

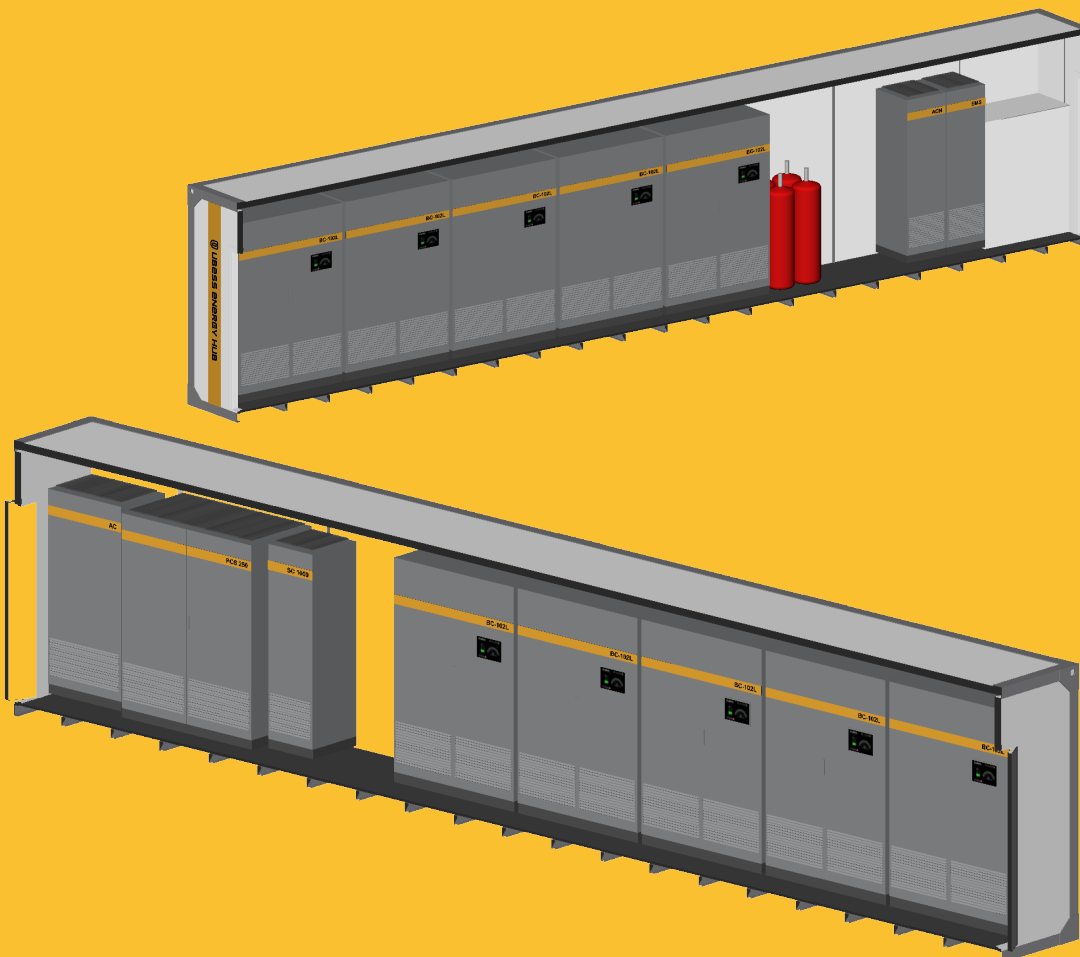


Model: SEH-420/3200 LFP



UBESS SOLAR ENERGY HUB

For the construction of new high efficiency solar energy plants as well as for the modernization of existing ones.



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

- At a glance**
- Solar Energy Hub is a complete solution for storing and optimizing energy from solar power plants. Energy Hub contains all the necessary DC-DC converters, as well as the central solar inverter.
 - All you need to create a solar energy plant with an energy storage, is to connect PV panels and a power transformer to the Energy Hub. Inverter is a part of the Energy Hub, so no additional inverters are required for the solar power plant.
 - Energy Hub works with different battery electrochemistries without hardware modification. Solar Energy Hub 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 integrated climate control.
 - Energy Hub is equipped with North American and European components. LFP ESS batteries are designed and developed by UBESS and manufactured by well-known manufacturers in China.
 - 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**. Cost of storage (LCOS) for LTO batteries will be only **1.9 cents/kWh/cycle** because of the higher cycle life.

General information

UBESS Solar Energy Hub is designed in a 40ft container version and provides a predetermined schedule of electricity supply with integration of solar power plants.

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.

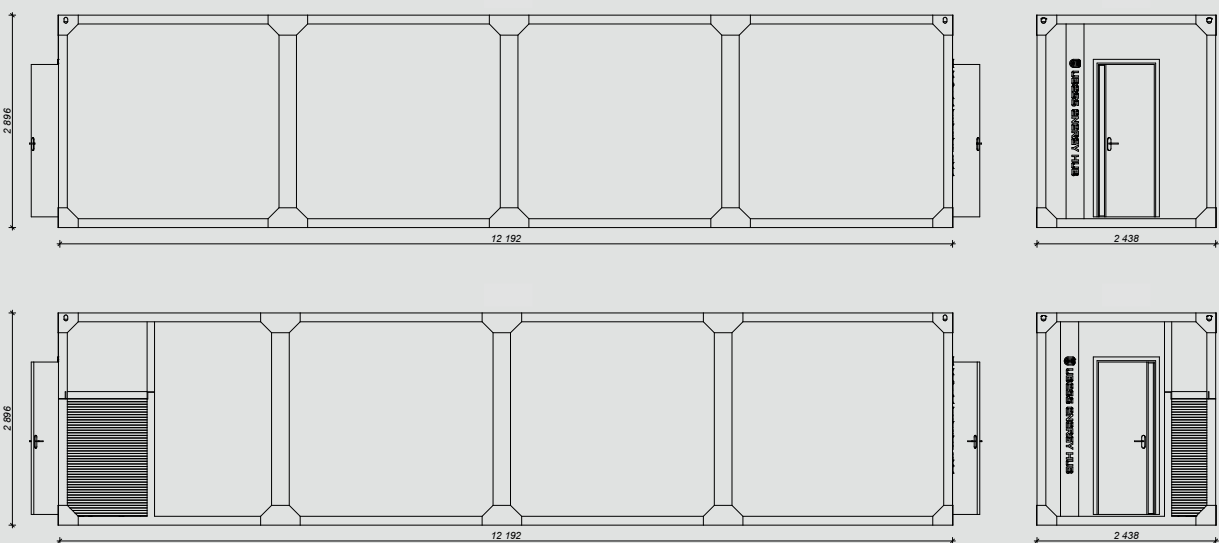
Solar panels are connected directly to the hub without the need for additional optimizers. Solar Energy Hub is connected directly to the included central solar inverter. **No additional inverters are required**, thanks to the DC Bus on board of the Energy Hub.

Scope of delivery

Each energy Hub includes:

- 10x 319 kWh battery cabinets with UBESS LFP 277Ah 3.2V customized energy storage batteries.
- DC-DC bidirectional converters with galvanic isolation, 5 units with a total power of 420 kW
- Battery management system (BMS) and battery management unit (BMU)
- DC-DC uni-directional convertors optimizers for a direct connection of PV panels
- Early warning system of battery failures with thermal runaway prevention
- Firefighting system with 3M Novec 1230 agent
- Climate control system with 24h temperature ($25^{\circ}\text{C} \pm 2^{\circ}\text{C}$) and humidity control
- Security, motion CCTV and lighting systems
- Energy Hub Management System (EMS), communication cabinets with remote monitoring and management
- Web server with connection to SCADA
- 40ft thermally insulated container shell

One central 2 500 kW solar inverter is included per 6 Solar Energy Hubs.



Solar Energy Hub system layout



Technical specifications

Energy storage

Model	SEH-420/3200 LFP	
Rated voltage	<1500	VDC
Rated current	5 x 56	A
Efficiency	≥ 98	%
Rated power	420	kW
Battery capacity @64% DoD	2042	kWh
Rated battery capacity	3191	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	yrs

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	6.0	magn.
Dimensions of the container (Length/width/height)	L: 12.19 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. 60 cassettes are combined in a rack. Two racks connected in series form a battery capacity of 638 kWh with rated voltage of 1152 VDC.
- Bidirectional DC/DC converters** Energy Hub has five independent power channels using five modular DC/DC bidirectional converters, 84 kW each. The channels can be connected in parallel. Total power of the five converters is 420 kW. Converters implement galvanic isolation of the DC output from the battery. The converters regulate the charging and discharging voltages for the batteries operation.
- Uni-directional DC/DC PV optimizers** Energy Hub is equipped with necessary amount of external uni-directional DC-DC optimizers for voltage optimization from PV panels.
- 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, monitoring and control of DC/DC converter operation. 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.
- 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.
- Energy management system** EMS performs the high level functions of battery operation control, controls the ambient climate, implements the functions of fire alarm, detection of electrolyte gas leaks, 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.

Control system Control system is designed to ensure the joint operation of all systems in every possible configuration. A flexible adjustment of Energy Hub in accordance with the object parameters, is provided by a two-way information exchange channel with higher-level SCADA systems.

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 Energy Hub, 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 40ft ISO container version. The shell is responsible to protect Energy Hub 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

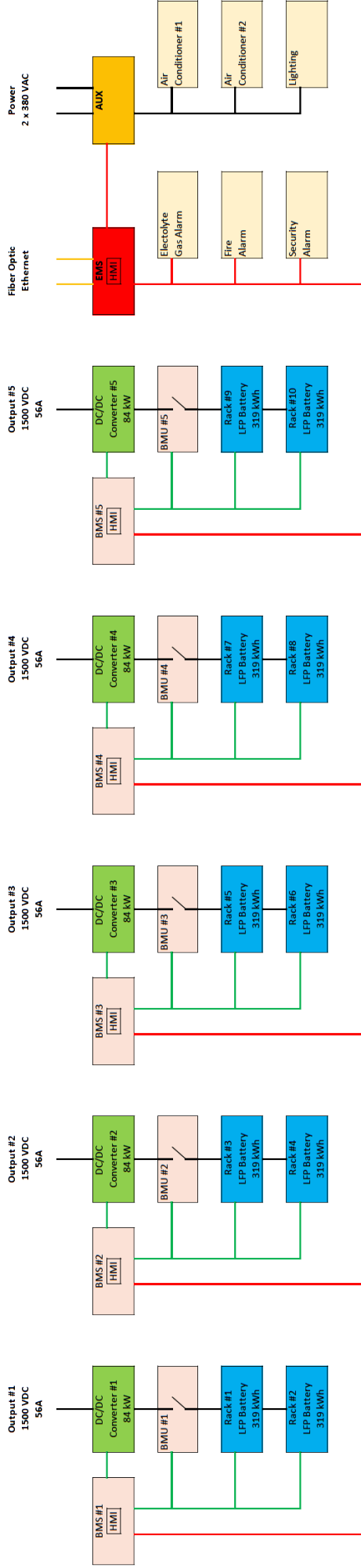
- Climate control system includes an air conditioner, electric heaters and powerful fans.
- The safety system includes fire alarm system, gas fire extinguishing system, security alarm and video surveillance system, as well as access control system.

Compliance Solar Energy Hub 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 2020



Structural diagram of the system – SEH-420/3200 LFP Attachment #1





Cabinets layout – SEH-420/3200 LFP

Attachment #2

