

# United Purpose

Out of poverty

# **Experiences in Micro-grid Development in Malawi**

Presenter: Elizabeth Banda Date: 29<sup>th</sup> April 2021 Presentation prepared for EASE project knowledge sharing webinar



Partnership project coordinated by the University of Strathclyde with collaborating partners United Purpose, Community Energy Malawi and WASHTED.

The role of UP

- Deploy and operate 2 Micro-grids and 4 energy Kiosks in Dedza district
- Develop a business model to scale-up this type of off-grid electrification through a social enterprise
- Coordinate community engagement and capacity building

# Micro-grid development process



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- Engaged with MERA, DoE, EAD for regulatory approvals
- Conducted project inception meetings at Dedza DEC, TA Kachindamoto ADC, Mthembanji
- Conducted community sensitization meetings in Mthembanji village managing expectations
- Set up a community energy committee whose role is to represent the community in their wider energy access needs

# Land rights approvals





- A piece of land (20m\*10m) was identified at the centre of the village
- Land lease agreement signed between United Purpose and Mthembanji community leaders
- Funding does not allow purchase of land



Demand surveys carried out at household and business level to assess load

profiles and ability to pay.

**System design** – carried out by UoS, in dialogue with the generation system supplier.

#### **Key technical specifications**

Battery specifications	48V, Lithium Ion Batteries
Battery capacity kWh	19.2 kWh
PV Specifications	Monocrystalline, 320W
PV Array size	11.52 kW
Battery Inverter	8 kW
PV Inverter	10 kW



- Over 100 applications received
- Connection fee MK20,000
- 60 customers registered during customer sign-up (53 households, 5 businesses and 2 institutions)
- Registration criteria within 600m radius and payment of connection fee
- Network reticulation surveys for distribution grid design using GPS coordinates

## **Procurement and Installation**

**Generation System:** A containerized 11.5 kW solar PV system unit provided by Sustain Power, South Africa

- Container fitted out in Cape Town and shipped to Malawi
- PV panels and mounting structure installed on site by local contractor



## **Procurement and Installation**

**Distribution grid:** Installed by BNG contractors (Lilongwe) and included house wiring and installation of smart meters.

230V AC single phase







Three different tariff categories

- Banja bundle: Provides a set amount of electricity each day, can be bought daily, weekly or monthly, a full month cost MMK3,500 (\$5)
- Ufulu bundle: PAYG tariff based on usage, it incorporates different rates based on time of the day and level of consumption
- Mudzi tariff: Institutional tariff with a certain amount of free electricity each month, then same as Ufulu

# Commissioning





- Mthembanji micro-grid switched-on 4<sup>th</sup> June 2020 with 60 customer connections
- Coordinated by BNG and UP, with remote support from UoS, Sustain Power and Steamaco
- A lot of excitement for electricity and battery bank drained during commissioning week due to free power, this hasn't happened again since commissioning



- Day to day operations done by two local site agents, trained on basic system maintenance, sales, reporting and customer relations
- Usage lights, radios, TVs, DVDs, stereo, phone charging, fridge, shavers, computers, sewing machines
- Total income to-date MK2,173,670
- Some microgrid operation and maintenance costs being covered by the main EASE project budget
- Maintenance contract signed with BNG contractors
- Maintenance visits made every quarter and attend to emergency call outs
- BNG to provide hands on training to UP project's technical staff



- Customers pay site agents for credit bundles
- Site Agents update customer accounts through a website on their smart phones
- Smart meters switch on connections and log consumption, automatically switch off when balance runs out
- Customers can check their balances and get warning texts to top up and low balance
- Data is gathered on revenue, load profiles and payment frequencies
- Remote monitoring of generation system through SMA Sunnyportal provides data on technical parameters (e.g. battery state of charge, energy balance, grid voltage)



- Malawi's first smart metered solar-PV micro-grid
- Developed business model to scale this type of off-grid electrification
- Introduction of ICT equipment at the school in partnership with Turning Trust
- New businesses being set up 11 businesses running from the Microgrid
- Valuable data being collected on technical performance, demand, and social impact to inform business models and future microgrid designs







- Capital costs under-budgeted Obtained VAT and duty waivers obtained from the Malawi Revenue Authority to reduce costs
- Cost reflective tariffs are much higher than national grid tariffs
- Households consume all electricity at night, which requires expensive battery storage, increasing costs
- Evidence of demand as we are still receiving applications for new connections
- Planning to add large productive use customers during the day to increase energy consumption and income and reduce tariffs

