

Energy storage system for hybrid microgrids

Multi-source power supply for an isolated site



The customer: **Mini Green Power**



Mini Green Power is a French company specialising in the development of biomass power plants and boilers.

To meet its aim of local low-carbon energy self-sufficiency, Mini Green Power develops, finances, manufactures and operates renewable energy generation solutions worldwide, using locally recovered plant residues to produce electricity, heat and refrigeration.

Mini Green Power offers support throughout the duration of its projects to enable customers to achieve complete energy self-sufficiency.

The project

The aim of the Mini Green Power project is to show that it is possible to run and operate its green mini power plants by connecting them to a solar installation to produce electricity and refrigeration on an isolated grid or in non-electrified areas.

In this project, Mini Green Power combines several technological solutions, which are controlled by an Energy Management System (EMS) developed by the company.

The microgrid created within this project includes:

- A biomass co-generation plant connected to an Organic Rankine Cycle (ORC) that transforms heat into electrical energy
- An energy storage system using Lithium-ion batteries
- A field of photovoltaic solar panels
- A refrigerated container
- A backup genset

The project was financed with European Regional Development Funds (ERDF).

The requirements

For isolated locations, Mini Green Power wants to use its solutions without relying on gensets under normal operating conditions. The idea is to run the mini power plant on 100% green energy. The diesel genset is on standby, used only for emergencies or after extended downtime.

The storage system required must therefore fulfil several major functions: voltage generation, frequency regulation on the microgrid, energy supply/storage in the event of sudden load variations and self-consumption.



Photovoltaic plant

Voltage generation

The storage system must be able to function as a voltage generator to start up the microgrid. The entire biomass ORC and solar panels all need voltage to run in the first place.

The mini green power plant takes two to three hours to start up before it can generate electricity itself. Without a mains connection, the storage system holds the energy needed for a "black start". While the mini power plant is starting up, the storage system must ensure that the voltage and frequency of the microgrid are maintained within acceptable limits to power the auxiliaries. As soon as the ORC of the mini green power plant starts, it connects to the bus controlled by the storage system, and recharges the storage batteries that provided the energy needed to start it. The battery recharges with energy so it can continue generating voltage indefinitely.

Microgrid frequency regulation

The electrical consumption of the mini power plant varies continuously to regulate the multi-stage combustion process. However, the frequency must remain stable.

It is the storage system that accurately and instantly delivers the right power to the mini plant, to ensure a perfectly stable frequency.

Managing load changes

When the ORC is synchronised and generating on the microgrid, it cannot instantly regulate the required load. This is because the biomass ORC has a certain inertia. If there is a change in load, it will not respond immediately:

- As microgrid consumption increases, the storage system is used to provide the missing energy, while waiting for the ORC to take over.
- When microgrid consumption decreases, the storage system is used to absorb excess energy until the ORC reduces the load.

Self-consumption

The final aim of the storage system is to maximise the rate of self-consumption across the entire installation. The idea is to store the surplus production, rather than disconnecting the solar panels. One of the means of storing excess energy for this project is the refrigerated container, which increases the stability of the grid by self-consuming surplus energy.



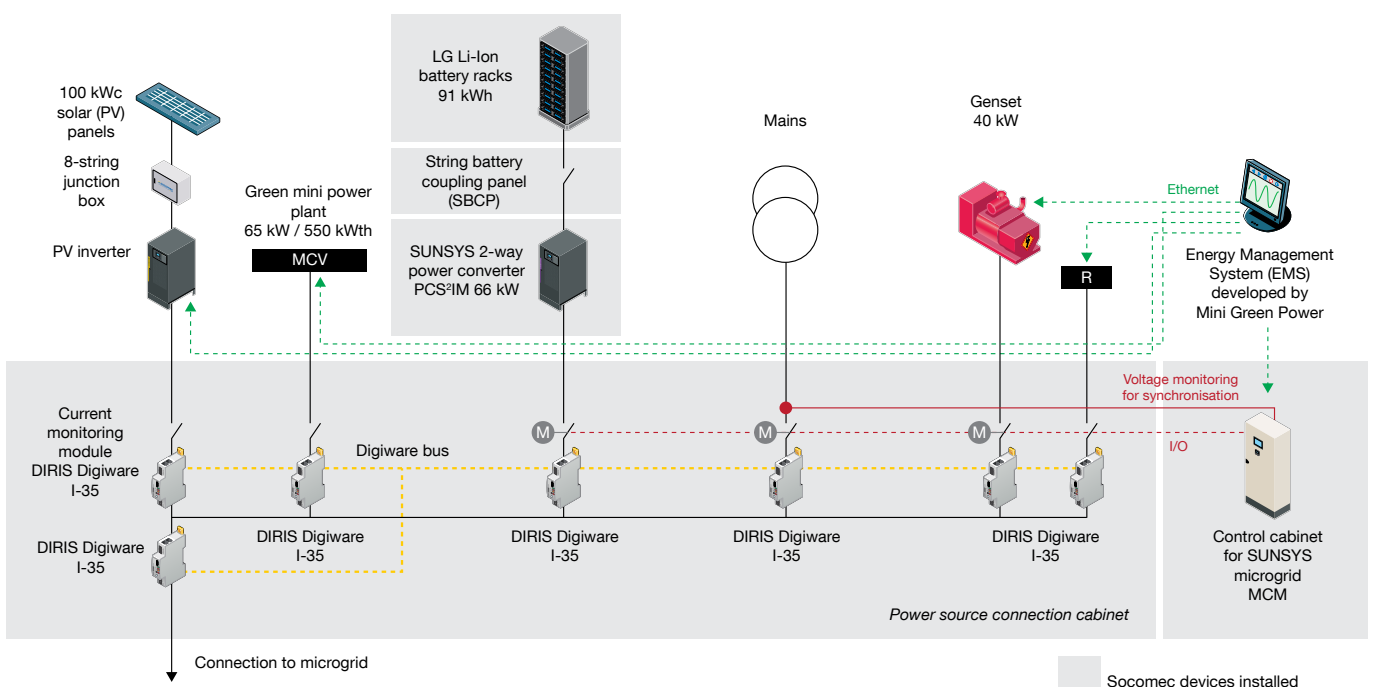
Cogeneration plant connected to an ORC (green mini power plant)

The solution

Socomec's solution consists of a system that includes:

- A 66 kVA two-way converter capable of operating as a voltage generator (island mode)
- A 91 kWh Lithium-ion battery rack
- A DC distribution box
- The cabinet for paralleling the different power sources
- A control cabinet (MCM) that manages the storage system and synchronisation to the grid for non-isolated sites.

Mini Green Power managed the electrical and mechanical interfaces between the equipment and developed the Energy Management System (EMS).



The advantages

- Complete system tested by Socomec.
- System compliant with EN 62477-1 and IEC 62619.
- Operating tests carried out by Socomec experts on the Mini Green Power site.
- System commissioning carried out by Socomec experts at the Mini Green Power site.
- Simple interfacing between the storage system and other production sources with the Energy Management System (EMS) manufactured by Mini Green Power.
- Easy replacement of conversion modules (in Socomec converters) without total loss of power.

→ Focus

Gonzague DE BORDE
Development Manager



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The Isolated Grid project is fully in line with Mini Green Power's mission, which aims to bring local low-carbon energy self-sufficiency to our customers. Producing renewable and economical energy from biomass and solar panels on isolated sites is a real challenge for governments and manufacturers, particularly in southern countries.

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Key figures

Project duration: 24 months
PV production installed: 100kWc
Converted power installed: 66kVA
Battery energy installed: 91 kWh
Total biomass/ORC: 65kW/550kWth

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