

Sieyuan®



esGrid Battery Energy Storage System



Sieyuan Qingneng Electric & Electronics Co., Ltd.

Smarter Power Better Life

Sieyuan Electric Stock Code: 002028



Profile

Sieyuan Qingneng Electric & Electronics Co., Ltd. (hereinafter referred to as "Sieyuan Qingneng"), a subsidiary established by the publicly listed Sieyuan Electric Co., Ltd. in 2008. holds proprietary intellectual property rights in a variety of flexible AC and DC power transmission and distribution technologies. In response to the evolving requirements of new power systems, the company has vigorously pursued research into digital grid and power electronics integration. Sieyuan Qingneng offers a comprehensive array of solutions, including grid stability support, full-spectrum oscillation suppression, comprehensive power quality management, versatile full-time energy storage systems, and one-stop photovoltaic and storage solutions for industrial and commercial applications. Additionally, it provides consultancy services in power system equipment management, energy efficiency enhancement, and strategic system planning.

The core team and principal technical staff at Sieyuan Qingneng, drawing on more than 30 years of power system application experience from its parent company, have a broad and deep range of expertise. The company has achieved numerous domestically and internationally leading or advanced results in areas such as power electronics, power system simulation and analysis, control and protection systems, high voltage and insulation technologies, electromagnetic fields, mechanical structures, thermal design, electrochemistry, power devices and materials, artificial intelligence, big data technology, and information security. In recent years, Sieyuan Qingneng has increased its R&D investment and expanded its external collaborations, earning widespread trust and recognition from customers due to its excellent product performance, cutting-edge technology, and efficient after-sales service.

Focused on the Power System for 30 Years

Founded in 1993, Sieyuan Electric Co., Ltd. is a high-tech enterprise under the National Key Torch Program and a national enterprise technology center, with over 30 years of dedication to the power system sector. Sieyuan Qingneng, leveraging the group's extensive experience in power system applications, has achieved remarkable results in the fields of power quality and energy storage systems.

High Power STATCOM ($\geq 50\text{Mvar}$)

Top 1 Global Sales

- First Class Award for Scientific and Technological Progress in Power Construction**
 Key Technologies for Grid Connection of Large-scale Wind Power and Stability Enhancement Techniques for Large-scale Power Electronic Converters.
- Technical Assessment by the China Machinery Industry Federation**
 High Voltage Active Filter SVG-APF Device has passed technical assessment.
- Shanghai Science and Technology Progress Award, First Prize**
 Operation Control Technology and Key Devices for Renewable Energy Micro-grid.
- German TUV Rheinland Safety Testing Certification**
 The esGrid Utility Scale Energy Storage System has passed safety tests including UL9540A, EN62477, and IEC62619.

R&D Investment of The Group

With R&D as the core driving force, Sieyuan Electric continuously increases its investment in research and development to maintain a leading position in the industry. In 2023, R&D investment increased by 36.2% year-over-year to 916 million yuan, accounting for 7.36% of the revenue. The company has 3,646 R&D personnel, making up 46.55% of the total workforce. Over the past 30 years, the group has focused on the power system field, accumulating rich experience and technical strength. Currently, the group holds 759 authorized patents, including 263 invention patents, 482 utility models, 14 design patents, and 145 software copyrights.



916million

R&D Investment: 916 Million Yuan



759

Authorized Patents



145

Software Copyrights

Data Sources: Sieyuan Electric Co., Ltd. 2023 Annual Financial Report

Data Sources: Shangpu Consulting Group: Through expert consultations, corporate and end-sales channel surveys, it has been determined that Sieyuan Qingneng leads globally in sales of large-capacity high-voltage dynamic reactive power compensation devices SVG ($\geq 50\text{Mvar}$); these devices have reactive power over 50MVar and rated voltage above 3kV. The statistics cover the period from March 2008 to October 2024, with the report finalized in November 2024.

Joint Scientific Research Cooperation

Sieyuan Electric has established long-term collaborations with renowned institutions such as Tsinghua University, Shanghai Jiao Tong University, Xi'an Jiao Tong University, Huazhong University of Science and Technology, and Zhejiang University in areas including high-voltage technology, power electronics technology, power system control technology, power equipment monitoring, and live-line testing techniques. Additionally, the company has formed strategic partnerships with the China Electric Power Research Institute, various provincial electric power research institutes, and TUV, to conduct product testing and certification. The company possesses a professional power system simulation analysis team that focuses on network construction, energy storage, auxiliary services, and power quality products. It offers customized solutions based on global mainstream analysis software such as PSCAD, PSS/E, DigSILENT, ADPSS, and PSASP, providing grid-level power system simulation modeling.



CNAS Authoritative Certification Laboratory

The electrical and electronic laboratory, accredited by the China National Accreditation Service for Conformity Assessment (CNAS), is capable of conducting EMC performance tests, environmental adaptability tests, mechanical performance tests, safety performance tests, electrical performance tests, and accelerated life tests.



EMC Performance Test



Environmental Adaptability Test



Mechanical Performance Test



Safety Performance Test



Accelerated Life Test



Service Support



Global Service Network

100

Sieyuan Electric has established representative offices in over 100 countries and regions worldwide, providing customers with high-quality, rapid pre-sales and post-sales services.

50

Sieyuan has established localized and specialized engineering service centers and spare parts centers in over 50 countries and regions worldwide.

Rapid Response

1 - Hour

Commitment to respond within 1 hour

48 - Hour

Commitment to arrive at the customer's site within 48 hours

Customers

Sieyuan Qingneng's products and services are widespread across more than 50 countries and regions globally, serving over 6000 projects in total. The company is a qualified supplier for several major power operators including China State Grid, China Southern Power Grid, Saudi Electricity Company (SEC), Abu Dhabi Transmission & Despatch Company (Transco), Mexico's Federal Electricity Commission (CFE), Chile's Transelec, and Uzbekistan's National Electric Grids of Uzbekistan Company (NEGU), among others in over 50 countries and regions.



esGrid Battery Energy Storage System

Application Scenarios

Photovoltaic/wind power substations, standalone energy storage stations, renewable energy convergence stations, large industrial settings, and port terminals.



Photovoltaic/Wind Power Substations



Standalone Energy Storage Stations



Renewable Energy Convergence Stations



Large Industrial



Port Terminals

Technical Advantages

The system's available capacity has been increased by **15%**

Innovative "Cluster-Control" Architecture: Prevents inter-cluster DC circulating currents, increasing system usable capacity by 15% and improving efficiency by 2%.

Compared to the conventional plan, it is reduced by **30%**

Integrated AC/DC Setup: Shoulder-to-shoulder mirror layout reduces the total footprint of the station by 30% compared to conventional setups.

The system's cycle life is improved by **1000** cycles

Three-dimensional Cooling System: Ensures a temperature difference of $\leq 2^{\circ}\text{C}$ between battery cells, enhancing the system's cycle life by 1000 cycles.

Safety Design **4+1**

"4+1" Safety Design: Features include inter-cell thermal isolation, liquid-electrical Pack isolation, electrical isolation between clusters, physical isolation within the cabin, and comprehensive station-wide intelligent early warning systems to mitigate fire risks.





esGrid Battery Energy Storage System

Model	ES6070W1-1H-T	ES6687W1-2H-T	ES6687W1-4H-T
DC-side parameters			
Battery cell type	LFP 3.2V 285Ah	LFP 3.2V 314Ah	
Battery system configuration	16P416S		
Battery voltage range	1000 - 1500V		
System capacity	6.07MWh	6.68MWh	6.68MWh
AC-side parameters			
Rated power	6MW	3.34MW	1.67MW
Rated voltage	690V		
Rated frequency	50/60Hz		
Power factor/regulation range	>0.99@rated power/0.8leading - 0.8lagging		
Transformer parameters			
Voltage ratio	6~35kV/0.69kV		
Rated power	6MVA	3.4MVA	1.7MVA
System parameters			
Rated charge/discharge rate	1P	0.5P	0.25P
Operating temperature range	-30 ~ 50°C (>45°C derating)		
Operating humidity range	0 ~ 95%RH, non-condensing		
Operating altitude	Max 5000m (>4000m derating)		
Thermal management system	Intelligent liquid cooling		
Container IP rating	IP54		
Communication protocol	Modbus, IEC104, IEC61850, etc.		
Dimensions	3*6058(W)x2438(D)x2896(H) in mm		
Operation modes	Frequency regulation, price arbitrage, peak shaving, energy market, etc.		
International certifications	IEC62619, IEC63056, IEC62477, IEC61000, UL9540A		

Model	ES3035W1-1H-T	ES3343W1-2H-T	ES3343W1-4H-T
DC-side parameters			
Battery cell type	LFP 3.2V 285Ah	LFP 3.2V 314Ah	
Battery system configuration	8P416S		
Battery voltage range	1000 - 1500V		
System capacity	3.03MWh	3.34MWh	3.34MWh
AC-side parameters			
Rated power	3MW	1.67MW	0.84MW
Rated voltage	690V		
Rated frequency	50/60Hz		
Power factor/regulation range	>0.99@rated power/0.8leading - 0.8lagging		
Transformer parameters			
Voltage ratio	6~35kV/0.69kV		
Rated power	3MVA	1.7MVA	0.9MVA
System parameters			
Rated charge/discharge rate	1P	0.5P	0.25P
Operating temperature range	-30 ~ 50°C (>45°C derating)		
Operating humidity range	0 ~ 95%RH, non-condensing		
Operating altitude	Max 5000m (>4000m derating)		
Thermal management system	Intelligent liquid cooling		
Container IP rating	IP54		
Communication protocol	Modbus, IEC104, IEC61850, etc.		
Dimensions	2*6058(W)x2438(D)x2896(H) in mm		
Operation modes	Frequency regulation, price arbitrage, peak shaving, energy market, etc.		
International certifications	IEC62619, IEC63056, IEC62477, IEC61000, UL9540A		

7 Bft

Power Conversion System



Key Features



High Integration

Internally integrated with BCMU



High Reliability

Intelligent liquid cooling



Supports multi-machine parallel operation

Equipped with black start, primary frequency regulation, and VSG functionality



High Usable Capacity

Cluster-level power conversion to enhance battery discharge depth



High Efficiency and Fast Response

Maximum efficiency $\geq 99\%$, response time in milliseconds



Control Mode

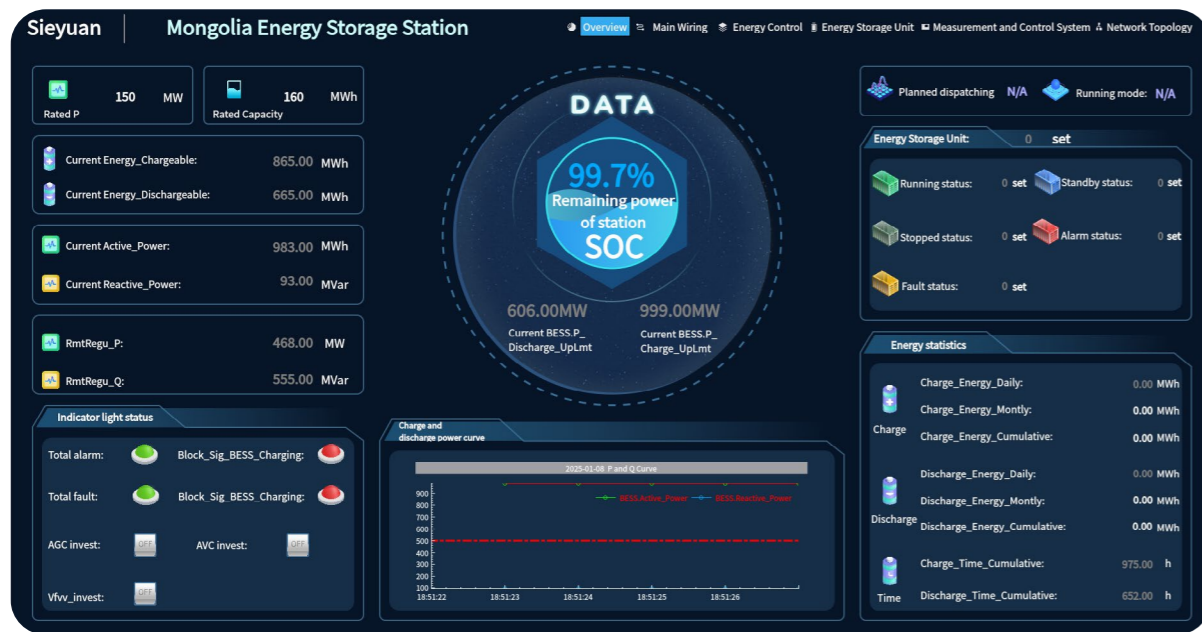
Supports grid-following and grid-forming control modes

Model	ESC400WH	ESC200WH	ESC100WH
DC-side parameters			
Rated Voltage	1331.2V		
Voltage Range	1000~1500V		
AC-side parameters			
Rated Output Power	470kW	250kW	125kW
Rated Output Voltage	690V		
Normal Operating Frequency Range	50Hz / 60Hz		
Rated Output Current	393A	209A	105A
Current Harmonic (THDi)	< 3% @rated output power		
Power Factor $\cos\phi$	> 0.99 @rated output power		
Efficiency	>99%		
Power Factor Range	0.8(leading)~0.8(lagging)		
System parameters			
Dimensions	770x258x1242 (W x H x D) in mm		
Weight	<130kg	<120kg	<120kg
Ingress Protection	IP66		
Operating Temperature Range	-25°C~40°C		
Altitude	Max 5000m (>4000m derating)		
Thermal Method	Liquid cooling		

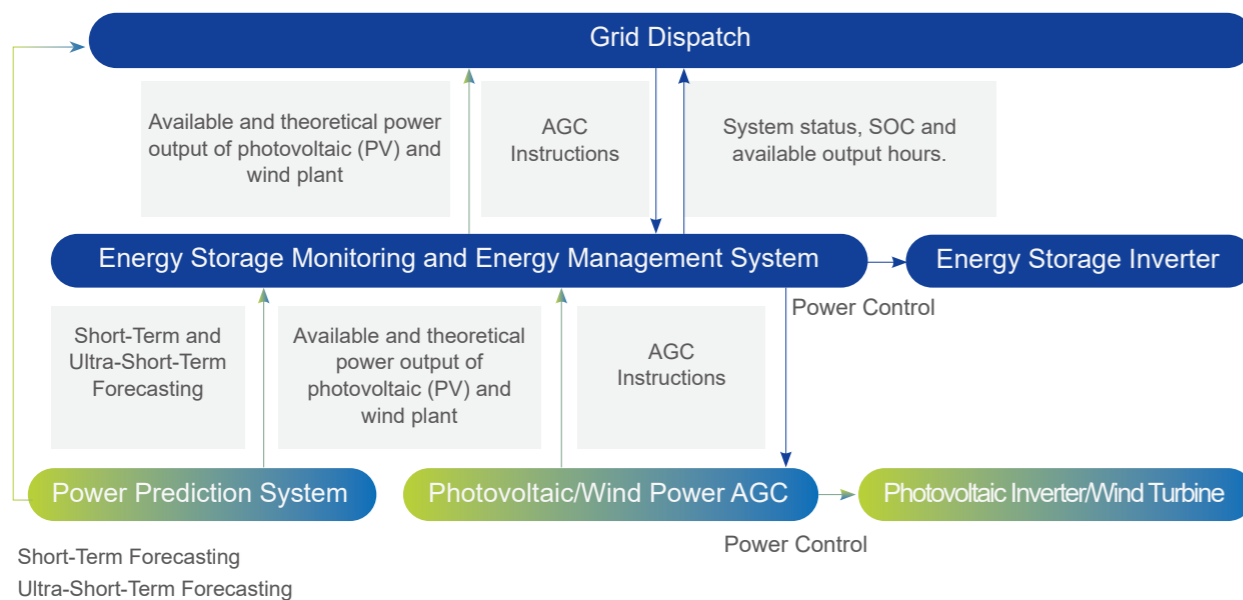
Energy Management System

Key Features

- AGC Response Time: ≤ 1 s.
- Supports IEC61850, IEC104, and Modbus protocols.
- Comprehensive Accident Trace and Reconstruction: Full-holographic and full-model analysis to accurately reflect the operational state during faults.
- Massive Data Point Support: Handles millions of data points, enabling energy storage stations of various capacities.
- Proprietary High-Speed Temporal Database: Independently developed to ensure high efficiency and reliability.



Integrated Control Strategy for PV/Wind + Storage



Battery Management System

Key Features

- High-Speed Data Acquisition for Battery Cells
 - Cell voltage sampling rate: < 16 ms.
 - Temperature sampling rate: < 16 ms.
- SOC Calibration
 - Real-time online estimation for continuous SOC error monitoring.
 - Cluster-level SOC online calibration for more precise charge/discharge management.
 - Dual overcharge and overdischarge protection.

ESB416			
Analog Sampling	Single Cell Voltage	Accuracy	$\leq 5\text{mV}@-20^{\circ}\text{C}\sim 65^{\circ}\text{C}$
		Channels	> 400
	Cell Temperature Measurement	Sampling Period	$< 16\text{ms}$
		Accuracy	$\leq \pm 1^{\circ}\text{C}@-20^{\circ}\text{C}\sim 65^{\circ}\text{C}$
Internal Communication (BMS)	Channels	224	
	Sampling Period	$< 16\text{ms}$	
	Communication Interface	Daisy chain	
	Baud Rate	1Mbps	
Communication with PCS	Communication Period	$\leq 100\text{ms}$	
	Communication Interface	Isolated CAN	
	Protocol	CAN Protocol	
Balancing	Interface Count	2	
	Balancing Type	Passive	
SOC	Balancing Current	$\geq 100\text{mA}$	
	Estimation Accuracy	$\leq 5\%$	
Control Power Supply		DC24V/3W	



Grid-Forming Energy Storage System

Key Features



Utility-scale Grid-forming

PCS-Unit Controller-Coordination Controller Hierarchical Grid-Forming Algorithm and High-Speed Communication Protocol: With a communication delay of <math><0.5\text{ ms}</math>, this system significantly enhances grid-forming performance at the PCC (Point of Common Coupling).



Oscillation Suppression

Positive resistance characteristics across the full frequency band effectively suppress wideband oscillations.



Grid Adaptability

Proprietary grid-forming control algorithm achieves adaptability to both strong and weak grids. Ensures full power stable operation even under extreme weak grid conditions with an SCR (Short Circuit Ratio) = 1.



Stable Operation

Advanced current limiting algorithm provides transient support of 3 pu current during faults, ensuring system stability.

Key Performance Indicators	
High and Low Voltage Ride-Through	SCR = 2, Maintains voltage amplitude and phase angle stability under three-phase symmetric faults and single-phase asymmetric faults in both charge and discharge conditions. Provides dynamic reactive power support of up to 300% rated reactive current.
Inertia	Inertia time constant adjustable between 2–20 seconds, offering flexibility.
Phase Jump Adaptability	Tolerates $\pm 60^\circ$ phase jumps during charge and discharge conditions.
Weak Grid Adaptability	Positive damping characteristics across the full frequency range, including low-frequency, sub-synchronous, and high-frequency oscillations (0.2–100 Hz). Full power stable operation at SCR = 1, with maximum deviation <math><0.8\% P_n</math>.
Black Start Capability	Supports black start. Current distortion rate in multi-machine parallel operation: <math><3\%</math>.

Project Cases



Project Location: Laizhou City, Shandong Province

Project Details: 224.2 MW / 488.04 MWh + 4 MW / 30 s hybrid energy storage system

Project Significance: The largest renewable energy storage project in Shandong Province, this initiative represents a practical implementation of the "PV + Energy Storage" green energy solution, setting a benchmark and serving as a demonstration model in the salt-PV complementary power generation field.



Project Location: Wenchang City, Hainan Province

Project Details: 25MW/50MWh energy storage system

Project Significance: The energy storage system works in conjunction with photovoltaic power generation to smooth fluctuations and shift peak loads, utilizing the region's abundant solar resources to supply power to the local grid. This promotes sustainable regional economic development and supports the construction of environmentally friendly, green energy infrastructure.



Project Location: Chengde City, Hebei Province

Project Details: 15MW/30MWh energy storage system

Project Significance: This project adopts a "renewable energy + agricultural planting" model, integrating complementary systems for solar, agricultural planting, and hydrogen storage. It adjusts the energy structure, transforms traditional rural farming practices, optimizes land use, and enables large-scale farming and modernized standardized planting.

Project Cases



Project Location: Zhangjiakou, Hebei Province
Project Details: 30MW/60MWh energy storage system
Project Significance:

The energy storage system works in conjunction with photovoltaic power generation to smooth fluctuations and shift peak loads, utilizing the region's abundant solar resources to supply power to the local grid. This promotes sustainable regional economic development and supports the construction of environmentally friendly, green energy infrastructure.



Project Location: Chengde City, Hebei Province
Project Details: 15MW/60MWh energy storage system
Project Significance:

This project includes the construction of a 100 MW photovoltaic installation paired with a 15 MW / 60 MWh energy storage system. It adopts an "agriculture-PV complementary" model, which allows the planting of astragalus, sophora, and other crops between the solar panels, ensuring normal photovoltaic power generation while achieving both ecological and economic benefits.



Project Location: Shahe City, Hebei Province
Project Details: 15MW/30MWh energy storage system + step-up station
Project Significance:

Ensures timely grid connection for the 150 MW photovoltaic station project, improves renewable energy generation characteristics, smooths fluctuations in renewable energy power output, and reduces curtailment of wind and solar power.

Project Cases



Project Location: Tashkent, Uzbekistan
Project Details: 0.84 MW / 3.84 MWh energy storage system
Project Significance:

This is Uzbekistan's first energy storage project, providing reliable emergency power for factories during outages. In addition to enhancing energy security, the system delivers economic benefits through peak shaving, load balancing, improved energy efficiency, and reduced power costs.



Project Location: Zamiin-Uud, Mongolia
Project Details: 20MW/80MWh energy storage system
Project Significance:

The energy storage system effectively mitigates solar power fluctuation issues, reducing the curtailment rate from 19% to 3%. This significantly improves the integration and utilization of renewable energy within the grid.



Project Location: Ankara, Turkey
Project Details: 2.5MW/2.5MWh energy storage system
Project Significance:

By applying energy storage technology, this project achieves effective peak shaving, reducing peak load and optimizing grid operating efficiency. The system stores energy during low-demand periods and releases it during peak demand, lowering electricity costs and demand charges. Additionally, the system can generate economic benefits by participating in ancillary services.

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