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SUN SYNK®

Mobile Energy Storage System

1 Mega Watt (983 MWh)

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Sunsynk introduces its 1MWh **truly modular** and **ultra-scalable** portable battery energy storage system

The modular system was designed from the ground up as the replacement for back up diesel generators. It provides a portable energy solution for temporary installations and brings stable electricity to its clients in countries with energy instability, disruptions and short-supply.

Not only are these systems a lot more cost-effective, but they're also addressing sustainability goals. Apart from causing high cost per kWh, diesel generators are noisy, costly and environment unfriendly and not made to run continuously. Besides, they require lots of maintenance and often cause damage to connected equipment due to in-rush currents when the system switches over to the generator.

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Sunsynk BESS solutions are **unique**

- Designed from the ground up by renown global brand Sunsynk
- Robust high performance BESS solution
- Versatile and made to tackle all major battery applications
- Designed and manufactured as an integrated solution by one single brand
- Modular and scaleable to support multi-site fleet optimisation
- Best in class remote monitoring and management platform
- Backed by global- and local maintenance and service organisation
- Brought to customers in pay per use / leasing model by Solar Bess Corporation

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Fast-growing British Owned **Sunsynk Group** taking solid market position among industry leaders

British owned Sunsynk, a global leader in smart inverters and battery storage solutions, was founded 20 years ago. Sunsynk's main drive to innovate has always been *the customer experience* and with that in mind Sunsynk developed its own sophisticated software platform and user apps which sets the company apart from most of its competitors. Easy to install and easy to operate

Originating from the UK, where human resources are a major cost factor, the company understands the importance of creating products that are faster and easier to install and commission, with proper English training videos for installers and end-users. Using a Sunsynk product, is an intuitive experience.

It is therefore not surprising that the company grew fast. From its humble beginnings twenty years ago, to commissioning approximately 30.000 new monthly installations on its platform today, the company has become a leading brand in the renewable energy market with an annual revenue well on its way to a billion USD

With offices in the UK, Hong Kong, South Africa, The Netherlands and Spain and more offices to open soon, the company is well prepared for continuous growth and support to its global customers.

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Sunsynk Energy Storage Systems
are more than a piece of hardware

Sunsynk BESS is more than a piece of hardware. As an established global inverter brand with over one hundred thousand systems deployed, **Sunsynk** started developing its own battery range of products with a few key objectives; **Portability, Scalability, Modular** building blocks to avoid redundancy during maintenance.

The brains of the product is however not the batteries or the inverters but the sophisticated ecosystem being run by its home developed BMS, where the magic really happens.
The systems can be remotely monitored from the secure **Sunsynk** cloud platform, settings can be altered and trouble shooting often does not require a physical presence.

The system provides machine learning algorithms for micro-grid optimization to meet client objectives, i.e., maximizing site energy cost reduction. Including real power flow simulations within the “digital twin” of each system running on the **Sunsynk** cloud to understand optimum control variable settings.

Energy storage is vital for an accelerated energy transition to the energy system of the future. Energy storage is providing fast access to power when the grid capacity is insufficient or when customers need to peak-shave.

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Advantages of Sunsynk Energy Storage Systems

CLOUD CONNECTED
The Sunsynk platform remotely monitors every commissioned system supporting many functionalities to monitor, service and optimise the systems 24/7 from anywhere in the world. User interfaces include an end- user app which continuously provides all valuable data in real time. Over 100K installed systems are running successfully on the secure Sunsynk cloud.

FLEXIBLE
Sunsynk Mobile is a hybrid system which enables multiple energy sources and many stackable revenue streams. The containers can be easily reassigned to other locations to right-size all solutions to the changing needs of the customer

SCALABLE
The system easily scales up and down as to the changing needs of the location where it's deployed

SUSTAINABLE
Poisonous CO2 emissions from noisy, environment-unfriendly diesel generators are a thing of the past

MOBILE
The plug & play containers can be installed within a few hours and easily be reassigned to other locations when needed. Ideal for efficient optimised fleet management

ROBUST & SAFE
The system is designed and built around all safety standards and is fully certified. Sunsynk's products are proven and robust with well over 100.000 systems deployed globally

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Supported Functionalities

MICRO-GRID
Create a grid of your own design. For instance, by integrating solar or wind turbine energy generation into your micro-grid

STAND ALONE
(Island) Mode
Create a standalone-grid through the inverters source mode

PEAK SHAVING
Peak shaving of a grid connection to support short bursts into power demand. Seamless switching over to stand alone mode in case of grid failures

GRID DEPLOYMENT
Generate or buy electricity off-peak to store and sell at peak price

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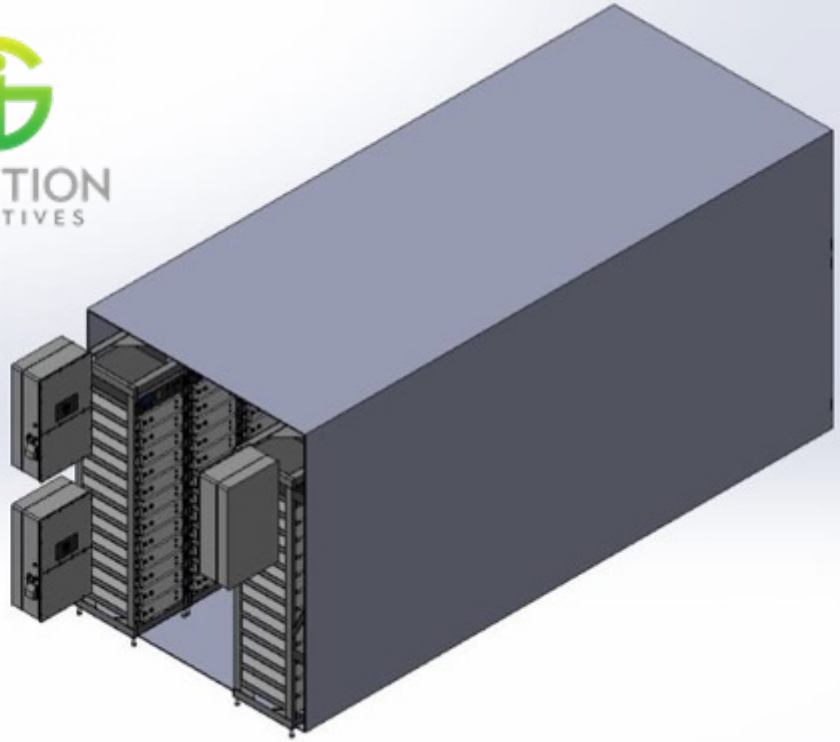

Easily **Scalable** & Mobile **Solution**

Sunsynk Mobile offers a totally modular solution, both for the inverters and battery packs.

The system can easily scale by simply connecting multiple BESS containers in parallel
The modular Inverter and battery topology prevents redundancy as only small portions of the total solution will stop working in case of a failure. Racks and batteries can be scaled up or down as per the changing needs of the application.
For instance, if load shedding is reduced, the total capacity of the battery can be brought down and the remaining capacity can be re-deployed elsewhere in the customer's battery fleet.
Modular topologies are easier to install as well.

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Grid-Independent with SUN SYNK® Mobile Energy Storage Systems

- Eliminate or reduce the use of environment-unfriendly diesel generators
- Protection of your equipment, no inrush currents
- Negligible maintenance costs, no downtime
- Energy security during load shedding hours
- Peak shaving solution
- Completely flexible, connects to every source, grid supply, PV, generators, wind turbines

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E Mobility – Electrical Vehicle Charging

- Management and control of EV Charging Points for additional revenue stream for our clients. Optimum use of renewable energy and BESS for EV Charging
- Enable Electrical Vehicles in any environment
- Deploy fast-chargers without expensive upgrades

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Distribution **Grid**

1. Temporary Power during maintenance activities
2. Back Up Power during grid outages
3. Temporary Peak Shaving solution to support network constraints

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Battery System Overview

The battery modules are based Lithium Iron Phosphate (LiFeP04) used for the cell cathode. They are CE marked and comply with the requirements of IEC 62619, UL 1973, UL 9540A and UN38.3 for transport. They have a deep Depth of Discharge (DOD) of 90% at 0.5C charge / discharge at a temperature of 25^0C. The battery modules are mounted on standard 19" racks. Each battery rack consists of 12 battery modules connected in series. This gives a rated energy of 61.44 kWh and a usable energy of 55.29 kWh. Each battery rack is equipped with an intelligent Battery Management System (BMS) which manages the charging / discharging, cell voltage checks and balancing current. The complete battery module is non-toxic, non-polluting and environmentally friendly.

Based on the **Sunsynk** BESS 1 kWh unit, there are a total of 16 battery modules which equates to a system rated energy of 983 kWh and a system usable energy of 885kWh. These are in a 40-foot ISO compliant container. There is a dedicated room for the batteries where the environment is managed by a HVAC system. There is a fire detection and suppression system also fitted. The battery racks are wired via DC cables back to the DC Combiner box located in the control room. The control room and battery room are separated by an internal wall with personnel door. The DC combiner box then connects to the Power Converter System (PCS), this consists of 4 x 100kW **Sunsynk** bi-directional converters. This gives a system total active power rating of 400 kW.

The batteries and PCS are supervised, managed and controlled by the BESS Energy Management System (EMS)

Power Converter System (PCS) Overview

The PCS consists of 4 x 100kW **Sunsynk** bi-directional converters. This gives a system total active power rating of 400 kW. Each converter receives an AC power supply via the AC grid connection to the BESS container. The DC output of each converter then feeds the DC combiner box, this consists of DC protection and isolation and then DC feeders to each of the 16 battery racks. The converter interconnects and then carries out the requisite AC to DC transformation (rectification) for battery charging and DC to AC transformation (inversion) for battery discharging. The converters are linked with communication channels which transmit / receive data using RS485 over copper wire signal cables using the Modbus RTU protocol. A single converter acts as a master, the other three converters are its slaves. The master converter is connected to the EMS using the same Modbus RTU protocol. This allows the EMS to supervise and control battery charging / discharging, battery and converter monitoring. The PCS are also able to operate in grid connected mode, this is the normal method of operation where the BESS can charge / discharge power to the site local network or directly to the grid, depending on the prevailing technical and economic conditions. The PCS are also able to operate in off grid mode, when the grid is lost, then the BESS quickly detects this condition and provides power to the site critical load. Based on the 1 MWh BESS unit, the maximum power the BESS can produce is 400kW, hence the connected critical load must be equal to or less than 400kW. If the critical load is 400kW the BESS will be able to power this load between 2 – 2.5 hours. Upon return of the grid, the BESS automatically re-synchronises and reverts to grid tied operation. This operation is under the supervision and control of the EMS.

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Energy Management System (EMS) Overview

Introduction

The EMS is a sub-module of a Microgrid Controller. It is a capable of operating standalone for only BESS Management or within a Microgrid Architecture operating as a node in a site wide Microgrid scheme.

The EMS consists of base functionality for the monitoring, control, optimisation and safe operation of the BESS.

The EMS consists of optional functionality for the monitoring, control, optimisation and safe operation of a site wide Microgrid capable of integrating multiple local Distributed Energy Resources (DERs).

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EMS
Hardware

The EMS consists of the following hardware:

1. Compliance with local regulations and appropriate African / IEC standards.
2. Housed in a rugged control panel enclosure adequate for installation internally in the BESS container.
3. The control panel meets the requirements of IEC 60529.
4. Control Panel equipped with dedicated HVAC system which operates in conjunction with the battery room HVAC. If the battery room HVAC system fails, then the control HVAC system shall continue to operate to maintain the operability of the EMS.
5. The control panel hardware is a powered by a normal power supply and a back UPS with a 12-hour autonomy. UPS batteries are located in a separate enclosure of similar construction to the control panel enclosure.
6. The EMS components are arranged in an N-1 configuration, for any single point of failure the EMS will remain operational.
7. The EMS will have all wiring, terminals and other components adequately sized for maximum steady state current, fault level and over voltages. Power losses is a kept to a minimum. Calculation sheets are provided verifying the design process and compliance with local regulations. This will include temperature rise calculations.
8. Electrical design will ensure adequate segregation and shrouding between voltage levels and components. All components is a IPXXB rated.
9. Control panel screening and earthing will meet EMC requirements and system earthing requirements of local regulations.
10. All control panel components will be protected by overcurrent and earth fault protection which offers adequate protective device discrimination and speed of operation to protect components.
11. The control panel is equipped with Surge Protection in compliance with local regulations.
12. Ethernet switches are managed and supervised by the EMS.
13. Failure of any component in the control panel will provide an alarm signal to the EMS.
14. Frequency transducer is provided for accurate measurement of system frequency in compliance with national grid codes. Data is fed back to the EMS.
15. Power Quality metering is provided for measurement up to the 50^{th} integer harmonics, inter-harmonics, voltage and current transients. Data is fed back to the EMS.
16. Tariff class metering is provided. Data is a fed back to the EMS.
17. Main controller will have interface modules suitable for connection to temperature and humidity sensors throughout battery room, PCS, DC Distribution Panels and AC Distribution Panels.
18. Touchscreen HMI for local system monitoring and Operation and Maintenance
19. Fibre optic to ethernet converter to allow connection of communication with site fibre optic network

EMS Communication Interface

1. Communication connection to the Battery Management System (BMS) is a N-1. High speed communication links.
2. Communication connection to the PCS is a N-1. High speed communication links
3. Communication connection to the HVAC system.
4. Communication connection to the Fire Detection and Suppression system.
5. Internet connection is via VPN router capable of accommodating hardwired internet from the local site or a sim card with 5G.
6. Modbus TCP connection to grid energy company for any grid trading.
7. Connection of main controller and local components is a via LAN ethernet tcp connected to LAN side of VPN router.

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EMS
Base Functionality

The EMS is equipped with the following base functionalities for the monitoring, control, optimisation and safe operation of the BESS.

1. Client web based Graphical User Interface (GUI) for monitoring of system data and performance by client.
2. Operation and Maintenance GUI for monitoring of system data, alarms and trips. Includes the ability to remotely interrogate system and update software.
3. Battery Safety Shutdown System
4. Local data historian backed up on secure cloud.
5. Cybersecurity and authentication modules
6. Management of battery charging / discharging regime based on interface with site electricity network, grid connection and any site generation / renewables.
7. Power Management System (PMS) Functionality
    a. PCS Active Power Control
    b. PCS Reactive Power Control
    c. PCS Power Factor Control
    d. PV Inverter Control
    e. AC and DC breaker open / close / trip / monitor
    f. Grid Parallel / Grid island operation
    g. Grid code compliance in terms of power factor, power flow and power quality
    h. Network Single Line Diagram for viewing on control panel HMI, client web-based GUI and Operation and Maintenance GUI
8. Machine Learning Algorithms operating locally:
    a. Battery Optimisation in terms of life prediction, safety margins.
    b. Battery room HVAC optimisation
    c. Prediction of PV Solar available for site use and battery charging.
    d. Prediction of site demand
9. Digital Twin in order to simulate differing system operating scenarios to maximise performance.

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EMS
Optional Functionality

The EMS consists of optional functionalities for the monitoring, control, optimisation and safe operation of a site Microgrid capable of integrating multiple local Distributed Energy Resources (DERs). This allows additional systems to be installed across the site to improve site decarbonisation, energy cost reduction and improve energy security.

1. Grid Side Services Module
    a. Allows additional revenue streams to be obtained for the client via grid trading of site assets
2. Site Energy Monitoring and Carbon Reporting Module
    a. Accurate measurement of site energy usage including calculation of carbon usage for carbon compliance requirements.
    b. Measurement and monitoring of other site utilities such as water, gas and waste etc.
3. Wind Turbine Integration
    a. Monitoring and control of wind turbine for optimum system operation
4. Low Carbon Generator Integration
    a. Monitoring and control of low carbon generation (Biomass, Biodiesel etc.) for optimum system operation
5. Electric Vehicle Charging
    a. Management and control of EV Charging Points for additional revenue stream for client
    b. Optimum use of renewable energy and BESS for EV Charging
6. Machine Learning algorithms for Microgrid Optimisation to meet Client Objectives, i.e. maximising site energy cost reduction, including real power flow simulations within Digital Twin to understand optimum control variable settings.

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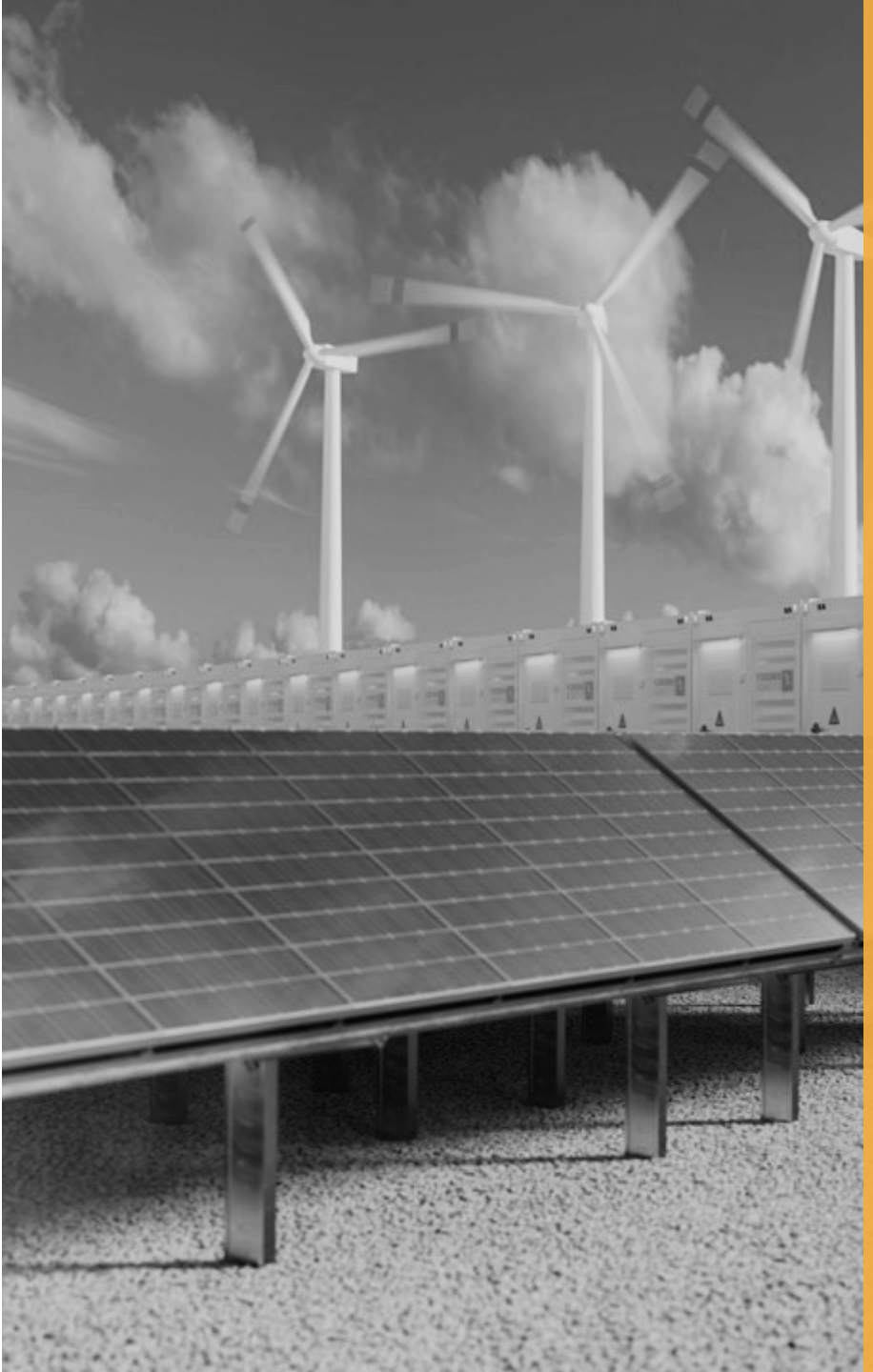

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BMS System Architecture

- The battery stack adopts a two-level BMS architecture and the BMS host and PCS adopt CAN communication
- Both BMS and BMU have independent automatic coding functions and CAN communication is used between BMS and BMU
- The battery stack system has voltage monitoring, current monitoring, power accumulation, short circuit protection, etc

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BESS System Integrations

- EMS and PCS integrated technology, support grid connection and off grid, prevent reverse current, dynamically adjusting power
- Battery Auxiliary power supply redundancy design, support black start function
- Positive Balance Intelligent BMS, providing complete protection, can effectively extend cycle life of battery packs
- Lithium Iron Phosphate (LFP) battery
- Using Hepta-fluoropropane fully submerged fire fighting system
- Emergency stop button to quickly stop the system, support for remote control

PRODUCT CERTIFICATES

- UN38.3,IEC62619,UN3536,IEC61000,IEC62040

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System & **Technical Details**

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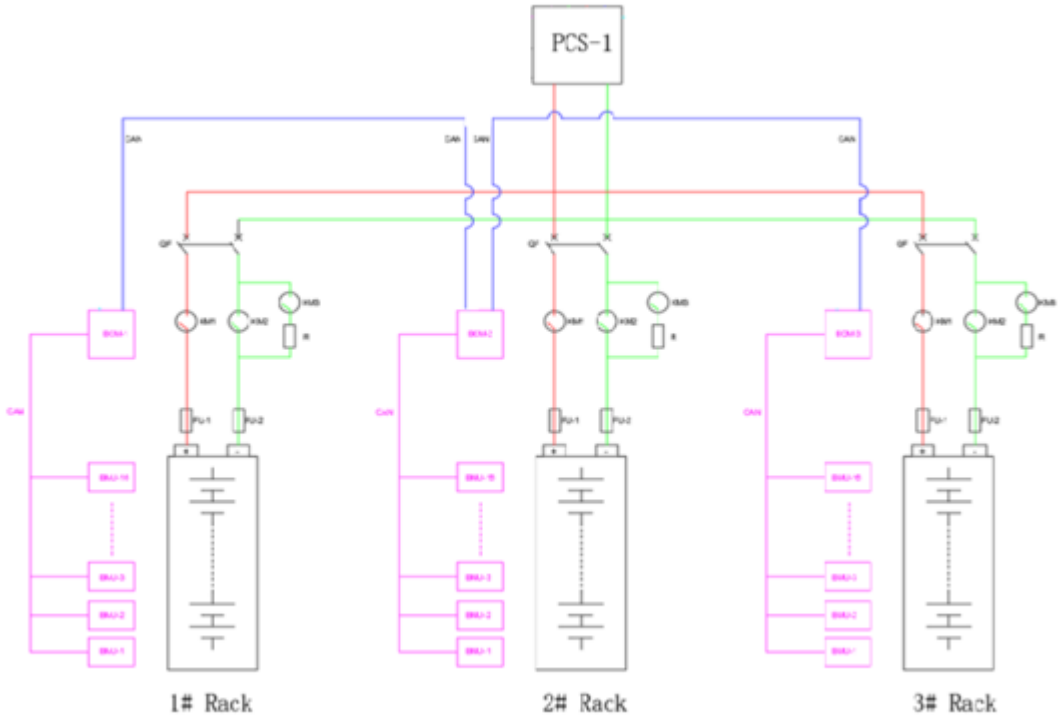
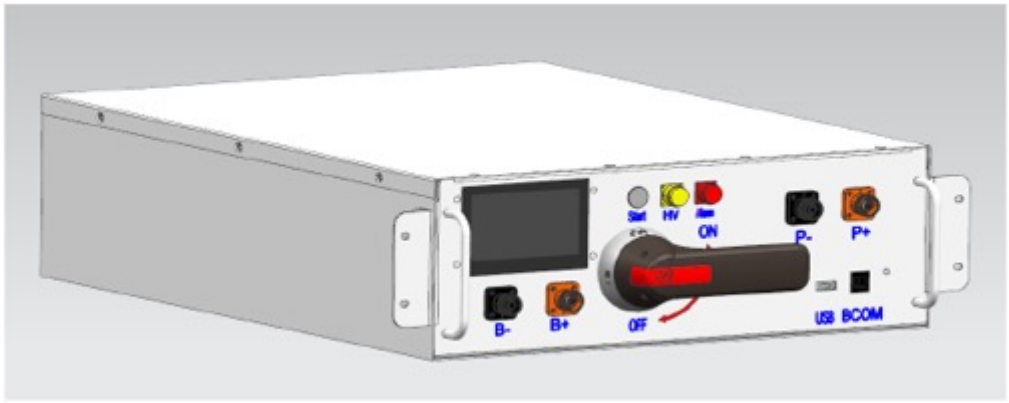
System Overview

BMS + DC combiner

System Overview– BMS+DC Combiner

- The system is equipped with short circuit protection, lightning protection, operation indication and a single PCS module is configured with a protection switch for safe disconnection to meet operation and maintenance requirements
- Grid connection: QF0 is closed, the maximum input power of the grid is 400KW, and the energy storage converter is composed of four 100KW modules. CT4~6 detects current to prevent reverse power output. The total power is 400KW
- Off grid: PT detects voltage loss, disconnects QF0, and the maximum load power is 400KW

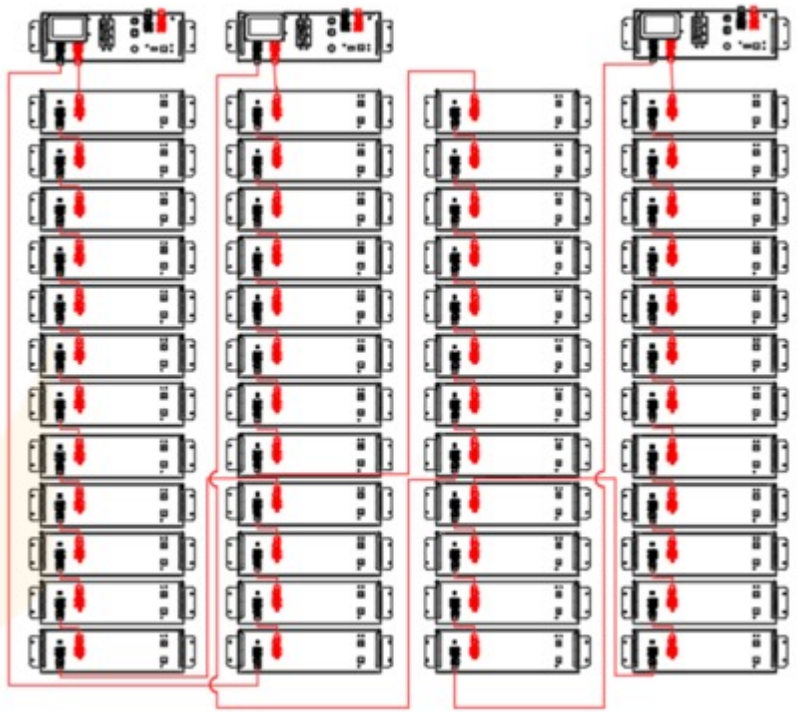




Mobile Energy Storage System 1MW

Battery Technical Specification	
Cell	3.2V/100Ah
Weight （kg)	1.98
Dimension (L x W x H,mm)	160 x50x118
Pack Configuration	1P16S (16 Cells)
Rated Energy （kWh)	5.12
Weight （kg)	44
Dimension (W x D x H,mm)	440*570*133mm
Rack Configuration	1P256S (16 Packs)
Stack Configuration	4*3P256S (12Racks)

Modular
Rack Configuration
BESS SYSTEMS



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Sunsynk Mobile Battery & Inverter **Specifications**

Battery Capacity **1MWh**
Inverter Capacity **400kW**

Model	SSK-400-2H
System Specification	
AC Output/Input Power (kW)	400
AC Output Frequency and Voltage	50/60Hz; 400Va.c
Off-Grid Back up Power (kW)	400
Off-Grid Switching Duration (ms)	500ms~1500ms
Grid Type	3W+N+PE
THD	<3%
Power Factor	-1-+1
System Communication	ETH, Wi-Fi
Black Start	Yes
Fire Detection	Heat and smoke detection
Fire Alarm	Alarm panel, strobes and horns with UPS backup
Aux Load	10kW
Auxiliary Power Interface	400Va.c, 3W+N+PE
Auxiliary Power Back Up	30min (important load)
Local Emergency Stop	Yes
Remote Stop/Shut-off	Yes
Battery Technical Specification	
Battery Capacity (kWh)	5.12kWh x 12 = 61.44kWh x 16 = 983.04kWh
Battery Operating Voltage (V)	716.8 ~ 934.4
Battery Communication	CAN,RS485
Pack Configuration	1P16S (16 Cells)
Rack Configuration	1P256S (16 Packs)
Stack Configuration	4*3P256S (12Racks)
Other Technical Specification	
Dimension (L x W x H mm)	6058*2438*2896 mm (238.50*95.98*114.02 in)
Weight Appr. (kg)	16500
IP Rating of Enclosure	IP54
Seismic Parameter	Zone 4
Noise @1m distance	≤ 75 dB
Operating Temperature Range (°C)	-25~60(>45 °C derating)
Relative Humidity	≤95% (non condensing)
Certification	UN38.3, IEC62619, CE, UN3536, IEC62040

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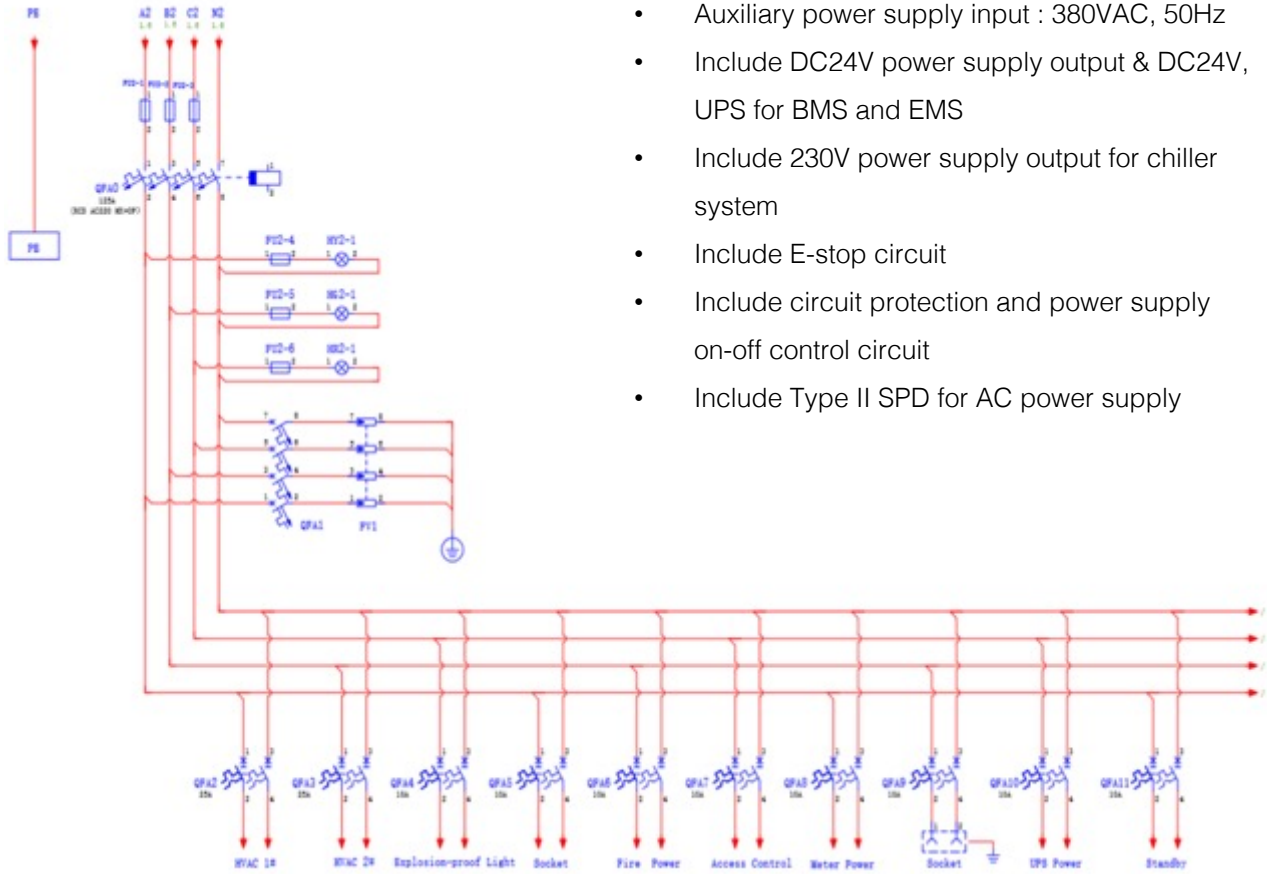
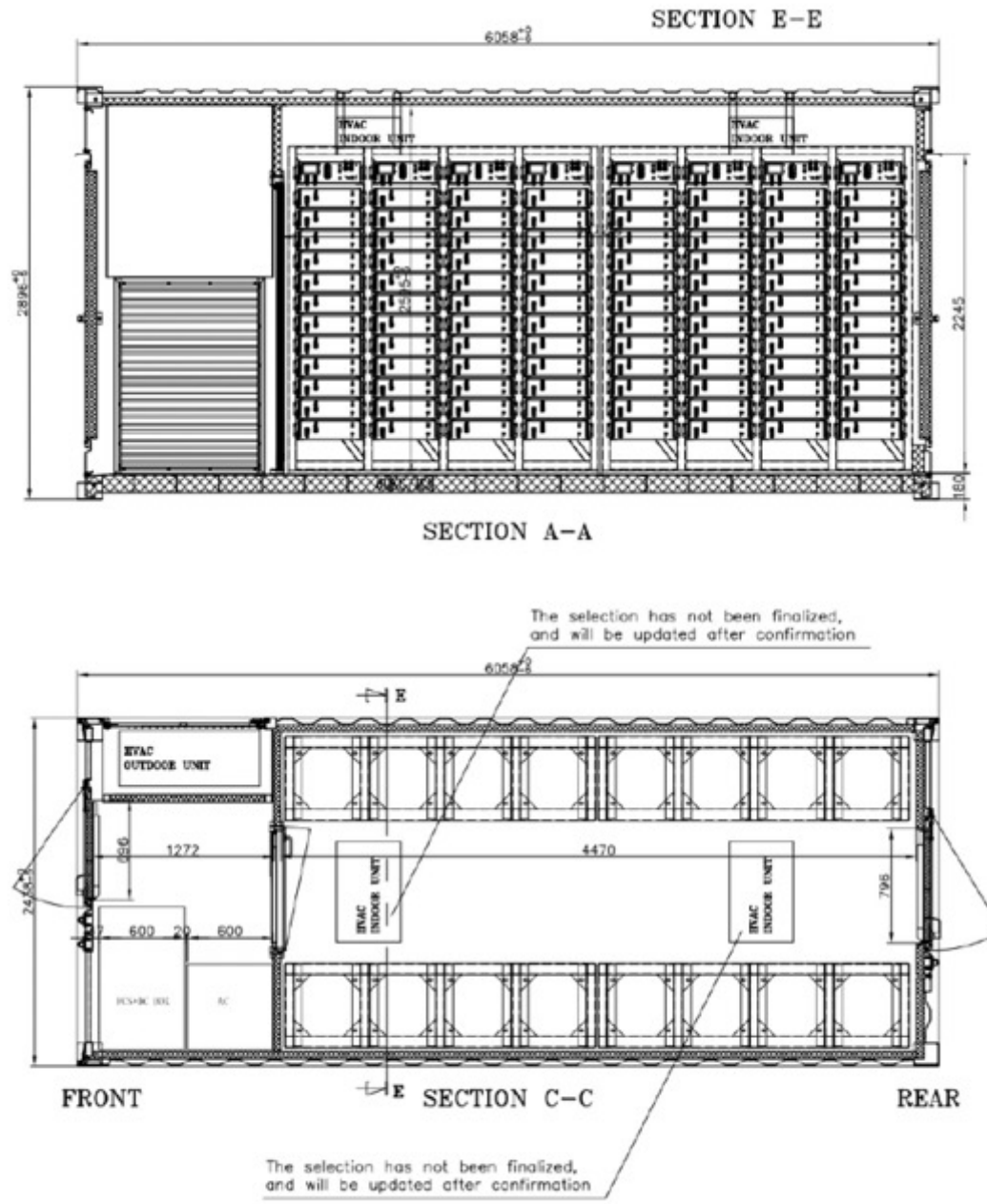
System Overview
Auxiliary **Power Supply**



- Auxiliary power supply input : 380VAC, 50Hz
- Include DC24V power supply output & DC24V, UPS for BMS and EMS
- Include 230V power supply output for chiller system
- Include E-stop circuit
- Include circuit protection and power supply on-off control circuit
- Include Type II SPD for AC power supply

System Overview
Auxiliary **Power Supply**

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