

Techno-Economic Analysis of PAYG Productive Uses of Energy in Malawi

Kyle Smith, **Aran Eales**, Damien Frame, Stuart Galloway
University of Strathclyde,

Aran.eales@strath.ac.uk

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Overview

- Context:
 - Energy Access in Malawi
 - PUE Theory of Change
- Methodology
 - Feasibility Studies
 - Piloting
- Results
- Conclusions



SUSTAINABLE DEVELOPMENT GOALS

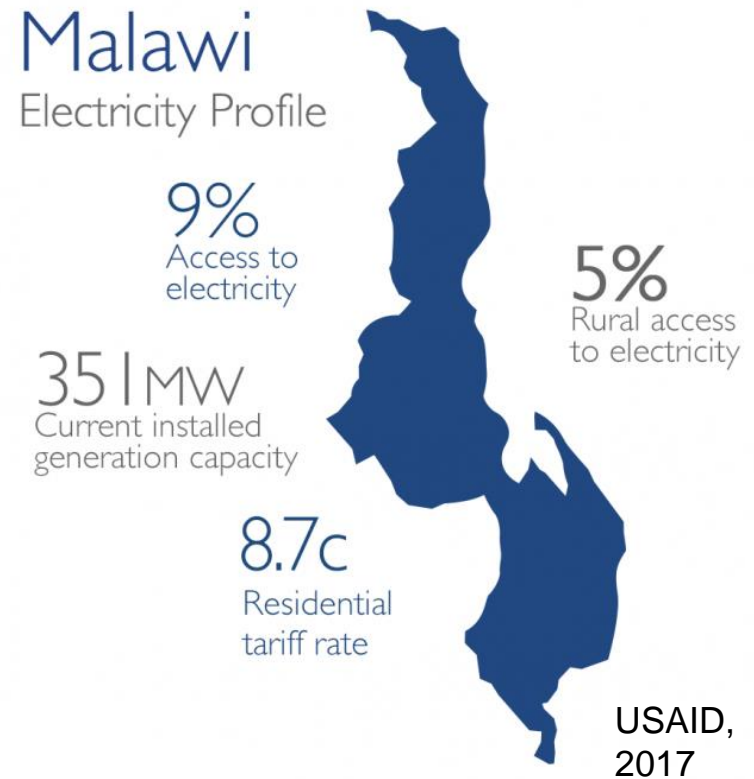


Sustainable energy powers education and health systems, new businesses in previously unserved communities, jobs, manufacturing and industrialization, and water storage and food security.

Context: Energy Access in Malawi

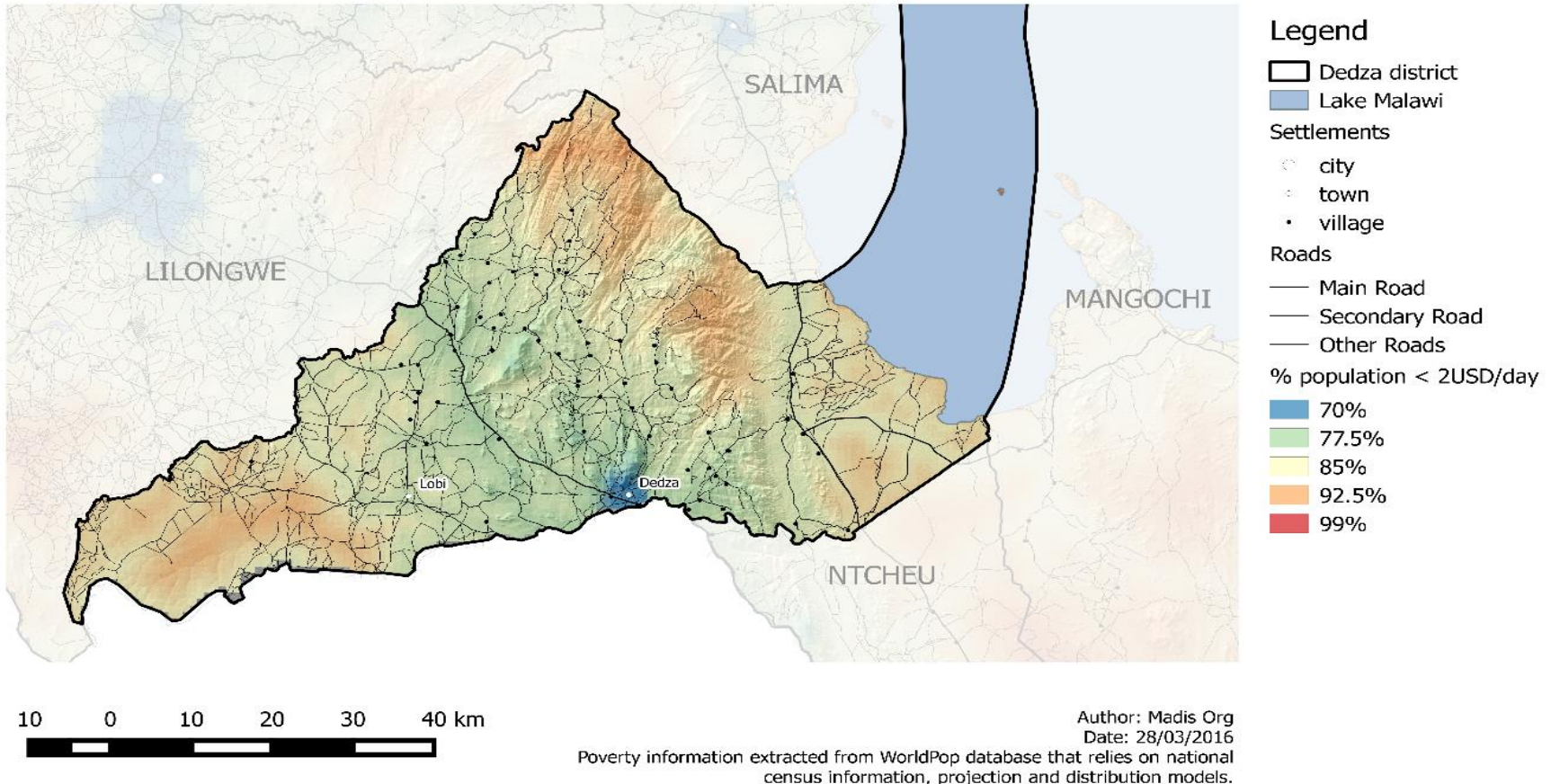


- Energy access is an enabling factor for human development (UNDP)
- Access to national electricity grid in Malawi is currently just 9.8% (SE4All, 2016)
- 13.6 million people live off-grid in Malawi
- Lighting needs served by kerosene, candles and non-rechargeable batteries.
- The Malawi National Energy Policy contains policies to tackle the challenges
- Donor funded nationwide initiatives to increase energy access in a low carbon manner



Snapshot: Dedza District

Poverty Levels in Dedza



- Poverty levels range between 70% - 99% of the population living under \$2/day
- Low life expectancy (45.4 yrs) and very high fertility rate (5.8 children).
- Main challenges affecting communities in Dedza include lack of capital to start businesses, drinking water, infrastructure, and availability/affordability of agricultural inputs.

Productive Use of Solar PV



“Agricultural, commercial and industrial activities involving energy services as a direct input to the production of goods or provision of services.”

PUE: Theory of Change

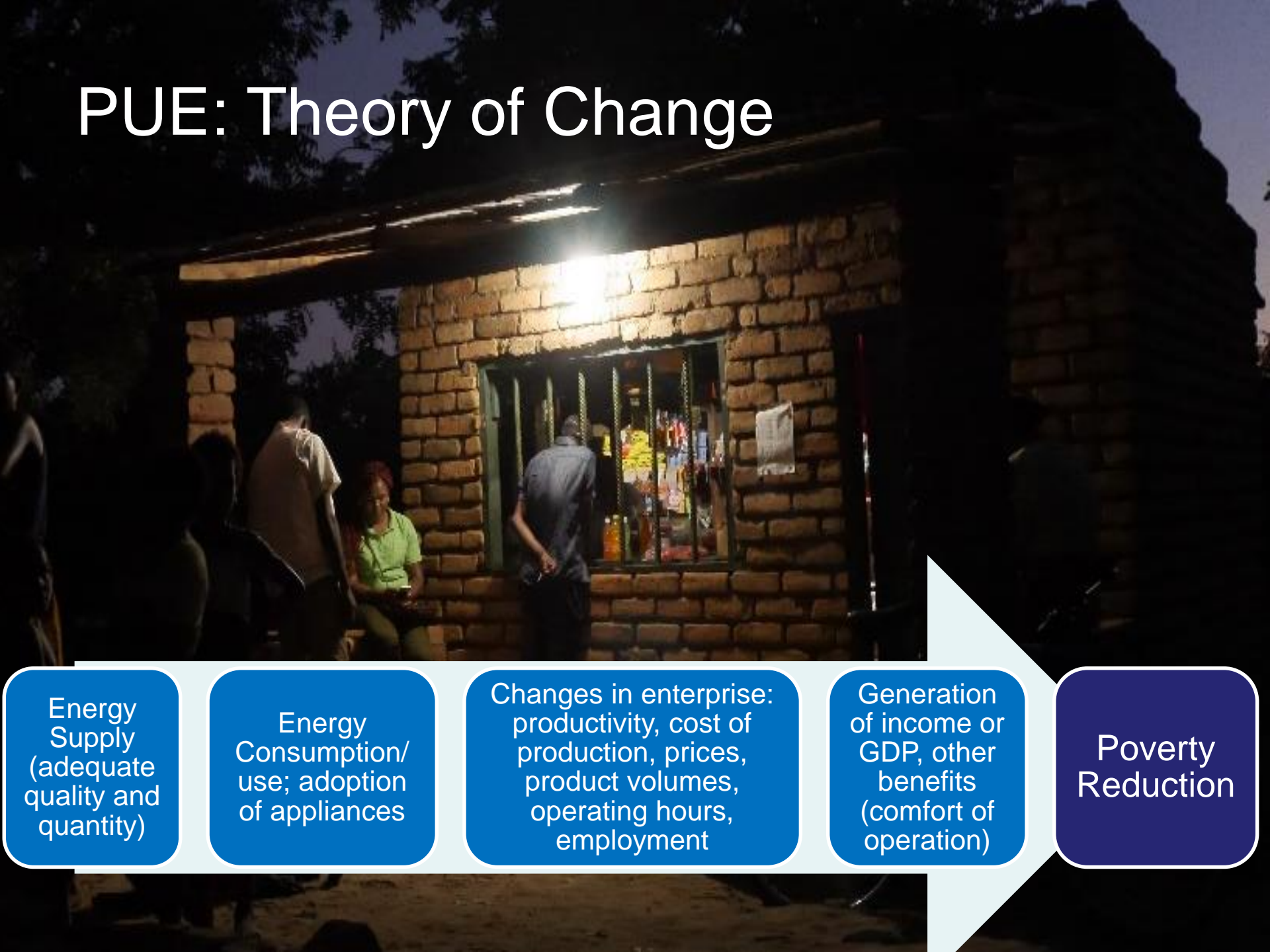
Energy Supply
(adequate quality and quantity)

Energy Consumption/
use; adoption of appliances

Changes in enterprise:
productivity, cost of production, prices,
product volumes,
operating hours,
employment

Generation of income or
GDP, other benefits
(comfort of operation)

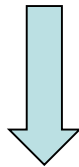
Poverty Reduction



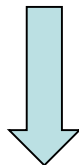
Methodology



Feasibility Studies



Pilot Projects



Recommendations

- Fieldwork conducted by University of Strathclyde and Community Energy Malawi in Dedza District, Malawi, 2017-2018
- Funding from Scottish Government through ongoing Decentralised Energy Access research and implementation programme

PUE Feasibility Studies: Primary Data Collection

Existing
electricity using
business
surveys

- CAPEX, OPEX, Income
 - Load Profiles

Off-grid
household
surveys

- Socio-economic data
- Ability and Willingness to Pay
- Local need and desirability of rural businesses

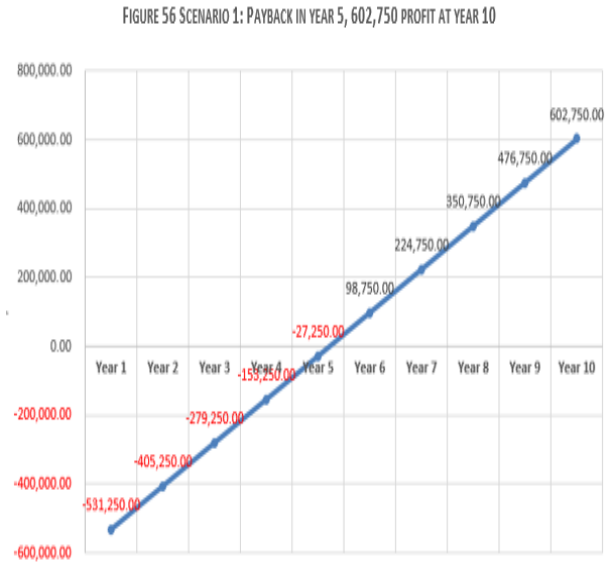
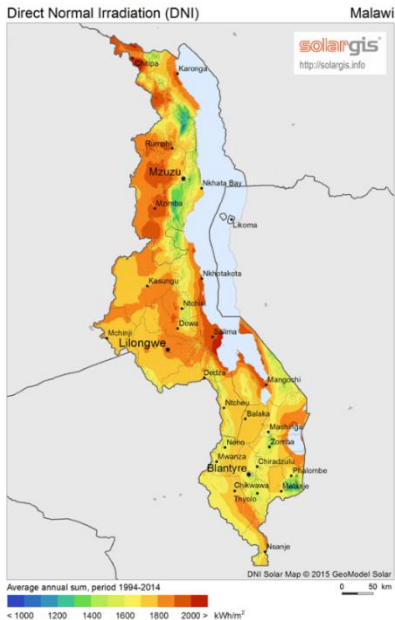
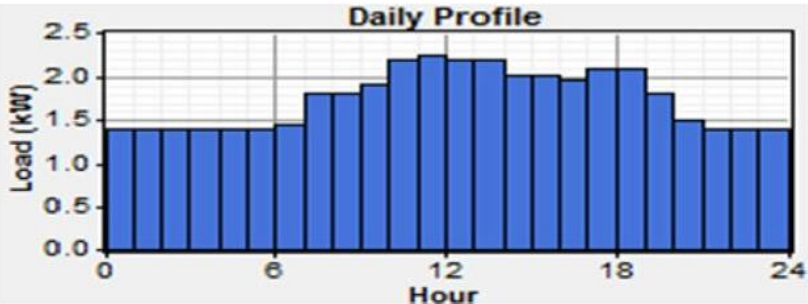
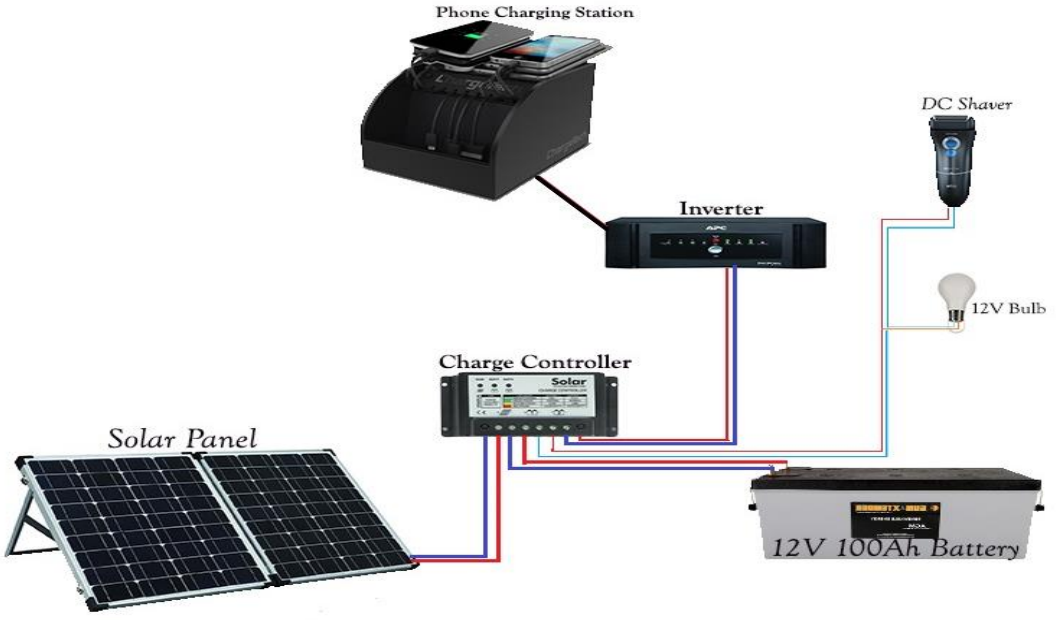
Focus Group
Discussions

- Perception and Awareness
 - Multi Criteria Scoring



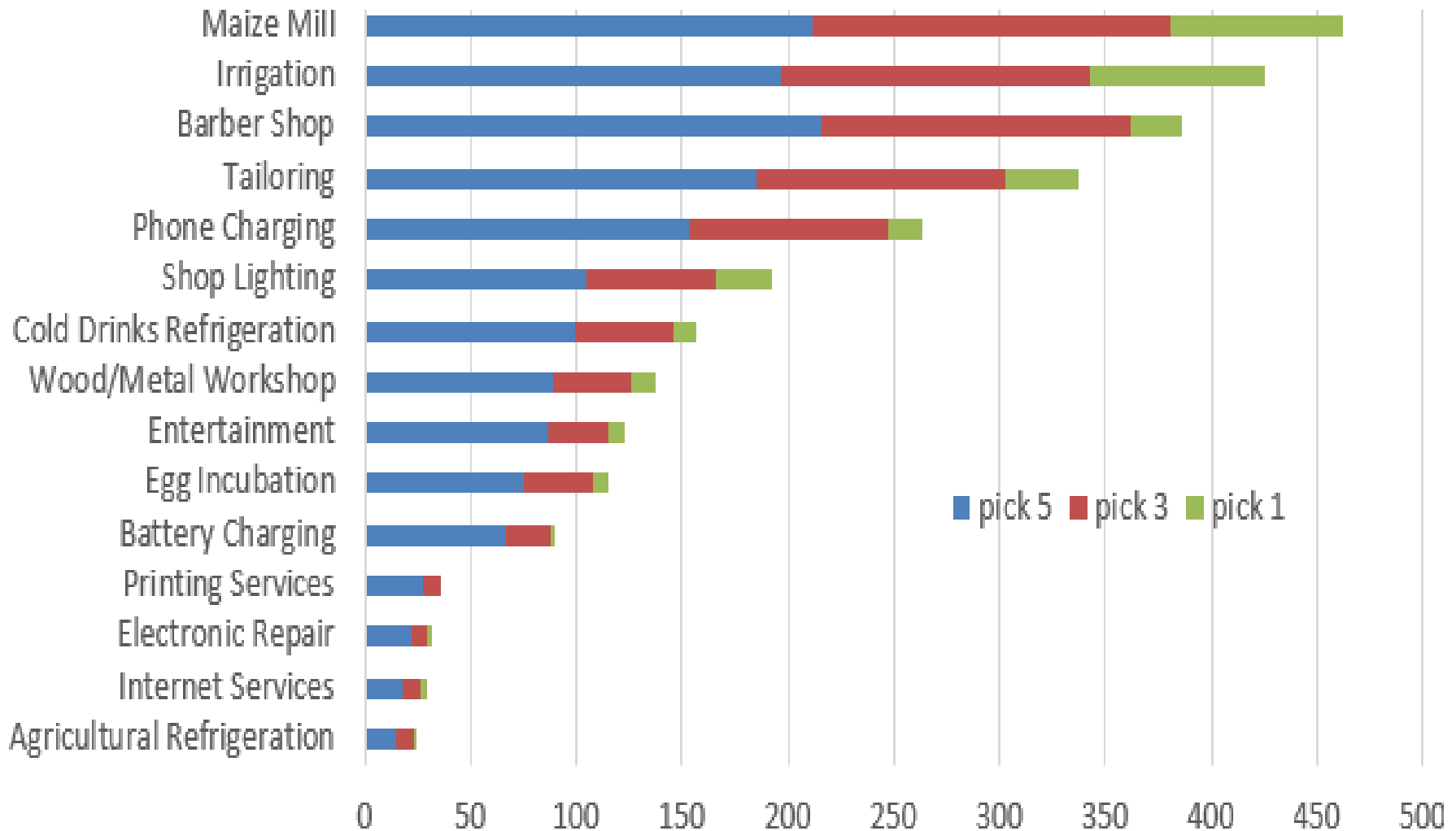
PUE System Design and Business Modelling

- Load Profile
- Solar Resource Assessment
- Component Specification
- Supplier Quotes
- System Cost
- Cash Flow Forecasting



Feasibility Results: Business Desirability

Ranked businesses from the “pick 5, 3 and 1” Question



Feasibility Results: Cash Flow Forecast

Businesses	Scenario 1		Scenario 2		Scenario 3		Viability
	Payback (years)	10 year profit	Payback (years)	10 year profit	Payback (years)	10 year profit	
Irrigation	2	\$8,552	3	\$7,711	5	\$17,902	HIGH
Barbershop and Phone Charging	2	\$2,762	2	\$1,851	>10	0	HIGH
Maize mill	5	\$6,896	8	\$2,135	>10	0	MEDIUM
Tailoring	5	\$831	8	\$169	>10	0	MEDIUM
Metal workshops	>10	0	>10	0	>10	0	LOW

Pilot Projects: Pay As You Go Business Energy (PAYGO-BE)

- Local entrepreneurs receive a PUE PV system and agree to pay-back the cost of the system over a period of time.
- Piloted in Dedza, logging electrical demand and income/expenditure



Product	Deposit	Loan Amount	Monthly Payment	Term (months)
Refrigeration	\$63	\$2,414	\$49	36
Barber & Phone Charging	\$21	\$605	\$34	18
Shop Lighting	\$13	\$227	\$13	18
Irrigation	\$56	\$2,268	\$63	36
TV show	\$42	\$1,837	\$49	36



Pilot Projects: System Specifications

Barbershop & Phone Charging

- Solar PV: 100W, Batteries: 192Ah, Inverter: 10A
- Appliances: Hair clippers, phone chargers, bulbs, and sound system
- Total cost to customer: 432, 000 MKW

Shop Lighting

- Solar PV: 10W, Batteries: 3Ah, Inverter: NA
- Appliances: Radio, cables for charging phones, 4 LED lights, torch
- Total cost to customer: 162, 000 MKW

Irrigation

- Solar PV 275W, Batteries: NA, Inverter: NA
- Appliances: Water pump
- Total cost to customer: 1, 620, 000 MKW

Refrigeration

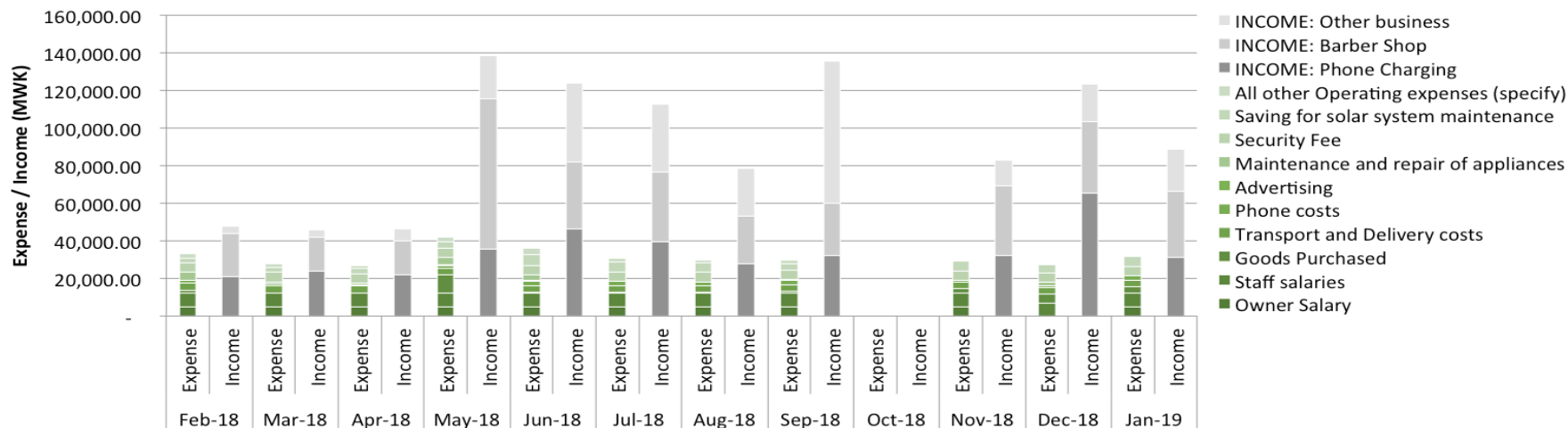
- Solar PV: 200W, Batteries 400Ah, Inverter: Sine Wave and 6.8A
- Appliances: Fridge (DEFY), phone charger, bulbs
- Total cost to customer: 1, 724, 000 MKW

TV System

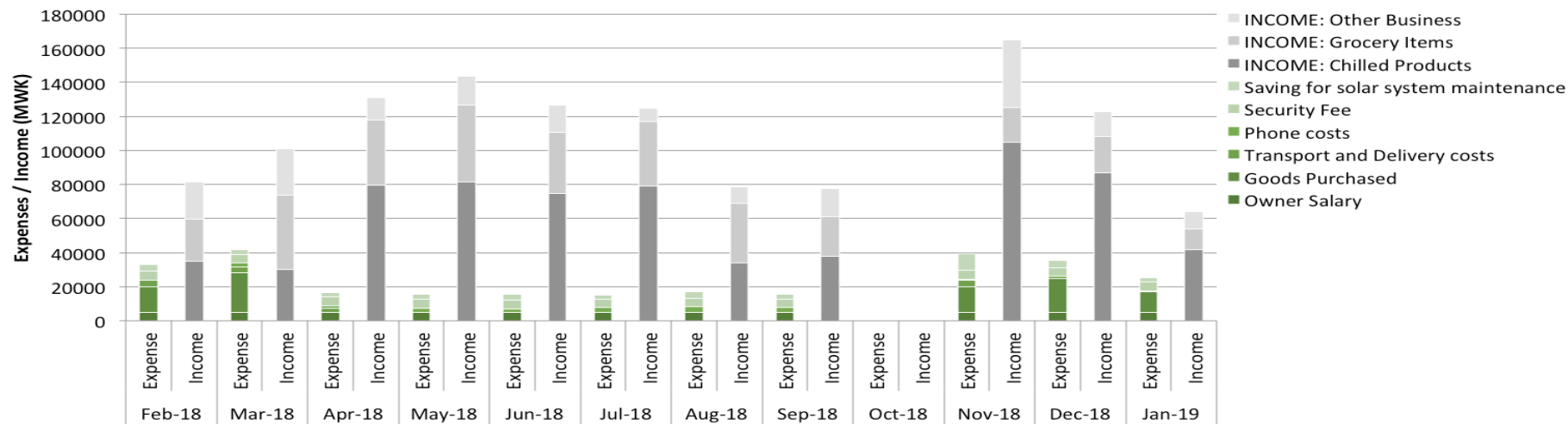
- Solar PV: 2 x 150W, Batteries: 2 x 150Ah, Inverter: 500W
- Appliances: TV, decoder, DVD
- Total cost to customer: 1, 312, 000 MKW

Pilot Project Financial Results

Barber Shop Financial Statement



Refrigeration: Chilled Products & Groceries



After twelve months of operating the PUE systems, all entrepreneurs stated that their business income has increased and that monthly repayments have not been a burden.

Barriers in the PUE Enabling Environment



Capacity

Lack of entrepreneurship, management, accounting skills

Standards and Regulations

Lack of regulation of the Solar PV market causing an influx of cheap counterfeit products. Being addressed in part by the Malawi Bureau of Standards (MBS) and Malawi Energy Regulatory Authority (MERA)

Finance

Limited options, none ideal: Bank Loans, Microfinance, Village Savings and Loans

Supply Chain

Availability of system components materials can be a limiting factor. Becoming more available in trading centres, with concerns over quality of the goods supplied.

Policy and Governmental support

Lack of clarity on national Energy Policy, no support for energy at district level.

Availability and Affordability of Energy

Even competitive innovations can remain unaffordable to the majority in emerging markets. PV Maintenance costs prohibitive for smaller businesses

Conclusions

- Methodologies for assessing PUE feasibility in Malawi have been presented which can be adapted to use in other scenarios.
- There is a commercial case for PAYG-BE customers but this must be implemented at scale (**>100 installations are required**).
- The long-term sustainability of the PAYG-BE case requires sufficient revenue to be generated that can support the central management and administration costs of the PUE provider. This can only be achieved if the current projects/solutions are deployed at scale
- Future PAYG-BE customers should use a mobile payment solution to collect the monthly payments rather than cash in-hand. This ensures transparency in reporting for both sides (the PUE provider and the local entrepreneur).
- The development of this business case must also demonstrate an accurate and transparent financial reporting process for the issuing of loans and collection of loan payments.
- Barriers in the enabling environment need to be tackled to promote scale up

***Thanks for
listening***

aran.eales@strath.ac.uk