Case Study

Jinko ESS Solution of AC-coupled in Weak Grid Infrastructure

8.6MW/17.2MWh Li-ion BESS Project in French Polynesia (Tahiti Island)

Project Overview

Location: French Polynesia (Tahiti Island)
Grid Characteristics: Weak grid infrastructure with frequent voltage and frequency fluctuations.

System Configuration:

Hybrid System: 8.6MW/17.2MWh lithium iron phosphate ($LiFePO_4$) energy storage system paired with Jinko Solar-supplied photovoltaic (PV) modules.

Key Components:

- 1× SMA MVPS 2660 PCS connected to 1× 3.44MWh battery container.
- 2× SMA MVPS 3450 PCS each connected to 2× 3.44MWh battery containers.
- SMA Power Plant Manager (PPM): Centralized communication hub for coordinating PCS, BMS, and third-party EMS.
- Environmental Challenges: Coastal environment with high salinity and humidity, requiring C5-M anti-corrosion protection for all equipment.

Key Achievements:

- Seamless integration of solar PV and storage to stabilize weak grids.
- Full compatibility with SMA PCS and third-party EMS, validated in harsh conditions.
- By replacing diesel generation with solar-stored energy, the system reduces CO_2 emissions, directly supporting Tahiti's decarbonization goals.

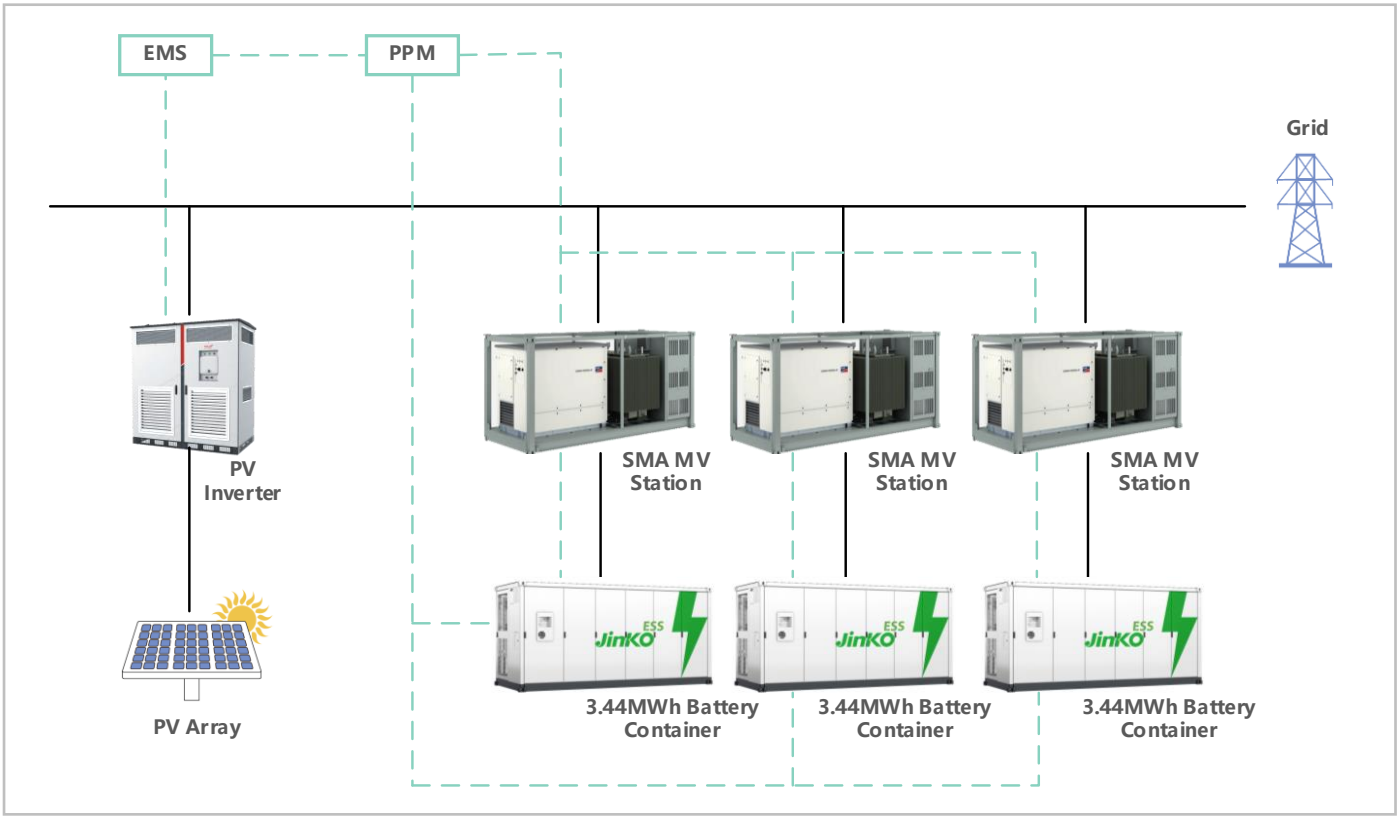

Fig. 1 Diagram of the Photovoltaic and Energy Storage System

Jinko's Solution

Core Components Delivered:

- LiFePO4 Battery Containers (Total 17.2MWh):
- Configuration: 5 containers (3.44MWh each) with IP55 protection, C5-M coating, and modular redundancy.
- Deployment: Strategically grouped to match PCS capacity (1× MVPS 2660 + 2× MVPS 3450).
- PCS & System Integration:
- SMA MVPS Series: High-efficiency PCS (2660 and 3450 models) for bidirectional power conversion and grid-forming capabilities.
- SMA PPM: Unified communication gateway ensuring interoperability between PCS, BMS, and client's EMS via protocols like Modbus TCP.
- Solar PV Integration: Jinko Solar PV Modules: Supplied high-efficiency panels, synchronized with storage for round-the-clock renewable energy dispatch.
- Multi-Layer Architecture:
- SMA PPM as Central Hub:
- Simplified Integration: Unified communication interface between PCS, BMS, and third-party EMS, reducing protocol complexity.
- Enhanced Reliability: Redundant communication paths (Ethernet + dry contact) minimized single-point failure risks.
- Reduced Onsite Effort: Pre-configured protocols and plug-and-play design cut commissioning time by 30%.
- Third-Party EMS Compatibility: EMS dynamically optimizes PV-storage synergy based on grid demand and weather forecasts.

Support Model:

- Onsite Expertise: Technical teams assisted in commissioning and troubleshooting.

Communication & Control:

Fig. 2 PV system and ESS system

Operation Logic

PV-Storage Synergy:

- Daytime Operation: PV modules generate power for immediate consumption and excess energy storage.
- Night/Grid Instability: Stored energy discharged to stabilize the grid, reducing reliance on diesel backup.

Advanced Grid Support:

- Weak Grid Adaptation: The energy storage system actively responds to Tahiti's weak grid conditions by dynamically adjusting power output to stabilize voltage and frequency fluctuations.
- Load Management via PPM: The SMA PPM coordinates real-time communication between PCS and BMS, enabling rapid response to sudden load changes and smoothing grid imbalances.

Environmental Resilience:

- Containers and PCS equipped with C5-M anti-corrosion coatings to withstand coastal salinity.

Summary of the Project's Significance

- **Technical Milestone:** Validated Jinko Solar's ability to deliver hybrid PV-storage solutions in weak-grid environments, with 8.6MW/17.2MWh capacity supporting Tahiti's energy resilience.
- **Industry Leadership**
- **Proven Interoperability:** Demonstrated seamless integration with SMA PCS and third-party EMS, positioning Jinko as a globally compatible system integrator.
- **Scalable Architecture:** The SMA PPM's success in simplifying communication complexity makes this solution replicable for projects requiring multi-vendor coordination.
- **Sustainability Impact:** Reduced carbon emissions by displacing diesel generation, aligning with Tahiti's renewable energy targets.
- **Market Expansion:** This project serves as a benchmark for promoting Jinko's ESS systems in island microgrids and weak-grid regions worldwide.

Key Takeaways for Future Projects

Seamless Integration with Top-Tier PCS Partners: Jinko ESS products demonstrate full compatibility with industry-leading PCS providers like SMA, offering turnkey solutions that combine high efficiency and reliability.

Third-Party EMS Flexibility

The system's open architecture supports smooth integration with client-sourced EMS, streamlining commissioning and ensuring hassle-free delivery across diverse project requirements.

Proven Resilience in Harsh Environments: Engineered for coastal high-salinity conditions and weak-grid scenarios, JinKo's solutions deliver stable performance while reducing carbon footprints, ideal for island and remote microgrid deployment.

Fig. 3 BESS system