Zambia residential energy storage

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Africa-Press – Zambia. Distributed rooftop solar electricity solutions empower individual users to manage their own energy needs effectively. Utilising small solar power plants as a source of electricity brings several benefits, including reducing dependency on unreliable utility provision, mitigating environmental harm like pollution and deforestation, offering a straightforward installation process, requiring minimal maintenance, and delivering a long service life that supports sustainability.

Although the initial capital costs of a domestic or commercial solar system may seem daunting for many, there are business models that allow users to lease solar panels while gradually paying off the investment. Solar systems are also modular, enabling users to install equipment according to their budget and expand capacity as their financial situation improves. Moreover, the cost of solar panels has significantly decreased in recent years, making solar power systems one of the most cost-effective means of electricity generation, even on a small scale.

Draft net metering regulations were issued in Zambia in August 2022 by the Energy Regulation Board (ERB). This was followed by a consultative process calling for electricity supply stakeholders and the public to scrutinise the draft regulations and submit proposed amendments and comments in September 2022. In over a year since then there has been little progress publicly visible on net metering by the main state stakeholder institutions (ERB, ZESCO and the Ministry of Energy).

This has occurred during a time in which the legacy hydropower electricity generation methods have continued to suffer from the ill-effects of climate change leading to a brief period of load shedding in January 2023. With the El Nino climate pattern predicted for the 2023-2024 rainy season there has been an even greater imperative to quickly diversify electricity generation in Zambia away from its high reliance on hydropower.

Increased solar power generation attached to the grid introduces more variability compared to conventional baseload sources like hydropower. This variability is evident in the creation of the "duck curve" (resembling the silhouette of a duck) of grid electricity power demand, resulting from abundant solar generation during daylight hours, followed by a rapid decline in generation as the day ends. Addressing this shift requires the development of innovative supply and demand management techniques to ensure grid stability, especially as peak electricity demand occurs just after sunset.

The introduction of 389 GWh of rooftop solar electricity annually, equivalent to 2% of total annual electricity generation, with a peak power of 150 MW, is shown modelled in the plot below. This indicates that the rooftop solar power could largely displace power produced at Kariba North Bank Extension (KNBE) during the morning and afternoon peak.

Further increases of rooftop solar to 5% of total annual electricity generation, 972 GWh with peak power 370 MW, as modelled below could further displace generation at KNBE but also require reduced production at the main Kariba North Bank (KNB) power plant. Managing such a variable output from KNB and KNBE would require innovative techniques of grid stability operation. This would be needed throughout the day as well as at sunset when generation at both stations would have to be ramped up to compensate for the loss of significant amounts of solar generation.

The technology required to create a grid responsive to the new dynamics caused by increased generation variability would invariably increase costs for grid operators. However, with rooftop solar, this could be offset financially by increasing power generation without having to invest in large scale grid upgrades. It would also be the advent of a smart grid which is a necessary innovation from a technological advancement point of view.

The South African electricity grid has been subjected to load shedding at various times since 2008. To counter this effect a recent surge in solar panel installations has occurred on the rooftops of houses and commercial and industrial buildings. In the 18 months to July 2023 a capacity of 3800 MW of solar panels has been installed. This is equal to 11% of peak power demand.

Figure 4 - Increase in rooftop solar power generation in South Africa [4]Whilst there is not yet a net-metering policy in place across South Africa (some municipalities are in the process of implementing one), the main driver for the greater uptake of rooftop solar has been the crippling effect of extended periods of load shedding. For the commercial and industrial sectors, a relaxation of the rules has allowed embedded systems greater than 1 MW to be installed without needing government approval.

The rooftop solar capacity in Vietnam increased by a factor of 25 in 2020 going from 378 MW in December 2019 to 9.3 GW in December 2020. This was encouraged by policy incentives including a net metering tariff of USD 0.084 per kWh of electricity sold back to the grid (on par with other solar generation) and power purchasing contracts of 20 years duration. This expansion of solar power generation also helped create a solar panel manufacturing industry in Vietnam.