First mover of solar energy in the Malian market

-Case study on 250 kWp, 537,6 kWh ESS project

Background:

As one of the largest country in Africa, Mali's electricity system encompasses a national grid that is owned and operated by Energie du Mali SA (EDM SA) which supplies 35 towns, including its capital city Bamako.
Hydropower and thermal power stations are the main energy generation sources at the national level in Mali. Although hybrid (solar/diesel) and small-scale decentralized solar PV systems have been increasingly installed since 2011, the share of renewable energy still remains low in the country. The average consumption is also characterized by a strong disparity between rural and urban areas. Urban population has around 80% higher access to electricity than rural population. People in the rural areas are still suffering from poor power supply.

Project details:

To improve the power condition for the people living in rural areas, United Nations Development Program (UNDP) decided to build a full solar system with battery in Bamako Mali for a village. And this is one of their poverty alleviation projects for underdeveloped countries.

The system was designed with PV panel 250.25kWp, peak load around 220kwh, and an existing diesel generator. The system is expected to operate on solar as the main source of power in order to reduce fossil fuels–and thereby being first mover in the Malian market in regards to sustainable solar energy.

Site Survey	
Location	Bamako
Grid	Unstable
Load	220kWh
PV installation	250.25Kwp
Equipment installation	Indoor

Figure 1

According to the condition on site, two HPS120 parallel systems with container were deployed for the customer. (Figure 2)

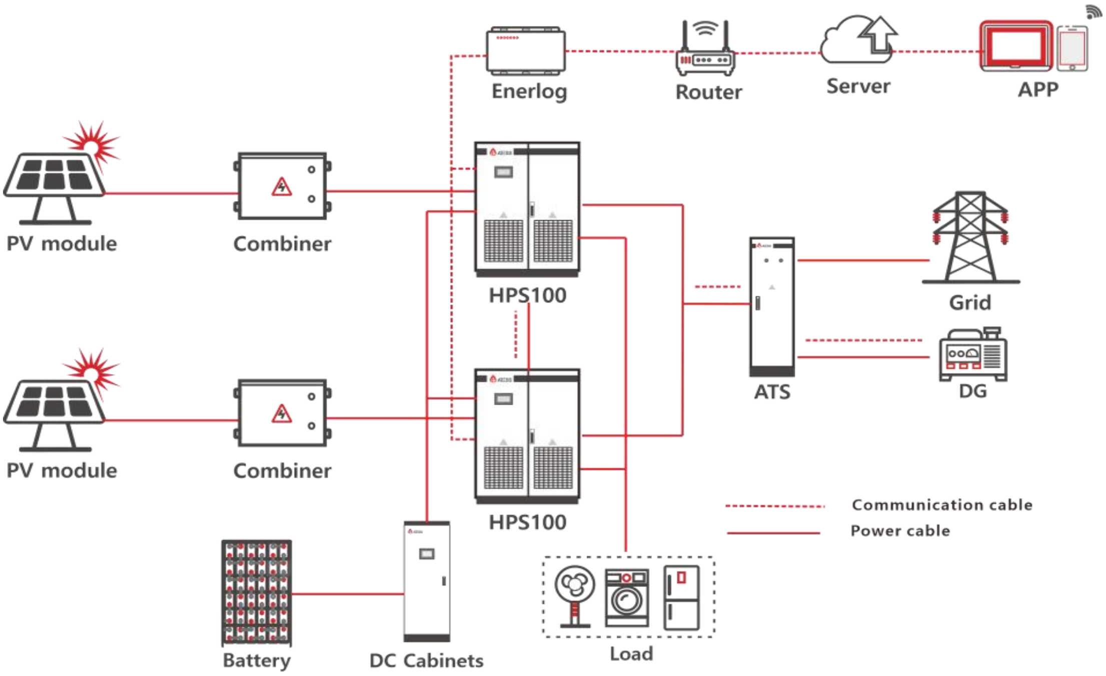

Figure 2

Configuration: (Figure 3)

Item		Description	Qty.	Supplier
PV		PV capacity is 250.25kWp		EPC
Battery: 537.60kWh(430.08kWh available at 80% DOD)	Battery DC Cabinet	With BPU in battery rack	1	ATESS
	Slave Battery Rack BR100T	With BPU in battery rack	5	ATESS
	ESS-BM-38.4-200TPB	Battery module 38.4V, 200Ah Capacity 7.68kWh	70	ATESS
PV-CB8M		For combination of multiple PV module strings	6	ATESS
HPS120		120kW hybrid inverter	2	ATESS
ATS150		Switch between on-grid and off-grid	2	ATESS
20FT Container		For outdoor installation with HVAC and FSS	2	ATESS
Enerlog		Monitoring datalogger	1	ATESS

Figure 3

System advantages

Based on Client's on-peak load, and most existing loads such as A/C, pumps and motors were inductive loads, so a designed of two HPS120 units parallel with the maximum PV capacity up to 240kWh will be more stable and flexible. The rated power of entire system could fully meet client's demand, with possibility of expanding the PV capacity to 180kWp for each HPS120.

Multiple strings of PV modules can be connected to bothHPS120s through ATESS PV combiner box, and each HPS120couldreceive PV modules with different orientations or angles.

Due to unstable grid on site, ATS was a necessary accessory for seamless switch between ON & OFF Grid. When needed, it sends a signal through dry contact to control DG in the system, thus the system can fulfill automatic DG switch on/off function.

A smart monitoring system includes Enerlog and smart cloud platform enables the client to monitor and manage the system online with a few taps.

The whole system was divided into two 20FT containers make it more organized. One was the equipment container, and another one was the battery container. ATESS containers are all integrated with cooling system to provide a suitable working environment, also with full security system including fire suppression system, smoking detective and exit lighting indicator to ensure safety.

Working mode

The working mode has been chosen is Load First & Zero Export for this project.

On-Grid: Load First Mode

1) When PV power is higher than load consumption, PV will supply load first, then excess power will charge battery;
2) When PV power is lower than load consumption, battery will discharge automatically. If battery voltage approaches the under voltage limit, battery will stop discharging, and the load will be supplied by PV and grid. In the meantime, the grid will charge battery in low current to protect battery.

Off-Grid Mode

1 When PV is higher than load consumption, PV will supply load and charge battery.

2 When PV is lower than load consumption, battery will discharge until approaches under voltage limit, then,

1) In default setting, HPS will stop working, and PV will charge battery only.
2) If generator is connected, HPS will start generator using its relay output, generator will supply load and charge battery.

DG Mode

Generator connection (dry contact control)

In off-grid mode: When battery voltage is approaching under voltage limit, HPS will start generator to supply load and charging battery. HPS will stop supplying power, only using generator power to charge battery.

If generator is started,

1) When PV is higher than charging power, PV will charge battery only.
2) When PV is lower than charging power, PV will priority charge battery. Generator will supply load, and generator also allow charging charge battery according to customer’s requirement.
3) When battery is full, HPS will stop the generator and switch to off-grid mode.
4) During off-grid mode, generator allows connect to HPS directly. If grid and generator needs connect to HPS simultaneously, an ATS will be needed for the connection.

Conclusion

The system has been commissioned and started running from Oct 2021. The diesel generator on site has been turned on just once after the energy storage system came into use, and grid power consumption has been reduced around 20%. People in the village can enjoy clean energy 24/7. Overall, ATESS provides a convenient, stable and flexible system for the client.

As a matter of fact, this is not the first time that ATESS supplied for UNDP project. Since 2020, ATESS has supplied 6MW/6MWh energy storage systems for their poverty alleviation projects around Africa. We are so inspired by becoming a brand recognized by UNDP and helping people in underdeveloped countries. We will never stop our steps to the sustainable goal of making our world greener by supplying uninterrupted, clean and safe energy.