



Case Study

Jinko ESS Solution of Micro-grid AC-coupled System

150kW/540kWh Li-ion BESS Project in Saudi Arabia

Project Overview

In recent years, the global energy landscape has undergone significant transformations, with renewable energy sources taking center stage in the fight against climate change. In this transition, energy storage system (ESS) has emerged as a crucial enabler, bridging the gap between intermittent renewable energy generation and constant energy consumption. GCC countries are equipped with competitive advantages in renewable plus storage procurement, due to the availability of vast lands and low-cost solar and

wind generation capacities. Among the countries actively embracing this transformation, Saudi Arabia stands out with its ambitious plans to revolutionize its energy sector through the development of a robust energy storage market.

Saudi Arabia, traditionally known as an oil-rich nation, has been working diligently to diversify its energy portfolio. In line with the goals of Saudi Arabia's "Vision 2030" and the "Belt and Road" initiative, the need for power system flexibility and

capacity is firming, especially in Saudi Arabia to realize 10% of electricity generation from renewable energy by 2025, and 50% by 2030.

Moving towards clean energy would at the same time reduce their dependency on fossil fuels. The microgrid project combining both PV and energy storage systems (ESS) offers great potential to solve the energy issues can also minimize

cost by optimizing the selected energy storage system and maximize value by stacking as much revenues as possible.

AC-coupled Photovoltaic (PV) Energy Storage System (ESS) is a popular renewable energy solution, especially for power backup applications. By combining the existing PV subsystem, the ESS serves as the optimizer of the PV generation and the supplier of emergency power.

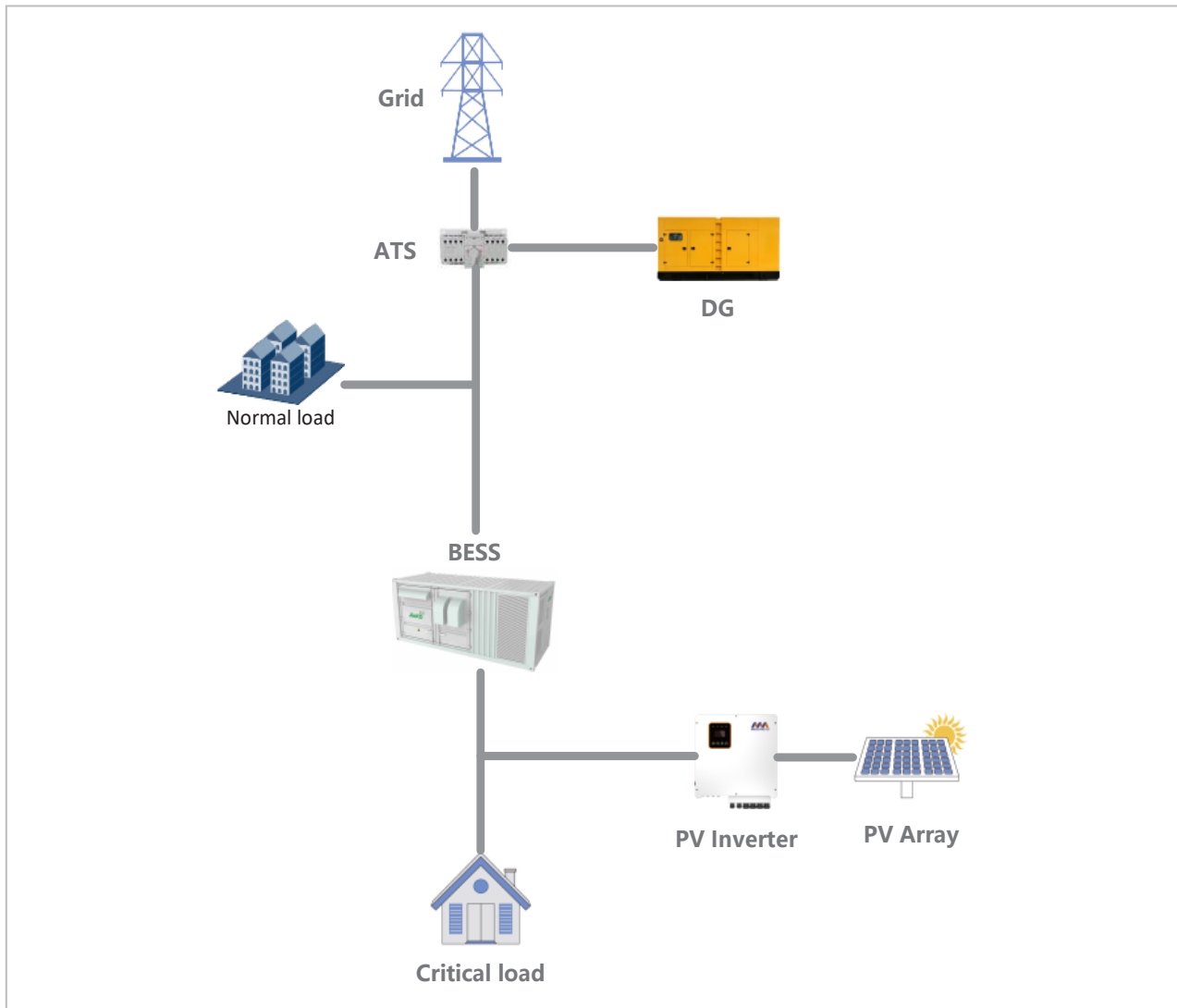


Fig. 1 Single Line Diagram of Micro-grid AC-Coupled System

The Solution

Featuring a 540kWh LFP battery, a 150kW PCS, a set of DG, and an Energy Management System (EMS), this project has emerged as a successful modern micro-grid solution in GCC region boasting the following features:

Scalability and Flexibility

Independent Operation and Scalability

In an AC-coupled system, the PV inverter and the battery

inverter operate independently. This means that the system can optimize the use of solar energy and manage the charging and discharging of the battery based on power demand. Moreover, AC-coupled systems allow for the independent expansion of both the photovoltaic generation and the energy storage components, enabling quick adjustments to the system to accommodate changing demands.

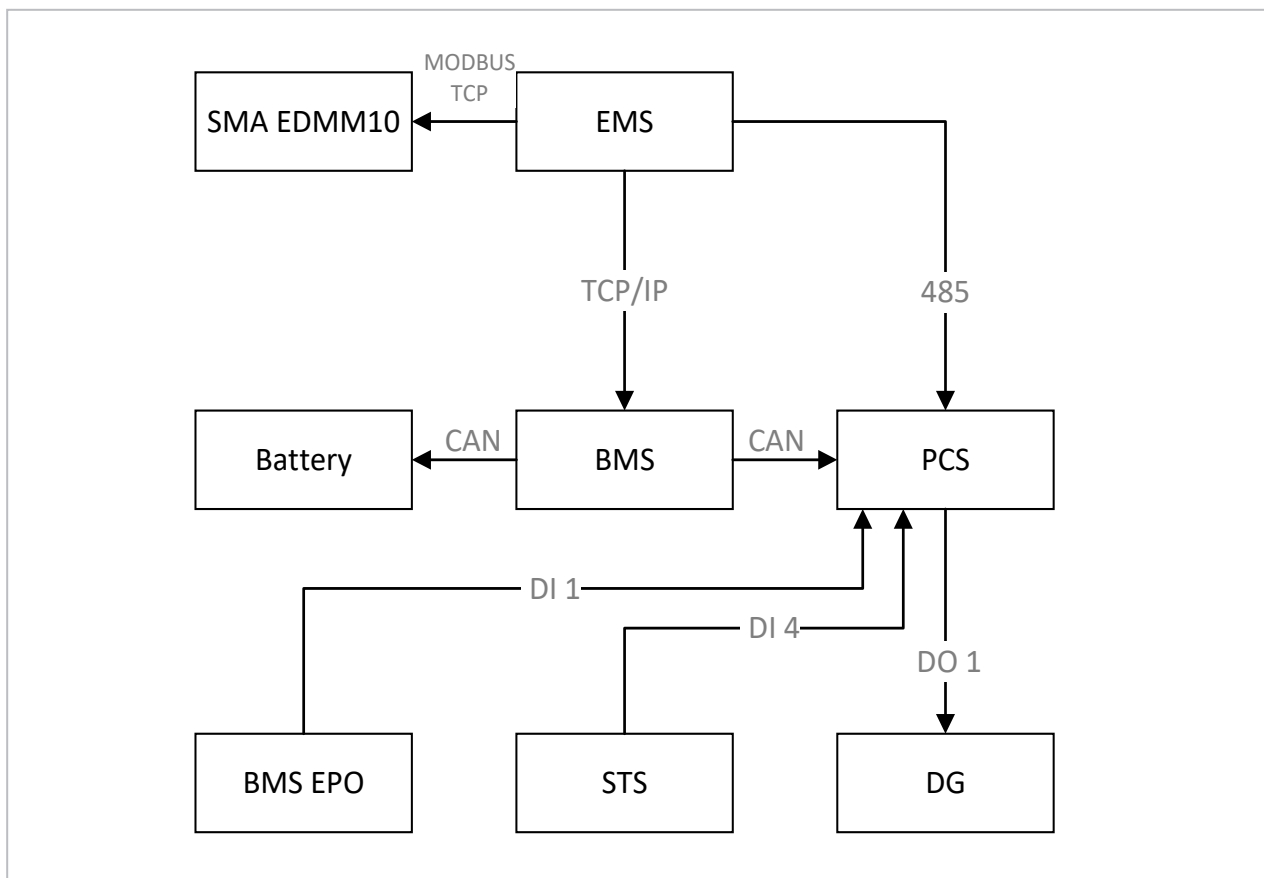


Fig. 2 Topological Graph of Micro-grid AC-coupled System

Integration Flexibility

AC-coupled system provides a flexible way to integrate the existing solar panels with the new ESS. It allows for the addition of storage to existing PV without modifying the PV electrical connections or the DC/AC inverters. This flexibility

makes it easier to retrofit existing solar power systems with energy storage capabilities. Jinko ESS solution also includes intelligent EMS which coordinates the PV subsystem with the ESS in joint effort to fully utilize the renewable energy.

2024-06 Daily statistics Discharge efficiency: 98.5%

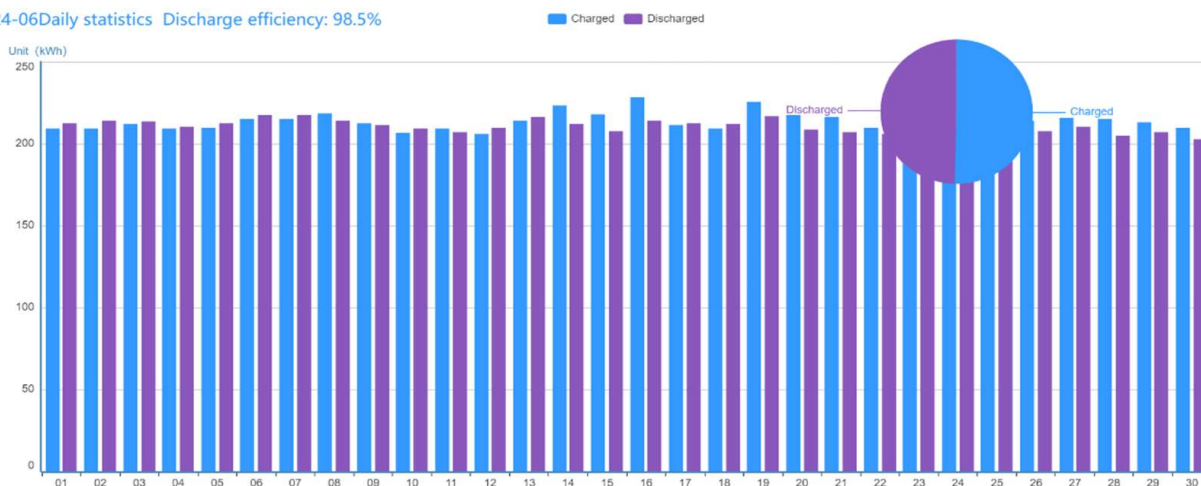


Fig. 3 Jinko ESS Cloud Daily statistics Charged and Discharged Energy

Grid-interaction Compatibility and Back-up Reliability

Resilience and Reliability

During power outages, with the implementation of Grid-forming (GFM) PCS in this project ensures continuous power

supply. Similar to a synchronous generator, GFM PCS can operate and serve the load both with and without the other synchronous machines in this AC-coupled system to provide backup power by utilizing stored energy from the batteries. The system is designed to switch automatically to backup

mode, ensuring that critical loads remain powered. In power backup applications, the primary goal is to ensure reliability and resilience in the face of power outages. Static Transfer Switch (STS) is an automatic static switching equipment designed to transfer critical loads between two independent AC power sources. By incorporating a smart STS and a real-time monitor of the micro-grid, the transfer time is maintained unsensible in less than a cycle (20ms), enabling the micro grid system to provide immediate switch-over to backup power, maintaining critical operations without interruption.

Grid Interaction

Renewable energy sources such as solar and wind are

inherently intermittent, leading to fluctuations in energy supply. Jinko ESS can help smooth out these variations, ensuring a seamless transition between energy generation, storage, and distribution with the sophisticated energy management system (EMS). The system can operate in coordinate with the grid connection, allowing for energy import for power consumption and storage. This interaction is managed through Jinko EMS to optimize the usage and reach balance in solar energy, battery storage, and grid electricity. EMS make intelligent decisions based on real-time power flow data to minimize costs, maximize the use of renewable energy, and sustain emergency power supply.

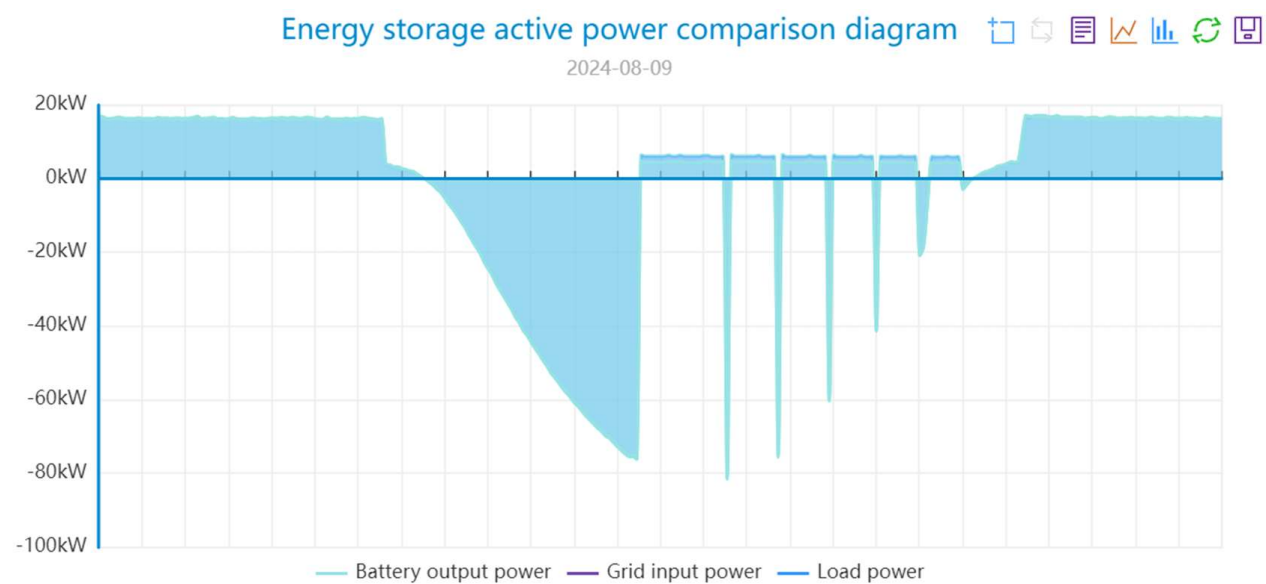


Fig. 4 Jinko ESS Cloud Energy Storage Active Power Comparison Diagram

Conclusion

As the Kingdom strives to diversify its energy mix and reduce carbon emissions, Jinko is actively joining to play a pivotal role in ensuring the stability and reliability of its renewable energy grid.

With the government's commitment, supportive regulatory measures, and increasing private sector involvement, the Saudi Arabia energy storage market is poised for continued growth. Jinko ESS AC-coupled PV-ESS systems offer a

versatile, efficient, and scalable solution for integrating existing renewable energy sources with energy storage, providing significant advantages for power backup applications, playing a crucial role in the transition towards a more resilient and sustainable power supply, and is an inspiring example of how existing PV system can embrace ESS for the betterment of the clients.

* The report serves as a general overview and is subject to updates by Jinko ESS. Jinko ESS reserves the right to modify the content and holds the final authority in its interpretation.



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