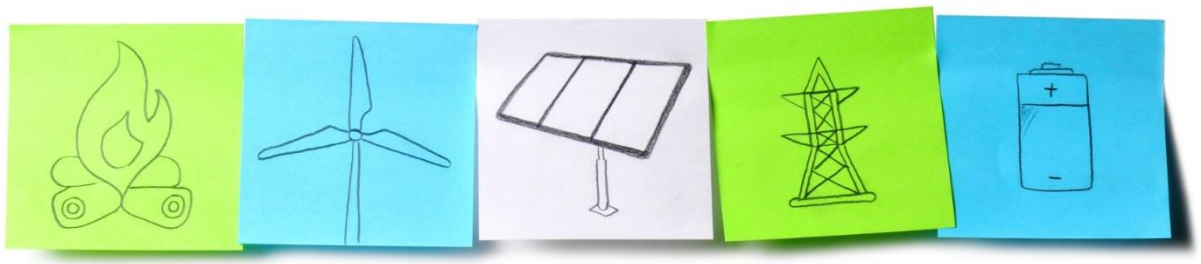
Malawi SEforALL Action Agenda

June 2017



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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	Concentrated solar power
DNA	Designated National Authority
DOE	Department of Energy Affairs
DOF	Department of Forestry
DSM	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
MBS	Malawi Bureau of Standards
MEPs	Minimum energy performance standards
MERA	Malawi Energy Regulatory Authority
MGDS	Malawi Growth and Development Strategy
MRA	Malawi Revenue 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
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SEforALL	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

Access to modern energy services is a necessary precondition for achieving development goals that extend beyond the energy sector to eradicate poverty, provide access to clean water, improve public health and education, empower women and increase food production.

The United Nations (UN) Secretary General launched the Sustainable Energy for All (SEforALL, formerly written as SE4ALL) initiative in September 2011. It aims to achieve the following three inter-related global goals by 2030:

- Ensure universal access to modern energy services;
- Double the global rate of improvement in energy efficiency; and
- Double 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 aforementioned SEforALL goals by 2030.

The SEforALL initiative is country-driven. While international institutions and consultants provide assistance to facilitate the process, achieving SEforALL's objectives will require all major stakeholders in Malawi to play a leading role. Specifically:

- 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; and
- 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, while embracing SEforALL guidelines. The SEforALL Africa Hub hosted by the African Development Bank provided technical assistance to assist the GoM. Given the country's priority placed on increased energy access to underserved populations, the AA outlines a strategy to increase efforts in this area. For the purposes of this document, electricity access is defined as "any connections to the national grid system or distributed (off-grid) electricity solutions, including solar home systems (SHS) and mini-grids. This definition is also 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 16.5 million Malawians use wood, charcoal or other solid fuels. The solid fuel is used primarily for cooking. Its prevalence leads to substantial indoor air pollution linked to illness and premature death. In addition, the 7.5 million tonnes of annual wood usage greatly exceeds the 3.7 million tonne sustainable supply. 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 and other factors have greatly reduced the output of the country's hydroelectric plants, which provide most of the country's electricity. As the government works to develop additional hydroelectric plants, it is also investigating the potential of additional generation capacity from solar and other renewable sources, in addition to coal and diesel. To date, the only large-scale solar project connected to the grid is the 830 KW demonstration solar power plant installed at Kamuzu International Airport in Lilongwe.

Across the country, energy efficiency is low. There are however, ample opportunities to improve the energy performance of existing structures and implements such as factories, buildings, barns, streetlights,

and water pumps. There is also potential to improve “supply side” inefficiencies that lead to power loss in the electric transmission and distribution grids.

The transportation sector remains heavily reliant on imported petroleum products, in spite of Malawi’s sugarcane-based ethanol program that blends ethanol with petrol at about an E20 level (containing 20% ethanol). The nation’s fledgling biodiesel industry offers considerable potential for expansion. Opportunities also abound in energy efficiency improvements to the country’s urban mass transit system and motor vehicles.

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

1.1 Targets

1.1.1 Energy access targets – 2030

By 2030, the country’s projected population is expected to increase to 26.6 million.[1] The percentage of the rural population is likely to decrease from its current level of 84% of total population to 79% by the same year, based on projections from the United Nations’ Population Pyramids of the World from 1950 to 2100. Average household size is expected to remain at 4.4 persons. Targets are based on an acceleration of existing trends and the goals from Malawi’s *Cook Stove Road Map* and ESCOM’s - the national power distribution utility - Accelerated Access to Electricity Project.

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. 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 large-scale LPG program takes time. 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 for clean cooking solutions

Cooking technology	Baseline 2016	Target 2030	Percentage of rural[2] households with access to modern cooking solutions, 2016	Percentage of rural[3] households with access to 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	5 000 000	17.6%	100%

[1] Malawi Population Data Sheet 2012, Population Reference Bureau, http://www.prb.org/pdf12/malawi-datasheet-2012.pdf.
[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.
[3] The rural population is projected to be 21 million by 2030, 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/.

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 solar 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 for water heating technology

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 other 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 for electricity access

Electricity access Served	Number	Percentage of rural pop.
Grid extension – homes/business connected through 2030	1, 510, 000	31.6
Rural solar home systems installed through 2030	75,000	29.3
Mini-grids installed through 2030	90[4]	< 1.0
Pico solar systems provided through 2030	4, 500, 000	100

1.1.2 Renewable energy targets - 2030

The renewable energy targets were developed based on national power development needs; the proposed renewable energy (RE) project developments proposed by ESCOM; the potential for independent power producer RE power development; a grid study indicating how much intermittent power can be added over the next 12 to 24 months; and the recommendations provided by the Malawi SEforALL RE Working Group and the Department of Energy Affairs 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%

[4] 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.

Small hydro	4.35 MW	103.35 MW	Percent of generation: 4%
Solar	.38 MW	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 the aforementioned 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.

1.1.3 Energy efficiency targets - 2030

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

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 pre-paid/smart meters	1,600,000
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%

1.1.4 Transportation targets - 2030

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

Table 6: Alternative fuel targets

Biofuels	Baseline (2016)	Target (2030)
Ethanol production	19 million litres	40 million litres
Biodiesel production	150,000 litres	55 million litres
Ethanol blend	10%	30%
Biodiesel	*9%- 2016*	15%

The automobile fuel efficiency target is based on the Global Fuel Economy Initiative (GFEI), one of the SEforALL flagship programs aimed at reducing emissions and at least doubling the efficiency of the global vehicle fleet from an average of 8 litres per 100km in 2005 to 4 litres per 100km by 2050. Given the low fuel efficiency starting point of local vehicles, Malawi's fuel efficiency target is slightly lower than the GFEI target. Although the country's current fuel efficiency level is unknown due to lack of data, this target nonetheless is expected to represent an improvement. The target should be revised by end of 2017 at the

latest, based on the collection of data pursuant to the development of the National Transport Master Plan currently underway.

Table 7: Urban transportation target

Urban transportation	Target
Fuel efficiency by 2030	8 litres/100 km

1.2 Priority actions

1.2.1 Access to improved cooking

- The Department of Energy Affairs will work with the Department of Forestry to increase the up-stream supply of biomass.
- The Department of Energy Affairs, working with the Ministry of Finance, Economic Planning and Development, Malawi Revenue Authority and Malawi Investment and Trade 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 like schools, not households.
- The Department of Energy Affairs will develop a strategy to assist poor households in urban areas to access energy-efficient wood and charcoal stoves.
- The Department of Energy Affairs will facilitate development of a sustainable value chain for biogas production for targeted communities, institutions, and industries.
- The Department of Energy Affairs will promote sustainable charcoal production at different scales of production.
- The Department of Energy Affairs will promote the manufacture, distribution, use and financing mechanisms for different end use energy technologies.
- The Department of Energy Affairs, in collaboration with cooperating partners, will conduct research into alternative production of charcoal.

1.2.2 Access to electricity

- Under Phase 8 of the Malawi Rural Electrification Programme's (MAREP) rural electrification plan, the Rural Electrification Agency will electrify at least two rural trading centres per district until 2030. About 336 sites are planned to be connected between 2016 and 2017. [5]
- MAREP will electrify all public institutions 5KM away from the MV line through off-grid options.
- MAREP will continue the practice of providing pre-paid meters to all new connections.
- MAREP will revive support for mini-grids.
- Malawi Bureau of Standards (MBS) will lead an effort to enforce standards on imported and domestically manufactured RE products used to provide electricity in

[5] Official Malawi Government Online, https://www.facebook.com/malawigovernment/posts/431737397012760.

unserved areas. The Department of Energy Affairs will support MBS and work to increase MBS's capability to carry out this function.

- The Department of Energy Affairs 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; provide a subsidy for the operation and maintenance of mini-grids; and establish a low price for licensing mini-grids.
- The Ministry of Agriculture, Irrigation and Water Development will continue to irrigate schemes far away from the grid with solar PV.
- The Ministry of Health will ensure that health centres remotely located from the grid are electrified by solar PV.

1.2.3 Renewable energy

Comprehensive Renewable Energy Policy

The greatest 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 independent power producer (IPP) rules for approval of IPPs and for the acquisition of RE electricity, such as REFiT (Renewable energy feed-in tariff), RE Obligation, or RE auction;
- Adoption of net metering for smaller, on-site RE projects;
- Provision of financial incentives such as tax incentives and production credits to RE developers;
- Establishment of rules for on-site supply of RE electricity to large users by third party developers;
- Adoption of performance standards for RE equipment, and training and licensing of RE installers;
- Targets and timetables for the acquisition of RE electricity;
- Streamlining of project planning processes and decreasing project development and licensing costs;
- Assigning roles to ESCOM, Malawi Energy Regulatory Authority (MERA), the Department of Energy Affairs, other government entities, and other stakeholders; and
- 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 power purchase agreements (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; and
- Streamline the licensing process and minimize licensing fees and requirements.

Addressing 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 value-added tax (VAT) on RE products. This will only be done if it is shown that the increased revenues resulting from RE investment will offset any lost revenue from VAT exemptions. VAT-exempt equipment must be further clearly identified and used only for renewable energy projects; and
- Establishing rules for solar service agreements so that solar vendors/installers may 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.

Future National Energy Efficiency & Renewable Energy Development Commission

The government will consider establishing a dedicated energy efficiency/renewable energy commission.

- The commission would be somewhat like the Indian Renewable Energy Development Agency Limited and have a clear mandate to implement national RE policy. The activities of the commission would include: helping establish the country's IPP policy; assisting 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.

Electric grid modernization

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

- Improving transmission and distribution infrastructure to allow wheeling of RE-generated electricity and increased overall reliability;
- Leveraging advanced information and communication technologies in a variety of ways, such as those required to incorporate and manage electricity coming to the grid from a variety of intermittent RE sources; and
- Utilizing other grid improvement techniques, such as GIS mapping, synchrophasers, and AMI metering with remote reading and load control.

Education and training

The government will implement RE education and training programs aimed at:

- Improving and increasing educational and training opportunities for students as well as officials in national government, local government, financial institutions and small and medium-sized enterprises (SMEs);
- Establishing RE training programs at technical colleges;
- Introducing an RE internship program for college graduates; and
- Launching an RE awareness initiative, which includes the introduction of a media strategy targeting radio and newspaper, as well as RE trade fairs.

1.2.4 Energy efficiency

Solar hot water heating

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

- Requiring new future housing schemes to install solar geysers;
- Rolling out a large-scale promotion campaign through local banks and the utility company, offering subsidized loans that can be repaid through household electricity bills; and
- Proposing additional tax incentives that encourage local manufacturers to engage in production of solar-powered geysers.

Domestic lighting

- The government and ESCOM will expand efforts to promote efficient household lighting.
- Future programs will involve popularization of the most efficient technologies currently present at the market level (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 energy efficiency (EE) promotion in the industrial and mining sectors. Special attention will be paid to the following priority areas:

- Programs for upgrading standard burnt motors, gear boxes and conveyors with energy efficient replacements;
- 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; and
- Promotion of sub metering in complex industrial and manufacturing processes.

Agriculture

- Special focus will be placed on the highest energy consuming processes, such as tobacco curing, tea drying, and irrigation water pumping.

Supply-side

Special attention will be paid to the following:

- 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; and
- Rehabilitation of existing power plants.

Institutional approach

In the long run (up to 2030, a national EE/RE commission will aim 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 Ministry of Natural Resources, Energy and Mining (MoNREM), determine specific EE targets for large energy consumers;
- Collect and record energy savings related data and pursue compliance with specific EE targets set for large energy consumers;
- Issue certificates for energy auditors and maintain a list of certified auditors and auditing firms; and
- Organize energy management and energy audit training events.

New energy efficiency law

A new energy efficiency law will focus on the following:

- Energy management regulations;
- Minimum energy performance standards (MEPS);
- Green building code promotion; and
- National EE audit and action plan.

1.2.5 Transportation – Biofuels and electric vehicles (EVs)

The government will work to:

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

1.2.6 Urban transportation

It will further:

- 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 appropriate car maintenance;
- Improve road capacity and maintenance;
- Develop an urban and suburban rail transportation system;
- Support the development of non-motorised transport;
- Develop land use planning policies; and
- Improve efficiency of traffic flow.

Harmonizing decision making

To harmonize decision making, the government will:

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

Introduction of mass transit system

The government will work to:

- 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; and
- Prohibit the entrance of minibuses in city centres and other areas with high congestion.

Mobilization of funding

The government will further work to:

- Mobilise 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;
- Place a levy on second-hand vehicles, coupled with an imposition of a levy on fuel sales and highway tolls, to support mass transit and other transport-related activities;
- Direct funding from the state budget and private investors; and
- Provide concessions to associations and other private sector investors.

Increasing fuel efficiency

With respect to increasing the average fuel efficiency of motor vehicles, the government will:

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

Establishing travel demand management

The government will further improve upon:

- 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; and
- Traffic flow efficiency by:
    - Supporting the development of non-motorized transport;
    - Restricting the parking supply by either limiting the physical supply of parking space in the central area or charging parking space to discourage private vehicles entering the central business district;
    - Developing synchronised traffic signals, such as those which rely upon an intelligent traffic light control algorithm (“Adaptive Traffic Control system”) that works on GPS and other data (being piloted in Johannesburg);
    - Integrating traffic flow concerns into land use planning by prohibiting heavy vehicles in densely populated areas, promoting mixed use planning to minimise the need for traffic, and planning for pedestrians and street vendors to minimise conflict with vehicular traffic, etc.;

- Promoting eco-driving through the use of smarter and more fuel-efficient driving techniques; and
- Embarking on awareness campaigns on the benefits of public transportation, non-motorised transport and other aspects of sustainable transportation.

2. Introduction

Malawi is a small landlocked country in South Central Africa bordered by Mozambique, Tanzania and Zambia. 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.[6] Approximately 84% of Malawians live in rural areas, practicing subsistence farming as their main source of livelihood.

Between 2008 and 2011, implementation of the Malawi Growth and Development Strategy (MGDS), saw the country's gross domestic product (GDP) grow at an average rate of 7.1% up from an average rate of 3.5%. GDP grew by 6.1% in 2014 up from 5% the previous year to US$4.2 Billion.[7]

Malawi's economy is based on agriculture, with tobacco the largest export earner. The growth of other sectors such as mining led to a decline in the contribution of agriculture to the national economy from 38% in 1994 to 27% in 2010.

Since its inception in 2009, the Kayelekera uranium mine in Karonga boosted the mining sector. However, the closure of the mine in May 2014 following a global price decrease, led to a decline in mining by 7.8% compared to the 7.6% growth the previous year.

Foreign exchange reserves increased by 20% during the same year and closed at US$922 million, equivalent to 4.83 months of import cover compared to 4.09 months of import cover in 2013. Inflation remained high in 2014 and closed at 24.2% by December, compared to 23.5% the previous year. The current detailed economic status of the country may be found in the IMF's *Economic Report 2016 for Malawi*.

Meanwhile, the number of people living in extreme poverty dropped from 50% in 2005 to 39% in 2010. The number of people living without adequate energy dietary intake requirements also decreased from 22% in 2005 to 15% in 2009 (MGDS II, 2012). The statistics are however likely to be less positive at this time 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 2011 United Nations Human Development report categorizes Malawi's human development as low and ranked the country 171 out of 187 countries that were assessed.

Through the MGDS II - the medium-term development strategy for the period 2012 to 2016, the government is committed to the implementation of the Millennium Development Goals (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. Certain indicators of the 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. 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 SEforALL is to reduce that reliance through improved cook stoves and alternative cooking fuels like LPG and biogas.

Another energy challenge 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 oil. This oil tends to be more expensive in Malawi because the country is landlocked and overland fuel transportation costs are high.

[6] http://www.worldbank.org/en/country/malawi.
[7] http://www.worldbank.org/en/country/malawi.

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 SEforALL initiative calls for a global doubling of renewable energy use – an achievement highly possible in Malawi. MERA, the energy regulator, has developed a REFiT and 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 SEforALL is energy efficiency. There is great potential to improve energy efficiency in Malawi's industries, buildings, appliances and motor vehicles.

The SEforALL 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. 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 one largely biomass reliant 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 MGDS II 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.[8]

This SEforALL 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 SEforALL actions outlined in this report, and integrating them within a broader economic policy. SEforALL 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.

[8] Intended Nationally Determined Contribution, Republic of Malawi, UNFCC 2015.

3. Methodology

This Action Agenda is based on extensive desk and field research. Desk research included, among others, review of policy documents, strategic plans, national development plans, budget statements, quarterly and yearly fiscal reviews, and audit and parliamentary reports. It also involved review 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 two-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 more detailed views on certain policy matters. These were supplemented by additional 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, the Department of Energy Affairs and the African Development Bank. A second set of working group meetings was 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 outside the energy ministry.

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

4. Part I -Vision and targets through 2030

Guided by its National Energy Policy of 2003 and 2016, 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; and 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 business-as-usual (BAU) trajectory and targets, and describes the barriers preventing achievement of the targets.

4.1 Energy sector status and trajectory

4.1.1 Energy sector status

Malawi's energy sector includes biomass, electricity, liquid fuels and gas, coal and renewables. Biomass provides 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 accounts for 3.5% of the energy and electricity produced from hydro power accounts for 2.3% of all energy.

The country's interconnected grid electricity comes from hydro. The installed interconnected capacity of hydro is 351 MW of which 311 MW is operational but is not all used due to low water levels along the Shire River. The suppressed demand is 350 MW. More than 90% of the hydro power is concentrated on the Shire River with only 4.5 MW on the Wovwe River leading to insecurity in terms of national power supply. Likoma Island is powered by diesel generators rated at 250kW. The units generated in 2014 totalled 1,906.51GWh while those consumed totalled 797,46GWh. If all 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, Engen, Simso, Afrox Malawi Ltd, Press Cane and Ethanol Company Ltd. Those trading in petrol, diesel and lubricants are Puma Energy, Total, Petroda, Energem, Injena, Mt Meru, Engen and Simso, while Afrox Malawi Ltd trades 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 Petroleum Importers Ltd 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 that enables the vehicles to use fuel ethanol without blending. If the test is successful and ethanol production can be increased to meet demand, all petrol vehicles will be fitted with the enabler device, reducing importation volumes of petrol thereby saving foreign exchange.

Ethanol was approved by MERA as a legal fuel in 2014. Plans are underway in all major towns to construct separate pumps for fuel ethanol at stations in which petrol vehicles fill their tanks. However, blending of ethanol fuel with petrol at 90:10 is still continuing. National Oil Company of Malawi, which has been established under an act of parliament to manage a strategic fuel reserve facility, is 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

Table 8 below.

Table 8: Energy demand by fuel type[9]

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%**
Services	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 2017, which emphasizes moving the country away from biomass to more modern energy sources. Specifically, NEP calls for the following:

- Increasing the number of households with electricity to 30% by 2020 and 40% by 2050. The current (2015) electricity access rate is around 10%;
- Constructing a new 220-330 kV backbone North – South transmission line;
- A 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);
- Increasing petrol-ethanol blending ratio from 80:20 to 70:30;
- Increasing internal storage capacity using government and private sector facilities from 15 days to 90 days; and
- Promoting use of LPG at the household level.

[9] Biomass Energy Strategy (2009), Matthew Owen et al.

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

Table 9: Energy mix projections[10]

	2000	2010	2020	2050
Biomass	93	75	50	30
Liquid Fuels	3.5	5.5	7	10
Electricity	2.3	10	30	40
Coal	1	4	6	6
Renewables	0.2	5.5	7	10
Nuclear	0	0	0	4
TOTAL	100%	100%	100%	100%

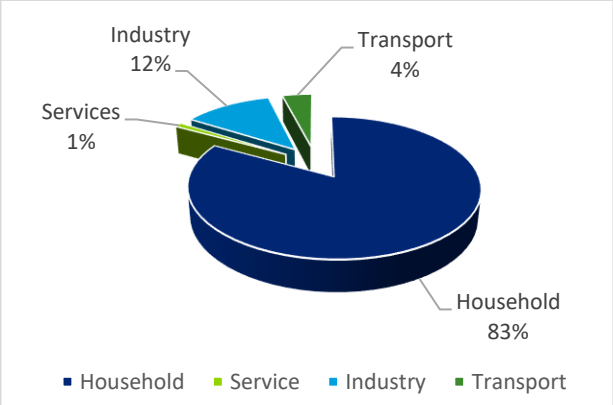


Figure 1: Energy consumption (NEP, 2003)

Annual energy consumption is estimated to range from 150TJ to 156TJ.[11] A 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. The 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 the 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 demographics (84% rural based population) and 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.

According to NEP 2003, the Malawi energy mix is made up of five components, namely: biomass,[12] 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 residue.
- The share of total commercial energy[13] 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.

However, it is important to take note that these mixes have been revised in the draft NEP 2017 in terms of both categorisation of energy sources and projections by energy source in the mix.

4.1.2 Electricity generation and transmission plans

According to NEP 2003, 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 is 420 MW in

[10] GoM, 2003.Source: Adapted from Openshaw (2008).
[11] Kambewa, P. and Chiwaula, L., (2010), "*Biomass energy use in Malawi*," A background paper prepared for the International Institute for Environment and Development (IIED) for an international workshop on biomass energy, 19-21 October 2010, Parliament House Hotel, Edinburgh.
[12] Traditional firewood and charcoal, mostly unsustainably sourced from forests
[13] According to National Energy Policy (2003), page 58, commercial energy includes liquid fuels, electricity and coal.

2015, 1,000 MW in 2020, 1,750 MW in 2025 and 2,550 MW in 2030 under a 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[14]

Year (all figures in MW)[2]	2014	2018	2022	2026	2030
Peak Demand Forecast	378	720	1,300	1,950	2,550
Reserve Margin	69	104	162	227	287
Total Capacity Requirement	447	824	1,462	2,177	2,837
ESCOM (Utility) Supply[3]	351	429	429	429	429
Capacity Supply Shortfall	-96	-395	-1,022	-1,748	-2,408

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. IPPs have been signing MOUs with the government, and the government plans to add 1,500 MW by the year 2020.[15] MERA is reported to assume the responsibility of a negotiator from ESCOM, which is viewed as an interested party.[16]

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 by Intra-Energy/Project 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 the sub-bituminous type) with average calorific value of 24.9 GJ/tonne (NEP 2003, page 10), this is equivalent to 547.8PJ 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 required coal.

Meanwhile, a total of 70 MW of solar energy projects with four different solicited IPPs are underway. The solicitation has been done by the Government of Malawi-ESCOM.

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.[17]

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

[14] Business Opportunities in the Malawi Power Sector, Spring 2015.
[15] Malawi's Mini Integrated Resource Plan, 2016-2020.
[16] MERA.
[17] Lapukeni, P. G. (Controller of Policy and Planning, Ministry of Energy), 2013. Status of Energy Policy in Malawi. PowerPoint presentation at JICA International Centre, Tokyo, Japan, 2nd to 22nd June 2013. Available https://eneken.ieej.or.jp/data/5006.pdf.

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: such as a 40 MW plant on Bua River at Mbongozi by HE Power. The government is also in the process of upgrading the nation's transmission grid with support from MCC and the World Bank (See Figure 3).

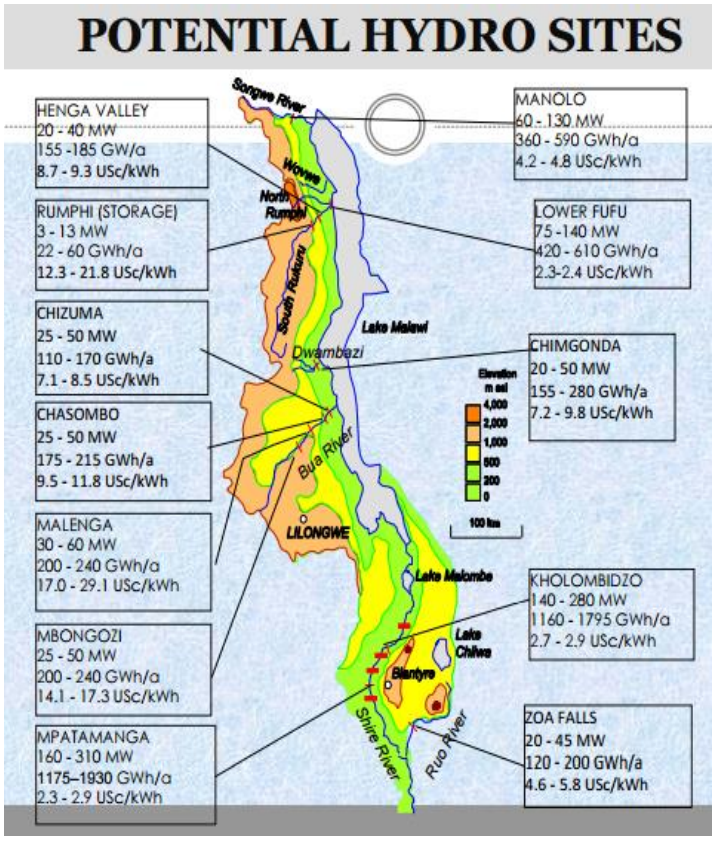


Figure 2: Potential hydropower projects in Malawi

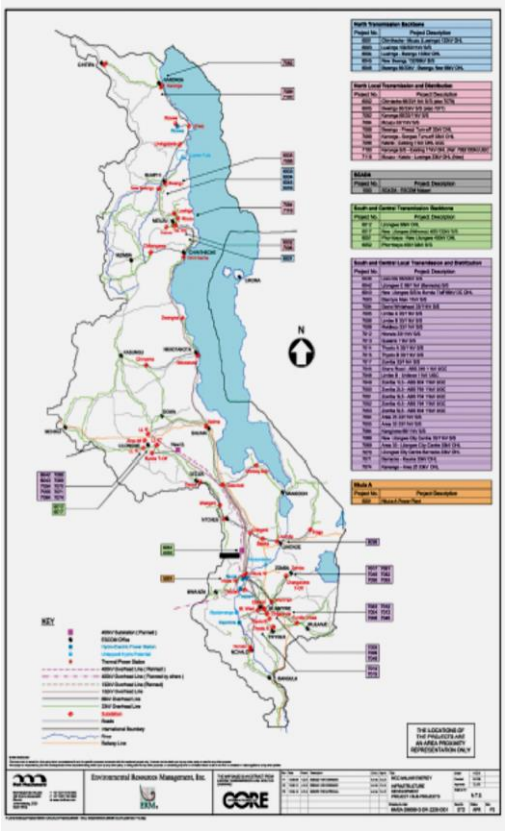


Figure 3: MCC infrastructure project investments

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 of 20:80.[18] The blending ratio is however not met due to limitations of the locally produced ethanol.

Under national energy law, MERA is mandated to regulate the pump price for fuel. There is an automatic pricing mechanism that is triggered by movements in the procurement costs and the exchange rate of the Malawi Kwacha against the US Dollar.

[18] National Energy Policy, 2013.

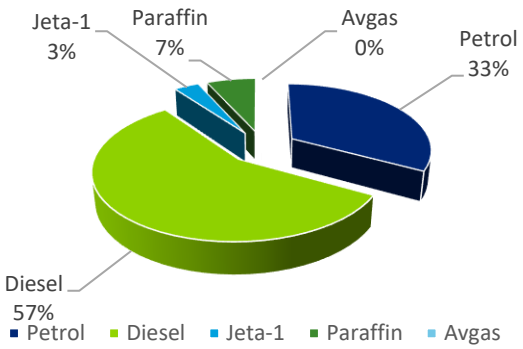


Figure 4: Petroleum products supply based on total imports from 1999 to 2013[19]

Due to the rapid growth of the number of vehicles, the demand for petroleum products will witness a growth in demand. It was expected to rise to more than 350 million litres by 2015, and further increase to around 417 million litres by 2030 assuming straight line growth. However, the Annual Economic Report (2015) showed a sharp decline due to the lower demand of diesel for electricity generation at Kayelekera Uranium Mine. 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.

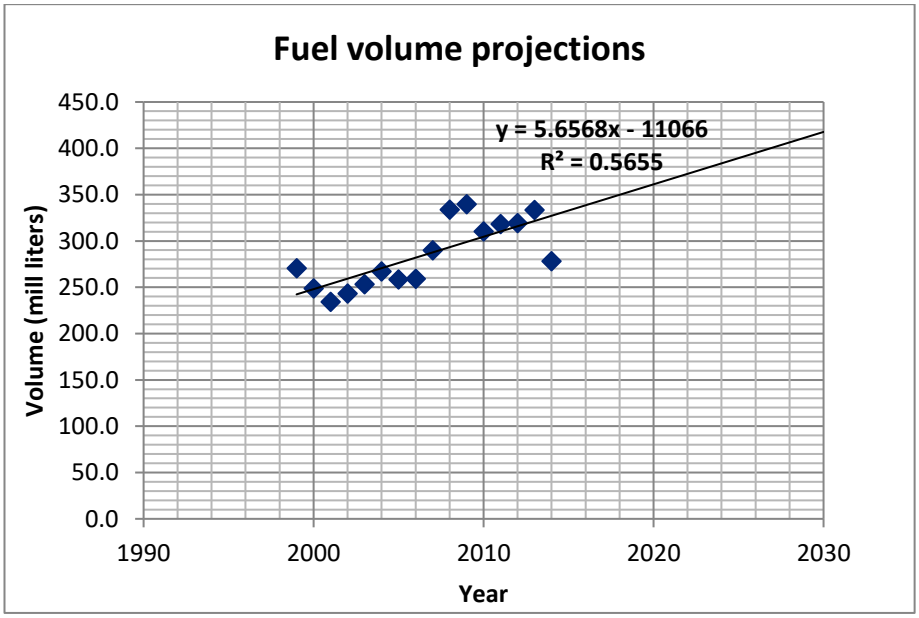


Figure 5: Fuel import projections[20]

Other energy-related policy processes

The SEforALL 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.

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 the MGDS II.

National Energy Policy (NEP) of 2003, updated 2017. NEP calls for making Malawi`s energy sector sufficiently robust and efficient to support the country's efforts towards poverty reduction and sustainable economic growth. This policy's long term vision is to drive the Malawian economy from a hugely biomass energy reliant one to an economy based on efficient use of modern means and sources of energy. The

[19] Graph was generated from fuel import data in Annual Economic Report – 2014.
[20] Graph and trend line equation for projection were generated from fuel import data in Annual Economic Report – 2015.

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.

4.2 Energy access – Clean cooking

4.2.1 What is the current status and business-as-usual (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.[21] The population is estimated to reach 20 million by 2020 and 27.5 million by 2030. It is further estimated that the rural population is approximately 84% that predominantly uses biomass as a source of energy for cooking. This entails 2.9 million households residing in rural areas depending upon biomass for cooking and requiring efficient cook stoves for clean cooking. This is evidenced by 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 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 residue	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

Participants at stakeholder consultations summarised the current biomass situation as follows:

- 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 10% tree cover, but tobacco industry still a problem.
- Institutions with a 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

[21] National Statistical Office (NSO): at www.nsomalawi.mw/publications/134-population projections.

forests. The nation's overall wood consumption exceeds sustainable supply by about 2.37 million cubic metres. The National Energy Policy (2003) estimates that 48% of the biomass used comes from sustainable supply, 47% from natural woodlands (unsustainable) and 5% comes from wastes from the agriculture and industrial sectors. The biomass consumption by the different energy sectors is as shown in Figure 6 below:

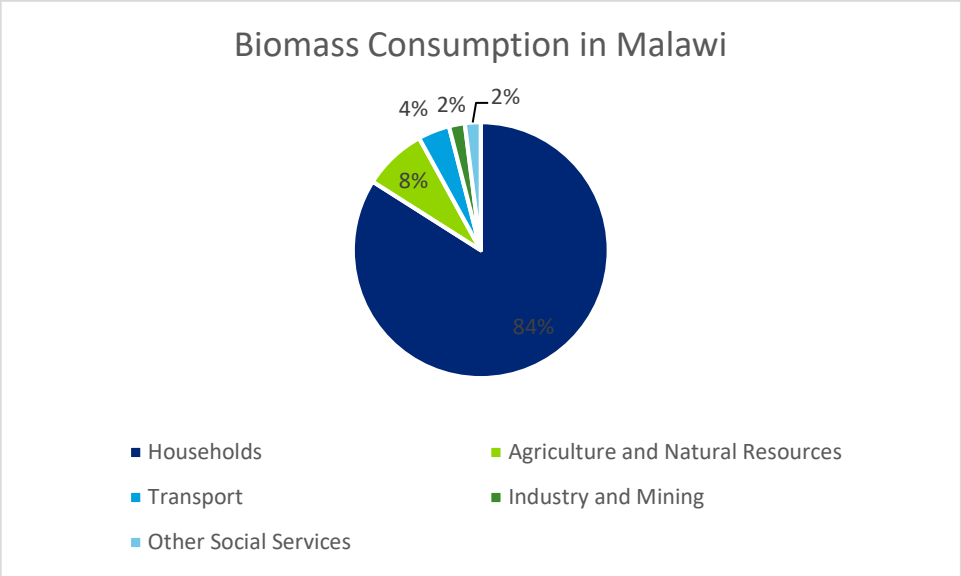


Figure 6: Biomass consumption in Malawi[22]

There have been a number of programs to reduce the pressure on forests through the promotion of improved biomass stoves that generate fewer emissions 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, and 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 used in Malawi when the number of electrified households in Malawi, numbering 308,278 in June 2015, are considered. 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 program, the Government of Malawi through its Department of Energy Affairs 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.[23] The BEST analyses the supply and demand side of biomass in Malawi to determine the challenges and solutions to those challenges. According to the BEST, the greatest challenge is that biomass demand exceeds supply in most parts of the country, especially the central and southern regions. As a result, biomass is used unsustainably 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

[22] National Energy Policy.
[23] Draft BEST, 2009.

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:

- At the community level, biomass should be exploited in such a way that the community closest to the biomass benefits.
- 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 sector operators.
- 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 an informal sector, as is currently the case.
- The government and NGOs should play their rightful role of policy and advocacy, respectively.

Currently, there is a Cook Stove Road Map Program that aims 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 Affairs, 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 program include the following:[24]

- A strengthened and functional National Cook Stove Taskforce;
- Established cook stove standards and testing mechanisms;
- Revised and harmonized relevant policy and regulatory frameworks in tandem with the current alternative energy situation;
- Promoted cook stove technologies on the basis of evidence from consistent testing results;
- Strengthened national capacity of cook stove stakeholders; and
- Improved delivery models and financing mechanisms for catalysing mass uptake of cook stoves in place.

The Cook Stove Road Map acknowledges that its success in achieving the set target is possible through the promotion of different types of cook stoves to suit various market segments. The road map specifies 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 (of 20% or more thermal efficiency) are encouraged to produce more stoves. The capacity of local manufacturers should be enhanced to avoid the need for importation so that moving forward efficient stoves are produced locally. The Department of Energy Affairs and NGOs should further lobby the Ministry of Finance, Economic Planning and Development to either reduce or remove taxes on materials for production of efficient cook stoves.

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 93% in 2000 to below 50% by 2030 (NEP 2003) 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 Stove 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

[24] Cook Stove Road Map, 2015.

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. In turn, this may influence fuel switching 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 may also increase 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 households using electricity for cooking under a business-as-usual scenario (where electricity access will be at 22%). Assuming instead a target of 10% of electrified households using electricity for cooking, at 30% electricity access rate, there will be 540,000 households using electricity for cooking by 2030.

LPG is believed to be used mainly by affluent consumers and restaurants. There is no existing data on the amount of LPG and biogas used for cooking, nor is there reliable data on the number of LPG or biogas users. However, using the data provided by NSO (2011), it is estimated that 0.2% of households use LPG for cooking. This translates into roughly 6,800 households using LPG. With regard to biogas plants, few are in operation. SEforALL stakeholders therefore agreed to an estimate of 50 biogas plant using households as a baseline figure. 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 a 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.

4.2.2 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 Policy's (NEP 2017) target, but the 5 million target in 2030 is higher than the NEP 2017 target, which is 4 million by 2035. Though the 5 million target for 2030 is very ambitious, it is 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[25]	4.8	4.0
LPG stoves	<1.0	6,800.00	15,000	34,000	54,000[26]	2.0	1.6
Efficient cook stoves	3.0	500,000	2 million	3.5 million	5 million[27]	100	100
Biogas	<1.0	50	500	1000	2,000	<1.0	<1.0

[25] Estimate based on current electricity use by domestic customers.
[26] Estimate based on current electricity use by domestic customers.
[27] Estimate based on the Cook Stove Road Map.

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 as close to 100% of households currently use *inefficient* wood stoves. Furthermore, it should be noted that households that use electric cookers and LPG stoves tend to *also* use wood stoves. As a result, as the penetration of alternative cooking technologies increases and wood use decreases, the percentage of households that have wood stoves, albeit efficient ones, will remain high.

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

Although there are several main types of efficient cook stoves, roughly estimated, 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 therefore amount to 10 million tons per year.

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

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

- High upfront costs of electric and gas cookers;
- High upfront costs of LPG cylinders and ancillary equipment;
- Unavailability of affordable financing for the purchase clean cooking equipment;
- Inadequate awareness on the availability of 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;
- Unsustainable or illegal existing charcoal production establishments; and
- 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 programs and projects. In this regard the government will:

- Ensure that the heavy work burdens of men and women are lightened by modernising the 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; and
- 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.

Given only 10% of the population have access to electricity, a mere 2.5% of the population use it for cooking. This reveals that 97.5% of the population is heavily dependent upon traditional fuels for heating and cooking.

In Malawi, energy poverty affects women greatly as they are most often the ones involved in the sourcing of energy for the household. Whether they are sourcing firewood, charcoal or agricultural waste, women travel long distances to collect it. The aim is to address this gender imbalance by 2030 through the removal of barriers to the uptake of modern energy sources.

The objective and activities stated in the National Energy Policy 2003 on energy and gender underscore the need to modernise energy access such that women are not exposed to unnecessary safety and health dangers when accessing 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 and accessible.

In order to achieve this goal, it is imperative that women become involved in the promotion of decentralised energy options such as solar mini-grids, biogas, and mini and micro hydro power plants. Decentralised systems provide a greater opportunity for creation of equality in energy access by bringing the power source closer to home. There is therefore a need for deliberate government policy to promote interventions of female-driven energy entrepreneurships such as production of biomass briquettes and production of efficient cook stoves.

In order to improve the participation of women in energy access, UN Women, UNDP and the UNEP Working Paper of December 2015 agree that:

- Women need to be involved in decision making and play a leadership role in promoting decentralised renewable energy access.
- Women need to benefit from renewable energy programs for economic empowerment.
- A cross-sectoral approach to gender, climate and energy policy and programming must be applied.
- Women's productive use of renewable energy must be promoted.
- Women's time dedicated to unpaid care and domestic work must be reduced.
- Policy processes and capacity building that mainstream gender, climate and energy in an integrated approach must be targeted.
- Investment barriers must be removed. Equal opportunities must be created for female entrepreneurship and decent employment. And access to technologies must be improved.
- Budget processes must be influenced to fund implementation of gender sensitive energy and climate solutions.

4.3 Electricity access – On-site installation and mini-grids

4.3.1 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 only 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). As of June 2015, the percentage of the population with access to electricity translated to 312,846 customers as shown in

Table 13.28 Comparatively, the sub-Saharan average is 10% for rural populations and 36% overall.[29]

[28] MERA.
[29] Regional Electricity Regulators of Southern Africa Meeting-Blantyre – September 2015.

Table 13: Customers connected to electricity in Malawi (2015)[30]

Number of Customers as at June 30, 2015	Number
Domestic Prepaid	186,205
Domestic Post-paid	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 spent on paraffin and candles for lighting, some rural households should be able to afford electricity, or at minimum, that used 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 rural and low-income urban households, ESCOM launched a US$500,000 Accelerated Electrification Access Project.[31] The project will allow consumers to have their houses wired and electrified for US$100 with the 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[32]

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

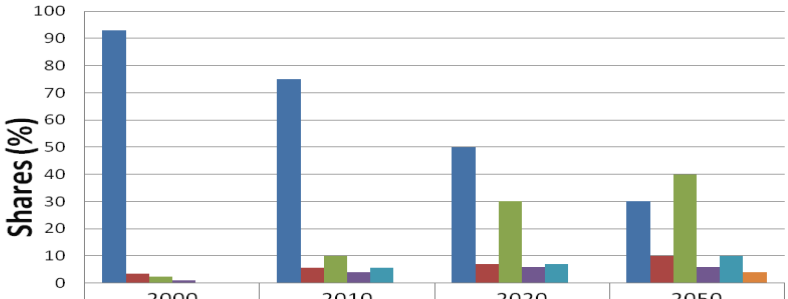
The government continues to extend the grid to rural areas through MAREP based on the Master Plan Study conducted in 2002, which is regularly reviewed and updated. Since the original study, three phases have been implemented. These phases are MAREP Phase V targeting 27 sites at a cost of MK889million, 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. At the time of preparing this SEforALL Action Agenda, the implementation of MAREP Phase VIII was underway targeting 336 sites. MAREP is funded through a 4.5% levy on energy sales.

What is the 2030 target for grid extension?

The target for 2030 is derived from the projected energy mix in the 2003 Malawi Energy Policy shown in Figure 7 below.

[30] MERA, 2015.
[31] ESCOM, April 2016.
[32] 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.

Figure 7: 2030 target for grid extension



	2000	2010	2020	2050
Biomass	93	75	50	30
Liquid Fuels	3.5	5.5	7	10
Electricity	2.3	10	30	40
Coal	1	4	6	6
Renewable Energy Technologies	0.2	5.5	7	10
Nuclear	0	0	0	4

By 2030, 30% of households and businesses will be connected to electricity.[33] This will be possible if MAREP continues with its plan of increasing the number of trading sites per year through grid extension and ESCOM continues with the Accelerated Electrification Access Project. This entails the connection of 87,000 households and businesses 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 – SEforALL

Method	Number of households & businesses-baseline 2016/Yr.	Number of households & businesses/year through 2030
MAREP-Grid Extension	5,000	23,000
ESCOM-Grid Extension	50,000	64,000

The table below however shows the BAU scenario.

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	10,000
ESCOM-Grid Extension	50,000	50,000[34]

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

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

[33] Integrated Resource Plan, 2015.
[34] ESCOM KPI.

Table 17: Grid extension targets - Gap

Method	Number of households & businesses-baseline 2016/Yr.	Gaps in the targets
MAREP-Grid Extension	5,000	13,000
ESCOM-Grid Extension	50,000	14,000

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 US$9.4 cents/kWh, up from US$8.0 cents/kWh.
- Vandalism of utility company equipment such as transformers and earth mats has raised ESCOM operating costs and diverted funds that could be used for new connections.
- Low generation capacity means that new customers will add to the generation shortfall and increase the strain on the system.
- River catchment areas that provide hydro power suffer from environmental degradation.

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 (National Energy Policy, 2003). In off-grid areas, the most 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 are about 305,000 pico-solar lanterns and SHS in use as of 2016.
- There is an 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 about 10 solar kiosks 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 following is proposed:

- Increasing public awareness and sensitisation on renewable energy technologies.
- Enforcing quality and discouraging non-certified importers to reduce price differences.
- Categorizing solar access at levels and financing mechanisms for various levels (micro-financing, pay-as-you-go (PAYG)) while noting the difficulties of implementing these financing mechanisms, such as the lack of guarantees in many PAYG initiatives.
- Instituting government subsidies on renewable energy technologies and products.
- Training personnel for certified companies.
- Using of new and efficient technological products.
- Promoting solar electricity generation by industries for own use and feeding into the grid.
- Promoting off-grid systems for productive use.

4.3.3 Existing plans and projections to 2030

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

Existing plans and projections covering 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 is the Sustainable Off-grid Electrification of Rural Villages (SOGERV) project. SOGERV aims to electrify households, businesses and community energy infrastructure in rural areas of Chikwawa district. The second is the Powering Development in Mulanje (PDM) project. The objective of PDM is to catalyse social and economic development of the poor communities around Mulanje Mountain by supplying renewable electricity through mini-grid option powered by a micro hydro power station.

European Union Initiative

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

Government of Malawi initiative

Following review of its energy policy, the government plans to fund renewable energy projects through the rural electrification fund. If the reviewed energy policy is approved, funding for renewable energy projects is expected to become available enabling the re-/operationalization of failed solar villages. The fund is further expected to enable private sector participation in the investment of renewable energy projects through off-grid options. The Ministry of Agriculture, Irrigation and Water Development has started powering certain irrigation schemes via solar power, while the Ministry of Health continues to electrify grid remote health centres through solar power as well. 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 the 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.[35] During a stakeholder meeting it was estimated that there are currently 5,000 solar home systems and 300,000 pico solar systems. These estimates were provided by renewable energy company representatives that attended the 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 1.5 million by 2020, 3 million by 2025 and 4.5 million 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[36]	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 costs of solar systems and an absence of 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, such as duty waivers, to end users appear to benefit only renewable energy technology (RET) suppliers;
- Current rigorous regulation appears to impede the implementation of mini-grids. Appropriate amendments must be made which ensure safety and quality in service delivery;
- Lack of incentives, such as operation and maintenance subsidies, to attract private sector investment in mini-grids;
- Lack of incentives, such as operation and maintenance subsidies, to attract private sector investment in rural solar energy kiosks; and
- Delays and the overall operating environment for power purchase agreements appear to prevent IPP entry into power generation.

[35] Malawi Energy Policy, 2003.
[36] The number of people to be served by mini-grids, expected to involve approximately 90 mini-grids by 2030.

4.4 Renewable energy

Worldwide, renewable energy (RE) was the largest new source of electricity generation in 2016 as the cost of RE, 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.

In Malawi, lower RE prices will be reflected in the 2030 RE targets, which may be set higher than the proposed ones.

4.4.1 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 procurement of the first four Solar IPPs by ESCOM has just been concluded. In addition, one grid-connected solar project has been developed at Kamuzu International Airport.

Current situation by energy type

Solar

According to a 2015 World Bank analysis, Malawi has solid potential for exploitation of solar resources and good opportunities for photovoltaics, predominantly small to medium size ground-mounted and roof-top systems.[37] In addition, several IPPs have applied for power purchase agreements for their large-scale solar PV projects. An 830 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 design, 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 the 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 of such installations.

Wind

No utility-grade wind turbines have been constructed in Malawi. As mentioned above, six hybrid wind-solar projects were built, but only one is still operating. There are a few water pumping wind turbines. The government is currently receiving funding from the World Bank and the Government of Scotland to conduct a wind resource mapping exercise.

Biomass

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

Biogas

[37] Solar Resource Mapping in Malawi: Solar Modelling Report, Energy Sector Management Assistance Program, World Bank, March 2015.

Although no data is available on biogas for electricity, there is potential for electricity generation from biogas especially from the cities' organic municipal solid waste.

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.[38]

Geothermal

No geothermal power projects have been developed yet, but the Government of Malawi, with World Bank financial support, conducted feasibility studies on the potential for geothermal resources in Fall 2016.

Current situation with power generation

Malawi's electric system is supplied 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 (Figure 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.

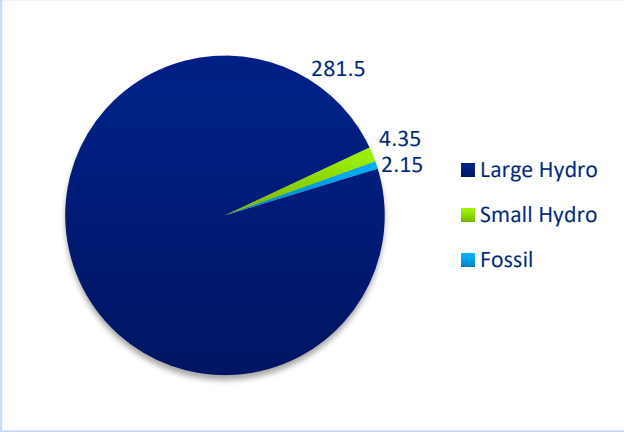


Figure 8: Available generation capacity in MW, 2014

Two small diesel units are connected to 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 450 MW. If all potential domestic and industrial customers were connected, the demand would roughly triple.

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

Table 19: Installed electricity generation units in 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

[38] World Small Hydropower Development Report 2013 – Eastern Africa, UNIDO and International Center on Small Hydro Power, www.smallhydroworld.org.

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 to south 220-400 kV backbone transmission lines are underway with support from the Millennium Challenge Corporation (MCC) and the World Bank. 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.[39]

Current relevant government policy

The main legislation guiding energy sector development are the following:

- National Energy Policy 2003 (reviewed 2017);
- The Electricity Act 2004 (appealed 2016);
- Rural Electrification Act 2004;
- Energy Regulation Act 2004; and
- Liquid Fuels and Gas Act 2004.

There is no specific RE law, but RE is embedded in the above listed laws.

The Government of Malawi will approve a new National Energy Policy in 2017 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 SEforALL stakeholder consultations, stakeholders stated that some Malawi Revenue Authority (MRA) officials are not knowledgeable about what constitutes a renewable energy product. As a result, some importers have consistently had problems clearing 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. However, when MBS officials waive import fees on RE products, lack of knowledge as to the difference between quality and substandard products, often leads to cheap, inferior products entering the market.

In terms of disincentives, although RE products are exempt from import duties, they are not exempt from the standard VAT, which is set at 16.5%. In addition, licensing fees and the lengthy time required to process a license application further deter expansion of the RE sector.

Existing plans and projections to 2030

According to the INDC submitted by the Government of Malawi 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 includes projections that reach 1,900 MW by 2025, mainly through construction of large hydro plants. Large hydro would therefore remain the country's dominant power source, at 75% of total installed capacity.

[39] Draft Malawi Renewable Energy Strategy, February 2017, p. 19.

The government's proposed energy policy update references a discussion in August 2015 in which the Ministry of Natural Resources, Energy and Mining (MoNREM), 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.[40]

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 residue or animal waste.

Table 20: Government-planned electricity generation projects 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	18	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 funds. Awaiting WB review in September.
SUB TOTAL		**1,546**	
Medium-term (2020 – 2025)			

[40] "Energy Supply Options & Technologies Recommendations," PWC, 2015, p. 5.

Project	Technology	Capacity (Mw)	Current Status
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 Malawi Grid Capacity Study (2016) the amount of energy generated from intermittent sources like solar and wind is 70 MW given current generation and grid capacity. This amount may increase following completion of the 400 kV power line and transmission and distribution power line upgrades.

An energy policy paper for Malawi outlined conservative solar figures - 5 MW of solar added by 2020 and 99 MW added by 2025 under a BAU power sector trajectory (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 sources, large hydro will account for 75% of capacity. Moving forward, continued reliance on large hydro, particularly on hydro plants located along a single river, will maintain, and likely increase Malawi's vulnerability to inadequate water flows for hydropower generation. Not only do the negative consequences of climate change increase the likelihood of drought, large hydro plants are also known to cause serious environmental damage. While the SEforALL 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

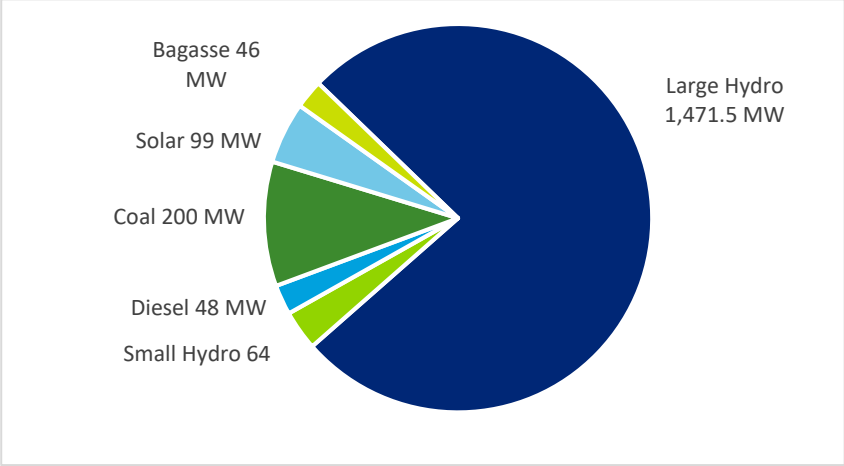
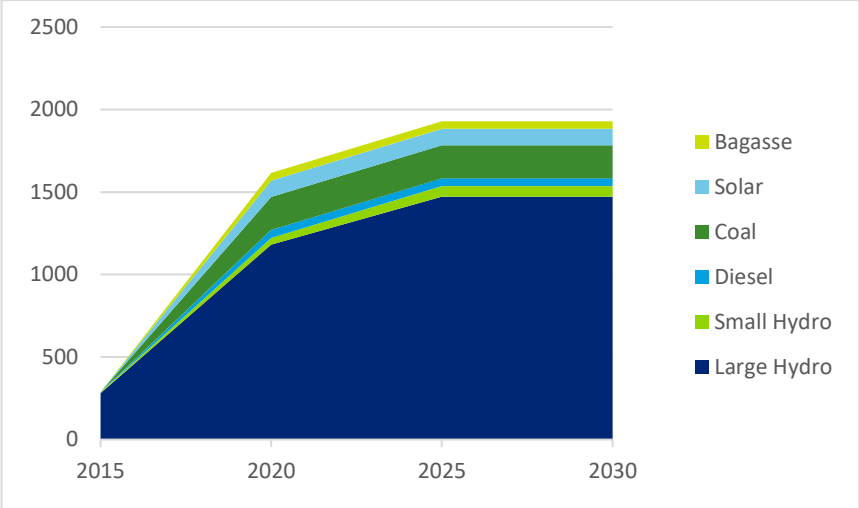


Figure 10: Anticipated trajectory of new power supplies from Energy Policy Paper, MW



4.4.2 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 low water levels at 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 sources may be a more prudent path. Potential also exists for the development of coal, solar and wind power resources. Table 21 shows the first 15 IPP projects that have memorandum of understandings (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 preliminary conceptual stage, while others have completed all studies and licensing and are simply awaiting ESCOM to sign the PPA. The numbers of MOUs are constantly changing, but as far as the number of projects in place, none have yet been built.

Table 21: Pipeline of independent power projects (November 2015)[41]

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 and 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 and 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

Due to the uncertainty surrounding the signing of 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 PPAs that are in, or nearly in, the negotiation stage as of February 2016, total 966 MW. If these are approved, financed, built and interconnected to the grid, it will quadruple Malawi's available capacity. The solar power will be intermittent and the hydro power will be subject to the same risks of insufficient river flows as the existing hydro projects however. Nonetheless, adding solar to the mix will help diversify the power sources. For the purpose of establishing renewable energy targets, hydro projects are typically the fastest to be approved and built, and thus are a good basis for setting small hydro targets. Based on discussions with industry and the Department of Energy Affairs' (DOE) best judgment, at least two large solar PV projects are projected to 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.

The proposed 2030 target for small-to-medium hydro is therefore 101 MW. The solar target is 550 MW by 2030, with an interim target of 100 MW by 2020 as specified by the SEforALL Renewable Energy Working Group. While the targets are based on the potential capacity of just a few MOUs and discussions with

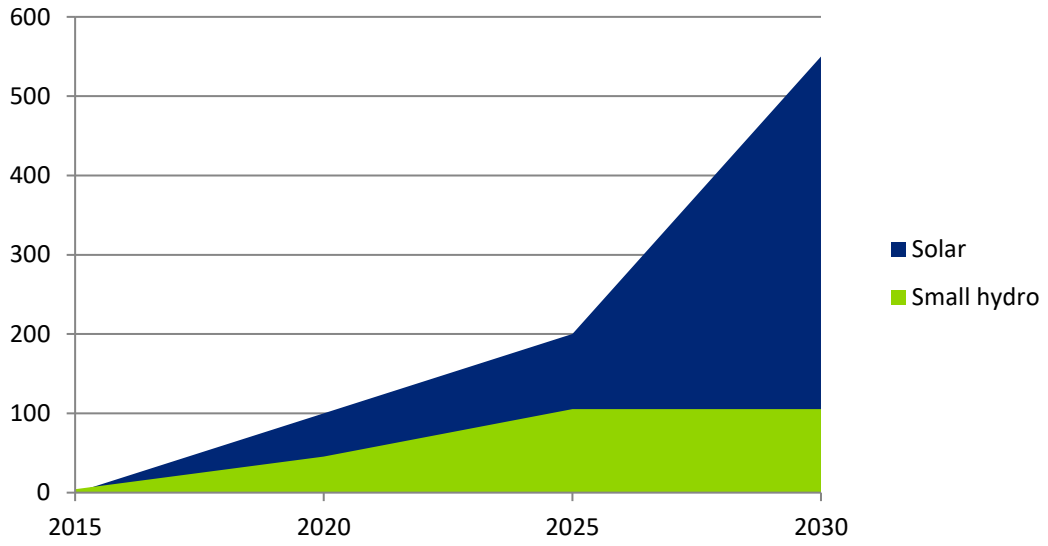
[41] Ministry of Natural Resources, Energy and Mining, Press Release, November 26, 2015.

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 to become part of the generation mix. They are not included in the current targets because detailed resource assessments are required 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 4 MW-300 MW are possible over the 12 to 24 month period beginning July 2016, particularly in the central and southern parts of the transmission system.[42] Furthermore, with the MCC-supported grid upgrades currently underway, the aforementioned are not expected to 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. As a result, the 550 MW target appears 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.

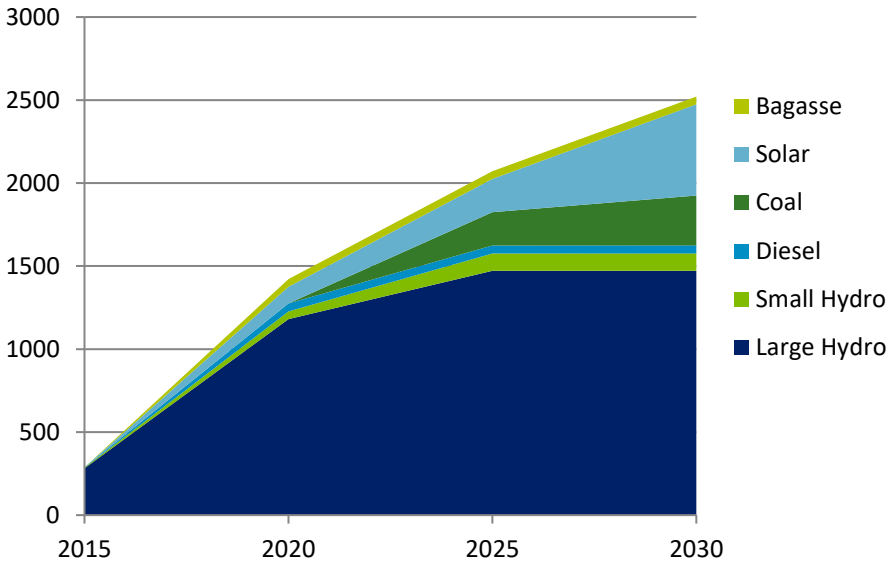
Figure 11: Renewable energy targets achieved by 2030, MW



Combining these projects with Malawi's existing installed generation 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.

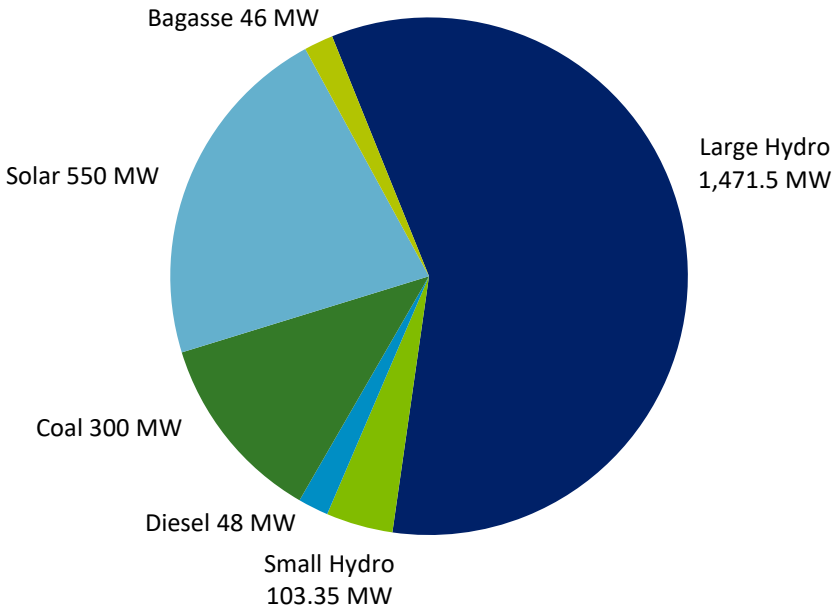
[42] Malawi Grid Capacity Study, Final Report, Mott MacDonald, July 2016.

Figure 12: Installed generating trajectory including RE targets, MW



The full 2030 installed capacity based on the 2017 energy policy paper projections, plus the addition of the SEforALL 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. As more thorough 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 SEforALL RE targets



The 550 MW solar target does not include on-site grid-connected solar installations on rooftops, parking lots nor streetlights. 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.[43]

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.[44] 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 reveal only a thin sliver as they represent one percent of total electric capacity.

4.4.3 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 SEforALL 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 awaiting PPAs. There is thus a gap of 451 MW between the BAU strategy and the achievable SEforALL target.

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

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

- Capital finance shortage, resulting in underinvestment in generation, transmission, and distribution;
- Lack of interest and participation of other ministries, corporations, and other organisations;
- Reluctance by banks and individuals to finance on-site RE projects as the technology and business is still considered risky;
- Unavailability of consumer financing for RE and unaffordability of RE such systems for most rural communities;
- Slow expansion of the rent to own (“Pay-as-you-go”) approach, whereby consumers are given the system which they buy by paying in small instalments;
- Non-use of MAREP fund, which finances grid extension, for off-grid applications;
- Lack of training and skills; and
- Ambiguous exemption plan whereby certain RE products e.g. turbines and generators for hydro use and solar water heating, are not yet included in the exemption schedule.

[43] Mini Integrated Resource Plan, 2015, p. 28.
[44] IRENA (2016), *Solar PV in Africa: Costs and Markets.*

4.5 Energy efficiency

4.5.1 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 (Figure 14). 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% of urban household supply. This is 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 the 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 encouraging the efficient use of biomass through a set of market pitching activities.

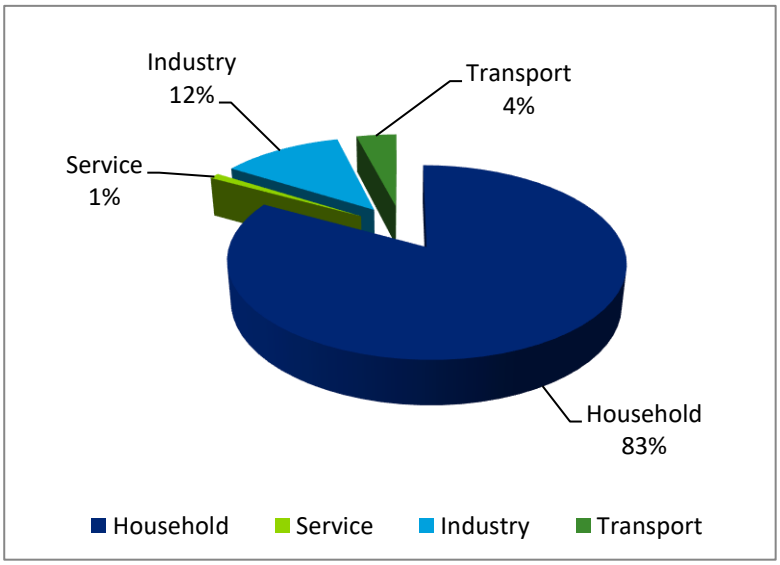


Figure 14: Energy supply by sector

Energy intensity of Malawi's economy

Energy intensity (expressed as the ratio between gross inland energy consumption and the 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 is not available in the International Energy Agency's (IEA) database. According to statistics from the Open Data for Africa web portal (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 downward trend in Malawi's energy intensity ratio is observed over the past six years between 2006 and 2011, the most recent period for which energy intensity data is available. (See Table 22 below.) This is mainly fuelled by the sustainable GDP growth attained over the same period. However, this is not necessarily a sign of a 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's energy intensity Btu/USD of GDP, 2005

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

Tariff development

For many years, electricity consumers in Malawi enjoyed well-subsidized tariffs, rendering 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%) implemented in January 2011. In 2009, a time-of-use tariff was introduced for commercial and industrial customers through a 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 was still low compared to regional and international standards. To further encourage energy consumers (especially non-household consumers) to implement EE measures, MERA may introduce an inclining block tariff structure for such users (industrial, commercial entities). Implementation of an 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's current electricity tariff

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

Clean cook stoves initiatives

As cooking is the most energy consuming household activity, a number of improved cook stove promotion projects were carried out throughout the country in recent years. According to the National Energy Policy 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. The following initiatives have been active in Malawi:

- **Chinansi Foundation Improved Cook Stoves project.** Financed by the Fair Climate Network Southern Africa, the project aims to reduce 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 year 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 it 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 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 stoves. In order to successfully achieve its targets, MAEVE developed a network of vendors in all urban centres ensuring countrywide availability of the product and ease of access for those who wish to purchase. MAEVE engaged one of the major local retailers, Chipiku Stores, with over 80 outlets nationwide, as one of the distributors of the stoves. 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 was 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.

- ***Cook Stove Road Map.*** The 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 the United States and Ireland, among others) and local NGOs. This is part of the country's commitment as a signatory to the Global Alliance for Clean Cookstoves, which aims to see the adoption of clean cook stoves by 100 million households by 2020 worldwide.

Lighting

The Energy Efficient Lighting Project

In an effort to curb the overall system peak demand of ESCOM, the Government of Malawi 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. The CFLs were targeted to be distributed and installed free of charge to residential household customers, small businesses and public buildings, while the commercial sector entities were granted the opportunity to buy energy saving bulbs at subsidized prices. The project's outcomes were verified by measurements taken directly from 17 feeders nationwide, and indicate a reduction of 65 MW 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 savings among 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 2017, ESCOM is planning to distribute an additional 400,000 energy efficient bulbs.

Capital Hill Solar Street Lighting Project

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

Import tariff and fiscal incentives

The GoM has already taken fiscal measures toward encouraging local consumers to use more energy efficient products. To complement the efforts of the roll out of the energy saving bulbs 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 in recent years. A number of awareness raising initiatives have been carried out, usually as a complementary component of some tangible EE projects (such as efficient light bulbs or clean stoves roll outs), but with limited impact. In a separate component to the EnDev-run energy conservation project, a national awareness campaign to support the wider uptake of high quality solar lighting products (solar lanterns and lighting kits) has taken place. The campaign aimed to reach 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. For example, the ability to receive instant feedback on energy usage, prompts an energy saving attitude. Impact assessments of pre-paid meter programs implemented in other southern African countries (e.g. Zimbabwe) show that a shift from post to pre-paid metering might lead to a decrease in energy usage 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 (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. Approximately 105,000 households (or 34% of all clients) and around 22,000 industrial clients still use post-paid metering devices.[45] 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

World Bank Energy Sector Support Project

In an effort to increase the reliability and quality of electricity supply in Malawi's major load centres, the government, with support from the 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 project's priority areas. 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 five years (the project implementation started in 2012, but is expected to be delayed). A total of five substations will be upgraded and 26 km of distribution lines will be rehabilitated.

[45] MERA 2015.

The DSM and EE measures component is evaluated at USD 6.8 million. The activities of this component will aim at reducing load peaks by promoting energy saving technology and measures. The project will specifically address 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 through a free replacement program; ii) installation of "insulation blankets" through a free program to better insulate existing HWGs; and 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 five-year project with intended value of over USD 350.7 million started in 2013 and is still in its early stages with only USD 23 million of grant extended and USD 52 million committed. It 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, while 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 ESCOM, MERA and the Ministry of Natural Resources, Energy and Mining.

Institutional

In general, various national plans and programs include some reference to energy efficiency – the National Energy Strategy, Malawi's Biomass Energy Strategy, Malawi's Growth and Development strategy II, etc.:

- **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 an 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 the rehabilitation of major hydropower stations and the transition and distribution networks, are among the focus actions and activities outlined in the Strategy.

- **National Energy Policy (NEP) of 2003 – currently under revision.** Acknowledging that biomass is a 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; and iii) involvement of all stakeholder groups (incl. local communities) in producing and marketing efficient biomass technologies, etc.

- **Malawi Biomass Energy Strategy (BEST).** 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 biomass is a major energy source in Malawi and is expected to remain so in the foreseeable future, this Strategy is a cornerstone national document in the country's aspirations towards efficient energy use.

- **National Climate Change Investment Plan 2013 – 2018 (NCCIP):** Complementary to the MGDS II, the NCCIP aims to create an enabling environment for the 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. The NCCIP calls for the development of the following climate change tackling programs and initiatives that reference EE:

    - **The Enhancing Energy Saving Technology Program** 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 emissions. This program is aimed at improving energy efficiency and effectiveness in select urban and rural areas in Malawi by building local capacity (technical, analytical, and policy) and establishing a national GHG inventory management system. The program is estimated to cost approximately USD 60 million over its five year duration.

    - **The Climate Change Mitigation Technology Development Programme** 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 the country'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.

    - **The National Climate Change Fund (NCCF)** originates from a call from the NCCIP to establish a dedicated national climate change fund. The Fund aims to develop a streamlined and efficient mechanism for channelling international finance intuition and locally raised climate change resources. It will further provide financing and technical support and advice to all climate change stakeholders in Malawi. The NCCF will partner with international and regional donors and lenders, local and international NGOs, and private sector entities in developing climate change investment projects. The Fund will also promote fund-raising schemes for various development programs on climate change management and will serve as a think tank for new "green" financing mechanisms.

To date, there exists no national EE audit or similar study that indicates the current energy consumption baseline and the underlying energy saving potential across various sectors (industry, households, commercial sector, public sector, agriculture, etc.) at the national level.

4.5.2 What is the target for 2030 and the gap?

When considering energy efficiency in Malawi, the focus should fall on reduction of biomass consumption, given 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 a good position to further lower the ratio by implementing a number of EE improvement activities and policies. Based on the average achieved energy intensity reduction pace of 4% annually (2006-2011), it may be reasonably assumed that Malawi can lower its energy intensity to below 900 Btu per USD 2005 of GDP (PPP terms) by the year 2030.

Table 24: Malawi's 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 cook 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. It can therefore be reasonably assumed that the number has increased to between 30,000 and 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 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 reasonably attainable target is 40,000 SWH installations.

With respect 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 purpose. The Malawi Biomass Energy Strategy states that, on average, urban households consume 293 kg of 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 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 population growth and a distribution of 30% urban and 70% rural). Substantial woodland resources can be spared by supporting 20% of 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 power	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 schemes by 2030. Assuming that 30% of households will be grid connected by then, this reveals 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 meter 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 roll-out project achieved a 65 MW reduction in the morning peak and a 51 MW reduction in the evening peak. There was an overall 15 - 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 also 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 eight light bulbs per household, the total number of lighting fixtures in the household sector will increase to 16.5 million. An average of 550,000 LEDs will need to be installed annually to attain a 50% penetration rate by 2030. The implementation of minimum energy performance standards (MEPS) and the ban on the use of inefficient light bulbs will prevent 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	5,500,000	8,250,000

Agriculture

Creating around 80% of employment, generating over 70% of foreign exchange earnings and nearly 30% of the country's GDP, 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 tonnes of dry wood equivalent per year.[46] Smallholder farmers have limited capital, which leads them to resort to 'low cost' fuel wood for curing tobacco. Data from the 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 shift to more efficient (rocket type) barns or barns based on other energy sources can halve the tobacco curing related wood consumption by 2030.

[46] Malawi Biomass Energy Strategy final report,

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 (which includes upgrades to five substations, and rehabilitation of at least 26 km of distribution lines) is expected to decrease 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%

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

The following list includes major challenges for mainstreaming energy efficiency at the national level as identified by Malawi`s various energy related policies and strategies, as well as barriers outlined by SEforALL stakeholders during bilateral meetings and workshops:

- Inefficient production of biomass, use of inefficient technologies, and low uptake of efficient biomass cook stoves;
- Insufficient awareness among energy end-users about energy conservation possibilities given the 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), in addition to the low penetration of modern energy saving technologies;
- 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; and
- Current electricity tariff encourages inefficient energy use.

4.6 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" includes 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 Liquefied Natural Gas - and bioCNG - bio Compressed Natural Gas - in city buses).

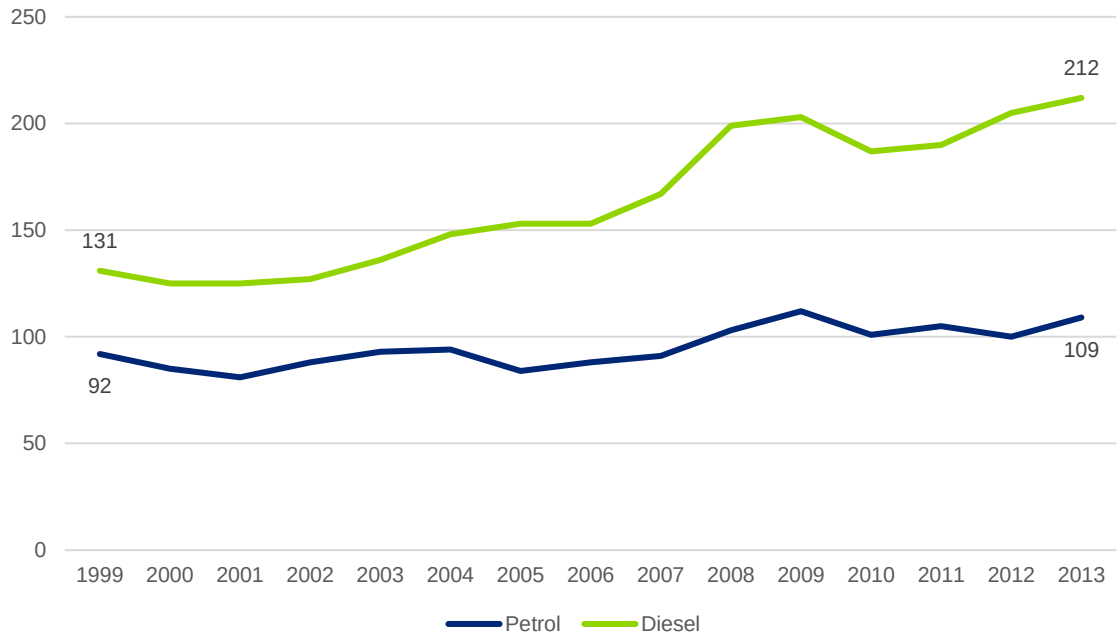
In addition, this section provides findings on the use of conventional fuels in the transportation sector in order to assess the potential of partially replacing those fuels with the alternative fuels mentioned above.[47]

4.6.1 What is the current status and BAU trajectory to 2030?

Conventional fuel consumption

Malawi imports almost all of its liquid fuel requirements (except for ethanol, which is domestically produced). Since 1999, the compound annual growth rate of diesel has been 3.3% and gasoline (petrol) is slightly greater than 1%. In 2013, compared to petrol, twice the amount of diesel was imported (212 million litres and 109 million litres).[48]

Figure 15: National importation of petroleum products between 1999 and 2013 (million litres)[49]



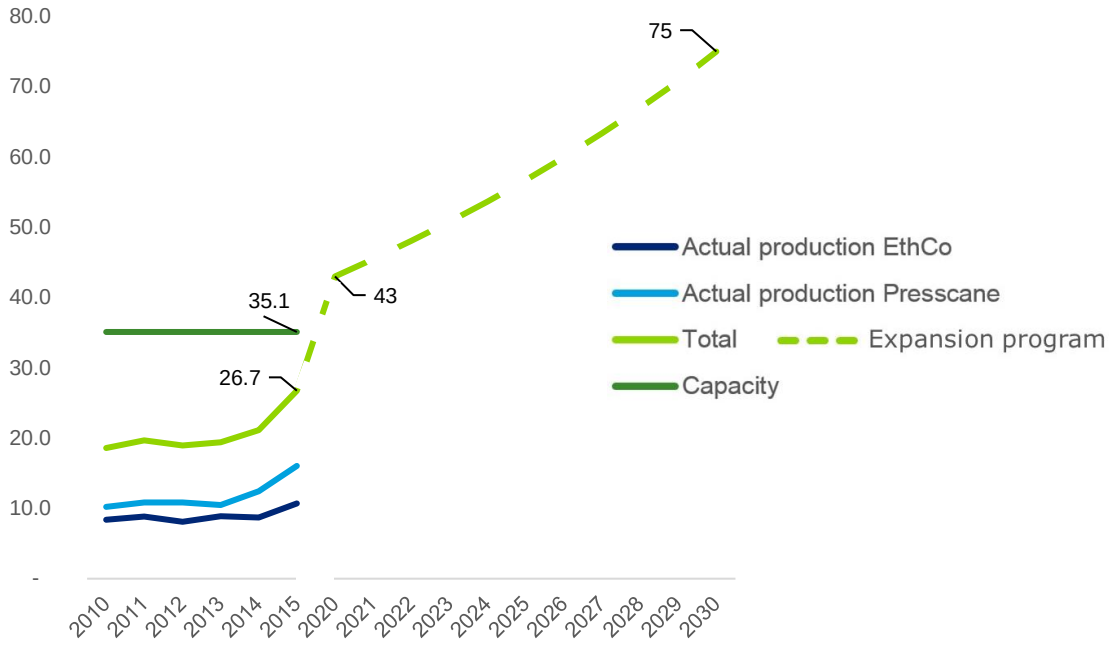
Biofuel production and consumption

Ethanol production levels

All ethanol consumed in Malawi is produced locally. There are neither importations nor exportations of the fuel. See Figure 30 below.

[47] 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.
[48] Data is 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.
[49] 2014 Annual Economic Report Full Book.

Figure 30: Malawi ethanol production since 2007 and projections to 2030[50]



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.[51] According to consultations with Press cane Ltd. however, the company's production does not meet its capacity due to the 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).[52] Nevertheless, according to market observers, ethanol is often marketed at a 10% blend with petrol.[53]

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 to increase its production to nearly 600,000 litres in 2017 and 60 million litres in 2030. The following figures are given by the company.

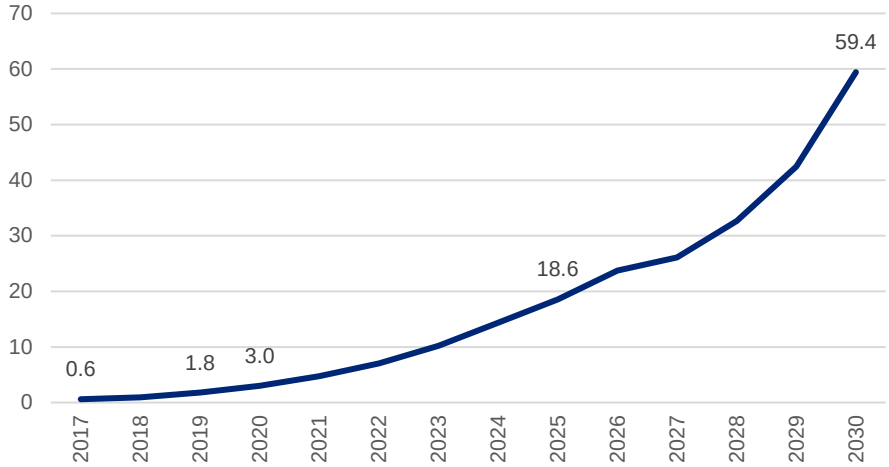
[50] Press Corporation Ltd.

[51] The United Nation Development Program UNDP/Malawi - Growing Sustainable Business for Poverty Reduction Program in Malawi: Feasibility Study for the use of ethanol as a household cooking fuel in Malawi, 2007.

[52] Ethanol fuel mixtures have "E" numbers that describe the percentage of ethanol fuel in the mixture by volume; for example, E85 is 85% anhydrous ethanol and 15% gasoline.

[53] Taulo J., Gondwe K., Sebitosi A. (2015), Energy supply in Malawi: Options and issues, Journal of Energy in Southern Africa • Vol 26 No 2 • May 2015.

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



Existing plans to support biofuels

Regarding biofuel 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, Mitsubishi 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 program for the increased use of ethanol in motor vehicles.

NCST proceeded to develop the Rollout Programme of Increased Ethanol Use as Vehicle Fuel under the Malawi Ethanol Programme in July 2013. The rollout program, 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 program;
- Undertake research and development (R&D) on emerging issues on ethanol at all levels of the supply chain; and
- Monitor and evaluate the program.

The 2003 National Energy Policy (NEP) and the **Malawi Growth and Development Strategy II** (2011-2016), aimed to increase the ethanol mandatory and average percentage from 10% to 20% in volume. To date, that increased blending rate has not been achieved due to 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 to 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, which reflects the "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 2017).

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.[54]

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

Following this initiative, Press Corporation Limited rolled out the flex-fuel vehicle which can run on either 100% ethanol, 100% biodiesel 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 roll out 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.

4.6.2 What is the target for 2030?

Biofuel target

Proposed targets

Currently there is no consensus on 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 the rapid growth in the number of vehicles, petroleum products will witness a growth in demand that is expected to further 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).

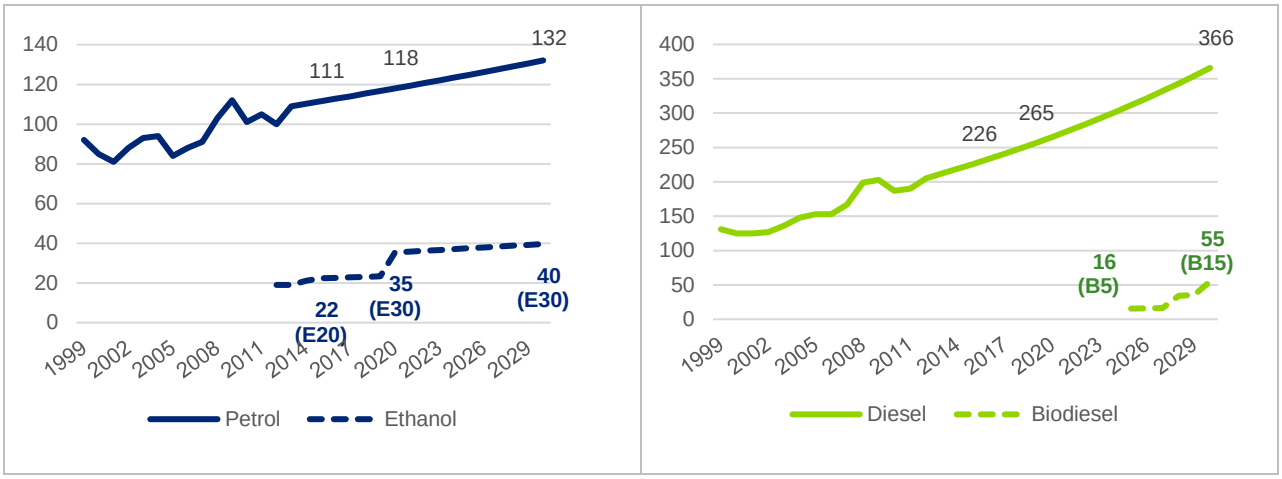
Ethanol and biodiesel expected production through 2030 can then be settled, depending on blending targets decided for each of the liquid fuels:

- 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 entire fleet of car engines).

[54] Malawi Ethanol Programme (Maethol): Roll Out Programme of Increased Ethanol Use as Vehicle Fuel, 2013.

- 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 product importations since 1999 and projection through 2030 compared to biofuel production levels since 2012 and targets through 2030 (million litres)[55]



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 vehicle 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.

Maintaining updated targets

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

Stakeholder consultations will help determine whether it is possible to envision the introduction of electric vehicles in Malawi in the coming years. Such consultations will help to set a target expressed in either the percentage or number of EVs in Malawi's car fleet.

[55] 2014 Annual Economic Report Full Book for 1999-2013 and calculations for 2014-2030.

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

Gaps between business-as-usual trajectory and targets

Blending ratio

The current blending ratio is around 10:90 ethanol-petrol. NEP 2003 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 anticipated barriers

The main challenge affecting ethanol production is *volume* as there is not enough molasses from sugar mills. This is due to a variety of factors, including the:

- Inconsistent production of sugarcane for ethanol;
- Pegged price of ethanol to that of petrol which often acts as a disadvantage for ethanol companies whether global petroleum prices increase or decrease, despite Rule 25 of the 2004 Liquid Fuels and Gas (Production and Supply) Regulations that defines biofuel prices; and
- Limited availability of land for sugarcane plantations.

The main challenges to an increased use of biodiesel include the:

- Low production of oil seeds for biodiesel;
- Limited incentives for farmers as the plantation of Jatropha is only allowed along the boundaries of the farms;
- Low output per farmer, making logistical costs high; and
- Unclear policy direction in relation to the blending of biofuels with diesel, unlike that of ethanol.

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).

4.7 Transportation – Urban transportation

The urban transportation infrastructure in Malawi faces significant challenges. Mass transportation is dominated by the use of mini-buses (especially mini-vans). 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 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, 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.[56] 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.[57] In parallel, urban transportation is one of the fastest growing sources of GHG emissions. Passenger transportation is particularly significant in urban areas that are often congested due to the convergence of commuting, commercial transactions and cultural activities all in one place. Therefore, it is of outmost importance to develop a holistic EE transportation policy for passengers, while at the same time, ensure 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 Transport 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.

4.7.1 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.[58] 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 no more than five 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; and
- Others: Cargo trucks, trailers, tractors, 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.[59]

[56] Malawi Government (2014), Annual Economic Report.
[57] UNDESA (2012), Shanghai Manual: A Guide for Sustainable Urban Development in the 21st Century.
[58] WHO (2014), Global Health Observatory data repository - Registered vehicles Data by country.
[59] National Statistical Yearbook (2012), Statistical yearbook 2012.

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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 is important to note that these figures refer only to registered vehicles. A significant number of unregistered vehicles are also on the roads. Data on these unregistered vehicles does not exist.

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

Current efficiency of vehicles

Most of the population relies upon second-hand vehicles from Europe and East Asian countries. These old "grey vehicles" have 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.[60]

Urban road networks have an increasing proportion of paved roads, but the majority are still unpaved; and, in suburban areas especially, 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 Urban Structure Plan of Lilongwe City (Lilongwe Plan), the road density will increase from 0.3 km/km^2 (current land area: 393 km^2) in 2009 to 0.64 km/km^2 (2030 land area: 468km^2) in 2030. The majority of the road network requires improvement.

According to the Lilongwe Plan, the city is currently characterised by 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, road congestion is expected to become severe in the future.

Parking spaces are relatively scarce in Lilongwe. As a result, in certain areas a large number of cars park on roadsides causing traffic flow problems. 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, road expansion or development of bus lanes to improve the flow proves challenging.

[60] 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.

Transportation network – rail

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

Figure 18: Rail network (Railroad Development Corporation, 2016)[61]

Currently, the rail network is operated by 19 locomotives (including both those used for passenger and freight transport).[62] It accounts for only 0.92% of passenger transportation, largely non-urban, as it connects to few urban areas.[63]

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" were introduced in urban areas by unofficial operators. [64&65] In 2011, the number of bicycle taxis was estimated at between 4,000 to 5,000. These figures fluctuate 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 projects the annual energy consumption for transportation will increase from 396 ktoe in 2015 to 1,025 ktoe in 2030, which corresponds to an increase of 159%.

There are no projections on the average fuel consumption of vehicles up 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.[66] 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.

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[61] Available at: http://www.rrdc.com/op_malawi_cear.html#system_map.
[62] Railroad Development Corporation.
[63] PWC (ongoing), Consultancy services to carry out Malawi energy policy review, Energy Status Report.
[64] Bicycle taxis are ordinary bicycles that have been fitted with a cushion on the back upon which a passenger may sit.
[65] 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.
[66] Mutenyo et al (2015) Baseline survey of Uganda's national average automotive fuel economy.

Under the assumption of stable fuel efficiency, it is assumed that the urban fleet will increase following the trends of fuel consumption in the transportation sector. 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.[67] 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 existing data, it can be assumed that the share of each mode of transportation (see Table 31) will not change significantly. An increase in 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 (up from 0.92% and 0%, respectively in 2008).

Existing plans

Adopted in 2015, the National Transport Policy (NTP) provides the direction and intent of the government in developing the transport sector so it may effectively contribute towards the country's development objectives. With respect to urban transportation, the NTP focuses on issues related to the increasing number of vehicles, the resulting congestion and the poor quality of roads. The NTP promotes the development of an efficient transportation system, focusing more on service than on energy efficiency. Energy efficiency is addressed indirectly through the promotion of a "socially and environmental sustainable and climate resilient transportation system." With respect to funding, the NTP establishes the Transport Sector Investment Programme (TSIP), a scheme that will aim to coordinate investments and ensure they contribute to a reduction of transportation costs.

Specifically focused on roads, the Road Traffic Act was enacted in 1997 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) prioritizes the development of an efficient transportation system. It aims to do this by focusing largely on reducing 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 rail infrastructure. Plans to develop an urban rail network for passengers are not included.

At the local level, the Lilongwe Plan acts as the statutory land use plan for the city of Lilongwe.[68] It 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 the road network, including missing links to smoother traffic flow;
- Improvement of accessibility to community areas by, amongst others, constructing paved roads; and
- Development of mass transportation, including large city buses, bus stops and bus schedule.

Malawi does not have any laws that focus on urban transport. The Road Traffic Act is the only law that

[67] PWC (ongoing), Consultancy services to carry out Malawi energy policy review, Energy Status Report.
[68] Lilongwe City Council (2013), The Urban Structure Plan of Lilongwe City.

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.[69] 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 importation of old, polluting and inefficient vehicles.[70]

4.7.2 What is the target for 2030?

The Global Fuel Economy Initiative (GFEI) is a SEforALL flagship program aimed at reducing emissions and at least doubling 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 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 is therefore set at a 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 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 matter.

Transportation involves a variety of modes 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.

4.7.3 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 the transportation sector is the high costs associated with its development and maintenance, among the highest in the region. The fact that Malawi is a landlocked country with no access to the sea coupled with the country's economic realities, keep costs high. For

[69] 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.

[70] Thomson Reuters Foundation (2013), Malawi tax on second-hand vehicles cuts emissions, government says. http://news.trust.org//item/20131231164852-v6g3t/?source=shem.

example, due to the country's negative trade balance, two thirds of outward hauls remain empty, making imports more expensive. At the same time, resources to fund sector programs remain inadequate.

Finance is one of the key pillars necessary for the creation of a sustainable urban transport system. 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 available resources in the road sector are low. As a result, existing infrastructure is deteriorating and the development of new infrastructure is limited. This has also a negative effect on non-motorised traffic, such as bicycles and pedestrian traffic, as the quality of existing infrastructure deteriorates due to higher and unsupportable levels of motorized transport. In addition, the provision for non-motorized is negligible.

Capacity constraints

There are a variety of stakeholders involved in Malawi's transportation sector. These include:

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

The Join Transport Sector Review (JTSR) Annual Meetings 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 constraints in all key sectors, including the private sector.

Travel Demand Management

There is a lack of capacity and in-depth knowledge on how to tackle transport challenges in the country. The achievement of sustainable urban transport cannot be accomplished without implementing some travel demand management (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 traffic growth.

In addition, as stipulated by the MGDS II, currently 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 city's urban transportation system efficiency (e.g. mixed land use), with a limited number of measures to actual promote travel efficiency. For example, the mass transport system is promoted without indicating the financial means or other concrete measures (e.g. capacity building, material specification, planning tools etc.) necessary to do so. 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.

4.8 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 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 evidenced by recent prolonged drought); Changing 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	5. By 2030, 80% of households have moved to WHO standards IT-3 (15 fine particulate matter) in improving indoor air quality 6. All gas suppliers adhere to safety standards by 2016 and cylinders regularly tested
Food	1. Land-use competition is heightened 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 are tasked with sourcing primary energy for cooking, at considerable expense to their productive time and security; Poor lighting affects education; Poor indoor air quality disproportionately affects women as they are the main food preparers. 2. 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. Enable young girls to study science to enhance opportunities of working in the energy sector

5. PART II – Priority Action Areas

5.1 Energy access – Cooking

5.1.1 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 heightened demand from an increasing population, as well as by the increased clearing of land for agriculture. At the same time, there are institutional challenges with regard to managing the supply of biomass and enforcing biomass-related regulations. The Department of Forestry (DoF) 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 (DOE) 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 DOE 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 that 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 DOE 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 DOE will also prepare a recommended set of interventions to assist poor households in 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 DOE'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 DOE 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 the 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 already working on such interventions. The DOE will take the lead in following up on the promotional activities of the NGOs. It will also assist NGOs to access funding for efficient cook stove initiatives. The Cook Stove Road Map will be aggressively implemented so that both the SEforALL cook stove targets and the Road Map's targets can be achieved.

Monitor and evaluate improved biomass cook stove initiatives

The Government of Malawi, through the Department of Energy Affairs, will implement BEST in order to ensure that the financing models that were developed under BEST are utilized. The Department of Energy Affairs 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 Affairs will take the lead as a facilitator of the two initiatives. The Department of Energy Affairs 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 Affairs 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.[71] 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.

[71] 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.

Promotion and adoption of institutional biogas plants

Most institutions that require biomass energy use inefficient cook a stove, which leads to heavy depletion of forests due to the large quantity of biomass that they require. These institutions however have a readily available source of feed stock for biogas plants in the 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 Affairs with other stakeholders to promote institutional biogas plants. The Department of Energy Affairs 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 Affairs should, after installing the biogas plant, calculate the amount of wood saved thereby increasing the revenue for the institution.

5.2 Energy access – Electricity

5.2.1 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 to the national power grid under MAREP. The following priority actions will be pursued.

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 puts forward the number of people to be connected by assigning 50 pre-paid meters per each trading centre. Monitoring access per trading centre and the number of people requiring connections must be sustained. MAREP will continue to assign the pre-paid meters to those requiring connections. There are also mini-grids that were established under MAREP, but not functional. It is important that MAREP revives these mini-grids. The mini-grids will be maintained and operated by a private operator. MAREP will electrify all public institutions 5 km 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 modern energy services. There is therefore need for deliberate effort by the government through the Department of Energy Affairs to invest in education, training and awareness on modern energy services.

Capacity building of MBS on certification and enforcement of RETs standards

Imports of low quality RETs are on the increase. This is largely due to the prevalence of non-certified companies and the fact that MBS is currently overwhelmed. There is thus a need to support capacity building within MBS to ensure that enforcement of quality standards in RETs is achieved and punitive measures established to discourage non-certified importers from bringing in substandard products. MERA should work together with MBS on the enforcement of standards given certified companies are expected to follow standards. MERA must also ensure that companies are in possession of all standards from MBS if they are to be certified. Lastly, MERA should further ensure that certified RE companies are contributing to the development of RETs in the country by being members of the Renewable Energy Industries Association of Malawi (REIAMA), 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 (PAYG) 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.[72] Some microcredit institutions provide small-scale loans to people who have no credit history but who can get community members to co-sign on the loans.

Debt financing for household clean energy projects however is waning in the face of various forms of the energy service model. In other words, the emergence of the pay-as-you-go 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 Affairs will resuscitate the Guarantee Fund that 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 subsidized energy prices as well as free access to electricity by way of either MAREP or the ESCOM grid extension nearby. 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 is placed on either the upfront investment cost or on the operation and maintenance costs. The government, led by the Department of Energy Affairs, 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.[73] 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 internal rate of return (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. Private entrepreneurs regard them as risky investments, although with sound financial structuring and government support, mini-grids could be financially sustainable. The DOE will identify the appropriate form of subsidy that will be needed (See "Provision of Subsidies" below).

[72] "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.
[73] 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

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 the mini-grid's financial and technical stability; safety standards; and proper equipment and operating practices that will allow it 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 mini-grids from certain expenses or at least streamline processes such as environmental impact assessments.

Electrification of public institutions

Most public institutions located in 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 that 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 already engaged in the promotion and distribution of solar pico products. The DOE 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; and
- 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 programs 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 Affairs and Department of Forestry	Short-term	DOE 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-term	DOE	Ministry of Finance, Malawi Revenue Authority, Malawi Trade Investment Centre, private firms, NGOs	Awareness campaign US$250,000/year; Financial incentives for private firms US$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-term	DOE	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-term	DOE	NGOs, development partners	US$50,000/year for monitoring and evaluation Mid-term evaluation: US$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-term	DOE	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 US$400,000; incentives for businesses US$1.2 million over 2-3 years; public awareness campaign US$175,00/year

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs
Promotion of biogas plants	Increase the use of biogas plants at institutions such as schools; undertake pilot projects	Short to medium-term	DOE	Schools, hospitals, clinics, biogas plant manufacturers	Pilot projects US$750,000
Innovation at MAREP	Connect households in close proximity to distribution lines, monitor trading centre connections, revive and maintain the dysfunctional mini-grids	Short, medium, and long-term	DOE	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 offer them to providers and/or consumers	Medium-term	DOE	Ministry of Finance, solar companies, ESCOM, Renewable Energy Association of Malawi	Appraisal US$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 and financing of pico solar and other energy products	Short, medium, and long-term	DOE	NGOs, universities, local governments	US$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-term	DOE	MERA, Renewable Energy Association of Malawi	Develop regulatory structure US$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, and long-term	DOE	NGOs, manufacturers, importers, installers, Renewable Energy Association of Malawi	Appraisal US$100,000

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs
Capacity building at Malawi Bureau of Standards	Support MBS on certification and enforcement of RETs and mini-grid standards	Short to medium-term	DOE	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-term	DOE	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, and long-term	DOE	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, and long-term	DOE	NGOs, MAREP, Renewable Energy Association of Malawi	Annual monitoring US$50,000 Mid-term evaluation US$80,000

Which (global) high-impact opportunities are relevant?

- Advanced lighting and appliance efficiency
- Off-grid lighting and 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 to:

- 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; and
- 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.[74]

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

Renewable energy policy adoption

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 an 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 decreasing 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 Affairs, other government entities, and other players; and

[74] 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.

- 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.[75] The government, through ESCOM, can either build 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 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 SEforALL 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 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 concentrated solar power (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

[75] For off-grid solar home systems, and RE mini-grids, see the Energy Access section.

types of incentives help improve cash flow and reduce risk for 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 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 that 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 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 its 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 may be offered 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. The RE policy will therefore consider ways of providing security for investors, such as working with international financial institutions to provide partial payment guarantees to 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 performance certification on certain types of RE equipment, particularly for 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, in 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 household and commercial buyers of RE systems -- such as solar PV panels and solar hot water systems -- to pay for the systems over time through their utility bills. OBF can work with prepayment meters as well. It is convenient for users because they don't have a separate loan payment. It is also attractive to the bank that operates the program for the utility because there is close to a zero default rate as default results in cutting off the customer's electricity supply.

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. The Department of Energy Affairs, with assistance from donors, could conduct tests of the fuels and technologies, and determine their applicability and costs in Malawi.

Establishment of 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. 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.

Development of an RE financing strategy

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 problems, e.g., off-taker (ESCOM) credit worthiness risk, such as providing a sovereign guarantee;
- Eliminating or decreasing the VAT on RE products; and
- Establishing rules for solar service agreements so that solar vendors/installers may 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 such installations.

Improvements and modernization of 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.

Adoption of an effective IPP policy

The feed-in tariff provides a guide for IPPs to participate in supplying power. 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; and
- Streamline the licensing process and minimize licensing fees and requirements.

Implementation of RE education and training program

The government must aim to help:

- 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; and
- Establish an RE awareness initiative, including introduction of a media strategy including radio and newspaper, and holding RE fairs.

Refurbishment of old RE installations

One of the reasons Malawians are sceptical about the viability of RE is that a number of previous RE projects failed due to poor design and 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.

5.2.3 Priority actions synthesis

A summary of the priority actions proposed in the SEforALL 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[76]
Large hydro capacity additions	Add 350 MW Mpatamanga, 200 MW Kholombidzo, 40 MW Mbongozi, 50 MW Chizuma, 90 MW Songwe 160 MW Songwe 2, and 140 MW Fufu	Short, medium and long-term	MoNREM	MERA, ESCOM, EGENCO, private sector	Unit cost: US$2.9 million/ MW Total: US$2.7 billion
Small hydro capacity additions	Add 21 MW Tedzani IV, 23 MW Ruo	Short and medium-term	MoNREM	MERA, private sector	Unit cost: US$2-4 million/ MW Total: US$90-180 million
Solar capacity additions	Add 550 MW of PV projects at various sites	Short, medium and long-term	MERA	MoNREM, private sector	Unit cost: US$3.8 million/ MW Total: US$2.1 billion
Bagasse cogeneration capacity additions	Add 46 MW at two Illovo sites	Medium and long-term	MERA	MoNREM, private sector	Unit cost: US$6.7-7.4 million/ MW Total: US$308 - 340 million
Policy	Adopt RE Policy, financing strategy	Short-term	MoNREM	MERA, private sector, Renewable Energy Association of Malawi, NGOs	n.a.
Research	Conduct detailed RE resource assessments, especially wind,	Short-term	MoNREM	Universities and other research institutions (University of Malawi	n.a

[76] 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.

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs[76]
	geothermal and non-sugarcane biomass resources			– Polytechnic, University of Mzuzu – Department of Energy Studies) National Commission for Science and Technology	
Capacity building	Training for government and private sector on licensing and permitting processes, costs, regulatory policy and procedures, major challenges in developing an RE project	Short-term	MoNREM	MERA, private sector	n.a.

5.3 Energy efficiency

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

Priorities identified by the SEforALL 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 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 household electricity bills. 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 of improved EE. Based on the success of the recent two 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 on 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 the program 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 to 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 must be cautiously approached due to budgetary specifics. Resistance from some ministries and government departments and agencies may be anticipated because of the requirement to pay upfront for the energy to be used. ESCOM will need to work with the Ministry of Finance, Economic Planning and Development to eventually devise 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 out 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; and
- Promotion of sub metering in complex industrial and manufacturing processes. Implementation of sub-metering systems will help business owners and their energy managers to more precisely analyse the company's energy consumption data and identify the least efficient processes or machines. It will subsequently help them to implement necessary EE measures on the identified items, thus increasing overall energy performance and reducing energy-related costs.

Agricultural

The focus will be on the most energy consuming agricultural processes: tobacco curing, tea drying and irrigation water pumping. 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; and iii) replacement of old and obsolete equipment and mechanization (tractors, seeders, harvesters).

Capacity building

The government (through the Department of Energy Affairs) 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 to create a capable steady countrywide technical workforce trained in international best practices.

The Energy Authority will therefore start offering technical support and financing 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 program, 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

Past national energy efficiency sensitization campaigns have not been 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 to induce change in people's attitude. These include use of posters and pamphlets written in simple language that the public can understand and to which it can relate. 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 solid 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 the local economy.

Supply-side

Acknowledging that vast EE potential lies in the distribution and transmission sector, Malawi will take full advantage of the World Bank-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; and
- Rehabilitation of 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 the country's aspirations towards achieving a 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.[77] It 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;
- Determine specific EE targets for large energy consumers, together with the MoNREM;
- 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; and
- 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 the country level, SEforALL 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 a technical excellence centre to carry out activities such as: i) testing the energy performance of imported or locally produced equipment and appliances; and 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 an 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 SEforALL coordination and the follow-up

[77] World Energy Council definition for National EE Agency.

process. It will allow the government and the SEforALL regional hub to precisely assess the progress of the initiative and to timely intervene by policy adjustments when needed. The 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 SEforALL 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) and 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 sectors. 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, ESCOM should launch an on-the-bill financing program for efficient light bulbs by the end of 2017.

Private banks – specialized EE credit lines

Despite high interest rates, local commercial banks can play a key role in the development of an EE and RE financial products market and will serve as a major channel for passing international money to local households and business. With their extensive branch networks, excellent understanding of the market and sound loan approval rules and processes, local financial institutions will greatly help streamline EE/RE financing. To motivate 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 in the coming years.

International and bilateral financial institutions and partners

Malawi is attracting increasing amounts of international capital for climate change projects and is building expertise that 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 market levels. The Government of Malawi has already taken 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 UNFCCC's Kyoto Protocol.

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 the entry point for 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 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 local financial institutions, as well as the 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 unlock a massive inflow from international and bilateral financial institutions 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:** According to the NCCIP, the CCF will be vested in the Ministry of Natural Resources, Energy and Mining, and appoint an independent and professional fund manager to give the Fund more credibility to international funders. The Fund manager will be mandated through a competitive and transparent procurement procedure.
2. **Social and environmental responsibility:** The Fund will adopt and comply with 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 are 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 NGO sectors, ensuring all applicants receive equal attention and all applications processed with equal diligence.

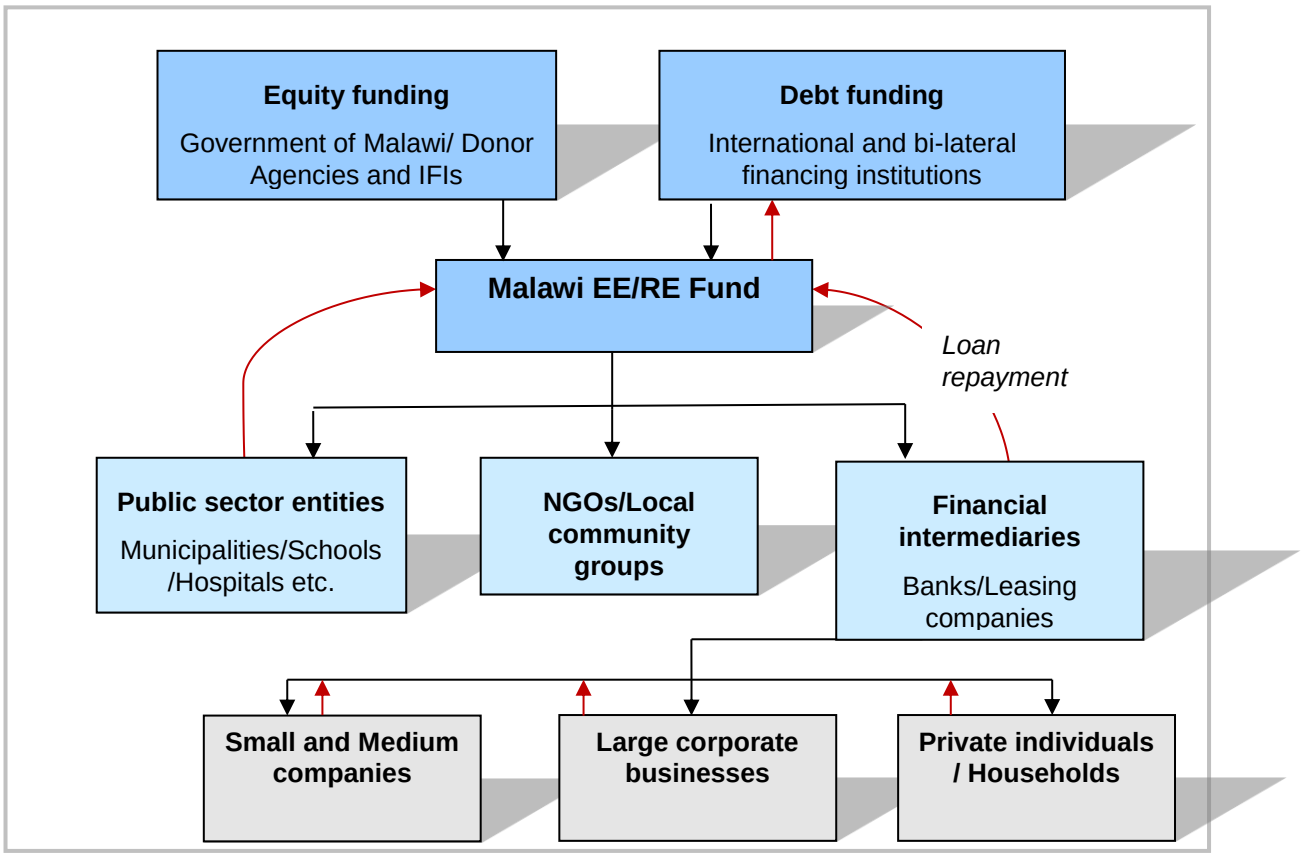


Figure 19: Malawi EE Fund – proposed structure and business cycle

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 to further adjust and fine tune existing energy policies and strategies; and iii) energy auditors and auditing firms licensing – the NEMR will outline the certification process and the training local auditors must complete 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 the development of a set of regulations that seek to ban the use of inefficient products through the 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 light bulbs only. They will 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 relief (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 baseline across different sectors (industrial, mining, agriculture, domestic, public) to 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 an implementation timeframe.

Promotion of green building code

Malawi will consider adopting a green building code or implementing minimum energy performance standards for buildings within existing building regulations. The country may decide to follow the lead of the 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; and 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 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.

5.3.2 Which (global) high-impact opportunities are relevant?

Efficient cook stoves/solar water heater programs and women's and children's health

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 flame three stone stove poses risks of burns (particularly for children) and fires. Promotion of efficient cook stoves and solar water heaters (as a replacement for 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 creating a cleaner and safer environment in kitchens and reducing 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

Energy efficiency financing mechanism such as a dedicated EE fund, specialized bank credit lines, and 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 local business owners, but will render the Malawian economy more competitive at the regional and international levels.

5.3.3 Priority actions synthesis

A summary of the priority actions proposed in the SEforALL 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	MoFEP&D	MERA, Malawi Development Bank (upon establishment)	US$ 30 million[78]
Agriculture	Build/Install 5,000 efficient tobacco curing barns	Long-term	Ministry of Agriculture, Irrigation and Water Development	Tobacco Control Commission, MoFE &PD	US$ 7.5 million[79]
Policy	Introduce National Energy Management Regulations	Short-term	MERA	MoNREM	n.a.
	Introduce Minimum Energy Performance Standards and labelling regulations for light 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	US$ 250,000
	Establish 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, Economic Planning Development	Approx. US$ 16.5 million[80]
DSM	Install 1.6 million pre-paid meters to grid-connected households	Medium to long-term	ESCOM	MoFEP&D, MoNREM	US$ 64 million[81]

[78] 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 US$ 100,000 – 150,000.
[79] Based on the average rocket barn cost of US$ 1,500.
[80] Assuming an average price of US$ 2 per unit throughout the AA period.
[81] Assuming US$ 40 average price per pre-paid meter.

5.4 Transportation – Alternative fuels

5.4.1 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 for SEforALL targets on alternative fuels to be met.

Develop a policy framework that promotes use of cleaner fuels

Governance

This AA recommends implementing a coordination mechanism as soon as possible and establishing a biofuels coordinating committee. This committee will be in charge of coordinating policies and ensuring they are properly implemented, especially with respect to 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 the 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 Biofuels Coordinating Committee

Organisation	Role
Department of Energy Affairs	Coordinating committee chair
Ministry of Agriculture, Irrigation and Water Development	Provide information on crop production
Ministry of Agriculture, Irrigation and Water Development - Environmental Affairs Department	Provide an environmental framework to the activity (and especially information on water quality, identified as a main barrier)
Ministry of Transport and Public Works - 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 Constitutional Affairs 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 Industries Association of Malawi	Provide information on biofuels
Universities and other research institutions (University of Malawi – Polytechnic, University of Mzuzu – Department of Energy Affairs 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

Reinforcement of existing or introduction of additional incentives to support biofuel production

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

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.

Market opportunity development

A clear business case will be created that will encourage 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.

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

Creation of innovative financing models

As for actions proposed in renewable energy and energy efficiency sectors, 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 costs, which will contribute to making it 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).

Promotion of biofuel use

Biofuel prices

The price of commodities is the main driving force of their demand. Therefore, the price of biofuels needs 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 which:

- Set 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 Affairs proposed during the SEforALL consultation process to set a lower price for the ethanol blend (lower by 10% compared to gasoline); and

- End in the implementation of tax incentives for biofuel users.

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

- Provision of a 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; and
- Potential development of ethanol by-products such as electricity, stock-feed and energy briquettes.

Facilitate biofuel distribution

Biofuels distribution should be facilitated through the following measures:

- Promoting the installation of appropriate pumps, especially for biodiesel, as there are currently no filling stations (except the one at the BERL production site). (With respect to ethanol, the draft NEP sets the target of 200 filling stations with ethanol fuel tanks in 2020.)
- Establish a network of fuelling stations offering E85 by 2018.

Encouragement of biofuel use

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, shift the government fleet to biofuels, and promote the local manufacturing of conversion kits; and
- Encourage the use of renewable fuel for the mass transport system (mainly buses).

Ensuring 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, it is estimated that the land cultivated for Jatropha in 2016 was around 85 hectares.[82] In 2030, there will be a need for more than 30,000 hectares cultivated under irrigated conditions.

[82] http://www.nuglobalnrg.com/jatropha_facts_and_figures.html.

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.[83] The need for land will then be nearly 150,000 hectares.

[83] 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.

Table 37: Required land for cultivation 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. Forty tons of cane would be realized from one hectare of land under rain-fed, compared to 100 tons of cane per hectare if it were irrigated cane.[84] 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, to determine the strategy that maximizes available land and irrigation spaces.

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 Global Water Footprint Standard 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 simple framework would entail an evaluation of water consumption during the production processes and supply chains (such as the total amount of water needed to grow crops, total cubic meters needed for each unit produced). Most efficient production processes can be identified and supported.

Other energy sources

Promotion of electric vehicles

Globally, the trend on the global market indicates 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 at a 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.

Promotion of biogas in transportation

Research should be conducted on the feasibility of the use of 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 results of the study. This would require an assessment of the efficiency of the supply of this fuel and the supply of bi-fuel and dual-fuel vehicles.

[84] Malawi ethanol producers (PressCane and EthCo).

Research and development, and education

The Government of Malawi should capitalise on the research, development and experience in other countries on other feedstocks other than Jatropha and sugarcane.

5.4.2 Which (global) high-impact opportunities are relevant?

Sustainable bioenergy

Developing biofuel 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 practices outlined in the Roundtable on Sustainable Biofuels standards.

5.4.3 Priority actions synthesis

A summary of the priority actions proposed in the SEforALL 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 will succeed the former Biofuels Advisory Committee.	Short-term	Department of Energy Affairs	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 Affairs	MERA, Ministry of Finance, Economic Planning and Development, Renewable Energy Industries Association of Malawi, private sector players in the biofuels industry (especially manufacturers)	n.a.
	Promote the use of biofuels	Medium-term	Department of Energy Affairs	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 Affairs	Ministry of Transport and Public Works	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 Affairs	Ministry of Transport and Public Works, 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 Affairs	Universities and other research institutions (University of Malawi – Polytechnic, University of Mzuzu – Department of Energy Studies)	n.a.

5.5 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 challenges. Currently, petroleum imports, which are used largely in motor vehicles, are increasing. Substituting biofuels for 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.

5.5.1 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 Joint 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 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, Economic Planning and 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 respective major issues per administrative area
Roads Authority	Allocation of revenue 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 best 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 overlap and gaps among the responsible institutions, i.e. Roads Authority. Harmonisation will be required on the design and maintenance of roads to reduce congestion 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 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 litres of diesel (based on a trial using a city bus in a mixed traffic system).[85] In addition, a study conducted in Uganda, found that in terms of fuel consumption and CO_2 emissions, one bus with a capacity of 80 people replaces 3 mini-buses, 14 private vehicles or 80 motorcycles.[86] The efficiency will increase further if proper bus schedules are implemented together with 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 provide the backbone of public transport in urban areas in Malawi. Therefore, a public transportation system should be developed in two 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 comprise 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 routes: mini-buses must not be allowed to operate on these routes and strict enforcement is required; and
- Support the cooperatives in buying large and efficient buses (e.g. though tax reductions or subsidies).

Encouraging current mini-bus operators 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 three 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:

- Undertaking detailed studies to analyse the current transportation system (mapping of transport modes, infrastructure, population distribution, etc.) to inform the nature of

[85] Personal communication with a member of the Transportation Working Group.
[86] The study refers specifically to taxis, but is assumed the same with private vehicles in terms of capacity and environmental impact.

intervention that will need to be implemented (e.g. allocation of bus lanes);

- Developing pilot bus systems (i.e. one route in one city) to guide the development of a comprehensive transportation system;
- Phasing 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. 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). And,
- Prohibiting 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 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:

- 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 support mass transit and other transport-related activities;
- Reduction of importation taxes of large buses;
- Direct funding from the state budget and private investors; and
- Provision of concessions 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.

Increasing 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 levels 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 CO_2 emissions. Such standards exist mostly in developed countries, such as the USA, Japan, and the EU and less developed countries, 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 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 depend on the age and size of the vehicle's engine.[87]

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.

Improvements in road capacity and maintenance

The poor condition of urban roads, increases congestion. In parallel, the planning and design of roads, does not allow for future expansion 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 from walking on the street) and ring roads to lower the congestion levels, especially in the Central Business District (CBD).

Development of urban and suburban rail transportation systems

The possibility of reintroducing rail passenger transportation for urban and suburban transportation should be assessed. The railways that 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 considering light rail for the bus corridors with the greatest ridership.

Support for the development of non-motorised transport

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

- Increasing their safety through the development of bike lanes (also stipulated by the

[87] 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.

NTP);

- Raising awareness by establishing a bicycle commuting campaign to increase the social acceptability of biking;
- Establishing bike share programs (e.g. as the scheme currently in development in Johannesburg);
- Providing incentives to employers for bicycle commuting (starting with national and municipal governments); and
- Providing 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.

Establishment of 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 must implement land use planning policies that integrate residential and employment areas to minimise the need for transport.
- With respect to high density, mixed use development, cities must undertake short, medium and long term urban transport planning as an integrated element of the overall city planning.
- The capacity of competent authorities must be strengthened to understand the technical and non-technical skillset required for the consideration of transportation in land use planning, including on the areas of climate resilient transport planning and infrastructure.

Improvements in traffic flow efficiency

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:

- Supporting the development of non-motorized transport;
- Parking supply restrictions which can be achieved either by limiting the physical supply of parking space in the central area or charging for parking space to discourage private vehicles from entering the central business district;
- Developing synchronised traffic signals, such as the intelligent traffic light control algorithm (“Adaptive Traffic Control system”) that works on GPS and other data (pilots in Johannesburg);
- Integrating traffic flow concerns in land use planning, by preventing heavy vehicles in densely populated areas, promoting mixed use planning to minimise the need of traffic, and planning for pedestrians and street vendors to minimise conflict with

vehicular traffic, etc.;

- Promoting eco-driving: smarter and more fuel-efficient driving techniques; and
- Embarking upon 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 the Urban Transportation Coordinating Committee:

- Promoting eco-driving: smarter and more fuel-efficient driving techniques that are fuel efficient;
- Embarking upon awareness campaigns on the benefits of public transportation, non-motorised transport and other aspects of sustainable transportation; and
- As stipulated by the NTP, strengthening 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 programs for capacity building in the private service providers should be also envisaged.

5.5.2 Which (global) high-impact opportunities are relevant?

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 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.

5.5.3 Priority actions synthesis

A summary of the priority actions proposed in the SEforALL 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 US$235,000; Operational cost (including maintenance) is estimated at US$33,000/year
Fuel efficiency of motor vehicles	Use of labels and standards through the integration of EU minimum emission standards for all registered vehicles	Short-term	Ministry of Natural Resources, Energy and Mining	Ministry of Transport and Public Works; Ministry of Justice and Constitutional Affairs; Road Traffic Directorate; Private sector transport operator representatives	n.a.
	Develop urban and suburban rail transportation system	Long-term	Ministry of Transport and Public Works	Central Eastern African Railways	US$ 1.98 million per km for diesel rail and US$ 3.53 million for electrified line[88]

[88] 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.

Category	Action	Indicative time frame	Lead agency	Cooperating stakeholders	Estimated costs
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.

5.6 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 as 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.

5.6.1 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 initiated 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; and
- Center for Energy Efficiency (CENEf) in Russia.

The energy centres are often the institutions that keep clean energy initiatives like SEforALL 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 EE and RE activities. It could be a stand-alone agency, but more likely it would be a department within the government ministry. In this regard, it would be appropriate if the committee were vested at the Ministry of Natural Resources, Energy and Mining.

5.6.2 Sub-national initiatives

While DOE, 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 SEforALL themes in a comprehensive and coordinated manner.

Among the local initiatives that could be pursued under the SEforALL 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; and
- Procuring flex-fuel vehicles for local government fleets.

5.6.3 Finance and risk management

A number of SEforALL 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 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) and credit guarantees. It will include set-aside funding 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 US$ 5 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.

5.6.4 Capacity building and education

All the SEforALL 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 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; and
- Training for entrepreneurs on how to establish an LPG distribution and refuelling business, an energy auditing and management business, and a rural mini-grid business, etc.

5.6.5 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 revenue from a surge in 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**.**

6. PART III – Coordination and Follow-up

6.1 National SEforALL 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 Affairs, as the National SEforALL Coordinator will champion the implementation of the priority actions that have been agreed by the AA development process. It will ensure that SEforALL is mainstreamed into the national development agenda.

DOE 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 DOE 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. DOE 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 SEforALL meetings with multilateral and bilateral donors to discuss progress on SEforALL priority actions and what financial resources will be needed. Private investors can attend these meetings at the invitation from the Permanent Secretary.

6.2 Regional coordination

Many of the SEforALL 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 SEforALL 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 an appropriate financing mechanism and fiscal regimes suitable for the development of Renewable Energy Technologies (RETs);
- Strengthening 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 to promote commercialization and greater use of RETs;
- Promotion of cost-effective pilot activities and projects for diffusion of RETs;
- Collaborating with stakeholders to identify specific needs of different energy users in order to develop programs 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; and
- Facilitation of contact and cooperation among institutions involved in research and development of RETs to establish consistent product standards.

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 SEforALL 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; and
- Joint procurement of LPG and other petroleum products on the world market.

6.3 Follow-up analysis

The Action Agenda provides the strategic framework towards achieving the SEforALL 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 SEforALL goals, especially in order to confirm and detail, when necessary, targets and actions that have been set in the Action Agenda. It is therefore recommended that the government:

- 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; and
- Reassess the biofuels targets in light of 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).

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

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

6.4 Monitoring, evaluation and reporting

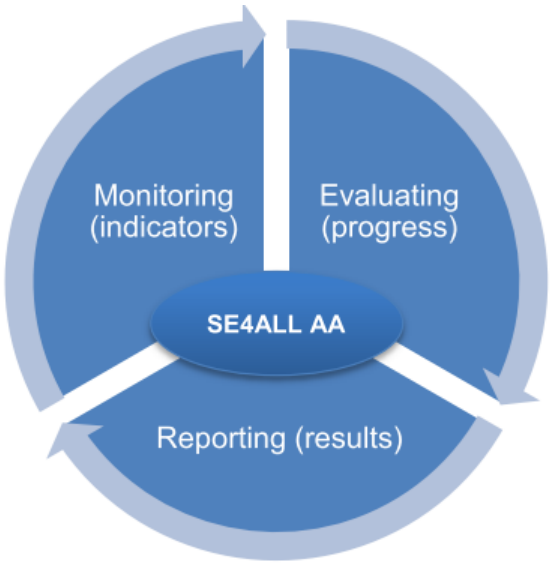
MER System guidelines

A detailed Monitoring, Evaluation and Reporting (MER) system for tracking and reporting on program time-bound milestones and accomplishments will be prepared by the SEforALL Secretariat at the beginning of 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 SEforALL initiative. The MER, as a tool, allows for identifying key issues that need to be addressed to ensure 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 SEforALL 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 SEforALL 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 SEforALL 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 SEforALL initiative

Results	Indicators	
Goal		
Sustainable Economic Growth	Deaths by indoor air pollution (deaths/year)	
	GDP per capita (USD/person*year)	
	National electricity generation capacity (MW)	
	Poverty in rural and urban areas (%)	
SE4ALL Global Objective 1: Universal access to modern energy services		
Increase Electricity Access	National electricity access rate (%)	*Percentage of population with electricity access calculated as % of households with connections*
	Energy consumption per capita (kWh/person*year)	
Increase access to modern cooking solutions	National access rate to modern cooking solutions (%)	*Percentage of population with access to modern cooking solutions. Definition of modern cooking solutions can be taken from GTF.*
SE4ALL Global Objective 2: Doubling share of renewable energy in global energy mix		
Increase renewable energy share in national mix	Share of RE in the national energy mix (%)	*Proportion of installed capacity from renewable energy sources, over the total installed capacity*
	On-grid RE installed capacity (MW)	
	Off-grid RE installed capacity (MW)	
	Sustainable biomass used in process heat (%)	
SE4ALL Global Objective 3: Doubling global rate of improvement of energy efficiency		
Reduce energy intensity	Reduction in the annual rate of energy intensity per year (%)	
	Energy losses in electricity distribution (%)	

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

Furthermore, a Multi-Tier Framework for tracking energy access - both electricity and modern cooking solutions - can provide the necessary level of detail that is required for effective monitoring.[89] 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).

[89]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.

Table 42: Key components for measuring access to household electricity services under the GTF

Item		Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Tier Criteria			Task lighting and phone charging	General lighting, television, and fan (if needed)	Tier 2 criteria plus any medium-power appliances	Tier 3 criteria plus any high-power appliances	Tier 4 criteria plus any very-high-power appliances
Type of Appliance	Indicative list of appliances		Very-low-power appliances	Low-power appliances	Medium-power appliances	High-power appliances	Very-high-power appliances
	Lighting		Task lighting	Multi-point general lighting			
	Entertainment and communication		Phone charging, radio	Television, computer	Printer		
	Space cooling and heating			Fan	Air cooler		Air conditioner,* space heater*
	Refrigeration				Refrigerator,* freezer*		
	Mechanical load				Food processor, washing machine, water pump		
	Product heating					Iron, hair dryer	Water heater
	Cooking				Rice cooker	Toaster, microwave	Electric cooker

* Intermittent use.

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 SEforALL AA.

The evaluation will ensure a broad and representative perspective on the achievements and challenges in the implementation of Malawi's SEforALL 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 to:

- Contribute to improving program effectiveness and delivery towards Malawi's SEforALL goals by 2030 by using knowledge and lessons learnt from its implementation back into the country initiative;
- 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 SEforALL initiative; and
- Update the AA as required taking into account progress made and new developments.

During the annual SEforALL evaluation, the designated SEforALL 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 SEforALL Secretariat will report on an annual basis on the progress and performance towards the implementation of Malawi's SEforALL 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 a consistent manner and shared with stakeholders for awareness, socialization and proper contributions on their part.

6.5 Link to investment prospectuses

The Action Agenda is a stand-alone document that provides a framework for achieving the national SEforALL 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 investment. 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 considers Malawi's enabling environment and explains 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 SEforALL initiative

Introduction

The Sustainable Energy for All (SEforALL) 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 initiative aims to:

1. Ensure universal access to modern energy services;

2. Double the global rate of improvement in energy efficiency; and
3. Double the share of renewable energy in the global energy mix.[90]

The strategy on how to achieve these goals was then elaborated in *Sustainable Energy for All – A Framework for Action (2012)*. Section 1 of this document summarizes the objectives, benefits, as well as the key figures regarding investments of the program. Section 2 lays out in further detail why each type of organization should engage (government, businesses, civil society organizations), their roles to play (policies planning, regulation and institutions, technology innovation, finance, implementation capacity, end-user demand), and the benefits that can be gained by coordinating commitments. Section 3 then proceeds to show 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 4 describes principles and next steps for the initiative.

The country action process to be implemented by the countries wishing to participate in the SEforALL initiative consists of the following key four steps:

1. *Declaration of Partnership:* With this declaration the country's government expresses its interest in participating in the SEforALL 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 SEforALL in this particular country.
3. *Action Agenda (AA):* The AA is edited at the country level and 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 SEforALL 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 possible for a specific sector or subsector is identified and developed to then be presented to potential investors, be it private or public ones.[91]

A first wave of countries already completed their AAs and IPs. However, a structured follow-up and support to implementation of AA/IPs is critical for maintaining SEforALL momentum. Thus, accompanying African countries during the realization of their AAs and IPs will be key to assisting them on their journeys to a sustainable future.

AA and IP: Key steps for achieving SE4All objectives

Action Agenda

The AA is:

[90] http://www.se4all.org/our-vision/our-objectives/.
[91] Sustainable Energy for All (2014). SE4All Country Action Reference Document.

- A strategy-driven and holistic document that intends to determine how the three goals of SEforALL may 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 SEforALL goals; and
- 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); and
- A 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 SEforALL 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 country's broader policy framework;
- Identifies sector gaps and suggests actions to address gaps and costs to achieve targets;
- Identifies central repositories of resources for the purpose of coordination of SEforALL as well as defining follow-up actions;
- Provides a platform for sharing experiences on best practices; and
- Provides a tool to accelerate the mobilization of needed investment into the sector.

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; and
- Benefits from the convening power of SEforALL to promote plans and assist with matchmaking between potential investors and facilitating access to finance from available resources of partners.

"Promote the SEforALL Investment Prospectus as a tool to mobilize the required financing for accomplishing both SEforALL's objectives and those of the proposed SDG 7 on energy." SEforALL Energy Access Committee, May 2015.[92]

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 an inclusive development process; and
    - 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; and
    - Structured follow-up to AA/IPs (targeted support packages, market-place for IPs).
3. Strengthening of SEforALL focal points/offices.

[92] The Sustainable Development Goal (SDG) 7 was adopted end of September in New York. Implementation will be key for Africa.

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 Affairs
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 Affairs
Emmanuel Mjimapemba	UNDP
Edgar Bayani	Community Energy Malawi
Martina Kunert (Rapporteur)	RENAMA
Thokozani Malunga	Department of Energy Affairs
Cornwell Chisale	Department of Energy Affairs
Godfrey Moto	Imani Development
Gift D.Kasamira	Lilongwe City Council

Energy Efficiency Working Group

SURNAME	ORGANISATION
Dr Collen Zalengera (Chair)	University of Mzuzu - Department of Energy Affairs Studies
Sophie Makoloma	Christian Aid
Blessings Mwale	Kulera Biodiversity Project - Total Land Care
Yamungu Botha	Concern Universal
Lusungu Kumwenda	MEGA Ltd.
Temwani Mkandawire	UNIMA
Gift Chiwayula	Department of Energy Affairs
Samuel Perenje	Press Corporation
Griffin Salima	UNIMA
Ephraim Banda	LWB
Edaward Chilima	ECAMA
Weyani Mhango	Lilongwe City Council

Transport Working Group

SURNAME	ORGANISATION
Dr I Ngoma (Chair)	Polytechnic - University of Malawi
Kenneth J Gondwe (Rapporteur)	Polytechnic - University of Malawi
Dominic Chanyenga	MITC
Emmanuel Muleso	MITC
Dr B.O. Mkandawire	University of Malawi-Polytechnic
Chikaiko Chadzunda	BioEnergy Resources Ltd (BERL)
Moses Zuze	Ministry of Local Government
Walter Mkandawire	MIE LTD
Kondwani Ndau	Ethanol Company of Malawi Ltd
Mphatso Chiwewe	Department of Energy Affairs

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

Annex 3: SEforALL 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 Affairs and Department of Forestry	Short-term	DOE 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-term	DOE	Ministry of Finance, Malawi Revenue Authority, Malawi Trade Investment Centre, private firms, NGOs	Awareness campaign US$250,000/year; financial incentives for private firms US$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-term	DOE	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-term	DOE	NGOs, development partners	US$50,000/year for monitoring and evaluation Mid-term evaluation: US$80,000

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs
LPG expansion	Roll out a campaign to greatly increase LPG use for cooking, addressing legal, financial, safety and ownership issues	Medium to long-term	DOE	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 US$400,000; incentives for businesses US$1.2 million over 2-3 years; public awareness campaign US$175,00/year
Promotion of biogas plants	Increase the use of biogas plants at institutions such as schools; undertake pilot projects	Short to medium-term	DOE	Schools, hospitals, clinics, biogas plant manufacturers	Pilot projects US$750,000
Innovation at MAREP	Connect households in close proximity to distribution lines, monitor trading centre connections, revive and maintain dysfunctional mini-grids	Short, medium, and long-term	DOE	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-term	DOE	Ministry of Finance, solar companies, ESCOM, Renewable Energy Association of Malawi	Appraisal US$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-term	DOE	MERA, Renewable Energy Association of Malawi	Develop regulatory structure US$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;	Short, medium, and long-term	DOE	NGOs, manufacturers, importers, installers, Renewable Energy Association of Malawi	Appraisal US$100,000

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs
	resuscitate the Guarantee Fund				
Capacity building at Malawi Bureau of Standards	Support MBS on certification and enforcement of RETS and mini-grid standards	Short to medium-term	DOE	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-term	DOE	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, and long-term	DOE	NGOs, Renewable Energy Association of Malawi	Budget to be developed
Monitoring and evaluation of 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, and long-term	DOE	NGOs, MAREP, Renewable Energy Association of Malawi	Annual monitoring US$50,000 Mid-term evaluation US$80,000

Table 44: Implementation of priority actions: Renewable Energy

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs[93]
Large hydro capacity additions	Add 350 MW Mpatamanga, 200 MW Kholombidzo, 40 MW Mbongozi, 50 MW Chizuma, 90 MW Songwe 160 MW	Short, mid and long-term	MoNREM	MERA, ESCOM, EGENCO, private sector	Unit cost: US$2.9 million/ MW Total: US$2.7 billion

[93] 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.

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs[93]
	Songwe 2, and 140 MW Fufu				
Small hydro capacity additions	Add 22 MW Tadzani IV, 23 MW Ruo	Short and mid-term	MoNREM	MERA, private sector	Unit cost: US$2-4 million/ MW Total: US$90-180 million
Solar capacity additions	Add 550 MW of PV projects at various sites	Short, mid and long-term	MERA	MoNREM, private sector	Unit cost: US$3.8 million/ MW Total: US$2.1 billion
Bagasse cogeneration capacity additions	Add 46 MW at two Illovo sites	Mid and long-term	MERA	MoNREM, private sector	Unit cost: US$6.7-7.4 million/ MW Total: US$308 - 340 million
Policy	Adopt RE Policy, financing strategy	Short-term	MoNREM	MERA, private sector, Renewable Energy Association of Malawi, 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 and permitting process, costs, regulatory policy and	Short-term	MoNREM	MERA, private sector	n.a.

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs[93]
	procedures, major issues in developing an RE project				

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)	US$ 30 million[94]
Agriculture	Build/Install 5,000 efficient tobacco curing barns	Long-term	Ministry of agriculture and water development	Tobacco control commission, MoFED	US$ 7.5 million[95]
Policy	Introduce National Energy Management Regulations	Short-term	MERA	MoNREM	n.a.
	Introduce Minimum Energy Performance Standards and labelling regulations for light 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	
	Establish EE and RE technical excellence centre	Short-term	Malawi Bureau of Standards	MoNREM, MERA	n.a.

[94] US$ 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 US$ 100,000 – 150,000.

[95] Based on the average rocket barn cost of US$ 1,500.

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs
DSM (lighting)	Roll out 8.25 million LEDs	Throughout 2030	ESCOM	MoNREM, Ministry of Finance, Economic Planning and Development	around US$ 16.5 million[96]
DSM	Install 1.6 million pre-paid meters to grid connected households	Medium to long-term	ESCOM	Ministry of Finance, Economic Planning and Development, MoNREM	US$ 64 million[97]

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; and controls the implementation of policies, especially those on mandatory blend; this committee can succeed the former Biofuels Advisory Committee	Short-term	DOE	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; and innovative financing models	Medium-term	DOE	MERA, Ministry of Finance, Economic Planning and Development, Renewable Energy Industries Association of Malawi, private sector players in the biofuels industry (especially manufacturers)	n.a.

[96] Assuming an average price of US$ 2 per unit throughout the AA period.
[97] Assuming US$ 40 average price per pre-paid meter.

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs
	Promote the use of biofuels through: attractive price for users (and fair for producers); ease 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.); and installation of appropriate fuelling pumps (distributing biodiesel and E85)	Medium-term	DOE	MERA, Ministry of Finance, Economic Planning and Development, Ministry of Transport and Public Works, 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	DOE	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	DOE	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	DOE	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: curbing all unregistered vehicles which is a significant proportion of the mini-bus population; supporting operators in	Medium-term	Ministry of Transport and Public Works	City Councils; Ministry of Local Government and Rural Development; Road	n.a.

Category	Action	Indicative time frame	Lead agency	Cooperating stakeholders	Estimated costs
	buying large and efficient buses (e.g. though tax reductions or subsidies); and franchising of routes: mini-buses must not be allowed to operate on city bus routes and strict enforcement is required			Traffic Directorate; private sector transport operator representatives	
	Development of a public transportation system by: phasing 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; prohibiting 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 US$ 235,000 Operational cost (including maintenance) is estimated at US$ 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.

Category	Action	Indicative time frame	Lead agency	Cooperating stakeholders	Estimated costs
	Develop urban and suburban rail transportation system	Long-term	Ministry of Transport and Public Works	Central Eastern African Railways	US$ 1.98 million per km for diesel rail and US$ 3.53 million for electrified line[98]
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.

[98] 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.

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 SEforALL 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 Stove 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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