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MINISTRY OF WATER AND ENERGY
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National Roadmap for Scaling Up Productive Use of Renewable Energy in Ethiopia

Unlocking the Potential of Renewable Energy for Economic Development

WATER and ENERGY for FOOD

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Acronyms

ACCs:	Agriculture Commercial Clusters
ADELE:	Access to Distributed Electricity and Lighting in Ethiopia
ASEDA:	Amhara Solar Energy Development Association
AfDB:	African Development Bank
ATI:	Agricultural Transformation Institute
CAE:	Conformity Assessment Enterprise
CoE:	Center of Excellence
CRGE:	Climate Resilience Green Economy
CSA:	Central Statistics Agency
DBE:	Development Bank of Ethiopia
ECAE:	Ethiopian Conformity Assessment Enterprise
ECC:	Ethiopia Customs Commission
EEA:	Ethiopian Energy Authority
EEU:	Ethiopian Electric Utility
EIC:	Ethiopia Investment Commission
EnDev:	Energy Development
ERA:	Ethiopian Road Authority
ESA:	Ethiopian Standards Agency
ESEDA:	Ethiopian Solar Energy Development Association
ETB:	Ethiopian Birr
EU:	European Union
FOREX:	Foreign Exchange
GDP:	Gross Domestic Product
GIZ:	German Society for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit)
GOE:	Government of Ethiopia
GOGLA:	Global Off-Grid Lighting Association
IAIPs:	Integrated Agriculture Industrial Parks
JCC:	Job Creation Commission
kWh:	kilowatt-hour
LDCs:	Least Developed Countries
MCCs:	Milk Collection Centers
MFI:	Microfinance Institution
MILLs:	Ministry of Irrigation and Lowlands Development
MoA:	Ministry of Agriculture
MoF:	Ministry of Finance
MoPD:	Ministry of Planning and Development
MoTRI:	Ministry of Trade and Regional Integration
MoWE:	Ministry of Water and Energy
MQCS:	Market-friendly Quality Control Standards
MSMEs:	Micro, Small, and Medium Enterprises
MW:	Mega Watt
NBE:	National Bank of Ethiopia
NEP:	National Electrification Program
NGOs:	Non-governmental Organizations
OGS:	Off-Grid Solar
OSEDA:	Oromia Solar Energy Development Association
PAYGO:	Pay-as-you-go
PEAE:	Power East Africa Engineering PLC
PLC:	Private Limited Company
P&P:	Plug and Play
PR:	Public Relations

Acronyms

PURE:	Productive Use of Renewable Energy
R&D:	Research and Development
RBF:	Result-Based Financing
REBs:	Regional Energy Bureaus
RMI:	Rocky Mountain Institute
SACCOs:	Savings and Credit Cooperative Organizations
SDGs:	Sustainable Development Goals
SEFFA:	Sustainable Energy for Smallholder Farmers
SSEDA:	Southern Solar Energy Development Association
SWP:	Solar Water Pump
TSEDA:	Tigray Solar Energy Development Association
TVET:	Technical and Vocational Education Training
USAID:	United States Agency for International Development
USD:	US Dollar
WTP	Woreda Transformation Plan
VAT:	Value-Added Tax

Acknowledgements
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Executive Summary

The National Roadmap for Scaling Up Productive Use of Renewable Energy in Ethiopia aims to create an enabling environment for the scaleup of a sustainable PURE market in Ethiopia, bringing the country one step closer to unlocking the economic and livelihood opportunities enabled by universal energy access and achieving the Sustainable Development Goals (SDGs). It provides an overview of the current PURE market situation, the policies in place, the barriers to scaling up PURE, and the priority actions needed to address them.

The roadmap builds on the foundations created by the Market Assessment for the Productive Use of Renewable Energy in Ethiopia (July 2023), which identified several opportunities for scaling up the productive use of solar energy technologies. These opportunities are summarized in Table 1, with the market readiness levels further described in Annex 3.

Table 1 - Market Opportunities of Productive Use of Renewable Energy

- High market readiness level: The technology is ready to be scaled up and commercialized.
- Medium market readiness level: The technology is still in the piloting stage. It needs to be refined and perfected before it can be used on a large scale.
- Low market readiness level: The technology has not yet been proven to be commercially viable. It needs to be shown to be profitable and scalable before it can be brought to market.

Market Application	Technologies	Market Readiness Level (MRL)
Agriculture and Agro-processing	Solar water pumps for irrigation, primarily for cash crops	High
	Solar-powered hydroponic fodder for animal feed	Low
	Solar mills for agro-processing, primarily for grain milling	Medium
	Solar-powered sprinkler systems and drip irrigation systems	High
	Cold chain storage in horticulture value chains	Medium
Livestock, dairy, and poultry industries	Milking machines for animal husbandry	High
	Cooling / storage tanks for dairy	High
	Solar-powered butter churner and cream separator	High
	Solar-powered poultry shed lighting and heating	High
	Solar milk cans used for the distribution and transportation of milk	Medium
Micro, Small, and Medium Enterprises (MSMEs)	Solar-powered barber kits and hair clippers	High
	Solar charging stations for mobile phones	High
	Solar TV and solar refrigerators for restaurants and other businesses	High
	Solar lighting for extended business hours	High
	Solar sewing machines for small-scale garment businesses	Low
	Coffee washing for small coffee shops	Low
Transport: E-mobility	Electric two and three-wheelers for rural communities	Low
	Cold storage rooms in vehicles for the transportation of goods	Low
E-cooking	E-cooking gadgets, primarily stoves	Low

Executive Summary

Why Productive Uses of Renewable Energy?

Food security and agriculture productivity: In 2023, an estimated 20 million people[1] in Ethiopia required food assistance. The agricultural sector, which employs 75%[2] of Ethiopia's population, is struggling to meet the country's food needs. Only 5%[3] of Ethiopia's land is irrigated and the agricultural sector is characterized by a lack of decentralized agricultural mechanization technologies, weak post-harvest handling systems, and little to no modern animal husbandry technologies, refrigeration, and cold storage facilities. This leads to significant losses due to spoilage and quality deterioration, which directly correlates to food security issues and malnutrition.

Economic development and job creation: Ethiopia has a young and rapidly growing population. The country's overall population reached 117.9[4] million in 2021, and 50%[5] of its people are between the ages of 20 and 50. 600,000[6] new workers enter the labor force every year. In some urban areas, the unemployment rate among youth is as high as 19%,[7] with an even greater number of young people underemployed.[8] PURE products, appliances, and services can help to power agriculture and enterprise, leading to the creation of new employment opportunities. For example, PURE technologies in the horticulture, dairy, and grain milling value chain have the potential to create up to 190,000[9] new jobs.

Enhance access to energy: More than half of Ethiopia's population (56%)[10] still lacks access to electricity. Access to reliable and affordable energy is critical for Ethiopia's economic development, with a direct relationship to economic growth and eradicating poverty. Ethiopia's government recognizes the benefits of electricity for socioeconomic development and plans to electrify 100% of households by 2025. Of these connections, 35% will be off grid.[11] Alongside these efforts to rapidly accelerate access to electricity, PURE has the potential to significantly improve the livelihoods of Ethiopians disproportionately affected by energy poverty.

Living with climate change: Ethiopia is already one of the most drought-prone countries in the world, and climate change is expected to make droughts even more frequent and intense. It will lead to decreased crop yields, more frequent and severe floods, and sea level rise.[12] Replacing 50% of petrol-powered systems (by installing 800,000 solar water pumps) in Ethiopia will cumulatively eliminate production of 1.1 million tons of CO_2 and save $404 million on petrol costs for farmers by 2030. This rapid growth in solar irrigation would also result in a $7.1 billion increase in cumulative value of crops produced by 2030,[13] lift more than a million people out of poverty and raise Ethiopia's GDP by $203.5 million.[14]

1 Food and Agriculture Organization of the United Nations (FAO)
2 Agriculture and Food Security, USAID
3 Precise Consultation with Ministry of Irrigation & Lowlands
4 UN Population Division
5 UN Population Division
6 UN Population Division
7 USAID Feed the Future and CARE (2018), Labor Market Assessment Report
8 Ethiopia Job Creation through Off-grid Access, 2021
9 Ethiopia Job Creation through Off-grid Access, 2021
10 NEP 2.0, 2019
11 NEP 2.0, 2019
12 Climate Risk Profile: Ethiopia
13 Transforming a billion lives
14 Transforming a billion lives

Executive Summary

Call to Action

Scaling up the use of off-grid solar energy is essential for achieving Ethiopia's energy, food, water, economic, health, and education goals, as well as its climate change targets.

Considering the challenges facing Ethiopia's emerging off-grid solar market, public sector institutions and agencies responsible for energy, agriculture, water, and environment are encouraged to recognize the importance of off-grid solar and help to maximize its impact on Ethiopia's green growth and development agenda. Key actions include:

- **Ensuring an adequate supply of foreign currency and affordable financing for the PURE market:** This includes setting up a FOREX facility for PURE technologies and related products and appliances and prioritizing improving access to foreign currency for PURE import businesses, encouraging foreign investment in the PURE market, and providing guarantees and other forms of support to financial institutions that are lending to PURE businesses.
- **Establishing favorable policies and regulations for PURE market scaleup.** This includes removing barriers to entry for PURE businesses, providing tax breaks and other incentives, and creating a regulatory environment that is supportive of innovation.
- **Ensuring synergies, strategic alignment, and inter-ministerial coordination in the PURE ecosystem.** This will ensure that all stakeholders in the PURE ecosystem are working together towards a common goal. It can be achieved by strengthening the National PURE Taskforce, which is responsible for coordinating the activities of different stakeholders in the PURE ecosystem. The Taskforce should create a forum for dialogue and collaboration between different stakeholders and implement a comprehensive ecosystem awareness strategy to raise awareness of PURE technologies and their benefits.

Key Challenges for Market Scaleup

The Market Assessment for the Productive Use of Renewable Energy in Ethiopia (July 2023), outlines the challenges in policy, awareness, finance, capacity, demand, research, and development which are limiting the scale-up of the PURE sector. These include:

- Unfavorable policy and regulatory practices, such as unclear legislative or institutional frameworks and inconsistency in the implementation of regulations and plans.
- Severe foreign currency shortages, which make it challenging to import PURE technologies and other necessary products and appliances.
- Inadequate access to consumer financing, working capital, and innovative financing mechanisms.
- Limited awareness among PURE ecosystem players (including end users, suppliers, government, etc.) about the variety of PURE technologies, their usage, and the socioeconomic benefits they can provide.
- Scarcity of trained professionals who can provide technical assistance and support for installing, operating, and maintaining PURE technologies.
- Limited research, data, and information management practices, which makes it difficult to make informed decisions.
- Ambiguity in inter-ministerial coordination, synergy, and strategic alignment.

Executive Summary

Key Recommendations:

- The government should lead PURE ecosystem coordination to ensure alignment in implementing the national roadmap and addressing challenges in the sub-sector. This includes supporting the National PURE Taskforce to be a continuous endeavor and establishing multi-stakeholder periodical forums.
- The government should establish a revolving foreign exchange facility, encourage solar remittances, explore climate financing options, and help to attract foreign investment. The government should also work with international donors to secure grants and loans to help finance the import of PURE technologies.
- The government, in partnership with development partners, should implement an awareness campaign to profile PURE technologies amongst policymakers, government institutions, private companies, and end-users. This should include exhibitions and the launch of demonstration pilot projects to showcase the benefits of PURE technologies.
- The government should implement supply-side Result Based Financing (RBF) programs and consumer financing trust funds for end users with a low interest rate and explore innovative financing mechanisms and the smart use of end user subsidies to make PURE technologies more affordable for consumers.
- The government should review import tax policies and regulations to consider exemptions and/or reductions. Reducing taxes on PURE technologies will reduce their cost for low-income homes and businesses and help to increase private sector involvement in PURE market expansion. In addition, for more mature technologies, the government should create and implement a voluntary quality standard system based on the Verasol and/or International Electrotechnical Commission (IEC) system. RBFs, tax and tariff exemptions and other subsidies should be linked to quality verified products where appropriate.
- The government should establish a PURE knowledge hub or utilize the existing National Taskforce and ESEDA forums, to serve as a conduit for best practice development and dissemination, accelerating industry learning, reducing information asymmetries, and facilitating systemic changes across the supply side of the business model. The hub can provide a single point of access to data and information related to the PURE ecosystem.
- The government, in partnership with development partners, should provide training programs to train professionals in the installation, operation, and maintenance of PURE technologies. In addition, the government should provide technical support programs for key players, such as private companies, financial institutions, and solar industry groups, to enhance their capabilities.
- The government should support research institutions and universities to conduct strategic research and pilot programs on PURE applications to address market challenges.

Introduction and Background

Introduction and Background

1.1 Introduction

National Roadmap for Scaling Up Productive Use of Renewable Energy (PURE) in Ethiopia is designed to unlock the opportunities created by increased availability of solar powered technologies to improve productivity, income, and well-being. In turn this will help to realize Ethiopia's national development objectives. PURE can support the development of various sectors, including agriculture, animal husbandry, industry, transportation, healthcare, and education.

The roadmap is a valuable resource for policymakers, development partners, businesses, and other stakeholders who are interested in scaling up PURE in Ethiopia. It provides a comprehensive overview of the current situation, identifies the key challenges, and proposes priority actions to accelerate PURE technology adoption. The roadmap can help to guide efforts to promote the productive use of renewable energy in Ethiopia and contribute to the country's economic development and sustainable energy future.

1.2 Background

Ethiopia is the second most populous country in Africa after Nigeria, with a population of 117 million people.[15] It has one of the fastest-growing economies in Africa, with an average annual economic growth of 9.5% per year. The population is growing rapidly, and with it, electricity demand. The national power grid is struggling to maintain adequate transmission due to, among other things, substandard substations constructed around the country. Extending the grid system at the lowest possible cost requires energy off-takers to raise their energy demand or else it becomes uneconomical. Scaling up off-grid solutions is therefore critical to meeting Ethiopia's ambitious national electrification targets, outlined in the National Electrification Plan 2.0, while improving the reliability, affordability, and environmental sustainability of electricity supply.

Access to reliable and affordable energy is critical for Ethiopia's economic development, with a direct relationship to promoting economic growth and eradicating poverty. The country has abundant solar resources, receiving an average of 5.2 kWh/m^2/day of solar radiation.

The government of Ethiopia recognizes the many benefits that electricity can bring, such as improved health, education, and economic opportunities. To this end, the government has set a goal of electrifying 100% of households in Ethiopia by 2025. Of these connections, 35%, or approximately 9.2 million households, are expected to rely on off-grid sources. This is because the national grid is not yet able to reach all parts of the country, particularly rural areas. As of 2019, only 11% of households with electricity access were sourced from off-grid solutions. This leaves a 24% gap that the government needs to close to achieve its goal of universal electrification by 2025.[16]

Expanding the impact of this electrification through support for PURE has the potential to significantly improve the livelihoods of Ethiopians disproportionately affected by energy poverty. PURE products and appliances come with the potential to drive economic empowerment, improve livelihoods, support food security and mitigate the impacts of climate change. However, there are significant challenges to getting PURE products to last mile consumers, including affordability, availability, and awareness.

15 https://www.worldbank.org/
16 NEP 2.0, 2019

Situation Analysis

2.1 Fiscal Policy Framework and Institutional Framework

2.1.1 Fiscal Policy Framework

The Ethiopian government has implemented encouraging fiscal policies and legal measures over the past decade to develop the off-grid solar market.[17]

To encourage the sector, the Ministry of Finance modified the tax exemption clause in 2021 to include all productive use products and appliances that have a duty rate of 15% or less to be exempt from paying the 10% surtax.[18] Custom tax exemptions are also provided for agricultural PURE products and appliances, such as egg incubators, crop mills, chicken brooders, and milk churning equipment under the tariff rule modifications (see Annex 4).

The 2022 updates to Ethiopia's tax code specifically formalize the tariffs for imported solar products not subject to duty tax.[19] Ethiopia has also implemented other fiscal policy measures for the PURE sector, such as the provision of access to finance to consumers and suppliers through development banks and microfinance institutions (MFIs).[20]

However, while these measures have helped to develop the off-grid solar market, there is confusion and inconsistency around the implementation of tax rates and exemptions.[21]

2.1.2 Legal Framework

Ethiopia's PURE legal frameworks emphasize the use of off-grid electricity beyond lighting for productive uses, such as agricultural processing, water pumping, and small-scale manufacturing. These frameworks aim to promote the productive use of electricity services to enhance rural employment and income generation, as well as strengthen inter-sectoral linkages for the promotion of energy-efficient productive use technologies and services.

Table 2 - Ethiopia PURE related legal frameworks

Legal Framework	Key Focus Area and Objectives
National Electrification Program (NEP 2.0, 2019)	Provides the action plan, targets, and timetables for achieving universal electricity access nationwide by 2025. The plan's off-grid program components include providing pre-electrification solutions for those households not connected to the grid by 2025.
Ethiopian National Energy Policy (Draft, 2018)	The Energy Policy of Ethiopia was issued in 1994. Updated in 2013 and later in 2018. Both are still at draft level. The policy aims to ensure accessibility of affordable and reliable energy services to support and accelerate socio-economic development to: • Promote and enhance solar energy development and use. • Improve the security and reliability of energy supply and become a regional export power hub for renewable energy. • Increase access and connectivity to affordable modern energy. • Promote efficient, cleaner, and appropriate energy technologies and conservation measures. • Strengthen energy sector governance and building strong energy institutions. • Ensure environmental and social safety and sustainability of energy supply and utilization. • Strengthen energy sector financing through the involvement of the private sector.
Climate Resilience Green Economy (CRGE) strategy for water and energy (2015)	The CRGE promotes diversity and efficiency for electricity supply on the grid while promoting increased access through off-grid renewable energy technologies for off-grid areas.
Energy standards and regulations	The prevalent energy standards and regulations provide a set of standards for goods and services including off-grid solar products, verifies that goods and services meet the required standards, and implements standards and regulations.
Customs Proclamation No. 849/2014 - amended by Customs Amendment Proclamation No.1160/2019	The principal customs legal framework defines customs operations as the collection of charges and taxes on imported and exported goods. These charges and taxes are levied in accordance with the Customs Tariff Regulations and the International Convention on the Harmonized Commodity Description and Coding System. The framework also defines taxes as payments collected in accordance with the existing tax laws on imported and exported goods.

17 Ethiopia Customs Handbook, 2022
18 Ethiopia - Impact Assessment of Value Added Tax and Duty Exemptions
19 Off- and weak-grid solar appliance market, Ethiopia Country Profile, 2022
20 Off- and weak-grid solar appliance market, Ethiopia Country Profile, 2022
21 ACE-TAF Ethiopia Customs Handbook for SAS products and Components, 2022

However, in practice, these frameworks are fragmented and lack clarity, which has hindered their effectiveness. This is because the frameworks were mostly developed in response to ad hoc measures, rather than as a well-thought-out integrated action to address the country's key development objectives. Additionally, the frameworks provide limited fiscal policy incentives for PURE technologies.

2.1.3 Institutional Frameworks and Implementation Arrangement

The Ministry of Water and Energy (MoWE) is the leading government institution for the development and promotion of alternative energy resources and technologies, including PURE. MoWE coordinates with other government organizations, development partners, and the private sector to create an enabling environment for PURE solutions in the country.

The national PURE Taskforce, chaired by MoWE, will work with a variety of stakeholders, including government, private sector, and development partners, to implement the call-to-action activities (see Table 8) and ensure that Ethiopia's PURE market is scaled up sustainably and efficiently. The task force will do this by coordinating, implementing, and monitoring the activity plan.

International development partners and off-grid organizations will provide a range of support to ensure that the activities outlined in the roadmap are successfully implemented. These organizations include GOGLA, GIZ, World Bank, the IKEA Foundation, Selco Foundation, USAID, European Union (EU), Africa Development Bank (AfDB), Shell Foundation, and others.

The main government institutions involved in the scale up of PURE technologies scale-up and their key role are summarized in Table 3.

Table 3 - Policy Framework for PURE

Government Institution	Major Role	Roles in Upscaling of PURE
Ministry of Water and Energy (MoWE)	Responsible for resource planning, development, and management, as well as developing and implementing guidelines, strategies, policies, programs, and sectoral laws and regulations for PURE. Developing and promoting alternative energy resources and technologies, including PURE.	Lead
Ministry of Irrigation and Lowlands (MILLs)	The Ministry of Irrigation and Lowlands (MILLs) is a newly established ministry through Proclamation NO. 1263/2021 in October 2021 under the new government structure of Ethiopia to bridge the gap between energy and water infrastructures and agricultural productivity. Mandated to develop solar irrigation projects supported by innovative technologies that will enhance productivity and adopt mechanisms for effectively using natural resources.	Co-Lead
Ministry of Agriculture (MOA)	Leads efforts to improve agricultural productivity, sustainability, and farmer capacity building through extension systems. Promotes PURE technology adoption in agricultural and rural areas.	Co-Lead
Ministry of Planning and Development (MoPD)	Mandated to bring about rapid structural economic transformation and long-term development by guiding the economy through long-term and medium-term development planning.	Co-Lead
Agriculture Transformation Institute (ATI)	A strategy and delivery-oriented government agency, created to help accelerate the growth and transformation of Ethiopia's agriculture sector, including PURE technology adoption in the agriculture sector.	Co-Lead
Ethiopian Electric Utility (EEU)	Sells and distributes electricity. Responsible for providing cost-effective, safe, dependable, and high-quality power. Mandated for power purchase and sale, as well as the construction and operation of off-grid generation, sub-transmission, and distribution networks.	Co-Lead
Ethiopian Energy Authority (EEA)	Independent regulatory agency. Establishes and enforces technical and safety regulations for off-grid solar products along with Ethiopian Standards Agency.	Enable
Ethiopian Standards Agency (ESA)	Develops or adopts international standards for the productive use of solar products.	Enable

Regional Energy Bureaus (REBs)	Represents regional power priorities and makes grid and off-grid expansion possible.	Enable
National Bank of Ethiopia (NBE)	Regulates the financial industry including the supply, availability, and cost of money and credit, manages and administers the country's international reserves, supervises loans of commercial banks, and regulates interest rates.	Enable
Ministry of Finance (MoF)	Determines national budget allocation, fiscal policy measures and fiscal regulation.	Enable
Development Bank of Ethiopia (DBE)	A major financial intermediary in off-grid finance, whose activities range from managing revolving funds for customers to providing a line of credit to enterprises selling off-grid solar products and services. DBE is also well-positioned to leverage carbon credits and concessional financing to promote the growth of Ethiopia's off-grid solar industry.	Enable
Ethiopia Investment Commission (EIC)	Promotes investment in Ethiopia and facilitates implementation of investment opportunities and conditions to foreign and domestic investors.	Enable
Job Creation Commission (JCC) Ethiopia	JCC is mandated with the authority to lead the job creation agenda, coordinate stakeholders and monitor and evaluate performance. JCC uses MSMEs as means of creating employment for millions of young people and achieving the sustainable development goals.	Influence
Ministry of Trade and Regional Integration (MoTRI)	Responsible for checking that imported products comply with standards before they are cleared from customs.	Influence
Ethiopian Conformity Assessment Enterprise (ECAE)	Provides quality testing services for productive use technologies for importers and manufacturers.	Influence
Ministry of Transport (MOT)	Mandated to expand transport infrastructure, international standards, and establish a sustainable and reliable reform system for the transport sector. Responsible for e-mobility adoption, regulation, and market expansion.	Influence
Ethiopian Customs Commission (ECC)	Enforces tax law on PURE technology products, as per tax and customs legislation.	Influence

2.2 Stakeholders Mapping

Several actors operate in or influence the PURE market. These include government ministries, financial institutions, NGOs, foundations, industry groups and private sector companies. An overview of key stakeholders in Ethiopia's PURE ecosystem have been identified, along with their roles and duties, which can be found in Annex 1.

2.3 Overview of Productive Use of Renewable Energy Applications

PURE refers to the use of energy-efficient, solar-powered appliances that serve as a direct input for producing goods or providing services for income-generating activities.[22] PURE appliances, products, and services have the potential to transform various sectors in Ethiopia.

Agriculture: One such sector is the agricultural sector, which employs an estimated 75% of the country's population. The Government of Ethiopia (GOEs) has recently shifted its focus towards sustainable agriculture through decentralized renewable energy in recognition of its beneficial impact on farmer income, nutrition, job creation, and the potential foreign exchange earnings.

While a recent study of six agricultural production and processing opportunities in rural areas showed that an estimated USD 4 billion in additional annual value could be generated from activities such as irrigating horticulture, grain milling and milk cooling;[23] decentralized solar solutions could act as a catalyst in taking advantage of this opportunity.

22 International Institute for Environment and Development
23 Rocky Mountain Institute, Capturing Productive Use Dividend

Situation Analysis

PURE has the potential to increase income and productivity, mechanize agricultural activities, support the development of climate resilient industries, and create employment opportunities. Recent analysis of Ethiopia's agricultural sector found that PURE products and appliances can create 130,000 new jobs across the horticulture value chain, 50,000 jobs across the wheat value chain, and over 11,000 jobs in the milk sector.[24]

The Market Assessment for the Productive Use of Renewable Energy in Ethiopia (July 2023) found that in the short-to-medium period (> five years), the government will prioritize solar-powered irrigation initiatives to support the agricultural sector,[25] which is commercially viable with government subsiding.[26] The assessment revealed that there is the greatest potential amongst cash crops such as wheat, avocado, banana, mango, and fruits.[27]

Dairy and Horticulture: Government consultations further revealed that there are short-term aspirations to accelerate PURE scaleup in the dairy and horticulture sectors (via cold chain technologies), for use in grain milling and growing hydroponic fodder.

Micro-small and Medium Sized Enterprises (MSMEs): The GOEs plan to reach 3.3 million households through off-grid electricity access by 2025[28] could also help to catalyze the uptake of PURE. Already, micro-small and medium sized enterprises (MSMEs) use solar energy kits (lanterns and home systems) to support their businesses (e.g., with light, power, phone charging, hair clippers, entertainment systems and refrigerators etc.), while mini grids can also power a range of other productive assets (air coolers, freezers, food processors, water pumps, rice cookers and welding equipment). The government is also exploring how it can support MSMEs to further benefit from PURE technologies.[29] The breadth of sectors where PURE can play a catalytic role in Ethiopia are profiled in Table 4.

Table 4 - PURE Technologies Application

PURE Technologies	Power Source Structure	End User Subsector / Industry	Business Model
Solar Water Pumps Sprinkler systems and Drip irrigation Systems Solar Powered Hydroponic fodder Solar Mills Agriculture Cold storage Electric 2 and 3 wheelers Cold Storage Rooms in Vehicles Coffee Washing	Plug and Play (P&P) Component-based systems (which dominate the market)	Agriculture Production Agriculture post-Harvest Agro-processing Horticulture cold storage Washing, pulping, drying Transportation Milling	Vertical Integration Product sale (pay-to-own) Credit Fee-for-Services
Milking Machine Milk Cooling/ Storage Tanks Solar-Powered Butter Extractors Cream Separator Solar Milk Can Solar-Powered Poultry Shed Lighting	Mini-grid	Livestock, Dairy, and Poultry Production Livestock, Dairy, and Poultry Processing Milking Pasteurization System / Solar-Powered Butter Extractors / Cream Separator Transportation	
Solar Energy Kits + Lighting Solar Cooking Hair Clippers Mobile Phone Solar Powered Charging Stations Solar TV Solar Refrigerators Solar Water Supply Pump Solar Sewing Machines		Restaurants Barber Shops Retail Shops Entertainment Tailoring	

24 Ethiopia Job Creation through Off-grid Access, 2021
25 Interview with ATI
26 Interview with MILLs
27 Interview with MILLs
28 NEP 2.0, 2019
29 Interview with MoWE

2.4 Demand Analysis

The market study recognizes the growing demand in the use of solar technologies for productive uses in agriculture, animal husbandry, industry, transportation, MSMEs, health, and the education sector.[30] In particular, the agricultural sector has seen an increase in the adoption of PURE technology, with the use of PURE for irrigation purposes being a main emphasis area for the government.[31]

A latent demand for PURE products and appliances has been identified in the agricultural and animal husbandry sectors, particularly for agriculture irrigation, poultry, and dairy production. It is being driven by the need to improve efficiency and reduce costs.

In addition, a range of drivers are anticipated to drive demand growth. These are summarized in Table 5.

Table 5 - PURE demand and key drivers

Application	Key Demand Drivers	Required Technologies
Irrigation	• Establishment of Ministry of Irrigation and Lowlands (MILLs). MILLs distributed 54,000 solar water pumps to cultivate some 280,000 hectares in the first nine months of FY 2022/23. • MILLs decided to end imports of water pumps that run on diesel and/or gasoline and instead focus on green energy options as of May 2023.[32] • GOE's NEP 2.0 target is to irrigate seven million hectares of small-holder farms using solar pumps. • Exponential rise in diesel selling prices.	• Solar water pumps • Sprinklers and inverters
Processing	• GOE identified nationwide productive use locations across the country.[33] • ATI runs several agro-processing programs. • The private sector is heavily invested in agro-processing including unions and cooperatives. • Electrifying milling for maize, wheat, teff, and barley is commercially feasible.[34]	• Cold storage and cooling systems • Solar mills • Butter churner and cream separator • Oil press • Coffee washing
Micro, Small, and Medium Enterprises (MSMEs)	• The Jobs Creation Commission (JCC) prioritizes the potential of utilizing PURE technologies to increase employability in MSMEs sector. Which has the potential to create 130,000 jobs.[35] • Ethiopia Electric Utility (EEU) has advocated for the use of energy efficient products such as radios, televisions, and fans.[36] • In 2022, only 2% of off-grid households in Ethiopia were projected to own a TV and just 0.4% own a refrigerator.[37] • GOE's ambitions to increase power access from 45% to 100% by 2025 creates additional potential for the productive use of e-cookers in restaurants and canteens.[38]	• Solar water pumps for horticulture • Solar mills for grains • Cold storage for milk chilling • Solar energy kits for light and power • Barber kits and hair clippers • Solar phone charging stations • TV and refrigerators • Solar sewing machines
Transport: E-mobility	• Recent exemption of all-electric vehicles from VAT, Surtax, and Excise Tax by Ethiopia's Ministry of Finance. • The growth of local assemblers.	• Electric 2 and 3 wheelers with cold storage
Education and Health	• Over 45,000 institutions (including +26,000 elementary schools, 15,000 health posts, and approximately ninety hospitals) need access to electricity services. • Huge market potential in the health sector for vaccine cooling solutions.	• Cooling solutions • Education plasma TVs

30 Interview with ESEDA
31 Interview with ATI
32 Addis Standard News Paper
33 NEP 2.0, 2019
34 Productive Uses of Energy in Ethiopia Agricultural Value Chain and Electrification, Feasibility Study, March 2021
35 Precise Consult International (2020), Creating Jobs through Off-grid Energy Access
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37 Off- and weak-grid solar appliance market, Ethiopia Country Profile, 2022
38 Exploring the market for e-cooking: Insights from sub-Saharan Africa and South Asia

2.5 Supply Analysis

Ethiopia's solar PURE market is still in its emerging stages of development. Most companies engaged in the market are importing and distributing component-based PURE systems.

The limited variety of PURE technologies available in Ethiopia are each at their own stage of market maturity and scaling potential (see Figure 1). The leading appliance in the market is the solar water pump (SWP). They are the most popular PURE technology among farmers and sold by 90% of PURE companies. Other PURE technologies that have gained acceptance include milking machines, butter churning machines, solar-powered poultry barn illumination, and irrigation systems (mostly sprinklers and drip).

In Ethiopia's PURE industry, most suppliers rely on orders from non-governmental organizations (NGOs) and government agencies. The FOREX crunch is a huge barrier for the private sector to import and supply PURE products. As such the private sector relies on orders from NGO's and governments, where FOREX is extended for that particular bid. However, in the future, PURE supply companies might also create fee-for-services business models, allowing customers to pay only for the services they use, making PURE appliances, products, and services more accessible and helping to reduce the affordability gap.

Cooperatives, SACCOs, and unions are also playing an important role in the adoption of PURE technologies by smallholder farmers in Ethiopia by providing access to financing, training, and technical support.

Figure 1 - PURE Technologies maturity stage in Ethiopia

Concept	Horizon	Emerging	Near-to-market
Solar Sewing Machines	Coffee Washing	Mobile Phone Charging Stations	Solar Water Pump
Agriculture Cold storage	Cold Storage Rooms in Vehicles	Hair Clippers	Solar Refrigerators
Solar Cooking	Electric 2 and 3 wheelers	Poultry Shed Lighting & Egg Incubator	Solar TV
Solar Powered Hydroponic fodder	Solar Mills	Milk churning machine	
		Milk chiller, & Milk pasteurizer	
		Milking Machine	
		Sprinkler & Drip irrigation systems	

2.6 Access to Finance

The lack of financing for PURE is a major barrier to market growth. It makes it difficult for businesses and farmers to access the capital they need to purchase PURE technologies. As a result, many entrepreneurs are unable to take advantage of the benefits of PURE technologies. In theory, financing is available for the purchase of PURE technologies by end users, as well as to support the development of PURE businesses. However, in reality, the supply of financing is limited. For example:

- The Development Bank of Ethiopia (DBE) has a line of credit available for PURE technologies. However, this line of credit is oversubscribed and does not meet the needs of the market.[39]
- Commercial banks are still hesitant to accept these technologies as collateral and there is a lack of awareness about the benefits of PURE technologies among potential lenders who perceive the sector to be high risk. As a result, they require high coverage ratios (sometimes more than the capital), fixed collateral, and transaction costs. These requirements make it difficult for small businesses and farmers to access financing for PURE equipment.

However, the government recently issued a notification requiring banks to allocate at least 5% of their loan portfolios to agriculture, implying an ideal opportunity for PURE to explore new business opportunities in the agricultural sector.

The key financial provisions, projects, and endeavors from different players in the PURE ecosystem are summarized in Table 6.

2.7 Market Key Challenges and Barriers for Scaling up PURE Adoption

There is clear untapped potential to increase the uptake of PURE technologies in various sectors. However, the adoption of PURE technologies is limited due to a lack of awareness, affordability, and access, working capital and end-user finance, a poor enabling environment, and a lack of knowledge amongst ecosystem stakeholders. In addition, market growth is impeded by severe FOREX shortages. Successfully addressing these issues requires a comprehensive approach that considers the PURE market maturity stages as well as the country's macroeconomic aspects. An overview of the key challenges and barriers related to PURE and proposed actions to address them can be found in Table 7.

Table 6 - Financial initiatives and actions that can help to accelerate the adoption of PURE

Financing Institution	Initiatives and actions which can help to accelerate the adoption of PURE
Government	• The Development Bank of Ethiopia (DBE) as the financial intermediary, and the Ministry of Water and Energy (MOWE) and the Ethiopian Electric Utility (EEU) as technical intermediaries, have supported PURE reach. • Since 2009, the Agricultural Transformation Institute (ATI) has had a program initiative for developing productive uses. This includes the creation of Agriculture Commercial Clusters (ACCs), Integrated Agriculture Industrial Parks (IAIPs), Milk Collection Centers (MCCs), and the Woreda Transformation Plan (WTP).
MFIs & SACCOs	• Several MFIs and SACCOs serve as a consumer financing facility that provides access to financial resources to low-income households.
Donors	• GIZ Sustainable Energy for Smallholder Farmers (SEFFA) is an €8 million fund that began in 2021 and will run until the end of 2023. This focuses on the development of scalable business cases and cross-country learnings through the use of PURE technologies that provide affordable energy services to smallholder farmers. • The World Bank Access to Distributed Electrification and Lighting in Ethiopia Project (ADELE) is a US$500 million fund that provides financing for off-grid solutions in rural and remote rural areas. It invests into SHS, mini-grids and PURE equipment through subsidy and credit lines. The project duration is 2021 to 2027. • Under SEFFA, the IKEA Foundation, in collaboration with EnDev, began promoting PURE in Ethiopia's dairy and horticultural value chains in 2021. • Power Africa and EnDev support a learning and innovation community of practice on PURE. • Shell Foundation, along with Precise Consultants, is providing technical assistance to address the policy and regulatory challenges under the ESEDA umbrella. • Others: Selco Foundation, GIZ, USAID, EU, AfDB.
Debt	• Several PURE companies provide credit services to help end users purchase their products.

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Table 7 - Key challenges and barriers regarding PURE and proposed actions to address them.

Challenges	Barriers	Required Priority Actions
Unfavorable policy and regulatory practices	The current policy and regulatory environment are not favorable to the development of the PURE market. The legislative framework is unclear, and there is inconsistency in the implementation of regulations. This permits the importation of subpar and/or fake PURE technologies and limits companies' ability to import various types of PURE technologies	• For more mature PURE technologies, the government should develop voluntary quality control requirements based on Verasol or others quality standards to ensure service delivery excellence and increase market attractiveness for all parties. This includes increasing the technical capacity of Conformity Assessment Enterprise (CAE) to design detailed and distinct quality control standards for all PURE technologies in the market, as well as increasing Ethiopia Customs Commission (ECC) capacity in implement an effective quality standard system that is well connected with financial support and subsidies. • Government should provide tax incentives for the importation of a wide range of PURE technologies to make them more affordable for businesses and farmers.
Severe FOREX shortages	Almost all companies engaged in supplying (importing and distributing) PURE products and appliances are experiencing slow business growth due to a severe foreign exchange shortage.	• Set up a revolving foreign exchange facility for PURE technologies and related products and appliances. The government should prioritize and improve access to foreign currency for PURE import businesses. This can be done by replicating previously successful foreign currency financing interventions in off-grid electrification and advocating for prescribed funding towards PURE technology within existing initiatives. • Set up and implement supply-side results-based financing in partnership with international donors for eligible PURE companies selling high quality products. • Seek international investments in Ethiopia PURE spaces. The government should encourage solar remittances from diaspora communities and support international investors to invest in the Ethiopian PURE market.
Inadequate access to financing (working capital/ consumer financing)	Most businesses and end users do not have financial access. Working capital loans from local banks are scarce and come with hefty interest rates, making it difficult to expand business operations. End users are unable to access PURE technology due to limited consumer financing options.	• Government, with the support of development partners, should carefully select one model commercial bank as a partner, collaborate with this bank to build a long-term strategy, and give guarantees and other catalytic funds for enhanced working capital loan access to PURE enterprises. • Consumer financing arrangements piloted through partnerships with model cooperatives (SACCOs) with a strong track record and network in providing financial services to members while providing non-collateral financing mechanisms can have large impact on enhancing the adoption of PURE products and appliances. • Government should explore climate financing options to help set up a consumer financing revolving fund and for unlocking working capital for PURE companies.
Limited awareness	Many businesses, end users, policymakers, financial institutions, and regulatory agencies, do not have a good understanding of the available products and appliances and their socioeconomic benefits.	• Launch demonstration pilot projects for PURE technologies in strategically selected focus value chains to show the benefits of PURE products and appliances in practice. These projects can be funded by the government, businesses, or development partners. Agri-input dealers and commercial agriculture corporations could be invaluable in assuring the success of the pilot initiatives. • Develop a comprehensive ecosystem awareness strategy to enhance knowledge and drive greater engagement in Ethiopia's PURE space among policymakers, government institutions, development partners, private companies, and end users. This approach would involve a variety of activities, including public awareness campaigns, education and outreach programs, media campaigns, community participation awareness-raising demonstration projects, technical training, and capacity building programs.

Limited research and data management practice	Research into determining end-use requirements and pinpoints is minimal, making informing investors of strategic potential in PURE technologies difficult. There are no centralized data management practices to better understand technologies profitability, market potential, end-consumer preferences, etc.,	• ESEDA, in collaboration with development partners, should create a system for collecting and recording data on PURE, notably in large PURE-focused programs, to improve monitoring and evaluation of PURE programs, which would aid in identifying and addressing any obstacles for market advancements. • Governments should provide financial and technical support to research institutions and universities to conduct research on the PURE ecosystem. This research will help to improve the efficiency of data centers and enable market growth.
Ambiguity in inter-ministerial coordination	There is ambiguity in inter-ministerial coordination, synergy, and strategic alignment. This makes it difficult to develop and implement policies and programs that maximize the impact of each stakeholder's efforts.	• Government should empower the National PURE Taskforce to be a champion as an inter-ministerial coordination body. This will ensure synergy, strategic alignment, and inter-ministerial collaboration to address PURE market challenges. The Taskforce should be mandated to develop national performance targets and indicators that can be integrated into the upcoming National Electrification Program 3.0 at policy or plan level. In particular, bringing together initiatives from the Ministries of Water and Energy, Irrigation and Lowlands, and Agriculture will give strategic focus and drive results in the solar PURE market scale-up. • Government and development partners should give technical and financial assistance to improve multi-stakeholder periodic forums on PURE, such as the National PURE Taskforce and ESEDA. These can provide a platform for all stakeholders to come together to share their experiences and learn from each other. This can be done through regular meetings, workshops, or conferences. One example of a multi-stakeholder forum is a series of alignment workshops between government agencies. These workshops would bring together representatives from the Ministry of Agriculture (MOA), the Ministry of Industry (MILLs), and the Ministry of Water, Irrigation, and Energy (MOWE), among others. The goal of these workshops would be to align the different government agencies' efforts and ensure that they are working together towards a common goal.
Limited technological innovations and domestic manufacturing / customization	There are limited technological innovations in the PURE sector. This makes it difficult to develop more efficient and affordable PURE technologies.	• Government should establish a PURE knowledge hub and technical support programs to develop and disseminate best practices, accelerate industry learning, reduce information asymmetry, and facilitate systemic changes across the entire PURE supply business model. This can be accomplished by forming a knowledge sub-working group within current PURE ecosystem structures. • The government in collaboration with ESEDA, TVETs and universities should enhance the technical capacity of PURE companies and technicians to improve after-sales services. This would help to ensure that PURE systems are properly installed and maintained, which would lead to improved PURE performance. • Provide training and certification programs for PURE companies and technicians by developing a curriculum of qualified PURE service providers and technicians. E.g., Explore the potential of Ethiopia's TVET system supported by donors. • Governments should support local manufacturing by creating a more favorable environment, offering tax exemptions, and related incentives.

Strategic Aspirations for PURE Market Scale-Up

Strategic Aspirations for PURE Market Scale-Up

The Strategic Aspirations section defines a desired future state for the PURE market in Ethiopia. It includes a clear and concise statement of the desired future state of the market, as well as the purpose of the PURE sector and its players. The section also outlines the key objectives of the roadmap for realizing the desired future state.

3.1 Vision Statement

"To establish a thriving and competitive Productive Use of Renewable Energy ecosystem for achieving inclusive economic growth and poverty reduction."

3.2 Mission Statement

"To create an enabling environment in Productive Use of Renewable Energy ecosystem for all Ethiopians to have access to affordable, reliable, and sustainable energy services that enable them to improve their lives and livelihoods."

3.3 Strategic Objectives

The objective of the roadmap for Productive Use of Renewable Energy (PURE) is to design an integrated, comprehensive strategy that considers the PURE market maturity stages as well as the country's macroeconomic aspects.

The roadmap-specific objectives are;

- To build an enabling environment for the PURE expansion by advocating for favorable policies and regulations, fostering stakeholder engagement, and strengthening institutional coordination.
- To mainstream PURE into relevant sector plans and strategies to maximize the realization of specific sector goals and objectives as applicable.
- To address the challenges of severe foreign exchange shortages and improve access to financing for both PURE supply and demand.
- To raise awareness and disseminate information about the variety and benefits of PURE technologies.
- To strengthen inter-ministerial coordination, synergy, and alignment towards a common goal of scaling up PURE.
- To promote technological innovation and domestic manufacturing in PURE.
- To improve research and data management practices in PURE for Ethiopia.

3.4 Scope of the Roadmap

The national roadmap aims to increase the use of productive use of renewable energy (PURE) technologies in agriculture, livestock, micro, small, and medium enterprises (MSMEs), healthcare, and transport (e-mobility) in Ethiopia over the next five years. This will help to increase agricultural productivity, improve electricity access, create jobs, and improve the lives of millions of people in Ethiopia.

Strategic Interventions for PURE Market Scale-Up

Strategic Interventions for PURE Market Scale-Up

To achieve the goal and strategic objectives of the roadmap several key strategic interventions and initiatives should be undertaken.

4.1 Create a Conducive Environment for Market Scale Up

4.1.1 Establish favorable policies and regulations for PURE market scaleup:

The government should create a more favorable environment by reviewing current policies and regulations to identify any barriers for increased private sector involvement in Ethiopia's PURE market. The government should introduce tax reductions or exemptions for the import of PURE technologies to realize the socioeconomic benefits of the solar sector. This would help to accelerate the adoption of PURE technology and help to achieve national electrification and economic development goals. The current market scaleup barriers include fragmented legal frameworks, ambiguous and inconsistent taxation, a lack of public subsidies, and a lack of incentives for local manufacturing. The government should also mainstream PURE action plans into specific sector plans and strategies.

4.1.2 Design and implement market-friendly quality control standards in the PURE ecosystem:

When technologies have reached maturity, implement quality control standards to increase PURE technology accessibility and affordability, ensure service delivery excellence (improves customer experience and after-sales services), eliminate counterfeit products, and increase market attractiveness for all parties involved. Quality control standards should be aligned with globally accepted standards (such as Verasol and IEC) to improve efficiency. This will increase end-user trust, increase financial sector confidence in providing credit, and ensure fair market competition among suppliers.

4.1.3 Ensure synergy, strategic alignment, and inter-ministerial coordination in the PURE ecosystem:

This would provide support on addressing the issues of the PURE market's expansion environment and provide a platform to co-create strategic national PURE solutions and programs. In particular, bringing together activities from the Ministries of Water and Energy, Irrigation and Lowlands, Agriculture, and various development partners will provide tactical focus and drive results in Ethiopia's solar PURE market scale-up. Strengthening the newly constituted national PURE Task Force, which will serve as the PURE coordinating body and conduct multi-stakeholder platforms in various topics, must be an ongoing and long-term endeavor.

4.1.4 The government should facilitate access to finance for PURE ecosystem actors:

The government should coordinate and make it simpler for ecosystem stakeholders (companies, end users, etc.) to access finance, making PURE technologies more accessible and inexpensive, hence driving the PURE market's growth. Private companies should have easy access to working capital, and end users should have access to innovative consumer financing options.

4.2 Raising Awareness and Disseminating Information

4.2.1 Implement a comprehensive ecosystem awareness strategy:

Government should implement a comprehensive ecosystem awareness strategy to raise awareness of PURE technology types, usage, and socioeconomic benefits among policymakers, public institutions, private companies, and end users.

4.2.2 Reinforce agro-dealership market-based solutions to increase awareness and access of PURE technologies:

Improve the knowledge and capacities of agro-dealer networks so that they can market and distribute PURE agricultural inputs to farmers. This has the potential to raise awareness and adoption of PURE agricultural inputs for increasing agriculture productivity and profitability.

4.2.3 Promote PURE technologies through a comprehensive public awareness effort:

Conduct a public awareness campaign in rural regions to provide relevant information about PURE technology to a wide audience. These campaigns can be carried out using a range of mediums, such as print, television, radio, TV, and social media.

4.2.4 Provide education and outreach programs for specific audiences:
Provide more extensive and tailored information about PURE technology to strategically selected groups, such as policymakers, financial institutions, customs employees, diaspora communities, private firms, and influential end users. These programs can be delivered in a variety of formats, such as workshops, seminars, technical training, and conferences. This would improve the understanding of PURE technology and encourage their use.

4.2.5 Community participation awareness-raising pilot demonstration projects:
Demonstrating and piloting PURE technologies in real-world settings for high-potential value chains would increase awareness of variety technologies, create knowledge about their benefits, and make them more attractive to private investors.

4.3 Adequate Supply of Foreign Currency and Affordable Financing

4.3.1 Government should prioritize and improve access to foreign currency:
The government should improve access to foreign currency for PURE import business by establishing a revolving FOREX facility, replicating previously successful foreign currency financing interventions in off-grid, and advocating for prescribed funding for PURE technology within existing initiatives.

4.3.2 Incentivize PURE companies:
The government should set up Results Based Financing (RBF) facilities for eligible PURE companies to incentivize the sale and adoption of PURE. These should be eligible to companies that are committed to meeting PURE quality standards and responsible business practices.

4.3.3 Leverage solar remittances and attract international investors in PURE market:
The government should harness solar remittances from diaspora groups and encourage overseas investors to participate in PURE businesses to reduce existing FOREX financial limitations, while also providing a potential for long-term expansion of the PURE sector.

4.3.4 Partner with financial institutions to create sufficient working capital:
The government should collaborate with model commercial banks to create and execute innovative financing models for scalable working capital supply in PURE.

4.3.5 Develop market-appealing consumer finance products:
Government should work with microfinance institutions (MFIs) and savings and credit cooperative organizations (SACCOs) to develop market-appealing consumer finance products for PURE products and appliances (e.g., using non-collateral consumer financing mechanisms or using the technologies as collateral). This would make PURE products and appliances more affordable for consumers and would encourage more people to adopt them.

4.4 Capacity Building of the Ecosystem Players

4.4.1 Develop a certification program for PURE technicians:
Government should offer a structured certification program for PURE technicians to install, operate, and maintain PURE technologies. This would enhance the technical know-how of PURE private companies to provide improved after-sales services and boost end users confidence.

4.4.2 Provide capacity building support for PURE private companies:
PURE companies should be supported with training in business skills such as strategy, technology marketing, financial management, and project management. This would enable private companies to better manage their operations and expand their geographic coverage and services.

4.4.3 Provide capacity-building support for local manufacturing and customization:
Provide training for PURE enterprises to improve the skills and expertise required to produce and customize environmentally sustainable PURE products and appliances, including product design, manufacturing, and quality control. This would lead to increased competition and innovation in the PURE sector, which would benefit consumers.

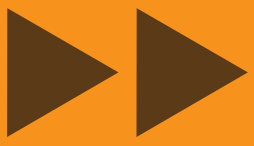
Strategic Interventions for PURE Market Scale-Up

4.5 Research and Development

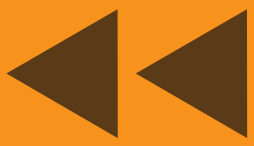
4.5.1 Promote PURE research and development practices in universities:
Provide funding for research projects, provide access to data and resources, and provide training and mentorship to researchers. This could be done through grants, contracts, or other mechanisms.

4.5.2 Foster collaboration between researchers and industry:
Create a network of research and innovation centers that would bring together researchers from different disciplines to work on collaborative R&D projects on various topics, such as PURE business models, innovative financing arrangements, and enhancing the socioeconomic benefits of PURE technologies. The centers would also create opportunities for researchers to work with industry partners.

4.5.6 Set up a PURE knowledge hub using the Centre of Excellence (CoE) model:
A knowledge hub should be established to collect and share information from a variety of sources about the PURE technology ecosystem to accelerate the adoption of PURE technologies, improve PURE ecosystem efficiency, and enhance data tracking capabilities. The hub would serve as a conduit for the development and dissemination of best practices, accelerate industry learning, reduce information asymmetries, and facilitate systemic changes.



Call to Action



Call to Action

The National Roadmap for Scaling Up Productive Use of Renewable Energy in Ethiopia Action Plan (see Table 8) details the strategic activities that must be taken to fulfill the roadmap's goals. It comprises tentative timeframes for each strategic action and recommends the organization that could be responsible for delivery of each action.

Table 8 - Key activities to achieve the roadmap's objectives

Strategic Interventions	Strategic Actions	Key Action Steps	Time Lines	Responsible Body
1. Create a Conducive Environment for Market Scale Up	1.1 Establish favorable policies and regulations for PURE market scaleup	• Review and update existing policies and regulations to promote private investments in the PURE market. • Develop new policies and regulations that create a level playing field for PURE businesses. • Provide incentives for PURE businesses, such as tax breaks and grants. • Train government employees to implement regulations consistently. • Mainstream PURE into the different sector plans, strategies, programs, and budgeting.	2 to 3 Years (2024 to 2025)	MoWE, MILLs, MOA, MoPD, EIC, ECC,
	1.2 Design and implement market-friendly quality control standards (MQCS) in the PURE ecosystem	• Form a technical team to review and develop MQCS that are tailored to the specific needs of the PURE market. • Implement MQCS that are transparent and easy to understand. • Provide training and support to PURE businesses to help them comply with MQCS.	1 Year to 1 Year and 6 Months (2024 to 2025)	MoWE, EEA, ESA, MoTRI, ECAE, ECC
	1.3 Ensure synergy, strategic alignment, and inter-ministerial coordination in the PURE ecosystem	• Create a forum for dialogue and collaboration between different stakeholders in the PURE ecosystem. • Strengthen the national PURE Taskforce to be an ongoing endeavor. • Establish clear lines of communication and coordination between different government ministries that are involved in the PURE sector.	1 Year (2023)	MoWE, MILLs, MOA
	1.4 Facilitate PURE ecosystem players' access to finance	• Provide financial assistance to PURE businesses, such as loans, subsidies, and grants. • Work with banks and other financial institutions to develop financial products and services that are tailored to the needs of PURE businesses. • Provide guarantees and other risk-mitigation measures to make it easier for PURE businesses to access finance for both consumer and industry needs.	2 to 3 Years (2023 to 2025)	MoWE, MILLS, MOA, MoF

Call to Action

2. Raising Awareness and Disseminating Information	2.1 Implement a comprehensive ecosystem awareness strategy	• Develop a communication strategy that targets different stakeholders in the PURE ecosystem. • Use a variety of communication channels, including traditional media, social media, and community outreach, to raise awareness of PURE technologies. • Tailor communication plans to the specific needs of key stakeholders and implement awareness campaigns.	1 Year to 1 Year and 6 Months (2023 - 2024)	MoWE, MILLs, MOA, ATI, ESEDA, Development Partners
	2.2 Reinforce agro-dealership market-based solution to increase awareness and access to PURE technologies	• Provide training and support to agro-dealers about PURE technology types, use, and marketing approaches. • Provide financial assistance to agro-dealers who expand to sell PURE technologies. • Create a forum for agro-dealers to share information and best practices.	1 Year to 1 Year and 6 Months (2023 to 2024)	FCA, MoA, ATI
	2.3 Promote PURE technologies through a comprehensive public awareness effort	• Develop and disseminate educational materials about PURE technologies, such as brochures, videos, and infographics. • Organize public events and workshops to raise awareness of PURE technologies. • Partner with community-based organizations to promote PURE technologies in local communities.	1 Year to 1 Year and 6 Months (2023 to 2024)	MoWE, MILLs, MOA, ATI, ESEDA, Development Partners
	2.4 Provide education and outreach programs for specific audiences	• Develop and deliver training programs for businesses and other organizations that are interested in using PURE technologies. • Create educational materials for specific audiences, such as farmers, entrepreneurs, and women. • Organize field visits and demonstrations to showcase the benefits of PURE technologies. • Provide training and support to strengthen agro dealers' networks in improving awareness and adoption of the PURE agricultural input supply system.	2 to 3 Years (2023 to 2025)	MoWE, MILLs, MOA, ATI, ESEDA, Development Partners
	2.5 Community participation awareness-raising pilot demonstration projects	• Work with communities to develop and implement pilot projects that demonstrate the benefits of PURE technologies. • Use the results of the pilot projects to raise awareness of PURE technologies and to identify best practices for scaling up the use of PURE technologies in communities.	3 to 4 Years (2023 to 2026)	MoWE, MILLs, MOA, ATI, ESEDA, Development Partners

Call to Action

3. Adequate Supply of Foreign Currency and Affordable Financing	3.1 Improve access to foreign currency	• Set up a revolving FOREX facility for PURE technologies and related products and appliances and prioritize improving access to foreign currency for PURE import business. • Develop financial industry regulations that enforce and standardize FOREX facility allocation in commercial banks for PURE firms. • Develop a monitoring and evaluation system and build partnerships with key stakeholders to assure the revolving FOREX facility's success. • Undertake research to identify potential FOREX funding sources and allocations from international donors. • Work with international partners to secure foreign currency financing for PURE projects.	1 Year to 1 Year and 6 Months (2023 to 2024)	NBE, MoWE
	3.2 Incentivize PURE companies	• Establish Results-Based Financing (RBF) facilities for qualifying PURE enterprises by conducting an analysis to define the targeted beneficiaries' criteria, developing a monitoring and evaluation system, and forming partnerships with key stakeholders to assure the RBF program's success. • Provide tax breaks and other incentives to PURE company's undertaking local manufacturing and customizations. • Guarantee loans and other forms of financing for PURE companies. Provide technical assistance to PURE companies to help them grow and succeed.	2 to 3 Years (2023 to 2025)	MoWE, MILLS, ATI, MFI, DBE, MOF
	3.3 Leverage solar remittances and attract international investors in a PURE market	• Work with the Ethiopian diaspora to encourage them to invest in the PURE sector. • Carry out a public relations campaign to create awareness and properly communicate with the diaspora community to engage in PURE business through Ethiopia's international embassy. • Develop a regulatory framework that is attractive to foreign investors and encourages international investors to participate in Ethiopia PURE business. • Profile PURE market potential through investment websites, conferences, and networking events. • Develop pay-as-you-go (PAYGo) payment platforms that accept international top-up payments.	3 to 4 Years (2023 to 2026)	MoWE, EIC, MoFA
	3.4 Partner with financial institutions for sufficient working capital	• Work with banks and other financial institutions to develop working capital financing products for PURE businesses. • Secure fund support from a variety of sources, such as donor agencies or private investors. • Provide financial literacy and capacity-building training for PURE companies. • Provide guarantees and other risk-mitigation measures to make it easier for PURE businesses to access finance. • Use lessons and achievements to advance and promote the attractiveness of the PURE market for other financial institutions.	2 to 3 Years (2023 to 2025)	MoWE, MILLS, ATI, Commercial Banks
	3.5 Develop market-appealing consumer finance products	• Work with banks and other financial institutions to develop non-collateral consumer financing mechanisms or use the technologies as collateral for end users. • Develop innovative consumer financing products tailored to the needs of consumers who want to purchase PURE products and services by partnering with model financial institutions. • Establish a pilot plan and implement a strategy for developing consumer financing for PURE-targeted business models, products, and services. • Partner with MFIs to provide consumer lending to target recipients, especially low-income borrowers. • Train MFIs on PURE products and services.	2 to 3 Years (2023 to 2025)	MoWE, MILLS, ATI, Financial Institutions (Banks, MFIs, SACCOS)

Call to Action

4. Capacity Building of the Ecosystem Players	4.1 Develop a certification program for PURE technicians	• Develop a curriculum for the PURE technician's certification program. • Identify qualified institutions and build partnerships to deliver the training. • Develop a testing and evaluation system for the certification program. • Promote the certification program for PURE technicians.	3 to 4 Years (2023 to 2026)	MoWE, ESEDA
	4.2 Provide capacity-building support for PURE private companies	• Identify the capacity limitations of PURE private companies and develop capacity building and training programs. • Identify qualified institutions, build partnerships, and implement programs in-person and online to optimize the number of people that can engage with them. • Provide training in business skills such as strategy, technology marketing, financial management, and project management. • Provide technical assistance to PURE private companies to help them implement what they have learned. • Monitor and evaluate regularly to ensure that capacity-building programs are achieving their objectives.	2 to 3 Years (2023 to 2025)	MoWE, ESEDA, National PURE Taskforce
	4.3 Provide capacity-building support for local manufacturing/ customization	• Identify the key gaps for local manufacturing and customization businesses in the PURE market. • Develop training programs that meet the needs of local manufacturing and customization businesses. • Deliver training programs to local manufacturing and customization businesses. • Provide technical assistance to local manufacturing and customization businesses to help them implement what they have learned.	3 to 4 Years (2023 to 2026)	MoWE, MoTRI, ATI, ESEDA, National PURE Taskforce
5. Research and Development	5.1 Promote PURE research and development practices in universities	• Identify universities that have the potential to conduct PURE research and development. • Provide funding and support to universities to conduct PURE research and development. • Promote PURE research and development through conferences, workshops, and other events.	3 to 4 Years (2023 to 2026)	MoWE, ATI, ESEDA, National PURE Taskforce
	5.2 Foster collaboration between researchers and industry	• Create a network of research and innovation centers that would bring together researchers from different disciplines to work on collaborative R&D projects. • Provide funding and support to businesses to collaborate with researchers on PURE research and development. • Host annual seminars that recognize and award the top PURE research papers.	3 to 4 Years (2023 to 2026)	MoWE, ESEDA, ATI, National PURE Taskforce
	5.3 Set up a PURE knowledge hub using the Centre of Excellence (COE) model	• Establish a PURE knowledge hub that provides information and resources about PURE technologies. • Make the knowledge hub accessible to all stakeholders in the PURE ecosystem, including government officials, businesses, civil society organizations, and development partners. • Support ESEDA to manage the knowledge hub, creating a team of experts who have a deep understanding of PURE technologies.	2 to 3 Years (2023 to 2025)	MoWE, MILLs, MOA, ESEDA

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Annex 1 - Ethiopia PURE stakeholders mapping

Table 9 - Ethiopia PURE stakeholders mapping

Government	Financial Institutions	Development Partners	Industry Groups	Active Private Companies
Ministry of Water and Energy (MoWE): PURE regulatory body that develops and promotes alternative energy resources and technologies, including PURE. **Ministry of Agriculture (MoA):** Promotes PURE technologies adoption in agricultural and rural areas. **Agriculture Transformation Institute (ATI):** Accelerates PURE growth and transformation in agriculture. **Ethiopian Energy Authority (EEA):** Enforces technical and safety regulations for off-grid solar products. **Ethiopian Standards Agency (ESA):** Develops/adopts international standards for the productive use of solar products. **Ethiopian Electric Utility (EEU):** Coordinates off-grid energy solutions in the country. **Regional Energy Bureaus (REBs):** Enables off-grid expansion. **Ministry of Trade and Regional Integration (MoTRI):** Checks that imported PURE products comply with standards. **Ethiopian Conformity Assessment Enterprise (ECAE):** Provides quality testing services for PURE products and appliances. **Ethiopian Customs Commission (ECC):** Enforces tax law on the productive use of technology appliances. **Ministry of Planning and Development (MoPD):** Develops long-term development plans & national directions in renewable energy.	**Development Bank of Ethiopia (DBE):** Major player in off-grid financing, offering revolving money for PURE consumer borrowing. Mostly involved in managing World Bank funds. **Commercial Banks:** Not yet providing consumer financing services for PURE technologies, some PURE companies borrowed using personal collaterals for working capital. Underdeveloped loan products for PURE financing. **Cooperatives and SACCOS:** Credit services for small-holder farmers to buy PURE products and appliances. **MFIs:** Provide group loans for PURE technologies finance, high collateral, and interest rates. Limited practice in the PURE sector due to low awareness of technologies. **Solar Companies:** Provide credits + PAYGo	**World Bank:** US$15 million fund in off-grid infrastructure, piloting incentive, technical assistance, and subsidy research. **SNV** applied a market approach for PURE scale up. **Sustainable Energy for Small-holder Farmers (SEFFA):** develops scalable business cases and cross-country learnings through PURE technologies. **Power Africa, EnDev:** Support learning and innovation community of practice on PURE **EnDev and IKEA Foundation:** began promoting PURE in Ethiopia's dairy and horticultural value chains in 2021. **Shell Foundation,** along with Precise Consult, provides technical assistance to address policy and regulatory challenges under the ESEDA umbrella. **World Bank, Selco Foundation, GIZ, USAID, EU, AfDB + others.**	**National PURE Task Force:** The newly established working group led by MoWE and ESEDA. **GOGLA:** Association for the Global Off-Grid Solar Energy Industry **ESEDA:** Ethiopian Solar Energy Development Association **ASEDA:** Amhara Solar Energy Development Association **TSEDA:** Tigray Solar Energy Development Association **SSEDA:** Southern Solar Energy Development Association **OSEDA:** Oromia Solar Energy Development Association **Industry groups have financial and technical capacity limitations.**	**Import & Distribution:** Sun Transfer Tec PLC, Solar Village PLC, Solar Development PLC, Green Scene, Renesys Engineering & Trading PLC, ACME Engineering and Trading PLC **Import, Distribution, & modification/ customization*:** Power East Africa Engineering PLC, Amio Energy PLC, Lydetco PLC, Marasat General Mechanics, AFEsol Technology PLC

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Annex 2 - Available technologies and their maturity stage

Table 10 - Available technologies and their maturity stage

PURE Technologies	Technology Stage	Market Status	Market Maturity (Observed with Description)
Solar Powered Hydroponic fodder	Concept	Concept	**Concept:** Appliance prototypes exist, and the market is in its early stages.
Solar Sewing Machines	Concept	Concept	
Solar Cooking	Concept	Concept	
Agriculture Cold storage	Concept	Concept	
Solar Mills	Concept	Horizon	**Horizon:** Appliances and business models have been tested for several years. Technologies that have yet to reach full scale but are expected to do so in the near future.
Electric 2 and 3 wheelers	Horizon	Horizon	
Cold Storage Rooms in Vehicles	Concept	Horizon	
Coffee Washing	Concept	Horizon	
Power Generators	Emerging	Emerging	**Emerging:** Viable demand exists for appliances. Early-stage technologies that have gained market traction in recent years but remain out of reach for most consumers due to supply-side challenges.
Sprinkler systems and Drip irrigation systems	Emerging	Emerging	
Milking Machine	Emerging	Emerging	
Milk churning machine	Emerging	Emerging	
Milk chiller, and Milk pasteurizer	Emerging	Emerging	
Solar Milk Can	Emerging	Emerging	
Poultry Shed Lighting, Egg Incubator, and Chicken brooder	Emerging	Emerging	
Hair Clippers	Emerging	Emerging	
Mobile Phone Solar Charging Stations	Emerging	Near to Market	
Solar TV	Near to Market	Commercial Market	**Near to Market:** Appliances are being sold in volume by market participants even though the market ecosystem is not yet supported. Sales are increasing, and new market entrants are appearing.
Solar Refrigerators	Near to Market	Commercial Market	
Solar Water Pumps	Near to Market	Commercial Market	
Solar Lighting Technologies	Near to Market	Commercial Market	

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Annex 3 - Market Readiness Level Traffic Light Matrix

Table 11 - Market Readiness Level Traffic Light Matrix

Scale	Color Code	Descriptions
High		**The technology is ready to be scaled up and commercialized.** High MRL (Market Readiness Level) products or services are ready to be scaled up and commercialized. They have been tested and refined and are classified as emerging or near-market maturity.
Medium		**The technology is still in the piloting stage. It needs to be refined and perfected before it can be used on a large scale.** Products or services with a medium MRL require additional development and refining before they can be scaled up. They have not been thoroughly tested or refined yet and are generally in the horizon market maturity stage.
Low		**The technology has not yet been proven to be commercially viable. It needs to be shown to be profitable and scalable before it can be brought to market.** Low MRL products or services require extensive research and improvement before they can be considered for commercialization. They are still in the early stages of development and are typically seen at the concept stage.

Annex 4 - Selected PURE Appliances Tax Regulations

Table 12 - Applicable tax rate for solar-powered appliances

Products	Import duty	Excise Tax	Sur tax
Selected agriculture products and appliances powered by solar (e.g., Solar Water Pumps for irrigation, electric grain milling that can work by solar, machines for cleaning, sorting, or grading seed, grain, or dried leguminous vegetables)	0%	0%	0%
Solar components (e.g., inverters, batteries, charge controllers)	0%	0%	0%
Selected poultry and dairy products and appliances powered by solar (e.g., Egg incubator, Chicken brooder, Milk churning machine, Milk chiller, Milk pasteurizer)	0%	0%	0%
Hair clipper (DC)	35%	0%	0%
Hair dryer (DC)	35%	0%	0%
Sewing machine (DC)	0%	0%	0%
Electric vehicle*	0%	0%	0%
Solar TV**	0%	0%	0%
Solar Refrigerators	0%	0%	0%

*Electric vehicles are now tax-free in Ethiopia, except for a 15% customs tax on fully assembled vehicles and a 5% customs tax on semi-assembled vehicles. CKD vehicles, which are assembled in Ethiopia, are not taxed.
**As of 2018, off-grid energy products were also exempt from duty tax, excise tax, and surtax, and those not used for commercial purposes were also exempt from 15% value-added tax (VAT) and 2% withholding tax.

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Annex 5 - Interviewed PURE Ecosystem Organizations

Table 13 - Stakeholders interviewed.

Name of Organization	Type
Green Scene Energy PLC	Private Company
Sun Transfer Tec PLC	Private Company
Lydetco PLC	Private Company
Solar Village PLC	Private Company
Rensy General Business	Private Company
Solar Development PLC	Private Company
Power East Africa Engineering PLC (PEAE)	Private Company
Amio Engineering	Private Company
Agro-vet PLC	Private Company
AFEsol Technologies	Private Company
Marast General Mechanics	Private Company
Vera International Business PLC	Private Company
ACME Engineering and Trading PLC	Private Company
HelloSolar International	Private Company
Ministry of Water and Energy	Government
Ministry of Irrigation and Lowlands Development	Government
Ministry of Planning and Development	Government
Agricultural Transformation Institute	Government
GIZ Energizing Development Ethiopia (EnDev)	Development Partner
SELCO Foundation	Development Partner
Ethiopia Solar Development Association	Industry Association

Johan Cruijff Boulevard 91
1101 DM Amsterdam
The Netherlands

info@gogla.org
+31 202 400 729

The Voice of the **Off-Grid Solar Energy** Industry