



Republic of Malawi

Malawi Renewable Energy Strategy

March 2017

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1. Executive Summary

1.1 Background and Vision

The Government of Malawi (GoM) Renewable Energy Strategy (MRES) sets out a detailed set of priorities and actions to achieve the following vision for renewable energy in Malawi:

Universal access to renewable electricity and a sustainable bioenergy sector.

As things stand, 89% of Malawi's total energy supply is biomass (Government of Malawi, 2009), most of which is unsustainably sourced resulting in widespread deforestation. Electricity remains unreliable and accounts for only 3% of energy used in the country (Government of Malawi, 2009), while over 90% of people are not connected to the national electricity grid (ESCOM, 2016).

Working to achieve the actions and goals in the MRES will bring vital economic, social and environmental benefits for industries, businesses, families and ultimately people across the country.

1.2 Aims and Objectives

Grid-Scale Renewables

Upgrades to the network and existing power stations will be complemented by a restructuring of the power market to create a competitive market for investors to build new large-scale power generation in Malawi.

GoM aims for the first Power Purchase Agreement (PPA) to be signed with an independent investor in 2017. Following grid extensions and upgrades there will be potential for hundreds of megawatts of new developments in the next decade.

Clean Energy Mini-Grids

Malawi already has some experience in clean energy mini-grid development and will build on this in the next few years with more pilot schemes in different areas utilising different technologies. Meanwhile, there will be a comprehensive review of regulations and policy to lower the barriers to entry for commercial mini-grid operators. These actions, combined with sharing information and experiences how to start a clean-energy mini grid in Malawi should mean that by 2025 there will be at least 50 operational clean energy mini-grids.

Off-Grid Solar

Malawi will adopt international standards for off-grid solar products and solar home systems to raise quality across the country and ensure consumer confidence. The sector will benefit from continued assistance and support by development partners who are distributing devices and creating supply chains across the country as well as sharing information to the public about the benefits of switching to solar. As the global trend of cost reduction continues and Malawi's market grows, GoM estimates that these devices will be available to everyone who isn't grid-connected.

Bioenergy

GoM recognises that huge efforts must be made to ensure that using biomass for energy is done in a more sustainable way.

GoM is working with development partners to make, market and sell over 2 million cleaner cookstoves by 2020. As well as stoves, new regulations and better enforcement can create a sustainable fuel stock and slow down the rate of deforestation.

In transport, GoM has identified targets for increasing the sustainability of fuels, aiming for the percentage of bioethanol in petrol to reach 20% by 2025 and the percentage of biodiesel in the total diesel supply to equal 30% by 2030.

1.3 Delivery

The Malawi Renewable Energy Partnership Group (MREPG)

GoM in collaboration with the UNDP will establish a multi-stakeholder Malawi Renewable Energy Partnership Group (MREPG) with membership from donors, NGOs, public sector bodies, academia and the private sector. This group will be formed immediately on publication of the MRES and will be tasked with delivering the actions within the MRES as well as recommending new actions in future as the sector develops.

Malawi Renewable Energy Agency (MREA)

In the longer term, GoM will introduce a delivery agency for renewable energy in Malawi. This public sector agency will implement projects and programmes which meet the aims and objectives of the MRES as set by GoM and the MREPG.

Rural Electrification Fund

GoM will expand the scope of the Rural Electrification fund, which currently focuses extending the national grid, to include a range of other activities, as allowed by law. The MREPG should be influential in working with GoM to determine what funds are needed and where. In future, the MREA will be tasked with distributing and using these funds to meet the objectives of the MRES.

External Funding and Support

As highlighted throughout the MRES there are opportunities for external partners to support the development of the renewable energy sector via a number of different projects which require funding. GoM and the MREPG are open to hearing from potential partners.

District Energy Officers

In terms of local support, GoM has committed to employing District Energy Officers across Malawi by 2022. These officers will perform a range of duties from advising the general public to informing local energy plans, all to meet the aims and objectives of the MRES. There is currently a pilot project ongoing to determine the exact role of the district energy officers.

2. Introduction

2.1 Foreward

At the United Nations Sustainable Development Summit on 25 September 2015, world leaders adopted the 2030 Agenda for Sustainable Development which included a set of 17 Sustainable Development Goals (SDGs) to end poverty, fight inequality and injustice, and tackle climate change by 2030.

One of these goals, SGD 7, aims to secure access to modern, affordable and sustainable energy for all.

Achieving this goal is important for all nations in the shared fight against climate change and for Malawi it is critical for the country's economic, social and environmental future.

In terms of the country's prosperity, the use of renewable energy technologies has the potential to increase the productivity of industries and businesses which in turn can attract further investment and economic growth.

There are profound social benefits of increasing renewables uptake. Clean electricity access has the potential to improve essential services locally across the country. In areas without access to electricity from the grid, renewables can offer access to lights during medical operations or can improve a child's education by facilitating study at night. Furthermore, reducing the reliance on technologies which burn fuel in the home can help to prevent serious diseases and deaths from respiratory problems as a result of smoke-inhalation.

In terms of the environment, modern energy services can drastically reduce reliance on wood fuel and begin to tackle the widespread deforestation which is causing massive environmental damage across the country and contributing to climate change. Renewables are the only energy option which can achieve these aims without producing hazardous and polluting emissions.

Given these benefits, and the cost and impacts of continuing to source energy from environmentally and socially damaging sources, the time to act to increase renewable energy across Malawi is now.

By delivering the actions outlined in this document, Malawi's first ever Renewable Energy Strategy, the country will be able to deliver renewables at all scales and across all parts of the the country, allowing industry, businesses, families and ultimately people to take full advantage of this potentially transformative industry.

2.2 Background and Scope

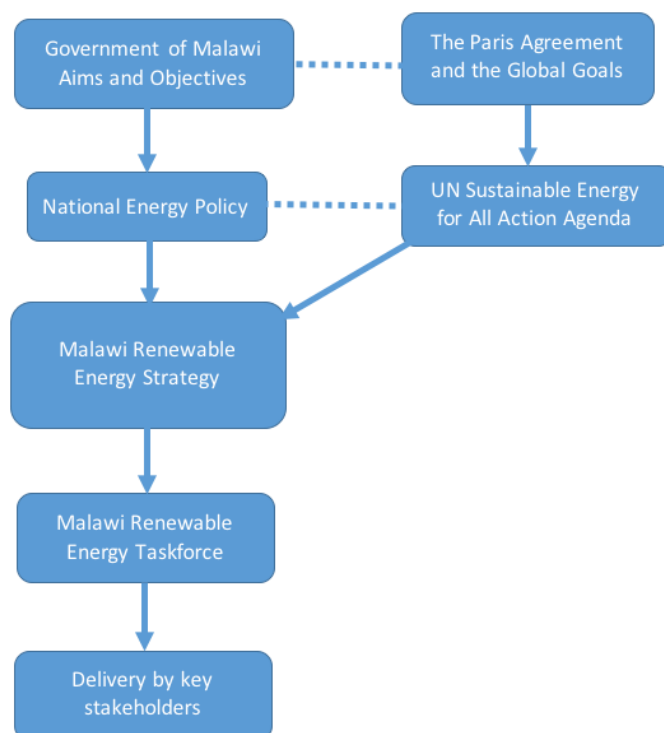
2.2.1 Purpose, Methodology and Audience

The MRES follows on from the publication of the new National Energy Policy (NEP), the first time the policy has been reviewed and revised since 2003. The MRES will aim to work towards practical delivery of Malawi's ambitions in renewable energy as highlighted by the NEP.

The document is also closely linked to Malawi's involvement in the UN's Sustainable Energy for All (SE4All) programme and the Government's commitment to the UN Global Goals. Although the

SE4All Action Agenda covers a broader spectrum of issues in relation to sustainability, the Malawi Renewable Energy Strategy (MRES) will be able to act as a working document for delivery of the high level aims and objectives of the SE4All Action Agenda specifically in relation to renewable energy.

The following diagram highlights where the MRES fits in the policy landscape and highlights how it will be used by a GoM-led Malawi Renewable Energy Partnership Group (MREPG) of key stakeholders in the industry. The MRES will set the agenda for the MREPG to deliver identified actions. Full details of the set-up of the partnership group are found in the Section 7.1.3 of this document.



As well as taking note of the Government's priorities in the NEP and the work of the SE4All programme, the strategy draws upon a huge amount of recent and on-going research across the renewables sector in Malawi and further afield. Reports that have been reviewed as part of the development of this strategy include but are not limited to:

- Malawi Grid Capacity Study, Mott MacDonald
- Bioenergy Strategy, GoM
- A Framework for Independent Power Producers in Malawi, GoM
- Cookstoves Roadmap, GoM
- Malawi Policy and Regulatory Review, Oxfam
- Mini Integrated Resource Plan, GoM
- Malawi Energy Africa Compact, DFID/GoM
- Wind Resource Studies, Sgurr Energy
- Off-grid Lighting and Phone Charging Study, Business Innovation Facility
- Malawi Renewable Energy Acceleration Programme, Strathclyde University

Alongside written reports, GoM has worked together with renewables stakeholders across the country including donors, non-governmental organisations (NGOs) and industry. Ongoing communication and interaction throughout the development of this strategy has meant that the work and ambitions of those in the sector today has been captured in the MRES.

The MRES is intended to serve a number of purposes. For GoM, the MRES will be used to set the immediate agenda for action to promote renewables and improve the regulatory, fiscal and legal framework for the sector. Key stakeholders such as businesses, donors and NGOs will also be involved in the delivery of this work as part of the MREPG. Such stakeholders may also use the MRES to look for where their resources and expertise could assist with the delivery of specific actions, noting that the document identifies key actions which are not yet underway and which may still require assistance and funding.

For other interested stakeholders and those in wider society for whom renewable energy could be a critically important sector in terms of jobs, income, equality, health or welfare, the content of the MRES and work of the MREPG should be seen as a way to sense-check the Government's agenda in this vital area. An open approach to delivering the actions in the strategy with a wide range of stakeholders will be encouraged by GoM so as that many interested parties as possible can make the case for change and action.

2.2.2 Timeframes

The MRES will present a long future vision for renewables in the country up to 2030, working towards the policy objectives of the NEP as well as being in line with the UN's SDGs and the SE4All action agenda.

Although the document sets out a longer-term vision, the MRES also aims to prioritise the practical actions and targets which can be implemented immediately and over the short-term. This will ensure that initial progress is made across all key areas while allowing for flexibility to change, adapt and add to what will be required to continue to make progress in future.

With that in mind, and in line with plans for a similar approach with the NEP, it is advised that the renewable energy strategy is revised at least every 5 years. Therefore, although there are no actions in this document planned beyond 5 years it is expected that revised versions will continue to strive towards the same vision and outcomes but will have a different set of actions as the sector develops.

The MREPG who will be responsible for overseeing delivering the actions within the MRES and will ensure that further appropriate actions are set on an on-going basis. The group will also lead on revising the MRES on a more comprehensive basis at least every 5 years.

2.2.3 Layout

The MRES will begin by presenting a brief overview of the energy sector in Malawi followed by a section outlining the case for renewable energy and why it is so important to many of the Government's key objectives.

The proposed vision will then describe how Malawi's renewable energy sector could look like in the lead up to 2030. The vision section will highlight the overarching themes of the MRES and identify what the benefits and outcomes could be for the country. It will also identify a series of targets that GoM are confident of meeting if the identified actions in the chapters in the MRES are delivered.

Following the vision, the MRES will focus on a series of chapters detailing how different aspects of the industry can contribute towards the overall vision, split into renewable electricity, sustainable bioenergy and a series of cross-cutting areas. Each of these chapters will be split again into

specific areas of focus and will include a table of key actions with information about timescales, responsibility for delivery, and an overview of current progress and funding.

Each of the remaining areas of focus will contain detailed background information highlighting why that particular area is important to Malawi's overall progress in renewables, introducing work that is already ongoing in the sector and providing reasoning for the identified actions.

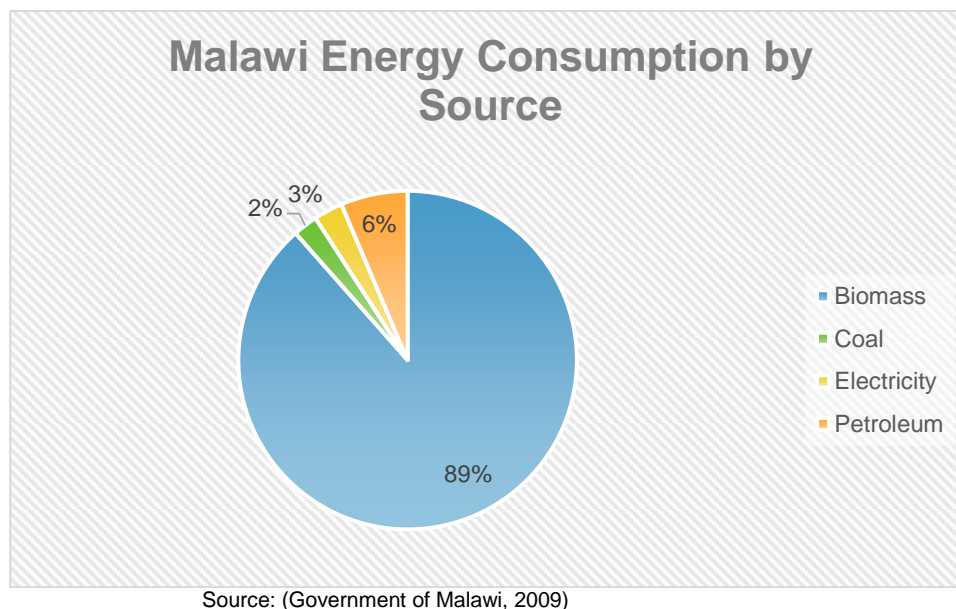
The MRES closes with a final chapter on coordination, leadership and next steps which highlights what roles various stakeholders have in implementing the strategy and also suggests the Malawi Renewable Energy Partnership Group (MREPG) will be formed to bring people together to implement the actions and set new goals as progress is achieved in line with the timeframes mentioned above.

3. Overview

3.1 Malawi's Energy System Today

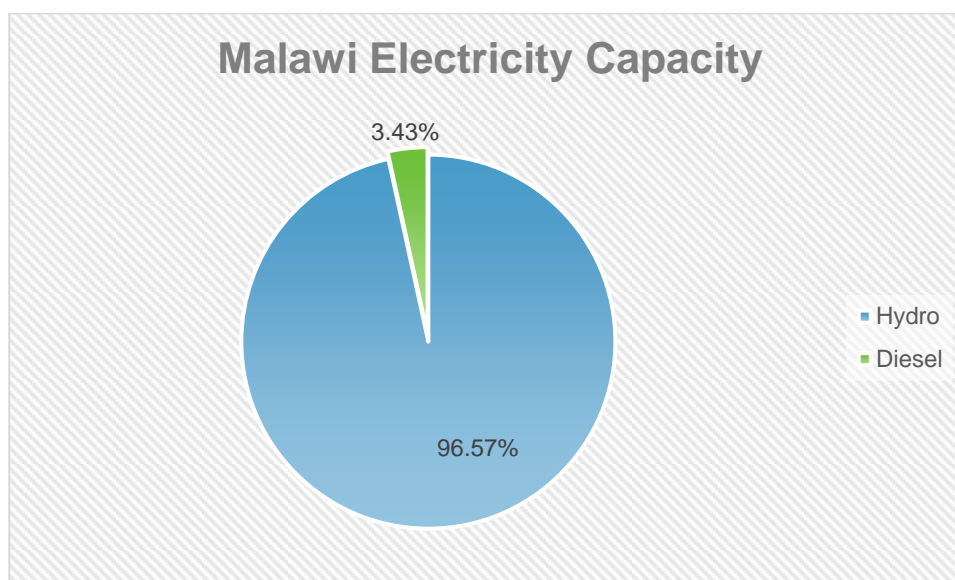
89% of Malawi's total energy supply is sourced from biomass while electricity accounts for only around 3% of the total (Government of Malawi, 2009). Around 90% of Malawi's 17.75 million people (United Nations, 2016) are not connected to the national electricity grid (ESCOM, 2016) and rely on firewood for the vast majority of their energy needs while many who are connected to grid still use firewood or charcoal for cooking while power supplies remain unreliable.

As Malawi's population continues to rise at around 3% every year (United Nations, 2016) the country is facing increasing demand for energy resulting in widespread deforestation.



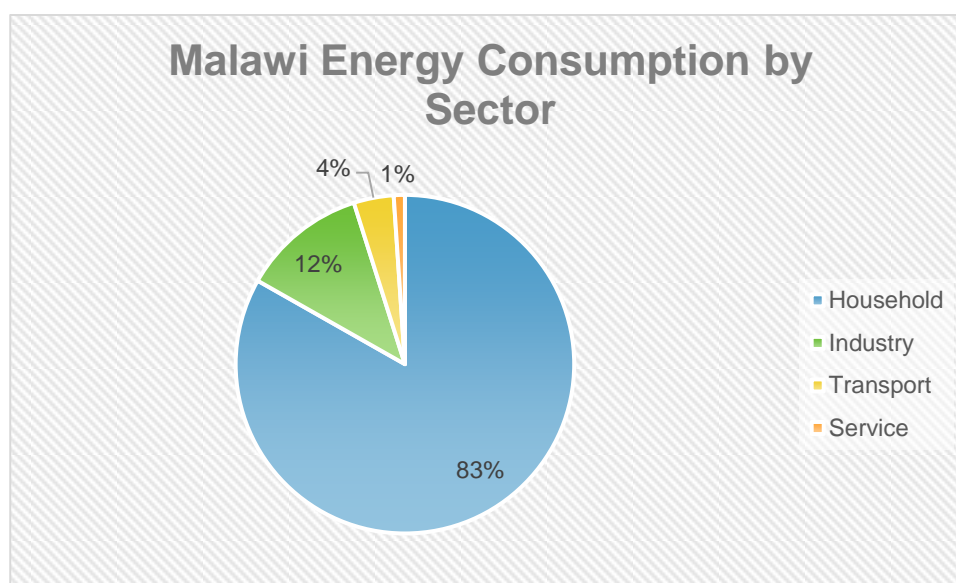
The electricity grid in Malawi only reaches only around 10% of the population (ESCOM, 2016) and has a total installed capacity of just over 360 MW (Table 1, Chapter 3). Supply is already well short of demand (Zalengera, 2014) leading to widespread power outages.

Over 96% of the current capacity which fuels the grid is sourced from hydro schemes on just one river, the Shire (See chapter 4.1.2, Table 1). This leads to seasonal variability in power supplies during the dry season resulting in more severe outages for homes, businesses and industry.



Source: (Table 1, Chapter 3)

Malawi's energy use is also weighted towards one sector, households, which represent 83% of consumption. Industry represents 12% of energy consumption and transport only 4% (Government of Malawi, 2009). This is a clear indicator that modern, productive industries and businesses are not yet present in Malawi on a large scale, in no small part due to the lack of available, secure and reliable energy services. These figures also highlight the huge pressure on biomass stocks from domestic use.



Source: (Government of Malawi, 2009)

Despite these difficulties, Malawi starts from a position where almost all energy in the country, namely biomass and hydro, could potentially be sustainable and renewable if managed properly.

3.1 The Case for Renewables in Malawi

Malawi clearly needs to make the transition away from current practices into a modern, sustainable, energy sector which meets the needs of the people, helps to boost the economy, and safeguards the country's environment. Only energy from renewable sources can achieve all of these aims simultaneously.

The NEP has set an overall goal of providing, “*access to affordable, reliable, sustainable, efficient and modern energy for all Malawians by 2030*” and sets out five policy outcomes which GoM hopes to achieve in reaching this goal.

The MRES highlights that renewables are essential to the delivery of every outcome, as detailed below:

1. An energy sector that is based on diversified energy sources;

Malawi has an urgent need to develop a more diverse energy supply and the potential for a wide range of renewables technologies in the country means that is possible. Resource assessments that have been carried out show high potential for hydro, solar and wind at a range of scales and ongoing studies will continue to assess potential.

GoM are equally aware of the need for research and development in a range of other areas to support a diversified sector including novel energy generation technologies, new off-grid solutions, energy storage, interconnection and grid management.

Although fossil fuels are still likely to play some part in years to come, perhaps even as baseload power in the near future, the long term prospects for renewables are positive given falling global costs, increasing efficiencies and experience of development in neighbouring countries. Malawi should be at the forefront of this industry, showcasing how development and industrialisation can be decoupled from increasing pollution and reliance on fossil fuels.

2. A well developed and efficiently managed energy sector;

GoM are aware that in order to develop such an array of technologies and to deliver them to so many different parts of Malawi’s society, good management is key. GoM are confident that the MRES highlights how the renewables industry can benefit from reforms across the sector, a focus on the long-term and creation of new industries and opportunities, and a more collective approach between key stakeholders.

As well as a number of reforms currently underway in the electricity sector, the MREPG, which will be set up to deliver the actions within the MRES, will be another opportunity for promoting good management of the sector going forward.

3. An energy sector that promotes and supplies modern and sustainable energy services for driving the country’s economic growth;

Businesses will inevitably be more attracted to invest in Malawi if power supplies can be reliable. Given the country’s low economic growth rate (World Bank, 2016) in comparison to many neighbouring countries, the need for more power to help support businesses and attract new investment is clear.

From rural sole-traders utilising small solar panels and batteries to industrial processes utilising large-scale power plants, renewable energy can help to create jobs and achieve prosperity. There is also potential for a thriving renewables industry to create jobs in the development of the sector such as in assembly or manufacturing of renewable energy products or in joining the efforts to extend and upgrade the power network and generation capacity.

4. An energy sector that promotes and results in a high standard of living for all men and women in Malawi; and

A thriving renewables sector could significantly enhance the welfare for citizens and provide a range of societal and social benefits.

Provision of basic lighting needs from renewables devices to local health centres can drastically improve services, making basic and complex medical procedures, such as giving birth, safer. Electricity access from renewables also allows for remote areas to benefit from refrigeration, allowing for essential medicines and vaccines to be stored safely.

In response to emergencies, lighting and basic healthcare can be provided as a rapid response by modern off-grid devices, providing electricity at short notice to remote areas.

In education, lights in rural homes and schools can give children an opportunity to study after dark to increase their chances of achieving their full potential and help to continue to improve Malawi's development prospects in the long term. Power availability is also a motivating factor for attracting teachers to live and work within rural communities. With access to electricity, better teachers are attracted to the area and they can in turn work more effectively with their pupils.

Renewable energy can also create a more equal society and reduce the current discriminations women in Malawi face when it comes to accessing energy. The benefits of reduced illness and death from smoke inhalation will mainly benefit women who cook in the home using open biomass fires. Modern and efficient cooking methods will also see women and girls spend less time collecting firewood, thus increasing school attendance by girls.

Safety is another major issue. Unfortunately, it has been found that sexual violence and abuse is often perpetrated in areas without access to electricity and light to help safeguard those most at risk. Providing lighting in local communities, on streets and in institutions like schools and hospitals, can help keep those at risk safe, especially women and girls.

As well as the inherent progression towards equality offered by renewable energy, as the GoM give the industry support and intervene where needed it will be ensured that these interventions promote and present equal opportunities for men and women of all ages.

5. Access to clean and sustainable energy for all people.

As well as diversification in terms of the types of renewable energy employed, there will also be a diversification in the scale, cost and ultimately the accessibility of renewables as a result of the MRES with the promotion of better grid connected solutions as well as access to small scale and personal solutions for those in remote areas.

GoM want to promote renewable energy and the benefits it brings to all Malawians regardless of gender, income levels, age or any other factor.

3.2 A Vision for Renewables in Malawi

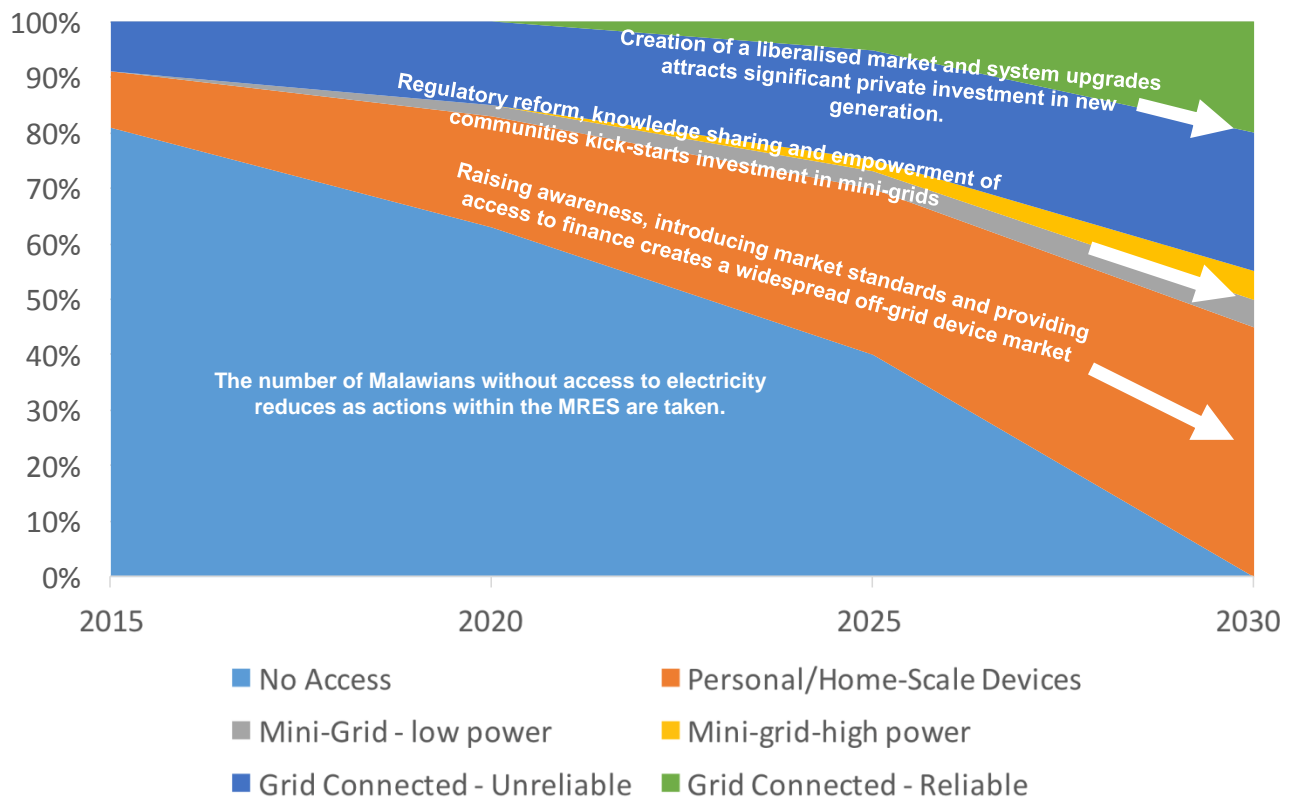
The following vision articulates a potential route forward for the renewables sector up to 2030. This route starts with effective delivery of the actions identified within the MRES. Although ambitious, the vision should be used as a reference for what could be possible given collective and collaborative action and a focus on tackling the issues the sector currently faces.

In summary, the vision focusses on two very broad themes: creating access to renewable electricity for all while substantially improving the sustainability of the country's biomass energy consumption.

3.2.1 Electricity Access for All

The MRES aims to set in course actions that will ultimately lead to access to electricity for every citizen in the country by the year 2030 in line with the UN Sustainable Development Goals. The chart below highlights a potential route towards achieving this.

Vision for Electricity Access Rates in Malawi up to 2030



Rapid changes in the rates of access to modern, sustainable electricity sources can be achieved through a number of actions and interventions in priority areas, coupled with continued cost reductions and technological progress in renewables globally. The chart above tracks what progress could look like from the current status whereby around 23% of citizens have access to electricity access of some form to universal access by 2030. This 23% figure is made up of those connected to the national grid, 10% (ESCOM, 2016), and those with access to an off-grid solar device, 13% (Business Innovation Facility, 2016).

The projections going forward are estimates based on the following descriptions of each sector and have been informed by numerous discussions with key stakeholders involved in programmes across all sectors as well as through discussion and debate during a consultation process across Malawi. Although it is impossible to say for certain that this will be achieved, what is clear is that without completing the actions in the MRES there is no chance of this vision becoming a reality.

Off-Grid

It is hoped that the off-grid solar sector could play a hugely important role in achieving this goal through the spread of very small-scale personal solar devices to larger home systems. Initially, in the run up to 2020, with off-grid solar devices currently owned by only 13% (Business Innovation Facility, 2016) of households the industry will still rely on support from social enterprises and NGOs in order to develop the supply chain and provide subsidies for those who are most in need. By 2020, with costs falling and greater consumer awareness as the market develops, many sections of society will already be able to afford these products and make the switch to off-grid solar devices. By 2025 the market should almost be fully commercial as prices continue to fall and

finance models are available for the poorest in society. By 2030 it is hoped that the market will have already reached full penetration and mini-grid and grid-scale power will begin to displace those who initially purchased off-grid solar products.

Clean Energy Mini-Grids

Mini-grids will also play an increasingly important role with the economics of such schemes becoming more attractive and Malawi gaining experience from a number of pilot schemes in the run up to 2020. By 2025 it is hoped that at least 50 mini-grids will be operational, including the first fully commercial schemes. Businesses and industry will also begin to develop renewable power sources for their own use, either selling excess power to local off-grid communities or to the national grid. By 2030, mini-grids will increase in scale as independent suppliers become more ambitious. Productive and large-scale clean energy mini-grids will replace the need for connections to the national grid in some areas and could integrate with the national grid in some instances.

Grid-Scale Power

GoM hope to sign the first Power Purchase Agreement (PPA) with an independent investor in 2017 and for the first independently owned renewables development to be operational by 2020. Grid extensions and upgrades will continue to reach more of Malawi's population and as the market is liberalised, more interest in investing in large-scale renewables will occur. By 2025 GoM aim to have around 500 MW of new renewables generation capacity on the system. By 2030, the grid will be more reliable as upgrades continue. Industry and businesses will begin to generate significant demand for power which will continue to see the generation capacity expand.

Although 100% electricity access is the aim for 2030, it is hoped that essential services will receive power as a priority and GoM are therefore aiming for all schools and health centres to have electricity access by 2025.

3.2.2 Making Bioenergy Sustainable

It is estimated that over 3 billion people globally and 700 million people in Africa rely on biomass fuel as their main source of domestic energy (PwC, 2016). Much of Malawi's population in urban as well as rural areas still rely on firewood and charcoal, with 86% of the country's total energy use coming from biomass and 96% of households using firewood or charcoal for cooking (Zalengera, 2014).

The overall consumption of wood exceeds sustainable supply to such an extent that the net loss of forest reserves in Malawi each year is over 50,000 hectares (REEEP, 2012). Deforestation not only harms natural habitats and destroys a natural store of carbon, it also removes the structure from the soil which leads to erosion and increased flood risk as well as the knock on effect of increased siltation in rivers during the rainy season. Siltation frequently interrupts water supplies and affects power generation in the hydro schemes on the Shire River.

Even by achieving 100% electricity access as detailed in the table above, many millions of Malawian's are still likely to rely on biomass for energy intensive activities, especially cooking. Therefore, in tandem with increasing access to modern and renewable electricity, GoM recognises that huge efforts must be made to ensure that use of biomass energy becomes far more sustainable than it currently is. If managed correctly, biomass energy can be a renewable resource. The MRES will work towards this goal.

With this in mind, Malawi has set an ambitious target to sell 2 million cleaner cookstoves by 2020. If this target is reached the country will be well on track for all households off the grid to be using cleaner cookstoves by 2030 meaning the country as a whole will be burning fuel at a much slower rate than is currently the case.

Alongside sustainability issues, indoor air pollution from biomass fuel is increasingly recognised as a major health concern in the developing world, ranking tenth among preventable risk factors contributing to the global burden of disease, and is responsible for an estimated 36% of mortality due to respiratory disease (PwC, 2016). Cleaner cookstoves can drastically reduce the health risks of domestic cooking with biomass.

As well as cleaner cookstoves, the fuel used in the cooking process or indeed any other activity is equally if not more important to consider. Without fuel sourced from sustainable stocks or produced in a sustainable manner, burning biomass or biofuel for any purpose cannot be considered renewable. The MRES highlights the need to protect Malawi's remaining forestry reserves by properly recognising their economic and environmental value. Without intervention to correct what is a long term market failure, these reserves will quickly disappear.

In the run-up to 2030, new regulations and better enforcement should mean sustainable production of fuels and sustainable industrial processes using fuels will become more competitive and further increase the efficiency of biomass stocks. Many of these regulations will be detailed in the forthcoming National Charcoal Strategy which will be published later in 2017.

The transport sector is also likely to increase in size as Malawi's economic growth increases. For this reason, and to be in line with the SE4All Action Agenda, the MRES has identified targets for the percentage of bioethanol in petrol to reach 20% by 2025 and percentage of biodiesel in the total diesel supply to equal 30% by 2030 (Econoler, 2016).

Bioenergy has an important role as Malawi's main energy source. GoM want to ensure that as domestic supplies of this valuable commodity are used, it is done so in a progressively more sustainable manner until Malawi's bioenergy sector can be called a truly sustainable energy sector.

4. Renewable Electricity

4.1 Grid-Scale Power

4.1.1 Actions

Year of completion	Action	Implementers	Status	Funding Status
2017	Deliver MAREP phase 8 grid extensions to benefit over 170 trading centres	GoM	Underway	Funded
	Complete World Bank Energy Sector Support Project to deliver grid extensions and upgrades.	World Bank, GoM	Underway	Funded
	Carry out tender process for solar developments totalling 70 MW	ESCOM	Underway, closed for bids as at 31 January 2017	No funding required
	Develop a new Integrated Resource Plan to plan for future renewable energy developments and attract further funding	GoM, World Bank and consultants	Underway	Funded
2018	Assess the need for and viability of a renewable energy Feed-in Tariff in Malawi.	Not identified – GoM seeking partners	Not started	Funding required
	Ensure legal and financial experts are in place in key institutions to assist with development of initial IPP framework and PPA process	GoM, ESCOM, MERA and MCC	Underway but only for the short term, long term additional support needed	Longer term funding and support required
	Complete a review of electricity prices to ensure they are	GoM, MERA	Not started	Funding not yet identified, support required.

	reflective of the cost of new generation and infrastructure upgrades			
2020	Fully-developed IPP framework to allow for solicited, competitive bids for new renewable energy generation projects	GoM, ESCOM, IPP experts, international finance community	Process underway but additional, long term support and expertise required	Partly funded, long term support needed.
	Technical capabilities developed to allow the national grid to easily integrate more distributed and small scale developments.	ESCOM	Not started	No funding identified

4.1.2 Current Status and Potential

As the MRES highlights, the case for investing in the new renewable electricity generation is clear. The current capacity (shown in detail in Table 1 below) is not sufficient to meet the needs of even those few who are already connected to the electricity grid in Malawi as well as the rest of the population, businesses and industries that could benefit from an electricity connection.

Table 1 - Current Installed Capacity

Power Station	Installed Capacity (MW)	Year Commissioned
Nkula Falls A (Shire River)	24	1966
Nkula Falls B (Shire River)	60	1980
	20	1986
	20	1992
Tedzani Falls I (Shire River)	20	1973
Tedzani Falls II (Shire River)	20	1977
Tedzani Falls III (Shire River)	52.7	1996
Wovwe Mini Hydro (Wovwe River)	4.35	1995
Kapichira Falls Phase I (Shire River)	64.8	2000
Kapichira Falls Phase II (Shire River)	64.8	2013
Likoma Island Diesels (GoM owned mini-grid)	1.05	2003
Kanengo Diesel Plant	10	2016
Chizumulu Island Diesels (GoM owned mini-grid)	0.3	2003
Total Installed Capacity in 2016	362	

Sources: (ESCOM, 2016) (Econoler, 2016) (ESCOM, 2016)

The immediate priorities for grid scale power are to upgrade and extend the existing network, and to introduce new generation to meet demand.

What is clear is that to meet future demand, and to attract a more diverse renewables generation portfolio, the country will require investment from independent power producers alongside Government-backed developments. Given the falling global costs and the vast potential in Malawi, the majority of interested investors are backing renewable energy generation, particularly solar energy.

There are already over 40 Independent Power Producers (IPPs) who have formally expressed an interest in the market in Malawi by signing memorandums of understanding with GoM. Although non-binding, these agreements highlight the scale of interest and give further impetus to complete grid upgrades and reform the market to unlock new generation potential.

This interest in renewables is understandable given the outstanding resources Malawi has on offer. In large-scale hydro, feasibility studies show potential for many new schemes. In solar, a report on radiation confirms strong levels across the country (World Bank, 2015) and in large-scale wind, monitoring at some sites is already complete (Strathclyde University, 2015) with more underway. GoM is also exploring the potential for more novel technologies such as geothermal energy.

A recent study on grid capacity indicated that renewables developments of 15 to 17 MW (dependent on location) could be accommodated across the network up to a maximum total capacity of 70 MW (Mott MacDonald, 2016).

Despite this potential, and the continued interest of IPPs, there are still no independently owned grid-connected developments in the country. GoM recognises it is important to pursue these initial IPP developments now to begin to bridge the gap between demand and supply and also to begin to develop the appropriate legal and institutional reforms as Malawi looks towards introducing a fully functioning IPP framework for future developments when more capacity is available on the grid.

As such, GoM ran an initial invitation to tender for solar projects, as detailed below.

A full Integrated Resource Plan (IRP) is currently being developed which will take into consideration the new market reforms and grid upgrades to determine the expected capacity and demand for new electricity developments in future.

4.1.3 Upgrading the Network

There are various ongoing initiatives to upgrade Malawi's electricity grid, including donor supported schemes as well as Government backed plans.

Millennium Challenge Corporation Compact

The US Government is working with GoM to deliver a \$350.7 million Millennium Challenge Corporation (MCC) Compact, part of which is aimed at the most urgent rehabilitation, upgrade and modernisation needs of Malawi's power system. This part of the MCC Compact is composed of three activities aimed at preserving and stabilizing existing generation capacity, improving capacity of the transmission and distribution network, and increasing the efficiency and sustainability of hydropower generation.

A conservative estimate of the total the value of additional grid throughput capacity as a result of the MCC Compact is at least an additional 300 MW. Furthermore, the investment in the transmission system will provide future opportunities for power supply to additional distribution

substations and consumers. Work is ongoing and progress can be found online (Millennium Challenge Account, 2017)

The World Bank's Energy Sector Support Project

An \$84.7 million World Bank programme is also helping to improve the capacity of the network. The Energy Sector Support Project, which is due for completion in 2017, aims to strengthen and expand the electricity network, carry-out feasibility studies for new generation projects, introduce demand side management and energy efficiency measures and finally, to build capacity and technical knowledge within the Ministry of Natural Resources, Energy and Environment as well as ESCOM.

Quality and reliability of supply will be improved through installation of increased transformer capacity, and construction of new distribution substations to take the load off those substations that are currently overloaded. Four new substations will be constructed, together with new 33kV and 11 kV distribution lines. In addition to new substations, existing ones will be upgraded.

Malawi Rural Electrification Programme

GoM is committed to extending the grid through the Malawi Rural Electrification Programme (MAREP), allowing connections to be made to more homes and businesses every year. MAREP is funded by the Rural Electrification Fund which in turn is funded through a levy on retail energy sales. GoM will continue with this initiative in order to deliver more modern energy services to new parts of the country.

The latest stage of the project, Phase 7, was completed in August 2015 and benefited a total of 136 trading centres. This brings the total connected through the programme to over 376 trading centres across Malawi. Phase 8 of MAREP is now underway and will seek to reach 173 more trading centres utilising a budget of MWK12 billion.

All of the above programmes will work to strengthen and extend the grid and make way for renewables developments in the short, medium and long term.

4.1.4 Energy Market Reform

GoM's ambition is that new renewables developments could be developed by independent power producers in an open, competitive market. To do this, the Government is taking a number of important steps to create a route to market for private renewables developments.

Unbundling ESCOM

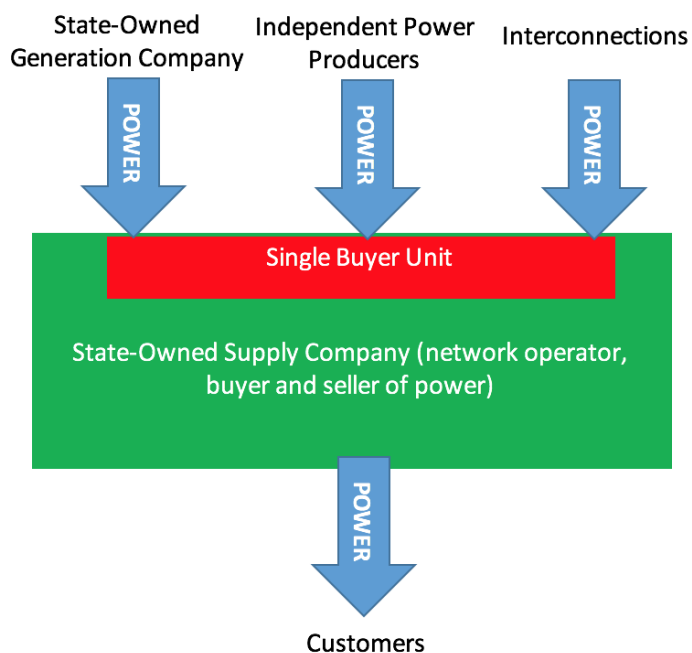
In August 2016 Malawi's Parliament passed legislation which allows for the 'unbundling' of ESCOM into two separate entities thereby creating two independent businesses in energy generation and energy supply.

The new generation company, which was registered in September 2016, will own and operate existing and future GoM-owned power stations and will enter into a competitive market with independent generators to develop new projects.

The new supply company is made up of the residual functions of ESCOM such as operating the distribution and transmission network and delivering and selling power to customers. The new supply company will add include an additional function of being the single buyer of electricity in a new liberalised market, purchasing power from independent or state-owned power plants through a

competitive bidding process. Steps have been taken to ensure the single-buyer function of the new supply company is entirely independent and impartial.

Malawi's Reformed Power Market



Given the level of interest in renewable energy developments these reforms could unlock significant amounts of new generation from wind, hydro and solar in the next few years as the market opens up and grid upgrades allow for more capacity on the network.

As well as the grid project outlined above, the MCC is also supporting this reform agenda while also strengthening institutions and enhancing regulation and governance of the power sector that includes rebuilding the now unbundled ESCOM into a financially sustainable, socially and gender responsive and operationally well-managed utility. This work should foster an environment across ESCOM, the Malawi Energy Regulatory Authority (MERA) and GoM that is consistent with the best practice in independent power utility regulation in the energy sector.

Independent Power Producer Framework

Following the unbundling of ESCOM, the reform agenda will focus on taking the steps to establish a competitive framework for investment in new generation to utilise the newly energy market arrangements outlined above.

In realisation of the need for inward investment by IPPs in Malawi, efforts were initiated to develop such a framework in 2013 by GoM in conjunction with project partners ESCOM, MERA, and MCC. Together, they published a report (MCC, 2016) in April 2016 which outlines the steps that GoM and

agencies should take to develop a functioning, successful IPP framework. GoM are considering the recommendations of the report with a view to implementing the following actions:

1. **Identifying what generation Malawi needs and when:** a new Integrated Resource Plan (IRP) is currently being undertaken and is due for publication in 2017. This will be an essential document to clarify GoM policy on what type of generation is needed in Malawi, when it can be developed and what infrastructure upgrades are required. However, it is already clear from recent studies that there is room for investment in some new renewables generation now and that this should be pursued as soon as possible.
2. **Establishing a single buyer for electricity:** As detailed above, Malawi's Parliament has now passed legislation to unbundle ESCOM and for a new state-owned supplier to become the single buyer of electricity from IPPs or other Government funded generation projects. GoM is now working to consider the next steps to build on the legislation and finalise this transition. Options will be explored as to whether or not to establish an interim single buyer before the ESCOM reforms are complete in order to fast-track some projects.
3. **Ensuring financial viability of an IPP market:** GoM will fully consider the guarantees it can offer IPPs when agreeing power contracts to minimise the risk of investing in new developments. Issues such as exchange rate volatility and credit worthiness of the single buyer will have to be analysed as part of this process. GoM will also liaise with international financiers such as the International Monetary Fund (IMF) to look at how to de-risk a new Malawian power market. GoM will facilitate discussions as soon as possible with these institutions, as well as potential investors, to work towards establishing what guarantees a new single buyer can offer investors. This process will also consider how best to protect the revenues from Malawi's power consumers which could serve to de-risk the investment market for IPPs.
4. **Energy Pricing:** GoM will work with MERA to evaluate energy pricing in Malawi. In order to allow for new investments, consumer energy tariffs must be reflective of the both the costs incurred to operate the current system as well as the costs of new developments and infrastructure upgrades across the country. If energy prices are not reflective of these costs, the GoM will be unable to purchase power from independent producers without losing money and therefore new developments are not likely to be constructed and the country will remain under-supplied.
5. **Capacity and Expertise:** GoM and agencies like ESCOM and MERA will need staff in place with sufficient legal and financial expertise to develop and deliver a fully-functioning IPP framework and to negotiate power purchase agreements (PPAs).

GoM recognises the steps above are far reaching and complex and therefore discussions with policy experts, investors, international development financiers and others should start now to ensure that the country takes the necessary steps to ensure Malawi has a modern IPP framework in place as soon as possible.

It is clear that this framework may not be solely reserved for renewables generation but as the interest in new solar and wind developments is so high, it is a crucial part of the development of the renewables sector.

Initial Tender for Solar Developments

For the long-term sustainability and affordability of the sector it is important that GoM and partners work towards putting a fully functioning and fair IPP framework in place. However, given the urgent need for new generation in Malawi in the short term, it was determined that the currently available capacity for renewables generation be put out to tender for bids from developers.

The tender was arranged by ESCOM, now in its new form without generation assets, and invited bids for four solar developments with a combined output of 70 MW in line with the review of available grid capacity for renewables developments.

Although this doesn't represent a fully-fledged IPP framework, the process will be an important learning curve for ESCOM and GoM along with inward investors and should help to develop the full IPP framework and pave the way for further developments.

The tender closed for bids on 31 January 2017.

Case Study: Access Power

Access Power is one of a number of independent power producers who recognise Malawi's potential for new renewables developments in the country.

A pre-feasibility study which includes a review of wind speeds from the Scottish Government-funded Malawi Renewable Energy Acceleration Programme¹ has identified an area in northern Malawi, near Mzimba, which could be suitable for a 50 MW wind farm.

This could potentially increase generation capacity in the country by almost 14%. The scheme would be sited in an area of the country that currently has no power stations and relies on long-distance transmission of power from hydro schemes in the south of the country.

Access Power has signed an MoU with GoM to carry out more detailed assessments including more wind measurements as well as assessments of the environmental and social impacts of the scheme. It has been estimated that the development could generate investment in Malawi of around \$86 million.

Access Power, like many other prospective independent generators, is now in discussion with GoM and ESCOM to agree to terms and ultimately sign a power purchase agreement. These first IPP developments will help develop a robust framework for future schemes with the intention that a market is then created for further investment to satisfy the urgent demand for new generation capacity.

Although the majority of companies investing in Malawi are interested in solar developments, wind has an important role in developing a diversified, sustainable energy mix for Malawi. GoM, in collaboration with the World Bank, is currently investing in more wind monitoring in the country with a view to attracting similar investments.

4.1.5 Fiscal Incentives

Although there is already a strong interest, GoM recognises that in order to encourage more renewables developments in the future or to ensure that renewables are sufficiently competitive against investments in fossil fuel generation, consideration of further incentives such as a renewable energy feed-in tariff (RE:FiT) is sensible.

GoM has already developed a RE:FiT framework in conjunction with MERA in 2012. Given global reductions in the cost of some renewables technologies, especially in solar, if a RE:FiT is going to be introduced there will be a need to update this framework to ensure it is reflective of current prices and has estimates for future pricing.

¹ Malawi Renewable Energy Acceleration Programme, Strathclyde University (2015)

<https://www.strath.ac.uk/engineering/electroniclectricalengineering/ourinternationalprogrammesprojects/malawirenewableenergyaccelerationprogramme/>

In addition to taking the price changes into account, given the time elapsed since the framework was initially developed, it is important that GoM and partners look again at the feasibility of introducing a RE:FiT policy in Malawi in general.

There is now clear evidence from other countries in the region that a RE:FiT scheme can be an effective way to attract more generation onto the grid. A full exploration of what has and has not worked would therefore be valuable, as would consideration of the scale of technology to be supported and how it will be funded. For the latter there are a number of options available such as levies on consumer bills, donor support and carbon finance.

A RE:FiT framework should also encourage a range of scales of development which can be connected to the grid. In particular, many countries have found it useful to offer rates for householders or businesses to benefit from such a scheme. This could mean technologies like rooftop solar or small scale wind turbines could be supported. This requires these developments to be connected to the national grid and as such GoM will work with ESCOM to understand what steps need to be taken to develop this capability. It is also therefore likely that encouragement of privately owned, small scale renewables developments on the grid system is a prospect for the medium and not the short term.

If a study can be funded which then highlights that a RE:FiT is feasible and useful for Malawi, GoM will be looking to work with partners to fund a full report on how to implement and fund such a scheme by developing a fully-updated and cost-reflective framework.

4.1.6 Interconnection

Malawi is a landlocked country that works with its neighbours on a number of key issues, including strong trade links. In the future, there is no reason why this can't also work in the electricity sector where interconnection could be mutually beneficial to neighbouring countries who would be able to buy or sell power to each other at times of excess demand or supply.

Malawi is already working with countries as a member of the Southern African Development Community (SADC) on a cooperative Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP). It is hoped that eventually this shared vision will lead to greater potential for trading of energy between countries in the region and in the long run a regional trading pool.

This strategy and action plan should be closely aligned to the policies and regulations adhered to by the The Southern African Power Pool (SAPP), an organisation created with the primary aim to assist in power trading between SADC states. Malawi has already signed memorandums of understanding for interconnections with Mozambique and Zambia and is working towards finalising trading arrangements. Interconnection is also feasible with Tanzania and the Government will enter talks as soon as possible.

To ensure that long term trading is an option, Malawi will continue a dialogue with countries in the SADC, especially bordering countries, to try to standardise regulations for the grid and for new power stations to ensure that in future, power that Malawi produces can be traded on an international market.

4.2 Clean Energy Mini-Grids

4.2.1 Actions

Year of completion	Action	Implementers	Progress	Funding Status
2017	Expansion of MEGA mini-grid scheme in Mulanje continues.	UNDP, GoM, MEGA	Underway	Funded for next phase
	Roll-out funding for new pilot schemes across the country alongside training of local staff.	UNDP, GoM, successful applicants	Underway	Initial pilots funded
	Assess the need for and viability of a renewable energy feed-in tariff for clean energy mini-grids in Malawi.	Not identified – GoM seeking partners	Not started	Funding required
2018	Development of a web portal on GoM website containing information on mini-grid development in Malawi with accompanying toolkit.	UNDP, GoM	Underway	Funded
2019	Implementation of streamlined regulations that are proportionate to the scale of mini-grid developments	GoM, MERA, UNDP	Early discussions	Funded
	Introduce new mini-grid standards in the country to ensure better quality regulation.	GoM, MERA, UNDP	Not started, potential to conduct study into appropriate standards	Could require funding for studies in to standards
	Clarify licensing requirements for generators or renewables.	GoM, MERA, UNDP	Not started yet.	Funded
2021	Technical capabilities developed to allow the national grid to	ESCOM	Not started	No funding identified

	easily integrate mini-grids and excess power generated by businesses			
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4.2.2 Current Status and Potential

A mini-grid is an isolated system separate from the main electricity grid network that consists of the generation and distribution of electricity to local consumers.

The UN have highlighted that clean energy mini-grids are a ‘high-impact opportunity’ for sustainable development and can be a viable and cost effective route to electrification where communities are far from the national grid or where population is not dense enough to justify a grid connection before other communities.

Clean energy mini-grids can be powered by a variety of renewable sources (solar, hydro, wind or biomass) and provide more productive power and enhanced services compared to smaller, household or personal solutions. In some instances, mini-grid systems offer services comparable with those provided by a national power grid. Therefore, mini-grids can help local enterprises reliant on a secure, productive power supply to become established and generate income from businesses that are in demand in the community while allowing for greatly improved local services such as education and healthcare.

In Malawi, research suggests that mini-grids are the most economically viable technology solution in areas with a population which has a density above 250 inhabitants per square kilometre and are situated more than 5km from the medium-voltage grid line. This represents more than 4.5 million Malawians or 27% of the people currently living without electricity in the country (Strathclyde University, MEGA, Practical Action, 2015). Malawi is therefore considered one of the more suitable countries for a dedicated mini-grid programme.

Despite the benefits and the potential in Malawi, there are currently very few examples of fully-operational mini-grids in Malawi. These include a small scale hydro plant at Bondo village in the Mulanje district funded by a number of international donors as well as a number of very small-scale schemes in the Nkhata Bay and Mzimba districts that have been developed by local entrepreneurs.

There are a number of major hurdles for mini-grid implementation and operation at present related to policy, regulations and finance, as well as the lack expertise to develop, operate and maintain the systems.

GoM is committed to working with partners to overcome these hurdles and catalyse the mini-grid sector to promote rural development and rural livelihoods. If the current projects prove successful, the regulatory framework for mini-grids will improve and as costs for these technologies continue to fall globally, GoM are hopeful that Malawi could have at least 50 operational clean energy mini-grids by 2025.

4.2.3 Ongoing Projects

Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi

GoM is working in conjunction with the UNDP and a range of other donors on a 3-year project to create opportunities for investment in further mini-grids and to recommend changes to policy and regulations to remove barriers to development in the sector. The project has three components as follows:

- **Expansion of the Mulanje Electricity Generation Agency (MEGA) Micro Hydro Power Plant and mini-grid scheme:** the project will support the implementation of a second 80 kW micro-hydro powered mini-grid operated by MEGA in the Mulanje district and provide institutional support for the development of several other MEGA micro-hydro schemes to bring the installed capacity of their power production up to 216kW. The project will also support the institutional capacity of MEGA to help work towards establishing it as a self-sustaining entity;
- **Replication of the MEGA model via piloting of new mini-grid schemes in other areas of Malawi:** the project will aim to initiate an open and competitive mechanism to select and support the establishment of Public-Private-Partnerships (PPPs) for clean energy mini-grids with an emphasis on viable business models. Clean energy mini-grids will be supported.
- **Institutional strengthening and capacity building for promotion of decentralized mini-grid applications across the country:** training and capacity building at sub-national and national levels on clean energy mini-grids will be undertaken while a national information clearing house will be established to facilitate mini-grid based rural electrification. An analysis of the policy and regulatory changes should take place to make mini-grids part of the mainstream GoM rural electrification policy. Furthermore, there will be support for the development of a toolkit for communities and potential developers to show-case the lessons learned and experiences gained in Malawi so far. More details on the changes to policy and regulations that the programme is working on with GoM and partners are found below.

Sustainable Energy for Rural Communities (SE4RC)

The EU-funded SE4RC will give 20,000 Malawian citizens from poor isolated rural communities access to clean electricity for productive use. SE4RC will anchor off-grid energy service delivery to underlying agriculture and socio-economic development and the mini-grids will serve irrigation schemes, clinics, schools, small agricultural initiatives and other businesses. Energy kiosks will enable service delivery to low energy users.

The project aims to establish three Community Energy Service Companies in Malawi comprising of energy kiosks and solar mini-grids, thus providing access to energy services for small-scale farmers, households, clinics, schools and small businesses.

Sustainable Off-grid Electrification for Rural Villages (SOGERV)

SOGERV, funded by the Scottish Government, will target four mini-grids in villages in Chikwawa that currently lack access to electricity in homes, schools, health centres and businesses. The projects will provide services such as lighting, mobile phone charging, and supply for refrigeration, which are the first step of the energy ladder.

The project will consider new business models and approaches to ownership of community schemes to try to encourage greater uptake in rural areas and will be implemented by the University of Strathclyde, Concern Universal and WASHTED. It is hoped that these models will be replicated across Malawi.

Case Study: MEGA and Bondo Hydro

The Bondo Micro Hydro Scheme is an 80 kW development situated in Bondo Village on Mulanje Mountain. The scheme has taken a number of years to develop with funding from partners such as the UNDP, the European Commission and the Scottish Government. Many residents at Bondo have been connected and have been purchasing metered power from the scheme since January of 2016, while the local schools and health centre are given power free of charge.

The Mulanje Electricity Generating Authority (MEGA) is a social enterprise which was established in 2013 and is wholly owned by the Mulanje Mountain Conservation Trust (MMCT). MEGA is the first entity in Malawi other than ESCOM to receive generation and supply licences for electricity.

The extension of Bondo Micro Hydro Scheme will mean the scheme will serve 1000 households, 6 schools, 1 health clinic and 2 maize mills as well as a variety of business enterprises within the communities under the three Group Village Headmen for Bondo, Nessa and Namainja.

Ultimately, MEGA want to develop and operate a number of schemes in the area to provide power to:

- 4 health centres serving a population of over 29,000 people*
- 6 schools serving 1,400 students as well as enabling evening classes for adult learning*
- 3 business centres (1 in each community), serving at least 11 businesses*
- 4,000 people in 810 households with direct connections to the mini-grids*
- 13,000 people in 2,600 households with access to battery-charging facilities*

Revenues from multiple schemes will be crucial if MEGA is to reach its goal of being a self-sustaining social enterprise. The model that MEGA is using is being studied by the UNDP to learn how the positive aspects of the scheme can be replicated across Malawi, where further funding for mini-grids should be targeted and where GoM should make appropriate policy and regulatory changes.

4.2.4 Policy and Regulation

GoM is already considering a number of regulations and policies that will facilitate the development of more mini-grids across the country. The current regulatory framework requires mini-grid operators to comply with largely the same regulations as a large grid-connected development, which results in costs that are often insurmountably high. GoM wants to ensure that principles of sustainability, safety and affordability remain a priority for licence holders, but that the costs and burdens are equitable considering the scale and profitability of new mini-grid schemes.

Other specific areas with the potential to have distinct regulations include the level of technical detail and environmental considerations in license applications and the regulations governing power availability, tariffs, customer communications and reporting. GoM and MERA, working in collaboration with the UNDP, will consider these aspects in producing new licences and regulations.

Tariffs, Cost Recovery and Flexibility

One way in which GoM has already assisted existing and potential mini-grid developers is to allow for cost-recovery by suppliers of electricity. This allows independent suppliers to charge higher prices than those paid by consumers of electricity from the national grid. This reflects the additional costs of mini-grid developments such as the need for construction of a bespoke distribution network and the high construction costs for schemes in remote areas.

GoM will continue to work with MERA to ensure that mini-grid developers have the flexibility to set tariffs which allow for cost recovery in order to make mini-grids financially viable.

To further address the issue of competitiveness, a review of retail pricing for electricity, as mentioned in the previous chapter will go some way to ensuring that mini-grids can operate on a more level playing field where electricity prices are reflective of the cost of generation. If it is found that electricity prices are far lower than the cost of generation, then mini-grid developers are unlikely to be able to compete in terms of pricing for their customers.

The mini-grid scheme at Bondo is a good example of a price discrepancy, with residents supplied by that scheme paying more per unit of electricity than those connected to the national grid.

Quality Standards

GoM will explore the possibility of specific mini-grid quality standards which would provide appropriate guidance for developers, regulators and customers. GoM understands that the Powering Africa and SE4All initiatives are developing a quality assurance framework based upon levels of customer service and common accountability that may offer a framework that could be useful in the Malawian context and easily adopted and transcribed by Malawi's regulators.

Licensing

As noted above, GoM recognise that the licensing process for mini grids in Malawi may not always be an ideal fit in terms of the amount of work required and the costs involved. Generation and supply licenses for mini-grids at all scales currently come under the same licensing arrangements as large scale grid connected power schemes while supply licensing was so far untested prior to the MEGA mini-grid development. GoM will now work with counterparts in MERA and UNDP and others in industry to make changes to create a licensing process that retains an appropriate level of rigour and high standards but is more financially viable for smaller developments.

As well as streamlining licencing for clean energy mini-grids, GoM and MERA will clarify the minimum level at which a generation licence for electricity is required.

Private individuals and businesses regularly use diesel generators without the need for a licence and GoM want to ensure that people can also easily invest and generate their own power from renewable sources in a similar fashion. The new requirements for generation licences for off-grid generation as well as any exemptions for personal and business use will therefore be clarified as part of this review.

GoM will work with MERA to outline the requirements for licences for off-grid generation as well as any exemptions for personal and business use as part of this review. GoM will work towards introducing a policy for renewables which is similar to that in relation to diesel generators whereby if self-generated power is not entering the grid, no licencing requirements are placed on individuals or businesses if the development is under a certain capacity. In the case of diesel generators the exemption capacity is currently set at 20kW.

MERA and GoM expect a full review of licensing for off-grid generation to be completed by the end of 2018.

4.2.5 Fiscal Incentives

As well as fiscal support for grid-connected renewables schemes, GoM would like to explore the potential for off-grid and decentralized schemes.

If such support were to be designed to make mini-grid developments as financially viable as grid-connected schemes, a RE:FiT for mini-grids would be higher to ensure that it reflected the need for mini-grid generators to build and maintain a grid network as well as the additional costs of building in remote areas.

As noted earlier, even if mini-grid developers were to be fully compensated for the additional costs of construction and grid infrastructure, the price they are required to charge may still be higher than that which customers experience who are connected to the national grid, if a review of retail prices shows that they are currently set at lower than the cost of new generation.

GoM seeks partners and international expertise to help to find and investigate the potential for fiscal incentives at all scales, on and off grid. It is also possible that an expanded Rural Electrification Programme could help fund the additional cost of mini-grid schemes, particularly grid infrastructure. The Rural Electrification Fund is discussed in more detail in Section 6.1.

4.2.6 Business and Industrial Use

As well as developing mini-grids to meet the demand of local communities, the schemes can be developed to serve industrial and commercial ventures which require large quantities of power. This enables businesses to own and generate their own secure power from renewable energy as well as having the potential to sell excess power to local communities and other businesses or the national grid. Usually businesses develop mini-grids to secure a reliable source of power for commercial reasons.

To enable this, further policies and guidelines should be adopted for businesses in activities such as mining and agriculture to encourage self-generation. To that end, GoM will seek to apply the same streamlined generation licensing rules for businesses looking to install renewables as for clean energy mini-grids, as mentioned above.

GoM will work with high energy users and donors who have already developed their own renewable power systems such as Kamuzu International Airport, Illovo Sugar and Lujeri Tea Estate to establish what lessons can be learned from these schemes, what processes they went through to build and install the systems and how those processes could be improved upon and streamlined.

As Malawi upgrades the grid network and develops a fully functioning IPP framework, there should be more flexibility in place to allow companies to sell power to the national grid.

Case Study : Illovo Sugar Bagasse Plant

There is already evidence of businesses generating electricity for their own use in Malawi. Illovo Sugar utilises waste bagasse to fuel two plants with a combined capacity of 18.6 MW that provides electricity for the sugar production process.

If this plant were connected to the national grid it would represent an increase in total generating capacity of 5%. Furthermore, Illovo have also stated that the generating capacity at the site could be doubled if there were additional uses for the power or customers who could access it.

Establishing more simple licencing and regulations to allow for the generation and supply of electricity to customers could open the door for more investment in this kind of generation from businesses and industry. These businesses should also benefit from the establishment of a state-

owned single buyer for electricity in that any excess generation could compete with other potential generators to meet the demand of Malawi's consumers.

4.3 Off-Grid Power

4.3.1 Actions

Year of completion	Action	Implementers	Progress	Funding Status
2017	Complete study into impacts of additional fiscal incentives (such as VAT relief)	Donors, NGOs and industry	Not started	Requires funding
2018	Adopt and enforce international standards for solar products	GoM, MERA, MBS	Underway	Funding possibly required for enforcement measures
	Review import licence application	GoM, MERA	Not started	No further funding required
	Ensure all importers are licenced	GoM, MERA	Ongoing	No funding required
2020	Extend business rates relief until at least this point	GoM	In place	No funding required.

4.3.2 Current Status and Potential

Over 15 million people in Malawi live out of reach of the main electricity grid, with the vast majority having no access to electricity at all. Despite the efforts outlined above to extend and modernise the grid it is clear that for some time to come new generation and grid extensions will not reach the entire population of Malawi while mini-grids are still in their infancy and will not be an option for most Malawian's in the short term. Despite this, renewable energy can still play a role in off-grid locations, providing safe, secure and effective energy to meet the needs of some of the most vulnerable members of Malawi's society.

Off-grid solar products such as Pico Solar Products (PSP) or Solar Home Systems (SHS) generally use a combination of solar panels linked to rechargeable batteries to deliver electricity for a range of uses. Most commonly these devices are used for lighting and phone charging with some of the more powerful products able to generate energy for a range of uses such as refrigeration, radios and televisions, or even to provide power for small businesses like barber shops.

Distribution and use of these products will result in significant benefits for the population of Malawi, such as:

- Health benefits by reducing inhalation of harmful gases from fossil fuel based lighting.

- Education improvements by enabling children to study at night.
- Better healthcare provision, particularly for facilitating safe delivery of babies at night.
- Enhanced communications by enabling people to charge their own mobile phones locally.
- Potential to generate income by starting small businesses that utilise solar electricity.
- Enhanced safety in local communities and institutions by providing light at night.
- Long term financial benefits brought about by avoidance of regular expenditure on candles, kerosene or batteries.

There was a 300% growth in sales of quality-assured solar lighting products across Africa in 2013 and over 7.7 million people in Africa now enjoy access to clean, safe lighting using quality solar products from as little as \$8 for a single device (Business Innovation Facility, 2016). A recent survey undertaken by DFID and the Business Innovation Facility (BIF) suggests that around 13% of households now have access to off-grid lighting in the form of solar products in Malawi - more than are connected to the national grid.

Figures from that survey also highlight that those with solar lights compared to other sources like torches or kerosene lamps used their products on more days, for more hours and were generally more satisfied with the products.

Although these signs are very encouraging, the market is still in its infancy and off-grid solar has not yet reached its full potential in Malawi. The BIF study highlights that Malawi spends nearly \$50 million (MWK34 billion) on bad quality and harmful lighting every year, with the average annual spend per household at \$14. Considering that the average household spends also around \$9 on mobile phone charging, this makes a convincing case that a competitive market for PSPs will emerge soon.

Technological advances and innovative business models will also continue to boost the chances of commerciality in Malawi along with learning lessons from other countries in the region such as Kenya, Tanzania and Rwanda in order to appreciate how they have achieved greater success.

4.3.3 Ongoing Projects

There are a number of initiatives in Malawi aimed at reaching the rural population with PSPs. These range from fully funded donor programmes, to fully commercial ventures aiming to find the market for products which could lead to their widespread distribution and use in Malawi.

There is a broad network of stakeholders in the PSP market in Malawi including a range of donors, NGOs, private sector enterprises and even designers of products.

The approach to marketing and distribution of solar PSP products across Malawi is diverse. There are some products available in retail outlets in urban settings and at agricultural wholesalers in many trading centres. These products are sold on a commercial basis. However, reaching those in more rural areas still requires support from social enterprises, donors and NGO backed programmes.

Programmes include EnDev, which is funded by a number of major international donors. EnDev is working with a number of NGOs and distributors to educate people on the benefits of household solar products and to promote and market the technology to people in Malawi, especially those in more rural and remote areas.

Similarly, Sunny Money, a charity and social enterprise and the biggest PSP seller in Malawi works to create the channels and markets which will eventually enable the sector to take-off commercially. Their most common business model is a vendor system in which local entrepreneurs buy stock from Sunny Money and then sell lights to local communities, along with providing aftercare.

Looking to the future, DFID and GoM have recently signed the Energy Africa Compact which sets out agreed actions both parties will take to deliver more funding and expertise to the off-grid electricity access sector and to deliver key policy and regulatory changes in the solar PSP market.

USAID's Power Africa is also committed to continuing to engage robustly in the energy sector in Malawi and is exploring opportunities to complement existing investments through MCC and the work of other Power Africa partners with targeted Beyond the Grid investments, which would focus on off-grid areas and technologies.

There are many more innovative NGO and donor programmes currently being delivered and it is hoped that through their work, awareness and accessibility to the solar PSP market will be strengthened and eventually a widespread commercial market will exist in Malawi.

4.3.4 PSP Standards and Enforcement

Regulation of PSPs is governed by the Malawi Energy Regulatory Authority (MERA), the Malawi Bureau of Standards (MBS) and to a lesser extent the Malawi Revenue Authority (MRA). MERA issues licences for the importation and sale as well as the installation and maintenance of solar products while MBS is responsible for issuing import certificates for products adhering to a set of national standards. The MRA has a strong presence at the borders and can assist in enforcement of standards at this point.

New Standards

MBS, in collaboration with MERA must introduce new international standards for PSPs. MBS does have standards in place for solar products but given advancements in the technology these are now considered to be out of date and in need of revision. This revision does not need to be a lengthy process and Malawi does not need to develop a new standard from scratch. Instead, GoM will work with MERA and MBS to adapt and adopt the Lighting Global Standards, already developed by the World Bank and the International Finance Cooperation (IFC) and adopted by many countries throughout the world as robust, international industry standards.

Enforcement

A further benefit of adopting globally recognised standards is that products are already tested and monitored internationally by the World Bank and the IFC and a list of devices that have met the standards is published online (<https://www.lightingglobal.org/products/>). This list could be used as the basis for MBS to assess imports; only requiring in-country verification. This would reduce the time and cost of testing, minimising the burden and cost for MBS and importers.

Enforcement can also be led by increased awareness in the market from other manufacturers, donors, NGOs, distributors, vendors, financiers and consumers. By joining the global community for standards, a clear definition of products that are acceptable can emerge. A self-regulated industry which does not support products which are not registered and which do not meet these standards will quickly side-line counterfeit goods. Over time, this process could be supported by the presence of District Energy Officers, discussed later in this strategy, who should have good awareness of what products are legitimate.

GoM will also work with MERA to establish what other methods they can use to enforce standards and what punishments are appropriate for businesses that fail to meet these standards and operate without licences.

4.3.5 PSP Licensing

To ensure that importers are reputable, they must be required to be licensed by MERA. A requirement of the licence will be to offer a 12 month guarantee for products in case they prove to be faulty. At the same time, MERA must work to ensure that those seeking the licence can do so in a timely manner and will work to streamline the process.

4.3.6 Fiscal Support for PSPs

GoM recognizes that a fully functioning PSP market will not only benefit those in rural areas but also create jobs and income across a broad supply chain from international importers to local distributors. In recognition of this, GoM has provided business rates relief in an effort to kick start the market for PSPs. GoM will extend this relief for the foreseeable future while the market is still developing.

GoM recognise the calls from industry to remove VAT but in order to take decisions about more fiscal relief for the industry evidence of the benefits must be presented and GoM call upon donors, NGOs and the solar industry to work together to make the case for change. Such a study needs to take into account the long-term benefits to the industry as well as the overall impact on the economy. Upon this evidence being presented, GoM will be better equipped to consider the merits of further fiscal stimuli for the PSP market.

4.3.7 Finance

GoM recognises that the target groups for off-grid solar electricity are often those who receive the lowest incomes and who therefore have the most difficulty in raising finance to buy the products. GoM is keen to work with financiers, donors and NGOs to try to establish what the best models are for financing these products in the short to medium term, before a widespread commercial market becomes apparent.

Research suggests that over its lifetime a PSP comfortably works out as one of the cheapest methods for providing light, and certainly for bringing electricity, into a home without mains power. However, the products do require a large capital outlay in comparison to alternatives, for example battery powered torches or candles. For this reason, GoM are encouraged by the models that offer pay-as-you-go (PAYG) options. Sunny Money, who are using such a method, have reported repayment rates as high as 99%.

Innovative PAYG models include solar kiosks where portable batteries charged by solar panels can be hired. This can be used as a good way to implement a PAYG system whereby when someone leases a battery pack they also pay towards purchasing the system. This type of funding can be arranged through an individual organisation or through revolving fund groups set up by local communities or other collectives such as farmers.

Although signs for the market are encouraging reaching full commerciality is still a difficult task, especially given the current high rates of inflation. Despite the price of solar products coming down four-fold in the last 4 years (Business Innovation Facility, 2016) the rate of inflation in Malawi, at over 20% (World Bank, 2015), is such that prices in Malawian Kwacha have still risen significantly. It is hoped that as the economic situation stabilises, the off-grid renewables market will benefit greatly, making interest rates low enough for people to take out and repay small loans.

Mobile money is another way in which the transaction costs of loans and payments could be reduced. Unfortunately, Malawi is still behind neighbouring countries in this area. Mobile money

would make PAYG systems far simpler and could reduce the cost of finance for off-grid solar, making PAYG systems cheaper and more accessible. Given that Malawi's mobile money market is still in its infancy and is expected to grow, it is envisaged that this will make a positive impact soon.

GoM urge all financial institutions to continue to work with suppliers of solar lights to work out the best way to provide financing to allow the lights to reach those in the most remote communities. GoM is encouraged to note that many are already engaged with NGOs and donors who are working in this area.

Case Study: Fistula Care Centre and Rehabilitation through Solar

The Fistula Care Centre in Lilongwe treats women who have had a fistula injury, generally sustained during an obstructed labour. In Malawi a problematic labour like this can last up to 6 or 7 days before medical treatment is found, if it is found at all. The injury results in permanent damage if not treated surgically, leading to leakage of urine or stools as a daily complaint. This in turn leads to many women being ostracised by their communities, often leading to isolation and depression. Not only is this a devastating problem, it is not widely discussed in communities in Malawi and often goes untreated.

As well as providing physical healing, the clinic offers constant support and care from nurses who have had a fistula in the past and who can act as proof of what a positive recovery can be like. In addition, the women receive a range of classes every day, from basic literacy to various craft and business skills - and for a few, in renewable energy. A programme to give women from the clinic solar devices means that upon recovery they can take electricity back to their villages.

The solar devices can be used to generate income for the women after recovery, often through phone charging for the whole community. This has the secondary benefit of making the beneficiary the focal point of her village and leading them back into society in a positive way. They are also armed with their experience of the advice given at the clinic and can educate others in the community about fistula and about how they can be helped. Amazingly, this is how the clinic gets most of their patients, creating a positive cycle where recovery is achieved through openness and inclusiveness within communities.

In societies as poor as this, the solar panels provided were generating a huge percentage of income for the beneficiaries as well as helping the wider community, especially children who were now able to study at night. The clinic is now looking for more funding to continue with the solar programme.

5. Sustainable Bioenergy

5.1 Cleaner Cookstoves

5.1.1 Actions

Year of completion	Action	Implementers	Progress	Funding Status
Ongoing Commitment	Support and lead the National Cookstoves Steering Committee (NCSC) to work towards targets for 2020 and beyond.	GoM and NCSC members	Ongoing	Long term funding to support the group in future may be required
2017	Host a cleaner cookstoves camp	NCSC members and GoM	Early planning stages	Potential for more partners to fund the event
	Ensure the cleaner cookstoves camp kick starts a wider national campaign to raise awareness of benefits of cleaner cookstoves and the costs of unsustainable fuels	NCSC members and GoM	Early planning stages	Potential for more partners to fund the ongoing campaign
	Efficiency standards for stoves developed	NCSC members and potentially a consultant	Not started	Funding required for a full study
	Complete study into impacts of additional fiscal incentives (such as VAT relief)	NCSC members and consultant	Not started	Funding required for a study
2018	Certification based on efficiency standards	NCSC, MERA and MBS	Not started	Funding not likely to be needed

5.1.2 Current Status and Potential

The vast majority of Malawian households rely on firewood and biomass to provide energy, with the most energy intensive activity in the home being cooking. Therefore, one way to improve the sustainability of the available biomass fuel stock is to find ways to make the cooking process more

efficient than it currently is. Traditional cooking practices are engrained into society in Malawi but there are alternatives in the form of cleaner cookstoves that can be more effective and can offer a range of advantages over traditional firewood and stoves, such as:

- Reduction in the amount of fuel needed leading to less deforestation across Malawi.
- Reduced pollution in and around the home leading to a reduction in respiratory diseases.
- Reduction in the hours spent by those in rural areas collecting firewood; mainly benefitting women and girls.
- Cost savings through the purchase of less firewood, charcoal or briquettes.
- Job and wealth creation from production of stoves, which can take place in rural areas with low start-up costs.

In light of these clear benefits, GoM has set a challenging yet attainable target for the uptake of two million cleaner cookstoves by 2020. At this stage, over 500,000 cleaner cookstoves have been produced across the country.

5.1.3 National Cookstoves Steering Committee and Ongoing Programmes

Through the leadership of GoM in collaboration with key donors and NGOs, a National Cookstoves Steering Committee (NCSC) has been established to bring stakeholders together to try and reach the 2020 target. The \$400,000 Irish Aid-funded National Cookstoves Programme, which runs from January 2015 to December 2017, is intended to catalyse the uptake of stoves to help to reach the two million target. This programme also assisted in developing the 'Cookstoves Roadmap' in 2014, which provides a full background to the cleaner cookstoves market in Malawi and the aims and objectives of the NCSC.

In short, the roadmap advocates that GoM and NCSC work in collaboration to take a leading role in planning and implementing a cookstoves strategy which includes a number of initiatives to reach the target.

GoM is now also developing a National Charcoal Strategy that along with the MRES will include a further update to policy and progress towards shared aims for cleaner cookstoves and bioenergy.

5.1.4 Progress to Date

There have already been a number of outstanding achievements by the group and real progress towards the 2020 target. Some of the group's successes are as follows:

- To monitor progress towards the 2 million target and to provide industry insights geographically to avoid duplication of effort and promote sales, the NCSC have mapped sustainable cookstove activities (production, retailers, projects). The online map and database can be found at the following link:

https://energypedia.info/wiki/Malawi_Cookstove_DB

- The NCSC, in collaboration with GoM, hosted the Cleaner Cooking Camp Workshop and Open Day in 2016 with an appearance and speech by Hon. Bright Msaka, Minister of Natural Resources, Energy and Mining. The event's agenda was set by the NCSC members and following the event a declaration was written to provide direction to the group's further work.
- A stove testing team has been trained to test the efficiency of the existing cookstoves in the Malawian market to ensure quality standards are met. The NCSC does not support or recognise stoves as sustainable if they have a fuel efficiency of less than 20%.

- Ongoing capacity building is part of many programmes NCSC members carry out, sharing knowledge on how to use the stoves and also on how to make them, creating local employment and entrepreneurial activities.

These activities and the ongoing programmes that NCSC members are involved in have resulted in over 500,000 stoves being produced in Malawi while the cookstove market now supports 280 production groups and employs 4,500 people, 89% of whom are women.

5.1.5 Next Steps

The NCSC now needs to maintain this positive momentum up to and beyond 2020 and have set a number of key objectives for the year ahead.

Promotion and Awareness Raising

The NCSC will seek to repeat the success of the 2016 Cleaner Cookstoves Camp by holding another event in 2017. GoM will commit to providing Ministerial support to the event with a view to raising its profile and getting as many people as possible involved in the programme.

Alongside the standalone event the NCSC and GoM are looking into developing an ongoing promotional campaign for cleaner cookstoves and ensuring that the benefits are communicated clearly and widely to the Malawians who stand to benefit the most, especially those in rural and hard-to-reach areas.

Capacity Building

A number of donor and NGO programmes in Malawi have an element of training and capacity building at their heart. These training programmes can have a long-lasting impact on local economies in Malawi, often meaning that a local producer is taught how to make stoves which can be sold to the surrounding area, creating economic activity and the chance to benefit from stove technologies simultaneously.

Fiscal Incentives

The NCSC and other stakeholders have long campaigned for the removal of VAT and other charges such as import duty on sustainable stove components. However, without clear evidence as to the costs and benefits to Malawi's economy and society from such actions it is difficult to properly assess whether or not it would be advisable for GoM to implement such an initiative. As with solar products it is important that a more detailed case is developed for VAT removal. GoM therefore urge partners including donors and NGOs to help fund a study led by the NCSC to look into the impact of VAT removal on consumers and the uptake of cleaner cookstoves, as well as the wider benefits and losses to Malawi in the short, medium and long term.

In terms of import duty, GoM recognise that some components for more advanced and innovative cookstoves such as the rocket stoves are not produced in Malawi and the uptake of even more innovative technologies might increase if VAT were reduced. However, it is important to be wary of the impact on GoM finances as well as on local producer groups who are beginning to take off around the country. GoM want to ensure that new products can enter the market but also encourage production in Malawi, even for more advanced stoves in future. Given that GoM are open to making changes if they benefit the industry and Malawi as a whole, these issues should be part of an industry-led study into the impacts of removing or reducing VAT or import duties.

GoM understands there may be wider societal benefits to removing VAT but this evidence is so far only anecdotal. Only with full evidence in place will GoM be able to fully understand and evaluate what further fiscal incentives can be applied to cleaner cookstoves in the country.

Efficiency Standards

The NCSC already have a fuel efficiency standard for measuring what passes as a sustainable cookstove in Malawi. In 2017 this standard, along with any other relevant standards regarding the design and production of stoves, should be benchmarked and formalised in order to create proper standards for the production and sale of cleaner cookstoves in the country. Lessons learned from the solar PSP market show that if standards are not in place or up to date, counterfeit and poor-quality products could flood the market.

When the NCSC has developed a robust standard the group should work with GoM officials, MERA and MBS to implement an official certification standard for cleaner cookstoves in the country by 2018.

Case Study – Dziwani Enterprises and EnDev

After visiting a production facility of ‘Chitetezo Mbaula’ cleaner cookstoves in 2011, 33 year-old Alfred Chisale decided to quit his job as a building supervisor and pursue a new career. After purchasing a plot of land at Chadza, close to a source of clay, Alfred established his own cleaner cookstoves production business, Dziwani Enterprises.

Although the production facility proved to be a success, Alfred struggled to find a route to market for the stoves. His team was able to produce stoves very quickly but he found that he was only able to sell around 300 over a two-month period – well below the number required for his venture to be profitable.

This is where EnDev stepped in and assisted with finding a market for the business through the NGO, Maeve. Once people produce fuel-efficient stoves, Maeve assist them in promoting their goods.

Maeve also partakes in the marketing of fuel efficient technologies as well as promotion of clean technologies with the aim of mitigating climate change and promoting sustainable energy for all.

The supply of stoves to Maeve’s programs has bolstered the demand for Alfred’s stoves and he has been able to employ many local people who have in turn been able to invest in their own businesses, spreading the entrepreneurial spirit throughout the community. One employee who had to survive as a subsistence farmer now helps out at Dziwani Enterprises and has used his savings to buy land to utilise his skills as a farmer to sell crops commercially.

Of course, as well as the economic benefits to Alfred, his employees and the community, the production facility benefits everyone who receives a stove in terms of saving money, protecting forests and improving the health of those who use the Chitetezo Mbaula stoves every day.

5.2 Solid Biofuels

5.2.1 Actions

Year completion	of	Action	Implementers	Progress	Funding Status
2017		Publish a National	GoM and steering	Draft report	Funders

	Charcoal Strategy	committee	complete, further consultation needed	should engage in consultation process to consider where gaps remain.
2019	Industry standard established for sustainable charcoal and briquette production, as well as outlining methods of enforcement	GoM and MERA	Details for undertaking this activity to be outlined in the National Charcoal Strategy	Funding may be required for setting standards and for enforcement
	Explore impacts of rates relief and subsidies into supporting equipment that produces sustainable solid biofuels	GoM with willing partners	Not started	Funding required for a study
	Government, donor and NGO-backed projects will only use sustainably sourced solid fuels and materials produced using sustainable fuels	GoM, Donors and NGOs	No discussions yet, National Charcoal Strategy Committee could begin talks and coordinate key stakeholders	This could mean increased short term costs but long term benefits should be clear

5.2.2 Current Status and Potential

Malawi is one of the countries with the highest dependence on solid biomass fuels. Although much of the fuel is used in its natural form it is also often converted to charcoal or briquettes, which are themselves produced in an unsustainable manner. 86% of the country's total energy consumed is biomass and 96% of fuel used for cooking in Malawi is solid biomass. Solid fuels are used across Malawi, even in urban areas where charcoal is the primary source of cooking energy, with 54% of households depending on it (Zalengera, 2014).

In addition to households, many businesses and industrial processes in Malawi including prominent and growing areas of the economy such as at tea plantations and brick-making businesses, also rely on solid biofuels.

Given the high demand for and the economy's dependence on these fuels, GoM recognises the importance of making them as sustainable as possible, thereby trying to minimise the potentially devastating environmental impacts of widespread deforestation in the country.

In 2017, GoM will complete a comprehensive National Charcoal Strategy (NCS) to address many of the issues arising from the use of unsustainable fuels. The NCS will be a coordinated, government-wide plan that addresses both supply and demand dynamics across the entire solid-fuel value chain. Although only currently in draft form, the NCS is likely to include actions such as enhancing enforcement, regulating production, raising awareness, communication and education.

The MRES presents a combination of important factors to consider in fuel production and sets out some key principles the forthcoming National Charcoal Strategy should adhere to.

5.2.3 Next Steps

Addressing Deforestation

It is clear that the demand for firewood in Malawi is such that current levels of deforestation are extremely high and illegal and unregulated tree-felling is commonplace. The NCS will begin to address these issues in more detail and try to make sure that a combination of continued enforcement of regulations takes place where resources allow and that this is coupled with incentives to support tree planting and management.

Alternative fuel sources should also be considered for charcoal production. For example, there is some evidence that other crops, such as bamboo, may be more sustainable if planted for use as a solid fuel. What is clear is that in order to ensure there is a market for any alternative fuels, the illegal production of solid fuels will first have to cease.

Solid Fuel Production

In addition to increased enforcement of regulations, GoM should also take positive steps to encourage sustainable production of wood fuel, charcoal and briquettes, including exploration of fiscal incentives to kick-start sustainable production facilities. There are already excellent examples of these types of businesses in Malawi. However, most are currently donor funded. GoM will continue to seek external support as well as considering what aspects of these businesses make them successful to ensure they can be replicated across the country.

Along with measures to encourage sustainable production, efforts to impose penalties and enforce laws and regulations in relation to illegal production of solid biofuels also has to be stepped up. The National Charcoal Strategy will contain more information on these measures and plans to try to minimise illegal practices.

As more businesses are established that rely on wood fuel there should be a natural element of self-regulation whereby there will be an interest on the part of business owners to safeguard biomass stocks for the long term. Raising awareness of the long term issues for producers and consumers will be a key aspect of the overall campaign to raise awareness as highlighted in the Cleaner Cookstoves in Section 5.1.

Case Study – Karonga Rice Husks Briquettes

In Karonga, an initiative to produce heating and cooking fuel from rice husks is a fantastic example of how reliance on firewood can be reduced while creating local economic opportunities and high quality products. In Malawi, about 45,000 tons of rice are milled every season but only a small proportion of the remaining husks is used by some of the large industrial customers, with most usually discarded as a waste product.

Over 1000 local youths have been trained at the facility which uses these husks and turns them into high-quality briquettes that can be used for cooking and heating in the home. The profits from sales are partially re-invested in the enterprise, the remaining funds being shared amongst the group members.

The business also provides excellent economic opportunities, with some able to earn up to MWK150,000 per month, well above the country's average salary.

The project was established with funding from SEED, the UN-backed global partnership which promotes entrepreneurship for sustainable development and assists growth in small and medium term enterprises. The number of trained youths now working on the project confirms that this knowledge and expertise can easily be replicated throughout Malawi.

Industrial Processes

In addition to the production of the fuels, GoM promotes the use of all modern and efficient technologies that can reduce the volume of firewood used in any manufacturing or production process. GoM also recognise the value in these technologies in creating jobs and income across Malawi.

It will be important that the NCS reviews the support offered to these businesses to invest in purchasing sustainably produced solid biomass fuels and also to invest in infrastructure or staff training that increases the sustainability of the fuels used.

Case Study – Eco-Brick Facility

Malawi's population has created the demand for around 120,000 new houses every year. Almost all of these homes are built using locally produced materials, with bricks that are made from soil and intensively fired in small batches with local firewood and charcoal.

In 2013, Eco-Matters, a Malawian-based company with support from GIZ (the German donor agency) constructed a facility on the outskirts of Lilongwe to make and fire building bricks in a more environmentally sustainable manner.

The bricks themselves are produced using waste materials, with soils taken from local landscaping projects mixed with tobacco and coal residues as well as combustible waste such as rice husks to allow them to be fired with very little need for additional fuel.

The bricks are then sun-dried before being fed into vertical kilns which are housed in the main building at the site. These kilns can efficiently fire 5000 bricks at once using no firewood and only a small amount of coal residue to keep the combustion going.

The production process not only utilises far more waste materials but also uses 80% less fuel than traditional methods, while producing a more consistent, high quality product.

Those involved with the Eco-Bricks project can see the potential for local brick makers to come together in cooperatives, much like rural farmers have done in Malawi, to try to establish centralised, good quality, efficient and environmentally friendly kilns. Investment in the technology starts at only around MWK

60 million but there is only one such plant in the country.

Consumers

Finally, as well as the production and the use of the fuels, the consumer also has a responsibility to ensure that illegally produced fuels are not purchased and that sustainable, locally produced products should be favoured. In order to lead the way GoM will review procurement practices to ensure that sustainable products are given priority in government backed projects, for example,

exploring whether GoM can commit to using only sustainably produced bricks for some Government building programmes. GoM also encourage donors and NGOs to investigate the potential to adopt similar sustainable procurement practices to bolster those who are abiding by regulations and good practice.

It is also the responsibility of Government to properly educate and inform these consumers as to the long term negative impacts that purchasing inefficiently produced solid biofuels will bring. It is right that education campaigns and awareness raising activities are stepped up and full plans will be outlined in the forthcoming National Charcoal Strategy.

5.3 Biogas

5.3.1 Actions

Year of completion	Action	Implementers	Progress	Funding Status
2017	Roll out 60 biogas pilot schemes in 9 districts and provide training for local communities on operations and maintenance.	GoM and UNDP	Underway	Fully funded
2020	Study into impacts of the biogas mini-grid pilot after 3 years of use.	GoM with willing partners.	Not started.	Funding may be required.
	Information sharing and good practice study based on lessons learned from pilot study.	GoM with willing partners.	Not started	Funding may be required.

5.3.2 Current Status and Potential

Biogas produced from organic materials and waste can be used as fuel for cooking. Biogas can be produced from different sources such as agricultural materials (crop residues, liquid manure and energy crops), animal waste, vegetable waste, municipal and sewage waste.

There are no large scale gas networks in Malawi but there is a large potential market for biogas which could help replace fossil fuel based canisters that are used for cooking in homes, as well as lead to a switch from firewood-based fuels in cooking in other areas. There are also many opportunities to establish smaller biogas networks, utilising local waste products in rural and urban areas.

Biogas is one way of promoting more efficient and sustainable use of biomass compared to the use of fuel wood. The technology has all of the advantages of cleaner cookstoves as outlined earlier, and some additional ones as well, including:

- Far less smoke inhalation, even compared to cleaner cookstoves.
- Improvement of local sanitation and waste recycling.

- Production of bio-fertiliser from the residue of the biogas process.
- Creation of local jobs in the operation and maintenance of the system.
- Simple, on/off valve makes it very convenient and avoids waste.

There are some fundamental challenges that are hindering the uptake of the technology in Malawi. Unlike the relatively simple and adaptable cookstove technology, biogas production and use requires a higher degree of technical knowledge in order to set up and maintain a system as well as a higher level of up front capital investment.

Operating the system without proper training is also unsafe and could result in serious accidents and fires. Further robust training and awareness programmes are necessary to ensure safe transportation and use of such systems.

In addition, if biogas is produced for sale in canisters, there isn't a large distribution network or system for exchanging of gas cylinders in Malawi, with charcoal still the more popular fuel even in urban areas. It is therefore perhaps more likely, and more sustainable, for people to develop their own biogas mini grids while a market emerges for gas in canisters. Those who already have livestock in rural areas have an ideal opportunity to create a biogas plant and use animal waste as the fuel.

5.3.3 Current programmes

GoM, through the UN's Sustainable Energy Management program are piloting 60 biogas mini-grids in nine districts across Malawi.

The biogas sites have been selected where local communities have a reliance on firewood and charcoal but also where there are significant waste supply streams that could support a switch to a biogas cooking.

The programme will endeavour to train local people in how to maintain systems and how to use them safely. It is hoped that this pilot will demonstrate best practice in how to establish and maintain biogas mini-grids in rural areas and highlight the opportunity to other communities across the country, especially those neighbouring the pilot projects. The programme will also target a cross section of Malawian society and highlight that biogas can offer benefits to everyone.

There are also a number of similar projects being implemented in Malawi, independently of Government. GoM hope that these projects, generally carried out by NGOs, will have a similarly positive impact on the host communities.

5.3.4 Next Steps

GoM will ensure the results of studies are publicised to enable others to learn from good practice examples, as well as attracting investment to develop more biogas mini-grids if the pilots prove successful.

GoM hope this will encourage further programmes to be supported in the country as the technology reaches full commercial availability.

GoM will also look to work with companies in neighbouring states who are already benefitting from fully commercial markets and try to understand what Malawi will need to do to allow the market to grow and to attract these kinds of businesses into the country.

5.4 Biofuels in Transport

5.4.1 Actions

Year of completion	Action	Implementers	Progress	Funding Status
Ongoing	Biofuels which use resources that would otherwise be utilised for food production will not be promoted.	GoM, donors, NGOs and industry	Ongoing	No funding required.
2018	Introduce regulations to set mandatory levels of bioethanol and biodiesel to be sold in fuel, increasing the levels year on year from 2018.	GoM and MERA	Although blending does occur, there is a need to agree on tighter regulations. Discussions not yet started.	No funding need yet identified.
2019	Uncouple the price of bioethanol and petrol following the introduction of regulations to set mandatory biofuel levels	GoM and MERA	Requires regulations to be first enforced.	No funding required.
2020	Pilot dedicated fleet of biofuel vehicles.	GoM seeking industry partners.	Not started.	Funding may be required.

5.4.2 Current Status and Potential

Transport currently only makes up around 4% of Malawi's energy demand (Zalengera, 2014). However, GoM recognise that as the economy grows the demand for vehicles to fuel trade and industry, as well as for personal use, will increase. It is therefore important that the growing number of vehicles on the roads in Malawi are made as environmentally friendly and sustainable as possible.

The most impact Malawi can have over the next decade in this area is likely to be increasing the level of biofuel that is found in petrol and diesel blends across the nation's filling stations. This requires little to no change in infrastructure at the pumps and no costly conversion of vehicles.

Over the longer term, research and demonstration projects for vehicles which can run on 100% biofuel should be implemented. Given the potential to produce biofuels domestically this could ease the reliance on imported fuels.

The use of locally produced ethanol and biodiesel could have a number of advantages, such as:

- Savings in foreign exchange transactions as a result of importing less petrol
- Utilising energy from waste and reducing greenhouse gas emissions,

- Helping to support the growth of the agriculture sector and creating local jobs,
- Creating the long term potential for exportation of biofuels if production is high enough.

Bioethanol

The bioethanol consumed in Malawi is produced locally with neither importations nor exportations permitted. The average annual production is currently 26 million litres, split between two production companies. Each of these companies already has the potential to produce 17 to 18 million litres per year (Econoler, 2016).

Locally produced ethanol can be blended with petrol at rates of up to 20%. However, it has been estimated that currently production levels in Malawi mean the average blend is more likely to be at around 10% (Econoler, 2016).

In 2006 the National Commission for Science and Technology (NCST) developed the Ethanol Driven Vehicle Project (EDVP) for trials of motor vehicle performance using ethanol. In October 2012, following these trials, the cabinet authorised the NCST Malawi Ethanol Programme, 2013. The Programme aims for the increased use of ethanol in motor vehicles with key activities including:

- Review of policies and regulations related to ethanol fuel, its distribution and utilisation 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 the programme

The overall goal of the programme is to “increase bioethanol production and its use as fuel from the current 18 million litres per annum to 49 million litres and 104 million litres per annum by 2015 and 2020 respectively”.

Biodiesel

Malawi produces domestic biodiesel, at a smaller scale than bioethanol through only one domestic company with production levels of 70,000 litres in 2015 (Econoler, 2016).

Biodiesel can also be blended with conventional diesel and therefore, like bioethanol, can quickly make an impact on the sustainability of the country's current vehicles. The company have ambitious production figures and estimate that by 2020 they alone would be producing some 1 million litres of biodiesel (Econoler, 2016).

5.4.3 Next Steps

Regulation

Given that there are already companies in Malawi producing bioethanol domestically, and the current rates of blending are not at their maximum level, a simple first step to increase the sustainability of transport fuel is to set regulated targets for blended ethanol with petrol to reach 20% by 2025.

For biodiesel it has been determined that more modest targets should be set, aiming for a 10% blend in 2025 and 30% blend in 2030. Based on estimates developed in the UN's SE4All Action Agenda that would represent the need of 30 and 110 million litres of biodiesel produced in 2025 and 2030 respectively.

To implement this strategy, GoM should work with MERA to estimate the exact levels of blend that will be aimed for in each year, for both biodiesel and bioethanol, and determine what penalties fuel suppliers would have to pay should these levels not be met.

Pricing

The price of ethanol is pegged to that of petrol in Malawi, which is often to the disadvantage of ethanol companies. GoM has committed to uncoupling the two prices and by bringing in regulations to reach set levels of biofuels in the fuel mix. This should ensure that a set demand for ethanol is achieved and that domestic producers are encouraged to invest in production of more ethanol every year by investing in the appropriate infrastructure and human capital to deliver desired levels. If these levels are not achieved at reasonable prices, GoM will have to consider allowing for biodiesel imports.

Research and Development

In 2014, MERA approved ethanol as a motor vehicle fuel (100% ethanol, not only petrol-ethanol blends). 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% petrol or on any blend of the two through installation of a conversion kit. Fifty cars were used in a successful trial runs of the vehicles.

Developing ethanol filling stations on the open market has been slow due to a lack of demand. GoM will work with the private sector to implement a pilot project to operate a fleet of vehicles that run on 100% ethanol while introducing pilot filling pumps in Lilongwe, Blantyre and Mzuzu. GoM and Press Corporation should work with any other willing partners on a feasibility study for this project in 2017 with the project being taken forward in 2018 if it is deemed suitable.

In terms of electric cars, GoM is aware of global advances in the technology and the potential for charging stations for such vehicles to be powered by solar energy. GoM will continue to review the market for electric cars that can run on solar energy as the renewables market grows and global advancements in the technology continue, however there are no concrete actions intended at this stage.

6. Cross Cutting Issues

6.1 The Rural Electrification Fund and Renewable Energy Agency

6.1.1 Actions

Year of completion	Action	Implementers	Progress	Funding Status
2018	Full details of possible expansion of the Rural Electrification Fund to be announced.	GoM in partnership with agencies and key stakeholders.	No formal discussions have taken place yet, but they should commence as soon as possible.	Funders to work with GoM to establish whether investment can be made in an expanded Rural Electrification Fund.
2020	Renewable Energy or Rural Electrification Agency to be established.	GoM in partnership with agencies and key stakeholders.	No discussions have taken place, early stage discussions should take place as to what remit the group could have and formal plans should be made if the Rural Electrification Fund is expanded and GoM determines an agency should lead on delivering that fund.	Long terms funding welcomed if an agency is established to deliver funds.

6.1.2 Current Status and Potential

Malawi's Rural Electrification Act (2004) was established to, "make provision for the promotion, funding, management and regulation of rural electrification".

So far, the fund has been used effectively for extending Malawi's electricity grid to areas that did not previously benefit from access to the national grid. It is primarily funded by a levy on fuel, as stated in earlier in the MRES.

Although rural electrification via grid extension was central to the fund's original objectives, there is scope within the Act to broaden this scope to cover a range of activities in relation to rural electrification, cutting across a range of technologies and scales. The full scope of the Act as includes:

- The capital cost of rural electrification grid extension and off-grid electrification
- The capital cost of solar home system equipment to be acquired for public institutions
- Operational and maintenance costs of rural electrification projects, to the extent to which it makes the project viable
- Provision of credit guarantees for the capital cost of solar home system equipment other than those to be acquired by a concessionaire
- Any monetary contribution required to be made by the Government for the implementation and execution of a donor-funded rural electrification project
- The administrative expenses associated with the execution of the duties and functions and responsibilities of the Committee and the management of the Fund
- Research and consultancy assignments related to rural electrification
- Expenses for credit guarantee funds management
- Compensation for removal of off-grid installations in accordance with section 33.

GoM recognises the benefits of many of these activities and actively advocates policies and programmes of this nature throughout this MRES. Given their relevance, GoM will explore whether mechanisms can be put in place to fairly and effectively utilise the Rural Electrification Fund to benefit a wider range of activities than it currently does.

6.1.3 Next Steps

GoM will work internally at first, then with key stakeholders across the sector to carry out assessments as to how the scope of the fund could be expanded, considering the financial constraints of the fund and other practical constraints to implementing and expanding the scheme.

If the scope of beneficiaries and the remit of the fund is significantly expanded, GoM will consider as to whether or not a separate renewable energy agency should be established as the delivery body for these projects. This ties in with the direction in the National Energy Policy to, 'Create the Rural Electrification Authority as a semi-autonomous legal entity under an Act of Parliament and that its mandate includes renewable energy activities' as well as the UN Sustainable Energy for All Action Agenda which indicates that a renewables agency should be established. However, the first stage in this process is to establish the scope of the funding, before determining how best to deliver it.

6.2 District Energy Officers

6.2.1 Actions

Year of completion	Action	Implementers	Progress	Funding Status
2017	Completion of project to blueprint the role of a District Energy Officer.	GoM, Lilongwe District Council, Community Energy Malawi and Strathclyde University	Project underway to be complete in first half of 2017.	Funded.
2019	District Energy Officers to have been piloted in different regions of the country.	GoM in partnership with Community Energy Malawi and Local Government.	Proposals should be outlined as part of the conclusion to the blueprinting	Additional funding and support likely to be required.

			exercise.	
2022	Energy Officers to be rolled out in all districts of the country.	GoM, local Government and potentially Malawi's Renewable Energy Agency.	Following pilot schemes, final proposals for remit and function of officers should be made.	No funding is identified yet, but significant amounts are required.

6.2.2 Current Status and Potential

Advice and support for energy issues in local areas is not readily available. Although some support is often provided by smaller GoM projects and donor and NGO programmes that operate in rural areas, it is not strategically planned and coordinated. For example, it is often the case that programmes to distribute PSPs or cleaner cookstoves have an element of energy education and advice to them in order to highlight why the technologies are useful to those who could benefit.

Furthermore, part of the UNDP's Sustainable Energy Management programme in conjunction with GoM includes funding to build capacity to mainstream innovative renewable energy and energy efficiency technologies in some district development plans. Since DoE has no technical officers at district level and no field officers at community level, it has been necessary to work with and train extension workers from other departments such as Forestry and Community Services in order to promote renewable energy initiatives. This is certainly progress in terms of mainstreaming energy as a critical issue; however energy is not a priority for these officers and given the importance of energy issues to so many aspects of development in Malawi there is significant need for leadership at a local level.

Given the lack of a targeted programme of advice and support for much of the population in Malawi, there is a strong feeling among stakeholders and GoM that officers in districts should provide more assistance and advice on energy matters, especially since energy issues are often at the heart of many problems the local communities are facing, whether that be in healthcare, education or the environmental.

To address this gap, GoM will seek to introduce district officials who specialise in energy. Prior to this a programme of work is required to fully establish what the role and responsibilities of a District Energy Officer should be, what benefits such a role will create and the associated costs of implementation. There is also a need to consider how best to integrate District Energy Officers, whether through local governments directly or potentially via a standalone agency. This could be the same agency which is in place to deliver an expanded rural electrification programme.

6.2.3 Blueprinting the Role

GoM will support ongoing work by local NGO, Community Energy Malawi, and Strathclyde University who are being funded by the Scottish Government to 'blueprint' the role of a District Energy Officer. Following the outcome of this study, GoM will be better placed to understand the full benefits and costs of such a role and to take a decision as to how to begin to implement a District Energy Officer network across the country.

Community Energy Malawi will carry out field work by developing and testing the role and remit of an District Energy Officer along with research techniques to determine what the local demands are for the job.

These targeted activities will inform the final definition of the District Energy Officer role. At present, GoM expect the role to include the following principles:

- Providing impartial advice to local communities and District Governments in order to develop more sustainable and effective energy planning within District Development Plans.
- Working directly with other district officers in departments such as Forestry, Health, Education and Environment in order to incorporate sustainable and effective energy strategies into all local government planning.
- Targeting public sector institutions, especially schools and hospitals, to determine how best to meet their energy needs with a focus on renewable and sustainable solutions, including off-grid initiatives.
- Increasing awareness of product standards and being able to provide impartial advice to local people and groups.
- Pointing local groups towards ongoing initiatives to assist with energy projects and financing.

6.2.4 Funding and Integration with District Governments

Following this study and the published results, GoM will work with Community Energy Malawi, key local government officials and other stakeholders to develop a finalised job description as well as consider how district energy officers will be integrated into local departments, including an evaluation of how much the scheme would cost if implemented across the country.

As well as the role and remit, GoM will have to determine how to best manage the new district energy officers to achieve maximum impact. This could be through housing officers directly within the current local government structure or, as mentioned previously, they could be part of a national renewable energy agency that would operate as an umbrella organisation to train and coordinate the officers while working with local and national government.

GoM aim to have the first district energy officers in place by the end of 2018 and to have officers in all districts by 2022.

6.1 Education, Capacity Building and Research

6.1.1 Actions

Year of completion	Action	Implementers	Progress	Funding Status
2017	Develop incentives to encourage participation in renewables courses by women and girls as well as low-income groups and youths to try to increase gender balance in the industry and create greater equality in the industry.	GoM, Education Institutions and key industry stakeholders.	Gender and wider equality in renewables identified by NEP, next steps need to be taken to support these groups.	Funding and coordinated support required
2017	Ensure that current short courses in renewable energy are continued and review how they could be affordable and practical for a greater number of people, particularly encouraging women candidates and those from rural areas.	Educational institutions	Ongoing but further investment in reach of courses needed.	Funding could be sought for remote learning and subsidised rates.
2018	Review completed on how to implement affordable training and capacity building for local communities in order for them to begin to implement renewables projects.	GoM, educational institutions.	No progress made, discussions should start as soon as possible.	Funding required

	Review completed to consider where to develop further education courses to fill current and future skills gaps for renewable energy across a range of areas such as engineering, law and finance.	GoM, Education Institutions and key industry stakeholders.	No progress made, discussions should start as soon as possible.	Funding required
	Capacity building efforts in Malawi to be more coordinated and strategic.	GoM in collaboration with donors and NGOs who are delivering capacity building activities.	No progress made, discussion should start as soon as possible as part of MREPG.	Funding available but needs to be better coordinated.
Ongoing	Results from research projects and from implementing programmes in Malawi to be shared widely through GoM and other stakeholders as part of the MREPG.	GoM in collaboration with researchers as well as donors, NGOs and businesses working in the sector.	To begin on formation of the MREPG.	No additional funding required.

6.1.2 Current Status and Potential

Developing and supporting Malawi's human capital is essential in order to foster a successful renewables sector. Malawi requires trained individuals with a wide range of skills sets and functions within the renewables sector including technicians, engineers, legal experts, financial professionals and managers.

As this document clearly identifies, the sector in Malawi must service various different technologies over a range of scales. It is a challenge for Malawi to find people with these skills, but an opportunity for GoM and educational institutions to train people in these skills.

6.1.3 Higher Education

There is already provision of graduate and post-graduate capacity building through existing higher education institutions, but this needs to be further enhanced, particularly to address the needs of the newly restructured electricity industry.

The University of Malawi's Polytechnic offers a 4-year Bachelor's degree in electrical engineering, with a strong focus on renewable energy technologies. Students from this programme undertake industrial placements for one semester, as well as a compulsory module in entrepreneurship and business management.

The Polytechnic has also developed an MPhil research degree programme in renewable energy. This programme started in 2013 and has so far has produced around 20 graduates with research degrees, predominantly in the technical aspects of Renewable Energy. There are also plans in place to introduce an international MSc in Renewable Energy, currently under development.

There is a Bachelors in Energy Studies that is offered by Mzuzu University, plus a number of short courses offered by various institutions around the country.

The University of Malawi's Chancellors College offers Bachelors programmes in Physics which includes components of technical research into renewable energy technologies.

All such courses in Higher Education institutions should try to encourage gender balance when selecting candidates and seek ways to try to ensure more women enrol in such courses.

6.1.4 Institutional Capacity Building

There is significant demand for technical training from ESCOM, and MERA. Training courses offered by commercial training organisations are often over-subscribed. At the small scale end of the spectrum, a number of solar installation companies have been established with in-house training provided by the equipment suppliers.

In order for Malawi to fully implement and support a modern IPP framework over the long term, expertise is required within institutions that will be working and negotiating with power producers. This includes legal and financial expertise to manage complex PPAs.

It is clear that Malawi's energy system would also benefit from enhanced grid demand and supply management. This requires not only an upgrade in terms of the software and hardware on the grid, but also trained engineers and technicians who can build, operate and manage such systems.

The Millennium Challenge Committee, through the restructuring of the electricity industry has also highlighted the following areas as priorities for skills development:

- Technical understanding of grid management for the inclusion of renewables.
- The technical basis of long-term grid development planning.
- Economic understanding of tariff setting within the openly competitive power market.
- Policy instruments for the support of renewable energy development.
- Legal and commercial knowledge of the development and monitoring of power purchase agreements.

GoM urges universities in Malawi to recognise these gaps and build upon the current programmes with a focus on how the identified skills gaps can be filled.

In the short term, before Malawi develops these skills within the country, institutions like ESCOM and MERA should continue to seek external expertise where there are skills gaps. This has already proved successful in helping to develop an IPP framework and was again supported by the MCC.

6.1.5 Local Capacity Building

In addition to the large-scale electricity industry that requires a high level of engineering excellence, the rural power sector, which has the potential to reach the majority of Malawi's population, also urgently needs people on the ground who have the skills and knowledge to establish and maintain energy systems, ranging from individual solar devices to mini grids.

Malawi already has a number of short courses provided by the University of Mzuzu which focus on renewable energy technologies. This kind of training is ideal for those in more rural off-grid areas who are looking to establish themselves as community champions of renewable energy and start local energy businesses. However, this course is still inaccessible to the majority of the population due to a lack of awareness, location and cost.

In mini-grids and off-grid solar systems, skilled workers are required to maintain and manage systems and can also become involved in the sale of such devices and systems. The University of Mzuzu should work with other institutions across the country and with GoM to provide these courses at an affordable rate across all regions in Malawi and to provide special incentives for eligible young women and low-income youth.

As well as skilled local technicians, more basic capacity building and awareness is required. A number of donor and NGO delivered programmes already include capacity building as part of their projects. For example, the EnDev cleaner cookstoves manufacturing programme includes capacity building in coordination of the planning and delivery of these projects.

There is an opportunity here for this kind of capacity building not only to raise awareness of how to use renewable technologies but also to provide more holistic insights into why renewables technologies are now necessary. For example, a capacity building course for cleaner cookstoves manufacturing could also highlight the importance of protecting forests.

It is likely that when they are in place, District Energy Officers will be able to play an important role in both providing basic advice to communities and in highlighting where training can be accessed across the country as well as how this could be funded. Until this point, Government, donors and NGOs need to make sure their capacity building is coordinated and strategic in order to best utilise the resources currently being used. The MREPG could be a good forum for discussion on this issue.

6.1.6 Future Leaders in Renewables

At all levels, skilled managers and leaders will be required, from coordinating the roll-out of new grid extensions in the public sector or developing distribution channels for pico-solar products in the private sector. It is clear that Malawi's further and higher education institutions that offer courses in management and leadership will have a critical role in educating the next generation of experts that will take forward the renewable energy industry in the country.

As a result, renewables will be promoted by GoM and education institutions as a career that is fulfilling in terms of progression and responsibility and also in terms of benefitting Malawi's wider society.

6.1.7 Coordinating Research and Knowledge Sharing

GoM encourages research at all levels to further understanding of what is achievable in the renewables sector in Malawi today and in the future.

As such, GoM recognises the importance of academic research in renewable energy and encourages collaboration at home and abroad between universities, NGOs and practitioners for conducting and disseminating research on renewable energy in Malawi.

There are a number of ongoing research projects in Malawi, and relevant studies taking place elsewhere, which could assist in the development of the renewables sector. In addition, many programmes and work ongoing in the field in Malawi that are mentioned in this document have a research or pilot aspect to them.

In future, the establishment of a Renewable Energy Agency could provide strong links between stakeholders in academia and industry in Malawi, and globally, to determine future research requirements. Before then, the MREPG will seek to engage with research national and international research institutions to encourage research that supports the delivery of renewables strategies and allows research evidence to inform on-going policy and strategy development.

As well as determining the direction of future research, the outputs and results from ongoing studies and programmes must be shared widely and discussed by GoM and stakeholders to have a practical impact on work across the country. The MREPG should be used as a central hub for knowledge and information sharing and any programme operating within Malawi or with relevance to Malawi should be willing to share data which can inform the work of GoM, other donors and NGOs and ultimately Malawian businesses.

GoM understand that businesses may not wish to share any commercially sensitive information but it must be ensured that the work of donors and NGOs is not treated in this way. These programmes should benefit Malawian businesses and provide vital information and lessons as an output of their work.

6.2 Information, Transparency and Statistics

6.2.1 Actions

Year of completion	Action	Implementers	Progress	Funding Status
Ongoing	Cookstoves Map with location of sales as well as production centres maintained.	EnDev, GIZ and the NCSC	Published and will be maintained.	Funded
2017	Publish and regularly update energy statistics on the Department of Energy Affairs website.	GoM	Ongoing	Funding sought for more advanced monitoring and reporting of statistics in line with the UN

				Global Tracking Framework.
2018	Map showing the existing grid network, expansion plans, off-grid systems, population centres, renewable energy resources, and other key information to be published to assist developers and communities.	GoM, UN and partners who can assist with information.	Project to begin in early 2017.	Funded.
Ongoing	Members of the CONREMA network to continue to provide off-grid project information and other industry players encouraged to sign up.	CONREMA network members, developers of off-grid technologies	Ongoing	Currently running but funding welcomed.

6.2.2 Public Data

GoM intends to make a lot more data on renewable energy and energy access far more accessible to key stakeholders and the general public.

The new Department of Energy Affairs website will lead the way in publishing new energy statistics online in 2017. This will give the wider public awareness of Malawi's energy sector including basic statistics on the capacity and output of power stations as well as a list of where developments are and the number of people who have energy access in the country. It is envisaged that this page will be updated at least every 6 months.

6.2.3 Tracking Progress

As outlined in the summary of targets at the start of the MRES, GoM aims to adopt a similar approach to the UN SE4All Global Tracking Framework (GTF) for defining and measuring access to electricity and sustainable energy in Malawi.

The framework better represents the energy situation in Malawi and recognises the role of off-grid renewables and clean energy mini-grids across the country. As things stand GoM and ESCOM only measure electricity and energy access through customers who are connected to the national

electricity grid. However, as this document demonstrates, modern energy services can be provided by off-grid means, the vast majority of which are fuelled from a renewable source.

The framework measures energy access at six different tiers. GoM has adopted these to fit with the Malawian sector:

- 1) No Access
- 2) Pico Solar Access
- 3) Small-Scale Mini-Grids
- 4) Large Scale Mini-Grids
- 5) Grid Connected (Lower Reliability)
- 6) Grid Connected (High Reliability)

As things stand, it is only possible to estimate the future impacts of these technologies in order to illustrate a route forward for Malawi. However, with more funding and support from partners it will be possible to fully adapt the UN Global Tracking Framework to measure energy access on the ground at all scales and across technologies and to properly forecast access rates in future.

Before the GTF is fully adopted GoM aim to work with partners in the sector to update the electricity access statistics annually. This requires cooperation from businesses, donors and NGOs working in these sectors to assist in providing high level information in order to inform these statistics. Only by collecting this kind of information is it possible to determine where progress is being made and where shortfalls are. Therefore, it is in the interest of all stakeholders to work with GoM to update these statistics in future.

GoM have developed a statistical summary of the energy sector to the Department of Energy Affairs' new web pages which will be launched shortly - this will be where annual updates will be published in future.

6.2.4 Mapping

Mini-Grid Information 'Clearing House' and Grid Map

As part of the UNDP's *'Increasing Access to Clean and Affordable Decentralised Energy Services in Selected Vulnerable Areas of Malawi'* programme, an online information portal will be created which will consist of the following data:

- Current electricity grid networks
- Planned and known rural electrification efforts of MAREP
- Existing off-grid systems
- Population centres
- Renewable energy resource information and infrastructure criteria
- Location of government public service institutions
- Energy access criteria linked to rural infrastructure, land use, environmental and social issues.

This information will be collected for all un-electrified villages and areas of the country in collaboration with MAREP and MCC Malawi and will be validated and published. This adds to publically available, general information on mini-grids which can be found as part of the UN's Sustainable Energy for All Africa online 'Green Mini Grid Help Desk' at the following web address - <http://greenminigrid.se4all-africa.org/>

This information will be made available to all stakeholders through a clean energy mini-grid portal. Arrangements for periodic updates and maintenance of the website will be overseen by MAREP.

Efforts will be made to make available the information on the website in a graphical GIS format that will enable all stakeholders to download the datasets for each un-electrified village.

Although primarily designed to be a clearing house for mini-grid developments, the project will serve as a valuable source of information for a range of other stakeholders and members of the public. The map and clearing house are expected to be available for use in 2018.

Cleaner Cookstoves Map

As mentioned earlier, the National Cookstoves Steering Committee, through the EnDev programme, has developed a national database and map of cleaner cookstove production and sales. This is available online now at the following link:

https://energypedia.info/wiki/Malawi_Cookstove_DB

All of these interactive maps will be available through links from the newly updated Department of Energy Affairs website from 2017 or as soon as they become available.

CONREMA Off-Grid Database and Network

The Cooperation Network for Renewable Energy in Malawi (CONREMA), provides an exchange and learning platform which any renewable energy stakeholder in the country can take advantage of. Registration to the network is free and open to all who wish to share information with other network members.

CONREMA hosts a comprehensive database of projects in Malawi that are fully or partly related to institutional or household-scale community energy supply beyond the national electricity grid, including solar, wind and bioenergy projects.

Through making this database available, the network seeks to support GoM, funding partners, researchers, private sector and non-profit implementers of these projects. The project database and the wider contributor network provides an opportunity to compare approaches to development of these technologies and share information and advice.

CONREMA members also have access to a capacity database in which experts in all aspects and roles relevant to the sector can post their profiles and services thus raising awareness of the expertise available in the country creating business to business links.

7. Coordination, Leadership and Next Steps

7.1.1 Actions

Year of completion	Action	Implementers	Progress	Funding Status
2017	Establish the Malawi Renewable Energy Partnership Group (MREPG)	GoM and key industry, donor and NGO stakeholders	Should be implemented on publication of MRES	Seeking long term funding for the group.
2018	REIAMA to formally relaunch following a comprehensive review of role and remit	REIAMA staff. Industry, donors and NGOs	Early discussions held but formal discussions need to commence.	Funding should be sought but on a sustainable basis without reliance on one source.
tbc	Publish regional Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP)	GoM, with Southern African Development Community	Project underway, a project completion date should be estimated.	Funded.
Ongoing until 2030	Closely engage with the global SE4All process	GoM, UN, SE4All	Links already made, MREPG to link up with SE4All global advisory groups.	Funded

7.1.2 Overview

For the MRES to succeed there is a clear need for a collective approach with a clear agenda that all stakeholders agree on and can work towards together.

Stakeholders regularly meet informally across the renewable energy sector in Malawi but there is a clear need for an overarching group to help deliver shared objectives. At present there is a substantial amount of activity taking place across Malawi but also a lack of the strategic, collective thinking across Government, industry, donors and NGOs to achieve the long term vision outlined in the MRES.

7.1.3 Malawi Renewable Energy Partnership Group (MREPG)

GoM recognises the importance of implementation of the actions outlined in the MRES in order to achieve Malawi's vision for renewable energy.

GoM also recognise that this task is not one that can be completed alone and without cooperation with a number of key stakeholders. It is therefore intended to establish a Malawi Renewable Energy Partnership Group (MREPG) to help deliver the actions identified in the MRES. Only with ongoing support and engagement from donors, NGO and the private sector will such a group be a success. For that reason, the Department of Energy Affairs and another key stakeholder from the renewables sector will co-chair and manage the group.

Membership of the partnership group will consist of a range of stakeholders including Government and associated agencies, industry, donors, NGOs and civic society. The group will meet quarterly and measure progress against the actions as well as determining what the next steps should be to able to fully implement the actions or where new actions need to be identified. The MREPG will be the body responsible for periodic re-drafting of the MRES as and when required. The group's agenda should reflect the identified actions of the MRES and these actions should evolve and develop as they are undertaken, while always relating to the overall vision and aims of the MRES and the NEP.

The group will act as a focal point for those working across the sector, providing a forum to coordinate work and resources more strategically as well as sharing ideas and results.

7.1.4 Industry, Donor and NGO coordination

The renewables industry in Malawi is a mix of private sector companies as well as donors and NGOs who are looking to help develop the sector. Since the sector is in its infancy in Malawi, GoM encourage these broad groups to work together as much as possible to provide a united voice to GoM on key issues effecting the sector. Many donors and NGOs also bring experience from more developed markets and can pass on critical knowledge about how to help grow Malawi's fledgling renewables sector.

The MREPG needs strong voices from the private sector and the international donor community to continue to highlight where progress needs to be made and what changes are a priority in the sector. Other already established groups such as the National Cookstoves Steering Committee and the emerging DFID Energy Africa group of donors should also feed into this group and provide updates on progress in their respective areas. GoM would welcome more of this kind of coordination and collaboration to inform the direction of the MRES in future.

The motivation for industry stakeholders to meet to discuss their interests and the current environment for renewables in Malawi inherently exists in the sector. What is needed is a small amount of work to coordinate these organisations and groups and bring them together more regularly.

Renewable Energy Industries Association of Malawi (REIAMA)

The Renewable Energy Industries Association of Malawi (REIAMA) could play an important role helping to organise such meetings between like-minded stakeholders under a single banner.

The organization has received donor funding from 2014-16 to help with running costs and has managed to attract around 20 paying members during that period to try to become self-sustaining.

However, since the level of membership is not yet high enough to pay for the organisation's costs and make it a more effective representative group, more players need to become involved.

Even with limited resources, in the short term REIAMA should seek to fulfil the core function of facilitating further industry discussions, assuming a simple secretariat role to help meet the need for industry stakeholders to meet up and discuss shared issues.

If REIAMA is active in this role initially and helps to coordinate such meetings, it is hoped that funders can be found to offer support for administration costs or to offer venues for meetings. As the network of organisations involved grows, REIAMA could then explore its own income generating activities such as asking for membership fees, hosting events and conferences or in sharing industry information.

Although traditionally REIAMA has sought to only cater for the needs of commercial companies, given the current stage of Malawi's renewables sector, the group should also look to include donors and NGOs as the market develops.

REIAMA should also create stronger links with networks such as CONREMA and members should be encouraged to contribute to the CONREMA database of projects which has already been developed. Increased cooperation between groups will lead to further benefits for the whole industry as a result of better networking, sharing of information and collective thinking.

A recommended plan for the re-development REIAMA is as follows:

- REIAMA to provide a basic secretariat to facilitate industry discussion, that should involve donors and NGOs. This may require some support from willing industry partners and the donor community.
- Sector meetings should be organised and attendance should be open to any organisation interested in discussing key renewable energy issues.
- To reduce costs and barriers, organisations should offer office space for meetings and organisational support if required.
- If groups are successful, continue to meet and require more organisation, REIAMA will be able to seek membership fees from a wider range of stakeholders.
- REIAMA should eventually seek to be the host of industry events, disseminating key industry information on a more regular basis.

7.1.5 The International Community

The Southern Africa Development Community

GoM recognise that to achieve the goals of the MRES and in renewables it will be crucial to collaborate closely with neighbouring countries. To that end GoM have been involved in a project with the Southern Africa Development Community (SADC) to develop a Renewable Energy and REEESAP.

Much like the SE4All Action Agenda the REEESAP aims to provide a framework for member states in the SADC to develop their own renewable energy and energy efficiency strategies and action plans to contribute towards achieving access to clean, modern, sustainable and affordable energy services for the planned industrialisation, ensuring energy security and achieving energy access.

The MRES builds on the knowledge and work already undertaken by those in the Department of Energy Affairs who are involved in the SADC REEESAP process.

United Nations and Sustainable Energy for All

GoM recognises that climate change is a global issue that needs global solutions, while also realising how important renewable energy can be to the country domestically. This is why Malawi is delighted to be one of the first countries to be involved in the UN's Sustainable Energy for All (SE4All) initiative to help increase access to sustainable, modern energy solutions for everyone by 2030.

The SE4All Action Agenda is a high level umbrella framework for the energy sector in Malawi that also includes a focus on issues such as food security, gender, health and water. Of course, many of its goals and ambitions are in renewable energy and it is hoped the MREPG will be able to help deliver actions that will contribute to these aims. The MREPG should be the first point of contact for future work on the SE4All Action Agenda in order to ensure that the MRES and Action Agenda are complimentary and work towards the same vision to improve the renewable energy sector in Malawi for all citizens.

Acronyms and Abbreviations

BIF	Business Innovation Facility
DFID	Department for International Development, UK Government
EDVP	Ethanol Driven Vehicle Project
ESCOM	Electricity Supply Corporation of Malawi
GIS	Geographic Information System
GIZ	German Corporation for International Cooperation
GoM	Government of Malawi
GTF	Global Tracking Framework
IFC	International Finance Corporation
IMF	International Monetary Fund
IPP	Independent Power Producer
IRP	Integrated Resource Plan
MAREP	Malawi Rural Electrification Programme
MBS	Malawi Bureau of Standards
MCC	Millennium Challenge Corporation
MEGA	Mulanje Electricity Generation Authority
NERA	Malawi Energy Regulatory Authority
MMCT	Mulanje Mountain Conservation Trust
MoU	Memorandum of Understanding
MRA	Malawi Revenue Authority
MRES	Malawi Renewable Energy Strategy
MREPG	Malawi Renewable Energy Partnership Group
MW	Mega-Watt
NCSC	National Cookstoves Steering Committee
NCST	National Commission for Science and Technology
NEP	National Energy Policy
NGO	Non-Governmental Organisation
PPA	Power Purchase Agreement
PPPs	Public-Private-Partnerships
PSP	Pico Solar Products
PAYG	Pay As You Go
R&D	Research and Development
RE:FiT	Renewable Energy Feed-in Tariff
REEEP	Renewable Energy and Energy Efficient Partnership
REEESAP	Renewable Energy and Energy Efficiency Strategy and Action Plan
REIAMA	Renewable Energy Industries Association of Malawi
SADC	Southern African Development Community
SAPP	The Southern African Power Pool
SDGs	Sustainable Development Goals
SE4All	Sustainable Energy for All
SE4RC	Sustainable Energy for Rural Communities
SHS	Solar Home Systems
SOGERV	Sustainable Off-grid Electrification for Rural Villages
UN	United Nations

UNDP	United Nations Development Programme
VAT	Value Added Tax
WASHTED	Centre for Water, Sanitation, Health and Alternative Technology Development

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