

SOUTHERN AFRICA'S POWERHOUSE

Rob Graham, CPCS, Canada, details the designs and plans for Sub-Saharan Africa's largest solar and battery storage procurement programme, based in Mozambique.

Mozambique's generation potential of 187 GW is greater than Africa's entire electricity production. It is virtually Southern Africa's power generator. However, despite being a net exporter of power, only 29% of Mozambique's population has access to electricity. This is because the country and the electricity utility lack the capital to invest in the transmission and distribution infrastructure needed to effectively deliver power to all of the population.

As a rapidly developing country, Mozambique has committed to achieve universal access to electricity by 2030. This is where the Global Energy Transfer Feed-in Tariff (GET FIT) programme comes into play.

Developed by the German development bank KfW, GET FIT provides tools to help emerging economies develop small scale

renewable energy projects. Provisions such as technical and funding assistance and risk mitigation make projects part of this programme attractive to investors.

After successful implementation in Uganda, and with a second ongoing programme in Zambia, Mozambique is next to benefit from GET FIT. Through GET FIT, Mozambique has realised that achieving universal access to electricity will likely require renewable energy, battery storage, and decentralised solutions.

How to make the solution fit

Making GET FIT work in the Mozambican context is easier said than done.

CPCS, a global management consulting firm in the infrastructure sector, brought the right combination of technical, financial, and public-private partnership knowledge to develop an innovative solution for the country.

"GET FIT is a toolbox of support options," says Robert Graham, CPCS's Managing Director, Infrastructure Development Advisory. "Our role was to craft a plan to best adapt these tools to Mozambique's unique needs and context and achieve stated objectives."

Doing so requires deep knowledge of the country's economic, financial, and political realities. Equally important

is the technical aspect of the programme. While GET FIT promotes renewable energy projects, it does not specify which technologies to use and how to adapt the tools to the local context.

The challenge, then, was to determine the support tools as well as the renewable energy technology that best addresses energy needs in Mozambique.

Bringing solar and battery into the mix

CPCS experts concluded that combining solar power and large scale batteries was the best way to energise Mozambican cities and villages.

This was not a routine assessment, because pairing solar power with battery procurement of such a scale had never been achieved in Africa, however CPCS felt confident breaking the mould, for many reasons.

First, this combined solution is financially sound, as the price of solar has plummeted over the past decade. In Africa, solar can be as cheap as US\$0.03/kWh. Compared to other renewable energy sources such as hydro and wind, solar tends to be the economic choice.

The same goes for the price of battery storage. Similar to what happened to solar in the 2010s, batteries will likely become much more affordable in the 2020s. Low costs mean that financial donors and investors are likely to be more interested in backing renewable projects in Mozambique.

Second, solar power is quicker to deploy than other sources of renewable energy. "Having a solar power system running in three months is possible," says Robert. "In contrast, large hydro projects can take decades. Even wind turbines can require up to 18 months of data collection before moving to the development stage."

Third, pairing solar and battery is flexible. Solar power systems can be installed anywhere with good sunlight, and batteries can be placed right next to demand centres. Other renewable energy sources are more limited in terms of placement.

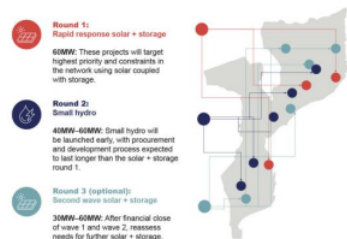


Figure 1. Targeted grid stabilisation and support with Global Energy Transfer Feed-in Tariff (GET FIT) projects.

In short, the solar and battery combination addresses Mozambique's main energy objective, which is to improve access to electricity as quickly as possible.

A complete solution for a growing economy

Coupling solar with battery storage not only addresses Mozambique's energy needs but also meets infrastructure challenges in the power sector.

Mozambique has always had difficulties moving electricity from power stations to people's homes; the country's power stations tend to be far from cities and villages. As such, Mozambique had to build lengthy transmission lines to connect these stations with population clusters. Overloaded or inadequate long transmission lines mean more power outages.

Due to the fact Mozambique lacks access to sufficient capital to invest in adequate transmission and distribution infrastructure, abundant power generation has not translated into reliable electricity access for Mozambicans. More traditional power generation projects on their own are not the solution to electricity access goals.

This is where the flexibility of solar power systems and batteries kicks in. They can be placed right next to cities with unreliable power. This way, these cities can bypass their reliance on long, overloaded, or unreliable transmission lines.

Battery storage technology also ensures plenty of energy in the off-hours, alleviating the traditional inability of solar power systems to provide round the clock solutions. Solar power systems themselves do nothing to address peak electricity demand hours in Mozambique, which are between 6 pm and 10 pm.

Overall, the innovative solar and battery solution resolves Mozambique's power infrastructure challenges in three ways:

- Reduces reliance on expensive transmission lines.
- Provides power to cities that need it the most.
- Minimises the frequency of outages.

In the near future, every population centre in Mozambique, no matter how remote, will have access to electricity at any time of the day.

Innovation on the ground

Of course, using batteries to complement solar power systems is not new.

"The innovation lies in how CPCS applied this solution in a way consistent with Mozambique's regulatory, legal and financial realities, and how CPCS has attracted private capital to pay for these projects," argues Robert.

In fact, battery procurement was not even part of the original GET FIT toolbox.

Before CPCS set foot in Mozambique, no framework detailed how to fit battery storage into the country's regulatory, legal, and financial context. Neither has it been part of the GET FIT toolbox.

Predictably, investors and financial donors were cautious to fund large battery programmes.



Figure 2. The traditional strategy to address energy constraints, which relies on transmission lines.



Figure 3. CPCS's solution: battery storage near demand centres can alleviate transmission constraints.

They also downplayed the economic competitiveness of this solution. Hence, buy-in was scarce. Therefore, the brunt of CPCS's work in Mozambique was to show stakeholders that the union of battery storage and solar is technically and financially feasible with the right programme design.

Mozambique will soon launch the largest solar-storage programme ever conceived in Sub-Saharan Africa, as imagined and designed by CPCS.

Following the roadmap

Mozambique intends to commit to the procurement of renewable energy projects in three rounds:

- The first is acquiring solar generation systems and battery storage for areas in the greatest need of energy. CPCS expects an additional energy production and transmission of 60 MW.
- Traditional small hydro projects will be developed, providing a relief of 40 - 60 MW.
- Building on the success of the first round, a third potential round was designed to use solar and battery procurements to target even smaller and more remote sites, strengthening and extending the electric grid in Mozambique.

"All things considered, we expect that GET FIT will improve the reliability of energy access for over a million Mozambicans currently suffering from unreliable grid power," opines Robert.

Flash in the pan or sustainable solution?

While Mozambique is the first beneficiary of a large scale, comprehensive, solar plus storage solution in Africa, it is unlikely to be the last.

Challenges in replicating this project on the continent certainly abound, but they are primarily commercial rather than technical.

Utility-scale battery services are still somewhat foreign in Africa, and the market for the services battery technologies provide is generally not yet developed. For example, ancillary services, an important market for battery technologies, are largely absent in Africa.

Other commercial frameworks are needed to develop commercially viable battery projects in Africa. "The workaround lies in bundling batteries with existing market services in the form of a comprehensive power purchase agreement," says Robert. "As our project in Mozambique has demonstrated, batteries can be integrated into the existing market framework by coupling with intermittent energy in PPAs."

The logic is that cheap power generation can subsidise the cost of the more expensive battery. This allows Africans to benefit from the best of both worlds: reliable power made possible by battery technology and affordable prices thanks to this contractual formula.

Showing decision makers the additional benefits battery services provide to the grid, and convincing utilities of the value for money in these projects, will be key in replicating these projects across the continent.

It is hoped that CPCS's programme design in Mozambique will provide a replicable model to apply these exciting new technologies sustainably and viably throughout Sub-Saharan Africa.

By doing so, this will allow citizens to benefit from access to clean, affordable, and reliable power without dependence on foreign energy imports or expensive traditional solutions to do so.