

Hybrid power plants: electrifying isolated villages

Benfeld, March 13, 2019

The electrification of African countries is becoming increasingly vital – not only to serve basic human needs but also to access commercial and developmental opportunities. As electricity demand is growing, the use of diesel generators – a previously popular but expensive solution - is proving insufficient to meet this underserved population's evolving daily needs.

ELECTRIFICATION: WHAT ARE THE OPTIONS?

When it comes to bringing electrical power to locations across Africa, there is currently a choice between several established systems as well as more recent renewable energy developments.

The first and seemingly simplest solution is to install additional diesel generators to provide electricity over a longer period of time. Despite appearing straightforward, this solution has several drawbacks; in some remote areas, access can be a significant challenge not only in terms of installation but also when it comes to refueling. Additional generators come at a price, with the rising cost of fuel being a serious drawback – prohibitively so, in many cases – but also in terms of the negative environmental impact. The associated increase in CO₂ emissions is in direct conflict with wider sustainability objectives making it both impractical and unattractive to deploy additional generators.

A second potential solution is the installation of large scale photovoltaic plants of several tens of MW, used as standard thermal power plants to guarantee a stable power supply. Generally, these are connected to the grid and their size is sufficient to cover the annual needs of the population, enabling access to education and medical care, for example. This solution is ideal from an environmental point of view as it reduces the CO₂ emissions while improving a country's energy mix. On the down side, however, it doesn't work for isolated sites that are not connected to the grid.

For these off-grid isolated sites, creating new infrastructure for connection to the grid is not a workable solution – as well as being cost-prohibitive, the complexities in terms of access are difficult to address successfully. In the case of a handful of residential houses, the electrification can be carried out with Solar Home Systems (SHS), providing electricity for lighting, radios and televisions, for example, for a few hours a day. In the case of industries, hospitals, entire villages or even islands, this solution is not sufficient. In these instances, and to realise the potential of these development opportunities, the most pragmatic solution would be the installation of solar panels in conjunction with a battery energy storage system.

18 MONTHS TO ELECTRIFY ISOLATED AFRICAN VILLAGES

A project has been running in Senegal since 2017 that simultaneously uses the above described solutions 2 (large scale PV power plants) and 3 (smaller hybrid power plants) to electrify very remote areas.

The tens of MWp of PV installed for this project aim to meet the annual needs of 140,000 people - whilst also reducing atmospheric CO₂ emissions amounting to 18,919 tons per year. In addition to solar panels, the plants also include generator sets and batteries.

To support this development, Socomec has been selected to supply and install 4 energy storage systems – from 132 kW / 183 kWh to 396 kW / 731 kWh - composed of lithium-ion batteries, with Socomec DC and

AC distribution cabinets and controllers. Delivered in maritime containers, the installation will supply 4 islands; with a combined total of 1 MWp of photovoltaic panels, they will reduce the use of the Gensets, diesel consumption and harmful CO₂ emissions - and will provide the islands and other remote locations with unprecedented reliability and control.

Elodie Hestin, ESS Marketing Manager at Socomec explains: “As the original manufacturer of the system and the majority of its components, we have complete control – which is particularly critical in this specific application. For example, when commissioning equipment in a location that is several days of travel away from headquarters – and without a phone connection – having the breadth and depth of knowledge, skill and expertise of the original manufacturer on hand, in the field, is a distinct advantage when it comes to a successful and safe integration.”



WHY SOLAR + STORAGE

The aim of this electrification is to supply secure and reliable electricity - 24 hours a day - while increasing the use of renewables, whose production is intermittent.

A first step could be simply to increase the quantity of PV installed in combination with diesel generators. This is possible up to a certain level, beyond which challenges will arise. For example, having too much PV in comparison to generators will lead to generator perturbations. The main issue is that this will not be used at nominal power but at lower power, resulting in poor efficiency, overconsumption of fuel and a reduction in the working life of the generator. Furthermore, if production outweighs consumption, the PV operation will cease, which is a real loss. Therefore, by adding an energy storage system that, combined with the power generation, will overcome the issues currently associated with intermittent production, it is possible to ensure continuity of supply and mitigate against the issues associated with generators.

DIESEL GENERATORS AND BATTERY ENERGY STORAGE: AN EASY MATCH?

In a hybrid power plant, the battery storage system is often added retrospectively, which means that the generators are already up and running. For ease, therefore, the storage system is frequently used as a backup for the generator, for example when it runs out of fuel or during maintenance. To benefit from real gains, however, the challenge is to use the storage system as the master and to reduce the use of the generator as much as possible. This should help to ensure that the generators are deployed at their optimum power, and only used as a backup when necessary.

A second challenge is to ensure transition between Genset operation mode and Energy Storage - without interruption, the objective being to target as near as possible to « 0 break ». As a manufacturer of UPS equipment for more than 50 years, Socomec is ideally positioned to guarantee complete continuity of service.

Hestin continues; “These electrification projects are not only vital for industrial development, but are also delivering a better quality of life – providing greater access to medical care, for example, which is a key factor in the sustainable economic development of Africa. We are incredibly proud to be part of this energy transition and to play a role in the electrification of these otherwise isolated villages, industries and islands – now looking forward to a brighter future.”

SOCOMECC: When energy matters

Founded in 1922, SOCOMECC is an independent, industrial group with a workforce of 3600 people spread over 28 subsidiaries in the world. Our core business – the availability, control and safety of low voltage electrical networks with increased focus on our customers’ power performance. In 2018, SOCOMECC posted a turnover of 537M€*.



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Press contact

Elodie Hestin

Marketing Manager

+33 3 88 57 78 38

info.energystorage@socomec.com

www.socomec.com