Case Study

Jinko ESS's BESS Application for Peak Shaving and TOU Arbitrage

10MW/20MWh Li-ion BESS Project at Thai Cement Factory

Project Overview

The project is located in the suburbs of Bangkok. Jinko ESS has once again reached a storage cooperation agreement with one of Thailand's largest distributors. Jinko ESS supplied 2 * 5MW PCS-MV Skid + 20MWh battery containers for one site and 2.5MW PCS-MV Skid + 5MWh battery containers for the other site of landmark project at a local cement factory.

One site is equipped with 20MWh (4 ESS units) and the other site with 5MWh (1 ESS unit). This initiative aims to support the factory's transition from traditional fossil fuel-based power generation to a cleaner, more sustainable energy model.

The Cement Factory, which currently relies on a mix of diesel generators, thermal power plant, and solar energy, is seeking to reduce its carbon footprint and operational costs by integrating PV + ESS solutions. The SunTera systems will enable the factory to replace coal-fired power with renewable energy while leveraging photovoltaic (PV) generation and energy storage for peak shaving and time-of-use (TOU) arbitrage. This approach not only supports the factory's sustainability goals but also enhances energy efficiency and cost savings.

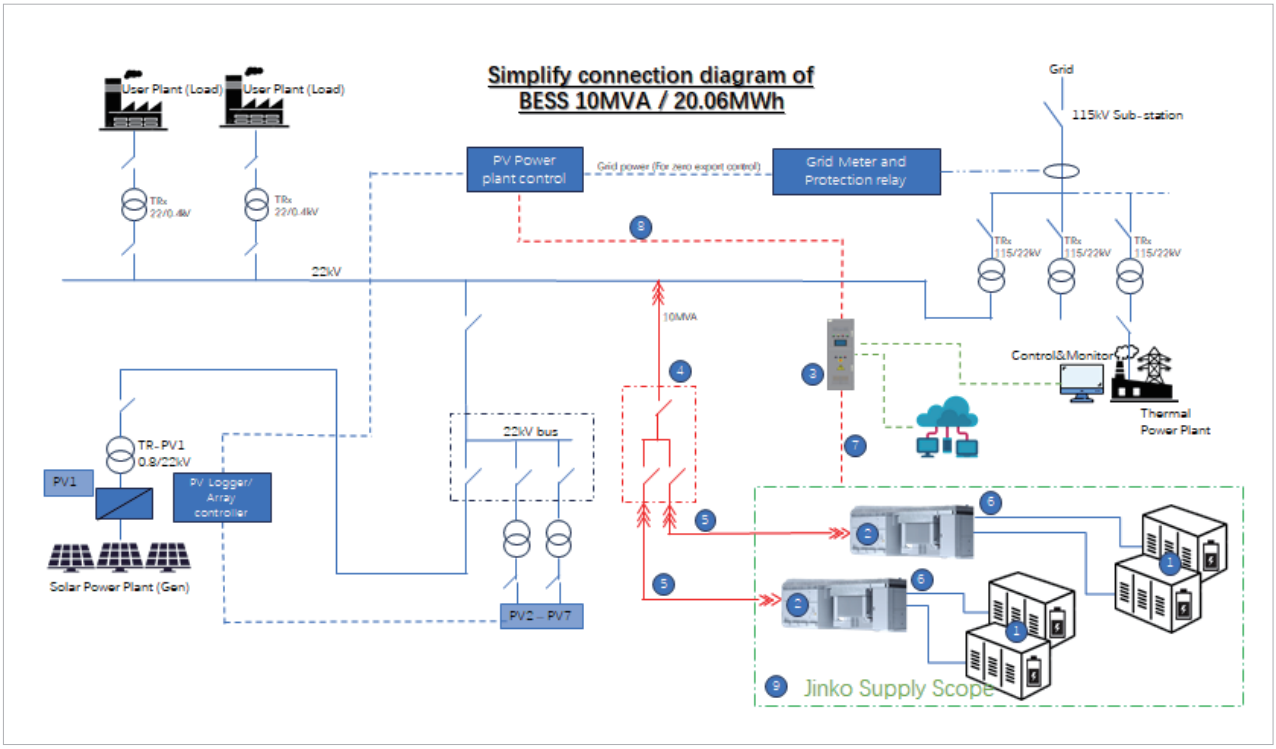

Fig. 1 Single Line Diagram of Microgrid AC Coupling System

The Solution

Jinko has provided an energy storage system that meets Thailand local PEA certification requirements.
The solution consists of (4*5MWh) containerized battery storage units and (2*2.5MW) MV Skid integrated units. The system optimizes operations through the following logic:

Store and Release (Energy-Shifting):

- Store: Charge using surplus PV power generated during the day.
- Release: Discharge in the evening to cover the load gap and replace thermal power generation.

Store and Release (Energy-Shifting):

- Stabilize: Utilize the fast-response characteristics of the ESS to stabilize grid frequency.
- Profit: Implement a "two-cycle-per-day" charge-discharge strategy to capitalize on the time-of-use (TOU) price arbitrage.

Operation Logic

The Energy Storage System (BESS) employs various control strategies based on the operating status of the grid, PV, and the Thermal Power Plant (TPP) during different time periods:

- From 22:00 to 09:00: The BESS charges at a low power level until fully charged. The charging schedule can be adjusted upon operator request. Once fully charged, the BESS enters an idle state.
- From 09:00 to 11:00: The BESS discharges to the

minimum State of Charge (SOC). The discharging plan can be adjusted according to operator requirements, after which the TPP may reduce its capacity accordingly.

• From 11:00 to 18:00: The BESS charges and discharges (≤10MW) to maintain grid power stability. If operational limits are reached, the system notifies the operator to adjust the output of the TPP or PV.

• From 18:00 to 22:00: The BESS calculates the remaining energy to plan the discharge power and duration, executing the discharge as per the operator's requirements.

Time	Grid	PV	Thermal Power Plant (TPP)	BESS	Expectation
22.00-09.00	On	Off-On	Produce	Schedule control	• The BESS charges constantly until SOC = %max (Charge at low power to avoid high temperature) • Request from the operator →e.g. Charge at 5 MW 4 Hrs from 22.00 to 02.00 then TPP may increase its capacity as informed or allow grid to charge. • After BESS SOC = % max → BESS = Idle.
09.00-11.00	On	Produce	Produce	Schedule control	• The BESS discharges constantly until SOC = %min (2hrs at 0.5C) • Inform to the operator →e.g. Discharge at 10MW 2Hrs from 09.00-11.00 then TPP may reduce its capacity as informed.
11.00-18.00	On	Produce	Produce	Grid tracking	• The BESS will be charged and discharge (<=10MW) to maintain the grid power close to 0MW or any required setpoint. • If the BESS reaches its limit but is still unable to maintain the grid power. It will be reported to the system operator to reduce the production capacity of the TPP. If client want to reduce PV plant capacity the BESS also can perform.
18.00-22.00	On	Off	Produce	Schedule control	• The BESS calculates the remaining energy to plan discharging power and duration of discharging. • Inform to the operator →e.g. Energy remaining 10MWH - Discharge at 2.5 MW - 4 Hrs from 18.00-22.00

Fig. 2 Jinko ESS BESS Control Logic

Customer Benefits

This project delivers multifaceted value and results to the client through the installation of a Battery Energy Storage System (BESS), primarily reflected in economic benefits, grid stability, and operational flexibility:

Reducing Electricity Costs and Achieving Peak-Valley Arbitrage

The BESS fully utilizes Thailand's significant peak-to-off-peak electricity price spread. It stores power during low-price periods (such as late at night) and discharges during high-price periods (such as evening peaks), replacing expensive grid purchases or thermal power generation. This significantly reduces the client's overall electricity expenditure.

Improving Renewable Energy Utilization and Reducing Waste:

Excess solar power generated during the day is no longer wasted but is stored by the BESS. This maximizes the utilization of clean energy, improves overall energy efficiency, and aligns with the concept of sustainable development.

Stabilizing Grid Operation and Enhancing Power Quality

The BESS possesses rapid response capabilities. It can quickly charge and discharge to smooth out power fluctuations and stabilize grid frequency and voltage when PV output fluctuates violently. This improves grid quality and reduces the risk of equipment failure caused by grid instability.

Optimizing Power Dispatch and Improving Operational Flexibility

The BESS can flexibly adjust its charge/discharge strategy based on grid demand and price signals, working in coordination with the thermal power plant. For example, it signals the thermal plant to reduce output when discharging, and allows the thermal plant or grid to supply power when charging. This achieves efficient collaborative management of generation, grid, load, and storage.

Conclusion and Outlook

Thailand 10MW/20MWh Li-ion BESS project not only brings direct economic benefits to the client (reduced electricity costs) but also enhances the stability and security of the power supply, while optimizing the energy structure and operational efficiency, demonstrating significant comprehensive benefits.

Fig. 3 Site Picture