

CHARGING THE ENERGY REVOLUTION

Introducing the Power-Intensive ALTI-ESS Suite

> Creating more efficient, resilient and reliable electricity grids

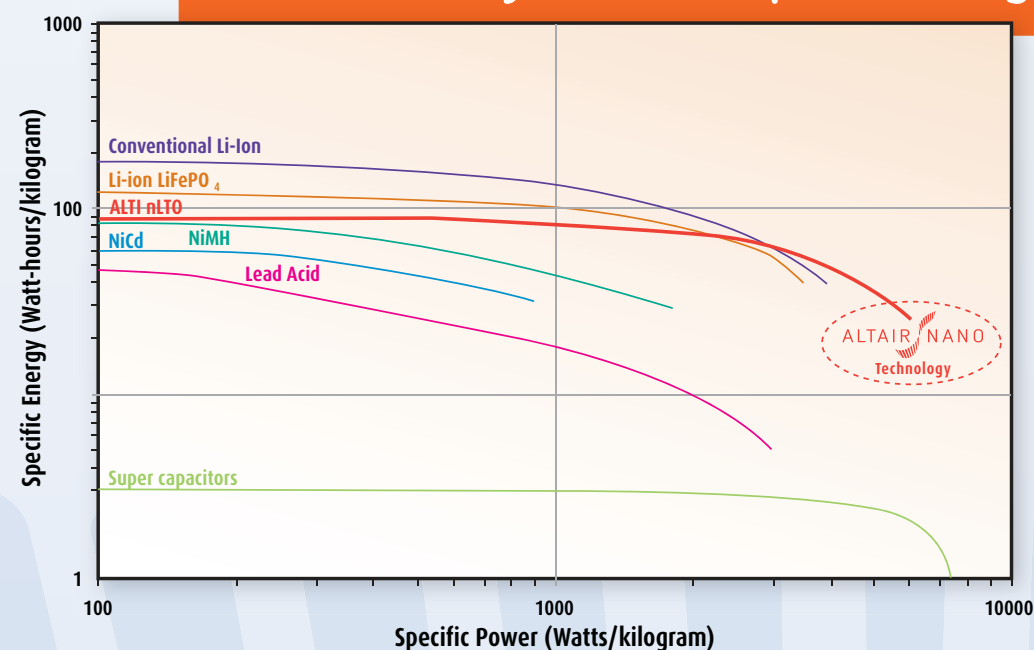
Advanced energy storage technologies are helping transform the electricity grid to more effectively respond to changes in energy generation, utilization, and policy. By delivering clean energy storage solutions that strengthen the efficiency, resiliency, and reliability of the electricity grid, Altairnano is helping utilities and energy services companies achieve sustainable, and economical, power and energy management practices.

For example, Altairnano is helping independent system operators (ISOs) more effectively regulate the stability of the electricity grid, a process often referred to as frequency regulation. Today, utility and independent system operators respond to rapid and unexpected fluctuations in electricity generation and demand by continually ramping up or ramping down the production of conventional generation, such as gas-fired and diesel turbines.

The Altairnano Energy Storage System is a cleaner and more energy efficient, as well as operationally efficient, system for managing grid stability. This system, known as the ALTI-ESS™ suite, is an adaptive, intelligent, and scalable power and energy management platform. It reduces dependencies on conventional carbon-based generation required for frequency regulation. Based on advanced lithium-titanate technologies, the ALTI-ESS responds within milliseconds to frequency fluctuations by releasing or absorbing power from the electricity grid. This helps improve equipment and capacity utilization, strengthen operational efficiencies and reduce carbon emissions.

And with a growing proportion of energy production being supplied by renewable generation, the demand for rapid and flexible power regulation capacity for grid stability will only increase. The ALTI-ESS reduces the need for backup conventional generation for maintaining grid stability associated with utility-scale renewable integration. Responding immediately to sudden shifts in generation, the ALTI-ESS releases or absorbs power from the electricity grid, and if needed, continues to release or absorb power until conventional generation is dispatched.

Only Altairnano achieves a 4C rate at the extended cycle life required for grid regulation



Altairnano's products have power delivery capabilities equal to a super capacitor, with significantly more energy storage than a super capacitor. Although competing technologies may perform at the required charge and discharge rates, they lack the extended cycle life required to deliver an economical solution.

> KEMA validates potential for utility applications

KEMA, an independent consulting firm providing testing and validation for the utility and energy sectors, verified Altairnano's **fast response** and more than **90 percent roundtrip efficiency**.

- "Well suited for scalable regulation applications based on a rapidly changing power dispatch."
- "Successfully demonstrated the potential of using the new battery technology for utility applications."

Read the KEMA report at altairnano.com.



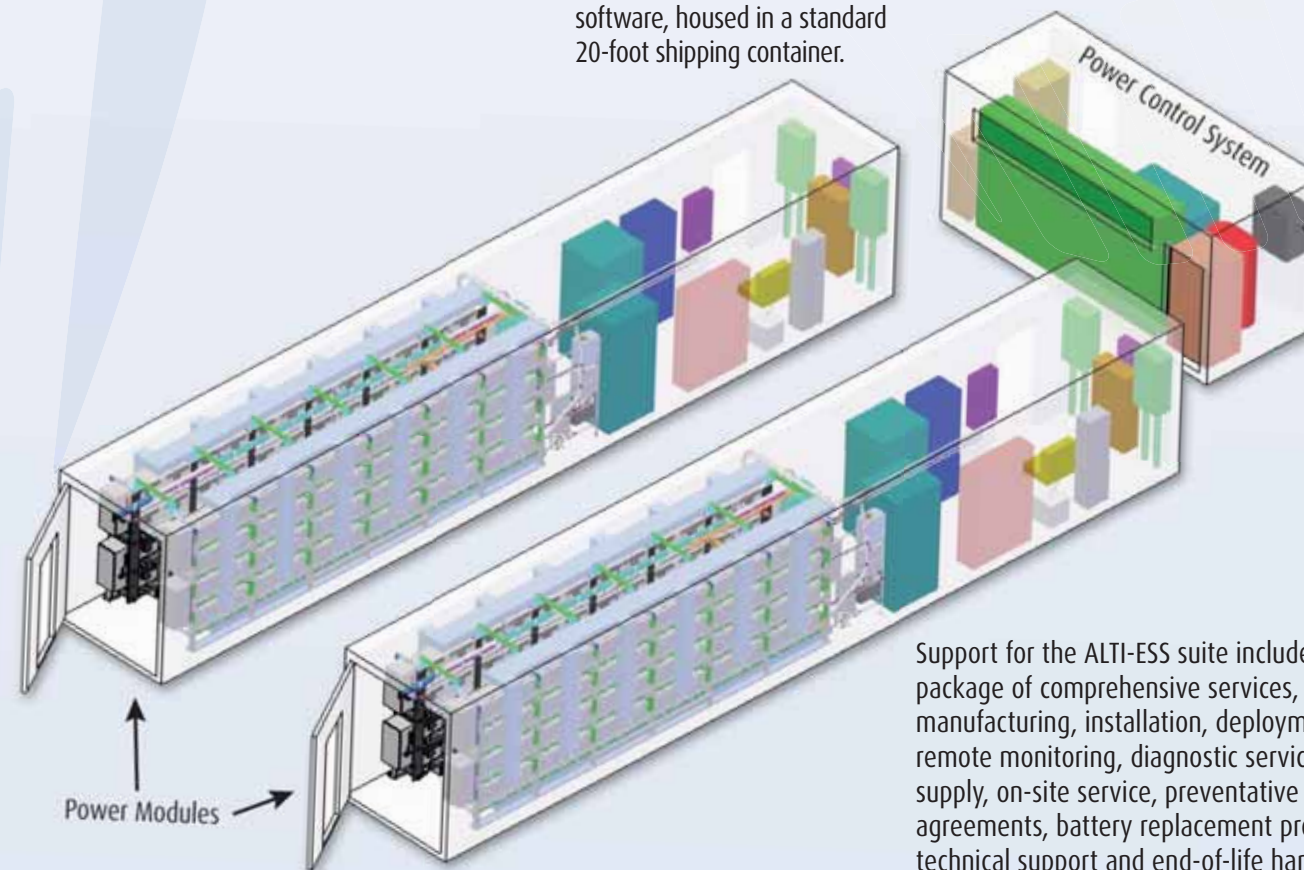
> Modular system designed for pure power

The use of nano-structured lithium titanate in Altairnano's cell technology produces distinctive performance attributes, including extremely fast charge and discharge rates, the industry's highest round-trip efficiencies, long cycle life, safety, and the ability to operate under diverse environmental and temperature conditions. These unique performance attributes make the ALTI-ESS ideally suited for power-dependent applications.

Altairnano provides a fully integrated system easily interconnected to the utility grid.

The ALTI-ESS consists of a modular system design, including the following components:

- The Power Module consists of a 1 x 1.0 MW battery pack and Battery Management System (BMS), fire suppression equipment and thermal-management system, housed in a standard 53-foot shipping container.
- The Power Control System (PCS) contains necessary power electronics and communications systems, transformers, programmable logic controllers and the ISO interconnect system software, housed in a standard 20-foot shipping container.



Support for the ALTI-ESS suite includes a complete package of comprehensive services, including design, manufacturing, installation, deployment, field training, remote monitoring, diagnostic services, spare parts supply, on-site service, preventative maintenance agreements, battery replacement programs, 24/7 technical support and end-of-life handling.

ALTI-ESS benefits

Responsive

The ALTI-ESS has the highest charge rate of any lithium ion energy storage device. Featuring a powerful 4C rate, it can receive a dispatch signal and respond with required power and energy outputs in milliseconds.

Efficient

86% total roundtrip efficiency, including power conversion system, for a 1 MW dispatch, or 93% for a 250 kW dispatch. (Other energy storage systems have a roundtrip efficiency between 60 to 80 percent.) The ALTI-ESS uses less energy to achieve the same charge/discharge results when compared to other energy storage devices, including traditional lithium-ion.

Long Life

With a 12,000+ cycle life and a 15-year calendar life, Altairnano's advanced lithium ion cells and battery systems ensure power is available when it's needed the most.

Powerful

With a maximum continuous discharge of 1,400 Amperes, the ALTI-ESS is the solution for power-dependent applications.

Scalable

Based on the 1MW/250Kwh component configuration, the ALTI-ESS can be scaled to virtually any multi-MW power and energy capacity. This ensures the right balance of power to energy is matched to meet application requirements.

Redeployable

The ALTI-ESS is modular, allowing for quick field deployment, or later relocation as needs and requirements change.

Comprehensive

Scalable 1 MW/250 kWh battery configurations, including battery management system, solid-state inverter, power electronics, programmable logic controllers, and interconnect system software for grid connectivity, plus a package of support services.

> Your needs

Altairnano is helping companies respond to a number of challenges and opportunities within today's energy markets and emerging Smart Grid energy storage applications, including:

- Frequency regulation
- Renewable integration
- Dispatchable demand response
- Ancillary services
- Distributed energy storage

> Technical specifications

AC Voltage	13.8 kV 3 phase standard, or to customer specification
DC Voltage	1050 V at end of charge 750 V at end of discharge
DC Current (max continuous)	1400 A charge and discharge
Power at grid	1 MW charge and discharge
Energy at grid	250 kWh
Response time (-/+ 1 MW) or (full range)	<20 milliseconds
Cell size	50 amp hour
Operating temperature	-10°C to 40°C with no derating -40°C and 55°C with derating
Storage temperature	-40°C to 55°C

The ALTI-ESS suite is compliant with the following standards: IEEE 1547, IEEE 1547.1, IEEE 519, IEEE 979, IEEE C62.41.2-2002, IEEE 693-2005, UL 1741, ANSI C51.110-1986, ANSI C84.1, NFPA 70, NEC Article 480, ANSI/IEEE C2-2007, OSHA 1926.441 and FCC Title 47 part 15 Class A.

For more information about the ALTI-ESS suite and other solutions, call (775) 856-2500 or email sales@altairnano.com.



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