Malawi Sustainable Energy Investment Study: **Building a Project Pipeline**

Department of Energy Affairs | Ministry of Natural Resources, Energy and Mining | Malawi

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Increasing the supply of and access to reliable, affordable energy is at the core of Malawi’s development goals

Malawi Growth and Development Strategy III (2017) aims to:
“Provide sufficient sustainable energy for industrial and socio-economic development”

Malawi’s Sustainable Energy for All Action Agenda (2017) aims to:
Provide access to modern energy services for all by 2030, through on- and off-grid electrification and improved cookstoves

The goal of the Malawi Energy Policy (2018) is:
“To increase access to affordable, reliable, sustainable, efficient, and modern energy for every person in the country”

Sources: World Bank; SE4All Action Agenda
Recognizing the scale of this challenge, we are collaborating with UN-OHRLLS and Rocky Mountain Institute in the implementation of a sustainable investment study

Malawi Sustainable Energy Investment Study:

- Aims to provide a clear and specific investment prospectus for meeting Sustainable Development Goal 7 and improving power sector financial health and service
- Identifies immediate and near-term opportunities to make progress and unlock investment in Malawi
- Supports Malawi in securing the right finance at the right time
- Builds on extensive work carried out by Malawi government and development partners over the past years

Department of Energy Affairs:

DoEA coordinates formulation of energy policies, planning & ICT; the provision of rural electrification services; and the provision of alternative energy and energy conservation services

Implementation partners:
By adopting an integrated approach to power systems planning, we build out a clear list of priorities for Malawi’s investment needs.

- **Power Generation**
- **Transmission**
- **Distribution**
- **Off-Grid Lighting**
- **Productive Use: Mini-grids and Stand-alone Systems**
- **Cooking Solutions**
- **Demand Side Management**
#1 – Improve demand-side management
Demand forecasting must be dynamic to account for rapid changes and the adoption of distributed energy resources

Demand forecasts must be regularly updated to reflect changing conditions and avoid risks of a supply–demand imbalance

Distributed energy resources change demand profiles

• **Suppressed demand** from load shedding is difficult to quantify
• **Self-generation** with solar + battery or hybrid systems is increasingly common
• **Captive power** solutions are being developed in several major industries
• **Tariff increases** and time-of-use tariffs have depressed demand

Energy efficiency programs reduce demand

A comprehensive efficiency program could reduce peak demand by 15–20% and save 10–15% of total energy consumption, while providing the same levels of energy services
#2 – Develop an optimized power generation pipeline
Malawi has a range of available energy sources from which the most cost-effective portfolio can be developed.

Estimated Levelized Cost of Electricity (LCOE) from different power generation sources (2017 IRP)

- Utility EE Program Benchmark*: 4.6
- Large Hydro (Mpatamanga): 2.9
- Medium Hydro (Songwe): 5.0
- Mini Hydro (Ndiza/Ruo): 8.7
- Coal: 8.8
- Wind: 10.4
- Solar PV: 11.4
- Biomass: 13.0

Savings from efficiency cost less than generating electricity, and should therefore be considered the “first fuel”

There is rapid cost reduction in renewables, especially solar photovoltaics (PV) + batteries.
- Malawi PV prices reached 8¢/kWh in 2018
- Zambia awarded PV tenders with bids of 4¢ in 2019

LCOE source: RMI’s calculation based on the 2017 IRP.
* The efficiency cost is an average cost across all utility efficiency programs in the United States. Source: https://emp.lbl.gov/sites/all/files/total-cost-of-saved-energy.pdf
A least-cost generation pathway mixes renewables with flexible power provision to meet Malawi’s power needs at 25% lower cost than alternative scenarios.

Net present value (NPV) from 2019 to 2030 of alternative generation infrastructure scenarios

- **Optimized scenario**: diverse portfolio with small-scale generation, renewables, some import
  - >$200M saved

- **Coal and renewables**: diverse portfolio provides some synergies, but higher OPEX

- **Centralized infrastructure**: large coal & hydro risks supply-demand imbalance

Source: RMI analysis. A range of scenarios have been modelled in Malawi’s full investment study report.
#3 – Ensure appropriate grid infrastructure for power take-off and grid connection
Grid densification and expansion coordinated with off-grid solutions is the most cost-effective way of expanding electricity access

**Distributed generation**
- Make use of local generation resources
- Interconnect minigrids as the grid arrives
- Reduce grid losses and improve reliability

**Least-cost grid densification**
- Connect customers close to existing lines first
- Prioritize connection of areas with significant loads

**Off-grid electrification**
- Pico-solar provides least-cost lighting for homes
- Minigrids and stand-alone solar meet demand for heavier loads

**Productive-use and demand stimulation**
- Support businesses and help them acquire appliances to grow demand
- Increase development impact of electricity
- Improve economics of electrification

A more robust, cheaper, more sustainable grid
Continued investment in the transmission network is essential; increasing access will require ongoing investments for adding new connections.

Intensive investments to build out the transmission backbone and interconnectors to Southern African Power Pool (SAPP)

Grid expansion and densification to increase electrification are significant costs (Note that the exact distribution of new connection costs over this time is still to be determined)

Source: RMI analysis for Malawi Sustainable Energy Investment Study
#4 – Build in complementary off-grid solutions
To reach universal access, Malawi can complement grid development with around 3.5M additional off-grid connections by 2030, subsidizing the poorest households.

Due to the short lifetime of units, additional investments to cover replacement costs will be needed going forward.
#5 – Develop a cohesive strategy for cooking energy provision

- **Power Generation**
- **Transmission**
- **Distribution**
- **Off-Grid Lighting**
- **Productive Use: Mini-grids and Stand-alone Systems**
- **Cooking Solutions**
- **Demand Side Management**
Malawi can develop an integrated approach to clean cooking in order to address urgent national needs and an unsustainable biomass supply–demand balance.

Cooking Solutions

- Reducing Biomass Demand for Cooking
  - Rapidly increase uptake of cooking alternatives: Liquefied petroleum gas (LPG), ethanol, electricity, briquettes
  - Improved efficiency in biomass use and charcoal production

- Restoring Biomass Supply
  - Conservation agriculture
  - Farmer-managed natural regeneration
  - Community plantations and private woodlots

- Addressing national targets related to health and gender equality

Next Step: interministerial planning process for development of a clean cooking strategy with quantitative targets

Current trends in supply and demand of biomass are unsustainable

~90% of cooking demand is from biomass

<table>
<thead>
<tr>
<th></th>
<th>Firewood</th>
<th>Charcoal</th>
<th>LPG</th>
<th>Electricity</th>
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<td>% Demand</td>
<td>74.1%</td>
<td>15.7%</td>
<td>9.8%</td>
<td>&lt;0.5%</td>
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Source: National Charcoal Strategy; Malawi WISDOM analysis
By mapping the funding requirements and candidate projects across each of these sectors, Malawi is building a clear investment prospectus.

- **Power Generation**: US$2,091M
- **Transmission**: US$1,031M*
- **Distribution**: US$122M
- **Off-Grid Lighting**: US$226M
- **Productive Use: Mini-grids and Stand-alone Systems**: US$226M
- **Cooking Solutions**: US$122M
- **Demand Side Management**: US$122M

*Investment requirements for both Transmission & Distribution
The government can now provide increasing clarity on investment needs through to 2030, in accordance with national targets.

Expected disbursements for **building out generation and transmission** to meet suppressed demand will drive up required cash inflows from 2019 to 2021.

Additional **wind and hydro** generation projects will drive up required cash inflows in 2026 and 2027.

*Investment requirements do not include cooking solutions.
Thank you

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