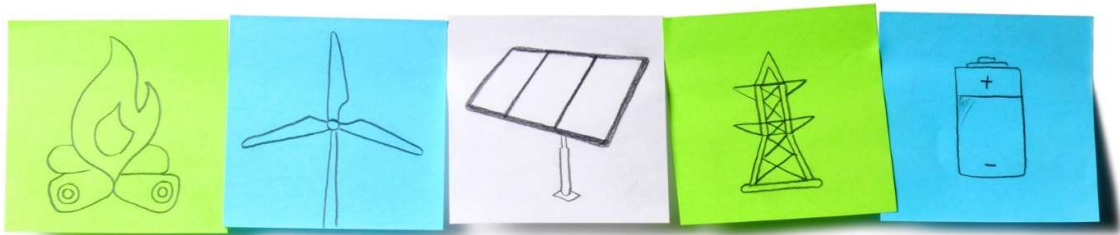




## Support to SE4ALL Country Actions processes in Malawi

### Action Agenda

*January 2017*



**Deloitte.**



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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	Concentrating solar power
DNA	Designated National Authority
DSM	Demand-side management
EE	Energy efficiency
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
MEPS	Minimum energy performance standards
MERA	Malawi Energy Regulatory Authority

MoNREM	Ministry of Natural Resources, Energy and Mining
MoTPW	Ministry of Transport and Public Works
MW	Megawatt
NCST	National Commission for Science and Technology
NEMR	National Energy Management Regulations
NEP	National Energy Policy
NEPAD	New Partnership for Africa's Development
NGO	Non-governmental organization
NCCRS	National Climate Change Response Strategy
NOCMA	National Oil Company of Malawi
NTP	National Transportation Policy
PIDA	Program for Infrastructure Development in Africa
PPA	Power purchase agreement
PPM	Prepayment meter
PV	Photovoltaic
RE	Renewable energy
REFiT	Renewable energy feed-in tariff
RO	Renewable energy obligation
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SE4All	Sustainable Energy for All initiative
SME	Small and medium sized enterprise
TPES	Total Primary Energy Supply
TDM	Travel Demand Measures
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Program



# 1.Executive Summary

The United Nations (UN) Secretary General launched the SE4All Initiative in September 2011 to achieve three inter-related global goals by 2030:

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

This Action Agenda (AA) presents an energy sector-wide vision spanning the period 2015 to 2030. It outlines how Malawi will achieve the SE4All goals of universal access to modern energy services, increase the rate of energy efficiency, and increase the share of renewable energy in its energy mix, by 2030.

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

The SE4All initiative is country-driven. That is, while international institutions and consultants are providing assistance helping facilitate the process, achieving SE4All's objectives will require all major stakeholders in Malawi to play a guiding role. Specifically:

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

The Government of Malawi (GoM) has developed the present AA building on existing plans, programs and strategies, and embracing the SE4All guidelines. Increased energy access to underserved populations is a high priority and the SE4All initiative will increase efforts in this area. The definition of electricity access is connections to the national grid system or distributed (off-grid) electricity solutions which include Solar Home Systems (SHS), mini-grids), which is consistent with the Global Tracking Framework (GTF) and with the multi-tier approach under GTF.

As of 2015, less than 10% of the population had access to electricity. In rural areas, it is less than 1%. Meanwhile, 95% of the population, or 16,500,000 Malawians use wood, charcoal or other solid fuels. The solid fuel is used primarily for cooking. Its high usage causes a high rate of indoor air pollution related diseases. In addition, the 7.5 million tonnes of annual usage of wood greatly exceeds the sustainable supply of 3.7 million tonnes. A variety of initiatives, mainly run by NGOs and funded by donor governments are promoting improved cook-stoves, biogas.

The electric power sector in Malawi is facing challenges as well. Drought conditions and other factors have greatly reduced the output of the country's hydroelectric plants, which provide most of Malawi's electricity. The Government is working to develop additional hydroelectric plants, but also is looking to add generation capacity from solar and other renewable energy resources as well as from coal and diesel. So far, no large-scale solar projects have been built and connected to the grid except for a demonstration solar power plant of 830 kW installed at Kamuzu International Airport.

Malawi has a low level of energy efficiency and there are ample opportunities for improving the energy performance of factories, buildings, barns, and water pumping, street lighting and other uses.

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

Based on the November 2015 stakeholder meetings in Salima, Malawi, plus discussions with individual stakeholders and the research conducted for the Rapid Assessment and Gap Analysis report, the AA includes the following 2030 targets and priority actions:

## 1.1 Targets

### 1.1.1 Energy Access Targets – 2030

Below are the 2030 targets for modern cooking solutions. The projected 2030 population of the country is 26.6 million.<sup>1</sup> The percentage of the population that is rural likely is projected to decrease from its current level of 84% of total population to 79%, based on projections from the United Nations' Population Pyramids of the World from 1950 to 2100. We assume that the average household size will continue to be 4.4 persons. Targets are based on an acceleration of existing trends and the goals of the Cooks Stoves Road Map and the Accelerated Access to Electricity Project of ESCOM, the national utility.

The increased use of efficient wood stoves will impact the most people. But a major effort to replace wood with LPG for cooking will be undertaken and is projected to result in an eightfold increase in LPG users by 2030.

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

Cooking technology	Baseline 2016	Target 2030	Percentage of rural <sup>2i</sup> households with access to modern cooking solutions, 2016	Percentage of rural <sup>3</sup> households access with modern cooking solutions, 2030
Electric cookers	84,000	120,000	3.0	2.5
LPG stoves	6,800	54,000	..2	1.1
Efficient wood stoves	500,000	5 million	17.6	100

In addition to cooking technologies, another thermal energy service is water heating as a replacement for electric water heating.

**Table 2: Targets on solar water heaters**

Water heating technology	Baseline 2016	Target 2030	Percentage of population affected
Solar water heaters	2,000	21,000	.4

Electricity access includes both grid extension and alternative means of supplying electricity in areas with no grid service. It also include small-scale pico solar systems such as solar lanterns for people who cannot afford to pay for grid power or the alternative electricity supply approaches. Between grid extension and the provision of pico solar services in rural areas, the target is for 100% of the population to have at least Tier 1 electricity service by 2030.

**Table 3: Targets on electricity access**

Electricity Access	Number	% rural pop served
Grid extension – homes/business connected through 2030	1.51 million	31.6

<sup>1</sup> Malawi Population Data Sheet 2012, Population Reference Bureau, <http://www.prb.org/pdf12/malawi-datasheet-2012.pdf>

<sup>2</sup> 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.

<sup>3</sup> The rural population is projected to be 21 million, representing 79% of the total projected population of 26.6 million. Source: Population Pyramids of the World from 1950 to 2100, United Nations, Department of Economic and Social Affairs, Population Division, <https://populationpyramid.net/malawi/2030/>

Electricity Access	Number	% rural pop served
Rural solar home systems installed through 2030	75,000	29.3
Mini-grids installed through 2030	90 <sup>4</sup>	< 1.0
Pico solar systems provided through 2030	4.5 million	100

### 1.1.2 Renewable Energy Targets -2030

The renewable energy targets were developed based on national power development needs, the proposed RE project developments proposed by ESCOM, the potential for IPP RE power development, and the recommendations provided by the Malawi SE4ALL RE Working Group and the Department of Energy focal point, based on grid capacity and the draft national energy policy. The percentages are based on a projected total 2030 installed capacity of 2,620.85 MW.

**Table 4: Renewable Energy Baseline and 2030 Targets**

RE source	2016 capacity	2030 target	Target Percentage
Large hydro	281.5 MW	1,471 MW	Percent of generation: 56
Small hydro	4.35 MW	103.35 MW	Percent of generation: 4
Solar	.8	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

### 1.1.3 Energy Efficiency Targets -2030

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

**Table 5: Energy Efficiency Targets**

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

### 1.1.4 Transportation Targets

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

<sup>4</sup> 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.

**Table 6: Targets on alternative fuels**

Biofuels	Baseline (2012)	Target (2030)
Ethanol production	19 million liters	40 million liters
<b>Biodiesel production</b>	0 million liters	110 million liters
Ethanol blend	10%	30%
Biodiesel	<i>No mandatory blend in 2012</i>	30%

The automobile fuel efficiency target is based on the Global Fuel Economy Initiative (GFEI), one of the SE4All flagship programs with the main objective being to reduce emissions and at least double the efficiency of the global vehicle fleet from an average of 8 litres/100 km in 2005 to 4 litres/100 km by 2050. The fuel efficiency target for Malawi is slightly lower than the GFEI target because of the low fuel efficiency starting point of Malawian vehicles, but represents an improvement over the country's current fuel efficiency level, which is not known due to lack of data. The target should be revised, at the latest by end of 2017, based on the collection of data pursuant to the development of the National Transport Master Plan currently under way.

**Table 7: Target on urban transportation**

Urban Transportation		
Auto fuel efficiency by 2030	8 litres/100 km	

## 1.2 Priority actions

### 1.2.1 Access to improved cooking

- The Department of Energy will work with the Department of Forestry to increase the up-stream supply of biomass.
- The Department of Energy, working with the Ministry of Finance, Malawi Revenue Authority and Malawi Trade and Investment Centre, will encourage and incentivize businesses to enter into supplying alternative fuels for cooking, including LPG, biogas, biomass briquettes, bamboo, pellets, and ethanol gel; and improved biomass cook stoves, solar PV cookers and biogas cookers. Within this activity, the highest priority will be on improved biomass cook stoves, followed by an expanded focus on LPG.
- The Department of Energy will develop a strategy to assist poor households in the urban areas to access energy-efficient wood and charcoal stoves.

### 1.2.2 Access to electricity

- Under Phase 8 of MAREP's rural electrification plan, the agency will continue with electrification of more than two rural trading centres per District until 2030. About 80 training centers are planned to be connected between 2016 and 2017<sup>5</sup>.
- MAREP will electrify all public institutions 5Km away from the MV line through off-grid options.
- MAREP will continue the practice of providing prepaid meters to all new connections.
- MAREP will revive support for Mini-grids.
- MBS will lead an effort to enforce standards on imported and domestically manufactured RE products used to provide electricity in unserved areas. The Department of Energy will support MBS and work to increase MBS's capability to carry out this function.

<sup>5</sup> Official Malawi Government Online, <https://www.facebook.com/malawigovernment/posts/431737397012760>

- The Department of Energy will resuscitate the Guarantee Fund to help finance solar energy installations and other off-grid RE solutions.
- The Government will encourage private parties to operate mini-grids and will provide a subsidy for the operation and maintenance of mini-grids and a low price for licensing the mini-grids.
- Ministry of Agriculture, Irrigation and Water Development will continue to irrigate schemes far away from the grid with solar PV.
- Ministry of Health will ensure that health centres far way from the grid are electrified by solar PV.

### 1.2.3 Renewable energy

The Government will adopt a comprehensive renewable energy policy and law that will include:

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

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

- Helping identify funding for pre-feasibility studies for RE projects, particularly in the areas of waste-to-energy systems and cogeneration.
- On-bill financing for small-scale on-site solar systems, including solar geysers.
- Assisting and encouraging 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 firm before the bill collection revenue is given to ESCOM. This later approach is already being undertaken for the first solar IPPs.
- Eliminating or decreasing the VAT on RE products.
- Establishing rules for solar service agreements so that solar vendor/installer can

receive tax incentives from the government as well as payments from the solar consumer for the electricity, and can then sell that electricity to ESCOM at the feed-in tariff price.

The Government will consider establishing a dedicated EE/RE committee:

- It would be somewhat like India's IREDA and have a clear mandate to implement the national RE policy. The activities of the committee 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.

Improve and modernize the electric grid:

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

Adopt an effective IPP policy:

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

Implement RE education and training program:

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

## 1.2.4 Energy Efficiency

### Solar hot water heating

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

- Future new housing schemes will be required to install solar geysers.
- A large scale promotion campaign will be carried out through the local banks and the Utility company, offering subsidized loans that can be repaid through the electricity bills of the households.

- Additional tax incentives will be proposed that will encourage local manufacturers to engage in production of solar powered geysers.

### Domestic lighting

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

### Pre-paid meters

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

### Large industrial and mining companies

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

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

### Agriculture

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

### Supply-side

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

### Institutional approach

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

- Supervise and follow the achievement of the nationally determined annual targets for energy savings and RE potential utilization.
- Actively participate in the development of drafts for EE and RE related national legislation and bylaws.
- Develop national energy savings measurement methodologies (based on internationally accepted protocols).
- Issue national energy auditing guidelines for buildings and industrial processes.
- Together with the MoNREM determine specific EE targets for large energy consumers.
- Collect and record energy savings related data and follow for compliance with the specific EE targets set for large energy consumers.

- Issue certificates for energy auditors and maintain a list of certified auditors and auditing firms.
- Organize energy management and energy audit training events.

### **New Energy efficiency law**

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

### **1.2.5 Transportation – Biofuels and EV's**

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

### **1.2.6 Urban Transportation**

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

### **Harmonize decision making**

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

### **Mass transit system**

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



congestion.

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

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

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

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

### **Establish travel demand management**

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

## 2.Introduction

Malawi is a small landlocked country in South/Central Africa bordered by Mozambique, Tanzania, etc. It's population, according to the most recent assessment in 2012, was 14.8 million people. By 2014, the population had increased to 16.8 million<sup>6</sup>. Approximately 84% of Malawians live in rural areas, practicing subsistence farming as their main source of livelihood.

Malawi's economy is based on agriculture, with tobacco as the largest export earner. The growth of other sectors such as mining has seen the contribution of agriculture in the National Economy declining from 38% in 1994 to 27% in 2010. The Kayelekera Uranium mine in Karonga boosted the mining sector since its inception in 2009. The gross domestic product (GDP) has grown at an average of 7.1% during the period of implementing MGDS, roughly from 2008 to 2011, compared to an average of 3.5% during the period prior to the Malawi Growth and Development Strategy (MGDS). GDP grew by 6.1% in 2014 up from 5% the previous year and was US\$4.2 Billion<sup>7</sup>. Mining declined by 7.8% as compared to the growth of 7.6% in the previous year. This has been due to the closure of Kayekera Uranium mine in May, 2014 as a result of price shrinking on the global market. Foreign exchange reserves increased by 20% during the year and closed at US\$922 million equivalent to 4.83months of import cover compared to 4.09 months of import cover in 2013. Budgetary support has been suspended due to the cash gate scandal of routing public funds. However there is direct donor funding of projects which cushions the forex reserves. Inflation remained high in 2014 and it closed at 24.2% by December whereas in 2013 it closed at 23.5% in December. The current detailed economic status of the country is outlined in the Economic Report 2015 for Malawi.

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

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

Energy is essential for Malawi's economic development and efforts to reduce poverty. Yet, despite increasing electrification and use of modern fuels, just 10% of the population has access to electricity, and biomass, used chiefly for cooking, dominates the country's energy balance. Biomass in the form of wood is the main fuel used in rural areas. Such heavy reliance on biomass has negative consequences for human health and the environment. One of the main objectives of SE4All is to reduce that reliance through improved cook-stoves and alternative cooking fuels like LPG and biogas.

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

Electricity represents a small share of Malawi's energy use, but its generation, transmission and distribution dominates overall energy sector investment. Hydroelectric generation has been the dominant power generation technology and while it will continue to play a major role, there will be an increasing emphasis on sources like solar, wind, sugarcane-fired bagasse cogeneration and small hydro power (> 30

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<sup>6</sup> <http://www.worldbank.org/en/country/malawi>

<sup>7</sup> <http://www.worldbank.org/en/country/malawi>

MW). The SE4All initiative calls for a global doubling of renewable energy use and this is certainly possible in Malawi. MERA, the energy regulator, has developed a Renewable Energy Feed-in Tariff (REFiT) and independent power producers (IPPs) have submitted RE power supply proposals.

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

Another key focus of SE4All is energy efficiency. There is great potential to improve energy efficiency in Malawi's industries, buildings, appliances and motor vehicles.

The SE4All initiative comes to Malawi at a time when there is increased government activity in support of sustainable energy development. Policy initiatives that are already underway include the Malawi Energy Policy (NEP) of 2003 – currently under revision. The NEP calls for making Malawi's energy sector sufficiently robust and efficient to support the country's efforts in poverty reduction and sustainable economic growth. This policy's long term vision is to drive the Malawian economy from a largely biomass reliant one to an economy based on efficient use of modern energy sources like LPG and renewable energy.

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

Although the energy sector accounts for just 4% of Malawi's total greenhouse gases (GHG), it is projected to expand to 17% by 2040. The forestry sector accounts for the largest share of Malawi's emissions, at 78%, and much of this is due to forest cutting for fuelwood and charcoal for cooking. There is thus strong support for sustainable energy development in the Malawi Climate Policy and in the country's Intended Nationally Determined Contribution (INDC) to reduce GHG<sup>8</sup>.

This SE4All Action Agenda for Malawi has been developed according to the guiding principles contained in the Guidelines for Developing National Sustainable Energy for All Action Agendas in Africa that were developed by African stakeholders, notably: (i) Building on existing plans/programs/strategies; (ii) Political commitment and leadership; (iii) A balanced and integrated approach; (iv) An inter-ministerial and cross-sectoral approach; (v) Adherence to sustainable development principles; (vi) Participation and meaningful involvement of all stakeholders; (vii) Gender equality and inclusiveness; and (viii) Transparency and accountability.

The Government is committed to accelerating Malawi's SE4All actions outlined in this report, and integrating them within a broader economic policy. SE4All builds on Malawi's energy and economic foundations to move the country to an energy system that is clean, efficient, and reliable, and that makes modern fuels available to all citizens.

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<sup>8</sup> Intended Nationally Determined Contribution, Republic of Malawi, UNFCCC 2015

# 3. Methodology

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

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

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

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

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

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

# 4.Part I -Vision and targets through 2030

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

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

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

## 4.1 Energy sector status and trajectory

### 4.1.1 Energy Sector Status

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

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

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

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

Ethanol was approved by MERA as a legal fuel in 2014. This has resulted into plans which are underway to construct separate pumps for fuel ethanol where petrol vehicles will be filling their tanks for fuel ethanol in all major towns of the country. However blending of ethanol fuel with petrol at 90:10 is still continuing. National Oil Company of Malawi which has been established under the act of Parliament to manage a strategic fuel reserve facility 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 the Table 8 below.

**Table 8: Energy demand by fuel type<sup>9</sup>**

Sector	Energy demand by fuel type (TJ/ yr)					
	Bioma	Petroleu	Electricit	Coa	Total	
Household	127,57	67	1,79	5	130,04	83.
Industry	10,00	313	201	348	18,62	11.
Transport	27	564	35	1	5,96	3.
Service	45	55	47	17	1,66	1.
<b>Totals</b>	<b>138,30</b>	<b>10,00</b>	<b>432</b>	<b>367</b>	<b>156,29</b>	
%	88.	6.4	2.	2.		

The Malawi government's aspirations are depicted in the National Energy Policy of 2016 in terms of medium and long term plans for the energy mix to move away from biomass towards more modern energy sources. These objectives have been reemphasized in a new draft national energy policy as well.

The strategic objectives of the energy sector (in NEP) include the following:

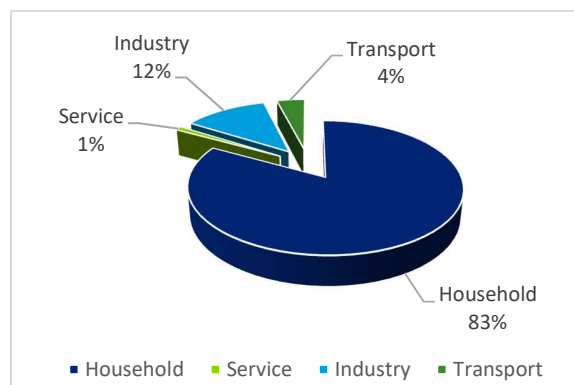
- Increase the number of households with electricity to 30% by 2020 and 40% by 2050. The current (2015) electricity access rate is around 10%.
- Construct new 220-330 kV backbone North – South transmission line.
- Policy and regulatory review to encourage private sector generation and adoption of vandal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

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

<sup>9</sup> Biomass Energy Strategy (2009), Matthew Owen et al.

**Table 9: Energy mix projections<sup>10</sup>**

	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**

Annual energy consumption is estimated to range from 150TJ to 156TJ<sup>11</sup>. The study by Openshaw showed that the consumption pattern has not changed much as per Figure 1.

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

The Malawi energy mix is made up of five components, namely: biomass<sup>12</sup>, electricity, liquid fuel and gas, coal and other renewables. Just as biomass is the main fuel used, it is also the main fuel supplied.

- Biomass contributes the largest share (89%) of total energy use, and is mainly in the form of firewood, charcoal (for urban areas) and crop residues.
- The share of total commercial energy<sup>13</sup> consumption to total energy consumption is relatively small (at 26% of the total energy consumed). Most of the commercial energy consumed is biomass (15%) followed by petroleum (6%).
- By sector, the household is the largest consumer of energy (83%) followed by industry (12%). At 98% of total energy consumed, biomass is the dominant energy source in the household sector.

#### 4.1.2 Electricity generation and transmission plans

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

With the support of the US Government through the Millennium Challenge Corporation (MCC), there is ongoing work to improve transmission and distribution, as well as upgrade generation.

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.

<sup>10</sup> GoM, 2003. Source: Adapted from Openshaw (2008)

<sup>11</sup> 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.

<sup>12</sup> Traditional firewood and charcoal, sourced from forests unsustainably in most of the times

<sup>13</sup> According to National Energy Policy (2003), page 58, commercial energy include liquid fuels, electricity and coal.



**Table 10: Projections on peak demand, capacity requirement and ESCOM's supply capacity<sup>14</sup>**

Year (all figures in MW) <sup>2</sup>	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 <sup>3</sup>	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 ESCOM. This project is currently at the pre-feasibility stage and is slated for completion in 2020.

Apart from the government/ESCOM supported projects, independent power producers are also expected to bring an additional capacity into the national grid dependent on favourable power purchase agreements. Independent Power Producers have been signing MOUs with the government, and the government plans to add 1,500 MW by the year 2020<sup>15</sup>. MERA is reported to assume the responsibility of a negotiator from ESCOM, who are viewed as an interested party<sup>16</sup>.

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

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

In addition, a 30 MW solar energy project with Canadian firm JCM Capital is in the early stages of discussion with the government.

Illovo sugar estates produce electricity from cogeneration using bagasse. The total installed electricity capacity from Nchalo and Dwangwa estates is 18 MW but could potentially generate 100 MW from the two estates<sup>17</sup>.

Malawi has more than 2,000 MW of hydropower potential. Figure 2 shows the location and other details for these potential hydropower projects. Six hydropower projects exist with completed feasibility studies or with feasibility studies currently underway with donor support. These are: a 50 MW hydropower project called Chizuma; a 50 MW hydropower project called Chasombo; a 100-280 MW Mpatamanga project; a 100-150 MW Lower Fufu project; a 20-50 MW Chingonda project; and a 140-280 MW Kholombidzo Project.

There are other Interests in hydropower plants by IPPs: a 52MW plant at Mulanje massif by Kuwale Power and a 40MW plant on Bua River at Mbongozi by HE Power.

<sup>14</sup> Business Opportunities in the Malawi Power Sector, Spring 2015,

<sup>15</sup> Malawi's Mini Integrated Resource Plan, 2016-2020

<sup>16</sup> MERA

<sup>17</sup> 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, 2<sup>nd</sup> to 22<sup>nd</sup> June 2013. Available <https://eneken.ieej.or.jp/data/5006.pdf>



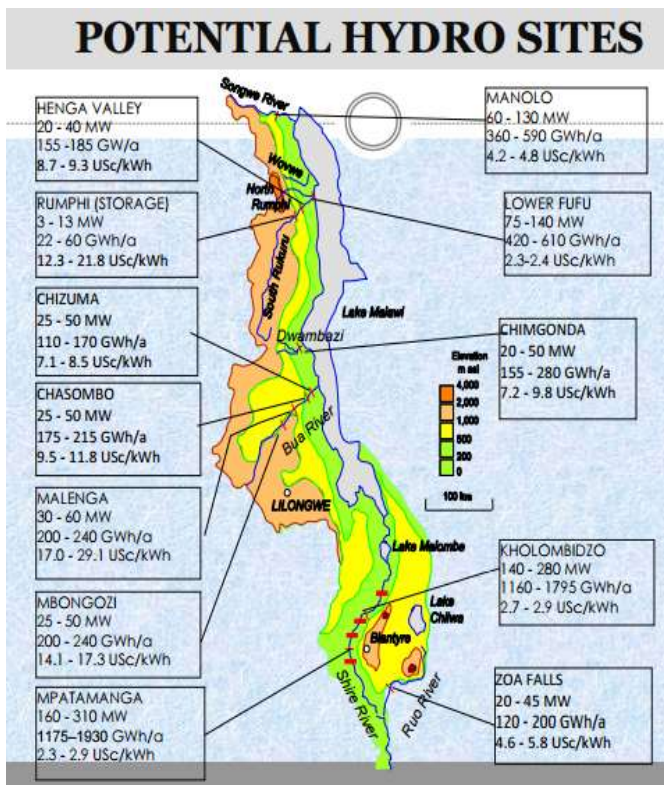


Figure 2: Potential hydropower projects in Malawi

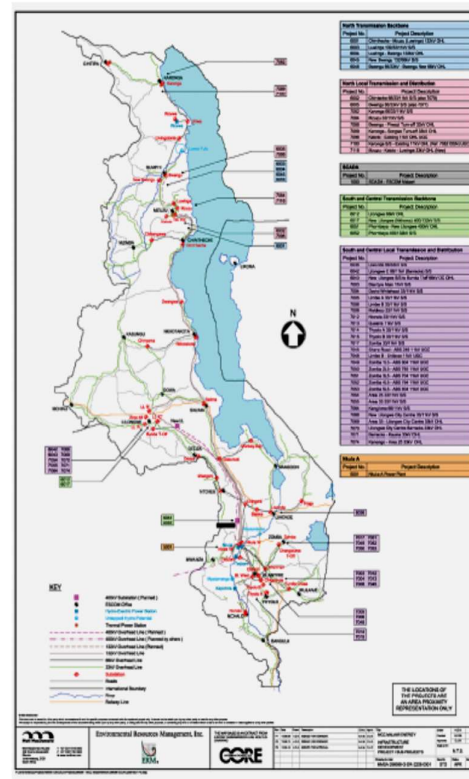


Figure 3: MCC Infrastructure Project Investments

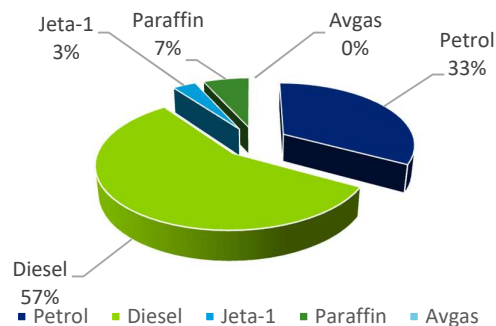
## Petroleum

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

The transport sector consumes about 43% of the commercial energy in Malawi. Petroleum products provide 96% of transport energy, with the remaining 4% coming from local ethanol that is blended with petrol at an official blending ratio is 20:90<sup>18</sup>. The blending ratio is however not met because of limitation of the locally produced ethanol.

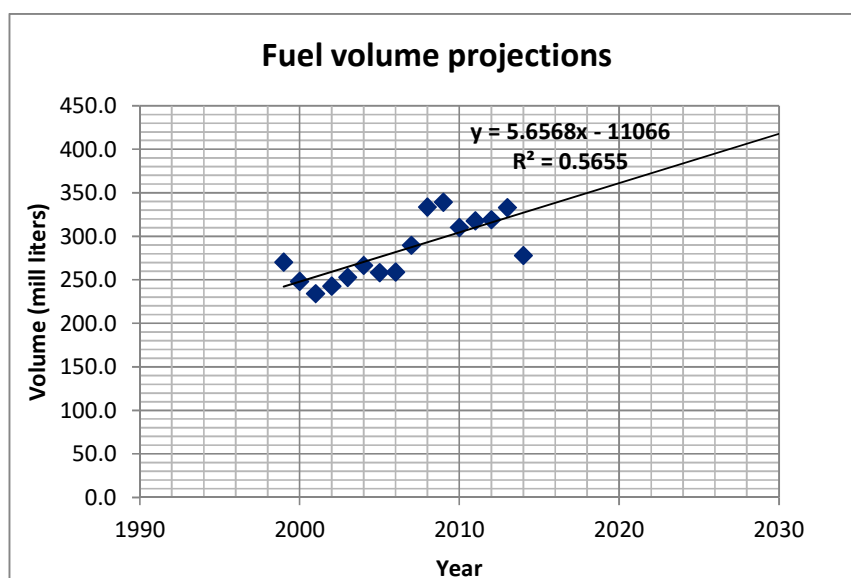
Under Energy Laws, MERA is mandated to regulate pump price for fuels. There is an automatic pricing mechanism which is triggered by movements in the procurement costs and the exchange rate of the Malawi Kwacha against the US Dollar.

<sup>18</sup> National Energy Policy, 2013



**Figure 4: Petroleum products supply based on total imports from 1999 to 2013<sup>19</sup>**

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



**Figure 5: Fuel import projections<sup>20</sup>**

### Other energy-related policy processes

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

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

**Malawi Energy Policy (NEP) of 2003, updated 2016.** The NEP calls for making Malawi's energy sector sufficiently robust and efficient to support country's efforts towards poverty reduction and sustainable economic growth. This policy's long term vision is to drive Malawian economy from a hugely biomass energy reliant one to an economy based on efficient use of modern means and sources of energy. The

<sup>19</sup> Graph was generated from fuel import data in Annual Economic Report - 2014

<sup>20</sup> 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 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.<sup>21</sup> The population is estimated to reach 20 million by 2020 and 27.5 million by 2030. It is further estimated that rural population is approximately 84% which predominantly uses biomass as a source of energy for cooking. This entails 2.9 million households residing in rural areas depend on biomass for cooking and require efficient cook stoves for clean cooking. This is evidenced by the Table 11 below which indicates that 87.7% of households use firewood for cooking in Malawi.

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

**Table 11: Fuel use distribution**

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

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

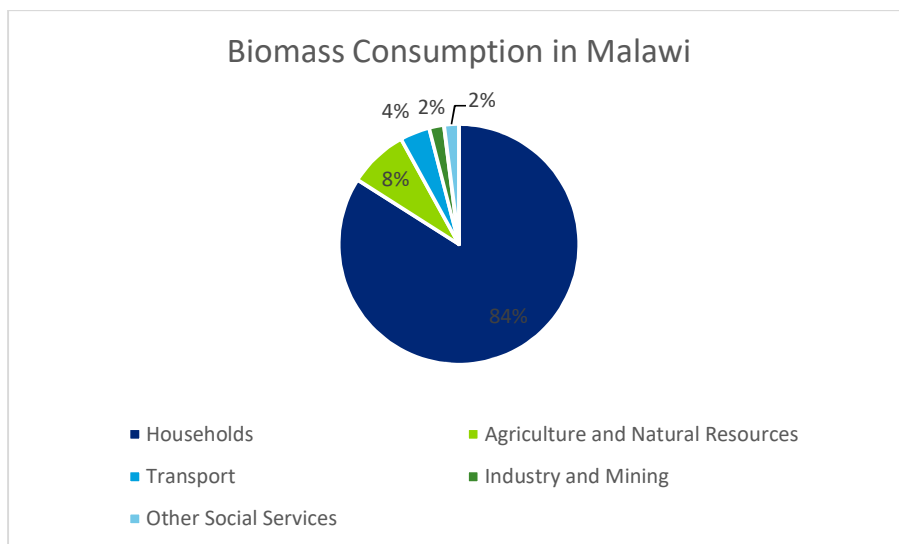
- A country-wide overdependence on biomass.
- Limited use of, and access to, efficient cook stoves.
- Limited access to biomass energy sources.
- Widespread unsustainable charcoal production.
- Tea industry still maintaining the 10% trees cover but tobacco industry still a problem.
- Institutions with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

#### Biomass

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

<sup>21</sup> National Statistical Office (NSO): at [www.nso.malawi.mw/publications/134-population-projections](http://www.nso.malawi.mw/publications/134-population-projections) .....

industrial sectors. The biomass consumption by the different energy sectors is as shown in the Figure below:



**Figure 6: Biomass Consumption in Malawi<sup>22</sup>**

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

After the ProBEC programme the Government of Malawi through Department of Energy instituted the preparation of the Biomass Energy Strategy (BEST) in 2009. The BEST objective was to develop a rational and implementable approach to the management of Malawi's biomass energy sector through a combination of measures designed to improve the sustainability of biomass energy supply, raise end user efficiencies and promote appropriate alternatives. The strategy addresses thermal application of energy and primary cooking. It covers domestic, institutional and industrial applications of biomass and includes both commercial and non-commercial users of fuel<sup>23</sup>. The BEST analyses the supply and demand side of biomass in Malawi with a view to come up with challenges and solutions to the challenges. The major challenge highlighted by the BEST is that most parts of the country especially Central and Southern Regions has the demand for biomass more than the supply such that biomass is being used 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 88.5% of final energy demand and 92% of household demand. In order to ensure that biomass is exploited in a sustainable manner the BEST puts forward the following recommendations:

- Biomass that is at community level should be exploited in such a way that the community closer to the biomass should benefit.

<sup>22</sup> National Energy Policy

<sup>23</sup> Draft BEST, 2009

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

Currently, there is a Cook Stoves Road Map Program whose objective is to accelerate the uptake of clean and efficient stoves to 2 million households by 2020. The program period is January 2015 to December 2017. The partners in the program include the National Cook Stoves Taskforce, Department of Energy, Department of Forestry, Private Sector, Civil society organizations and Development partners. The program will catalyse sustained uptake of clean and efficient stoves in Malawi in order to save energy and reduce smoke emissions for improved cooking environment in Malawi households. Specifically the expected outputs of the programme include the following<sup>24</sup>:

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

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

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

### Existing plans and projections to 2030

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

MAREP will continue extending the grid to rural trading centres and in turn this could influence fuel switching i.e. away from biomass towards electricity for cooking provided the grid extension is backed by adequate investment in new electricity generation. ESCOM has launched the Accelerated Access to Electricity Project which would also add on the number of consumers using electricity for cooking by way

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<sup>24</sup> Cook Stove Road Map, 2015

of fuel switching. Currently 2.5% of households use electricity for cooking (HIS by NSO, 2011). This represents 85,000 households. By 2030 there will be 135,000.00 households using electricity for cooking under BAU scenario. Under BAU the electricity access will be at 22%. However if we put a target of 10% of electrified households at 30% electricity access using electricity for cooking, there will be 540,000 households using electricity for cooking by 2030.

There is no data on the amount of LPG and biogas use for cooking. Nor is there data on the number of LPG or biogas users. We know LPG is used mainly by more affluent consumers and restaurants, but this information is simply anecdotal. However we can estimate that 0.2% use LPG for cooking if we use the data provided by NSO, 2011. This translates into 6,800 households using LPG. As regard biogas plants the stakeholders agreed to the number of 50 for baseline year while the target number was agreed to be 2,000 in 2030 during the working group meeting held on 27<sup>th</sup> April, 2016.

The Government Policy is that Malawi should 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 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?

**Table 12: Proposed targets for Energy Access through 2030**

Type of energy technology	Baseline 2016	Target 2020	Target 2025	Target 2030	Percent of rural population with access, 2030	Percent of total population with access, 2030
<b>Electric Cookers</b>	84000	94,000	106,000	135,000 <sup>25</sup>	4.8	4.0
<b>LPG stoves</b>	6,800.00	15,000	34,000	54,000.00 <sup>26</sup>	2.0	1.6
<b>Efficient cook stoves</b>	500,000	2 million	3.5 million	5 million <sup>27</sup>	100	100
<b>Biogas</b>	50	--	--	2,000	<1.0	<1.0
<b>Solar water heaters</b>	2,000	7,500	17,000	21,000	.7	.6

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

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

- High upfront cost of electric and gas cookers.
- High upfront cost of LPG cylinders and ancillary equipment.

<sup>25</sup> Estimated Based on Current Electricity Domestic Customers

<sup>26</sup> Estimated Based on Current Electricity Domestic Customers

<sup>27</sup> Estimated Based on the Cook Stove Road Map



- Unavailability of affordable financing for the purchase clean cooking equipment.
- Lack of openness to alternatives to charcoal and firewood such as LPG.
- Safety concerns with LPG.
- Limited production of energy efficient technologies such as efficient cook stoves.
- Limited sustainable production of firewood and charcoal.
- Existing charcoal production establishments are not sustainable or legal.
- Limited government capacity to enforce standards.

## Energy Access and Gender

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

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

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

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

- Women need to be involved in the decision making and play a leadership role in promoting decentralised renewable energy access.
- Women need to benefit from renewable energy programmes for economic empowerment.
- Apply a cross sectoral approach to gender, climate and energy policy and programming.
- Promote women's productive use of renewable energy.
- Reduce women's time dedicated to unpaid care and domestic work.
- Target policy processes and build capacity to mainstream gender, climate and energy in an integrated approach.
- Remove investment barriers and create equal opportunities for women's entrepreneurs and decent employment and access technologies.

- Influence budget processes to fund implementation of gender sensitive energy and climate solutions.

## 4.3 Electricity access – On site installations & 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 just 10% of the overall population connected to electricity. Just 37% of the urban population and only 2% of the rural population have electricity connections (NSO, 2009). Overall, as of June 2015, the 10% of the population who had electricity amounted to 312,846 customers, as shown in **Table 9**<sup>28</sup>. Comparatively, the sub-Saharan average is 10% for rural and 36% overall<sup>29</sup>.

**Table 13: Customers connected to electricity in Malawi (2015)**<sup>30</sup>

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

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

In order to increase access to electricity among the rural and low income urban households, ESCOM has launched a US\$500,000.00 Accelerated Electrification Access Project<sup>31</sup>. The project will allow the consumers to have their houses wired and electrified at US\$100.00 with this cost to be repaid in instalments bundled with electricity purchases. Table 10 shows the electricity access rates for different regions of the country.

**Table 14: Access rates**<sup>32</sup>

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

<sup>28</sup> MERA

<sup>29</sup> Regional Electricity Regulators of Southern Africa Meeting-Blantyre –September 2015

<sup>30</sup> MERA, 2015

<sup>31</sup> ESCOM, April 2016

<sup>32</sup> Adapted from IHS 3 (NSO, 2011), page 124. Access rates are based on the Integrated Household Surveys (IHS). HIS-2 was published in 2005, and HIS-3 was published in 2012.



<b>Rural</b>	11.2	13.8	2	2.4
<b>North</b>	8.2	16.2	1.5	6.3
<b>Centre</b>	7.9	18.4	1.8	5.9
<b>South</b>	23.3	25.1	9	8.5

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

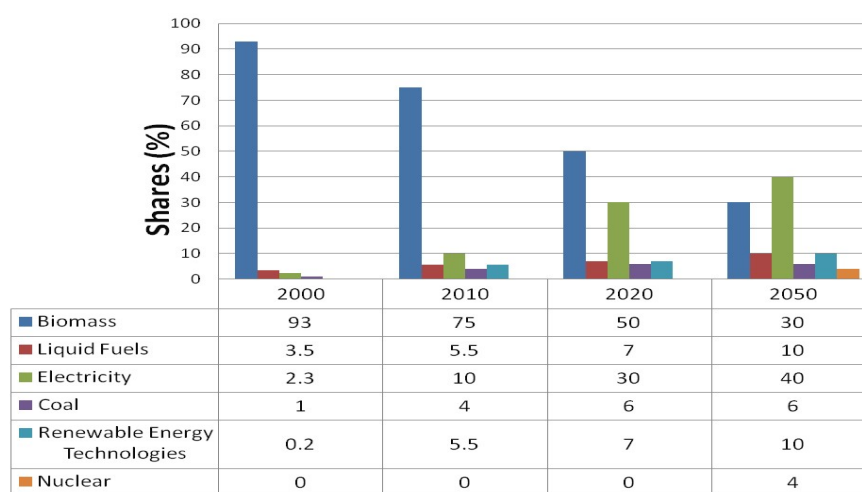
During the stakeholders meeting the following solutions were proposed to accelerate the electricity access through grid extension:

- Formulation of enabling environment to support IPPs for power development.
- Collaboration with relevant institutions to improve and protect catchment areas and enhancement of data collection and management.
- Alternative models of distributing electricity to support productive use in small scale enterprises (charging centres).

### What is the target for 2030 for grid extension?

The target for 2030 is derived from the projected energy mix of the Malawi Energy Policy, as shown in **Error! Reference source not found.** below:

**Figure 7: 2030 target for grid extensions**



By 2030, 30% of households and businesses will be connected to electricity<sup>33</sup>. This will be possible if MAREP continues with its plan of increasing the number of trading centers per year through grid extension and ESCOM continues with the Accelerated Electrification Access Project. This entails 87,000 households and businesses being connected per year up to 2030. The 87,000 households and businesses could be attained per year through the following projected figures:

**Figure 8: Grid extension targets – SE4ALL**

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

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

**Figure 9: Grid extension targets - BAU**

Method	Number of Households & Businesses-Baseline 2016/Yr	Number of Households & Businesses/Year through 2030
<b>MAREP-Grid Extension</b>	5,000.00	10,000.00
<b>ESCOM-Grid Extension</b>	50,000.00	50,000.00 <sup>34</sup>

#### 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 SE4ALL targets are as follows:

**Figure 10: Grid extension targets - Gap**

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

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

- High upfront connection cost (i.e. wiring cost and connection fee).
- High back log of unconnected customers by the utility company.
- Lack of connecting equipment such as meters and drop wire by the utility company.
- Failure of the utility company to involve private companies in the provision of meters and drop wire by way of selling them directly to customers.
- Currently the utility company has hiked its tariff by 18.18% resulting into 9.4 US Cents per unit from 8 US Cents per unit while the purchasing power of Malawians is low due to the poor performance of the economy.
- Vandalism of the utility company equipment such as theft of transformer oil and earth

<sup>33</sup> Integrated Resource Plan, 2015

<sup>34</sup> ESCOM KPI

mats.

- Overdependence on Shire River for on-grid electricity generation.
- Low generation capacity.
- Environmental degradation of the catchment areas for rivers that provide hydro power.

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

Malawi is well endowed with renewable energy sources, which include solar, wind, biomass, biogas, geothermal and hydropower. Malawi has solar irradiation of 21.1MJ/m<sup>2</sup>/dy and wind speeds averaging 2-7m/s (Malawi Energy Policy, 2003). All these renewable energy sources can bring electricity to the Malawi communities. The mostly used renewable energy resource for electricity for off-grid options is solar energy. The current status of Off-Grid Options as pointed out during the stakeholders meeting is characterised by:

- A maximum of 140,000 pico-solar lanterns and SHS reported / estimated as sold over the past few years.
- Influx of poor quality products.
- Poor maintenance regimes of solar systems in public institutions. For example, a survey solar conducted by the UN Foundation in Malawi of health centers with solar systems found that only 57% of solar systems were functional.
- Lack of information on the operation and maintenance of the system.
- There are more than 5 solar energy kiosk centres to cater for the rural communities far away from the grid.
- 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).

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

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

#### 4.3.3 Existing plans and projections to 2030

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

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

#### Scotland Government Initiative

The Government of Scotland is funding two renewable energy projects in the period 2015 to 2018. One project is the Sustainable Off-grid Electrification of Rural Villages (SOGERV). The project aims to electrify the rural areas of Chikwawa District. The project will electrify households, businesses and community energy infrastructure. The objective of the project is to reduce energy poverty in the rural areas. The project cost is 599,028 pounds. The project is implemented by Concern Universal in coordination with the

Centre for Water Sanitation Health & Appropriate Technology Development (WASHTED) at the Polytechnic. The overarching aim of SOGERV project is to meet the Sustainable Energy for All goal of increasing energy access in Malawi where electricity access is currently only 10% overall and less than 1% in rural areas. The other project is Powering Development in Mulanje (PDM). The objective of the project is to catalyse social and economic development of the poor communities around Mulanje Mountain by supplying renewable electricity through mini-grid option powered by micro hydro power station. The project cost is 599,374 pounds.

### European Union Initiative

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

### Government of Malawi Initiative

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

### What is the target for 2030 for off grid options?

The targets for 2030 are estimated as shown in the table below. The targets are estimated based on the Malawi Energy Policy, 2003. It is expected that 10% of households and businesses will be using renewable energy by 2030<sup>35</sup>.

**Table 15: Off grid targets**

Energy Type	Baseline 2016	Target 2020	Target 2025	Target 2030
<b>Grid extension</b>	291,000	640,000	1.08 million	1.51 million
<b>Solar Home Systems</b>	5,000	25,000	50,000	75,000
<b>Mini grids</b>	900	4,500	9,000	13,500
<b>Pico solar Systems</b>	300,000	1.5 million	3 million	4.5 million

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

- High upfront cost of solar systems and yet there are no appropriate financing mechanisms.
- Low quality products such as solar panels due to limited capacity to enforce standards by MBS.

<sup>35</sup> Malawi Energy Policy, 2003

- Low transparency on quality and pricing issues to end users such as duty waivers seem to benefit only the RETs suppliers.
- Rigorous Regulation , in its current form, appears to impede the implementation of mini-grids. There will be need to rationalize and make appropriate amendments while ensuring safety and quality in service delivery.
- Private companies are not encouraged to invest in mini-grids by way of operation and maintenance subsidy from Government.
- Private companies are not encouraged to invest in rural solar energy kiosks by way of operation and maintenance subsidy from Government.
- Power purchase agreements delays and its operating environment seem to prevent IPP entry into the power generation.

## 4.4 Renewable Energy

The costs of grid-connected renewable energy projects, particularly solar and wind, have been in a worldwide decline in recent years. The lower costs, combined with innovative financing techniques, have made renewable energy projects competitive with conventional energy projects in many places. Governments are responding by removing barriers to RE projects, such as cumbersome licensing and approval processes, and adopting RE-friendly policies like feed-in tariffs and RE purchase obligations for utilities.

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

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

## Current situation by energy type

### Solar

According to a 2015 World Bank analysis, Malawi has very good potential for exploitation of solar resources and good opportunities for photovoltaics predominantly small to medium size ground-mounted and roof-top systems.<sup>36</sup> 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

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<sup>36</sup> Solar Resource Mapping in Malawi: Solar Modeling Report, Energy Sector Management Assistance Program, World Bank, March 2015

lighting systems have been installed in some households and public institutions such as hospitals. However, these systems usually fail after a short period due to poor technical capability (poor designs, poor installation, lack of independent supervision/assessment/certification during project implementation, limited knowledge on operation and maintenance, supply of poor quality products etc.). Problems were also experienced with wind-solar hybrid systems. The Government of Malawi installed six wind-solar grids but due to beneficiaries' failure to pay for the use of the system and the resulting lack of maintenance, all but one of the systems have ceased operating.

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

### **Wind**

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

### **Biomass**

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

### **Biogas**

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

### **Small hydro**

Micro Hydro at MEGA is supplying power to about 200 households. Resource assessments estimate there is a 15 MW potential for small and micro hydro<sup>37</sup>.

### **Geothermal**

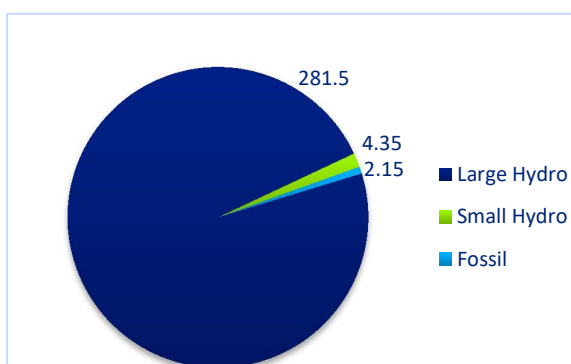
No geothermal power projects have been developed yet, but the Government of Malawi, with World Bank support, is sponsoring a feasibility study that is currently under way (fall 2016).

## **Current situation with power generation**

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<sup>37</sup> World Small Hydropower Development Report 2013 – Eastern Africa, UNIDO and International Center on Small Hydro Power, [www.smallhydroworld.org](http://www.smallhydroworld.org)

Malawi's electric system is based mainly by hydropower, with 90% of the hydro capacity located on the Shire River. The installed capacity of hydro is 351 MW, of which 311 MW is operational, but not fully available due to low water levels on the Shire River. The available capacity is about 286 MW (See Fig. 6). Only 4.5MW 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 11: Available Generating Capacity, MW, 2014**

Two small diesel units are connected on the national grid. Likoma Island is powered by diesel generators with a capacity of 250 kW. The total electricity generated in 2014 was 1,906.51 GWh, of which 797.46 GWh were consumed. All grid-connected power plants are listed in Table 16

The country experiences regular power outages, and nationwide suppressed demand is estimated at 350 MW. If all the potential domestic and industrial customers were connected, the demand would roughly triple.

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

**Table 16: Installed Electric Generation Units, MW, 2014**

Project	Description	Total capacity
<b>Nkula Falls A</b>	3 units at 8 MW each	24.00
<b>Nkula Falls B</b>	5 units at 20 MW each	100.00
<b>Tedzani Falls I</b>	2 units at 10 MW each	20.00
<b>Tedzani Falls II</b>	2 units at 10 MW each	20.00
<b>Tedzani Falls III</b>	2 units at 26.35 MW each	52.70
<b>Wovwe Mini Hydro</b>	3 units at 1.45 MW each	4.35
<b>Kapichara Falls Phase I</b>	2 units at 32.4 MW each	64.80
<b>Mzuzu Diesel</b>	1 unit at 1.1 MW	1.10
<b>Likoma Island Diesel</b>	3 units at 250 KW each	0.75
<b>Chizumulu Islands Diesel</b>	2 units at 150 KW each	0.30
<b>TOTAL</b>		288.00

Currently the construction of new North-South 220-330 kV backbone transmission lines are underway. These will improve the reliability of the electricity grid and allow it to more readily accommodate intermittent power generation sources like solar and wind.

### Current situation with government policy

The main legislation guiding energy sector development are the following:

- National Energy Policy 2003.
- The Electricity Act 2004.

- Rural Electrification Act 2004.
- Energy Regulation Act 2004.
- Liquid Fuels and Gas Act 2004.
- No specific RE law but RE is embedded in pieces in above laws.

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

### Incentives/Disincentives/Taxation

Current government policy allows RE products to be exempt from import and excise duty. However, during the SE4All stakeholder consultations, stakeholders stated that some MRA officials are not knowledgeable about what constitutes a renewable energy product. As a result, some importers have consistently had problems clearing their RE merchandise into the country. This appears to be a particular problem with turbines and generators used for hydro projects as well as batteries used in solar home systems.

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

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

### Existing plans and projections to 2030

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

The government’s proposed energy policy update references a discussion in August 2015 in which MNREM, in consultation with MERA, ESCOM, and the Public Private Partnership Commission, came up with a list of projects to be implemented (shown in Table 14). 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<sup>38</sup>.

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

**Table 17 Government-Planned Electricity Generation Projects Planned for 2015 - 2025**

Project	Technology	Capacity (Mw)	Current Status
<b>NEAR- TERM (2015 – 2020)</b>			
<b>Unspecified solar</b>	Solar	15	Solar mapping in progress
<b>Unspecified Diesel (ESCOM)</b>	Diesel	10	Installation in progress

<sup>38</sup> “Energy Supply Options & Technologies Recommendations,” PWC, 2015, p. 5.



Project	Technology	Capacity (Mw)	Current Status
Unspecified Diesel (ESCOM)	Diesel	6	Procurement in progress
Unspecified Diesel (ESCOM)	Diesel	30	Procurement in progress
Illovo	Bagasse	6	Engineering studies in progress
Illovo	Bagasse	40	Feasibility Study in progress
Unspecified DSM	EE & conservation	105	Concept stage
Tadzani IV (ESCOM)	Hydro	22	Funding ready (JICA)
Kammwamba (GVT)	Coal	300	Awaiting financing
Mpatamanga (ESCOM)	Hydro	350	Feasibility Study in progress
Karonga	Coal	200	Concept Stage
Kholombidzo	Hydro	200	Feasibility Study in progress
Unspecified solar	Solar	99	Financing ready
Malawi-Mozambique	Imports	50	MOU signed
Mbongozi (HE Power)	Hydro	41	Awaiting PPA
Nkula A	Hydro upgrade	12	
Tedzani III	Hydro upgrade	10	
Chizuma(SINO hydro)	Hydro	50	Awaiting financing
Unspecified geothermal	Geothermal		Consultancy put on hold due to funds. Awaiting WB review in September.
<b>SUB TOTAL</b>		<b>1,546</b>	
<b>Medium-term (2020 – 2025)</b>			
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
<b>SUB TOTAL</b>		<b>313</b>	
<b>GRAND TOTAL</b>		<b>1,859</b>	

According to the referenced energy policy paper, these figures were generated from a rule of the thumb that a grid can accommodate only 6% of its total capacity from intermittent sources like solar and wind. But this rule of thumb is incorrect. Wind already supplies 24% of Denmark's electricity generation and over 14% of Spain and Portugal's.<sup>39, 40</sup> Germany generates more than 30% of its electricity from renewable

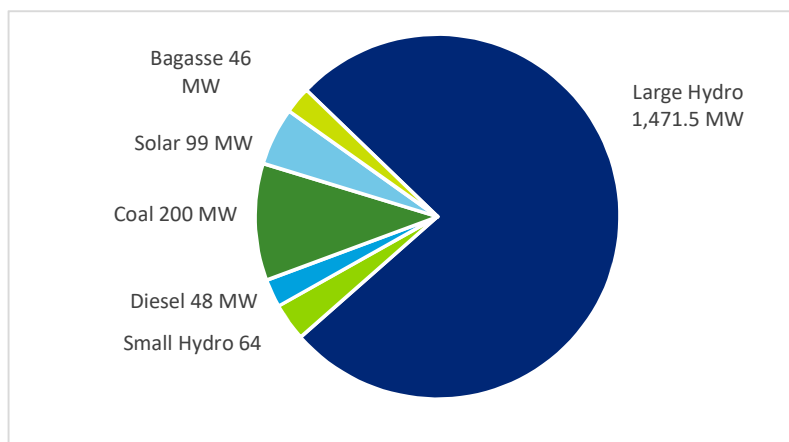
<sup>39</sup> "Energy System Analysis of 100% Renewable Energy Systems – The Case of Denmark in Years 2030 and 2050," 4<sup>th</sup> Dubrovnik Conference, 2009 <http://www.sciencedirect.com/science/article/pii/S0360544208000959>;

sources. Its goal is at least 80% by 2050. A number of other grid operators in the world plan to generate far more than 6% of their power from intermittent RE sources, and many studies show how various countries can derive 100% of their power generation from renewable energy<sup>41</sup>. While the examples cited are all industrialized countries, the future of electricity grids around the world is one of the greater reliances on renewable energy. Malawi can move in that direction.

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

We have included energy policy paper's conservative solar figures - 5 MW of solar added by 2020 and 99 MW added by 2025 - in our BAU power sector trajectory for Malawi (see Figure 13). 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 13. Even though proposed energy policy shows an increasing diversity of generation resources, large hydro will account for 75% of capacity.

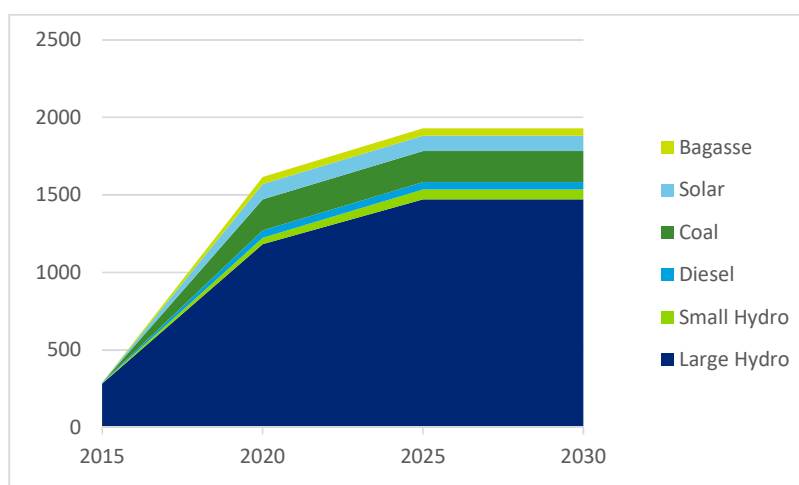
**Figure 12: Anticipated 2025 Capacity from Energy Policy Paper, Year 2025**



<sup>40</sup> "How To Achieve 100% RES Electricity Supply for Portugal, 5<sup>th</sup> Dubrovnik Conferences, 2011  
<http://www.sciencedirect.com/science/article/pii/S0306261910003703>

<sup>41</sup> "Can Renewables Provide Baseload Power?" Skeptical Science, <http://www.skepticalscience.com/print.php?r=374>

**Figure 13: 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 the low water levels at the existing Shire River hydro plants, and the uncertain impact of climate change on future water flows, a diversification of generation resources may be a more prudent path. There is also good potential for development of coal, solar and wind power resources. Table 19 shows the first 15 IPP projects that have MOUs with the Government of Malawi as of November 2015 (There are over 30 projects with signed MOUs as of October 2016). They represent roughly 3,500 MW worth of installed capacity, although none have begun construction and just one has a signed PPA. Many are still at a very preliminary conceptual stage, while others, such as the Atlas solar project, have completed all studies and licensing and are simply waiting for ESCOM to sign the PPA. The numbers of MOUs are constantly changing, but as far as the number of projects in place, none have been built yet.

**Table 18: Pipeline of Independent Power Projects (November 2015)<sup>42</sup>**

Company	Technology	Capacity (MW)	Date MOU Signed	Status
<b>Mbongozi (HE Power)</b>	Hydro	41	24-Jun-11	Financial closure stage
<b>Bua Hydro Power Ltd.</b>	Hydro	60	04-Apr-12	Negotiating term sheet with ESCOM
<b>Maple Ltd.</b>	Coal	190	Jan-15	Seeking feasibility study funding
<b>Atlas Energy Malawi</b>	Solar	200	10-Feb-15	Waiting for ESCOM to sign PPA
<b>CTI Africa LLC</b>	Solar	120	02-Aug-15	Under discussion with ESCOM & Ministry
<b>Sinohydro</b>	Hydro (Chizuma) Coal Solar	80 300 125	05-Aug-15	Preparing project proposal
<b>Airon Green Energy</b>	Wind, solar & hydro	tbd	09-Aug-15	Preparing to invest 1st Q, 2016
<b>Water Wheel Int'l Inc.</b>	Hydro	30	04-Sep-15	Conducting feasibility study
<b>JCM Clean Power Dev.</b>	Solar	20-25	10-Sep-15	Feasibility study & PPA negotiation underway
<b>Africa Energy &amp; Power</b>	Solar	350	15-Sep-15	Negotiating PPA

<sup>42</sup> Ministry of Natural Resources, Energy and Mining, Press Release, November 26, 2015

Company	Technology	Capacity (MW)	Date MOU Signed	Status
<b>Corp.</b>				
<b>AX-ON Africa Holdings</b>	Solar	90	17-Sep-15	Conducting grid impact study
<b>Grow Mine Africa (PTY) Ltd.</b>	Solar, wind, geothermal, coal, natural gas	2,000	06-Oct-05	Waiting for signing of term sheets and PPAs
<b>CDC Group, UK</b>	Solar Heavy fuel	10 56	12-Oct-15	Negotiating project documents
<b>Ulalo Capital Investments Ltd.</b>	Solar	200	06-Nov-15	Negotiating PPA
<b>China Gezhouba</b>	Coal	300	11/18/2015 (preliminary)	Hope to start project implementation in mid-2016
<b>Dongfang Electric Intl. Corp.</b>	Solar, hydro, diesel	tbd	20-Nov-15	Project proposals under development

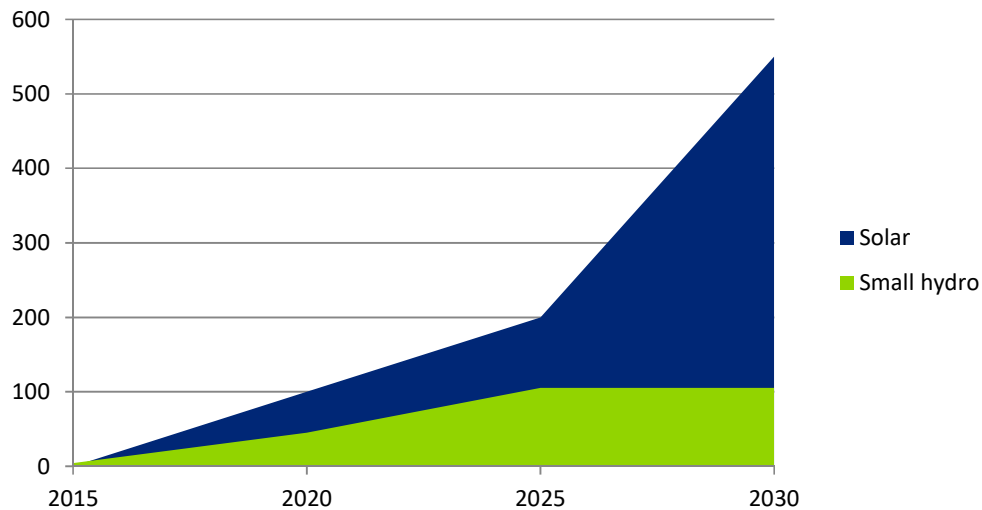
Because of the uncertainty surrounding the signing of the PPAs, it is difficult to determine the trajectory of power development in Malawi. The RE projects on this list total 1,326 MW. Of those, the ones that are in, or nearly in, the PPA negotiation stage as of February 2016 come to 966 MW. If these can be approved, financed, built and interconnected to the grid, it will quadruple Malawi's available capacity, although the solar power will be intermittent and the hydro power will be subject to the same risks of insufficient river flow as the existing hydro projects. Still, adding solar to the mix will help diversify the power sources. We assume just four of the IPP RE projects waiting for PPAs move forward by 2030:

- HE Power (hydro) 41 MW.
- Bua (hydro) 60 MW.
- Atlas (solar) 200 MW.
- Africa Energy & Power (solar) 350 MW.

Thus, the proposed 2030 target for small-to-medium hydro is 101 MW. The solar target is 550 MW by 2030, with an interim target of 100 MW by 2020 as specified by the SE4ALL Renewable Energy Working Group. While the targets are based on the above several projects, many RE projects have been proposed and the eventual mix of projects implemented to reach the targets may well be different from those listed. .

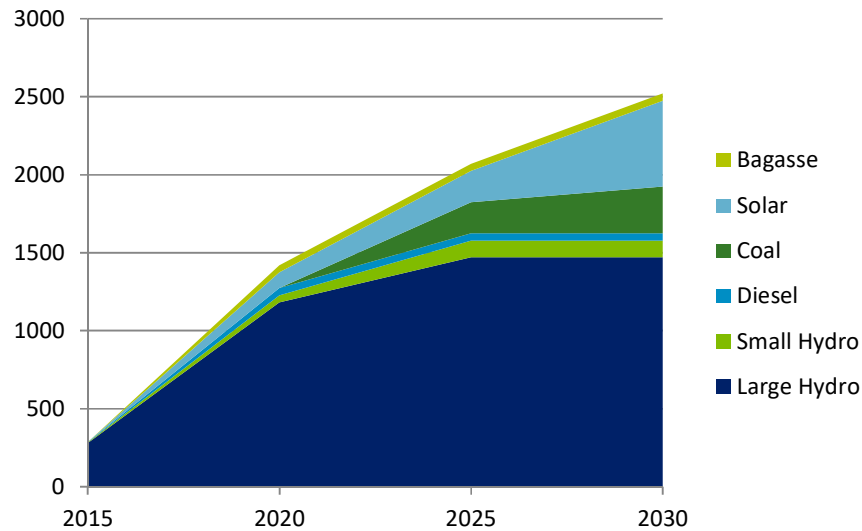
A possible trajectory of these projects, totalling 651 MW by 2030, might look like 11.

**Figure 14: Renewable Energy Targets Achieved by 2030, MW**



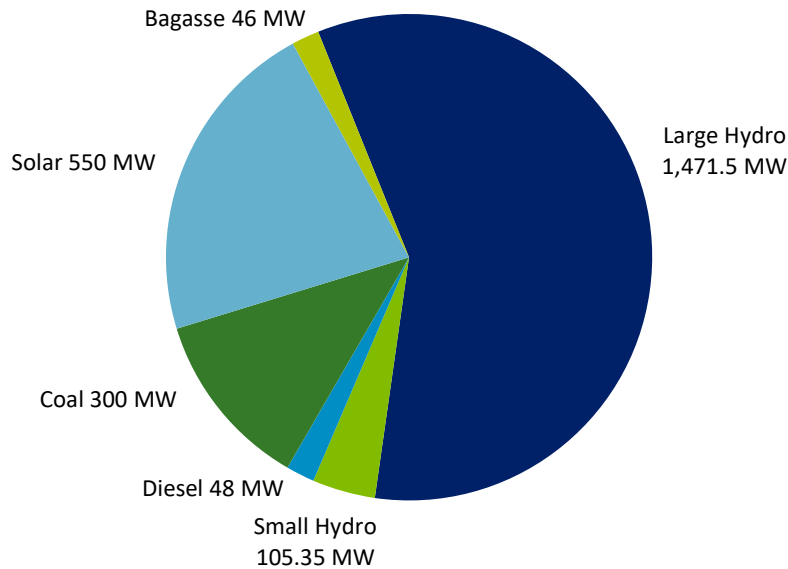
Combining these projects with Malawi’s existing installed generating capacity and the additional hydro and fossil projects anticipated in the energy policy paper, Malawi’s electric generating trajectory looks like Figure 12. In this scenario, most of the solar generating capacity is added between 2025 and 2030. It will account for approximately 22% of Malawi’s generating capacity. Total RE capacity (including large hydro, small hydro, solar and bagasse) will be 2,173 MW or roughly 86% of Malawi’s installed capacity.

**Figure 15: Installed Generating Trajectory Including RE Targets, MW**



The full 2030 installed capacity, based on the energy policy paper projections plus the addition of the SE4ALL RE target of 651 MW (2 solar and 2 small-to-medium hydro) amounts to 2,620.85 MW and is shown in Figure 16. We note that as better renewable energy resource assessments are conducted in Malawi in the coming years, additional RE resources will likely be identified (particularly wind energy) that could contribute to the 2030 energy picture, and the targets will need to be adjusted accordingly.

**Figure 16: Installed Generating Capacity in 2030 based on Energy Policy Paper plus SE4All RE Targets**



We further note that the solar target does not include on-site grid-connected solar installations on rooftops or over parking lots or for powering street lights. The Government supports such installations, particularly at colleges and hospitals, but because of the high uncertainties surrounding their possible development and their relatively small size, they are not included in these targets. However, they are addressed in the Energy Access section of the report<sup>43</sup>.

#### **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 SE4All solar target of 550 MW of grid-connected solar power by 2030 based on the combined capacity of just two of the solar projects currently waiting for PPAs. There is thus a gap of 451 MW between the BAU strategy and the achievable SE4All target.

For large hydro and small hydro, there is no gap between the BAU estimates and the SE4All targets for 2030.

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

- Capital finance shortage, resulting in underinvestment in generation, transmission, and distribution.
- Lack of political will.
- Lack of interest and participation of other ministries, corporations, and other organisations.
- Banks and individuals are reluctant to finance on-site RE projects as the technology and business is still considered risky.
- Consumer financing for RE is not readily available and most of the rural communities cannot afford to purchase RE systems.
- The rent to own ("Pay-as-you-go" or PaYG) approach has been introduced -- whereby

<sup>43</sup> Mini Integrated Resource Plan, 2015, p. 28

consumers are given the system which they buy by paying in small instalments – but is not expanding very quickly.

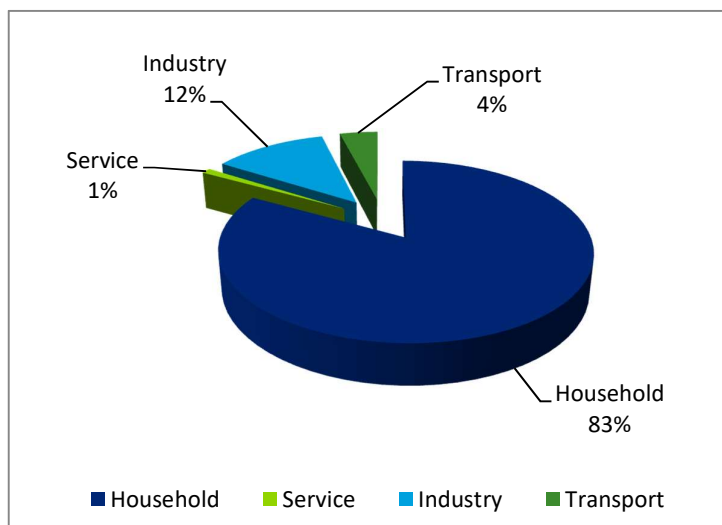
- MAREP fund, which finances grid extension, is not being used for off-grid applications.
- Lack of training and skills.
- Ambiguous/un-clear exemption plan. Some RE products are not yet in the schedule for exempted products e.g. turbines and generators for hydro use and even SWH.

## 4.5 Energy Efficiency

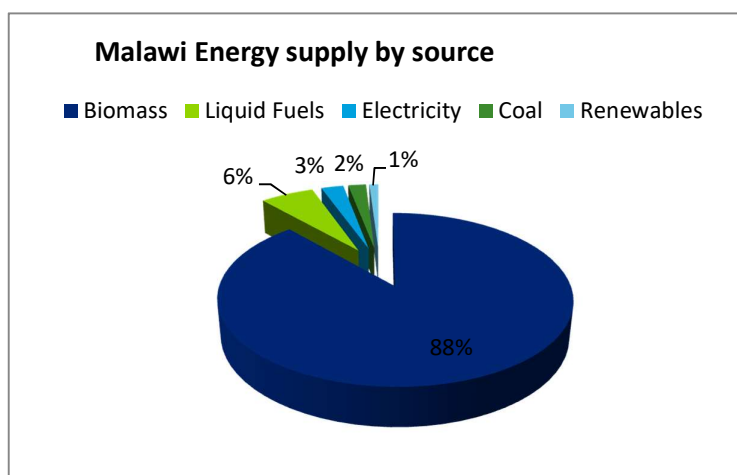
### 4.5.1 What is the current status and BAU trajectory to 2030?

#### 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 (see figure 14 below). As figure 15 below indicates, the energy supply in the country is heavily dominated by biomass (over 88% of total energy supply), followed by liquid fuels (6%) and electricity (2.5%). Firewood is the major energy source in Malawi, providing 95% of rural household energy supply and 55% for urban households, followed by charcoal which accounts for over 30% of urban household energy supply. The present structure of Malawi's energy supply and demand with its inherent dependence on biomass not only renders the national economy highly uncompetitive, but also exhausts country's once abundant natural resources. Acknowledging the importance of efficient energy use the GoM committed itself (in the National Energy Policy of 2003) to encourage the efficient use of biomass through a set of market pitching activities.



**Figure 17: Energy supply by source**



**Figure 18: Energy consumption in Malawi by sector**

### Energy intensity of Malawi's economy

Energy intensity (expressed as the ratio between gross inland energy consumption and country's GDP) is commonly used as an indication of the energy efficiency of a country's economy. Unfortunately, data on Malawi's energy intensity (a ratio of energy consumption to country's GDP) is not available in International Energy Agency's (IEA) database. According to statistics from the Open data for Africa web portal ([www.opendataforafrica.org](http://www.opendataforafrica.org)), the energy intensity (British thermal units/GDP USD 2005) of the Malawian economy in 2011 was 1,655 Btu/USD, which is well below the reported intensity of most of countries in the region (Zambia – 7,518 Btu/USD; Zimbabwe – 5,871 Btu/USD; Mozambique – 9,917 Btu/USD) and slightly over the least energy intensive regional peers such as Uganda (1,047 Btu/USD 2005). A robust downtrend in Malawi's energy intensity ratio is observed over the past six years between 2006 and 2011 (the most recent period energy intensity data is available for – see Table 19 below), mainly fuelled by the sustainable GDP growth attained over the same period. However, this is not necessarily a sign of highly energy efficient economy, but is rather a reflection of the specific structure of the national economy (dominated by rural and agricultural sectors) and the large scale of consumption of unsustainably sourced fire wood, which is not accounted for in the official statistic.



**Table 19 Malawi Energy intensity Btu/2005 US Dollar of GDP**

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

### Existing situation and projections to 2030

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

#### Tariff development

For many years the electricity consumers in Malawi enjoyed well-subsidized tariffs, rendering the EE related investments highly unprofitable. In November 2009, MERA approved a 56.2% increase in electricity tariffs to cover four years between 2010 and 2013; the increase was implemented in two stages with a 36% increase taking place in December 2009 and a second hike of 20.2% (relative to the electricity tariff levels prevailing at the time, which effectively translated into a cumulative tariff increase of 61 percent) implemented in January 2011. In 2009, a time-of-use tariff was introduced for commercial and industrial customers on three-phase supply. Several other electricity rate hikes took place in recent years, the most recent one in November 2015, but due to the local currency devaluation the tariff is very low compared to the regional and international standards. 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 20: ESCOM current electricity tariff**

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

#### Clean cook stoves initiatives

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

- Chinansi Foundation Improved Cook stoves project: the project financed by Fair Climate Network Southern Africa aims at reducing the deforestation rate in the climate change vulnerable Balaka district by rolling out about 60,000 improved cook stoves (called mtetezi mbaula) among local families. The seven years project is expected to deliver multiple environmental benefits. Not only will it reduce the deforestation rate by bringing down the quantity of firewood used for cooking, but will also create a healthier kitchen environment in the district. The implementation of this initiative will positively

affect the local business environment, since the efficient stoves will be produced by local craftsmen who will be trained under the project.

- EnDev / MAEVE energy conservation Malawi project. MAEVE is a Malawian NGO whose main domain of activity is promoting the uptake of fuel efficient and clean technologies across the country. After receiving a grant from Energizing Development (EnDev) MAEVE has launched a project in 2013 aiming to promote the Chitetezo Mbaula stove among urban households. Relative to the three stone fire the Chitetezo stoves decrease fuel use by 34%. The project involves carrying out measures to strengthen both the supply and the demand side. Demand-side activities focus on generating greater consumer interest in the ceramic, wood-burning stove known locally as the 'Chitetezo Mbaula'. On the supply side, the project partners provide training and skills for the craftsmen who produce the stove. To successfully achieve its targets, MAEVE developed a network of vendors in all urban centres ensuring availability of the product countrywide and ease of access for those who wish to buy. Maeve has engaged one of the major local retailers, Chipiku Stores, who have over 80 outlets nationwide to be one of their distributors of the stove. The initial objective of the initiative that started in 2013 was to reach at least 28 000 households within the first 15 months of the project. Early stage results indicate that by December 2014, nearly 93,654 people had gained access to improved forms of energy for cooking. The number of stoves manufactured by around 50 producer groups and subsequently sold through sales channels introduced by EnDev has risen to 8,000 each month, which is much more than the initially anticipated uptake pace. The end goal of the project is to provide access to clean cooking to some 625,000 people countrywide by the end of 2016. The planned measures are expected to reduce exposure to smoke – mainly among women and children – in 140,000 urban households, and reduce deforestation by saving 65,000 tonnes of wood.
- The Cook stoves road map, currently developed and promoted by the GoM will roll out 2 million efficient stoves to both rural and urban households by 2020. The initiative recently launched by the President will be carried out in collaboration with international development partners (the governments of US and Ireland among others) and local NGOs. This is part of the country's commitment as a signatory to the Global Alliance on clean cook stoves which aims at adoption of clean cook stoves by 100 million households by 2020 worldwide.

## Lighting

### The Malawi Energy Efficient Lighting Project

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

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

### Capital Hill Solar Street Lights Project

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

### Import tariff and fiscal incentives

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

### Public awareness campaigns

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

### Prepaid meters

Prepaid meters have some inherent Demand Side Management (DSM) features that improve energy efficiency for customers as they receive instant feedback on their energy usage, which prompts energy saving attitude. Impact assessments of pre-paid meter programs implemented in other South-African countries (e.g. Zimbabwe) show that a shift from post to pre-paid metering may inflict energy usage decrease as high as 22%. Since the start of its pre-paid meters program in 2011, ESCOM has achieved remarkable progress. The number of domestic consumers (the households account for over 90% of all ESCOM customers) with installed pre-paid meters surpassed 186,000 or nearly 60% of all grid connected clients. Nearly 105,000 (or 34% of all clients) households and around 22,000 industrial clients still use post-paid metering devices<sup>44</sup>. Along with substantial energy savings, the pre-paid meters program may well improve ESCOM's financial status, driving up the electricity bill collection rate.

### Supply side projects

#### The WB Energy Sector Support Project

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

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

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

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<sup>44</sup> MERA 2015

## Millennium Challenge Corporation – Malawi Power Sector Revitalization Project

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

### Institutional

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

- **The Malawi Growth and Development Strategy II (MGDS II)** The Strategy acknowledges that a well-developed and efficient energy system is vital for socio-economic development and calls for development of efficient energy system in Malawi. Improving the management of energy generation, transmission, distribution and supply and promoting the use of renewable sources of energy are among the key strategies set forth in the MGDS II. Installation of smart meters on distribution feeders, review of the existing electricity master plan and rehabilitation of major hydropower stations and the transition and distribution network are among the focus actions and activities outlined in the Strategy.
- **Malawi Energy Policy (NEP) of 2003 – currently under revision.** Acknowledging that the biomass is the major energy source and will remain so for the years to come, the NEP states that the GoM will encourage the efficient use of biomass through market pitching activities such as: i) promotion of efficient biomass use through civic education; ii) training and research in production, marketing and use of efficient technologies; iii) involvement of all stakeholders groups (incl. local communities) in producing and marketing efficient biomass technologies), etc.
- **Malawi Biomass Energy Strategy (BEST)** aims at developing a rational and implementable approach to the management of Malawi's biomass energy sector through a combination of measures designed to improve the sustainability of biomass energy supply, raise end-user efficiencies and promote appropriate alternatives. BEST provides detailed insight on both biomass energy demand and supply side, recommending a number of potential priority actions and measures to render the biomass energy consumption more efficient. Provided that the biomass is the major energy source in Malawi and is expected to remain so in the foreseeable future, this Strategy is a cornerstone national document in country's aspirations towards efficient energy use.
- **The National Climate Change Investment Plan 2013 – 2018(NCCIP):** a complementary to the MGDS II this plan aims to create enabling environment for increase of the overall volume of climate change related investments in Malawi. The Plan identifies four priority areas to promote climate change management in Malawi: i) adaptation; ii) mitigation; iii) climate change research, technology development and transfer and iv) capacity building. NCCIP calls for the development of several climate change tackling programmes and initiatives with reference to EE:
  - **Enhancing energy saving technology program** that focuses on enhancing capacity for low emission development strategies (EC-LEDS) to pursue long-term, transformative development and accelerate sustainable, climate-resilient economic growth while slowing the growth of greenhouse gas (GHG) emissions. This program is aimed at improving energy efficiency and effectiveness in selected urban and rural areas in Malawi by building local capacity (technical, analytical, and policy) and establishing a national GHG

Inventory Management System. The enhancing energy-saving technology programme is estimated to cost app. USD 60 million over the 5 years period of the Plan.

- **Climate change mitigation technology development programme** which is expected to improve Malawi's mitigative capacity to climate change by supporting research projects focused on selecting the most appropriate climate change mitigating technologies. The research projects will aim at identifying Malawi's climate change related technology needs, finding the most efficient technology options available and adapt them to meet Malawi's specific needs and the local business and social environment.
- **Establishment of a National Climate Change Fund (NCCF):** to develop a streamlined and efficient mechanism for channelling IFI and locally raised climate change resources, the NCCIP calls for the establishment of a dedicated National Climate Change Fund. The Fund will provide financing and technical support and advice to all climate change stakeholders in Malawi. NCCF will partner with international and regional donors and lenders, local or international NGOs and private sector entities in developing climate change investment projects. The Fund will also be promoting fund-raising schemes for various development programs on climate change management in Malawi and will serve as a think tank for new "green" financing mechanisms.

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

#### 4.5.2 What is the target for 2030 and the gap?

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

##### Overall energy intensity of the national economy

As stated in section 3.6.1 above and depicted in Table 21, Malawi has relatively low energy intensity and is in good position to further lower the ratio by implementing a number of EE improvement activities and policies. Based on the average achieved EI reduction pace of 4% annually (2006-2011), we can reasonably assume that Malawi can bring its energy intensity down to below 900 Btu per USD 2005 of GDP (PPP terms) by year 2030.

**Table 21: Malawi target energy intensity projection 2015-2030**

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

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

##### Energy-efficient cooking stoves

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

##### Hot Water Heating

There is no consensus on how many electric-powered solar geysers are installed in Malawi. A World Bank Energy Sector Management Support program study estimated there were around 23 000 installed electric geysers in 2011 so it can be reasonably assumed that the number has increased to 30,000 – 40,000 in 2015, meaning that approximately 15% of the households with access to grid electricity use electric geysers. The electric heaters are energy-intensive and may account for up to 40% of household electricity bills in households that have them. In its INDC to UNFCCC the GoM has already pledged to replace at

least 20,000 electric heaters with solar-powered water heaters by 2030, provided that technical and financial support from third parties (donors) can be obtained. This is an achievable target but with sufficient funding/financing and government mandate, a more ambitious yet still reasonable target is 40,000 SWH installations..

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

**Table 22: Target number of solar powered water heaters by 2030**

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

### Pre-paid meters

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

**Table 23: Target for pre-paid/smart meters installations**

	2020	2025	2030
Number of newly installed pre-paid/smart meters	564 000	1 250 000	1 600 000

### Lighting

An energy saving bulb rollout project achieved a 65 MW reduction in the morning peak and a 51 MW reduction in the evening peak. There was an 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 include import duty and tax reliefs, soft loans, MEPS (Minimum Energy Performance Standards) and labelling measures, etc.

Assuming 30% grid connected households in 2030 and an average of 8 light bulbs per household, the total number of lighting fixtures in the household sector will increase to 16.5 million. Around 550,000 LEDs on average will need to be installed annually to reach 50% penetration rate by 2030.

**Table 24: Target number of efficient bulbs**

Lighting technology	2020	2025	2030
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LED	2 750 000	5 50 000	8 250 000
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### Agriculture

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

According to the Biomass energy strategy, tobacco curing is the most energy intensive activity within the agricultural sector, consuming 100,000 tones dry wood equivalent<sup>45</sup> per year. Small-holder farmers have limited capital, which leads them to resort to 'low cost' fuel wood for curing tobacco. Data from Tobacco control commission of Malawi indicates that as of 2016 there are nearly 30,000 tobacco growers in the country, most of these small scale farmers, using wood for curing. Helping the small scale growers to shift to more efficient (rocket type) barns or barns based on other energy sources can halve the tobacco curing related wood consumption by 2030.

**Table 25: Efficient tobacco curing barns target**

	2020	2025	2030
<b>Number of new efficient barns constructed</b>	2,000	3,500	5,000

### Electricity production, transmission and distribution

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

**Table 26: Transmission and distribution losses targets**

	2020	2025	2030
<b>Combined transmission and distribution losses</b>	17%	15%	12%

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

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

- Inefficient production of biomass and use of inefficient technologies. Very low uptake of efficient biomass cook stoves.
- Insufficient awareness among energy end-users about energy conservation possibilities. Social preferences towards traditional technologies.
- High upfront costs of EE technologies (usually imported and associated with additional foreign exchange issues).
- Inadequate funding to finance energy efficiency and conservation initiatives.
- Insufficient economic analysis of the EE implementation benefits.
- Insufficient capacity of efficiency testing labs.

<sup>45</sup> Malawi Biomass Energy Strategy final report

- Use of outdated and energy inefficient equipment (motors, boilers, etc.) in major economy subsectors (mining, agriculture, industry). Low penetration of modern energy saving technologies.
- Very limited capacity at the National level to conduct energy audits.
- Lack of EE related technical expertise in the industrial sector.
- Lack of financial incentives encouraging EE investments to offset the higher cost of modern EE equipment.
- Electricity tariff encouraging inefficient energy use.

## 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” include the introduction of the following types of energy supply: biofuels (ethanol and biodiesel); electricity (introduction of electric vehicles and electric modes of mass transportation); biogas (bioLNG - bio Liquified Natural Gas - and bioCNG - bio Compressed Natural Gas - in city buses).

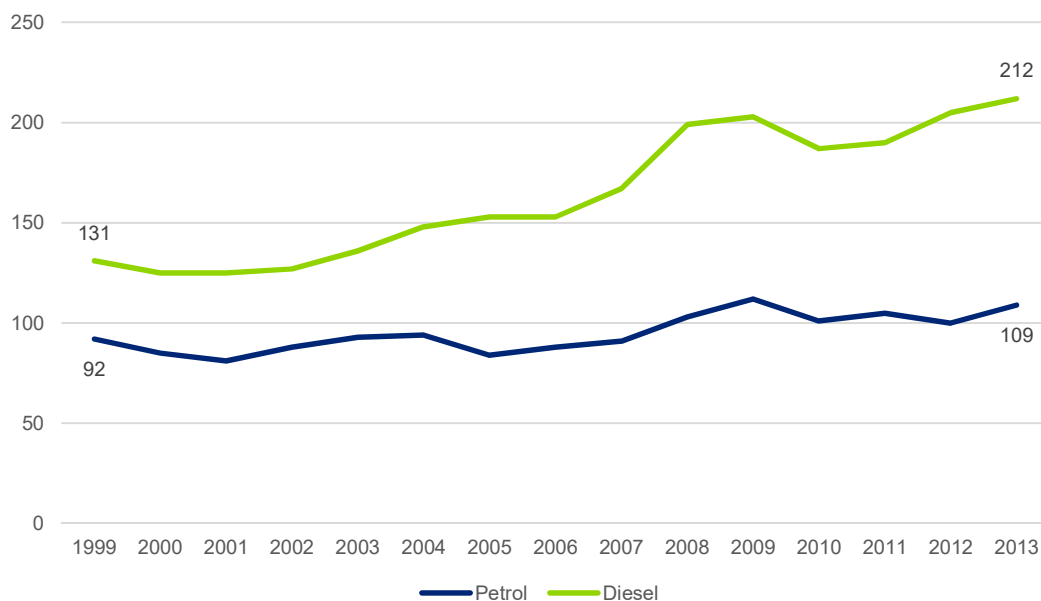
In addition, this section provides findings on the use of conventional fuels in the transportation sector in order to assess the potential of partially replacing those fuels with the alternative fuels mentioned above<sup>46</sup>.

### 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 (Ethanol is domestically produced). Since 1999, the compound annual growth rate of diesel is 3.3% and gasoline (petrol) is a little bit more than 1%. Diesel is, in 2013<sup>47</sup>, twice as imported as petrol (212 million litres and 109 million litres).

**Figure 19: National importations of petroleum products between 1999 and 2013 (million litres)<sup>48</sup>**



<sup>46</sup> 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.

<sup>47</sup> Data are available for 2014 (Economic Report 2015): 109 million litres of petrol imported in 2014, which is perfectly flat compared to 2013. For diesel, 160 million litres have been imported, which is comparable to 2007 level. Thus, these figures have not been represented, waiting for confirmation.

<sup>48</sup> 2014 Annual Economic Report Full Book

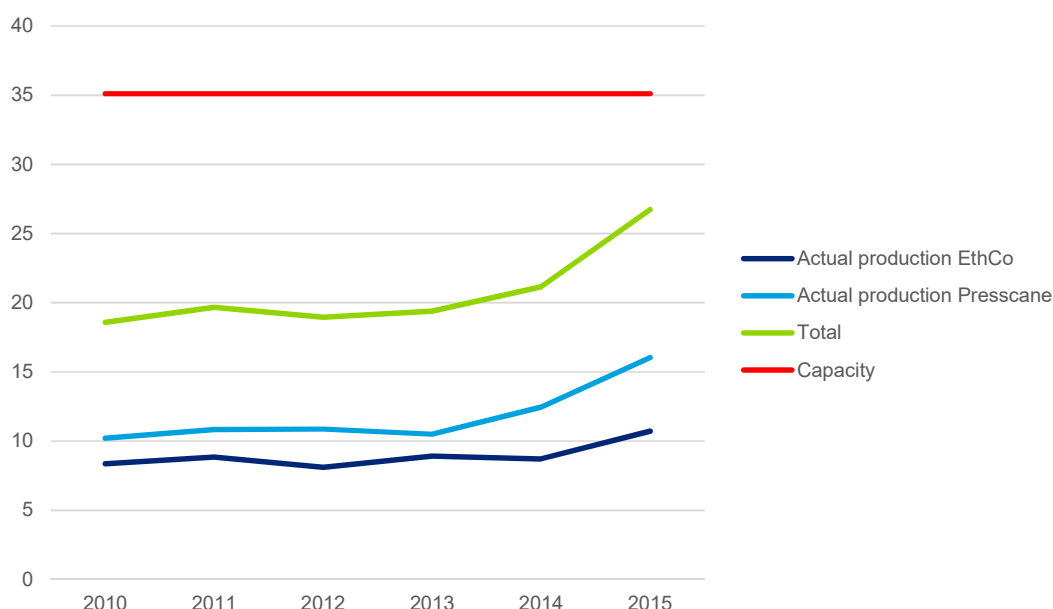


## Biofuels production and consumption

### Ethanol production levels

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

**Table 27: Malawi ethanol production since 2007 and projections to 203<sup>49</sup>**



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<sup>50</sup>, according to consultations with Press cane Ltd, the company's production does not meet its capacity due to inconsistent supply of raw materials and power cuts.

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

Locally produced ethanol is blended with petrol at the officially designated average rate of 20% (E20<sup>51</sup>). Nevertheless, according to market observers, ethanol is often marketed at a 10% blend with petrol<sup>52</sup>.

### Biodiesel production levels

Biodiesel is produced by Bio Energy Resources Ltd (BERL), the only biodiesel producer in the country and is used by some diesel cars and tractors. In 2015, BERL produced 70,000 litres of biodiesel but aims at increase its production in the coming years until 150 million litres in 2030. The following figures are given by the company.

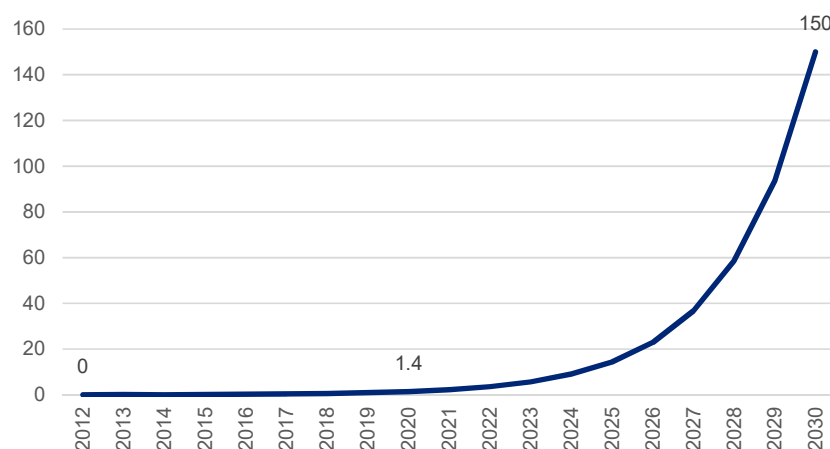
<sup>49</sup> Press Corporation Ltd

<sup>50</sup> 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

<sup>51</sup> Ethanol fuel mixtures have "E" numbers which describe the percentage of ethanol fuel in the mixture by volume, for example, E85 is 85% anhydrous ethanol and 15% gasoline.

<sup>52</sup> Taalo 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 20: Expected biodiesel production of BERL through 2030 (million litres)**



### Existing plans to support biofuels

Regarding biofuels consumption, there have been some efforts to incentivise motorists to use ethanol. Specifically, in 2016, NCST developed the Ethanol Driven Vehicle Project (EDVP). The Commission carried out various trials of motor vehicle performance while using ethanol on three different car models, namely, 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 programme for the increased use of ethanol in motor vehicles.

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

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

**The 2003 National Energy Policy (NEP)** and the **Malawi Growth and Development Strategy II** (2011-2016), aimed at increasing the ethanol mandatory and average percentage from 10% to 20% in volume. That increased blending rate has not been achieved yet because of insufficient ethanol production. The new National Energy Policy also sets production level targets for ethanol and biodiesel in 2017 and 2035 (see Table 28; 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 return on investment rate by pricing ethanol on the basis of full cost recovery. Specifically, **rule 25 of the 2004 Liquid Fuels and Gas (Production and Supply) Regulations** requires that for the definition of the price of biofuels, MERA shall take into account the cost of production, transportation, distribution, weighted storage cost, cost of goods-in-transit insurance and transit losses, taxes and levies plus the licensee's mark-up, and thus define a price sufficiently high to encourage ethanol production. However, currently, the price of ethanol is pegged to price movements of petrol, meaning that this regulation is still not implemented. MERA is in charge of defining this price structure that reflects "true" cost of ethanol and will be independent of petrol price. They hope to achieve this by the beginning of the new financial year (1st July 2016).

The Malawi Ethanol Programme (2013) aimed to increase ethanol production and its use as fuel from the 2013 level (18 million litres of hydrous / anhydrous ethanol produced) to 49 million litres and 104 million litres per year respectively by 2015 and 2020<sup>53</sup>.

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

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

## Electricity and biogas

### Alternative fuels: electricity

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

### Alternative fuels: biogas

Biogas is not used in transportation.

## 4.6.2 What is the target for 2030?

### Biofuels target

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

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

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

The NCST noted that estimated annual fuel requirements for petrol driven vehicles for the country would hit 198.6 million litres by the year 2015 and 320 million litres by the year 2020. According to petrol importations highlighted in Figure 19, and the average growth rate of 1% during this period of time, it seems difficult to rely on these figures.

Moreover, the draft new National Energy Policy for Malawi, currently discussed, sets the following targets.

Output	Performance indicator	Target	Baseline (2013)	Source of verification
<b>Increased supply of bio-ethanol and biodiesel</b>	Number of litres of biodiesel and bio-ethanol produced annually	20 million litres by 2017; 460 million litres by 2035	18.5 million litres	Production reports from MERA

**Table 28: Draft NEP biofuels targets**

<sup>53</sup> Malawi Ethanol Programme (Maethol): Roll Out Programme of Increased Ethanol Use as Vehicle Fuel, 2013

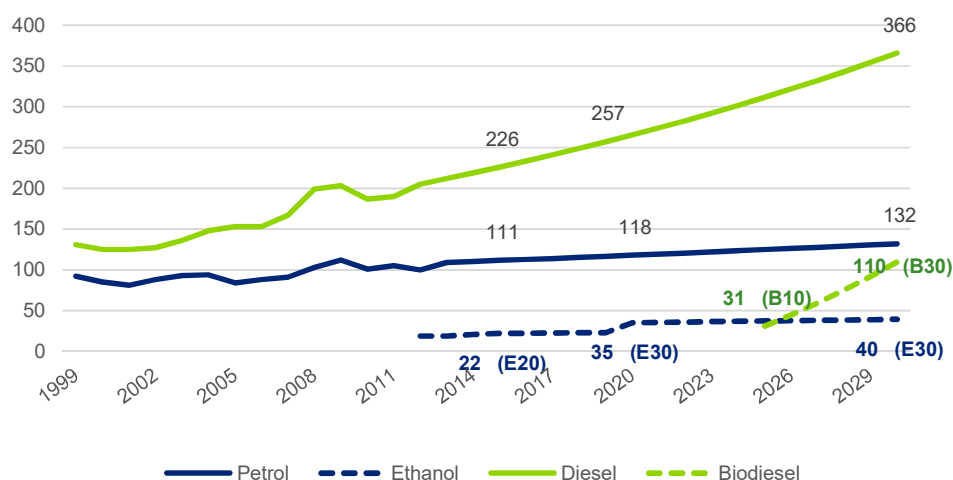
Once again, these targets need to be clarified (what is the proportion of biodiesel and ethanol in the 460 million litres produced in 2035).

Assuming straight line growth from importation levels between 1999 and 2013, liquid fuels are expected to rise to more than 325 million litres by 2015 (111 million for petrol and 226 million for diesel), which will further increase to nearly 500 million litres by 2030 (132 million for petrol and 366 for diesel).

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

- E20 through 2020, according to the recommendations of Malawi Growth and Development Strategy II (2011-2016).
- E30 from 2020 to 2030 (allows to reach the maximum capacity of 40 million litres of ethanol produced by Ethco and Press Cane Ltd).
- For biodiesel, the production is not expected to exceed the level of one million litres until 2020. It is then difficult to set a minimum blending ratio before 2020. The participants to the consultation agree that the achievable targets are 10% (B10) in 2025 and 30% (B30) in 2030. That would represent a need of 30 million litres of biodiesel produced in 2025 and 110 million litres in 2030.

**Figure 21: Petroleum products importations since 1999 and projection through 2030 compared to biofuel production levels since 2012 and targets through 2030 (million litres)<sup>54</sup>**



## Electric vehicles target

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

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

## Gaps between business as usual and targets

### Blending ratio

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

<sup>54</sup> 2014 Annual Economic Report Full Book for 1999-2013 and calculations for 2014-2030

### Production level and expected scarcity

The total demand for ethanol is expected to be around 40 million litres in 2020 against current production level between 32 and 36 million litres. This results in a shortfall of around 8 million litres ethanol between 2020 and 2030, depending on consumption annual growth during this period.

For biodiesel, there will be a need of around 110 million litres in 2030, which would be covered by the national production, under the condition that the exponential growth shown in Figure 20 is realised.

### Main barriers that can be anticipated

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

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

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

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

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

## 4.7 Transportation – Urban transportation

The urban transportation infrastructure in Malawi faces significant issues. Mass transportation is dominated by the use of mini-buses (especially mini-vans), and the availability of rail transportation for passengers is limited. In addition, the capacity of roads in urban areas is not adequate to accommodate the increasing numbers of private vehicles and the increasing urbanisation. Simultaneously the transportation sector is playing an increasing role in the country's economy. In the 2014 annual economic report<sup>55</sup>, the share of the transportation sector (including storage) to the country's GDP was estimated to have grown by 5.6% from the previous year compared to 4.9% estimated in 2012 and a mere 1.7% in 2011. In terms of energy consumption, according to the latest data (2009), the transportation sector is responsible for approximately 3.8% of total energy consumption, but it has the potential to become one of the largest energy-consuming sectors in the country.

Globally transportation is the second largest contributor to global GHG emissions<sup>56</sup>. In parallel, urban transportation is one of the fastest growing sources of GHG emissions. Passenger transportation is particularly significant as urban areas are locations where complicated traffic patterns are taken place with strong interlinkages to commuting, commercial transactions and cultural activities. Therefore, it is of outmost importance to develop a holistic transportation policy for passengers seeking mitigation goals, while at the same time ensuring economic growth and social inclusion.

In Malawi, the policy response to the challenges faced in the transportation sector is addressed in several policy documents, including a National Transportation Policy. Much attention is directed towards

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<sup>55</sup> Malawi Government (2014), Annual Economic Report

<sup>56</sup> UNDESA (2012), Shanghai Manual: A Guide for Sustainable Urban Development in the 21st Century

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<sup>57</sup>. The road sector handles more than 70% of the internal freight traffic and 99% of the passenger traffic.

Vehicles are widely categorised as follows:

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

Detailed data on the population of vehicles in urban areas does not exist. The estimates on the fleet of road vehicles, presented in the table below, are based on the situation in neighboring Zimbabwe, where it is estimated that 61% of the total fleet is located in urban areas. The total number of specific types of vehicles are based on national statistics on new registered vehicles<sup>58</sup> in Malawi and the number per category on data in Zimbabwe.

**Table 29: Population of road vehicles in urban areas, in 2014, by type of vehicle**

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

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

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

###### Current efficiency of vehicles

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

<sup>57</sup> WHO (2014), Global Health Observatory data repository - Registered vehicles Data by country

<sup>58</sup> National Statistical Yearbook (2012), Statistical yearbook 2012

**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<sup>59</sup>.

Urban road networks have an increasing proportion of paved roads but the majority are still unpaved and, especially in suburban areas, of poor quality. In Lilongwe, the total length of the road network in 2009 was 131 km (consisting of main/secondary roads and urban roads) and is projected to increase to 303 km in 2030. According to the Lilongwe Plan, the road density will increase from 0.3 km/km<sup>2</sup> (current land area: 393 km<sup>2</sup>) in 2009 to 0.64 km/km<sup>2</sup> (2030 land area: 468km<sup>2</sup>) in 2030. The majority of the road network requires improvement.

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

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

### Transportation network – rail

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

**Figure 22: Rail network (Railroad Development Corporation, 2016)<sup>60</sup>**



Currently, the rail network is operated by 19 locomotives and 403 locomotives (including both those used for passenger and freight transport)<sup>61</sup>. It accounts for only 0.92% of the passenger transportation<sup>62</sup> with a

<sup>59</sup> 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

<sup>60</sup> Available at: [http://www.rdc.com/op\\_malawi\\_cear.html#system\\_map](http://www.rdc.com/op_malawi_cear.html#system_map)

<sup>61</sup> Railroad Development Corporation



smaller share on urban passenger transportation, as it connects few urban areas with their suburban outskirts.

### Non-motorised transport

Infrastructure for non-motorised transport is non-existent. Nevertheless, the use of bicycles (including tricycles) as well as walking as modes of transportation is significant in urban areas. In 2014, the bicycle taxis<sup>63</sup> were introduced in urban areas by unofficial operators<sup>64</sup>. In 2011, the number of bicycle taxis was estimated at between 4,000 to 5,000. These figures are fluctuating due to the unregulated nature of this activity.

### Future trends

Petroleum (i.e. gasoline and diesel) is by far the main fuel used in the sector. The Draft National Energy Policy<sup>65</sup> projects the annual energy consumption for transportation will increase from 396 ktoe in 2015 to 1,025 ktoe in 2030 which correspond to an increase of 159%.

There are no projections on the average fuel consumption of vehicles, until 2030. A comprehensive study in Uganda found that the average fuel efficiency decreased from 12.52 l/ 100 km in 2005 to 13.73 l/ 100 km in 2014<sup>66</sup>. In Malawi, it assumed that the energy efficiency will remain stable, as the benefits from the penetration of new and more efficient vehicles will be offset by a high share of second-hand vehicles and the poor maintenance of roads and vehicles.

Under the assumption of a stable fuel efficiency, it is assumed that the urban fleet will increase following the trends of the fuel consumption in the transportation section. This means that the fleet will increase from 437,416 vehicles in 2014 to 1,132,200 vehicles in by 2030. This large increase (covering only small vehicles) is also confirmed by the ongoing study on the energy policy review<sup>67</sup>. The study estimates that the car ownership (i.e. person/car) for intercity transportation will increase from 303 in 2008 to 90 in 2030. According to the same study, the current size of the public transportation (urban, rural and intercity) is expected to decrease in the following years and then it will start increasing.

Based on the existing data, it can be assumed that the share of each mode of transportation (see Table 29) will not change significantly. An increase on the number and share of buses will absorb a respective decrease of the share of mini-buses and non-motorised means of transport, including walking.

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

### Existing plans

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

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<sup>62</sup> PWC (ongoing), Consultancy services to carry out Malawi energy policy review, Energy Status Report

<sup>63</sup> Ordinary bicycle, which is fitted with a cushion at the back for the passenger to sit on

<sup>64</sup> 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.

<sup>65</sup>

<sup>66</sup> Mutenyo et al (2015) Baseline survey of Uganda's national average automotive fuel economy

<sup>67</sup> PWC (ongoing), Consultancy services to carry out Malawi energy policy review, Energy Status Report



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

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

At the local level, the Urban Structure Plan of Lilongwe City<sup>68</sup> (Lilongwe Plan) acts as the statutory land use plan for the City of Lilongwe. The Lilongwe Plan consists of a statement of policies and proposals together with a plan to be implemented by 2030. In relation to transportation, the plan promotes:

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

Malawi does not have any laws which focus on urban transport. The Road Traffic Act is the only law that regulates road transportation and it does not address urban transportation. However, Malawi is in the process of developing a National Transport Master Plan (NTMP) to guide the sustainable development of an integrated multi modal transport sector over the period 2017 to 2037<sup>69</sup>. 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<sup>70</sup>.

#### 4.7.2 What is the target for 2030?

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

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

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

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<sup>68</sup> Lilongwe City Council (2013), The Urban Structure Plan of Lilongwe City

<sup>69</sup> 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](http://ntu.eu/files/manager/jobs/malawi_experts_70mm.pdf)

<sup>70</sup> Thomson Reuters Foundation (2013), Malawi tax on second-hand vehicles cuts emissions, government says. <http://news.trust.org/item/20131231164852-v6q3t/?source=shem>

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

Transportation involves different modes of transportation and is affected by several factors. The implementation of the fuel efficiency target, requires a set of fuel economy measures, including fiscal measures and incentives, numeric standard, training and awareness raising. These measures are described in section 5.6.1.

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

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

##### **Capacity constrains**

There is a multiplicity of actors:

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

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

##### **Travel Demand Management (TDM)**

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

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

### Inadequate regulatory regime

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

## 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 (SDGs) for energy seem to be interwoven with other goals such as water and sanitation, food security and nutrition, health, and gender. The relevant nexus targets are summarized in Table 30 below.

**Table 30: Relevant nexus targets**

Nexus	Issues	Targets
Water	1. Vulnerability of hydro supplies to climate change impacts as corroborated 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 increasing with increasing populations and mandatory biofuels blending. 2. With more mechanisation and expansion of irrigation, energy consumption in agriculture is increasing	1. Beyond 2018, net expansion of land use for bio-energy (such as sugar cane growing) production will only be considered if it will not affect food security objectives 2. As government embarks on extensive irrigation, solar and wind technologies are prioritised for pumping energy. Efficient irrigation technologies are adopted 3. Waste to energy is pursued vigorously
Gender	In the Malawian context, energy interventions impact women and men differently. 1. Women have the task to sourcing primary energy for cooking, thus eating away their time and often threatening their security. Poor lighting affects education, whilst poor indoor air quality affects women mainly as they prepare food. 2. The high up-front costs of access to modern energy services may impact more severely female-headed households, often over-represented in low income quintiles.	1. Reduce the time women spend collecting firewood in rural areas by 80% by 2030 2. Capacitate women in manufacturing improved cook-stoves and constructing bio-digesters 3. Promote the girl child to study science subjects to enhance their opportunities of working in the energy sector



# 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 energy is being threatened by increase in the population as well as increase in the clearing of land for agriculture. The energy supply component of biomass is not being addressed by the Department of Energy but by the Department of Forestry. These are intertwined. The Department of Energy needs an ongoing or “sustainable” biomass supply while the Department of Forestry is in charge of supplying the biomass as well as enforcement on the utilization of biomass. It has however been transpired that the Department of Forestry is overwhelmed with the task of provision of sustainable biomass for energy and non-energy uses. It is in this vein that an additional effort is required from the Department of Energy to work on the up stream of biomass in regard to energy provision through biomass. The reviewed Energy Policy can ably address this.

#### Transformative Awareness Campaign on alternative energy sources and associated efficient energy technologies

There are many alternative sources of energy and efficient energy technologies which the Malawian population can utilize to reduce the burden on biomass supply. These alternative energy sources include biogas, biomass briquettes, bamboos, pellets, LPG, gel fuel and others. The associated efficient energy technologies include efficient biomass cook stoves, solar cookers and biogas cookers. The utilization of these alternatives is very low due to their higher prices. The Government will encourage the private sector to enter into the business of providing these energy alternatives. The Department of Energy will work together with the Ministry of Finance, Malawi Revenue Authority and Malawi Trade Investment Centre to incentivise the private sector into such investments. The Government through the Department of Energy will come up with interventions to assist the poor households in the urban areas access efficient firewood and charcoal stoves. This will be done in collaboration with NGOS that are working in the provision of efficient firewood and charcoal stoves. Government through the Department of Energy and ESCOM will carry out a campaign on the use of electricity for cooking. A comparative cost analysis study done by UNDP (2007) showed that the cheapest cooking fuel is electricity followed by firewood using improved wood stove, Chitetezo Mbaula and LPG and gel fuel stoves were the last two in terms of cooking costs.

#### Financing Mechanisms for Improved Cook Stoves

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

#### Biomass Energy Sub- Sector Regulation

The sub-sectors that are currently regulated are electricity, liquid fuels and gas, renewables and rural electrification. It is only the biomass sector that is not regulated. There is need to regulate the biomass energy sub-sector for it to be able to provide biomass to the population in an efficient, effective and affordable manner. The regulation of the biomass energy sector will target commercial energy supply companies. The reviewed Energy Policy will examine the possibility of tackling the regulation of the biomass sub-sector.

## 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 priority actions that will be pursued are the following.

#### Innovation of MAREP

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

#### Programmes Intensification on Education, Training and Public Awareness

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

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

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

#### Financing household-scale electricity technologies

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

Bank loans may be applicable in some cases, although the interest rates and collateral requirements are prohibitive for most households. Besides, most Malawians do not have conventional credit records and are thus considered too risky for a loan. However, there are a number of alternative approaches people are using in many countries to obtain consumer debt for clean energy investments such as SHS. These include microcredit loans, community credit union loans, village pools, utility on-bill financing, and vendors offering pay-as-you-go solar financing. A large Malawian micro-finance institution, CUMO, regards the potential savings for a household purchasing solar lights as a good reason to lend to such households<sup>71</sup>.

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<sup>71</sup> "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,

Some microcredit institutions provide small-scale loans to people who have no credit history but who can get community members to co-sign or the loans.

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

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

### **Financing community-level electricity generation (Mini-grids)**

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

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

### **Provision of subsidies**

Currently the population that is on the national grid enjoys subsidized energy price as well as free access to electricity by way of either MAREP or ESCOM grid extension nearby them. The majority of the population far away from the grid do not enjoy these benefits. It is therefore imperative that if a private investor goes into the SHS business, particularly in rural areas, or a mini-grid construction and operation venture, a subsidy will be needed on either the upfront investment cost or on the operation and maintenance costs. The government, led by the Department of Energy, will appraise various subsidy options, from investment tax credits to production credits to the waiving of certain fees and taxes. For mini-grids, there could be a subsidy provided per new connection, as is done in Mali<sup>72</sup>. Alternatively, capital subsidies could be provided over time in tranches to better ensure good performance by the operator. The subsidies will be designed to achieve a certain IRR for the investors, although they will be responsible for a lower IRR if they are unable to contain costs.

### **A Regulatory Structure for mini-grids**

While mini-grids can operate largely without regulation, a basic regulatory structure is needed to ensure financial and technical stability of the mini-grid, ensure safety standards are followed, and equipment and operating practices will allow the mini-grid to be more readily connected to the grid when the grid reaches the mini-grid. There is also the matter of regulating mini-grid tariffs. In some cases, the tariffs are reduced because people on the mini-grids are poor and cannot afford to purchase electricity at full price. Finally, because mini-grids are inherently risky investments, the GoM will look to find ways to reduce fees and

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<sup>72</sup> 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](http://www.ren21.net/Portals/0/documents/Resources/MGT/MinigridPolicyToolkit_Sep2014_EN.pdf)



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 assessment.

### Promotion of Pico solar systems in unelectrified houses

In order to ensure that electricity is available to the majority of Malawians, the Government will support an acceleration of pico solar systems being introduced in all unelectrified houses. NGOS will be encouraged to come up with large-scale programmes to distribute and finance pico solar products. NGOS will also be encouraged to introduce solar energy kiosks in remote areas. These mini-stores that provide refrigerated food and drinks have been a success in Tanzania, Kenya, Rwanda, Ethiopia and elsewhere.

Which (global) high-impact opportunities are relevant?

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

## 5.3 Renewable energy

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

- Make the energy sector sufficiently robust and efficient to support GoM's socio-economic agenda of poverty reduction, sustainable economic development, and enhanced labour productivity.
- Catalyse the establishment of a more liberalized, private sector driven energy supply industry in which pricing will reflect the competition and efficiency that will develop in the reform process.
- Transform the country's energy economy from one that is overly dependent on biomass to one with a high modern energy component in the energy mix<sup>73</sup>.

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

#### Adopt a renewable energy policy

The increased use of renewable energy is consistent with the Malawi Growth and Development Strategy II and the 2003 Malawi energy policy currently being updated. But there is no 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 one or more sets of rules for the acquisition of RE electricity, such as REFit, RE Obligation, or 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.

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<sup>73</sup> Status of Energy Policy in Malawi, by Patrick Lapukenim Ministry of Energy, presentation at JICA International Centre, Tokyo, June 2013, <https://eneken.iecee.or.jp/data/5006.pdf>



- Introducing independent assessment, supervision and certification (independent consultants) of RE projects as is the case in other engineering and construction projects.
- Assigning roles to ESCOM, MERA, the Department of Energy, other government entities, and other players.
- Ensuring adequate consultation with stakeholders and the public in the project development process.

### Mechanism for acquiring electricity from RE sources

Malawi has choices to make about how to acquire large-scale, grid-connected RE.<sup>74</sup> The Government, through ESCOM, can either build the RE power projects itself or enter into contracts with private suppliers or do both. The government will seek to do both, but will place a major emphasis on using private suppliers or IPPs.

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

Given the somewhat cumbersome and controversial nature of a REFiT, an alternative mechanism is the Renewable Energy Obligation (REO). An REO would simply require ESCOM to supply a certain percentage of its power from RE sources by a certain date. It would be up to ESCOM to decide how to go about doing this. For example, it could finance the projects itself. It could enter into PPAs with IPPs. It could create its own tariff at which it will offer to acquire power from various types of RE projects, or it could hold a competitive bidding process. The choices would be up to ESCOM as long as it meets the target date. The amount of RE power ESCOM would have to supply by that date would be based on the SE4All targets. REO's exist in the UK, US, China, Korea, Japan, Australia and Germany, among other countries. They can be simple in design and just require the utility to supply a certain percentage of MWh from RE sources; or they can specify targets for specific RE technologies.

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

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

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

### Providing financial incentives for developers and users

Many countries provide incentives for the development of RE sources. The types of incentives used include concessional import duties, excise tax benefits, corporate and personal income tax benefits (including tax exemptions, holidays, credits, and deductions, as well as accelerated depreciation), subsidies against investment costs, low-interest loans, and premium power purchase prices. In particular, corporate tax credits and RE production credits will be seriously considered by the Government of Malawi. The size of the production credits would be based on the number of MWh delivered to the grid. These kind of incentives help improve cash flow and reduce risk for the project developers and investors. The

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<sup>74</sup> For off-grid solar home systems, and RE mini-grids, see the Energy Access section.

Government would not lose revenue it would otherwise have received from these projects because the projects wouldn't have been built without the existence of the incentives.

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

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

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

#### **Streamlined requirements and quick and inexpensive MERA licensing process for developers**

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

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

For larger RE projects, a number of these studies are needed to determine the amount and quality of electricity that will be delivered to the grid, and what 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 to back up payments by ESCOM. Even if ESCOM agrees to buy electricity from an RE project and signs a long-term PPA, investors may question the reliability of ESCOM as a long-term payer. This is a common concern by RE investors. So the RE policy will consider ways of providing security for the investors, such as working with international financial institutions to provide partial payment guarantees to the investors. The guarantee would state that if ESCOM falls behind on its payments by a certain amount, then the payment guarantee will pay the investors a certain percent of what it owed.

#### **Rules for on-site RE generation by third parties**

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

#### **Performance standards for RE equipment and licensing of installers**

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

Likewise, trained and licensed RE installers, particular small-scale solar PV installers, is needed in order to have properly configured RE systems.

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

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

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

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

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

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

### **Establish a Renewable Energy Agency**

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

### **Develop a financing strategy for RE**

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

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

### **Improve and modernize the electric grid**

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

### Adopt an effective IPP policy

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

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

### Implement RE education and training program

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

### Refurbish old RE installations

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

## 5.3.2 Priority actions synthesis

A summary of the priority actions proposed in the SE4All initiative is presented in the table below.

**Table 31: Summary of priority actions on Renewable Energy**

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs <sup>75</sup>
<b>Large hydro capacity additions</b>	350 MW Mpatamanga, 200 MW Kholombidzo, 40 MW Mbongozi, 50 MW Chizuma, 90 MW Songwe 1, 60 MW Songwe 2, and 140 MW Fufu	Short, mid and long-term	MERA	MoNREM, private sector	Unit cost: \$2.9 million/MW Total: \$2.7 billion
<b>Small hydro capacity additions</b>	22 MW Tadzani IV, 23 MW Ruo	Short & mid term	MERA	MoNREM, private sector	Unit cost: \$2-4 million/MW Total: \$90-180 million
<b>Solar capacity additions</b>	550 MW of PV projects at various sites	Short, mid & long term	MERA	MoNREM, private sector	Unit cost: \$3.8 million/MW Total: \$2.1 billion
<b>Bagasse cogeneration capacity additions</b>	46 MW at two Illovo sites	Mid & long term	MERA	MoNREM, private sector	Unit cost: \$6.7-7.4 million/MW Total: \$308 - 340 million
<b>Policy</b>	Adopt RE Policy, financing strategy	Short term	MoNREM	MERA, private sector, Renewable Energy Association of Malaw, NGOs	n.a.
<b>Research</b>	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,	n.a

<sup>75</sup> 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 <sup>75</sup>
				University of Mzuzu – Department of Energy Studies) National Commission for Science and Technology	
<b>Capacity building</b>	Training for government and private sector on licensing & permitting process, costs, regulatory policy and procedures, major issues in developing an RE project.	Short term	MoNREM	MERA, private sector	n.a.

## 5.4 Energy efficiency

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

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

#### Demand-side measures

##### Solar for hot water heating

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

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

##### Domestic lighting

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

##### Pre-paid meters

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

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

##### Large industrial and mining customers

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

- Programs for replacement of standard burnt motors, gear boxes and conveyors with energy efficient ones.
- Installation of variable speed drives on large motors operating under fluctuating loads.
- Mandatory regular examination and maintenance of large motors.
- Automation of steam generating boilers.



- Installation of combined heat and power generators where applicable.
- Promotion of sub metering in complex industrial and manufacturing processes. Implementation of sub-metering system will help the company owners and their energy managers to more precisely analyse company's energy consumption data and identify the least efficient processes or machines and subsequently implement necessary EE measures on the identified items, thus increasing the overall energy performance of the company less expensively.

### Agricultural

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

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

### Capacity building

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

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

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

### Awareness raising campaigns

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

### Supply side

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

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

### Institutional approach

#### National EE Committee



Establishing a specialized body to supervise and administer all EE related activities in Malawi will undoubtedly underpin country's aspirations towards achieving more balanced and sound energy system. This will be a dedicated unit within the Ministry of Natural resources, Energy and Mining. The committee will be established as a body with strong technical skills, dedicated to implementing the national energy efficiency policy<sup>76</sup> and will have the following powers and responsibilities to:

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

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

#### **EE and RE technical excellence centre**

To efficiently apply MEPS and promote energy performance labelling programs, Malawi will set up technical excellence centre to carry out activities such as: i) testing the energy performance of imported or locally produced equipment and appliances; ii) defining national energy performance standard thresholds, etc. This will be vested as a unit in the Malawi Bureau of Standards or established as an independent entity. NEP acknowledges that a robust energy policy and planning process should necessarily involve development of a high quality data collection, recording, storage and analysis system. The technical excellence centre will play a key role in responding to NEP's call. The data collected and analysed will create enabling environment for a highly efficient policy making and target setting process. Implementation of a sound set of monitoring and verification (M&V) methodologies and procedures will be of utmost importance to SE4All coordination and follow up process and will allow the Government and the SE4All regional hub to precisely assess the progress of the initiative and to timely intervene by policy adjustments when needed. Energy Valuation Organization's (EVO) International Performance Measurement and Verification Protocol (IPMVP) provides an overview of current best practice techniques available for verifying results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities and may also be used by facility operators to assess and improve facility performance. IPMVP presents common principles and terms that are widely accepted as basic to any good M&V process and can be easily adopted in Malawi. The Technical excellence unit will gather record and process the feedback data derived through M&V activities and will make this information available for all SE4All stakeholders and other interested parties. The set-up and operation of this unit will be partly funded by the Government (MoNREM), while equipment testing fees (payable by local producers and importers) data access subscription charges (payable by various EE/RE stakeholders for access to the centre's database) will complement the budget revenue. The technical excellence centre will operate in close collaboration with the National energy management training centre, sharing expertise and joining efforts to promote the most current EE trends and technologies in Malawi.

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<sup>76</sup> World Energy Council definition for National EE Agency

## Possible Financing solutions

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

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

### Private banks – specialized EE credit lines

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

### International and Bilateral Financial Institutions and Partners

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

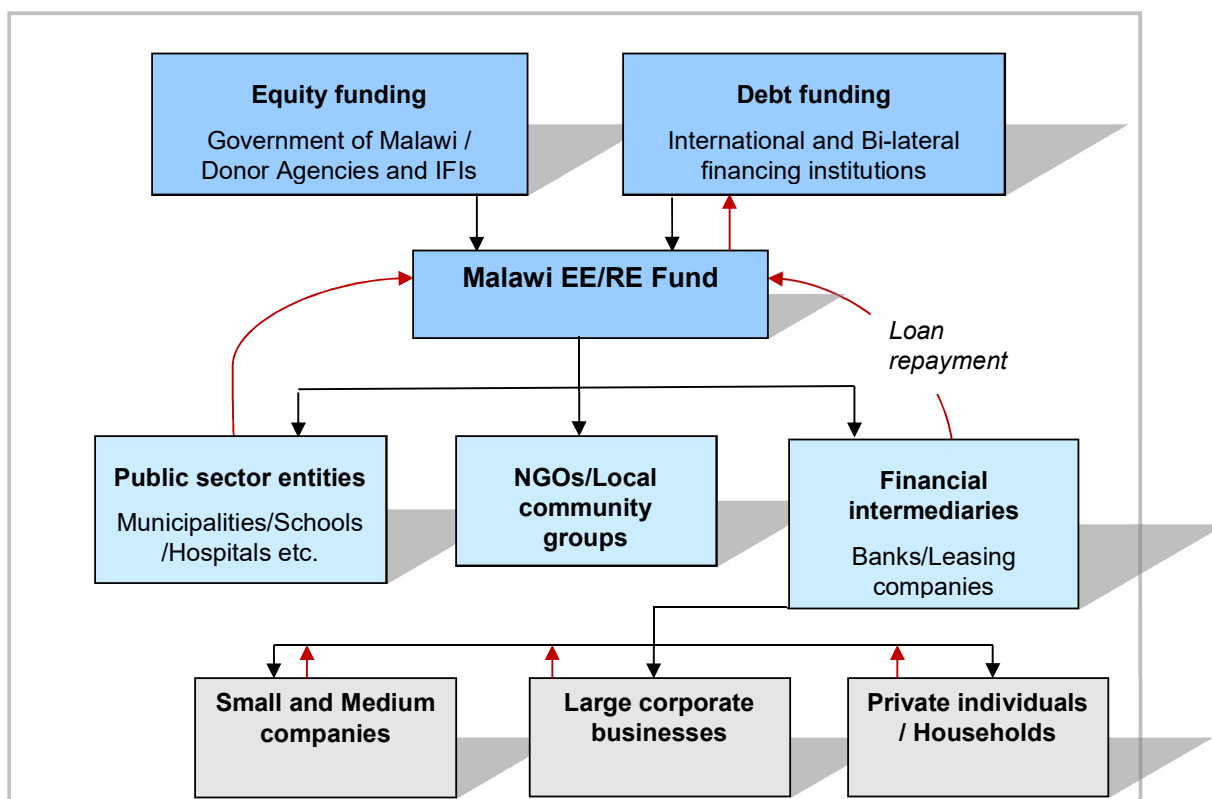
Other potential sources of concessional EE and RE financing are: the World Bank's carbon funds, the Global Environment Facility (GEF), the African Development Bank (AfDB), African Sustainable Forestry Fund, the UNFCCC's Adaptation Fund, The Global Climate Partnership Fund and many more international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

### Dedicated Climate Change Fund

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

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

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



**Figure 23 Malawi EE Fund – proposed structure and business cycle**

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

#### Energy Efficiency / Management Regulations

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

#### Minimum Energy Performance Standards and Labelling

To accelerate the penetration of energy efficient lighting and household appliances, Malawi will embark on development of a set of regulations that seek to ban the use of inefficient products through application of minimum energy performance standards (MEPS). Once promulgated and enforced, the regulations will prohibit the importation, production and sale of products that do not meet the requirements of the MEPS.

To ensure smooth transition to use of highly efficient products, the minimum performance standards shall first be tested on lighting bulbs only and then be extended to cover other household electrical products/appliances and at a later stage eventually include other energy intense equipment such as industrial motors, pumps and refrigerators. Adjustments to the import duty tariff and some tax reliefs (e.g. 0% VAT rate) for products that meet the MEPS will greatly underpin the success of such policy.

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

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

#### **Promotion of green building code**

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

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

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

### **5.4.2 Which (global) High-Impact Opportunities are relevant?**

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

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

### **5.4.3 Priority actions synthesis**

A summary of the priority actions proposed in the SE4All initiative is presented in the table below.

**Table 32: Summary of priority actions on Energy Efficiency**

Category	Action	Indicative time frame	Lead agency	Cooperating stakeholders	Estimated costs
<b>Institutions</b>	Establish National Energy Efficiency Committee	long term	MoNREM	MERA	n.a.
	Establish EE/RE Fund	short to medium term	MoFED	MERA, Malawi Development Bank (upon establishment)	USD 30 million <sup>77</sup>
<b>Agriculture</b>	Build/Install 5 000 efficient tobacco curing barns	long term	Ministry of agriculture and water development	Tobacco control commission, MoFED	USD 7.5 million <sup>78</sup>
<b>Policy</b>	Introduce National Energy Management Regulations	short term	MERA	MoNREM	n.a.
	Introduce Minimum Energy Performance Standards and Labelling regulations for lighting bulbs and other electrical appliances and equipment	short term	MERA	MoNREM	n.a.
	Conduct national EE audit and develop national EE action plan	short term	MERA	MoNREM	USD 250 000
	Establishment of EE and RE technical excellence centre	short term	Malawi Bureau of Standards	MoNREM, MERA	n.a.
<b>DSM (lighting)</b>	Roll out 8.25 million LEDs	throughout 2030	ESCOM	MoNREM, Ministry of Finance and Economic Development	around USD 16.5 million <sup>79</sup>
<b>DSM</b>	Installation of 1.6 million pre-paid meters to grid connected households	medium to long term	ESCOM	MoFED, MoNREM	USD 64 million <sup>80</sup>

<sup>77</sup> USD 30 million is the target initial capitalization of the Fund (blend of Malawi Government equity stake, International agencies grant contributions and International financing institutions loans). Administrative costs for setting up the Fund should be in the range of USD 100,000 – 150,000.

<sup>78</sup> Based on the average rocket barn cost of USD 1 500

<sup>79</sup> Assuming an average price of USD 2 per unit throughout the AA period

<sup>80</sup> Assuming USD 40 average price per pre-paid meter

## 5.5 Transportation – Alternative fuels

### 5.5.1 What are the actions and funding levels needed to achieve the overarching objective in the field of alternative fuels?

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

#### Develop a policy framework that promotes use of cleaner fuels

##### Governance

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

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

**Table 33: Composition of the Biofuels Coordinating Committee**

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

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

#### Support sustainable biofuel production and use

## Reinforce existing or Introduce additional incentives to support biofuel production

### 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 licensing process and promote the establishment of new businesses.

### Develop market opportunities

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

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

### Create innovative financing models

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

## Promote the use of biofuels

### Biofuel prices

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

- Sets the maximum blend price in relation to the theoretical price of unblended mineral fuel, including all duties and levies, (or liberalise prices and let market forces determine them).
- Implements tax incentives for biofuels users.

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

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



## Facilitate biofuels distribution

The biofuels distribution should be facilitated through the following measures:

- Facilitate the distribution of biofuels through the country promoting the installation of appropriate pumps. Especially for biodiesel, there are currently no filling station (except the one in BERL production site). Regarding ethanol, the draft NEP sets the target of 200 filling stations with ethanol fuel tanks in 2020. **Error! Reference source not found.**
- By 2018 establish a network of fuelling stations offering E85.

## Encourage the use of biofuels

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

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

## Ensure a sustainable biofuel production

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

## Other energy sources

### Promote electric vehicles

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

### Promote biogas in transportation

The introduction of biogas in transportation should be considered. This would require an assessment of the efficiency of the supply of this fuel and the supply of bi-fuel and dual-fuel vehicles.

### Research and development, and education

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

## 5.5.2 Which (global) High-Impact Opportunities are relevant?

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

## 5.5.3 Priority actions summary

A summary of the priority actions proposed in the SE4All initiative is presented in the table below.





**Table 34: Alternative fuels priority actions**

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

Category	Action	Indicative time frame	Lead agency	Cooperating stakeholders	Estimated costs
				University of Mzuzu – Department of Energy Studies)	

## 5.6 Transportation – Urban transport

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

### 5.6.1 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 Join Transport Sector Review (JTSR) annual meetings and Joint Technical Committee that have the role to monitor the performance of the transport sector.

**Table 35: Composition of the Urban Transportation Coordinating Committee**

Organisation	Role
<b>Ministry of Natural Resources, Energy and Mining</b>	Provide energy efficiency targets, monitor progress, provision of technical advice. Integration of environmental concerns in transportation (e.g. climate change, air pollution, land use)
<b>Ministry of Finance and Economic Development</b>	Funding infrastructure and maintenance and assisting on third party funding from international organisations
<b>Ministry of Justice and Constitutional Affairs</b>	Definition of fines and other measures to increase energy efficiency in transportation (e.g. the integration of emission standards in national legislation)
<b>Ministry of Local Government and Rural Development</b>	Definition of the role of city councils in the development and maintenance of public transportation
<b>City Councils (i.e. Municipal or Town Councils)</b>	Provide insight on the major issues in their administrative areas
<b>Roads Authority</b>	Allocation of revenues from tolls from the development of infrastructure in urban areas
<b>Road Traffic Directorate</b>	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
<b>Malawi Revenue Authority</b>	Revenue collection
<b>Malawi Energy Regulatory Authority</b>	Administration of the fuel levy
<b>Universities and other research institutions</b>	Definition of needs in research and development
<b>Private sector transport operator representatives (e.g. Minibus Owners Association of Malawi and Bus Owners</b>	Key stakeholders and investors.

Organisation	Role
<b>Association, Central Eastern African Railways)</b>	
<b>Non-governmental organisations</b>	Provision of advice on good practices (e.g. from international experience) and depending on the specialisation of the NGOs provision of expertise on specific environmental and social concerns.

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

### Mass transit system

Mass transit vehicles carry a far higher number of passengers compared to private vehicles, making them an efficient user of road space ultimately helping decongest the cities. A city bus with a carrying capacity of about 108 passengers replaces almost 7 mini-buses of 16 seater passenger capacity. The mini-buses will use 23-25 litres of diesel for a 20 km journey and a city bus will use between 8 and 10 litters of diesel (based on a trial using a city bus in a mixed traffic system)<sup>81</sup>. In addition, a study conducted in Uganda, found that in terms of fuel consumption and CO<sub>2</sub> emissions, one bus with a capacity of 80 people replaces 3 mini-buses, 14 private vehicles<sup>82</sup> or 80 motorcycles<sup>Error! Bookmark not defined.</sup>. The efficiency will increase further if proper bus schedules are implemented together measures on Travel Demand Management.

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

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

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

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

It is inconceivable and unrealistic to set an immediate ban of mini-vans as at present they consist of the backbone of public transport in urban areas in Malawi. There is a need to start the process to phase out mini-buses with the capacity of less than 26 seats by not licensing new ones. At the same time, measures to support the acquisition of city buses will set the basis for the development of a mass transportation system. The initiative needs to be supported by the Government, at the intermediate level (i.e. by 2020) through the following measures:

- Curb on all unregistered vehicles which is a significant proportion of the mini-bus population.
- Support the operators in buying large and efficient buses (e.g. though tax reductions or subsidies).
- Franchising of routes: mini-buses must not be allowed to operate on these routes and strict enforcement is required.

The current operators of mini-buses should be encouraged to participate in cooperatives that invest in city buses. This approach that has been applied successfully in other countries (e.g. Kenya) ensures that any damages on the investments of the current operators of mini-buses are minimised.

<sup>81</sup> Personal communication with a member of the Transportation Working Group

<sup>82</sup> The study refers specifically to taxis, but is assumed the same with private vehicles in terms of capacity and environmental impact

### Development of a public mass transportation system

By 2020, a mass transport system shall be established at least in the 3 largest cities (Lilongwe, Blantyre, Mzuzu) through PPPs or private initiatives. The NTP is already providing freedom to the industry to set tariffs and has removed restrictions on entry in the passenger as well as freight transportation. Such a system can be based upon ongoing initiatives, such as the establishment of the association mentioned above. This objective can be reached through the following measures:

- 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. The design of such systems should be built on lessons from similar developments on other African cities (e.g. Accra, Lagos and Dar es Salaam).
- Prohibit the entrance of mini-buses in city centres and other areas with high congestion.
- Develop pilot bus systems (i.e. one route in one city) to guide the development of comprehensive transportation system.

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

### Funding of the transportation system

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

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

The development of a mass transport system should be supported by the Transport Sector Investment Programme (TSIP).

### Increase the average fuel efficiency of vehicles

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

#### Use of labels and standards

The integration of EU minimum emission standards for all registered vehicles is an effective priority action that would ensure a significant reduction of fuel consumption and CO<sub>2</sub> emissions. Such standards exist mostly in developed countries, such as the USA, Japan, and the EU and less developed, for example the BRICS (Brazil, Russia, India, China and South Africa) and Mauritius. Emission standards are linked directly to fuel efficiency, as cleaner and more efficient vehicles are promoted in the market. Additional environmental benefits arising from a cleaner environment are added to the financial gains from the fuel savings.

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

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

The use of labels and standards should be coupled with the strengthening of the import law that charges higher levies for older vehicles and larger engines. This levy should be variable and its level should depend on the age and size of the engine of the vehicle<sup>83</sup>.

### **Promote appropriate car maintenance**

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

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

### **Improve road capacity and maintenance**

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

### **Develop urban and suburban rail transportation system**

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

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

### **Support the development of non-motorised transport**

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

- Increase the safety of their use through the development of bike lanes (also stipulated by the NTP).
- Raise awareness by establishing a bicycle commuting campaign to increase the social

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<sup>83</sup> 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.

acceptability of the biking.

- Establish bikeshare programs (e.g. as the scheme currently in development in Johannesburg).
- Provide incentives to employers for bicycle commuting (starting with national and municipal governments).
- Provide secure bicycle parking.

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

### **Establish Travel Demand Management**

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

#### **Land use planning policies**

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

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

#### **Improve efficiency of traffic flow**

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

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

#### **Capacity building, education and raising awareness**

The planning and implementation of measures to increase the fuel-efficiency of transportation will be enhanced if coupled with educational and awareness raising actions. Such actions should be continuous and targeted both at decision-makers and the society as a whole. By 2018, the following actions should be



promoted by the MoTPW in collaboration with other members of Urban Transportation Coordinating Committee:

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

### 5.6.2 Which (global) High-Impact Opportunities are relevant?

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

### 5.6.3 Priority actions synthesis

A summary of the priority actions proposed in the SE4All initiative is presented in the table below.

**Table 36: Summary of priority actions on urban transportation**

Category	Action	Indicative time frame	Lead agency	Cooperating stakeholders	Estimated costs
<b>Mass transit system</b>	Phase out mini-buses	Medium term	Ministry of Transport and Public Works	City Councils; Ministry of Local Government and Rural Development; Road Traffic Directorate; Private sector transport operator representatives	n.a.
	Development of a public transportation system:	Medium term	Ministry of Transport and Public Works	City Councils; Ministry of Local Government and Rural Development; Road Traffic Directorate; Private sector transport operator representatives	Capital cost per bus is estimated at \$235,000 Operational cost (including maintenance) is estimated at \$33,000
<b>Fuel efficiency of motor vehicles</b>	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	n.a.
<b>Travel Demand Management</b>	Land use planning policies	Medium term	Ministry of	City Councils;	n.a.

Category	Action	Indicative time frame	Lead agency	Cooperating stakeholders	Estimated costs
			Transport and Public Works	Ministry of Local Government and Rural Development	
	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.

## 5.7 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

### 5.7.1 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 would initiate the establishment of a centre that could be modelled on one or more existing centres such as following:

- KNUST in Ghana.
- SEVEN in the Czech Republic.
- Energy Efficiency Centre in Nepal.
- China National Renewable Energy Center.
- Center for Energy Efficiency (CENef) in Russia.

The energy centres are often the institutions that keep clean energy initiatives like SE4All moving forward when government priorities change or budgetary constraints make it difficult for ministries to carry out their intended programs.

In addition to, or instead of, an energy centre, there is the option of establishing an EE/RE development committee. This is discussed in the Energy Efficiency section of Part III of this report (Section 5.4.1). The purpose of establishing a government committee rather than an independent centre would be to instil the entity with greater authority to supervise and administer the EE and RE activities. It could be a stand-alone agency but more likely it would be a department within the credibility in the eyes of many people than a government ministry. In this regard, it would be appropriate if the committee is vested at the Ministry of Natural Resources, Energy and Mining.

### 5.7.2 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 SE4All themes in a comprehensive and coordinated manner.

Among the local initiatives that could be pursued under the SE4All initiative are:

- Improving energy efficiency in local government facilities, including buildings, street lights, and water pumping.

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

### 5.7.3 Finance and risk management

A number of SE4All actions will require funding or financing to be implemented. For example, the construction of rural mini-grids, the installation of energy-efficient equipment in mines and factories, the establishment of an LPG distribution, storage and refuelling network, and the expanded cultivation of sugar-cane for ethanol production, among other activities, all require some form of debt and/or equity investments.

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

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

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

### 5.7.4 Capacity building and education

All the SE4All thematic areas will require capacity building and training activities. Examples include:

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

# 6.PART III – Coordination and Follow-up

## 6.1 National SE4All taskforce (structure and coordination strategy)

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

The Department of Energy, as the National SE4All Coordinator will champion the implementation of the priority actions that have been agreed by the AA development process. It will ensure that SE4All is mainstreamed into the national development agenda.

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 SE4ALL meetings with multilateral and bilateral donors to discuss progress on SE4ALL priority actions and what financial resources will be needed. Private investors can attend these meetings at the invitation from the PS.

## 6.2 Regional Coordination

Many of the SE4All actions will benefit from coordination with other countries in the Southern Africa region. For example, adoption of Minimum Energy Performance Standards (MEPS) for refrigerators, lights, and other energy-consuming equipment should be harmonized across the region so that there is a larger and more uniform market for energy-efficient appliances.

SADC is an appropriate regional coordinating institution for SE4All and has a long experience in energy. It is already in the process of establishing a regional Centre for Renewable Energy and Energy Efficiency in Namibia.

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

- Development of appropriate financing mechanism and fiscal regimes suitable for the development of Renewable Energy Technologies, (RETs).
- Strengthening of the regional capacity and capability for RETs project development, management, monitoring and evaluation via training and regional human resource pooling.
- Facilitation of the link between stakeholders with a view to promoting commercialization and greater use of RETs.
- Promotion of cost-effective pilot activities and projects for diffusion of RETs.
- Collaborating with stakeholders in identifying specific needs of different energy users in order to develop programmes that tally with these needs.
- Increased public awareness of RETs by lobbying governments, donors, commercial

entities and industries for their financial and political support of a RETs agenda.

- Facilitation of contact and cooperation among institutions involved in research and development of RETs technologies with a view to establishing consistent product standard.

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

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

## 6.3 Follow-up analysis

The Action Agenda provides the strategic framework towards achieving the SE4All targets, but in many cases there will be a need for subsequent in-depth studies and analysis.

Independent research and analysis must be encouraged to provide unfettered views on each of the SE4All goals, especially in order to confirm and detail, when necessary, targets and actions that have been settled in the Action Agenda:

- Conduct a study on the low uptake of improved cook-stoves in Malawi.
- Conduct a research program to identify, appraise and demonstrate opportunities in waste-to-energy, biomass power, geothermal, cogeneration, energy storage, etc.
- Develop national energy savings measurement methodologies (based on internationally accepted protocols).
- Assess the potential environmental and socio-economic impacts of the priority actions (e.g. on water, land, biodiversity, waste-related impacts, gender and jobs) and develop mitigation measures for negative impacts through a wider Strategic Impact Assessment.

Indeed, the Action Agenda provides priority actions to achieve targets. Nevertheless, there is a need to develop more detailed action plans, and especially to clarify the coordination between SE4All Action Agenda and national strategies mentioned in Part 1.

The Action Agenda also provides specific targets for each SE4All goals. But there is a need for additional scenario analysis to assess the costs (technical, economic and social) of different pathways to the SE4All targets and revise the targets if necessary in response to progress made between now and 2030.

## 6.4 Monitoring, evaluation and reporting

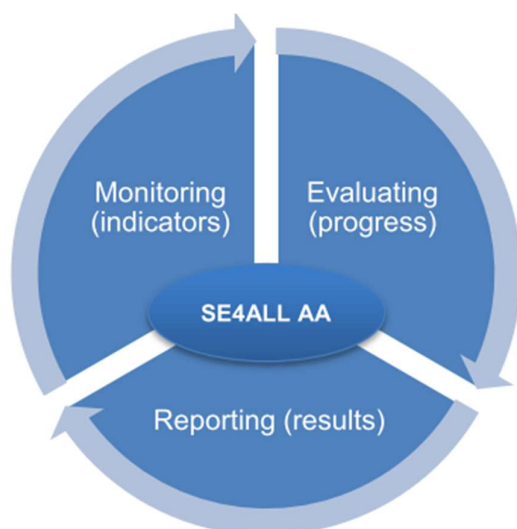
### MER System guidelines

A detailed Monitoring, Evaluation and Reporting (MER) system for tracking and reporting on program time-bound milestones and accomplishments will be prepared by the SE4All Secretariat at the beginning of the project implementation which will be periodically updated.

Designing and implementing a MER system is an essential task that will allow Malawi to track, assess and report progress on the achievement of expected outcomes under the SE4All initiative. The MER, as tool, allows for identifying key issues that need to be addressed to ensure a proper implementation of the AA. It will also allow the Government of Malawi to review and update the AA in the future. The MER system will therefore comprise a Monitoring Plan, an Evaluation Plan, and a Reporting Plan.

The monitoring plan provides a guide on how to monitor the set of indicators that will show how Malawi is progressing towards the achievement of its SE4All targets. A monitoring protocol should be defined for each indicator. The evaluation process basically consists of comparing the results obtained against a selected baseline and against the interim (if any) and final targets that are set in Malawi's AA. This evaluation plan enables the country to redefine strategies and goals for the following monitoring periods. The reporting plan implies producing a performance assessment report or similar document where the results from the monitoring and evaluation are described and, potentially, shared with the public. As shown in the figure below, MER is a continuous process that needs to be carried out periodically.

**Figure 24: Relationship among different parts of a MER framework and the AA**



## Monitoring Plan

The Global Tracking Framework (GTF) proposes guidelines for monitoring each SE4All target, i.e. for monitoring the progress made on energy access, renewable energy, transportation and energy efficiency, see Figure 18 below. For instance, a traditional approach to measuring access looks at whether households “have an electricity connection” and “have access to non-solid fuels” but does not provide information on energy services delivered through other technologies such as solar lanterns for electricity and improved biomass stoves for cooking. Nor does it provide information on the reliability or affordability of the service delivered to the “connected” household.

The development of the Monitoring Plan will require the definition of indicators and a systematic and coherent collection of data for their valuation. These indicators will enable the aggregation and analysis of data. The figure below, shows an example of high-level indicators used in the Tanzanian SE4All initiative. Such indicators can act as the starting point for the establishment of a comprehensive Monitoring Plan. They largely correspond to existing data, thus allowing the monitoring of indicators from the initial stages of the application of the AA.



**Figure 25: Illustrative list of indicators for the SE4All 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 expand to include indicators at a less aggregate level which should correspond at least to the AA targets.

Furthermore, a Multi-Tier Framework<sup>84</sup> for tracking energy access - both electricity and modern cooking solutions - can provide the required level of detail that is required for effective monitoring. This Framework, see Figure 19, 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).

<sup>84</sup>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.

**Figure 26: Key components for Measuring Access to Household Electricity Services under the GTF<sup>85</sup>**

Item		Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
<b>Tier Criteria</b>			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
<b>Type of Appliance</b>	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 SE4All AA.

The evaluation will ensure a broad and representative perspective on the achievements and challenges in the implementation of Malawi’s SE4All actions, and will allow the adequacy of the adopted strategy to be assessed to meet the targets as planned and take any corrective action if needed. The evaluation should include the provision of recommendations for future monitoring periods and it is also intended to inform the stakeholders participating in the implementation of the AA of follow-up actions required to further strengthen its performance and strategic activities.

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

- To contribute to improving program effectiveness and delivery towards Malawi’s SE4All goals by 2030 by using knowledge and lessons learnt from its implementation back into the country initiative
- To contribute to overall alignment of strategic activities of the AA and ensure that it remains relevant to addressing country level objectives whilst also aligned to the global SE4All initiative
- To update the AA as required taking into account progress made and new developments.

<sup>85</sup> World Bank/ESMAP and IEA (2015b), Table A1.1 (Multitier Matrix for Measuring Access to Household Electricity Services)

During the annual SE4All evaluation, the designated SE4All Secretariat will review the results achieved in the current monitoring period in comparison to the baseline and the previous year: progress on actions and targets met as planned in Malawi's AA using the selected indicators. It will also help identify the actions needed for the following year.

## Reporting Plan

Using the results of the evaluation phase, the designated SE4All Secretariat will report on an annual basis on the progress and performance towards the implementation of Malawi's SE4All AA. The yearly progress will be presented in a Performance Assessment Report. The report must clearly show the baseline scenario and the progress made against the targets set. The annual report would be prepared in consistent manner and shared with stakeholders for awareness, socialization and proper contributions on their part.

## 6.5 Link to Investment Prospectuses

The Action Agenda is a stand-alone document that provides a framework for achieving the national SE4All objectives. On a "global" level, it provides for interventions (policy adjustments, financial allocations, business model developments and capacity building initiatives) that will focus national support for energy access, renewable energy and energy efficiency. However, the Action Agenda provides specific measures that will drive particular investments that are part of the Investment Prospectus. In this way, some AA activities will be "operationalized" by an Investment Prospectus (IP) that is a separate document and describes a set of investments, through identified bankable projects, that Government, the private sector developers, civil society organisations, finance organizations and other stakeholders can support.

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

**Figure 27: Action Agenda and Investment Prospectus linkages**



# Annex 1: The SE4All initiative

## Introduction

The Sustainable Energy for All (SE4All) initiative was launched by UN Secretary-General Ban Ki-moon in 2011 with the vision of providing sustainable energy to all in the world by 2030. In order to achieve this, the following three interlinked key objectives were declared:<sup>86</sup>

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

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

The country action process to be implemented by the countries wishing to participate in the SE4All initiative consists of the following key four steps<sup>87</sup>:

1. *Declaration of Partnership*: With this declaration the country’s government expresses its interest in participating in the SE4All initiative.
2. *Rapid Assessment/Gap Analysis*: The analysis performed by each participating country sheds light on the current energy situation in the national development context of the country. It provides the economic, political, environmental and social background for the drafting of plans in order to promote SE4All in this particular country.
3. *Action Agenda (AA)*: The AA is edited on country level and it addresses the challenges that were previously identified in the Rapid Assessment/Gap Analysis in that it outlines and prioritizes the different courses of actions and demonstrates how the three SE4All objectives can be achieved. It takes the form of a holistic and strategy-driven document.
4. *Investment Prospectus (IP)*: There can be one or more IPs showing how the AA can be put into action. In order to do so a set of implementable programs and projects including related costs possibly for a specific sector or subsector is identified and developed to be then presented to potential investors, be it private or public ones.

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<sup>86</sup> <http://www.se4all.org/our-vision/our-objectives/>

<sup>87</sup> Sustainable Energy for All (2014). SE4All Country Action Reference Document.



A first wave of countries already completed their AAs and IPs. However, Dr Daniel-Alexander Schroth, the coordinator of the SE4All Africa Hub, stated that a structured follow-up and support to implementation of AA/IPs would be critical for maintaining SE4All momentum.<sup>88</sup> Thus, accompanying African countries during the realization of its AA and IP is the key on their way to a sustainable future.

## AA and IP: Key steps for achieving SE4All objectives

### Action Agenda

The AA is:

- A strategy-driven and holistic document that intends to determine how the three goals of SE4All could be achieved by 2030.
- An umbrella framework for the sector that includes nexus angles.
- A long-term vision which ensures the sector-wide coherence and synergy of accumulated efforts towards SE4All goals.
- A developed in an inclusive manner.

### Investment Prospectus (es)

The IPs provide:

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

## The role of the AA and IP

### Country views on the role of the AA

Countries expressed their views on the AA at the SE4All Forum. According to them, the AA:

- Provides a framework to align stakeholder objectives.
- Provides a long term view of the sector and a holistic planning tool integrated to the broader policy framework of the country.
- Identifies sector gaps and suggests actions to address gaps and costs achieving targets.
- Identifies central repository of resources for the purpose of coordination of SE4All as well as defining follow-up actions.
- Provides a platform for sharing experiences on best practices.

<sup>88</sup> Presentation delivered during the Energy Access Committee Meeting on October 1, 2014 in Brussels.

- Provides a tool to accelerate the mobilization of needed investment into the sector.

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

## Mobilizing support and investments

Mobilizing support and investments:

- Provides partners (public and private) with a clear roadmap of what the country envisages to undertake (link to monitoring and tracking).
- Provides development partners with a guiding tool for assistance to the country (link to inclusive development process).
- Provides countries with a tool to identify investment opportunities as a “live rolling” document with new opportunities being added.
- Benefit from the convening power of SE4All to promote plans and assist with matchmaking between potential investors and facilitating access to finance from available resources of partners.

*“Promote the SE4All Investment Prospectus as a tool to mobilize the required financing for accomplishing both SE4All’s objectives and those of the proposed SDG 7<sup>89</sup> on energy”* SE4All Energy Access Committee, May 2015.

## Realizing the full potential of the AA/IP

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

1. High quality outcomes of AA/IP processes:
  - Application of established “quality circle” as country support mechanism.
  - Ensuring required high-level buy-in, and inclusive development process.
  - Involvement of HIOs and thematic Hubs in the development and follow-up processes.
2. Concerted follow-up to AA/IPs:
  - AA to be formally recognized as coordination and implementation tool for emerging SDG 7.
  - Promotion/marketing for mobilizing finance for implementation of AA/IPs.
  - Structured follow-up to AA/IPs (targeted support packages, market-place for IPs).
3. Strengthening of SE4All focal points/offices

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<sup>89</sup> 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
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
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 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

## Ministry of Energy and Power Development

SURNAME	NAME
CHATSAMA	M
GUBBA	ALECK
KAVU	S
MAKICHI	K
MANYUNDO	M
MUKUZUNGA	JOHHANES
MUNYARADZI	BENSON
MUSARIRI	DAVID
MUVERENGWI	PHANUEL
MUVIRIMI	TAFARA
MUVUYA	T
MUZENDA	TSITSI VERONICA
NDEMERA	P
NYATSANZA	CHENGETAI G
ZHOU	B

## Other actors consulted

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



## Annex 3: SE4All implementation plan

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

**Table 30: Implementation of priority actions: Energy Access**

**Table 37: Implementation of priority actions: Renewable Energy**

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs <sup>90</sup>
Large hydro capacity additions	350 MW Mpatamanga, 200 MW Kholombidzo, 40 MW Mbongozi, 50 MW Chizuma, 90 MW Songwe 1, 60 MW Songwe 2, and 140 MW Fufu	Short, mid and long-term	NERA	MoNREM, private sector	Unit cost: \$2.9 million/MW Total: \$2.7 billion
Small hydro capacity additions	22 MW Tadzani IV, 23 MW Ruvo	Short & mid term	NERA	MoNREM, private sector	Unit cost: \$2-4 million/MW Total: \$90-180 million
Solar capacity additions	550 MW of PV projects at various sites	Short, mid & long term	NERA	MoNREM, private sector	Unit cost: \$3.8 million/MW Total: \$2.1 billion
Bagasse cogeneration capacity additions	46 MW at two Illovo sites	Mid & long term	NERA	MoNREM, private sector	Unit cost: \$6.7-7.4 million/MW

<sup>90</sup> 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 frame*	time	Lead agency	Cooperating stakeholders	Estimated costs <sup>90</sup>
						Total: \$308 - 340 million
Policy	Adopt RE Policy, financing strategy	Short term		MoNREM	MERA, private sector, Renewable Energy Association of Malaw, NGOs	n.a.
Research	Conduct detailed resource assessments for RE, especially wind, geothermal and non-sugarcane biomass resources.	Short-term		MoNREM	Universities and other research institutions (University of Malawi – Polytechnic, University of Mzuzu – Department of Energy Studies)  National Commission for Science and Technology	n.a
Capacity building	Training for government and private sector on licensing & permitting process, costs, regulatory policy and procedures, major issues in developing an RE project.	Short term		MoNREM	MERA, private sector	n.a.

**Table 38: Implementation of priority actions: Energy Efficiency**

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs
Institutions	Establish National Energy Efficiency Committee	long term	MoNREM	MERA	n.a.
	Establish EE/RE Fund	short to medium term	MoFED	MERA, Malawi Development Bank (upon establishment)	USD 30 million <sup>91</sup>
Agriculture	Build/Install 5 000 efficient tobacco curing barns	long term	Ministry of agriculture and water development	Tobacco control commission, MoFED	USD 7.5 million <sup>92</sup>
Policy	Introduce National Energy Management Regulations	short term	MERA	MoNREM	n.a.
	Introduce Minimum Energy Performance Standards and Labeling regulations for lighting bulbs and other electrical appliances and equipment	short term	MERA	MoNREM	n.a.
	Conduct national EE audit and develop national EE action plan	short term	MERA	MoNREM	
	Establishment of EE and RE technical excellence centre	short term	Malawi Bureau of Standards	MoNREM, MERA	n.a.
DSM (lighting)	Roll out 8.25 million LEDs	throughout 2030	ESCOM	MoNREM, Ministry of Finance and Economic Development	around USD 16.5 million <sup>93</sup>
DSM	Installation of 1.6 million pre-paid meters to grid connected households	medium to long term	ESCOM	MoFED, MoNREM	USD 64 million <sup>94</sup>

<sup>91</sup> USD 30 million is the target initial capitalization of the Fund (blend of Malawi Government equity stake, International agencies grant contributions and International financing institutions loans). Administrative costs for setting up the Fund should be in the range of USD 100,000 – 150,000.

<sup>92</sup> Based on the average rocket barn cost of USD 1 500

<sup>93</sup> Assuming an average price of USD 2 per unit throughout the AA period

<sup>94</sup> Assuming USD 40 average price per pre-paid meter

**Table 39: Implementation of priority actions on alternative fuels**

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs
Policy framework	<p>Establish a Biofuels Coordinating Committee, that:</p> <ul style="list-style-type: none"> <li>- Coordinates biofuel development across all sectors of the economy</li> <li>- Supports and develops sector development plans beyond 2030</li> <li>- Controls the implementation of policies, especially those on mandatory blend</li> </ul> <p>This committee can succeed the former Biofuels Advisory Committee</p>	Short term	Department of Energy	Government and all entities involved in this committee (see proposed list in Part II – Priority Actions)	n.a.
Production level and use	<p>Introduce incentives to support biofuel production:</p> <ul style="list-style-type: none"> <li>- Special electricity / water tariffs and feed-in tariffs for any surplus</li> <li>- Energy levy removed for biofuel industries</li> <li>- One-stop shop for all licencing of biofuel production facilities</li> <li>- Incentives for the growing of feedstocks on commercial scales, opportunities for by-products and conformity with international sustainability standards</li> <li>- Innovative financing models</li> </ul>	Medium term	Department of Energy	MERA, Ministry of Finance, Economic Planning and Development, Renewable Energy Association of Malawi, Private players in the biofuels industry (especially manufacturers)	n.a.
	<p>Promote the use of biofuels:</p> <ul style="list-style-type: none"> <li>- Attractive price for users (and fair for producers)</li> <li>- Easiness of importation of flex-fuel vehicles, distribution of flex-fuel converter kits and exemplarity measures (shift the government fleet to biofuels, renewable fuel for mass transport system, etc.)</li> <li>- Installation of appropriate fuelling pumps (distributing biodiesel and E85)</li> </ul>	Medium term	Department of Energy	MERA, Ministry of Finance, Economic Planning and Development, Ministry of Transport, Representatives of Motor Industry Association, Consumers Association of Malawi	n.a.
Other energy sources	<p>Introduce electric vehicles in Malawi and promote the use of these vehicles</p> <p>This action is linked to the overall energy access level in the country and reliability of energy supply</p>	Long term	Department of Energy	Ministry of Transport	n.a.

Category	Action	Indicative time frame*	Lead agency	Cooperating stakeholders	Estimated costs
	Consider supply of biogas for transportation as well as supply of compatible vehicles (such as bi-fuel and dual-fuel vehicles)	Long term	Department of Energy	Ministry of Transport	n.a.
	Research and development on other feedstocks (other than jatropha and sugar cane)	Long term	Department of Energy	Universities and other research institutions (University of Malawi – Polytechnic, University of Mzuzu – Department of Energy Studies)	n.a.

**Table 40: 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: <ul style="list-style-type: none"> <li>- Curb on all unregistered vehicles which is a significant proportion of the mini-bus population</li> <li>- Support the operators in buying large and efficient buses (e.g. through tax reductions or subsidies)</li> <li>- Franchising of routes: mini-buses must not be allowed to operate on city bus routes and strict enforcement is required</li> </ul>	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: <ul style="list-style-type: none"> <li>- Phase in a comprehensive public transportation system in major cities with a combination of large and small capacity buses to serve at least the 5 major</li> </ul>	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 USD 235,000 Operational cost (including maintenance) is estimated at USD 33,000

Category	Action	Indicative time frame	Lead agency	Cooperating stakeholders	Estimated costs
	<ul style="list-style-type: none"> <li>urban areas</li> <li>- Prohibit the entrance of kombis in city centres and other areas with high congestion</li> </ul>				
Fuel efficiency of motor vehicles	Use of labels and standards through the integration of EU minimum emission standards for all registered vehicles	Short term	Ministry of Natural Resources, Energy and Mining	Ministry of Transport and Public Works; Ministry of Justice and Constitutional Affairs; Road Traffic Directorate; Private sector transport operator representatives	n.a.
	Promote an appropriate car maintenance	Short term	Ministry of Transport and Public Works	Road Traffic Directorate	n.a.
	Improve road capacity and maintenance	Medium term	Ministry of Transport and Public Works	Ministry of Local Government and Rural Development; Road Traffic Directorate; Malawi Energy Regulatory Authority	n.a.
	Develop urban and suburban rail transportation system	Long term	Ministry of Transport and Public Works	Central Eastern African Railways	n.a.
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	City Councils; Ministry	n.a.

Category	Action	Indicative time frame	Lead agency	Cooperating stakeholders	Estimated costs
			Transport and Public Works	of Local Government and Rural Development; Universities and other research institutions	

## Annex 4: References

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

### Legal framework and institutions

Reference name	Energy Access	Renewable Energy	Energy Efficiency	Transportation
<b>Legal Framework</b>				
Liquid Fuels and Gas (Production and Supply) Act, 2004 (rule 25)				X
Road Traffic Act, 1997				X
<b>Policy Framework</b>				
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
Malawi Growth and Development Strategy II (2011-2016)				X
National Transport Policy, 2015				X
Cook Stoves Road Map (2015 – 2017)	X		X	
<b>Institutions consulted</b>				
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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