



# National Road Map on Scaling Up Productive Use of Solar Energy



Leveraging solar energy for economic empowerment and food security



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## Abbreviations

BGFA	Beyond-the-Grid Foundation Africa
CAPEX	Capital Expenditure
CSO	Civil Society Organization
DC	Direct Current
DP	Development Partner
EASP	Energy Access Scale up Project
ERA	Electricity Regulatory Authority
EU	European Union
FI	Financial Institution
GEAPP	Global Energy Alliance for People and Planet
GOGLA	Global Association for the Off-Grid Solar
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
kWh	Kilo Watt Hour
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MW	Mega Watt
MWh	Mega Watt Hour
MDA	Ministries, Departments and Agencies
MEMD	Ministry of Energy and Minerals Development
MTIC	Ministry of Trade Industry and Cooperatives
MWE	Ministry of Water and Environment
NDCs	Nationally Determined Commitments
NDP	National Development Plan
NGO	Non-Government Organization
NREP	National Renewable Energy Platform
OGS	Off Grid Solar system
PAYGo	Pay as You Go
PUSE	Productive Use of Solar Energy
PV	Photo Voltaic
PVOC	Pre export verification of conformity (PVOC)
RBF	Results-based Financing
RESP	Rural Electrification and Plan
SHS	Solar Home Systems
SPIS	Solar Pump Irrigation System
SWP	Solar Water Pumping
UECCC	Uganda Energy Credit Capitalisation Company
UNBS	Uganda National Bureau of Standards
UNREEEA	Uganda National Renewable Energy and Energy Efficiency Alliance
UOMA	Uganda Off Grid Market Accelerator
URA	Uganda Revenue Authority
USAID	United States Agency for International Development
USEA	Uganda Solar Energy Association
VAT	Value Added Tax
VSLA	Village Saving and Loan Association



# Acknowledgments

This National Roadmap for Productive Use of Solar Energy (NR-PUSE) has been prepared by the Ministry of Energy and Mineral Development (MEMD) in partnership with the Uganda Solar Energy Association (USEA) and GOGLA, with the financial support of the German Federal Ministry for Economic Cooperation and Development (BMZ) and the European Union (EU), through the international initiative Water and Energy for Food (WE4F). The PURE Roadmap builds on the work started by Power for All who convened stakeholders in the Agriculture and Energy sectors to develop an Action Plan on Productive Use of Renewable Energy in Uganda's Agriculture sector.



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# Executive Summary

This National Roadmap for Productive Use of Solar Energy (NR-PUSE) has been prepared by the Ministry of Energy and Mineral Development (MEMD) in partnership with the Uganda Solar Energy Association (USEA) and GOGLA, with the financial support of the German Federal Ministry for Economic Cooperation and Development (BMZ) and the European Union (EU), through the international initiative Water and Energy for Food (WE4F).

The roadmap provides a situational analysis and the needed strategic interventions to leverage the productive use of solar energy (PUSE) in Uganda. It further provides an analysis of the policy and legal framework, an overview of the PUSE applications in the country, and provides a list of challenges, barriers, and opportunities. The national roadmap goes further to provide for financing and implementation actions, a monitoring and evaluation framework and to lay the channels for collaboration between the Government of Uganda, Development Partners, and all sector players to achieve a common vision for the country.

From the Market assessment on Productive Use of Solar Energy for the off-grid segment undertaken, several opportunities were identified. These are summarised in Table 0.1:

The market assessment report further identifies key barriers to the promotion of PUSE which include:

- Limited access to financing/working capital for vendors.
- Limited financing for end users.
- Lack of affordability and high cost of appliances.
- Limited levels of awareness and education.
- Limited technical and human capacity of solar technicians.
- Presence of low-quality product on the market.
- To address the barriers and increase the uptake of PUSE, a roadmap has been prepared which has a Vision, Mission, Objectives and Recommendations.

## Vision

**“To have a vibrant and competitive productive use of the renewable energy ecosystem for food security and economic empowerment”.**

**Table - Sectors with opportunities for the productive use of solar energy**

Sectors with Opportunities for PUSE	Required Technologies
Agriculture, Fisheries, Poultry, and Dairy Industry	Solar water pumping for irrigation and animal feeding, fishponds Cold room storage for milk and fish Individual solar refrigerators Lighting (solar fishing lights) Egg incubation Fertilizing sprays Milking machines
Transport – E-Mobility	Electric vehicles and motorcycles Storage or charging stations
E-cooking	Solar powered electric pressure cookers or enabled cook stoves
Rural Electrification (Off – grid applications)	Mini grids: Solar PV panels Quality storage batteries Quality inverters
Tourism Sector	Solar water heaters Quality storage batteries Quality inverters
Health – Vaccine & pharmaceutical storage	Cold room storage and lighting E-cooking technologies

# Executive Summary

## Objectives

To outline a clear and comprehensive strategy for scaling up PUSE to meet energy needs in a sustainable way.

The Specific Objectives of the roadmap include:

- To improve the policy and regulatory environment for PUSE.
- To increase the level of awareness and information dissemination regarding the available opportunities created by PUSE.
- To provide affordable financing for PUSE, either to PUSE companies or end-users.
- To enhance the capacity of the sector players in PUSE.
- To promote research and development in PUSE.

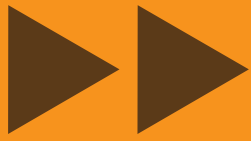
## Recommendations

Key recommendations from the roadmap include the following:

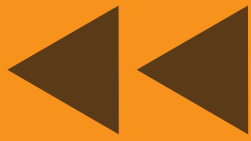
- Government should coordinate sector players through the appropriate working Group under the Sustainable Energy Development Programme with a view of addressing challenges in the sub-sector.
- Government should design and launch potential PPPs with the private sector.
- Government should provide additional incentives to encourage private sector participation and engage Development Partners to scale up affordable financing for both the technology suppliers and the end users so that the technologies are affordable.
- Government should put in place appropriate standards for PUSE and have them enforced.
- Concerted efforts should be made to enhance the capacity of the sector players in PUSE to ensure sustainability.
- Academia should work with the private sector to undertake research and development on appropriate technologies and models for adoption in PUSE.

## Mission

**“To create a local and national enabling environment to scale up Productive Use of Solar Energy (PUSE), a conducive, economic, coordinated, interlinked and political environment for private sector investment, and create employment and green jobs in the PUSE value chain for improved household incomes and service delivery.”**



# Introduction and Background





# Introduction and Background

## 1.1 Introduction

This National Roadmap for Productive Use of Solar Energy (NR-PUSE) has been prepared by the Ministry of Energy and Mineral Development (MEMD) in partnership with the Uganda Solar Energy Association (USEA), with support from GOGLA.

The roadmap provides a situational analysis and the needed strategic interventions to leverage the productive use of solar energy (PUSE) in Uganda. It further provides an analysis of the policy and legal framework, an overview of the PUSE applications in the country, and provides a list of challenges, barriers, and opportunities. The national roadmap goes further to provide for financing and implementation actions, a monitoring and evaluation framework and to lay the channels for collaboration between the Government of Uganda, Development Partners, and all sector players to achieve a common vision for the country at large.

## 1.2 Background

Uganda is richly endowed with renewable energy resources for energy production and the provision of energy services. The total estimated potential is about 5,300 MW.<sup>1</sup> These resources, however, remain largely unexploited, mainly due to the perceived technical and financial risks. Uganda's energy mix is largely dominated by hydroelectricity power (82%), followed by thermal power (8%), PV solar (5%) and Bagasse (5%). The generated electricity is largely consumed by extra-large industries that consume 28% of the electricity followed by large industries (25%), domestic consumption (22%), medium industrial consumption (14%) and commercial consumption (11%).<sup>2</sup>

The Government of Uganda has made remarkable progress in recent years, with power sector reforms and other incentives to speed up the rate of connections. This has led to increase in the total installed capacity to 1,346.6 MW<sup>3</sup> which is expected to increase with the completion of the 600 MW Karuma Dam. However, the national electrification rate remains low. According to official sources, in 2022, electricity access from the national grid was at 28%, 28% from solar photovoltaic (PV), and 1% from mini grid. This brings the combined electricity

access to 57% of which the majority is based in urban areas and only 8% in rural areas.<sup>4</sup>

The Government of Uganda considers electrification a national priority and placed it at the core of the Third National Development Plan (NDP III) which targets universal energy access by 2030. The plan has been complemented by other efforts, such as the Electricity Connections Policy and the Rural Electrification Programme that set an annual target of 300,000 new connections with about a third coming from the off-grid segment. Together, these programs support the realization of Uganda's Vision 2040, which aims to increase national electrification access to 80% of the population. Given the cost-effectiveness and viability as a solution for last-mile electrification, distributed renewable energy (DRE) technologies will be instrumental to the government's ambitions of providing clean energy.<sup>5</sup>

Until recently, Productive Uses of Electricity has not been prioritised in Uganda's energy policy and strategies. This led to low-capacity utilisation of energy in the rural electrification projects in Uganda. The targets used by the Ministry of Energy & Mineral Development to measure progress were the number of new electricity connections rather than the amount of electricity consumed. While Vision 2040 provides for the improvement of access to electricity by connecting to productive areas, the Electricity Connection Policy (ECP) recognises the role played by productive use of energy.

## 1.3 The Off-Grid Sector

The off-grid sector in Uganda has steadily grown over the last 15 years with new players including foreign investors entering the market. This has been mainly in areas of Solar PV, most especially solar home systems and mini-grids. The lack of grid access in rural areas, high connection fees, and the growth of telecoms which facilitate mobile payment and monitoring systems, are structural factors that have benefited off grid solar development. Policy measures such as tax exemptions for equipment for solar (such as solar panels, complete solar home systems, deep cycle batteries, etc.) and subsidies for the end-user have also supported expansion of the sector.

1 Final Energy Report 2018 - Netherlands Enterprise Agency <https://www.rvo.nl/sites/default/files/2019/02/Final-Energy-report-Uganda.pdf>

2 "Energy Sales by Customer Category 2022" <https://www.era.go.ug/index.php/stats/distribution-statistics/energy-sales-by-customer-category>

3 "Installed Capacity" <https://www.era.go.ug/index.php/stats/generation-statistics/installed-capacity>

4 giz, "Advising companies on sustainable commitment in developing countries and emerging economies." <https://www.giz.de/en/worldwide/93161.html> (accessed Aug. 22, 2022).

5 "Renewed Hope for Free Electricity Connections - Ministry of Energy and Mineral Development." <https://energyandminerals.go.ug/renewed-hope-for-free-electricity-connections/> (accessed Aug. 22, 2022).

# Introduction and Background

Currently, more than 400 off grid solar companies are operating in Uganda of which 239<sup>6</sup> are registered with Uganda Solar Energy Association and are active in solar home systems, mini-grid and solar thermal markets.<sup>7</sup> The Utilities 2.0 initiative—also known as the Twaake<sup>8</sup> pilot—is currently testing an integrated energy model to demonstrate that both centralised and decentralised energy technologies are instrumental to achieving universal energy access in Uganda. Funded by the Rockefeller Foundation and coordinated by Power for All, the project brings together the centralized power utility company, UMEME Ltd, and several Uganda-based off-grid companies.<sup>9</sup> This integrated energy approach aims to deploy faster connections, increase the productive use of electricity, improve grid reliability and stability, reduce grid losses, promote economic growth in rural communities, and improve overall business profitability.

## 1.4 Rationale for the Roadmap

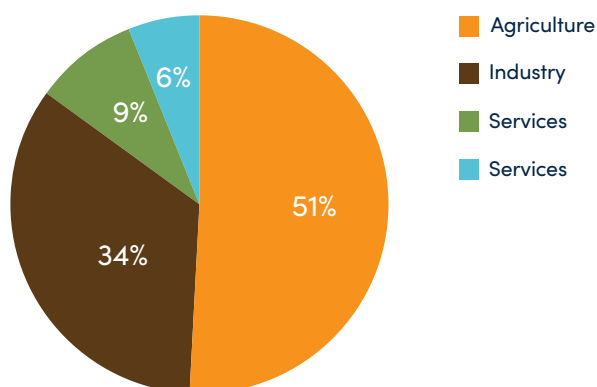
In the third National Development Plan (NDP III) covering the period 2020/21 to 2024/25, the Government of Uganda (GoU) aims to eradicate poverty, achieve economic growth and as well the social and cultural transformation of society. Central to this aspiration is the availability of sustainable (reliable, affordable, and clean) energy

services. However, some of the barriers highlighted in NDP III hindering access to sustainable energy are as highlighted below:

- Over reliance on biomass sources in the energy mix.
- Limited access to off-grid solutions.
- Uncoordinated intra and inter sectoral planning.
- Constrained electricity transmission and distribution infrastructure.
- Low levels of energy efficiency.
- Limited productive use of energy.

With the pursuit of productive uses of energy, the low levels of energy per capita consumption is consolidated with a reliable base load for off-grid power developers. This in-turn attracts sustained investment in the off-grid sector to realise the agenda 2030 of universal electrification. The development and acceleration of off-grid solutions would do away with the need to extend transmission lines to off-grid communities, a venture which is hugely costly and unsustainable. Furthermore, the development of this roadmap clearly spells out the roles and responsibilities of all sector stakeholders, from MDAs, to DPs, to private sector, to NGOs, thereby solving the challenge of “Uncoordinated intra and inter sectoral planning”.

**Figure 1.1 - PV Market Segments in Uganda (USEA Statistics)**



<sup>6</sup> According to Uganda Solar Energy Association as of March 2023.

<sup>7</sup> giz, “Advising companies on sustainable commitment in developing countries and emerging economies.” <https://www.giz.de/en/worldwide/93161.html> (accessed Aug. 22, 2022) and Uganda solar energy association

<sup>8</sup> See details about the Twaake pilot project via, <https://www.powerforall.org/resources/action-plans/backgrounder-twaake-more-just-light>

<sup>9</sup> “New integrated energy model to reduce electrification cost in Uganda,” Power For All. <https://www.powerforall.org/news-media/press-releases/new-integrated-energy-model-reduce-electrification-cost-uganda> (accessed Aug. 22, 2022).



# Situation Analysis Report





# Situation Analysis Report

## 2.1 Policy Legal Framework and Institutional Framework

### 2.1.1 Policy and Legal Framework

The Government of Uganda has put in place laws, regulations, and policies aimed at increasing access to modern, reliable, and affordable renewable energy and energy-efficient technologies. MEMD oversees the energy transition space and ensures the development of appropriate policies and regulations to provide a conducive environment for the growth of the sector. The policies in place to increase access to modern forms of energy as well as scale up the Productive Use of Solar Energy are in Annex 1.

### 2.1.2 Legal Framework

The legal framework for Productive Use of Solar Energy in Uganda (Table 2.1) is partly developed, with a regulated on-grid segment while the off-grid segment is not fully regulated. The existing legal regime largely focus on the Hydroelectricity

power, standards, and regulations of the PAYGo payment model. The absence of a clear law that regulates the Productive Use of Solar Energy leaves a huge gap and exposure to poor service delivery.

### 2.1.2 Institutional Framework

MEMD is the line ministry charged with the task of developing an enabling environment for scaling up the productive use of energy by developing and putting in place the right policies and regulations. The ministry acts as an anchor for all other stakeholders within the country. Table 2.2 shows the policy framework for PUSE.

## 2.2 Stakeholder Mapping

During the market assessment, key stakeholders active in PUSE were identified together with their roles and responsibilities. A detailed Stakeholder mapping was undertaken, and a matrix of stakeholders is provided in Annex 2.

**Table 2.1 - Legal framework related to PUSE**

Legal Framework	Key focus areas on PUSE	Responsible Agency / Government Department
Electricity Amendment Act	The Electricity Amendment 2022 that makes it possible for isolated grid operators to sell power directly to customers.	Ministry of Energy and Mineral Development
The Uganda National Bureau of Standards Act	Monitors standards of solar equipment coming into the country.	Uganda National Bureau of Standards.
Microfinance Institutions and Money Lenders Act 2016	Provides for management, regulation, licensing, supervision, and control of money lending businesses in Uganda. Most of the SACCOs and microfinance institutions that extend credit to end users and some solar companies fall under this law.	Uganda Micro finance regulatory authority
The Hire Purchase Act, 2018	The act requires all companies dealing in hire purchase business to have a licence, stipulating penalties for default. This Act specifically affects all PAYGo companies that sale products on credit (in technical terms, hire purchase).	Ministry of trade, industry, and cooperatives
National Environment Management Act	Put in place laws to regulate the disposal of waste including E-Waste generated by off grid companies to protect the environment.	National Environment Management Authority
Isolated Grid Regulation, 2020	This off-grid regulation seeks to help Uganda's energy sector to encourage further private sector investment and achieve its ambitious national electrification target of 80% electricity access by 2040.	Electricity Regulatory Authority
Rural Electrification Strategy and Plan (RESP II) 2013-2022	This plan has been the guiding document for rural electrification. It targeted access and service penetration of 26% for rural households, businesses, and institutions by 2022, as well as 1.28 million new on-grid connections and 14,000 new off-grid connections leveraging solar and mini-grid technologies.	Ministry of Energy and Mineral Development

# Situation Analysis Report

**Table 2.2 – Policy framework for PUSE**

Institution	Key role played
Ministry of Energy and Mineral Development	Creates an enabling for scaling up productive use of energy in Uganda through policies, regulations, tax exemptions, and extending subsidies to the end-user.
Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)	Developed policies to scale up or support the growth of or mechanization of agriculture through use of solar powered water pumps, tax exemption on agricultural inputs including solar powered pumps.  National irrigation policy developed by MWE, which guides the agricultural transformation through irrigation development. The policy focuses on to ensure reliable water for irrigation to optimize, intensify and diversify crop production and productivity.
Ministry of Water and Environment (MWE)	Developed policies to promote water for production including established of irrigation using solar powered water pumps.  National irrigation policy developed by MWE, which guides the agricultural transformation through irrigation development. The policy also calls for prioritization of investments in irrigation development by the public, private and other players.

## 2.3 Overview of Productive Use of Energy Applications

The World Bank paper on Productive Uses of Renewable Energy (2004) defines productive uses of energy as activities that involve the utilization of energy – both electric and non-electric energy in the forms of heat, and mechanical energy – for activities that enhance income and welfare in rural contexts.<sup>10</sup> These activities are typically in the sectors of agriculture, rural enterprise, and education. More recently IFC’s PULSE report adopts a narrower definition for PULSE (Productive Use Leveraging Solar Energy): any agricultural, commercial, or industrial activity that uses solar energy as a direct input to the production of goods or provision of services.<sup>11</sup> According to ENDEV Productive use of energy is defined as, “Energy that facilitates income generating activities and improves overall business climate.<sup>12</sup> Any use of energy that contributes toward education, health, and gender equity should also be considered a productive use of energy”.<sup>13</sup> According to GIZ, productive use can be defined as<sup>14</sup>: “Agricultural, commercial, and industrial activities involving electricity services as a direct input to the production of goods or provision of services.

From the above definitions, in this National Road map, Productive use of solar energy is the utilization of solar energy for income generation in formal and informal enterprises for the production of goods or provision of services for job creation, improved livelihoods, food security and economic empowerment.

Through increased productivity, energy access can be stimulated by private sector revenue. In the long term, increased energy access stimulates economic activity in communities, which in turn increases income and the proportion of income spent on energy, creating a continuous virtuous cycle. Productive use technologies have the potential to supplement demand, lower costs and to drive growth.<sup>15</sup> Residential demand and growth are often insufficient to make the business case for high-capacity generation tech, resulting in either high tariff structures or long CAPEX payback. Productive use of solar technologies – if properly targeted – have the potential to significantly, and perhaps sufficiently, supplement overall demand, boost productivity, and lower cost.<sup>16</sup> The agricultural sector employs over 70% of Uganda’s workforce and has significant potential for value addition

10 KAPADIA, K. (2004): Productive Uses of Renewable Energy: A Review of Four Bank-GEF Projects. January 2004 draft version. Washington, D.C [http://www.martinot.info/Kapadia\\_WB.pdf](http://www.martinot.info/Kapadia_WB.pdf)

11 IFC PULSE report, 2019. <https://www.lightingglobal.org/wp-content/uploads/2019/09/PULSE-Report.pdf>

12 Productive Use of Energy: Moving to scalable business cases, GIZ/ENDEV publication, pg 49, learning and innovation [https://endev.info/wp-content/uploads/2021/03/EnDev\\_Learning\\_Innovation\\_PUE.pdf](https://endev.info/wp-content/uploads/2021/03/EnDev_Learning_Innovation_PUE.pdf)

13 Productive Use of Energy: Moving to scalable business cases, GIZ/ENDEV publication, pg 49, learning and innovation [https://endev.info/wp-content/uploads/2021/03/EnDev\\_Learning\\_Innovation\\_PUE.pdf](https://endev.info/wp-content/uploads/2021/03/EnDev_Learning_Innovation_PUE.pdf)

14 GIZ’s “Productive Use of Energy – PRODUSE A Manual for Electrification Practitioners”: [http://www.produce.org/imglib/downloads/manual/euei\\_productive\\_use\\_manual\\_med.pdf](http://www.produce.org/imglib/downloads/manual/euei_productive_use_manual_med.pdf)

15 Promoting Productive Uses of Energy in Uganda Status and Potential for Growth, October 2017 report by open capital advisors and Shell foundation. [https://shellfoundation.org/app/uploads/2018/10/SF-OCA-Uganda-Accelerator-\\_-Productive-Use-Technology.pdf](https://shellfoundation.org/app/uploads/2018/10/SF-OCA-Uganda-Accelerator-_-Productive-Use-Technology.pdf)

16 Promoting Productive Uses of Energy in Uganda Status and Potential for Growth, October 2017 report by open capital advisors and Shell foundation. [https://shellfoundation.org/app/uploads/2018/10/SF-OCA-Uganda-Accelerator-\\_-Productive-Use-Technology.pdf](https://shellfoundation.org/app/uploads/2018/10/SF-OCA-Uganda-Accelerator-_-Productive-Use-Technology.pdf)

# Situation Analysis Report

across the country.<sup>17</sup> Productive use of equipment in agriculture could potentially increase individual monthly incomes by 30%.<sup>18</sup>

In Uganda, the Northern region is a particularly high potential for increasing irrigation and food security.<sup>19,20</sup> Due to the increasing bouts of drought last year across the country, access to solar irrigation has been noted as a government priority and is rapidly being included as a business line for several solar home systems (SHS) companies.<sup>21</sup>

## 2.4 Demand Analysis

Uganda is endowed with plenty of sunshine giving solar irradiation of about 5.1 kWh/m<sup>2</sup>/day.<sup>22</sup> This level of insolation is favourable for all solar technology applications. Solar energy applications in Uganda include solar PV, water heating, cooling, and crop drying. The estimated market potential for solar is the over six million households that lack access to electricity<sup>23</sup>, thus referred to as the total market potential.

In Uganda, even at the currently limited scale of adoption, PUSE has been used by farmers to increase farm yields and revenues, reduce post-harvest losses, and build resilience to shocks.<sup>24</sup> Greater application could stimulate growth in electricity demand and enhance progress in the

real economy. Further, small-sized off grid solar system (OGS) such as water pumps and sprinklers, milling, and refrigeration can be leveraged by over 80% of Uganda's smallholder farmers for various crop value chains. In Uganda, solar water pumps have high initial costs averaging UGX 4 to 8 million; diesel pumps are cheaper to buy but have relatively lower life spans compared to solar pumps.

Presently, solar-powered irrigation is more scalable compared to other solar-powered productive use applications given its relative competitiveness in the long-term, against alternatives like diesel and petrol pumps (high maintenance costs and volatile prices of the fuels). Further, solar water pumps can be purchased by individuals, compared with larger assets such as milk chilling plants or produce processing equipment which are only economically viable for large commercial farmers, or require farmer groups to pool resources.

In the health sector, rural health centres particularly suffer unreliable energy and water supply. Solar water pumping and solar refrigeration systems could secure their water supply and provide cold storage for vaccines and samples respectively.

**Table 2.3 - Productive Use of Solar Energy Applications**

Category	Applications	Band by minimum daily consumption
Large agro-processing	<ul style="list-style-type: none"> <li>Coffee hulling, maize, rice, and millet processing.</li> <li>Tea processing, oil pressing, milk processing, tea, and beef processing.</li> </ul>	2 to 9 KWh
Cold chains	Storage for agricultural products or inputs and health products like medicines and vaccines.	0.1 to 1.5 KWh
Small agro-processing	Dryers, low-capacity milling, threshers, oil seed pressers.	
Irrigation	Sprinklers and water pumps.	
Retail appliances	Fridges, television for cinema halls, radios, hair clippers for salons, phone charging.	0.012 to 0.1 KWh

17 CIA World Factbook: <https://www.cia.gov/the-world-factbook/>

18 National Survey and Segmentation of Smallholder Households in Uganda <https://www.cgap.org/research/publication/national-survey-and-segmentation-of-smallholder-households-in-uganda>

19 Future Water's map of irrigation potential in Nile Countries: <http://www.futurewater.eu/projects/irrigation-potential/>

20 FAO report on food security in the Horn of Africa: <https://www.fao.org/3/x8530e/x8530e00.htm>

21 Promoting Productive Uses of Energy in Uganda Status and Potential for Growth, October 2017 report by open capital advisors and Shell foundation. <https://shellfoundation.org/app/uploads/2018/10/SF-OCA-Uganda-Accelerator--Productive-Use-Technology.pdf>

22 GIZ 2022: Sector Brief Uganda: Renewable Energy - <https://www.giz.de/en/downloads/giz2022-en-sectorbrief-uganda-renewable-energy.pdf>

23 <https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=UG>

24 UOMA 2020: Productive Use of Energy in Uganda: Learnings from the Uganda Off-Grid Energy Market Accelerator (UOMA) <https://uoma.ug/1336-2/>



# Situation Analysis Report

## 2.5 Supply Analysis

PUSE Technology suppliers interviewed predominantly deal in energy technologies for agriculture, with the highest agricultural application being seen in irrigation. Solar water pumps are sold by 45% of the interviewed companies.

## 2.6 Available Opportunities in PUSE

There are several opportunities for Productive use of Energy in Renewable Energy as listed in

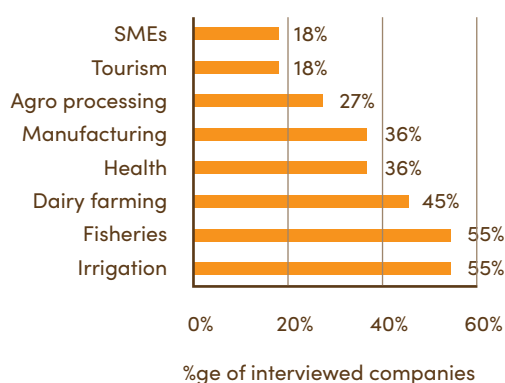
Table 2.6. The details regarding the opportunities with key highlights and technologies required is in Annex 3.

## 2.7 Access to Finance

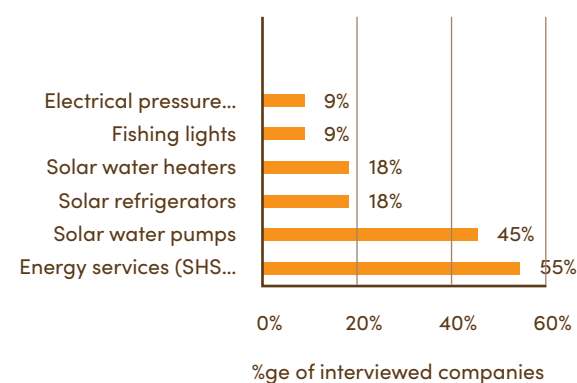
PUSE financing in Uganda is an amalgamation of debt, retained earnings, equity, grants, venture, and impact investments. Both local and international investors are players on the scene. Some of the key financing projects or actors are summarized in the Table 2.5.

**Figure 2.1 – Supply sector – company profiles**

**Sectors served by interviewed companies**



**Percentage of companies dealing in particular technologies**



**Table 2.4 – Sectors with opportunities of Productive use of energy**

Sectors with Opportunities for PUSE	Required Technologies
Agriculture, Fisheries, Poultry, and Dairy Industry	<ul style="list-style-type: none"> <li>Solar water pumping for irrigation and animal feeding, fishponds</li> <li>Cold room storage for milk and fish</li> <li>Lighting (solar fishing lights)</li> <li>Egg incubation</li> <li>Motorised spray pumps</li> <li>Milking machines</li> </ul>
Transport – E-Mobility	<ul style="list-style-type: none"> <li>Electric vehicles and motorcycles</li> <li>Storage or charging stations</li> </ul>
E-cooking	<ul style="list-style-type: none"> <li>Solar powered electric pressure cookers or enabled cook stoves</li> </ul>
Tourism Sector	<ul style="list-style-type: none"> <li>Solar water heaters</li> <li>Quality storage batteries</li> <li>Quality inverters</li> </ul>
Health – Vaccine & pharmaceutical storage	<ul style="list-style-type: none"> <li>Cold room storage</li> <li>Lighting</li> <li>E-cooking technologies</li> </ul>
Information Communication Technology	<ul style="list-style-type: none"> <li>Panels</li> <li>Inverters</li> <li>Batteries</li> <li>Rectifiers</li> </ul>

# Situation Analysis Report

## Box: Innovative Integrated Energy Approach

### Case Study: Innovative Integrated Energy Approach

Utilities 2.0 (Twaake) Project is a strategic initiative led by Power for All and a consortium of partners (East African Power, Equatorial Power, Energrow, Umeme Limited, Zola Electric (formerly Off-Grid Electric), the University of Massachusetts, Makerere University and CLASP, among others) with the goal of testing cost effective and faster ways accelerating access to electricity. Sites: A. Grid connected sites: Kyampisi and Nyenje B. Non-electrified sites: (Namasumbi and Kiwumu) 3km off the grid.

#### Approach:

- Joint Set up of Solar mini-grids in the two non-electrified sites (Kiwumu and Namasumbi).
- Provision of commercially productive appliances to the customers in one of the electrified villages and one non-electrified village (Kiwumu).
- Preparation for near future integration by aligning the solar mini-grid network and metering designs to Umeme standards.
- Joint implementation and knowledge transfer.

#### Objectives:

- Test the benefits of integrating centralized and decentralized energy (including solar home systems, mini-grids, grid, and smart grid technology) on accelerating access faster and more cost effectively.
- To test the impact of appliance financing on stimulating demand for both existing and new customers, to improve profitability and customer livelihoods.
- To test how decentralized technologies can be used to improve electricity reliability and help reduce distribution losses.

**Table 2.5 - Projects implementing Productive use of Energy in Renewable Energy**

Financing Institution	Projects on Productive Use of Energy
Government	<ul style="list-style-type: none"> <li>• WB has launched the Energy Access Scale-up Project (EASP) implemented by MEMD and Uganda Energy Credit Capitalisation Company (UECCC) with PUSE as one of the key areas of focus.</li> <li>• The Micro-Irrigation scheme under the Uganda Intergovernmental Fiscal Transfer (UgIFT) program has supported several solar powered irrigation (SPI) companies to reach farmers.</li> </ul>
Donors (Grants and RBFs)	<ul style="list-style-type: none"> <li>• GIZ EnDev has two RBFs supporting market-based approach of PUSE (with one focused on SPIs for agriculture).</li> <li>• CLASP has recently launched a PUSE Results-based Financing (RBF) (with support from Global Energy Alliance for People and Planet (GEAPP) in several countries including Uganda).</li> <li>• Beyond the Grid Fund for Africa (BGFA) has launched in Uganda its second window in Uganda with PUSE as one of the target areas.</li> </ul>
Debt	<ul style="list-style-type: none"> <li>• SIMA's Energy Access Relief fund continues to provide debt to companies including PUSE companies.</li> <li>• Local debt financing is still a challenge for most PUSE companies.</li> </ul>
Investors	<ul style="list-style-type: none"> <li>• Angel investors, impact investors and venture capitalists and impact investors are increasingly picking interest in PUSE.</li> </ul>

# Situation Analysis Report

**Government:** The government is partnering with development agencies and other governments to finance PUSE. The EASP will under its financial intermediation component through the UECCC offer access to finance for entrepreneurs' PUSE applications such as solar milling, solar irrigation and refrigeration. The government of Uganda is also employing instruments such as export loans. Nexus Green was contracted by the government of Uganda to supply and install 687 micro-irrigation sites supported by a \$104.1 million loan from UK Export Finance.

**Grants and RBFs:** RBFs schemes are commonplace especially for near-to-market and mature technologies. RBFs are increasingly utilised as an implementation modality from smaller funding tickets to larger million-euro tickets. Under this modality, companies receive an incentive for achieving pre-agreed milestones and targets. BGFA has recently launched the BGFA 6.3 million EUR fund targeting among other applications, productive use. GIZ EnDev had two RBFs targeting PUSE, with one specifically focusing on solar irrigation for horticulture. SEforAll has Uganda as one of its target countries for the Universal Energy Facility targeting productive use and mini grids. It should be noted that while RBFs offer a good opportunity for financing to companies, they often have stringent eligibility and verification requirements that may be prohibitive for the smaller companies.

**Debt:** Local debt financing is still low. The local financial institutions (FIs) still regard most of the business models as risky and thus are reluctant to provide debt to the companies. The FIs also have high interest rates. Market rates for local currency loans are between 18 - 26%, and about 12% for US dollar borrowing. Their tenures vary from 1 to 5 years and are mostly collateralized. Impact debt financiers like SIMA fund are however also active in the sector with the Energy Access Relief Fund designed to offer low-cost unsecured loans of \$ 50,000 to \$ 2.5 million to energy companies in several countries including Uganda. Some companies also seek supplier credit as a form of financing operations, but this is not easy to attain especially for longer periods.

**Financing from own earnings:** Financing from profits/earnings is possible but still difficult. The business models like asset financing result

in unpredictable cash flows, working capital constraints and longer break-even periods. Cash models are possible but mostly in the commercial segment, otherwise, they require a long time to build a client base and are also affected by the affordability and access to end-user finance.

**Investors:** Foreign investment is not uncommon, but generally targets the larger PUSE companies or indeed the already foreign owned entities. Impact investors such as Acumen Fund that have previously provided impact investment for organisations such as Solar Now are still actively seeking investment opportunities to the tune of millions of Euros in PUSE in Uganda.

## 2.8 Coordination of PUSE Activities

MEMD is responsible for the coordination of sector players in the energy sector. Productive use of energy falls under the Sustainable Development Programme of the Ministry. The Sustainable Energy Development (SED) Programme is among the 20 programmes that have been earmarked for implementation in the National Development Plan III. The goal of the Sustainable Energy Development Programme is to meet the energy needs of the country by providing adequate, affordable, clean, and reliable energy for sustainable socio-economic growth and development. The sub-programmes under this programme are: Transmission and Distribution, Generation, Renewable Energy Development; Energy Efficiency and Conservation.

The Renewable Energy development sub programme established the Clean Energy Technical Working Group (CETWG) which is responsible for handling matters regarding clean energy that fall under the Sustainable Energy Working Group. Membership of CETWG is limited to representatives of the members of the SEDP.

To support the coordination of other sector players, the Renewable Energy Department established the National Renewable Energy Platform (NREP). NREP brings together sector players that include Ministries, Departments & Agencies, Development Partners, and Private Sector & Civil Society Organizations. NREP activities are handled under five thematic areas. Issues of PUSE in the roadmap will be addressed and coordinated under the Thematic Area of Technology Development and Deployment-TIDD.



# Situation Analysis Report

## 2.9 Challenges and Barriers to the promotion of PUSE

The productive use space in Uganda is still very nascent, as in other countries, particularly for smaller-scale applications in agriculture. Beyond the frequent usage of Tier 1 – 2 appliances such as solar lights and solar home systems to run retail shops, charge phones, and power other low-energy appliances such as TVs for entertainment halls, few examples exist across the region and even fewer cases in Uganda.<sup>25</sup> The bulk of medium-powered (Tier 3) appliances have high-impact potential but have limited traction in the market. High-powered productive use technologies (Tier 4 – 5) such as off-grid telecom towers are commercially viable and have existed for a while but have very few use cases in rural off-grid areas.<sup>26</sup>

Uganda's agricultural sector presents multiple highly profitable investment opportunities both for profit-oriented investments and partnerships. However, if Uganda's agriculture sector is not modernized with sustainably powered

technologies, the country risks missing its key development targets of reducing poverty, boosting prosperity, and creating jobs, especially for women and youth. The sector is facing quite a few constraints that have on a large extent also slowed the mechanization and scaling productive use of energy in this sector which is considered the backbone of Uganda's economy.

Barriers to access to debt financing include:

- Limited observed traction in revenues, cashflows, balance sheet and customers, increases the perceived risk of borrowers.
- Lack of robust data collection systems impedes credit assessments by Financial Institutions.
- Lack of collateral, which most banks heavily rely on to lend.
- Lack of awareness amongst distributors and businesses on process for effectively accessing loans.
- Quality inconsistencies in local on-and off-grid PUSE increases default risk by agriculture and healthcare businesses.



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25 Shell Foundation, UOMA, Promoting Productive Use of Energy

26 UOMA – PUE White paper, <https://uoma.ug/wp-content/uploads/2020/10/UOMA-PUE-white-paper.pdf>

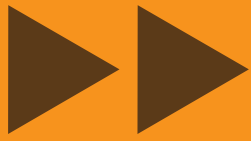
# Situation Analysis Report

**Table 2.6 – Key Challenges/Barriers regarding PUSE and the Proposed Actions to address them**

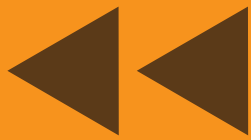
Challenge	Barrier	Required Action
There is lack of clarity in the Policy and Regulatory environment	<ul style="list-style-type: none"> <li>The tax regime for PUSE equipment and accessories is not clear to the suppliers and the tax body.</li> <li>There are sub-standard products of solar systems on the market.</li> <li>The sector players in PUSE are not well coordinated.</li> </ul>	<p>There is a need for the Government to put in place an appropriate policy and regulatory environment to promote PUSE.</p> <p>National Renewable Energy Platform (NREP) should ensure the sector Players in PUSE are well coordinated. Standards for solar PV systems should be developed and enforced.</p>
Limited access to affordable and patient financing / working capital for SMEs in PUSE	Many households and businesses in Uganda struggle to access financing for solar PV systems. This is important to address the high upfront costs of purchasing PUSE equipment which often hold back the scaling up of the sector.	<ul style="list-style-type: none"> <li>Wider periods of RBF programs and acceptance of applicants on a rolling basis.</li> <li>Government led funding for pilot projects with PUSE themed solutions that benefit farming communities.</li> <li>Government and Development Partners (DPs) should provide additional de-risking mechanisms to increase the level of intermediated PUSE lending through Fis.</li> <li>Government should increase investment into critical infrastructure, such as substations, to unlock PUSE investment.</li> <li>PUSE distributors should explore partnerships with financing schemes to access and extend flexible payment solutions.</li> <li>Sector associations should aggregate entrepreneurs to support purchase of equipment and machinery.</li> <li>Banks and MFIs should partner with DPs to grow their balance sheets for PUSE lending.</li> <li>FIs should explore trainings and other partnerships to build a pipeline of investment ready PUSE opportunities.</li> <li>Inclusion of guarantees in different transactions including manufacturers and suppliers or as supplier credits to distributors.</li> <li>Modification of existing guarantees to embrace PUSE.</li> </ul>
Underdeveloped supply chain, particularly in rural areas	The supply chain has not been well developed in the rural areas due to financial limitations.	<ul style="list-style-type: none"> <li>Develop local supply chains for PV solar systems to reduce costs and increase access particularly in rural areas where transportation costs can be high.</li> <li>Support expanded distribution infrastructure (e.g., sales outlets, sales force, and distribution partnerships) of solar companies that are focusing on, or have plans of distributing to, rural areas and under-served regions such as Northern Uganda. Support includes Technical Assistance to develop scalable businesses.</li> <li>Develop and operate models that are suitable for management systems and incentives to expand sales outlets e.g., results-based financing.</li> </ul>
Affordability Challenge	Most of the rural population without access to electricity cannot afford to pay for solar systems due high upfront costs due to both production and distribution.	<ul style="list-style-type: none"> <li>Provide financing facilities (loans but no subsidy because of the risk of market distortion) in particular, for base of the pyramid (BoP) and female consumers.</li> <li>Provide information on financing instruments (mobile payment, MFI, PAYGo, solar kiosks) and improved payment platforms (multiple language options, transactions security, etc.).</li> <li>Inform and sensitize local financial institutions on the good quality solar products and their benefits.</li> <li>Support MEMD to work with the Bank of Uganda, the Ministry of Finance, and local financial institutions to simplify lending requirements and repayment process for solar solutions.</li> <li>Support MFIs to set up solar companies (e.g., build on success stories from Asia).</li> </ul>

# Situation Analysis Report

<p>Limited levels of awareness and education</p>	<p>Many potential off-grid PUSE customers do not understand their potential benefits, how they work and where they can be obtained.</p>	<ul style="list-style-type: none"> <li>• Raise awareness about the benefits of solar energy, including cost savings, improved access to electricity, and how to access good quality products, to help increase demand for PV solar systems.</li> <li>• Develop clear product specification (performance, certification), training and user manuals for clients of PV products.</li> <li>• Finance awareness campaigns, information platforms at national and local levels and guidelines (e.g., on certified products and companies). Include specific messages targeting women, children, and potential productive activities.</li> <li>• Strengthen the role of private sector representatives such as the Uganda Solar Energy Association (USEA) for example, to finance awareness campaigns on certified products and companies.</li> <li>• Build an information portal through websites and mobile technology to share information to end users regarding good quality solar products and services.</li> </ul>
<p>Limited technical and institutional capacity</p>	<p>There is a shortage of skilled technicians in Uganda who can install and maintain solar PV systems.</p>	<ul style="list-style-type: none"> <li>• Government should build the technical capacity among local installers and technicians to ensure the quality and safety of PV solar system installations. This will increase consumer confidence in the technology.</li> <li>• Train and certify solar technicians for design, installation, and after-sales service.</li> <li>• Provide financial support i.e., to purchase the necessary equipment, hire qualified instructors, and develop training materials.</li> <li>• Curriculum Development: Government to support in the development of a curriculum that aligns with industry standards and provides hands-on experience in the installation and maintenance of solar PV systems.</li> <li>• Access to Training Materials: Provide access to up-to-date training materials, including textbooks, videos, and simulations, to help students learn about the latest advances in solar PV technology.</li> <li>• Partnership with Industry: Technical institutions to benefit from partnerships with local solar PV installation companies or other businesses in the renewable energy sector.</li> </ul>
<p>Limited emphasis on research and development, innovation, and knowledge sharing</p>	<p>There is limited research and a lack of knowledge sharing support mechanisms, codes, and protocols.</p>	<ul style="list-style-type: none"> <li>• Creation and sustenance of the linkages between academia, research institutions, industry, and District Local Governments (DLGs) by developing a guiding framework.</li> <li>• Promotion of indigenous, North-South, South-South technology transfer, knowledge, and resource mobilisation partnerships.</li> <li>• Establishment of PUSE innovation challenges, academies, and incubation hubs / innovation centres.</li> <li>• Piloting and demonstration of PUSE technologies and innovations i.e., DLGs, Communities, Social Institutions.</li> <li>• Establishment of innovative mechanisms / models for financing research, technology development and innovation.</li> <li>• Consolidation and harmonisation of the different research agendas on PUSE at national and regional levels.</li> <li>• Establishment of a mechanism, protocols, and code of practice for data collection, management and sharing.</li> <li>• Development and promotion of the decision support systems for investment in PUSE.</li> <li>• Establishment of the requisite information management infrastructure and knowledge hub for PUSE.</li> </ul>



# Roadmap to Leverage PUSE Applications to Realize National Economic Empowerment and Food Security Goals





# Roadmap to Leverage PUSE Applications to Realize National Economic Empowerment and Food Security Goals

## 3.1 Vision

“A vibrant and competitive productive use of the renewable energy ecosystem for food security and economic empowerment.”

## 3.2 Mission

“To create a local and national enabling environment to scale up Productive Use of Solar Energy (PUSE), a conducive, economic, coordinated, interlinked and political environment for private sector investment, and create employment and green jobs in the PUSE value chain for improved household incomes and service delivery.”

## 3.3 Objectives

The objective of a roadmap for Productive Use of Solar Energy is to outline a clear and comprehensive strategy for scaling up Productive Use of Solar Energy to meet energy needs in a sustainable way.

The Specific objectives for the roadmap include to:

- To improve the policy and regulatory environment for PUSE.
- To increase the level of awareness and information dissemination regarding PUSE.
- Provide affordable financing for PUSE.
- Enhance the capacity of the sector players in PUSE.
- To promote Research and Development in PUSE.

## 3.4 Scope of the Roadmap

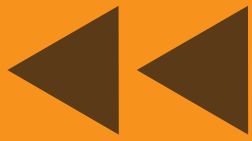
The national roadmap envisions scaling up PUSE in agriculture, health, transport, micro, small and mediums-sized enterprise (MSME), tourism and emerging markets in Uganda for the advancement of energy entrepreneurs for the next five years.







# Strategic Interventions to Address the Challenges



# Strategic Interventions to Address the Challenges

To achieve the goal and strategic objectives for the roadmap several key priority actions and interventions will be undertaken.

## 4.1 Enabling Environment for Scale Up

Government should create a conducive environment for private sector participation in the PUSE subsector. This is crucial for accelerating the adoption of renewable energy and achieving sustainable energy systems. The Actions to be undertaken include to:

- Develop and promote appropriate regulations to strengthen the regulatory environment for PUSE in Uganda.
- Develop, domesticate, and gazette standards and guidelines for PUSE equipment.
- Mobilise and engage stakeholders in PUSE to address issues in the PUSE sub-sector.
- Harmonise and domesticate the tax regime on entire PUSE packages with other East Africa Community member states.
- Harmonise and clarify the inconsistencies the tax regime criterion for PUSE packages.
- Develop and disseminate guidelines for handling waste from electronic waste.
- Mainstream the PUSE roadmap to ensure that all MDALGs incorporate PUSE in their Programmes, Projects, and Activities for sustainable development of communities.
- Strengthen the role and engagements of the SEDP technical working group on the PUSE.
- Coordinate Development Partners to avoid duplication of efforts and interventions on PUSE.
- Mainstream Gender, Equity, and Inclusivity in PUSE.
- Develop and promote a consumer protection code of practice and standards.

## 4.2 Increasing the level of knowledge, education and communication

The following groups are especially interesting for awareness building; innovators, fishers, information and communication technology (ICT) enterprises, workshops, MSME owners, aggregators (SACCO managers) and key opinion formers in the communities. They can help to spread awareness raising messages to a wider population to help stimulate demand.

To increase the level of awareness and information dissemination regarding the available opportunities in the Productive Use of Solar Energy, the following actions will be required:

- Conduct a Knowledge Attitude and Practices survey and value chain mapping among the key stakeholders with the PUSE ecosystem.
- Develop a PUSE Stakeholder Engagement Plan and activate respective communication pathways.
- Conduct education and awareness campaigns to inform the public about the benefits and opportunities of renewable energy as a way of increasing awareness. These campaigns could involve public lectures, workshops, seminars, and the use of social media platforms to disseminate information.
- Conduct energy barazas (discussion platforms) for citizen engagement on PUSE. This can be done by engaging with stakeholders, such as communities and businesses, to raise awareness of the benefits and available financing opportunities to encourage participation in renewable energy initiatives. This may include physical meetings or using online platforms for information sharing to disseminate information about renewable energy opportunities.
- Develop Productive Use of Solar Energy knowledge products (Information Education and Communication) materials and translate them into local languages to raise the level of understanding of the content.
- Set up demonstration sites at district local government level for specific end user categories such as farmers, the fishing community, women, people with disabilities (PWDs) and youth entrepreneurs to promote experiential learning.
- Establish a Community of Champions to help drive awareness and support for PUSE.

## 4.3 Affordable Financing

The issue of financing both at the service provider and the end user level should be addressed to make PUSE services affordable. Proposed actions include:

- Government should provide financial incentives to enable the market to grow: Governments can offer financial incentives such as tax waivers and subsidies. These incentives can help make renewable energy more affordable and competitive with fossil fuels.
- Design projects with grant components from

# Strategic Interventions to Address the Challenges

international organizations, and philanthropic foundations to support the development of renewable energy projects, especially in rural communities far from the main grid.

- Provide additional loans to both the equipment suppliers and end users at affordable terms. They can be obtained from banks, financial institutions, or other lenders.
- Engage investors interested in offering equity financing. This can be used by start-ups or early-stage companies that do not have access to traditional loans or grants.
- Support PUSE projects to register for carbon credits: Several PUSE projects can sell the right to emit carbon to other companies or organizations. This will provide an additional source of funding for renewable energy projects that reduce carbon emissions.
- Provide financing for startups and for extending the supply chain to rural communities. This could involve a result-based financing model.
- Government should promote Public-Private Partnerships (PPPs) in PUSE. The public and private sector organizations should combine to finance and implement PUSE projects. This will provide access to funding, expertise, and other resources that may not be available to either party alone.
- Promote pay-as-you-go (PAYGo) as a convenient way of financing some PUSE projects: There is a need to promote the use of PAYGo financing that involves providing renewable energy products to customers on a pay-as-you-go basis.

## 4.4 Capacity Building of the Sector Players

The members of USEA involved in the dissemination of renewable energy technologies require capacity training to build their skills and knowledge in various areas related to PUSE.

Here are some capacity training needs they may require:

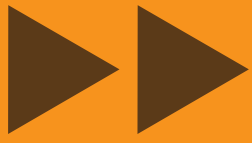
- Train technicians in the installation, operation, and maintenance of renewable energy systems. The systems include solar PV systems, solar dryers, solar water pumps, solar coolers, and energy storage systems. This may include training on the design, installation, and maintenance of renewable energy systems.

- Provide training in business skills, such as marketing of technologies, financial management, and project management. This may help them better manage their operations and expand their services.
- Offer training in environmental sustainability: Private sector companies involved in renewable energy require training on environmental sustainability, including best practices for reducing the environmental impact of their operations.
- Build the technical capacity of communities and end users in the operation and maintenance of PUSE equipment, so that there is capacity to repair the systems in case of system failure.

## 4.5 Research and Development

Research and Development (R&D) plays a critical role in advancing the Productive Use of Solar Energy. Here are some proposed actions in R&D include:

- Aligning science, technology, and innovation infrastructure to meet the needs of the PUSE sub-sector. This will entail a review of innovation systems and creating instruments / incentives to enhance triple helix collaboration between universities, industry, and government.
- Facilitation of networking among research institutions, academia, and industry for best practice sharing, and building partnership for collaborative R&D, technology, and innovation initiatives.
- Supporting the establishment of innovation challenges, academies and incubation hubs for technology transfer and innovation.
- Strengthening intellectual property rights (IPR) regimes as well as IPR protection infrastructure and capabilities in the country.
- Establishing innovative mechanism for profiling and financing indigenous R&D to catalyse innovation efforts and support collaborative Science, Technology, and Innovation initiatives.
- Organising regional and national technology conferences, webinars, and exhibitions to showcase and demonstrate latest trends in science, technology for industrial development.



# Activity Plan



## Activity Plan

The activity plan in Table 5.1 provides a list of activities to be undertaken to realize the intended objectives of the roadmap. The activity plan shows the timelines and the responsible entity to undertake an activity.

Table 5.1 - The activity plan to meet the roadmap objectives

Strategic Intervention	Activity	Timelines			Responsible Entity	Partner Agencies/ Partners
		Short	Medium	Long		
Enabling environment for scaling up	Develop and promote appropriate regulations to strengthen the regulatory environment for PUSE in Uganda.	X	X		MEMD	MoJCA, ERA
	Develop, domesticate, and gazette standards and guidelines for PUSE equipment.	X	X	X	MEMD	UNBS CLASP
	Mobilise and engage stakeholders in PUSE to address issues in the PUSE sub-sector.	X	X		NREP	MEMD
	Harmonise and domesticate the tax regime on entire PUSE packages with other East Africa Community member states.	X	X		MEMD	MoFPED, MoEACA
	Harmonise and clarify the inconsistencies the tax regime criterion for PUSE packages.	X			MEMD	MoFPED, URA, Private Sector, USEA
	vi. Develop and disseminate guidelines for handling waste from electronic waste.		X	X	MEMD	NEMA, DLGs
	vii. Mainstream the PUSE roadmap to ensure that all MDALGs incorporate PUSE in their Programmes, Projects, and Activities for the sustainable development of communities.	X	X		MEMD	All MDALGs
	viii. Strengthen the role and engagements of the SEDP technical working group on PUSE.	X	X		MEMD	SEDP PWG
	ix. Coordinate Development Partners to avoid duplication of efforts and interventions on PUSE.	X	X	X	NREP	MEMD, DPs, MoFA, MoFPED
	x. Mainstream Gender, Equity, and Inclusivity in PUSE.	X	X	X	MoGLSD	MEMD, DPs, CSOs
	xi. Develop and promote the consumer protection code of practice and standards.	X	X	X	Uganda Consumers Trust	PSFU, MEMD, USEA, GOGLA



# Activity Plan

Strategic Intervention	Activity	Timelines			Responsible Entity	Partner Agencies/ Partners
		Short	Medium	Long		
Increase the level of knowledge, education and communication	Conduct a Knowledge Attitude and Practices survey and value chain mapping.	X			NREP	Power for All, USEA, GCIC
	Develop a PUSE Stakeholder Engagement Plan and activate respective communication pathways.	X			UNREEEA	NREP, GCIC, USEA Development partners
	Conduct awareness campaigns among stakeholders.	X	X	X	USEA,	UNREEEA, UBA, DPs, CSOs MEMD, MDALGs
	Conduct energy barazas (discussion platforms) for citizen engagement on PUSE.	X	X	X	NREP	USEA, UNREEEA, Power for All, etc.
	Develop Productive Use of Solar Energy knowledge products (Information Education and Communication) materials and translate them into local languages to raise the level of understanding of the content.	X	X	X	MEMD	Development partners, USEA, NREP, Private sector, Research Institutions, MoEs, MoICT&NG
	Set up demonstration sites at district local government level for specific end user categories such as farmers, the fishing community, women, people with disabilities (PWDs) and youth entrepreneurs to promote experiential learning.	X	X		NREP	USEA, DPs, UNREEEA, MEMD, development Partners
	Establish a Community of Champions to help drive awareness and support for PUSE.	X	X		NREP, SED-PWG	Ministries of Agriculture, Water, and Energy, Development Partners
Provide affordable and patient financing	Design, widen the scope and promote financial incentives such as tax credits and appropriate subsidies for PUSE products.	X	X		UECCC	MoFPED, MEMD
	Lobby for project funding with some grant or TA from development partners to support the development of PUSE.		X	X	USEA	UECCC, MEMD, PSFU
	Develop innovative finance, risk mitigation instruments, and mechanisms to de-risk and increase the level of intermediated PUSE lending through Financial Institutions.		X	X	UECCC	PSFU, MEMD

# Activity Plan

Strategic Intervention	Activity	Timelines			Responsible Entity	Partner Agencies/ Partners
		Short	Medium	Long		
	Develop a profile of projects that qualify to receive carbon financing and engage prospective buyers.		X	X	USEA	MDAs, USEA, MEMD
	Enhance blended finance and capacity aggregation mechanisms for the PUSE sub-sector for promotion of local content and capacity.	X	X		MEMD	USEA, PSFU
	Promote the use of PAYGo and other innovative financing mechanisms.	X	X	X	UECCC	Telecom companies, USEA, PSFU
	Provide support to PUSE businesses to raise capital and investment to strengthen the supply and demand for PUSE.		X	X	PSFU,	UECCC, UDB
	Develop a pipeline of investment ready proposals and businesses for productive use projects, including feasibility studies and technical documentation.	X	X		PSFU	MEMD, UECCC, USEA, Banks/ FIs, Bankers Association
	Provide support in availing critical transaction services in partnership with business development service (BDS) providers to unlock financing and crowd in further investors.	X	X		UNCDF	PSFU, BDS, USEA, UECCC, DPs
	Work with transaction advisors and a wide network of investors to ensure businesses receive high quality support.		X	X	PSFU	UECCC, USEA
	Establish and promote asset-based finance partnerships between tech suppliers and banks to unlock off-balance sheet financing solutions for technology sales.		X	X	ENERGROW	Banks, Tech suppliers, UDB, DPs, USEA
	Develop and adopt financial mechanisms for protecting vulnerable consumers with targeted social support.	X	X		MoGLSD	MEMD, USEA, MoFPED, UECCC
	Perform a diagnostic study of existing programs to support socio-economic development and economic diversification to create new financing mechanisms.	X	X		UOMA	PSFU, MoFPED, UDB
	xv. Create and promote incentives for the introduction of innovations in energy efficient PUSE technologies.	X	X		EEAU	DPs, SNV, MEMD
	Build capacity of off-grid sector providers to profile and use credit reference bureaus for credit scoring.	X	X		UMRA	MEMD, BoU, URSB, USEA

# Activity Plan

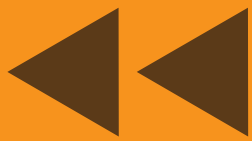
Strategic Intervention	Activity	Timelines			Responsible Entity	Partner Agencies/ Partners
		Short	Medium	Long		
	Expand RBF programs so that they are open for wider periods and accept applicants on a rolling basis, to avoid market distortion and exclusion of local market players, especially indigenous ones.		X	X	MEMD	USEA, DPs,
	Inclusion of guarantees in different transactions including manufacturers and suppliers or as supplier credits to distributors through receivables financing and microfinancing institutions that lend to consumers.		X	X	UECCC	Bankers Association, PSFU, MEMD, USEA
Enhance the capacity of the sector players in PUSE	Conduct Capacity Needs Assessment for the different stakeholders along the PUSE value chain.	X			UOMA	MEMD, CREEC, USEA
	Train technicians to address skill gaps in designing, installation, and maintenance of PUSE systems and business development issues.		X	X	CREEC	USEA, SENDEA, TVETs, MEMD
	Conduct workshops and trainings for Training of Trainers (TOT) to implement capacity building programs, including policy makers, companies, and individuals.		X	X	NREP	USEA, SENDEA, TVETs, CREEC
	Train communities and end users on the operation and maintenance of PUSE equipment.		X	X	SENDEA	USEA, CSOs, UNREEEA, CREEC, AVSI, PSFU, DLGs
	Train private companies in business skills, such as marketing, financial management, and project management.	X	X	X	PSFU	USEA, CREEC, MEMD, Enterprise Uganda, UNREEEA
	Provide training on Environment, Social and Governance including best practices for reducing the environmental impact of their operations.		X	X	NREP	USEA, UNREEEA, PSFU, MEMD, DLGs
	Train social and community engagement, including understanding the needs of local communities, gender, and equity considerations, building relationships with stakeholders, and managing community engagement programs.		X	X	MEMD	USEA, NREP, SIMA Funds, MoGLSD

# Activity Plan

Strategic Intervention	Activity	Timelines			Responsible Entity	Partner Agencies/ Partners
		Short	Medium	Long		
	Provide management training on resource mobilisation to enhance effective utilisation of solar resources for PUSE, development of internal systems and processes, monitoring and evaluation activities, and corporate governance amongst other areas.		X	X	PSFU	ECASA, Bankers Association, UECCC, MEMD
	Develop and strengthen institutional and infrastructural capacity to drive PUSE sub-sector needs.		X	X	NREP	USEA, NREP, SIMA Funds, ISA, The Open University, DPs
	Facilitate partnerships among PUSE value chain actors to enhance social capital for driving the sub-sector.		X	X	NREP	PSFU, USEA, UNREEEA, CREEC
Promote Research and Development, Innovation, and Knowledge Sharing	Create and sustain linkages between academia, research institutions, industry, and District Local Governments (DLGs) by developing a guiding framework.		X	X	NREP	MEMD, USEA, RESEARCH INSTITUTIONS, PSFU, UIRI
	Promote indigenous, North-South, South-South technology transfer, knowledge, and resource mobilisation partnerships.	X	X	X	MEMD	NREP, USEA, UIA, PSFU, UNREEEA
	Establish and support PUSE innovation challenges, academies, and incubation hubs / innovation centres.	X	X	X	NREP	MEMD, USEA, MoES, CREEC, STI-OP, UNREEEA
	Pilot and demonstrate PUSE technologies and innovations i.e., with DLGs, Communities, Social Institutions.		X	X	MEMD	NREP, USEA, RESEARCH INSTITUTIONS, MoES, DLGs
	Establish innovative mechanisms / models for financing research, technology development and innovation.	X	X	X	CREEC	MEMD, USEA, UNREEEA, RESEARCH INSTITUTIONS, UECCC, PSFU
	Consolidate and harmonise the different research agendas on PUSE at national and regional levels.	X	X	X	CREEC, EACREEE	MEMD, USEA, RESEARCH INSTITUTIONS
	Establish a mechanism, protocols, and code of practice for data collection, management and sharing.		X	X	NREP	MEMD, USEA, UNREEEA, CREEC, RESEARCH INSTITUTIONS
	Develop and promote decision support systems for investment in PUSE.		X	X	CREEC	MEMD, USEA, UNREEEA, CREEC
	Establish requisite information management infrastructure and a knowledge hub for PUSE.	X	X		CREEC	MEMD, USEA, UNREEEA, RESEARCH INSTITUTIONS



# Financing and Implementation Arrangement





# Financing and Implementation Arrangement

This section of the roadmap outlines the key considerations and broad approaches to financing and implementation arrangements. There is a need for a significant increase in the rate of disbursement of investment funds in the PUSE sub-sector. In the short to medium term, this capacity will have to come from both internal and external sources. To be executed successfully, the roadmap requires a centrally planned and centrally overseen investment program. To achieve the set targets, it is appropriate to work through existing and new sources of financing, and through appropriate allocations across the PUSE sector. Financing and implementation arrangements will be geared to achieve rapid and effective rollout of the roadmap, minimising transaction costs and ensuring good development partner coordination.

## 6.1 Implementation arrangement

A serious transition to renewables requires whole-of-system thinking and a program approach. This

will require commitment and willingness to work collaboratively across the renewable energy (RE) and energy efficiency (EE) sub-sector, and with development partners, private sector actors and government. To have any chance of meeting this roadmap's targets, the way of working in the RE and EE sub-sector will need to be qualitatively different than in the past, amongst the RE and EE private sector stakeholders, government, and the development partners. The ambitions mean that there is a need for planning and delivering projects, all at once, moving decisively in line with the shared vision. Doing so will require outstanding leadership and collaboration.

The roles and responsibilities for the different stakeholders in promoting this roadmap are in the Table 6.1. All the listed institutions have a role to play in the successful implementation of this roadmap.

**Table 6.1 - Roles of Stakeholders in Productive Use of Solar Energy**

No.	Institution	Roles in Productive Use of Solar Energy
<b>Government Ministries, Departments and Agencies</b>		
1.	Ministry of Energy and Mineral Development (MEMD)	<ul style="list-style-type: none"> <li>• Sets policies, regulations, and incentives to promote the development and utilisation of renewable energy.</li> <li>• Creates an enabling environment that encourages private sector investment in renewable energy.</li> <li>• Provides funding, infrastructure, and technical assistance to renewable energy projects.</li> </ul>
2.	Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)	<ul style="list-style-type: none"> <li>• Promotes the adoption of renewable energy technologies, such as solar and biogas in the agricultural sector.</li> <li>• Provides training and technical support to farmers and other stakeholders in the agricultural sector.</li> <li>• Develops policies and regulations for the agricultural sector.</li> <li>• Coordinates with other stakeholders.</li> <li>• Provides funding and incentives to the agricultural sector.</li> </ul>
3.	Ministry of Trade, Industry and Cooperatives (MoTIC)	<ul style="list-style-type: none"> <li>• Promotes the productive use of energy by supporting the adoption of renewable energy and energy efficient technologies in the industrial sector.</li> <li>• Provides training and technical support to stakeholders.</li> <li>• Provides funding and incentives to support the adoption of renewable energy technologies in the industrial sector.</li> </ul>
4.	Electricity Regulatory Authority (ERA)	<ul style="list-style-type: none"> <li>• Issues licences to companies involved in the distribution or sales of electricity.</li> <li>• Sets the electricity tariffs to be charged.</li> <li>• Puts in place standards and codes of conduct to be adhered to.</li> <li>• Puts in place the necessary regulations.</li> </ul>
5.	Ministry of Water and Environment	<ul style="list-style-type: none"> <li>• Implements projects that use renewable energy technologies for water pumping and other productive uses such as irrigation.</li> </ul>

# Financing and Implementation Arrangement

No.	Institution	Roles in Productive Use of Solar Energy
6.	Uganda Energy Credit Capitalisation Company	<ul style="list-style-type: none"> <li>Serves as a Credit Support Institution and to promote Private Sector led renewable energy Infrastructure Development.</li> <li>Provides financial, technical, and other support to Renewable Energy Projects in Uganda.</li> <li>Provides innovative financing modalities including Credit Enhancement Instruments directed at reducing real or perceived risks faced by primary lenders and other Financial Intermediaries.</li> </ul>
7.	Dairy Development Agency (DDA)	<ul style="list-style-type: none"> <li>Promoting the productive use of energy in the dairy sector in Uganda by supporting dairy processing plants.</li> <li>Promoting energy efficiency.</li> <li>Providing training and capacity building.</li> <li>Conducting research and development on the use of renewable energy technologies.</li> </ul>
<b>Private Sector</b>		
8.	Mini Grid operators	<ul style="list-style-type: none"> <li>Develop and implement renewable energy projects in Uganda.</li> <li>Invest in renewable energy projects and provide technical expertise and training.</li> <li>Increase the scale of renewable energy projects, create jobs, and promote economic growth.</li> <li>Mini-grid developers also develop PUSE projects.</li> </ul>
9.	Established distribution companies e.g. Aptech Africa, Davis & Shirliff, and Adtritex Advances Solar Power Limited, Tulima Solar, EnerGrow	<ul style="list-style-type: none"> <li>Distribute small-scale appliances from global manufacturers.</li> <li>Integrate systems with other use cases, for example offering solar water pumps with other components such as irrigation kits, tailored to the needs of the end user.</li> </ul>
10.	Solar Home System (SHS) operators e.g. Azuri Access to solar Village Power Power Trust	<ul style="list-style-type: none"> <li>Retail productive use of energy appliances such as solar refrigeration units and solar water pumps.</li> <li>Use pay-as-you-go (PAYGo) and cash payment models to facilitate the diffusion of the PUSE systems.</li> </ul>
<b>Financial Institutions</b>		
11.	Financial Institutions/ Microfinance Institutions	<ul style="list-style-type: none"> <li>Promote the adoption of renewable energy technologies by providing financing options to support PUSE in the country.</li> </ul>
<b>Industry Associations</b>		
12.	National Renewable Energy Platform (NREP)	<ul style="list-style-type: none"> <li>Optimise coordination of players / stakeholders and increase access to wider partnership opportunities in the development and delivery of collective actions to address shared challenges in the renewable energy sector.</li> <li>Shape and develop a harmonised strategic direction for the renewable energy sector.</li> <li>Strengthen private sector and institutional capacities in the renewable energy sector.</li> <li>Ensure quality assurance of technology implementation within the renewable energy sector.</li> <li>Strengthen national and global partnership to improve access to low-cost finance for RE and EE.</li> <li>Improve access to information, including funding opportunities for the renewable energy sector in Uganda and regionally.</li> </ul>
13.	Uganda Renewable Energy and Energy Efficiency Association (UNREEEA)	<ul style="list-style-type: none"> <li>Provides a common platform for the consolidation of private sector RE and EE actors.</li> <li>promotes RE market development through advocacy for favourable policy and regulatory environments.</li> <li>Campaigns for consumer protection and quality standards.</li> <li>Advocacy for standards and quality assurance among private sector RE and EE actors.</li> <li>Lobbies for just and patient financing of private sector RE and EE actors.</li> </ul>

# Financing and Implementation Arrangement

No.	Institution	Roles in Productive Use of Solar Energy
14.	Uganda Solar Energy Association (USEA)	<ul style="list-style-type: none"> <li>Provides a unifying platform for all private sector solar energy actors in the country.</li> <li>Promotes the development and adoption of solar energy technologies in Uganda.</li> <li>Lobbies for a conducive business environment for private sector solar energy actors.</li> <li>Undertakes capacity building training for solar systems technicians and companies.</li> <li>Conducts public awareness and sensitisation campaigns about solar energy.</li> </ul>
<b>Civil Society and NGOs</b>		
15.	Civil Society	<ul style="list-style-type: none"> <li>Work with communities to raise awareness about the benefits of renewable energy and provide training on how to use and maintain renewable energy technologies.</li> </ul>
<b>Development Partners and Foundations</b>		
16.	Development Partners	<ul style="list-style-type: none"> <li>Support the implementation of renewable energy projects in Uganda through funding, technical assistance, and capacity building to support the development of renewable energy projects in the country.</li> </ul>
<b>Academia and research institutions</b>		
17.	Academia	<ul style="list-style-type: none"> <li>Train experts for absorption across the entire energy value chain.</li> <li>Conduct research on renewable energy technologies and systems.</li> <li>Develop energy business models.</li> <li>Generate data and information that supports and guides decision making and planning.</li> </ul>

## 6.2 Financing arrangement

This roadmap will be financed mainly with resources from the private sector and development partners. In addition, some activities will be financed through budget allocations of the different MDAs. The respective stakeholders will mobilise funds accordingly to execute the earmarked activities. UECCC, which is mandated to coordinate for RE and EE sub-sector in Uganda, will lead in the drive for sourcing funds needed to execute this roadmap's activities. Currently, there are a range of financing facilities available in commercial banks dedicated to the promotion

of RE and EE technologies in the country. Also, UECCC will soon roll out a fund from the World Bank under the Electricity Access Scale-up Project dedicated to supporting access to clean energy for lighting, cooking and productive use. Furthermore, the Uganda Development Bank (UDB) receives significant funds from the Government of Uganda that are intended to support development and investment by the citizenry. Several international financing institutions offer grants and loans to actors in the RE and EE sub-sector to support its development.



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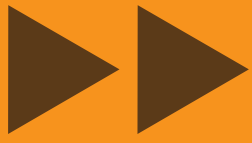
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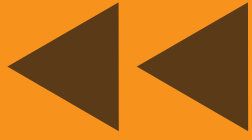


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# Annex



# Annex

## Annex 1 - The Policy Framework Supporting Productive use of Energy

Policy Framework	Key focus areas on PUSE	Responsible Agency
National Electrification Strategy	Government's universal energy strategy approved by the Ministry of Energy in 2022.	Ministry of Energy and Mineral Development
Draft Net Metering Code	Regulation governing bi-lateral sale of power between isolated grid operators and national utilities is currently being drafted and expected to be public in 2023.	Ministry of Energy and Mineral Development
Draft Energy Policy of Uganda 2022	The overall objective of the Energy Policy of Uganda 2022 is to ensure sustainable, adequate, affordable, competitive, secure, and reliable supply of energy at the least cost geared to meet national and county needs while protecting and conserving the environment. The strategic interventions include: Promotion of the productive use of energy for increased uptake and affordability of energy services in collaboration with other government agencies, focused on raising public awareness of energy resources, services, and programs The draft policy is before Cabinet for review and approval. It is expected to be approved in 2023.	Ministry of Energy and Mineral Development
The Renewable Energy Policy for Uganda 2007	Serves as the framework for renewable energy projects throughout the country and seeks to increase the share of renewables in the energy mix and make modern renewable energy a substantial part of the national energy consumption.	Ministry of Energy and Mineral Development
PUE Strategy	Strategy to improve the productive use of energy for solar applications is being developed by MEMD with support from Uganda off-grid market accelerator (UOMA)	Ministry of Energy and Mineral Development
National irrigation Policy	Policy objectives include: <ul style="list-style-type: none"> <li>To promote an Integrated Water Resources Management approach in irrigation planning, development, and management.</li> <li>To ensure that irrigation planning and development is technically feasible, economically viable, socially desirable, and environmentally sustainable.</li> <li>To strengthen institutional capacity at all levels for coordination, planning, development, and management of irrigation systems.</li> <li>To ensure efficient water use and functionality of irrigation systems.</li> <li>To promote the generation and utilization of irrigation research, innovations, technologies, and technical support services.</li> </ul>	Ministry of water and environment
Agricultural Sector Strategic Plan	The objectives include: <ul style="list-style-type: none"> <li>Promotion of micro and small-scale irrigation technologies as part of the climate change adaptation and mitigation strategy.</li> <li>Develop solar-powered micro and small-scale irrigation systems for smallholder farmers outside conventional irrigation schemes.</li> <li>Support to the private sector (suppliers and distributors) building the irrigation value chain and increasing access to technologies / spare parts / operation and maintenance.</li> </ul> <p>ASSP WfAP FIP recognizes that farmers' financial contribution is key to ensuring ownership and sustainability of irrigation development and leveraging public funds to speed up irrigation scale-up.</p>	Ministry of Agriculture Animal Industry and Fisheries
Electricity Connections Policy 2018	The policy subsidizes electricity connection fees and reduces inspection fees while raising awareness among the population about the policy and its benefits.	Ministry of Energy and Mineral Development
Rural Electrification Strategy and Plan (RESP II) 2013-2022	Targets access and service penetration of 26% for rural customers and the expansion of the household solar market towards achieving universal energy access by 2030.	Ministry of Energy and Mineral Development
Uganda Micro, Small and Medium Enterprise (MSME) Policy	The policy focuses on creating an enabling environment for Sustainable MSMEs for Wealth Creation and Socio-Economic Transformation.	Ministry of Trade Industry and Cooperatives
Local economic development policy	The policy aims to facilitate large organization to partner with SMEs for joint venture, outsourcing and sub-contracting among others and developing local entrepreneurship skills for SMEs, especially those operated by women and other vulnerable segments to increase their capacity for innovation and business growth	Ministry of Local Government

## Annex 2 - Roles and Responsibilities of Key Stakeholders in PUSE

Category	Stakeholder	Role and Responsibilities
Government	Ministry of Energy and Mineral Development	Policy and regulations Broadly supportive incl. promoting renewables, petitioning Treasury for tax exemptions
	Ministry of Agriculture, Animal Industry and Fisheries	Focused on mechanization, improving yields, climate resilience
	Ministry of Water and Environment	Developing policies and guidelines for agricultural transformation through irrigation development
	Ministry of Trade and Cooperatives	Regulating hire purchase transactions
	Ministry of Local Government	Developing policies and guidelines to promote government projects at district level.
	Ministry of Finance and Economic Development	Tax exemptions
	Uganda Revenue Authority	Tax exemptions
	Dairy Development Cooperation Uganda National Bureau of Standards	Ensuring standards and quality of products
Donor and Foundations	GIZ/ENDEV	Technical and financial assistance, grants, market development, and RBF
	SNV	Technical and financial assistance, grants, market development, and RBF
	UNCDF	Technical and financial assistance
	GGGI	Technical and financial assistance, and curriculum development for SWP
	UNDP	
	USAID/POWER AFRICA	Technical and financial assistance, grants, and RBF
	Shell Foundation	
	Rockefeller foundation	Technical and financial assistance and grants
Financial institutions	Equity Bank	Credit support to off-grid companies and end-users
	Centenary Bank	Credit support to off-grid companies and end-users
	Stanbic Bank	Credit support to off-grid companies and end-users
	UECCC	Credit support to off-grid companies and end-users
Microfinance institutions Industry groups	SACCO'S	
	VSLA's	
	Fintechs	
	Uganda Solar Energy Association	Advocacy, self-regulation and formed the TWG
	Uganda National Renewable Energy and Energy Efficiency Alliance	Advocacy, policy formulation, capacity building
Drilling associations		
Private Sector Companies	All solar energy service companies	
Training and research	Centre for research in energy and energy conservation	Research and testing
	Strategic impact advisors	
	Uganda open market accelerator (UOMA)	Market intelligence reports
Aggregators or off takers	Agriculture cooperatives	End users of Productive Use of Solar appliances and technologies
	Dairy Cooperatives	

# Annex

## Annex 3 – Available Opportunities for Productive Use of Solar Energy

Opportunity/Industry	Key Highlights	Required Technology
Agriculture, Fishing, Poultry, and Dairy Industry	<ul style="list-style-type: none"> <li>Eighty percent of Uganda’s land is arable but only 35% is being cultivated.</li> <li>In FY 2021/22, agriculture accounted for about 24.1% of GDP, and 33% of export earnings.</li> <li>The UBOS estimates that about 70% of Uganda’s working population is employed in agriculture.</li> <li>According to the Ministry of Agriculture, agriculture remains the major source of livelihoods in Uganda.</li> </ul>	<ul style="list-style-type: none"> <li>Solar water pumping for irrigation and animal feeding, fishponds</li> <li>Cold room storage for milk and fish</li> <li>Lighting (solar fishing lights)</li> <li>Egg incubation</li> <li>Milking machines</li> <li>Fertilizing sprays</li> </ul>
Transport – E-Mobility	<ul style="list-style-type: none"> <li>Uganda’s transport is dominated by road transport of which only about 30% constitutes a paved network.</li> <li>There are over 1 million motorcycles in Uganda.</li> <li>20 electric vehicles have been assembled and currently operate in Uganda.</li> <li>There are four companies in the motorcycle sub-sector, with over 300 motorcycles sold or repurposed in the last 3 years.</li> <li>There is limited charging infrastructure in Uganda, only 27 stations exist to serve 300 e-motorcycles.</li> </ul>	<ul style="list-style-type: none"> <li>Electric vehicles and motorcycles</li> <li>Storage or charging stations,</li> </ul>
E-cooking	90% of the population in Uganda depends on biomass for cooking and heating. There is a need to expand the use of e-cooking solutions to avert the impacts of increased deforestation.	Solar powered or enabled cook stoves
Mini – grid development	<p>Many people in rural Uganda do not have access to electricity. Mini-grid’s could provide a quick intervention. GIZ has supported construction of over 60 mini-grids in Northern Uganda.</p> <p>The Ministry of Water commissioned the construction of 687 solar powered irrigation sites across the country. The company constructing these mini grids is nexus green.</p>	Solar water panels, Quality storage batteries Quality inverters
Tourism Sector	<p>Many of the tourist campsites, cottages and most hotels are in areas that are not connected to the grid.</p> <p>There is need for solar energy for lighting, cool chain, water heating, etc.</p>	Solar water panels Quality storage batteries Quality Inverters
Health – Vaccine & pharmaceutical storage	Many of the health centres located upcountry in the rural regions do not have access to electricity. This causes problems during childbirth, for vaccines storage and for basic light and power for health services.	Cold room storage Lighting E-cooking technologies
Horizon/Emerging PUSE solutions	<ul style="list-style-type: none"> <li>In small towns, metalworking is a growing business, mentioned as important by several stakeholders. Although the energy demand is higher for the type of equipment, there may be a niche for equipment that is modestly powered.</li> </ul>	Compressors Spot-welding

## Annex 4 - Outstanding Issues in the PUSE Sub-sector that require proper Coordination

Enabling Environment	Convening Efforts	Tax Regime	Policy & Regulation
Overall, supportive government to PUSE appliances.	USEA, established in 2016, is the largest and most relevant association for solar PV off-grid operators.	Current tax regime VAT (18%) and import duties (22%). However, tax exemptions apply to smartphones and SWP, while reduced taxes apply to SHS, solar torches and hair straighteners.	Inter-ministerial efforts by MEMD under the Rural Electrification Program (REP) still lack policy coherence and face inadequate coordination among stakeholders.
VAT exemptions on solar kits but not yet on many PUSE solutions	USEA, supported by UNREEEA, is carrying out a survey on its members and other relevant sector players to gather data on PUSE systems and services.	EAC countries have a duty exemption for PV panels and batteries only, but not accessories or appliances	
Vibrant mobile money and growing PAYGo	Power for All initiative: Powering Uganda's Agriculture - a multi-stakeholder platform for the off-grid RE agri-food system.	Still inconsistent implementation of tax exemption at ports of entry	There is not yet a qualified research and testing institutions for off-grid PUSE appliances
Growing funding investment in PUSE businesses (early -stage capital, RBF, and innovation challenge funds	Relevant key stakeholders missing i.e., manufacturers, consumer finance institutions.	Local assembling in Uganda not commercially attractive although there are industrial areas established by government (UIA)	Inadequate national policy framework that harmonises priorities of the Ministry of Energy and Mineral Development and the Ministry of Agriculture Animal Industry and Fisheries



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