



Productive Use of Renewable Energy in Ethiopia: Market Assessment for Technologies Scale-up



Acronyms

ATI:	Agricultural Transformation Institute
CBE:	Commercial Bank of Ethiopia
CO ₂ :	Carbon Dioxide
CSA:	Central Statistics Agency
DBE:	Development Bank of Ethiopia
ECAE:	Ethiopian Conformity Assessment Enterprise
EEA:	Ethiopian Energy Authority
EEU:	Ethiopian Electric Utility
ERA:	Ethiopian Road Authority
ESA:	Ethiopian Standards Agency
ESEDA:	Ethiopian Solar Energy Development Association
ETB:	Ethiopian Birr
EU:	European Union
FOREX:	Foreign Exchange
GIZ:	German Society for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit)
GNI:	Gross National Income
GoE:	Government of Ethiopia
HGER:	Home-Grown Economic Reform
HRM:	Human Resource Management
HS Code:	Harmonized Code System
IDA:	International Development Association
IMF:	International Monetary Fund
IoT:	Internet of Things
JCC:	Job Creation Commission
MFI:	Microfinance Institution
MILLs:	Ministry of Irrigation and Lowlands Development
MoA:	Ministry of Agriculture
MoPD:	Ministry of Planning and Development
MoTRI:	Ministry of Trade and Regional Integration
MoWE:	Ministry of Water and Energy
MSMEs:	Micro, Small, and Medium Enterprises
NBE:	National Bank of Ethiopia
NEP:	National Electrification Program
NGOs:	Non-governmental Organizations
GDP:	Gross Domestic Product
PAYGO:	Pay-as-you-go
PEAE:	Power East Africa Engineering PLC
PLC:	Private Limited Company
PUE:	Productive Use of Energy
PURE:	Productive Use of Renewable Energy
PV:	Photovoltaic
REBs:	Regional Energy Bureaus
SACCOs:	Savings and Credit Cooperative Organizations
SAS:	Stand-alone solar
SDGs:	Sustainable Development Goals
UN:	United Nations
USAID:	United States Agency for International Development
USD:	US Dollar

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Executive Summary

Ethiopia is Africa's second largest country with a population of 117 million people¹, 66% of whom live in rural areas and work in agriculture.² Over the past 15 years, Ethiopia's economy has grown rapidly, with an average annual GDP growth rate of 9.5%.³ Despite this positive trajectory, the country has a very low electrification rate standing at only 44%⁴ in 2019. This leaves most Ethiopians without access to electricity and curtails the country's full economic growth potential. Solar-powered equipment, particularly productive use of renewable energy (PURE) solutions, have evolved considerably over the last decade and can help to reduce the electrification gap, enhancing green growth in rural regions.

PURE technologies have various value propositions for end-users, including increasing the mechanization of multiple industries, reducing reliance on rain-fed agriculture, reducing the use of fossil fuels, improving livelihoods, and creating energy-independent communities.

Within the emerging Ethiopian PURE market, solar water pumps (SWPs) are the leading PURE technology and are sold by 90% of PURE businesses. SWPs and other solar irrigation equipment show significant market potential, with studies indicating that they can irrigate 6,800 hectares and service over one million farmers. Additionally, the newly established Ministry of Irrigation and Lowlands Development intends to import approximately 100,000 SWPs per year and advocates that all pumps imported by the ministry be powered by solar energy. Similarly, the Ministry of Agriculture plans to deploy 210,000 - 400,000 irrigation pumps between 2020 and 2025.

However, there are several challenges that need to be addressed to increase the adoption of PURE technologies. Key issues include limited stakeholder awareness, severe FOREX shortages, inadequate access to finance, unfavorable policies and regulations, limited technological innovations and technical assistance, and limited research and data management practices.

Quick win recommendations to address these challenges and unlock the opportunities created by PURE are:

- Mobilizing key stakeholders to provide action points for solar PURE awareness, financing, and the creation of supportive policies and regulation in the preparation for the National Electrification Program 3.0.
- Developing a mechanism to align activities between the Ministries of Water and Energy, Irrigation and Lowlands and Agriculture to drive solar PURE market adoption through cross-sectoral programs.
- Building innovative models for scalable consumer financing possibilities in Ethiopia's component-based solar PURE market.

1 <https://www.worldbank.org>

2 <https://idea.usaid.gov/>

3 <https://www.worldbank.org/>

4 NEP 2.0, 2019

Acknowledgments

This market assessment was authored by Precise Consult in conjunction with GOGLA, the Ethiopian Solar Development Association (ESEDA) and the National PUE Taskforce led by the Ethiopian Ministry of Water and Energy (MoWE). The assessment was made possible through 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).

Precise Consult's core team consisted of Abel Endrias (Project Manager), Beza Samuel (Analyst), and Beza Seyoum (Analyst).

The authors would like to thank those who generously contributed their time to take part in the consultations that have informed this report, including government representatives, members of the PURE private sector, development partners and civil society organizations.



About GOGLA

GOGLA is the global association for the off-grid solar energy industry.

Our 200+ members provide millions of low-income and climate-vulnerable people with affordable, high-quality products and services; rapidly increasing customers' productivity, connectivity, and resilience.

To enable sustainable businesses and accelerate energy access, we provide market insights, standards and best practice, and advocate for catalytic policies, programmes and investment. With the right support, our pioneering industry can improve the lives of 1 billion people by 2030.

To find out more, visit www.gogla.org.



About ESEDA

The Ethiopia Solar Energy Development Association (ESEDA) is an independent non-profit association dedicated to facilitating the growth and development of the solar energy business in Ethiopia. ESEDA (previously SEDA-E) was established in September 2010 by dedicated solar energy market stakeholders in Ethiopia. ESEDA promotes the interests of members of the solar energy industry among the government, the public sector, the general public and other organizations that may impact industry development. ESEDA also acts as an information forum and ideas exchange on matters relating to solar energy development and adoption in Ethiopia.



About Precise Consult

Precise is a mission-driven consulting firm that works on Private Sector Development, specializing in the areas of off-grid energy Innovation, Sustainable Agro-industrial Value-network Innovation, and Development Policy Innovation in Ethiopia. Established in 2007, the firm is currently a leading private institution in the development of business and private sector revolution in Ethiopia, providing services to a wide range of clients including businesses, governments, and not-for-profits.

Precise is dedicated to the creation of learning ecosystems that maximize the growth of firms, farms, and industries. Precise also works with its partners to accelerate policy learning by the state to support that growth. Our overall aim is thus to see a proud, dignified, and prosperous Ethiopia at the forefront of the world's family of nations.

Acknowledgments



Water and Energy for Food (WE4F)

Water and Energy for Food (WE4F) a joint international initiative of the German Federal Ministry for Economic Cooperation and Development (BMZ), the European Union (EU), the Ministry of Foreign Affairs of the Government of the Netherlands, the Norwegian Agency for Development Cooperation (Norad), Sweden through the Swedish International Development Cooperation Agency (Sida), and the U.S. Agency for International Development (USAID).

WE4F, through its Regional Innovation Hubs, provides financial support, technical assistance, and investment facilitation to water-food, energy-food, and water-energy-food innovations,

The supported innovations impact smallholder farmers, helping them unlock missing inputs, finance, technology, and markets. By using these innovations, farmers and food companies can enhance their climate resilience and reduce CO2 emissions.

About the PUE Task Force of the Ethiopian Ministry of Water and Energy (MoWE)

To address various issues in the solar energy sector, ESEDA organized workgroups to challenge solar sector obstacles and tackle challenges the association faced. Among five working groups established by ESEDA, led by the MoWE, and supported by different sector developing partners, one is related to Water and Energy for Food (WE4F), supported by GOGLA. The WE4F Working Group is essential for the generation of knowledge on the productive energy of renewable energy (PURE) in the country, engaging with government at the national level on priority actions to be undertaken by government institutions and agencies, and developing a roadmap of actions needed to scale PURE.



Acknowledgements

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About this Report

This study assesses the current state of the productive use of renewable energy (PURE) market in Ethiopia to inform stakeholders of the market challenges and opportunities, alongside the actions needed to support PURE sector growth.

The research was conducted between March and April 2023. It included interviews with 13 Ethiopian PURE companies and seven key stakeholders working in the PURE ecosystem, and a review of relevant industry-focused documents. A full overview of the methodology can be found in Annex 1, while a list of organisations consulted can be found in Annex 2.

How is PURE defined in this market assessment?

The technologies covered in this PURE market assessment include applications that generate income and create employment. Broadly, PURE refers to any agricultural, commercial, or industrial activity involving off-grid solar electricity services as a direct input to the production of goods or services. PURE technologies include solar water pumps (SWPs), e-mobility, e-cooking, cold chain, agro-processing applications such as milling and drying, and appliances that can support MSMEs such as hair clippers, entertainment systems, phone charging units, and power tools.

Solar lanterns and home systems are also used for productive purposes (in addition to

lighting households), for example, for lighting a restaurant or stall at night. Globally, they are being used by over 10 million MSMEs. However, while solar lanterns and home systems are recognised throughout the market assessment, they are not covered in its in-depth analysis, as most mechanisms to catalyse their adoption are undertaken under initiatives to enhance energy access, rather than to specifically scale the use of PURE.

Based on the assessment, we suggest actions by stakeholder and technology type to improve the uptake of PURE technologies in Ethiopia and create a more vibrant market which improves the daily lives and incomes of Ethiopians.

PURE technologies used in Ethiopia

PURE technologies have particular potential for use in agriculture, animal husbandry, and micro business. An overview of the key PURE technologies available in Ethiopia, their power source, target industry and the business models used in their sale are captured in Table 1.



About this Report

Table 1 - PURE Technologies Overview

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) Mini-grid	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		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	

Benefits of PURE technologies in Ethiopia

PURE technologies have various value propositions to end users in the country and can be used to create a range of positive impacts, including:

- **Enhanced Mechanization:** across multiple industries, creating time savings and reduced drudgery, improvements in efficiency, productivity, and worker safety, reduced reliance on rain-fed agriculture and improved crop yield performance.
- **Environmental Benefits:** enabling the reduction in the use of fossil fuels and pollution. For example, replacing diesel-powered water pumps reduces CO2 emissions.
- **Improved Lives and Livelihoods:** across a range of development areas, including more income generation, job creation and savings (particularly in rural areas), increased food and water security, reduction in disease and food contamination, better health infrastructure, greater transfer of knowledge and the economic empowerment of women.
- **Energy Independence:** PURE users improve their energy independence, allowing them to generate their own electricity, reduce reliance on traditional energy sources, and make their communities less vulnerable to the risks of climate change.¹



Introduction



Introduction

1.1 Country Context

Ethiopia is the second most populous country in Africa, after Nigeria, with a population of 117 million people.⁶ It also has one of the fastest-growing economies in Africa that averaged annual economic growth of 9.5% per year over the past 15 years.⁷ A range of socio-economic indicators can be found in Table 2, while trends in population growth and GDP can be seen in Figures 1 and 2.

The Government of Ethiopia (GOE's) new 10-year plan¹⁸ aims to create structural changes in

the economy. The plan aims to cut agriculture's percentage of GDP to 22%, while increasing industry's share to 35.9% and services' share to 42.1%. Implementation of the 10-year plan is predicted to assist the industrial sector grow at a pace of 13% per year, the service sector grow at a rate of 10.6% per year, and agriculture grow at a rate of 5.9% per year. Realizing the economic and livelihood benefits of PURE will be key to achieving the government's goals and will require concerted national efforts linking agriculture, business, and electrification.¹⁹

Table 2 – Socioeconomic Indicators of Ethiopia

Socioeconomic indicators of Ethiopia	
Population size	117.9 million in 2021 ⁸
Population distribution	78% Rural Population, Urban population – 22.2 % (2021/22) ⁹
Age demographics	50% of Ethiopia's population is between the ages of 20 and 50 ¹⁰
Ethiopia's US Dollar GDP	\$126 billion (2021/22) ¹¹
Real GDP growth rate (%)	3.3% (2021/22) ¹²
Real GDP per capita (Thousand ETB)	21,863 (2021/22) ¹³
Average Inflation Rate	27% in 2021, 34% in 2022 ¹⁴
Forex Exchange Rate (ETB to USD)	55.0008 – April 4, 2023 ¹⁵

Figure 2 – Ethiopia Population Growth, 2010 to 2035¹⁶

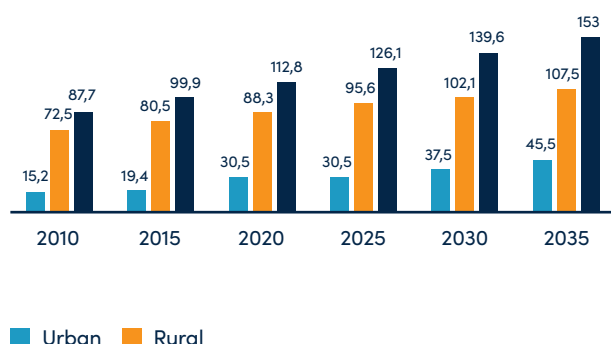
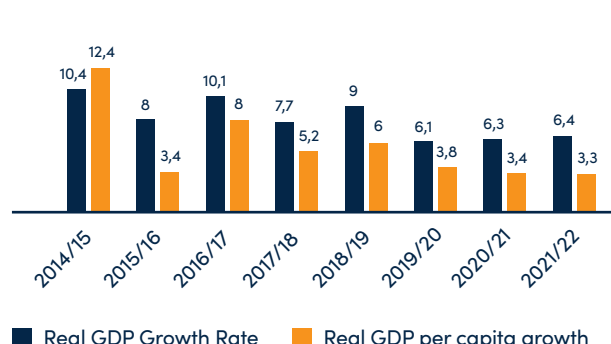


Figure 1 – Real GDP growth rate (%), 2014/15 to 2021/22¹⁷



6 <https://www.worldbank.org/>

7 <https://www.worldbank.org/>

8 UN Population Division

9 Central Statistical Agency

10 United Nations

11 Ethiopia: Macroeconomic Handbook 2023, Cepheus Growth Capital

12 Ethiopia: Macroeconomic Handbook 2023, Cepheus Growth Capital

13 Ethiopia: Macroeconomic Handbook 2023, Cepheus Growth Capital

14 Ethiopia: Macroeconomic Handbook 2023, Cepheus Growth Capital

15 Commercial Bank of Ethiopia

16 Ethiopia: Macroeconomic Handbook 2023, Cepheus Growth Capital

17 Ethiopia: Macroeconomic Handbook 2023, Cepheus Growth Capital

18 Ten Years Development Plan PDF

19 Capturing the Productive Use Dividend, 2020

Introduction

In 2022, agriculture employed most of Ethiopia’s working-age population, accounting for 66% of all jobs²⁰ (see Figure 3). 90% of the country’s agricultural sector is made up of small-scale household farms with less than two hectares of land.²¹ Although the sector can greatly impact the country’s economic growth, it is currently characterized as having low productivity.

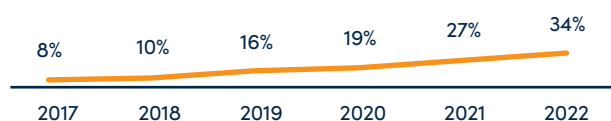
Small-holder farmers, who account for around 16 million households and produce nearly 356 million quintals of crops annually, continue to contribute the largest portion of GDP.²² Corn, wheat, and teff remain the three biggest grains produced, taking up around two-thirds of farmed total volumes. Commercial farms (private and state-owned entities) comprise only 4% of total production.²³

Ethiopia’s unemployment rate is seeing a steady increase, with a significant impact on the young, as the economy fails to provide employment to the country’s vast population; expansions of PURE businesses have a potential to drive job creation and youth development.

The rapid rise of national inflation has a negative impact on economic growth and the capacity of citizens to buy new assets, including PURE technologies. According to the Central Statistics Agency (CSA), Ethiopia’s inflation hit 34% in 2022 (see Figure 4).

Although the International Monetary Fund (IMF) predicted that inflation would gradually fall to as low as 8% in 2023 and beyond, recent trends indicate that inflation may in fact continue to rise.

Figure 4 - Ethiopia Inflation Rate, 2017 to 2022



This is due to a combination of rising oil prices because of the Russian-Ukraine conflict, the rising trade balance deficit, unfavorable weather, a bad harvest season, political instability, fiscal deficits, a depreciating currency, higher international food and raw material prices, and rapid depreciation in the value of the Birr (see Figure 5).

1.2 Market Potential

In off- and weak grid areas productive uses of renewable energy (PURE) technologies have the potential to increase income and productivity, mechanize agriculture, power MSMEs, support the development of climate resilient industries and create employment opportunities. PURE appliances could transform various sectors in Ethiopia. One such sector is agriculture, which employs most of the country’s population. The lack of agricultural mechanization, irrigation, refrigeration, and cold storage facilities currently leads to low yield sizes, curbs the frequency of harvests, and leads to significant levels of post-harvest food loss. This is directly correlated to food security issues and malnutrition in the country.

Figure 3 - Employment share by sector, 2021

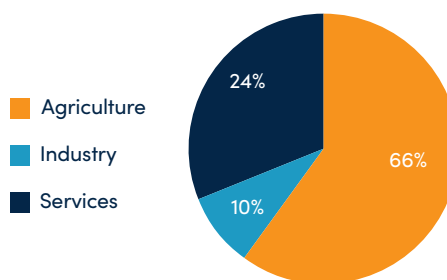
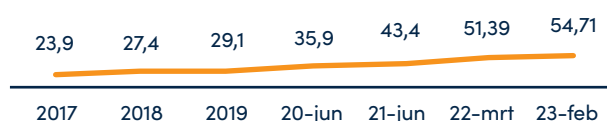


Figure 5 - Exchange Rate (ETB per USD), 2017 to 2022



²⁰ Ethiopia: Macroeconomic Handbook 2023, Cepheus Growth Capital

²¹ ibid

²² Macroeconomic Handbook 2023, Cepheus Growth Capital

²³ Macroeconomic Handbook 2023, Cepheus Growth Capital

Introduction

In recognition of the importance of modernizing the agricultural sector, the Government of Ethiopia (GoE) has recently shifted its focus towards the use of decentralized renewable energy to drive sustainable agriculture. This is expected to have a beneficial impact on farmer incomes, nutrition, job creation, and (potentially) foreign exchange earnings. The government has prioritized the adoption of solar powered irrigation, which has the potential to be commercially viable with government subsidies,²⁴ particularly for cash crops like wheat, avocado, banana, mango, and fruits. As part of its efforts, the government has engaged in consultations to scale up the adoption of cooling technologies in dairy value chains, horticulture cold chains (with a focus on cluster applications²⁵), grain milling, and hydroponic fodder, aspiring to achieve this in a short term.

A recent Rocky Mountain Institute study of six agricultural production and processing opportunities in rural areas, showed that an estimated US\$4billion in additional annual value could be generated from activities such as irrigating horticulture, mechanizing grain milling, and providing milk cooling. Decentralized solar solutions will be fundamental to realizing this economic benefit. Additionally, the adoption of PURE appliances has the potential to create 130,000 new jobs across the horticulture value chain, 50,000 jobs across the wheat value chain, and over 11,000 jobs in milk chilling.²⁶

The GoE's ambition to reach 3.3 million people with off-grid electricity access by 2025²⁷ 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.²⁸

1.3 Market Overview

The Ethiopian solar PURE market is still emerging, with most companies importing and distributing component-based PURE systems. About 20 solar PURE appliances are available on the market, with increasing visibility among end users.²⁹ However, the market is currently dominated by a grant-led approach to disseminating PURE technologies due to the absence of innovative ways to increase the affordability and accessibility of PURE appliances commercially. Governmental and non-governmental organizations (NGOs) are the primary customers of most PURE suppliers in Ethiopia.

SWPs are the leading PURE technology type in the Ethiopian market, with these being sold by 90% of the businesses surveyed. The use of small size SWPs has the potential to increase crop yields and improve incomes.³⁰ However, the affordability of SWPs needs to be addressed for market scale-up, as three out of every four Ethiopian farmers earn less than \$2 a day and cannot afford to purchase a system.³¹ The severe lack of foreign currency in Ethiopia, leading to a spike in the price of imported products in the country and the falling value of the Ethiopian Birr (ETB), has also led to a rapid rise in SWP prices,³² further expanding the 'affordability gap' for SWPs.

Small-holder farmers dominate the current customer base for PURE technologies. Most end users are organized by cooperatives (there are more than 92755 cooperatives in Ethiopia with 21,043,370 members in 2021³³), SACCOS (over 21,000³⁴), and unions (totalled 131³⁵). Alongside SWPs, other PURE technologies that have gained traction include milking machines, butter churning machines, solar-powered poultry barn illumination, and irrigation systems (mostly sprinklers and drip).

24 Interview with MILLS

25 Interview with MILLS

26 Ethiopia Job Creation through Off-grid Access, 2021

27 NEP 2.0, 2019

28 Interview with MoWE

29 Analysis by Precise Consulting

30 Powering People and Planet

31 FAO. (2018). Data Portrait of Smallholder Farmers in the Twenty-First Century.

32 Interview with Solar PUE Companies

33 Federal Cooperative Agency (FCA)

34 Federal Cooperative Agency (FCA)

35 Federal Cooperative Agency (FCA)

Introduction

1.4 Key Market Challenges

Several key challenges must be overcome to increase the adoption of PURE. These include:

Limited awareness: For years, the growth of Ethiopia's PURE sector has been hampered by a lack of awareness of the technologies and socioeconomic benefits among businesses, end users, the government, and other key stakeholders in the ecosystem.³⁶ While there has been a recent focus on PURE by policymakers and regulatory agencies, more awareness is needed amongst key stakeholders to foster a robust and supportive enabling environment that encourages investment in PURE, reduces bureaucratic challenges and builds capacities.³⁷ The establishment of a knowledge center, as well as business model demonstration initiatives, could help to alleviate the market's information gaps in the PURE space.

Severe FOREX shortages: Primarily, companies engaged in the deployment of PURE appliances are experiencing slow business growth due to a severe FOREX shortage, with foreign currency shortages also driving up the price increase of PURE appliances. Setting up a revolving FOREX facility, replicating previously successful foreign currency financing interventions in off-grid, and advocating for prescribed funding towards PURE technology within existing initiatives are critical to reducing capital requirements for market scale-up.³⁸

Inadequate access to finance: Currently, Ethiopia has 31 banks, 44 microfinance institutions (MFIs), and six capital goods finance firms. However, as of 2023, none of them have designed PURE financing products for demand or supply side parties, owing to a lack of appliance awareness and limited credit risk assessment capabilities. Consumer financing for PURE is still in its early stages of development. Even though the number of end users' willing to pay for PURE products is growing, they cannot secure finance to acquire PURE technology since it requires collateral. For example, horticulture is considered a high-risk sector, and loan amounts either need to be increased for PURE technology or require group lending, which many farmers are not interested in.³⁹ For PURE appliance private

companies, commercial loans (working capital loans) from local banks are few, and interest rates are high, limiting access to working capital. Lack of a suitable working capital facility for businesses means that PURE companies have a limited ability to maintain stocks and thus respond to peak customer demand on time.⁴⁰

Unfavorable policy and regulatory practices: Market consultation shows that there need to be more policies and laws to encourage the expansion of PURE technologies in Ethiopia. Tax and import laws, financing regulations, mobile payment regulations, and other investment-enabling policies all require reform studies for Ethiopia to grow its PURE adoption. The available PURE-related tax laws are also inconsistently applied at customs, owing to customs personnel lack of knowledge on the components of PURE appliances parts. This means that import taxes are not correctly levied, raising end-user pricing and discouraging investment. Other critical issues include the lack of a specific business license for PURE companies, the lengthy customs clearance process, the absence of quality standards requirements, and a business environment that does not make it easy for foreign companies to invest.

Ambiguity in inter-ministerial coordination: Who owns and drives PURE market growth is still an unresolved question. Responsibility for the scaling up of standalone solar systems to drive electricity access has direct ownership in government institutions, backed by national performance targets and indicators. However, this is not the case for PURE. With MOWE at the center (with no clear targets for PURE market growth), approximately ten government institutions oversee and/or influence the development and adoption of PURE technologies in Ethiopia (see Table 3). There is a need for more alignment among government institutions, development partners, and private company practices and a need for standard communication systems among important stakeholders across PURE value chains. Strong alignment and communication among these institutions are critical for the scale-up of the PURE market in Ethiopia.⁴¹

36 Interview with Suppliers, ESEDA, ATI

37 Interview with PUE Technology Suppliers

38 Stand Alone Solar (SAS) Market Update, Ethiopia, 2021

39 Sustainable Energy for Small-holder Farmers (SEFFA) in Ethiopia, Kenya, and Uganda

40 Sustainable Energy for Small-holder Farmers (SEFFA) in Ethiopia, Kenya, and Uganda

41 Ethiopian Revenues and Customs Authority (ERCA), Ethiopian Customs Guide, March 2017

Introduction

Limited domestic customization and assembly:

Affordability of PURE appliances can be supported by domestic manufacturing and enhancing local assembly capacity. However, unfavorable tax laws for local production and assembly of PURE appliances stifle market expansion for DC systems. Available PURE appliances are mainly powered by AC systems, which might contribute to the unaffordability and lack of customization of technologies to meet market demands. For example, due to a much higher landing cost in Ethiopia than neighboring countries, most imported solar pumps cost at least three times (and, more often, up to 10 times) that of a diesel pump. The problem of affordability is exacerbated by limited technological innovations, productivity, and poor market linkages.⁴² Creating an enabling environment for technological innovations has the potential to enhance the adoption and expansion of PURE appliances. By implementing a low tax on imports, providing funding to support the manufacture of other components, and encouraging in-country assembly the government can increase the affordability of PURE appliances.

Limited technical assistance: The lack of trained personnel to provide technical assistance and support for the installation, operation, and

maintenance of PURE systems has eroded end users' confidence in the market. In the health and education sectors, PURE usage is also limited by the availability of solar-related technicians in the civil service job profile catalog.⁴³ More skilled and qualified technicians are needed to help scale the industry, alongside more personnel with management capabilities.

Limited research and data management practice:

There is little research to determine end-use requirements of PURE, making it difficult to inform investors of the strategic potential of PURE. The need for centralized data management practices to better understand market potential, end-consumer preferences, and the unit economics of different products is critical to Ethiopia's PURE market expansion. For example, in a recent study, 67% of the MSMEs interviewed in Ethiopia needed more information on using PURE technologies and integrating them into their production cycles. Moreover, they also needed more information on where to purchase them.⁴⁴ Ethiopia Solar Energy Development Association (ESEDA) needs to catch up in understanding what is going on in Ethiopia's PURE space and enhance its capacity and funding support to champion PURE sector research and data management practices.



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⁴² Ethiopian Revenues and Customs Authority (ERCA), *Ethiopian Customs Guide*, March 2017

⁴³ Interview with ESEDA

⁴⁴ *Ethiopia Job Creation through Off-grid Access*, 2021

Introduction

1.5 Stakeholder Mapping

A broad range of stakeholders are already active in the Ethiopian market as highlighted in Table 3.

Table 3 - Ethiopia PURE Stakeholders

Government	Financial Institutions	Development Partners	Industry Groups	Active Private Companies
<p>(MoWE) Ministry of Water and Energy: PURE regulatory body – develops and promotes alternative energy resources and technologies, including PURE.</p> <p>(MoA) Ministry of Agriculture: Promotes PURE technologies adoption in agricultural and rural areas.</p> <p>(ATI) Agriculture Transformation Institute: Accelerates PURE growth and transformation in agriculture.</p> <p>(EEA) Ethiopian Energy Authority: Enforces technical and safety regulations for off-grid solar products.</p> <p>(ESA) Ethiopian Standards Agency: Develops/adopts international standards for the productive use of solar products.</p> <p>(EEU) Ethiopian Electric Utility: Coordinates off-grid energy solutions in the country.</p> <p>(REBs) Regional Energy Bureaus: Enable off-grid expansion.</p> <p>(MoTRI) Ministry of Trade and Regional Integration: Check that imported PURE products comply with standards.</p> <p>(ECAE) Ethiopian Conformity Assessment Enterprise: Provides quality testing services for PURE appliances. Ethiopian Customs</p> <p>(ECC) Commission: Enforces tax law on the productive use of technology appliances.</p> <p>(MoPD) Ministry of Planning and Development: Develops long-term development plans & national directions in renewable energy.</p>	<p>(DBE) Development Bank of Ethiopia: Major player in off-grid financing, offering revolving money for PURE consumer borrowing. Mostly involved in managing World Bank funds.</p> <p>Commercial Banks: Not yet providing consumer financing services for PURE technologies, some PURE companies borrowed using personal collateral for working capital. Underdeveloped loan products for PURE financing.</p> <p>Cooperatives and SACCOS: Credit services for small-holder farmers to buy PURE appliances.</p> <p>MFI: Provides group loans for PURE technology finance, high collateral, and interest rates. Limited practice in the PURE sector due to low awareness of technologies.</p> <p>Solar Companies: Provide credits + PAYGo</p>	<p>World Bank: US\$15 million fund in off-grid infrastructure, piloting incentive, technical assistance, and subsidy research.</p> <p>SNV applied a market approach for PURE scale up.</p> <p>(SEFFA) Sustainable Energy for Small-holder Farmers: develops scalable business cases & cross-country learning through PURE technologies.</p> <p>Power Africa, EnDev: Supports learning & innovation community of practice on PURE. In collaboration with EnDev, IKEA Foundation began promoting PURE in Ethiopia’s dairy and horticultural value chains in 2021.</p> <p>Shell Foundation, along with Precise Consultants, is providing technical assistance to address policy and regulatory challenges under the ESEDA umbrella.</p> <p>World Bank, Selco Foundation, GIZ, USAID, EU, AfDB + others.</p>	<p>National PUE Task Force: The newly established working group led by MoWE and ESEDA.</p> <p>(GOGLA) Global Association for the Off-grid Solar Energy Industry</p> <p>(ESEDA) Ethiopian Solar Energy Development Association</p> <p>(ASEDA) Amhara Solar Energy Development Association</p> <p>(TSEDA) Tigray Solar Energy Development Association</p> <p>(SSEDA) Southern Solar Energy Development Association</p> <p>(OSEDA) and Oromia Solar Energy Development Association</p> <p>Industry groups have financial and technical capacity limitations.</p>	<p>There is no separate license for PUE technology suppliers.</p> <p>Import & Distribution: Sun Transfer Tec PLC, Solar Village PLC, Solar Development PLC, Green Scene, Renesys Engineering & Trading PLC, ACME Engineering and Trading PLC</p> <p>Import, Distribution, & modification/ customization*: Power East Africa Engineering PLC, Amio Energy PLC, Lydetco PLC, Marasat General Mechanics, AFESol Technology PLC</p>

Introduction

1.6 Market Opportunities

The Government of Ethiopia released the National Electrification Program 2.0 (NEP 2.0) in 2019, recognizing the multifaceted advantages that energy can unlock. The plan's off-grid program components include providing pre-electrification solutions for those citizens not connected to the grid by 2025 and long-term solutions for those who will not be reached by the grid at that time.⁴⁵ 35% of the connections are planned to be through off-grid solutions, reaching approximately 9.2 million households, many of whom are rural.⁴⁶ Despite the multiple obstacles to growth in Ethiopia, some PURE solutions are being introduced to the market and gaining acceptance.

PURE irrigation equipment offers significant market potential, notably SWPs, with studies indicating that SWPs can irrigate 6,800 hectares and service over 1 million farmers.⁴⁷ The newly established Ministry of Irrigation and Lowlands Development intends to import approximately 100,000 SWPs per year and is advocating that all pumps imported by the ministry be powered by solar energy.⁴⁸ Similarly, the Ministry of Agriculture plans to deploy 210,000 – 400,000 irrigation pumps between 2020 and 2025.⁴⁹

There is growing awareness about solar technologies for productive uses in agriculture by smallholder farmers.⁵⁰ The exponential rise in diesel costs creates a high demand for PURE technologies by farmers in most rural areas where grid connection is not feasible.⁵¹ Replacing 50% of petrol-powered systems (installing 800,000 solar water pumps) in Ethiopia will cumulatively

eliminate production of 1.1 million tons of CO₂ and save \$404 million on petrol costs for farmers by 2030, while 2.2 million smallholder farmers jobs and livelihoods will be improved.⁵² This would result in a \$7.1 billion increase in cumulative value of crops produced by 2030.⁵³ PURE solar irrigation could lift more than 1 million people out of poverty and raise Ethiopia's GDP by \$203.5 million.⁵⁴

Aside from agriculture, the use of productive applications has potential in the transportation sector.⁵⁵ While there is little activity to date, there is growing interest in e-mobility by private-sector investors. For example, Mitsui & Co Ltd, a Japanese electric vehicle manufacturer, has announced plans to produce two- and three-wheeled electric vehicles in Ethiopia.⁵⁶

The Incoming New Governing Program (NEP 3.0) provides an opportunity to integrate PURE in electrification plans: In November 2017, the Government of Ethiopia launched the National Electrification Program (NEP), representing the action plan for achieving universal electricity access nationwide by 2025.⁵⁷ The National Electrification Program 2.0 (NEP 2.0) is an updated version of the National Electrification Program (NEP) that was released in 2017. NEP 2.0 stated the government's commitment to continuously updating electrification targets and timetables based on new analytics and ground progress. The Ethiopian government is in the early stages of updating the program to NEP 3.0, which provides a sizeable opportunity to integrate key agendas of solar PURE technologies scaling up at the program level.⁵⁸

45 [The World Bank](#)

46 [NEP 2.0, 2019](#)

47 [Business Model Scenarios and Suitability: Smallholder Solar Pump-based Irrigation in Ethiopia](#)

48 Interview with MILLS

49 [Business Model Scenarios and Suitability: Small-holder Solar Pump-based Irrigation in Ethiopia](#)

50 Interview with ESEDA

51 Interview with ATI

52 [Transforming a billion lives Transforming a billion lives](#)

53 [Transforming a billion lives Transforming a billion lives](#)

54 [ibid](#)

55 [Building the Market for Rural Electrification in Ethiopia, 2020](#)

56 [New Business Ethiopia. E-Trike Launches Electric Car Assembly in Ethiopia, 2019.](#)

57 [NEP 2.0, 20219](#)

58 Interview with MoWE, 2023

Introduction

Recommendations for Quick Wins

1. Include PURE Action Points in the NEP 3.0:

Mobilize key stakeholders from policymakers (National Bank of Ethiopia, Ministry of Finance, Ministry of Water and Energy, Ethiopia Customs Commissions), financial institutions, universities, and NGOs to consult and provide action points in the NEP 3.0 to help create solar PURE awareness, and to meet financing, policy, and regulatory challenges. This could include the two key actions noted below.

Key action:

- a. Set up a Forex facility for PURE importers, assemblers, and manufacturers to allow private enterprises to borrow in FOREX and repay in local currency. Local currency can then be utilized to finance end users.
- b. Conduct a thorough tax reform analysis for various PURE appliances and replacement parts, with the goal of offering tax breaks that encourage market investment.

2. Enhance Inter-ministerial Collaboration:

Develop a mechanism to align activities between the Ministries of Water and Energy, Irrigation and Lowlands, and Agriculture, to drive PURE adoption through the development of cross-sectoral programs.

Key action:

- a. Create a multi-stakeholder platform where the lessons learned from various programs and projects are compiled and given to the appropriate parties for action. The national PURE task force is an excellent starting point but must be a persistent and long-term endeavor. This will enable discussions between energy and other sectoral stakeholders who benefit from energy.
- b. Conduct a series of inter-ministerial cooperation workshops to promote PURE market scaleup.
- c. Organize a series of exhibitions, roadshows, and radio programs at the farmers' level to raise awareness among rural communities.

3. Unlock Innovative Finance: Drive innovative financing models for scalable consumer financing possibilities in Ethiopia's component-based solar PURE market.

Key action:

- a. Conduct financial sector-focused PURE awareness campaigns and capacity-building interventions to encourage them to issue loan products for PURE technologies.
- b. Design PURE loan products that use the appliances as a collateral.
- c. Set up Results Based Financing (RBF) facility available to PURE companies that provide high-quality products to consumers with appropriate after sales services.



Demand Analysis



Demand Analysis

2.1 Demand Overview

This study recognizes the growing demand in the use of solar technologies for productive uses in agriculture, industry, transportation, MSMEs, health, and education sector.⁵⁹ In particular, the agriculture sector has seen an increase in the adoption of PURE technology, with the use of PURE for irrigation supported by the government in recent years.⁶⁰ The increased demand for PURE technologies is reflected in some of the key activities and priority areas listed below.

Key Activities and Priority Areas

1. The government identified large-scale irrigation, agricultural processing, e-cooking, and e-vehicles as key areas for developing productive uses of energy in accordance with Ethiopia's Climate Resilient Green Economy Strategy.⁶¹
2. Under the NEP 2.0, the government has conducted a rapid assessment and a parallel nationwide comprehensive study of productive use locations across the country that recommended PURE as a least cost way to support different crops across the country's administrative areas, or woredas. These include the use of PURE in horticulture (13 woredas), horticulture and maize (4 woredas), maize (77 woredas), malt barley (23 woredas), sesame (19 woredas), sesame and maize (1 woreda), wheat (64 woredas), wheat and maize (1 woreda), and wheat and malt barley (9 woredas).⁶² According to a recent feasibility study, grain flour milling in Ethiopia is already ready to be electrified and implemented. Strong fundamental properties of maize, wheat, teff, and barley flour milling suggest that electrifying the processing of these crops can be simple and successful.⁶³
3. The Ethiopia Jobs Creation Commission (JCC) plans further include recommendations to enhance the untapped job creation potential of micro, small, and medium-sized enterprises (MSMEs) using PURE technologies. MSMEs can grow by implementing PURE technologies to improve their commercial operations.⁶⁴

4. The Ethiopia Electric Utility (EEU) connects about 4.5 million households to the grid.⁶⁵ The government currently subsidizes 70% of the cost. Even though Ethiopian power costs only 3 to 4 cents per KW/h, the cost-reflective price is estimated to be 10 to 11 cents USD.⁶⁶ It is implementing several initiatives to capitalize on the country's abundant solar resources, which have an estimated capacity of over 45,000 MW, and reduce its huge grid connection expenses.⁶⁷ In line with this, the EEU has advocated for the use of off-grid household products such as radios, televisions, and fans.

2.2 Potential Demand Snapshots

- According to NEP 2.0, over 45,000 institutions (including 15,000 health posts, and approximately 90 hospitals) need access to electricity services. Given that needs will include powering vaccine fridges and ICT, this indicates that there is a potential market for PURE technologies.
- Following the GOE's target to irrigate seven million hectares of small-holder farms using solar pumps, 200,000 solar pumps are required to pump water from as shallow as 25 meters.⁶⁸
- Between 2018 and 2024, the African market for solar pumps is predicted to expand by 20%, with Ethiopia potentially being the second-largest market for solar pumps.⁶⁹
- According to the current high demand for appliances in horticulture irrigation, grain milling, injera baking, milk cooling, bread baking, and coffee washing for PURE, the estimated value of supplier costs for purchasing these appliances is estimated to be around US\$380 million. This estimated investment represents a large opportunity for local suppliers of PURE products to meet the demand.⁷⁰
- Milk cooling alone can generate \$1.3 billion in annual revenue by 2025 due to enhanced milk storage facilities, resulting in less milk deterioration and longer shelf life.⁷¹
- The agriculture, health, and agro-processing sectors are expected to account for most PURE technology end users.⁷²

59 Interview with ESEDA

60 Interview with ATI

61 [Productive Uses of Energy in Ethiopia Agricultural Value Chain and Electrification, Feasibility Study, March 2021](#)

62 NEP 2.0

63 [Productive Uses of Energy in Ethiopia Agricultural Value Chain and Electrification, Feasibility Study, March 2021](#)

64 [Ethiopia: Job Creation through Off-grid Energy Access](#)

65 [EEP, 2020](#)

66 Interview with MILLS

67 NEP 2.0

68 [AfDB \(2019\). Market Assessment for the Off-grid Facility](#)

69 [ACE-TAF Stand Alone Solar Market Update Ethiopia](#)

70 [Capturing the Productive Use Dividend, 2020](#)

71 [Capturing the Productive Use Dividend, 2020](#)

72 Interview with PUE Technology Suppliers in Ethiopia

Demand Analysis

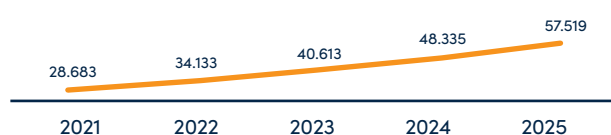
2.3 Demand for Key Technologies

Solar Water Pumps

With most of Ethiopia's 117 million population working in the agriculture sector and only 10% of its land irrigated, there is a large potential in the market for the use of SWPs. The recent and exponential rise in diesel costs has created a high demand for PURE technologies by small-holder farmers in most rural areas where grid connection is not feasible.⁷³ SWPs have the potential to create upwards of 100,000 jobs in the horticultural sector and value chain, as the lack of adequate water supply is one of the sector's key bottlenecks.⁷⁴

Forecasts undertaken in the Stand Alone Solar study project significant growth in SWP sales (see Figure 6). While interviews with ATI, MOA, and MILL's, found that their estimates of future demand expect annual solar water pump sales to range from 40,000⁷⁶ to 70,000 units.

Figure 6 - Projected demand for Solar pumps (600Wp)⁷⁵



Cold Storage / Cold Chambers

The dairy, poultry, and horticulture industries have a high demand for PURE cold storage, as most small-scale farmers reside in places with little to no access to electricity and there is a high incidence of produce perishing before it reaches market.

Ethiopia has Africa's largest cattle population yet still imports dairy products to meet local demand.⁷⁷ As per FAOSTAT, the country imported 173 tons of fresh cow milk, 181 tons of butter, and 178 tons of cheese in 2019.⁷⁸ Solar appliances have the potential to help dairy farmers overcome major challenges in Ethiopia's dairy value chain, such as feed scarcity, low milk quality, and inefficient butter churning methods.⁷⁹

Milk Cooling

In 2016, the Netherlands division of Paul Mueller, a private food processing company, tested an off-grid biogas-powered milk cooling system for small dairy farms in collaboration with SimGas, a biogas supplier. The innovation was recognized with an OpenIDEO Agricultural Innovation Award in 2016.

There is a high degree of interest in this technology. However, there is also a high degree of misunderstanding about the benefits of cooling: the reason stated by most respondents for being interested in cooling technologies is to store milk over the fasting periods – given the duration of most fasting periods (over two weeks), this is not a viable solution.

Despite the successful technical pilot, the Mueller solar or biogas equipment has yet to be developed as a commercial product. The main problems cited are the lack of FOREX and challenges in the ease of doing business.

Cold chambers present high potential at various stages of the horticulture value chain, from aggregation to retail, with the potential to extend the shelf life of fresh produce. Solar freezers and refrigerators are key PURE technologies for reducing energy use and meeting the estimated energy requirements of Tier 3 of the National Electrification Program 2.0.⁸⁰

PURE cold storage technologies also have potential to support the health sector by providing vaccine cooling solutions. This reduces hospital expenses and provides appliances in rural health centers disconnected from the grid.

73 Interview with ATI

74 Interview with ATI

75 Stand Alone Solar (SAS) Market Update, Ethiopia, 2021

76 Stand Alone Solar (SAS) Market Update, Ethiopia, 2021

77 Precise Ethiopia | Publications

78 <https://www.fao.org/faostat/en/>

79 <https://www.fao.org/faostat/en/>

80 Ethiopia Job Creation through Off-grid Access, 2021

Demand Analysis

Solar Refrigerators

Solar refrigerators retail prices are unaffordable for most small farmers or household consumers.⁸¹ In 2022, only 0.4% of off-grid households in Ethiopia were projected to own a refrigerator.⁸² The obtainable market for off-grid refrigerator market in Ethiopia has a growth projection of 567% from 2018 to 2030.⁸³ However, Refrigerator Unit (RU) sales are still small, with only 1% of off-grid households purchasing them.⁸⁴

Plug & Play (PP)

TVs and RUs are the most common PURE appliances sold as part of a 'plug and play' off-grid solar kit. Despite financial setbacks due to COVID, GOGLA affiliates reported selling 602 solar TVs in Ethiopia in the second half of 2020.⁸⁵ In 2022, only 2% of off-grid households in Ethiopia were projected to own a TV.⁸⁶ The obtainable market for off-grid TVs in Ethiopia has a growth projection of 224% from 2018 to 2030.⁸⁷ Solar energy kits, often accompanied by appliances such as TVs, radios, phone charging units and RUs, have shown a positive potential for providing income to MSMEs. ATI and ESEDA experience indicate solar-powered mobile phone charging stations, which can charge up to 50 mobile phones at once, are being adopted in off-grid villages at scale.⁸⁸

E-mobility

In Ethiopia, there were 1.3 million registered gasoline-powered vehicles in 2020.⁸⁹ Following the recent exemption of all-electric vehicles from VAT, Surtax, and Excise Tax by Ethiopia's Ministry of Finance, electric vehicle (EV) adoption is steadily gaining traction on the roads. It creates a significant potential for PURE, with e-motos being trailed in other countries in East Africa.⁹⁰

The all-electric Hyundai Ioniq began being assembled in Ethiopia in 2020 by Marathon Motor Engineering, a partnership between Hyundai Motor Company and Olympic Champion Haile Gebrselassie. Another firm, Greentech Africa, has also been selling electric cars, energy storage, and water purifiers.⁹¹

Electric Cooking

Since the 1970s, when government projects encouraged e-cooking gadgets (especially electric injera stoves), e-cooking has been a feature of Ethiopian cooking practices. Nevertheless, only 4.1% of all homes use electricity as their primary cooking fuel, while the bulk of the population (96%) still cooks using polluting fuels, with firewood being the most used (82%).⁹² It is estimated that between 200,000 and 2.1 million domestically manufactured electric stoves have been sold in the market.⁹³ There is clear untapped potential to increase uptake of e-cooking in productive uses as 41% of the population appear to have an electricity connection but do not use it for the bulk of their cooking needs.⁹⁴

81 Analysis by Precise Consulting

82 [Off- and weak-grid solar appliance market, Ethiopia Country Profile, 2022](#)

83 [Off- and weak-grid solar appliance market, Ethiopia Country Profile, 2022](#)

84 [Off- and weak-grid solar appliance market, Ethiopia Country Profile, 2022](#)

85 [Global Off-Grid Solar Market Report H2 2020](#)

86 [Off- and weak-grid solar appliance market, Ethiopia Country Profile, 2022](#)

87 [Off- and weak-grid solar appliance market, Ethiopia Country Profile, 2022](#)

88 Interview with ATI and ESEDA

89 [Ministry of Transport and Logistics](#)

90 [ESI Africa 2021. Rwanda Electric Motorbike Company Secures \\$3.5 Million Investment](#)

91 [Clean Tech China](#)

92 [Exploring the market for e-cooking: Insights from sub-Saharan Africa and South Asia](#)

93 [Exploring the market for e-cooking: Insights from sub-Saharan Africa and South Asia](#)

94 [Exploring the market for e-cooking: Insights from sub-Saharan Africa and South Asia](#)

Demand Analysis

2.4 Key Demand Barriers

While potential demand for PURE in Ethiopia is high, consultations and research undertaken during this analysis show that it is hampered by significant barriers. These include:

1. **Affordability:** PURE technology is expensive when compared to the income levels of many Ethiopian households (mostly smallholder farmers). This makes it difficult for many farmers to afford PURE technology, even if they are aware of its benefits and would prefer to use it.
2. **Consumer Awareness:** Many Ethiopians are unaware of the various sorts of PURE products that are available, or how they work. Due to this lack of understanding, consumers are unable to make an informed decision about whether to purchase PURE technology.
3. **Consumer Financing:** There are currently no financing solutions available for PURE appliances from commercial banks or microfinance institutions, which makes it difficult for consumer to finance the acquisition of PURE technology even if they are aware of the technology benefits.
4. **Maintenance and after sales service:** There is a scarcity of qualified professionals in Ethiopia who can perform maintenance and after-sales service for PURE products. This can make it difficult for farmers to get assistance if their PURE appliances fail. PURE technology must adhere to strict standards and quality control methods to attract early adopters and first movers.



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Supply Analysis



Supply Analysis

3.1 Technology and Product Mapping

This study discovered twenty types of PURE technologies available in Ethiopia in various product styles and used across five main market applications. These are at varying stages of market maturity and have different potential to scale. Most PURE technologies come with a one-year warranty. Table 4 highlights some PURE technology brands and types.

Table 4 – PURE Technologies Brands and Type

HS Code	PURE Technologies	Common Brands	Type
8413 6000 8413 7000 8413 8100	Solar Water Pumps	Paspura International, India LORENTZ Pumps, Germany, and other countries Luminous Safe Pumps, India PEVER, China Sun Culture, Kenya PUMPING SOLUTIONS Pumping Solutions – List of Featured Products Dayliff SUNFLO Series	For small-scale farmers, there are two sizes: 0.35 and 0.75 kilowatts for 1-2 hectares), as well as Panel, pump, irrigation kits, sprinkler, or drip kits separately if needed. Rain Maker 2c- both with and without a battery, with a 2700 liters per hour capacity. Rainmaker 2s- with and without battery, 1200 liters per hour output capacity Kubwa- 3000 liters per hour output capacity without battery ⁹⁵
84192900 84181020 84182120 85182920 85183020 85185020 85186920	Solar Refrigerator	Steca, Germany Global Ice, Germany Inspira farms modular pack Houses & cold storage In most cases, solar fridges and freezers are imported from Europe and the United States of America ⁹⁶	Medium-sized refrigerators have large shares (several sizes ranging from small to large (55L to 315L) Capacity: 100 Wp or more AC refrigerators are available but typically lack an inverter and are more expensive than the DC models on the market ⁹⁷ 165-liter capacity, thermal storage, no battery ⁹⁸ Medical/ Vaccine Refrigerators
84181020 84182120 85182920 85183020 85185020 85186920	Cold Storage Units	EcoZen (on the pipeline)	Customized 20-60 ft containers ⁹⁹ Deep freezer (AC/ DC): Long-term storage of milk and milk products (Powered by renewable sources or other sources)
84369100 84369100 84362900	Egg Incubator Chicken Brooder	Melasty, Turkey	Poultry-keeping machinery or poultry incubators and brooders Solar incubator for hatching eggs

95 Interview with PUE Technology Suppliers in Ethiopia

96 OFF-GRID productive use of energy catalog, Ethiopia, 2020

97 Off- and weak-grid solar appliance market in Ethiopia, Efficiency for Access Coalition, MAY 2022

98 Interview with PUE Technology Suppliers in Ethiopia

99 Interview with PUE Technology Suppliers in Ethiopia

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84342000	Milking Machines	Melasty, Turkey	A machine for dairy application to churn milk to produce butter.
84193100	Milk Chiller		Instantaneous milk chiller to preserve milk from production to delivery.
84342000	Milk Pasteurizer (batch or continuous system)		Pasteurized in plate heat exchangers at 72-75°C for 15 seconds
	Butter Churning Machines, Cream Separator		36L/h churner, 1.5Kw, single phase 500L-3000L, three-phase, 3Kw-6Kw
85287220	Solar TV	Powerequestion, Alphapower, D. Light, and Fosera	AC/DC Compatible TVs designed to work with solar power ¹⁰⁰ TV sizes range from 14 to 32 inches ¹⁰¹
84371000	Solar Milling Machine	Zebra Mills, Spain, and Gemco	less than 10kW capacity
84378000		Energy, India	Solar-powered electric crop milling machine ¹⁰²
85102000	Hair Clipper	Omni Voltic	Electric hair trimmer/ clipper for barber shops
85163100	Hair Dryer		Hairdressing saloons in rural areas
84521000	Sewing Machine		Solar-powered sewing machines



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100 [Off- and weak-grid solar appliance market in Ethiopia, Efficiency for Access Coalition, MAY 2022](#)

101 [Interview with PUE Technology Suppliers in Ethiopia](#)

102 [ACE-TAF Ethiopia Customs Handbook for stand-alone solar products and components](#)

Supply Analysis

3.2 Suppliers

Ethiopia is also host to several PURE technology suppliers' and businesses. The most active are summarized in Table 5.

Table 5 – Overview of PURE Companies in Ethiopia

Active Suppliers	Description	Position in the Value Chain	Business Model	PURE Technologies	Market Challenges
 <p>Sun Transfer Tec PLC</p>	A technology company involved in the field of renewable energy, mainly on solar photovoltaic systems, with the scope of system sizing, assembling, import, installation, commissioning, and training.	Import and distribution	The businesses operate in PURE based on project demands by donors	Solar water pumps Solar-powered milking machine Solar-powered butter churner machine Inverters Power generators PURE systems	PURE technologies are not widely known by end users and by various stakeholders engaged in the market. Difficulty in finding skilled PURE maintenance technicians Customs' administrative burdens and bureaucratic challenges. Price fluctuations due to time lag from order to shipment of products.
 <p>Green Scene Energy PLC</p>	A solar energy appliances company with the mission of providing off-grid communities with productive use of solar energy that is both affordable and of the highest quality.	Import and distribution Semi-manufacturing (Customization)	Businesses in PURE run according to project demands from donors and specific clients.	Solar refrigerator Solar water pumps Cold storage units Irrigation kit and drip systems	Absence of financing options. Logistics problems (lack of roads, fuel cost). Foreign currency shortage. Tax exemption for local manufacturers does not apply.
 <p>Solar Village PLC</p>	Solar-powered technology supplying company engaged in the sourcing, supply, and installation.	Import and distribution	Operates primarily on an order basis from NGOs and government agencies for PURE technologies, but they also maintain a stock of products.	Solar water pumps Power generators PURE systems Sprinklers and drip farming systems (used for urban farming)	Due to a lack of competition in the market, unskilled/ unspecialized imported goods of low quality are distributed, eroding a burgeoning market of end-user trust.
 <p>Power East Africa Engineering PLC</p>	A company that provides electromechanical solutions in Ethiopia, like supply, installation, testing, and commissioning of projects mainly in solar systems, power and transmission, and industrial boilers.	Import and distribution Semi-manufacturing (Customization)	The PURE business model relies on orders from NGOs, governmental organizations, and subcontracting with other organizations.	Solar water pumps (both submersible solar water pumps and surface-level water pumps) Hydroponic systems Dairy equipment	High research and development costs. Lack of cooperation and inconsistency of support in some regions. Some regions require an exorbitant amount of money for performance guarantees, especially when MFI affects the company's financial flow, and it isn't easy to recover the money.
 <p>Solar Development PLC</p>	A solar systems integrator company aims to design, distribute, install, and service turnkey solar systems.	Import and distribution	Business is primarily focused on pilot programs for PURE technologies in a specific area; once the project is deemed valuable and sustainable by both the company and potential customers in the area, they move on to a larger distribution with a target of off-grid rural communities.	Solar water pumps Solar-powered mobile charging stations Tallow bellow (barber kits, hair clippers) Fridges as part of their pilot program Inverters Solar power generators	Supply-side issues with price fluctuation and the rapid rise of PURE technology costs. High transportation costs and regional instability during transportation. Raw material cost fluctuations. Small-scale demand in the market for some PURE technologies. Political instability in the regions and Covid pandemic.

Supply Analysis

<p>Amio Energy PLC</p> 	<p>An electromechanical company that manufactures and trades machinery and tools for industrial, agricultural, and construction applications.</p>	<p>Import and distribution</p> <p>Semi-manufacturing (Customization)</p>	<p>The company performs its functions in PURE under contract with non-governmental organizations.</p>	<p>Solar water pumps</p> <p>Power generators PURE Systems</p> <p>Solar powered dairy equipment</p>
<p>AFEsol Technology PLC</p> 	<p>An innovation company manufacturing small and medium-scale machinery mainly deals with manufacturing machinery and equipment fitted for grids and off-grid technologies.</p>	<p>Import and distribution</p> <p>Semi-manufacturing (Customization)</p>	<p>PURE business is based on orders and uses locally sourced manufacturing products and custom-made products.</p>	<p>Solar-powered milking machines</p> <p>Manufacture PURE technologies that can be fitted for solar extensions.</p>
<p>Lydetco PLC</p> 	<p>An engineering company engaged in designing, supplying, and installing solar photovoltaics, thermal systems, solar home systems & solar lanterns.</p>	<p>Import and distribution</p> <p>Semi-manufacturing (Customization)</p>	<p>PURE technology products businesses are based on orders from non-governmental organizations, government agencies, and other customers.</p>	<p>Thermal energy solar cooker</p> <p>Solar water pumps</p> <p>Solar refrigerators</p>
<p>HelloSolar</p>	<p>A solar technology company focused on the installation of SHS and PUE products mainly solar water pumps.</p>	<p>Assembly, import, and distribution</p>	<p>Provides PURE and SHS systems to end-users, governments, and NGOs. Imports Semi-knocked down components and assembles products locally.</p>	<p>SHS systems, and Solar water pumps</p>
<p>Marasat General Mechanics</p>	<p>A local innovation company that works on various industrial input machinery innovations, including PURE Technologies. This includes importing, designing, and proposing potential PURE technology and solutions.</p>	<p>Import and distribution</p> <p>Semi-manufacturing (Customization)</p>	<p>Providing optimization and modest PURE innovations for large industries Project-based PURE solutions for different donors, such as USAID</p>	<p>Solar refrigerators: Developed to test a cooling unit that includes a cold room, a small kiosk, lighting, and battery chargers</p> <p>The cooling system's primary purpose is to serve as a milk collection center for nearby farmers.</p> <p>Solar hydroponic fodder rack; Electromechanical equipment for dairy machinery</p>
<p>Rensys General Business</p>	<p>Engineering & Trading Company offers energy solutions.</p>	<p>Import & distribution</p>	<p>Provide PURE solutions for micro businesses and agriculture.</p>	<p>Solar pumps</p>
<p>Agro-vet PLC</p>	<p>A trading company of solar-powered technologies</p>	<p>Import & distribution</p>	<p>At the early stage of PURE appliances sales</p>	<p>Solar pumps</p>
<p>Vera International Business PLC</p>	<p>A trading company of solar-powered technologies</p>	<p>Import & distribution</p>	<p>Works in agriculture technology solutions</p>	<p>Solar pumps</p>
<p>ACME Engineering and Trading PLC</p>	<p>Engineering and trading company of solar-powered technologies</p>	<p>Import and distribution</p> <p>Semi-manufacturing (Customization)</p>	<p>ACME currently participates in four sectors (energy, water, agriculture and irrigation, and laboratory) to provide solar-powered technologies.</p>	<p>Solar pumps</p> <p>Hair clippers (Saloon Pack)</p> <p>Mobile charging stations</p> <p>Solar milling</p>

Supply Analysis

3.3 Maturity Assessment

In comparison to neighboring countries like Kenya and Uganda, Ethiopia's PURE market is still in its emerging stages and has only a limited number of PURE product sales. Figure 7 depicts the different technology and market maturity levels, while Table 6 illustrates where key PURE technologies rank against these levels in Ethiopia.

Figure 7 - PURE Technology Maturity Level Mapping Framework

	1 Concept	2 Horizon	3 Emerging	4 Near to market	5 Commercial Market
Tech level	Product prototype exists	Product being piloted for more than 5 years	Minimum viable product exists	High rates of design and manufacturing innovation types of product technologies exists	Incremental changes in cost, performance and efficiency
Market level	Nascent	Business model being piloted for more than 5 years	Appliances for which the demand is strong and clear	Growing sales and new entrants in the market	Product sold at volume by market players, market ecosystem supporting inputs and services exists

Table 6 - PURE Technologies Market Maturity Stages

PUE Technologies	Technology Stage	Market Status
Solar Powered Hydroponic fodder	Concept	Concept
Solar Sewing Machines	Concept	Concept
Agriculture Cold storage	Concept	Concept
Solar Mills	Concept	Horizon
Electric 2 and 3 wheelers	Horizon	Horizon
Cold Storage Rooms in Vehicles	Concept	Horizon
Coffee Washing	Concept	Horizon
Power Generators	Emerging	Emerging
Sprinkler systems and Drip irrigation systems	Emerging	Emerging
Milking Machine	Emerging	Emerging
Milk Cooling/ Storage Tanks	Emerging	Emerging
Solar-powered butter Churner	Emerging	Emerging
Cream Separator	Emerging	Emerging
Solar Milk Can	Emerging	Emerging
Solar-Powered Poultry Shed Lighting	Emerging	Emerging
Solar Cooking	Emerging	Emerging
Hair Clippers	Emerging	Emerging
Mobile Phone Solar Charging Stations	Emerging	Near to Market
Solar TV	Emerging	Near to Market
Solar Refrigerators	Emerging	Near to Market
Solar Water Pumps	Near to Market	Commercial Market
Solar Energy Kits (lighting and systems)	Commercial Market	Commercial Market

Supply Analysis

3.4 Business Models

A key driver for innovative business models is the need to make solar technologies more accessible and affordable. Pay-as-you-go (PAYG) models, for example, allow households and small businesses to pay for solar systems over time, making them more affordable than traditional financing models. In Ethiopia's PURE industry, however, most of the supplier's business model depends on orders from non-governmental organizations and government agencies. According to this study's current business model analysis, Ethiopia's PURE market is currently lagging in innovation regarding technological options, payment methods, and implementing market-led initiatives.

The key customers of the PURE market are NGOs and government offices who buy products in bulk and provide it to end users (mainly in agriculture). End-users who are direct, commercial, customers are few and far between. This leads to distribution channels being relatively short as suppliers provide products directly from entry to the country

to end-users, without retailers and wholesalers participating in the ecosystem. PURE suppliers have strong connections to NGOs, as they are the key demand segment in addition to government agencies.

3.5 Distribution Channels

Most suppliers interviewed run their distribution channels through procurement, importing, and directly distributing appliances to government and non-government organizations. In Ethiopia, just a few private companies' hold stock of PURE technologies. Some PURE companies use agent-based distribution channels to recruit and train agents (retailers) to handle installation, maintenance, and end-user training.

The Ethiopian PURE industry has yet to leverage agriculture input dealers as a distribution channel for appliances to reach out to rural and remote end customers. Another distribution channel that is being piloted is direct distribution to farmers, or engaging MFIs to work with them in the scale-up of PURE technologies.¹⁰³



© xx

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Table 7 – PURE Enterprises Current State Business Model Summary

Key Partnerships	Key Activities	Value Proposition	Customer Relationships	Key Customer Segments
<ul style="list-style-type: none"> International NGOs. To date, the government of Ethiopia and NGOs have been the largest purchasers of PUE technologies, accounting for more than 95% of total sales. Governmental Agencies Regional government bureaus of Agriculture and Energy PUE Technology Suppliers ESEDA MOWIE MoF MOA and ATI 	<ul style="list-style-type: none"> Business development (Bid submission) Managing relationships with suppliers and financial institutions for LC opening and access of Forex Presales Evaluation Installation of PURE products Aftersales Services Maintenance of PURE products <hr/> <p>Key Resource</p> <ul style="list-style-type: none"> Availability of Forex Quality and brand of technologies 	<p>Pre-sales Service</p> <ul style="list-style-type: none"> Need Assessment Site Evaluation Construction Works (E.g. Well Drill/ Digging Holes) Training on Equipment Market Linkage (Few) <p>Aftersales Services</p> <ul style="list-style-type: none"> Installation Maintenance <p>Warranty</p> <ul style="list-style-type: none"> Most PUE technologies have a one year warranty 	<ul style="list-style-type: none"> Personal Relationships (Based on previous performance, key relationships are formed with NGOs and government agencies) Website to look up for bid announcements. Events and Exhibitions (Low Frequency) <hr/> <p>Channels</p> <ul style="list-style-type: none"> Most distributors import and directly transfer technologies to the buyers (who are primarily NGOs) A few suppliers do semi-manufacturing/ customization on technologies 	<p>International NGOs</p> <ul style="list-style-type: none"> CARE Ethiopia Concern Ethiopia United States Agency for International Development International Red Cross Orthodox Development Agency World Vision SOS Children’s Villages Feed the children Sasakawa Africa Association ACDI/VOCA <p>Government Agencies</p> <ul style="list-style-type: none"> Ministry of Agriculture Agricultural Transformation Institute Regional Agriculture Bureaus Ministry of Water and Energy Ministry of Irrigation and Lowlands Development Regional Governments Agriculture and Energy Bureaus <p>Retailers (Limited)</p>
<p>Cost Structure</p> <ul style="list-style-type: none"> Freight Cost (Inbound and Outbound Logistics/ Transportation) Tax (Mainly for spare parts of PUE Technologies) Warehouse costs (Relatively low to others cost types) R&D costs (The primary cost type impeding market scaleup – adding these costs to technologies affects the competitiveness of technology market price) 		<p>Revenue Streams</p> <ul style="list-style-type: none"> Sales of PUE Products (The majority of the products have profit margins of 40% of higher.) Service Fees (The majority of services revenue comes from maintenance service fees, but there are also some revenue sources from end-user training and presales activities) 		
<p>Import-related expenses make up the majority of the PUE business’ operating costs</p>				

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**Enabling
Environment**

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Enabling Environment

4.1 Access to Finance

The financing environment for the productive use of solar energy in Ethiopia remains challenging for market scale-up.¹⁰⁴ Consumer financing facilities, such as microfinance institutions (MFIs) and savings and credit cooperative organizations (SACCOs), can increase access to financial resources but are limited in the off-grid solar market.¹⁰⁵

Financing is available in theory, but its supply is limited for a range of reasons.¹⁰⁶ The line of credit available from the DBE is oversubscribed and insufficient to the market need.¹⁰⁷ Moreover, commercial banks represent only a small portion of lending as they perceive the sector to be high risk, so they require high coverage ratios (sometimes more than the capital) and strong requirement of fixed collateral. Banks also see transaction costs as too high, given the relatively small size of loans.¹⁰⁸ The current PURE financing context is exacerbated by financial institutions that have yet to accept the technologies as collateral and lack of awareness issues.¹⁰⁹

The main consumer finance facility in the market has been the World Bank credit line. This is a USD45 million facility financed by the International Development Association (IDA) specifically for retail lending to stand alone solar companies and wholesale lending to MFIs.¹¹⁰ The credit facility is managed by DBE as the financial intermediary and MoWE as the technical intermediary.

The main financing challenge on the supply side of the market is the lack of access to foreign currency. Almost all suppliers interviewed stated FOREX as a major constraint to operations and scale-up. Lack of foreign currency access is a

challenge faced by many sectors in Ethiopia; as PURE suppliers import and distribute PURE products; this challenge poses a distinct hindrance to the PURE ecosystem.

4.2 Research and Data

Research and data are essential for developing innovative technologies, strengthening the skills of stakeholders, and improving the policy and regulatory environment. However, the existing research and data management practice in the Ethiopian PURE sector is inadequate and holding back the growth of the market. For example, inadequate knowledge of end-user demand for PURE technologies discourages PURE companies from importing and distributing products.¹¹¹ This lack of information is a significant impediment to the PURE sector's strategic efforts to scale up. Additionally, there is limited access to finance for research and data management activities in the solar energy sector, further hindering its development.

4.3 Capacity Building

There is a lack of technical capacity in the solar energy sector, which limits the development of innovative technologies and products including PURE. This is particularly true for small and medium-sized enterprises (SMEs) in the solar energy sector, which often lack the technical and managerial skills to grow their businesses.¹¹² Capacity-building initiatives can be developed to increase stakeholders' technical and managerial skills. This can be achieved through training programs, workshops, and seminars. Capacity-building initiatives can target various stakeholder groups, including entrepreneurs, researchers, government officials, and communities.

104 Interview with PUE Technology Suppliers

105 <https://pfchange.org/support-solar-cell-energy-project/?lang=en>

106 [Ethiopia: Financing Off-Grid Energy to Achieve Universal Electrification and SDG 7](#)

107 [ibid](#)

108 [ibid](#)

109 Interview with Suppliers and ESEDA

110 [African Power Platform - Stand Alone Solar \(SAS\) Market Update: Ethiopia](#)

111 [Ethiopia Job Creation through Off-grid Access, 2021](#)

112 [Ethiopia Job Creation through Off-grid Access, 2021](#)

Enabling Environment

4.4 Public Finance

Tax and duty exemptions/incentives are a critical ecosystem enabler for Ethiopia’s PURE market scale-up. The main customs legal framework is provided by Customs Proclamation No. 849/2014, as amended by Customs Amendment Proclamation No.1160/2019 and Definition of Powers and Duties of the Executive Organs of the Federal Democratic Republic of Ethiopia Proclamation No.1097/2018. The taxes and duties commonly applied on imported goods are customs duty, surtax, excise tax, Value Added Tax (VAT), and withholding tax. Most solar products are exempted from import duty.¹¹³

On April 3, 2020, the Ministry of Finance issued a letter indicating that agricultural mechanization and irrigation equipment imported into Ethiopia would be exempt from customs duty, including agriculture technologies powered by renewable sources such as solar and wind.¹¹⁴ Solar water pumps are taxed at 5% duty and 10% surtax, or 0% duty and 0% surtax if imported under an agricultural technology import license. Converters

and inverters receive 20% duty, 10% surtax charges. Charge controllers attract 5% duty, 10% surtax.

Another potential public finance initiative for PURE scaleup is the adoption of results-based financing (RBF). The World Bank-sponsored ADELE initiative has invested \$10 million to establish an RBF which provides financial incentives to off-grid solar enterprises to grow into deep rural areas.¹¹⁵ However, the government is yet to adopt RBF for PURE.

4.5 Policy

About ten government institutions oversee the development and adoption of PURE technologies in Ethiopia. Strong alignment and communication among these institutions is critical for the scale-up of Ethiopia’s PUE technology market. Lack of proper alignment and communication among these institutions is one of the challenges to expanding PURE technologies.¹¹⁶ The main government institutions involved in the PURE are listed in Table 8.

Table 8 - Regulatory Institutions in the PURE Sector¹¹⁷

Institution	Description	Level of Power Over PURE Technologies Scale-up
Ministry of Water and Energy (MoWE)	Oversees Ethiopia’s electricity, as well as natural and man-made energy resources. Charged with developing and promoting alternative energy resources and technologies, including PURE. The regulatory body is responsible for resource planning, development, and management, as well as developing and implementing guidelines, strategies, policies, programs, and sectoral laws and regulations in 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.	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.	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/adopts international standards for the productive use of solar products.	Enable

113 Africa clean energy (ACE) technical assistance facility (TAF) Ethiopian customs handbook (draft), January 2021

114 MoF, 2020

115 Ethiopia: Financing Off-Grid Energy to Achieve Universal Electrification and SDG 7

116 Ethiopian Revenues and Customs Authority (ERCA), Ethiopian Customs Guide, March 2017

117 Adopted from Stand Alone Solar (SAS) Market Update, Ethiopia, 2021

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Ethiopian Electric Utility (EEU)	Sell and distribute 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.	Enable
Regional Energy Bureaus (REBs)	Represents regional power priorities and makes grid and off-grid expansion possible. Enabler for off-grid expansion.	Enable
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
Ethiopian Customs Commission	Enforces tax law on the productive use of technology products per tax and customs legislations.	Influence

Table 9 – PURE Market Regulatory Challenges

Key Challenges	Descriptions
Licensing	There is no separate license for PURE technology suppliers. Currently, most PURE technology suppliers' licenses are for technology, renewable energy business, import, trading, and electromechanical engineering activities that are engaged in activities other than PURE and often on a loose focus. ¹¹⁸
Customs	There are delayed clearing periods for imported products, including some products with short shelf lives, such as batteries. This is exacerbated by customs officers' lack of technical knowledge about PURE technologies and subjectivity; the process is lengthy. Products are not checked for standard results due to the customs clearance process. Substandard products are being presented in the market. ¹¹⁹
Tax	Import prices are incorrectly valued ¹²⁰ Taxes are calculated accordingly, almost always yielding higher results due to decentralized taxation and a lack of coordination among government agencies. MOF, for example, has recently taxed some PURE technologies, such as inverters and charge controllers. ¹²¹ The customs pricing list or database for solar import goods is outdated, and no proper pricing is prepared. For some PURE technologies, inconsistent taxation practices and HS code inconsistency exist. For example, there is no specific rate for solar appliances such as solar TV, resulting in inconsistent taxation in PURE technologies. Spare parts and raw materials are taxed if the raw material is not designated duty-free. ¹²²

Based on interviews with MoWE, MILLS, ATI, suppliers, and document reviews, this study identifies the following key PURE market challenges in the regulatory environment in Table 9.

4.6 Infrastructure

The increasing availability of internet connectivity and mobile devices have been the main drivers in the country's technology-related markets.

The government has invested in building out the country's telecommunications infrastructure, and the number of internet users in the country has been steadily increasing. This has created opportunities for tech companies to develop products and services that can be accessed through mobile devices.

Mobile money services have become increasingly popular in Ethiopia, providing an alternative to traditional banking services. However, despite these developments, a low mobile phone penetration rate has contributed to the slow adoption of PAYGo for PURE technologies.¹²³ The penetration of mobile phones in Ethiopia is below its regional counterparts, with just over one-third (~33%) of the population owning a mobile device. The lack of mobile phones, mainly in rural areas, reduces the use of mobile money services and mobile banking that can facilitate payment plans for PURE technologies through PAYGo.¹²⁴

118 Interview with MoWE

119 ACE-TAF Ethiopia Customs Handbook for SAS products and Components, 2022

120 Interview with PURE Suppliers

121 ACE-TAF Ethiopia Customs Handbook for SAS products and Components, 2022

122 Interview with Suppliers

123 Ethiopia Job Creation through Off-grid Access, 2021

124 Ethiopia Job Creation through Off-grid Access, 2021

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Table 10 - Key Infrastructure Developments for PURE Scale-up in Ethiopia

Key Infrastructure Investments	Highlights
Technology and Telecom	<ul style="list-style-type: none"> • Ethio Telecom, one of Ethiopia’s two telecommunications providers, announced solid financial results for the fiscal year’s first half. According to the company, revenues increased by 20% to 33.8 billion Birr (\$632.99 million).¹²⁵ • Safaricom Ethiopia, the country’s second telecom competitor, is adding 20,000 customers per day on average. On November 16, 2022, the telecom operator will surpass one million users in Ethiopia.¹²⁶
Mobile Money and Fintech	<ul style="list-style-type: none"> • Ethiopia remains a country that relies solely on cash transfers. • However, the country already has several significant factors influencing Fintech adoption, including the demographic trends of the world’s second-most populous nation. • Famous mobile money platforms Tele birr, Amole, M-Birr, CBE-Birr, and Hello-Cash have aggressively expanded in the post-COVID era to encourage cashless transactions. • Tele birr alone reached 27.2 million of Ethio Telecom’s total 70 million subscribers in the middle of the fiscal year 2022/23.
Transportation	<ul style="list-style-type: none"> • The Ethiopian Road Authority (ERA) reports that the country’s total road network reached 138,127km in 2018, a 9% increase over 2017. • Ethiopian Airlines, a leading African airline, is important in connecting Africa to the rest of the world. On July 1, 2022, the airline will serve 127 international destinations.



© Baobab+

125 Ethio Telecom
 126 Safaricom Ethiopia

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**Recommendations
and Discussions for
PURE Market Scale-Up**

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Recommendations and Discussions for PURE Market Scale-Up

Ethiopia's PURE market has scale-up challenges relating to the following major areas: policy, capacity building, demand, research, and development. Accordingly, our analysis suggests strategic initiatives and essential activities to implement.

5.1 Improve policy and regulatory frameworks

The policy and regulatory environment surrounding the productive use of the solar energy ecosystem in Ethiopia plays a critical role in the growth and development of the sector. Although there are challenges and barriers to the sector's growth, notably affordability, there are opportunities for companies and investors to develop and deploy innovative solar energy products and services to meet the growing demand for solar energy in the country. Creating an enabling legislative and regulatory framework can encourage investment in the PURE market and provide investors and businesses with confidence. Key solutions to create an enabling policy and regulatory environment include:

Promoting PURE-focused policies and regulations:

Policies and regulations that support solar energy investment and incentivize the deployment of PURE technologies should be developed. This can be accomplished by mobilizing key stakeholders to provide action points for solar PURE awareness, financing, and policy and regulatory barriers in scale-up in the incoming NEP 3.0 planning.

Ensuring synergy and strategic alignment

between stakeholders: Collaboration between government, research institutions, the private sector, and NGOs can lead to the development of innovations in PURE business models and technologies and improved capacity building. Partnerships can be formed to facilitate knowledge sharing, technology transfer, and joint R&D projects. Particularly, 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. The newly established national PURE task force is an ideal starting point for building a multi-stakeholder platform where lessons learned from various programs and projects are collated and distributed to the right parties for action. This multi-

stakeholder platform must be a persistent and long-term endeavor. Creating similar task force groups for other significant market challenges in PURE spaces will enable communication between energy stakeholders and other stakeholders that benefit from energy.

5.2 Introduce innovative financing systems

Innovative financing systems can be introduced through two main channels: government-led interventions and private-led interventions.

Government-led interventions: Governments can introduce innovative financing systems through a variety of channels, such as tax breaks, subsidies, and grants. They can also create or support financial institutions that specialize in innovative financing, such as establishing a FOREX facility and seeking international investments in the PURE market. Key areas that could be explored by the government include:

- **Establishing a FOREX facility and seeking international investment:** Setting up a revolving FOREX facility, replicating previously successful foreign currency financing interventions in off-grid, and advocating for prescribed funding towards PURE technology within existing initiatives are critical to reducing capital requirements for market scale-up.¹²⁷ This can be accomplished by pressing the National Bank of Ethiopia (NBE) to adopt regulations that enforce and standardize FOREX facility allocation in commercial banks for PURE firms.
- **Creating an enabling environment for tapping into remittance corridors:** In the Ethiopian fiscal year 2021-2022, remittances from Ethiopians living abroad totaled US\$4.2 billion. Tapping into remittance corridors between diaspora Ethiopians in developed countries and their rural families back home can be an impactful solution if accompanied by proper promotional efforts. This solution has an impressive track record in other countries, including Kenya.¹²⁸

127 Stand Alone Solar (SAS) Market Update, Ethiopia, 2021

128 Ethiopia: Financing Off-Grid Energy to Achieve Universal Electrification and SDG 7

Recommendations and Discussions for PURE Market Scale-Up

This increases demand for solar remittances and encourages diasporas to participate in the PURE market if the profitability and commercial feasibility are properly communicated through Ethiopia's international emphasis. To realize the full potential of remittance corridors, PAYGo payment systems that allow international top-up payments for PURE devices purchased in this manner are required.¹²⁹

- **Championing public subsidies and tax exemptions:** RBFs and other subsidies are another important mechanism to help PURE companies to grow, expand distribution capacity, improve affordability, and raise awareness among rural communities. Applying additional tax incentives such as exemptions or reduced rates can also help businesses and households invest in PURE. Tax incentives for local assembly/manufacturing and the establishment of standards for PURE products and services also have the potential to help technologies scale. In addition, consistently applying tax levies and rules to all PURE appliances will lower sales prices.
- **Exploring the use of climate finance:** Looking at the experiences of neighboring countries, exploring climate financing options to generate foreign currency could help to increase finance for PURE.
- **Private-led interventions:** The private sector can also introduce innovative financing systems through a variety of channels, such as developing new finance products such as crowdfunding, and social impact bonds. They can also partner with governments and other organizations to create and support innovative financing systems. Areas where private finance for PURE can be enhanced include:
- **Developing new consumer finance products:** Developing non-collateral consumer financing mechanisms, or using the technologies as collateral for end users, has a huge potential to enhance the adoption of PURE appliances.
- **Building the capacity of MFIs and Capital Goods Finance Companies (CGFCs).** The Designing and Piloting Financial Solutions project ('Financing Solutions project') will provide technical advisory and capacity building to MFIs and Capital Goods Finance Companies (CGFCs) to design financial products suitable for small-scale agricultural PURE equipment purchases. The Financing Solutions project will also provide capital injections to MFIs and CGFCs to on-lend to the productive use market (processors and suppliers).¹³⁰ Improving the MFIs group lending model has proven to be a powerful mechanism for reducing risks and transaction costs, especially in remote and low population density areas for PURE adoption.¹³¹ MFI consumer financing can apply for local currency retail and wholesale loans for up to six years at 6% interest, financed by revolving fund repayments.¹³²
- **Partnering with model cooperatives (SACCOs) and implementing pilot PURE projects** (including consumer financing arrangements). Alternatively, a SACCO-centric purchase and finance scheme could be developed to help cooperatives buy PURE products for their member's use without any involvement of a third party.¹³³
- **Exploring the development of a PURE financial product in one of Ethiopia's commercial banks:** By using a learn-by-doing method that shortens commercial banks' learning curves, it is possible to strategize how to finance working capital (the capital required for a firm to run daily) by developing a 'model commercial bank' that can pilot, iterate, and scale PURE technology.¹³⁴ Instead of distributing resources thinly, donors and development financial institutions might carefully select one model bank as a partner, collaborate with this bank to build a long-term strategy, and give guarantees and other catalytic funds for enhanced loan access to PURE enterprises.¹³⁵
- **Piloting other financial innovations:** According to a recent study¹³⁶ potential funding options for addressing working cash difficulties include selling future income at a discount, purchase order financing, and asset-based lending (such as inventory) as collateral under a short-term revolving arrangement. These could be explored for PURE products.

129 [Ethiopia: Financing Off-Grid Energy to Achieve Universal Electrification and SDG 7](#)

130 [Productive Uses of Energy in Ethiopia Agricultural Value Chain and Electrification, Feasibility Study, March 2021](#)

131 [Ethiopia: Financing Off-Grid Energy to Achieve Universal Electrification and SDG 7](#)

132 [Stand-alone solar investment Map Ethiopia](#)

133 [Stand-alone solar investment Map Ethiopia](#)

134 [Stand-alone solar investment Map Ethiopia](#)

135 [Stand-alone solar investment Map Ethiopia](#)

Recommendations and Discussions for PURE Market Scale-Up

- **Taking best practice from previous initiatives:** In 2021, the World Bank launched the Accelerating Distributed Electricity and Lighting in Ethiopia (ADELE) credit facility, which aimed to alleviate the shortage of FOREX access while offering consumer finance. The insights learned in this flagship project can be used to create equivalent consumer financing options for the PURE space in the future, notably for designing a debt-funding credit facility administered by a coalition of government and donors.

5.3 Engage in demand stimulation initiatives

Enhance PURE stakeholders' awareness: Creating awareness through demonstration and pilot projects has a significant potential for enhancing technology adoption among end users and private investors. There is increasing awareness of solar irrigation pumps (in particular) through media and farmer-to-farmer knowledge sharing. However, awareness of other forms of renewable energy technology (e.g., cooling systems, EVs, e-cooking, solar-powered processing machines, etc.) is limited, with no clear perceived advantage to using solar-based tech instead of diesel-run coolers. Increased awareness and the technical feasibility of PURE products will contribute towards investments that farmers are willing put in the technology.¹³⁶

Table 11 - PURE Use Case in the Dairy Sector

Demonstrated PURE Technology	Challenges	Demonstrated PURE Technology	Technical details of the technology	Financial Model
Mr. Engida runs a medium-scale dairy farm in Bishoftu, Oromia, Ethiopia. He owns 17 crossbreed cows, with 12 providing an average of 14 liters of milk daily each.	<ul style="list-style-type: none"> • Difficulty in acquiring and retaining employees due to the drudgery nature of manual milking. • Decreasing milk yield due to manual milking techniques - not being able to extract the milk from the cows leads to permanent blockage of some of the cow teats due to mastitis disease. • The farm lacks an electrical connection, which makes him rely on his neighbors to extend grid lines (power outages for 2-3 days per week on average) 	A solar-powered double cluster milking machine (1 HP / 736 kW - AC) with 11, 7W AC LED dairy shed lights.	<p>Solar system + Lights Solar Panel: 1.98 kWp, Battery: 600 Ah, 48 V Charge Regulator: 40 A, 48 V, Inverter: 3 kW, 48 V, Shed lights: 7W AC LED (11 nos.)</p> <hr/> <p>Milking Machine Power: 1 HP, 220 V Vacuum Pump capacity: 225 Lt/min (30 in Kpa), Bucket Capacity: 40 Liter, Weight: 75 kg</p>	<ul style="list-style-type: none"> • Total Cost: 770, 897 ETB / 9,697 USD • Saving/ Increase in Profit/ Year: 160,585 ETB / 3,039 USD* • Pay-back period: 3.2

*ASSUMPTIONS: 12 cows, savings in electricity and labor cost, increase/savings in 0.5 Liter of milk per day
SOURCE: Precise Consult, 2022¹³⁸

Post-Intervention Impacts on the Dairy Business

- 1 hour saved for milking 12 cows
- He won't have to lose his cows to Mastitis anymore. He had to sell seven cows recently for ETB 25,000 for meat since they were infected by Mastitis and lost production. These cows were worth 75,000 to 90,000 had they been sold as milking cows.
- Reduced need for extra workers, hence mitigation of the labor cost
- Reduction in the electricity bill with cost-effective solar systems
- Lesser requirement for veterinary services through the improvement of shed hygiene and prevention of diseases.
- Encouragement to expand the business by adding more cows.

Challenges

Mr. Engida Ashnafi, Dairy entrepreneur: The milking machine is a solution for me to address several issues on my farm, including drudgery due to manual milking and clogging of udders in cows. Going forward, I will be promoting the solutions for the community around me and working on effectively scaling up the availability of quality milk in a community aspect. I hope to be a champion who will inspire and push others.

Mr. Yonas, Sun Transfer, Clean Energy Enterprise partner: We want to focus on productive use technologies, and that's why we are working on the solar system for milking machines. This is important because solar energy will focus on the productive use of solutions that will increase farmers' productivity. We are happy that we installed the systems for Mr.Engida.

136 Stand-alone solar investment Map Ethiopia

137 Sustainable Energy for Small-holder Farmers (SEFFA) in Ethiopia, Kenya, and Uganda

138 Precise Ethiopia | Publications

Recommendations and Discussions for PURE Market Scale-Up

Table 12 – PURE Use Case in the Poultry Sector

Description of the Poultry Business	Challenges	Demonstrated PURE Technology	Technical details of the technology	Financial Model
Mr. Engida is an individual poultry and dairy farmer in Bishoftu, a peri-urban region of Ethiopia. They have four poultry sheds housing 3300 Bovans variety layer birds. The eggs produced on the farm are sold to wholesale dealers in Addis Ababa, the country's capital city.	<ul style="list-style-type: none"> Inaccessibility and unreliability of electricity in the off-grid area where his farm is located (average power outages for 2-3 days per week). Despite vaccination, there is a high rate of disease-related chick mortality. Due to a lack of a proper lighting and heating system, obtaining DOCs and layer chickens was impossible. 	Solar-Powered Poultry Shed Lighting: For every 200 sq. ft. area of space, one DC LED shed light of 5W is required. As per this criterion, the solution is designed with 8 hours of backup, considering the end user's 15-18 hrs requirement.	Solar system + Lights Solar Panel: 1.98 kWp, Battery: 600 Ah, 48 V Charge Regulator: 40 A, 48 V, Inverter: 3 kW, 48 V, Shed lights: 7W AC LED (11 nos.) <hr/> Milking Machine Power: 1 HP, 220 V Vacuum Pump capacity: 225 Lt/min (30 in Kpa), Bucket Capacity: 40 Liter, Weight: 75 kg	<ul style="list-style-type: none"> Total Cost: 401,888 ETB / 7,582 USD Saving/ Increase in Profit/ Year: 305,963.17 ETB / 5,849 USD** Pay-back period: 1.1

*ASSUMPTION: 3300 layer birds, 3% reduction in the mortality rate, savings in electricity cost

SOURCE: Precise Consult, 2022139

Post-Intervention Impacts on the Poultry Business

- Lower Feed Conversion Ratio leads to savings in feed cost
- An additional tray of eggs was produced due to extended lighting provision up to 10:00 pm.
- No dependency on the grid leads to savings on electricity bill
- Body weight is managed, and the bird is healthy (2 kg)
- Average weight increase in constant number results in a reduction in the number of rearing days and saves the feed cost

Challenges

Mr. Engida Ashnafi, Poultry entrepreneur: Before installing solar lighting, I used to lose 10-15 chicks due to them stepping on each other. They lay eggs only when there is light. As the farm is in an off-grid area, I faced extreme difficulty providing adequate lighting. Now, my poultry sheds have ample light due to solar energy, which has led to a decrease in chick mortality and an increase in egg production.

Development partners, NGOs, and government institutions should allocate resources to conduct a series of PURE pilots and demonstration projects in agriculture, dairy, poultry, agro-processing, e-mobility, and MSMEs to provide evidence to demonstrate the technical and financial viability of equipment and business models, thereby enhancing PURE market expansion. Compelling examples from the poultry and dairy sectors can be seen in Table 11 (Dairy) and Table 12 (Poultry).

Public awareness campaigns: Awareness campaigns and pilot demonstration projects can be used to create knowledge about the benefits of PURE technologies and increase demand for PURE solutions. Targeted awareness programs for key stakeholders, such as the financial industry and policymakers, can also create significant impacts on the sector's growth. Education and outreach programs, media campaigns, and community participation can all be used to promote awareness-raising projects.

5.4 Increase capacity-building and research-and-development programs

Set up a knowledge hub and provide technical support programs: A Centre of Excellence (CoE) model can serve as a conduit for best practice development and dissemination, accelerating industry learning, reducing information asymmetries, and facilitating systemic changes across the entire business model.¹⁴⁰ Improved data tracking capabilities in large PURE-focused programs can increase sector transparency and investor confidence in the market.¹⁴¹ This can be achieved by enabling ESEDA to champion research and data management in Ethiopia's PURE market. Given ESEDA's existing operational model, becoming the knowledge hub for PURE growth will require financial resources and strategy-driven implementing structures.

139 Precise Ethiopia | Publications

140 Ethiopia: Financing Off-Grid Energy to Achieve Universal Electrification and SDG 7

141 Productive Uses of Energy in Ethiopia Agricultural Value Chain and Electrification, Feasibility Study, March 2021

Recommendations and Discussions for PURE Market Scale-Up

Build technical capacity within the PURE sector:

The technical capacity of PURE companies and investors in the solar energy sector is limited.¹⁴² This hinders their ability to create new products and services and expand their operations. Exploring the potential of Ethiopia's TVET system to improve maintenance in PURE technologies by training solar technicians and using TVET service stations (workshops) to repair the equipment could alleviate the current maintenance challenges. This study notes that not many resources are available in the PURE ecosystem for developing a knowledge center and technical support program. To address this issue, the government can invest greater resources to support TVET research and

curriculum design programs. International funders and development partners might also contribute financially to establishing a knowledge hub to expand the PURE market. This further requires development partner grants for testing new business models and technical innovations.

Scaling up capacity building for policymakers and regulators:

Enhancing the PURE awareness and strategic design capability of the MoPED, MoWE, NBE, ESA, and ECC can have an exponential impact on promoting PURE market scale-up. This capability-building initiative has the potential to strengthen tax, industry, and competition policies.



Annexes



Annexes

Annex 1

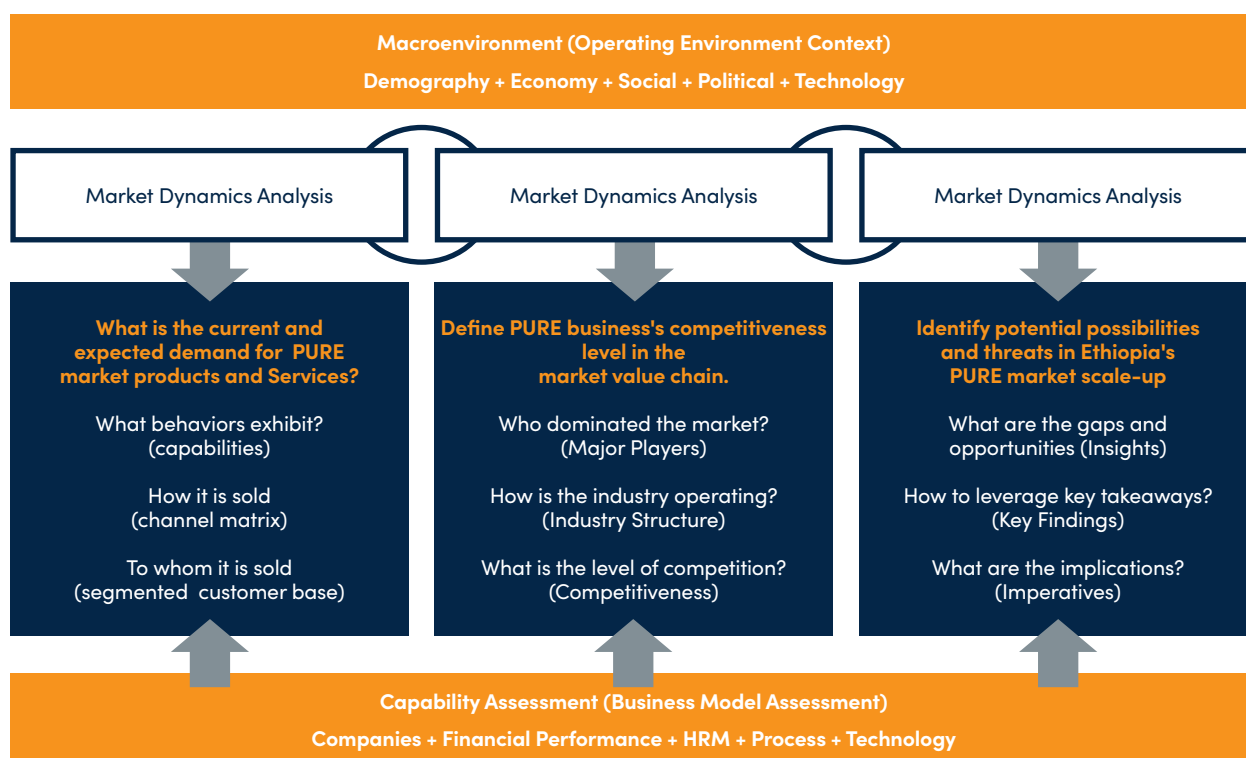
An overview of the methods used to capture the insights shared in this market assessment can be seen in Table 12.

This study also used a variety of analyses to understand the current PURE market. An overview of these can be seen in Figure 8.

Table 13 - Methods and sources of data used in this market assessment

Methods	Activity	Source
Document Review	Identify and collect relevant documents, such as off-grid sector studies and economic and market reports from various governmental and non-governmental organizations. Reports on macroenvironmental context and Ethiopia's PURE market structure from websites, annual reports, and other various sources.	National Electrification Program 2.0 Researches publications by SNV, WB, GOOGLE, USAID, JCC, IKEA, etc.
Stakeholders Interview	Conduct semi-structured interviews with PURE business owners, government officials, development partners, and other relevant parties after conducting a stakeholder analysis using the criterion reviewed by the GOGLA team.	Sun Transfer Tec PLC, Solar Village PLC, Solar Development PLC, Power East Africa Engineering PLC, Amio Energy PLC, Lydetco PLC, Marasat General Mechanics, AFEsol Technology PLC, ACME Engineering and Trading PLC MoWE, ATI, MILLS, MoPED GIZ (EnDev) Siinqee Bank ESEDA
Working Session	A roundtable discussion was held with the National PUE TASK force, selected stakeholders, and the ESEDA team to inform and validate the study's key findings. Following the completion of the market assessment report, the study held a working session and frequent discussions with key stakeholders throughout the project's lifespan to enrich the study findings.	Two working sessions - participants encompass MoWE, ATI, ESEDA, GIZ, Private Co, and GOGLA representatives.

Figure 8 - Study Analytical Framework



Annexes

Annex 2

A range of PURE stakeholders generously shared their time to provide their insights and knowledge to this market assessment. Table 13, includes the name and organization type of all contributors.

Table 14 - 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

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