Case Study

Jinko ESS's BESS Application in Hybrid System for Island Mining

5MW/5.96MWh Li-ion BESS Project in Philippines

Project Overview

The site is an island mining area in the Philippines where the utility grid is fragile and supply chronically unreliable. Therefore, an LFO/HFO power plant were installed as the primary generation source to guarantee round-the-clock production for gold-mine and other industrial loads.

Conventional generator units, characterized by high noise, heavy exhaust emissions, flammability, and intensive maintenance, are no longer acceptable under tightening carbon and environmental statutes.

To address these constraints JinkoESS engineered and delivered a 5 MW/5.96 MWh micro-grid battery energy storage system that integrates PV solar, BESS and generators to provide stable, highly efficient and low-carbon power.

The Solution

The hybrid system is designed to reduce fuel consumption of the power house by shutting down one generator during daylight hours. The existing generators, configured as an engine power plant (EPP), remain the backbone of supply, while the 5MW/5.96MWh battery system, comprising two 2.981MWh LFP battery containers and one 5MW PCS skid, which is wired directly to the 13.8 kV busbar and forms a typical AC-coupled architecture.

The 1C charge and discharge rate delivers fast response to load transients and enables high efficiency energy conversion and transfer. An advanced EMS supervises and coordinates the PV plant and BESS in real time. The EPP continue to be operated manually through the legacy EPP SCADA, the BESS EMS simply communicates with this system to obtain data for start-stop recommendations.

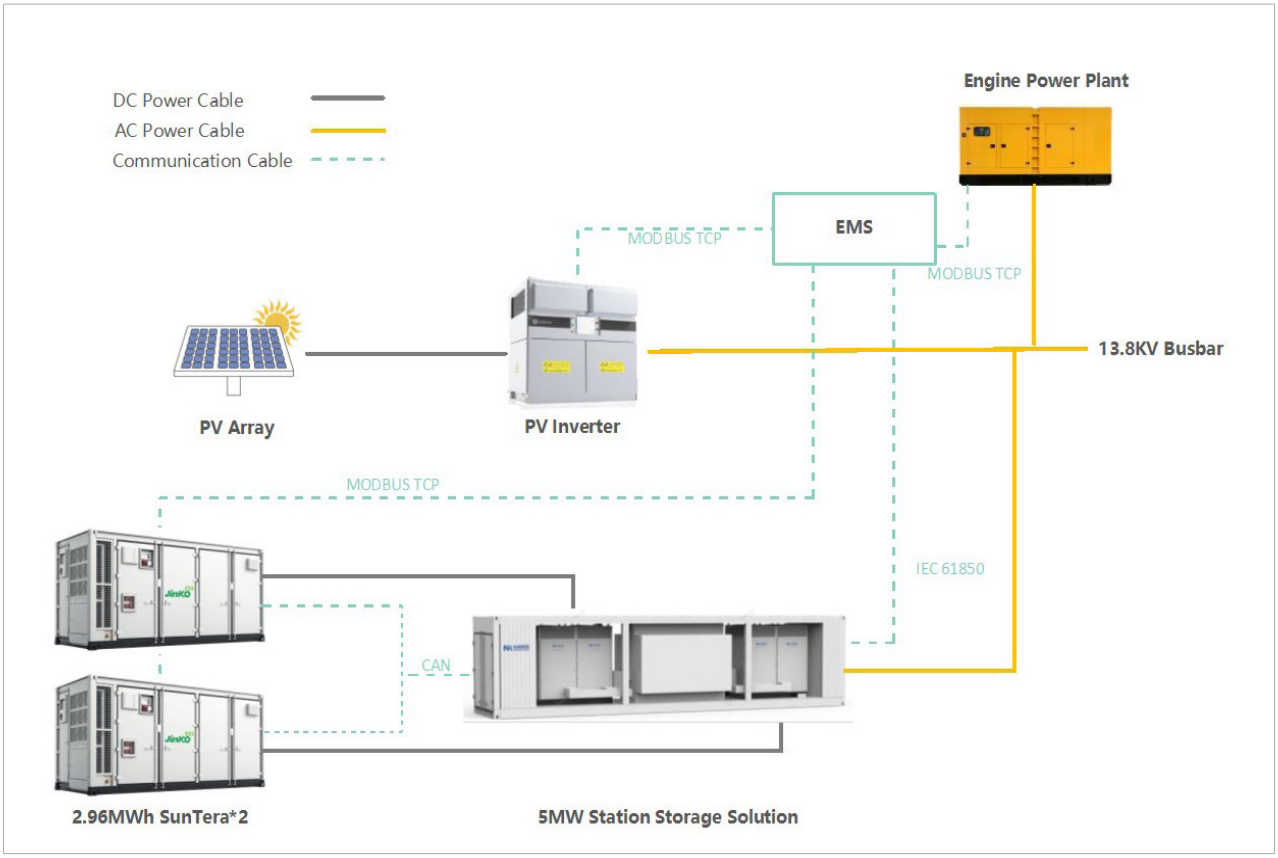

Fig. 1 Single Line Diagram of Microgrid DC Coupling System

Operation Logic

Generator start/stop planning

Provide recommendations through EMS HMI to operators when to start and stop, as well as the capacity level during daylight hours, based on forecasted solar power generation, battery state of charge (SOC), spinning reserve requirements, load forecast, engine status etc.

Minimize engine fuel consumption

The EMS control strategy maximizes renewable-energy utilization, thereby reducing heavy fuel oil consumption to the absolute minimum.

Maintain generator operating limit

The EMS ensures that the EPP remains within its defined operational envelope- min/max output levels, min runtime, max. ramp up/down, max. load step up/down, among others.

Solar generation output smoothing

EPP ramp up/down rates related to fluctuating PVPP generation are limited by charging/discharging BESS.

High grid quality, stability and reliability

The whole BESS stabilizes the grid's frequency and voltage and also provides optimized dispatch of the EPP to guarantee sufficient power reserves in case of a major generation system failure; blackouts or load shedding will be avoided even in emergency events such as the instant loss of a generator, large consumer, or PVPP output due to feeder trip(s).

Project Features

Multi-source synergistic optimisation

The project achieves multi-energy coordination by deeply analysing the characteristics of PV, battery storage and traditional generator, dynamically balancing each source in real time to maintain high efficiency under all operating conditions, maximise renewable-energy utilisation and simultaneously safeguard power-supply stability.

Superior Battery Energy Storage Performance

The BESS employs lithium-iron-phosphate (LFP) cells that combine high energy density, extended cycle life and exceptional safety. Engineered for continuous operation under harsh conditions of elevated temperature, high humidity and salt mist, the system executes precise device-level control. Its 1C charge/discharge capability enables rapid charging and discharging, which effectively smooths PV fluctuations and load shocks.

High-efficiency Energy Management System (EMS)

Equipped with an advanced EMS featuring robust energy management and dispatch functions, the platform continuously monitors the operating status of PV, storage and EPP while intelligently controlling the renewable system. Embedded smart algorithms automatically optimise genset start/stop schedules and battery charge/discharge strategies based on load forecasts, PV-generation forecasts and battery state information, delivering optimal energy allocation and reduced fuel consumption.

High-efficiency Energy Management System (EMS)

The system integrates meteorological and PV-generation forecasting modules capable of predicting solar output hours to days in advance, supplying the EMS with high-accuracy forecast data. By combining these forecasts with load projections and real-time battery status, the EMS pre-formulates unit-commitment schedules, enabling preemptive control that optimises the generation portfolio, trims reserve margins and enhances overall economic operation.

Customer Benefits

Substantial Improvement in Power-Supply Stability

Since commissioning, power-supply stability for Island's gold-mine and other industrial consumers has improved markedly. In islanded mode the system delivers autonomous, stable electricity that fully satisfies the continuous-production requirements of critical loads.

Coordinated generation from PV solar, Battery Storage and EPP has markedly enhanced voltage and frequency stability: voltage deviation is held within ±5 % and frequency deviation within ±0.1 Hz, achieving internationally advanced power-quality levels.

Remarkable Progress in Green-Energy Transition

The highly efficient synergy between PV generation and battery storage has substantially increased the share of renewables in the electricity mix. During the first year of operation the PV output accounted for more than 30 % of total energy supplied, and annual diesel savings are projected to exceed 500,000 litres. Greenhouse-gas emissions are correspondingly reduced by approximately 1,500 t of CO_2 per year, supporting the Philippines' green-energy transition and carbon-neutrality objectives while advancing local sustainable development.

Economic Benefits and Demonstration Effect

By cutting fuel consumption and optimizing the power-supply structure, the project is expected to save the gold mine more than USD 500,000 in annual electricity costs, delivering significant economic returns.

Conclusion and Outlook

The Philippines Island micro-grid energy-storage project has resolved local power-supply challenges through an advanced technical solution and outstanding system performance, delivering green, highly efficient and stable electricity.

v

The technological breakthroughs achieved in multi-energy coordination, intelligent EMS dispatch and stable islanded operation set a new benchmark for energy-storage development across Southeast Asia.

Going forward, JinkoESS will continue to deepen R&D in Energy Storage technologies, expand into additional application scenarios and support global energy transition and sustainable development.

Fig. 2 Site Picture