

Support to SE4ALL Country Actions processes in Malawi

Action Agenda

*May 2017*

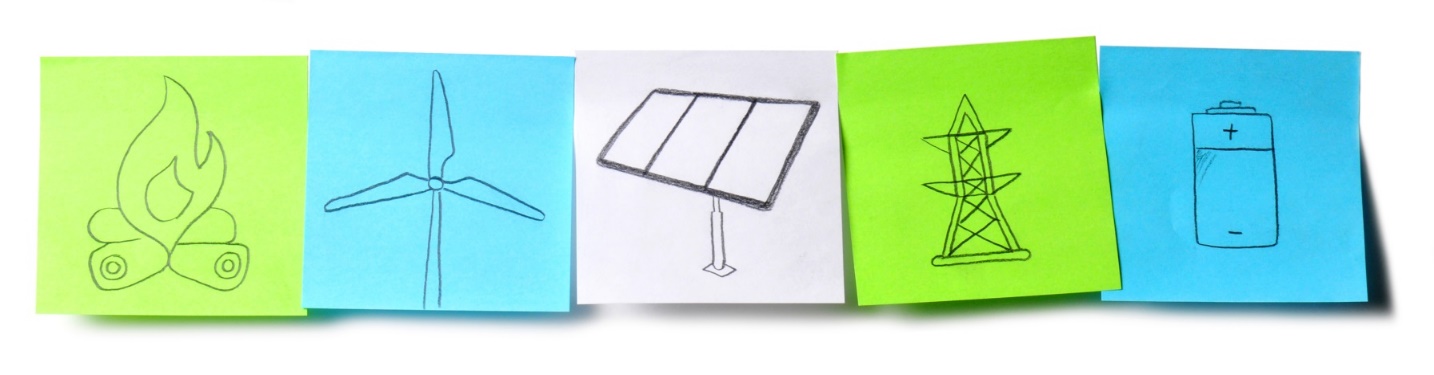






Table of contents

[1. Executive Summary 9](#_Toc481614864)

[1.1 Targets 10](#_Toc481614865)

[1.1.1 Energy Access Targets – 2030 10](#_Toc481614866)

[1.1.2 Renewable Energy Targets -2030 11](#_Toc481614867)

[1.1.3 Energy Efficiency Targets -2030 11](#_Toc481614868)

[1.1.4 Transportation Targets 12](#_Toc481614869)

[1.2 Priority actions 12](#_Toc481614870)

[1.2.1 Access to improved cooking 12](#_Toc481614871)

[1.2.2 Access to electricity 12](#_Toc481614872)

[1.2.3 Renewable energy 13](#_Toc481614873)

[Comprehensive Renewable Energy Policy 13](#_Toc481614874)

[Policy on Independent Power Producers (IPPs) 13](#_Toc481614875)

[Address Financial Barriers 14](#_Toc481614876)

[The Government will take steps to address the financial barriers that currently exist for RE projects, thereby de-risking the investments 14](#_Toc481614877)

[National Energy Efficiency & Renewable Energy Development Commission 14](#_Toc481614878)

[The Government will consider establishing a dedicated EE/RE commission 14](#_Toc481614879)

[Modernize the Electric Grid 14](#_Toc481614880)

[Education and Training 15](#_Toc481614881)

[The Government will implement RE education and training programmes 15](#_Toc481614882)

[1.2.4 Energy Efficiency 15](#_Toc481614883)

[Large industrial and mining companies 15](#_Toc481614884)

[Agriculture 16](#_Toc481614885)

[1.2.5 Transportation – Biofuels and EV’s 16](#_Toc481614886)

[1.2.6 Urban Transportation 16](#_Toc481614887)

[2. Introduction 19](#_Toc481614888)

[3. Methodology 21](#_Toc481614889)

[4. Part I -Vision and targets through 2030 22](#_Toc481614890)

[4.1 Energy sector status and trajectory 22](#_Toc481614891)

[4.1.1 Energy Sector Status 22](#_Toc481614892)

[4.1.2 Electricity generation and transmission plans 24](#_Toc481614893)

[4.2 Energy access – Clean cooking 28](#_Toc481614894)

[4.2.1 What is the current status and BAU trajectory to 2030? 28](#_Toc481614895)

[4.2.2 What is the target for 2030? 31](#_Toc481614896)

[4.2.3 What is the gap between BAU trajectory and the new targets? What are the barriers? 31](#_Toc481614897)

[Energy Access and Gender 31](#_Toc481614898)

[4.3 Electricity access – On site installations & Mini Grids 32](#_Toc481614899)

[4.3.1 What is the current status and BAU trajectory to 2030? 32](#_Toc481614900)

[**4.3.2** **What is the gap between BAU trajectory and the new targets? What are the barriers?** 34](#_Toc481614901)

[4.3.3 Existing plans and projections to 2030 36](#_Toc481614902)

[4.4 Renewable Energy 37](#_Toc481614903)

[4.4.1 What is the current status and BAU trajectory to 2030? 37](#_Toc481614904)

[4.4.2 What is the target for 2030? 42](#_Toc481614905)

[4.4.3 What is the gap between BAU trajectory and the new targets? What are the barriers? 46](#_Toc481614906)

[4.5 Energy Efficiency 46](#_Toc481614907)

[4.5.1 What is the current status and BAU trajectory to 2030? 46](#_Toc481614908)

[4.5.2 What is the target for 2030 and the gap? 51](#_Toc481614909)

[4.5.3 What is the gap between BAU trajectory and the new targets? What are the barriers? 54](#_Toc481614910)

[4.6 Transportation – Alternative Fuels 54](#_Toc481614911)

[4.6.1 What is the current status and BAU trajectory to 2030? 55](#_Toc481614912)

[Biofuels production and consumption 55](#_Toc481614913)

[4.6.2 What is the target for 2030? 58](#_Toc481614914)

[4.6.3 What is the gap between BAU trajectory and the new targets? What are the barriers? 59](#_Toc481614915)

[4.7 Transportation – Urban transportation 60](#_Toc481614916)

[4.7.1 What is the current status and BAU trajectory to 2030? 61](#_Toc481614917)

[4.7.2 What is the target for 2030? 64](#_Toc481614918)

[4.7.3 What is the gap between BAU trajectory and the new targets? What are the barriers? 65](#_Toc481614919)

[4.8 Relevant nexus targets – by 2030 66](#_Toc481614920)

[5. PART II – Priority Action Areas 67](#_Toc481614921)

[5.1 Energy access – Cooking 67](#_Toc481614922)

[5.1.1 What are the actions and funding levels needed to achieve the overarching objective in the field of energy access - cooking? 67](#_Toc481614923)

[LPG Expansion 68](#_Toc481614924)

[5.2 Energy access – Electricity 68](#_Toc481614925)

[5.2.1 What are the actions and funding levels needed to achieve the overarching objective in the field of energy access - electricity? 68](#_Toc481614926)

[Education, Training and Public Awareness 69](#_Toc481614927)

[Promotion of Pico solar systems 70](#_Toc481614928)

[5.2.2 What are the actions and funding levels needed to achieve the overarching objective in the field of renewable energy? 73](#_Toc481614929)

[5.2.3 Priority actions synthesis 77](#_Toc481614930)

[5.3 Energy efficiency 80](#_Toc481614931)

[5.3.1 What are the actions and funding levels needed to achieve the overarching objective in the field of energy efficiency? 80](#_Toc481614932)

[5.3.2 Which (global) High-Impact Opportunities are relevant? 85](#_Toc481614933)

[5.3.3 Priority actions synthesis 85](#_Toc481614934)

[5.4 Transportation – Alternative fuels 87](#_Toc481614935)

[5.4.1 What are the actions and funding levels needed to achieve the overarching objective in the field of alternative fuels? 87](#_Toc481614936)

[Support sustainable biofuel production and use 88](#_Toc481614937)

[5.4.2 Which (global) High-Impact Opportunities are relevant? 90](#_Toc481614938)

[5.4.3 Priority actions synthesis 90](#_Toc481614939)

[5.5 Transportation – Urban transport 92](#_Toc481614940)

[5.5.1 What are the actions and funding levels needed to achieve the overarching objective in urban transport? 92](#_Toc481614941)

[5.5.2 Which (global) High-Impact Opportunities are relevant? 97](#_Toc481614942)

[5.5.3 Priority actions synthesis 97](#_Toc481614943)

[5.6 Cross-cutting Actions 100](#_Toc481614944)

[5.6.1 Institutional structure and coordination 100](#_Toc481614945)

[5.6.2 Sub-national initiatives 100](#_Toc481614946)

[5.6.3 Finance and risk management 101](#_Toc481614947)

[5.6.4 Capacity building and education 101](#_Toc481614948)

[5.6.5 Review of VAT Exemption for clean energy products 101](#_Toc481614949)

[6. PART III – Coordination and Follow-up 102](#_Toc481614950)

[6.1 National SE4All taskforce (structure and coordination strategy) 102](#_Toc481614951)

[6.2 Regional Coordination 102](#_Toc481614952)

[6.3 Follow-up analysis 103](#_Toc481614953)

[6.4 Monitoring, evaluation and reporting 103](#_Toc481614954)

[6.5 Link to Investment Prospectuses 107](#_Toc481614955)

[Annex 1: The SE4ALL initiative 108](#_Toc481614956)

[Introduction 108](#_Toc481614957)

[AA and IP: Key steps for achieving SE4All objectives 109](#_Toc481614958)

[The role of the AA and IP 109](#_Toc481614959)

[Annex 2: Stakeholders consulted in the development of AA 111](#_Toc481614960)

[Annex 3: SE4ALL implementation plan 113](#_Toc481614961)

[Annex 4: References 122](#_Toc481614962)

[Legal framework and institutions 122](#_Toc481614963)

[Bibliography 123](#_Toc481614964)

List of Figures

[Figure 1: Energy consumption 24](#_Toc481614965)

[Figure 2: Potential hydropower projects in Malawi 26](#_Toc481614966)

[Figure 3: MCC Infrastructure Project Investments 26](#_Toc481614967)

[Figure 4: Petroleum products supply based on total imports from 1999 to 2013 27](#_Toc481614968)

[Figure 5: Fuel import projections 27](#_Toc481614969)

[Figure 6: Biomass Consumption in Malawi 29](#_Toc481614970)

[Figure 7: 2030 target for grid extensions 34](#_Toc481614971)

[Figure 8: Available Generating Capacity, MW, 2014 39](file:///\\frfiler001\DDD\1_Clients\African%20Development%20Bank\2015_African%20Development%20Bank_SE4ALL%20Zimbabwe%20&%20Malawi\Working%20docs\Malawi\04%20-%20AA\8%20-%20Draft%206\AA_Malawi_FINAL%2003May17_clean.docx#_Toc481614972)

[Figure 9: Anticipated 2025 Capacity from Energy Policy Paper, Year 2025 42](#_Toc481614973)

[Figure 10: Anticipated Trajectory of New Power Supplies from Energy Policy Paper, MW 42](#_Toc481614974)

[Figure 11: Renewable Energy Targets Achieved by 2030, MW 44](#_Toc481614975)

[Figure 12: Installed Generating Trajectory Including RE Targets, MW 45](#_Toc481614976)

[Figure 13: Installed Generating Capacity in 2030 based on Energy Policy Paper plus SE4ALL RE Targets 45](#_Toc481614977)

[Figure 14: Energy supply by sector 47](#_Toc481614978)

[Figure 15: National importations of petroleum products between 1999 and 2013 (million litres) 55](#_Toc481614979)

[Figure 16: Expected biodiesel production of BERL through 2030 (million litres) 57](#_Toc481614980)

[Figure 17: Petroleum products importations since 1999 and projection through 2030 compared to biofuel production levels since 2012 and targets through 2030 (million litres) 59](#_Toc481614981)

[Figure 18: Rail network (Railroad Development Corporation, 2016) 62](#_Toc481614982)

[Figure 19: Malawi EE Fund – proposed structure and business cycle 84](#_Toc481614983)

[Figure 20: Relationship among different parts of a MER framework and the AA 104](#_Toc481614984)

[Figure 21: Action Agenda and Investment Prospectus linkages 107](#_Toc481614985)

List of Tables

[Table 1: Targets on electric cookers, LPG stoves and efficient wood stoves 10](#_Toc481614986)

[Table 2: Targets on solar water heaters 10](#_Toc481614987)

[Table 3: Targets on electricity access 11](#_Toc481614988)

[Table 4: Renewable Energy Baseline and 2030 Targets 11](#_Toc481614989)

[Table 5: Energy Efficiency Targets 11](#_Toc481614990)

[Table 6: Targets on alternative fuels 12](#_Toc481614991)

[Table 7: Target on urban transportation 12](#_Toc481614992)

[Table 8: Energy demand by fuel type 23](#_Toc481614993)

[Table 9: Energy mix projections 24](#_Toc481614994)

[Table 10: Projections on peak demand, capacity requirement and ESCOM's supply capacity 25](#_Toc481614995)

[Table 11: Fuel use distribution 28](#_Toc481614996)

[Table 12: Proposed targets for Energy Access through 2030 31](#_Toc481614997)

[Table 13: Customers connected to electricity in Malawi (2015) 33](#_Toc481614998)

[Table 14: Access rates 33](#_Toc481614999)

[Table 15: Grid extension targets – SE4ALL 34](#_Toc481615000)

[Table 16: Grid extension targets - BAU 34](#_Toc481615001)

[Table 17: Grid extension targets - Gap 35](#_Toc481615002)

[Table 18: Off grid targets 37](#_Toc481615003)

[Table 19: Installed Electric Generation Units, MW, 2014 39](#_Toc481615004)

[Table 20: Government-Planned Electricity Generation Projects Planned for 2015 - 2025 40](#_Toc481615005)

[Table 21: Pipeline of Independent Power Projects (November 2015) 43](#_Toc481615006)

[Table 22: Malawi Energy intensity Btu/2005 US Dollar of GDP 47](#_Toc481615007)

[Table 23: ESCOM current electricity tariff 48](#_Toc481615008)

[Table 24: Malawi target energy intensity projection 2015-2030 52](#_Toc481615009)

[Table 25: Target number of solar powered water heaters by 2030 52](#_Toc481615010)

[Table 26: Target for pre-paid/smart meters installations 53](#_Toc481615011)

[Table 27: Target number of efficient bulbs 53](#_Toc481615012)

[Table 28: Efficient tobacco curing barns target 53](#_Toc481615013)

[Table 29: Transmission and distribution losses targets 54](#_Toc481615014)

[Table 30: Malawi ethanol production since 2007 and projections to 2030 56](#_Toc481615015)

[Table 31: Population of road vehicles in urban areas, in 2014, by type of vehicle 61](#_Toc481615016)

[Table 32: Relevant nexus targets 66](#_Toc481615017)

[Table 33: Summary of priority actions on Energy Access 71](#_Toc481615018)

[Table 34: Summary of priority actions on Renewable Energy 78](#_Toc481615019)

[Table 35: Summary of priority actions on Energy Efficiency 86](#_Toc481615020)

[Table 36: Composition of the Biofuels Coordinating Committee 87](#_Toc481615021)

[Table 37: Required land for cultivations of jatropha and sugarcane 89](#_Toc481615022)

[Table 38: Alternative fuels priority actions 91](#_Toc481615023)

[Table 39: Composition of the Urban Transportation Coordinating Committee 92](#_Toc481615024)

[Table 40: Summary of priority actions on urban transportation 98](#_Toc481615025)

[Table 41: Illustrative list of indicators for the SE4ALL initiative 105](#_Toc481615026)

[Table 42: Key components for Measuring Access to Household Electricity Services under the GTF 106](#_Toc481615027)

[Table 43: Implementation of priority actions: Energy Access 113](#_Toc481615028)

[Table 44: Implementation of priority actions: Renewable Energy 115](#_Toc481615029)

[Table 45: Implementation of priority actions: Energy Efficiency 117](#_Toc481615030)

[Table 46: Implementation of priority actions on alternative fuels 118](#_Toc481615031)

[Table 47: Implementation of priority actions on urban transportation 119](#_Toc481615032)

List of Acronyms

|  |  |
| --- | --- |
| AA | Action Agenda |
| AfDB | African Development Bank |
| AMI | Advanced Metering Infrastructure |
| BAU | Business as usual |
| BERL | Bio Energy Resources Ltd |
| CFL | Compact fluorescent lamp |
| CHP | Combined heat and power |
| CNG | Compressed natural gas |
| CSP | Concentrating solar power |
| DNA | Designated National Authority |
| DOEA  DOF  DSM | Department of Energy Affairs  Department of Forestry  Demand-side management |
| EE | Energy efficiency |
| EGENCO | Electricity Generation Company |
| EPC | Engineering, procurement & construction |
| ETHCO | Ethanol Company Ltd |
| EV | Electric vehicle |
| EDVP | Ethanol Driven Vehicle Project |
| GCF | Green Climate Fund |
| GDP | Gross Domestic Product |
| GFEI | Global Fuel Economy Initiative |
| GHG | Greenhouse gas |
| GIS | Geographic information system |
| GFEI | Global Fuel Economy Initiative |
| GWh | Gigawatt-hour |
| GTF | Global Tracking Framework |
| IEA | International Energy Agency |
| ILPBL | Inefficient Lighting Products Ban and Labelling |
| INDC | Intended Nationally Determined Contribution |
| IP | Investment Prospectus |
| IPMVP | International Performance Measurement and Verification Protocol |
| IPP | Independent power producer |
| IRENA | International Renewable Energy Agency |
| kWh | Kilowatt-hour |
| LED | Light-emitting diode |
| LNG | Liquefied Natural Gas |
| LPG | Liquefied petroleum gas |
| MAREP | Malawi Rural Electrification Programme |
| MAREP | Malawi Rural Electrification Programme |
| MERA | Malawi Energy Regulatory Authority |
| MoNREM | Ministry of Natural Resources, Energy and Mining |
| MoTPW | Ministry of Transport and Public Works |
| MW | Megawatt |
| NCST | National Commission for Science and Technology |
| NEMR | National Energy Management Regulations |
| NEP | National Energy Policy |
| NEPAD | New Partnership for Africa’s Development |
| NGO | Non-governmental organization |
| NCCRS | National Climate Change Response Strategy |
| NOCMA | National Oil Company of Malawi |
| NTP | National Transportation Policy |
| PIDA | Program for Infrastructure Development in Africa |
| PPA | Power purchase agreement |
| PPM | Prepayment meter |
| PV | Photovoltaic |
| RE | Renewable energy |
| REFiT | Renewable energy feed-in tariff |
| RO | Renewable energy obligation |
| SADC | Southern African Development Community |
| SAPP | Southern African Power Pool |
| SE4ALL | Sustainable Energy for All initiative |
| SME | Small and medium sized enterprise |
| TPES | Total Primary Energy Supply |
| TDM | Travel Demand Measures |
| UN | United Nations |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environment Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| UNIDO | United Nations Industrial Development Programme |

1. Executive Summary

The United Nations (UN) Secretary General launched the SE4ALL Initiative in September 2011 to achieve three inter-related global goals by 2030:

* + Ensuring universal access to modern energy services.
  + Doubling the global rate of improvement in energy efficiency.
  + Doubling the share of renewable energy in the global energy mix.

This Action Agenda (AA) presents an energy sector-wide vision spanning the period 2015 to 2030. It outlines how Malawi will achieve the SE4ALL goals of universal access to modern energy services, increase the rate of energy efficiency, and increase the share of renewable energy in its energy mix, by 2030.

Access to modern energy services is a necessary precondition for achieving development goals that extend beyond the energy sector to poverty eradication, access to clean water, improved public health and education, women's empowerment and increased food production.

The SE4ALL initiative is country-driven. That is, while international institutions and consultants are providing assistance helping facilitate the process, achieving SE4ALL’s objectives will require all major stakeholders in Malawi to play a guiding role. Specifically:

* + The national and local governments must design and implement a set of integrated actions (i.e. action agenda and investment prospectus).
  + The private sector, through its trade associations and individual firms and investors, must bring business and technical solutions to the Malawian market and drive investment.
  + Non-governmental organizations (NGOs) and civil society organizations (CSOs) must advocate for, and monitor, public policy and businesses actions.

The Government of Malawi (GoM) has developed the present AA building on existing plans, programs and strategies, and embracing the SE4ALL guidelines. Increased energy access to underserved populations is a high priority and the SE4ALL initiative will increase efforts in this area. The definition of electricity access is connections to the national grid system or distributed (off-grid) electricity solutions which include Solar Home Systems (SHS), mini-grids), which is consistent with the Global Tracking Framework (GTF) and with the multi-tier approach under GTF.

As of 2016, less than 10% of the population had access to electricity. In rural areas, it is less than 1%. Meanwhile, 95% of the population, or 16,500,000 Malawians use wood, charcoal or other solid fuels. The solid fuel is used primarily for cooking. Its high usage causes a high rate of indoor air pollution related diseases. In addition, the 7.5 million tonnes of annual usage of wood greatly exceeds the sustainable supply of 3.7 million tonnes. A variety of initiatives, mainly run by NGOs and funded by donor governments are promoting improved cook-stoves and the use of biogas digesters.

The electric power sector in Malawi is facing challenges as well. Drought conditions and other factors have greatly reduced the output of the country’s hydroelectric plants, which provide most of Malawi’s electricity. The government is working to develop additional hydroelectric plants, but also is looking to add generation capacity from solar and other renewable energy resources as well as from coal and diesel. So far, no large-scale solar projects have been built and connected to the grid except for a 380 KW demonstration solar power plant installed at Kamuzu International Airport in Lilongwe.

Malawi has a low level of energy efficiency and there are ample opportunities for improving the energy performance of factories, buildings, barns, and water pumping, street lighting and other uses. There are also opportunities to improve efficiency on the “supply side” involving reduction of losses in the electric transmission and distribution grids.

The transportation sector is heavily reliant on imported petroleum products, although Malawi has a sugarcane-based ethanol program that is blending the ethanol with petrol at about an E20 level. The nation has a fledgling biodiesel industry but there are great opportunities for the expansion. There are also opportunities for improving the energy efficiency of motor vehicles and the performance of the country’s urban mass transit systems.

Based on a series of stakeholder meetings held from 2015 to 2017, plus research and analysis of the energy sector reflected in a separate publication, Rapid Assessment and Gap Analysis, a set of targets were established for energy access, renewable energy, energy efficiency and transportation. The targets, which focus on the year 2030, are ambitious but achievable.

* 1. Targets

Energy Access Targets – 2030

Below are the 2030 targets for modern cooking solutions. The projected 2030 population of the country is 26.6 million.[[1]](#footnote-2) The percentage of the population that is likely to decrease from its current level of 84% of total population to 79%, based on projections from the United Nations’ Population Pyramids of the World from 1950 to 2100. We assume that the average household size will continue to be 4.4 persons. Targets are based on an acceleration of existing trends and the goals of Malawi’s Cook Stoves Road Map and the *Accelerated Access toe Electricity Project* of ESCOM, the national power distribution utility.

The main target is the increase in the number of energy-efficient wood stoves from 500,000 in 2016 to 5 million by 2030. The increased use of efficient wood stoves will have the greatest impact on biomass use compared to any other activity. But a major effort to replace wood with LPG for cooking will be undertaken as well. Although the effort will only reach about 2% of households by 2030, that will represent an eightfold increase in LPG-using households by 2030. Experience in other countries, such as Ghana, shows that gearing up a largescale LPG program takes time. The LPG distribution, storage and retail operations must be established and the public’s safety concerns have to be addressed by demonstrating a long-term safety record with LPG handling and use.

Table 1: Targets on electric cookers, LPG stoves and efficient wood stoves

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Cooking technology | | Baseline 2016 | Target 2030 | Percentage of rural[[2]](#footnote-3)[[3]](#endnote-2) households with access to modern cooking solutions, 2016 | Percentage of rural[[4]](#footnote-4) households access with modern cooking solutions, 2030 |
| Electric cookers | 84,000 | | 135,000 | 3.0% | 4% |
| LPG stoves | 6,800 | | 54,000 | 0.2% | 2% |
| Efficient wood stoves | 500,000 | | 5 million | 17.6% | 100% |

It should be noted that the target of 100% of households using efficient wood stoves does not mean that wood use will increase. Rather, it means a decrease in wood use because currently close to 100% of households use *inefficient* wood stoves. It should also be noted that households that use electric cookers and LPG stoves tend to also use wood stoves, so even as the penetration of alternative cooking technologies increases and wood use decreases, the percentage of households that have wood stoves will remain high.

In addition to cooking technologies, another thermal energy service is water heating as a replacement for electric water heating. The 2030 target involves a twenty-fold increase in the use of solar water heaters.

Table 2: Targets on solar water heaters

|  |  |  |  |
| --- | --- | --- | --- |
| Water heating technology | Baseline 2016 | Target 2030 | Percentage of population affected |
| Solar water heaters | 2,000 | 40,000 | 0.5% |

The targets for increasing electricity access address both grid extension and the expanded use of off-grid electricity-generating installations such as solar home systems and mini-grids. There is also a target for small-scale pico solar systems, such as solar lanterns, for people who cannot afford to pay for grid power or for the off-grid power generation sources. Between grid extension and the provision of pico solar services in rural areas, the target is for 100% of the population to have at least Tier 1 electricity service by 2030.

Table 3: Targets on electricity access

| Electricity Access Number % rural pop served | | |
| --- | --- | --- |
| Grid extension – homes/business connected through 2030 | 1.51 million | 31.6 |
| Rural solar home systems installed through 2030 | 75,000 | 29.3 |
| Mini-grids installed through 2030 | 90[[5]](#footnote-5) | < 1.0 |
| Pico solar systems provided through 2030 | 4.5 million | 100 |

Renewable Energy Targets -2030

The renewable energy targets were developed based on national power development needs, the proposed RE project developments proposed by ESCOM, the potential for IPP RE power development, a grid study indicating how much intermittent power can be added over the next 12-24 months, and the recommendations provided by the Malawi SE4ALL RE Working Group and the Department of Energy focal point. The percentages are based on a projected total 2030 installed capacity of 2,620.85 MW.

Table 4: Renewable Energy Baseline and 2030 Targets

|  |  |  |  |
| --- | --- | --- | --- |
| RE source | 2016 capacity | 2030 target | Target Percentage |
| Large hydro | 281.5 MW | 1,471 MW | Percent of generation: 56% |
| Small hydro | 4.35 MW | 103.35 MW | Percent of generation: 4% |
| Solar | .38 | 550 MW | Percent of generation: 21% |
| Bagasse | 18 MW | 46 MW | Percent of generation:1.8% |
| TOTAL | 303.85 | 2,170 MW | Percent of generation: 83% |

In addition to these RE sources, there is potential for wind, waste-to-energy and geothermal power. However, further analysis of their contribution is needed before targets can be set for them.

Energy Efficiency Targets -2030

The energy intensity target up to 2030 is based on this past performance data. It is expected that Malawi`s overall energy intensity will decrease by more than 50% over the period 2015 – 2030. The other EE targets below are based on population projections, household connection projections, and projections based on EE initiatives planned or under way.

Table 5: Energy Efficiency Targets

|  |  |
| --- | --- |
|  | Target |
| Energy intensity of economy - Btu/USD (Currently 1,655) | 897 (45.8% decrease) |
| Solar water heater replacements by 2030 | 40,000 |
| New prepaid/smart meters | 1.6 million |
| Lighting: Additional LED bulbs installed by 2030 | 8,250,000 |
| New EE barns constructed | 5,000 |
| Combined transmission and distribution losses (currently estimated at 22%) | 12% |

Transportation Targets

Biofuel production targets are based on liquid fuel demand linear projection through 2030, based on past annual growth, and mandatory blend. Mandatory blends considered in 2030 were defined based on discussion with stakeholders.

Table 6: Targets on alternative fuels

| Biofuels | Baseline (2012) | Target (2030) |
| --- | --- | --- |
| Ethanol production | 19 million litres | 40 million litres |
| Biodiesel production | 150,000 litres | 55 million litres |
| Ethanol blend | 10% | 30% |
| Biodiesel | *No mandatory blend in 2012* | 15% |

The automobile fuel efficiency target is based on the Global Fuel Economy Initiative (GFEI), one of the SE4ALL flagship programs with the main objective being to reduce emissions and at least double the efficiency of the global vehicle fleet from an average of 8 litres/100 km in 2005 to 4 litres/100 km by 2050. The fuel efficiency target for Malawi is slightly lower than the GFEI target because of the low fuel efficiency starting point of Malawian vehicles, but represents an improvement over the country’s current fuel efficiency level, which is not known due to lack of data. The target should be revised, at the latest by end of 2017, based on the collection of data pursuant to the development of the National Transport Master Plan currently under way.

Table 7: Target on urban transportation

|  |  |
| --- | --- |
| Urban Transportation | Target |
| Fuel efficiency by 2030 | 8 litres/100 km |

* 1. Priority actions

Access to improved cooking

* + The Department of Energy will work with the Department of Forestry to increase the up-stream supply of biomass.
  + The Department of Energy, working with the Ministry of Finance, Malawi Revenue Authority and Malawi Trade and Investment Centre, will encourage and incentivize businesses to enter into supplying alternative fuels for cooking, including LPG, biogas, biomass briquettes, bamboo, pellets, and ethanol gel; and improved biomass cook stoves, solar PV cookers and biogas cookers. Within this activity, the highest priority will be on improved biomass cook stoves, followed by an expanded focus on LPG. Given the economics of biogas, the focus of biogas policy will be on institutions likes schools, not households.
  + The Department of Energy will develop a strategy to assist poor households in the urban areas to access energy-efficient wood and charcoal stoves.
  + The Department of Energy will facilitate development of a sustainable value chain for biogas production for targeted communities, institutions, and industries.
  + The Department of Energy will promote sustainable charcoal production at different scales of production.
  + The Department of Energy will promote the manufacture, distribution, use and financing mechanisms for different end use energy technologies.
  + The Department of Energy in collaboration with cooperating partners will conduct research into alternative production of charcoal

Access to electricity

* + Under Phase 8 of MAREP’s rural electrification plan, the agency will continue with electrification of more than two rural trading centres per District until 2030. About 80 training centres are planned to be connected between 2016 and 2017 [[6]](#footnote-6).
  + MAREP will electrify all public institutions 5Km away from the MV line through off-grid options.
  + MAREP will continue the practice of providing prepaid meters to all new connections.
  + MAREP will revive support for mini-grids.
  + MBS will lead an effort to enforce standards on imported and domestically manufactured RE products used to provide electricity in unserved areas. The Department of Energy will support MBS and work to increase MBS’s capability to carry out this function.
  + The Department of Energy will resuscitate the Guarantee Fund to help finance solar energy installations and other off-grid RE solutions.
  + The Government will encourage private parties to operate mini-grids and will provide a subsidy for the operation and maintenance of mini-grids and a low price for licensing the mini-grids.
  + Ministry of Agriculture, Irrigation and Water Development will continue to irrigate schemes far away from the grid with solar PV.
  + Ministry of Health will ensure that health centres far away from the grid are electrified by solar PV.

Renewable energy

Comprehensive Renewable Energy Policy

The highest priority renewable energy priority for the Government is to adopt a comprehensive renewable energy policy and Integrated Resource Plan. The policy will include:

* + Formal adoption of IPP rules for approval of IPPs and for the acquisition of RE electricity, such as REFit, RE Obligation, or RE auction.
  + Adoption of net metering for smaller, on-site RE projects.
  + Providing financial incentives such as tax incentives and production credits to RE developers.
  + Establishing rules for on-site supply of RE electricity to large users by third party developers.
  + Adopting performance standards for RE equipment, and training and licensing of RE installers.
  + Targets and timetables for the acquisition of RE electricity.
  + Streamlining the project planning process and decreasing project development and licensing costs.
  + Assigning roles to ESCOM, MERA, the Department of Energy, other government entities, and other players.
  + Ensuring adequate consultation with stakeholders and the public in the project development process.

Policy on Independent Power Producers (IPPs)

Based on work already conducted on a draft IPP framework, the Government will adopt an effective IPP policy, including support for the feed-in tariff.

* + The feed-in tariff provides a guide for IPPs to participate in supplying power, and ESCOM has had discussions with RE IPPs. Some PPAs have been signed, but no projects have been built. A specific IPP policy is needed to set the terms for IPP participation in the power market. The policy, which may overlap with the RE policy outlined above, will:
    - State that at least some predetermined level of new RE supply will be provided by IPPs.
    - Allow IPPs to sell directly to large users – with prepayment meter (PPM) funds going straight to the IPP.
    - Establish clear land ownership and leasing rules for IPPs.
    - Streamline the licensing process and minimize licensing fees and requirements.

Address Financial Barriers

The Government will take steps to address the financial barriers that currently exist for RE projects, thereby de-risking the investments. Among the actions it will consider taking are:

* + Helping identify funding for pre-feasibility studies for RE projects, particularly in the areas of waste-to-energy systems and cogeneration.
  + Adopting on-bill financing for small-scale on-site solar systems, including solar geysers.
  + Assisting and encouraging commercial banks to work with multilateral and bilateral donors to establish special on-lending and co-financing initiatives to increase the availability of affordable debt capital to small-scale renewable energy businesses.
  + Assisting and encouraging commercial banks to pursue a renewable energy loan bundling strategy that allows the bundled loans to be sold on the secondary market, as is being done in Kenya and Rwanda.
  + Pursuing solutions to the high country risk problem, such as off-taker (ESCOM) payment risk, foreign exchange risk, and regulatory and policy-related risk. The government will examine ways to reduce the foreign exchange risk and will address off-taker payment risk through either the use of sovereign guarantees or by allowing RE IPPs to receive PPA payments directly from the utility bill collection entity before the collected bill revenue is given to ESCOM. This later approach is already being undertaken for the first solar IPPs.
  + Eliminating or decreasing the VAT on RE products. This can only be done if it can be shown that the increased revenues resulting from RE investment will offset the lost revenue from the VAT exemptions. The equipment exempted from the VAT will have to be clearly identified and be used only for renewable energy projects.
  + Establishing rules for solar service agreements so that solar vendor/installer can receive tax incentives from the government as well as payments from the solar consumer for the electricity, and can then sell that electricity to ESCOM at the feed-in tariff price.

**National Energy Efficiency & Renewable Energy Development Commission**

The Government will consider establishing a dedicated EE/RE commission

* + The commission would be somewhat like India’s IREDA and have a clear mandate to implement the national RE policy. The activities of the commission would include helping establish the country’s IPP policy, helping IPP developers through the regulatory process, certifying RE products and installers, working with MERA on setting and revising feed-in tariffs, and developing new policy to be established as law.

Modernize the Electric Grid

The Government will take steps to improve and modernize the electric grid:

* + Widespread development of RE is not possible without an improved T&D infrastructure to allow wheeling of RE-generated electricity and increased overall reliability.
  + Modernization of the grid, including the use of advanced information and communication technologies, will be beneficial on a number of levels, including the ability to incorporate and manage electricity coming to the grid from a variety of intermittent RE sources.
  + Other grid improvement techniques could include GIS mapping, synchrophasers, and AMI metering with remote reading and load control.

**Education and Training**

The Government will implement RE education and training programs:

* + Improve/increase educational and training opportunities for students as well as officials in national government, local government, financial institutions and small and medium-sized enterprises (SMEs).
  + Establish RE training programs at technical colleges.
  + Establish an RE internship program for college graduates.
  + Establish an RE awareness initiative, including introduction a media strategy including radio and newspaper, and holding RE fairs.

Energy Efficiency

**Solar hot water heating**

The Department of Energy will coordinate with other ministries and stakeholders to move a solar hot water heating initiative forward. It will support the following actions.

* + Future new housing schemes will be required to install solar geysers.
  + A large scale promotion campaign will be carried out through the local banks and the Utility company, offering subsidized loans that can be repaid through the electricity bills of the households.
  + Additional tax incentives will be proposed that will encourage local manufacturers to engage in production of solar powered geysers.

**Domestic lighting**

* + The Government and ESCOM will expand their effort to promote efficient household lighting.
  + Future programs will involve popularization of the most efficient technologies currently present at the market (e.g. LED) and will be combined with extensive awareness raising campaigns.

**Pre-paid meters**

* + ESCOM will extend the PPM program until a 100% coverage in the residential sector is reached before 2030.
  + Pre-paid metering for public sector entities will also be considered.

Large industrial and mining companies

Malawi can achieve substantial energy saving results by supporting and incentivizing various programs for EE promotion in the industrial and mining sectors. Special attention will be paid to the following priority areas:

* + Programs for replacement of standard burnt motors, gear boxes and conveyors with energy efficient ones.
  + Installation of variable speed drives on large motors operating under fluctuating loads.
  + Mandatory energy audits for large users.
  + Mandatory regular examination and maintenance of large motors.
  + Automation of steam generating boilers.
  + Installation of combined heat and power generators where applicable.
  + Promotion of sub metering in complex industrial and manufacturing processes.

Agriculture

* + Focus on the highest energy consuming processes – tobacco curing, tea drying, irrigation water pumping.

**Supply-side**

* + Revitalization and upgrade of the existing transmission network.
  + Reinforcement of the existing electricity distribution network through upgrades of substations and installation of modern communication equipment.
  + Rehabilitation of the existing power plants.

**Institutional approach**

In the longer run (up to 2023) establish a National EE and RE committee to:

* + Supervise and follow the achievement of the nationally determined annual targets for energy savings and RE potential utilization.
  + Actively participate in the development of drafts for EE and RE related national legislation and bylaws.
  + Develop national energy savings measurement methodologies (based on internationally accepted protocols).
  + Issue national energy auditing guidelines for buildings and industrial processes.
  + Together with the MoNREM determine specific EE targets for large energy consumers.
  + Collect and record energy savings related data and follow for compliance with the specific EE targets set for large energy consumers.
  + Issue certificates for energy auditors and maintain a list of certified auditors and auditing firms.
  + Organize energy management and energy audit training events.

**New Energy efficiency law**

* + Energy management regulations.
  + MEPS.
  + Promote green building code.
  + National EE audit and action plan.

Transportation – Biofuels and EV’s

* + Establish a biofuels inter-ministerial coordinating committee to promulgate and evaluate biofuels policies.
  + Reinforce or introduce incentives for biofuel production.
  + Promote the use of biofuels through pricing policy, tax incentives for users, price floor for producers and facilitate biofuel distribution.
  + Promote EV’s, especially electric buses and trams in the near-term.
  + Promote biogas for transportation.
  + Capitalise on research and development and experience in other countries on other feedstocks (other than jatropha & sugarcane).

Urban Transportation

* + Phase out mini-buses.
  + Develop a public transportation system.
  + Use labels and standards through the integration of EU minimum emission standards for all registered vehicles.
  + Promote an appropriate car maintenance.
  + Improve road capacity and maintenance.
  + Develop urban and suburban rail transportation system.
  + Support the development of non-motorised transport.
  + Develop land use planning policies.
  + Improve efficiency of traffic flow.

**Harmonize decision making**

* + Establish inter-ministerial committee with authority to develop and implement the transport planning measures.

**Mass transit system**

* + Phase out minibuses and create a public road transportation system.
  + Phase in a comprehensive public transportation system in major cities with a combination of large and small capacity buses to Blantyre, Lilongwe and Mzuzu including the establishment of dedicated bus lanes on the corridors with the highest ridership levels.
  + Prohibit the entrance of minibuses in city centres and other areas with high congestion.

**Establish a funding system for the transportation system**

* + Mobilising funding from international organisations (e.g. UNIDO, UNEP, EU, World Bank) and individual countries to support fuel-efficient transit options and sustainable urban transport planning.
  + Use of the levy on second-hand vehicles, coupled with an imposition of a levy on fuel sales and highway tolls to supporting mass transit and other transport-related activities.
  + Direct funding from the state budget and private investors.
  + Provision of concession to associations and other private sector investors.

**Increase the average fuel efficiency of motor vehicles**

* + Adopt a system of labels and standards.
  + Promote appropriate car maintenance.
  + Improve road capacity and maintenance.
  + Develop urban and suburban rail transportation system.

**Establish travel demand management**

* + Land use planning policies that integrate residential and employment areas to minimize the need for transport.
  + City planning and development measures that focus on high density mixed use development.
  + Improve the efficiency of traffic flow:
    - Support the development of non-motorized transport.
    - Parking supply restrictions: This can be achieved either by limiting the physical supply of parking space in the central area or charging parking space to discourage private vehicles entering the central business district.
    - Develop synchronised traffic signals: intelligent traffic light control algorithm (“Adaptive Traffic Control system”) that works on GPS and other data (pilots in Johannesburg).
    - Integrate traffic flow concerns in land use planning, by preventing heavy vehicles in densely populated areas, promote mixed use planning to minimise the need of traffic, plan for pedestrians and street vendors to minimise conflict with vehicular traffic etc.
    - Promote Eco-driving: smarter and more fuel-efficient driving techniques.
    - Embark on awareness campaigns on the benefits of public transportation, non-motorised transport and other aspects of sustainable transportation.

1. Introduction

Malawi is a small landlocked country in South/Central Africa bordered by Mozambique, Tanzania, etc. Its population, according to the most recent assessment in 2012, was 14.8 million people. By 2014, the population had increased to 16.8 million[[7]](#footnote-7). Approximately 84% of Malawians live in rural areas, practicing subsistence farming as their main source of livelihood.

Malawi’s economy is based on agriculture, with tobacco as the largest export earner. The growth of other sectors such as mining has seen the contribution of agriculture in the National Economy declining from 38% in 1994 to 27% in 2010. The Kayelekera Uranium mine in Karonga boosted the mining sector since its inception in 2009. The gross domestic product (GDP) has grown at an average of 7.1% during the period of implementing MGDS, roughly from 2008 to 2011, compared to an average of 3.5% during the period prior to the Malawi Growth and Development Strategy (MGDS). GDP grew by 6.1% in 2014 up from 5% the previous year and was US$4.2 Billion[[8]](#footnote-8). Mining declined by 7.8% as compared to the growth of 7.6% in the previous year. This has been due to the closure of Kayekera Uranium mine in May, 2014 as a result of price shrinking on the global market. Foreign exchange reserves increased by 20% during the year and closed at US$922 million equivalent to 4.83months of import cover compared to 4.09 months of import cover in 2013. Budgetary support has been suspended due to the cash gate scandal of rooting public funds. However there is direct donor funding of projects which cushions the forex reserves. Inflation remained high in 2014 and it closed at 24.2% by December whereas in 2013 it closed at 23.5% in December. The current detailed economic status of the country is outlined in the Economic Report 2015 for Malawi.

Extreme poverty has also dropped from 50% in 2005 to 39% in 2010, while population without adequate energy dietary intake requirement dropped from 22% in 2005 to 15% in 2009 (MGDS II, 2012). The statistics are likely to be worse off now following the recent implementation of a “zero deficit budget” and other austerity and balance of payment measures, including the devaluation of the local currency.

The United Nations Human Development report of 2011 categorizes Malawi’s human development as low and is ranked at 171 out of 187 countries that were assessed. Through MGDS II, Malawi Government is committed to the implementation of Millennium Development Goals (MDGs). MGDS II is the current medium term overarching development strategy which is supposed to run for the period 2012 to 2017. In terms of achievement of MDGs, Malawi is on course to attain at least five out of the eight MDGs. The three that are unlikely to be attained include achieving universal primary education, reducing gender inequality and maternal mortality, though certain indicators of MDG-7 on Environmental Sustainability, specifically around forest cover, are also lagging behind.

Energy is essential for Malawi’s economic development and efforts to reduce poverty. Yet, despite increasing electrification and use of modern fuels, just 10% of the population has access to electricity, and biomass, used chiefly for cooking, dominates the country’s energy balance. Biomass in the form of wood is the main fuel used in rural areas. Such heavy reliance on biomass has negative consequences for human health and the environment. One of the main objectives of SE4ALL is to reduce that reliance through improved cook-stoves and alternative cooking fuels like LPG and biogas.

Another energy issue for the country is the increasing reliance on oil imports for road transport despite the country’s biofuel blending program. Malawi, like most countries in the world, relies heavily on imported oi, which tends to be more expensive in Malawi because the country is landlocked and overland fuel transportation costs are high.

Electricity represents a small share of Malawi’s energy use, but its generation, transmission and distribution dominates overall energy sector investment. Hydroelectric generation has been the dominant power generation technology and while it will continue to play a major role, there will be an increasing emphasis on sources like solar, wind, sugarcane-fired bagasse cogeneration and small hydro power (> 30 MW). The SE4ALL initiative calls for a global doubling of renewable energy use and this is certainly possible in Malawi. MERA, the energy regulator, has developed a Renewable Energy Feed-in Tariff (REFiT) and independent power producers (IPPs) have submitted RE power supply proposals.

In particular, solar energy will play a greatly expanded role in providing electricity both to the grid and to unserved populations in rural areas. Electricity access will increase through both ongoing grid extension and the expansion of off-grid solar home system programs and mini-grids.

Another key focus of SE4ALL is energy efficiency. There is great potential to improve energy efficiency in Malawi’s industries, buildings, appliances and motor vehicles.

The SE4ALL initiative comes to Malawi at a time when there is increased government activity in support of sustainable energy development. Policy initiatives that are already underway include the Malawi Energy Policy (NEP) of 2003, updated in 2016. The NEP calls for making Malawi`s energy sector sufficiently robust and efficient to support the country`s efforts in poverty reduction and sustainable economic growth. This policy`s long term vision is to drive the Malawian economy from a largely biomass reliant one to an economy based on efficient use of modern energy sources like LPG and renewable energy. In addition to the NEP, the government has developed a Renewable Energy Strategy (in draft form in February 2017) and is implementing transmission system upgrades and regulatory reforms with support from the Millennium Challenge Corporation and the U.S. Power Africa initiative.

The Malawi Growth and Development Strategy II (MGDS II) is the second medium term national development strategy formulated to attain the country`s 2020 Vision. It is a decisive and strategic single reference document to be followed by all stakeholders to achieve the goal of wealth creation through sustainable economic growth and infrastructure development. Energy is among the nine Key priority areas identified and addressed in MGDS II.

Although the energy sector accounts for just 4% of Malawi’s total greenhouse gases (GHG), it is projected to expand to 17% by 2040. The forestry sector accounts for the largest share of Malawi’s emissions, at 78%, and much of this is due to forest cutting for fuelwood and charcoal for cooking. There is thus strong support for sustainable energy development in the Malawi Climate Policy and in the country’s Intended Nationally Determined Contribution (INDC) to reduce GHG[[9]](#footnote-9).

This SE4ALL Action Agenda for Malawi has been developed according to the guiding principles contained in the Guidelines for Developing National Sustainable Energy for All Action Agendas in Africa that were developed by African stakeholders, notably: (i) Building on existing plans/programs/strategies; (ii) Political commitment and leadership; (iii) A balanced and integrated approach; (iv) An inter-ministerial and cross-sectoral approach; (v) Adherence to sustainable development principles; (vi) Participation and meaningful involvement of all stakeholders; (vii) Gender equality and inclusiveness; and (viii) Transparency and accountability.

The government is committed to accelerating Malawi’s SE4ALL actions outlined in this report, and integrating them within a broader economic policy. SE4ALL builds on Malawi’s energy and economic foundations to move the country to an energy system that is clean, efficient, and reliable, and that makes modern fuels available to all citizens.

1. Methodology

This Action Agenda is based on extensive desk and field research by the Deloitte-Econoler consulting team. The desk research entailed reviews of policy documents, strategic plans, national development plans, budget statements, quarterly and yearly fiscal reviews, and audit and parliamentary reports, among others. It also involved reviews of scholarly reports, newspaper and magazine articles, and documents about sustainable energy approaches employed in other countries in Africa and around the world.

The field research involved conducting interviews with stakeholder institutions in Lilongwe and Blantyre. The interviewed stakeholders included representatives of government ministries, local governments, energy suppliers, private firms, universities, trade associations and NGOs.

In addition, a 2-day workshop was held in Salima, Malawi in November 2015 to facilitate discussion among stakeholders from around the country and collect their viewpoints and policy recommendations. Their input came in the form of both presentations from key stakeholders and discussions/recommendations from four thematic working groups organized around Energy Access, Energy Efficiency, Renewable Energy, and Transportation.

Finally, questionnaires were sent to a set of stakeholders in the areas of energy efficiency and transportation in order to get their more detailed views on certain policy matters. These were supplemented by more in-person bilateral meetings with people active in energy access and renewable energy. A draft of this report was prepared by the consultants and circulated to the working groups and the Department of Energy and African Development Bank. A second set of working group meetings were convened in Lilongwe in April 2016 to discuss the draft Action Agenda and to recommend priority actions.

After these working group meetings, a second draft of the Action Agenda was prepared and circulated to the working groups and other stakeholders. A third draft was prepared and circulated to a “quality circle” of reviewers such as donors and other international agencies.

A fourth draft was then prepared and submitted to a “validation workshop” held in Lilongwe in February 2017. The participants invited to the validation workshop were mainly high-level government officials from other ministries besides the energy ministry.

This final Action Agenda is based on the results of the validation workshop as well as additional comments received from stakeholders.

1. Part I -Vision and targets through 2030

Guided by its Energy Policy of 2003 and 2016 a, Malawi is seeking to develop its energy sector in an environmentally and economically sustainable manner, to strengthen its electricity grid, diversify its generating capacity and extend electricity services to its unserved populations. Among other measures, the nation has developed an ethanol industry that has resulted in blending ethanol with petrol for motor vehicles; preliminarily approved a feed-in tariff to incentivize large-scale renewable energy investments; increased rural household access to electricity and improved cooking technologies through initiatives with a number of donor agencies and NGOs; However, on Malawi’s current trajectory, it will be many decades before the country’s economy and people will derive a majority of their energy from clean, efficient sources of energy.

In this chapter, the current state of affairs in energy is reviewed and the business-as-usual trajectories are examined. This is followed by the presentation of new targets in the areas of energy access, renewable energy, energy efficiency and transportation. The targets are based on analysis of the existing situation, consideration of existing trajectories and consultations with stakeholders in Malawi. It is this last area – consultation with stakeholders – that is of paramount importance in developing the targets outlined in this chapter to increase the use of efficient cook-stoves, increase off-grid access to electricity, develop large-scale, grid-connected renewable energy projects, increase the use of alternative fuels in transportation, and improve the efficiency of urban transport systems. The proposed targets are ambitious but are achievable if the right leadership, legal and institutional structures, and financial resources are brought to bear on the energy sector.

Finally, this chapter addresses the gap between the BAU trajectory and the targets, and describes the barriers preventing the achievement of the targets.

* 1. Energy sector status and trajectory

Energy Sector Status

The energy sectors of Malawi include biomass, electricity, liquid fuels and gas, coal and renewables with biomass having the largest contribution to the energy balance of the country. The Malawi Energy Policy indicates that approximately 93% of energy comes from biomass largely exploited in a non-sustainable manner. Imported petroleum account for 3.5% of the energy and electricity produced from hydro power accounts for 2.3% of all energy.

Malawi’s interconnected grid electricity is from hydro. The installed interconnected capacity of hydro is 351 MW of which 311MW is operational but is not all used due to low water levels along the Shire River. The suppressed demand is 350 MW. The hydro power is more than 90% concentrated on the Shire River with only 4.5MW on Wovwe River and this brings about high insecurity in terms of national power supply. Likoma Island is powered by diesel generators rated at 250kW. The total units generated in 2014 were 1,906.51GWh and consumed were 797,46GWh. If all the potential domestic and industrial customers were connected, the demand could even triple. All petroleum products are imported. The current levels of importation by Petroleum Importers Ltd and National Oil Company of Malawi according to Malawi Energy Regulatory Authority (MERA) are as shown in Annex 1.

The operators in the liquid fuels and gas industry include: Puma Energy, Total, Petroda, Energem, Injena,Mt Meru, Afrox Malawi Ltd, Press Cane and Ethanol Company Ltd. Puma Energy, Total, Petroda, Energem, Mt Meru and Injena trade in petrol, diesel and lubricants while as Afrox Malawi Ltd trade in gas and LPG. Press Cane and Ethanol Company Ltd trade in fuel ethanol as an energy component. It should be pointed out that all the import volumes by PIL less handling losses are consumed by the end of the year.

The production of fuel ethanol by Press Cane and Ethanol Company of Malawi subsidiaries of Press Corporation Group of Companies is currently being tested on petrol vehicles by fitting in a device which enables the vehicles to use fuel ethanol without blending. If the test is successful and ethanol production can be increased to meet the demand, all petrol vehicles will be fitted with the enabler device and reduce importation volumes of petrol thereby saving forex.

Ethanol was approved by MERA as a legal fuel in 2014. This has resulted into plans which are underway to construct separate pumps for fuel ethanol where petrol vehicles will be filling their tanks for fuel ethanol in all major towns of the country. However blending of ethanol fuel with petrol at 90:10 is still continuing. National Oil Company of Malawi which has been established under the act of Parliament to manage a strategic fuel reserve facility in now operational. Currently the government is negotiating to import electricity from Mozambique. This would tap into the Southern Africa Power Pool (SAPP) and substantially reduce power outages and rationing which is frustrating both domestic and industrial users. Issues of energy subsidies and tariffs will be critical.

Energy Demand

The Malawi Energy Policy 2003 has segmented the energy demand sectors into the following categories household, agriculture and natural resources, industry, mining and construction, transport and social services. As of 2003, biomass was satisfying 99% of the household energy demand. The situation has slightly changed to 98% with the increase in the access to electricity. According to the Biomass Energy Strategy (2009) the energy mix has been estimated as shown in the Table 8 below.

Table 8: Energy demand by fuel type[[10]](#footnote-10)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sector | Energy demand by fuel type (TJ/ yr) | | | | | |
| **Biomass** | **Petroleum** | **Electricity** | **Coal** | Total | |
| Household | 127,574 | 672 | 1,798 | 5 | 130,049 | 83.2% |
| Industry | 10,004 | 3,130 | 2,010 | 3,481 | 18,625 | 11.9% |
| Transport | 270 | 5,640 | 35 | 15 | 5,960 | 3.8% |
| Service | 452 | 558 | 477 | 174 | 1,661 | 1.1% |
| Totals | 138,300 | 10,000 | 4,320 | 3,675 | 156,295 |  |
| % | 88.5 | 6.4 | 2.8 | 2.4 |  |  |

The Malawi government’s aspirations are depicted in the National Energy Policy (NEP) of 2016, which emphasizes moving the country away from biomass to more modern energy sources. Specifically, the NEP calls for the following:

* + Increase the number of households with electricity to 30% by 2020 and 40% by 2050. The current (2015) electricity access rate is around 10%.
  + Construct new 220-330 kV backbone North – South transmission line.
  + Policy and regulatory review to encourage private sector generation and adoption of vandal free technologies. (Independent Power Producer Agreement Framework and Feed-in-tariff have been developed).
  + Increase petrol-ethanol blending ratio from 90:10 to 80:20.
  + Increase internal storage capacity using government and private sector facilities from 6 days to 30 days.
  + Promote use of LPG at the household level.

Malawi's energy consumers consist of household, services, industry and transport. Household subsector accounts for 83% (Table 9 below).

|  |  |
| --- | --- |
| Table 9: Energy mix projections[[11]](#footnote-11) | Figure 1: Energy consumption |

Annual energy consumption is estimated to range from 150TJ to 156TJ [[12]](#footnote-12). The study by Openshaw showed that the consumption pattern has not changed much as per Figure 1.

Despite positive trends in the economy, Malawi's energy per capita is still very low. International Energy Agency estimated it as 12.14 GJ compared to an average of 23.57 GJ and 76.2 GJ for low income countries and global average respectively. Energy per capita is not growing at the same rate as the economy. Factors that constrain the growth in energy per capita are a combination of demographic (84% rural based population) and entrenched poverty, hovering around 50%. The majority of people cannot afford modern energy services. The issue of affordability is a main reason for the limited success of rural electrification efforts.

The Malawi energy mix is made up of five components, namely: biomass[[13]](#footnote-13), electricity, liquid fuel and gas, coal and other renewables. Just as biomass is the main fuel used, it is also the man fuel supplied.

* + Biomass contributes the largest share (89%) of total energy use, and is mainly in the form of firewood, charcoal (for urban areas) and crop residues.
  + The share of total commercial energy[[14]](#footnote-14) consumption to total energy consumption is relatively small (at 26% of the total energy consumed). Most of the commercial energy consumed is biomass (15%) followed by petroleum (6%).
  + By sector, the household is the largest consumer of energy (83%) followed by industry (12%). At 98% of total energy consumed, biomass is the dominant energy source in the household sector.

4.1.2 Electricity generation and transmission plans

The growth in electricity generation capacity has lagged behind the growth in electricity demand for a long period. In the recent past, the government has expressed the urgency to expand its generation capacity. The National Energy Policy forecasted demand for electricity would be 420 MW in 2015, 1,000 MW in 2020, 1,750 MW in 2025 and 2 550MW in 2030 under moderate economic growth scenario.

With the support of the US government through the Millennium Challenge Corporation (MCC) and the Power Africa initiative, there is ongoing work to improve transmission and distribution, as well as upgrade generation and improve regulations with regard to IPPs.

The Malawian government has firm plans to add generation from 351 to 429 MW by 2018 through upgrading Nkula A (24 MW + 12 MW), expansion of Tedzani (21 MW) and installation of three diesel generators that will add 45 MW for peak power management. Table 10 below shows the supply deficit if the status quo remains.

Table 10: Projections on peak demand, capacity requirement and ESCOM's supply capacity[[15]](#footnote-15)



Furthermore, a 50 MW Kapichira III hydropower plant expansion project is to be funded by EGENCO, the new government generation company created by the break-up of the government electric utility company, ESCOM. This project is currently at the pre-feasibility stage and is slated for completion in 2020.

Apart from the government/EGENCO supported projects, independent power producers are also expected to bring an additional capacity into the national grid dependent on favourable power purchase agreements. Independent Power Producers have been signing MOUs with the government, and the government plans to add 1,500 MW by the year 2020[[16]](#footnote-16). MERA is reported to assume the responsibility of a negotiator from ESCOM, which is viewed as an interested party[[17]](#footnote-17).

In addition, a 300 MW Kammwamba coal-fired electric power plant is planned for completion between 2018 and 2020 using coal from Moartize in Mozambique, while 100 MW at Pamodzi in Salima will be using local coal.

Malawi has coal reserves of over 1 billion metric tonnes but about 22 million metric tonnes are proven (most of which are of sub-bituminous type)-with average calorific value of 24.9 GJ/tonne( NEP,2003, page10), this is equivalent to 547.8 PJ of energy. Coal production was 70,552 and 67,024 million metric tonnes in 2012 and 2013 respectively. Coal companies in Malawi (Mchenga, Kaziwiziwi, Malcoal and Eland) supply about 95% of coal required.

In addition, a 30 MW solar energy project with Canadian firm JCM Capital is under discussion with the government.

Illovo sugar estates produce electricity from cogeneration using bagasse. The total installed electricity capacity from Nchalo and Dwangwa estates is 18 MW but could potentially generate 100 MW from the two estates[[18]](#footnote-18).

Malawi has more than 2,000 MW of hydropower potential. Figure 2 shows the location and other details for these potential hydropower projects. Six hydropower projects exist with completed feasibility studies or with feasibility studies currently underway with donor support. These are: a 50 MW hydropower project called Chizuma; a 50 MW hydropower project called Chasombo; a 100-280 MW Mpatamanga project; a 100-150 MW Lower Fufu project; a 20-50 MW Chimgonda project; and a 140-280 MW Kholombidzo Project. There are other Interests in hydropower plants by IPPs: a 52MW plant at Mulanje massif by Kuwale Power and a 40MW plant on Bua River at Mbongozi by HE Power. The government is also in the process of upgrading the nation’s transmission grid, with the MCC supporting the installation of a new North-South transmission line (See Figure 3).

|  |  |
| --- | --- |
| Figure 2: Potential hydropower projects in Malawi | Figure 3: MCC Infrastructure Project Investments |

Petroleum

The dominant petroleum products used in Malawi are diesel and petrol (Figure 4) that are used chiefly for transportation. Malawi is not a producer of any petroleum products. All of it is imported. Figure 5 gives the history of petroleum imports for the period 1999 to 2013.

The transport sector consumes about 43% of the commercial energy in Malawi. Petroleum products provide 96% of transport energy, with the remaining 4% coming from local ethanol that is blended with petrol at an official blending ratio is 20:90[[19]](#footnote-19). The blending ratio is however not met because of limitation of the locally produced ethanol.

Under Energy Laws, MERA is mandated to regulate pump price for fuels. There is an automatic pricing mechanism which is triggered by movements in the procurement costs and the exchange rate of the Malawi Kwacha against the US Dollar.

Figure 4: Petroleum products supply based on total imports from 1999 to 2013[[20]](#footnote-20)

Due to rapid growth of the number of vehicles, the demand for petroleum products will witness a growth in demand and it was expected to rise to more than 350 million litres by 2015, which will further increase to around 417 million litres by 2030 assuming straight line growth. However, the Annual Economic Report (2015) showed sharp decline due to lower demand of diesel for electricity generation at Kayelekera Uranium Mines. From 2013 to 2014, diesel alone dropped from 212.6 to 159.8 million litres. The actual demand for 2014/15 was 278 million litres.

Figure 5: Fuel import projections[[21]](#footnote-21)

Other energy-related policy processes

The SE4ALL process comes to Malawi at a time when the country has emphasized energy as a key element of its development strategy and is developing an update to its national energy policy of 2003.

**The Malawi Growth and Development Strategy II (MGDS II)** is the second medium term national development strategy formulated to attain the country`s 2020 Vision. It is a decisive and strategic single reference document to be followed by all stakeholders to achieve the goal of wealth creation through sustainable economic growth and infrastructure development. Energy is among the nine Key priority areas identified and addressed in MGDS II

**Malawi Energy Policy (NEP) of 2003, updated 2016.** The NEP calls for making Malawi`s energy sector sufficiently robust and efficient to support country`s efforts towards poverty reduction and sustainable economic growth. This policy`s long term vision is to drive Malawian economy from a hugely biomass energy reliant one to an economy based on efficient use of modern means and sources of energy. The new draft energy policy addresses some of the same themes as this Action Agenda, particularly in the areas of increasing energy access and grid-connected renewable energy.

* 1. Energy access – Clean cooking

What is the current status and BAU trajectory to 2030?

Current status

According to the National Statistical Office (NSO), Malawi's population is estimated at 17 million, growing at 2.8% per annum.[[22]](#footnote-22) The population is estimated to reach 20 million by 2020 and 27.5 million by 2030. It is further estimated that rural population is approximately 84% which predominantly uses biomass as a source of energy for cooking. This entails 2.9 million households residing in rural areas depend on biomass for cooking and require efficient cook stoves for clean cooking. This is evidenced by the Table 11 below which indicates that 87.7% of households use firewood for cooking in Malawi.

Biomass is however the dominant fuel for cooking in both urban and rural areas. Table 11 below shows the fuel use distribution based on the Integrated Household Survey (IHS) 3 that was conducted by NSO (2011).

Table 11: Fuel use distribution

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | % using solid fuel | Firewood | Electricity | Charcoal | Crop residues | Other |
| Malawi | 97.4 | 87.7 | 2.5 | 8.9 | 0.8 | 0.2 |
| Urban | 87 | 41.9 | 12.6 | 44.6 | 0.5 | 0.4 |
| Rural | 99.3 | 96.2 | 0.6 | 2.3 | 0.9 | 0.1 |
| N. Region | 98.9 | 95.3 | 1.1 | 3.5 | 0.1 | 0.1 |
| C. Region | 97.8 | 89.9 | 2.1 | 7.6 | 0.3 | 0.1 |
| S. Region | 96.7 | 83.8 | 3.1 | 11.5 | 1.5 | 0.2 |

During the stakeholders meetings, the current biomass situation was summarised by stakeholders as consisting of:

* + A country-wide overdependence on biomass.
  + Limited use of, and access to, efficient cook stoves.
  + Limited access to biomass energy sources.
  + Widespread unsustainable charcoal production.
  + Tea industry still maintaining the 10% trees cover but tobacco industry still a problem.
  + Institutions with high number of people still using firewood for cooking.
  + Limited access to firewood alternatives Some institutions using electric pots.

Biomass

Rural and urban cooking fuels include firewood, charcoal and agricultural wastes. Charcoal is mostly used in urban areas but it originates in rural areas, including protected government forests and community forests. The nation’s overall wood consumption exceeds sustainable supply by about 2.37 million cubic metres. The Malawi Energy Policy estimates that 48% of the biomass used comes from sustainable supply, 47% from natural woodlands (unsustainable) and 5% comes from wastes from agriculture and industrial sectors. The biomass consumption by the different energy sectors is as shown in the Figure below:

Figure 6: Biomass Consumption in Malawi[[23]](#footnote-23)

There have been a number of programs to reduce the pressure on forests through the promotion of improved biomass stoves that generate fewer emission and are more energy-efficient than traditional cook stoves. Probably the largest program was the GIZ-funded Programme on Biomass Conservation (ProBEC). The program started in Malawi and expanded to Tanzania, Zambia, Zimbabwe and Mozambique, building community capacity to build improved stoves. It played a big part in the popularization of the improved biomass stoves in the country and the region. Another large program was the EU-funded Program on Sustainable Energy in Balaka managed by Concern Universal. There have been many other smaller improved stove dissemination programs by Total Land Care, Pride Africa, USAID, among others. Currently, there is a Cook Stoves Road Map Program whose objective is to accelerate the uptake of clean and efficient stoves to 2 million households by 2020. It is estimated that there are more than 500,000 clean and efficient cook stoves being used in Malawi if we consider the number of electrified households in Malawi which were 308, 278 in June, 2015.This is so because most electrified households use clean, efficient cook stoves in addition to their electric cookers, hot plates and LPG gas cookers. However, many electrified households use charcoal as well.

After the ProBEC programme the government of Malawi through Department of Energy instituted the preparation of the Biomass Energy Strategy (BEST) in 2009. The BEST objective was to develop a rational and implementable approach to the management of Malawi’s biomass energy sector through a combination of measures designed to improve the sustainability of biomass energy supply, raise end user efficiencies and promote appropriate alternatives. The strategy addresses thermal application of energy and primary cooking. It covers domestic, institutional and industrial applications of biomass and includes both commercial and non-commercial users of fuel[[24]](#footnote-24). The BEST analyses the supply and demand side of biomass in Malawi with a view to come up with challenges and solutions to the challenges. The major challenge highlighted by the BEST is that most parts of the country especially Central and Southern Regions has the demand for biomass more than the supply such that biomass is being used un sustainably in these two regions. The BEST also highlights the fact that biomass is the most important fuel in terms of quantity and it accounts for 88.5% of final energy demand and 92% of household demand. In order to ensure that biomass is exploited in a sustainable manner the BEST puts forward the following recommendations:

* + Biomass that is at community level should be exploited in such a way that the community closer to the biomass should benefit.
  + The pricing of biomass should be economical.
  + The regulation of the biomass sector should not only involve punitive measures but should also bring forward incentives for the operators in the biomass sector.
  + The private sector should be encouraged to be involved in the biomass sector through organized markets backed up by effective regulation.
  + Institutional mechanisms should be put in place such that the biomass sector becomes a formal sector rather than the informal sector in which it is currently operating.
  + The government and NGOS should play their rightful role of policy and advocacy respectively.

Currently, there is a Cook Stoves Road Map Program whose objective is to accelerate the uptake of clean and efficient stoves to 2 million households by 2020. The program period is January 2015 to December 2017. The partners in the program include the National Cook Stoves Taskforce, Department of Energy, Department of Forestry, Private Sector, Civil society organizations and Development partners. The program will catalyse sustained uptake of clean and efficient stoves in Malawi in order to save energy and reduce smoke emissions for improved cooking environment in Malawi households. Specifically the expected outputs of the programme include the following[[25]](#footnote-25):

* + National Cook Stoves Taskforce strengthened and functional.
  + Cook stoves standards and testing mechanisms put in place.
  + Relevant policy and regulatory frameworks revised and harmonized in tandem with current alternative energy situation.
  + Cook stoves technologies promoted on basis of evidence from consistent testing results.
  + National capacity of cook stoves players strengthened.
  + Delivery models and financing mechanisms for catalysing mass uptake of cook stoves in place.

The Cook Stove Road Map recognizes that the rolling out of the road map to achieve the set target is achievable by promotion of different types of cook stoves to suit the different market segments. It is said in the road map that no single type of stove can be promoted to achieve the set target. It is therefore imperative that all institutions involved in the promotion of efficient cook stoves should be encouraged to produce more of their type of stove. The capacity of local manufacturers of stoves should be enhanced such that efficient stoves that were earlier imported should be locally produced. The Department of Energy and NGOS should lobby with the Ministry of Finance to reduce taxes on materials for production of efficient cook stoves.

It is estimated that there are more than 500,000 clean and efficient cook stoves being used in Malawi if we consider the number of electrified households in Malawi which were 308, 278 in June, 2015.This is so because most electrified households use clean, efficient cook stoves besides electric cookers, hot plates and LPG stoves. However, many electrified households use charcoal as well.

Existing plans and projections to 2030

Biomass will remain a dominant form of energy for Malawi for many years, but its contribution will significantly decrease in the energy mix from over 90% in 2000 to below 50% by 2030 as a result of major efforts to supply alternatives in the form of electricity, LPG and biogas. In addition, there will be more Malawians using energy-efficient biomass as the Cook Stoves Road Map is implemented. The Road Map’s objective is to increase the uptake number of efficient cook stoves to 2 million by 2020. By 2030, there will be 5 million efficient stoves disseminated in the country which will translate into 100% access to efficient cook stoves.

MAREP will continue extending the grid to rural trading centres and in turn this could influence fuel switching i.e. away from biomass towards electricity for cooking provided the grid extension is backed by adequate investment in new electricity generation. ESCOM has launched the Accelerated Access to Electricity Project which would also add on the number of consumers using electricity for cooking by way of fuel switching. Currently 2.5% of households use electricity for cooking (HIS by NSO, 2011). This represents 85,000 households. By 2030 there will be 135,000.00 households using electricity for cooking under BAU scenario. Under BAU the electricity access will be at 22%. However if we put a target of 10% of electrified households at 30% electricity access using electricity for cooking, there will be 540,000 households using electricity for cooking by 2030.

There is no data on the amount of LPG and biogas use for cooking. Nor is there good data on the number of LPG or biogas users. We know LPG is used mainly by more affluent consumers and restaurants, but this information is anecdotal. However we can estimate that 0.2% of households use LPG for cooking if we use the data provided by NSO (2011). This translates into roughly 6,800 households that use LPG. With regard to biogas plants, very few are in operation and the SE4ALL stakeholders agreed to an estimate of 50 households using biogas plants as a baseline figure, while the target of 2,000 in 2030 was thought to be ambitious but reasonable if government-supported technical assistance and financial incentives are put in place.

The government’s policy calls for Malawi to switch from a biomass-based energy economy to a modern energy economy. This entails a high level of investment in alternatives to biomass, such as LPG, biogas and electric cookers, as well as the use of more energy-efficient charcoal- and firewood-burning stoves. The Government of Malawi, through various stakeholders (mainly NGOS), is encouraging the usage of clean and efficient cooking stoves.

What is the target for 2030?

The following targets were established as a result of consultations with stakeholders regarding the current state of affairs and what targets might be achievable given sufficient technical, financial and regulatory support. As can be seen in the table below, efficient cook stoves have the highest target in terms of sheer numbers of units. The 2020 target of 2 million efficient cook stoves is the same as the National Energy Plan’s (NEP) target, although the 5 million target in 2030 is higher than the NEP target, which is 4 million by 2035. Stakeholders in the SE4ALL Energy Access Working Group thought the 5 million target for 2030 was very ambitious but achievable if sufficient support was in place for cook stove enterprise development, training for entrepreneurs, and public awareness and marketing campaigns.

Table 12: Proposed targets for Energy Access through 2030

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Type of energy technology | Percent of total population with access, 2016 | Baseline 2016 | Target 2020 | Target 2025 | Target 2030 | Percent of rural population with access, 2030 | | Percent of total population with access, 2030 | |
| Electric Cookers | <1.0 | 84,000 | 94,000 | 106,000 | 135,000[[26]](#footnote-26) | | 4.8 | | 4.0 |
| LPG stoves | <1.0 | 6,800.00 | 15,000 | 34,000 | 54,000.00[[27]](#footnote-27) | | 2.0 | | 1.6 |
| Efficient cook stoves | 3.0 | 500,000 | 2 million | 3.5 million | 5 million[[28]](#footnote-28) | | 100 | | 100 |
| Biogas | <1.0 | 50 | 500 | 1000 | 2,000 | | <1.0 | | <1.0 |
| Solar water heaters | <1.0 | 2,000 | 12,500 | 25,000 | 40,000 | | 0.7 | | 0.5 |

It should be noted that the target of 100% of households using efficient wood stoves does not mean that wood use will increase. Rather, it means a decrease in wood use because currently close to 100% of households use *inefficient* wood stoves. Furthermore, it should be noted that households that use electric cookers and LPG stoves tend to *also* use wood stoves. So even as the penetration of alternative cooking technologies increases and wood use decreases, the percentage of households that have wood stoves, albeit efficient one, will remain high.

Thus, the percentage of households that have efficient wood stoves is an imperfect measurement of biomass use. The ideal measurement of success should not be the number of energy-efficient cook stoves, but the lower amount of biomass used by households. We will explore the possibility of establishing a target for overall household biomass use and per capital household biomass use. Random samples of household biomass use and national surveys may be possible ways to establish a baseline on which to base a target.

As a very rough estimate, although there are several main types of efficient cook stoves, we can assume each efficient stove will avoid about 2 tons of wood use per year. With the target of 5 million efficient cook stoves in place by 2030, the amount of avoided wood use will amount to 10 million tons per year.

What is the gap between BAU trajectory and the new targets? What are the barriers?

There are a number of barriers to the uptake of clean cooking identified during the stakeholder meetings. These include:

* + High upfront cost of electric and gas cookers.
  + High upfront cost of LPG cylinders and ancillary equipment.
  + Unavailability of affordable financing for the purchase clean cooking equipment.
  + Lack of openness to alternatives to charcoal and firewood such as LPG.
  + Safety concerns with LPG.
  + Limited production of energy efficient technologies such as efficient cook stoves.
  + Limited sustainable production of firewood and charcoal.
  + Existing charcoal production establishments are not sustainable or legal.
  + Limited government capacity to enforce standards.

### Energy Access and Gender

The objective of the National Energy Policy with respect to gender is to ensure that gender issues are always considered in the planning and implementation of energy programmes and projects. In this regard the government will:

* + Ensure that the heavy work burdens of men and women are lightened by modernising household fuel supply system for the kitchen and for agriculture.
  + Identify ways in which men and women become equally independently involved in using energy as a source of income.
  + Ensure that men and women effectively participate in decision making.
  + Ensure that men and women are equally represented in local, national and international dialogue, extension work and resource management and are offered employment opportunities in the energy sector itself.

The objective and activities stated in the National Energy Policy, 2003 on energy and gender underscores the need to modernise the energy access such that women are not exposed to dangers of health when accessing energy. In Malawi energy poverty affects women greatly. This is so because it is women who are heavily involved in the sourcing of energy for the household. The energy sources which women are involved in sourcing are firewood, charcoal and agricultural wastes. Women travel long distances to collect such sources of energy. It is therefore important that modern sources of energy for heating and cooking such as electricity, LPG Gas and biogas are made readily available to the majority of the population. It is unfortunate that only 10% of the population have access to electricity and 2.5% of the population use electricity for cooking. This entails that 97.5% of the population heavily depend on traditional fuels for heating and cooking. There is therefore high gender imbalance in the energy sector which needs to be addressed by 2030 through removal of barriers to uptake of modern energy sources. Women should therefore be greatly involved in the promotion of decentralised energy options such as solar mini grids, biogas, mini and micro hydro power plants. The decentralised systems provide a greater opportunity for creation of equality in the energy access. There is need for deliberate government policy to promote interventions of energy entrepreneurships that involve women such as production of biomass briquettes and production of efficient cook stoves.

In order to improve the participation of women in energy access the following are put forward by the UN Women, UNDP and UNEP Working Paper of December, 2015:

* + Women need to be involved in the decision making and play a leadership role in promoting decentralised renewable energy access.
  + Women need to benefit from renewable energy programmes for economic empowerment.
  + Apply a cross sectoral approach to gender, climate and energy policy and programming.
  + Promote women’s productive use of renewable energy.
  + Reduce women’s time dedicated to unpaid care and domestic work.
  + Target policy processes and build capacity to mainstream gender, climate and energy in an integrated approach.
  + Remove investment barriers and create equal opportunities for women’s entrepreneurships and decent employment and access technologies.
  + Influence budget processes to fund implementation of gender sensitive energy and climate solutions.
  1. Electricity access – On site installations & Mini Grids

What is the current status and BAU trajectory to 2030?

Current status of Electricity Sector-Grid Extension

Malawi is one of the least electrified countries in the world, with just 10% of the overall population connected to electricity. Just 37% of the urban population and only 2% of the rural population have electricity connections (NSO, 2009). Overall, as of June 2015, the10% of the population who had electricity amounted to 312,846 customers, as shown in Table 13[[29]](#footnote-29). Comparatively, the sub-Saharan average is 10% for rural and 36% overall[[30]](#footnote-30).

Table 13: Customers connected to electricity in Malawi (2015)[[31]](#footnote-31)

|  |  |
| --- | --- |
| Number of Customers as at June 30, 2015 | Number |
| Domestic Prepaid | 186,205 |
| Domestic Postpaid | 104,858 |
| Single Phase P/Paid | 16,915 |
| Domestic 3 Phase p/Paid | 300 |
| 3 Phase General P/paid | 3,713 |
| 3 Phase MD LV | 752 |
| 3 Phase MD MV | 103 |
| Export | 11 |
| Total | 312,857 |
| Total Malawian Customers | *312,846* |

Given the amount they spend on paraffin and candles for lighting, some rural households should be able to afford to pay for electricity, at least for lighting. But house wiring costs and connection fees are beyond their reach. If the MAREP could extend the grid nationwide, up to 25% of the population could be connected and pay their lighting bills.

In order to increase access to electricity among the rural and low income urban households, ESCOM has launched a US$500,000.00 Accelerated Electrification Access Project[[32]](#footnote-32). The project will allow the consumers to have their houses wired and electrified at US$100.00 with this cost to be repaid in instalments bundled with electricity purchases. Table 14 shows the electricity access rates for different regions of the country.

Table 14: Access rates[[33]](#footnote-33)

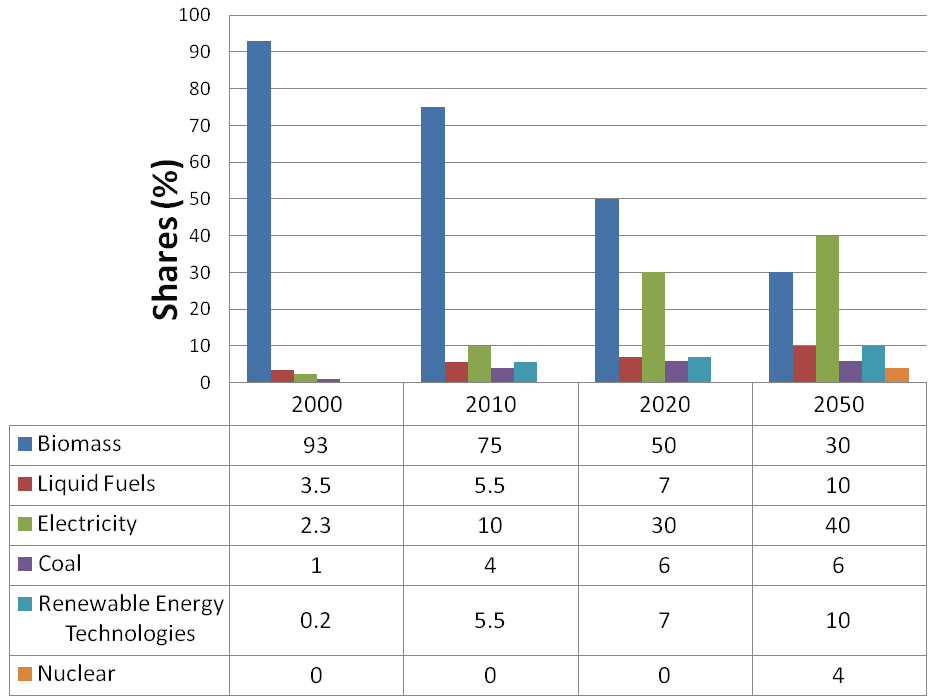
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Place of residence | Electricity within 100 m of dwelling | | Electricity in the dwelling | |
| IHS 2 | IHS 3 | IHS 2 | IHS 3 |
| Urban | 68 | 79.4 | 33.1 | 33 |
| Rural | 11.2 | 13.8 | 2 | 2.4 |
| North | 8.2 | 16.2 | 1.5 | 6.3 |
| Centre | 7.9 | 18.4 | 1.8 | 5.9 |
| South | 23.3 | 25.1 | 9 | 8.5 |

The Malawi Government continues to extend the grid to rural areas through MAREP based on the Master Plan Study conducted in 2002, which is regularly reviewed and updated. Since the original study, three implementation phases have been implemented. These phases are MAREP Phase V targeting 27 sites at a cost of MK889million, MAREP Phase VI targeting 54 sites at a cost of MK2.4 billion and MAREP Phase VII targeting 81 centres at a cost of MK6.8 billion. Currently the planning of MAREP Phase VIII is under way to be implemented in the financial year 2015/16 targeting 81 centres. The funding of MAREP is through a 4.5% levy on energy sales.

What is the target for 2030 for grid extension?

The target for 2030 is derived from the projected energy mix of the Malawi Energy Policy, as shown in Figure 7 below.

Figure 7: 2030 target for grid extensions



By 2030, 30% of households and businesses will be connected to electricity[[34]](#footnote-34). This will be possible if MAREP continues with its plan of increasing the number of trading centres per year through grid extension and ESCOM continues with the Accelerated Electrification Access Project. This entails 87,000 households and businesses being connected per year up to 2030. The 87,000 households and businesses could be attained per year through the following projected figures:

Table 15: Grid extension targets – SE4ALL

|  |  |  |
| --- | --- | --- |
| Method | Number of Households & Businesses-Baseline 2016/Yr | Number of Households & Businesses/Year through 2030 |
| MAREP-Grid Extension | 5,000.00 | 23,000.00 |
| ESCOM-Grid Extension | 50,000.00 | 64,000.00 |

The table below however shows the BAU scenario which was agreed upon during the Energy Access Working Group discussions held in Lilongwe on 27th April, 2016.

Table 16: Grid extension targets - BAU

|  |  |  |
| --- | --- | --- |
| Method | Number of Households & Businesses-Baseline 2016/Yr | Number of Households & Businesses/Year through 2030 |
| MAREP-Grid Extension | 5,000.00 | 10,000.00 |
| ESCOM-Grid Extension | 50,000.00 | 50,000.00[[35]](#footnote-35) |

* + 1. **What is the gap between BAU trajectory and the new targets? What are the barriers?**

The gaps between the BAU trajectory and the new SE4ALL targets are as follows:

Table 17: Grid extension targets - Gap

|  |  |  |
| --- | --- | --- |
| Method | Number of Households & Businesses-Baseline 2016/Yr | Gaps in the Targets |
| MAREP-Grid Extension | 5,000.00 | 13,000.00 |
| ESCOM-Grid Extension | 50,000.00 | 14,000.00 |

The following barriers and gaps affect electricity connection through grid extension:

* + New connections are costly and ESCOM has insufficient funds to accelerate the pace of connecting new customers..
  + Instead of hiring private companies to provide and install meters, drop wire, and other equipment directly on customer premises, ESCOM has kept the operations in-house, causing bureaucratic problems and high administrative costs.
  + It is difficult for many households to pay for grid electricity, especially because ESCOM has hiked its tariff by 18.18% resulting in a retail price of US9.4 cents/kWh, up from US8.0 cents/kWh..
  + Vandalism of the utility company equipment such as theft of transformer oil and earth mats has raised ESCOM operating costs and diverted funds that could be used for new connections.
  + Low generating capacity means that new customers will add to the generation shortfall and increase the strain on the system.
  + Environmental degradation of the catchment areas for rivers that provide hydro power.

Current Status of Renewable Energy for Electricity for Off-grid options

Malawi is well endowed with renewable energy sources, including solar, wind, biomass, biogas, geothermal and hydropower. The country has solar irradiation of 21.1MJ/m2/day and wind speeds averaging 2-7m/s (Malawi Energy Policy, 2003). In off-grid areas, the mostly widely used renewable energy source for electricity generation is solar PV. The current state of affairs of off-grid electricity supply can be characterised as follows:

* + There are seven mini-grids in Malawi. Six are government owned though only one of them is operating. The seventh is owned privately by Mulanje Electricity Generation Agency (MEGA).
  + There is a maximum of 140,000 pico-solar lanterns and SHS in use, as of 2016.
  + There is a influx of poor quality products such as solar panels and solar lanterns.
  + Solar systems in public institutions are poorly maintained. A UN Foundation survey found that only 57% of solar systems installed at schools, hospitals and other institutions were functional.
  + There is a general lack of understanding by households, businesses and institutions about how to operate and maintain solar systems.
  + There are 5-10 solar kiosks are in place to cater to rural communities far from the grid. There are no programs or incentives to expand solar kiosks to other parts of the country.

In order to improve the current situation on renewables the stakeholders meeting proposed the following:

* + Public awareness and sensitisation on renewable energy technologies.
  + Enforcement of quality and discouragement of non-certified importers to reduce price differences.
  + Solar access to be categorised at levels and financing mechanisms for various levels (micro-financing, PAYG) while noting the difficulties of implementing these financing mechanisms, such as the lack of guarantees in many PAYG initiatives
  + Government subsidies on renewable energy technologies and products.
  + Training of personnel for certified companies.
  + Use of new and efficient technological products.
  + Promotion of solar electricity generation by industries for own use and feed in to the grid.
  + Promotion of off-grid systems for productive use.

Existing plans and projections to 2030

The vision is that by 2030 every household far away from the grid should have access to clean, affordable, sustainable and adequate energy for lighting through either off grid options or mini grid options.

The existing plans and projections cover projects that are being implemented through donors as well as government are indicated below:

Scotland Government Initiative

The Government of Scotland is funding two renewable energy projects in the period 2015 to 2018. One project is the Sustainable Off-grid Electrification of Rural Villages (SOGERV). The project aims to electrify the rural areas of Chikwawa District. The project will electrify households, businesses and community energy infrastructure. The objective of the project is to reduce energy poverty in the rural areas. The project cost is 599,028 pounds. The project is implemented by Concern Universal in coordination with the Centre for Water Sanitation Health & Appropriate Technology Development (WASHTED) at the Polytechnic. The overarching aim of SOGERV project is to meet the Sustainable Energy for All goal of increasing energy access in Malawi where electricity access is currently only 10% overall and less than 1% in rural areas. The other project is Powering Development in Mulanjje (PDM). The objective of the project is to catalyse social and economic development of the poor communities around Mulanje Mountain by supplying renewable electricity through mini-grid option powered by micro hydro power station. The project cost is 599,374 pounds.

European Union Initiative

The European Union is funding several renewable energy projects in Malawi. One such project is the supply and installation of solar powered stations to supply electricity for households, businesses and irrigation. Practical Action is the leading partner in this initiative. There are four mini-grid systems to be powered by solar to provide electricity to households, businesses and irrigation in the four sites in Chikwawa and Nsanje Districts. The other project involves supply and installation of solar energy kiosks in the rural areas of Chikwawa and Nsanje Districts. The lead partner for this project is HIVOS. The total number of solar energy kiosks is six.

Government of Malawi Initiative

The government is planning to fund renewable energy projects through the rural electrification fund as evidenced by the reviewed energy policy. It is anticipated that if the reviewed energy policy is approved, the unlocking of funds for renewable energy projects will be possible thereby enabling the failed solar villages to be re operationalized. It is also anticipated that the fund will enable private sector participation in the investment of renewable energy projects through off-grid options. Ministry of Agriculture, Irrigation and Water Development has started powering some of the irrigation schemes with solar power. Ministry of Health continues to electrify health centres away from the grid through solar power. The government is also planning to extend the rural electrification fund to the in-house wiring of public facilities such as schools and health centres in all trading centres where grid will be extended. This has been included in the reviewed energy policy.

What is the target for 2030 for off grid options?

The targets for 2030 are estimated as shown in the table below. The targets are estimated based on the Malawi Energy Policy, 2003. It is expected that 10% of households and businesses will be using renewable energy by 2030[[36]](#footnote-36). During the stakeholders meeting it was estimated that there are currently 5,000 solar home systems and 300,000 pico solar systems. The estimates came from the renewable energy companies that attended the stakeholders meeting. It was then projected that the solar home systems could reach 25,000 by 2020, 50,000 by 2025 and 75,000 by 2030. As for the pico solar systems it was projected that they could reach 1.5million by 2020, 3 million by 2025 and 4.5million by 2030.

Table 18: Off grid targets

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Energy Type | Baseline 2016 | | Target 2020 | Target 2025 | Target 2030 |
| Grid extension | | 291,000 | 640,000 | 1.08 million | 1.51 million |
| Solar Home Systems | | 5,000 | 25,000 | 50,000 | 75,000 |
| Mini grids[[37]](#footnote-37) | | 900 | 4,500 | 9,000 | 13,500 |
| Pico solar Systems | | 300,000 | 1.5 million | 3 million | 4.5 million |

The following barriers prevent the quick uptake of off-grid and mini-grid options:

* + High upfront cost of solar systems and yet there are no appropriate financing mechanisms.
  + Low quality products such as solar panels due to limited capacity to enforce standards by MBS.
  + Low transparency on quality and pricing issues to end users such as duty waivers seem to benefit only the RETs suppliers.
  + Rigorous Regulation in its current form, appears to impede the implementation of mini-grids. There will be need to rationalize and make appropriate amendments while ensuring safety and quality in service delivery.
  + Private companies are not encouraged to invest in mini-grids by way of operation and maintenance subsidy from government.
  + Private companies are not encouraged to invest in rural solar energy kiosks by way of operation and maintenance subsidy from government.
  + Power purchase agreements delays and its operating environment seem to prevent IPP entry into the power generation.
  1. Renewable Energy

Worldwide, renewable energy was the largest new source of electricity generation in 2016 as the cost of renewable energy, particularly solar and wind, continued its decline. The lower costs, combined with innovative financing techniques, have made renewable energy projects competitive with conventional energy projects in many places. Governments are responding by removing barriers to RE projects, such as cumbersome licensing and approval processes, and adopting RE-friendly policies like feed-in tariffs and RE purchase obligations for utilities.

For Malawi, the lower RE prices mean the 2030 targets for how much RE can be put in place can be set higher than what might have even been thought possible even one year ago.

What is the current status and BAU trajectory to 2030?

The Government of Malawi has placed an increasing emphasis on renewable energy in government plans and policy. A feed-in tariff has been drafted and many RE proposals, especially solar proposals, have been submitted by IPP developers. So far, no PPAs have been signed between ESCOM and independent RE developers and, aside from 4.35 MW worth of small hydro, few grid-connected RE projects have been developed. The reasons for the lack of PPAs are: uncertainty on the part of ESCOM over how to handle large amounts of intermittent sources of power; disagreements between ESCOM and the IPPs over the feed-in tariff price and conditions; and lack of capability and/or readiness on the part of many IPPs to move.

Current situation by energy type

Solar

According to a 2015 World Bank analysis, Malawi has very good potential for exploitation of solar resources and good opportunities for photovoltaics predominantly small to medium size ground-mounted and roof-top systems.[[38]](#footnote-38) In addition several IPPs have applied for power purchase agreements for their large-scale solar PV projects. An 380 KW solar demonstration plant was installed at the Kamuzu International airport in Lilongwe. On a smaller scale, solar lighting systems have been installed in some households and public institutions such as hospitals. However, these systems usually fail after a short period due to poor technical capability (poor designs, poor installation, lack of independent supervision/assessment/certification during project implementation, limited knowledge on operation and maintenance, supply of poor quality products etc.). Problems were also experienced with wind-solar hybrid systems. The Government of Malawi installed six wind-solar grids but due to beneficiaries’ failure to pay for the use of the system and the resulting lack of maintenance, all but one of the systems have ceased operating.

Other solar applications include water pumping, water heating and crop drying, although there are not many installations and there are no government programs to promote them.

Wind

No utility-grade wind turbines have been constructed in Malawi. Six hybrid wind-solar projects were built, as mentioned above, but only one is still operating. There are a few water pumping wind turbines. The government is currently supporting a wind resource mapping exercise.

Biomass

Sugarcane bagasse cogeneration is in place at the sugar companies in Dwangwa and Nchalo, but the electricity they produce is for captive use.

Biogas

Although no data is available on biogas for electricity, there is potential for electricity generation from biogas especially from the Organic Municipal Solid Waste in the cities.

Small hydro

Micro Hydro at MEGA is supplying power to about 200 households. Resource assessments estimate there is a 15 MW potential for small and micro hydro[[39]](#footnote-39).

Geothermal

No geothermal power projects have been developed yet, but the Government of Malawi, with World Bank support, is sponsoring a feasibility study that is currently under way (fall 2016).

Current situation with power generation

Malawi’s electric system is based mainly by hydropower, with 90% of the hydro capacity located on the Shire River. The installed capacity of hydro is 351 MW, of which 311 MW is operational, but not fully available due to low water levels on the Shire River. The available capacity is about 286 MW (See Fig. 8). Only 4.35 MW of hydro is located off the Shire River (located on the Wovwe River). Such heavy reliance on the Shire River basin results in high insecurity of the national power supply.

|  |  |
| --- | --- |
| Figure : Available Generating Capacity, MW, 2014 | Two small diesel units are connected on the national grid. Likoma Island is powered by diesel generators with a capacity of 250 kW. The total electricity generated in 2014 was 1,906.51 GWh, of which 797.46 GWh were consumed. All grid-connected power plants are listed in Table 19.  The country experiences regular power outages, and nationwide suppressed demand is estimated at 350 MW. If all the potential domestic and industrial customers were connected, the demand would roughly triple. |

Currently, the government is negotiating to import electricity from Mozambique. This would tap into the Southern Africa Power Pool (SAPP) and would allow for the connection of new customers as well as substantially reduce power outages and rationing. It has also installed a diesel power peaking plant.

Table 19: Installed Electric Generation Units, MW, 2014

|  |  |  |
| --- | --- | --- |
| Project | Description | Total capacity |
| Nkula Falls A | 3 units at 8 MW each | 24.00 |
| Nkula Falls B | 5 units at 20 MW each | 100.00 |
| Tedzani Falls I | 2 units at 10 MW each | 20.00 |
| Tedzani Falls II | 2 units at 10 MW each | 20.00 |
| Tedzani Falls III | 2 units at 26.35 MW each | 52.70 |
| Wovwe Mini Hydro | 3 units at 1.45 MW each | 4.35 |
| Kapichara Falls Phase I | 2 units at 32.4 MW each | 64.80 |
| Kapichara Falls Phase II | 2 units at 43.4 MW each | 64.80 |
| Kanengo Lilongwe Diesel | 1 unit at 10 MW | 10.00 |
| TOTAL |  | 360.65 |

Currently, the construction of new North-South 220-330 kV backbone transmission lines are underway with support from the Millennium Challenge Corporation (MCC). These will improve the reliability of the electricity grid and allow it to more readily accommodate intermittent power generation sources like solar and wind. The MCC’s improvements to the transmission and distribution grids are expected to increase grid throughput capacity by at least 300 MW.[[40]](#footnote-40)

Current situation with government policy

The main legislation guiding energy sector development are the following:

* + National Energy Policy 2003.
  + The Electricity Act 2004.
  + Rural Electrification Act 2004.
  + Energy Regulation Act 2004.
  + Liquid Fuels and Gas Act 2004.
  + No specific RE law but RE is embedded in pieces in above laws.

The Government of Malawi has approved a new National Energy Policy in 2016 that focuses on power sector restructuring and reform of oil import policy. The policy addresses renewable energy, mainly off-grid RE.

Incentives/Disincentives/Taxation

Current government policy allows RE products to be exempt from import and excise duty. However, during the SE4ALL stakeholder consultations, stakeholders stated that some MRA officials are not knowledgeable about what constitutes a renewable energy product. As a result, some importers have consistently had problems clearing their RE merchandise into the country. This appears to be a particular problem with turbines and generators used for hydro projects as well as batteries used in solar home systems.

The government has quality standards on imported RE products, but another problem is that even when MBS officials waive the import fees on RE products, they can go too far and waive the fees on low-quality products, thereby allowing cheap, inferior products into the country.

Although RE products are exempt from import duties, they are not exempt from the standard VAT, which is set at 16.5%. Additional disincentives include licensing fees and the long time it takes to process a license application.

Existing plans and projections to 2030

According to the INDC that Malawi submitted to the UNFCCC, “Recent electricity projections show that Malawi has to rapidly increase its generation capacity to between 1,200 MW and 1,500 MW by 2020 in order to meet demand.” The government’s 2016 energy policy paper has projections that could reach 1,900 MW by 2025, mainly through construction of large hydro plants, which keep large hydro as the dominant power source in Malawi, at 75% of total installed capacity.

The government’s proposed energy policy update references a discussion in August 2015 in which MNREM, in consultation with MERA, ESCOM, and the Public Private Partnership Commission, came up with a list of projects to be implemented (shown in Table 20). These parties believed that, due to fears of grid instability, a total of 15 MW (5 MW in each region) from solar could be added in the short term and 99 MW could be added in the medium term[[41]](#footnote-41).

The list does not specify any wind or geothermal power projects, although those are certainly possible once the resource mapping exercise is completed and feasibility studies are conducted for specific projects. The list includes two sugarcane bagasse power projects, but no other biomass-type projects. There could in the future be solid biomass or biomass gasification projects fuelled by crop residues or animal waste.

Table 20: Government-Planned Electricity Generation Projects Planned for 2015 - 2025

| Project | | Technology | Capacity (Mw) | Current Status |
| --- | --- | --- | --- | --- |
| *NEAR- TERM (2015 – 2020)* | | | | |
| Unspecified solar | Solar | | 15 | Solar mapping in progress |
| Unspecified Diesel (ESCOM) | Diesel | | 10 | Installation in progress |
| Unspecified Diesel (ESCOM) | Diesel | | 6 | Procurement in progress |
| Unspecified Diesel (ESCOM) | Diesel | | 30 | Procurement in progress |
| Illovo | Bagasse | | 6 | Engineering studies in progress |
| Illovo | Bagasse | | 40 | Feasibility Study in progress |
| Unspecified DSM | EE & conservation | | 105 | Concept stage |
| Tadzani IV (ESCOM) | Hydro | | 22 | Funding ready (JICA) |
| Kammwamba (GVT) | Coal | | 300 | Awaiting financing |
| Mpatamanga (ESCOM) | Hydro | | 350 | Feasibility Study in progress |
| Karonga | Coal | | 200 | Concept Stage |
| Kholombidzo | Hydro | | 200 | Feasibility Study in progress |
| Unspecified solar | Solar | | 99 | Financing ready |
| Malawi-Mozambique | Imports | | 50 | MOU signed |
| Mbongozi (HE Power) | Hydro | | 41 | Awaiting PPA |
| Nkula A | Hydro upgrade | | 12 |  |
| Tedzani III | Hydro upgrade | | 10 |  |
| Chizuma(SINO hydro) | Hydro | | 50 | Awaiting financing |
| Unspecified geothermal | Geothermal | |  | Consultancy put on hold due to funs. Awaiting WB review in September. |
| SUB TOTAL |  | | **1,546** |  |
| *Medium-term (2020 – 2025)* | | | | |
| RUO | | Hydro | 23 | Review of feasibility study, ESIA and designs required |
| Songwe 1 | | Hydro | 90 | Detailed designing |
| Songwe 2 | | Hydro | 60 | Detailed designing in progress |
| Fufu (ESCOM) | | Hydro | 140 | Feasibility Study in progress |
| Unspecified wind | |  |  | Procuring wind musts |
| SUB TOTAL | |  | **313** |  |
|
| GRAND TOTAL | |  | **1,859** |  |

According to the referenced energy policy paper, these figures were generated from a rule of the thumb that a grid can accommodate only 6% of its total capacity from intermittent sources like solar and wind. But this rule of thumb is incorrect. Wind already supplies 24% of Denmark’s electricity generation and over 14% of Spain and Portugal’s.[[42]](#footnote-42),[[43]](#footnote-43) Germany generates more than 30% of its electricity from renewable sources. Its goal is at least 80% by 2050. A number of other grid operators in the world plan to generate far more than 6% of their power from intermittent RE sources, and many studies show how various countries can derive 100% of their power generation from renewable energy[[44]](#footnote-44). While the examples cited are all industrialized countries, the future of electricity grids around the world is one of the greater reliance on renewable energy. Malawi can move in that direction.

The amount of renewable energy a grid can accommodate is based on the quality of the grid, its interconnection with other grids via the SAPP, and regulatory measures like time-of-use tariffs that can incentivize users to switch their electricity usage to times when renewables are generating the most power. The Millennium Challenge Corporation is supporting the upgrade and capacity expansion of Malawi’s transmission infrastructure.

We have included energy policy paper’s conservative solar figures - 5 MW of solar added by 2020 and 99 MW added by 2025 - in our BAU power sector trajectory for Malawi (see Figure 10). The BAU trajectory also includes an additional 1,190 MW of large hydro, which would result in large hydro continuing to dominate Malawi’s installed capacity. This can be seen even more dramatically in the trajectory shown in Figure 10. Even though proposed energy policy shows an increasing diversity of generation resources, large hydro will account for 75% of capacity. A continued reliance mainly on large hydro, particularly on hydro plants on a single river - the Shire River, will maintain, if not increase, Malawi’s vulnerability to inadequate water flows for hydropower generation brought on by drought. With climate change, the likelihood of drought will only increase. Large hydro plants also can cause serious environmental damage. While the SE4ALL power generation targets in the following section include an expansion of large hydro, there is a major emphasis on increasing the diversification of power sources, with particular focus on solar power.

Figure 9: Anticipated 2025 Capacity from Energy Policy Paper, Year 2025

Figure 10: Anticipated Trajectory of New Power Supplies from Energy Policy Paper, MW

What is the target for 2030?

As mentioned, both the INDC and energy policy paper include projections for a major expansion of large-scale hydro. There is indeed a great potential for such expansion. However, given the low water levels at the existing Shire River hydro plants, the uncertain impact of climate change on future water flows, and the negative environmental impacts of large dams, a diversification of generation resources may be a more prudent path. There is also good potential for development of coal, solar and wind power resources. Table 21 shows the first 15 IPP projects that have MOUs with the Government of Malawi as of November 2015 (There are over 30 projects with signed MOUs as of February 2017). They represent roughly 3,500 MW worth of installed capacity, although none have begun construction and just one has a signed PPA. Many are still at a very preliminary conceptual stage, while others have completed all studies and licensing and are simply waiting for ESCOM to sign the PPA. The numbers of MOUs are constantly changing, but as far as the number of projects in place, none have been built yet.

Table 21: Pipeline of Independent Power Projects (November 2015)[[45]](#footnote-45)

| Company | Technology | Capacity (MW) | Date MOU Signed | Status |
| --- | --- | --- | --- | --- |
| Mbongozi (HE Power) | Hydro | 41 | 24-Jun-11 | Financial closure stage |
| Bua Hydro Power Ltd. | Hydro | 60 | 04-Apr-12 | Negotiating term sheet with ESCOM |
| Maple Ltd. | Coal | 190 | Jan-15 | Seeking feasibility study funding |
| Atlas Energy Malawi | Solar | 200 | 10-Feb-15 | Waiting for ESCOM to sign PPA |
| CTI Africa LLC | Solar | 120 | 02-Aug-15 | Under discussion with ESCOM & Ministry |
| Sinohydro | Hydro (Chizuma) Coal Solar | 80 300 125 | 05-Aug-15 | Preparing project proposal |
| Airon Green Energy | Wind, solar & hydro | tbd | 09-Aug-15 | Preparing to invest 1st Q, 2016 |
| Water Wheel Int'l Inc. | Hydro | 30 | 04-Sep-15 | Conducting feasibility study |
| JCM Clean Power Dev. | Solar | 20-25 | 10-Sep-15 | Feasibility study & PPA negotiation underway |
| Africa Energy & Power Corp. | Solar | 350 | 15-Sep-15 | Negotiating PPA |
| AX-ON Africa Holdings | Solar | 90 | 17-Sep-15 | Conducting grid impact study |
| Grow Mine Africa (PTY) Ltd. | Solar, wind, geothermal, coal, natural gas | 2,000 | 06-Oct-05 | Waiting for signing of term sheets and PPAs |
| CDC Group, UK | Solar Heavy fuel | 10 56 | 12-Oct-15 | Negotiating project documents |
| Ulalo Capital Investments Ltd. | Solar | 200 | 06-Nov-15 | Negotiating PPA |
| China Gezhouba | Coal | 300 | 11/18/2015 (preliminary) | Hope to start project implementation in mid-2016 |
| Dongfang Electric Intl. Corp. | Solar, hydro, diesel | tbd | 20-Nov-15 | Project proposals under development |

Because of the uncertainty surrounding the signing of the PPAs, it is difficult to determine the trajectory of power development in Malawi. The RE projects on this list total 1,326 MW. Of those, the ones that are in, or nearly in, the PPA negotiation stage as of February 2016 come to 966 MW. If these can be approved, financed, built and interconnected to the grid, it will quadruple Malawi’s available capacity, although the solar power will be intermittent and the hydro power will be subject to the same risks of insufficient river flow as the existing hydro projects. Still, adding solar to the mix will help diversify the power sources. For the purpose of establishing renewable energy targets, we assume that hydro projects will be the quickest to approve and build, and thus can be the basis for setting the small hydro targets. Based on discussions with industry and the DOEA’s best judgment, we project that at least two large solar PV projects can be approved and built by 2030, although these may end up being broken into a number of smaller projects connected to the grid at various locations.

Thus, the proposed 2030 target for small-to-medium hydro is 101 MW. The solar target is 550 MW by 2030, with an interim target of 100 MW by 2020 as specified by the SE4ALL Renewable Energy Working Group. While the targets are based on the potential capacity of just a few MOUs and discussions with project sponsors, many more RE projects have been proposed and the eventual mix of projects implemented to reach the targets may well be different from those listed above. In fact, the Government expects wind and waste-to-energy projects will become part of the generation mix. They are no included in the current targets because detailed resource assessments are needed first.

The 550 MW solar target is ambitious in the sense that Malawi is starting from a low baseline of installed, grid-connected solar. There is also some concern about the capacity of the electric grid to handle large additions of intermittent solar power, although a 2016 grid capacity study indicated that PV connections of 4MW-300MW are possible over the 12-24 month period beginning July 2016, particularly in the Central and Southern parts of the transmission system.[[46]](#footnote-46) Furthermore, with the MCC-supported grid upgrades currently underway, we believe that will not be a barrier to reaching the 550 MW target by 2030. The solar PV technology is well understood, the price of solar PV projects has been steadily dropping, the lead time to build solar projects is comparatively short, and many countries are now aggressively adding solar capacity. From these standpoints, the 550 MW target is reasonable and achievable.

A likely trajectory of renewable installations, totalling 651 MW by 2030, is shown in Figure 11, with the small hydro capacity added in the near-term and most of the solar capacity added in the later years.

Figure 11: Renewable Energy Targets Achieved by 2030, MW

Combining these projects with Malawi’s existing installed generating capacity and the additional hydro and fossil projects anticipated in the energy policy paper, Malawi’s electric generating trajectory looks like Figure 12. In this scenario, most of the solar generating capacity is added between 2025 and 2030. This is well after the current transmission system upgrades are completed, meaning that there should be no technical problem with the grid accommodating the solar capacity additions. Solar will account for approximately 22% of Malawi’s generating capacity. Total RE capacity (including large hydro, small hydro, solar and bagasse) will be 2,173 MW or roughly 86% of Malawi’s installed capacity.

Figure 12: Installed Generating Trajectory Including RE Targets, MW

The full 2030 installed capacity based on the 2016 energy policy paper projections, plus the addition of the SE4ALL RE target of 651 MW (2 solar and 2 small-to-medium hydro), amounts to 2,620.85 MW and is shown in Figure 13. We note that as better renewable energy resource assessments are conducted in Malawi in the coming years, additional RE resources will likely be identified (particularly waste-to-energy and wind energy) that could contribute to the 2030 energy picture, and the targets will need to be adjusted accordingly.

Figure 13: Installed Generating Capacity in 2030 based on Energy Policy Paper plus SE4ALL RE Targets

We note that the 550 MW solar target does not include on-site grid-connected solar installations on rooftops or over parking lots or for powering street lights. The government supports such installations, particularly at colleges and hospitals, but because of the high uncertainties surrounding their possible development and their relatively small size, they are not included in these targets.[[47]](#footnote-47).

A full picture of the role of renewable energy in power generation would include the anticipated contribution from off-grid sources, specifically pico solar systems and solar home systems (SHS). Table 12 in the Energy Access section shows the 2030 targets for both types of off-grid systems. For pico, the target is 4.5 million systems. For SHS, the target is 75,000 systems. The panel capacity of pico systems typically ranges from 0.3 to 10 peak watts. Assuming an average size of 5 W in Malawi, 4.5 million pico systems x 5 W = 22 peak MW of additional power generation.

For SHS, the average capacity of residential solar PV system in OECD countries is 3 to 5 KW. In Africa, the typical capacity ranges from 20 to 100 W.[[48]](#footnote-48) Assuming an average SHS capacity of 50 W in Malawi, 75,000 systems x 50 W = 3.75 MW of additional solar capacity.

Adding the pico solar and SHS targets to the pie chart would be represented by a very thin sliver as they would represent one percent of total electric capacity.

What is the gap between BAU trajectory and the new targets? What are the barriers?

According to the energy policy paper, the estimated installed solar capacity in 2030 is projected to be 99 MW. This is in contrast with the SE4ALL solar target of 550 MW of grid-connected solar power by 2030 based on the combined capacity of just two of the solar projects currently waiting for PPAs. There is thus a gap of 451 MW between the BAU strategy and the achievable SE4ALL target.

For large hydro and small hydro, there is no gap between the BAU estimates and the SE4ALL targets for 2030.

There are a range of barriers to the RE targets being met. Some are barriers common in other countries and some are specific to Malawi:

* + Capital finance shortage, resulting in underinvestment in generation, transmission, and distribution.
  + Lack of interest and participation of other ministries, corporations, and other organisations.
  + Banks and individuals are reluctant to finance on-site RE projects as the technology and business is still considered risky.
  + Consumer financing for RE is not readily available and most of the rural communities cannot afford to purchase RE systems.
  + The rent to own (“Py-as-you-go” or PaYG) approach has been introduced -- whereby consumers are given the system which they buy by paying in small instalments – but is not expanding very quickly.
  + MAREP fund, which finances grid extension, is not being used for off-grid applications.
  + Lack of training and skills.
  + Ambiguous/un-clear exemption plan. Some RE products are not yet in the schedule for exempted products e.g. turbines and generators for hydro use and even SWH.
  1. Energy Efficiency

What is the current status and BAU trajectory to 2030?

Current status

Malawi`s national energy consumption reflects the country`s economic situation, with domestic users (households) accounting for 83% of all energy consumption, industry for only 12%, transport for 4%, and the remaining 1% consumed in the services sector (see Figure 14 below). As Figure 14 below indicates, the energy supply in the country is heavily dominated by biomass (over 88% of total energy supply), followed by liquid fuels (6%) and electricity (2.5%). Firewood is the major energy source in Malawi, providing 95% of rural household energy supply and 55% for urban households, followed by charcoal which accounts for over 30% of urban household energy supply. The present structure of Malawi`s energy supply and demand with its inherent dependence on biomass not only renders the national economy highly uncompetitive, but also exhausts country`s once abundant natural resources. Acknowledging the importance of efficient energy use the GoM committed itself (in the National Energy Policy of 2003) to encourage the efficient use of biomass through a set of market pitching activities.

|  |
| --- |
| Figure 14: Energy supply by sector |

Energy intensity of Malawi`s economy

Energy intensity (expressed as the ratio between gross inland energy consumption and country`s GDP) is commonly used as an indication of the energy efficiency of a country`s economy. Unfortunately, data on Malawi`s energy intensity (a ratio of energy consumption to country`s GDP) is not available in International Energy Agency`s (IEA) database. According to statistics from the Open data for Africa web portal ([www.opendataforafrica.org](http://www.opendataforafrica.org)), the energy intensity (British thermal units/GDP USD 2005) of the Malawian economy in 2011 was 1,655 Btu/USD, which is well below the reported intensity of most of countries in the region (Zambia – 7,518 Btu/USD; Zimbabwe – 5,871 Btu/USD; Mozambique – 9,917 Btu/USD) and slightly over the least energy intensive regional peers such as Uganda (1,047 Btu/USD 2005). A robust downtrend in Malawi`s energy intensity ratio is observed over the past six years between 2006 and 2011 (the most recent period energy intensity data is available for – see Table 22 below), mainly fuelled by the sustainable GDP growth attained over the same period. However, this is not necessarily a sign of highly energy efficient economy, but is rather a reflection of the specific structure of the national economy (dominated by rural and agricultural sectors) and the large scale of consumption of unsustainably sourced fire wood, which is not accounted for in the official statistic.

Table 22: Malawi Energy intensity Btu/2005 US Dollar of GDP

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Cumulative change 2006 – 2011 (%) |
| Energy intensity (Btu / USD 2005) | 2,176 | 2,057 | 1,998 | 1,656 | 1,693 | 1,655 | -24% |

Existing situation and projections to 2030

The SE4ALL initiative calls for at least doubling the EE rate in the country by 2030 and Malawi has already taken some steps towards achieving this overarching target.

Tariff development

For many years the electricity consumers in Malawi enjoyed well-subsidized tariffs, rendering the EE related investments highly unprofitable. In November 2009, MERA approved a 56.2% increase in electricity tariffs to cover four years between 2010 and 2013; the increase was implemented in two stages with a 36% increase taking place in December 2009 and a second hike of 20.2% (relative to the electricity tariff levels prevailing at the time, which effectively translated into a cumulative tariff increase of 61 percent) implemented in January 2011. In 2009, a time-of-use tariff was introduced for commercial and industrial customers on three-phase supply. Several other electricity rate hikes took place in recent years, the most recent one in November 2015, but due to the local currency devaluation the tariff is very low compared to the regional and international standards. . To further encourage energy consumers (especially different from households) to implement EE measures, the MERA may consider the idea of introducing an inclining block tariff structure for such users (industrial, commercial entities). Implementation of inclining block tariff will, however, require a national EE audit or rigorous survey to establish baseline consumption for different types of consumers and adequately set the pricing blocks.

The table below shows the current tariff rates by type of client. The MKW/USD exchange rate used is the market rate as of 11.02.2016

Table 23: ESCOM current electricity tariff

|  |  |  |  |
| --- | --- | --- | --- |
| Type of client | Unit | Price in MWK | Price in USD |
| Domestic single phase prepaid | kWh | 29.43 | 0.0397 |
| Domestic single phase post-paid | kWh | 25.48 | 0.0343 |
| General single phase prepaid | kWh | 50.67 | 0.0683 |
| General single phase post-paid | kWh | 60.80 | 0.0819 |
| General three phase prepaid | kWh | 53.19 | 0.0717 |
| General three phase post-paid | kWh | 50.67 | 0.0683 |

Clean cook stoves initiatives

With the cooking being the most energy consuming household activity, a number of improved cook stoves promotion projects were carried out throughout the country over the past years. According to the National Energy Strategy of 2003 an improved cook stove may reduce biomass consumption between 10% to about 61% depending on the technology compared to the traditional three stone open fire method of cooking.

* + Chinansi Foundation Improved Cook stoves project: the project financed by Fair Climate Network Southern Africa aims at reducing the deforestation rate in the climate change vulnerable Balaka district by rolling out about 60,000 improved cook stoves (called mtetezi mbaula) among local families. The seven years project is expected to deliver multiple environmental benefits. Not only will it reduce the deforestation rate by bringing down the quantity of firewood used for cooking, but will also create a healthier kitchen environment in the district. The implementation of this initiative will positively affect the local business environment, since the efficient stoves will be produced by local craftsmen who will be trained under the project.
  + EnDev / MAEVE energy conservation Malawi project. MAEVE is a Malawian NGO whose main domain of activity is promoting the uptake of fuel efficient and clean technologies across the country. After receiving a grant from Energizing Development (EnDev) MAEVE has launched a project in 2013 aiming to promote the Chitetezo Mbaula stove among urban households. Relative to the three stone fire the Chitetezo stoves decrease fuel use by 34%. The project involves carrying out measures to strengthen both the supply and the demand side. Demand-side activities focus on generating greater consumer interest in the ceramic, wood-burning stove known locally as the ‘Chitetezo Mbaula’. On the supply side, the project partners provide training and skills for the craftsmen who produce the stove.To successfully achieve its targets, MAEVE developed a network of vendors in all urban centres ensuring availability of the product countrywide and ease of access for those who wish to buy. Maeve has engaged one of the major local retailers, Chipiku Stores, who have over 80 outlets nationwide to be one of their distributors of the stove. The initial objective of the initiative that started in 2013 was to reach at least 28 000 households within the first 15 months of the project. Early stage results indicate that by December 2014, nearly 93,654 people had gained access to improved forms of energy for cooking. The number of stoves manufactured by around 50 producer groups and subsequently sold through sales channels introduced by EnDev has risen to 8,000 each month, which is much more than the initially anticipated uptake pace. The end goal of the project is to provide access to clean cooking to some 625,000 people countrywide by the end of 2016. The planned measures are expected to reduce exposure to smoke – mainly among women and children – in 140,000 urban households, and reduce deforestation by saving 65,000 tonnes of wood.
  + The Cook stoves road map, currently developed and promoted by the GoM will roll out 2 million efficient stoves to both rural and urban households by 2020. The initiative recently launched by the President will be carried out in collaboration with international development partners (the governments of US and Ireland among others) and local NGOs. This is part of the country’s commitment as a signatory to the Global Alliance on clean cook stoves which aims at adoption of clean cook stoves by 100 million households by 2020 worldwide.

Lighting

**The Malawi Energy Efficient Lighting Project**

In an effort to curb the overall system peak demand of ESCOM, the Government of Malawi (GoM) through the Ministry of Natural Resources, Energy and Mining has implemented the Energy Efficient Lighting Project (EELP) with support from the UK Department for International Development (DfID). The project started in April 2011 with the overarching goal to roll out two million units of good quality compact fluorescent lamps (CFLs) and replace the previously used incandescent bulbs (IBs). The CFLs were targeted to be distributed and installed free of charge to the residential household customers, small businesses and public buildings, while the commercial sector entities were granted the opportunity to buy energy saving bulbs at subsidized price. The project’s outcomes were verified by measurements taken directly from 17 feeders nationwide, and indicate 65 MW reductions of peak demand during morning spikes, and 51 MW during the evening period. This decrease - which equates to 20% and 15% respectively - has helped reduce power outages during both peak periods. The project sparked real interest in energy savers among the consumers as ESCOM reported to have sold over 330 000 efficient bulbs in addition to those that were handed out for free.

By the end of 2016 ESCOM is planning to distribute additional 400,000 energy efficient bulbs.

**Capital Hill Solar Street Lights Project**

The Ministry of Natural Resources, Energy and Mining embarked on a project to install solar street lights at the Capital Hill with funding from People’s Republic of China. A total of 226 street lights have been installed in 2014. The project was mostly induced by security needs, but may serve as a showcase pilot for future larger scale street lighting projects in country`s major cities

Import tariff and fiscal incentives

The GoM has already taken some fiscal measures toward encouraging the local consumers to use more energy efficient products. To complement the efforts of the energy saving bulbs roll out project, the government has removed the excise duty on CFLs while doubling the duty on incandescent bulbs. Import duty and excise reliefs were also granted for certain types of solar powered products.

Public awareness campaigns

The lack of awareness of the benefits associated with efficient energy use among the population was quoted as a major impediment for EE development by almost all local stakeholders. Unfortunately, too little has been done to sensitize the broad public on how to preserve energy over the recent years. A number of awareness raising initiatives have been carried out, usually as complementary component of some tangible EE projects (such as efficient light bulbs or clean stoves roll out), but with very limited impact. In a separate component to the Energy conservation project EnDev is running a national awareness campaign to support the wider take-up of high quality solar lighting products (solar lanterns and lighting kits), with a target of reaching 100,000 people, mainly in rural areas.

Prepaid meters

Prepaid meters have some inherent Demand Side Management (DSM) features that improve energy efficiency for customers as they receive instant feedback on their energy usage, which prompts energy saving attitude. Impact assessments of pre-paid meter programs implemented in other South-African countries (e.g. Zimbabwe) show that a shift from post to pre-paid metering may inflict energy usage decrease as high as 22%. Since the start of its pre-paid meters program in 2011, ESCOM has achieved remarkable progress. The number of domestic consumers (the households account for over 90% of all ESCOM customers) with installed pre-paid meters surpassed 186,000 or nearly 60% of all grid connected clients. Nearly 105,000 (or 34% of all clients) households and around 22,000 industrial clients still use post-paid metering devices[[49]](#footnote-49). Along with substantial energy savings, the pre-paid meters program may well improve ESCOM`s financial status, driving up the electricity bill collection rate.

Supply side projects

**The WB Energy Sector Support Project**

In an effort to increase the reliability and quality of electricity supply in the major load centres in Malawi, th government, with support from World Bank, started implementing the Energy Sector Support Project. Rehabilitation of the existing electricity network, improved demand side management and energy efficiency measures, and capacity building activities are among the priority areas of the project. The total project amount is USD 84.7 million, of which the electricity network strengthening and expansion component accounts for the largest share (USD 56.2 million). The project is expected to reduce the level of distribution related losses from 17.4% to 13.4% over a period of 5 years (the project implementation started in 2012, but is expected to be delayed). A total of 5 substations will be upgraded and 26 km of distribution lines will be rehabilitated.

The demand side management (DSM) and EE measures component is evaluated at USD 6.8 million. The activities of this component will aim at reducing the coincident load peaks by promoting energy saving technology and measures. The project will specifically address the electric hot water geysers (HWG). The blend of energy saving activities to be carried out include: i) de-rating of HWG heating elements to a limit of 2.5 kW via a free replacement program; ii) Installation of ”insulation blankets‟ via a free program to better insulate existing HWGs; iii) implementation of wireless load control, allowing ESCOM to remotely switch-off HWGs in given areas at given times. The component is expected to generate total estimated savings of 11 MW during peak hours.

The capacity building and technical assistance component will strengthen the technical capacity at the Ministry of Natural Resources, Energy and Mining as well as at ESCOM through a series of trainings and workshops.

**Millennium Challenge Corporation – Malawi Power Sector Revitalization Project**

This 5 years project with intended value of over USD 350 million has started in 2013 and is still in its early stages with only USD 23 million of grant extended and USD 52 million committed. This is a single-sector program designed to increase incomes and reduce poverty by revitalizing Malawi’s power sector and improving the availability, reliability and quality of the power supply. It involves two priority areas: i) Infrastructure development and ii) Power sector reform. The Infrastructure development component will aim at preserving and stabilizing existing generation capacity, improving capacity and efficiency of the transmission and distribution network. The Power sector reform activity complements the Infrastructure development component by providing support for the GoM’s policy reform agenda and by building capacity in critical sector institutions. The activity will build capacity and provide technical assistance to the Electricity Supply Corporation of Malawi (ESCOM), the Malawi Energy Regulatory Authority (MERA) and the Ministry of Natural Resources, Energy and Mining.

Institutional

Various national plans and programs generally have some reference to EE – the National Energy Strategy; Malawi`s Biomass Energy Strategy; Malawi`s Growth and Development strategy II, etc.:

* + **The Malawi Growth and Development Strategy II (MGDS II)** The Strategy acknowledges that a well-developed and efficient energy system is vital for socio-economic development and calls for development of efficient energy system in Malawi. Improving the management of energy generation, transmission, distribution and supply and promoting the use of renewable sources of energy are among the key strategies set forth in the MGDS II. Installation of smart meters on distribution feeders, review of the existing electricity master plan and rehabilitation of major hydropower stations and the transition and distribution network are among the focus actions and activities outlined in the Strategy.
  + **Malawi Energy Policy (NEP) of 2003 – currently under revision.** Acknowledging that the biomass is the major energy source and will remain so for the years to come, the NEP states that the GoM will encourage the efficient use of biomass through market pitching activities such as: i) promotion of efficient biomass use through civic education; ii) training and research in production, marketing and use of efficient technologies; iii) involvement of all stakeholders groups (incl. local communities) in producing and marketing efficient biomass technologies), etc.
  + **Malawi Biomass Energy Strategy (BEST)** aims at developing a rational and implementable approach to the management of Malawi’s biomass energy sector through a combination of measures designed to improve the sustainability of biomass energy supply, raise end-user efficiencies and promote appropriate alternatives. BEST provides detailed insight on both biomass energy demand and supply side, recommending a number of potential priority actions and measures to render the biomass energy consumption more efficient. Provided that the biomass is the major energy source in Malawi and is expected to remain so in the foreseeable future, this Strategy is a cornerstone national document in country`s aspirations towards efficient energy use.
  + **The National Climate Change Investment Plan 2013 – 2018(NCCIP):** a complementary to the MGDS II this plan aims to create enabling environment for increase of the overall volume of climate change related investments in Malawi. The Plan identifies four priority areas to promote climate change management in Malawi: i) adaptation; ii) mitigation; iii) climate change research, technology development and transfer and iv) capacity building. NCCIP calls for the development of several climate change tackling programmes and initiatives with reference to EE:
    - **Enhancing energy saving technology program** that focuses on enhancing capacity for low emission development strategies (EC-LEDS) to pursue long-term, transformative development and accelerate sustainable, climate-resilient economic growth while slowing the growth of greenhouse gas (GHG) emissions. This program is aimed at improving energy efficiency and effectiveness in selected urban and rural areas in Malawi by building local capacity (technical, analytical, and policy) and establishing a national GHG Inventory Management System. The enhancing energy-saving technology programme is estimated to cost app. USD 60 million over the 5 years period of the Plan.
    - **Climate change mitigation technology development programme** which is expected to improve Malawi’s mitigative capacity to climate change by supporting research projects focused on selecting the most appropriate climate change mitigating technologies. The research projects will aim at identifying Malawi`s climate change related technology needs, finding the most efficient technology options available and adapt them to meet Malawi`s specific needs and the local business and social environment.
    - **Establishment of a National Climate Change Fund (NCCF):** to develop a streamlined and efficient mechanism for channelling IFI and locally raised climate change resources, the NCCIP calls for the establishment of a dedicated National Climate Change Fund. The Fund will provide financing and technical support and advice to all climate change stakeholders in Malawi. NCCF will partner with international and regional donors and lenders, local or international NGOs and private sector entities in developing climate change investment projects. The Fund will also be promoting fund-raising schemes for various development programs on climate change management in Malawi and will serve as a think tank for new “green” financing mechanisms.

Up to date, there is no National EE audit or similar study conducted to indicate what is the energy consumption baseline and the underlying energy saving potential across various sectors (industry, households, commercial sector, public sector, agriculture, etc.) at the National level.

What is the target for 2030 and the gap?

When considering EE in Malawi, one`s focus should necessarily fall on reduction of biomass consumption, provided that biomass fuels accounts for nearly 90% of country`s total energy consumption.

Overall energy intensity of the national economy

As stated in section 3.6.1 above and depicted in Table 24, Malawi has relatively low energy intensity and is in good position to further lower the ratio by implementing a number of EE improvement activities and policies. Based on the average achieved EI reduction pace of 4% annually (2006-2011), we can reasonably assume that Malawi can bring its energy intensity down to below 900 Btu per USD 2005 of GDP (PPP terms) by year 2030.

Table 24: Malawi target energy intensity projection 2015-2030

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | 2015 | 2020 | 2025 | 2030 | Cumulative change 2015 – 2030 (%) |
| Energy intensity (Btu / USD 2005) | 1, 655\* | 1,349 | 1,100 | 897 | -45.8% |

*\* Most recent available figure (2011) assumed for a starting point*

Energy-efficient cooking stoves

Biomass constitutes a major source of energy for cooking especially for the rural and low-income urban population. The 2030 energy – efficient cook stoves target and the existing gap is described in detail in section 4.2.

Hot Water Heating

There is no consensus on how many electric-powered solar geysers are installed in Malawi. A World Bank Energy Sector Management Support program study estimated there were around 23 000 installed electric geysers in 2011 so it can be reasonably assumed that the number has increased to 30,000 – 40,000 in 2015, meaning that approximately 15% of the households with access to grid electricity use electric geysers. The electric heaters are energy-intensive and may account for up to 40% of household electricity bills in households that have them. In its INDC to UNFCCC the GoM has already pledged to replace at least 20,000 electric heaters with solar-powered water heaters by 2030, provided that technical and financial support from third parties (donors) can be obtained. This is an achievable target but with sufficient funding/financing and government mandate, a more ambitious yet still reasonable target is l 40,000 SWH installations.

With regard to the use of firewood for hot water heating, there is no reliable data on the number of households or amount of wood that is used for this. The Malawi Biomass Energy Strategy states that, on average, urban households consume 293 kg firewood per capita annually, of which 22% (or 65 kg per capita annually) is used for water heating. Rural households consume 601 kg per capita annually (no indication on what proportion is used for water heating). Assuming that the rural households use 25% of their firewood for water heating, the total consumption of firewood for heating in Malawi stands at over 1.8 million tonnes. If not properly addressed, the water heating-related wood consumption could grow to 2.5 million tonnes annually by 2030 (assuming the population growth and a distribution of 30% urban and 70% rural). Substantial woodland resources can be spared by supporting 20% of the rural households to install solar powered water heating systems by 2030. Assuming that the number of rural households will reach 3.5 million by 2030, the gap will be as large as 700,000 solar powered domestic hot water heating systems.

Table 25: Target number of solar powered water heaters by 2030

|  |  |  |  |
| --- | --- | --- | --- |
|  | 2020 | 2025 | 2030 |
| Target replacements of existing electric geysers with solar powered | 12,500 | 25,000 | 40,000 |
| Target installations of solar water heaters in rural households | 235,000 | 470,000 | 700,000 |

Pre-paid meters

Based on ESCOM`s early success with the implementation of the pre-paid meters program, an achievable goal would be to shift all grid connected households to pre-paid scheme by 2030. Assuming that 30% of the households will be grid connected by then, this makes a gap of over 1.6 million pre-paid meters in the residential sector alone. The 100% pre-paid meters coverage in the household sector should be achieved in 2025 and maintained through 2030

Table 26: Target for pre-paid/smart meters installations

|  |  |  |  |
| --- | --- | --- | --- |
|  | 2020 | 2025 | 2030 |
| Number of newly installed pre-paid/smart meters | 564 000 | 1 250 000 | 1 600 000 |
| Share of grid connected households using pre-paid metering | 85% | 100% | 100% |

Lighting

An energy saving bulb rollout project achieved a 65 MW reduction in the morning peak and a 51 MW reduction in the evening peak. There was an overall15 - 20% reduction of national peak demand, which proved that lighting efficiency initiatives can have a significant impact in Malawi. To further improve the energy situation in the country, the GoM will, through various programs, subsidize the shift from more energy intensive lighting solutions (incandescent, CFL) to LED. Such programs are not necessarily limited to dissemination of free LED bulbs to the consumers, but can include import duty and tax reliefs, soft loans, MEPS (Minimum Energy Performance Standards) and labelling measures, etc.

Assuming 30% grid connected households in 2030 and an average of 8 light bulbs per household, the total number of lighting fixtures in the household sector will increase to 16.5 million. Around 550,000 LEDs on average will need to be installed annually to reach 50% penetration rate by 2030. The implementation of minimum energy performance standards (MEPS) and the ban on use of inefficient light bulbs will prevent the people from going back to incandescent bulbs after the LEDs burn out.

Table 27: Target number of efficient bulbs

|  |  |  |  |
| --- | --- | --- | --- |
| Lighting technology | 2020 | 2025 | 2030 |
| LED | 2 750 000 | 5 50 000 | 8 250 000 |

Agriculture

Creating around 80% of the employment, generating over 70% of the foreign exchange earnings and nearly 30% of country`s GDP, the Agriculture is naturally the most important sector of Malawi`s economy.

According to the Biomass energy strategy, tobacco curing is the most energy intensive activity within the agricultural sector, consuming 100,000 tones dry wood equivalent[[50]](#footnote-50) per year. Small-holder farmers have limited capital, which leads them to resort to ‘low cost’ fuel wood for curing tobacco. Data from Tobacco control commission of Malawi indicates that as of 2016 there are nearly 30,000 tobacco growers in the country, most of these small scale farmers, using wood for curing. Helping the small scale growers to shift to more efficient (rocket type) barns or barns based on other energy sources can halve the tobacco curing related wood consumption by 2030.

Table 28: Efficient tobacco curing barns target

|  |  |  |  |
| --- | --- | --- | --- |
|  | 2020 | 2025 | 2030 |
| Number of new efficient barns constructed | 2,000 | 3,500 | 5,000 |

Electricity production, transmission and distribution

According to the World Bank Energy Sector Management Program (ESMAP) report, the combined distribution and transmission losses of ESCOM amount to some 22% (17.4% attributed to distribution operations). Malawi is already addressing this problem and the implementation of this project alone (upgrade of 5 substations, and rehabilitation of at least 26 km. of distribution lines) should result in decrease of distribution losses from 17.4% to 13.4% over a period of five years. Benefiting from the Millennium Challenge Corporation compact and other internationally funded energy sector projects, Malawi will be able to bring down the combined distribution and transmission losses to as low as 12% by 2030.

Table 29: Transmission and distribution losses targets

|  |  |  |  |
| --- | --- | --- | --- |
|  | 2020 | 2025 | 2030 |
| Combined transmission and distribution losses | 17% | 15% | 12% |

What is the gap between BAU trajectory and the new targets? What are the barriers?

The list below includes major challenges for mainstreaming EE at the National level, identified by Malawi`s various energy related policies and strategies as well as barriers outlined by SE4ALL stakeholders during the bilateral meetings and workshops held:

* + Inefficient production of biomass and use of inefficient technologies. Very low uptake of efficient biomass cook stoves.
  + Insufficient awareness among energy end-users about energy conservation possibilities. Social preferences towards traditional technologies.
  + High upfront costs of EE technologies (usually imported and associated with additional foreign exchange issues).
  + Inadequate funding to finance energy efficiency and conservation initiatives.
  + Insufficient economic analysis of the EE implementation benefits.
  + Insufficient capacity of efficiency testing labs.
  + Use of outdated and energy inefficient equipment (motors, boilers, etc.) in major economy subsectors (mining, agriculture, industry). Low penetration of modern energy saving technologies.
  + Very limited capacity at the National level to conduct energy audits.
  + Lack of EE related technical expertise in the industrial sector.
  + Lack of financial incentives encouraging EE investments to offset the higher cost of modern EE equipment.
  + Electricity tariff encouraging inefficient energy use.
  1. Transportation – Alternative Fuels

This section provides an overview of the current status, trajectory, target and gaps in relation to the use of alternative fuels in Malawi. In the context of the Action Agenda “alternative fuels” include the introduction of the following types of energy supply: biofuels (ethanol and biodiesel); electricity (introduction of electric vehicles and electric modes of mass transportation); biogas (bioLNG - bio Liquified Natural Gas - and bioCNG - bio Compressed Natural Gas - in city buses).

In addition, this section provides findings on the use of conventional fuels in the transportation sector in order to assess the potential of partially replacing those fuels with the alternative fuels mentioned above[[51]](#footnote-51).

* + 1. What is the current status and BAU trajectory to 2030?

Conventional fuel consumption

Malawi imports almost all of its liquid fuel requirements (Ethanol is domestically produced). Since 1999, the compound annual growth rate of diesel is 3.3% and gasoline (petrol) is a little bit more than 1%. Diesel is, in 2013[[52]](#footnote-52), twice as imported as petrol (212 million litres and 109 million litres).

Figure 15: National importations of petroleum products between 1999 and 2013 (million litres)[[53]](#footnote-53)

Biofuels production and consumption

Ethanol production levels

The ethanol consumed in Malawi is produced locally with no importations nor exportations. The national production is presented in the table below.

Table 30: Malawi ethanol production since 2007 and projections to 2030[[54]](#footnote-54)

The average production of ethanol in Malawi is currently 26 million litres, split between the two ethanol production companies Ethanol Company Ltd (ETHCO) and Press Cane Ltd. Each of these companies has potential to produce 17 to 18 million litres per year[[55]](#footnote-55), according to consultations with Press cane Ltd, the company’s production does not meet its capacity due to inconsistent supply of raw materials and power cuts.

The 2013 Malawi Ethanol Programme, promoted by the National Commission for Science and Technology (NCST) aimed to “increase ethanol production and its use as fuel”. To this end, targets were established for 2015 and 2020 (see the following section on targets). Nevertheless, according to a PwC draft study to update the National Energy Policy, there is no evidence on the ground to show that Malawi has registered any sensitive increases in ethanol production since the release of the Malawi Ethanol Program in 2013.

Locally produced ethanol is blended with petrol at the officially designated average rate of 20% (E20[[56]](#footnote-56)). Nevertheless, according to market observers, ethanol is often marketed at a 10% blend with petrol[[57]](#footnote-57).

According to both ethanol producers in Malawi, a total of 43 million litres is possible by 2020 as the two ethanol companies in the country are currently implementing an expansion program. By 2030, 70-80 million litres of Ethanol is possible through an increase of the production by 5% per year from 2020. This increase can be achieved either by a higher production from the current producers or the entrance of new producers in the market.

Biodiesel production levels

Biodiesel is produced by Bio Energy Resources Ltd (BERL), the only biodiesel producer in the country and is used by some diesel cars and tractors. In 2015, BERL produced 70,000 litres of biodiesel but aims at increase its production to nearly 600,000 litres in 2017 and 60 million litres in 2030. The following figures are given by the company.

Figure 16: Expected biodiesel production of BERL through 2030 (million litres)

Existing plans to support biofuels

Regarding biofuels consumption, there have been some efforts to incentivise motorists to use ethanol. Specifically, in 2016, NCST developed the Ethanol Driven Vehicle Project (EDVP). The Commission carried out various trials of motor vehicle performance while using ethanol on three different car models, namely, Mitsubish Pajero, Ford Escort and Nissan Tiida. Following a series of trials, in October 2012, the Cabinet approved the EDVP and authorized the NCST to proceed with the rolling out of a programme for the increased use of ethanol in motor vehicles.

NCST proceeded to develop the Roll out Programme of Increased Ethanol Use as Vehicle Fuel under the Malawi Ethanol Programme in July 2013.The roll out programme among other things aimed to:

* + Review policies and regulations related to ethanol fuel, its distribution and utilization within the ethanol supply chain.
  + Increase ethanol production, distribution and storage.
  + Carry out capacity building activities throughout the ethanol value chain.
  + Increase public awareness of the programme.
  + Undertake research and development (R&D) on emerging issues on ethanol at all levels of the supply chain.
  + Monitor and evaluate of the programme.

**The 2003 National Energy Policy (NEP)** and the **Malawi Growth and Development Strategy II** (2011-2016), aimed at increasing the ethanol mandatory and average percentage from 10% to 20% in volume. That increased blending rate has not been achieved yet because of insufficient ethanol production. The new National Energy Policy also sets production level targets for ethanol and biodiesel in 2017 and 2035 (these targets are discussed in 4.6.2).

In order to encourage ethanol companies to increase investment in ethanol production, the government established an appropriate rate of return on investment by pricing ethanol on the basis of full cost recovery. Specifically, **rule 25 of the 2004 Liquid Fuels and Gas (Production and Supply) Regulations** requires that for the definition of the price of biofuels, MERA shall take into account the cost of production, transportation, distribution, weighted storage cost, cost of goods-in-transit insurance and transit losses, taxes and levies plus the licensee’s mark-up, and thus define a price sufficiently high to encourage ethanol production. However, currently, the price of ethanol is pegged to price movements of petrol, meaning that this regulation is still not implemented. MERA is in charge of defining this price structure that reflects "true" cost of ethanol and will be independent of petrol price. They hope to achieve this by the beginning of the new financial year (1st July 2016).

The Malawi Ethanol Programme (2013) aimed to increase ethanol production and its use as fuel from the 2013 level (18 million litres of hydrous / anhydrous ethanol produced) to 49 million litres and 104 million litres per year respectively by 2015 and 2020[[58]](#footnote-58).

In 2014, MERA approved ethanol as a motor vehicle fuel (100% ethanol, not only in blending). This has resulted in plans which are underway to construct separate ethanol pumps at filling stations in all major towns.

Following this initiative, Press Corporation Limited rolled out the Flexi fuel vehicle which can run on either 100% ethanol or 100% or on any blend of the two through installation of a conversion kit. Fifty cars were used in a successful trial run of the vehicles. The full program rollout is awaiting the finalisation of a pricing model.

Electricity and biogas

Alternative fuels: electricity

There are no electric road vehicles in the country (neither small nor large vehicles).

Alternative fuels: biogas

Biogas is not used in transportation.

* + 1. What is the target for 2030?

Biofuels target

Proposed targets

Currently there is no consensus on what is the maximum level of ethanol blending in low-blends (blends that do not require any transformation on vehicle’s engines) that can be used in conventional vehicles. Car manufacturers and oil companies generally are in favour of a 10:90 blending wall, while ethanol producers and farming promote a higher blending wall. Indeed, a blending rate higher than 20:80 might require an engine conversion. However, the increasing share of flex-fuel vehicles will allow a blending rate of E85, and even higher.

Although ethanol is now produced in quantities sufficient to allow blending higher than 10%, the situation is different for biodiesel, with Jatropha production in the country still very modest. The determination of necessary biofuel supply is complicated by gaps in fuel usage data per sector, especially for diesel.

Nevertheless, due to rapid growth of the number of vehicles, the demand for petroleum products will witness a growth in demand and it is expected to rise in the coming years. It is possible to anticipate national liquid fuel demand, based on different methodologies and studies.

The NCST noted that estimated annual fuel requirements for petrol driven vehicles for the country would reach 198.6 million litres by 2015 and 320 million litres by 2020. Assuming straight line growth from importation levels between 1999 and 2013, liquid fuels are expected to rise to more than 325 million litres by 2015 (111 million for petrol and 226 million for diesel), which will further increase to nearly 500 million litres by 2030 (132 million for petrol and 366 for diesel).

Ethanol and biodiesel expected production through 2030 can then be settled, depending on blending targets decided for each of this liquid fuel:

* + E20 through 2020, according to the recommendations of Malawi Growth and Development Strategy II (2011-2016).
  + E30 from 2020 to 2030 (according to projections, ethanol will be produced in sufficient volumes by Ethco and Press Cane Ltd by 2030. But it seems difficult to go further than a E30 blend without adapting the whole car fleet engines).
  + For biodiesel, the production is not expected to exceed the level of one million litres until 2019. Considering the high volumes of diesel imported and consumed (265 million litres in 2020), it is then difficult to set a minimum blending ratio before 2025. The participants to the consultation agree that the achievable targets are 5% (B5) in 2025 and 15% (B15) in 2030. That would represent a need of 16 million litres of biodiesel produced in 2025 and 55 million litres in 2030.

Figure 17: Petroleum products importations since 1999 and projection through 2030 compared to biofuel production levels since 2012 and targets through 2030 (million litres)[[59]](#footnote-59)

|  |  |
| --- | --- |
|  |  |

The biodiesel target through 2030 (55 million litres) is close to the production projections provided by BERL (59 million litres). On the contrary, the ethanol target (40 million litres) is lower than PressCane and EthCo production expectations (75 million litres). The gap between the average blend (E30) and production projections may be absorbed if the country initiates a flex-fuel vehicles importation policy (see below), which would allow the increase of the average blend from E30 to E85 vehicles. Alternatively the country could export the surplus ethanol produced.

Keeping the targets updated

These targets are calculated in a static model and based on linear growth projections. Nevertheless, there might be some technological, economic or political developments with an impact on the levels of consumption. For example, if the country starts importing flex-fuel vehicles in the coming years, the target could be increased and met by the ethanol produced in Malawi (E30 on all conventional vehicles, plus E85 on flex-fuel fleet). Alternatively an ambitious policy supporting the importation and use of electric vehicles (see below) will impact the demand of liquid fuels in transportation, including biofuels, and the target will need to be reduced.

Electric vehicles target

The discussions with the stakeholders will have to help deciding whether it is possible to envision the introduction of electric vehicles in Malawi in the coming years. An ambitious target expressed in percentage of EVs in Malawi car fleet or in number of EVs can then be set.

* + 1. What is the gap between BAU trajectory and the new targets? What are the barriers?

Gaps between business as usual and targets

Blending ratio

The current blending ratio is around 10:90 ethanol-petrol, whereas NEP established that the government will work with the private sector to encourage the expansion of ethanol production to reach a 20:80 petrol-ethanol blend.

Production level and expected scarcity

The total demand for ethanol is expected to be around 40 million litres in 2030 which is considerably higher when compared to the projected production levels by the two ethanol companies of 70 – 80 million litres.

For biodiesel, there will be a need of around 55 million litres in 2030, which would be covered by the national production, under the condition that the exponential growth shown in Figure 16 is realised.

Main barriers that can be anticipated

The main challenge affecting ethanol production is volume as there is not enough molasses from the sugar mills:

* + The production of sugarcane for ethanol is inconsistent.
  + Despite the rule 25 of the 2004 Liquid Fuels and Gas (Production and Supply) Regulations that defines biofuel prices, the price of ethanol is pegged on that of petrol which often acts as a disadvantage for ethanol companies whether global petroleum prices increase or reduce.
  + The land availability for sugarcane plantations is limited.

The main challenges that impose barriers on an increased use of biodiesel include the following:

* + There is a low production of oil seeds for biodiesel.
  + The incentives for farmers are limited as the plantation of jatropha is only allowed along the boundaries of the farms.
  + The output per farmer is low, making logistical costs high.
  + Unlike ethanol, there is an unclear policy direction in relation to the blending of biofuels with diesel.

In general, there is a lack of policies in biofuels, and especially in the setting of mandatory blend ratios that would promote higher production levels, close to the national production capacity (of ethanol and biodiesel).

* 1. Transportation – Urban transportation

The urban transportation infrastructure in Malawi faces significant issues. Mass transportation is dominated by the use of mini-buses (especially mini-vans), and the availability of rail transportation for passengers is limited. In addition, the capacity of roads in urban areas is not adequate to accommodate the increasing numbers of private vehicles and the increasing urbanisation. Given that currently the most significant pressures on transportation are directed towards urban areas, the Action Agenda is focused on urban transportation which has the highest potential for increased energy efficiency. Nevertheless, a more efficient urban transportation will drive improvements in rural transportation as well.

Simultaneously the transportation sector is playing an increasing role in the country’s economy. In the 2014 annual economic report[[60]](#footnote-60), the share of the transportation sector (including storage) to the country’s GDP was estimated to have grown by 5.6% from the previous year compared to 4.9% estimated in 2012 and a mere 1.7% in 2011. In terms of energy consumption, according to the latest data (2009), the transportation sector is responsible for approximately 3.8% of total energy consumption, but it has the potential to become one of the largest energy-consuming sectors in the country.

Globally transportation is the second largest contributor to global GHG emissions[[61]](#footnote-61). In parallel, urban transportation is one of the fastest growing sources of GHG emissions. Passenger transportation is particularly significant as urban areas are locations where complicated traffic patterns are taken place with strong interlinkages to commuting, commercial transactions and cultural activities. Therefore, it is of outmost importance to develop a holistic transportation policy for passengers seeking mitigation goals, while at the same time ensuring economic growth and social inclusion.

In Malawi, the policy response to the challenges faced in the transportation sector is addressed in several policy documents, including a National Transportation Policy. Much attention is directed towards establishing a safe and effective transportation system, but energy efficiency is not addressed in a direct and holistic manner.

What is the current status and BAU trajectory to 2030?

Current status and trajectory

Current population of vehicles

The National Transport Policy (NTP) identifies road transport as the major mode of transport due to the fact that Malawi is a land-locked country. In 2014, there were 437,416 registered vehicles[[62]](#footnote-62). The road sector handles more than 70% of the internal freight traffic and 99% of the passenger traffic.

Vehicles are widely categorised as follows:

* + Motorcycles: two or three-wheeler vehicles.
  + Small vehicles: vehicles other than motorcycles intended for the carriage of passengers and designed to seat at the maximum 5 passengers. This category also includes light pick-up trucks.
  + Mini-buses: carrying vehicle, designed to carry 9-25 passengers. This category also includes multi-purpose vehicles or minivans (also known as kombis).
  + Buses: Large vehicles, designed to carry over 25 passengers, typically on a fixed route.
  + Others: Cargo trucks, trailers, tractors and farm implements and others.

Detailed data on the population of vehicles in urban areas does not exist. The estimates on the fleet of road vehicles, presented in the table below, are based on the situation in neighbouring Zimbabwe, where it is estimated that 61% of the total fleet is located in urban areas. The total numbers of vehicles of each type are based on national statistics of newly registered vehicles in Malawi and the number per category on data in Zimbabwe.[[63]](#footnote-63)

Table 31: Population of road vehicles in urban areas, in 2014, by type of vehicle

| **Type** | **Number** |
| --- | --- |
| **Motorcycles** | 27,494 |
| **Small vehicles** | 308,670 |
| **Mini-buses** | 8,722 |
| **Buses** | 25,633 |
| **Others** | 66,897 |
| **Total** | 437,416 |

It must be highlighted that these figures refer only to registered vehicles but there is also a significant number of unregistered vehicles. Data on the unregistered vehicle does not exist.

Malawi does not have an urban mass transit bus system. Currently, walking, non-motorised transport and mini-buses dominate the transportation of the poorest population in the country.

Current efficiency of vehicles

Most of this population is consisted by second-hand vehicles from Europe and East Asian countries. The large share of old “grey vehicles” in the total population result to a lower fuel efficiency and higher air emissions compared to fleets of more industrialised countries.

**Data on the energy efficiency of the road fleet does not exist.**

Transportation network – roads

There have been no studies on traffic congestion and fuel consumption in Malawi. But they have been done in other countries. An analysis in Germany found that congestion can increase fuel consumption up to 80% and is a more important factor in fuel consumption than distance travelled[[64]](#footnote-64).

Urban road networks have an increasing proportion of paved roads but the majority are still unpaved and, especially in suburban areas, of poor quality. In Lilongwe, the total length of the road network in 2009 was 131 km (consisting of main/secondary roads and urban roads) and is projected to increase to 303 km in 2030. According to the Lilongwe Plan, the road density will increase from 0.3 km/km2 (current land area: 393 km2) in 2009 to 0.64 km/km2 (2030 land area: 468km2) in 2030. The majority of the road network requires improvement.

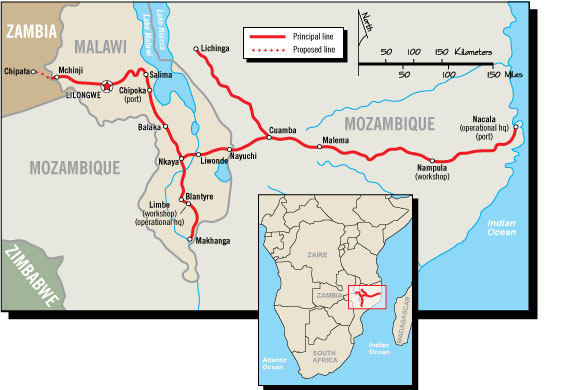
As put forward in the Urban Structure Plan of Lilongwe City (Lilongwe Plan), currently Lilongwe is characterised by a low density land use. Nevertheless, the urban concentration in the Old Town and City Centre is expected to continue. The low concentration will allow the development of urban infrastructure in an efficient manner. Nevertheless, an increase of the population to more than two to three million after 2030, might lead to adverse effects, including traffic congestion. Without any appropriate action, the road congestion is expected to become severe in the future.

The parking areas are relatively scarce in Lilongwe. As a result, in certain areas a large number of cars are parked on road sides, thus imposing problems on the flow of the traffic. In addition, most of the main roads have no road boundaries (reserves), making it practically impossible to expand the roads without demolishing existing buildings. This issue is more significant in Blantyre where density is higher compared to the capital city. As a result, the expansion of the roads to smoothen the flow, or the development of bus lanes becomes a difficult option.

Transportation network – rail

A rail network run by diesel locomotives is on place but mainly for freight transport. The rail network is operated Central East African Railways consortium led by Railroad Development Corporation. The size of the rail network is small (approximately 800 km) and the infrastructure is in a poor condition. MGDS II as well as the National Transportation Policy highlight that there is an urgent need for financial resources as the current state of the infrastructure compromises greatly the safety and efficiency of the network.

Figure 18: Rail network (Railroad Development Corporation, 2016)[[65]](#footnote-65)



Currently, the rail network is operated by 19 locomotives and 403 locomotives (including both those used for passenger and freight transport)[[66]](#footnote-66). It accounts for only 0.92% of the passenger transportation[[67]](#footnote-67) with a smaller share on urban passenger transportation, as it connects few urban areas with their suburban outskirts.

Non-motorised transport

Infrastructure for non-motorised transport is non-existent. Nevertheless, the use of bicycles (including tricycles) as well as walking as modes of transportation is significant in urban areas. In 2014, the bicycle taxis[[68]](#footnote-68) where introduced in urban areas by unofficial operators[[69]](#footnote-69). In 2011, the number of bicycle taxis was estimated at between 4,000 to 5,000. These figures are fluctuating due to the unregulated nature of this activity.

Future trends

Petroleum (i.e. gasoline and diesel) is by far the main fuel used in the sector. The Draft National Energy Policy[[70]](#footnote-70) projects the annual energy consumption for transportation will increase from 396 ktoe in 2015 to 1,025 ktoe in 2030 which correspond to an increase of 159%.

There are no projections on the average fuel consumption of vehicles, until 2030. A comprehensive study in Uganda found that the average fuel efficiency decreased from 12.52 l/ 100 km in 2005 to 13.73 l/ 100 km in 2014[[71]](#footnote-71). In Malawi, it assumed that the energy efficiency will remain stable, as the benefits from the penetration of new and more efficient vehicles will be offset by a high share of second-hand vehicles and the poor maintenance of roads and vehicles.

Under the assumption of a stable fuel efficiency, it is assumed that the urban fleet with increase following the trends of the fuel consumption in the transportation section. This means that the fleet will increase from 437,416 vehicles in 2014 to 1,132,200 vehicles in by 2030. This large increase (covering only small vehicles) is also confirmed by the ongoing study on the energy policy review[[72]](#footnote-72). The study estimates that the car ownership (i.e. person/car) for intercity transportation will increase from 303 in 2008 to 90 in 2030. According to the same study, the current size of the public transportation (urban, rural and intercity) is expected to decrease in the following years and then it will start increasing.

Based on the existing data, it can be assumed that the share of each mode of transportation (see Table 31) will not change significantly. An increase on the number and share of buses will absorb a respective decrease of the share of mini-buses and non-motorised means of transport, including walking.

The use of train (both diesel and electric) is also expected to increase. According to the 2014 Economic Report, between 2013 and 2014, the rail passenger volumes increased by 16.6%. These volumes are expected to increase even further when the Moatize-Nacala corridor opens. An increase of the rail intercity passenger volumes is also projected by the ongoing study on the policy review. Specifically by 2030 diesel and electric rail will account for 2% each of the total transportation volumes (from respectively 0.92% and 0% in 2008).

Existing plans

Adopted in 2015, the National Transport Policy (NTP) provides the direction and intent of the Government of Malawi in the development of the transport sector for it to effectively contribute towards the development objectives of the country. On urban transportation, the NTP focuses on issues related to the increasing number of vehicles, the resulted congestion and the poor quality of roads. The NTP promotes the development of an efficient transportation system but in terms of service and not necessarily of energy efficiency. The latter is addressed indirectly through the promotion of a “socially and environmental sustainable and climate resilient transportation system”. On funding, the NTP establishes the Transport Sector Investment Programme (TSIP), a scheme that will aim to coordinate investments and to ensure that they contribute to a reduction of transportation costs.

Specifically focused on roads, the Road Traffic Act was enacted in 1997 with a view to amend and consolidate the law relating to road traffic and vehicles in Malawi. The Act concentrates on the establishment of the Road Traffic Directorate as a registering and licencing authority for motor vehicles, motor vehicle manufacturers, builders and importers as well as drivers, driving schools and driving instructors. The NTP called for a review of this policy and for a promotion of its enforcement.

The Malawi Growth and Development Strategy II 2011-2016 (MGDS II), sets the development of an efficient transportation as one of its high priorities. The transportation-specific priority areas focus largely on reducing the costs for road infrastructure, promoting competition between operators, building technical capacity and improving the domestic and cross boarder connectivity. The strategy also promotes the improvement and expansion of the rail infrastructure. Plans to develop an urban rail network for passengers are not included.

At the local level, the Urban Structure Plan of Lilongwe City[[73]](#footnote-73) (Lilongwe Plan) acts as the statutory land use plan for the City of Lilongwe. The Lilongwe Plan consists of a statement of policies and proposals together with a plan to be implemented by 2030. In relation to transportation, the plan promotes:

* + Expansion of traffic capacity in roads where the traffic is expected to increase.
  + Improvement of road network, including missing links to smoother traffic movement.
  + Improvement of accessibility to community areas by amongst others constructing paved roads.
  + Development of mass transportation with large city buses, bus stops and schedule.

Malawi does not have any laws which focus on urban transport. The Road Traffic Act is the only law that regulates road transportation and it does not address urban transportation. However, Malawi is in the process of developing a National Transport Master Plan (NTMP) to guide the sustainable development of an integrated multi modal transport sector over the period 2017 to 2037[[74]](#footnote-74). NTMP will identify requirements for the sector in terms of the transport provision required for freight and passenger services under each mode and necessary inter-modal transfer facilities. This will include a prioritized time bound plan for institutional (organizational, policy and regulatory) reform and capacity building in all sub-sectors. Detailed master plans for each sub-sector to meet the requirements will be developed working with the respective agencies and organisations.

Malawi does have one policy that focuses indirectly on improving the energy efficiency of Malawi’s motor vehicle fleet. In 2013, a duty was levied on the cost, insurance and freight (CIF) of second-hand vehicles in order to reduce the importaiton of old, polluting and inneficient vehicles[[75]](#footnote-75).

What is the target for 2030?

The Global Fuel Economy Initiative (GFEI) is one of the SE4ALL flagship programs with the main objective being to reduce emissions and at least double the efficiency of the global vehicle fleet from an average of 8l/100 km in 2005 to 4l/100 km by 2050. Assuming a linear improvement of the efficiency, this means that by 2015, the average of efficiency should have reached about 7l/100 km and 5.8l/100 km by 2030. The current fuel efficiency of vehicles in the country is unknown but given the high penetration of old and inefficient vehicles it can be assumed that it is well above the world average. Therefore, the implementation of the GFEI target is unrealistic.

The 2030 target therefore is set at less challenging level, specifically to an average of 8l/100 km for all vehicles. An intermediate target is set at 9l/100 km to be completed by 2025.

The targets should be revised, at the latest by end of 2017, based on robust and recent data that are expected from NTMP. Vehicle-specific energy audits for each type of vehicle will be required to estimate the current average energy efficiency of the fleet in Malawi.

From an economic perspective, the implementation of this target would lead to equivalent cost and energy savings in addition to the climate benefits. Additional benefits would be created from reduced emissions of atmospheric pollutants, such as NOx and particulate matters.

Transportation involves different modes of transportation and is affected by several factors. The implementation of the fuel efficiency target, requires a set of fuel economy measures, including fiscal measures and incentives, numeric standard, training and awareness raising. These measures are described in section 5.5.1.

What is the gap between BAU trajectory and the new targets? What are the barriers?

Poor urban planning

In Malawi, there are no long term town planning or infrastructure development plans for cities. Most of the main roads have no road boundaries, making it practically impossible to expand the roads without demolishing existing buildings.

High transportation costs and lack of resources to finance the development and maintenance of infrastructure

The NTP highlights that the major challenge for transportation sector is the high costs which are amongst the highest in the region. The high costs are associated with the fact that Malawi is a landlocked country with no access to the sea and economic characteristics of the country. For example, due to the negative trade balance of the country, two thirds of the outwards hauls remain empty, making imports more expensive. At the same time the resource to fund sector programmes, remain inadequate.

Finance is one of the key pillars for sustainable urban transport. Nevertheless, the financial resources in the country are lacking. In addition, according to MGDS II the construction costs in Malawi are high (i.e. in comparison to other southern and eastern African countries) and the absorptive capacity of the available resources in the road sector are low. As a result, the existing infrastructure is deteriorating and the development of a new one is limited. This has also a negative effect on non-motorised traffic, such as bicycles and walking as the quality of the existing infrastructure is adversely affected by the higher levels of transport. In addition, the provision for pedestrian traffic is negligible.

Capacity constrains

There is a multiplicity of actors:

* + Ministry of Transport and Public Works.
  + City Councils.
  + Roads Authority.
  + Malawi Traffic Department.
  + Others involved in transport.

The Join Transport Sector Review (JTSR) annual meetings that have been established by the NTP bring different authorities (as well as actors from the private sector) together to monitor the performance of the sector. Nevertheless, as stipulated by the NTP, there are capacity constrains in all key instructions, including the private sector.

Travel Demand Management (TDM)

There is a lack of capacity and paucity of a deeper knowledge on how to tackle transport challenges in the country. The achievement of sustainable urban transport cannot be accomplished without implementing some TDM measures (e.g. parking fees, subsidising public transportation cost for employees, workplace travel plans etc.). For instance, the City Council of Lilongwe would greatly benefit by employing TDM as the Local Authority has no funds to build new roads that are required to accommodate growth in traffic.

In addition, as stipulated by the MGDS II, currently the connectivity among the various modes of transportation is poor.

Inadequate regulatory regime

Overall, there are no well-planned long term urban transport policies. The Lilongwe Plan focuses on the system efficiency of urban transportation in the city (e.g. mixed land use), with a limited number of measures to promote travel efficiency. For example, the promotion of a mass transport system is promoted without indicating the financial means or other concrete measures (e.g. capacity building, material specification, planning tools etc.). In addition, there are no policy measures to promote vehicle efficiency. The weak regulatory environment as well as the poor management and enforcement of concession agreements, is recognised by the NTP.

* 1. Relevant nexus targets – by 2030

Energy interacts with and influences important areas of development such as water, food, human health, and gender. The Sustainable Development Goals (SDGs) for energy seem to be interwoven with other goals such as water and sanitation, food security and nutrition, health, and gender. The relevant nexus targets are summarized in Table 32 below.

Table 32: Relevant nexus targets

| Nexus | Issues | Targets |
| --- | --- | --- |
| Water | 1. Vulnerability of hydro supplies to climate change impacts as corroborated by recent prolonged drought. Chnaging rainfall patterns might also affect bioenergy resources. Coordination of water planning and management | 1. By 2018 all water bodies are assessed for climate vulnerability while adaptation measures are identified, costed and adopted 2. Risk mitigation measures are addressed by 2030 3. Conduct feasibility studies by 2020 on all dams to install turbines for small hydropower generation 4. Water harvesting methods are adopted |
| Health | Burning of firewood and other solid biomass material impacts on indoor air quality affecting women and children in the process causing health complications | 1. By 2030, 80% of households have moved to WHO standards IT-3 (15 fine particulate matter) in improving indoor air quality 2. All gas suppliers adhere to safety standards by 2016 and cylinders regularly tested |
| Food | 1. Land-use competition is increasing with increasing populations and mandatory biofuels blending. 2. With more mechanisation and expansion of irrigation, energy consumption in agriculture is increasing | 1. Beyond 2018, net expansion of land use for bio-energy (such as sugar cane growing) production will only be considered if it will not affect food security objectives 2. As government embarks on extensive irrigation, solar and wind technologies are prioritised for pumping energy. Efficient irrigation technologies are adopted 3. Waste to energy is pursued vigorously |
| Gender | In the Malawian context, energy interventions impact women and men differently.   1. Women have the task to sourcing primary energy for cooking, thus eating away their time and often threatening their security. Poor lighting affects education, whilst poor indoor air quality affects women mainly as they prepare food. 2. The high up-front costs of access to modern energy services may impact more severely female-headed households, often over-represented in low income quintiles. | 1. Reduce the time women spend collecting firewood in rural areas by 80% by 2030 2. Capacitate women in manufacturing improved cook-stoves and constructing bio-digesters 3. Promote the girl child to study science subjects to enhance their opportunities of working in the energy sector |

1. PART II – Priority Action Areas
   1. Energy access – Cooking

What are the actions and funding levels needed to achieve the overarching objective in the field of energy access - cooking?

Biomass supply intervention

The supply of biomass for cooking is being threatened by the increasing demand from an increasing population as well as by the increased clearing of land for agriculture. At the same time, there are institutional issues with regard to managing the supply of biomass and enforcing biomass-related regulations. The Department of Forestry (MOF) is in charge of managing Malawi’s forests and forest products, but ensuring an adequate supply of biomass as an energy fuel has not been a part of its mission. At the same time, the Department of Energy Affairs (DOEA) is charged with establishing energy policy but has no authority over the use and management of forests and forest products. The missions of the two departments, which are both under the Ministry of Natural Resources, Energy and Mining, are intertwined and their respective roles need to be clarified. A more coordinated effort will be pursued by the DOEA and the DOF to increase the up-stream supply of biomass. The coordinated approach will need to address improved efficiency in the use of biomass (through efficient cook stoves) and preserving a sustainable supply of biomass through controls on forest clearing for agriculture

Transformative awareness campaign on clean cook stoves and alternative cooking technologies

There are many alternative sources of energy and efficient energy technologies which the Malawian population can use to reduce the burden on the nation’s biomass supply. These alternatives include biogas, biomass briquettes, bamboo, pellets, solar energy, LPG and gel fuel. LPG is a particularly viable alternative for households, particularly in urban and peri-urban areas, as discussed below. The use of these alternatives is very low at the present time due mainly to their relatively high prices compared to biomass. The Government will encourage and support private companies and entrepreneurs to enter the business of providing these energy alternatives. The DOEA will work together with the Ministry of Finance, Malawi Revenue Authority and Malawi Trade Investment Centre to incentivise private firms and provide a clear policy framework, potentially involving the establishment of LPG concessional areas. The DOEA will also prepare a recommended set of interventions to assist the poor households in the urban and peri-urban areas with access to efficient wood and charcoal stoves. This will also be done in rural areas but the uptake of the efficient stoves can occur much more quickly in and near cities. The DOEA’s effort will be done in collaboration with NGOS that have already been working on the provision of efficient wood and charcoal stoves. In addition, the DOEA and ESCOM will carry out a campaign on the use of electricity for cooking. A comparative cost analysis study by UNDP (2007) showed that electricity is the cheapest cooking fuel, followed by firewood in improved cook stoves, Chitetezo Mbaula, LPG, and gel fuel stoves were next cheapest alternatives.

Support implementation of efficient biomass cook stove initiatives

The expanded use of efficient cook stoves will lead to a reduction in the quantity of biomass used overall for cooking. Efficient cook stoves also reduce the indoor pollution, which in turn reduces respiratory disease and mortality rates. It is therefore important that these stoves are promoted throughout the country. The promotion will require the increased efforts of NGOS who are already working on such interventions. The DOEA will take the lead in following up on the promotional activities of the NGOS. It will also assist NGOS to access funding to for efficient cook stove initiatives. The Cook Stove Road Map will be aggressively implemented so that both the SE4ALL cook stove targets and the Road Map’s own targets can be achieved.

Monitor and evaluate improved biomass cook stove initiatives

The Government of Malawi, through the Department of Energy, will implement BEST in order to ensure that the financing models that were developed under BEST are utilized. The Department of Energy will also ensure that the Cook Stoves Road Map Programme is a success. The Department will continue monitoring the activities carried out under BEST as well as the previously mentioned Cook Stoves Road Map Programme. The Department of Energy will take the lead as a facilitator of the two initiatives. The Department of Energy will ensure that the two initiatives have funding to implement the activities by encouraging donors as well as the private sector to take the lead in the financing. The Department of Energy will explore various financing mechanisms such as bilateral donors, micro financing, the Global Environment Facility, Carbon funds, Climate Investment Funds, and International Finance Corporation. The Department can also explore the possibility of utilizing the Rural Electrification Fund to partly fund small scale community programs for improved cook stoves monitoring, evaluation and promotion.

LPG Expansion

In addition to promotion of clean cook stoves, the Government of Malawi will mount a major campaign to increase the use of LPG in both urban and rural households and small businesses as an alternative to biomass use.[[76]](#footnote-76) MoNREM will work with local governments, universities and NGOs to raise awareness of the benefits of LPG cooking and how to handle LPC cylinders and associated equipment in a safe manner, The Ministry will support the development of businesses to manufacture cylinders and stoves as well as businesses that can engage in the transport, storage and retail sale of LPG.

In partnership with oil companies, MERA, and Malawi’s development partners, the government will prepare a nationwide plan that addresses the many issues involved in a strategic expansion of LPG use, including issues related to concessions, ownership of LPG cylinders, LPG pricing, financing for LPG-related businesses, safety rules and enforcement, and increasing public awareness. Advice will be sought from other countries, such as Ghana, that have a long track record with LPG programs.

Specifically, the MoNREM will:

* Establish a nationwide framework for LPG distribution, storage and retail operations. The framework will address priority geographical areas for the roll-out of the LPG campaign, whether LPG concessions will be awarded or a more competitive approach will be used, and whether consumers will own their own cylinders or a cylinder trade-in operation will be established.
* Establish a financing facility to support the establishment and expansion of LPG-related businesses. The government will approach development partners and private banks to support the facility.
* Explore risk mitigation options related to the fact that LPG prices are linked to world oil prices and that volatility in those world prices can have a negative ripple effect on a domestic LPG market.
* Identify and recommend fiscal incentives, especially related to subsidies and taxation on LPG cylinders and stoves so that LPG will be competitive with traditional fuels and will be more attractive to users, particularly low-income households.
* Work with the Malawi Bureau of Standards, oil companies, LPG distributors, and others within the existing standards development framework, and other relevant stakeholders, to formulate and implement quality and safety standards for LPG cylinders and stoves and the supporting transport and cylinder refilling infrastructure.
* Work with the Ministry of Industry and Trade, as well as industrial organisations, to promote local manufacturing of LPG cylinders and cooking appliances. In the meantime, the cylinders and burners will need to be imported. The government will monitor and inspect the cylinders and otherwise ensure the cylinders are of high quality.

Promotion and adoption of Institutional Biogas Plants

Most institutions which require biomass energy use efficient cook stoves which lead to heavy depletion of forests due to the large quantity of biomass that they require. These institutions however have readily available source of feed stock for biogas plants in form of human waste. There was once an institutional biogas plant at one of the private schools but it is now non-functional. It is in this vein that there is need for a deliberate effort by the Department of Energy with other stakeholders to promote institutional biogas plants. The Department of Energy should come up with pilot projects at least one in every region of the country to incentivise the use of institutional biogas plants. The Department of Energy should after installing the biogas plant calculate the amount of wood saved thereby increasing the revenue for the institution.

* 1. Energy access – Electricity

What are the actions and funding levels needed to achieve the overarching objective in the field of energy access - electricity?

In order to meet the electricity access targets, a range of options - from stand-alone solar systems to mini-grids to grid connections - will be pursued. The government will work with donors and NGOs in each of these areas and will encourage households to access the most appropriate form of electricity based on their income and usage needs. Households and businesses will continue to be connected the national power grid under MAREP. The priority actions that will be pursued are the following.

Innovation at MAREP

The MAREP needs to be innovative and target its resources not only on extending the grid but also on connecting those already within reach of distribution lines. Currently the MAREP extends grid lines to selected trading centres and put forward the number of people to be connected by assigning 50 prepaid meters per each trading centre. There is need to keep on monitoring the access on those trading centres and if there are upcoming people needing to be connected, MAREP will continue to assign the prepaid meters to those upcoming people. There are also mini-grids which were done under MAREP but not functional. It is important that MAREP revives the mini-grids. The mini-grids will be maintained and the operation and maintenance be provided to a private operator. MAREP will electrify all public institutions 5Km away from the MV line through off-grid options.

**Education, Training and Public Awareness**

The majority of the Malawian population are not aware of the availability and benefits of the modern energy services. There is therefore need for deliberate effort by the government through the Department of Energy to invest in education, training and awareness on the modern energy services.

Capacity Building of MBS on Certification and Enforcement of Standards on RETS

Imports of low quality RETs are on the increase. It is carried out by non-certified companies. This is so because MBS is overwhelmed with the task. There is thus a need to support capacity building within MBS to ensure that enforcement of quality standards in RETs is achieved and put punitive measures that would discourage non-certified importers bring substandard product into Malawi. MERA should work together with MBS on the enforcement of standards because certified companies are supposed to follow standards. MERA should ensure that companies are in possession of all standards from MBS if they are to be certified. MERA should also ensure that certified companies are contributing to the development of RETS in the country by being members of REIAMA. A certified renewable energy company should be a member of REIAMA so that the development of RETS in Malawi is coordinated by a reputable private sector body with which MERA can work.

Financing household-scale electricity technologies

Solar energy technologies, particularly photovoltaics, can play a major role in providing modern energy services to the majority of Malawi’s population. It is particularly applicable in rural areas, though there is scope for the unserved urban population. However, access to these technologies is beyond the reach of the majority of the country’s population. It is therefore essential that financing approaches be identified and supported by the government.

Bank loans may be applicable in some cases, although the interest rates and collateral requirements are prohibitive for most households. Besides, most Malawians do not have conventional credit records and are thus considered too risky for a loan. However, there are a number of alternative approaches people are using in many countries to obtain consumer debt for clean energy investments such as SHS. These include microcredit loans, community credit union loans, village pools, utility on-bill financing, and vendors offering pay-as-you-go solar financing. A large Malawian micro-finance institution, CUMO, regards the potential savings for a household purchasing solar lights as a good reason to lend to such households[[77]](#footnote-77). Some microcredit institutions provide small-scale loans to people who have no credit history but who can get community members to co-sign or the loans.

But debt financing for household clean energy projects is waning in the face of various forms of the energy service model. That is, the emergence of the pay-as-you-go (PAYG) arrangement for SHS has rapidly expanded because it requires low or no down payments from consumers. Instead, the energy solar vendors/installers own and service the equipment for the duration of a contract period. After the installation of the SHS or other energy technology, the customer merely has to continue purchasing electricity at roughly the same price they were paying in the past. But instead of the money going to the electric utility, it goes to the solar provider. The vendor covers its costs and earns a profit through the customer’s electricity payments plus any tax benefits that may accrue from ownership of the solar system. The financial arrangement is a variation on a lease or lease-purchase.

The government is interested in seeing this kind of approach expand throughout Malawi. In order to provide these financing ventures with seed capital, the Department of Energy will resuscitate the Guarantee Fund which was set up through the Malawi Environment Endowment Trust. How the fund will be used will be determined through consultations with stakeholders such as importers, manufacturers, installers and organizations representing the household sector.

Currently the population that is on the national grid enjoys subsided energy price as well as free access to electricity by way of either MAREP or ESCOM grid extension nearby them. The majority of the population far away from the grid do not enjoy these benefits. It is therefore imperative that if a private investor goes into the SHS business, particularly in rural areas, or a mini-grid construction and operation venture, a subsidy will be needed on either the upfront investment cost or on the operation and maintenance costs. The government, led by the Department of Energy, will appraise various subsidy options, from investment tax credits to production credits to the waiving of certain fees and taxes. For mini-grids, there could be a subsidy provided per new connection, as is done in Mali[[78]](#footnote-78). Alternatively, capital subsidies could be provided over time in tranches to better ensure good performance by the operator. The subsidies will be designed to achieve a certain IRR for the investors, although they will be responsible for a lower IRR if they are unable to contain costs.

Financing and regulation of community-level electricity generation (Mini–grids)

Along with individual SHS, mini grids are a key element in Malawi’s rural electricity service strategy, particularly where population densities are high enough to support them. Ideally, mini-grids would be built by an entrepreneur or by a community, who manage the system and charge consumers a fee for the electricity sufficient to cover the cost of building and operating the mini-grid. But in practice, this has been a challenge in many countries. Experience in many countries indicates that many mini-grids have high generation costs and low revenues. They are regarded as risky investments by private entrepreneurs, although with sound financial structuring and government support, mini-grids could be financial sustainable. The DOEA will identify the appropriate form of subsidy that will be needed (See “Provision of Subsidies” below).

There are several ownership and financing models that the Government of Malawi will explore for developing mini-grids on a sound financial footing. The government will not select a particular approach but will encourage approaches that attract private investment. An attractive model is for a private entity to own the generation while the community owns the mini-grid itself. The private entity could also have a service contract to maintain the mini-grid. Whichever approaches are chosen, private ownership of at least part of the mini-grid system will be desirable.

While mini-grids can operate largely without regulation, a basic regulatory structure is needed to ensure financial and technical stability of the mini-grid, ensure safety standards are followed, and equipment and operating practices will allow the mini-grid to be more readily connected to the grid when the grid reaches the mini-grid. There is also the matter of regulating mini-grid tariffs. In some cases, the tariffs are reduced because people on the mini-grids are poor and cannot afford to purchase electricity at full price. Finally, because mini-grids are inherently risky investments, the GoM will look to find ways to reduce fees and other expenses faced by a mini-grid start-up. It may also be possible to exempt mni-grids from certain expenses or at least streamline processes such environmental impact assessment.

Electrification of Public Institutions

Most public institutions which are in the rural areas where there is no grid electricity are not electrified. The Rural Electrification Programme should intensify its efforts to electrify all public institutions where the grid has reached. The electrification should include in-house wiring of the institutions. Those public institutions far away from the grid should be electrified through off-grid options. This will lead to 100% electrification of public institutions by 2030. Those public institutions which are in the urban areas but not electrified should also benefit from the Rural Electrification Programme through the arrangement of in-house wiring and meter connection.

Promotion of Pico solar systems

The government’s strategy to broaden the use of pico solar products, such as solar lanterns, will rely on a strong collaboration with NGOs, which are already engaged in the promotion and distribution of solar pico products. The DOEA will mount a promotional campaign in select, isolated geographic areas to encourage people to use pico solar products as an alternative to kerosene and candles. The promotional campaign will also:

* Inform consumers about how to purchase quality equipment, for example, by choosing certified products;
* Work with local governments and village leaders to begin using pico solar products themselves and participate in encouraging other people to use them;
* Offer training courses and develop the capacity of local entrepreneurs on the sale, servicing and financing of pico solar products as well as SHS and other alternative energy products. A possible model for this is the “energy stores” established in the KwaZulu-Natal province of South Africa, which provide a range of solar, LPG and other energy services to rural communities.
* Work with universities to establish rural business incubation facilities to assist entrepreneurs and start-ups in developing pico solar and related businesses that provide energy services in rural areas.

NGOS will be encouraged to come up with large-scale programmes to distribute and finance pico solar products in specific geographical areas of the country. They will also be encouraged to introduce solar energy kiosks in remote areas. These mini-stores, which provide refrigerated food and drinks, have been a success in Tanzania, Kenya, Rwanda, Ethiopia and elsewhere.

Table 33: Summary of priority actions on Energy Access

| Category | Action | Indicative time frame\* | Lead agency | Cooperating stakeholders | Estimated costs |
| --- | --- | --- | --- | --- | --- |
| Biomass supply intervention | Improve coordination between Department of Energy and Department of Forestry | Short | DOEA and DOF | MoNREM | n.a. |
| Awareness campaign for efficient cook stoves and alternative cooking technologies | Work with private sector and other stakeholders to promote clean cooking technologies and provide financial incentives for private firms to increase supply of these technologies | Medium | DOEA | Ministry of Finance, Malawi Revenue Authority, Malawi Trade Investment Centre, private firms, NGOs | Awareness campaign $250,000/year; Financial incentives for private firms $2-3 million/year |
| Support implementation of efficient biomass cook stove initiatives | Provide support to NGOs implementing cook stove projects; Pursue implementation of Cook Stove Road Map | Short to medium | DOEA | NGOs | Budget to be determined |
| Monitor and ensure implementation of clean cook stove initiatives | Implement BEST and monitor its impact. Arrange for independent evaluation of the Cook Stoves Road Map Programme, including household surveys pursuant to the World Bank’s Global Tracking Framework. | Short to Medium | DOEA | NGOs, Development partners | $50,000/year for monitoring and evaluation  Mid-term evaluation: $80,000 |
| LPG expansion | Roll out a campaign to greatly increase LPG use for cooking, addressing legal, financial, safety and ownership issues | Medium to Long | DOEA | Ministry of Finance, Malawi Bureau of Standards, oil companies, private companies, local governments, Small and Medium Enterprise Development Institute | Preparing the LPG roll-out plan $400,000; incentives for businesses $1.2 million over 2-3 years; public awareness campaign $175,00/year |
| Promotion of biogas plants | Increase the use of biogas plants at institutions such as schools; undertake pilot projects | Short to medium | DOEA | Schools, hospitals, clinics, biogas plant manufacturers | Pilot projects $750,000 |
| Innovation at MAREP | Connect households in close proximity to distribution lines, monitor trading centre connections, revive maintain the dysfunctional mini-grids | Short, medium, long | DOEA | MAREP | Budgets to be determined |
| Subsidies for solar home systems and mini-grids | Appraise subsidy options e.g., tax credits, interest rate subsidies, reduced fees, etc.) and provide them to providers and/or consumers. | Medium | DOEA | Ministry of Finance, solar companies, ESCOM, Renewable Energy Association of Malawi | Appraisal $100,000; Cost of subsidies to be determined |
| Support for expansion of pico solar solutions in select isolated areas | Establish promotional/awareness-raising campaign and support local entrepreneurs to provide sales, servicing & financing of pico solar and other energy products | Short, medium long | DOEA | NGOs, universities, local governments | $250,000/year |
| Financing and regulation of mini-grids | Identify subsidy mechanism to support mini-grids; Establish rules on safety, performance, operating practices | Short to medium | DOEA | MERA, Renewable Energy Association of Malawi | Develop regulatory structure $250,000 |
| Financing household scale electricity technologies | Appraise financing and subsidy needs to support solar home systems and other household scale technologies, including appraisal of how the Guarantee Fund could be used; Resuscitate the Guarantee Fund | Short, medium, long | DOEA | NGOs, manufacturers, importers, installers, Renewable Energy Association of Malawi | Appraisal $100,000 |
| Capacity building at Malawi Bureau of Standards | Support MBS on certification and enforcement of RETS and mini-grid standards | Short to medium | DOEA | MBS | n.a. |
| Electrification of Public Institutions | Electrify all of the country’s public institutions with either grid connections or off-grid technologies | Medium to long | DOEA | MAREP, Renewable Energy Association of Malawi | Budget to be developed |
| Support for pico solar products | Accelerate implementation of pico solar products by supporting and coordinating existing NGO pico solar programs | Short, medium, long | DOEA | NGOs, Renewable Energy Association of Malawi | Budget to be developed |
| Monitor and evaluate progress in providing electricity services | Arrange for independent M&E, which should use household surveys pursuant to the World Bank’s Global Tracking Framework | Short, medium, long | DOEA | NGOs, MAREP, Renewable Energy Association of Malawi | Annual monitoring $50,000  Mid-term evaluation $80,000 |

Which (global) high-impact opportunities are relevant?

* + Advanced Lighting & Appliance Efficiency.
  + Off-Grid Lighting & Charging.
  + PV Irrigation and Productive Use.

Renewable energy

The government has prioritized energy generation and supply as one of the priority areas (MGDS II & ERP) to stimulate economic growth. The specific goals are:

* + Make the energy sector sufficiently robust and efficient to support GoM’s socio-economic agenda of poverty reduction, sustainable economic development, and enhanced labour productivity.
  + Catalyse the establishment of a more liberalized, private sector driven energy supply industry in which pricing will reflect the competition and efficiency that will develop in the reform process.
  + Transform the country’s energy economy from one that is overly dependent on biomass to one with a high modern energy component in the energy mix[[79]](#footnote-79).

What are the actions and funding levels needed to achieve the overarching objective in the field of renewable energy?

Adopt a renewable energy policy

The increased use of renewable energy is consistent with the Malawi Growth and Development Strategy II and the updated energy policy. But while a draft IPP framework and draft Renewable Energy Strategy were developed in 2016 and 2017, respectively, there is not yet overall policy framework that addresses renewable energy comprehensively. Malawi will adopt a national renewable energy policy to be overseen by a steering committee composed of major stakeholders such as MERA, the energy ministry, ESCOM, REIMA, industrial associations, and universities. The RE policy will establish a framework for RE project development, including.

* + Formal adoption of rules for the acquisition of RE electricity, such as REFit, RE Obligation, and RE auction.
  + Targets and timetables for the acquisition of RE electricity.
  + Support for private investment in RE projects.
  + Streamlining the project planning process and decreases project development and licensing costs.
  + Introducing independent assessment, supervision and certification (independent consultants) of RE projects as is the case in other engineering and construction projects.
  + Assigning roles to ESCOM, MERA, the Department of Energy, other government entities, and other players.
  + Ensuring adequate consultation with stakeholders and the public in the project development process.

Mechanism for acquiring electricity from RE sources

Malawi has choices to make about how to acquire large-scale, grid-connected RE.[[80]](#footnote-80) The government, through ESCOM, can either build the RE power projects itself or enter into contracts with private suppliers or do both. The government will seek to do both, but will place a major emphasis on using private suppliers or IPPs.

For example, the government has already moved toward operationalizing a REFiT. However, there is disagreement about the price that ESCOM should pay for various types of RE. One of the disadvantages of a REFiT is that the government must continuously review and update the tariffs. There is also disagreement about how many years a certain price should be offered to an RE supplier. Some parties point to the decreasing costs of solar and wind and suggest that those costs will continue to decrease and so a 20-year contract to purchase RE electricity should reflect the decreasing costs by reducing the tariff in later years. However, the RE developers point out that the technology they install in Year 1 will be the same technology in future years and will not reflect the lower future technology costs, so the tariff should reflect the costs of the installed technology and thus remain the same for the duration of the contract. Regardless of which approach is taken, the REFiT will need to provide price predictability to RE investors for 20 years. Without price predictability, investors will not finance the RE projects.

Given the somewhat cumbersome and controversial nature of a REFiT, an alternative mechanism is the Renewable Energy Obligation (REO). An REO would simply require ESCOM to supply a certain percentage of its power from RE sources by a certain date. It would be up to ESCOM to decide how to go about doing this. For example, it could finance the projects itself. It could enter into PPAs with IPPs. It could create its own tariff at which it will offer to acquire power from various types of RE projects, or it could hold a competitive bidding process. The choices would be up to ESCOM as long as it meets the target date. The amount of RE power ESCOM would have to supply by that date would be based on the SE4ALL targets. REO’s exist in the UK, US, China, Korea, Japan, Australia and Germany, among other countries. They can be simple in design and just require the utility to supply a certain percentage of MWh from RE sources; or they can specify targets for specific RE technologies.

The government could decide to adopt a modified REO that has minimum targets for certain technologies like small hydro solar power, and wind so that ESCOM wouldn’t try to acquire all the RE in the form of large hydro. But ESCOM would still have flexibility in determining for itself how to acquire those RE sources. The government would not set targets for specific solar technologies, such as PV or CSP.

For larger RE projects (> 30 MW), a transparent and timely bidding process is probably the best approach. This could eventually lead to an RE auction system like South Africa is planning to operationalize.

Allowing small-scale on-site RE installations to sell excess power to the grid is a common policy. A limit on the size of each system, such as 0.5 MW is common as well. The government is supportive of net metering and will need to develop standards to ensure that the power from the small projects is of sufficient quality and does not cause voltage problems with the grid.

Providing financial incentives for developers and users

Many countries provide incentives for the development of RE sources. The types of incentives used include concessional import duties, excise tax benefits, corporate and personal income tax benefits (including tax exemptions, holidays, credits, and deductions, as well as accelerated depreciation), subsidies against investment costs, low-interest loans, and premium power purchase prices. In particular, corporate tax credits and RE production credits will be seriously considered by the Government of Malawi. The size of the production credits would be based on the number of MWh delivered to the grid. These kind of incentives help improve cash flow and reduce risk for the project developers and investors. The government would not lose revenue it would otherwise have received from these projects because the projects wouldn’t have been built without the existence of the incentives.

The financial incentives offered will need to be carefully calibrated with the mechanisms for acquiring the electricity, as discussed immediately above. A generous and dependable long-term REFiT might obviate the need for other financial incentives, as Uruguay has found. Likewise, a REO combined with a competitive bidding process for the purchase of electricity from RE projects may be all that is needed to provide sufficient long-term income to RE developers. However, looking at most other countries that have experienced significant expansions of grid-connected RE (e.g., India, China, Scotland, Germany, etc.), it appears that government financial incentives have played a key role in getting the expansions started. As the RE industry matures, the incentives can be scaled back.

Subsidized loans are another possibility for supporting the RE industry. Since most RE projects are highly leveraged – meaning a large percentage of their financing comes from debt – there may be a need for the government to work with international financial institutions to provide affordable (below-market) debt. But once again, providing subsidized debt will need to be carefully coordinated with other financial incentives the government may offer and with the REFiT/REO policies. While the government wants to support and assist RE developers, it does not want to foster free ridership.

Elimination of import duties on RE and EE equipment is common in many countries. However, there is a need to determine exactly which equipment qualifies for the exemptions. PV panels and inverters obviously do, but certain kinds of batteries which have other applications should nevertheless qualify as well,

Streamlined requirements and quick and inexpensive MERA licensing process for developers

As discussed in the previous chapter, permitting, licensing land leasing and EIA procedures can in combination be cumbersome and time-consuming. Establishing a streamlined approval procedure with an inter-agency project review committee will help speed the process and thus reduce costs and risks for the project developers.

Providing assistance to developers in the preparation of the energy yield studies, interconnection studies, economic models, EIAs, etc.

For larger RE projects, a number of these studies are needed to determine the amount and quality of electricity that will be delivered to the grid, and what it’s impact will be on the grid and the environment. These can be costly and there may be ways the government can help cover these costs. The studies for specific projects can be included in the Investment Prospectus as investments that donors may want to make. Risk guarantees to back up payments by ESCOM. Even if ESCOM agrees to buy electricity from an RE project and signs a long-term PPA, investors may question the reliability of ESCOM as a long-term payer. This is a common concern by RE investors. So the RE policy will consider ways of providing security for the investors, such as working with international financial institutions to provide partial payment guarantees to the investors. The guarantee would state that if ESCOM falls behind on its payments by a certain amount, then the payment guarantee will pay the investors a certain percent of what it owed.

Rules for on-site RE generation by third parties

Many industrial firms have on-site power generators to provide back-up power during outages. It may be desirable to have on-site power generation available at all times if it is provided by a contractor who installs a small RE plant such as a biomass power unit or a solar PV project. There will need to be rules to allow that contractor to build a generation facility connected to a grid-connected company, and there will need to be rules on the structure of the contract between the contactor and the power off-taker. This “chauffage” approach is also applicable to on-site cogeneration plants that sell both electricity and process heat to a facility.

Performance standards for RE equipment and licensing of installers

In order to avoid inferior equipment, such as PV modules or inverters, there may be a need for certification of the performance certain types of RE equipment, particularly that equipment used in small-scale and rooftop applications. There are likely advantages to having regional certification standards. A regional RE standard-setting and equipment certification initiative could be coordinated by SADC. There may also be a need for testing and labelling the equipment, which could also be conducted or coordinated by SADC. Likewise, trained and licensed RE installers, particular small-scale solar PV installers, is needed in order to have properly configured RE systems.

On-bill financing (OBF) for on-site residential RE installations

This approach allows buyers of RE systems for their homes or business -- such as solar PV panels and solar hot water systems -- to pay for the systems over time on their utility bills. OBF can work with prepayment meters as well. It’s convenient for the users because they don’t have a separate loan payment. It’s attractive to the bank that operates the program for the utility because there is close to a zero default rate because default results in cutting off the customer’s electricity.

Encouraging local governments to require mandatory solar water heaters in all new buildings

A requirement to install solar geysers in new construction can be done at either the national or local level. But since local governments oversee construction, it may be advantageous to include local governments in the initiative. It can also sensitize them to play a role in other energy activities like EE procurement of lights, pumps, etc. for local government facilities.

Research program to identify, appraise and demonstrate opportunities in waste-to-energy, biomass power, geothermal, cogeneration, energy storage, etc.

There is a need to explore other RE possibilities besides hydro, solar and wind, and the Department of Energy, with assistance from donors, could conduct tests of the fuels and technologies, and determine their applicability and costs in Malawi.

Establish a Renewable Energy Agency

Some countries, such as India, have established stand-alone RE agencies or combined RE-EE agencies that have a mandate to implement the national RE policy. In other countries, RE policies are implemented without a separate agency. But a dedicated RE agency, given sufficient authority, could make a major difference in the expansion of RE in Malawi. The activities of the agency would include helping establish the country’s IPP policy, helping IPP developers through the regulatory process, certifying RE products and installers, working with MERA on setting and revising feed-in tariffs, and developing new policy to be established as law.

Develop a financing strategy for RE

The Government of Malawi will take steps to address the financial barriers that currently exist for RE projects. Among the actions it will consider are:

* + Helping identify funding for pre-feasibility studies for RE projects, particularly in the areas of waste-to-energy systems and cogeneration.
  + Establishing another MAREP-like mechanism, running parallel to the original MAREP, to help fund RE. The mechanism can be used to capitalize a guarantee fund that can be used to ensure that ESCOM makes its payments under its PPAs.
  + On-bill financing for small-scale on-site solar systems, including solar geysers.
  + Assisting and encouraging banks to pursue an RE loan bundling strategy that allows the bundled loans to be sold on the secondary market, as is being done in Kenya and Rwanda.
  + Pursuing solutions to high country risk problem, e.g., off-taker (ESCOM) credit worthiness risk, such as providing a sovereign guarantee.
  + Eliminating or decreasing the VAT on RE products.
  + Establishing rules for solar service agreements so that solar vendor/installer can receive tax incentives from the government as well as payments from the solar consumer for the electricity, and can then sell that electricity to ESCOM at the feed-in tariff price. The advantage for the consumer is that they do not need to pay for the solar installation, which is owned and maintained by the vendor. The advantage for the vendor is that with the consumer not having to worry about paying for the solar installation, vastly more consumers will be interested in having the installations.

Improve and modernize the electric grid

* + Widespread development of RE is not possible without an improved T&D infrastructure to allow wheeling of RE-generated electricity and increased overall reliability.
  + Modernization of the grid, including the use of advanced information and communication technologies, will be beneficial on a number of levels, including the ability to incorporate and manage electricity coming to the grid from a variety of intermittent RE sources.
  + Other grid improvement techniques could include GIS mapping, synchrophasers, and AMI metering with remote reading and load control.

Adopt an effective IPP policy

The feed-in tariff provides a guide for IPPs to participate in supplying power, and ESCOM has had discussions with RE IPPs. But no PPAs have been signed. A specific IPP policy is needed to set the terms for IPP participation in the power market. The policy, which may overlap with the RE policy outlined above, should:

* + State that at least some predetermined level of new RE supply will be provided by IPPs.
  + Allow IPPs to sell directly to large users – with prepayment meter (PPM) funds going straight to the IPP.
  + Establish clear land ownership and leasing rules for IPPs.
  + Streamline the licensing process and minimize licensing fees and requirements.

Implement RE education and training program

* + Improve/increase educational and training opportunities for students as well as officials in national government, local government, financial institutions and small and medium-sized enterprises (SMEs).
  + Establish RE training programs at technical colleges.
  + Establish an RE internship program for college graduates.
  + Until training programs at the technical colleges are established, implement a near-term training program on RE for those electrical and mechanical engineers who are already starting to work in the field on RE.
  + Establish an RE awareness initiative, including introduction a media strategy including radio and newspaper, and holding RE fairs.

Refurbish old RE installations

One of the reasons Malawians are sceptical about the viability of RE is that a number of previous RE projects failed because of poor design and poor maintenance. It may be worthwhile to upgrade, rehabilitate or replace some of these projects to demonstrate the government’s commitment to RE and show that it can be done right.

Priority actions synthesis

A summary of the priority actions proposed in the SE4ALL initiative is presented in the table below.

Table 34: Summary of priority actions on Renewable Energy

| Category | Action | Indicative time frame\* | Lead agency | Cooperating stakeholders | Estimated costs[[81]](#footnote-81) |
| --- | --- | --- | --- | --- | --- |
| Large hydro capacity additions | 350 MW Mpatamanga, 200 MW Kholombidzo, 40 MW Mbongozi, 50 MW Chizuma, 90 MW Songwe 1, 60 MW Songwe 2, and 140 MW Fufu | Short, mid and long-term | MoNREM | MERA, ESCOM, EGENCO, private sector | Unit cost: $2.9 million/MW  Total: $2.7 billion |
| Small hydro capacity additions | 22 MW Tadzani IV, 23 MW Ruo | Short & mid term | MoNREM | MERA, private sector | Unit cost: $2-4 million/MW  Total: $90-180 million |
| Solar capacity additions | 550 MW of PV projects at various sites | Short, mid & long term | MERA | MoNREM, private sector | Unit cost: $3.8 million/MW  Total: $2.1 billion |
| Bagasse cogeneration capacity additions | 46 MW at two Illovo sites | Mid & long term | MERA | MoNREM, private sector | Unit cost: $6.7-7.4 million/MW  Total: $308 - 340 million |
| Policy | Adopt RE Policy, financing strategy | Short term | MoNREM | MERA, private sector, Renewable Energy Association of Malaw, NGOs | n.a. |
| Research | Conduct detailed resource assessments for RE, especially wind, geothermal and non-sugarcane biomass resources. | Short-term | MoNREM | Universities and other research institutions (University of Malawi – Polytechnic, University of Mzuzu – Department of Energy Studies)  National Commission for Science and Technology | n.a |
| Capacity building | Training for government and private sector on licensing & permitting process, costs, regulatory policy and procedures, major issues in developing an RE project. | Short term | MoNREM | MERA, private sector | n.a. |

* 1. Energy efficiency

What are the actions and funding levels needed to achieve the overarching objective in the field of energy efficiency?

Priorities identified by the SE4ALL stakeholders. Potential initiatives – indicative implementation timing and budget estimates (where possible).

Demand-side measures

**Solar for hot water heating**

The Malawi Intended Nationally Determined Contribution (INDC) to UNFCCC calls for installation of at least 20 000 solar water heaters by 2030. Provided that hot water geysers running on electricity are the most intense consumers of energy in the household sector, the government will make it a national priority to promote mass scale uptake of solar geysers provide as the most cost effective method of providing hot water. Future new housing schemes will be required to install solar geysers. A large scale promotion campaign will be carried out through the local banks and the Utility, offering subsidized loans that can be repaid through the electricity bills of the households. Additional tax incentives will encourage local manufacturers to engage in production of solar powered geysers.

The government will lead the way by installing solar hot water heating systems in schools, hospitals, social institutions and other public buildings.

**Domestic lighting**

Improving the energy efficiency of domestic lighting is one of the lowest-cost, quick results delivering and easiest to implement demand side management initiatives. It is also an efficient way to raise awareness and teach the general public of the benefits that improved EE brings along. Based on the success of the recent 2 million energy saving bulbs roll out initiative, the government and the Utility will expand its effort to promote efficient household lighting. Future programs will involve popularization of the most efficient technologies currently present at the market (e.g. LED) and will be combined with extensive awareness raising campaigns.

**Pre-paid meters**

Since 2011 ESCOM started the pre-paid metering program, offering pre-paid schemes to its newly connected customers. ESCOM will extend it until 100% coverage in the residential sector is reached before 2030. This will not only spark substantial energy savings in the domestic sector, but will also allow ESCOM substantially strengthen its financial position and cash flows by improving the electricity bill collection rate.

Pre-paid metering for public sector entities will also be considered but have to be cautiously approached due to budgetary specifics. Resistance from some ministries and government departments and agencies may be anticipated because of the requirement to upfront pay for the energy to be used. ESCOM will need to work with the Ministry of finance, economic planning and development and eventually to come up with a system for upfront payments for government departments and agencies.

**Large industrial and mining customers**

Malawi can achieve substantial energy saving results by supporting and incentivizing various programs for EE promotion in the industrial and mining sectors. Special attention will be paid to the following priority areas:

* + Programs for replacement of standard burnt motors, gear boxes and conveyors with energy efficient ones.
  + Installation of variable speed drives on large motors operating under fluctuating loads.
  + Mandatory regular examination and maintenance of large motors.
  + Automation of steam generating boilers.
  + Installation of combined heat and power generators where applicable.
  + Promotion of sub metering in complex industrial and manufacturing processes. Implementation of sub-metering system will help the company owners and their energy managers to more precisely analyse company`s energy consumption data and identify the least efficient processes or machines and subsequently implement necessary EE measures on the identified items, thus increasing the overall energy performance of the company less expensively.

Agricultural

The focus will be on the most energy consuming agricultural processes: tobacco curing, tea drying and irrigation water pumping being the top priority. About 5,000 efficient barns will be installed (constructed) by 2030. The GoM will channel carbon funds and donor money to subsidize the construction of efficient barns and to motivate farmers to shift from electric or diesel irrigation pumps to solar powered ones.

Other priority areas will be: i) installation of biogas digesters at dairy and pig farms; ii) utilization of solar powered pumps for irrigation; iii) replacement of old and obsolete equipment and mechanization (tractors, seeders, harvesters).

Capacity building

The Government (through the Department of Energy) in cooperation with MERA and ESCOM will start implementing an energy management training and certification program to create sufficient internal EE technical capacity. International expertise and trainers will be required during the initial phase, but the country will by 2020 aim at establishing a National Energy Management Training Centre within one of Malawi`s technical universities. The role of this National Energy Management Training Centre will be through adopting the international best practices to create steady technical capacity force countrywide.

The Energy Authority will start offering technical support and financing therefore to large energy consumers, which intend to implement EE measures in their business processes. Funds for TA and Capacity building activities will also be raised through cooperation with various international agencies and respective grant schemes (such as UNIDO`s Industrial EE programme, etc.).

All internationally funded EE/RE financing programs and credit lines to be implemented in Malawi will be required to provide free of charge technical assistance to end users.

**Awareness raising campaigns**

What was done on sensitizing the citizens of Malawi about efficient ways of energy use is not enough. The government, in cooperation with MERA, ESCOM and local NGOs and community groups will put extra effort to raise awareness among the population and subsequently translate it into action. Sustainable and continuous communication strategies will be developed to raise public awareness on efficient energy use and induce change in people`s attitude. These include use of posters and pamphlets written in simple language that the public can understand and relate to. Use of drama on both radio and local newspapers as well as in road shows will be encouraged. Prominent public figures will hopefully be attracted to support the awareness raising strategy. The cook stoves road map initiative will provide good opportunities to not only roll out efficient stoves but to inform and convince the general public of the benefits that EE offers to the people and local economy.

**Supply side**

Acknowledging that vast EE potential lies in the distribution and transmission sector, Malawi will take full advantage of the WB sponsored Energy Sector Support project and the Millennium Challenge Corporation compact to further focus on:

* + Revitalization and upgrade of the existing transmission network.
  + Reinforcement of the existing electricity distribution network through upgrades of substations and installation of modern communication equipment.
  + Rehabilitation of the existing power plants.

**Institutional approach**

**National EE Committee**

Establishing a specialized body to supervise and administer all EE related activities in Malawi will undoubtedly underpin country`s aspirations towards achieving more balanced and sound energy system. This will be a dedicated unit within the Ministry of Natural resources, Energy and Mining. The committee will be established as a body with strong technical skills, dedicated to implementing the national energy efficiency policy[[82]](#footnote-82) and will have the following powers and responsibilities to:

* + Supervise and follow the achievement of the nationally determined annual targets for energy savings and RE potential utilization.
  + Actively participate in the development of drafts for EE and RE related national legislation and bylaws.
  + Develop national energy savings measurement methodologies (based on internationally accepted protocols).
  + Issue national energy auditing guidelines for buildings and industrial processes.
  + Together with the MoNREM determine specific EE targets for large energy consumers.
  + Collect and record energy savings related data and follow for compliance with the specific EE targets set for large energy consumers.
  + Issue certificates for energy auditors and maintain a list of certified auditors and auditing firms.
  + Organize energy management and energy audit training events.

Acknowledging the fact that the experience of industrialized countries across Europe and Asia shows the need of a National Energy Efficiency Committee to coordinate, promote and monitor EE related activities at country level, the SE4ALL Working Group members reached a consensus that setting up such a committee in Malawi is not considered a priority in the short term. The National EE committee will be established after a national survey of the EE situation in Malawi and rigorous analysis of the impact that such an institution may have on the EE market in the country. The committee will therefore not become operational earlier than 2023.

**EE and RE technical excellence centre**

To efficiently apply MEPS and promote energy performance labelling programs, Malawi will set up technical excellence centre to carry out activities such as: i) testing the energy performance of imported or locally produced equipment and appliances; ii) defining national energy performance standard thresholds, etc. This will be vested as a unit in the Malawi Bureau of Standards or established as an independent entity. NEP acknowledges that a robust energy policy and planning process should necessarily involve development of a high quality data collection, recording, storage and analysis system. The technical excellence centre will play a key role in responding to NEP`s call. The data collected and analysed will create enabling environment for a highly efficient policy making and target setting process. Implementation of a sound set of monitoring and verification (M&V) methodologies and procedures will be of utmost importance to SE4ALL coordination and follow up process and will allow the government and the SE4ALL regional hub to precisely assess the progress of the initiative and to timely intervene by policy adjustments when needed. Energy Valuation Organization's (EVO) International Performance Measurement and Verification Protocol (IPMVP) provides an overview of current best practice techniques available for verifying results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities and may also be used by facility operators to assess and improve facility performance. IPMVP presents common principles and terms that are widely accepted as basic to any good M&V process and can be easily adopted in Malawi. The Technical excellence unit will gather record and process the feedback data derived through M&V activities and will make this information available for all SE4ALL l stakeholders and other interested parties. The set-up and operation of this unit will be partly funded by the government (through MoNREM), while equipment testing fees (payable by local producers and importers) data access subscription charges (payable by various EE/RE stakeholders for access to the centre`s database) will complement the budget revenue. The technical excellence centre will operate in close collaboration with the National energy management training centre, sharing expertise and joining efforts to promote the most current EE trends and technologies in Malawi.

Possible Financing solutions

**Utility – On-the-bill financing mechanisms**

The Utility may play a key role for amplifying the penetration of DSM technologies in both the domestic and the industrial sector. ESCOM, together with vendors of efficient domestic appliances or industrial equipment as well as local banks will set up financing campaigns. The end-user can obtain a loan (from a bank) or deferred payment scheme (from a vendor) to finance acquisition of an energy efficient appliance or machinery while the repayment is made in instalments through the electricity bill (or the pre-paid voucher). This financing channel may be used for mass scale promotion of efficient solar water heaters, efficient lighting fixtures and bulbs, cook stoves and other electric energy performance certified appliances and equipment. To ensure early stage success and pave the way to scaling up similar financing schemes, the ESCOM should launch an on-the bill financing program for efficient lightbulbs by the end of 2017.

**Private banks – specialized EE credit lines**

Local commercial banks, despite their high interest rates, can play a key role in the development of an EE and RE financial products market and will serve as major channel for passing international money to the local households and business. With their extensive branch networks, excellent understanding of the market and sound loan approval rules and processes, the LFIs will greatly help streamline the EE/RE financing. To motivate the local banks to engage in EE/RE financing, the government (through the MoNREM, MERA or other units) will offer free technical assistance and capacity building to those banks willing to participate in dedicated financing programs. Special attention will be paid to developing special financing products for local producers of fuel efficient cook stoves. This industry niche, predominantly occupied by women, will need specialized financing solutions in order to build capacity to meet the growing demand over the next years.

**International and Bilateral Financial Institutions and Partners**

Malawi is attracting increasing amounts of international capital for climate change projects and is building expertise which will further enhance improved access to EE dedicated international funds. As a result, the country will be able to access grant financing and credit lines at competitive rates. The injection of fresh capital will unlock growth opportunities across all sectors which will undoubtedly underpin the sustainable growth of the Malawian economy, rendering it more competitive at the regional and international markets. The Government of Malawi has already made its first steps to accessing international EE funds by designating the Environmental Affairs Department as the Designated National Authority (DNA) of the UNFCCC and a national focal point to the Green Climate Fund (GCF). It has also designated NCST as the National Designated Entity (NDE) for the adaptation fund under the Kyoto Protocol of the United Nations Framework Convention on Climate Change.

Other potential sources of concessional EE and RE financing are: the World Bank’s carbon funds, the Global Environment Facility (GEF), the African Development Bank (AfDB), African Sustainable Forestry Fund, the UNFCCC’s Adaptation Fund, The Global Climate Partnership Fund and many more international and bilateral financing institutions. To fully benefit from all available international EE financing opportunities Malawi is bound to create a “one-stop-shop” National Financial institution to meet all International lender`s transparency, environmental and social requirements and to serve as entry point to all potential investors. A Climate Change Fund as provided for in the National Climate Change Investment Plan may be accredited with the major financing sources, raise funds and pass them to the local final beneficiaries through all possible channels (local banks and leasing companies, government agencies, NGOs).

**Dedicated Climate Change Fund**

The lack of sufficient financing is often cited as being the major impediment for mainstreaming EE in developing countries. Usually the financial inflow is restrained due to high perceived level of risk associated with EE and RE projects among the local financial institutions as well as due to incoherent approach to the possible sources of financing at the national level. The Malawi National Climate Change Investment Plan provides for establishment of a Climate Change Fund (CCF) to raise money from development partners and provide technical and financial support to climate change related projects as well as to develop and invest in such projects in collaboration with international and local players. The new Fund will help Malawi to unlocking a massive inflow of IFI and bilateral financial institutions provided and private capital into the EE/RE financing market. The Fund will offer concessional financing (soft loans), credit guarantees and technical counsel to its clients. To overcome the high level of EE/RE risk perception of the local financial institutions and private investors, the Fund will invest sufficient resources in capacity building and awareness raising activities and will co-finance EE/RE projects together with the local banks.

Support from international and bilateral donors/lenders will be attained through meeting the following prudential criteria:

1. Transparent ownership and management structure: Notwithstanding that according to the NCCIP the CCF will be vested in the Ministry of Environment and Climate Change Management, appointing an independent and professional fund manager will give the Fund more credit before the International money providers. The Fund manager will be mandated through competitive and transparent procurement procedure.
2. Social and Environmental responsibility: The Fund will adopt and comply with a set internationally accepted Environmental and Social safeguards
3. Publicity and reliability: The Fund will employ high fiduciary standards for accurate and regular recording of transaction and balances. It will frequently report its financial and technical performance to the Management Board, the government and all international donors, all reports to be made available to the general public as well.
4. Equal treatment of all applicants: the Fund will provide financing to projects derived from the Public, Private and the NGO sectors, ensuring that all applicants will receive equal attention and all applications processed with equal diligence.

**Equity funding**

Government of Malawi / Donor Agencies and IFIs

**Public sector entities**

Municipalities/Schools/Hospitals etc.

*Loan repayment*

**Malawi EE/RE Fund**

**NGOs/Local community groups**

**Debt funding**

International and Bi-lateral financing institutions

**Small and Medium companies**

**Large corporate businesses**

**Private individuals / Households**

**Financial intermediaries**

Banks/Leasing companies

Figure 19: Malawi EE Fund – proposed structure and business cycle

Proposed new legislation, policy, regulations (info from previous sections)

**Energy Efficiency / Management Regulations**

Malawi currently lacks national energy management regulations (NEMR) to cover a number of issues such as: i) mandatory energy audits for intensive energy users (users with annual energy consumption above the predetermined threshold will be obliged to carry out frequent energy audits and comply with the auditor`s findings and recommendations); ii) mandatory reporting on energy use and EE data, which will enable the government for further adjustment and fine tuning of the existing energy policies and strategies; iii) energy auditors and auditing firms licensing – the NEMR will outline the certification process and the training local auditors need to go through before being licensed, etc.

**Minimum Energy Performance Standards and Labelling**

To accelerate the penetration of energy efficient lighting and household appliances, Malawi will embark on development of a set of regulations that seek to ban the use of inefficient products through application of minimum energy performance standards (MEPS). Once promulgated and enforced, the regulations will prohibit the importation, production and sale of products that do not meet the requirements of the MEPS. To ensure smooth transition to use of highly efficient products, the minimum performance standards shall first be tested on lighting bulbs only and then be extended to cover other household electrical products/appliances and at a later stage eventually include other energy intense equipment such as industrial motors, pumps and refrigerators. Adjustments to the import duty tariff and some tax reliefs (e.g. 0% VAT rate) for products that meet the MEPS will greatly underpin the success of such policy.

**National EE audit and National EE action plan**

To facilitate the overall EE improvement process as well as to streamline target setting on the national and industrial level, the Government of Malawi will conduct a comprehensive National Energy Efficiency Audit to set out a national energy consumption base line across different sectors (industrial, mining, agriculture, domestic, public) and identify the underlying energy saving potential and recommend measures. An EE action plan will define the roles and responsibilities of the various stakeholders, set national EE goals, prescribe priority actions and implementation timeframe.

**Promotion of green building code**

Malawi will consider adopting a green building code or implementing minimum energy performance standards for buildings in the existing building regulations. The country may decide to follow the lead of Republic of South Africa which introduced the Green star tool and adopted mandatory energy saving measures for newly built edifices. These include: i) obligatory use of renewable energy for space or water heating; ii) minimum insulation requirements for walls, floors and ceilings; iii) installation of energy efficient ventilation and air-conditioning systems, etc.

At the regional level, the local governments and city councils may consider issuing Green building guidelines for those who are interested in sustainable construction.

Establishment of a Malawi Green Building Council will greatly enhance the promotion and adoption of green building codes at both national and regional level. The government will partner with key industry leaders, engineering and architecture firms and associations to set up a national Green building council and foster nationwide adoption of green building standards through public – private partnerships.

Which (global) High-Impact Opportunities are relevant?

**Efficient cook-stoves / Solar water heaters programs and Women`s and Children`s Health** – Kerosene, paraffin and candles produce dirty and harmful fumes when burnt. The fumes can cause respiratory diseases, eye infections and lead to longer-term problems with eyesight. The use of the traditional open flames three stones stove pose risk of burns (particularly for children) and fires. Promotion of efficient cook-stoves and solar water heaters (as a replacement of wood fuelled heaters) will cast beneficial impact on the overall health status of society`s most vulnerable groups (women and children in rural regions) by producing cleaner and safer environment in kitchens and reducing the time spent on wood collection. In addition, these initiatives will create micro business opportunities for rural women (efficient stoves production and sale), which will improve their social standing.

**Financing – development of EE financing mechanisms** (dedicated EE Fund, specialized bank credit lines, on-the-bill financing models) will encourage various stakeholders from the private (local financial institutions, business and NGOs) and the public sector (ESCOM, MoNREE, MERA, the Treasury) to join efforts and improve the overall financial market environment in Malawi. The combined efforts of all stakeholders will not only enhance access to capital for the local business but will render Malawian economy more competitive at the regional and international level.

Priority actions synthesis

A summary of the priority actions proposed in the SE4ALL initiative is presented in the table below.

Table 35: Summary of priority actions on Energy Efficiency

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Category | Action | Indicative time frame | Lead agency | Cooperating stakeholders | Estimated costs |
| Institutions | Establish National Energy Efficiency Committee | long term | MoNREM | MERA | n.a. |
| Establish EE/RE Fund | short to medium term | MoFED | MERA, Malawi Development Bank (upon establishment) | USD 30 million[[83]](#footnote-83) |
| Agriculture | Build/Install 5 000 efficient tobacco curing barns | long term | Ministry of agriculture and water development | Tobacco control commission, MoFED | USD 7.5 million[[84]](#footnote-84) |
| Policy | Introduce National Energy Management Regulations | short term | MERA | MoNREM | n.a. |
| Introduce Minimum Energy Performance Standards and Labelling regulations for lighting bulbs and other electrical appliances and equipment | short term | MERA | MoNREM | n.a. |
| Conduct national EE audit and develop national EE action plan | short term | MERA | MoNREM | USD 250 000 |
| Establishment of EE and RE technical excellence centre | short term | Malawi Bureau of Standards | MoNREM, MERA, NCST | n.a. |
| DSM (lighting) | Roll out 8.25 million LEDs | throughout 2030 | ESCOM | MoNREM, Ministry of Finance and Economic Development | around USD 16.5 million[[85]](#footnote-85) |
| DSM | Installation of 1.6 million pre-paid meters to grid connected households | medium to long term | ESCOM | MoFED, MoNREM | USD 64 million[[86]](#footnote-86) |

* 1. Transportation – Alternative fuels
     1. What are the actions and funding levels needed to achieve the overarching objective in the field of alternative fuels?

The paragraphs below describe the priority action areas to be attained in order the SE4ALL targets on alternative fuels are met.

Develop a policy framework that promotes use of cleaner fuels

Governance

This AA recommends implementing a coordination mechanism as soon as possible, establishing a biofuels coordinating committee. This committee will be in charge to coordinate policies and make sure they are properly implemented, especially regarding mandatory blends that are the main driver for investment decisions. It will also be in charge of preparing production scenarios to support biofuel production and investment in this sector.

This committee could be revived from the former Biofuels Advisory Committee and the following members will be part of this group:

Table 36: Composition of the Biofuels Coordinating Committee

| Organisation | Role |
| --- | --- |
| Department of Energy Affairs | Coordinating committee chair |
| Ministry of Agriculture and Water Development | Provide information on crops production |
| Ministry of Agriculture and Water Development - Department of Environment | Provide an environmental framework to the activity (and especially information on water quality, identified as a main barrier) |
| Ministry of Transport - Department of Road Traffic | Provide information on biofuels consumption and use in motor vehicles |
| Ministry of Finance, Economic Planning and Development | Support production and consumption with incentives |
| Non-governmental organisations | Provide information on environmental and social impacts of supporting biofuels production and use |
| Ministry of Justice and human rights associations | - |
| Representatives of Motor Industry Association, Consumers Association of Malawi and private players in biofuels production | Provide information on producing and using the biofuels in engines |
| Renewable Energy Association of Malawi | Provide information on biofuels |
| Universities and other research institutions (University of Malawi – Polytechnic, University of Mzuzu – Department of Energy Studies)  National Commission for Science and Technology | Provide information on latest studies and key findings on biofuels |

Simultaneously, the cooperation between the vocational institutions and the biofuels and transport industry will be enhanced with a simultaneous engagement of stakeholders to develop sector development plans beyond 2030.

Support sustainable biofuel production and use

Reinforce existing or introduce additional incentives to support biofuel production

The following measures are expected to ensure profitability and value creation for biofuel production system. Implementing these actions will attract new producers, especially in biodiesel sector, and avoid a monopoly situation. The government, ensuring the implementation of the following recommendations, will seek to increase the number of companies in biofuel sectors.

**Economic instruments**

A set of special electricity and water tariffs will be set for biofuels industries, and feed-in tariffs for any surplus through PPAs. Some levies such as the energy levy could be removed for biofuel industries in order to keep the production costs, and therefore biofuel prices, low (see also the paragraph on biofuel prices below).

**Administrative procedures**

A one stop shop for all licencing will be set up and necessary documentation for biofuels should be developed. Permits especially are problematic as various ministries, government departments and authorities require various permits from the same entity. This would increase the efficiency of the livening process and promote the establishment of new businesses.

**Develop market opportunities**

A clear business case will be created that will encourage the rural farmers to actively participate in the growing of feedstock on commercial scales and terms. Simultaneously opportunities for by-products (e.g. jatropha press cake as organic fertilizer) will be created.

A conformity with international sustainability standards for biofuels (for instance, standards enacted by the Roundtable on Sustainable Biomaterials – RSB for European Union) will be explored as well.

**Create innovative financing models**

As for actions proposed in renewable energy and energy efficiency sections, examples and initiatives like the Green Revolving Fund can be set up by the government and other energy players or donors in the form of an internal investment vehicle that provides financing to organizations that successfully implement energy efficiency, renewable energy, and other sustainability projects that generate cost savings. Regarding biofuels, the fund can provide financing to biofuel producers to help them reduce their costs, which will contribute to make this fuel affordable. These savings would be then tracked and used to replenish the fund for the next round of green investments, thus establishing a sustainable funding cycle while cutting operating costs and reducing environmental impacts. Those initiatives are working well in some countries (e.g. USA and some European countries).

Promote the use of biofuels

**Biofuel prices**

The price of commodities is the main driving force of their demand. Therefore, the price of biofuels need to become more attractive. For instance, the price of ethanol is pegged to that of petrol, which is often to the disadvantage of ethanol companies, whether or not global petroleum prices are fluctuating. The government has approved the decoupling of the ethanol and petrol prices, although the decoupling has not yet been implemented. To this end, there should be a discussion over price setting mechanism that:

* + Sets the maximum blend price in relation to the theoretical price of unblended mineral fuel, including all duties and levies, (or liberalise prices and let market forces determine them). For instance, the Department of Energy proposed during the SE4ALL consultation process to set a lower price of the ethanol blend (lower by 10% compared to gasoline).
  + Implements tax incentives for biofuels users.

Regardless of the selected solution, this mechanism should be subject to a floor price in order to protect the ethanol producers. Pricing should take into account the non-valuated benefits of biofuels such as:

* + Clean and environmentally friendly renewable fuel.
  + Reduction of the country’s carbon footprint.
  + Job creation and employment in agriculture and technology.
  + Increased fuel security, foreign currency savings, balance of trade.
  + Increased rural development and community growth.
  + Potential development of ethanol by-products such as electricity, stock-feed and energy briquettes.

**Facilitate biofuels distribution**

The biofuels distribution should be facilitated through the following measures:

* + Facilitate the distribution of biofuels through the country promoting the installation of appropriate pumps. Especially for biodiesel, there are currently no filling station (except the one in BERL production site). Regarding ethanol, the draft NEP sets the target of 200 filling stations with ethanol fuel tanks in 2020.
  + By 2018 establish a network of fuelling stations offering E85.

**Encourage the use of biofuels**

The following measures to increase the consumption of biofuels should be implemented:

* + Encourage the importation of flex-fuel vehicles that can use E85 by reducing duties on importations (e.g. like in Brazil, and South Africa).
  + Distribute flex-fuel converter kits and shift the government fleet to biofuels and promote the local manufacturing of conversion kits.
  + Encourage the use of renewable fuel for mass transport system (mainly buses).

Ensure a sustainable biofuel production

Raising the biodiesel production from 150,000 litres in 2016 (70,000 in 2015) to 55,000,000 in 2030 will certainly have an impact on jatropha cultivation. With a yield of 7,000 kg of seeds for each hectare cultivated, and a yield of 1 litre of biodiesel for 4 kg of seeds[[87]](#footnote-87), it is estimated that the land cultivated for jatropha in 2016 was around 85 hectares. In 2030, there will be a need for more than 30,000 hectares cultivated under irrigated conditions.

The yield of 7,000 kg of seeds per hectare is an average yield under irrigation conditions. Nevertheless, jatropha trees can grow without irrigation, but the average yield will be lower: between 1,000 and 2,000 kg / hectare[[88]](#footnote-88). The need for land will then be nearly 150,000 hectares.

Table 37: Required land for cultivations of jatropha and sugarcane

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Jatropha | Rain-fed | Irrigated | Sugarcane | Rain-fed | Irrigated |
| 1 ha | | 1 ha | |
| Yield | 1,500 kg | 7,000 kg | Yield | 40,000 kg | 100,000 kg |
| 375 l | 1,750 l | 3,100 l | 7,750 l |
| Baseline 2016 (150,000 l) | 400 ha | 85 ha | Baseline 2016 (26,700,000 l) | 8,600 ha | 3,500 ha |
| Target 2030 (55,000,000 l) | 150,000 ha | 30,000 ha | Target 2030 (40,000,000 l) | 12,900 ha | 5,200 ha |

Similarly, the estimated yield of Ethanol is 77.5 litres per ton of cane and 40 tons of cane would be realized from 1 hectare of land under rain-fed, compared to 100 tons of cane per hectare if it is irrigated cane[[89]](#footnote-89). Irrigated plantations through 2030 would allow an increase of the production without using additional land, and would reduce the risks from droughts caused by climate change.

The Malawi biofuel strategy must then take into account the trade-off between irrigation and land space, and determine the strategy to follow between using additional land and irrigate plantations.

Another major environmental impact identified in Part 1 when increasing biofuels production is water scarcity, especially if jatropha and sugarcane fields are irrigated. There will be a need to provide a framework to this production increase in order to monitor water consumption. The methodology Water footprint can be applied to assess the impact of water consumption in growing energy crops and help evaluating the impact of supporting biofuels production. Or another way to do, easier to implement, is to evaluate the water consumption of production processes and supply chains (how much water in total is needed to grow crops, how many cubic meters are needed for each unit produced). Most efficient production processes can be identified and supported.

Other energy sources

Promote electric vehicles

Globally, the trends on the global market indicate a switch towards electric vehicles. Actions should be implemented to increase the share of electric vehicles, particularly in relation to electric buses and/or trams (already exists in large scale in Algeria, Egypt and Tunisia). In the longer term, incentives should be provided for the introduction of electric vehicles. Although the introduction of electric transportation are in line with the level of access to electricity in urban areas any deficits in overall supply of electricity in the country should be considered to assess the overall sustainability of this action.

Promote biogas in transportation

Conduct research on the feasibility of the use biogas as a vehicle fuel. The study should determine the potential, infrastructure requirements, standards and suitability of vehicles. The introduction of biogas in transportation should then be considered, in accordance with the result of the study previously mentioned. This would require an assessment of the efficiency of the supply of this fuel and the supply of bi-fuel and dual-fuel vehicles.

Research and development, and education

Capitalise on research and development and experience in other countries on other feedstocks (other than jatropha & sugarcane).

* + 1. Which (global) High-Impact Opportunities are relevant?

**Sustainable Bioenergy**: developing the biofuels production and consumption, especially for transportation in Malawi, will lead to the advancement of sustainable production on the ground supporting rural development, workers’ rights, biodiversity protection and reduction of greenhouse gas emissions in line with international best practice outlined in the Roundtable on Sustainable Biofuels standards.

Priority actions synthesis

A summary of the priority actions proposed in the SE4ALL initiative is presented in the table below. As the actions do not entail the acquisition of infrastructure but refer to policy measures, their cost of implementation will mainly entail administrative costs. A separate assessment will be required to estimate the required employment and the corresponding costs.

Table 38: Alternative fuels priority actions

| Category | Action | Indicative time frame | Lead agency | Cooperating stakeholders | Estimated costs |
| --- | --- | --- | --- | --- | --- |
| Policy framework | Establish a Biofuels Coordinating Committee. This committee can succeed the former Biofuels Advisory Committee. | Short term | Department of Energy | Government and all entities involved in this committee (see proposed list in Part II – Priority Actions) | n.a. |
| Production level and use | Introduce incentives to support biofuel production. | Medium term | Department of Energy | MERA, Ministry of Finance, Economic Planning and Development,  Renewable Energy Association of Malawi,  Private players in the biofuels industry (especially manufacturers) | n.a. |
| Promote the use of biofuels. | Medium term | Department of Energy | MERA, Ministry of Finance, Economic Planning and Development, Ministry of Transport, Representatives of Motor Industry Association, Consumers Association of Malawi | n.a. |
| Other energy sources | Consider the introduction of electric vehicles in Malawi and promote the use of these vehicles. This action is linked to the overall energy access level in the country and reliability of energy supply. | Long term | Department of Energy | Ministry of Transport | n.a. |
| Conduct research on feasibility and consider supply of biogas for transportation as well as supply of compatible vehicles (such as bi-fuel and dual-fuel vehicles). | Long term | Department of Energy | Ministry of Transport, MERA, NCST, universities, other research institutions, MBS | n.a. |
| Research and development on other feedstocks (other than jatropha and sugar cane). | Long term | Department of Energy | Universities and other research institutions (University of Malawi – Polytechnic, University of Mzuzu – Department of Energy Studies) | n.a. |

* 1. Transportation – Urban transport

Malawian cities do not have the same degree of congestion and energy waste that many other African cities have. But experience shows that as countries develop economically, motorization increases and problems can develop if no planning measures are put in place in advance. Malawi has an opportunity to not repeat the mistakes of other urban areas. It can also learn from how other cities have addressed these problems. Currently, petroleum imports, which are used largely in motor vehicles, are increasing. Substituting biofuels for the fossil fuels will help moderate the increasing imports. But the country has an opportunity to also reduce those imports through improvement in the efficiency of its urban transport systems. The paragraphs below describe the priority action areas in relation to the implementation of the urban transportation targets.

What are the actions and funding levels needed to achieve the overarching objective in urban transport?

Harmonise decision making

The planning and implementation of the measures described above requires the participation and harmonisation of several authorities at different levels (i.e. local, regional and national). Enforcement responsibilities will be harmonized under one responsible ministry (i.e. the Ministry of Transport and Public Works), which will oversee an Inter-Ministerial Committee with authority to develop and implement the transport planning measures discussed above. This body should be integrated in the existing Join Transport Sector Review (JTSR) annual meetings and Joint Technical Committee that have the role to monitor the performance of the transport sector.

Table 39: Composition of the Urban Transportation Coordinating Committee

| **Organisation** | **Role** |
| --- | --- |
| **Ministry of Natural Resources, Energy and Mining** | Provide energy efficiency targets, monitor progress, provision of technical advice. Integration of environmental concerns in transportation (e.g. climate change, air pollution, land use) |
| **Ministry of Finance and Economic Development** | Funding infrastructure and maintenance and assisting on third party funding from international organisations |
| **Ministry of Justice and Constitutional Affairs** | Definition of fines and other measures to increase energy efficiency in transportation (e.g. the integration of emission standards in national legislation) |
| **Ministry of Local Government and Rural Development** | Definition of the role of city councils in the development and maintenance of public transportation |
| **Ministry of Lands, Housing and Urban Development** | Allocation of land for the development of the required infrastructure and overall land-planning. |
| **City Councils (i.e. Municipal or Town Councils)** | Provide insight on the major issues in their administrative areas |
| **Roads Authority** | Allocation of revenues from tolls from the development of infrastructure in urban areas |
| **Road Traffic Directorate** | Provision of statistics on the number, type and age of vehicles and integration of emission levels in the registry. Integration and enforcement of the emission standard in national legislation |
| **Malawi Revenue Authority** | Revenue collection |
| **Malawi Energy Regulatory Authority** | Administration of the fuel levy |
| **Universities and other research institutions** | Definition of needs in research and development |
| **Private sector transport operator representatives (e.g. Minibus Owners Association of Malawi and Bus Owners Association, Central Eastern African Railways)** | Key stakeholders and investors. |
| **National Commission for Science and Technology** | Provision of advice on technological aspects (e.g. type of buses, synchronised traffic signals etc) |
| **Non-governmental organisations** | Provision of advice on good practices (e.g. from international experience) and depending on the specialisation of the NGOs provision of expertise on specific environmental and social concerns. |

One of the tasks of the Transportation Coordination Committee will be to harmonize management of roads to avoid overlaps and gaps among the responsible institutions, i.e. Roads Authority. Harmonisation will be required on the design and maintenance of roads to reduce congestions and on the management of funds (e.g. those collected through tolls and fines).

Mass transit system

Mass transit vehicles carry a far higher number of passengers compared to private vehicles, making them an efficient user of road space ultimately helping decongest the cities. A city bus with a carrying capacity of about 108 passengers replaces almost 7 mini-buses of 16 seater passenger capacity. The mini-buses will use 23-25 litres of diesel for a 20 km journey and a city bus will use between 8 and 10 litters of diesel (based on a trial using a city bus in a mixed traffic system)[[90]](#footnote-90). In addition, a study conducted in Uganda, found that in terms of fuel consumption and CO2 emissions, one bus with a capacity of 80 people replaces 3 mini-buses, 14 private vehicles[[91]](#footnote-91) or 80 motorcycles. The efficiency will increase further if proper bus schedules are implemented together measures on Travel Demand Management.

In terms of gender equality, many women carry heavy loads of goods for long distances. This occurs mainly in rural areas but also in urban and sub-urban areas. Comparably with private vehicles, buses would serve as a more affordable mean of transportation and would contribute in the mitigation of this practice. In addition, a mass transport system would improve the accessibility of pregnant women and women with small children to retail and healthcare facilities.

Public transportation has also a large potential to foster agglomeration through the development of urban clusters. These clusters boost the development of new business, jobs and consequently wages and economic activity. Overall, public transportation improves and expands access to education, goods and services.

In order to achieve the target on the fuel consumption per km, the following action areas will be undertaken.

Phase out mini-buses and create a public road transportation system

It is inconceivable and unrealistic to set an immediate ban of mini-vans as at present they consist of the backbone of public transport in urban areas in Malawi. Therefore, a public transportation should be developed in 2 phases: First, there is a need to start the process to gradually phase out mini-buses with the capacity of less than 26 seats by not licensing new ones; second and in parallel with the first phase, measures to support the acquisition of city buses will set the basis for the development of a mass transportation system.

In relation to the phase-out of the mini-buses, at the intermediate level (i.e. by 2020) the following subsequent steps should be established:

* + Curb on all unregistered vehicles which is a significant proportion of the mini-bus population.
  + Stop the registration and licensing of new mini-buses.
  + Support the development of cooperatives to consolidate current operators into companies.
  + Franchising of routes: mini-buses must not be allowed to operate on these routes and strict enforcement is required.
  + Support the cooperatives in buying large and efficient buses (e.g. though tax reductions or subsidies).

The encouragement of the current operators of mini-buses to participate in cooperatives that invest in city buses is a crucial step. This approach that has been applied successfully in other cities (e.g. Nairobi and Dar es Salaam) ensures that any damages on the investments of the current operators of mini-buses are minimised.

Simultaneously to the phasing out of mini-buses and also by 2020, a mass transport system shall be established at least in the 3 largest cities (Lilongwe, Blantyre, Mzuzu) through PPPs or private initiatives. The NTP is already providing freedom to the industry to set tariffs and has removed restrictions on entry in the passenger as well as freight transportation.. This objective can be reached through the following measures:

* + Undertake detailed studies to analyse the current transportation system (mapping of transport modes, infrastructure, population distribution etc) to inform the nature of intervention that will need to be implemented (e.g. allocation of bus lanes).
  + Develop pilot bus systems (i.e. one route in one city) to guide the development of comprehensive transportation system.
  + Phase in a comprehensive public transportation system in major cities with a combination of large and small capacity buses to Bllantyre, Lilongwe and Mzuzu including the establishment of dedicated bus lanes on the corridors with the highest ridership levels. The design of such systems should be built on lessons from similar developments on other African cities (e.g. Accra, Lagos and Dar es Salaam).
  + Prohibit the entrance of mini-buses in city centres and other areas with high congestion.

To optimise the efficiency of the mass transport system, the design should be based on robust traffic data, particularly the findings of the NTMP. Furthermore, a monitoring mechanism run by the Ministry of Transport should be established to identify and resolve issues on the running routes and to plan the development of new ones.

Funding of the transportation system

The development of a mass transportation system requires a significant funding even if all transport services in the Malawi are provided by the private sector. The funding will be required for the development of basic infrastructure such as bus stops, road barriers, bus garages etc., and for the system planning, demand projections, fare analysis, etc. While passenger fares will provide a large proportion of the system revenues, additional funding, especially during the start-up years, will be needed and will be requested from:

* + Mobilising funding from international organisations (e.g. UNIDO, UNEP, EU, World Bank) and individual countries.
  + Use of the levy on second-hand vehicles, coupled with an imposition of a levy on fuel sales and highway tolls to supporting mass transit and other transport-related activities.
  + Reduction of importation taxes of large buses.
  + Direct funding from the state budget and private investors.
  + Provision of concession to associations and other private sector investors.

The development of a mass transport system should be supported by the Transport Sector Investment Programme (TSIP). The involvement of international investors should also be encouraged, particularly those who have a track record in projects in other developing countries.

Increase the average fuel efficiency of vehicles

The fuel efficiency of Malawi’s private vehicle fleet is low due to the old age of the vehicles, poor maintenance and high level of congestion. The priority actions to increase the fuel economy are described below.

Use of labels and standards

The integration of EU minimum emission standards for all registered vehicles is an effective priority action that would ensure a significant reduction of fuel consumption and CO2 emissions. Such standards exist mostly in developed countries, such as the USA, Japan, and the EU and less developed, for example the BRICS (Brazil, Russia, India, China and South Africa) and Mauritius. Emission standards are linked directly to fuel efficiency, as cleaner and more efficient vehicles are promoted in the market. Additional environmental benefits arising from a cleaner environment are added to the financial gains from the fuel savings.

An immediate and full harmonisation with the EU standards might not be realistic due to the old age of the country’s fleet. Instead, the adoption of the standards will be implemented gradually, by 2020, by adopting old standards as a first step. Further benefits on fuel efficiency will be achieved by reducing the import duty of energy efficient, bi-fuel, dual-fuel and hybrid vehicles.

The Ministry of Transport and Public Works (MoTPW) should be responsible for the adoption of the standards and the Road Traffic Directorate should use them to ban vehicles that do not fulfil them. The imposition of standards will be coupled with strengthening the capacity of competent authorities to measure and monitor vehicle emissions.

The use of labels and standards should be coupled with the strengthening of the import law that charges higher levies for older vehicles and larger engines. This levy should be variable and its level should depends on the age and size of the engine of the vehicle[[92]](#footnote-92).

Promote appropriate car maintenance

The enforcement of vehicle inspection rules to ensure motor vehicles are well-maintained is crucial in order to reduce pollution and fuel consumption. Currently, there is a lack of control over vehicle maintenance standards, which leads to further deterioration of the performance of the vehicle. To this end, by 2018 the capacity of the MoTPW should be enforced. Inspections should be mandatory on a periodic basis. Inspection stickers that cannot be counterfeited should be affixed to each vehicle after it has passed inspection.

The responsible body for the adoption of this measure is the transport ministry. The funds can be collected through tollgate fees and fines.

Improve road capacity and maintenance

The poor condition of the urban roads, increases congestion. In parallel, the planning and design of roads, does not allow a future expansion of the roads to accommodate the increasing traffic. As also stipulated in the NTP, the design of the residential areas should accommodate the provision of adequate infrastructure. Such design should not only include roads, but also parking, pavements (i.e. to prevent pedestrians walking on the street) and ring roads to lower the congestion levels, especially in the Central Business District (CBD) areas.

Develop urban and suburban rail transportation system

The possibility of reintroducing rail passenger transportation for urban and suburban transportation should be assessed. The railways which are currently crossing parts of Lilongwe and Blantyre could be extended to introduce passenger carriages. The introduction of a metro system would have the highest benefits especially in terms of decongesting heavily dense areas but the cost would be excessively high.

The use of rail transport for long-distance movement of freight and passengers is generally more energy efficient than the alternatives (e.g. trucks, buses, cars, airplanes). By 2020, the possibility of upgrading the rail passenger transportation system for urban and suburban transportation should be assessed, both from a technical and economic perspective. Fares and ridership would have to be high enough to cover at least the operating costs, if not a share of the capital costs as well. The best course of action will likely be to concentrate on establishing an efficient bus-based mass transit system in the largest cities, and then only consider light rail for the bus corridors with the greatest ridership.

Support the development of non-motorised transport

The development of non-motorised transport covers the following two modes of transportation is focused on the increased use of bikes and short-haul bikes. A higher use of non-motorised should be established by 2025, through the following:

* + Increase the safety of their use through the development of bike lanes (also stipulated by the NTP).
  + Raise awareness by establishing a bicycle commuting campaign to increase the social acceptability of the biking.
  + Establish bikeshare programs (e.g. as the scheme currently in development in Johannesburg).
  + Provide incentives to employers for bicycle commuting (starting with national and municipal governments).
  + Provide secure bicycle parking.

The responsible body for the adoption of measures for an increased use of non-motorised transport is the Ministry of Transport. At the local level, a bicycle office with a staff person in each municipal government should be established to initiate and coordinate the above activities.

Establish Travel Demand Management

This category of measures refers to action that affect both directly and indirectly the demand of transportation. These actions aim to shift citizens towards the use of public transportation and at the same time minimise the need for travel. They are in line with the NTP which calls for the development of an appropriate traffic management and suitable urban planning and design.

Land use planning policies

Currently, land use planning does not facilitate local economic development by reducing trips and making these trips more energy efficient. Transport land use integration is a Travel Demand Management tool that should be implemented to achieve urban transport sustainability. Effective transport land use integration minimises travel costs and reduces congestion as the number of vehicles travelling to the central commercial areas are reduced. Specifically, the following actions should be undertaken by 2020:

* + Local authorities need to implement land use planning policies that integrate residential and employment areas to minimise the need for transport.
  + High density, mixed use development: cities to undertake short, medium and long term urban transport planning as an integrated element of the overall city planning.
  + Strengthen the capacity of competent authorities to meet the needs of technical and non-technical skills for the consideration of transportation in land use planning, including on the areas of climate resilient transport planning and infrastructure.

Improve efficiency of traffic flow

Improved traffic flow reduces idling time and increases energy efficiency. Traffic flow can be enhanced through a range of measures, from synchronized traffic lights to staggered working hours. These measures, some of which are specified in the NTP, include the following:

* + Support the development of non-motorized transport.
  + Parking supply restrictions: This can be achieved either by limiting the physical supply of parking space in the central area or charging parking space to discourage private vehicles entering the central business district.
  + Develop synchronised traffic signals: intelligent traffic light control algorithm (“Adaptive Traffic Control system”) that works on GPS and other data (pilots in Johannesburg).
  + Integrate traffic flow concerns in land use planning, by preventing heavy vehicles in densely populated areas, promote mixed use planning to minimise the need of traffic, plan for pedestrians and street vendors to minimise conflict with vehicular traffic etc.
  + Promote Eco-driving: smarter and more fuel-efficient driving techniques.
  + Embark on awareness campaigns on the benefits of public transportation, non-motorised transport and other aspects of sustainable transportation.

Capacity building, education and raising awareness

The planning and implementation of measures to increase the fuel-efficiency of transportation will be enhanced if coupled with educational and awareness raising actions. Such actions should be continuous and targeted both at decision-makers and the society as a whole. By 2018, the following actions should be promoted by the MoTPW in collaboration with other members of Urban Transportation Coordinating Committee:

* + Promote eco-driving: smarter and more fuel-efficient driving techniques and culture that are fuel efficient;
  + Embark on awareness campaigns on the benefits of public transportation, non-motorised transport and other aspects of sustainable transportation;
  + As stipulated by the NTP, strengthen the capacity of competent authorities to meet the needs of technical and non-technical skills, including on the areas of climate resilient transport planning and infrastructure. The possibility to establish training programmes for capacity building in the private service providers should be also envisaged.

Which (global) High-Impact Opportunities are relevant?

**Transport and Motor Vehicle Fuel Efficiency Accelerator:** Transport and Motor Vehicle Fuel Efficiency Accelerator: The energy efficiency of vehicles is impacted both directly and indirectly by this set of priority actions. Direct effects include the improvement of the energy efficiency of private vehicles through the introduction of labels and standards and the improvement of car maintenance. The development of a mass public transportation also increases the fuel efficiency as the fuel consumption for each travelled kilometre decreases. An improved traffic flow through an enhanced maintenance of roads together with an effective Travel Demand Management indirectly increases the energy efficiency of transportation. The establishment of an urban transportation committee is expected to accelerate action and commitments made by national and local policy makers to increase energy efficiency.

Priority actions synthesis

A summary of the priority actions proposed in the SE4ALL initiative is presented in the table below. A cost estimate is provided for the acquisition of buses and the development of rail infrastructure. As in the case of biofuels, a separate assessment will be required to assess the cost of the other actions which entail mainly administrative costs.

Table 40: Summary of priority actions on urban transportation

| Category | Action | Indicative time frame | Lead agency | Cooperating stakeholders | Estimated costs |
| --- | --- | --- | --- | --- | --- |
| Mass transit system | Phase out mini-buses | Medium term | Ministry of Transport and Public Works | City Councils; Ministry of Local Government and Rural Development; Road Traffic Directorate; Private sector transport operator representatives | n.a. |
| Development of a public transportation system: | Medium term | Ministry of Transport and Public Works | City Councils; Ministry of Local Government and Rural Development; Road Traffic Directorate; Private sector transport operator representatives | Capital cost per bus is estimated at $235,000  Operational cost (including maintenance) is estimated at $33,000 |
| Fuel efficiency of motor vehicles | Use of labels and standards through the integration of EU minimum emission standards for all registered vehicles | Short term | Ministry of Natural Resources, Energy and Mining | Ministry of Transport and Public Works; Ministry of Justice and Constitutional Affairs; Road Traffic Directorate; Private sector transport operator representatives | n.a. |
| Develop urban and suburban rail transportation system | Long term | Ministry of Transport and Public Works | Central Eastern African Railways | 1.98 $ million per km for diesel rail and 3.53 $ million for electrified line[[93]](#footnote-93) |
| Travel Demand Management | Land use planning policies | Medium term | Ministry of Transport and Public Works | City Councils; Ministry of Local Government and Rural Development | n.a. |
| Improve efficiency of traffic flow | Short term | Ministry of Transport and Public Works | City Councils; Ministry of Local Government and Rural Development; Universities and other research institutions | n.a. |

* 1. Cross-cutting Actions

While this report establishes targets and actions in the four thematic areas (Energy efficiency, renewable energy, energy access and transportation), there are some interventions that cut across these areas, such the creation of a fund that invests in EE, RE and rural energy access, or the establishment of an initiative focused on assisting local governments with all four thematic areas. This section addresses these cross-cutting actions

Institutional structure and coordination

Many industrialized and developing countries have autonomous energy centres that promote clean energy development by performing such activities as helping develop standards, training energy auditors and energy managers, administering energy programs, conducting research and analysis, developing legislative proposals and coordinating governmental and non-governmental energy activities. The centres typically have the support of the government but operate independently and thus have greater credibility in the eyes of many people than a government ministry. In this regard, it would be appropriate if the Ministry of Natural Resources, Energy and Mining would initiate the establishment of a centre that could be modelled on one or more existing centres such as following:

* + KNUST in Ghana.
  + SEVEn in the Czech Republic.
  + Energy Efficiency Centre in Nepal.
  + China National Renewable Energy Center.
  + Center for Energy Efficiency (CENEf) in Russia.

The energy centres are often the institutions that keep clean energy initiatives like SE4ALL moving forward when government priorities change or budgetary constraints make it difficult for ministries to carry out their intended programs.

In addition to, or instead of, an energy centre, there is the option of establishing an EE/RE development committee. This is discussed in the Energy Efficiency section of Part III of this report (Section 5.3.1). The purpose of establishing a government committee rather than an independent centre would be to instil the entity with greater authority to supervise and administer the EE and RE activities. It could be a stand-alone agency but more likely it would be a department within the credibility in the eyes of many people than a government ministry. In this regard, it would be appropriate if the committee is vested at the Ministry of Natural Resources, Energy and Mining.

Sub-national initiatives

While DOEA, MERA and other national ministries have the lead responsibility for developing and enforcing energy policy and regulations, a major role can be played by local governments at the provincial, district and municipal levels. This is particularly the case in urban transport in the larger cities, but local governments can also play a major role in increasing energy efficiency, energy access and renewable energy development.

Local governments around the world have taken major steps to address energy use in their own facilities and in the buildings, factories, appliances and motor vehicles used by their citizens and businesses. Many have committed themselves to reducing greenhouse gases.

National ministries will work with local governments to develop a strategy among local governments to address the SE4ALL themes in a comprehensive and coordinated manner.

Among the local initiatives that could be pursued under the SE4ALL initiative are:

* + Improving energy efficiency in local government facilities, including buildings, street lights, and water pumping.
  + Establishing a local government procurement policy that incorporates energy efficiency into purchasing decisions for lights, fans, and other equipment.
  + Helping facilitate energy efficiency improvements and installations of solar water heaters in residents’ homes and businesses.
  + Providing land for LPG storage and refuelling stations and helping promote LPG for cooking with local residents.
  + Procuring flex-fuel vehicles for local government fleets.

Finance and risk management

A number of SE4ALL actions will require funding or financing to be implemented. For example, the construction of rural mini-grids, the installation of energy–efficient equipment in mines and factories, the establishment of an LPG distribution, storage and refuelling network, and the expanded cultivation of sugar-cane for ethanol production, among other activities, all require some form of debt and/or equity investments.

One idea discussed as a priority action in the Energy Efficiency in Section 5.4.1 is the establishment of a dedicated fund for these kinds of activities as well as to fund feasibility studies, training workshops and other “soft” activities. Mainly, the Fund will offer concessional financing (soft loans), credit guarantees. It will include a set-aside for projects in the residential and SME sectors since these are the sectors that often have the most difficult finding affordable capital.

Options for capitalizing the Fund include contributions from the government of Malawi, allotments from international donors, and an energy or water surcharge. The Fund could be modelled on the USD5 million Vietnamese Green Credit Trust Fund, which is managed by commercial banks.

Financial instruments will include soft loans, loan guarantees, off-taking guarantees, and solar micro-leases.

Capacity building and education

All the SE4ALL thematic areas will require capacity building and training activities. Examples include:

* + Strengthening government ministries to develop, manage and evaluate sustainable energy programs.
  + Assisting local government to understand how to develop local energy plans and programs, how to finance them and how such plans and programs provide benefits to the local governments.
  + Training and certifying energy auditors, building energy managers, and program evaluators.
  + Building the capability of local banks to better understand and become more comfortable with lending to sustainable energy projects.
  + Building the capability of municipal governments to plan, design, finance and evaluate mass transit systems that are convenient, energy-efficient and affordable.
  + Training Ministry of Natural Resources, Energy and Mining staff on how to design, finance, administer and evaluate EE programs and on-site RE programs.
  + Training for entrepreneurs on how to establish an LPG distribution and refuelling business, an energy auditing and management business, a rural mini-grid business, etc.

Review of VAT Exemption for clean energy products

The high capital cost of many clean energy technologies, such as solar panels, inverters, LPG cylinders and wind turbines can act as a break on investment in clean energy products that are not domestically manufactured. Yet eliminating VAT on these products will reduce government revenues. These revenues might well be offset, however, by the increased revenues resulting from increased clean energy business activity. A careful study is needed to determine which products are suitable for a VAT exemption and whether the immediate revenue loss from the exemption (or partial exemption) will be offset by increased revenues from clean energy businesses**.**

1. PART III – Coordination and Follow-up
   1. National SE4All taskforce (structure and coordination strategy)

The implementation of the AA’s priority actions will require a strong and effective collaboration among public and private stakeholders.

The Department of Energy, as the National SE4ALL Coordinator will champion the implementation of the priority actions that have been agreed by the AA development process. It will ensure that SE4ALL is mainstreamed into the national development agenda.

DOEA will be supported by an Advisory Group comprised of specialised institutions such as MERA, research institutions, private sector, development partners and civic society/NGOs. The Advisory Group will advise the National Coordinator on policy planning, business models, capacity building, AA target setting and technology transfer amongst others.

The DOEA will also chair an inter-ministerial working group whose members will regularly meet to update each other and exchange information on clean energy-related matters. DOEA will maintain a database of EE, RE and transportation-related projects and plans at each ministry and will work to help the ministries implement their energy projects.

The Permanent Secretary of the Ministry of Finance, Economic Planning and Development will convene regular SE4ALL meetings with multilateral and bilateral donors to discuss progress on SE4ALL priority actions and what financial resources will be needed. Private investors can attend these meetings at the invitation from the PS.

* 1. Regional Coordination

Many of the SE4ALL actions will benefit from coordination with other countries in the Southern Africa region. For example, adoption of Minimum Energy Performance Standards (MEPS) for refrigerators, lights, and other energy-consuming equipment should be harmonized across the region so that there is a larger and more uniform market for energy-efficient appliances.

SADC is an appropriate regional coordinating institution for SE4ALL l and has a long experience in energy. It is already in the process of establishing a regional Centre for Renewable Energy and Energy Efficiency in Namibia.

Much of SADC’s energy focus is on power pooling, but it also has initiatives in renewable energy. The objectives of the SADC Renewable Energy Policy Framework are:

* + Development of appropriate financing mechanism and fiscal regimes suitable for the development of Renewable Energy Technologies, (RETs).
  + Strengthening of the regional capacity and capability for RETs project development, management, monitoring and evaluation via training and regional human resource pooling.
  + Facilitation of the link between stakeholders with a view to promoting commercialization and greater use of RETs.
  + Promotion of cost-effective pilot activities and projects for diffusion of RETs.
  + Collaborating with stakeholders in identifying specific needs of different energy users in order to develop programmes that tally with these needs.
  + Increased public awareness of RETs by lobbying governments, donors, commercial entities and industries for their financial and political support of a RETs agenda.
  + Facilitation of contact and cooperation among institutions involved in research and development of RETs technologies with a view to establishing consistent product standard.

It was envisaged by SADC member countries that regional cooperation in the energy sector would involve working together in areas such as wood fuel, petroleum and natural gas, electricity, coal, new and renewable energy sources, and energy efficiency. Some of the areas that will be explored for regional cooperation under SE4ALL might include:

* + Adoption of harmonized MEPS and labelling for appliances.
  + Adoption of motor vehicle fuel efficiency standards.
  + Harmonization of licensing requirements for RE and EE contractors and installers.
  + Joint procurement of EE and RE products.
  + Joint procurement of LPG and other petroleum products on the world market.
  1. Follow-up analysis

The Action Agenda provides the strategic framework towards achieving the SE4ALL targets, but in many cases there will be a need for subsequent in-depth studies and analysis.

Independent research and analysis must be encouraged to provide unfettered views on each of the SE4ALL goals, especially in order to confirm and detail, when necessary, targets and actions that have been settled in the Action Agenda:

* + Conduct a study on the low uptake of improved cook-stoves in Malawi.
  + Conduct a research program to identify, appraise and demonstrate opportunities in waste-to-energy, biomass power, geothermal, cogeneration, energy storage, etc.
  + Develop national energy savings measurement methodologies (based on internationally accepted protocols).
  + Assess the potential environmental and socio-economic impacts of the priority actions (e.g. on water, land, biodiversity, waste-related impacts, gender and jobs) and develop mitigation measures for negative impacts through a wider Strategic Impact Assessment.
  + Reassess the biofuels targets in light of the government efforts to introduce flexi-fuel vehicles. An increase should address environmental (i.e. land and water use) as well as social aspects (i.e. food vs fuel aspects)

Indeed, the Action Agenda provides priority actions to achieve targets. Nevertheless, there is a need to develop more detailed action plans, and especially to clarify the coordination between SE4ALL Action Agenda and national strategies mentioned in Part 1.

The Action Agenda also provides specific targets for each SE4ALL goals. But there is a need for additional scenario analysis to assess the costs (technical, economic and social) of different pathways to the SE4ALL targets and revise the targets if necessary in response to progress made between now and 2030.

* 1. Monitoring, evaluation and reporting

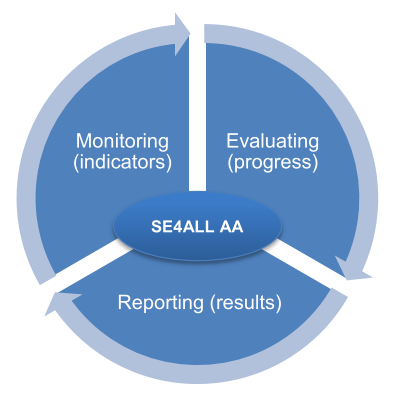
MER System guidelines

A detailed Monitoring, Evaluation and Reporting (MER) system for tracking and reporting on program time-bound milestones and accomplishments will be prepared by the SE4ALL l Secretariat at the beginning of the project implementation which will be periodically updated.

Designing and implementing a MER system is an essential task that will allow Malawi to track, assess and report progress on the achievement of expected outcomes under the SE4ALL initiative. The MER, as tool, allows for identifying key issues that need to be addressed to ensure a proper implementation of the AA. It will also allow the Government of Malawi to review and update the AA in the future. The MER system will therefore comprise a Monitoring Plan, an Evaluation Plan, and a Reporting Plan.

The monitoring plan provides a guide on how to monitor the set of indicators that will show how Malawi is progressing towards the achievement of its SE4ALL targets. A monitoring protocol should be defined for each indicator. The evaluation process basically consists of comparing the results obtained against a selected baseline and against the interim (if any) and final targets that are set in Malawi’s AA. This evaluation plan enables the country to redefine strategies and goals for the following monitoring periods. The reporting plan implies producing a performance assessment report or similar document where the results from the monitoring and evaluation are described and, potentially, shared with the public. As shown in the figure below, MER is a continuous process that needs to be carried out periodically.

Figure 20: Relationship among different parts of a MER framework and the AA

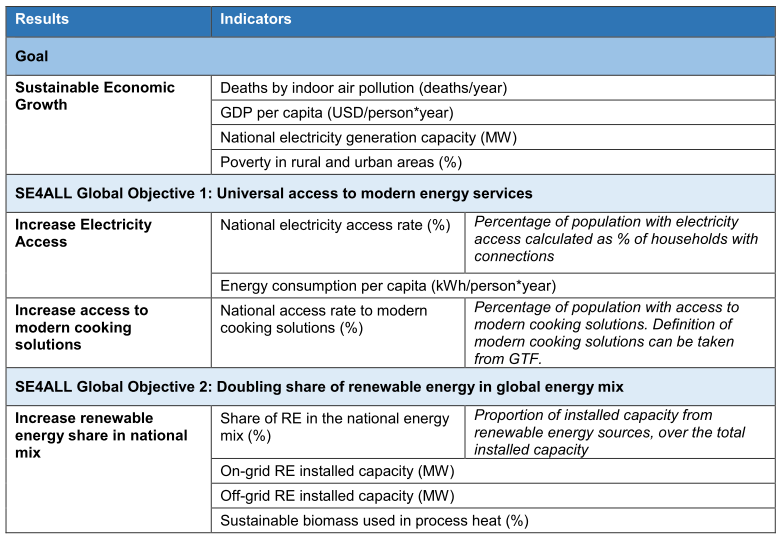


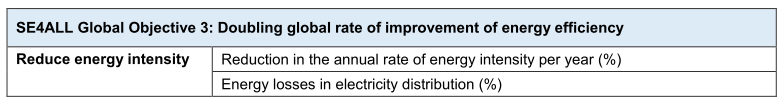
Monitoring Plan

The Global Tracking Framework (GTF) proposes guidelines for monitoring each SE4ALL target, i.e. for monitoring the progress made on energy access, renewable energy, transportation and energy efficiency, see Table 41 below. For instance, a traditional approach to measuring access looks at whether households “have an electricity connection” and “have access to non-solid fuels” but does not provide information on energy services delivered through other technologies such as solar lanterns for electricity and improved biomass stoves for cooking. Nor does it provide information on the reliability or affordability of the service delivered to the “connected” household.

The development of the Monitoring Plan will require the definition of indicators and a systematic and coherent collection of data for their valuation. These indicators will enable the aggregation and analysis of data. The figure below, shows an example of high-level indicators used in the Tanzanian SE4ALL initiative. Such indicators can act as the starting point for the establishment of a comprehensive Monitoring Plan. They largely correspond to existing data, thus allowing the monitoring of indicators from the initial stages of the application of the AA.

Table 41: Illustrative list of indicators for the SE4ALL initiative

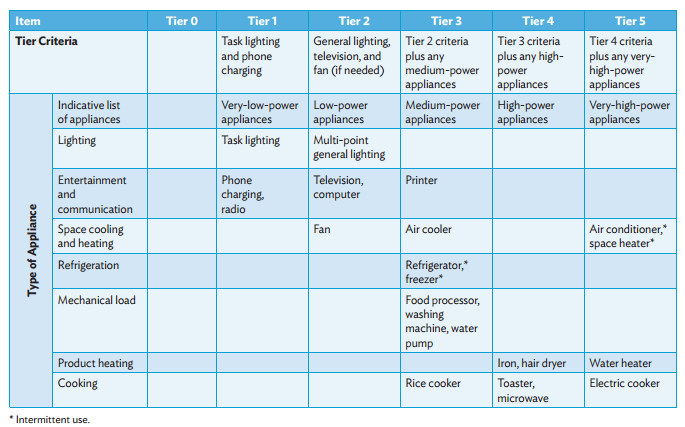




The monitoring process will gradually evolve expand to include indicators at a less aggregate level which should correspond at least to the AA targets.

Furthermore, a Multi-Tier Framework[[94]](#footnote-94) for tracking energy access - both electricity and modern cooking solutions - can provide the required level of detail that is required for effective monitoring. This Framework provides information on the quality of the service received by households, including its adequacy and availability, reliability, affordability, safety and impact on a user’s health. The Framework acknowledges that enhancing energy access involves a continuum of improvements and provides a methodology for measuring access in a tiered-spectrum – from Tier 0 (no access) to Tier 5 (the highest level of access).

Table 42: Key components for Measuring Access to Household Electricity Services under the GTF



As shown in the figure above, the GTF proposed to track access to energy using different “levels of access” or Tiers. Using a multi-tier approach, it is possible to track access not only from the “yes/no” point of view, which means that people have or do not have access, but also from a multi-dimensional perspective where it is possible to track the several attributes associated to access, such as affordability, quality, capacity (Watts), reliability, safety, efficiency, impact on health, etc. thus providing the opportunity to perform a much more in-depth analysis.

Evaluation Plan

The evaluation process consists of annual reviews of the progress made through the activities conducted and performance achieved towards the targets that are set under Malawi’s SE4ALL AA.

The evaluation will ensure a broad and representative perspective on the achievements and challenges in the implementation of Malawi’s SE4ALL actions, and will allow the adequacy of the adopted strategy to be assessed to meet the targets as planned and take any corrective action if needed. The evaluation should include the provision of recommendations for future monitoring periods and it is also intended to inform the stakeholders participating in the implementation of the AA of follow-up actions required to further strengthen its performance and strategic activities.

In general terms, the purpose of the evaluation activities is twofold:

* + To contribute to improving program effectiveness and delivery towards Malawi’s SE4ALL goals by 2030 by using knowledge and lessons learnt from its implementation back into the country initiative
  + To contribute to overall alignment of strategic activities of the AA and ensure that it remains relevant to addressing country level objectives whilst also aligned to the global SE4ALL initiative
  + To update the AA as required taking into account progress made and new developments.

During the annual SE4ALL evaluation, the designated SE4ALL Secretariat will review the results achieved in the current monitoring period in comparison to the baseline and the previous year: progress on actions and targets met as planned in Malawi’s AA using the selected indicators. It will also help identify the actions needed for the following year.

Reporting Plan

Using the results of the evaluation phase, the designated SE4ALL Secretariat will report on an annual basis on the progress and performance towards the implementation of Malawi’s SE4ALL AA. The yearly progress will be presented in a Performance Assessment Report. The report must clearly show the baseline scenario and the progress made against the targets set. The annual report would be prepared in consistent manner and shared with stakeholders for awareness, socialization and proper contributions on their part.

* 1. Link to Investment Prospectuses

The Action Agenda is a stand-alone document that provides a framework for achieving the national SE4ALL objectives. On a “global” level, it provides for interventions (policy adjustments, financial allocations, business model developments and capacity building initiatives) that will focus national support for energy access, renewable energy and energy efficiency. However, the Action Agenda provides specific measures that will drive particular investments that are part of the Investment Prospectus. In this way, some AA activities will be “operationalized” by an Investment Prospectus (IP) that is a separate document and describes a set of investments that the government, private sector developers, civil society organisations, finance organizations and other stakeholders can support.

The IP contains investment opportunities and a priority projects pipeline emanating from priority project areas identified in the AA. The projects in the IP are those that can be implemented in the short- and medium-term and have been prepared adequately to attract investments. The IP projects consist of both, infrastructural and non-infrastructural projects. The AA presents the strategic elements and project priorities for the IP. The IP has Malawi’s status of why investors should invest in Malawi’s energy sector considering both national and sector level investment conduciveness and the institutional framework that will support IP implementation.

Figure 21: Action Agenda and Investment Prospectus linkages



Annex 1: The SE4ALL initiative

Introduction

The Sustainable Energy for All (SE4ALL) initiative was launched by UN Secretary-General Ban Ki-moon in 2011 with the vision of providing sustainable energy to all in the world by 2030. In order to achieve this, the following three interlinked key objectives were declared:[[95]](#footnote-95)

1. Ensure universal access to modern energy services
2. Double the global rate of improvement in energy efficiency
3. Double the share of renewable energy in the global energy mix

The strategy on how to achieve these goals was then elaborated on in *Sustainable Energy for All – A Framework for Action (2012)*. Section one of this document summarizes the objectives, benefits, as well as the key figures regarding investments of the program. Section two lays out in further detail why each type of organization should engage (government, businesses, civil society organizations), what are their roles to play (policies planning, regulation and institutions, technology innovation, finance, implementation capacity, end-user demand), and what benefits can be gained by coordinating commitments. Section three then proceeds to showing how the initiative will help mobilise and coordinate commitments through a number of ‘high-impact areas’ and how progress could be monitored. It also provides four illustrative examples. Finally, Section four describes principles and next steps for the initiative.

The country action process to be implemented by the countries wishing to participate in the SE4ALL initiative consists of the following key four steps[[96]](#footnote-96):

1. *Declaration of Partnership:* With this declaration the country’s government expresses its interest in participating in the SE4ALL initiative.
2. *Rapid Assessment/Gap Analysis:* The analysis performed by each participating country sheds light on the current energy situation in the national development context of the country. It provides the economic, political, environmental and social background for the drafting of plans in order to promote SE4ALL in this particular country.
3. *Action Agenda (AA):* The AA is edited on country level and it addresses the challenges that were previously identified in the Rapid Assessment/Gap Analysis in that it outlines and prioritizes the different courses of actions and demonstrates how the three SE4ALL objectives can be achieved. It takes the form of a holistic and strategy-driven document.
4. *Investment Prospectus (IP):* There can be one or more IPs showing how the AA can be put into action. In order to do so a set of implementable programs and projects including related costs possibly for a specific sector or subsector is identified and developed to be then presented to potential investors, be it private or public ones.



A first wave of countries already completed their AAs and IPs. However, Dr Daniel-Alexander Schroth, the coordinator of the SE4ALL Africa Hub, stated that a structured follow-up and support to implementation of AA/IPs would be critical for maintaining SE4ALL momentum.[[97]](#footnote-97) Thus, accompanying African countries during the realization of its AA and IP is the key on their way to a sustainable future.

AA and IP: Key steps for achieving SE4All objectives

Action Agenda

The AA is:

* + A strategy-driven and holistic document that intends to determine how the three goals of SE4ALL l could be achieved by 2030.
  + An umbrella framework for the sector that includes nexus angles.
  + A long-term vision which ensures the sector-wide coherence and synergy of accumulated efforts towards SE4ALL l goals.
  + A developed in an inclusive manner.

Investment Prospectus (es)

The IPs provide:

* + An approach to operationalizing the Country Action Agenda.
  + Short- to medium-term set of investment opportunities (3-5 years).
  + Conversation starter for a variety of investment opportunities that will provide preliminary information to prospective investors.

The role of the AA and IP

Country views on the role of the AA

Countries expressed their views on the AA at the SE4ALL Forum. According to them, the AA:

* + Provides a framework to align stakeholder objectives.
  + Provides a long term view of the sector and a holistic planning tool integrated to the broader policy framework of the country.
  + Identifies sector gaps and suggests actions to address gaps and costs achieving targets.
  + Identifies central repository of resources for the purpose of coordination of SE4ALL as well as defining follow-up actions.
  + Provides a platform for sharing experiences on best practices.
  + Provides a tool to accelerate the mobilization of needed investment into the sector.

“The Action Agenda is as much a holistic planning tool encompassing our long- term vision as it is a framework to help align stakeholder objectives and partner interventions to mobilize necessary investments.” Alain Harelimana, Advisor to the Ministry of Infrastructure of Rwanda.

Mobilizing support and investments

Mobilizing support and investments:

* + Provides partners (public and private) with a clear roadmap of what the country envisages to undertake (link to monitoring and tracking).
  + Provides development partners with a guiding tool for assistance to the country (link to inclusive development process).
  + Provides countries with a tool to identify investment opportunities as a “live rolling” document with new opportunities being added.
  + Benefit from the convening power of SE4ALL to promote plans and assist with matchmaking between potential investors and facilitating access to finance from available resources of partners.

*“Promote the SE4All Investment Prospectus as a tool to mobilize the required financing for accomplishing both SE4ALL’s objectives and those of the proposed SDG 7[[98]](#footnote-98) on energy”* SE4ALL Energy Access Committee, May 2015.

Realizing the full potential of the AA/IP

The AA/IPs are potentially powerful tools. To realize their full potential requires:

1. High quality outcomes of AA/IP processes:
   * Application of established “quality circle” as country support mechanism.
   * Ensuring required high-level buy-in, and inclusive development process.
   * Involvement of HIOs and thematic Hubs in the development and follow-up processes.
2. Concerted follow-up to AA/IPs:
   * AA to be formally recognized as coordination and implementation tool for emerging SDG 7.
   * Promotion/marketing for mobilizing finance for implementation of AA/IPs.
   * Structured follow-up to AA/IPs (targeted support packages, market-place for IPs).
3. Strengthening of SE4ALL focal points/offices

Annex 2: Stakeholders consulted in the development of AA

Renewable energy Working Group

|  |  |  |
| --- | --- | --- |
| **SURNAME** |  | **ORGANISATION** |
| Wifreed Kasakula (Chair) |  | Malawi Energy Regulatory Authority (MERA) |
| Austin Theu (Rapporteur) |  | Department of Energy |
| Chisambazi Nyirenda |  | RECAPO |
| Chifundo Tenthani |  | Polytechnic |
| Francis Kambala |  | Sonlite Electricals |
| Steven Chirambo |  | Sunpower Technologies |
| Atamandike Chingwanda |  | REIAMA |
| Godfrey Sihanda |  | Practical Action |
| Gift Sageme |  | Central Region Water Board |
| Justin Rakasi |  | REIAMA |
| Hope Chamdimba |  | National Commission for Science and Technology |

Energy Access Working Group

|  |  |
| --- | --- |
| **SURNAME** | **ORGANISATION** |
| Khumbolawo Lungu (Chair) | Department of Energy |
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| MUSARIRI | DAVID |
| MUVERENGWI | PHANUEL |
| MUVIRIMI | TAFARA |
| MUVUYA |  |
| MUZENDA | TSITSI VERONICA |
| NDEMERA |  |
| NYATSANZA | CHENGETAI G |
| ZHOU |  |

Other actors consulted

|  |  |  |
| --- | --- | --- |
| **SURNAME** | **NAME** | **ORGANISATION** |
| Chingwanda | Atamandike | Renewable Energy Industries Association of Malawi |
| Andrews | Jane | University of Strathclyde |
| Rakasi | Justin | Renewable Energy Industries Association of Malawi |
| Mapfumo | Reginald | Humanist Institute for Co-operation with Developing Countries |
| Kainja | Gautoni | Kainja and Dzonzi/Price Waterhouse Coopers |
| Achoka | Pauline | UNDP |
| M’mangisa | Etta Rachel | UNDP |
| Flores | Raoul | USAID/Power Africa |
| Bashir | Jehangir | Atlas Energies Ltd. |
| Msimuko | Tumusime | Press Corporation Ltd. |
| Satar | Shakil | Standard Bank |
| Chinoko | Vitumbiko | ECRP/Christian Aid |
| Simwaka | Grace | Millennium Challenge Corporation |
| Nthakomwa | Joshua | Malawi Investment & Trade Center |
| Kumbemba | Clement | Malawi Investment & Trade Center |
| KARIMANZIRA | RUNGANO P. | Director in the Ministry of Higher Education and Harare Polytechnic (consulted for ethanol production data) |
| MPALATBC | PATRICK | Finealt Biodiesel Project |
| MAKONI | G. | Central Vehicle Registry |

Annex 3: SE4ALL implementation plan

This table is a distillation of the priority actions from Chapter 5, along with their timetable, lead agency and estimated investment cost. The timeframe definitions are short-term (1-5 years), mid-term (5-10 years) and long-term (>10 years). The estimated costs are for capital costs, not operating costs. The units for estimated costs are US$.

Table 43: Implementation of priority actions: Energy Access

| **Category** | **Action** | **Indicative time frame\*** | **Lead agency** | **Cooperating stakeholders** | **Estimated costs** |
| --- | --- | --- | --- | --- | --- |
| Biomass supply intervention | Improve coordination between Department of Energy and Department of Forestry | Short | DOEA and DOF | MoNREM | n.a. |
| Awareness campaign for efficient cook stoves and alternative cooking technologies | Work with private sector and other stakeholders to promote clean cooking technologies and provide financial incentives for private firms to increase supply of these technologies | Medium | DOEA | Ministry of Finance, Malawi Revenue Authority, Malawi Trade Investment Centre, private firms, NGOs | Awareness campaign $250,000/year; Financial incentives for private firms $2-3 million/year |
| Support implementation of efficient biomass cook stove initiatives | Provide support to NGOs implementing cook stove projects; Pursue implementation of Cook Stove Road Map | Short to medium | DOEA | NGOs | Budget to be determined |
| Monitor and ensure implementation of clean cook stove initiatives | Implement BEST and monitor its impact. Arrange for independent evaluation of the Cook Stoves Road Map Programme, including household surveys pursuant to the World Bank’s Global Tracking Framework. | Short to Medium | DOEA | NGOs, Development partners | $50,000/year for monitoring and evaluation  Mid-term evaluation: $80,000 |
| LPG expansion | Roll out a campaign to greatly increase LPG use for cooking, addressing legal, financial, safety and ownership issues | Medium to Long | DOEA | Ministry of Finance, Malawi Bureau of Standards, oil companies, private companies, local governments, Small and Medium Enterprise Development Institute | Preparing the LPG roll-out plan $400,000; incentives for businesses $1.2 million over 2-3 years; public awareness campaign $175,00/year |
| Promotion of biogas plants | Increase the use of biogas plants at institutions such as schools; undertake pilot projects | Short to medium | DOEA | Schools, hospitals, clinics, biogas plant manufacturers | Pilot projects $750,000 |
| Innovation at MAREP | Connect households in close proximity to distribution lines, monitor trading centre connections, revive maintain the dysfunctional mini-grids | Short, medium, long | DOEA | MAREP | Budgets to be determined |
| Subsidies for solar home systems and mini-grids | Appraise subsidy options e.g., tax credits, interest rate subsidies, reduced fees, etc.) and provide them to providers and/or consumers. | Medium | DOEA | Ministry of Finance, solar companies, ESCOM, Renewable Energy Association of Malawi | Appraisal $100,000; Cost of subsidies to be determined |
| Financing and regulation of mini-grids | Identify subsidy mechanism to support mini-grids; Establish rules on safety, performance, operating practices | Short to medium | DOEA | MERA, Renewable Energy Association of Malawi | Develop regulatory structure $250,000 |
| Financing household scale electricity technologies | Appraise financing and subsidy needs to support solar home systems and other household scale technologies, including appraisal of how the Guarantee Fund could be used; Resuscitate the Guarantee Fund | Short, medium, long | DOEA | NGOs, manufacturers, importers, installers, Renewable Energy Association of Malawi | Appraisal $100,000 |
| Capacity building at Malawi Bureau of Standards | Support MBS on certification and enforcement of RETS and mini-grid standards | Short to medium | DOEA | MBS | n.a. |
| Electrification of Public Institutions | Electrify all of the country’s public institutions with either grid connections or off-grid technologies | Medium to long | DOEA | MAREP, Renewable Energy Association of Malawi | Budget to be developed |
| Support for pico solar products | Accelerate implementation of pico solar products by supporting and coordinating existing NGO pico solar programs | Short, medium, long | DOEA | NGOs, Renewable Energy Association of Malawi | Budget to be developed |
| Monitor and evaluate progress in providing electricity services | Arrange for independent M&E, which should use household surveys pursuant to the World Bank’s Global Tracking Framework | Short, medium, long | DOEA | NGOs, MAREP, Renewable Energy Association of Malawi | Annual monitoring $50,000  Mid-term evaluation $80,000 |

Table 44: Implementation of priority actions: Renewable Energy

| **Category** | **Action** | **Indicative time frame\*** | **Lead agency** | **Cooperating stakeholders** | **Estimated costs[[99]](#footnote-99)** |
| --- | --- | --- | --- | --- | --- |
| Large hydro capacity additions | 350 MW Mpatamanga, 200 MW Kholombidzo, 40 MW Mbongozi, 50 MW Chizuma, 90 MW Songwe 1, 60 MW Songwe 2, and 140 MW Fufu | Short, mid and long-term | MoNREM | MERA, ESCOM, EGENCO, private sector | Unit cost: $2.9 million/MW  Total: $2.7 billion |
| Small hydro capacity additions | 22 MW Tadzani IV, 23 MW Ruo | Short & mid term | MoNREM | MERA, private sector | Unit cost: $2-4 million/MW  Total: $90-180 million |
| Solar capacity additions | 550 MW of PV projects at various sites | Short, mid & long term | MERA | MoNREM, private sector | Unit cost: $3.8 million/MW  Total: $2.1 billion |
| Bagasse cogeneration capacity additions | 46 MW at two Illovo sites | Mid & long term | MERA | MoNREM, private sector | Unit cost: $6.7-7.4 million/MW  Total: $308 - 340 million |
| Policy | Adopt RE Policy, financing strategy | Short term | MoNREM | MERA, private sector, Renewable Energy Association of Malaw, NGOs | n.a. |
| Research | Conduct detailed resource assessments for RE, especially wind, geothermal and non-sugarcane biomass resources. | Short-term | MoNREM | Universities and other research institutions (University of Malawi – Polytechnic, University of Mzuzu – Department of Energy Studies)  National Commission for Science and Technology | n.a |
| Capacity building | Training for government and private sector on licensing & permitting process, costs, regulatory policy and procedures, major issues in developing an RE project. | Short term | MoNREM | MERA, private sector | n.a. |

Table 45: Implementation of priority actions: Energy Efficiency

| **Category** | **Action** | **Indicative time frame\*** | **Lead agency** | **Cooperating stakeholders** | **Estimated costs** |
| --- | --- | --- | --- | --- | --- |
| Institutions | Establish National Energy Efficiency Committee | long term | MoNREM | MERA | n.a. |
| Establish EE/RE Fund | short to medium term | MoFED | MERA, Malawi Development Bank (upon establishment) | USD 30 million[[100]](#footnote-100) |
| Agriculture | Build/Install 5 000 efficient tobacco curing barns | long term | Ministry of agriculture and water development | Tobacco control commission, MoFED | USD 7.5 million[[101]](#footnote-101) |
| Policy | Introduce National Energy Management Regulations | short term | MERA | MoNREM | n.a. |
| Introduce Minimum Energy Performance Standards and Labeling regulations for lighting bulbs and other electrical appliances and equipment | short term | MERA | MoNREM | n.a. |
| Conduct national EE audit and develop national EE action plan | short term | MERA | MoNREM |  |
| Establishment of EE and RE technical excellence centre | short term | Malawi Bureau of Standards | MoNREM, MERA | n.a. |
| DSM (lighting) | Roll out 8.25 million LEDs | throughout 2030 | ESCOM | MoNREM, Ministry of Finance and Economic Development | around USD 16.5 million[[102]](#footnote-102) |
| DSM | Installation of 1.6 million pre-paid meters to grid connected households | medium to long term | ESCOM | MoFED, MoNREM | USD 64 million[[103]](#footnote-103) |

Table 46: Implementation of priority actions on alternative fuels

| **Category** | **Action** | **Indicative time frame\*** | **Lead agency** | **Cooperating stakeholders** | **Estimated costs** |
| --- | --- | --- | --- | --- | --- |
| Policy framework | Establish a Biofuels Coordinating Committee, that:   * Coordinates biofuel development across all sectors of the economy * Supports and develops sector development plans beyond 2030 * Controls the implementation of policies, especially those on mandatory blend   This committee can succeed the former Biofuels Advisory Committee | Short term | DOEA | Government and all entities involved in this committee (see proposed list in Part II – Priority Actions) | n.a. |
| Production level and use | Introduce incentives to support biofuel production:   * Special electricity / water tariffs and feed-in tariffs for any surplus * Energy levy removed for biofuel industries * One-stop shop for all licencing of biofuel production facilities * Incentives for the growing of feedstocks on commercial scales, opportunities for by-products and conformity with international sustainability standards * Innovative financing models | Medium term | DOEA | MERA, Ministry of Finance, Economic Planning and Development,  Renewable Energy Association of Malawi,  Private players in the biofuels industry (especially manufacturers) | n.a. |
| Promote the use of biofuels:   * Attractive price for users (and fair for producers) * Easiness of importation of flex-fuel vehicles, distribution of flex-fuel converter kits, promotion of the local manufacturing of its kits and exemplarity measures (shift the government fleet to biofuels, renewable fuel for mass transport system, etc.) * Installation of appropriate fuelling pumps (distributing biodiesel and E85) | Medium term | DOEA | MERA, Ministry of Finance, Economic Planning and Development, Ministry of Transport, Representatives of Motor Industry Association, Consumers Association of Malawi | n.a. |
| Other energy sources | Introduce electric vehicles in Malawi and promote the use of these vehicles  This action is linked to the overall energy access level in the country and reliability of energy supply | Long term | DOEA | Ministry of Transport | n.a. |
| Conduct research on feasibility and consider supply of biogas for transportation as well as supply of compatible vehicles (such as bi-fuel and dual-fuel vehicles) | Long term | DOEA | Ministry of Transport, MERA, NCST, universities, other research institutions, MBS | n.a. |
| Research and development on other feedstocks (other than jatropha and sugar cane) | Long term | DOEA | Universities and other research institutions (University of Malawi – Polytechnic, University of Mzuzu – Department of Energy Studies) | n.a. |

Table 47: Implementation of priority actions on urban transportation

| **Category** | **Action** | **Indicative time frame** | **Lead agency** | **Cooperating stakeholders** | **Estimated costs** |
| --- | --- | --- | --- | --- | --- |
| Mass transit system | Phase out mini-buses by:   * Curb on all unregistered vehicles which is a significant proportion of the mini-bus population * Support the operators in buying large and efficient buses (e.g. though tax reductions or subsidies) * Franchising of routes: mini-buses must not be allowed to operate on city bus routes and strict enforcement is required | Medium term | Ministry of Transport and Public Works | City Councils; Ministry of Local Government and Rural Development; Road Traffic Directorate; Private sector transport operator representatives | n.a. |
| Development of a public transportation system:   * Phase in a comprehensive public transportation system in major cities with a combination of large and small capacity buses to serve at least the 5 major urban areas * Prohibit the entrance of kombis in city centres and other areas with high congestion | Medium term | Ministry of Transport and Public Works | City Councils; Ministry of Local Government and Rural Development; Road Traffic Directorate; Ministry of Lands, Housing and Urban Development; Private sector transport operator representatives | Capital cost per bus is estimated at USD 235,000  Operational cost (including maintenance) is estimated at USD 33,000 |
| Fuel efficiency of motor vehicles | Use of labels and standards through the integration of EU minimum emission standards for all registered vehicles | Short term | Ministry of Natural Resources, Energy and Mining | Ministry of Transport and Public Works; Ministry of Justice and Constitutional Affairs; Road Traffic Directorate; Private sector transport operator representatives | n.a. |
| Promote an appropriate car maintenance | Short term | Ministry of Transport and Public Works | Road Traffic Directorate | n.a. |
| Improve road capacity and maintenance | Medium term | Ministry of Transport and Public Works | Ministry of Local Government and Rural Development; Road Traffic Directorate; Malawi Energy Regulatory Authority | n.a. |
| Develop urban and suburban rail transportation system | Long term | Ministry of Transport and Public Works | Central Eastern African Railways | 1.98 $ million per km for diesel rail and 3.53 $ million for electrified line[[104]](#footnote-104) |
| Non-motorised transport | Support the development of non-motorised transport | Medium term | Ministry of Transport and Public Works | City Councils; Ministry of Local Government and Rural Development | n.a. |
| Travel Demand Management | Land use planning policies | Medium term | Ministry of Transport and Public Works | City Councils; Ministry of Local Government and Rural Development; | n.a. |
| Improve efficiency of traffic flow | Short term | Ministry of Transport and Public Works | City Councils; Ministry of Local Government and Rural Development; Universities and other research institutions | n.a. |

Annex 4: References

The table below lists the key legislative documents and policies consulted during the development of the Action Agenda. A detailed review of the legislative and policy framework is provided in the legal analysis that has been developed as part of the SE4ALL process.

Legal framework and institutions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Reference name** | **Energy Access** | **Renewable Energy** | **Energy Efficiency** | **Transportation** |
| **Legal Framework** |  |  |  |  |
| Liquid Fuels and Gas (Production and Supply) Act, 2004 (rule 25) |  |  |  | X |
| Road Traffic Act, 1997 |  |  |  | X |
| **Policy Framework** |  |  |  |  |
| Malawi Ethanol Programme, 2013 |  |  |  | X |
| Draft National Energy Policy, 2016 | X | X | X | X |
| National Energy Policy (NEP), 2003, updated 2016 | X | X | X | X |
| Draft Renewable Energy Strategy |  | X |  |  |
| Draft IPP Framework |  | X |  |  |
| Malawi Growth and Development Strategy II (2011-2016) |  |  |  | X |
| National Transport Policy, 2015 |  |  |  | X |
| Cook Stoves Road Map (2015 – 2017) | X |  | X |  |
| **Institutions consulted (outside of multi-stakeholder meetings)** |  |  |  |  |
| Malawi Energy Regulatory Authority (MERA) | X | X | X | X |
| Malawi Investment and Trade Center (MITC) | X | X | X | X |
| National Oil Company of Malawi (NOCMA) |  |  |  | X |

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1. Malawi Population Data Sheet 2012, Population Reference Bureau, <http://www.prb.org/pdf12/malawi-datasheet-2012.pdf> [↑](#footnote-ref-2)
2. The rural population totals 12.5 million people and represents 84% of Malawi’s total population of 14.8 million,. Source: Malawi Population Data Sheet 2012. [↑](#footnote-ref-3)
3. [↑](#endnote-ref-2)
4. The rural population is projected to be 21 million, representing 79% of the total projected population of 26.6 million. Source: Population Pyramids of the World from 1950 to 2100, United Nations, Department of Economic and Social Affairs, Population Division, https://populationpyramid.net/malawi/2030/ [↑](#footnote-ref-4)
5. Based on experience in other African countries, we assume 40 kWp PV systems with battery systems and possible 12.5 KVA diesel back-up in some cases, which will support 220 connections. We assume roughly 1/3 of the connections will be non-residential, leaving about 150 residential connections per mini-grid. 90 mini grids x 150 residential connections = 13,500 residential connections. At 4.4 people per household, 59,400 people will be served by mini grids. [↑](#footnote-ref-5)
6. Official Malawi Government Online, https://www.facebook.com/malawigovernment/posts/431737397012760 [↑](#footnote-ref-6)
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20. Graph was generated from fuel import data in Annual Economic Report - 2014 [↑](#footnote-ref-20)
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22. National Statistical Office (NSO): at www.nsomalawi.mw/publications/134-population projections ….. [↑](#footnote-ref-22)
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26. Estimated Based on Current Electricity Domestic Customers [↑](#footnote-ref-26)
27. Estimated Based on Current Electricity Domestic Customers [↑](#footnote-ref-27)
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29. MERA [↑](#footnote-ref-29)
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31. MERA, 2015 [↑](#footnote-ref-31)
32. ESCOM, April 2016 [↑](#footnote-ref-32)
33. Adapted from IHS 3 (NSO,2011), page 124. Access rates are based on the Integrated Household Surveys (HIS) . HIS-2 was published in 2005, and HIS-3 was published in 2012. [↑](#footnote-ref-33)
34. Integrated Resource Plan, 2015 [↑](#footnote-ref-34)
35. ESCOM KPI [↑](#footnote-ref-35)
36. Malawi Energy Policy, 2003 [↑](#footnote-ref-36)
37. This is the number of people to be served by mini-grids which would involve about 90 mini-grids by 2030. [↑](#footnote-ref-37)
38. Solar Resource Mapping in Malawi: Solar Modelling Report, Energy Sector Management Assistance Program, World Bank, March 2015 [↑](#footnote-ref-38)
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51. The analysis is based on both quantitative and qualitative data gathered by the project team, given that the data availability in the country is in general limited. [↑](#footnote-ref-51)
52. Data are available for 2014 (Economic Report 2015): 109 million litres of petrol imported in 2014, which is perfectly flat compared to 2013. For diesel, 160 million litres have been imported, which is comparable to 2007 level. Thus, these figures have not been represented, waiting for confirmation. [↑](#footnote-ref-52)
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56. Ethanol fuel mixtures have "E" numbers which describe the percentage of ethanol fuel in the mixture by volume, for example, E85 is 85% anhydrous ethanol and 15% gasoline. [↑](#footnote-ref-56)
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64. Christian Thiemann Institute for Transport & Economics Technische Universität Dresden, How Much does Traffic Congestion Increase Fuel Consumption and Emissions? Applying a Fuel Consumption Model to the NGSIM Trajectory Data [↑](#footnote-ref-64)
65. Available at: <http://www.rrdc.com/op_malawi_cear.html#system_map> [↑](#footnote-ref-65)
66. Railroad Development Corporation [↑](#footnote-ref-66)
67. PWC (ongoing), Consultancy services to carry out Malawi energy policy review, Energy Status Report [↑](#footnote-ref-67)
68. Ordinary bicycle, which is fitted with a cushion at the back for the passenger to sit on [↑](#footnote-ref-68)
69. Kadaluka M. (2011), MCs Thesis: Thesis Title:

    Formalizing Bicycle Taxi Operations as a Sustainable means of public Transport in Mzuzu City, Malawi. Views from Operators, Users, and local Authorities. [↑](#footnote-ref-69)
70. [↑](#footnote-ref-70)
71. Mutenyo et al (2015) Baseline survey of Uganda’s national average automotive fuel economy [↑](#footnote-ref-71)
72. PWC (ongoing), Consultancy services to carry out Malawi energy policy review, Energy Status Report [↑](#footnote-ref-72)
73. Lilongwe City Council (2013), The Urban Structure Plan of Lilongwe City [↑](#footnote-ref-73)
74. Malawi Ministry of Transport and Public Works and National Transport Master Plan and Implementation Plans, available at: http://ntu.eu/files/manager/jobs/malawi\_experts\_70mm.pdf [↑](#footnote-ref-74)
75. Thomson Reuters Foundation (2013), Malawi tax on second-hand vehicles cuts emissions, government says. <http://news.trust.org//item/20131231164852-v6g3t/?source=shem> [↑](#footnote-ref-75)
76. The use of LPG stoves in urban areas will not only displace biomass cook stoves but some amount of electric cook stoves as well. Promotion of LPG cooking thus represents a DSM measure. [↑](#footnote-ref-76)
77. “Accelerating Access to Electricity in Africa With Off-Grid Solar: Off-Grid Solar Country Briefing – Malawi,” Overseas Development Institute et al. London: Department for International Development, 2015, [↑](#footnote-ref-77)
78. Mini-grid Policy Toolkit, EU Energy Initiative Partnership Dialogue Facility, Eschborn: 2014 , p. 27. http://www.ren21.net/Portals/0/documents/Resources/MGT/MinigridPolicyToolkit\_Sep2014\_EN.pdf [↑](#footnote-ref-78)
79. Status of Energy Policy in Malawi, by Patrick Lapukenim Ministry of Energy, presentation at JICA International Centre, Tokyo, June 2013, <https://eneken.ieej.or.jp/data/5006.pdf> [↑](#footnote-ref-79)
80. For off-grid solar home systems, and RE mini-grids, see the Energy Access section. [↑](#footnote-ref-80)
81. Cost estimates derived from “Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants,” U.S. Energy Information Administration, April 2013; For small hydro, “Renewable Energy Technologies: Cost Analysis Series – Hydropower,” International Renewable Energy Agency, June 2012; For bagasse cogeneration, “Frequently Asked Questions on Biomass Power Generation,” Ministry of New and Renewable Energy, India. [↑](#footnote-ref-81)
82. World Energy Council definition for National EE Agency [↑](#footnote-ref-82)
83. USD 30 million is the target initial capitalization of the Fund (blend of Malawi Government equity stake, International agencies grant contributions and International financing institutions loans). Administrative costs for setting up the Fund should be in the range of USD 100,000 – 150,000. [↑](#footnote-ref-83)
84. Based on the average rocket barn cost of USD 1 500 [↑](#footnote-ref-84)
85. Assuming an average price of USD 2 per unit throughout the AA period [↑](#footnote-ref-85)
86. Assuming USD 40 average price per pre-paid meter [↑](#footnote-ref-86)
87. Source: http://www.nuglobalnrg.com/jatropha\_facts\_and\_figures.html [↑](#footnote-ref-87)
88. Source: tables page 9 of the report FEASIBILITY STUDY ON GROWING JATROPHA, LIFE Integrated Water Resources Management and USAID, http://www.mwri.gov.eg/project/report/IWRMI/Report57FeasabiltyStudyonGrowingJATROPHA.pdf [↑](#footnote-ref-88)
89. Source: Malawi ethanol producers (PressCane and EthCo) [↑](#footnote-ref-89)
90. Personal communication with a member of the Transportation Working Group [↑](#footnote-ref-90)
91. The study refers specifically to taxis, but is assumed the same with private vehicles in terms of capacity and environmental impact [↑](#footnote-ref-91)
92. An example is provided by Thomson Reuters Foundation (2013): all second-hand vehicles with an engine capacity of up to 1,500 cc and below eight years of age attract a basic import duty of 25 percent on their cost, insurance and freight (CIF) cost, with a further 16.5 percent value added tax (VAT) levied on the sum of the CIF and import duty. Vehicles between 8 and 12 years old with the same engine capacity attract an additional excise duty of 35 percent, levied on the sum of the CIF, VAT and import duty.

    For vehicles over 12 years old, the excise is 50 percent. [↑](#footnote-ref-92)
93. Based on estimates provided by AfDB (2015) Rail Infrastructure in Africa – Financing Policy Options, available at: <https://www.afdb.org/fileadmin/uploads/afdb/Documents/Events/ATFforum/Rail_Infrastructure_in_Africa_-_Financing_Policy_Options_-_AfDB.pdf> [↑](#footnote-ref-93)
94. The Multi-Tier Framework, developed by the World Bank in its role as the SE4All Knowledge Hub, was launched in July 2015 at the Vienna Energy Forum. [↑](#footnote-ref-94)
95. <http://www.se4all.org/our-vision/our-objectives/> [↑](#footnote-ref-95)
96. Sustainable Energy for All (2014). SE4All Country Action Reference Document. [↑](#footnote-ref-96)
97. Presentation delivered during the Energy Access Committee Meeting on October 1, 2014 in Brussels. [↑](#footnote-ref-97)
98. The Sustainable Development Goal (SDG) 7 was adopted end of September in New York. Implementation will be key for Africa. [↑](#footnote-ref-98)
99. Cost estimates derived from “Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants,” U.S. Energy Information Administration, April 2013; For small hydro, “Renewable Energy Technologies: Cost Analysis Series – Hydropower,” International Renewable Energy Agency, June 2012; For bagasse cogeneration, “Frequently Asked Questions on Biomass Power Generation,” Ministry of New and Renewable Energy, India. [↑](#footnote-ref-99)
100. USD 30 million is the target initial capitalization of the Fund (blend of Malawi Government equity stake, International agencies grant contributions and International financing institutions loans). Administrative costs for setting up the Fund should be in the range of USD 100,000 – 150,000. [↑](#footnote-ref-100)
101. Based on the average rocket barn cost of USD 1 500 [↑](#footnote-ref-101)
102. Assuming an average price of USD 2 per unit throughout the AA period [↑](#footnote-ref-102)
103. Assuming USD 40 average price per pre-paid meter [↑](#footnote-ref-103)
104. Based on estimates provided by AfDB (2015) Rail Infrastructure in Africa – Financing Policy Options, available at: <https://www.afdb.org/fileadmin/uploads/afdb/Documents/Events/ATFforum/Rail_Infrastructure_in_Africa_-_Financing_Policy_Options_-_AfDB.pdf> [↑](#footnote-ref-104)