FirmPower™ Energy Storage

Capitalize - Monetize- Optimize

Battery Storage For Large Scale Grid and Load Generation Projects

ESP offers a utility-scale electric storage technology that is ideal for many applications including: commercial data centers, utilities, co-operatives, public sector and Government.

Our standard, containerized battery unit is comprised of 1.5 MVA bi-directional power electronics, 1 MWh of hyper-efficient energy storage technology, and a versatile, programmable control system.

ESP's integrated solution is designed to operate with most generation, grid, or load applications.

ESP's Proven Battery Storage Solution

Performance Highlights:

- Micro-second response and power precision within 10 kW
- Round-trip efficiency >90% (AC-DC-AC and DC-AC-DC)
- Simultaneously provides varying services
- Supplies or absorbs real and reactive power
- Performs reliably across a wide range of cycles and discharge depths

Containerized Unit:

- Housed in a durable, ISO-certified steel container
- Benefits:
- Mobility for site-to-site transport
- Convenient access via exterior roll up doors
- Easy installation and retrofitting for extreme climates
- Tamper-resistant design

Cost Efficiency:

- Competitive initial cost
- Lowest total cost of ownership:
- Integrated solution with storage, power management, and controls
- Minimal maintenance (no pumps or tanks)
- Designed for a 9-year life with easy power cell replacement

Safety and Sustainability:

- Non-Hazmat Rated
- No special site permitting required
- Operates at ambient temperatures
- 95% material recovery and recycling

ESP *FirmPower*™ Storage

Reliable. Efficient, and Environmentally Friendly!

Power Ensured!

SPECIFICATIONS

ESP Battery Storage Solution

Rated Power..... 1.5 MVA (Bi-directional)
Energy Storage..... 1 MWh
System Container Dimensions..... 40'L x 10'W x 10'H
Total System Weight.....< 100,000 lbs

Power Delivery

Max Instantaneous..... 200% of rated power, for 3 seconds
Max Continuous.....150% of rated power, for 5 seconds
VAR Capability..... ± 1.5 MVAW
AC Voltage (Input/Output)..... 480 VAC 3-phase*
DC Bus Voltage..... 750 - 1,200 VDC
Output Normal Frequency..... 50 Hz or 60 Hz
Total Parasitic Load..... 10 kW per MW
Round Trip Efficiency..... > 90%
Cooling Requirements.....Ventilation only**
Relative Humidity..... 95% WH non-condensing
Ambient Temperature Range..... -20°F to 110°F without derating
Altitude Range..... Sea Level to 5,000' without derating
Seismic Load Level..... Any seismic zone
Other Environmental Restrictions..... No siting restrictions
*Can be stepped up to any required voltage
**Except for liquid cooled IGBT

Power Electronics

Dimensions.....82"L x 96"W x 84"H
Weight..... < 9,000 lbs
Operational Input Voltage..... 750 - 1,200 VDC
Rated Input/Output Power..... 2,000 Amps DC
Rated Output Voltage..... 480 VAC 3-phase
Real Power Regulation..... ± 2% of rated power
Reactive Power Regulation..... ± 2% of rated power
Output Current & Voltage Distortion.....Total Harmonic Distortion << 5%
Rated Output Frequency..... 50 Hz or 60 Hz, ± 0.1%
Efficiency..... > 98% at full load

Environment, without derating

Ambient Temperature Range..... -20°F to 110°F
Stored Temperature Range..... -30°F to 150°F
IGBT Cooling System..... Liquid cooled
Compliance..... IEEE 519, IEEE 1547, UL 1741

Control System Capabilities

- Multi-tiered Control System (SCADA, PLC, FCB) for Redundant Safety
- Fully Automated Sub Micro-second Response Time
- 24/7 Intelligent Fault Response System with Text Notification
- Real Time Remote Interface
- Comprehensive HMI for Total System Control & Real-Time Monitoring
- Auto & Manual Modes of Operation
- Flexible Programmable Response for Any Application Inputs
- Micro-second Data Acquisition & Historical Performance Data Logging
- Interoperability with External SCADA Devices
- Employs LAN for Component Communication within Control Room
- Remote Access through Secure VPN Connection

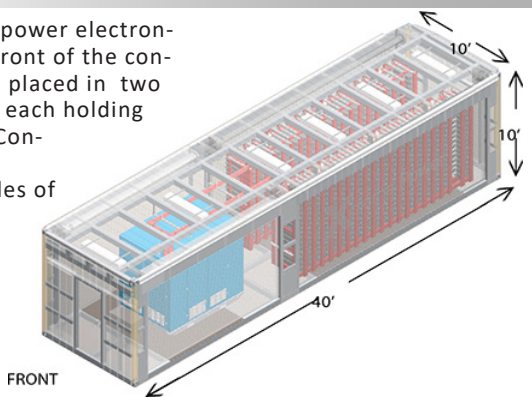
Battery Cells

Dimensions..... 30"L x 5"W x 5"H
Weight..... 58 lbs.
Cell Voltage..... 12 VDC
Current..... 2,500 Amps for 30 seconds
Energy..... 1 kWh @ 3 hour rate
Instant Power Capacity..... 50 kW
Cycle Efficiency..... 95% - 99%

Cycle Life

@190 Depth of -Discharge..... > 250,000 Warranty
@590 Depth of Discharge..... > 20,000 Warranty
Self Discharge Rate.....<1% per month for 3 months
Ambient Temperature Range..... -20°F to 120°F without derating
Operating Temperature..... Ambient +3°F
Environmental Impact....Non-Hazmat Rated, 95% Recyclable Potential

As depicted here, the power electronics (in blue)sit at the front of the container. Power cells are placed in two parallel racks (in red), each holding 500 kWh of storage. Controls (not illustrated) are placed on both sides of the front door.






While the life cycle of our battery storage solution is warranted according to the graph below, historic field performance has been > 3,000,000 cycles.