

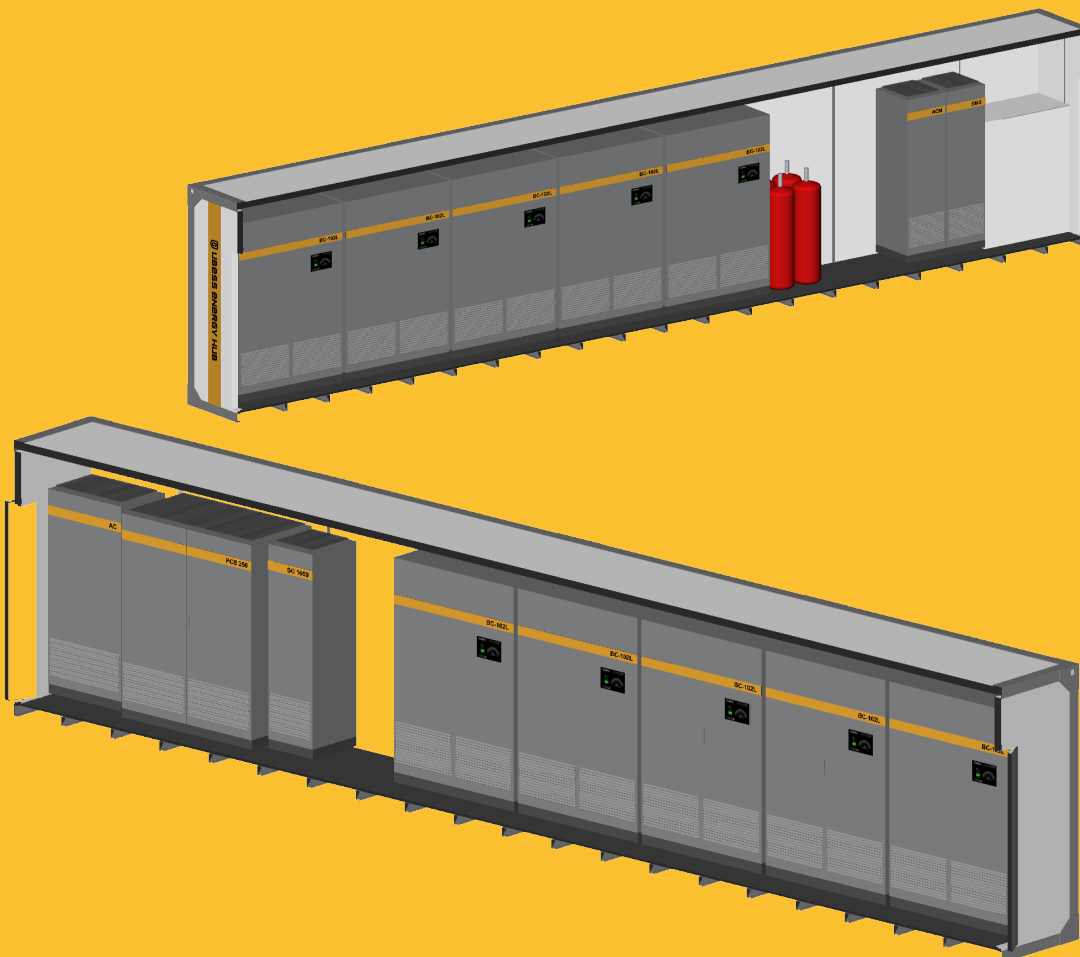


Model: Energy Hub SGH-2000/1000 LTO



UBESS SMART GRID HUB

Energy hubs for making revenue on primary energy
reserve market and ancillary network services



Thank you for your interest in the UBESS hybrid energy storage solutions for smart grids and ancillary services!

At a glance For the electricity market to function, it is important that the supply of electricity producers meets the actual demand. However, it is difficult to achieve this compliance in real time, which leads to the imbalance in the electricity market. To eliminate imbalances, UBESS Smart Grid energy hubs are needed and you can also make revenues by participating in primary energy reserve and ancillary services markets. Energy hubs for smart grid provide:

- The world's lowest charge-discharge cycle at **1.9 US cents per cycle per kWh** (LCOS).
- More than 16 charge-discharge cycles per day, suitable for 24h grid operation, which brings the payback period down to 3.5 years.
- 30 minutes for a full charge and 20 minutes for a full discharge (at 2C-Rate, battery maximum 10C)
- Specially designed lithium titanate (LTO) batteries provide 30,000 charge-discharge cycles and project lifespan of over 20 years.
- Operation both in automatic and in dispatcher controlled mode. Adjusts network power parameters.
- Safest Li-Ion batteries on the market, early fire detection system, gas fire extinguishing system, based on 3M Novec 1230 refrigerant.
- Equipped with North American and European components. LTO ESS batteries are designed and developed by UBESS and manufactured by renowned global manufacturers.

General information

UBESS Smart Grid Energy Hub is designed in a 45ft container version and provides grid imbalance regulation, frequency regulation and peak load balancing.

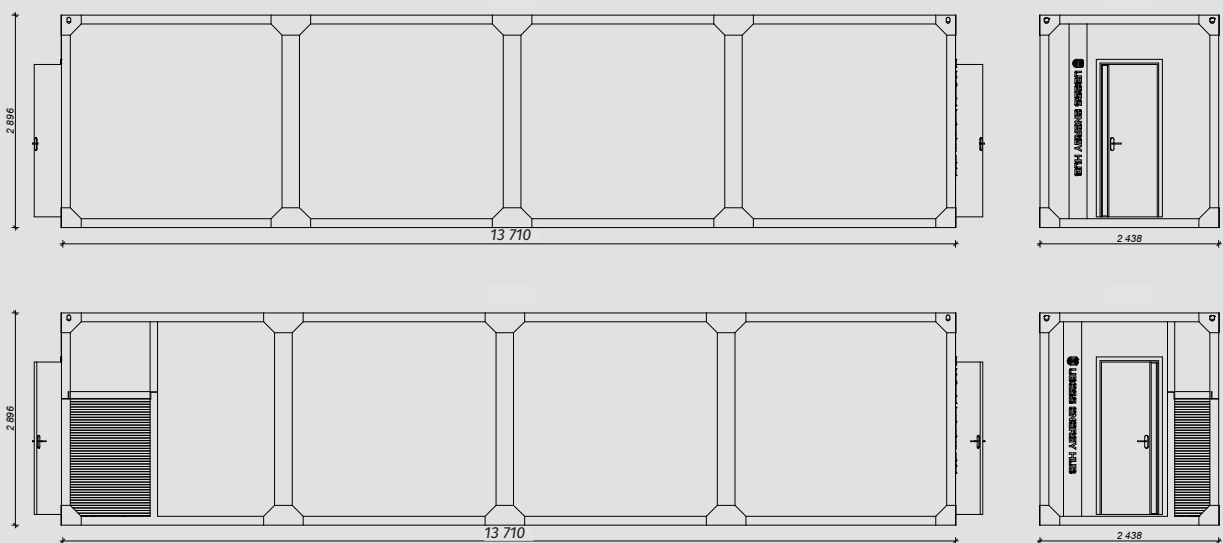
The system is universal and can also be used for compensation of voltage sags and swells, peak shaving, load balancing, adjustment of network power parameters, as a backup power source etc.

The relevant operating modes are programmed according to the customer's request.

Scope of delivery

EnergyHub includes:

- 12x 83.9 kWh battery cabinets with specialized UBESS LTO 33Ah 2.3V batteries for energy storage with frequency regulation and primary response
- Battery management system (BMS) and battery management unit (BMU)
- 2,000 kW Bidirectional network inverter (PCS) with a liquid cooling system
- Early warning system of battery failures with thermal runaway prevention
- Firefighting system with 3M Novec 1230 agent
- Climate control system with 24h temperature and humidity control
- Security, motion CCTV and lighting systems
- Energy Hub Management System (EMS)
- Communication cabinets for remote monitoring and management
- Web server with connection to SCADA
- Auxiliary backup power supply system (AUX)
- 45ft thermally insulated container shell



Smart Grid EnergyHub system layout



Technical specifications

Energy storage	Model	SGH-2000/1000 LTO	
	Rated voltage	380	V
	Efficiency	≥ 96	%
	Rated power	2000	kW
	Battery capacity @98% DoD	985	kWh
	Rated battery capacity	1005	kWh
	Energy storage type	Lithium-Ion	
	Single cell capacity	76	Wh
	Battery cells per container	13 248	pcs
	Electrochemistry type	Lithium titanate (LTO)	
	Recommended depth of discharge	98	%
	Number of cycles @DoD 98%	at least 30 000	cycles
	Battery life until replacement	20	years
Design	Climate category	moderate cool and general climate version	
	Constructive design	thermally insulated 45ft high-cube ISO container	
	IP rating of the outer shell	at least IP44	
	Earthquake resistance	6.0	magn.
	Dimensions of the container (Length/width/height)	L: 13.71 W: 2.43 H: 2.89	m
	Container weight	24 600	kg



System description

- Battery cabinets** Lithium titanate batteries are combined into 46 cassettes. Each cassette has 24 batteries (6s4p). Every cassette is equipped with primary Battery Management System, which monitors voltage and temperature of the cells. Primary BMS also contains balancing modules. BMS unit is mounted on the front side of the cassette. Cassettes are combined in a rack. One rack forms a 83.9 kWh battery with a rated voltage of 800 VDC.
- BMS cabinets** Each cabinet contains two pairs of BMS and BMUs that serve the neighbouring battery racks.
- Battery management unit** BMU acts as a battery circuit breaker and measures circuit current. Unit is designed in a rolling out version, which allows to ensure the staff safety through a visible circuit break.
- Battery management system** BMS unit implements the functions of a safe battery operation and monitoring. BMS is equipped with a touchscreen HMI display, showing current operating modes. Using HMI, you can access the operating parameters of the battery, program the desired operating mode and perform diagnostic functions.
- Bidirectional grid inverter (PCS)** This device allows you to convert alternating current from the power grid into direct current for charging the batteries, and accordingly receive direct current from the batteries and convert it into alternating current for delivery to the network. The cabinet contains power electronics with an liquid-cooled system, built-in microprocessor control with HMI display, capacitor and inductive filter units, and other necessary components.
- Liquid cooling system** Inverter liquid cooling system includes pumping group, hydronic module and an automation system.
- Auxiliary unit** AUX unit serves as an uninterruptible power supply for automation, security and auxiliary systems such as climate system, lighting etc. The unit is made in two sections – AC 380VAC and DC 24VDC. The unit is powered by two reserve 380V AC lines, and also contains an independent battery to provide 24VDC DC power to the automation systems.
- AC Switchgear** Protection and network connection cabinet.

EMS cabinet This is a control cabinet that contains:

- EMS controller
- Communication unit COMM
- Fire alarm and fire extinguishing panel
- Security and access control systems

Energy management system (EMS) The operation of the energy hub is controlled by the EMS unit. Control system is designed to ensure the joint operation of all systems in every possible configuration. EMS performs the high level functions of battery operation control, controls the ambient climate, implements the functions of fire alarm, fire extinguishing control and access control. The EMS module is integrated into the SCADA top level system. Module contains an HMI panel for system control.

Energy Hub can be adjusted in accordance with the object parameters through a two-way information exchange channel with higher-level SCADA systems.

Control system The control system includes an expert-level self-diagnostic system that provides signals on the state of both the energy storage system and its components. System indicates individual defective elements and shows recommendations for their maintenance. The control panel includes an HMI (human-machine interface) with a touch screen for system information monitoring, settings and direct control of the Energy Hub.

Human-machine Interface The HMI control panel allows:

- to monitor the current status of the Energy Hub, all of the system components, the path and direction of the power flow, as well as the current parameters and mnemonic state diagrams
- to control the key operating parameters (current, voltage, power, DC circuit load, current battery charge level and residual capacity) live on the main screen;
- to synchronize the current time (SNTP synchronization);
- to set and correct the setpoints that define the operating modes of the systems. Access to the viewing and changing of setpoints is ranked and available by inputting passwords;

- to enable and disable EnergyHub, or enable maintenance modes;
- to view all archived information of the database: alarm protocols, event protocols, setpoint change protocols, graphs of the main parameters of subsystems, load and network trends for the period indicated.
- to control the climate in the compartments by means of HVAC control systems.

Early detection system The system is designed to provide enhanced security for battery systems. System has an ability to prevent possible battery thermal runaways.

Fire extinguishing system To extinguish possible fires, 3M Novec™ 1230 refrigerant is used, which intensively absorbs heat. Fire suppression is carried out due to the effect of cooling (70 %), and chemical reaction of flame inhibition (30 %). The refrigerant is located in cylinders equipped with electric contact manometers. This allows to control the presence of gas in the system.

The container has a pipe system for feeding the refrigerant directly into cabinets. In case of fire, the sensor tube burns out and the refrigerant is discharged directly into the fire zone.

Outer shell The outer shell is created in a 45 ft ISO container version. The shell is responsible to protect EnergyHub equipment from external climatic and mechanical factors. It meets the demands of the moderate cool and general climate. Thus, Energy Hub can be operated within the wide range of outside air temperatures - from -40 to +45 °C.

Climate control and security

- Climate control system includes an air conditioner, electric heaters and powerful fans.
- The safety system includes fire alarm system, gas fire extinguishing system, security alarm and video surveillance system, as well as access control system.

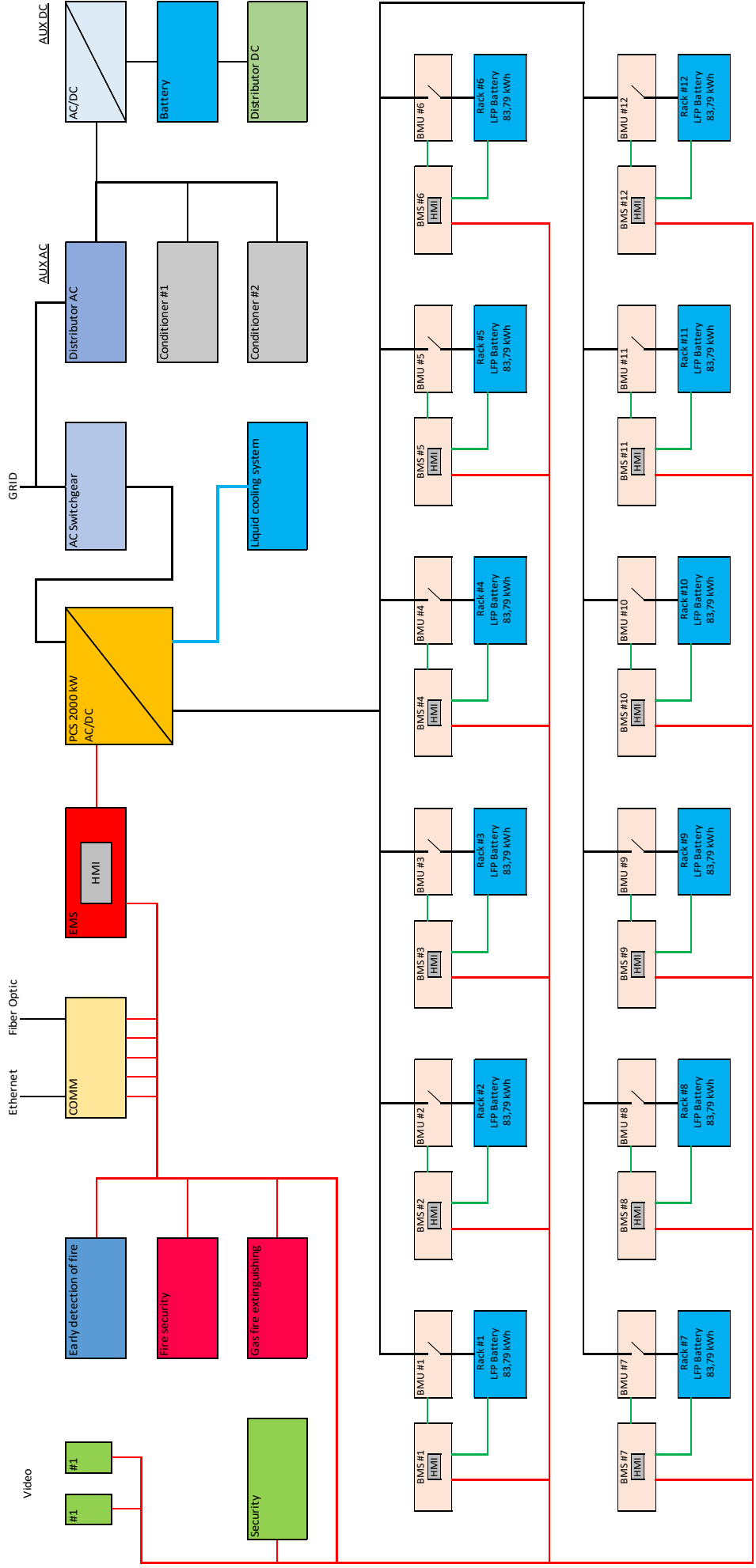
Compliance EnergyHub is designed in accordance with the electrical installation regulations, requirements of IEC, corresponds to the current state of technology and guarantees maximum reliability in compliance with the regulations for consumers electrical installations.

We reserve the right to change any designs, specifications or materials listed without further notice. © UBESS Group 2021



UBESS SGH-2000/1000 LTO – Structural diagram

Attachment #1





UBESS SGH-2000/1000 LTO – Cabinets layout

Attachment #2

