



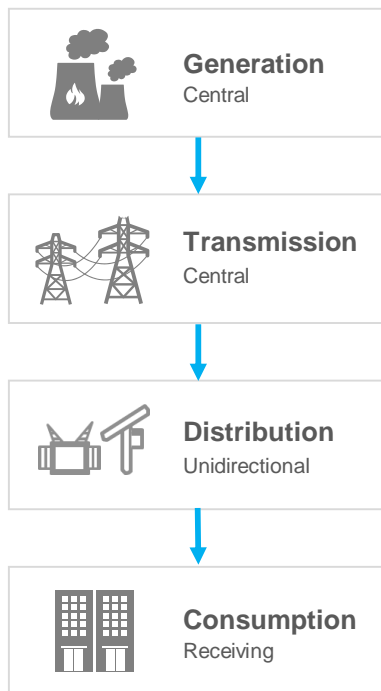
Battery Energy Storage Applications

Prapon Thamsattaya

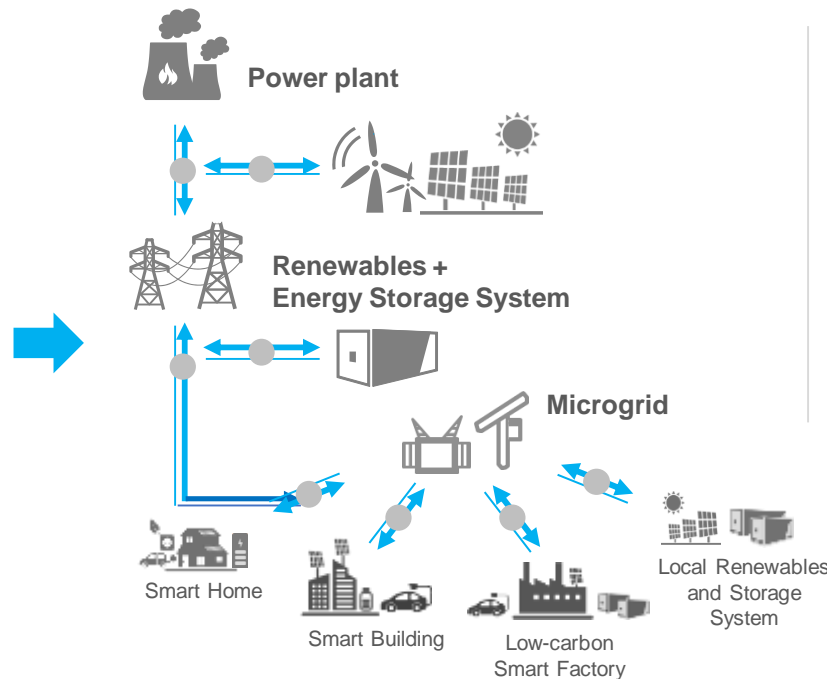
**Energy Infrastructure Solution Products Manager,
Delta Electronics (Thailand) PCL.**

Smart Grid and Energy Transformation

Conventional

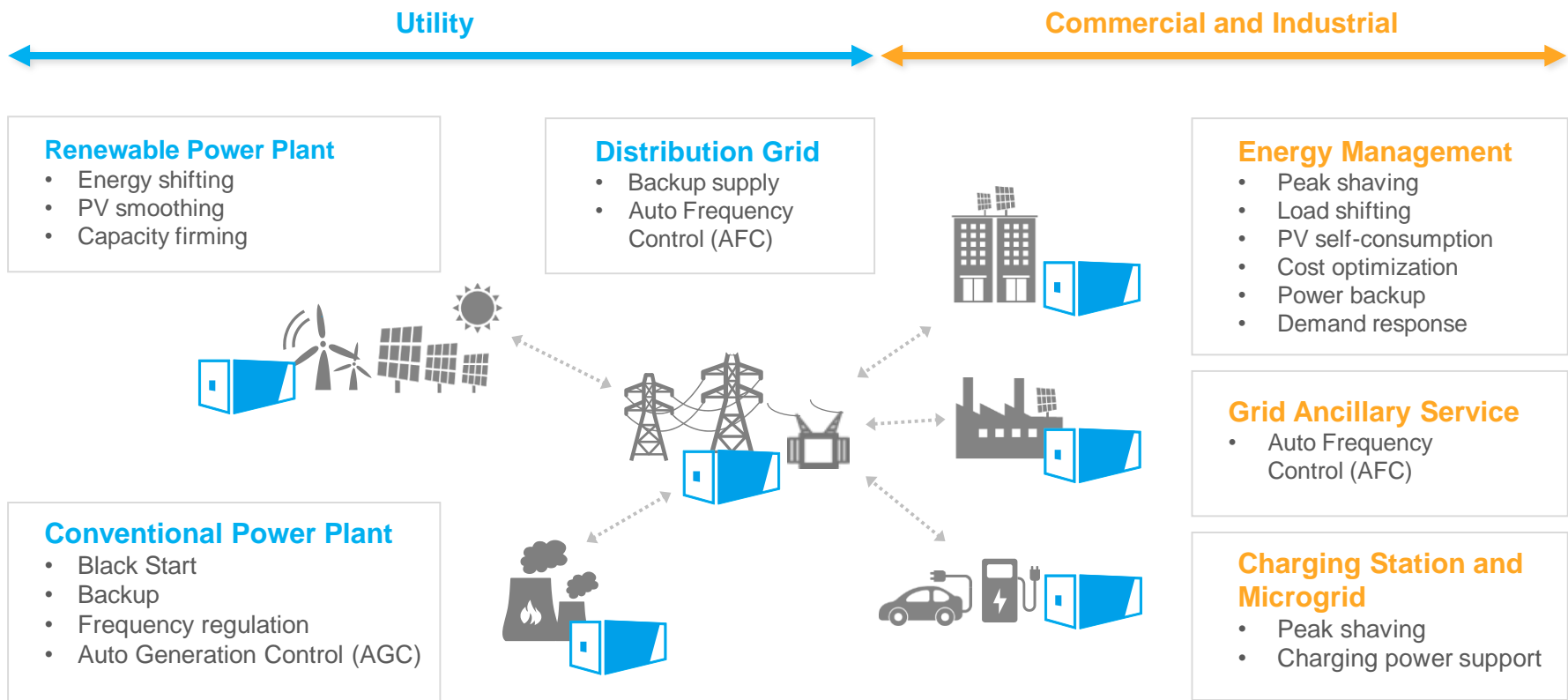


Smart Grid: Decentralization, Bi-Directional, Digitized



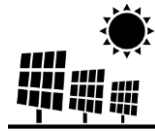
- **Deregulation & liberalization** of electricity industry
- **Decentralization & decarbonization** with renewable energy increase
- **Real-time** supply and demand management
- Rise of **DC grid** adoption to increase energy efficiency
- Rise of **Prosumer and Microgrid**
- **EV** – serve as a significant load and form of virtual generation (storage)

Energy Storage Application



Energy Storage Application

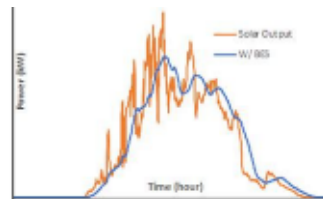
Utilities Application



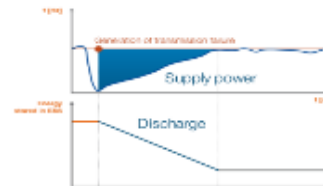
Complicate



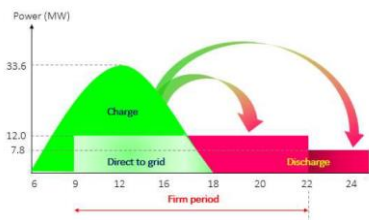
PV Smoothing



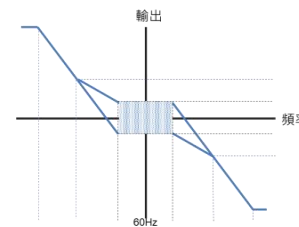
Generation Backup



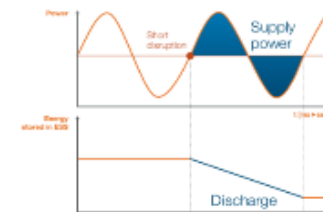
PV Firming



Frequency Regulation



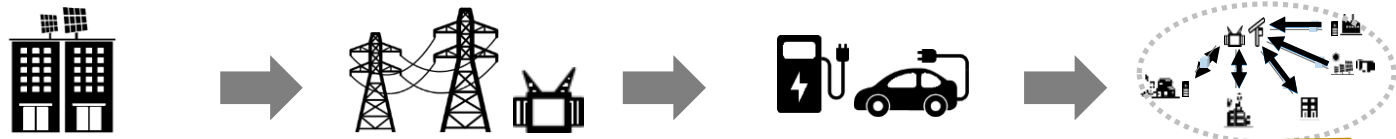
Emergency Backup for Transmission & Distribution



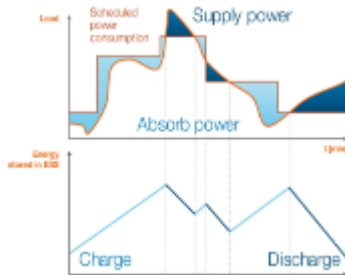
Energy Storage Application

Commercial and Industrial

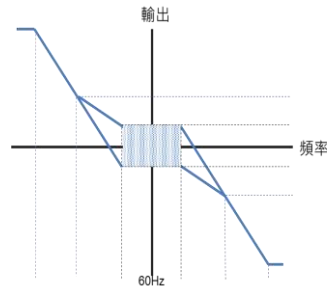
Complicate



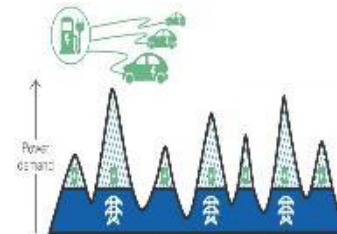
Energy Management



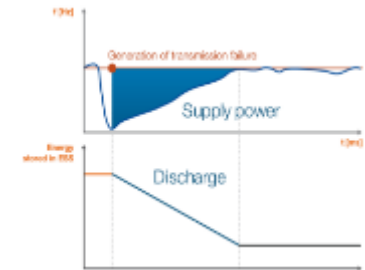
Frequency Regulation



EV Charging Station

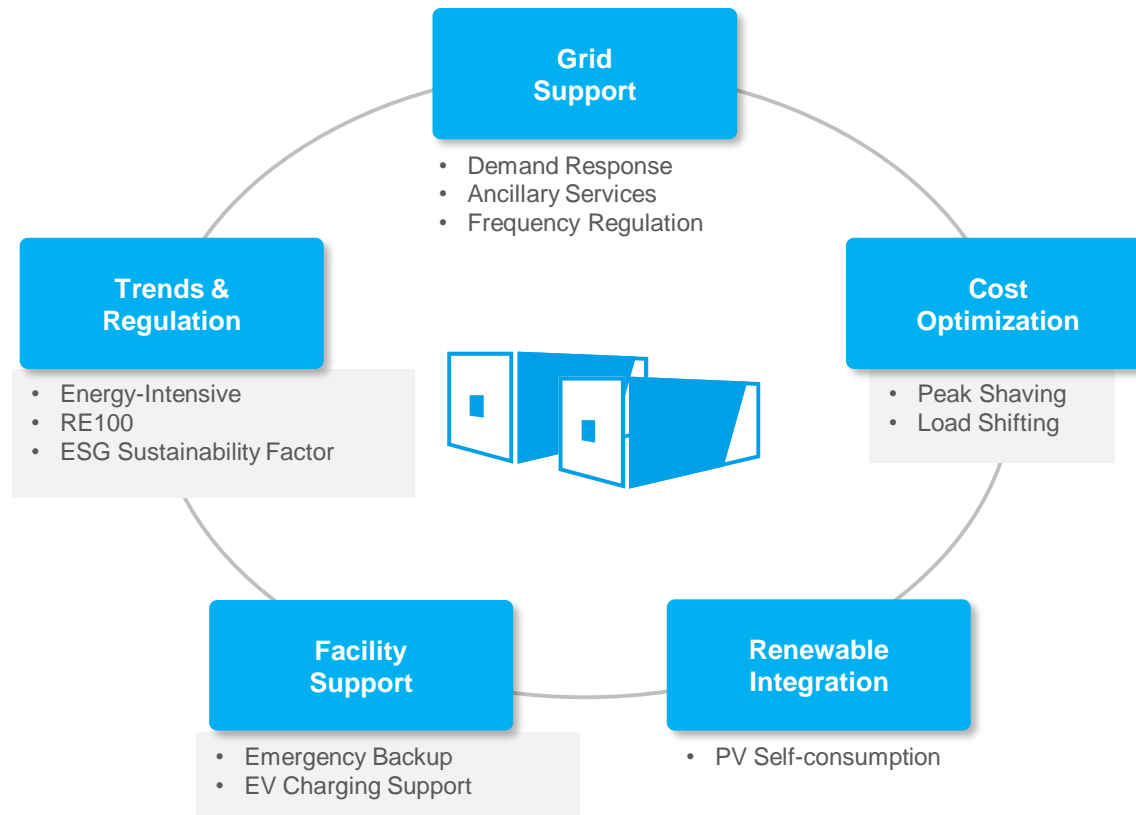


Micro(nano) Grid



Energy Storage Application

Benefits on storage apply



System configuration

Power Conditioning System (PCS)

Leading Power Efficiency

Flexible/ Scalable

Easy to Install/ Service



kW



MW



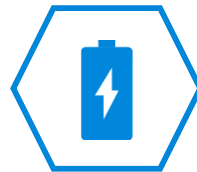
Advanced Power Control

- P/Q Control
- Frequency/Voltage Control
- Grid Forming VSG Control



Modular Design

- Flexible Offerings
- Non-Stop Redundancy System



Multiple Energy Source

- Bi-directional Energy Hub



Cloud-based Remote Management

- Predictive Maintenance
- Energy Management



Design for Harsh Environment

- Outdoor Protection
- Heat Dissipation

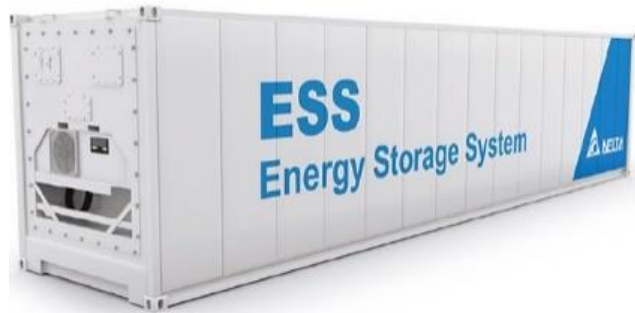


Integrated Solution

- Data Connection
- Device Control
- System Management

System configuration

Battery Energy Storage System



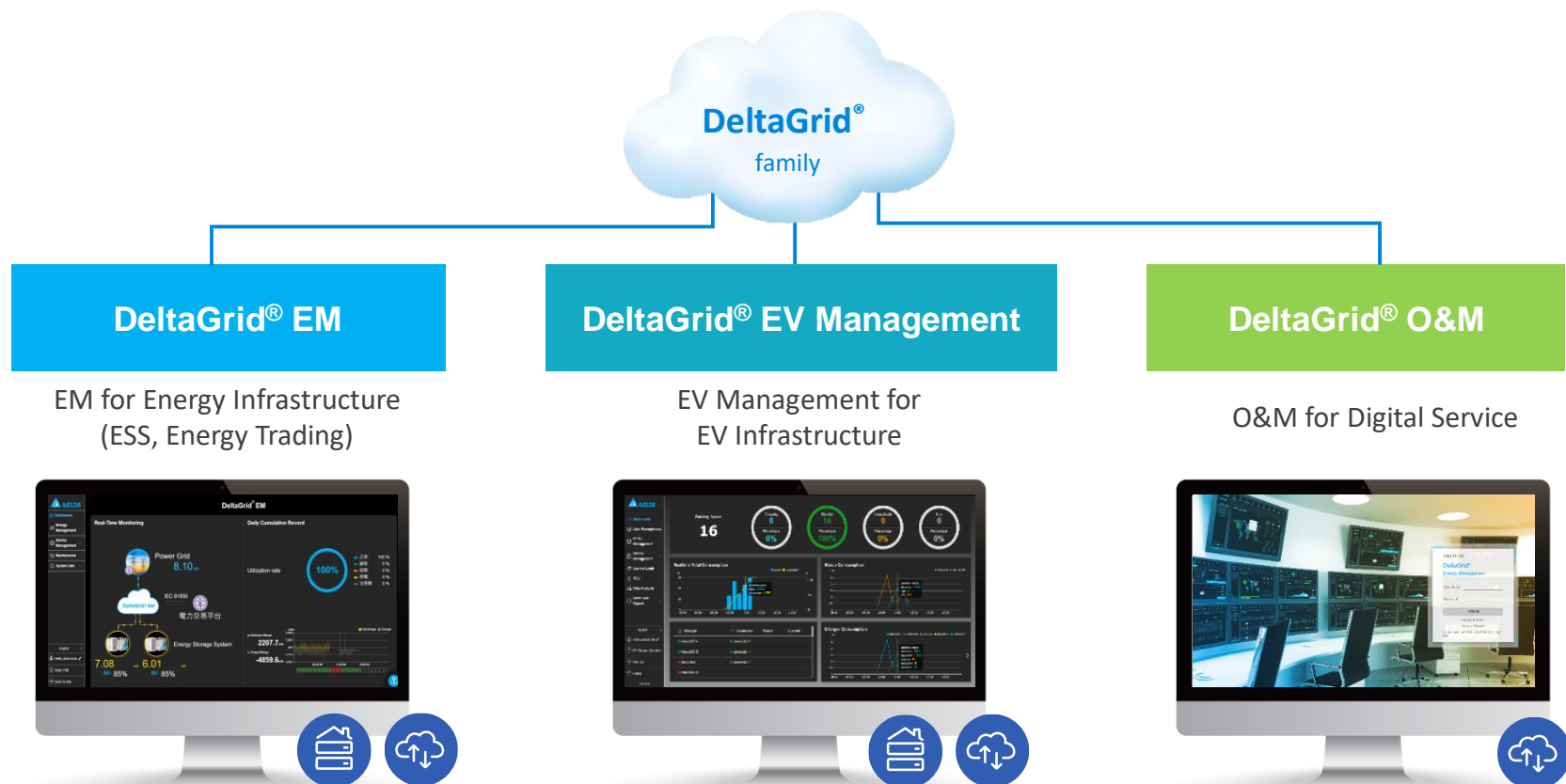
Expertise from battery cell to system design and manufacturing to ensure safety of battery system integration in different applications



- Scalable Outdoor cabinets
- Up to MWh installation battery capacity
- Container base frame with pre-wiring construction
- Integrating with DC switch panel 、 auxiliary power distribution panel and system controller
- Corrosion resistant enclosure & container frame

System configuration

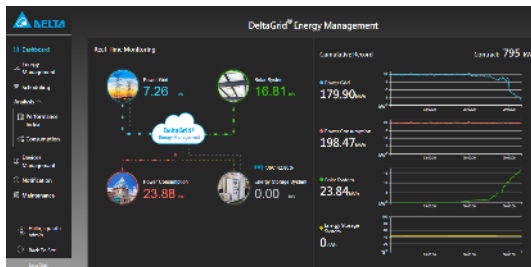
DeltaGrid® Energy Management System



System configuration

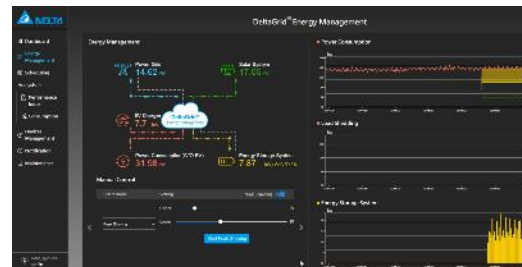
DeltaGrid[®] Energy Management System

System Dashboard



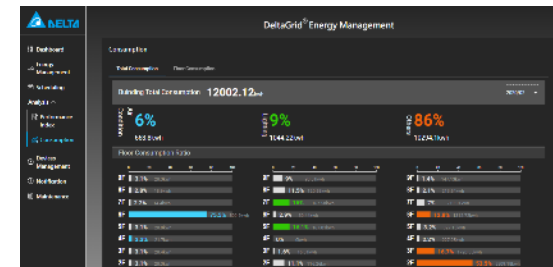
- ▶ Real-time energy view
- ▶ Daily energy analysis report

Operation mode



- ▶ Priority setting of operation modes
 - Peak shaving
 - Meter tracking
 - TOU scheduling
 - Alarm notification
 - Emergency power backup

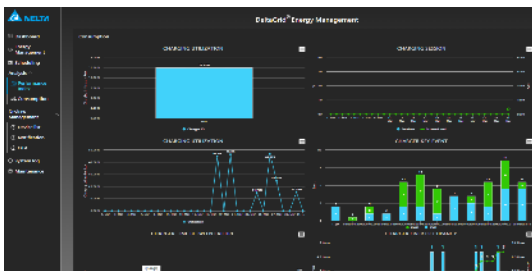
Energy dispatch optimization



- ▶ Energy Forecast base on weather forecast from Weather Underground

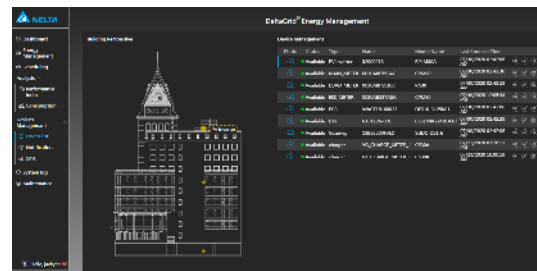
DeltaGrid[®] Energy Management System

Charge/ Discharge Control



- ▶ Scheduling and control
- ▶ In-time monitor

System status monitoring



- ▶ Real-time display of device status
- ▶ Real-time data collection
- ▶ System Management
 - Data log
 - Cloud monitoring
 - Client remote login

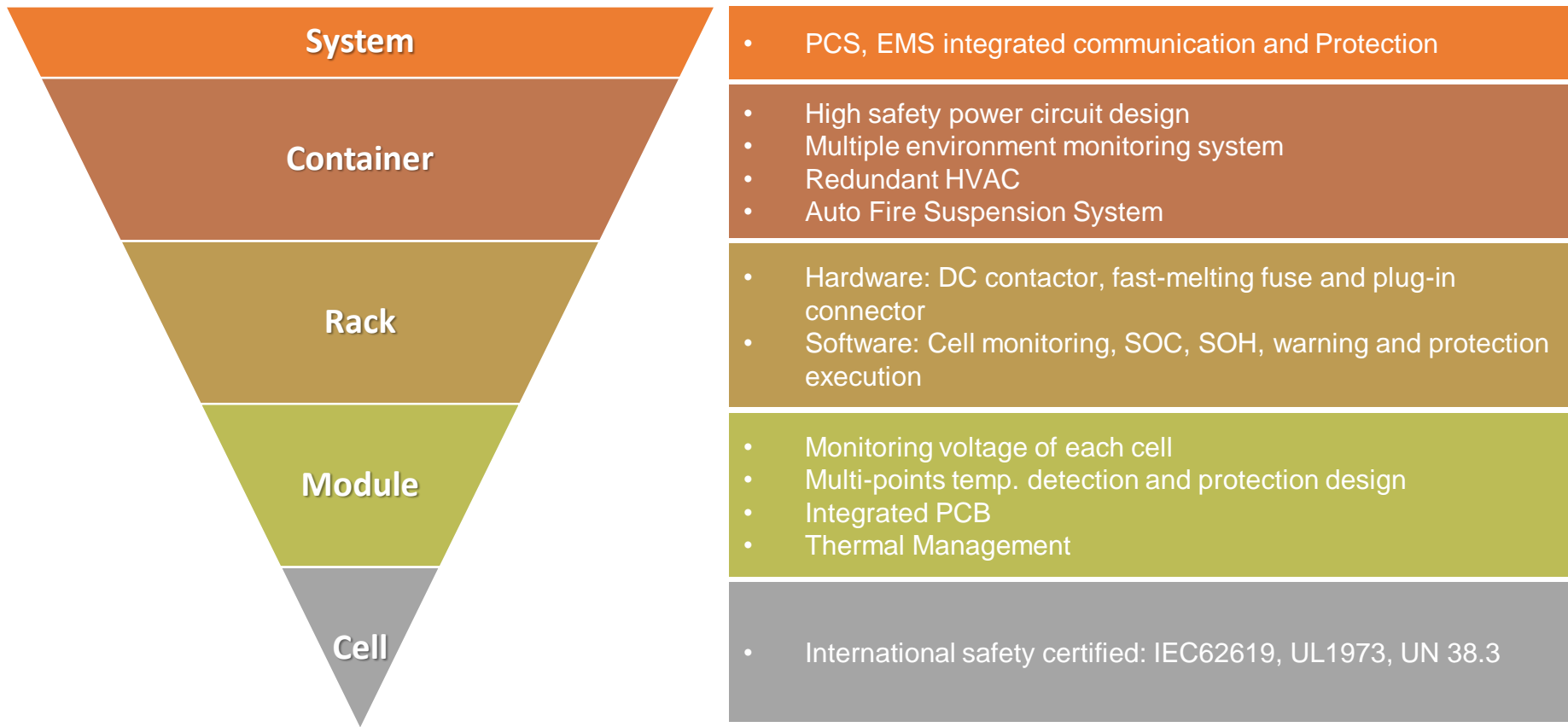
O & M



- ▶ O & M records
- ▶ Alarm Management · Audit logs

Battery Protection

Multi level safety protection

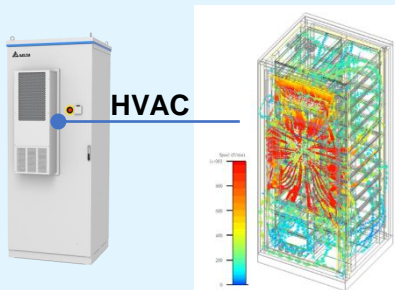


Battery Protection

Safety Design

Thermal Management

- Thermal management in cabinet level
- HVAC in each cabinet optimize the cooling efficiency
- Airflow guide to improve temperature consistence.



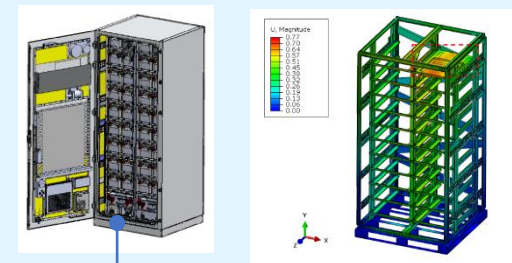
Fire Proofing

- Fire resistant fiber cover the inner wall to avoid fire propagation
- Alarm mechanism: Smoke and thermal detector.
- Automatic fire suspension system



Protection Design

- Flood detector.
- Aseismic structure for GR63 Zone-4



淹水偵測

Battery Protection

Prevention of Fire

- fire resistant Ceramic Fiber is added in the cabinet as fire insulation mechanism to avoid fire propagation.



Double layer Fire & thermal insulation



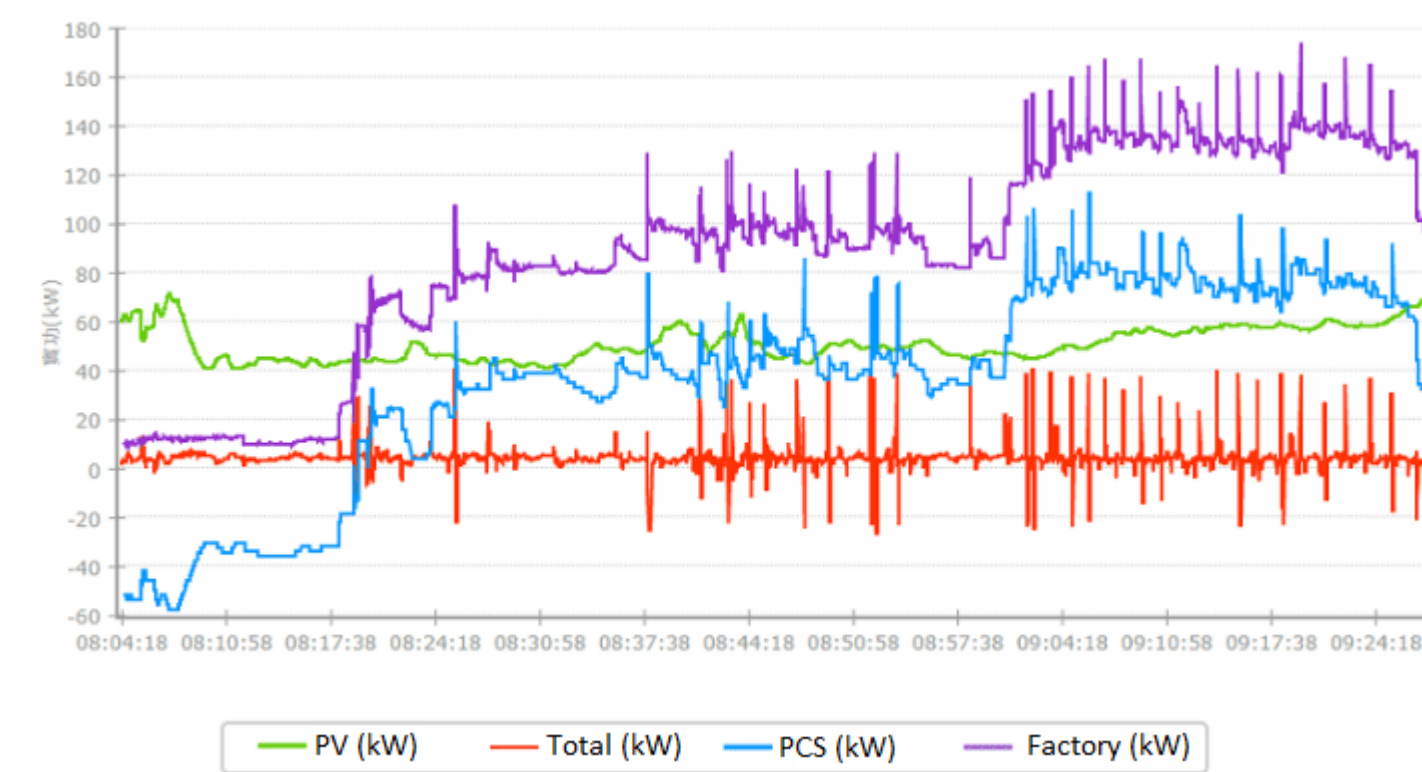
Success case

San Shin Industry Co., Ltd. is a company based in Southern Taiwan, specializing in the recycling of chemical and solvent waste. To keep pace with green supply chain trends, San Shin's new plant in Pingnan Industrial Park has installed Delta's 250kW/528kWh energy storage system, which is integrated with a 140kW rooftop photovoltaic (PV) system and the [DeltaGrid® Energy Management System](#)



Success case

- Load shifting for greater solar energy efficiency
- Peak shaving for optimal electricity consumption
- Backup power



Success case

Delta Pingjhen Plant Energy Storage System, Taoyuan, Taiwan
PCS 5MW, BESS 3.6MWh



Success case

Power Conversion System 5MW (2.5MW x 2Unit)



Success case

Batter cabinet



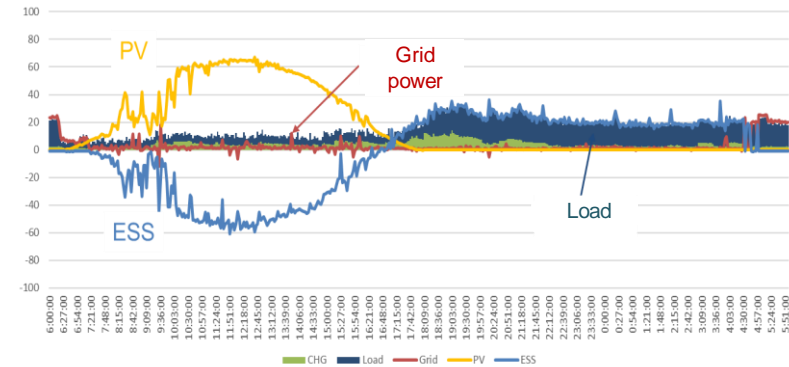
<https://www.youtube.com/watch?v=rtnLPXfjg3Y>

Success case

ESS for e-Scooter Charging Station

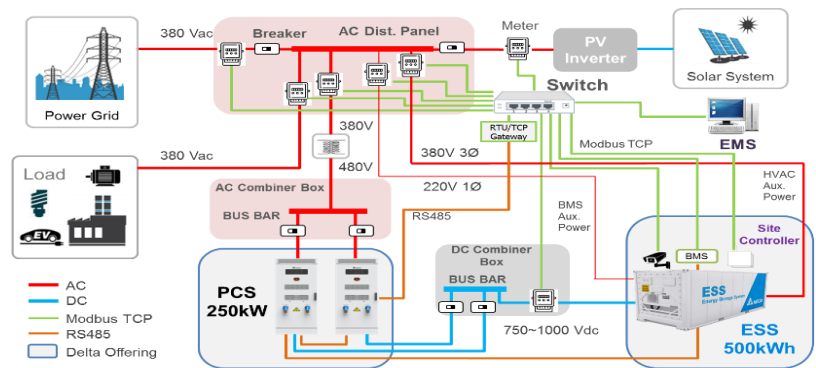


▶ Load Shifting



- **Location:** CPC Station, Chiayi, Taiwan
- **Commissioned:** Jan. 2019
- **Application:** Load shifting, EV charging power balancing and Micro-grid operation
- **Delta Offering**
 - 250kW PCS (125kW x2)
 - 500kWh 20ft battery container x1

▶ System Diagram



Delta EMEA HQ integration : PV, BESS and EV charger



The micro-grid demo site is able to optimize power usage and save electricity bills, and provide power backup when grid power is lost.

- ▶ **Location:** Hoofdrop, Netherlands
- ▶ **Official commissioning:** Q4., 2021
- ▶ **Application:** Micro-grid, Peak shaving, Load shifting, EV Charger, Ancillary service
- ▶ **Delta Offering:**
 - DC Wallbox x 2
 - AC Charger x 14
 - UFC charger x 2
 - PCS x 1 + Battery cabinet x 2
 - PV system x 1
 - DeltaGrid EMS x 1



Success case

Delta EMEA HQ integration : PV, BESS and EV charger



Next, power travels through the Power Conditioning System,

<https://www.youtube.com/watch?v=o05C8OSFBy4>

Success case

Japan



PV Power Plant

- 500kW/362kWh
- Ako, Japan
- PV Smoothing

Fuel Cell Plant

- 250kW & 1.8MW
- Nagoya, Japan
- Power grid support w/ fuel cell



Plant Factory

- 125kW/123kWh
- Fukushima, Japan
- Peak shaving



EV Charging Station

- 125kW/123kWh
- Yokohama, Japan
- Peak shaving



Manufactory

- 500kW/331kWh
- Sagamihara, Japan
- Micro-grid w/ PV, gas turbine



Success case

BESS on Micro grid



DeltaGrid® Charging Infra. and Energy Management

- Manage multiple energy sources
- Optimize energy consumption

Energy Storage System

- Energy regulation
- Increase renewable energy utilization
- Backup power



PV System

- Provide clean energy
- Integrate with energy storage & energy management system to build a microgrid

EV Charging

- Supply electricity to EVs
- V2X bi-directional charging for backup power, VPP applications