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Meeting the water and energy needs in the rural areas of Malawi using solar PV technologies

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Meeting the water and energy needs in the rural areas of Malawi using solar PV technologies



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1. Introduction

- Water and energy are two global challenges that need urgent solutions
- Approximately, 15% of Malawians still do not have access to potable water and even for those who do, the quality is questionable
- Only 10% of the country's population have access to grid electricity and less than 1% of rural areas

3. Methodology

The research was interdisciplinary and used mixed methods approach as illustrated in Fig. 1



2. Objectives

- Evaluate energy and water use in the rural areas of Malawi in the context of challenges, sustainable development, and human well-being
- Evaluate the potential for solar PV water pumping and carry out a Life Cycle Cost Analysis
- Develop a financing model for water provision

4. Results

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- **Needs Analysis** а.
- Households had low incomes, low educational qualifications and most were farmers
- Results (Fig 2), show that major challenges were queuing (Fig 3), and low yield









Fig 1: Research Methods

4. Results

- **b.** Techno-economic Analysis
- A directly-coupled solar photovoltaic water pumping system was designed (Fig 5)
- Water will be distributed to a public stand-post with four taps
- Results for water costs are shown in Table 1



Fig 2 Challenges with current water source

- From the qualitative study challenges were non-functionality (Fig 4), insufficient • boreholes, theft and vandalism and long time spent collecting water.
- Primary source of lighting is disposable dry cell batteries; also used for radios
- Mobile phone charging is done at long distances of up to 20 km

4. Results

- c. Payment Model
- · Sensitivity analysis showed that tariff caused the most impact to the NPV
- To meet the cost of the system, cross-subsidizing the water with cost of basic energy needs (mobile phone charging and lighting). For the new system cost of water is US\$1.19 per household per month
- Cross-subsidizing reduces the break-even cost of water from US\$1.19 to US\$0.49 per household per month

5. Conclusions

The research concludes that with proper design and planning solar PV pumping can meet the water and basic energy needs of the rural areas

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Fig 5: Directly –coupled SPV water pumping system

Table 1: Economic Analysis

Parameter	Value
System Size	1.5 kW
Amount of Water	20 m ³ /day
Cost of System	US\$18, 600
Cost of Water	US\$0.34/m ³
Cost of water equivalent	US\$1.08/month
Current Payment	US\$0.19/month
Income	US\$15/month
Ability to pay	US\$0.75 /month
Willingness to pay	US\$0.38/month

- The system can supply to more people than a borehole
- The system reduces manual pumping labor and time spent queuing
- Contributes to the Sustainable Development Goals of water, energy, education, health & gender
- Future Work : (i) subsidizing with water for irrigation (ii) Field performance studies and (iii) distribution of water to individual houses/compounds

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