



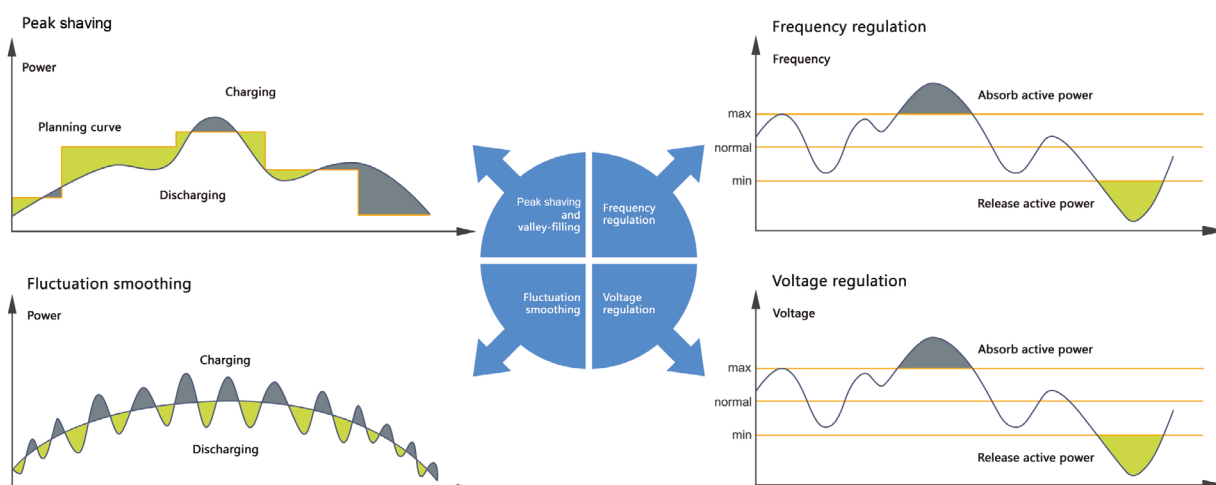
Power Stability Expert

Battery Energy Storage System Solution

For Better Energy Flexibility and Controllability



The energy storage technology allows the stored energy to be accessed exactly when it is required. When the power system adopts the energy storage technology, it can achieve more effective management at load side, such as reducing load difference between load peak and load valley. Besides, the energy storage helps to reduce power supply cost and promote the penetration of renewable energy, improve the power system stability, regulate the grid frequency and voltage, as well as compensate load fluctuation.





Based on comprehensive experience and solutions, NR Electric offers a sophisticated interconnection solution for flexible Battery Energy Storage System (BESS), which includes advanced converter/inverter technology and comprehensive control, protection and battery energy storage management system to ensure the safety, reliability and flexibility of BESS.

With years of experience in energy storage system application, NR Electric has acquired comprehensive know-how on storage media and built good partnership with various kinds of battery manufacturers. So NR could procure the battery and supply a turnkey solution according to customers' requirements. By choosing NR Electric as a BESS provider, the customer gains a reliable partner to provide optimized solution with high flexibility, reliability, safety and availability.

NR BESS solution is suitable for BESS size from 30kVA to 50MVA. NR BESS solution helps to unlock the true potential of the energy storage and maximize the value of the BESS application.

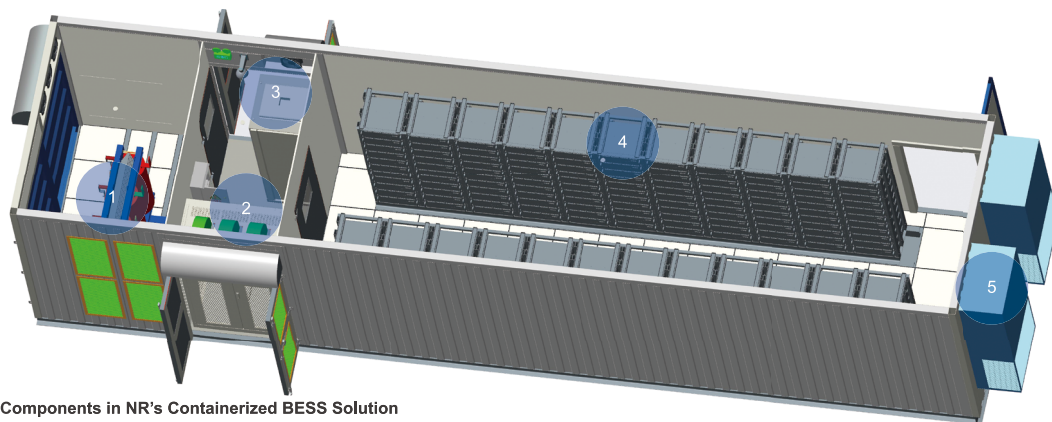
- NR BESS solution is based on decades of grid connection and control & protection experience to provide perfect system integration and control for energy storage system.
- NR's well-proven Power Conversion System (PCS), certified by UL and TUV, is able to connect any battery type or energy medium, such as lithium-ion, lead acid, sodium sulfur (NAS), vanadium redox and zinc bromide, etc.
- NR focuses on the research and development of innovative products and solutions with unique patents and know-how. NR BESS solution is able to make your ESS as effective as possible based on precise system control and operation.
- NR top-notch BESS solution helps to maximize the use of energy storage system and deliver exceptional recovery on investment.
- The advanced conversion control and energy management system in NR BESS solution guarantee the high efficiency, availability and reliability of the energy storage system.
- Proprietary control algorithms with utility grade BESS controller and energy management software help to enable a variety of energy storage applications and optimize system efficiency and performance.
- NR offers integrated turnkey BESS service package with qualified third-party products to meet clients' needs, especially based on good cooperative partnership with a variety of battery manufacturers.

Solutions and features

BESS products and solutions

NR Electric could provide a broad range of ESS products and solutions as follows.

- All-around protection for energy storage system, PCS-9000 series protection devices
- Well-proven power conversion system (PCS), PCS-9567 series PCS
- Top-notch energy management controller and software system, PCS-9617MG
- Utility grade SCADA system for flexible management of energy storage, PCS-9700
- Centralized management system for large scale distributed ESS applications, PCS-9700
- Tailored control algorithm most suitable for specific ESS applications
- High performance containerized design to withstand harsh environments
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Main Components in NR's Containerized BESS Solution	
Step-up Transformer	(1)
Power Conversion System	(2)
Local and remote control, protection device for transformer	(3)
Battery	(4)
Air conditioner	(5)
Metering	(optional)
Grid-connection switchgear	(optional)

The advantages of NR's BESS product portfolio are as follows.

- Millisecond level response speed of power conversion system
- PCS with higher efficiency, max up to 98.75%
- PCS certified by UL & TUV
- High conversion system efficiency (including transformer), >95%
- Modular design, easy for maintenance
- PCS solution with Less footprint
- Built-in advanced ESS control and protection system
- High voltage and low voltage ride-through (LVRT) capability for stabilizing system
- Flexible frequency regulation and voltage support ability to ensure the stable operation.
- Multiple ESS control functionality
- Compatible communication interface with battery management system (BMS)
- Proprietary versatile control algorithms and logics.
- ESS Control logics can be realized in either ESS controller or SCADA software
- Built-in transient fault recorder function in controllers for fault tracking and system analysis
- Virtual synchronous generator (VSG) control with synthetic inertia for stabilizing system
- Utility grade SCADA system
- Experienced and well-proven centralized SCADA system for decentralized ESS applications
- Versatile management software and SCADA for a variety of ESS applications
- Hundreds of communication protocols are supported.
- High quality and flexible design for withstanding condition environment

BESS Turnkey Provider

The choice of storage medium is the key issue that requires in-depth knowledge of the requirements of the storage system and experience about storage battery. Based on comprehensive know-how on various storage batteries and collaboration experiences, NR can help to select the optimal storage battery for each specific BESS project. These include a variety of battery technologies, such as lead-acid, lead-carbon, lithium-ion, zinc-bromide, vanadium flow battery and sodium sulfur (NaS), etc. With years of experience in BESS application, NR Electric has built good and cooperative partnership with various kinds of battery manufacturers. So, NR Electric becomes a turnkey supplier for BESS, covering complete scope for BESS, including battery.

NR's "All-In-One" turnkey package services are based on NR's full-range product and technical expertise and cover consulting, design, supply, installation, commissioning, training and operation.

- Project Management
- Consulting and Engineering Design
- Manufacturing & Testing
- Procurement
- Construction and Installation
- Onsite Testing and Commissioning
- Training
- Maintenance and Operation

NR's worldwide presence ensures service and support throughout the lifecycle of the BESS project, and our turnkey project capabilities allow us to support customers with all- around services. As a turnkey provider for BESS, the features of NR's BESS turnkey solution are as follows.

- Rapid Response
NR guarantees fast service response to maximize system reliability and availability.
- Lifecycle Service
NR guarantees providing all lifecycle service from project start-up to the end of the project, including supplying spare parts, trainings, upgrades and retrofits.
- Operational availability
NR supplies remote system monitoring and trouble tracking to realize preventive, quick and efficient solution for minimizing system downtime.

- **Performance improvement**
NR has the experience and skill set to best optimize your current assets and ensure high performance of the system, without any compromising. NR strives to ensure your critical assets to operate at their full potential.
- **Friendly localization**
NR's regional engineering teams are always working in close cooperation with end users to reduce site testing and commissioning time and cost. This service enables NR well trained technical engineers to provide hands-on trouble shooting and training.
- **Strong flexibility to fit diversified customer needs**
NR supplies optimal storage battery based on know-how on batteries and cooperative partnership with a variety of battery manufacturers.
- **Strict zero harm policy and control procedure**
Quality, Safety, Health, Environment (QSHE) are always the prime priority in project management and delivery.

Reference

NR NaS BESS in Nanjing City of China

Location: Nanjing, China

Capacity: 200kW, 1.44MWh

Application: Peak shaving and load management

The China's first and unique sodium- sulphur (NaS) based Battery Energy Storage System (BESS), locating at NR Electric Intelligent Electrical Equipment Industrial Park in Nanjing city, was put into operation on June 5th, 2015 by NR Electric. The whole system with the capacity of 200kW/1440kWh was successfully synchronized with the 400V bus for load management, such as load shifting and peak shaving.

- NR Designing team outlined the whole BESS
- NR Engineering team directed the installation of the whole system
- NR Engineering team undertook the testing and commissioning of the BESS
- NR Maintenance team undertook operation & maintenance

The BESS project consists of NaS battery, Power Conversion System (PCS), SCADA, protection and control system, etc. NGK, the Battery manufacturer, provides the NaS battery, whereas NR Electric develops and provides all the other key technology and advanced equipment including:

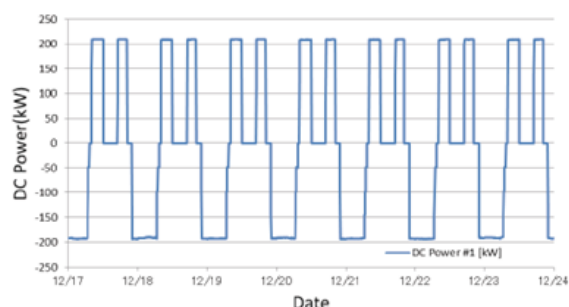
- UL certified Power Conversion System (PCS-9567)
- Micro Grid Controller (PCS-9617MG)
- Distributed Generation Interface IED (PCS-9617E)
- BESS SCADA (PCS-9700)
- Complete set of protection and control devices
- Integrated Power Management System (PMS)
- Mobile APP

The NaS Battery Energy Storage System has been successfully put into operation, and works perfectly without any failure so far. BESS discharges the energy to the grid at 8:00 am-12:00 am and 17:00pm-20:00pm when the electricity price is comparatively higher during the peak power time. And BESS stores the energy at 22:00pm-8:00am with lower electricity price during the off-peak time.

Since the BESS was put into service, the whole system operates in good condition. In addition, the system can offer powerful recording of events, messages, statistics, reports and curves, which are very helpful for analyzing and accident tracking.



Charge and Discharge data



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