



ENERGY STORAGE SOLUTIONS

EssPro™ Grid

Battery energy storage systems

The power to control energy



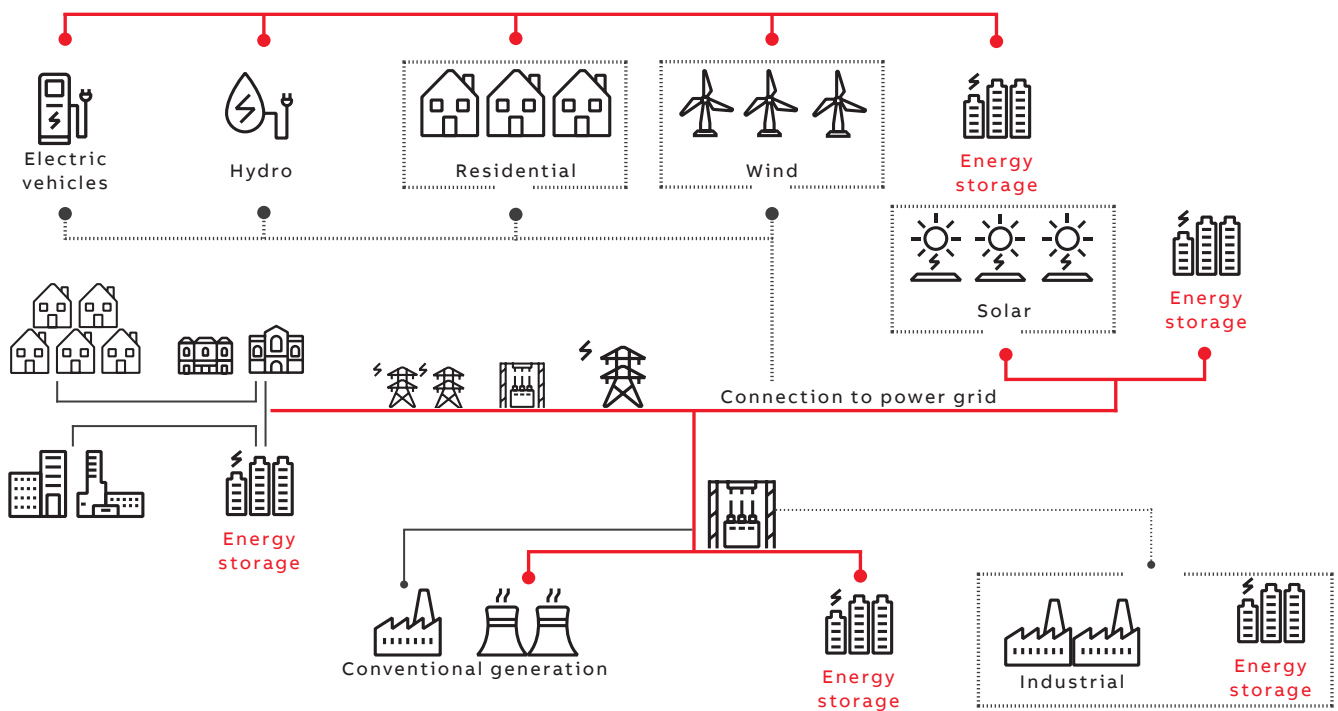
With more than 15 years of experience, ABB is a pioneer and technology leader in the field of distributed battery energy storage systems (BESS). The EssPro Grid portfolio offers fully integrated, reliable and safe storage solutions for a wide range of applications.

EssPro™ Grid

Enabling a stronger, smarter and greener grid

Strategically placed energy storage systems throughout the electrical grid can increase the operational performance and reliability of the utility network, better integrate alternative energy sources, balance electricity supply and demand, and ensure that energy is readily

available when primary power sources are interrupted. Energy storage benefits the entire power value chain, from generation, transmission and distribution, all the way to users.



Energy storage applications

Application	EssPro Grid benefits
Frequency regulation	Absorbs and injects power in order to keep grid frequency within pre-set limits
Capacity firming	The energy storage system smooths the power output to eliminate rapid voltage and power swings on the electrical grid
Ramp rate control	Ability to limit the power ramps of solar or wind plants for reliable interconnection to the grid
Load leveling	Stores power during low-load periods and delivers it during periods of high demand in order to reduce the load on less economical peak-generating facilities
T&D investment deferral	Grid operators can place storage close to the load so it can discharge during peak system periods, reducing stress on the local equipment and instantly increasing capacity without large T&D investments
Peak shaving	Reduce power consumption during periods of high demand which would reduce peak demand charges
Spinning reserve	Available power supply that can quickly respond to instant losses in generation or transmission outages
Power factor & voltage support	Provides reactive power compensation to regulate voltage to improve power quality

EssPro™ Grid advantages

EssPro Grid is a fully integrated turnkey energy storage solution connecting to MV and HV grids.

With the ability to connect different types of energy storage mediums, ABB's EssPro Grid is a turnkey energy storage solution that ranges in power from hundreds of kilowatts to 100 plus megawatts. The optimized energy storage systems enable fast response to variations in demand and supply, helping to maintain grid stability and ensuring reliable and high-quality energy supplies through a range of applications.

A trusted partner in delivering the overall system

From the design phase to project execution, ABB maintains collaboration with customers to secure overall project success.

Extensive experience managing complex projects

With over more than 15 years of experience in energy storage, ABB is a pioneer and technology leader in energy storage systems.

Rigorous technology evaluation and sourcing

From the batteries to the power electronics, ABB has a best-in-class supplier evaluation process in place to ensure the highest quality throughout the system.

ABB's experience in implementing energy storage systems for more than 15 years enables them to provide optimized solutions that are ready for grid connection. For turnkey systems, ABB's execution team acts as a single point of responsibility, thus minimizing project risk and complexity for the customer.

Grid integration expertise and experience

With extensive experience connecting large systems to the utility grid, ABB has the expertise to meet the local utility requirements for smooth interconnection.

Modular and compact designs to customized systems

ABB's modular platform allows for a wide range of solutions from a single compact design to a modular system scalable to any size.

Integrated controls and communication features

ABB's highly integrated controls enables the EssPro Grid to respond instantly and dynamically to the local demands of the grid.



EssPro™ Grid Energy Storage Solutions

From compact designs to modular systems, ABB offers a variety of solutions to fit project needs.

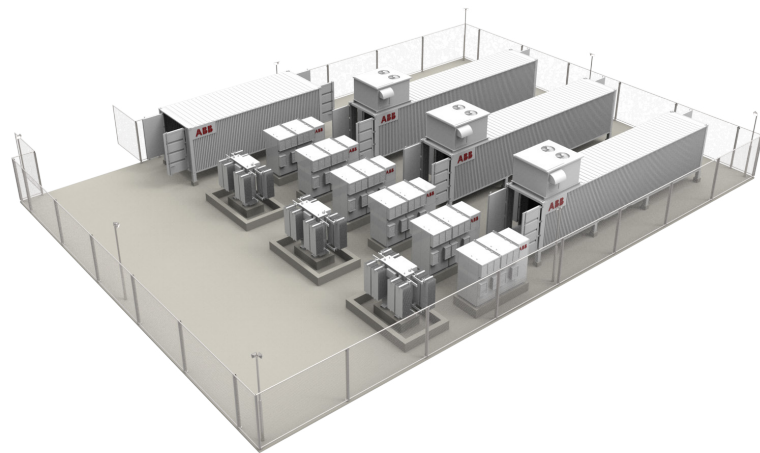
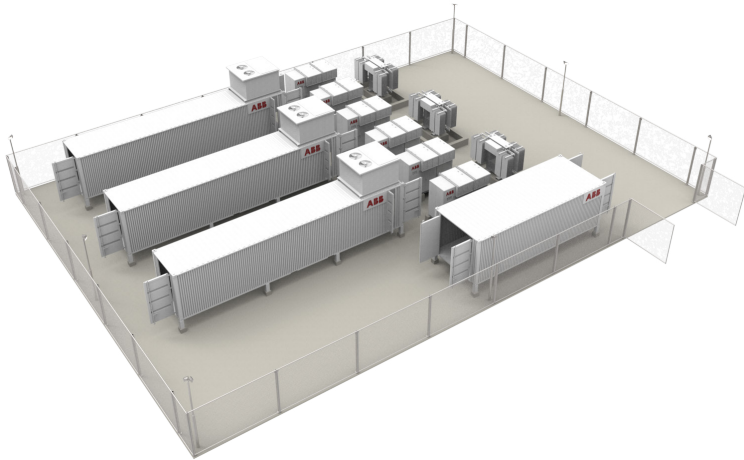
EssPro Grid - Modular

ABB's EssPro Grid-Modular is a fully integrated energy storage system that is able to provide customers with energy whenever and wherever it is needed. The modular approach enables a wide range of system sizes and layouts to accommodate the requirements specific to each energy storage project.

The modular system design offers a range of leading-edge power conversion systems, integrated system controls, state-of-the-art protection systems for AC and DC equipment, primary interconnecting equipment such as transformers and switchgear and the latest in lithium-ion technology to optimize the energy usage and density of the overall system.

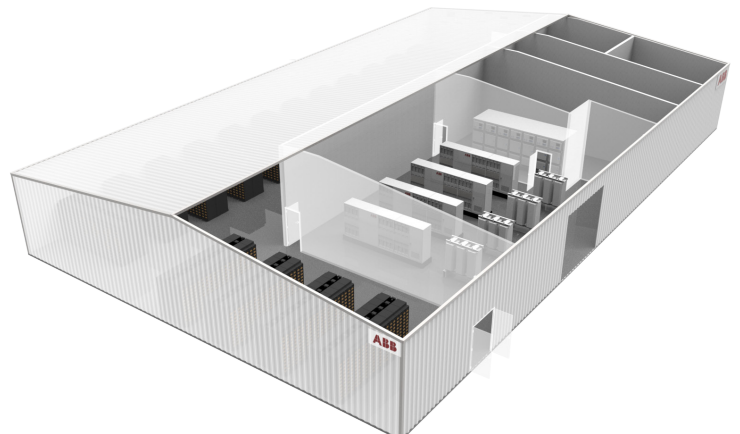
EssPro Grid

System sizes	Modular system up to 100 MW
Battery	Individual selection depending on application and customer requirements
AC voltage	Can connect to all voltage levels



EssPro Grid - Station

ABB is able to take their modular design and house the system in large buildings for added protection. The EssPro Grid-Station is designed to fully encapsulate the energy storage system into one single building.



EssPro™ Grid technical data

Technical data	
Power	min. 1 MW to >100 MW
Energy	min. 0.5 MWh to >200 MWh
AC Voltage	All voltages
Frequency	50 or 60 Hz
Efficiency	> 97% (converter)

Control	
Options	Standard, advanced, premium
Converter control modes	Dynamic power mode and voltage control mode (closed-loop control)
Communication protocols	Modbus TCP/IP, IEC 61850, IEC 60870-5-101, IEC 60870-5-104, DNP

Safety	
Protection	Chemical, mechanical, electrical, fire and environmental protection

Installation	Applications
Containerized or building solution, as per customer requirements	Frequency regulation, capacity firming, ramp rate control, load leveling, t&d investment deferral, peak shaving, spinning reserve, power factor & voltage support

Battery	
Technology	Individual selection depending on application and customer requirements (eg, lithium-ion, sodium-sulfur)
DC voltage range	< 1,500 VDC

Standards, product related	
All components of the system comply with the relevant standards	
Battery and battery management system (BMS)	<ul style="list-style-type: none"> IEC 62620-CD: Secondary cells and batteries containing alkaline or other non-acid electrolytes UL 1642: Standard for safety for lithium-ion batteries CISPR 22: Electromagnetic waves emission/conduction test 73/23/EEC: Low voltage directive
Power Converter	<ul style="list-style-type: none"> IEC / EN62477-1: Safety requirements for power electronic converter systems IEC 6100-6-2: Immunity for industrial environments EN55011:2016: Industrial, scientific and medical equipment UL9540: Energy storage systems and equipment UL1741 Standard for inverters, converters, controllers and interconnection system equipment for use with distributed energy resources IEEE 1547: Standard for interconnecting distributed resources with electric power systems IEEE 519: Recommended practice and requirements for harmonic control
HVAC	<ul style="list-style-type: none"> EN 292: Safety of machinery
Container/building	<ul style="list-style-type: none"> IEC 61140: Protection against electric shock IEC 60364: Electrical installations for buildings EN 15004: Fixed firefighting systems NFPA 70E: Standard for electrical safety in the workplace

Standards, system related	
EssPro Grid complies with all relevant local standards for installation and safety	
EN 50110-1: Operation of electrical installations	

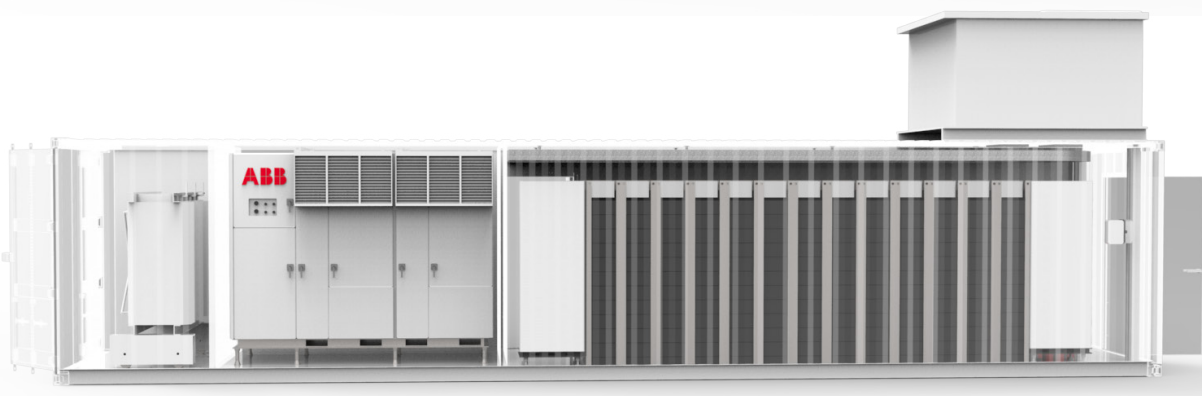


EssPro™ Grid technical data

EssPro Grid-Compact

ABB's EssPro Grid-Compact offers a "plug and play" approach to minimize the use of space, reduce installation time and expedite project execution. This highly integrated system includes the batteries, controls, protection cabinets and transformers all in a single platform.

EssPro Grid Compact	
System sizes	Compact systems up to 2.1 MW
Battery	Lithium - ion
AC voltage	Can connect to LV and MV networks



Technical data	
Power	min. 1000 kW to 2100 kW
Energy	min. 500 kWh to 2400 kWh
AC voltage	<35 kV
Frequency	50 or 60 Hz
Efficiency	> 98% (converter)

Battery	
Technology	Lithium - ion
DC voltage range	< 1,500 VDC

Standards, product related	
All components of the system comply with the relevant standards	
System size	• 45 feet HC ISO container dimensions
WxDxH in (mm)	(13,556 x 2,352 x 2,700)
Weight lbs (Tn)	• 35 to 45 tons
Cooling	• Forced air for converter and transformer • HVAC for batteries
Enclosure/rating/material	• Dry type transformer housing IP 44 • Inverter IP56 / UL Type 3R • Battery enclosure IP54 / UL Type 3R
Certifications	• CE / UL for individual equipments

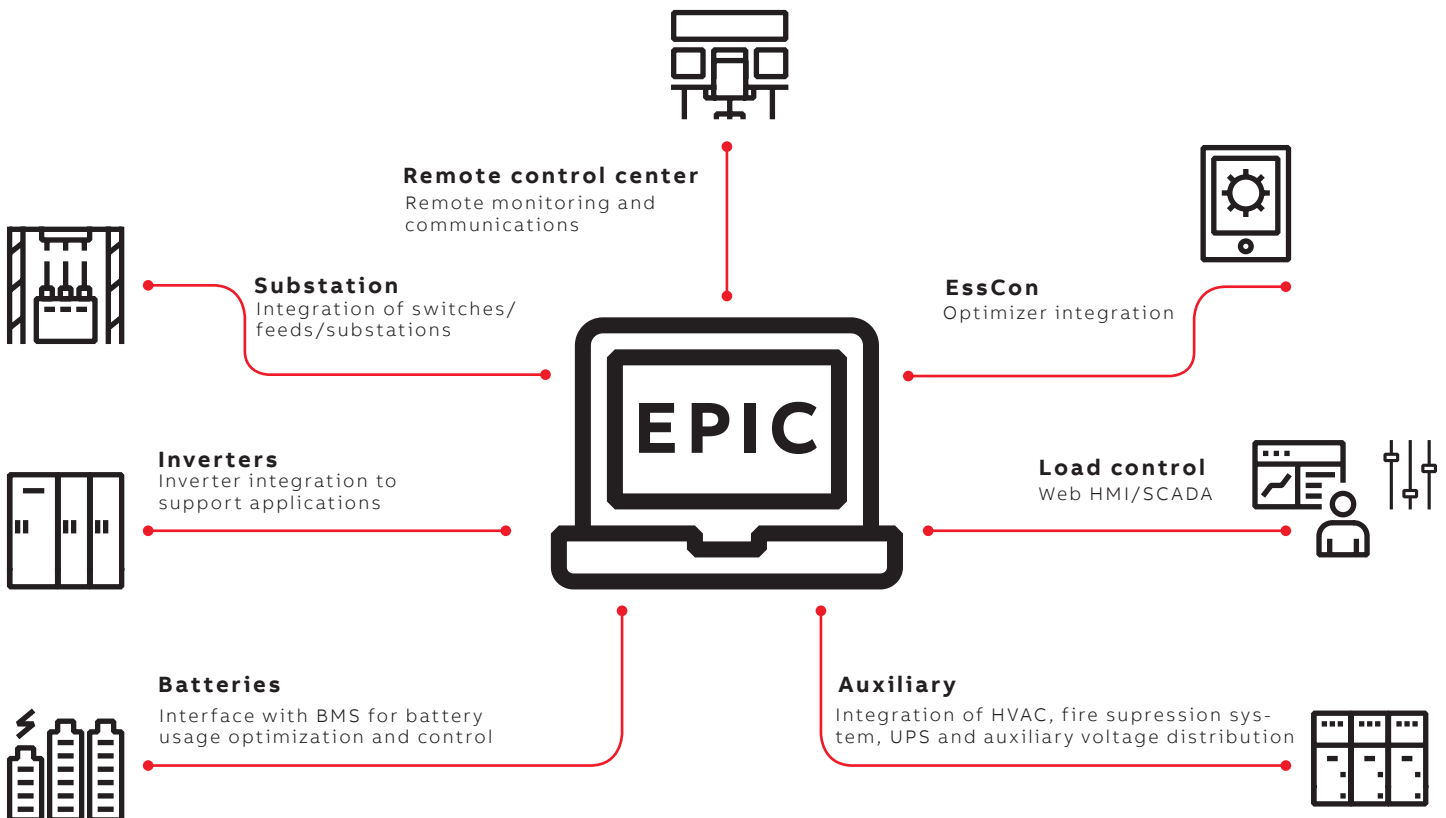
EssPro™ EPIC

ABB's EssPro EPIC is the electrical plant and inverter controller for EssPro Grid energy storage systems.

Once connected to the electrical grid, energy storage systems require effective control. EssPro EPIC ensures efficient control and optimal performance of grid-connected energy storage systems by using advanced logic and algorithms. The EssPro EPIC integrates the complete battery energy storage system into a single energy storage system site controller which hosts system applications according to the local demands. From ramp rate control for wind farms to providing power for an industrial plant during periods of peak demand, the EssPro EPIC enables a variety of energy storage applications based on the project requirements.

The EPIC supports common telecontrol protocols, simplifying integration with remote network centers providing centralized control of the grid. EPIC allows full control of the applications and connected equipment across the energy storage system. Applications can be parameterized to work autonomously or according to set points. Alarm and supervisory functions and the local HMI can be replicated at a remote location to provide seamless control.

With this comprehensive functionality, EssPro EPIC makes BESS smart additions to the grid, resulting in enhanced lifecycle, performance, and return on investment.



EssPro EPIC functionalities

- System application hosting
- Integration of BMS and EssCon (optimizer)
- Control and supervision of inverter
- Integration and control of HVAC, firefighting, auxiliaries and intrusion control
- Integration with local substation and remote network centers
- BESS local control, control authority handling
- Remote control through telecontrol protocols
- Integration of measurement and metering devices
- Virtual BESS control
- Protection, battery safe operation area check
- Black start
- Automatic battery maintenance
- Data logging

Virtual BESS – State of charge equalization

The virtual BESS feature allows the user to control multiple battery storage systems as one single large BESS. This allows the EPIC controller to gather information from all available systems, and other equipment, to calculate appropriate set points.

EssCon – Optimizer/forecasting

In addition to basic control functions, more-advanced algorithms can be applied to further optimize the operation of a battery energy storage system. These control algorithms consider external data such as weather forecasts or projected load profiles, to help optimize the state of charge as well as charging/discharging schedules, enhancing the operational efficiency.



EssPro™ EPIC

ABB's digital capabilities along with their energy storage technology enables customer connectivity and increases operational performance.

ABB offers a variety of control packages to fit the requirements and applications of any energy storage system. From the standard, advanced to premium package, ABB has a solution that can be custom tailored to the project's needs.



Features	Standard	Advanced	Premium
Open loop control	●	●	●
Web HMI	●	●	●
Closed loop control		●	●
Remote monitoring		●	●
IEC104/61850 Protocols		●	●
Virtual synchronous generator		●	●
Advanced algorithms		●	●
Data logging			●
SCADA			●
Cyber security			●
EMS optimizer			OPTIONAL



ABB Ability is a unified, cross-industry digital capability — extending from device to edge to cloud — with devices, systems, solutions, services and a platform that enables customers to know more, do more, do better, together.

Combining ABB Ability and EssPro EPIC makes BESS smart additions to the grid, resulting in enhanced lifecycle, performance and return on investment. ABB offers a suite of control options to best suit customers' project needs and budget requirements.

EssPro™ Grid service and support



Rapid Response

ABB guarantees fast and flexible service response to maximize customers' availability.



Lifecycle management

ABB offers powerful tools and comprehensive domain knowledge for optimizing the lifecycle of customers' equipment and systems.



Operational efficiency

ABB optimizes the usability and efficiency of customers' equipment and systems to increase productivity.



Performance improvement

ABB is a strategic partner that improves productivity, usability, reliability, safety, cost and energy efficiency and emissions and emissions control.

Rapid response

- Repairs: During emergencies or planned production breaks, when equipment or processes fail and need instant repairs.
- Spare parts: Delivery of spares and consumables.
- Replacement: Troubleshooting, identifying and analyzing the root causes of equipment failures and suggesting the most effective courses of action.
- Training: Equipment and system training services for personnel

Lifecycle management

- Installation and commissioning: Installation supervision and commissioning to reduce start-up time, increase safety and reliability, while decreasing lifecycle costs.
- Extensions, upgrades and retrofits: Upgrade current installations with next generation products or software to ensure maximum return on investment. Extend or retrofit existing systems or functionality to meet evolving needs.
- Service agreement: Tailored service agreements that guarantee quick help in all situations.

Operational efficiency

Remote monitoring: Outsource asset monitoring to experienced professionals with easy access to ABB's virtual engineer support team. Allow for real-time visibility into equipment performance with fast and secure information retrieval.

Performance improvement

Engineering and consulting: Engineering and consulting assistance in identifying areas for improvement in the reliability, availability, maintainability and safety of production processes. We offer advanced services that allow for appropriate sizing of systems and determine the optimal solution for each application.

Safety is at the core of ABB

ABB's proactive approach: Ensuring safety at all sites and facilities is a priority, and embedded in their core values. ABB strives to ensure that all activities are based on risk assessment. They manage health and safety risks at every

stage of the project, service, or manufacturing life cycle, where meeting national and international standards are the minimum requirement.

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9AKK106103A7002 REV D 05.09.2017

