

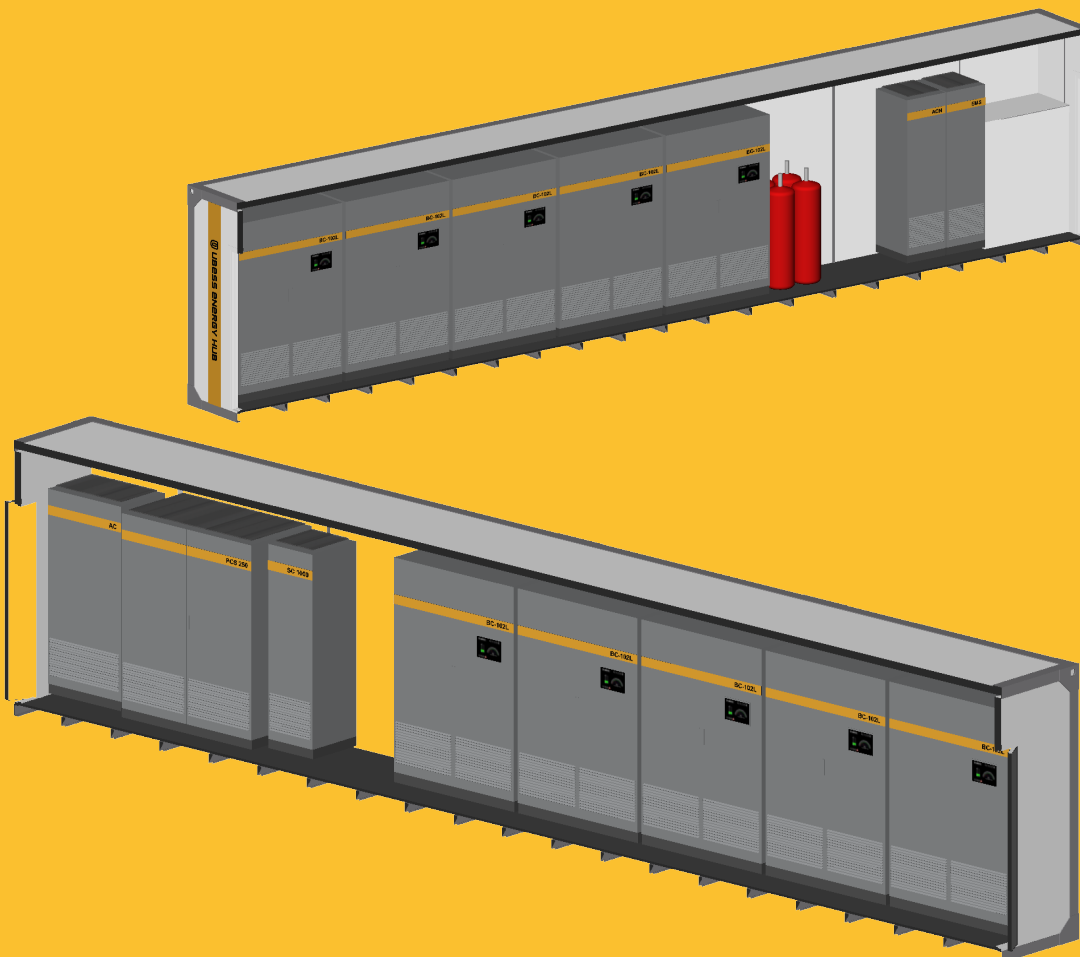


Model: EnergyHub EH-500/3000 LFP



UBESS ENERGY HUB

- Universal solution where energy storage is needed
- For modernization of existing solar power plants
- For the accumulation of night energy
- Backup power power supply of automatics



Thank you for your interest in the UBESS hybrid energy storage solutions!

- At a glance**
- EnergyHub uses specifically developed lithium-ion LFP batteries for energy storage, that provide 7,500 charge-discharge cycles and 20 years useful life at 64% Depth of Discharge (DoD) with precision climate control.
 - This is a turnkey energy storage solution: all necessary components to store energy are on board. Energy hub is easy to operate via a simple and intuitive HMI interface.
 - Early fire detection system and gas fire extinguishing system based on 3M Novec 1230 agent.
 - Security and access control system. Independent automation power supply system for reliability of EnergyHub.
 - Climate control system maintains an optimal environment for long battery life.
 - EnergyHub is equipped with North American and European components. LFP ESS batteries are designed and developed by UBESS and manufactured by renowned global manufacturers.
 - Estimated cost of storage (LCOS) is **3.9 cents/kWh/cycle**.
 - At customer's request, LFP batteries may be partially or fully replaced with Li-Ion LTO batteries with **30 000 cycle life**. LTO energy hub has the lowest cost of storage (LCOS) of only **1.9 cents/kWh/cycle** because of the higher cycle life.
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General information

UBESS Energy Hub is designed in a 45ft container version and provides a predetermined schedule of electricity supply.

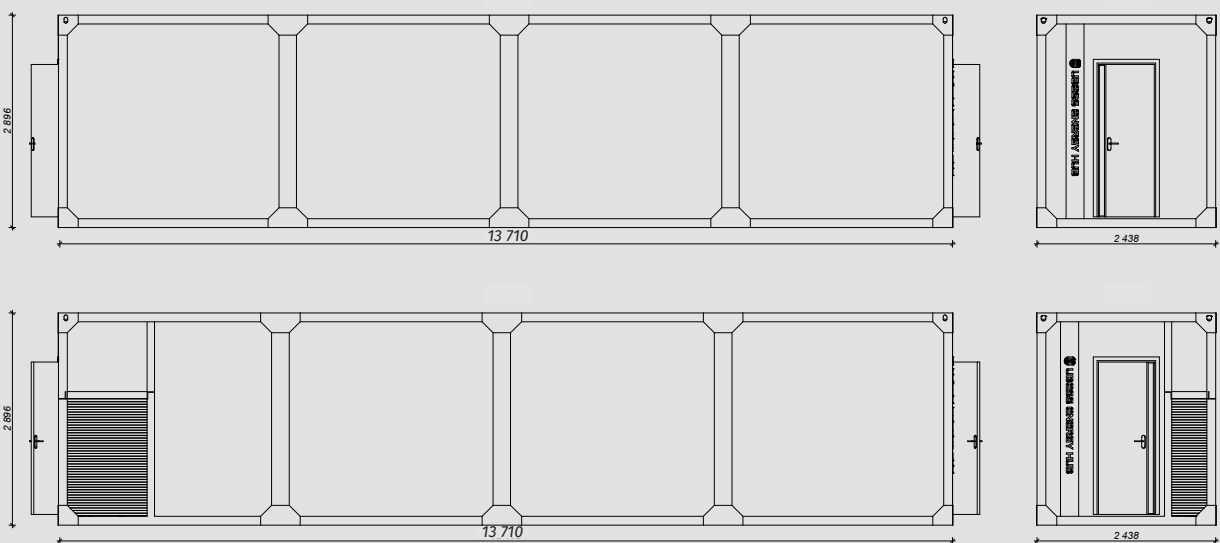
The system is universal and can also be used for frequency regulation, compensation of voltage sags and swells, peak shaving, load balancing, adjustment of network power parameters, as a backup power source etc.

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

Scope of delivery

EnergyHub includes:

- 8x 385 kWh battery cabinets with UBESS LFP 277Ah 3.2V customized energy storage batteries.
- Battery management system (BMS) and battery management unit (BMU)
- Bidirectional 500 kW power inverter (PCS)
- Early warning system of battery failures with thermal runaway prevention
- Fire alarm and fire-extinguishing system based on 3M Novec 1230 agent
- Climate control system with 24h temperature ($25^{\circ}\text{C} \pm 2^{\circ}\text{C}$) and humidity control
- Security and lighting systems
- Energy 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



EnergyHub system layout



Technical specifications

Energy storage

Model	EH-500/3000 LFP	
Rated voltage	380	V
Rated current	757	A
Efficiency	≥ 96	%
Rated power	500	kW
Battery capacity @64% DoD	1920	kWh
Rated battery capacity	3000	kWh
Energy storage type	Lithium-Ion	
Single cell capacity	886	Wh
Electrochemistry type	Lithium iron phosphate	
Recommended depth of discharge	64	%
Number of cycles @DoD 64%, 0.2C rate, 25°C ± 2°C	at least 7 500	cycles
Battery life until replacement	20	years

Design

Climate category	moderate cool and general climate version	
Constructive design	thermally insulated 40ft high-cube container	
IP rating of the outer shell	at least IP44	
Earthquake resistance	6	magn.
Dimensions of the container (Length/width/height)	L: 13.71 W: 2.43 H: 2.89	m
Container weight	29 200	kg



System description

Battery cabinets	Lithium iron phosphate batteries are combined into cassettes. Each cassette has 6 batteries (3s2p) and weights 36 kg. Every cassette is equipped with a 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. 72 cassettes are combined in a rack. One rack forms a 385 kWh battery with a rated voltage of 700 VDC.
Battery management unit (BMU)	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)	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 power conversion system (PCS)	This device allows you to convert alternating current from the power grid into direct current for charging the batteries, and receive direct current from the batteries and convert it into alternating current for the power grid. The cabinet contains power electronics with an air-cooled system, built-in microprocessor control with HMI display, capacitor and inductive filter units, and other necessary components.
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.
Energy management system	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.

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.

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

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.

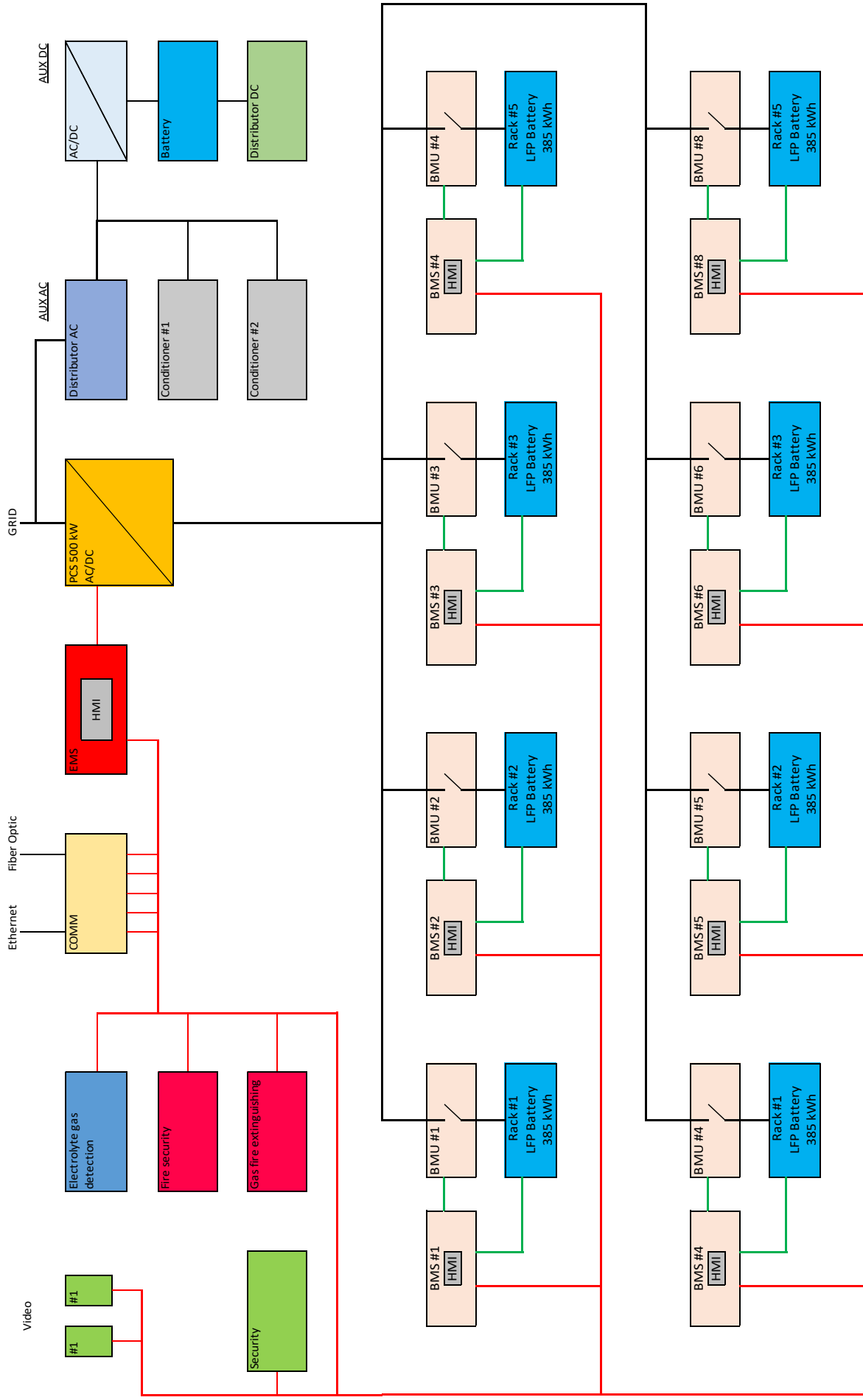
Compliance EnergyHub is designed in accordance with the electrical installation regulations, requirements of IEC, corresponds to the current state of technology and guarantees maximum reliability in compliance with the regulations for consumers electrical installations.

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Structural diagram of EnergyHub EH-500/3000 LFP

Attachment #1





Cabinet layout of EnergyHub EH-500/3000 LFP Attachment #2

