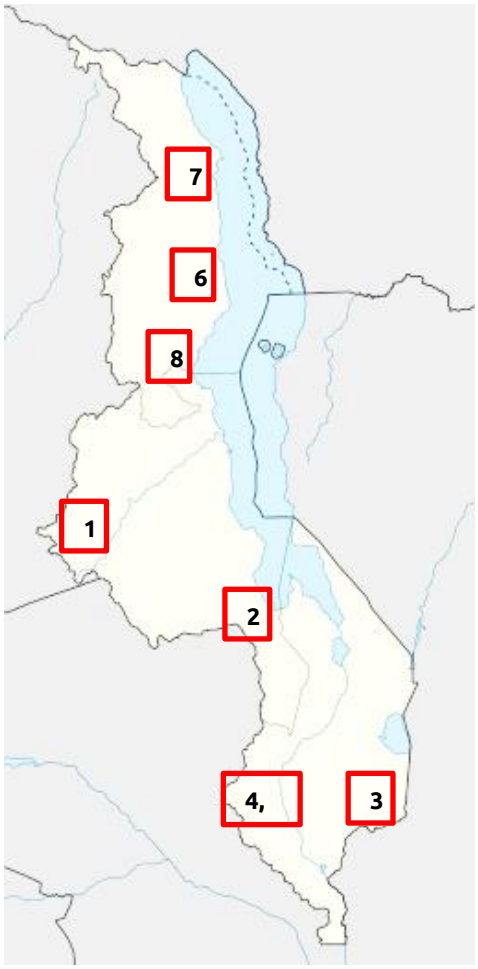
CESET
Community Energy and the Sustainable Energy Transition in Ethiopia, Malawi and Mozambique

Field visit summary of Community Energy projects and interventions in Malawi

Introduction

CESET partners from Loughborough and Mzuzu University recently carried out field visits to eight Community Energy Systems (CES) located in different regions of Malawi. The purpose of the visit was to investigate the landscape of CES in Malawi, evaluating best practices for community energy and resilience aspects. The team visited two projects- (1) Sitolo-PV minigrid and (2) Mthembanji solar PV system in central region, three projects- (3) Bondo microhydro, (4) Mwalija solar PV, and (5) Oleole solar PV in south and three projects- (6) Luafwa microhydro (7) Chipopoma microhydro, and (8) Mdyaka solar-wind hybrid system in northern part of Malawi (as indicated in map). In addition, our team also visited one solar shop and community engagement centre in central region along with a solar innovation workshop in south.



Map attribution: NordNordWest, CC BY-SA 3.0

1. Sitolo, Mchinji

This was the first community energy project site visited by our team in central region. It is a solar PV based minigrid project located in Mchinji district, 109 kms away from capital and close to the Zambian border. It is an 80kW$_P$ solar PV minigrid commissioned in 2018, connecting 750 consumers across a cluster of three villages. The project was funded by UNDP and Community Energy Malawi (CEM) and currently managed by CEM. It is one of the largest solar PV community energy projects connecting a substantive number of consumers and have been operating successfully over the last few years. It was interesting to see some of the consumers using variety of appliances like refrigerator, television, music systems, hot plates, etc. from power supply available through minigrid. With continuous increase in consumer demand the minigrid system is now facing power shortage and frequent blackouts during the night. They are looking to expand their capacity to support more consumers with high demand.

Sitolo solar PV power plant

Firewood usage as cooking fuel in a typical household at Sitolo

(Pictures taken by H.Vallecha)

2. Mthembanji, Dedza

This is the second site visited by our team. It is a community solar power plant installed at village Mthembanji in Dedza district located 92 kms away from capital, Lilongwe. It is owned and operated by United Purpose Malawi with technical support from University of Strathclyde. It was funded by Scottish Government International Development Program under Rural Energy Access through Social Enterprise and Decentralization (EASE) project. It is a 12 kW solar PV generation system serving 72 consumers since 2020. It is one of the pilot village electricity access projects operated by United Purpose under social enterprise business model. Installation of this plant faced number of barriers due to lack of local capacity, supply chain issues, and regulatory hurdles. However, it was interesting to see their data management and smart metering system. Customers are charged through prepaid smart metering system. Also, the operators there using the internet based smart monitoring mechanism to keep track of panels, batteries, inverters and other equipment.

The project demonstrates a significant impact on socio-economic life of people in Mthembanji. The project results an increase in number of children going to school due to availability of power. There reported to be an increase in business activities related to music shops, video shows, computer cafes, etc. through availability of electricity.

Mthembanji Solar PV installation

Household respondent at village

(Pictures taken by H.Vallecha)

3. Bondo, Mulanje

After visiting the intended sites in central region, our team proceeded towards Southern Malawi and visited Bondo microhydro project. It is located in Mulanje district, 390 kms away from capital which is home to Mount Mulanje and Sapitwa peak, the highest peak in Malawi. Bondo micro-hydro power project is one among the three micro-hydro projects installed by MEGA (Mulanje Electricity Generation Agency). MEGA is a social enterprise which aims to provide reliable and affordable power supply through environmentally friendly solutions. It is owned by Mulanje Mountain Conservation Trust (MMCT), an environmental endowment trust supporting biodiversity and conservation around Mount Mulanje. MMCT has installed three micro-hydro projects namely, Bondo 1, Bondo 2, and Bondo 3 in the region. MEGA is responsible for maintenance and operation of these projects. The mini-grid infrastructure for these projects has been funded by international development agencies. However, maintenance and operation are managed through revenue collected from electricity tariffs charged to consumers. There are three power houses built for each of the three (Bondo 1, Bondo 2, and Bondo 3) projects but three of them are injecting power to a single mini grid, i.e., three of the generators are interconnected. Firstly, Bondo 1 was built and when demand for power increased with a greater number of customers, subsequently Bondo 2 and Bondo 3 were commissioned. Three of the power houses are located at different elevations with respect to each other. Interestingly, water coming out at outlet from Bondo 1 is the intake for Bondo 3.

Bondo Community Micro Hydro Power Scheme Bondo-3 Powerhouse

(Pictures taken by H.Vallecha)

We visited the powerhouse of Bondo 3 which is recently built and more accessible than other two powerhouses. It was commissioned in 2019 with a capacity of 160 kW, highest as compared to Bondo 1 (80 kW) and Bondo 2 (88 kW). However, they were operating Bondo 3 at 120 kW by keeping some reserve capacity. The combined operating capacity of three powerhouses is around 268 kW (after keeping some reserve capacity). All of the three powerhouses are synchronized to serve around 2000 households connected to the mini grid. In addition, the mini grid is providing electricity to 12 maize mills, 13 schools, 8 churches, one health centre, and several small shops and businesses. It was interesting to see some of the consumers using electric cooking devices (mostly hot plates and kettles) from electricity available through mini grid. We came across a local grocery store owner who has built a Radio Station by his own through scrap material and provides free radio transmission to the houses in range.

Household respondent at Bondo Village

Radio station at local grocery shop

(Pictures taken by H.Vallecha)

4. Mwalija, Chikwawa

After visiting Mulanje, we went to Chikwawa, 110 kms from Mulanje. We visited a small village Mwalija where a solar PV based community energy system becomes non-operational due to severe floods two years ago. As the village is located close to the river Shire, it affected severely when water level raised, forcing the people to relocate to a different place. Presently, the whole village is shifted to a new place, a couple of kms away from previous place. Unfortunately, the solar PV system and electricity infrastructure has not been shifted to the new setting yet. Still, panels, batteries, transformers, poles, and wires are there in the previous location and are being abandoned due to non-operation. Interestingly, people shifted to the new location are not having any reliable source of power and just relying on a solar kiosk for charging their mobile phones or portable lights. It was interesting to know the challenges faced by the locals during floods, their response to the crisis, and problems with electricity access. The project was funded by European Union and installed in January 2019 with support of Practical Action, Hivos, Environment Africa, and CARD (Churches Action in Relief and Development). However, the project is currently struggling to move to the new location.

Abandoned solar microgrid

Migrated Mwalija residents to new location

(Pictures taken by H.Vallecha)

5. Oleole, Chikwawa

After visiting Mwalija, we went to Oleole, a distant village located far in interior of Chikwawa on a rough terrain. It took us two hours to reach the village from main highway due to poor roads. There, we visited a community solar PV power plant established in 2018. It is a 25 kW solar PV generation system where 15 kW is for household energy use while 10 kW is dedicated for irrigation pumps. The system currently supplies electricity to 17 households and six businesses. In addition, there are around 35 subscribers for irrigation system. The project was installed through funding received from European Union and is presently managed by the Village Energy Committee. The project encountered some major operational challenges in last few years when their prepaid metering system fails. It is still facing financial issues due to lack of revenue and minimum number of customers to operate the system sustainably.

Community Solar PV installation at village Oleole

Solar water pump control panel

(Pictures taken by H.Vallecha)

6. Luafwa, Mzuzu

After exploring the sites in southern Malawi, our team proceeded towards north Malawi. We reached Mzuzu (379 kms from capital), which is home to Mzuzu University campus. Mzuzu is known as the northern capital of Malawi surrounded by Viphya mountains which was once known to be the largest man-made forest in Africa. After arriving at Mzuzu, we visited Luafwa micro-hydro project located near to the city on a hilly terrain. It is a 75 kW micro-hydro power plant installed in 2022 by diverting a stream of water from river Ruafwa. The project is funded by Segal Family Foundation and Mzuzu Institute of Technology and Innovation (MZITI) along with some external donors. The technical and ground support is provided by MZITI.

Forebay carrying the water to powerhouse

Turbine driving the generator at Luafwa powerhouse

(Pictures taken by H.Vallecha)

Presently, three households are connected with electricity supply and the project is going through community mobilization for its operation and management. However, 200 households are planned to be connected in first phase along with some commercial establishments. It was fascinating to know that technical design of machinery and equipment was performed locally during installation. Even design of turbine and fabrication was carried out at MZITI workshop using scrap material. It was interesting to see their approach of minimum import of technology and machinery and building the whole system from scratch by their own with very limited resources and facility. We also got a chance to see a pico-hydro installation and live demonstration of power generation through it. [Video link]

MZITI workshop at Mzuzu

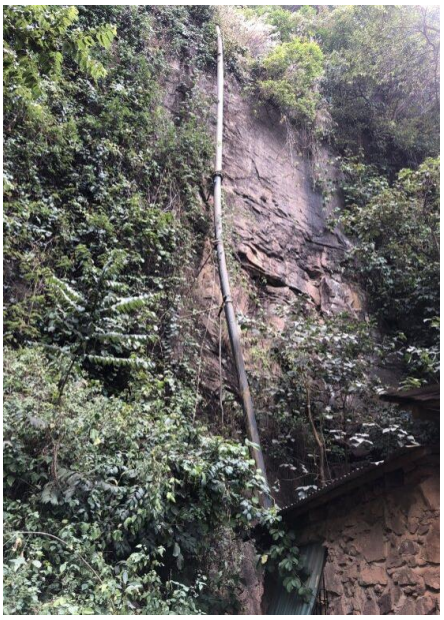
Worker designing the turbine at workshop

(Pictures taken by H.Vallecha)

7. Manchewe (Chipopoma), Livingstonia

After Luafwa, our next site was Chipopoma microhydro power plant located in Livingstonia, 127 kms away from Mzuzu. It is a 45 kW generation system commissioned in 2018. It was majorly funded by UNDP with some other external donors. It was installed by local people who received training from technical institutes with support of UNDP. The project is owned and managed by Village Energy Committee known as 'Chipopoma Power'. Major equipment like turbine was designed and fabricated locally. The project supplies electricity to 120 households, one maize mill, one primary school, two lodges, and few businesses. The project has been functional since its inception despite many challenges. Presently, it is facing financial challenges to maintain the machinery as not enough revenue is generated due to flat tariffs. Now the village committee is planning to introduce prepaid metering to minimize revenue loss and their dependency on external donors.

Chipopoma powerhouse at Manchewe



Penstock carrying water to powerhouse

(Pictures taken by H.Vallecha)

8. Mdyaka, Chipeka

This was the last community energy project visited by our team. It is one of the failed off-grid generation projects installed by the Government of Malawi some years back. It is solar and wind hybrid generation system of 20 kW established by the government in 2009 and becomes inoperative in 2013. It was a government funded project aimed to provide affordable energy access to village Mdyaka but becomes failed due to few incidences of lightning strikes in the region in 2013. One of the lightning strikes damaged wind turbine and batteries and also affected some of the connected households. Few of the consumers even suffered minor injuries and hospitalized post disaster. People of Mdyaka waited long for the government's intervention to restore the power plant but it didn't happen. People lived there without electricity access till 2019 when central grid extended to the village. Government officials collected back the solar panels in 2018 and disposed the batteries. However, damaged windmills, battery room and mounting structure still lies abandoned there.

Abandoned solar-wind hybrid system

Village residents at Mdyaka

(Pictures taken by H.Vallecha)

Mbangombe Village, Lilongwe (Other community level interventions)

This site was not a community energy project but an important community level intervention where locals were using low-cost solar based solutions for cooking, water pumping and lighting. This site is located close to the Lilongwe airport in a remote setting. We visited a solar shop there supported by Kachione LLC (MECS Challenge Fund recipient). This shop is the selling point for solar panels, Direct Solar Electric Pressure Cookers (EPCs), and Direct Solar Water Pumps to local people. It appeared more like a community place where people come to know more about the different solar products and sometimes cook their meals from EPCs. During our visit, we witnessed the live demonstration of local people cooking their regular meals on Direct Solar EPC. Even though, the weather was not enough sunny on that day, but they still managed to cook their food at low power rating. Robert from Kachione LLC carried out a cooking comparison test there to evaluate the cooking time and amount of charcoal required to cook the same quantity of food which has been cooked through EPCs. Villagers cooked Nsima (Malawi's staple food), red beans, and green leafy vegetables both on the charcoal stove as well as on direct solar EPC. They served us the cooked food to evaluate if there is any major difference in the taste based on the cooking method.

Village women cooking their meals

Village woman cooking Nsima on Direct Solar EPC on charcoal stove

(Pictures taken by H.Vallecha)

After that, we went to visit a nearby farm of a villager by riding a solar cart. There, we witnessed the operation of direct solar water pumps where people showed us how they use the portable submersible pumps to water their fields from a nearby well or natural water body. Interestingly, they were using the same solar panels which they have used to operate the EPC for cooking. Robert explained me how they are metering the usage of direct solar water pumps and providing the financial incentive or discount to the user on their next purchase for additional panel or cooker. Doing this, they are encouraging the people to maximize the utilization of solar energy either through direct solar water pumps or EPCs and providing them financial incentive for purchasing more devices based on their kWh consumption.

Villagers setting up the Direct Solar Water Pump

Women watering their fields through Direct Solar Pump

(Pictures taken by H.Vallecha)

Written by: Dr Harshit Vallecha, October 2023

Thanks to: CES projects Malawi

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