

MWh-Scale Liquid Cooled Storage Capabilities Blueprint: 1MW C&I Energy Storage Platform

PRODUCT IDENTIFICATION

OFFICIAL OEM WHITEPAPER: 1MW C&I ENERGY STORAGE PLATFORM

MODEL DESIGNATION: EnerStorage-C&I-1.0-LC

PRODUCT TYPE: STANDALONE LIQUID-COOLED BATTERY ENERGY STORAGE SYSTEM (BESS)

TARGET APPLICATION: COMMERCIAL & INDUSTRIAL (C&I) PEAK SHAVING, DEMAND RESPONSE, PV-STORAGE INTEGRATION, AND MICRO-GRID STABILITY



INTERNAL BESS TOPOLOGY

The EnerStorage-C&I-1.0-LC is an integrated, containerized 1MW / 2MWh storage solution engineered for high-cycle C&I environments. It features a centralized Power Conversion System (PCS) connected to a high-voltage DC busbar. The system is built around a modular battery rack architecture, populated with industry-leading, Tier-1 prismatic LFP cells. Each cell is individually monitored by a distributed Battery Management System (BMS) that communicates with a central Energy Management System (EMS) via isolated CAN bus. The high-voltage DC link connects the battery racks to a bi-directional, grid-interactive inverter.

THERMAL PROTECTION MECHANISMS

The system deploys a dual-loop, smart liquid cooling circuit. A primary loop circulates a proprietary water-glycol mixture through cold plates mounted directly to each battery module, maintaining cell temperature uniformity within $\pm 1.5^{\circ}\text{C}$. The secondary loop interfaces with an outdoor microchannel condenser, rejecting heat to the ambient environment. Temperature sensors are integrated at the cell, module, rack, and cabinet levels. The thermal management system is preemptively controlled by the EMS, which modulates pump speed and fan rotation based on real-time current draw and ambient temperature forecasts. This architecture prevents thermal runaway by proactively removing heat, ensuring the cells operate within their optimal $25^{\circ}\text{C} - 35^{\circ}\text{C}$ window, thus

maximizing cycle life and energy throughput.

OPERATIONAL ADVANTAGES

- HIGH ROUND-TRIP EFFICIENCY: Achieves up to 92% DC-to-AC efficiency at nominal power, minimizing operational energy losses.
- EXTENDED SERVICE LIFE: The LFP chemistry, combined with liquid cooling, guarantees 6,000+ cycles at 90% Depth of Discharge (DoD).
- RAPID RESPONSE: The PCS can transition from standby to full rated power in less than 100ms, making it ideal for frequency regulation and seamless islanding.
- GRID INDEPENDENCE: Supports off-grid operation via black-start capability and seamless transition from grid-connected to island mode.

SPECIFICATION MATRIX

Parameter	Specification
Nominal Capacity (DC)	1MW / 2MWh (Expandable up to 4MWh with parallel cabinets)
Cooling Method	Smart Dual-Loop Liquid Cooling (Water-Glycol)
Cell Chemistry	Tier-1 Prismatic LFP (LiFePO4)

Voltage Range (DC)	700V – 1000V (Nominal: 800V)
AC Output (Nominal)	1MW @ 380V – 480V, 3-Phase, 50/60Hz
Peak Output (10s)	1.1MW
Round-Trip Efficiency	92% (AC-to-AC at nominal power)
Cycle Life	6,000 cycles @ 90% DoD, 25 ° C ambient
Operating Temperature	-20°C to +50°C (derated above 45°C)
Enclosure Rating	IP54 (Outdoor Rated)
Communication Protocol	Modbus RTU/TCP, IEC 61850, CAN Bus
Dimensions (L x W x H)	Approx. 6,058mm x 2,438mm x 2,591mm (20ft Container)
Weight	~25,000 kg
Standards Compliance	UL 9540, UL 9540A, IEC 62619, UN 38.3, IEEE 1547

REGULATORY COMPLIANCE

The EnerStorage-C&I-1.0-LC is designed to meet the most stringent global safety standards. It is fully compliant with UL 9540 (Energy Storage Systems and Equipment) and UL 9540A (Thermal Runaway Fire Propagation Testing).

Additionally, the system meets IEC 62619 (Secondary Cells and Batteries - Safety Requirements for Industrial Batteries), UN 38.3 for transport, and IEEE 1547 for grid interconnection. The enclosure is rated IP54 for outdoor protection and features a multi-layer fire suppression system using Novec 1230 and early-warning gas detection.

