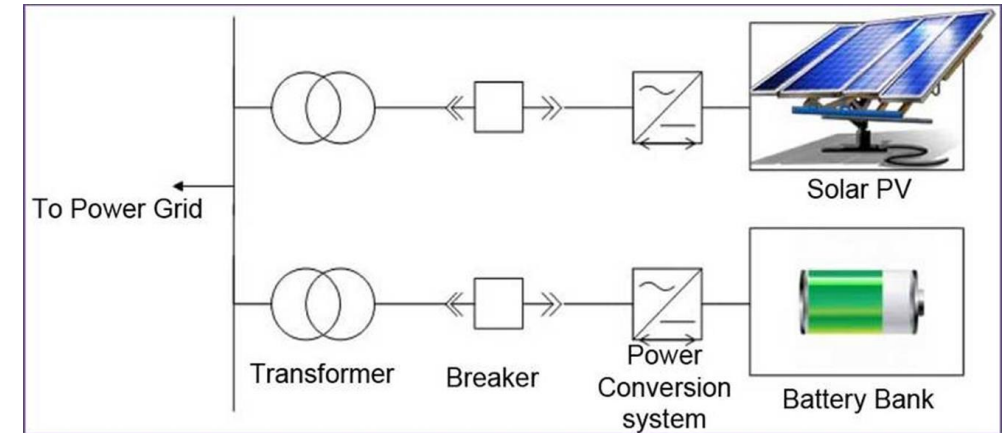
ESS Application : Frequency Regulation



ESS Application : RE (Renewable Energy) + ESS



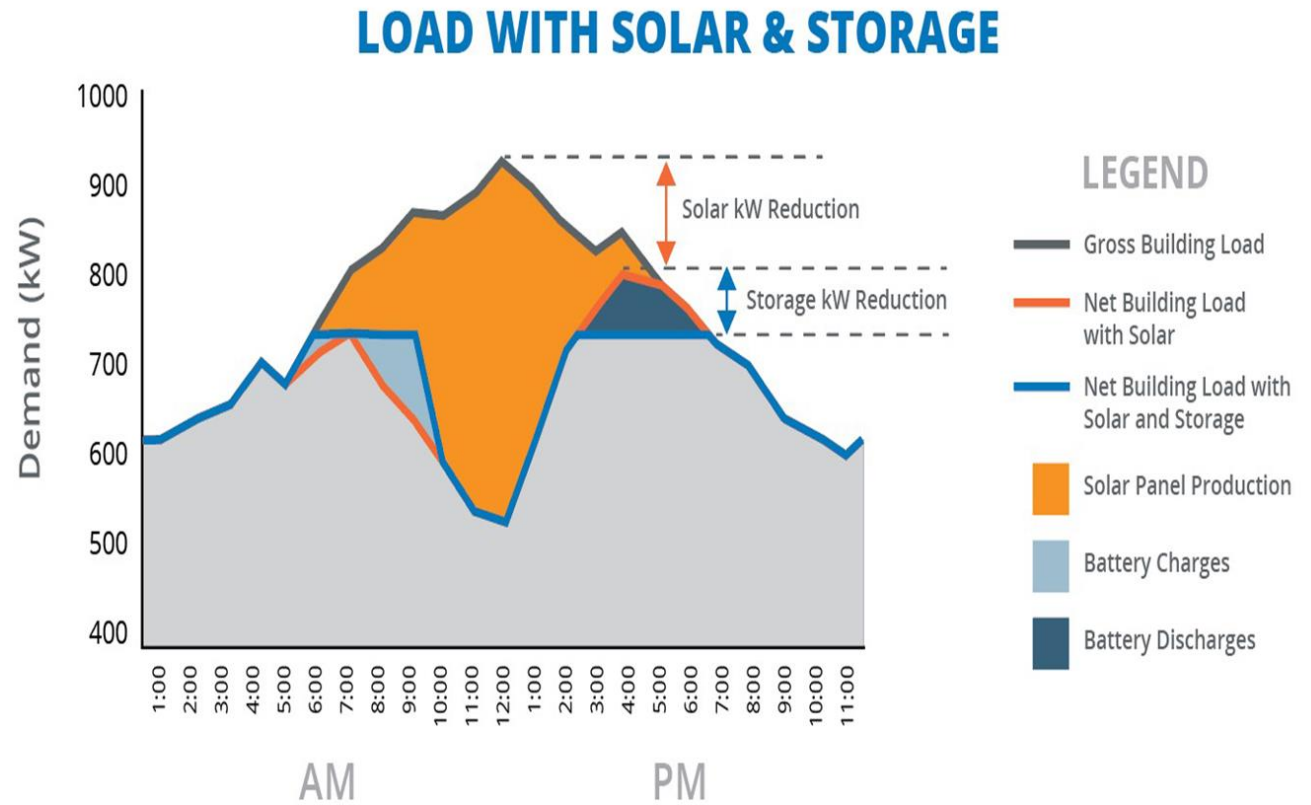
- ESS for Time Shifting
- Benefits : Grid Congestion Release (Investment Deferral)
Preventing RE Curtailment



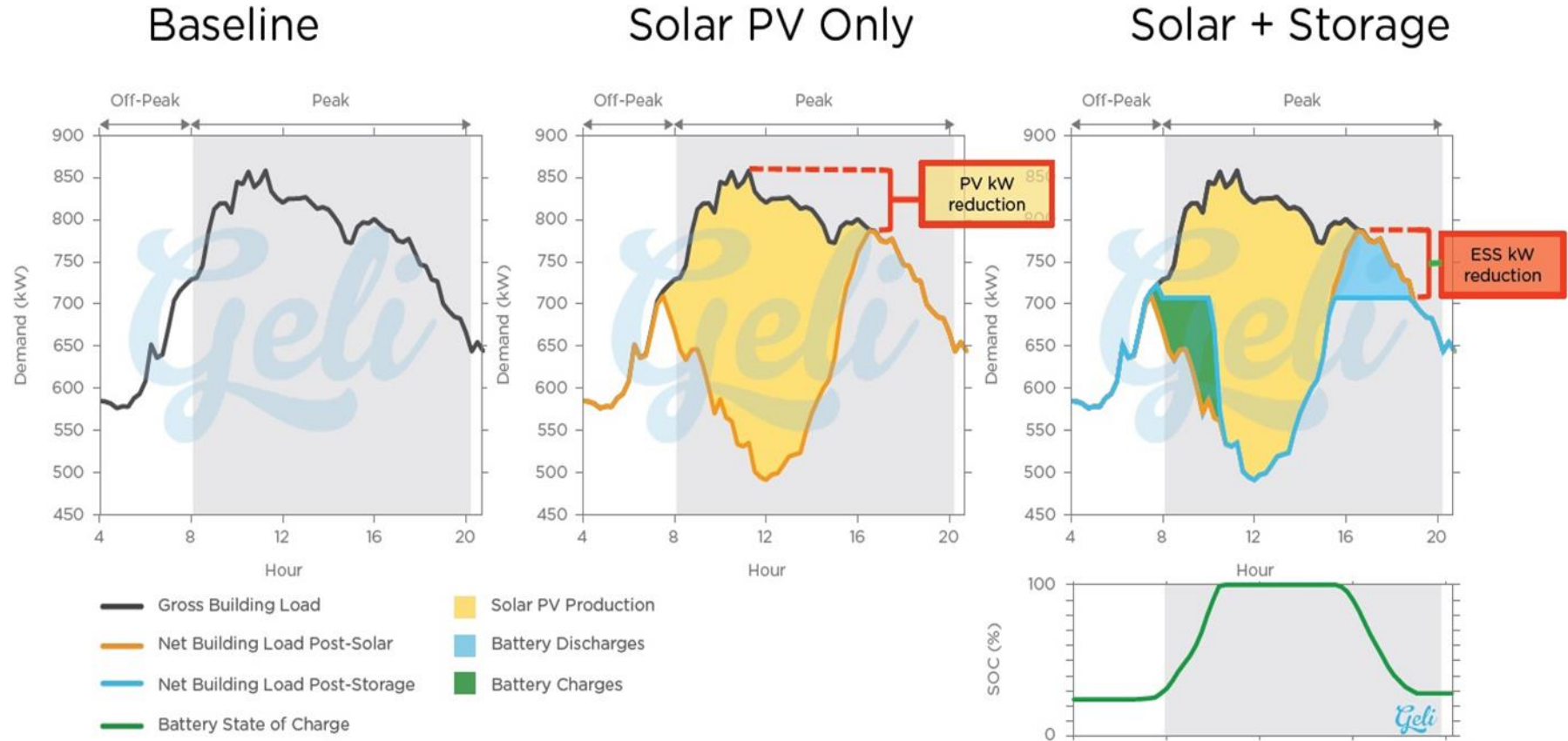
ESS Application : PV+ESS for C&I Building/Complex



- ESS for Demand Charge (\$/kW) Reduction & Energy Saving (\$/kWh)



Solar + Storage (Load Profile)

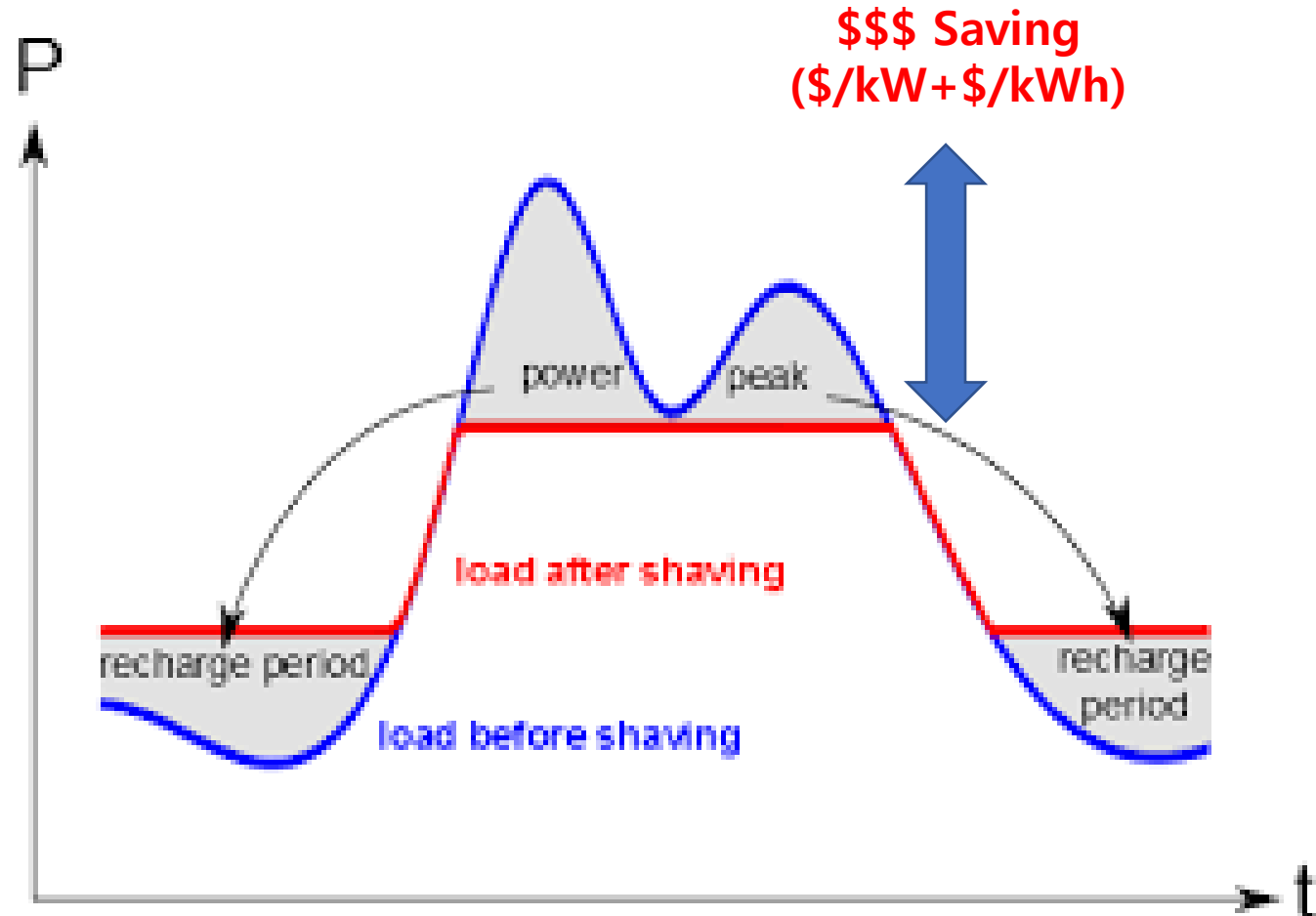


ESS Application : Building/Factory Peak Cut

(Demand Charge Reduction)



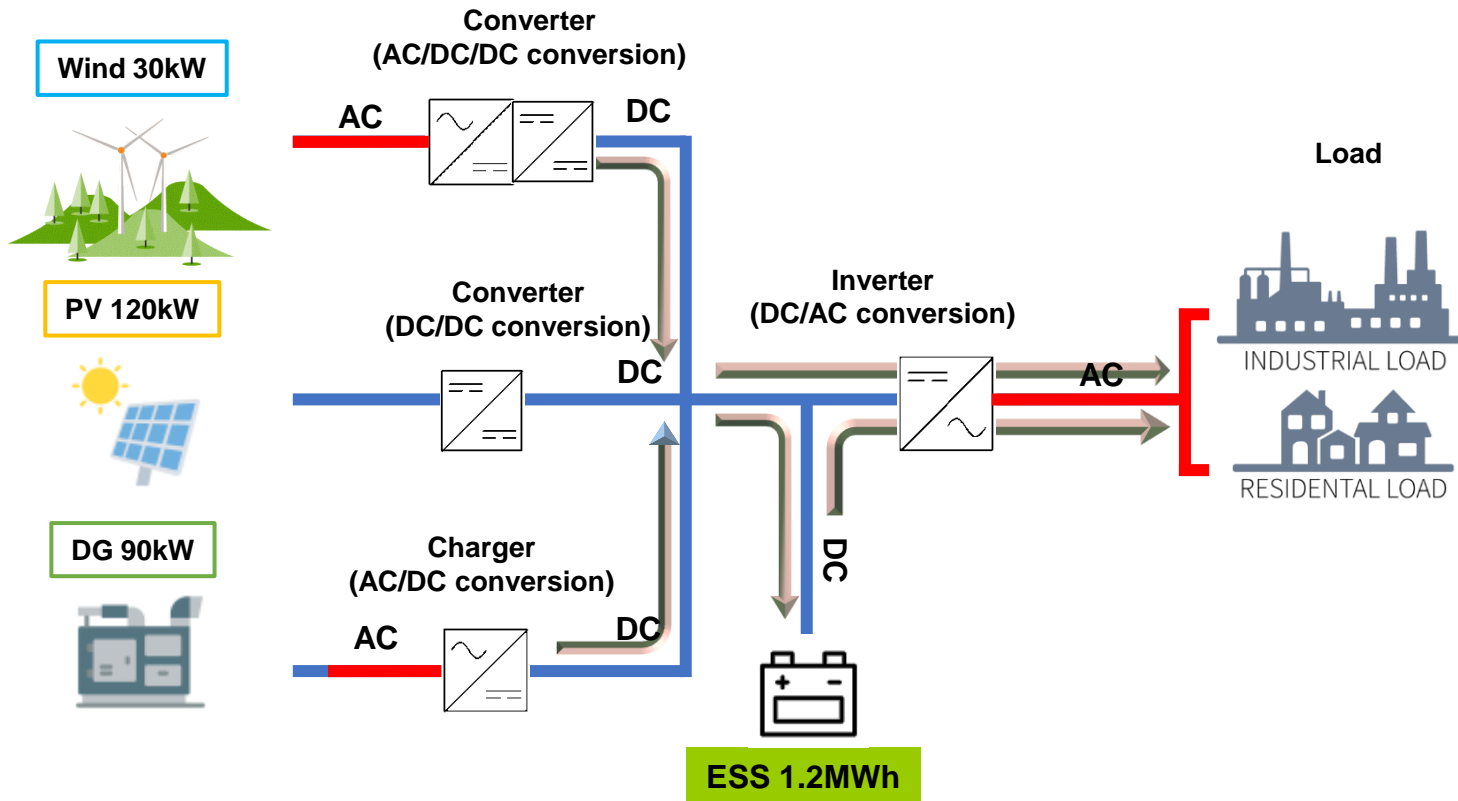
- Peak Cut with Energy Storage (Stand alone) for Commercial & Industrial Buildings/Factories



ESS Application : Microgrid (PV+WP+DG+ESS)

- RE + ESS to replace Diesel Genset (Saving Fuel Cost & No Emission/Noise)

■ Micro-grid(PV, WP, ESS)

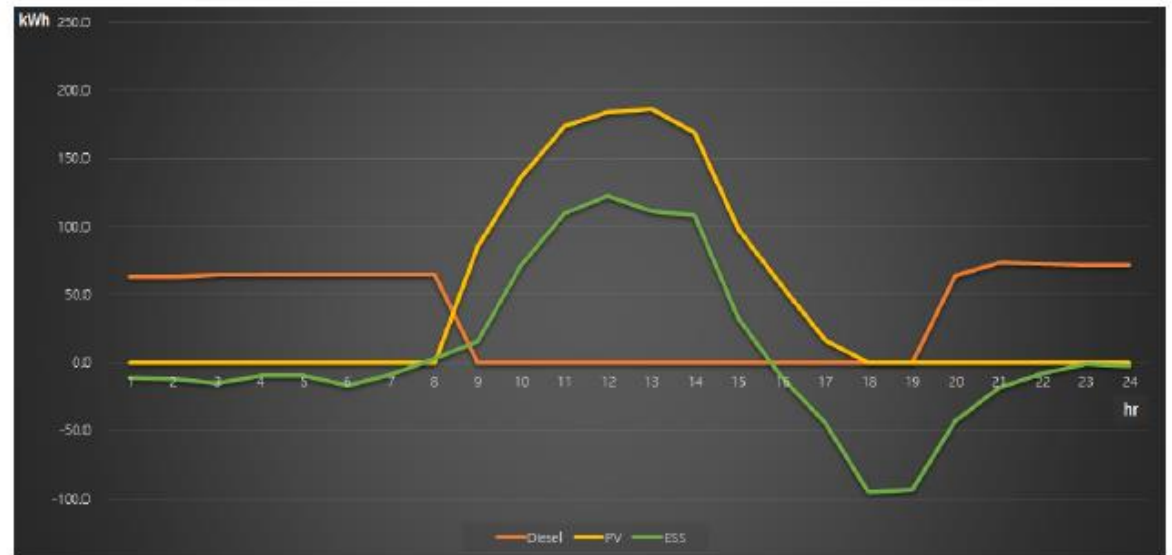
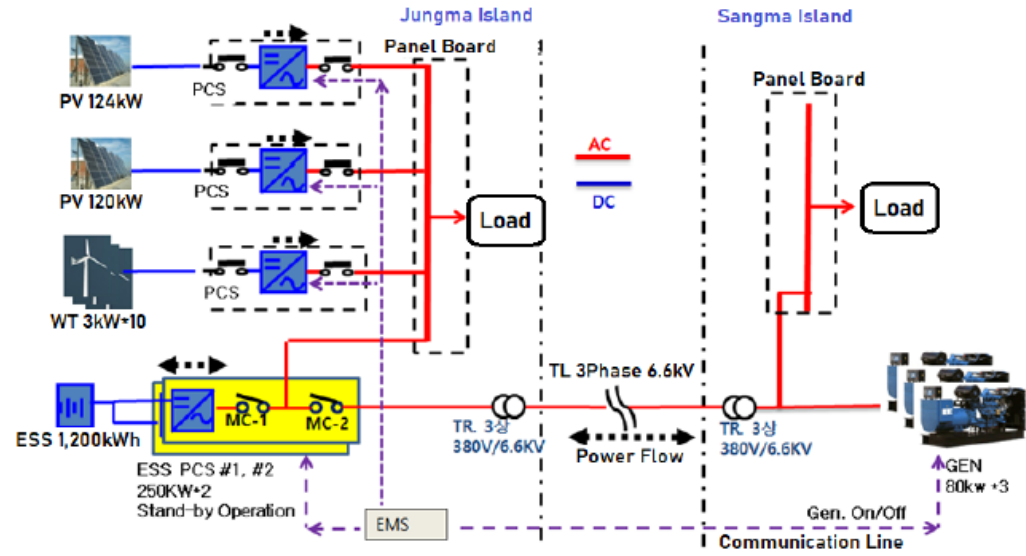


► Site: Samma Island (COD:2014)

ESS Application : Microgrid



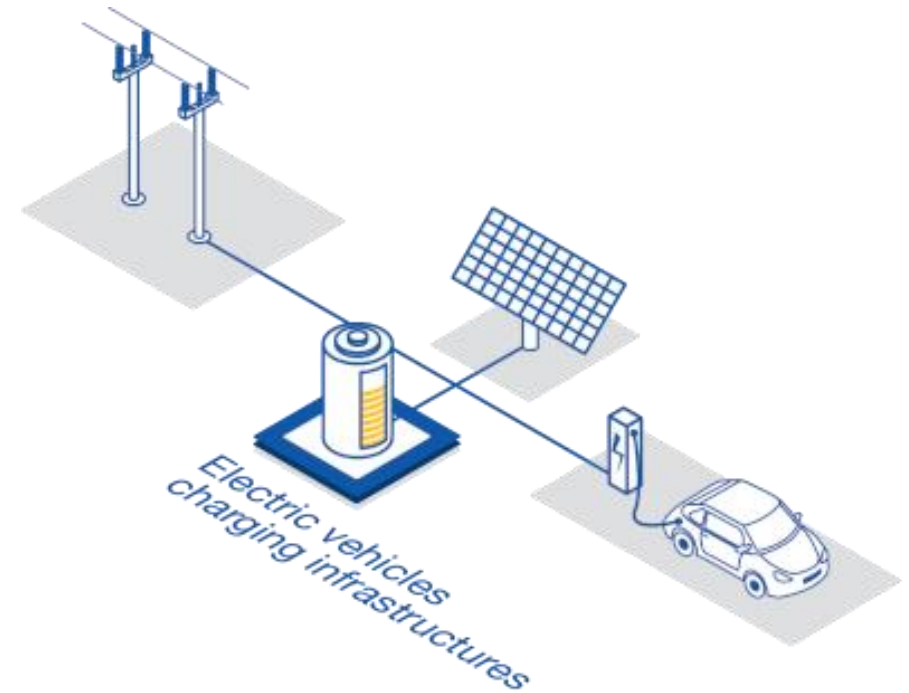
► Site: Sangma Island (COD:2014)



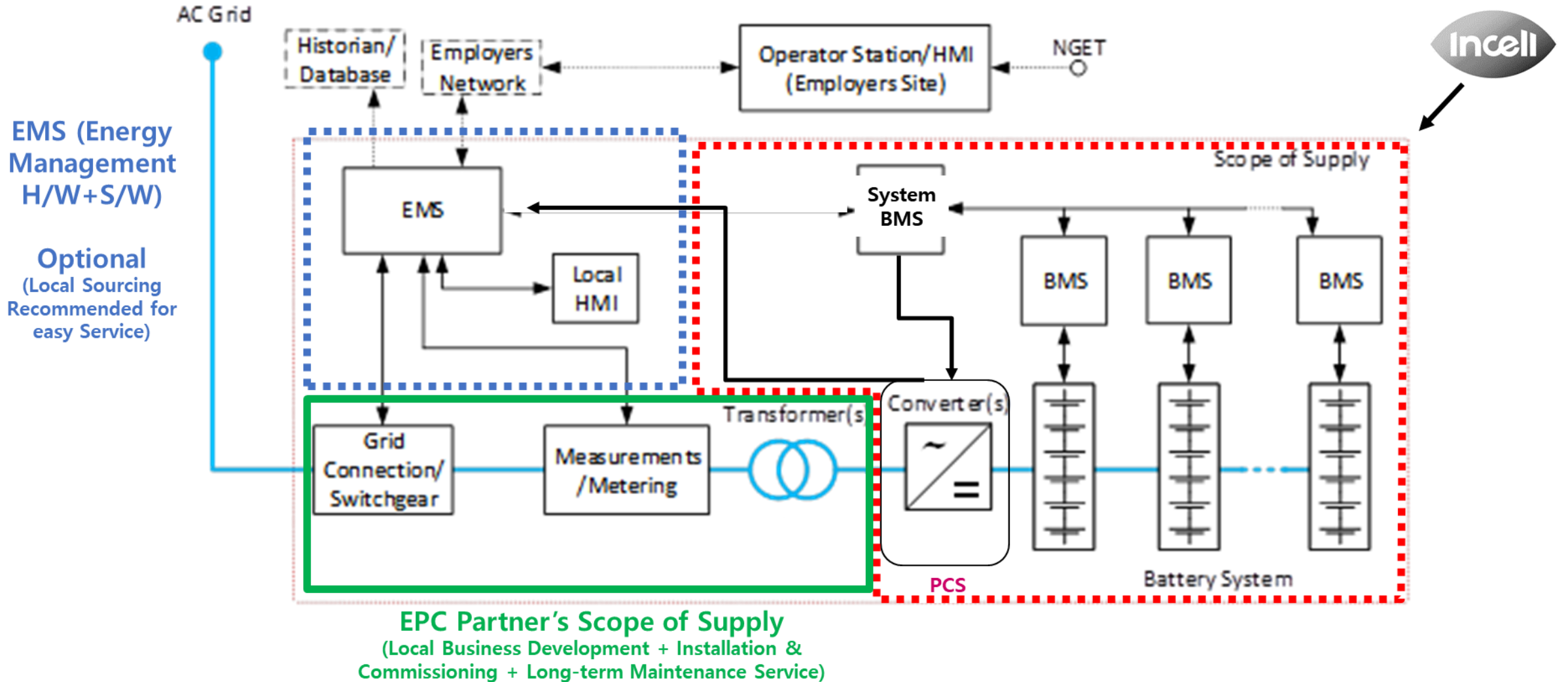
[Daily Operation : DG, PV, ESS]

ESS Application : EV Fast Charging Station + ESS

- ESS for Grid Protection + Peak Power Reduction + Energy Savings (from Grid)



ESS Configuration : BESS + EMS + Grid Connection





Corporate HQ in Gwangju, KR

- 17 years with Lithium-Ion Battery based Battery Packs/System Design
- ONLY using Battery Cells from **Samsung SDI (Cylindrical)**
- **Fire Safety** -proven Inhouse BMS Design with additional Sensors
- **UL9540A (Thermal Runaway) Test Certified**
- References : Domestic – over **400 MWh** for ESS, UPS, Mobility
Overseas - over **20 MWh** since 2021 (US, JP, TW, DE, etc)



Battery Racks for ESS



UL 9540A

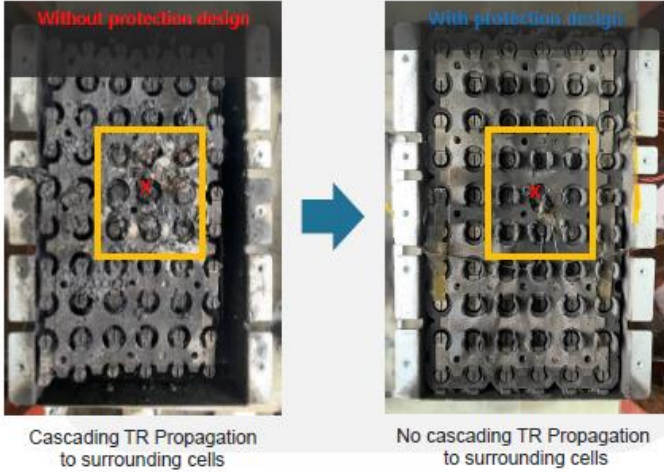


Fire Safety proven Technology with UL9540A

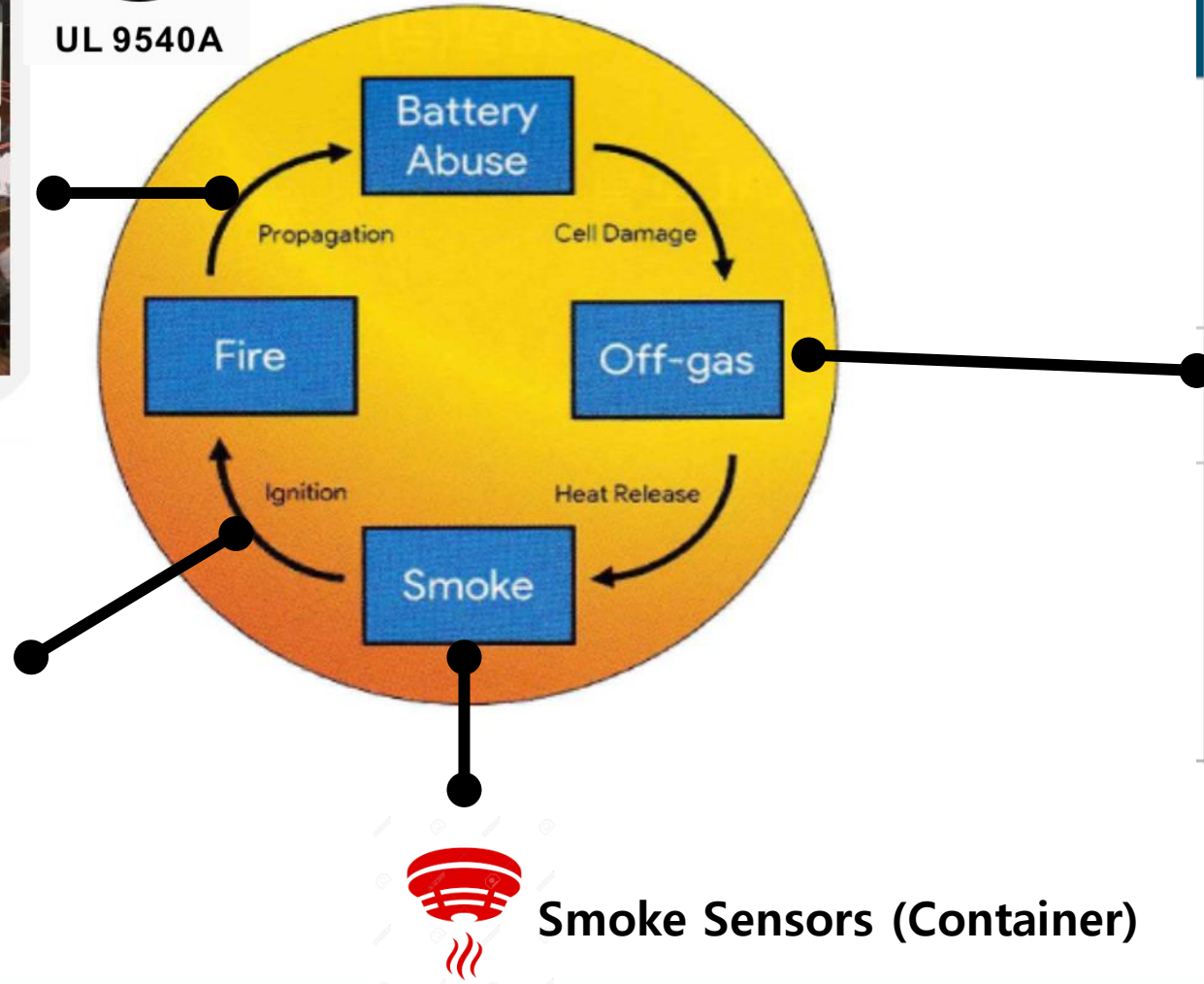


UL9540A Certified (Apr 2022)

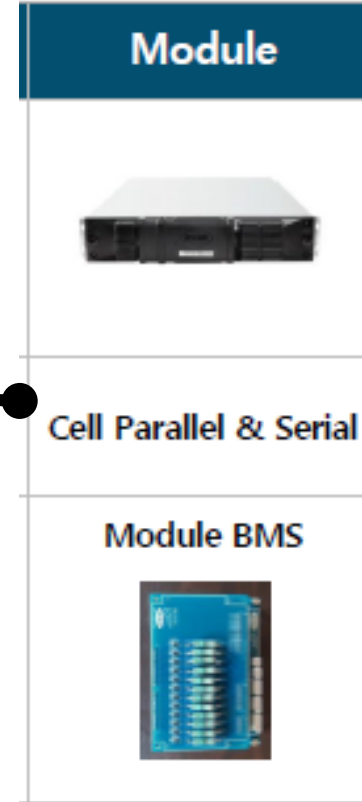
- TR propagation prevention design



UL 9540A



BMS w/Off-gas/Humidity Sensor



Battery Rack Specification (Power & Energy)



| Battery Rack Specification | | | | | | | | |
|----------------------------|-------------|------|--------------------------------------|------------------------|----------------------|----------------------|----------------------|---|
| [Rev 220824] | | | | | | | | |
| Item | | Unit | Power Application (Max 1C Discharge) | | Energy Application | | | Remarks |
| Model Name | Rack | - | R48-17-223T | R48-21-223T | LIB-R-40 | R50-17-300 | R50-20-300 | Unit Cells from Samsung SDI (Cylindrical 21700) |
| | Module | - | SP44-48-223 | | SP44-41-235 | SP44-50-300 | | |
| Capacity | Designed | kWh | 165.5 | 204.5 | 40.2 | 217.7 | 256.1 | |
| | Usable | kWh | 132.4 | 163.6 | 32.1 | 183.2 | 215.5 | |
| | Usable DOD | % | 80 | 80 | 80 | 84 | 84 | |
| Voltage | Norminal | V | 742.5 | 917.2 | 700 | 740.5 | 871.2 | |
| | DC Range | V | 612~836.4 | 756~1033 | 604.8~796.8 | 612~836.4 | 720~984 | |
| Max C-Rate | Charge | - | 1.0 | 1.0 | 0.5 | 0.3 | 0.3 | |
| | Discharge | - | 1.0 | 1.0 | 0.5 | 0.5 | 0.5 | |
| Charge Method | | - | CC-CV | CC-CV | CC-CV | CC-CV | CC-CV | |
| Dimension | W*D*H | mm | 855*560*2050 | 855*560*2338 | 575*565*1916 | 575*973*1974 | 575*973*2297 | |
| Weight (Approx.) | | kg | 1160 | 1400 | | 1410 | 1625 | |
| IP Grade | | - | IP22 | IP22 | IP22 | IP22 | IP22 | |
| Communication | | - | RS485 | RS485 | RS485 | RS485 | RS485 | |
| Operational Environment | Temperature | °C | 25±3°C | 25±3°C | 25±3°C | 25±3°C | 25±3°C | |
| | Humidity | % | 20~80%R.H | 20~80%R.H | 20~80%R.H | 20~80%R.H | 20~80%R.H | No Condensing |
| | Cooling | - | Fan Forced Air Cooling | Fan Forced Air Cooling | Air Cooling (No Fan) | Air Cooling (No Fan) | Air Cooling (No Fan) | |
| Certification | UNDOT | | Yes | Yes | Yes | Yes | Yes | Shipping Requirement |
| | IEC62619 | | Yes | Yes | No | Yes | Yes | |
| | UL1973 | | No | No | No | Yes | Yes | US Only |

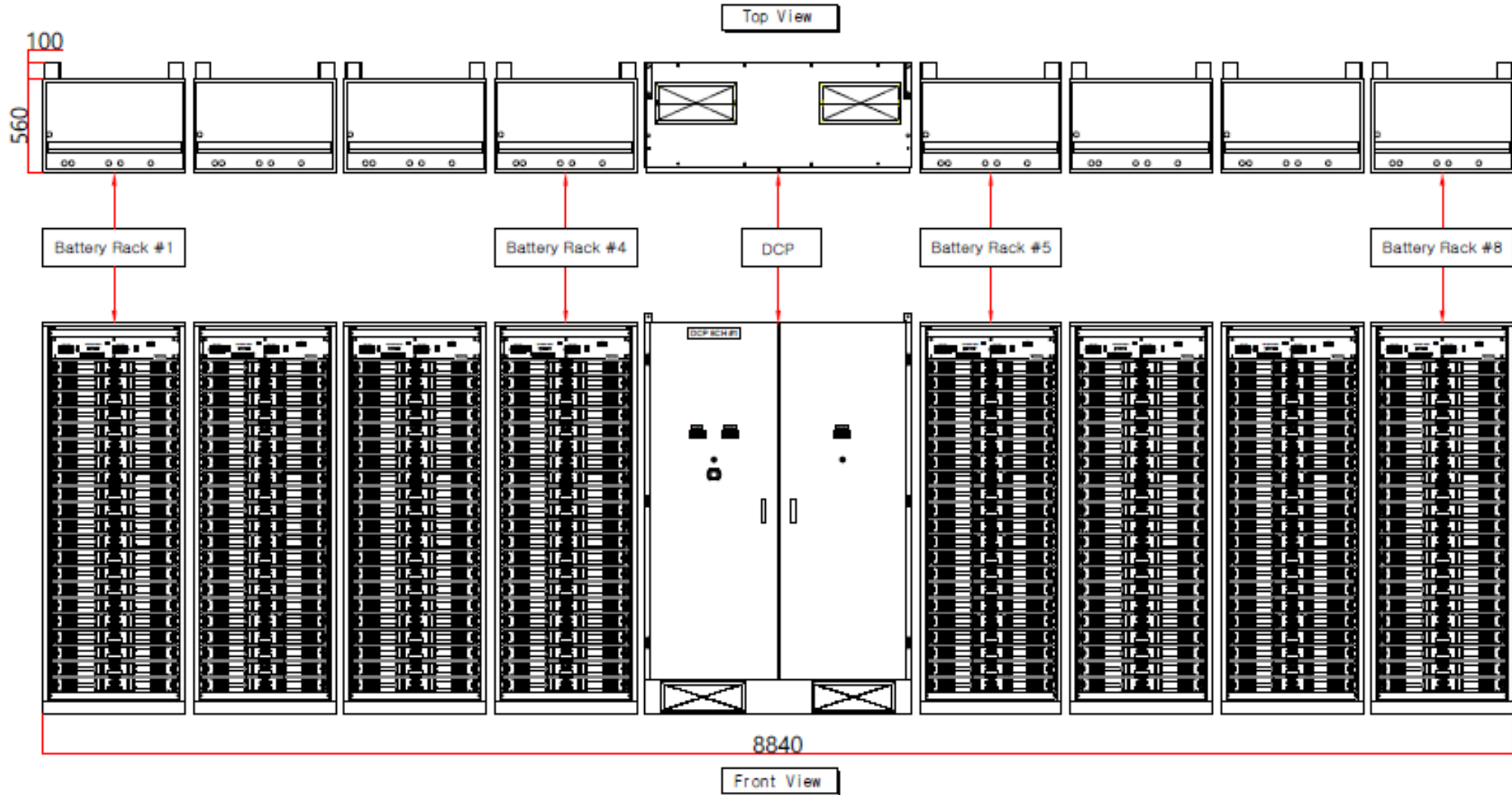
ESS Installation in Taiwan (6.5MWh for 2*40ft Containers)



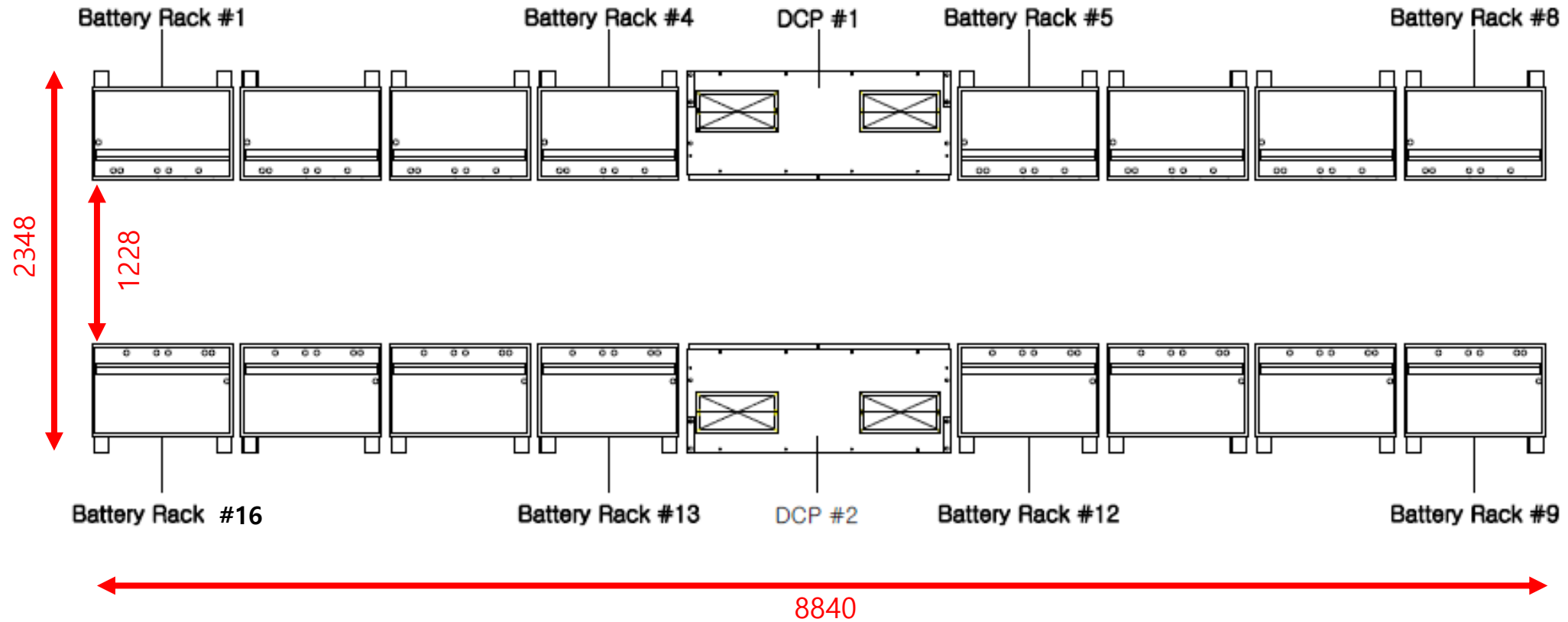
■ ESS for Frequency Regulation @ Taoyuan, Taiwan (2.5MW/3.25MWh per 40ft HC ISO Container)



Rack Drawings : 8 Racks (1.64MWh : Model 48X)



Rack Drawings : 16 Racks (3.28MWh : Model 48X)





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