

3.1.12. Increasing access to clean and affordable decentralized energy services in Malawi

Participating country: Malawi

Partners: GEF, UNDP

Start of technology uptake process: 2015

Climate technology: Green mini-grids (GMGs)

Contribution to NDC implementation: Reduced energy sector emissions from kerosene and unsustainable charcoal use

Further information:

Malawi Ministry of Energy: <https://www.energy.gov.mw>.

UNDP project website: <https://www.undp.org/malawi/projects/increasing-access-clean-and-affordable-decentralised-energy-services-selected-vulnerable-areas-malawi>.

<https://stories.undp.org/light-is-life>.

Climate technology: A GMG is a set of small-scale renewable energy electricity generators interconnected to a distribution network that supplies electricity to a localized group of customers and operates independently from the national transmission grid. GMGs usually serve the needs of remote and often rural or vulnerable communities. These communities are too distant to be economically connected to the grid in the near to medium term but densely populated enough to offer economies of scale in power delivery compared with individual home systems. While GMGs have not yet achieved the same commercial success as small-scale solar home systems, they represent a tremendous near-term opportunity to drive economic opportunities in rural areas.

The IACADES project established a solar photovoltaic GMG in Sitolo, Malawi, providing nearly 1,000 customers with renewable energy-based electricity. The project also contributed to an increasingly supportive policy and





regulatory framework, enhanced technical expertise and awareness within the public sector and improved access to information on GMGs in the country.

Uptake of the climate technology: Malawi is one of the least electrified countries in the world, currently at 11% overall, with 42% of the urban and only 4% of the rural population connected to electricity. Provision of sufficient, reliable and clean energy in Malawi is a critical challenge, as recognized by the Government, which has put energy as a focus area in the Malawi Growth and Development Strategy III (for 2017–2022). The demand for electricity by far exceeds the installed capacity and new generation capacity is urgently needed, with the Government focused on promoting diversified sources and utilization of the country’s abundant renewable energy resources, particularly hydropower and solar power.

The project started by surveying community members, businesses and social service providers on their current and projected energy needs in order to investigate ownership and management models, including the feasibility of establishing a profitable social enterprise, to examine user-pay options and to propose options for community-led governance. Community Energy Malawi and partners worked with community members to help put in place a locally led governance structure for the management and operation of the system, with pay-for-use revenue based on the Government of Malawi’s automatic tariff adjustment formula for GMGs. Champions from the Government, Community Energy Malawi and the village electricity committee continue to encourage study tours to Sitolo to accelerate peer-to-peer learning to move GMGs to scale.

Based on the community consultations and the technical assessment of suitable technology options, the GMG comprises 255 solar panels of 320 W peak in three arrays of 85 panels each. Transmission is over a 7.2 km 33 kV line that stretches from Sitolo to Molosiyo and Ndawambe villages linked to one step-up and three step-down transformers connected to 11.4 km of 400 V MV lines. The GMG has a battery storage capacity of 925 kWh. Local technicians were trained by Community Energy Malawi, a registered social enterprise, and certified by the Malawi Energy Regulatory Authority for maintenance and operation of the GMG.

Gender-responsiveness: The GMG has enhanced women-led businesses in the villages, such as grocery stores and hair salons, boosting their incomes. In place of erecting stand-alone business development services, the Sitolo GMG partners with the Government’s existing business development services and vocational training programmes to support women-led businesses. Gender issues have also been effectively integrated into the training component of the IACADES project, including through challenging gender norms and linkages to vocational training programmes in Malawi, in which women help to drive innovation in clean energy.

Financing: Given the lack of in-country traction and experience with GMGs, the ability to leverage commercial investment or co-financing from development finance or private finance institutions, or from private individuals and organizations, was limited. Thus, the GEF financing was crucial for the successful implementation of these pilot initiatives, which require a large portion of grant financing given the immature market of GMGs in Malawi. With an initial capital investment of USD 700,000 and average operation and management costs of USD 24,000 per year, the Sitolo GMG has achieved operational sustainability at an average tariff of USD 0.19/kWh. Each household consumes an average of 10 kWh per month, with businesses consuming an average of 750 kWh per month. Notably, the Sitolo GMG has generated an annual revenue in excess of USD 24,000 for the past three years.³⁰

Contribution to NDC implementation: The uptake of GMGs is contributing to the implementation of Malawi's updated NDC (submitted in 2021) mitigation target of reducing energy sector emissions from kerosene and unsustainable charcoal use through the promotion of off-grid small-scale solar photovoltaic systems.

Other impacts and results: The main impacts and results of the project are the operational 80 kW peak greenfield solar photovoltaic GMG with close to 1,000 additional customers connected to renewable-based electricity, an increasingly supportive policy and regulatory framework, enhanced technical expertise and awareness within the public sector, and an improved information access platform.³¹ Specifically, the project trained more than 400 people across 28 districts on energy demand assessments, planning and operation of GMGs. Importantly, the Malawi Energy Regulatory Authority has drafted a new GMG framework, which has helped to streamline the licensing and application processes. Additionally, the National Energy Policy (2018) and the Malawi Renewable Energy Strategy (2017) both clearly indicate support for GMGs; these two positive developments partially came about through the Government's commitment to the Sitolo GMG, with project partners revealing the need for policy reforms to incentivize GMG development at scale.

Perhaps the most significant impact was catalysing interest in GMGs. From a fairly unsuccessful public sector experiment with GMGs some decades ago, the IACADES project restored belief in and commitment to GMGs through technology demonstrations and work on the enabling framework, which are the fundamental first steps in establishing a sustainable GMG sector.

³⁰ See <https://ease.eee.strath.ac.uk/wp-content/uploads/2021/05/CEMT-Minigrid-Presentation.pdf>.

³¹ See <https://malawi-iep.sdg7energyplanning.org>.



From an environmental standpoint, renewable energy capacity from the Sitolo GMG has helped to reduce reliance on unsustainable harvesting of fuelwood and consumption of diesel and kerosene products for milling, lighting and cooking in the household, commercial and public sectors. A social impact assessment conducted in 2022 found that with the lighting available from the GMG, households have significantly reduced their use of single-use battery torches, kerosene, rechargeable torches and candles. Consequently, schoolchildren are able to study under the better lighting conditions made possible by household connections to the Sitolo GMG system.

Other benefits of the technology uptake demonstrated by the Sitolo GMG include an enhanced reliability of energy supply, better quality power, better environmental performance and a lower cost in remote locations. Other adaptation and resilience co-benefits include a reduced dependence on traditional biomass fuels, which are vulnerable to climate variability, and a reduced pressure on forests and forest biodiversity.

Challenges and lessons learned: The need for financing remains a challenge as GMGs are not yet commercially viable in Malawi. However, a promising development inspired by this project is that GMG developers can now access funding from the national Rural Electrification Fund, which was not the case earlier. While the ability of Malawi's Rural Electrification Fund to finance GMGs marks significant progress, the long-term sustainability of GMG programmes within Malawi will require a dedicated development finance institution and/or fund. Blended finance, whether it be grants or concessionary or other forms, will be required.

There is also a need to advance the currently untested GMG framework through subsequent GMG implementation and additional engagement with issues such as GMGs selling electricity to the grid through power purchase agreements, where possible, and GMGs assuming the role of a local distributor, etc. While it is true that the Sitolo GMG served as a proof of concept for the development of the GMG regulatory framework, further pilots are required to identify gaps and to strengthen GMG regulations.

Greater emphasis needs to be placed on commercial opportunities, in particular productive uses of electricity, which will diversify revenue streams for GMG while at the same time promote opportunities for MSMEs. Stronger linkages with more commercially orientated initiatives, and possible opportunity mapping or planning to that end, will open up possible linkages and opportunities with other sectors and initiatives that have the potential to add rigour and sustainability to the overall GMG strategy. There is also a need to develop a realistic electrification masterplan and consistently apply the plan in order to stabilize and de-risk the GMG sector. In addition, more detailed monitoring and evaluation frameworks need to be developed to deepen understanding of the socioeconomic impacts of electricity adoption, consumption and changing patterns over time. Furthermore, communities need to be well informed about the options, intentions and implications of the range of energy services.

The ICADES project has also inspired a follow-up GMG project in the country to ensure continuity and further market development. UNDP, with funding support from the GEF, is implementing the Malawi national project under the Africa Minigrids Program, aiming at supporting access to clean energy by increasing the financial viability and promoting scaled-up commercial investment in GMGs in Malawi. This new project is building upon the results and successes of the ICADES project.

Long-term sustainability, replicability and potential for scaling up: The ICADES project was designed to both demonstrate the requirements of sustainable GMGs and to create the enabling conditions for promoting these green power solutions by helping to ensure the replication of GMGs across the country. The following achievements helped to ensure the replicability of the technology: training of project developers and operators, including on planning, design, regulations, standards, construction methods, medium voltage safety and GIS planning; awareness-raising and capacity-building of local government representatives who have indicated an interest in GMGs; contribution to a number of key policy documents and regulatory frameworks; and access to finance from the Rural Electrification Fund. The foundation laid by ICADES has subsequently led to the development of a pipeline of 10 additional solar GMGs earmarked for construction under the World Bank-supported Malawi Electricity Access Project; feasibility studies for two GMGs completed by the government-owned power producer; three new GMGs under procurement through the UNDP-supported Access to Clean and Renewable Energy project; and two new GMGs commissioned and operational following a similar model by United Purpose and the University of Strathclyde, with an additional community-initiated micro-hydropower GMG completed and two under development.