



# Difficulties and Solutions in the Application of New Battery Power Storage System

**Guang Yang**

Hebei University of Water Resources and Electric Power, Cangzhou, Hebei, China.

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**\*Corresponding author:** Guang Yang, Hebei University of Water Resources and Electric Power, Cangzhou, Hebei, China.

## Abstract

New battery power storage systems have great potential for renewable energy integration, grid stability energy efficiency, etc. In most scenarios, new battery power storage systems are widely used, and in the context of technological development, the technological sophistication level of new battery power storage systems is constantly improving, and energy utilization efficiency, as well as safety, are comprehensively guaranteed. However, its application faces multiple challenges. In this paper, we discuss the main difficulties in the application of new battery power storage systems, including high cost, high difficulty in energy management control, and high difficulty in safety management. To cope with these challenges, we propose a series of solution strategies, including the development of new technologies to optimize cost management, the construction of multi-stage energy management control algorithms, and the addition of real-time battery status monitoring devices, aiming to improve the performance, reliability, and economics of the new battery power storage system and to promote its wide application in the field of clean energy.

## Keywords

Electric power storage system, new battery, difficulties, application strategy

## Introduction

As renewable energy sources (e.g., solar and wind) continue to increase in the energy supply, power systems face increasingly complex challenges. The constant fluctuation of these energy sources leads to instability and unpredictability in the power grid, therefore, an efficient energy storage solution is needed to balance supply and demand, improve power system reliability, and realize the maximum potential of clean energy sources [1]. Novel battery power storage systems have attracted much attention because of their ability to efficiently store and release electrical energy to cope with volatility in the power system. However, despite their potential, these systems face a complex set of challenges that limit their widespread application.

## 1. Overview of new battery power storage systems

New battery power storage systems are a key energy technology for capturing, storing, and releasing electrical energy to balance peaks and valleys in electricity demand, cope with power system instability, provide backup power, and facilitate the integration of clean energy sources. The core function of these systems is to store electrical energy when it is needed and then release it when it is needed in order to provide a stable supply of electricity during peak demand or unstable power supply situations. Energy storage is becoming increasingly important in power systems, especially when integrating renewable energy sources such as wind and solar, which are intermittent and

uncontrollable, and battery power storage systems can balance energy supply and demand and reduce stress on the power system.

Battery power storage systems consist of basic building blocks such as battery components, battery management systems (BMS), inverters, control systems, and energy storage containers. Battery components are the core part of the battery power storage system, usually using different types of battery technology, such as lithium-ion batteries, sodium-sulfur batteries, flow batteries, etc. The new battery power storage system adopts a variety of different types of energy storage technology to meet different uses and needs, and common energy storage technologies include lithium-ion batteries, sodium-sulfur batteries, lithium titanate batteries, flow batteries, etc., and the new battery power storage system is widely used in a variety of fields, including grid storage. In a number of fields, including grid energy storage, renewable energy integration, industrial applications, e-mobility, home and commercial energy management, etc. Energy storage systems can improve the efficiency of electricity utilization, provide backup power, reduce the cost of electricity, and reduce dependence on fossil fuels [2]. Battery power storage systems offer the advantages of high energy conversion, fast response, environmental sustainability, and low maintenance costs.

## **2. Difficulties in the application of new battery power storage systems**

### **2.1 Higher costs**

The high cost of the new battery power storage system limits its application in many fields to a large extent, which is also a key problem to be solved by the new battery storage system at this stage. First of all, the core of the battery power storage system is the battery component, which includes a variety of battery chemical materials, such as lithium-ion battery positive and negative materials, electrolytes, etc., the production cost of the relevant materials is relatively high, especially for some high-performance, high-security battery technology, such as lithium cobalt acid batteries. The cost of battery materials directly affects the total cost of the entire system, and the production of battery power storage systems requires highly sophisticated manufacturing processes, including the manufacture and assembly of battery components, the integration of the battery management system (BMS), and the packaging and installation of the system, etc., and the related manufacturing processes require specialized equipment and technologies, which are relatively costly [3]. Secondly, in battery power storage projects, the design and construction of infrastructure, electrical equipment, and control systems, including battery components, require significant engineering and installation costs. The size and special requirements of the project also affect these costs, and the battery power storage system requires regular maintenance and monitoring to ensure its proper operation and prolong the system's life.

### **2.2 Difficulty in controlling energy management**

Novel Battery Storage Systems At work, battery power storage systems need to constantly monitor and adapt to the dynamic energy flows in the power system, including the volatility of renewable energy sources and the uncertainty of power demand. Ensuring that battery charging and discharging operations take place at the right time to balance supply and demand in a highly variable energy environment requires sophisticated energy management algorithms and real-time control strategies. To ensure the long-term reliability of battery components, Battery Health Management (BHM) needs to be implemented. This involves battery condition estimation, health assessment, and lifetime prediction to monitor battery performance take appropriate maintenance and protection measures, and participate in the electricity market Battery Electricity Storage Systems need to monitor market prices, forecast electricity demand and supply, and conduct just-in-time energy trading. This requires highly intelligent energy management and market participation strategies to achieve optimal economic efficiency.

### **2.3 Difficulty of security management**

One of the difficulties in the application of new battery power storage systems is the high difficulty of safety management. Battery components used in battery power storage systems are subject to thermal runaway, overcharging, and over-discharging during the charging and discharging process, which leads to safety problems such as short circuits, leakage, fire, or explosion. Therefore, it is critical to ensure the safe operation of battery components. Firstly, battery components in battery power storage systems typically store large amounts of electrical energy, which can lead to fire risks if not properly managed and monitored, and conditions such as overheating and electrolyte leakage from battery components have led to fires, and some of the battery chemical materials have a negative impact on

the environment, especially if the battery components cannot be handled or disposed of properly. Recycling and disposal of battery materials also need to be carefully managed to avoid environmental pollution. On the other hand, battery power storage systems usually require communication and data exchange with power grids and energy management systems, which makes the systems susceptible to cyber-attacks, data leakage, or unauthorized access, and thus require enhanced cyber and data security measures. Maintenance and operation of battery power storage systems require specialist knowledge and skills, and operators must follow strict safety protocols to prevent accidents and injuries.

### **3. Optimisation strategies for novel battery power storage systems**

#### **3.1 Developing new technologies to optimize cost management**

Strategies for optimizing new battery power storage systems include developing new technologies and optimizing cost management, which can improve system performance, reliability, and economics. Firstly, battery technologies need to be further developed and improved, including lithium-ion batteries, sodium-sulfur batteries, solid-state batteries, etc. Research on new materials and innovations in battery design can improve energy density, cycle life, and safety, and reduce costs, and smarter and more efficient system integration technologies can be developed on this basis to optimize energy management, system monitoring, and collaborative control. This includes advanced battery management systems (BMS), smart inverters, energy management software, etc. New energy technologies, such as fixed-bed hydrogen storage and compressed air energy storage, are also being actively explored in order to broaden energy storage options and improve system flexibility. Secondly, there is a need to seek alternative materials, particularly cost-reducing renewable materials, to reduce the material costs of battery manufacturing, and to scale up projects to achieve greater economies of scale and reduce the cost per unit of capacity. Large-scale energy storage projects are usually able to attract more investment and reduce costs, on the basis of which a flexible energy market participation strategy is developed to participate in energy markets, such as the electricity market, the capacity market, and the frequency response market, through battery power storage systems, to obtain additional revenues, to improve the economics, and to implement an effective battery health management (BHM) and maintenance strategy to prolong the life of the battery components and to reduce the operating costs [4]. Finally, there is a need to develop recycling and remanufacturing technologies for battery components to reduce resource wastage, increase battery recycling rates, and reduce costs, and to seek partnerships with battery suppliers, technology providers, energy companies, and government agencies for technical support, investment, and policy support.)

#### **3.2 Constructing multi-stage energy management control algorithms**

Constructing a multi-stage energy management control algorithm is an important strategy to optimize the performance of a new battery power storage system, and an effective algorithm can intelligently manage the battery system in different operation stages to maximize its efficiency, reliability, and economy. The design of the multi-stage energy management control algorithm consists of the following stages: (1) Stage I, state estimation and prediction: installing suitable sensors and monitoring equipment to monitor the state parameters of the battery components in real time, such as current, voltage, temperature, charge state, etc., and using the real-time data, adopting data processing and analysis techniques, estimating the current state of the battery components, including the state of health, the remaining life, energy capacity etc. (2) Stage II, energy management and optimal control: based on the battery state estimation and market forecast, formulate optimised charging and discharging strategies to maximise the energy utilisation and economy of the battery, manage the energy balance of the battery power storage system in different time scales to ensure the balance between supply and demand in the power system and participate in the market trading to obtain the best energy price, consider the cycle life of the battery, and Extend the life of the battery by controlling the charge and discharge rate, temperature management and other strategies. (3) Stage III, system monitoring and safety control: Continuous real-time monitoring of the performance and status of the battery components, timely detection and response to abnormalities, in order to prevent battery failures or safety risks, and based on this, introduce safety control strategies, including over-charging, over-discharging, over-temperature protection, etc., to ensure the safe operation of the battery components, remote control functions can be implemented. the operation and remote control functions can be implemented to allow remote operators to monitor and control the battery power storage system in response to emergencies [5]. (4) Stage IV, data analysis and optimization strategy update: Based on historical data and real-time feedback, machine learning and data analysis techniques are used to

continuously improve the energy management algorithms in order to adapt to the changing operating conditions and regularly update and optimize energy management strategies to adapt to changes in different seasons, market conditions and battery health status. Building multi-stage energy management control algorithms requires in-depth domain knowledge, real-time data, and advanced computational capabilities.

### 3.3 Addition of real-time battery status monitoring devices

Real-time monitoring of battery status provides a more precise understanding of the performance and health of battery components, leading to improved energy management, longer battery life, and increased system reliability. On the one hand, there is a need to monitor the current input and output of the battery components in the battery storage system to determine the charging and discharging rates of the battery and to design for measuring the voltage of the battery components to determine the state of charge and voltage deviation of the battery, and to arrange temperature sensors in the backplane of the battery to monitor the temperature of the battery components to ensure operation within safe temperature ranges and to avoid overheating. On the other hand, sensors need to be deployed inside the battery so as to monitor the internal state of the battery, such as the health of the battery components, chemical reactions, etc., and to monitor the surrounding environmental conditions, such as humidity, barometric pressure, air temperature, etc., by means of environmental sensors, in order to understand the environment in which the battery operates. In addition, a real-time monitoring system needs to be established to continuously monitor the battery status detect abnormalities in a timely manner, and set alarm thresholds, so that the system will issue an alarm when the battery status exceeds the safe range so that timely measures can be taken. real-time monitoring data can be combined with energy management control algorithms to achieve automated control in order to adjust the charging and discharging strategies according to the battery status, and by continuously optimizing the control strategy, to ensure that the battery components operate under optimal conditions to improve system efficiency and performance.

## 4. Conclusion

The development of power storage technologies is essential to achieve efficient use of renewable energy and power system reliability. Novel battery power storage systems offer great potential as a key energy storage solution for power systems. However, this field still faces multiple challenges, which include cost issues, difficulty in controlling energy management, security management challenges, etc. In order to realize its full potential. In the process of specific application, it is necessary to optimize the control effect of the new battery power storage system through effective means and to combine effective solutions to comprehensively improve the control and management effect of battery power. Through continuous technological innovation, cost optimization, intelligent control, and safety management, the new battery power storage system will be able to better adapt to the needs of the power system and achieve a clean and sustainable energy future.

## References

- [1] Feng Jianbo. Application study of hydrogen energy power plant based on new power system [J]. Chinese Science and Technology Journal Database (Citation Edition) Engineering Technology, 2023.
- [2] Gao Hao. New fuel cell technology [J]. Automotive Digest, 2019(1): 48-50.
- [3] Xu Chuanbo & Liu Jianguo. Value, challenges and prospects of hydrogen energy storage in China's new power system [J]. China Engineering Science, 2022(24): 10.
- [4] Feng Jianbo. Research on the application of hydrogen energy power plant based on new power system [J]. Chinese Science and Technology Journal Database (Citation Edition) Engineering Technology, 2023(06): 53-56.
- [5] Hu Yu. Exploration of the use of new energy generation in power system [J]. Easy to learn computer, 2021(001): 1.