

# UGANDA

# TECHNOLOGY ACTION PLAN REPORT - MITIGATION

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September 2021



Photo Credit: Village Energy Limited, 4kW Custom PV Power System at Kajjansi Market




Source: UNDP Examples of fixed Institutional Cook stoves



Source: UNDP Composition of the bio-latrines technology: bio-latrines, bio-digester and gas cook stove

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## Abbreviations and Acronyms

<b>AC</b>	Alternating Current	<b>IICS</b>	Improved Institutional Cook Stoves
<b>AFOLU</b>	Agriculture Forestry and Other Land Use	<b>ktCO<sub>2</sub>e/a</b>	Kilotons of carbon dioxide equivalent per annum
<b>BA&amp;EF</b>	Barrier Analysis and Enabling Framework	<b>kW</b>	Kilowatt
<b>CCD</b>	Climate Change Department	<b>kWh</b>	kilowatt hour
<b>CH<sub>4</sub></b>	Methane	<b>LPG</b>	Liquefied Petroleum Gas
<b>COVID</b>	Coronavirus Disease	<b>LULUCF</b>	Land use, land use change and forestry
<b>CO<sub>2</sub></b>	Carbon dioxide	<b>MEMD</b>	Ministry of Energy and Mineral Development
<b>CO<sub>2</sub>e</b>	Carbon dioxide equivalent	<b>MFI</b> s	Microfinance Institutions
<b>DC</b>	Direct Current	<b>MoES</b>	Ministry of Education and Sports
<b>DPs</b>	Development Partners	<b>MoFPED</b>	Ministry of Finance, Planning and Economic Development
<b>ERA</b>	Electricity Regulatory Authority	<b>MoSTI</b>	Ministry of Science, Technology and Innovation
<b>ESMAP</b>	Energy Sector Management Assistance Program	<b>MtCO<sub>2</sub>e</b>	Metric tons of carbon dioxide equivalent
<b>FBUR</b>	First Biennial Update Report	<b>MTIC</b>	Ministry of Trade, Industry and Cooperatives
<b>FIs</b>	Financial Institutions	<b>MW</b>	Megawatt
<b>FY</b>	Financial Year	<b>MoWE</b>	Ministry of Water and Environment
<b>GEF</b>	Global Environment Facility	<b>NAMAs</b>	Nationally Appropriate Mitigation Actions
<b>Gg</b>	Gigagrams	<b>NDC</b>	Nationally Determined Contribution
<b>GHG</b>	Greenhouse gas		
<b>GoU</b>	Government of Uganda		
<b>HFO</b>	Heavy Fuel Oil		
<b>IEA</b>	International Energy Agency		
<b>IRENA</b>	International Renewable Energy Agency		

<b>NDP</b>	National Development Plan
<b>NGO</b>	Non-Governmental Organization
<b>NPA</b>	National Planning Authority
<b>N2O</b>	Nitrous oxide
<b>PAYG</b>	Pay As You Go
<b>PI</b>	Project Idea
<b>PPP</b>	Public-private partnership
<b>PV</b>	Photovoltaic
<b>RE</b>	Renewable Energy
<b>REA</b>	Rural Electrification Agency
<b>REP</b>	Renewable Energy Policy
<b>RETs</b>	Renewable Energy Technologies
<b>R &amp; D</b>	Research and Development
<b>SACCOs</b>	Savings and Credit Cooperative Organization
<b>SMEs</b>	Small and Medium-sized Enterprises
<b>SNC</b>	Second National Communication
<b>TAP</b>	Technology Action Plans
<b>ToT</b>	Training of Trainers
<b>tCO<sub>2</sub>eq</b>	Tonnes of Carbon dioxide equivalent
<b>TNA</b>	Technology Needs Assessment
<b>TW</b>	Terawatt

<b>UDBL</b>	Uganda Development Bank Limited
<b>UGGDS</b>	Uganda Green Growth Development Strategy
<b>UN</b>	United Nations
<b>UNBS</b>	Uganda National Bureau of Standards
<b>UNCST</b>	Uganda National Council for Science and Technology
<b>UNDP</b>	United Nations Development Programme
<b>UNEP</b>	United Nations Environment Programme
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>UNREEEA</b>	Uganda National Renewable Energy and Energy Efficiency Alliance
<b>UNSD</b>	United Nations Statistics Division
<b>URA</b>	Uganda Revenue Authority
<b>USD</b>	United States Dollars
<b>USEA</b>	Uganda Solar Energy Association
<b>WB</b>	World Bank
<b>WENRECO</b>	West Nile Rural Electrification Company
<b>WHO</b>	World Health Organization

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# Report III

## Technology Action Plan

### Executive Summary

Energy, and in particular electricity, is a driver of socio-economic transformation of a nation. Uganda's energy mix is dominated by biomass at 88%, followed by fossil fuels (oil products) at 10% and electricity contributes only 2%.

The Technology Needs Assessment (TNA) project was conducted in Uganda in order to identify and prioritize technologies that need to be implemented to achieve climate and development benefits; increased clean energy access being one of them. The objectives of the TNA project were:

- ▶ To identify and analyse through a country-driven process, climate change mitigation technology priorities for Uganda, the energy sector was selected.

- ▶ To identify, analyse and address the barriers hindering the deployment and diffusion of the prioritized technologies including enabling the framework for the said technologies
- ▶ To prepare Technology Action Plans (TAP) to support implementation of the prioritized technologies within the

country to achieve the climate and development benefits.

The project was coordinated by Uganda National Council for Science and Technology (UNCST). The institutional set up was made up of the Steering Committee, National Coordinator, Sectoral Working Groups and the mitigation National Consultants. During phase one (1) of the TNA, three (3) technologies were prioritized, namely; solar rooftop systems, efficient institutional cook stoves and biolatrines for institutions (using biogas technology). Phase two (2) of the TNA analysed the barriers that hinder the deployment and diffusion of the prioritized technologies and proposed an enabling framework required to ease the transfer and diffusion of the technologies.

This report covers the 3rd objective of the project. For phases one and two, stakeholders' views were gathered through individual interviews and stakeholders workshops; for the TAP, stakeholders were engaged individually due to COVID-19 restrictions. A number of existing policies and measures in the Energy sector were referred to in the development of the TAP as summarized below;

**Table 1: Summary of existing policies and measures in the Energy sector**

Name of law & policy	Enacted & revised	Brief contents
The national climate change bill, 2020	2020	According to Schedule 2 of the Bill, the parties to the UNFCCC, 1992 recognize that all countries, especially developing countries, need access to resources required to achieve sustainable social and economic development and that, in order for developing countries to progress towards that goal, their energy consumption will need to grow taking into account the possibilities for achieving greater energy efficiency and for controlling greenhouse gas emissions in general, including through the application of new technologies on terms which make such an application economically and socially beneficial.
Third NDP, 2020/21 – 2024/25	2020	For successful implementation of the NDPIII, one of the key development strategies will be to increase access to stable, reliable and affordable energy.
The Energy Policy for Uganda	2002, revised 2019	The policy statement for the renewable energy sub-sector is that the Government shall promote the sustainable development and utilisation of all renewable energy resources in a socially and environmentally responsible manner.
The Uganda Green Growth Development Strategy 2017/18 – 2030/31	2017	Energy for green growth is one of the five priority areas of the UGGDS. One of the planned strategic interventions is to support an increased focus on renewable energy investments including; improved technology for enhanced efficiency in using biomass for domestic cooking and industrial uses by 2020; and enhancing solar power potential especially for on-grid and local supply over the transitional period for the country from the current 10MW to 5,000MW by 2030.
Uganda Vision 2040	2010	The Vision recognizes that climate change affects all sectors of Uganda's economy, making the need for preparedness inevitable through adaptation and mitigation strategies in all sectors to ensure that the country is resilient to the adverse impact of climate change.
Uganda National Climate Change Policy	2015	The policy goal is to ensure a harmonized and coordinated approach towards a climate-resilient and low-carbon development path for sustainable development in Uganda.

Name of law & policy	Enacted & revised	Brief contents
Uganda's Nationally Determined Contribution (NDC)	2015	It stipulates that energy sector (supply) measures will increase the amount of renewable energy capacity by at least 1,100 Mega Watts compared to business- as- usual by 2030, generating an estimated 4.6 - 5.2 Terawatts (TW) more than in the business-as-usual scenario case. The mitigation impact is forecast to be between 2.7 Million tons Carbon dioxide equivalent per year (MtCO <sub>2</sub> e/a) and 3.7 MtCO <sub>2</sub> e/a. The mid-point is taken as 3.2 MtCO <sub>2</sub> e/a.
Uganda Second National Communication to the UNFCCC	2014	Uganda's mitigation options and measures in response to climate change in line with the objectives and provisions of the UNFCCC were assessed based on assumptions of GHG emissions projections from 2005 to 2035 following two scenarios: a business-as-usual scenario and a mitigation scenario based on specific actions in the key sectors of energy and transport, agriculture, Land use, land use change and forestry (LULUCF) and waste. One of the SNC recommendations is wider use of solar energy for low power electricity using photovoltaic systems and larger plants using steam or organic fluids in future.

Action plans have been drawn for the 3 prioritized technologies detailing; the Ambition for the TAP; actions and activities selected for inclusion in the TAP – this also covers the summary of barriers and measures to overcome them; activities identified for implementation of selected actions; actions to be implemented as project ideas; stakeholders, their roles and timeline for implementation of the TAP; scheduling and sequencing of specific activities; estimation of resources needed for action and activities; identified risks and possible contingency plans, immediate requirements and critical steps; and the overview table summarizing the TAP for each of the technologies. Below are summaries of the action plans for each of the technologies;

## Action plan for solar rooftop systems

**Ambition:** To install 65MW of solar PV (assuming an average of 8 sunshine hours per day) represented by; 63 MW for 140,000 households, 0.9MW for 300 schools and 0.9MW for 200 Health Center IIIs. Actions selected for inclusion in the TAP are;

1. Develop and implement financial incentives on solar rooftop systems
2. Strengthen Institutional frameworks
3. Develop a skilled workforce to install, operate and maintain solar rooftop systems

Action 1 will be implemented as a Project Idea (PI) with all the activities

under the action considered. Ministry of Energy and Mineral Development (MEMD) will coordinate the project and will work closely with Ministry of Science, Technology and Innovation (MoSTI), Rural Electrification Agency (REA), Ministry of Finance, Planning and Economic Development (MoFPED),

Uganda Development Bank Limited (UDBL), Ministry of Trade, Industry and Cooperatives (MTIC) and Financial Institutions (FIs). Roles for each of the stakeholders have been spelt out. Activities of the TAP are expected to cost USD 460,000. Key activities and resources needed are summarized in table 2 below;

**Table 2. Activities for Solar Rooftop Systems**

Action	Activities to be implemented	Responsible body and focal point	Budget (USD)
Action Develop and implement financial incentives on solar rooftop systems	Exempt taxes on all imported solar components	MoFPED	150,000
	Subsidize interest rates	MoFPED	70,000
	Conduct consultative meetings with financial institutions (FIs), and identify those which can cooperate in supporting the solar technology development	MoFPED, MEMD	50,000
	Provide capacity building trainings to FIs to understand the solar business models	MEMD	50,000
	Set up a renewable energy revolving fund to support the various stakeholders in the value chain including end-users	MoFPED, MEMD	120,000
	Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives	MEMD	20,000

## Efficient Institutional Cook Stoves

**Ambition:** Ambition: To construct 1,000 efficient institutional cook stoves in 500 schools. Actions selected for inclusion in the TAP are;

1. Develop and implement financial incentives for efficient institutional cook

stoves

2. Sensitize institutions about the benefits of efficient institutional cook stoves

3. Strengthen Institutional capacity

4. Develop a skilled workforce to manufacture, construct and maintain efficient institutional cook stoves.



Action 1 will be implemented as a Project Idea (PI). All activities under this action will be considered. MEMD will coordinate the project and will work closely with

MoSTI, MoES, MoFPED, FIs, MoWE and MTIC (UNBS). Key activities and resources needed are summarized in table 3;

**Table 3: Key activities for Efficient Institutional Cook Stoves**

Action	Activities to be implemented	Responsible body	Budget (USD)
Develop and implement financial incentives for efficient institutional cook stoves	Subsidize interest rates to lower FIs lending rates	MoFPED	160,000
	Conduct consultative meetings with FIs, and identify those which can cooperate in supporting the technology	MoFPED, MEMD	70,000
	Provide capacity building trainings to FIs to understand the efficient institutional cook stoves technology and its benefits	MEMD	30,000
	Set up a renewable energy revolving fund to support the various stakeholders in the value chain including end-users; to be implemented by FIs	MoFPED, MEMD	70,000
	Develop the carbon financing market	MEMD	50,000
	Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives	MEMD	20,000
	Sensitize institutions on the benefits of adopting this clean cooking technology	MEMD	50,000

### Bio-latrines for institutions (using biogas technology)

**Ambition:** To construct 500 bio-latrines in 500 schools replacing 32,130 tons of firewood over the period of the project. Actions selected for inclusion in the TAP are;

1. Educate/train technicians, operators and end-users on alternative forms of

feedstock for biogas and their usage  
 2. Sensitize institutions about the benefits of using this technology  
 3. Develop and implement financial incentives for institutions to afford the technology  
 4. Strengthen Institutional Capacity  
 5. Develop a skilled workforce to build, operate and maintain bio-latrines (using biogas)

Action 1 will be implemented as a Project Idea (PI). All activities under this action will be considered. MEMD will coordinate the project and will work

closely with MoSTI, MoES, and MTIC – Uganda National Bureau of Standards. Key activities and resources needed are summarized in table 4.

**Table 4: Key activities for Bio-latrines for institutions (using biogas technology)**

Action	Activities to be implemented	Responsible body	Budget (USD)
Action Educate/ train technicians, operators and end-users on alternative forms of feedstock for biogas and their usage	Consultancy to study the various forms of biogas feedstock available in the different parts of the country	MEMD	30,000
	Conduct more research and development in the technology	MEMD	100,000
	Develop study materials	MEMD	30,000
	Identify technicians and operators to be equipped with knowledge on alternative feedstock for biogas	MEMD	50,000
	Map suitable sites (schools with existing bio-latrines) for the practical trainings	MEMD	15,000
	Conduct Trainings of Trainers that will continuously train others as the technology uptake grows	MEMD	15,000
	Train technicians, operators and institutions on the alternative feedstock and their usage	MEMD	15,000

All the TAPs are expected to run from 2022 to 2025 considering the timelines for the country's NDPIII 2020/21 – 2024/25. The risks have been identified and the contingency plans indicated. The immediate requirements and critical steps for all the prioritized technologies' TAPs have been added.

**Project Ideas:** As a contribution to increased access to reliable clean

energy, three (3) project ideas have been proposed for the Energy Sector for implementation of the country's TAP. These are;

- ▶ Accelerated uptake of solar rooftop systems through provision of financial incentives
- ▶ Increased access to clean cooking through promotion of Efficient Institutional Stoves
- ▶ Scaling up diffusion of bio-latrines for

institutions (using biogas technology)  
The solar rooftop systems PI is intended to increase electricity access especially in off-grid communities in Ugandan households, schools and healthcare facilities; the PIs for efficient institutional cook stoves and bio-latrines (using biogas) are aimed at accelerating access to clean cooking technologies in institutions most especially schools which are big consumers of wood fuel.

**Cross cutting issues:** Many actions have been proposed for each of the prioritized technologies, however, three actions; one for each technology have been selected for the PIs. For further implementation of the TAP, each of the actions can be developed into a stand-alone PI. To scale up access to reliable clean energy in Uganda, implementation of all actions will be required. The prioritized technologies have some common barriers and measures. Common actions included in the cross cutting issues are; develop and implement financial incentives; strengthen institutional capacity; develop a skilled workforce and sensitize the public about the benefits of using RETs.

The list of stakeholders involved in the development of the TAP is attached; see Annex I.

# Chapter 1: Technology Action Plan and Project Ideas for the Energy Sector

## 1.1 TAP for the Energy Sector

### 1.1.1 Sector overview

Energy, and in particular electricity, is a driver of socio-economic transformation of a nation. Uganda is highly dependent on its natural resources for energy and socio-economic development.

As of 2019, biomass contributed 88% of the total primary energy consumed through firewood, charcoal and crop residues; electricity contributed approximately 2%; while fossil fuels (oil products) accounted for 10% of the national energy mix (MEMD, 2019). Transport consumes 90% of oil products whereas kerosene use in households consumes 6%. Current electricity access stands at 41.3% [<https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=UG>], this is expected to increase to 60% by 2024/25 (NPA, 2020) and to 80% by

2040 (NPA, 2013). Annually Uganda losses 120,000 hectares of forest cover of which 60% (72,000 hectares) is due to charcoal and firewood. Households (63.5%) comprise the largest energy consumer group followed by industry (20.1%), transportation (8.2%), commercial/public (3.4%,) and others (4.3%).

Biomass is Uganda's predominant cooking fuel used by the population with 85% using firewood and 13% using charcoal, mainly in the urban and peri-urban areas. The total charcoal demand was 2.09 million tonnes as of 2019; generating employment for about 200,000 people in production, transportation and trade. Most of the firewood is obtained by cutting forests which has significantly contributed to the reduction in forest cover. Currently the country suffers a biodegradation loss of USD 2.3billion, 25% of which is wood fuel (NPA 2020). The use of biomass in Uganda cuts across all sectors of the economy except the transport sector.

The main sources of electricity are hydropower, cogeneration, solar energy and thermal. The grid electricity installed capacity is 1236.3 MW of which 855 MW are large hydro and 155.7 MW small hydro, solar energy 60.8 MW, cogeneration 96.2 MW and diesel 1.1 MW, thermal (HFO) is 100 MW (ERA, 2021). Most of the electricity is generated from hydro (79.5% large and small plants), thermal plants 8.7%, co-generation 8.2%, solar 3.5% with the remaining technologies including Diesel and Biomass constituting about 0.1%. There are two large thermal plants which are using heavy fuel to power generators, Jacobsen thermal plant 50MW and Electromaxx Uganda limited (50 MW). WENRECO thermal

plant (1.1 MW) is an off-grid power installation serving West Nile region.

Electricity generated by cogeneration technology by the sugar factories is done using high pressure steam turbines. Lugazi Sugar Works and Kakira Sugar Works with installed capacity of 5 and 50 MW respectively, while Mayuge Sugar and Kinyara Sugar Works have installed capacity of 10 MW and 5 MW respectively (MEMD, 2019). The industrial sector is the lead electricity consumer, followed by the household sector and commercial sector. The electricity installed capacity was set to increase to about 1,800 MW in 2020 after full commissioning of Karuma Hydroelectric Power Station and other small generation plants in FY2020/21. The types of turbines used are variable speed Kaplan (150 MW) and Francis (600 MW), under construction and tubular (200 MW) turbines. Most of these large-scale plants are located along the River Nile. Pelton turbines are located in the western region of Uganda along the foothills of Rwenzori mountains. Generation capacity is constrained by the long lead time of energy projects. For instance, it takes on average about 10-years from design to commissioning of a hydro energy project. Additionally, there is inadequate planning for an appropriate energy generation mix to meet the needs of the country (NPA 2020).

Uganda's emissions have had a steady rise, increasing from 53 thousand Gg tonnes in 2005 to close to 90 thousand Gg tonnes in 2015 (MoWE, 2019). The energy sector accounts for 10.8% of these and is second to the Agriculture Forestry and Other Land Use (AFOLU) sector that has remained the most significant source accounting for over

86% of the emissions. Though lower than the AFOLU Sector, the emissions from the energy sector have more than doubled rising from 4.7 thousand Gg tonnes in 2005 to 9.5 thousand Gg tonnes in 2015. The transport subsector accounts for close to 66% of the emissions of Uganda's energy sector. The National Greenhouse Gas Inventory of Uganda's First Biennial Update Report (FBUR) referred to for this data covers the period 2005 to 2015. The gases covered in this inventory include the major direct gases - carbon dioxide, (CO<sub>2</sub>), Methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O).

The energy sector is vulnerable to adverse changes in climate which could disrupt energy supply, including hydropower, biomass and biofuels supply, among others. Climate change impacts include increased frequency and intensity of droughts, floods, glacial melting, landslides and heat waves. A key potential risk is the electricity sector's high dependence on hydropower which is prone to climate change impacts. There is need to optimize the energy mix to mitigate climate change risks, (MEMD, 2019).

**Table 5: Existing policies and measures in the Energy sector**

Name of law & policy	Enacted & revised	Main contents
The National Climate Change Bill, 2020	2020	According to Schedule 2 of the Bill, the parties to the UNFCCC, 1992 recognize that all countries, especially developing countries, need access to resources required to achieve sustainable social and economic development and that, in order for developing countries to progress towards that goal, their energy consumption will need to grow taking into account the possibilities for achieving greater energy efficiency and for controlling greenhouse gas emissions in general, including through the application of new technologies on terms which make such an application economically and socially beneficial.
Third National Development Plan, 2020/2021 – 2024/2025	2020	<p>The plan acknowledges that Uganda, like much of the world, is victim to forces outside of its control. The country's contribution to global warming and climate change is minimal but as a country, Uganda is forced to deal with the symptoms of processes caused outside of its borders. Uganda, however, does intend to fulfil its international obligations with regard to reduction of national emissions and adapt to the impacts of climate change by allocating the necessary resources to implement the partnership plan.</p> <p>For successful implementation of the NDP III, one of the key development strategies will be to increase access to stable, reliable and affordable energy. The Energy Development Programme aims to increase access and consumption of clean</p>



Name of law & policy	Enacted & revised	Main contents
		<p>energy. The key results to be achieved by 2025 are;</p> <ul style="list-style-type: none"> <li>▶ Increase proportion of the population with access to electricity from 24% in FY2018/19 to 60%</li> <li>▶ Reduce share of biomass energy used for cooking from 85% in FY2018/19 to 50%</li> <li>▶ Increase the share of clean energy used for cooking from 15% in FY2018/19 to 50%</li> </ul>
The Energy Policy Uganda	2002, revised 2019	<p>The policy statement for the renewable energy sub-sector is that the Government shall promote the sustainable development and utilisation of all renewable energy resources in a socially and environmentally responsible manner through the following strategies;</p> <ul style="list-style-type: none"> <li>i) Conduct national RE resource assessments including small hydropower and wind energy resources.</li> <li>ii) Promote technology transfer in the development of RE projects through regional demonstration centres</li> <li>iii) Promote local financing of RE projects and support public-private partnerships (PPP)</li> <li>iv) Support small and micro-enterprises through fiscal incentives on selected RE technologies</li> <li>v) Develop comprehensive legal, regulatory and institutional frameworks for effective and sustainable RE development and utilization</li> <li>vi) Conduct public awareness campaigns on the environmental, social and economic benefits of RE</li> <li>vii) Establish and enforce appropriate standards for modern RE technologies</li> </ul> <p>The policy's priority areas include;</p> <ul style="list-style-type: none"> <li>1. Increase access to reliable, affordable and modern energy services</li> <li>2. Manage environmental impacts of energy exploitation and consumption</li> <li>3. Promote renewable and alternative energy sources</li> </ul>
The Uganda Green Growth Development Strategy 2017/18 – 2030/31	2017	<p>The strategy recognizes that Climate change is expected to increase climatic variability by shifting and intensifying extremes, which could lead to more severe drought and flood events. The UGGDS serves as a framework and/or guidance tool that aims at catalyzing economic growth through the efficient use of the country's natural, human, and physical capital in an inclusive manner along a low emissions development pathway. Its goal</p>

Name of law & policy	Enacted & revised	Main contents
		<p>envisages an inclusive low emissions economic growth process that emphasizes effective and efficient use of the country's natural, human, and physical capital while ensuring that natural assets continue to provide for present and future generations. The main objective is to provide guidance and describe the governance framework on priorities and strategic interventions for implementation of the green economy, green growth and development in Uganda. The UGGDS is the guiding document for all green growth initiatives in the country.</p> <p>Energy for green growth is one of the five priority areas of the UGGDS. The UGGDS seeks to support energy supply growth while ensuring that options for energy efficiency, renewable and clean energy are maximized, and environmental pollution, risks and hazards associated, particularly with non-renewable energy sources, and with misuse of RE are minimized. The results framework area for energy is to support the promotion of RE investments and sustainable use of other energy sources. The strategies under this area are RE investments in biomass for electricity, technology efficiency for domestic cooking and industrial biomass energy, solar energy potential, geothermal, and mini and large hydropower generation.</p> <p>According to the strategy, the target outcome for the energy sector is GHG emission Reduction of 18.5 Million tonnes CO<sub>2</sub>e by supporting the promotion of RE investments and sustainable use of other energy sources (NPA, 2017). This is broken down into:</p> <ul style="list-style-type: none"> <li>▶ Efficient cook stoves abatement of 13.0 MtCO<sub>2</sub>e;</li> <li>▶ Solar PV abatement potential – 1.1 MtCO<sub>2</sub>e by 2030.</li> </ul>
Uganda Vision 2040	2013	<p>The Vision recognizes that climate change affects all sectors of Uganda's economy, making the need for preparedness inevitable through adaptation and mitigation strategies in all sectors to ensure that the country is resilient to the adverse impact of climate change. Due to climate change, emphasis will be on other renewable forms of energy including; wind, solar and biogas which will be harnessed and promoted. Government will invest in research and development (R&amp;D) and provide incentives to encourage use of RE.</p>
Uganda National Climate Change Policy	2015	<p>The policy recognizes that climate change is one of the greatest challenges facing humanity in the century, as the Earth's near surface temperatures continue to rise. Climate change is likely to disrupt the Earth's ecological systems and have serious negative</p>

Name of law & policy	Enacted & revised	Main contents
		<p>consequences on agricultural production and productivity, forests, water supply, health systems and overall human development. As temperatures throughout East Africa rise, precipitation is expected to increase, along with the frequency and intensity of droughts, floods, heat waves and landslides. Climate change impacts will be economically significant, especially for African countries, and investment to address climate change is well worth undertaking. Climate change is likely to impact on Uganda's macroeconomic stability and socioeconomic development, as well as its ability to achieve the Post 2015 Development Agenda. Key production sectors most affected by climate are agriculture, water, energy and transport.</p> <p>Mitigation Policy Priorities are to:</p> <ul style="list-style-type: none"> <li>•Support and accelerate the implementation of the Renewable Energy Policy (REP) in order to promote and develop new clean energy technologies and reduce GHG.</li> <li>•Promote conservation and efficient utilisation of energy to reduce GHG emissions especially at consumer levels (industries, households, commercial and institutional buildings).</li> <li>•Encourage the use of alternative fuels instead of heavily relying on biomass</li> <li>•Promote investment in clean energy generation under PPPs</li> <li>•Provide tax incentives and other benefits to private sector companies that invest in cleaner energy generation</li> <li>•Promote the use of alternative RE sources such as solar, biomass, wind and bio fuels as well as their associated technologies</li> <li>•Promote efficient firewood/charcoal stoves, solar and LPG cookers, also address the high upfront costs of acquiring these technologies through household subsidies or tax waivers</li> <li>•Reduce deforestation by providing alternative clean energy sources and efficient appliances for energy use, management and conservation</li> </ul>
Uganda's Intended Nationally Determined Contribution (INDC)	2015	<p>It stipulates that energy sector (supply) measures will increase the amount of RE capacity by at least 1,100 Mega Watts compared to business- as- usual by 2030, generating an estimated 4.6 - 5.2 Terawatts (TW) more than in the business-as-usual scenario case. Technologies include hydro, solar, biomass and geothermal. The mitigation impact is forecast to be between 2.7 Million tons Carbon dioxide equivalent per year (MtCO<sub>2</sub>e/a) and 3.7 MtCO<sub>2</sub>e/a.</p>

Name of law & policy	Enacted & revised	Main contents
Uganda Second National Communication to the United Nations Framework Convention on Climate Change	2014	<p>It acknowledges that Uganda's key economic sectors such as agriculture, water resources, fisheries, tourism and health are dependent and sensitive to climate variability and climate change. Therefore, climate change (CC) has serious direct and indirect impacts on the social and economic development of Uganda.</p> <p>Uganda's mitigation options and measures in response to climate change in line with the objectives and provisions of the UNFCCC were assessed based on assumptions of GHG emissions projections from 2005 to 2035 following two scenarios: a business-as-usual scenario and a mitigation scenario based on specific actions in the key sectors of energy and transport, agriculture, Land use, land use change and forestry (LULUCF) and waste. The business-as-usual scenario in the energy and transport sector showed that the transport sub-category will be the largest and fastest growing contributor of GHG emissions followed by residential, and manufacturing and construction sub categories. In the Mitigation scenario, it was projected that by 2035 transport sub category will dominate the total GHG emission. In order to reduce the projected GHG emissions, one of the SNC recommendations is wider use of solar energy for low power electricity using photovoltaic systems and larger plants using steam or organic fluids in future.</p>

## Solar rooftop systems

The average solar radiation is 5.1 kWh/m<sup>2</sup>/day and it is the RE resource on the market with the highest adoption rate in Uganda. Existing solar data clearly indicates that the solar energy resource in Uganda is high throughout the year with a variation of only about maximum 20% (from 4.5 to 5.5 W/m<sup>2</sup>) [ [https://energypedia.info/wiki/Uganda\\_Energy\\_Situation#Solar\\_energy](https://energypedia.info/wiki/Uganda_Energy_Situation#Solar_energy) ]. As at end of December 2020, the installed capacity of solar energy-based power was 60.8 MW; 60 MW as on-grid supply and 0.8 MW was off grid generation (ERA 2021). Opportunities within the solar PV sector are underlined by the government's ambitious target

to increase electricity supply to 60% by 2025 (NPA, 2020) and 80% by 2040 (NPA, 2013). Overall, RE resources (hydropower, geothermal, solar energy, and biomass) are expected to contribute 12,700MW to the national electricity mix in 2040. Solar energy is planned to contribute 5000MW out of the anticipated total cumulative capacity of 41,800MW by 2040 (NPA, 2013; Aarakit et al., 2021).

## Efficient institutional cook stoves

A number of schools and other institutions in Uganda currently use traditional cooking technologies which consume tremendous

amounts of firewood, causing significant CO<sub>2</sub> emissions, as well as creating health issues for the people working in the kitchens. Efficient institutional cook stoves reduce firewood consumption by around 50-70%. This represents significant financial savings. After 5 years of operation they will have saved more than the cost of the stoves[ <http://maximpactblog.com/uganda-cooking-stoves/> ]. The firewood savings from a single stove will result in a reduction of approximately 70 tons of CO<sub>2</sub> per year thereby helping to mitigate the global climate crisis. Efficient institutional cook stoves improve the indoor air quality, reducing the prevalence of respiratory diseases in the kitchens. They also decrease unsustainable deforestation. There is less than 5% uptake of clean cooking technologies and fuels in Uganda (IEA, IRENA, UNSD, WB, WHO (2019)). This is due to the relatively high cost of clean cooking technologies and equipment relative to traditional dominant biomass, unreliable supply of clean energy technologies, lack of financing schemes for purchase of clean or improved cook stoves and other clean technologies and insufficient gender-awareness in the promotion of clean cooking.

The opportunity available is Government of Uganda's (GoU) plan to promote the uptake and sustained use of clean, modern cooking technologies through development and enforcement of a comprehensive legal, regulatory and commercial framework for the clean cooking sector; promotion of local manufacturing of clean cooking equipment, fuels and accessories; provision of fiscal incentives e.g. subsidies, loans and tax incentives to the clean cooking sector to encourage private sector involvement; supporting the growth of women as promoters, suppliers, leaders and manufactures of

clean cooking equipment and resources; promotion of financing schemes for clean cooking fuels and equipment through loans from targeted microfinance institutions (MFIs), banks, SACCOs or other agencies and establishment and implementation of national standards, labelling and certification programs for the clean cooking sector (MEMD, 2019).

### **Bio-latrines for institutions (using biogas technology)**

Biogas from faecal matter has been used in many countries, but in Uganda, it is used in some schools and homes for the elderly. It is suitable for schools, prisons and barracks. It can be used to supplement firewood use. In most cases faecal matter is not enough to provide the necessary amount to meet the energy demand in an institution. It has to be supplemented by other resources like cow dung, cellulose containing organic materials, crop residues, and food wastes. Bio-latrines can turn waste into energy, this technology can be practiced as a waste management solution in institutions. MEMD constructed five (5) demonstration bio latrine systems with capacity of 40 m<sup>3</sup> at five schools. The school can use biogas from a bio-latrine for cooking, but the main barriers are continuous supply of feed stock and acceptance by the students. The students can provide feedstock (human waste) for 50% of the school energy needs, the rest can be met by other bio-degradable materials, firewood or other fuels. The proposed technology interventions of the NAMAs and their targets are improving cooking and sanitation conditions of schools with bio-latrines; targeting 5 per cent of the schools, thus 1,100 bio-latrines to be installed, with an average volume of bio-digester of 20m<sup>3</sup> (UNDP, 2017).



## 1.1.2 Action Plan for Solar rooftop systems

### 1.1.2.1 Introduction

Solar rooftop systems are the most suitable technology used in remote and rural areas, which are not served by the electricity grid or in places with frequent power outages/interruptions. This justifies the selection of solar rooftop systems as one of the prioritized technologies. A complete solar electric system requires components to produce electricity, convert power into alternating current that can be used by electric appliances, store excess electricity and maintain safety. Uganda is endowed with a high solar energy resource throughout the year with an average solar radiation of 5.1 kWh/m<sup>2</sup>/day. The insolation is highest at the Equator, however, it varies up to a maximum of 20% from place to place away from the Equator; the dryer areas (north-east) have highest temperatures and these are lowest in the mountainous areas (south-west) of the country (Broad & Hankins, 2015; Mubiru & Banda, 2012). Temperature variations throughout the year are little making it easy to use solar power as an alternative source of RE. The total estimated potential is about 5,000 MW. These resources remain largely untapped, due to the perceived technical and financial risks.

Solar energy is used for cooking food, water heating, refrigeration, lighting, telecommunications, and many others. The technology has many economic, environmental, and social benefits such as; improved health due to the fact the systems do not emit and can also be used to provide light in the rural off-grid health facilities, better education as students can learn for longer hours, improved skills/capacity due to training opportunities especially for solar technicians, improved

quality of lives due to increased information flow and entertainment in the homes, increased home safety as it reduces fire hazards that would have resulted from using candles or kerosene lamps, improved security and reduced crime which occurs after nightfall, job creation in the business value chain to mention. All these factors contribute to national development goals.

### 1.1.2.2 Ambition for the TAP

The ambition for solar rooftop systems is to install 65 MW of solar PV (assuming an average of 8 sunshine hours per day) represented by; 63 MW for 140,000 households, 0.9MW for 300 schools and 0.9MW for 200 Health Center IIIs. Taking an example; the proposed solar systems for the health center IIIs have a life line of 20 years. The ambition will contribute 1.3% of the planned solar energy installation of 5000 MW by 2040. This installation will cut down on the usage of diesel and petrol generators; and kerosene by households and small businesses hence the estimated reduction in the emissions will be 304,964tCO<sub>2</sub> eq. represented by 10,357 tons from households, 150,799 tons from schools and 143,808 tons from health centres.

### 1.1.2.3 Actions and Activities selected for inclusion in the TAP

Due to the low levels of electrification in Uganda, the solar PV market shows great development potential, however there are a number of barriers that need to be overcome before this potential demand can be translated into effective demand. These are detailed below;

**Table 6: Summary of barriers and measures to overcome barriers**

Category	Barrier	Measure
Financial	High upfront cost of solar rooftop systems	<ul style="list-style-type: none"> <li>•Implement innovative financing mechanisms such as subsidies</li> <li>•Tax exemptions</li> </ul>
	Difficulty in accessing finance	<ul style="list-style-type: none"> <li>•Implement innovative risk mitigation mechanisms and credit enhancement instruments to provide comfort to lenders</li> <li>•Develop financing schemes such as revolving funds</li> <li>•Setup a renewable energy fund</li> </ul>
	Low disposable income among the population	<ul style="list-style-type: none"> <li>•Provide grant funding to support agricultural activities especially for rural farmers to engage in commercial farming</li> <li>•Promote solar energy for productive use</li> </ul>
	Unclear tax policy on solar components	Government of Uganda should exempt all solar rooftop system components from taxes and this should be clearly communicated to all importers and other players in the sector.
	High cost of setting up distribution networks	Develop financing schemes adapted to local needs and traditions, such as revolving funds which can be accessed by distributors and retailers.
	Difficulty in managing currency risk	Favourable forex exchange conversion terms in order to overcome the barrier of difficulty in managing currency risk faced by importers who purchase solar rooftop components in foreign currency and sell the components in Uganda Shillings.
Non-financial barriers	Pay As You Go (PAYG) solutions discourage customers due to lockouts	Provide grant funding to support agricultural activities especially for rural farmers. Development of the agricultural sector will enable the rural communities to engage in commercial farming and this will lead to increased incomes among the population. Some will have the money to buy solar systems by cash and those who will buy on credit will also be able to cover their daily payments to avoid lockouts.
	Ineffectual quality control of products	<ul style="list-style-type: none"> <li>•Enhanced enforcement of quality standards</li> <li>•Strengthen the capacity of the private sector for self-regulation under the relevant umbrella associations</li> </ul>
	Inadequate legal and institutional framework	GoU should put in place proper institutional frameworks.
	Limited information and public awareness	Consistent information and technology awareness creation on the solar rooftop systems by Government, technology promoters, entrepreneurs and other interested parties.

Category	Barrier	Measure
	Capacity gaps in installation, operations and maintenance of solar rooftop systems	Develop a skilled workforce to install, operate and maintain solar rooftop systems most especially at local community level  Government should finance country wide clean energy awareness campaigns by setting up demonstration sites in communities for capacity building, research and job creation
	Service and maintenance are out of reach in rural areas	Develop financing schemes adapted to local needs and traditions, such as revolving funds which can be accessed by distributors and retailers
	R&D is not a Government priority	Government should fund and promote R&D and Technology Transfer and adoption of standards in the design and manufacturing of solar rooftop systems to promote local production

## Actions selected for inclusion in the TAP

1. Develop and implement financial incentives on solar rooftop systems. The major obstacle for wider spread uptake of solar rooftop systems is the high upfront costs of the systems. These costs result in the systems being very expensive hence most consumers especially the rural population find them unaffordable. This barrier is aggravated by lack of appropriate financing mechanisms to facilitate the development and promotion of solar rooftop systems. Most of the commercial banks are not providing long-term lending required for solar businesses.

2. Strengthen Institutional frameworks. Enhanced uptake of solar rooftop systems requires strong and coordinated institutions and regulatory frameworks. There are low institutional capacity and inadequate regulatory and investment frameworks to provide the enabling

environment for RE development. There is need to identify the capacity gaps in the various institutions and strengthen them.

3. Develop a skilled workforce to install, operate and maintain solar rooftop systems. Successful deployment and diffusion of the solar rooftop systems requires well trained and reliable technical expertise to install, operate and provide aftersales services to customers.

## Activities identified for implementation of selected actions

The actions and activities that have been selected for inclusion in the TAP for solar rooftop systems are presented in this section. The basis of the actions are linked to the measures that were identified following detailed analyses of barriers facing the technology, as well as the enabling environment required to promote the technology detailed in the BA&EF report.

**Table 7: Summary of Actions and corresponding activities for solar rooftop systems**

Actions	Activities for Action Implementation
<b>Action 1:</b> Develop and implement financial incentives on solar rooftop systems by MoFPED	1.1: Exempt taxes on all imported solar components 1.2: Subsidize interest rates 1.3: Conduct consultative meetings with financial institutions (FIs), and identify those which can cooperate in supporting the solar technology 1.4: Provide trainings to FIs to understand the solar business models 1.5: Set up a RE revolving fund to support the various stakeholders in the value chain including end-users; to be implemented by financial institutions 1.6: Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives
<b>Action 2:</b> Strengthen Institutional frameworks by MEMD, MTIC	2.1: Identify all the institutions and actors involved in the support of the solar sector 2.2: Carry out an assessment of technical & financial gaps in those institutions 2.3: Conduct training programs to fill the skills gaps 2.4: Equip the institutions with the necessary hardware, software and org-ware required for their smooth running to ably support the solar technology 2.5: Train the private sector to build their capacity to enable self-regulation under the relevant umbrella associations 2.6: Establish clear and transparent systems in all institutions to attract and increase private investments in the technology 2.7: Establish a multi-institutional coordination framework to oversee the activities of the different institutions
<b>Action 3:</b> Develop a skilled workforce to install, operate and maintain solar rooftop systems by MEMD in partnership with education institutions and the private sector	3.1: Carry out an assessment of technical skills gaps among the technology players 3.2: Identify training institutions that can fill the skills gaps 3.3: Equip training institutions with instrumentation, tools and materials needed for training solar energy technology technicians 3.4: Conduct training of trainers (ToT) 3.5: Organise trainings for solar technicians involved in installation, operations and maintenance of solar rooftop systems 3.6: Equip technicians with skills to provide basic training to system end-users

## Actions to be implemented as Project Ideas

Action 1: Develop and implement financial incentives on solar rooftop systems will be implemented as a Project Idea (PI). During the barrier analysis and enabling framework workshop, stakeholders identified high upfront costs as the major obstacle for wider spread uptake of solar rooftop systems. The stakeholders proposed development of financial incentives and a key measure in overcoming this barrier. All activities under the action will be considered.

### 1.1.2.4 Stakeholders and Timeline for implementation of TAP

**Table 8: Roles of stakeholders involved in the implementation of the solar rooftop TAP**

Stakeholder	Roles
MoSTI	<ul style="list-style-type: none"> <li>▶ As a Ministry responsible for the TNA project, MoSTI should organize a key stakeholders workshop to communicate about the project and the TAP in particular to get stakeholders buy-in</li> <li>▶ Actively participate in advising MoFPED during the development of the policy for financial incentives</li> </ul>
MEMD	<ul style="list-style-type: none"> <li>▶ Make policy amendments to GoU to exempt taxes on imported solar components, subsidize interest rates and set up a RE revolving fund. Since the National Energy policy is still in draft form, these amendments can be added as it is being finalized</li> <li>▶ Conduct consultative meetings with FIs</li> <li>▶ Provide capacity building trainings to FIs to understand the solar business models</li> <li>▶ Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives</li> </ul>
REA	Be in-charge of the RE revolving fund to support the various stakeholders in the sector
MoFPED	<ul style="list-style-type: none"> <li>▶ Develop and implement a policy on solar energy financial incentives to provide for exemption of taxes on all imported solar components and subsidization of interest rates for renewable energy enterprises</li> <li>▶ The Ministry is the focal point for GEF, MoFPED should seek for alternative funding to support the project.</li> </ul>
UDBL	<ul style="list-style-type: none"> <li>▶ Provide long-term low interest loans to solar importers and other players</li> <li>▶ Participate in consultative meetings with financial institutions</li> </ul>
MTIC	Through UNBS, control the quality of imported solar energy components

**Table 9: Sequence and timing of specific activities**

Action	Scale	Year			
		2022	2023	2024	2025
Develop and implement financial incentives on solar rooftop systems	Exempt taxes on all imported solar components	●	●	●	●
	Subsidize interest rates	●	●	●	●
	Consultative meetings with (FIs)			●	●
	Provide capacity building trainings to FIs to understand the solar business models.			●	●
	Set up a renewable energy revolving fund	●	●	●	●
	Develop an Inter-Ministerial Committee to oversee implementation of the financial incentives	●			



### 1.1.2.5 Estimation of Resources Needed for Action and Activities

**Table 10: Actions, activities, capacity building needs and Costs**

**Action: Develop and implement financial incentives on solar rooftop systems**

Activities	Capacity building and other needs	Costs (\$)
Exempt taxes on all imported solar components	Stakeholder meetings to gather information for the development of the policy on all proposed financial incentives	20,000
	Policy development and implementation	100,000
	Training Uganda Revenue Authority (URA) staff on solar energy components	30,000
Subsidize interest rates	Engage a consultant to study and advise MoFPED on the financial implications of the subsidy	50,000
	Training MoFPED staff to understand the basics of the solar energy business to justify the need for the subsidy	20,000
Conduct consultative meetings with FIs, and identify those which can cooperate in supporting the technology	Consultation costs	20,000
	Implementation of the subsidy by financial institutions by lowering lending rates	30,000
Provide capacity building trainings to FIs to understand the solar business models. To partner with education institutions and private sector	Procure education and private sector institutions that can provide the trainings	10,000
	Conducting Trainings of Trainers that will build capacity of financial institutions staff	20,000
	Provide capacity building trainings to financial institutions to understand the solar business models	20,000
Set up an RE revolving fund to support the various stakeholders in the value chain including end-users. Actively involve Development Partners (DPs)	Recruit a consultant to advise on the setup of the fund	30,000
	Set up the RE revolving fund secretariat	50,000
	Train MEMD, REA and other stakeholders staff on the practicalities and how to manage a revolving fund	20,000
	Develop proposals to development partners to fund the RE fund	20,000

Activities	Capacity building and other needs	Costs (\$)
Develop an Inter-Ministerial Committee to oversee implementation of the financial incentives	► Meetings to select Inter-Ministerial committee members	20,000
	► Planning and coordination meetings	20,000

### 1.1.2.6 Management Planning

**Table 11: Identified risks and possible contingency plans**

Type of risk	Description of risk	Contingency actions
Cost risk	The cost of activities may be higher than budgeted due to delays in TAP implementation	GoU should seek for support from DPs to speed up the implementation
	The cost of importing solar components is expected to rise due to the travel risks imposed by countries to curb the spread of COVID-19	MEMD should own the TAP and expedite its implementation
Performance Risk	The solar market has many sub-standard components which have partly contributed to the low uptake	Enhancing the enforcement of UNBS to ensure quality products are imported into the country
	Damage in transportation of components	Provide for insurance
Scheduling risk	Delay in implementation of the TAP due to; ► COVID-19	Implementation of NDP III has started and promotion of RE is one of the strategies in the plan.
	► Delays in coordination of stakeholders ► The budget for the year 2021-2022 is already in operation hence new budget items may be looked at in the next financial year ► Ownership of the TAP by all stakeholders may take some time	As the policy body in charge of Energy, MEMD should spearhead the implementation of the TAP by ensuring ownership of the various stakeholders from the start.
Financial risk	There is a growing need for Government to widen the tax base hence proposals of financial incentives may be delayed or ignored The budget to finance the TAP may not be available	Government has been engaging development partners to support other country priorities hence it is expected to approach them for this need too.

## Next Steps

**Table 12: Immediate requirements and Critical Steps**

Immediate requirements	Critical steps
UNCST under MoSTI should organize a stakeholders workshop to communicate the TAP	Get the stakeholders buy-in
MoSTI to prepare a cabinet paper on the TNA project to get Government's blessings for the TAP	Cabinet's approval for MoSTI to get other stakeholders on board to implement the TAP
MEMD should add a policy amendment on financial incentives to the draft National Energy policy before it is finalized	Development of the policy amendment by MEMD
MEMD to include TAP implementation budget to its 2022/2023 budget	MoSTI should urgently get all major stakeholders on board
Development of an Inter-Ministerial Committee to oversee the TAP implementation	

## 1.1.2.7 TAP overview table

**Table 13: TAP overview table for Solar rooftop systems**  
**TAP overview table**

Sector	Energy							
Sub-sector	Solar Energy							
Technology	Solar Rooftop Systems							
Ambition	Installation of 65 MW of solar PV							
Benefits	Reduced greenhouse emissions (304,964tCO2 eq.), improved health, provision of affordable energy especially to the rural population							
Action	Activities to be implemented	Sources of funding	Responsible body and focal point	Time frame	Risks	Success criteria	Indicators for Monitoring of implementation	Budget (USD)
Develop and implement financial incentives on solar rooftop systems	Exempt taxes on all imported solar components	GoU/DPs	MoFPED	4 years	There is a growing need for Government to widen the tax base hence proposals of financial incentives may be delayed or ignored	Approved Policy document on financial incentives	<ul style="list-style-type: none"><li>Minutes of stakeholders meetings</li><li>Minutes of Inter-Ministerial Committee meetings</li><li>Policy document development progress reports</li></ul>	150,000
	Subsidize interest rates	GoU/DPs	MoFPED	4 years	Delays in TAP implementation	Growth in uptake of solar loans from FIs	FIs reports on amount of solar loans disbursed	70,000
	Conduct consultative meetings with financial institutions (FIs), and identify those which can cooperate in supporting the solar technology development	GoU/DPs	MoFPED,	2 years	Delay in stakeholder coordination	Signed Partnership agreements between MEMD & FIs	Minutes of consultative meetings	50,000

Action	Activities to be implemented	Sources of funding	Responsible body and focal point	Time frame	Risks	Success criteria	Indicators for Monitoring of implementation	Budget (USD)
	Provide capacity building trainings to financial institutions to understand the solar business models	GoU/ DPs	MEMD	2 years	Delay in TAP implementation	Growth in uptake of solar loans from FIs	Number of trained financial institutions staff	50,000
	Set up a renewable energy revolving fund to support the various stakeholders in the value chain including end-users; to be implemented by financial institutions	GoU / DPs	MEMD, REA	4 years	The budget to finance implementation of the TAP may not be available	Growth in uptake of solar loans from FIs Increased solar rooftop systems installations	Reports on amount of solar loans disbursed from the revolving fund	120,000
	Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives	GoU / DPs	MoSTI , MEMD	2 years	Delay in stakeholder coordination Low interest from stakeholders	Active Inter-Ministerial Committee	Committee meeting minutes Committee activity reports	20,000

### 1.1.3 Action Plan for Efficient Institutional Cook Stoves

#### 1.1.3.1 Introduction

Firewood is the main source of fuel used by institutions both in urban and rural areas in Uganda. Institutional stoves are used in schools, prisons, restaurants, health facilities, refugee camps and other places that cook for very many people. There are over 31,000 schools in Uganda of which over 3,220 are secondary level[ <https://ugandaschools.guide/find-a-school/category/3> ]. Most of the rural schools use three-stone stoves because these can be installed at no cost. Most of the institutions in the rural areas have better access to firewood at lower prices, compared to those in urban areas. However, of recent there are changes in biomass cover maps for Uganda; the area under cultivation is increasing to feed the high population growth rate of about 3% per annum. There is a growing deficit in biomass supply, consequently the price of firewood is increasing steadily. There are very limited options for institutions to plant woodlots to meet their fuel needs due to limited land. The only viable mitigation option is to shift to efficient institutional cook stoves to reduce on the consumption of firewood.

Compared to households which use twigs, dead wood and small pieces of firewood, institutions use firewood logs which largely contribute to deforestation. Improving on the energy efficiencies of the stoves in the institutions will greatly contribute to reduction in the deforestation rate. There are many types of institutional stoves in Uganda. These can be divided into two major categories; fixed and movable institutional stoves. The use of institutional stoves will not

only reduce firewood consumption but also reduce the amount of greenhouse gases emitted into the atmosphere since forests are carbon sinks. In most areas of Uganda, firewood consumption is above the sustainable yield. The life of institutional stoves is about 4-5 years if they are well maintained.

Efficient institutional cook stoves have a number of benefits which include; minimized health risks due to reduced indoor air pollution, health effects of carrying wood for long distances by children and other institutional staff are avoided, gender considerations - both men and women can be engaged in the construction and utilization of the institutional stoves; better education as students can stay longer in school instead of spending some hours collecting firewood, improved skills due to training opportunities in stoves construction, job creation for those who manufacture and construct stoves, reduced deforestation given that institutions use less firewood for more cooking which also reduces GHG emissions. Uganda's NAMA "NS-151, The Promotion of the Use of Efficient Institutional Stoves in Institutions" is a good policy indicator that the technology will be promoted. This policy instrument could include incentives in the form of grants and loans for compliance.

#### 1.1.3.2 Ambition for the TAP

The Ambition is to construct 1,000 efficient institutional cook stoves in 500 schools saving 12,375 tons of firewood per year, which is 61,875 tonnes in a period of 5 years. This is expected to reduce emissions by 22,546 tons CO<sub>2</sub> eq. per year and 112,730 tons in a period of 5 years. The schools will be both from urban and rural areas since majority use firewood as the main source of fuel. The



proposed 1000 stoves with stainless steel source pans, installation and servicing for five years is expected to cost US\$1,995,000.

### 1.1.3.3 Actions and Activities selected for inclusion in the TAP

Summary of barriers and measures to overcome barriers; some of the barriers and measures are financial and others are non-financial as indicated below;

**Table 14: Summary of barriers and measures to overcome barriers**

Category	Barrier	Measure
Category Financial	High upfront cost for efficient institutional cook stoves	<ul style="list-style-type: none"> <li>▶ Implement innovative financing mechanisms such as subsidies</li> <li>▶ Tax exemptions</li> <li>▶ Implement innovative risk mitigation mechanisms and credit enhancement instruments to provide comfort to lenders</li> <li>▶ Develop financing schemes such as revolving funds</li> </ul>
Non-financial	Difficulty in accessing finance	<ul style="list-style-type: none"> <li>▶ Develop the carbon financing market.</li> <li>▶ Setup a renewable energy fund</li> </ul>
	Competing institution priorities	<ul style="list-style-type: none"> <li>▶ Subsidize interest rates</li> <li>▶ Develop financing schemes such as revolving funds</li> <li>▶ Proper implementation of the NAMAs</li> </ul>
	Fuel savings not recognized as income	Sensitization of institutions owners and managers on use of savings from fuel to cover stove installation costs
	Poor quality and stove designs	<ul style="list-style-type: none"> <li>▶ Develop standards and regulations for biomass cooking technologies</li> <li>▶ Enhanced enforcement of quality standards</li> <li>▶ Strengthen the capacity of the private sector for self-regulation under the relevant umbrella associations</li> </ul>
	Inadequate institutional framework	GoU should put in place proper institutional frameworks
	Limited information and public awareness about the technology	Consistent information and technology awareness creation by Government, technology promoters, entrepreneurs and other interested parties
	Capacity gaps in construction and maintenance of efficient institutional cook stoves	<ul style="list-style-type: none"> <li>▶ Develop a skilled workforce to construct and maintain efficient institutional stoves most especially at local community level</li> <li>▶ Government should finance country wide clean energy awareness campaigns by setting up demonstration sites in communities for capacity building, research and job creation</li> </ul>
	Low women participation in the sector	Implement policies to ensure gender inclusiveness in the energy sector

## Actions selected for inclusion in the TAP

1. Develop and implement financial incentives for manufactures and contractors who build efficient institutional cook stoves. Affordability is the main challenge for institutions and increasingly for manufacturers of institutional stoves. Most institutions need assistance in financing for stoves while manufacturers want more creative payment options for institutions, which would enhance affordability and improve repayment.
2. Sensitize institutions about the benefits of efficient institutional cook stoves to increase awareness and adoption of the technology

3. Strengthen Institutional capacity. Enhanced adoption of efficient institutional stoves requires strong and coordinated institutions.

4. Develop a skilled workforce to manufacture, construct and maintain efficient institutional stoves. Successful deployment and diffusion of the technology equires well trained and reliable technical expertise both in rural and urban areas.

## Activities identified for implementation of selected actions

**Table 15: Summary of actions and corresponding activities for efficient institutional stoves**

Actions	Activities for Action Implementation
<b>Action 1:</b> Develop and implement financial incentives for efficient institutional cook stoves - MoFPED	1.1: Subsidize interest rates to lower financial institutions lending rates 1.2: Conduct consultative meetings with financial institutions, and identify those which can cooperate in supporting the efficient institutions stoves technology 1.3: Provide capacity building trainings to financial institutions to understand the efficient institutional cook stoves technology and its benefits 1.4 : Set up a renewable energy revolving fund to support the various stakeholders in the value chain including end-users; to be implemented by FIs 1.5: Develop the carbon financing market 1.6: Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives 1.7: Sensitize institutions on the benefits of adopting the clean cooking technology
<b>Action 2:</b> Sensitize institutions about the benefits of using efficient institutional cook stoves - MEMD	2.1: Develop messages and materials to be used during sensitization campaigns 2.2: Map stakeholders involved in the management of institutions 2.3: Develop partnerships with media houses to conduct public awareness campaigns that target institutions 2.4: Identify institutions that are using efficient institutional stoves to use their success stories in awareness campaigns 2.5: Organize and conduct regional workshops that bring together stakeholders from various institutions and sensitize them on the technology
<b>Action 3:</b> Strengthen Institutional capacity - MEMD	3.1: Identify all the institutions and actors involved in the clean cook stoves sector 3.2: Carry out an assessment of technical & financial gaps in those institutions

Actions	Activities for Action Implementation
	3.3: Conduct training programs to fill the skills gaps 3.4: Equip the institutions with the necessary hardware, software and org-ware required for their smooth running to ably support the technology 3.5: Development of standards for stoves and implementation of quality control 3.6: Establish a multi-institutional coordination framework to oversee the activities of the different institutions
<b>Action4:</b> Develop a skilled workforce to manufacture, construct and maintain efficient institutional stoves – MEMD	4.1: Carry out an assessment of technical skills gaps among the technology players 4.2: Identify training institutions that can fill the skills gaps 4.3: Conduct research into the development of very efficient institutional stoves 4.4: Equip training institutions with instrumentation, tools and materials needed for training technicians who construct and maintain efficient institutional stoves 4.5: Conduct trainings of trainers (ToT) 4.6: Organise trainings for technicians involved in manufacture, construction and maintenance of efficient institutional stoves. Equip technicians with skills to provide basic training to end-users

## Actions to be implemented as Project Ideas

**Action 1:** Develop and implement financial incentives for efficient institutional stoves will be implemented as a Project Idea (PI). During the barrier analysis and enabling framework workshop, stakeholders identified affordability as the main challenge for institutions and increasingly for manufacturers of institutional stoves. Stakeholders proposed development of financial incentives as a key measure in overcoming this barrier. All activities under this action will be considered for the TAP.

### 1.1.3.4 Stakeholders and Timeline for implementation of TAP

**Table 16: Roles of stakeholders involved in the efficient institutional cook stoves technology**

Stakeholder	Roles
MoSTI	<ul style="list-style-type: none"> <li>▶ MoSTI should organize a key stakeholders workshop to communicate about the project and the TAP in particular to get stakeholders buy-in</li> <li>▶ Actively participate in advising MoFPED during the development of the policy for financial incentives</li> </ul>
MEMD	<ul style="list-style-type: none"> <li>▶ Make policy amendments to Government to subsidize interest rates and set up a RE revolving fund</li> <li>▶ Conduct consultative meetings with FIs</li> <li>▶ Provide capacity building trainings to FIs</li> <li>▶ Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives</li> <li>▶ Be in-charge of the RE revolving fund to support the various stakeholders in the value chain including end-users.</li> <li>▶ Conduct research for the development of more efficient institutional cook stove technologies</li> </ul>

Stakeholder	Roles
MoES	<ul style="list-style-type: none"> <li>▶ Together with MEMD, sensitize institutions on the benefits of adopting the clean cooking technology</li> <li>▶ Allocate capital development funds to government and government aided institutions to support them in uptake of the technology</li> <li>▶ Monitor education institutions to ensure they build efficient institutional stoves</li> </ul>
MoFPED	<ul style="list-style-type: none"> <li>▶ Develop and implement a policy on clean cooking financial incentives to provide for subsidization of interest rates for clean cooking technologies</li> <li>▶ The Ministry is the focal point for GEF, it should seek for alternative funding to support the project</li> </ul>
(FIs)	Provide low interest loans to contractors and education institutions
MoWE	The Climate Change Department (CCD) under MoWE as a focal point of UNFCCC will spearhead and provide information for the development of the carbon financing market
MTIC	Through Uganda National Bureau of Standards (UNBS), develop and enforce quality standards for efficient institutional cook stoves

**Table 17: Sequence and timing of specific activities**

Action	Scale	Year			
		2022	2023	2024	2025
Develop and implement financial incentives for efficient institutional cook stoves	Subsidize interest rates	●	●	●	●
	Consultative meetings with FIs, and identify those which can cooperate in supporting the efficient institutions stoves technology			●	
	Provide capacity building trainings to FIs to understand the technology and its benefits				●
	Setup a renewable energy revolving fund	●	●	●	●
	Develop the carbon financing market	●	●	●	●
	Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives	●			
	Sensitize institutions on the benefits of adopting the clean cooking technology	●			

### 1.1.3.5 Estimation of Resources Needed for Action and Activities

**Table 18: Actions, activities, capacity building needs and Costs**

**Action: Develop and implement financial incentives for efficient institutional cook stoves**

Activities	Capacity building and other needs	Costs (\$)
Subsidize interest rates	Stakeholder meetings to gather information for the development of the policy on all proposed financial incentives	10,000
	Engage a consultant to study and advise MoFPED on the financial implications of the subsidy	30,000
	Policy development and implementation	100,000
Conduct consultative meetings with financial institutions, and identify those which can cooperate in supporting the efficient institutions stoves technology	Training MoFPED staff to understand basics of the efficient institutional cook stoves to justify the need for the subsidy	20,000
	Consultation costs	20,000
	Provide capacity building trainings to FIs	20,000
	Implementation of the subsidy by FIs by lowering lending rates	30,000
Provide capacity building trainings to financial institutions to understand the efficient institutional cook stoves technology and its benefits	Procure education and private sector institutions that can provide the trainings	10,000
	Conducting Trainings of Trainers that will build capacity of financial institutions staff	20,000
Set up a renewable energy (RE) revolving fund to support the various stakeholders in the value chain including end-users; to be implemented by financial institutions. Actively involve Development Partners (DPs)	Consultancy to advise on the setup of the RE revolving fund	30,000
	Train MEMD on the practicalities and how to manage a revolving fund	20,000
	Set up a revolving fund secretariat	50,000
	Develop proposals to DPs to fund the RE fund	20,000
Develop the carbon financing market	Engage a consultant to study the efficient institutional cook stoves sub-sector and advise on the development of the carbon financing market	50,000

Activities	Capacity building and other needs	Costs (\$)
Develop an Inter-Ministerial Committee to oversee financial incentives implementation	Meetings to select Inter-Ministerial committee members Planning and coordination meetings	20,000
Sensitize institutions on the benefits of adopting the clean cooking technology	Develop sensitization materials Put in place a team to sensitize the education institutions	50,000

### 1.1.3.6 Management Planning

**Table 19: Identified risks and possible contingency plans**

Type of risk	Description of risk	Contingency actions
Cost risk Performance Risk	The cost of activities may be higher than budgeted due to delays in the implementation of the TAP	Government should seek for support from development partners to speed up the implementation
	Poor quality and design of efficient institutional cook stoves	Develop standards for efficient institutional cook stoves The manufacturers of stoves should have a UNBS certification
	Water spillage in stoves. Water could be poured in the liners, this can cause the lining to crack	Check on the designs and control quality of stoves
	Stove burns due to a hot stove body	Encourage cooks to use protective gears
Scheduling risk	Delay in implementation of the TAP due to; COVID-19 Delays in stakeholder coordination The budget for the year 2021-2022 is already in operation hence new budget items may be looked at in the next financial year Ownership of the TAP by all stakeholders may take sometime	Implementation of NDPIII has started and promotion of renewable energy is one of the strategies in the plan  MEMD should spearhead the implementation of the TAP by ensuring ownership of the various stakeholders from the start.
Financial risk	There is a growing need for Government to widen the tax base hence proposals of financial incentives may be delayed or ignored	Government has been engaging development partners to support other country priorities hence it is expected to approach them for this need too.
	The budget to finance implementation of the TAP may not be available	



## Next Steps

**Table 20: Immediate requirements and Critical Steps**

Immediate requirements	Critical steps
UNCST under MoSTI should organize a stakeholders workshop to communicate the TAP	Get the stakeholders buy-in
MoSTI to prepare a cabinet paper on the TNA project to get Government's blessings for the TAP	Getting cabinet's approval for MoSTI to get other stakeholders on board to implement the TAP
MEMD should add a policy amendment on financial incentives to the draft National Energy policy before it is finalized	Development of the policy amendment by MEMD
MEMD to include TAP implementation budget to its 2022/2023 budget	MoSTI should urgently get all major stakeholders on board
Development of an Inter-Ministerial Committee to oversee the TAP implementation	

### 1.1.3.7 TAP overview table

**Table 21: TAP overview table for efficient institutional stoves**  
**TAP overview table**

<b>Sector</b>	Energy								
<b>Sub-sector</b>	Biomass								
<b>Technology</b>	Efficient Institutional Cook Stoves								
<b>Ambition</b>	Construction of 1,000 efficient institutional cook stoves in 500 schools								
<b>Benefits</b>	Reduced emission of greenhouse gases, improve on the health, provision of affordable energy in the long run								
Action	Activities to be implemented	Sources of funding	Responsible body and focal point	Time frame	Risks	Success criteria	Indicators for Monitoring of implementation	Budget (USD)	
Develop and implement financial incentives for efficient institutional cook stoves	Subsidize interest rates	GoU, DPs	MoFPED	4 years	Delays in TAP implementation	Approved Policy document on financial incentives  Increased adoption of efficient institutional cook stoves	Minutes of stakeholders meetings Minutes of Inter-Ministerial Committee meetings Policy document development progress reports FIs reports on amount of efficient institutional stoves loans disbursed	160,000	
	Conduct consultative meetings with financial institutions, and identify those which can cooperate in supporting the efficient institutions cook stoves technology	GoU/ DPs	MoFPED, MEMD	2 years	Delays in stakeholder coordination	Partnership agreements between MEMD & FIs	Minutes of consultative meetings	70,000	

Action	Activities to be implemented	Sources of funding	Responsible body and focal point	Time frame	Risks	Success criteria	Indicators for Monitoring of implementation	Budget (USD)
	Provide trainings to FIs to understand the efficient institutional cook stoves technology and its benefits	GoU / DPs	MEMD	2 years	Delay in TAP implementation	Increased adoption of efficient institutional cook stoves	Number of trained financial institutions staff	30,000
	Set up a renewable energy revolving fund to support the various stakeholders in the value chain including end-users; to be implemented by financial institutions	GoU / DPs	MEMD	4 years	The budget to finance implementation of the TAP may not be available	Growth in uptake of efficient institutional stoves loans from FIs Increased adoption of efficient institutional stoves	Reports on amount of efficient institutional stoves loans disbursed from the revolving fund	70,000
	Develop the carbon financing market	GoU / DPs	MoWE	4 years	Delays in stakeholder coordination Delays in TAP implementation	Increased adoption of efficient institutional cook stoves	Number of efficient institutional stoves manufacturers benefitting from carbon finance	50,000
	Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives	GoU / DPs	MoSTI	2 years	Delays in stakeholder coordination Low interest from stakeholders	Active Inter-Ministerial Committee	Committee meeting minutes Committee reports	20,000
	Sensitize institutions on the benefits of adopting the clean cooking technology	GoU / DPs	MoES	2 years	Delays in TAP implementation	Increased adoption of efficient institutional stoves	Number of efficient institutional stoves in education institutions	50,000

## 1.1.4 Action Plan for Bio-latrines for institutions (using biogas technology)

### 1.1.4.1 Introduction

Uganda's energy mix is dominated by biomass, followed by petroleum and electricity. Biomass is available in many forms; solid biomass is mostly woody biomass which includes firewood while non-woody biomass is mostly agricultural waste. Biogas is one of the forms of biomass that can be generated from cow dung, food waste, human waste, peelings, dung from other animals and other bio-degradable materials. Biogas is a combustible gas produced by the anaerobic fermentation of cellulose containing organic materials. Biogas normally consists of 45% to 75% methane, 25-45% carbon dioxide and 2% - 3% moisture and about 1% trace gases.

Biogas from faecal matter has been used in many countries, but in Uganda, it is used in a few institutions. It is suitable for institutions such as schools, prisons and barracks; it can be used to supplement firewood use. In most cases faecal matter is not enough to provide the necessary amount to meet energy demand in an institution. It has to be supplemented by other feedstock. Bio-latrines can turn waste into energy; the technology can be practiced as a waste management solution in institutions. The most suitable type of the digester for institutions is the dome type digester. The performance of the digester can be improved by having a steerer, pH. meter and temperature sensors. The use of biogas has been majorly in households. However, there are few institutions where biogas systems have been operating for a while,

but the performance needs improvement. The bio-latrines technology has been piloted by MEMD in some schools. Biogas can be used to reduce on the amount of firewood used in institutions however; construction of bio-latrines for institutions is an expensive venture that needs a lot of support from Government and development partners.

Benefits of biogas technology include; smoke-free and ash-free kitchen, so women and their children are less prone to respiratory infections; students are spared the burden of gathering firewood hence they have more time for school translating into improved education; construction of a bio-latrine improves sanitation and hygiene conditions which is essential for the overall health and well-being of the students and the rest of the school population; reduced deforestation because biogas is an alternative clean fuel; the sludge remaining after digestion is a good fertilizer which increases land productivity; the release of methane is avoided thus contributing to climate mitigation; switching from traditional biomass resources to biogas fired generation capacity improves security of energy supply as the feedstock can mostly be acquired locally, biogas can replace firewood thus reducing the emission of GHGs and other harmful emissions, it's a natural waste treatment process.

### 1.1.4.2 Ambition for the TAP

The Ambition is to construct 500 bio-latrines in 500 schools. If the bio-latrine is well maintained it can serve for a period of 20 years. There are two options; the school can depend on the biogas from human waste for 50% of the energy supply and use firewood to cover the remaining energy need. The savings on

firewood will be 11,250 tonnes in a year, thus replacing 225,000 tons of firewood over the 20 years of the project. The second option is to construct one large system which will make the school self sufficient in clean energy. In this case the feedstock will be from human waste and other bio-degradable resources. With this option, the savings in firewood would be 450,000 tonnes. This is expected to reduce emissions by 1,363,608 tCO<sub>2</sub>eq. in a period of 20 years. The schools will be both from urban and rural areas since majority use firewood as the main source of fuel. The planned 500 bio-latrines are expected to cost \$17,796,610. Feedstock will include; waste from latrines and other available biomass with in the school, such as food remains; peelings and other bio-degradable materials. If the

school would like to use only the waste from latrines, the 500 units will cost US\$ 9,936,831.

### 1.1.4.3 Actions and Activities selected for inclusion in the TAP

One of the specific strategies for waste management is to promote the use of human waste for production of biogas, which can be used for cooking and lighting in institutions, while effluent can be used as fertiliser. The transfer and diffusion of this technology is facing a number of barriers some being economic and financial; and others being non-financial as shown below;

**Table 22: Summary of barriers and measures to overcome barriers**

Category	Barrier	Enabling framework
Category Financial	High upfront cost of bio-latrines	<ul style="list-style-type: none"> <li>▶ Implement innovative financing mechanisms such as subsidies</li> <li>▶ Tax exemptions</li> <li>▶ Implement innovative risk mitigation mechanisms and credit enhancement instruments to provide comfort to lenders</li> </ul>
	Difficulty in accessing finance	<ul style="list-style-type: none"> <li>▶ Develop financing schemes such as revolving funds</li> <li>▶ Develop the carbon financing market.</li> <li>▶ Setup a renewable energy fund</li> </ul>
Non-financial	Competing institution priorities	<ul style="list-style-type: none"> <li>▶ Subsidize interest rates</li> <li>▶ Develop financing schemes such as revolving funds, to enable market development and uptake of the technology</li> </ul>
	Fuel savings not recognized as income	Sensitization of institutions owners and managers on use of savings from fuel to cover bio-latrines and digester installation costs
	Limited knowledge of alternative feedstock	<ul style="list-style-type: none"> <li>▶ Educate/train users on alternative feedstock</li> <li>▶ Facilitate the establishment of linkages between institutions and communities that have alternative feedstock in abundance</li> </ul>
	Social biases on fuel from human waste	Sensitization of institutions about the benefits of the technology

Category	Barrier	Enabling framework
Category Financial	Inadequate institutional framework	GoU should put in place proper institutional frameworks
Non-financial	Limited information and public awareness about the technology	Consistent information and technology awareness creation by Government, technology promoters, entrepreneurs and other interested parties
	Capacity gaps in installation, operations and maintenance of bio-latrines	<ul style="list-style-type: none"> <li>▶ Develop a skilled workforce to install, operate and maintain bio-latrines most especially at local community level</li> <li>▶ Government should finance country wide clean energy awareness campaigns by setting up demonstration sites in communities for capacity building, research and job creation</li> </ul>

## Actions selected for inclusion in the TAP

1. Educate/train technicians, operators and end-users on alternative forms of feedstock for biogas and their usage. Limited knowledge of alternative feedstock was singled out as a major non-financial barrier to the uptake of biogas technology during the BA&EF workshop. Cow dung is the most known feedstock used for the generation of biogas in Uganda. Most institutions and individuals are not aware of any other alternative feedstock used for the generation of biogas.
2. Sensitize institutions about the benefits of using bio-latrines (using biogas technology). There is currently limited information on design, construction, operation and maintenance of bio-latrines.

3. Develop and implement financial incentives for institutions to afford the technology. Affordability is a big challenge for institutions such as schools and increasingly for contractors too.

4. Strengthening Institutional Capacity. Enhanced adoption of bio-latrines (using biogas technology) requires strong and coordinated institutions. There is need to identify the capacity gaps in the various institutions and fill them.

5. Develop a skilled workforce to build, operate and maintain bio-latrines (using biogas technology)

## Activities identified for implementation of selected actions



**Table 23: Summary of actions and corresponding activities for bio-latrines**

Actions	Activities for Action Implementation
<b>Action 1:</b> Educate/train technicians, operators and end-users on alternative forms of feedstock for biogas and their usage	1.1: Engage a consultant to study the various forms of feedstock available in the different parts of the country for generation of biogas 1.2: Conduct more research and development in the technology 1.3: Develop study materials 1.4: Identify technicians and operators to be equipped with knowledge on alternative feedstock for biogas 1.5: Map suitable sites (schools with existing bio-latrines) for the practical trainings 1.6: Conduct Trainings of Trainers that will continuously train others as the technology uptake grows 1.7: Train technicians, operators and institutions on the alternative feedstock and their usage
<b>Action 2 :</b> Sensitize institutions about the benefits of using bio-latrines	2.1: Develop messages and materials to be used during sensitization campaigns 2.2: Map stakeholders involved in the dissemination and usage of the technology 2.3: Develop partnerships with media houses and other community platforms to conduct public awareness campaigns that target institutions 2.4: Identify institutions that are already using the bio-latraine technology to use their success stories in awareness campaigns 2.5: Organize and conduct regional workshops to sensitize stakeholders
<b>Action 3:</b> Develop and implement financial incentives for institutions to afford the technology	3.1: Subsidize interest rates to lower financial institutions lending rates 3.2: Conduct consultative meetings with financial institutions, and identify those which can cooperate in supporting the technology 3.3: Provide capacity building trainings to financial institutions to understand the bio-latraine technology and its benefits 3.4: Set up a renewable energy revolving fund to support the various stakeholders in the value chain including end-users; to be implemented by FIs 3.5: Develop the carbon financing market 3.6: Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives
<b>Action 4:</b> Strengthen Institutional Capacity	4.1: Create awareness among policy makers and institutions about bio-latraine waste to energy potential 4.2: Identify all the institutions and actors involved in the technology 4.3: Carry out an assessment of technical & financial gaps in those institutions 4.4: Conduct training programs to fill the skills gaps that contribute to the technical gaps in the institutions 4.5: Equip the institutions with the necessary hardware, software and org-ware required for their smooth running to ably support the technology 4.6: Development of standards for bio-latrines 4.7: Establish a multi-institutional coordination framework to oversee the activities of the different institutions
<b>Action 5:</b> Develop a skilled workforce to build, operate and maintain bio-latrines	5.1: Carry out an assessment of technical skills gaps among the technology players 5.2: Identify training institutions that can fill the skills gaps 5.3: Conduct research into the development of the bio-latrines 5.4: Equip training institutions with instrumentation, tools and materials needed for

Actions	Activities for Action Implementation
	<p>training technicians. The materials should include teaching materials which should be developed in case they are not readily available</p> <p>5.5: Conduct trainings of trainers (ToT)</p> <p>5.6: Organise trainings for technicians involved in construction, operations and maintenance of bio-latrines. Equip technicians with skills to provide basic trainings to system end-users</p>

## Actions to be implemented as Project Ideas

Action 1: Educate/train technicians, operators and end-users on alternative forms of feedstock for biogas and their usage. All activities under this action will be considered.

### 1.1.4.4 Stakeholders and Timeline for implementation of TAP

**Table 24: Roles of stakeholders involved in the bio-latrine (using biogas) technology TAP**

Stakeholder	Roles
MoSTI	Organize a key stakeholders workshop to communicate about the TAP
MEMD	Coordinate all activities of the project
MoES	<ul style="list-style-type: none"> <li>▶ Sensitize institutions on the benefits of adopting the clean cooking technology</li> <li>▶ Allocate capital development funds to government and government aided institutions to support them in uptake of the technology</li> <li>▶ Monitor education institutions to ensure they adopt the technology</li> <li>▶ Identify and oversee institutions that will conduct R&amp;D on the technology</li> </ul>
MTIC	Through UNBS, develop and enforce quality standards for bio-latrines

**Table 25: Sequence and timing of specific activities**

Action	Scale	Year			
		2022	2023	2024	2025
Educate/ train technicians, operators and end- users on alternative forms of feedstock for biogas and their usage	Consultancy to study the various forms of biogas feedstock available in the country	●			
	Conduct more R&D on the technology	●	●		
	Develop study materials			●	●
	Identify technicians and operators to be trained		●	●	
	Map suitable sites for the practical trainings		●		
	Conduct Trainings of Trainers			●	●
	Train technicians, operators and institutions on the alternative feedstock and their usage			●	●

### 1.1.4.5 Estimation of Resources Needed for Action and Activities

**Table 26: Actions, activities, capacity building needs and Costs**

#### Action: Develop and implement financial incentives for efficient institutional cook stoves

Activities	Capacity building and other needs	Costs (\$)
Consultancy to study the various forms of biogas feedstock available in the country	Consultancy costs	30,000
Conduct more R&D in the technology	R&D costs	100,000
Develop study materials	Consultancy fees	30,000
Identify technicians and operators to be equipped with knowledge on alternative feedstock for biogas	Recruitment costs	30,000
	Capacity gaps assessment costs	20,000
Map suitable sites for the practical trainings	Mapping costs	15,000
Conduct Trainings of Trainers	Training costs	15,000
Train technicians, operators and institutions	Training costs	15,000

### 1.1.4.6 Management Planning

**Table 27: Overview of risk categories and possible contingencies of the Bio-latrline system**

Type of risk	Description of risk	Contingency actions
Cost risk	The cost of activities may be higher than budgeted due to delays in implementation of the TAP	GoU should seek for support from DPs to speed up the implementation
		MEMD should own the TAP and expedite its implementation
Performance Risk	The technology is a relatively new in Uganda, it has technical and operational risks that have to be studied and mitigated	Promotion of the technology is one of the strategies in the Draft National Energy Policy of 2019
Scheduling risk	Delays in implementation of the TAP due to; <ul style="list-style-type: none"> <li>► COVID-19</li> <li>► Delays in stakeholders coordination</li> <li>► 2021/22 budget is already in operation hence new budget items may be looked at in the next financial year</li> <li>► Ownership of the TAP by all stakeholders may take some time</li> </ul>	Implementation of NDPIII has started and promotion of renewable energy is one of the strategies in the plan  Ministry of Energy and Mineral Development should spearhead the implementation of the TAP by ensuring ownership of the various stakeholders from the start.
Financial risk	The budget to finance implementation of the TAP may not be available	GoU should engage DPs to support TAP implementation

## Next Steps

**Table 28: Immediate requirements and Critical Steps**

Immediate requirements	Critical steps
UNCST under MoSTI should organize a stakeholders workshop to communicate the TAP	Get the stakeholders buy-in
MoSTI to prepare a cabinet paper on the TNA project to get Government's blessings for the TAP	Getting cabinet's approval
MEMD to include TAP implementation budget to its 2022/2023 budget	MoSTI should urgently get all major stakeholders on board
Development of an Inter-Ministerial Committee to oversee the TAP implementation	

1.1.4.7 TAP overview table

Table 29: TAP overview table for Bio-Latrines  
TAP overview table

Sector	Energy
Sub-sector	Biomass energy
Technology	Bio-latrines for institutions (using biogas technology)
Ambition	Construction of 500 bio-latrines in 500 schools
Benefits	Reduced emission of greenhouse gases, improve on the health, provision of affordable energy in a long run, proper waste management

Action	Activities to be implemented	Sources of funding	Responsible body and focal point	Time frame	Risks	Success criteria	Indicators for Monitoring of implementation	Budget (USD)
Educate/train technicians, operators and end-users on alternative forms of feedstock for biogas and their usage.	Engage a consultant to study the various forms of feedstock available in the different parts of the country for the generation of biogas	GoU /DPs	MEMD	6 months	Delay in procurement of the consultant Delayed completion of the consultancy	Consultancy reports	Consultancy contract	30,000
	Conduct more research and development in the technology	GoU /DPs	MoES, MEMD	4 years	Delayed research results	Uptake of the technology by institutions	Complete research reports	100,000
	Develop study materials	GoU /DPs	MoES, MEMD	1 year	The funding may not be available	Complete study manuals	Testing of study materials	30,000
	Identify technicians and operators to be equipped with knowledge on alternative feedstock for biogas	GoU/DPs	MoES, MEMD	3 months	Delayed recruitment of trainees	Trained technicians and operators	Recruitment reports	50,000

Action	Activities to be implemented	Sources of funding	Responsible body and focal point	Time frame	Risks	Success criteria	Indicators for Monitoring of implementation	Budget (USD)
	Map suitable sites (schools with existing bio-latrines) for the practical trainings	GoU /DPs	MoES, MEMD	3 months	The funding may not be available	Report on mapped sites	Site visit reports	15,000
	Conduct Training of Trainers that will continuously train others as the technology uptake grows	GoU/DPs	MoES, MEMD	1 month	Retaining trainers may be costly hence some may move on to other engagements	Trained trainers with ample skills and knowledge in the technology	Training reports	15,000
	Train technicians, operators and institutions on the alternative feedstock and their usage	GoU /DPs	MoES, MEMD	3 months	Retaining technicians and operators may be costly	Trained technicians and operators	Training reports	15,000



## 1.2 Project Ideas for the Energy Sector

### 1.2.1 Brief summary of the Project Ideas for the Energy Sector

According to Uganda's Third National Development Plan (NPA, 2020), access to reliable clean energy is still low due to over reliance on biomass sources in the energy mix; constrained electricity transmission and distribution infrastructure; limited productive use of energy; long lead time of energy projects; low levels of energy efficiency; and uncoordinated intra and inter sectoral planning.

As a contribution to increased access to reliable clean energy, three (3) Project Ideas have been proposed for the Energy Sector for implementation of the country's Technology Action Plan. These are;

- ▶ Accelerated uptake of solar rooftop systems through provision of financial incentives
- ▶ Increased access to clean cooking through promotion of Efficient Institutional Cook Stoves

Scaling up diffusion of bio-latrines for institutions (using biogas technology)

These Project Ideas have been developed from the three technologies that were prioritized for the energy sector through a stakeholder's workshop conducted under step I of the Technology Needs Assessment (TNA) project. Technology prioritization was done by the stakeholders working together with the mitigation consultants using the Multi-Criteria Analysis tool. The criteria used were; Costs, Benefits (economic, social and environmental), Technology and Institutional considerations. A detailed barriers and enabling framework analysis was done for each of the prioritized technologies; summaries of the barriers and measures to overcome the barriers have been presented in Table 6 for solar rooftop systems; Table 14 for Efficient Institutional Cook Stoves and Table 22 for Bio-latrines for institutions (using biogas technology).

The solar rooftop systems PI is intended to increase electricity access especially in off-grid communities in Ugandan households, schools and healthcare facilities; the PIs for efficient institutional cook stoves and bio-latrines for institutions (using biogas technology) are aimed at accelerating access to clean cooking technologies in institutions most especially schools which are big consumers of wood fuel. A number of actions have been proposed for each of the technologies, however, three actions; one for each technology have been selected for the PIs. For further implementation of the TAP, each of the actions can be developed into a stand-alone project idea. To scale up access to reliable clean energy in Uganda, implementation of all actions will be required.

## 1.2.2 Specific Project Ideas

### 1.2.2.1: Specific Project Idea: Accelerated uptake of solar rooftop systems through provision of financial incentives

**Table 30: Specific Project Idea for Solar rooftop systems**

Introduction/ Background	Uganda is endowed with a high solar energy resource throughout the year with an average solar radiation of 5.1 kWh/m <sup>2</sup> /day. The insolation is highest at the Equator; however, it varies up to a maximum of 20% from place to place away from the Equator, the dryer areas (north-east) have the highest temperatures and mountainous areas (south-west) have the lowest. Temperature variations throughout the year are little making it easy to use solar power as an alternative source of RE. These resources remain largely untapped, this is due to the perceived technical and financial risks. During the barrier analysis and enabling framework workshop, stakeholders identified high upfront costs as the major financial barrier for wider spread uptake of solar rooftop systems. The stakeholders proposed development of financial incentives as a key measure in overcoming this barrier. This measure has been the basis for the development of the project idea for the technology. As at end of December 2020, the installed capacity of solar energy-based power in the country was 60.8 MW; 60 MW as on-grid supply and 0.8 MW was off grid generation. Opportunities within the solar PV sector are underlined by the government's ambitious target to increase electricity supply to 60% by 2025 according to the county's NDPIII 2020/21 – 2024/25 and to 80% by 2040 according to Vision 2040.
Objectives	<ol style="list-style-type: none"> <li>1.To increase private sector investments in the solar sector due to an improved enabling environment</li> <li>2.To increase electricity access especially in off-grid communities</li> </ol>
What are the outputs and are they measurable?	<ol style="list-style-type: none"> <li>1.A policy on financial incentives for the solar sector by 2025</li> <li>2.An Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives by 2023</li> <li>3.Partnership agreements between MEMD and financial institutions by 2025</li> <li>4.Trained financial institutions staff in solar business models by 2025</li> <li>5.A renewable energy revolving fund is in place with a secretariat by 2025</li> </ol>
Relationship to the country's sustainable development priorities	The project idea is in line with Uganda's Third National Development Plan 2020/21 – 2024/25. Under the plan, the goal of the energy development programme is to increase access and consumption of clean energy. One of the key results to be achieved over the next five years is to increase proportion of the population with access to electricity to 60%. In addition, Uganda Vision 2040 aims to have increased access to clean, affordable and reliable energy to facilitate industrialisation, among others with a target of increasing electricity supply by 80%.
Project Deliverables (Value/benefits)	<ol style="list-style-type: none"> <li>1.Increased private sector investments in the solar sector</li> <li>2.Increased electricity access especially in off-grid areas</li> <li>3.Improved coordination among policy makers, implementers and sector players</li> <li>4.Improved health due to increased electricity access especially in rural health facilities</li> <li>5.Improved education due to increased electricity access in rural schools</li> <li>6.Reduced greenhouse gas emissions due to increased access to clean energy</li> </ol>

Project Scope, Possible Implementation	The project can be implemented under the country's NDPIII 2020/21 – 2024/25 because all the targets are within the plan. It is feasible because of the growing demand for electricity especially in off-grid areas.	
Project activities	<ul style="list-style-type: none"> <li>▶ Conducting stakeholder meetings to gather information for the development of the policy on all proposed financial incentives</li> <li>▶ Establishment of an Inter-Ministerial committee</li> <li>▶ Inter-Ministerial Committee planning and coordination meetings</li> <li>▶ Policy development and implementation</li> <li>▶ Training Uganda Revenue Authority (URA) staff on solar energy components</li> <li>▶ Consultancy to study and advise MoFPED on the financial implications of the subsidies</li> <li>▶ Training MoFPED staff to understand the basics of the solar energy business to justify the need for the subsidy</li> <li>▶ Training financial institutions to understand the solar business models</li> <li>▶ Implementation of the subsidy by FIs by lowering lending rates</li> <li>▶ Consultancy to advise MEMD and MoFPED on the setup of the RE fund</li> <li>▶ Setting up the RE revolving fund secretariat</li> <li>▶ Train MEMD, REA on the practicalities and how to manage a revolving fund</li> <li>▶ Development of proposals to development partners to fund the RE fund</li> </ul>	
Timelines	The activities are expected to start in 2022 and run up to 2025	
Budget Resource requirements	<b>Activity/budget line</b>	<b>Budget (\$)</b>
	Conducting stakeholder engagements to gather information for the development of the policy on all proposed financial incentives	20,000
	Establishment of an Inter-Ministerial committee, Inter-Ministerial Committee planning and coordination meetings	20,000
	Policy development and implementation	100,000
	Training URA staff on solar energy components	30,000
	Consultancy to study and advise MoFPED on the financial implications of the subsidies	50,000
	Training MoFPED staff to understand the basics of the solar energy business to justify the need for the subsidy	20,000
	Conduct consultative meetings with financial institutions (FIs)	40,000
	Provide capacity building trainings to financial institutions to understand the solar business models.	30,000
	Implementation of the subsidy by financial institutions by lowering lending rates	30,000
	Consultancy to advise MEMD and MoFPED on the setup of the RE revolving fund	30,000
	Setting up the RE revolving fund secretariat	50,000

	Train MEMD, REA and other stakeholders staff on the practicalities and how to manage a revolving fund		20,000
	Development of proposals to DPs to fund the RE fund		20,000
	The project will be funded by Government of Uganda and Development Partners		
Measurement/ Evaluation	<b>Activity</b>	<b>Monitoring indicators</b>	<b>Success criteria</b>
	Development of policy document on financial incentives	<ul style="list-style-type: none"> <li>▶ Minutes of stakeholders meetings</li> <li>▶ Minutes of Inter-Ministerial Committee meetings</li> <li>▶ Policy document development progress reports</li> </ul>	Approved Policy document on financial incentives
	Conduct consultative meetings with financial institutions (FIs)	Minutes of consultative meetings	Signed Partnership agreements between MEMD & FIs
	Provide capacity building trainings to FIs	Number of trained financial institutions staff	Growth in uptake of solar loans from FIs
	Set up a renewable energy revolving fund	Reports on amount of solar loans disbursed from the revolving funds	<ul style="list-style-type: none"> <li>▶ Growth in uptake of solar loans from FIs</li> <li>▶ Increased solar rooftop systems installations</li> </ul>
	Develop an Inter-Ministerial Committee to oversee financial incentives implementation	<ul style="list-style-type: none"> <li>▶ Committee meeting minutes</li> <li>▶ Committee activity reports</li> </ul>	Active Inter-Ministerial Committee
Possible Complications/ Challenges	<ul style="list-style-type: none"> <li>▶ Failure to secure funding for implementation of the project</li> <li>▶ Differences in stakeholder priorities</li> <li>▶ Un-coordination among Ministries responsible for implementation</li> <li>▶ COVID-19 and its related effects</li> </ul>		
Responsibilities and Coordination	MEMD will coordinate the project and will work closely with MoSTI, REA, MoFPED, UDBL, MTIC and Financial Institutions		

### 1.2.2.2 Specific Project Idea: Increased access to clean cooking through promotion of Efficient Institutional Cook Stoves

**Table 31: Specific Project Idea for Efficient Institutional Stoves**

Introduction/ Background	<p>Firewood is the main source of fuel used by institutions both in urban and rural areas in Uganda. Efficient Institutional cook stoves are used in schools, prisons, restaurants, health facilities, refugee camps and other places that cook for very many people. There are over 31,000 schools in Uganda of which over 3,220 are secondary level. Most of the rural schools use three-stone stoves because these can be installed at no cost. Most of the institutions in the rural areas have better access to firewood at lower prices, compared to those in urban areas. However, of recent there are changes in biomass cover maps for Uganda, the area under cultivation is increasing to feed the high population growth rate of about 3% per annum. There is a growing deficit in biomass supply, consequently the price of firewood is increasing steadily. There are very limited options for institutions to plant woodlots to meet their fuel needs due to limited land. The only viable mitigation option is to shift to efficient institutional stoves to reduce on the consumption of firewood.</p> <p>During the barrier analysis and enabling framework workshop, stakeholders identified affordability as the main challenge for institutions and increasingly for manufacturers of institutional stoves. Stakeholders proposed development of financial incentives as a key measure in overcoming this barrier. This measure has been the basis for the development of the PI for the technology. Uganda's NAMA "NS-151, The Promotion of the Use of Efficient Institutional Stoves in Institutions" is a good policy indicator that the technology will be promoted.</p>
Objectives	<ol style="list-style-type: none"> <li>1.To increase private sector investments in the clean cooking sector due to an improved enabling environment</li> <li>2.To increase access to modern clean cooking technologies in institutions</li> <li>3.To reduce deforestation due to reduced utilization of firewood</li> </ol>
What are the outputs and are they measurable?	<ol style="list-style-type: none"> <li>1.A policy on financial incentives for efficient institutional stoves by 2025</li> <li>2.An Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives by 2023</li> <li>3.Partnership agreements between MEMD and financial institutions by 2025</li> <li>4.Trained financial institutions staff on the technology by 2025</li> <li>5. A renewable energy revolving fund is in place with a secretariat by 2025</li> </ol>
Relationship to the country's sustainable development priorities	<p>The PI is in line with Uganda's NDPIII 2020/21 – 2024/25. Under the plan, the goal of the energy development programme is to increase access and consumption of clean energy. Two of the key results to be achieved are; reduce share of biomass Energy used for cooking from 85% in FY2018/19 to 50% and increase the share of clean energy used for cooking from 15% in FY2018/19 to 50%.</p>
Project Deliverables (Value/benefits)	<ol style="list-style-type: none"> <li>1.Increased private sector investments in modern cooking technologies</li> <li>2.Improved coordination among policy makers, implementers and sector players</li> <li>3.Minimized health risks due to reduced indoor air pollution</li> <li>4.Improved education as students can stay longer in school instead of spending some hours collecting firewood</li> <li>5.Improved skills due to training opportunities in stoves construction</li> </ol>

	6. Employment created for those who manufacture and construct stoves 7. Reduced greenhouse gas emissions due to reduced deforestation	
Project Scope, Possible Implementation	The project can be implemented under the country's NDPIII 2020/21 – 2024/25 because all the targets are within the plan. It is feasible because it greatly contributes to environmental sustainability.	
Project activities	These include; <ul style="list-style-type: none"> <li>▶ Conducting stakeholder meetings to gather information for the development of the policy on all proposed financial incentives</li> <li>▶ Establishment of an Inter-Ministerial committee; Inter-Ministerial Committee planning and coordination meetings</li> <li>▶ Policy development and implementation</li> <li>▶ Consultancy to study and advise MoFPED on the financial implications of the subsidy</li> <li>▶ Training MoFPED staff to understand basics of the efficient institutional cook stoves to justify the need for the subsidy</li> <li>▶ Conduct consultative meetings with FIs</li> <li>▶ Provide trainings to FIs to understand the technology</li> <li>▶ Implementation of the subsidy by FIs by lowering lending rates</li> <li>▶ Consultancy to advise MEMD and MoFPED on the setup of the RE fund</li> <li>▶ Setting up the RE revolving fund secretariat</li> <li>▶ Train MEMD staff on the practicalities and how to manage a revolving fund</li> <li>▶ Develop proposals to development partners to fund the RE revolving fund</li> <li>▶ Consultancy to study the efficient institutional cook stoves sub-sector and advise on the development of the carbon financing market</li> <li>▶ Develop sensitization materials and put in place a team to sensitize the education institutions</li> </ul>	
Timelines	The activities are expected to start in 2022 and run up to 2025	
Budget Resource requirements	<b>Activity/budget line</b>	<b>Budget (\$)</b>
	Conducting stakeholder engagements to gather information for the development of the policy on all proposed financial incentives	10,000
	Establishment of an Inter-Ministerial committee, Inter-Ministerial Committee planning and coordination meetings	20,000
	Policy development and implementation	100,000
	Consultancy to study and advise MoFPED on the financial implications of the subsidies	30,000
	Training MoFPED staff to understand the basics of the solar energy business to justify the need for the subsidy	20,000
	Conduct consultative meetings with FIs	20,000
	Provide trainings to FIs to understand the efficient institutions stoves technology	30,000
	Implementation of the subsidy by FIs by lowering lending rates	30,000

	Consultancy to advise MEMD and MoFPED on the setup of the RE revolving fund	30,000	
	Train MEMD staff on the practicalities and how to manage a revolving fund	20,000	
	Set up a revolving fund secretariat	50,000	
	Development of proposals to DPs to fund the RE fund	20,000	
	Consultancy to study the efficient institutional cook stoves sub-sector and advise on the development of the carbon financing market	50,000	
	Develop sensitization materials and team	50,000	
	The project will be funded by Government of Uganda and Development Partners		
Measurement/ Evaluation	<b>Activity</b>	<b>Monitoring indicators</b>	<b>Success criteria</b>
	Development of policy document on financial incentives	<ul style="list-style-type: none"><li>▶ Minutes of stakeholders meetings</li><li>▶ Minutes of Inter-Ministerial Committee meetings</li><li>▶ Policy document development progress reports</li></ul>	Approved Policy document on financial incentives
	Conduct consultative meetings with financial institutions (FIs), and identify those which can cooperate in supporting the solar technology development	Minutes of consultative meetings	Signed Partnership agreements between MEMD & FIs
	Provide trainings to financial institutions to understand the technology	Number of trained FIs staff	Increased adoption of efficient institutional cook stoves
	Set up a renewable energy revolving fund to support the various stakeholders in the value chain including end-users; to be implemented by financial institutions	Reports on amount of efficient institutional stoves loans disbursed from the revolving fund	Growth in uptake of efficient institutional stoves loans from FIs Increased adoption of efficient institutional stoves
	Develop an Inter-Ministerial Committee to oversee the activities of the different ministries in implementation of the financial incentives	<ul style="list-style-type: none"><li>▶ Committee meeting minutes</li><li>▶ Committee activity reports</li></ul>	Active Inter-Ministerial Committee



Possible Complications/ Challenges	<ul style="list-style-type: none"> <li>▶ Failure to secure funding for implementation of the project</li> <li>▶ Differences in stakeholder priorities</li> <li>▶ Un-coordination among Ministries responsible for implementation</li> <li>▶ COVID-19 and its related effects</li> </ul>
Responsibilities and Coordination	MEMD will coordinate the project and will work closely with MoSTI, MoES, MoFPED, Financial Institutions (FIs), MoWE and MTIC - UNBS

### 1.2.2.3 Specific Project Idea: Bio-latrines for institutions (using biogas technology)

**Table 32: Scaling up diffusion of bio-latrines (using biogas technology)**

Introduction/ Background	<p>Biogas is a form of biomass that can be generated from cow dung, food waste, human waste, peelings, dung from other animals and other bio-degradable materials. Biogas is a combustible gas produced by the anaerobic fermentation of cellulose containing organic materials. Biogas normally consists of 45% to 75% methane, 25-45% carbon dioxide and 2%-3% moisture and about 1% trace gases. Biogas from faecal matter has been used in many countries, but in Uganda, it used in a few institutions. It can be used to supplement firewood use. In most cases faecal matter is not enough to meet the institution's energy demand; it has to be supplemented by other feedstock. Bio-latrines can turn waste into energy, the technology can be practiced as a waste management solution.</p> <p>The bio-latrines technology has been piloted by MEMD in some schools. Biogas from bio-latrines is a good alternative to reduce on the amount of firewood used in institutions however, construction of bio-latrines is an expensive venture. During the barrier analysis and enabling framework workshop, limited knowledge of alternative feedstock was singled out as a major non-financial barrier to the uptake of biogas technology. Educating/training technicians, operators and end-users on alternative forms of feedstock for biogas and their usage is a key measure in overcoming this barrier. This measure has been the basis for the development of the PI for the technology. Opportunities for development of this technology are underlined by the government's plan to promote institutional biogas and bio-latrines installations under the country's draft National Energy Policy of 2019. In addition, the country's NDPIII 2020/21 – 2024/25 will prioritize to promote uptake of alternative and efficient cooking technologies such as institutional biogas.</p>
Objectives	<ol style="list-style-type: none"> <li>1.To ensure sustainable operation of bio-latrines in institutions</li> <li>2.To increase access to modern clean cooking technologies in institutions</li> <li>3.To reduce deforestation due to reduced utilization of firewood</li> </ol>
What are the outputs and are they measurable?	<ol style="list-style-type: none"> <li>1.Research reports on the potential biogas feedstock in the country</li> <li>2.Study manuals on how to use the various feedstock for sustained operations</li> <li>3.Trained technicians and operators with ample skills to operate the systems</li> <li>4.Mapped bio-latrines sites that can be used as demonstration sites</li> <li>5.Trained trainers with ample skills and knowledge in the technology</li> </ol>
Relationship to the country's sustainable development priorities	<p>The PI is in line with Uganda's NDPIII 2020/21 – 2024/25. Under the plan, the goal of the energy development programme is to increase access and consumption of clean energy. Two of the key results to be achieved are; reduce share of biomass Energy used for cooking from 85% in FY2018/19 to 50% and increase the share of clean energy used for cooking from 15% in FY2018/19 to 50%.</p>

Project Deliverables (Value/benefits)	1.Sustainable operations of bio-latrines (using biogas technology) 2.Minimized health risks due to reduced indoor air pollution 3.Improved education as students can stay longer in school instead of spending some hours collecting firewood 4.Improved skills due to training opportunities in bio-latrines construction 5.Jobs created for those who are involved in the construction of bio-latrines 6.Reduced greenhouse gas emissions due to reduced deforestation 7.Policy makers will become more aware about the bio latrine waste to energy potential		
Project Scope, Possible Implementation	The project can be implemented under the country's NDP III 2020/21 – 2024/25 because all the targets are within the plan. It is feasible because it greatly contributes to environmental sustainability.		
Project activities	These include; ▶ Consultancy to study the various forms of biogas feedstock in the country ▶ Research and development in the technology ▶ Development of study materials ▶ Recruitment of technicians and operators to be equipped with knowledge on alternative feedstock for biogas ▶ Mapping suitable sites for the practical trainings ▶ Training of Trainers for continuous capacity development ▶ Training technicians, operators and institutions on the alternative feedstock		
Timelines	The activities are expected to start in 2022 and run up to 2025		
Budget Resource requirements	<b>Activity/budget line</b>		<b>Budget (\$)</b>
	Consultancy to study the various forms of biogas feedstock available in the country		30,000
	Research and development on the technology		100,000
	Development of study materials		30,000
	Mapping suitable sites for the practical trainings		50,000
	Training of Trainers for continuous capacity development		15,000
	Recruitment of technicians and operators to be trained on alternative feedstock		15,000
	Training technicians, operators and institutions on the alternative feedstock		15,000
	The project will be funded by Government of Uganda and Development Partners		
Measurement/ Evaluation	<b>Activity</b>	<b>Monitoring indicators</b>	<b>Success criteria</b>
	Consultancy to study the various forms of biogas feedstock available in the country	Consultancy contract	Consultancy reports
	Research and development on the technology	Complete research reports	Uptake of the technology

Possible Complications/ Challenges	Development of study materials	Testing of study materials	Complete study manuals
	Mapping suitable sites for the practical trainings	Site visit reports	Report on mapped sites
	Training of Trainers for continuous capacity development	Training reports	Trained trainers with ample skills
	Recruitment of technicians and operators to be trained on alternative feedstock	Recruitment reports	Trained operators and technicians
	Training technicians, operators and institutions on the alternative feedstock	Training reports	Trained operators and technicians
	Failure to secure funding for implementation of the project Differences in stakeholder priorities Un-coordination among stakeholders COVID-19 and its related effects		
Responsibilities and Coordination	MEMD will coordinate the project and will work closely with MoSTI, MoES and MTIC (UNBS)		

## Chapter 2: Cross-cutting Issues

A number of actions have been proposed for each of the prioritized technologies, however, three actions; one for each technology have been selected for the PIs.

For full implementation of the TAP, each of the actions can be developed into a stand-alone project idea. For successful implementation of the TAP, multiple stakeholder buy-in should be sought at the beginning of the interventions. To scale up access to reliable clean energy in Uganda, implementation of all actions will be required. Due to the fact that all prioritized technologies are in the energy sector, they have some common barriers. This section details common measures, actions and activities that can help address the barriers;

**Table 33: Common barriers, actions and activities**

Common barrier	Actions	Activities
High upfront cost of renewable energy technologies (RETs)	Develop and implement financial incentives on RETs	<ul style="list-style-type: none"> <li>▶ Exempt taxes on all imported RETs components</li> <li>▶ Subsidize interest rates to lower lending rates</li> <li>▶ Conduct consultative meetings with FIs, and identify those which can cooperate in supporting the RE technologies development</li> <li>▶ Provide trainings to FIs to understand RET business models</li> <li>▶ Set up an RE fund to support the various stakeholders</li> <li>▶ Develop an Inter-Ministerial Committee to oversee the activities for implementation of the financial incentives</li> </ul>
Inadequate and weak institutional capacity	Strengthen Institutional capacity	<ul style="list-style-type: none"> <li>▶ Identify all the institutions and actors involved in the RE sector</li> <li>▶ Carry out an assessment of technical &amp; financial gaps in those institutions</li> <li>▶ Conduct training programs to fill the skills gaps</li> <li>▶ Equip the institutions with the necessary hardware, software and org-ware required for their smooth running to ably support the RE technologies</li> <li>▶ Train the private sector to build their capacity to enable self-regulation under the relevant umbrella associations</li> <li>▶ Establish clear and transparent systems in all institutions to attract and increase private investments in the RE sector</li> <li>▶ Establish a multi-institutional coordination framework to oversee the activities of the different institutions</li> </ul>

Capacity gaps in installation, operations and maintenance of RETs	Develop a skilled workforce to install, operate and maintain RE technologies	<ul style="list-style-type: none"> <li>▶ Carry out an assessment of technical skills gaps among the technology players</li> <li>▶ Identify training institutions that can fill the skills gaps</li> <li>▶ Equip training institutions with instrumentation, tools and materials needed for training technicians in the RE sector</li> <li>▶ Conduct training of trainers (ToTs)</li> <li>▶ Organise trainings for technicians involved in RETs</li> <li>▶ Equip technicians with skills to provide basic training to technology end-users</li> <li>▶ Conduct continuous R&amp;D on the RE technologies</li> <li>▶ Organize benchmarking visits for policy makers and other key RE stakeholders to countries with strong RE sectors</li> </ul>
Limited information and public awareness about RETs	Sensitize the public about the benefits of using RETs	<ul style="list-style-type: none"> <li>▶ Develop messages and materials for sensitization campaigns</li> <li>▶ Map stakeholders involved in the RE sector</li> <li>▶ Develop partnerships with media houses to conduct public awareness campaigns</li> <li>▶ Identify ambassadors (individual and institutions) that are using RETs to share their success stories in awareness campaigns</li> </ul>

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## Annex I. List of stakeholders involved and their contacts

No	Name	Institution	Consultation Approach
<b>National Coordinator</b>			
1.	Dr. Maxwell Otim Onapa	Ministry of Science Technology and Innovation (MOSTI)	Technology Action Plan development
2.	Mrs. Deborah Kasule	Uganda National Council for Science and Technology	Technology Action Plan development
<b>Consultants</b>			
3.	Dr. Adam M. Sebbit	Makerere University	Technology Action Plan development
4.	Ms. Claire Kagga	Renewable Energy Business Incubator Limited	Technology Action Plan development
<b>Other stakeholders</b>			
5.	Mr. Emmy S. Kimbowa	Uganda Solar Energy Association (USEA)	Over the phone
6.	Mrs. Esther Nyanzi	UNREEEA: Uganda National Renewable Energy and Energy Efficiency Alliance (UNREEEA)	Over the phone
7.	Mr. Hatimu Muyanja	Ministry of Energy and Mineral Development	Over the phone
8.	Mr. Fred Tuhairwe	Global Green Growth Institute	Over the phone
9.	Head Teacher and Staff	St. Theresa Girls Primary School Kisubi	Over the phone
10.	Head Teacher and Staff	Bombo Army Secondary School	Over the phone
11.	Head Teacher and Staff	Bombo Senior Secondary School	Over the phone
12.	Robert Bakiika, Mr.	Climate Change Department, MoWE	Over the phone
13.	Mr. Abdu Kalema	Powercon Limited	Over the phone
14.	Dr. Gladys Aloyo	Healthcare Practitioner	Over the phone





# **TECHNOLOGY ACTION PLAN REPORT - MITIGATION**

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September 2021

