



# Jinko Sungiga Liquid Cooled Solution of Micro-grid DC- coupled System

150kW/430kWh Li-ion BESS Project in Kenya

Case Study

## Project Overview

The project is situated in Molo, Kenya for a flower plant where the grid supply power is generally unstable. The client had primarily been reliant on Diesel generator for back-up power operations resulting in high energy costs.

This project focuses on implementing an DC-coupled Energy Storage System (ESS) to be integrated with an existing grid-tie PV system and also hybridization with grid & Diesel Genset. The solution aims to enhance energy efficiency, reduce electricity costs, and improve power reliability by integrating battery storage

and PV with the existing power infrastructure.

The project requirements were achieved using the various components and using a central EMS to achieve the entire plant control and operation.

The facility has achieved a remarkable reduction in both grid & diesel fuel costs resulting in low operating costs which allows the farm to be competitive in the market.

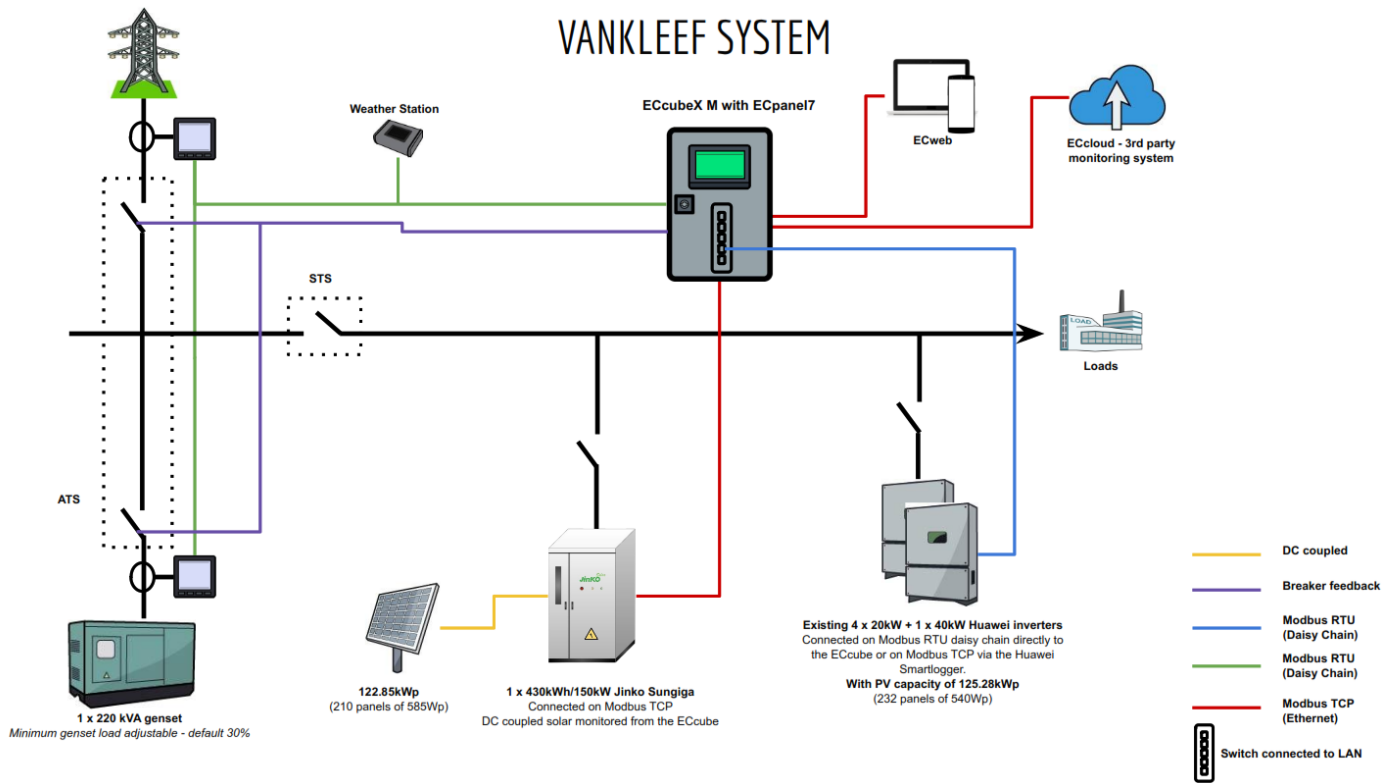


Fig. 1 Single Line Diagram of Micro-grid DC-Coupled System

## The Solution

Adopting 430kWh Jinko Sungiga energy storage cabinets, the client will benefit from the inherent advantages of its integrated design, simplified installation and maintenance procedures, while achieving a high level of system integration.

The 430kWh ESS system is designed in cabinets configuration, integrated with different sub systems to deliver optimal performance and safety. These include battery racks, battery management system (BMS), liquid cooling system, fire suppression system, power conversion system (PCS) and energy management system (EMS).

### Battery Rack

Each battery rack of 215kWh consists of 5 battery packs of 153.6V rated voltage connected in series to reach a total 768V.

Alongside a high voltage box (HVB) consisting of electrical protection for high and low voltage circuit and a battery cluster unit (BCU) responsible for collecting and processing data received from the battery pack units.

### Battery Management System

The solution adopts a BMS with two stage architecture using CAN bus communication: battery management unit (BMU) and battery cluster unit (BCU).

The BMU is integrated into each pack to monitor the cell voltages, temperature and current. The BCU is integrated into the HVB summarizing the data received by the BMUs.

The BMS is responsible for real time detection of thermal and electrical parameters (voltage, current, temperature, etc...), accurate estimation of battery state of charge (SOC) and state of health (SOH) with auto calibration and support over-charge protection, o v e r -discharge

protection, short circuit protection, reverse polarity protection, overload protection, and over-temperature protection.

The BMS can swiftly isolate local faults, report fault information and provide real time alarms.

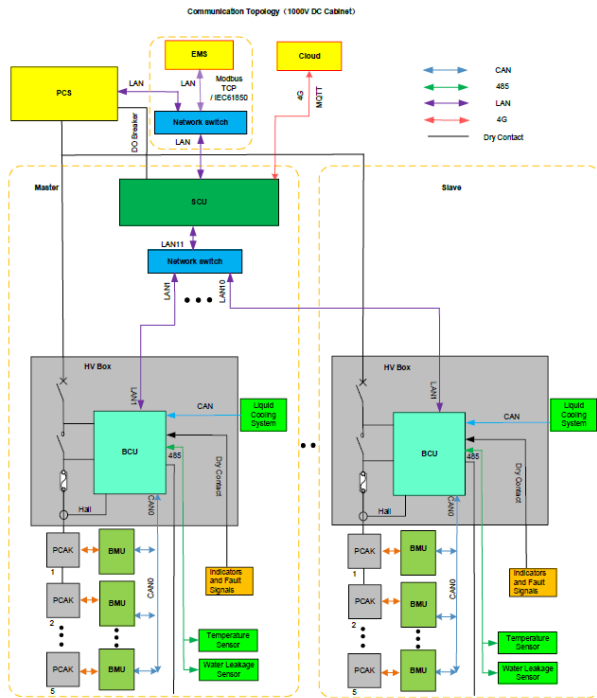


Fig. 2 BMS Communication Topology

temperature threshold, the fire extinguishing device will be triggered, releasing the extinguishing agent and extinguishing the fire; at the same time, a dry contact signal is fed back to the upper unit to remind the relevant personnel that the gas extinguishing agent has been released

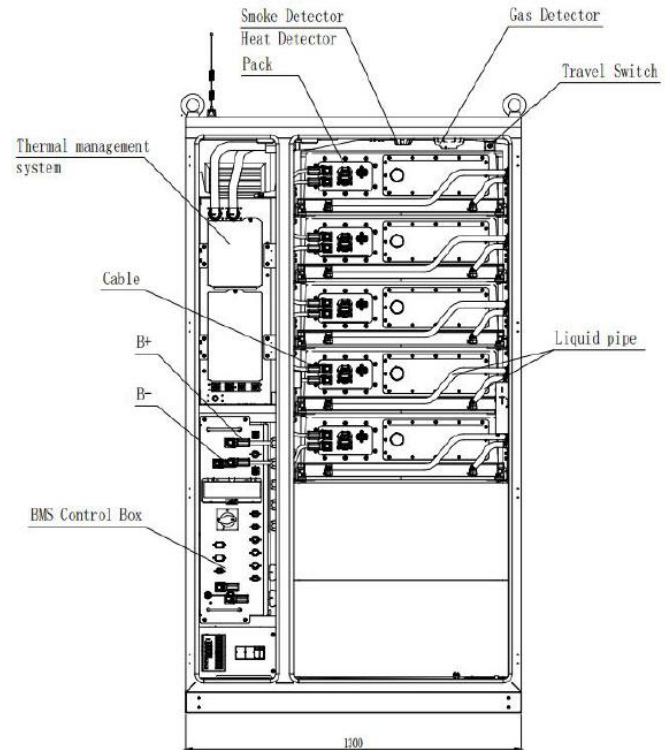


Fig.3 Sungiga Cabinet layout

### Liquid Cooling System

The solution adopts a liquid cooling system, which consists of liquid cooling host, liquid transmission pipeline and battery liquid cooling plate, and multi-mode refined thermal management control logic to maintain normal temperature and improve system consistency and lifetime.

### Fire Suppression System

The fire suppression system integrated within the ESS system is designed to ensure safety and minimize the risk of fire incidents using aerosol. The FSS consists of temperature and smoke detectors to promptly identify the When the protected area reaches the



## Energy Management System (EMS)

The EMS integrated with the Jinko ESS system offers a comprehensive range of functionalities to ensure efficient and reliable operation. It serves as a central control unit that optimizes energy flow, enhances system performance, and enables seamless integration with existing Huawei PV inverters.

The EMS provides real-time monitoring and control of the system, allowing users to monitor crucial parameters, such as state of charge (SOC), state of health (SOH), and power flow. Through a user-friendly visual interface, users can directly manage and adjust system settings, ensuring optimal performance and maximizing energy utilization.

The EMS plays a critical role in optimizing the operation of the ESS system to ensure efficient management between PV inverters, battery cabinets and DGs existing on site.

The BMS, PCS and PV inverters are connected to the EMS through Modbus TCP/IP. The EMS is communication with the existing DG through hard wiring configurable dry contact based on batteries state of charge % (SOC).

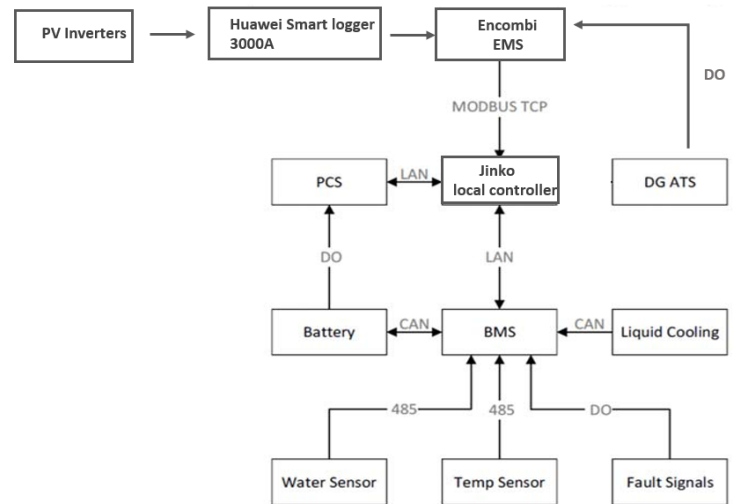


Fig.5: EMS Communication Topology

# Operation Logic

## Day time Operation:

Solar PV (existing grid-tied system) > BESS > Grid > Genset. During day time, the grid-tied works together with the grid to serve the loads. The PV connected to the hybrid inverter supplements the dips in solar from the grid-tie system and also charges the battery. Once the battery is full, the Solar PV system from the grid-tie & hybrid inverters serve the load requirements. In the event of a grid outage during the day, the transition is seamless with the PV inverters continuing to produce by getting reference from the PCS output.

## Night time Operation:

BESS > Grid > Genset. The stored energy in the battery is first discharged to the loads and at 40% SOC, the grid steps in to supply the loads. In the event of grid outage, the BESS is further discharged to 20% at which the EMS commands the genset to start up, supply the load and charge the BESS to 80% SOC before genset switches off. At this point, the battery then takes over to supply the load to the 40% set-point at which the grid should be restored or further to 20% when the genset is then engaged once more.

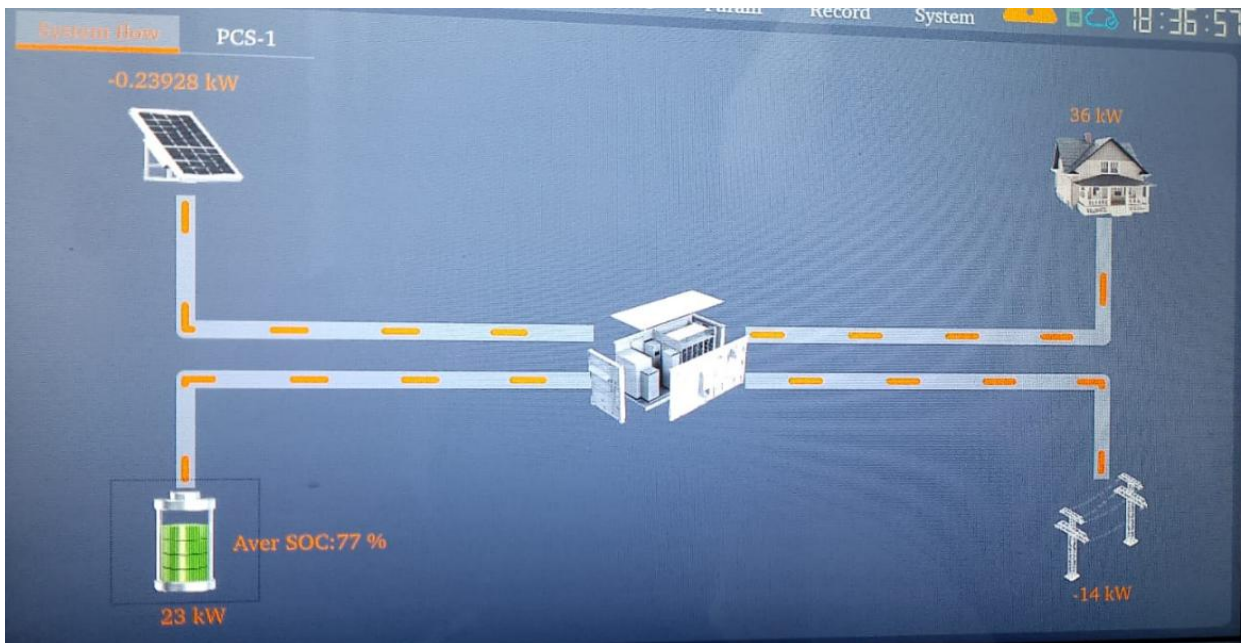


Fig. 6 EMS Local Controller Set up

# Monitoring Systems

## SCU Monitoring

The solution is equipped with one SCU connected to the 2 battery cabinets to monitor and control all connected subsystems (cooling system, FSS, BMUs, BCUs, etc....) and provide real time data for cluster and cells voltage, temperature and current as well as the

as the alarms log and running status of the SunGiga cabinets.

The SCU is connected to cloud via LAN cable connected to the client router. The SCU is accessed remotely through VPN.

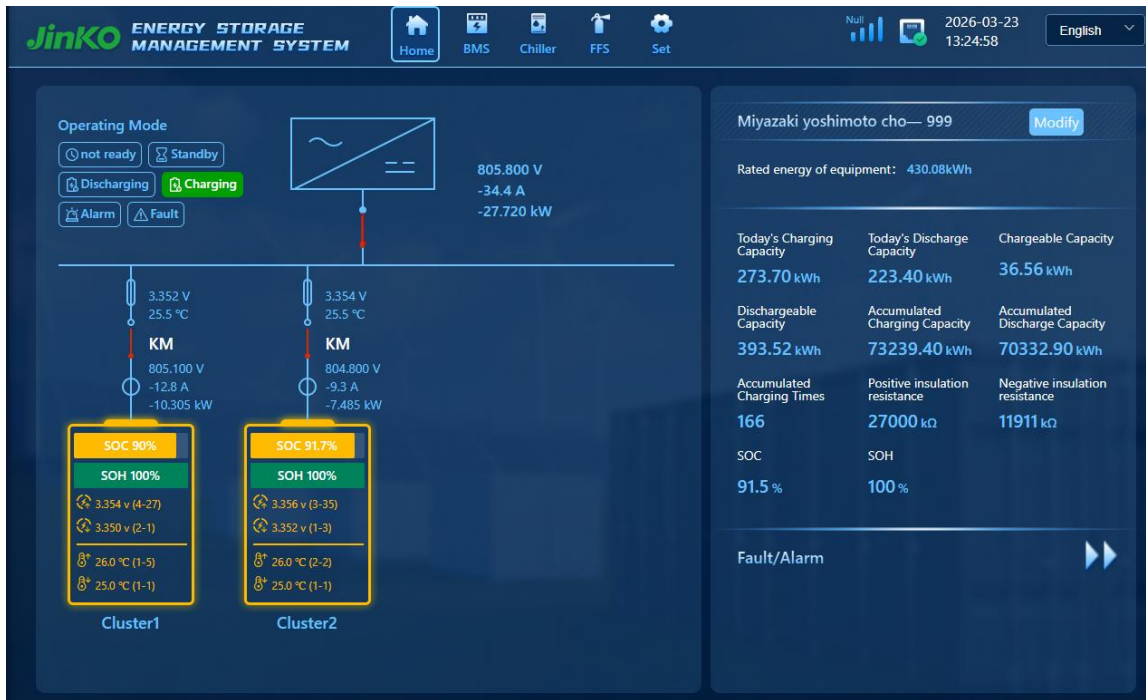


Fig. 7: SCU Cloud Monitoring Display

## Online Monitoring

The Local EMS cloud platform is an intelligent management system designed to control and monitor the ESS power systems on the Hybrid PCS by displaying the connected PV generation, Battery charging, grid & load consumption. The BMS, PCS and EMS HMI are connected to the IoT router located inside the local EMS controller integrated cabinet through Modbus TCP/IP. The router is connected to cloud monitoring platform through WAN connection coming from the client internet router.

The plant's overall EMS displays the data from the various energy infrastructure from a centralized online dashboard. The energy flow from the grid-tie PV, battery, grid/DG and load can be captured in real time. The respective kWh data can be downloaded on this dashboard for processing and analysis.



Fig. 8: Jinko Local Controller Cloud Monitoring Platform

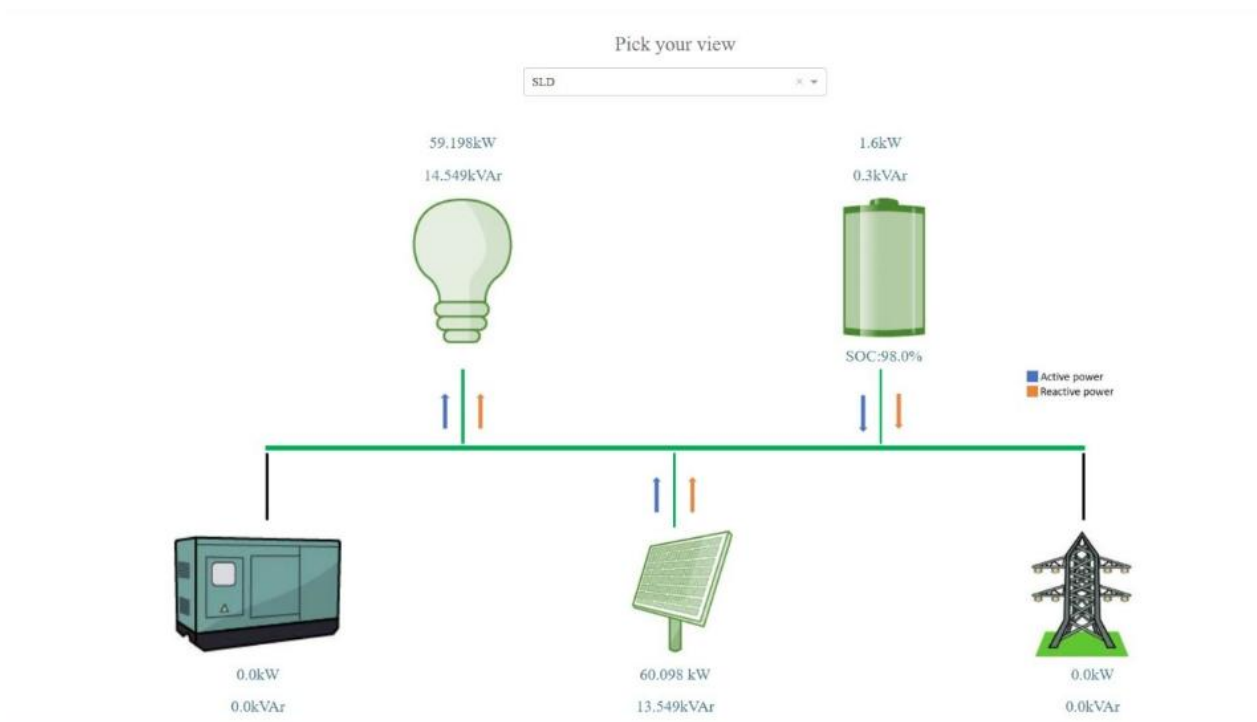


Fig.9: EMS Cloud Monitoring Platform

## Conclusion

The implementation of DC coupled Microgrid solution of 430 kWh C&I energy storage system has demonstrated significant advantages in terms of simplified installation, cost savings and environment requirements.

The project has also highlighted the potential of integrating energy storage systems with a wide range of existing energy infrastructure (PV inverters, DG & 3<sup>rd</sup> party EMS) to achieve key energy objectives.

Operational performance data highlighted the

system's high efficiency, reliability, and scalability, with minimal degradation over the study period.

Additionally, the project provided valuable insights into battery management strategies and control in Hybrid Solar PV systems.

Future expansions and advancements in battery technology and grid interconnection strategies will further enhance the effectiveness of similar ESS deployments.

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\* 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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#### Case Study

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