MAPPING THE OFF-GRID SOLAR MARKET IN ETHIOPIA

2019

Source: Signify Foundation

signify foundation

intellecap
AAVISHKAAR GROUP

Contents

Abbreviations

ACE	Africa Clean Energy Programme
AfDB	African Development Bank
Bn	Billion
CRGE	Climate Resilient Green Economy
DFID	Department for International Development
DOE	Directorate of Electrification
EEA	Ethiopian Energy Authority
EEP	Ethiopian Electric Power
EEU	Ethiopian Electric Utility
ELEAP	Ethiopia Electrification Programme
ENREP	Electricity Network Reinforcement and Expansion Project
ESMAP	Energy Sector Management Assistance Programne
FAO	Food and Agriculture Organization
GOE/ Govt.	Government of Ethiopia
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Abbreviations

GSM	Global System for Mobile Communications
GTP II	Growth and Transformation Plan II
HH	Household
METEC	Metals and Engineering Corporation
MNO	Mobile Network Operator
MoFEC	Ministry of Finance and Economic Cooperation
MoWIE	The Ministry of Water, Irrigation & Electricity
MFI	Microfinance Institution
Mn	Million
NEP	National Electrification Programme
OGS	Off-Grid Solar
PAYGO	Pay-as-you-go
REB	Rural Electrification Board
SE4ALL	Sustainable Energy for All
SHS	Solar Home Systems
SHG	Self Help Group
SLS	Solar Lighting Systems
SREP	Scaling up Renewable Energy Programme
UNHCR	United Nations High Commissioner for Refugees
USAID	United States Agency for International Development
WTP	Willingness to Pay

MARKET **OVERVIEW**

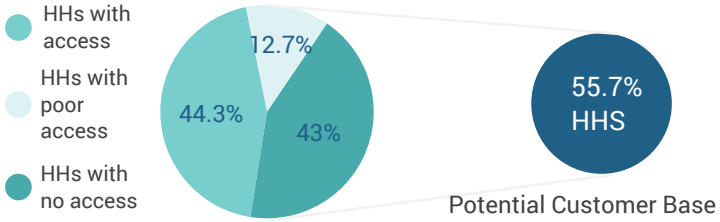
Source: Signify Foundation

Market potential: ~56% HHs in Ethiopia either lack access to electricity or grapple with capacity constraints and irregular availability, suggesting a sizeable potential market for off-grid solar (OGS) devices

ACCESS TO ELECTRICITY

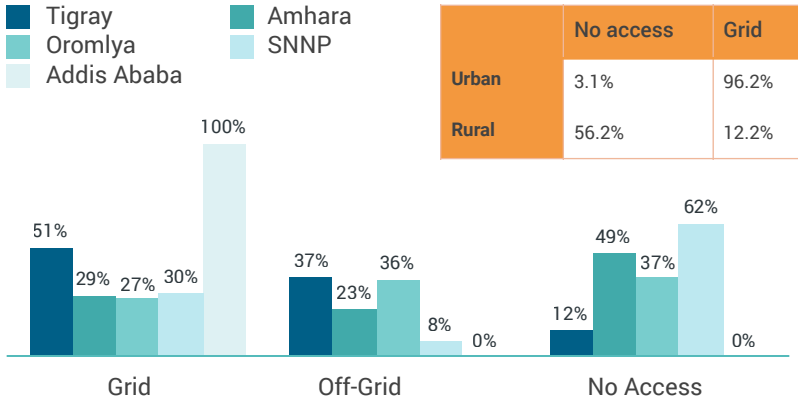
Of 57% with access

- 23.9% have access to off-grid solutions
- 33.1% have grid access



- Ethiopia is the **second largest market for OGS** devices in Sub-Saharan Africa and the largest in the world after India and Nigeria
- **There is untapped potential for OGS solutions,** with ~55.7% unserved or underserved HHs having no or inadequate electricity supply
- **There is scope for market development** as OGS market is very nascent. 82% HHs using OGS devices as a primary source acquired them in the last 3 years
- **Uptake of low capacity solar modules like lanterns, SLS is higher** as most HHs using OGS have very low load appliances, using OGS mainly for lighting, phone charging and radio

REGIONAL FOCUS



RURAL-URBAN SPLIT

	No access	Grid	Off-grid
Urban	3.1%	96.2%	0.7%
Rural	56.2%	12.2%	31.6%

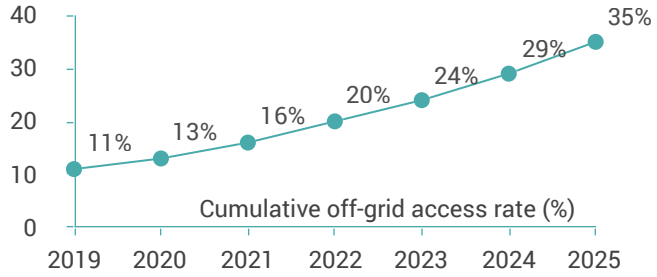
- Sizeable penetration of OGS is observed in **Tigray, Oromiya and Amhara**
- **Rural Ethiopia has a higher concentration of OGS devices** with 32% rural HHs using it as their primary source of energy

Source: Ethiopia: Beyond Connections - Energy Access Diagnostic Report Based on the Multi-Tier Framework, World Bank, June 2018 (Link)

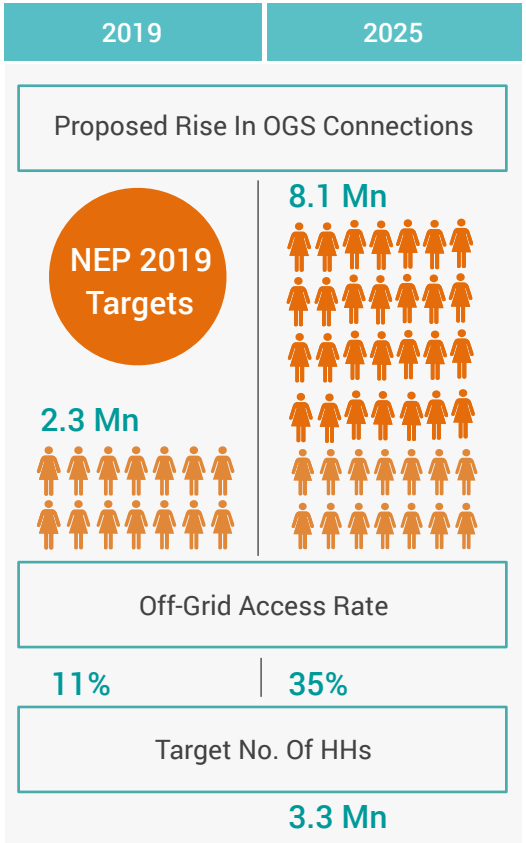
Market potential: The government aims to reach 3.3 Mn HHs through off-grid connections by 2025 providing electricity access to 35% of Ethiopia's population

TARGET CONSUMER SEGMENTS

Consumer Segments	HHs (Mn)	Years To Grid Connectivity	Stakeholders Involved
HHs within 2.5 km of the grid	3.3	5 years (by 2025)	To be served by the private sector
HHs more than 25 km away from the grid	0.7 (solar off-grid) + 0.2 (minigrids)	10 years (by 2030)	To be implemented with public funding support (Minimum Subsidy Tender) and combined public, cooperatives, and private implementation
HHs 2.5-25 km from the grid	5	5-10 years (Between 2025-2030)	To be served by OGS and minigrids systems for productive uses and social services with public, cooperative, and private sector implementation



- Opportunity to tap **3.3 Mn HHs**
- **Productive use technologies could see greater adoption** with a plan to electrify all health and educational institutions by 2025, and a rise in PAYGO models
- **Market correction initiatives** adopted by the govt. will boost private sector participation



Source: National Electrification Program 2.0 , Federal Democratic Republic of Ethiopia, 2019 (Link)

Market potential (Minigrids): Minigrids could serve ~13 Mn people with an estimated market of $513 Mn by 2020. GOE plans to set up 285 minigrids reaching 210,000 HHs by 2025, supporting productive uses

MARKET POTENTIAL

	Existing grid network	Planned grid network upto 2020
Minigrid population (Mn)	16.2	**13**
Minigrid - Market size ($ Mn)	638.59	**512.72**

Market size is calculated based on an estimated average per capita annual expenditure on energy of $39.5 in 2010. Minigrid regions are defined based on a distance of greater than 15 km from the grid and household density > 50 HH/km^2

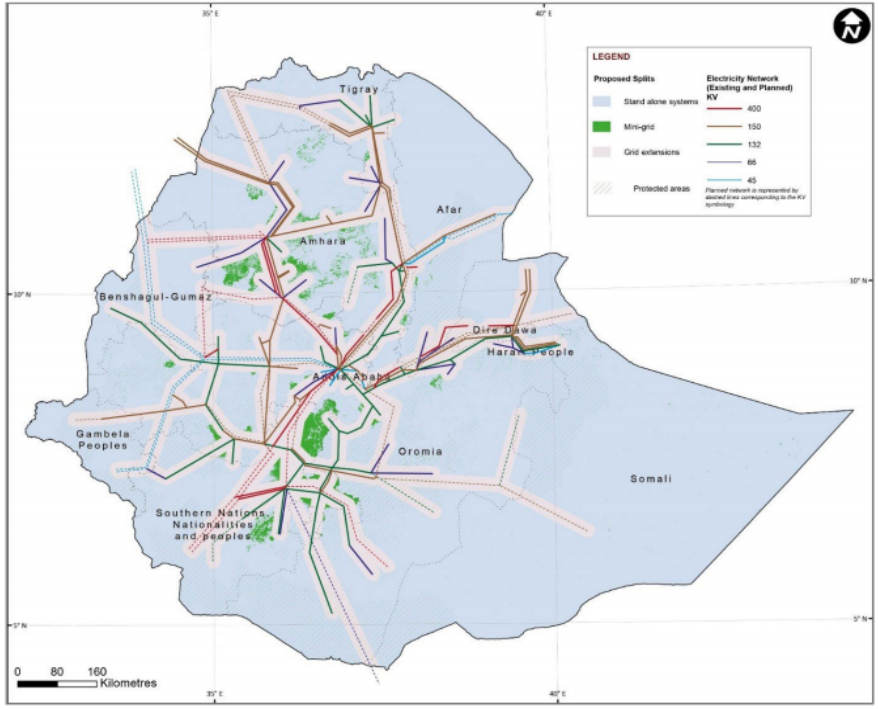
GOE TARGETS

Sites identified	Dist. from grid	HH connections (2019-25)	No. of minigrids
Long-term off-grid/deep rural (not reached by the grid by 2030)	>25 km	100,000	134
Long term off-grid	>100 km	110,000	151

Highest potential is found in Oromia (6.2 Mn, 5.5 Mn by 2020); Southern Nations (4.7 Mn, 2.7 Mn by 2020) and Amhara (3.1 Mn, 2.8 Mn by 2020)

REGIONAL FOCUS

Split of grid extension, minigrid and stand-alone systems. Dotted lines are planned grid extensions up to 2020.



Sources: Minigrid Market Opportunity Assessment: Ethiopia, AfDB, April 2017 (Link)

Note: For existing mini grid initiatives, refer Annexure (Slide 44 and 45)

Market potential (Productive use): Ethiopia is an attractive market for solar water pumps with a potential to irrigate 6,800 ha, serving 1 Mn+ farmers. PAYGO models should also boost adoption of such technologies

Productive use of energy refers to use of energy for technologies in agricultural, commercial, and industrial activities that result in the production of goods or the provision of services.

SOLAR WATER PUMPS

- **There is a high market potential for solar pumps in Ethiopia given the number of existing and potential pump users**: 68% (74.5 Mn) of the population is engaged in agriculture.~1.4 Mn farmers are involved in small scale irrigated agriculture and 210,000 to 400,000 of them use motor pumps (FAO 2012). Govt. aims to transition motor pump users to solar and introduce solar pump irrigation to those not irrigating
- **According to FAO potential area of 6,800 ha could be irrigated using solar PV water lifting in Ethiopia** (9% of irrigated land and 18% of rainfed land)
- **Market revenues are anticipated to grow at a CAGR of 20% between 2018-2024 in Africa.** In 2017, Ethiopia accounted for the second largest revenue share. Projects using solar water pumps include Kobo integrated irrigation development in Amhara; Fentale project in Oromia; Project by Somali region state & METEC in Kulen & Harewe

GOVERNMENT INITIATIVES

- The NEP off-grid programme aims to enable productive use applications of energy using solar minigrids
- Many systems imported through the World Bank credit line, have a peak power in excess of 40 W, up to 100 W, and are capable of powering many small-scale productive use applications, including freezers, small-scale egg incubators, and shallow pumping applications
- Solar-powered pumps for irrigation are imported tariff free into Ethiopia

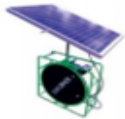
Other Use Cases

Other productive use applications include:

- Animal husbandry for instance powering poultry incubators that would improve poultry meat and egg yields, improving farmer margins
- Automated milking machines
- Cold chains

Demand Barriers

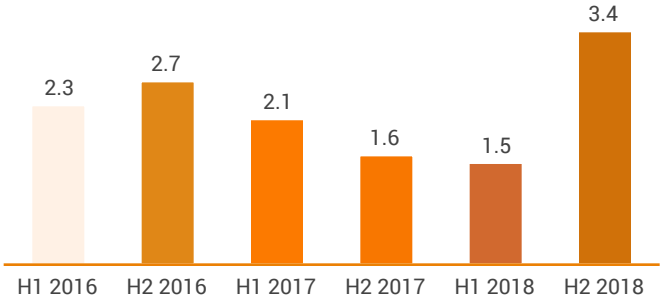
- **Affordability:** High cost of technology relative to farmer income levels
- **Awareness:** Poor knowledge about the technologies
- **Accessibility:** Limited options for obtaining the technology, and
- **Lack of customization:** Mismatch between farmers needs and solutions




Sources: Suitability mapping - Solar pump irrigation Ethiopia, FAO, 2018 (Link); National Electrification Program 2.0, Federal Democratic Republic of Ethiopia, 2019 (Link); Business Model Scenarios and Suitability: Smallholder Solar Pump-based Irrigation in Ethiopia, IWMI, 2018 (Link); Africa Solar Water Pump Market (2018-2024), Research and Markets, 2018 (Link)

Market penetration (SHS, SLS, Solar lanterns): With substantial push from GOE and PAYGO models gaining traction, OGS sales volume grew by 129% between July– Dec'18, with total value at $12.7 Mn (Jan-Dec'18)

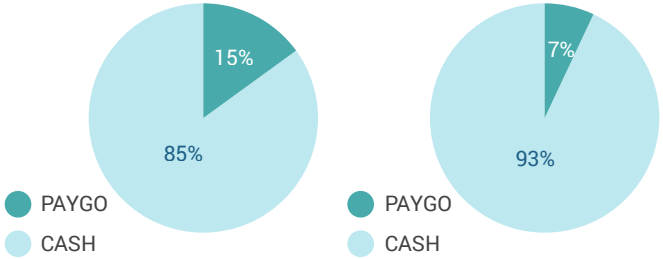
Solar lanterns, Solar light systems (SLS) and Solar Home Systems (SHS) sales volume increased by 31% between Dec'17 and Dec'18. Sales value declined by 9% during this period, mainly due to a dip in the first half of 2018



Volume of products sold (in lakhs)

- **Total installed capacity of OGS from Jan-Dec '18 was 1.58 MW, 0.91 MW** through cash sales and 0.67 MW through PAYGO
- **Portable lanterns** with indicative wattage of under 3 Wp **represent the majority of products** sold through cash
- The growth in the second half of 2018 was further boosted by the **market development credit line for private sector enterprises (PSEs) and MFIs** extended by the Development bank of Ethiopia (DBE) and funded by the World Bank

15% OF TOTAL VOLUME AND 7% OF TOTAL VALUE OF OGS GOODS SOLD WAS ATTRIBUTED TO PAYGO MODELS IN THE SECOND HALF OF 2018

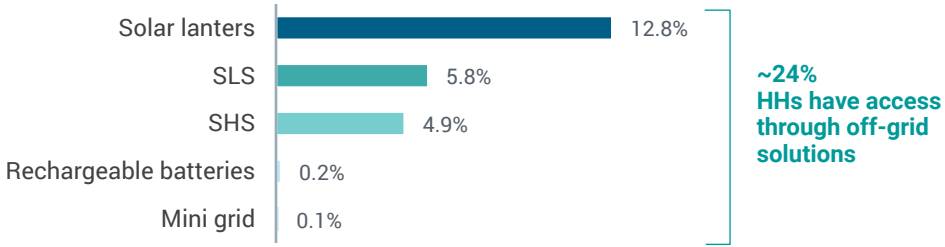


- **Sales through PAYGO saw a 92% jump** from 26,000 units in H1 2018 to 50,000 units in the second half, reflecting a greater market confidence in the model
- **Companies deploying PAYGO attracted 91% of total investment** in OGS market globally, between 2016 and 2018

Source: Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data, GOGLA - H1 2016 (Link), H2 2016 (Link), H1 2017 (Link), H2 2017 (Link), H1 2018 (Link), H2 2018 (Link)

Products: Off-grid solutions, particularly solar lanterns, are most popular in Ethiopia, followed by SLS and SHS. Uptake of minigrids is very limited

OFF-GRID TECHNOLOGIES USED BY HHS WITH OFF-GRID ACCESS



MODULE CAPACITY BY DEVICE AND THEIR USES

Category	Capacity (Wp)	Services provided	Price ($)
Lanterns	0-1.499	Single light only	**10 to 40**
	1.5-2.999	Single light and mobile charging	
SLS	3-10.999	Multiple light and mobile charging	
SHS	11-20.999	SHS, Entry Level (3-4 lights, phone charging, radio, fan)	**50 to 200**
	21 – 49.999	SHS, Basic capacity plus TV, additional lights, appliances	**200+**
	100+	SHS, Higher capacity	

Solar Lanterns

Solar lanterns with mobile charging (1.5-2.999 Wp) observed the highest sales globally in 2018
However, this segment faces various challenges

- Stagnating sales due to market saturation
- High fluctuation in sales volumes due to adhoc purchase for humanitarian crisis mitigation

Solar lighting systems (SLS)

SLS segment is growing consistently, with most sales (70% globally) attributed to PAYGO models

Solar Home Systems (SHS)

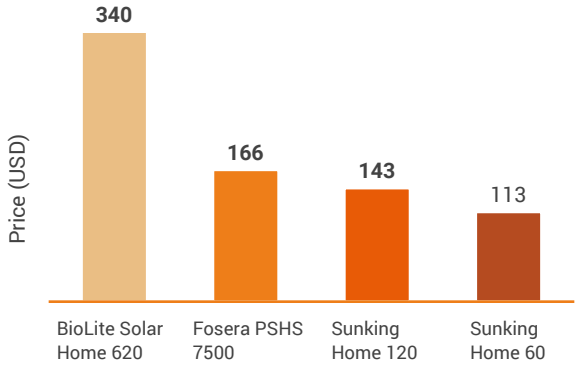
- Growing penetration of PAYGO models led to 133% increase in SHS sales globally (2016-18). Within SHS, SHS kits (11-20Wp) saw the highest sales
- As technology improves and prices fall, demand for larger SHS is likely to increase, boosting OGS appliance sales (like TVs, refrigerators etc.)
- Low quality and counterfeit products present the biggest challenge in the SHS market.

Note: For product mapping to World Bank's multi-tier framework, refer Annexure (Slide 40)

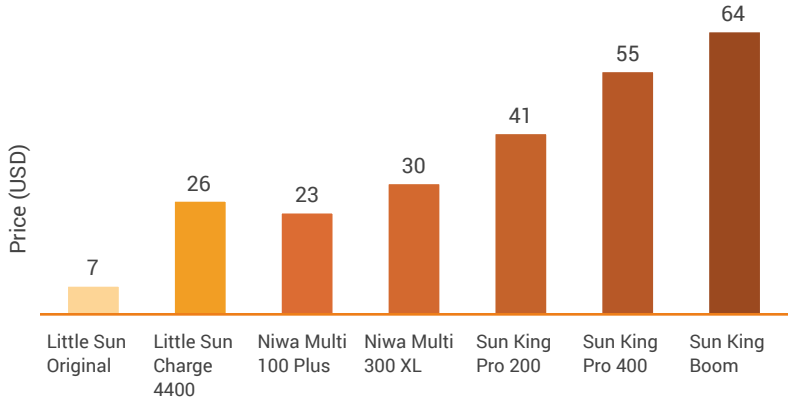
Source: Ethiopia: Beyond Connections - Energy Access Diagnostic Report Based on the Multi-Tier Framework, World Bank, June 2018 (Link); Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data, GOGLA - H2 2018 (Link)

Products: Product landscape is wide-ranged & divided, with price driven by quality, warranty, after sales service and PAYGO options

SOLAR HOME SYSTEMS PRODUCTS AND PRICES*



SOLAR LIGHTS/LANTERNS PRODUCTS AND PRICES*

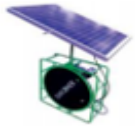


	Off-Brand Generics	Branded Retail	Branded Service Level
Description	Low cost, may offer similar specifications to branded products but maybe of lower quality	Brand-name, reputable systems sold via retail or through distributors	Brand-name, reputable systems sold via retail or through distributors and sold through PAYGO Highest cost due to PAYGO technology
Examples Of Operators In Ethiopia	Labelling varies	sunking, fosera, NIWA	Azuri, sunking, fosera, Stiftung Solarenergie, Green Scene, HelloSolar

Sources: GreenScene Ethiopia: Products (Link); Mangoo Marketplace (Link)

*List of products and prices is Indicative

Products (Productive use technologies): A few companies are incorporating productive use solar products in their offering such as solar water heaters, water pumps, fans, fridges etc.

Category	Products	Private dealers in Ethiopia (illustrative)
Household & Institutional use	 Solar water heater  Fan  Solar fridge for storing medicine and vaccines	Green Scene; Stiftung Solarenergie Solar Energy Foundation; Lydetco; NIWA
Small businesses	 Solar refrigerator  Hair Clippers	HelloSolar; mobisol
Agricultural Use	 Solar water pump	BIT Beshan International; d.light Solar

SUPPLIER MARKET TRENDS

Source: Signify Foundation

Supplier landscape: The OGS value chain comprises of developers (manufacturers); distributors (assemblers, wholesalers, retailers) and last mile distribution agents

Active | Partly Active

- Can also provide productive use tech
- Can also provide minigrids

	Manufacturers/Developers		Distributors and retailers				Consumers
	Design And Engineering	Production	International Distribution	National Distribution	Retailing	After Sales	Consumer Financing
Azuri						Partnered with MBIRR for PAYGO	
d.light					Established under MFI - Microcred; Angaza for PAYGO and MFI for consumer financing		MFIs, 1 SHS via PAYGO
fosera							Angaza* for PAYGO
NIWA					Partnered with Sun Transfer for assembly, consumer credit and after sales report		
SolarTech							
LYDETCO							
HelloSolar							Hello Cash for PAYGO
Local MFIs							
greenlight planet					Partnered with MFIs, micro-entrepreneurs		Angaza for PAYGO
Green Scene							Loans through MFIs, partnered with Angaza and MBIRR for PAYGO
Stiftung Solarenergie							Partnered with Sun Transfer
mobisol							Partnered with Sun Transfer
SUNTRANSFER							Provides after sales service and credit through its solar centres

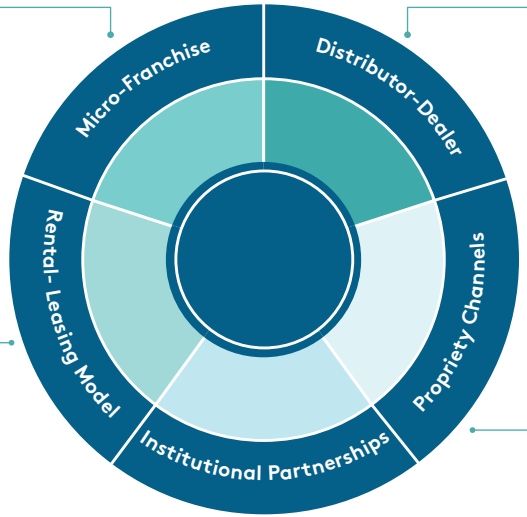
Distribution models: Most players distribute through institutional partnerships with MFIs and conventional dealer networks. Micro franchising and rental leasing models are gaining prominence

Microfranchise Model

The company offers franchising packages (such as financing, training, marketing support etc.) to micro-entrepreneurs who wish to become formalized retailers of exclusive company products

Distributor-Dealer

The company sells through established networks of generalist or specialist distributors, leveraging the traditional consumer durables supply chain. Products are retailed in a basket of consumer durables. A distribution hierarchy of at least two levels (distributor and dealer/retailer) is maintained



Rental-leasing Model

The solar company franchises to micro-entrepreneurs who set up solar charging kiosks. The micro-entrepreneurs either (1) rent products to consumers on an hourly/daily basis or (2) sell systems without a power source, offering a fixed fee for charging

Proprietary Channels

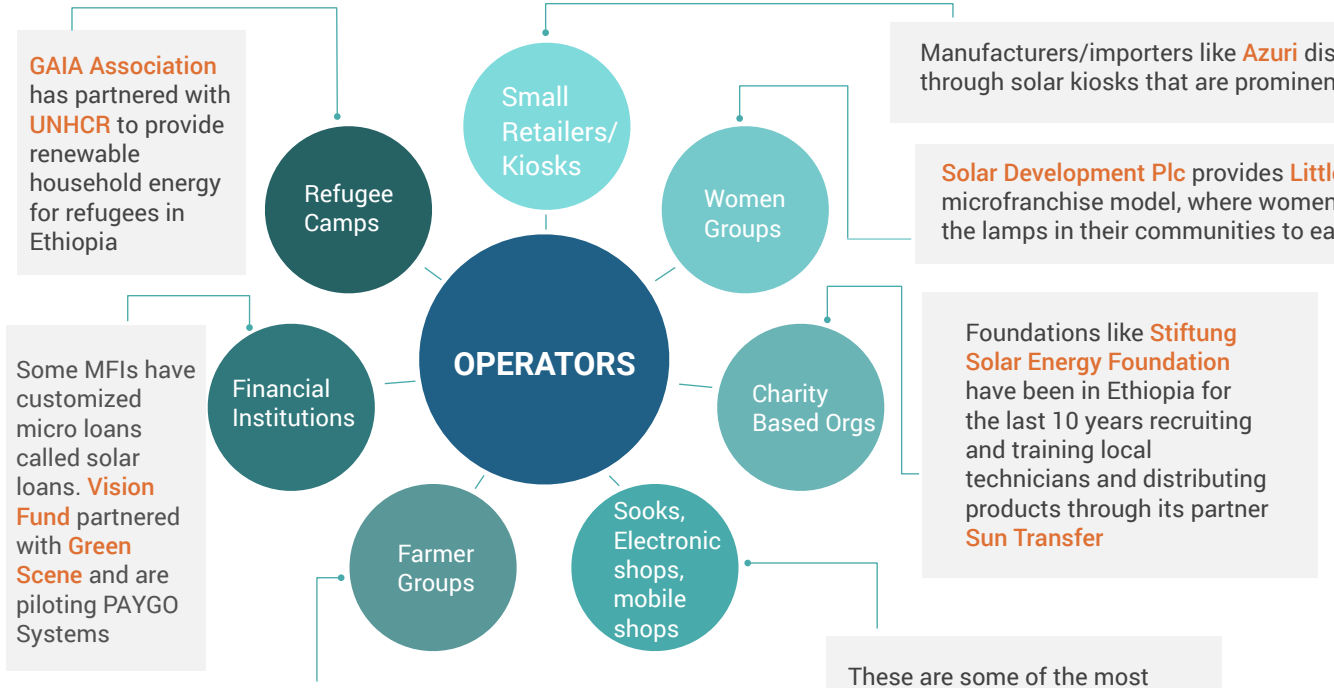
Products move through a proprietary distribution channel from manufacturer to in-house storage/ assembling facilities to a salaried/ contracted salesforce, which delivers them to customers directly

Institutional Partnerships

The company partners with an institution (e.g., NGO, MFI, rural bank, SHGs, MNC, assemblers, with links to a large potential customer base) to market its products to its customer base/members and/or to leverage its assembling & after-sales support services

Source: Accelerating Access to Electricity in Africa with Off-grid Solar, ODI, Jan 2016 (Link)

Distribution models: Businesses are exploring a variety of last mile distribution channels. Sooks, electronic and hardware stores and mobile phone shops have the the highest penetration of OGS devices



GAIA Association has partnered with UNHCR to provide renewable household energy for refugees in Ethiopia

Manufacturers/importers like Azuri distribute products through solar kiosks that are prominent in rural areas

Solar Development Plc provides Little Sun lamps for women in the microfranchise model, where women are engaged in the sales of the lamps in their communities to earn off-farm income

Some MFIs have customized micro loans called solar loans. Vision Fund partnered with Green Scene and are piloting PAYGO Systems

Foundations like Stiftung Solar Energy Foundation have been in Ethiopia for the last 10 years recruiting and training local technicians and distributing products through its partner Sun Transfer

Melike Silties Farmers' Cooperative Union brings together 76 local cooperatives with 93,000 members. The union provides its members with short-term consumer financing for HH products like solar lanterns

These are some of the most popular stocking points for OGS devices

- **Sooks* are the outlets with the highest penetration** of OGS in the market, followed by hardware and mobile phone stores
- **Highest solar handling incidence is observed in Electronics & electrical shops**
- **Majority solar retailers stock the products (mostly SHS) for less than a year,** an indication of growing momentum in the SHS segment

*Sooks are selling areas below 10 square metres handling non durables and high turnover products

Source: Deep Dive Supply Chain Report for Ethiopia, Lighting Africa, Jan 2016 (Link); Ethiopia – Market Intelligence Report, Lighting Africa June 2013 (Link)

Financing models: PAYGO is gaining importance in Ethiopia as consumers migrate to higher cost OGS devices like SLS with mobile charging and SHS

Business model	Benefits
PAYGO is a financing platform for off-grid energy systems with high up-front capital costs. An IT system underlies the platform, allowing automated payments and system monitoring/activation.	• Ability to provide longer duration and big-ticket loans to users • High consumer confidence in product due to financing by the supplier • Improved operational efficiency of suppliers as no coordination needed between financial and technology providers. • Reduced cost of payment collection (incase of mobile payments)

Companies on PAYGO platforms

HelloSolar, Green Scene, fosera, greenlight planet, azuri, Stiftung Solarenergie Solar Energy Foundation, SUNTRANSFER Sustainable Off-Grid-Solutions

PAYGO BUSINESS MODEL ATTRIBUTES

Payment Platform

- **Full connectivity model**– M2M and mobile money
- **Prepaid credit agent-based model** (off-network) – requires manual input of unique code (e.g. **Azuri, Sun King Easy Buy**)
- **Mobile airtime as prepaid credit**
- **Partial PAYGO models -** agents accept cash and activate products via cable, bluetooth or manual SMS code

Customer Relationships

- **Lease to own/Micro-loans:** Transfer of asset ownership to user after limited payment period. Payment via licensed platform (e.g. **Azuri**)
- **Energy service:** Co. provides electric service rather than financing. Service comes from a company-owned solar system.
- **B2B players:** Hardware/software support for energy service and payment logistics. (e.g. **Angaza**)

System Size

PAYGO solar products can be divided by system size, which dictates the service level that each provides.

- HH products: Solar lanterns, SLS, SHS
- Community level shared minigrids

Connectivity

- Systems that are fully online, including **mobile money** and **remote, real time connections** with the energy system
- Systems that are intermittently connected

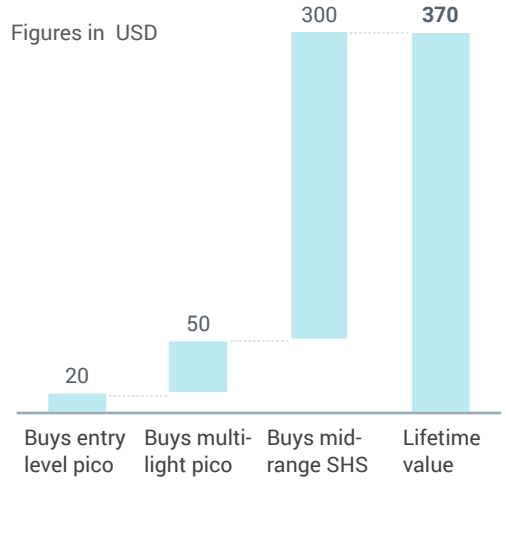
Partnership Strategy

- Partnerships could be made on distribution, payment portals, hardware/software service support, or other core business aspects

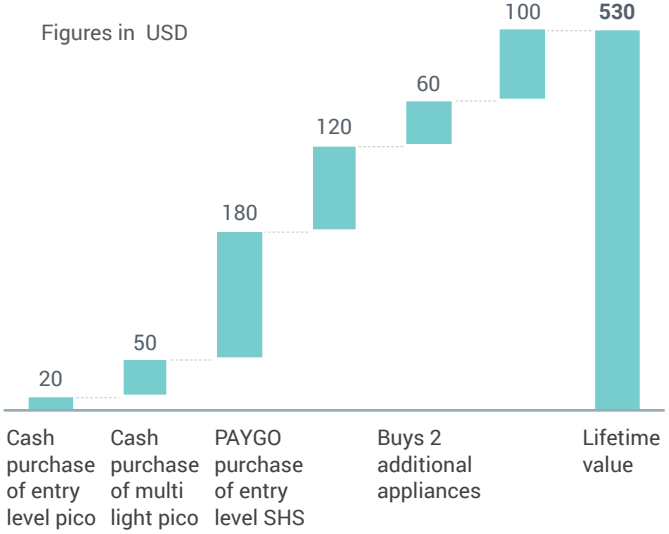
Sources: : Accelerating Access to Electricity in Africa with Off-grid Solar, ODI, Jan 2016 (Link) Note: For more details on PAYGO payment platform; and hardware and software features, refer to Annexure (Slide 48)

Financing models: The lifetime value of a customer through PAYGO models is much higher than it is with Cash based or Cash + PAYGO payment mechanisms

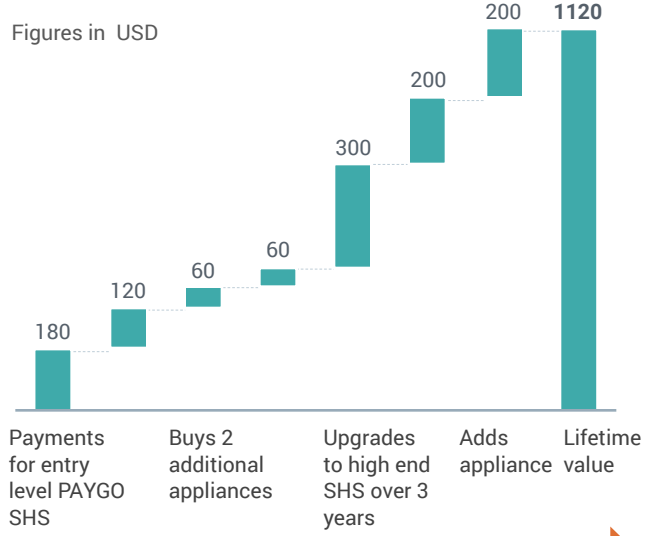
Cash



Cash + PAYGO



PAYGO



8-Year Horizon

- Players are **increasingly focusing on the lifetime value** they can derive from a consumer as consumers migrate from basic products to products with higher functionality
- **PAYGO models offer the highest lifetime customer value**, as is reflected by the increasing adoption of PAYGO models by most suppliers in the market

Source: Accelerating Access to Electricity in Africa with Off-grid Solar, ODI, Jan 2016 (Link)

Financing models: Partnerships with MFIs and credit cooperatives; and advancing inventory on credit to dealers, are a few popular models facilitating end-user financing

	DESCRIPTION	
One Stop Shop Model	In this model, the same organization provides the products and finance. This happens when a finance provider decides to offer energy products, or when an energy enterprise decides to offer finance. (e.g. **Sun King's** easy buy platform, **Greenlight Planet**)	HelloSolar, sunking. from Greenlight Planet
FI Partners With Energy Enterprise	In this case, an energy enterprise enters into a partnership with a local financial institution to sell OGS products. This model typically involves a financial institution (FI) providing credit to an end-user and managing the monitoring and repayment processes, while the energy company provides the energy product, installation, service and maintenance. (e.g. **Green Scene Energy PLC**)	Green Scene
Umbrella Partnership Model	The energy enterprise enters into a partnership arrangement with an "apex institution" that manages a network of local FIs (e.g. a union of credit cooperatives, credit unions, or other village-based FIs). The apex institution lends money to the local finance providers, who lend to an end-user and manage the monitoring and repayment processes. The energy enterprise provides the product, installation, service and maintenance. (e.g. **Melike Silties Farmers' Cooperative**)	Melike Silties Farmers' Cooperative
Franchise/ Dealership Model	The energy enterprise provides credit to dealers and/or franchises to allow them to sell to clients on an instalment basis. This particular model is common for relatively inexpensive products — usually those that cost under $50. (e.g. **Greenlight Planet**)	SOLAR DEVELOPMENT, sunking. from Greenlight Planet
Brokering Model	A t third-party organization is paid by the finance provider and the energy enterprise to market energy products and assess customers' suitability for financing. They bring viable customers forward to buy energy products. The broker may also be involved with loan payment collection, after-sales service, and technical upkeep.	

Source: Accelerating Access to Electricity in Africa with Off-grid Solar, ODI, Jan 2016 (Link)

Value proposition offered by select suppliers

	Product Offering	Financing And Distribution
greenlight planet / sun king. from Greenlight Planet	• Offers 5 **lanterns** and 2 SHS (6-12 W, 3 lights, and phone charging); exploring DC radios & TVs • **Flagship product is Sun King Pro series,** a $35 lantern equipped with 1-2 USB phone charging ports and a detachable solar panel, that provides 15 times brighter lighting than kerosene lanterns. • Products have a 5-year battery life, 2-year warranty, can provide 36 hrs of lighting per charge and are Lighting Global certified	• **Customers may buy directly or from its partners, either in cash, on credit** (through MFIs), or with PAYGO • **Greenlight Planet partnered with Angaza for the PAYGO metering** (remote shut-off) technology and back-end; dedicated teams for PAYGO operations • **Financing options can be costly for smaller products such as Home SHS** which is retailed at $80 in cash, but amounts to $125 with a 9-month PAYGO contract
d.light	• **Entry level solar lanterns:** Start at $5; life of ~5 years; 4–8 hrs light per charge, 2–3 times brighter than kerosene lamp; • **Multifunction solar lanterns:** Starts at ~$20 with mobile phone charging, 4-16 hrs of light /charge, 10 times brighter • **SHS:** Starts from ~$100, with 2–3 light points, 1 portable lantern / torch and a radio, 16–25 hours of runtime per charge, and 8–12 times brighter than kerosene lamp. Also offers a SHS, which includes a solar TV and/or solar fan • Products are Lighting Global certified with 2-year warranty	• **Customers can buy these products in cash or on credit,** in particular through **consumer finance provided by MFIs,** who bundle the product with a large asset loan • **D.light also offers one of its SHS through its proprietary PAYGO technology** which enables a customer to procure the SHS for a nominal deposit of 20–25 and then pay for the product in installments of $0.4–0.5 over a period of 12 months

Source: Reaching Scale in Access to Energy: Lessons from Practitioners, Hystra Hybrid Strategy Consulting, May 2017 (Link)

Value proposition offered by select suppliers

	Product Offering	Financing And Distribution
Stiftung Solarenergie (Solar Energy Foundation)	• Products range from small devices (e.g., **1.5 W panels** powering a LED lantern and a phone charger) and **home appliances** to **larger fixed SHS** with a payment charge controller (e.g., 70 W panels powering TVs, fridges, stoves) through smaller modular systems (e.g., for radios, fans, tablets) • Solutions available for health clinics, schools and solar water pumping. Batteries can be replaced at the end of product's life • Customers can benefit from trainings on how to use, charge and maintain solar products, installation at home if needed, maintenance for 3 years and financing solutions	• The foundation owns **SunTransfer Germany, a for-profit company distributing solar products** to the local partners, and **Sun-Connect, a cooperative that provides them with working capital.** The local partners sell products to end-users, mainly through rural solar centers • Customers can pay **monthly installments in cash** at the centre or remotely through **mobile banking.** In exchange, they get a code to enter in their SunControl Home system to activate the SHS (if they fail to do so, the system shuts down)
mobisol (Acquired by Engie in 2019)	• The entry-level (and best-selling) package includes **an 80 W SHS** (panel, battery, controller), **four lights, a phone charger, a solar lantern, a radio, and a 19" TV.** The other packages come with 120 W and 200 W panels, larger TVs and appliances. • Existing SHS have oversized batteries, which would enable the users to add more appliances. Also larger systems are being piloted with small businesses (e.g. in combination with welding machines) • Provides 3 years of warranty and free service	• Distribution is done through stores called **Mobishops** • Customers pay a **down payment, then $26 per month over 3 years.** They can also buy **SHS in cash,** with an upfront discount. They can use **mobile money** to pay their installments, in incremental payments. Incase of late payment, SHS are remotely shut-off • ~30% of Mobisol customers are already using their SHS for income generating activities and **earn an incremental income of $35 on average per month**

Source: Reaching Scale in Access to Energy: Lessons from Practitioners, Hystra Hybrid Strategy Consulting, May 2017 (Link)

Barriers to scale: Access to finance and complex import process are the two main barriers to scale for suppliers in Ethiopia. However, the government has adopted various measures to address these barriers

Barriers		Initiatives/Opportunities
Poor Access To Enterprise Finance	• Limited access to FOREX impedes the importation of off-grid lighting products • Limited access to finance for end-users • Limited access to working capital for private sector enterprises	• **Access to forex and working capital:** A revolving credit line was established by the government to provide access to FOREX and working capital to private sector enterprises and to MFIs to ensure affordability by end-users • **Reducing collateral requirements:** GOE is considering options for asset-based/inventory lending in collaboration with commercial banks and potential use of receivables as collateral assets • **Streamlining of loan provisions:** a) Reduction of loan application processing time to 15 days; b) Removal of open loans repayment requirement before application of new/additional loan; c) Repayment based on actual funds disbursed rather than the contract amount d) Setting up of Energy Directorate to manage increase in lending
Complex Import Process	• Complex importing rules and procedures • Delays and high costs in equipment importation	• **Tax exemptions:** Importers of solar products under 15 Wp have been exempted from 35% custom duty and 100% excise duty. Larger SHS are also exempt from custom duties (15% VAT and 3% withholding tax apply) • **Lifting of testing:** To streamline imports, govt. has approved certification of products before shipment (Pre-Verification of Conformity, or PVOC); and eliminated sample removal from every shipment, related testing fees, and 0.5% deposit based on shipment value

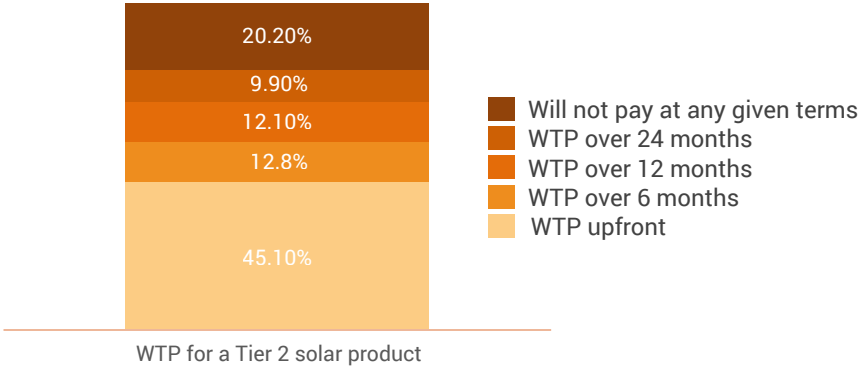
Source: National Electrification Program 2.0, Federal Democratic Republic of Ethiopia, 2019 (Link)

DEMAND **TRENDS**

Source: Signify Foundation

Affordability: Any approach to expand OGS solutions should prioritize SHS systems, given the high willingness to pay for them. Ability to pay can be boosted through PAYGO* models

NEARLY 80% HHS ARE WILLING TO PAY FOR A TIER 2 SOLAR PRODUCT



WTP for a Tier 2 solar product

Monthly expenditure scenarios for electricity expenditure by quintile (Q) and bottom deciles (D)

		D1	D2	Q2	Q3	Q4	Q5
Monthly expenditure ($)		**59**	**84**	**105**	**136**	**139**	**199**
Expenditure for electricity ($)	**5%**	**3**	**4**	5	7	7	10
	8%	5	7	8	11	11	16
	10%	6	8	11	14	14	20

WILLINGNESS TO PAY

- **WTP for Tier 1 off-grid solar devices (like solar lanterns and SLS):** Monthly payment for a Tier 1 system in Ethiopia could range from $4.5–$10 with the adoption of a PAYGO system, which will allow end-users to pay by installments (Source: NEP, 2019)
- **WTP for Tier 2 off-grid solar devices:** According to the Multi-Tier Framework (MTF) Energy Access Household Survey, pent-up demand for adequate access to electricity services is high for a Tier 2 system (~$500). 80% of the surveyed HHs are willing to pay for a Tier 2 solar product. However, female-headed households are less willing to pay for such products

ABILITY TO PAY

- The bottom 20% of the population has an **expected monthly expenditure on electricity of at least $4.5/5 per month**, and is therefore expected to be in need of some financial support to afford off-grid services

*Refer to slide 17 and 18 for details on PAYGO models

Source: Ethiopia: Beyond Connections - Energy Access Diagnostic Report Based on the Multi-Tier Framework, World Bank, June 2018 (Link)

Affordability: PAYGO models can significantly improve consumer's ability to pay

ETHIOPIA SCORES LOW ON WTP AND ATP SINCE OFF-GRID CONSUMERS SPEND LESS ON ELECTRICITY AND MOBILE PHONE CHARGING

Market Attractiveness Index, IFC

Country	Demand Score			Supply Score				Enabling Environment Score		
	Market Size	Ability to Pay	Willingness to Pay	Access to Finance	Operational Considerations	Market Penetration	Human Capital	ICT	Legal and regulatory	Trade and Commerce
Angola										
Cameroon										
Congo Dem Rep.										
Cote d'Ivoire										
Ethiopia										
Guinea										
Kenya										
Madagascar										
Malawi										
Mozambique										
Niger										
Nigeria										
Senegal										
Sierra Leone										
Tanzania										
Togo										
Uganda										
Zambia										
Zimbabwe										

- As mobile money penetration increases, high levels of consumer education is needed to curb risks that new mobile money users face such as low awareness on transaction fees, fraud among others.
- PAYGO models are expected to provide customers especially in the rural area with a more affordable option for off-grid modern (solar) lighting systems
- Flexible payment schedules for PAYGO solar will be key in increasing the ATP as rural consumers have seasonal income

Less than 100

Less than 70

Less than 50

Source: PAYGO Market Attractiveness Index, Lighting Global IFC, 2019 (Link); Power People and Planet: Seizing Africa's Energy and Climate Opportunities, Africa Progress Panel, 2015 (Link)

Demand Barriers: Quality assurance, low mobile penetration and limited awareness levels are key barriers to demand

Demand Barriers		Initiatives To Address Barriers
Poor Quality Standards	• Import of low-quality products and services • Increasing number of counterfeit products in the market affecting brand integrity of businesses • Inadequate capacity of the Conformity Assessment Enterprise which is responsible for testing and approval of imported products against national standards • Inadequate provisions for after sales service and maintenance of products, and absence of warranties undermine consumer protection	• **Quality standards:** Lighting Global (LG) standards are now mandatory for products up to 15 Wp. GOE plans to make current voluntary quality standards that apply to products up to 350 Wp mandatory. • **Capacity building:** DoE, in collaboration with Ministries of Revenues and Trade, will train custom officers on adopted regulations & standards for off-grid technologies to ensure quality assurance at entry • **Workforce expansion:** Workforce expansion in the off-grid market (technicians, after sales support staff) will be supported through training activities leveraging on the existing Technical Vocational Education and Training (TVET) programmes
Low Mobile Money Penetration	• Telecom and finance sectors are tightly controlled by government. Ethiopia has only one national teleco – Ethio Telecom • Regulations currently prevent telecommunications providers from participating in the CI/CO networks, as agents must be affiliated with a bank or MFI	• **Mobile penetration:** The GOE has established a goal of 5% adoption of mobile money by 2021. NEP has proposed a "bundled sale," that will enroll rural buyers of solar power systems, for a bank account, facilitating digital payments
Low Consumer Awareness	• Knowledge on how to identify quality-products is limited among consumers • Limited awareness about additional benefits especially productive use technologies	• The Lighting Africa programme implemented a 2-year long **consumer awareness campaigns** (2015-17) jointly with the government, targeting 12 Mn Ethiopians, to help consumers identify products meeting Lighting Global standards

Source: National Electrification Program 2.0, Federal Democratic Republic of Ethiopia, 2019 (Link)

ENABLING **ECOSYSTEM**

Source: Signify Foundation

Government: GOE has earmarked USD 2.5 Bn for its off-grid programme, and set ambitious targets to achieve universal electricity access nationwide by 2025, while meeting its climate obligations

As per the NEP (2019), Govt. plans to contribute $1 Bn for its off-grid access programme, raising $1.5 Bn for syndication through development partners and private sector resources.

Programmes	Mandate
National Electrification Programme (NEP) 2.0	Provides a roadmap for achieving and financing the universal electrification target. It comprises on-grid generation, grid extension and densification, and off-grid electrification
Growth and Transformation Plan II (GTP II) (2015/16-2019/20)	Provides a comprehensive strategy to improve the economic conditions of Ethiopia. Elaborates on the key objectives and targets for the energy sector
Climate Resilient Green Economy (CRGE) Strategy, 2011	Provides an action plan for creating a green economy, laying down key targets for reducing emissions and increasing climate resilience in 8 key sectors including Energy

Off-Grid Solar Targets

By 2025

Universal electricity access

- **8.1 Mn** connections
- **3.3 Mn** HHs
- **35%** off-grid access

By 2020

Increase electricity coverage to 90%

- **3.6 Mn** solar lanterns,
- **400,000 HH** solar PVs,
- **3,600** institutional solar PVs
- **300 MW** solar PV capacity
- **4,000** Solar Thermals
- **50** Solar water pumps
- **285** Minigrids

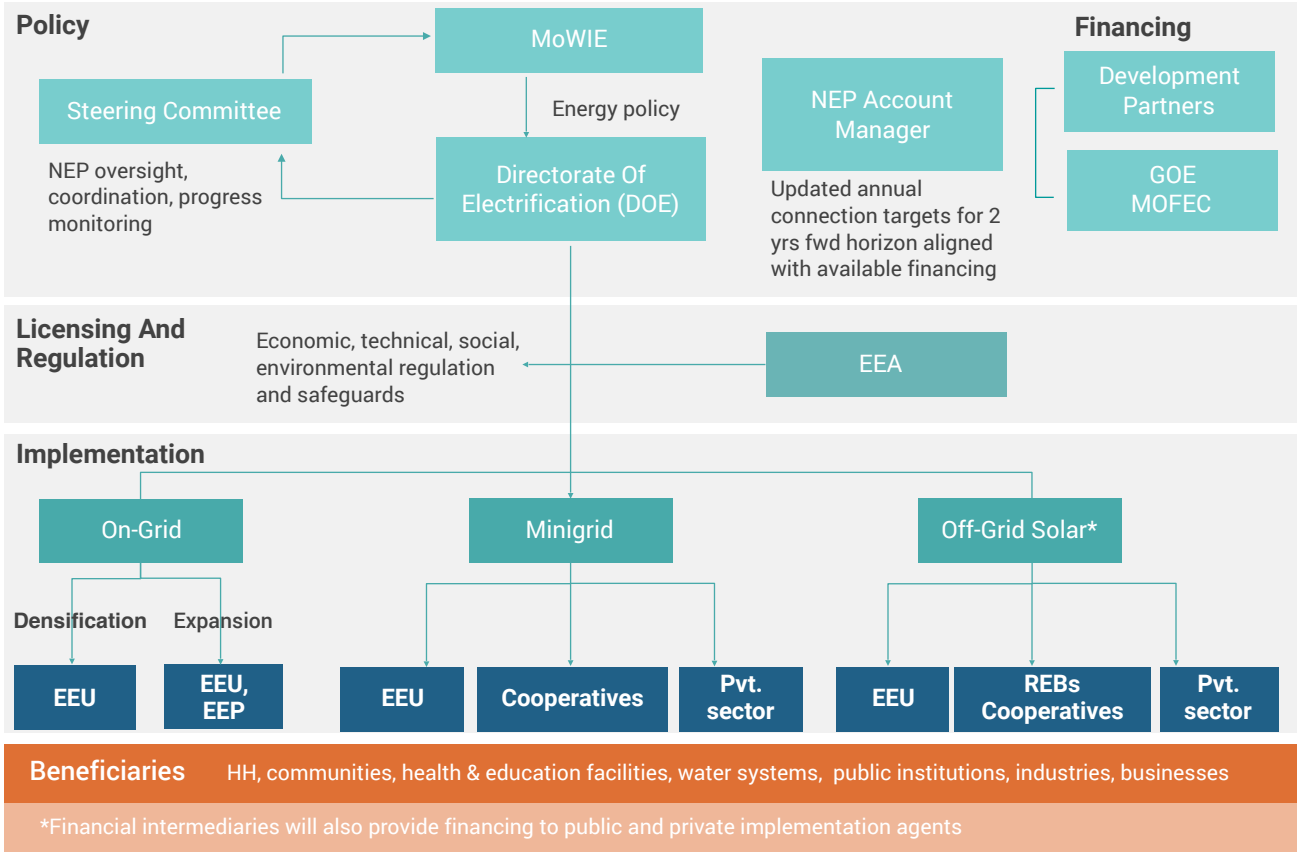
By 2030*

Limiting 2030 emissions to 150 $MtCO_2$ eq. (~250 $MtCO_2$ eq. less than business as usual scenario)

Source: National Electrification Program 2.0, Federal Democratic Republic of Ethiopia, 2019 (Link); Ethiopia's Climate-Resilient Green Economy Green economy strategy, Federal Democratic Republic of Ethiopia, 2012 (Link); Growth and Transformation Plan II (GTP II) (2015/16-2019/20), National Planning Commission, May 2016 (Link)

Government: There are several ministries/agencies dedicated to advancing energy access, with MoWIE setting the policies, EEP controlling generation, EEU managing distribution and EEA overseeing licensing & regulation

National Electrification Programme (NEP 2.0) institutional framework



The Ministry of Water, Irrigation & Electricity (MoWIE)

- Manufacturing, lab and training support for alternative energies including solar
- Guidance for implementation of policy- level strategic energy projects
- Research & technical support to bureaus

Ethiopian Energy Authority (EEA)

- Issuance of codes, standards and directives, licenses and certificates
- Compliance monitoring, grievance redressal

Ethiopian Electric Utility (EEU)

- Distribution and sale of electrical energy within 66 kV threshold
- Build and operate distribution networks for Independent power producers (IPPs)

Ethiopian Electric Power (EEP)

- Sole provider of bulk electricity to users
- Responsible for transmission (>132 kV) and generation, including negotiation and delivery of power exports

Source: National Electrification Program 2.0, Federal Democratic Republic of Ethiopia, 2019 (Link)

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Development Partners: A large number of development organisations are working to develop the OGS market in Ethiopia, especially contributing to business development and enterprise financing

Programme	Consumer awareness	Policy enabling	Access to finance		Transaction advisory	BD support and TA*	Quality assurance	Market intelligence	Funding (Mn USD)
			Consumer	Enterprise					
Lighting Africa	●	●				●	●	●	14.05
Market dev. credit line			●	●					40
Endev				●		●			48.4
Power Africa		●		●	●	●	●	●	
SE4All		●		●		●	●	●	18.8**
Africa Clean Energy Programme (ACE)		●		●		●		●	81***
Scaling solar						●			

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Programmes covering minigrids

Exchange Rate: 1 EUR = 1.09 USD and 1 GBP = 1.26 USD

*BD support includes skills development and capacity building for SMEs, for the development of business plans
**Covers Africa and Asia (donor income as on Dec 2018)
***Covers 14 African countries

Development Partners: The World Bank is supporting GOE through a $40 Mn credit line for MFIs and private enterprises, and has facilitated funding of ~$15 Mn for the off-grid programme under Lighting Africa

Implementing agency	Programme	Intervention areas	Results	Donors/ Partners	Funding
ESMAP, The World Bank, IFC	Lighting Africa (2013 – ongoing) (ELEAP*)	Awareness, BD support, access to finance, quality assurance, market intelligence	• 4 Mn beneficiaries reached • 490,500 tonns avoided	• SREP** of Climate investmengt funds • PPIAF (supported by World bank) • Govt. Of Italy and Netherands • IKEA foundation	$14.5 Mn
Development Bank of Ethiopia	Market Development Credit Line (2012-19) (ENREP***)	Working capital loans to private sector and micro-finance to HHs for purchasing solar lanterns & SHS	• 70,000 solar home systems and • 1.1 mn Lighting Global certified solar lanterns distributed	• The World Bank	$40 Mn
The World Bank, IFC	Scaling Solar	Accelerate development and operation of privately funded grid-connected solar projects within 2 years at competitive tariffs	Ethiopia's Public-Private Partnerships Directorate General (PPP-DG) launched an RfQ for solar projects for 750 MW under round two of the World Bank Group's Scaling Solar programme covering 6 sites	• Ministry of Foreign Affairs of the Netherlands • Ministry of Foreign Affairs of Denmark • USAID's Power Africa • UK DFID • The Private Infrastructure Development Group	

Source: Lighting Africa Ethiopia (Link); Ethiopia expands solar RfQ to 750 MW, Renewables Now, May 2019 (Link)

ELEAP - Ethiopia Electrification Program ($375 Mn of which $14.5 Mn is allocated for off grid solutions)
**SREP – Scaling up Renewable Energy Programme (~$2 Mn for Clean Energy SMEs Capacity Building and Investment Facility), for Lighting Ethiopia
**ENREP - Electricity Network Reinforcement and Expansion Project

Development Partners: The World Bank is supporting GOE through a $40 Mn credit line for MFIs and private enterprises, and has facilitated funding of ~$15 Mn for the off-grid programme under Lighting Africa

Implementing agency	Programme	Intervention areas	Results	Donors/ Partners	Funding
giz Netherlands Enterprise Agency	Energising Development Partnership (EnDev) (Phase 1: 2005-09 Phase 2 : 2010-20)	• Market development for modern energy supply focused on rural areas, ensuring energy access for poor households, social institutions and SMEs	• Reached 395,000 people with 298,000 solar lanterns and 12,331 SHS sold • 511 PV solar systems installed (455 kWp) at 562 social institutions and 3,200 enterprises	• GIZ • Irish Aid • Korea foundation for international healthcare • 6 donor countries – the Netherlands, Germany, Norway, the UK, Switzerland and Sweden • European Union	**$48.4 Mn**
USAID FROM THE AMERICAN PEOPLE	Power Africa (2013-ongoing)	• Policy and enabling environment development for SHS and minigrids • Access to enterprise finance • Market intelligence • BD support • Cross-Sectoral Integration • Transaction advisory • QA for minigrids	• Helped identify 150 villages for minigrids under GTP II • Enhanced GoE's IPP experience through competitively tendered Metahara Solar Project • Developed legal/regulatory IPP framework with GOE, lowering financing risks. • Set 2020 target of 450,000 off-grid connections	• Comprised of 12 US Government Agencies, over 145 private companies, and 18 bilateral and multilateral development partners (including Afdb, World Bank, Govts of Sweden, Norway, UK; European Commission, SE4All, IRENA, NEPAD)	

Source: Power Africa Annual Reports, USAID (Link) Energising Development Partnership: Country Project Ethiopia, GIZ (Link)

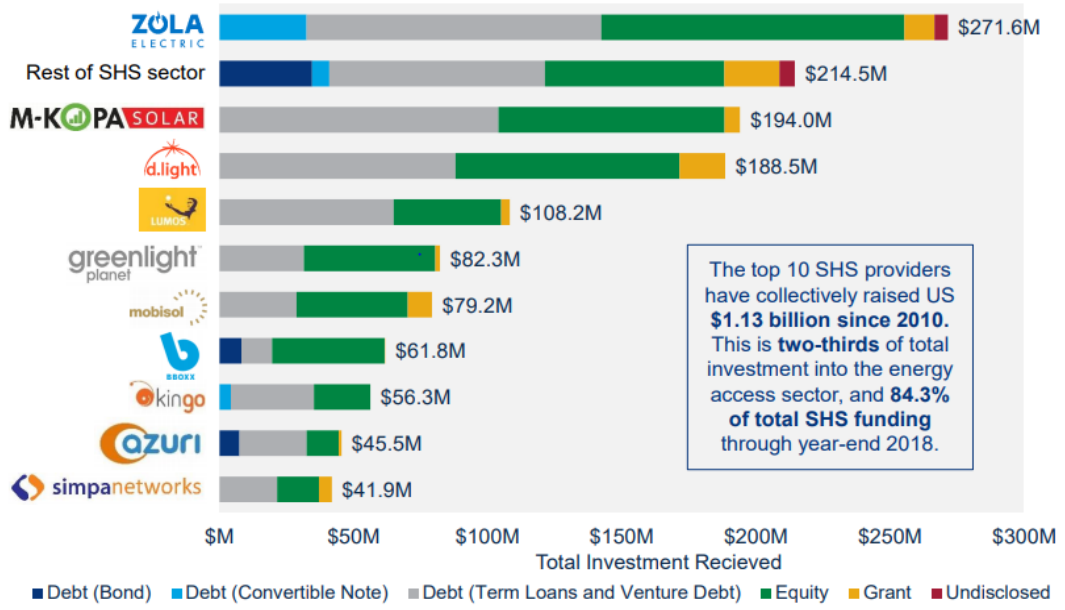
Development Partners: The World Bank is supporting GOE through a $40 Mn credit line for MFIs and private enterprises, and has facilitated funding of ~$15 Mn for the off-grid programme under Lighting Africa

Implementing agency	Programme	Intervention areas	Results	Donors/ Partners	Funding
	Sustainable Energy for All (SE4all) Africa Hub – GMG MDP (2015-ongoing)	• Market Intelligence on GMG development • Business development services • Policy and enabling environment development • Access to finance for GMG project developers • Technical standardization and quality control of minigrids	• Ethiopia's Rapid Assessment Gap Analysis on SE4all is complete • Action Agenda is under development • Investment prospectus is under development	• Partnership between the AfDB, the African Union Commission, the NEPAD Planning and Coordination Agency and UNDP	**$18.8 Mn** (Donor income as on Dec 2018)
DFID Department for International Development	Africa Clean Energy Programme (ACE) (2016-2022)	• Technical assistance to improve the enabling environment for a market-based approach for private sector delivery of solar home system (SHS) products and services • Enable enterprise finance • Test innovative approaches to stimulating private sector investment and market development.	• Conducted market study to assess business support needs in HH solar mkts • $7 Mn invested in 10 HH solar companies in 4 countries • Supported GOE to create a private sector solar industry association; increase capacity, improve federal inter agency and regional alignment for OGS sector	Funding • DFID , UK • Partners • Africa Enterprise Challenge Fund Ltd. • IFC • USAID Power Africa • DAI	**$81 Mn** (14 African Countries)

Source: Power Africa Annual Reports, USAID (Link) Energising Development Partnership: Country Project Ethiopia, GIZ (Link)

Financiers (Enterprise): Globally, off-grid access companies raised $1.7 Bn since 2010, of which 80% ($1.1 Bn) went to SHS providers (90% of whom used PAYGO models) and 80% was deployed in Africa.

TOP 10 SHS RECIPIENTS BY DISCLOSED FINANCING TYPE, CUMULATIVE TO YEAR-END 2018



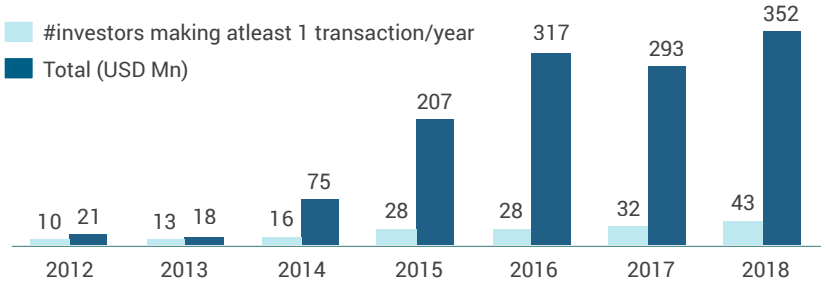
The top 10 SHS providers have collectively raised US **$1.13 billion since 2010.** This is **two-thirds** of total investment into the energy access sector, and **84.3% of total SHS funding** through year-end 2018.

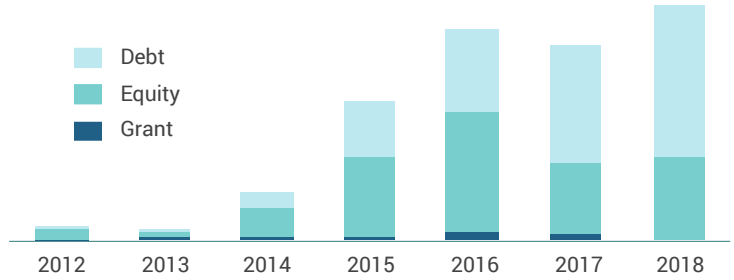
A few of these SHS market leaders such as Greenlight Planet , Mobisol in partnership with Sun Transfer, Azuri and D.light, have presence in Ethiopia

- **Geography:** Africa is an attractive market for investors absorbing 80% of total OGS funding globally. The customers of the top scaled companies in the OGS sector are concentrated in East Africa. Mobile money penetration and sensitization has helped attract 58% of disclosed capital to East Africa but market saturation is a risk
- **Product segment and financing models:** Companies deploying solar home systems (SHS), pay-as-you-go (PAYGO) business models have attracted 81% and 91% of investment, respectively
- **Asset Class:** Over 50% of total capital raised is debt, ~44% is equity and ~6% is grants.
- **Source of financing:** 71% of energy access finance is sourced from private capital markets while 86% of investments are dollar-denominated, but local currency is on the rise

Source: Strategic Investments in Off-grid Energy Access (Link)

Financiers (Enterprise): In 2018, the OGS energy sector attracted a total investment of $352 Mn, 20% more than 2017, and highest since 2012. However, investment by local banks remained low





Funding overview

- **East Africa was the largest recipient but there are signs of market saturation:** While East Africa received the largest amount of investment (44% of total) in 2018, it received the lowest absolute amounts of investment since 2012. Companies and investors are seeing growth potential in West Africa which attracted 19% of investments.
- **Highest debt funding of $225 Mn since 2012:** Specialised intermediary debt finance providers along with crowdfunding platforms and DFIs have contributed significant amounts of debt funding for inventory finance, working capital and financing of receivables.
- **Concentration of transactions dipped slightly from 2017 levels:** Top 10 fund recipients attracted 77% of the total funding compared to 85% in 2017 suggesting that more recipients now have access to capital.

Barriers to investment in OGS by local FIs in East Africa

Investments from local banks and MFIs is limited due to the following factors:

- **Mid-sized banks:** Inadequate data quality of OGS players, weak credit management systems and controls, default risk due to poor product quality and limited internal capacity of banks in OGS sector
- **Regional banks:** Limited data transparency, management related challenges, inability to meet disbursement criteria and mismatched interest of banks and other providers of guarantees/credit lines
- **MFIs:** Competition from PAYGO businesses, high transaction cost of small sized loans for low cost SHS systems, low quality standards and limited internal capacity

Source: Strategic Investments in Off-grid Energy Access (Link)

Financiers (Enterprise): Listed below are a few recent deals in OGS sector involving players who have operations in Ethiopia

Investor	Company	Asset class	Amount (USD)	Date	Sources Of Fund Deployment
Consortium led by Inspired Evolution, FMO, Swedfund and Norfund	**D.Light**	Equity	41 Mn	Dec 2018	To expand its solar and Pay-Go consumer finance business in Africa
European Investment Bank, responsAbility Investments, Social Investment Managers & Advisors (SIMA), SunFunder	**D.Light**	Debt	50 Mn	Apr 2018	To scale-up globally, launch new appliance and solar home system offerings, and provide financed "Pay As You Go" solar home system products in existing and new markets.
Marubeni Corporation	**Azuri**	Equity	26 Mn	Jun 2019	For its Africa clean energy initiative
EU Programme ElectriFi, TRINE	**Azuri**	Debt	20 Mn	Jan 2018	To provide end-user financing for its PAYGO products
Apis Partners	**Greenlight Planet**	Debt and equity	60 Mn	Dec 2017	To expand its solar-energy product lines, distribution networks, and financing capabilities in Africa and Asia.
SunFunder	**Zola Electric**	Debt	20 Mn	Jul 2018	Expansion across Africa to bring affordable, accessible and reliable solar energy to an additional 25,000 customers in four countries.

Companies with operations in Ethiopia

Source: Azuri Technologies $26 Mn investment to accelerate Africa's Clean Energy Drive, June 2019 (Link); Greenlight Planet Raises $60 Mn for Off-Grid Solar Financing Business, Dec 2017 (Link); Azuri set for growth with Innovative $20 Mn Debt Financing (Link); Solar Products Maker D.light Raises $41 Mn from African Investment Firm, Vccircle, Dec 2018 (Link); D.light Raises $50 Million in Debt Financing, April 2018 (Link); SunFunder and ZOLA Electric Close New Debt Facility, SunFunder, July 2018 (Link)

Financiers (End-user): A few MFIs in Ethiopia have partnered with private sector enterprises to finance OGS devices. M-BIRR is the most popular mobile money service used by some of the largest MFIs

Financiers	Overarching Goal	Funding Amount
OMO	• OMO works exclusively in Ethiopia's Southern Nations, Nationalities and Peoples' Region (SNNPR)	**M-BIRR**
Amhara Credit and Saving institution (ACSI)	• Established in 1997, ACSI aims to improve the economic situation of low income, productive poor people in the Amhara region. ACSI is working towards providing alternative power solutions (such as solar energy) to its customers	**M-BIRR**
Dedebit Credit and Savings Institution S.C (DECSI)	• Established in 1997, DECSI operates in Tigray, with an aim to stimulate the local economy, reduce the influence of moneylenders and drive income generation	**M-BIRR**
Addis Credit and Savings Institution	• ADCSI's mission is to promote micro and small enterprises to alleviate poverty and unemployment prevailing in Addis Ababa city	**M- BIRR**
Oromiya credit and savings S.C	• OCSSCO is an MFI in the Oromiya region. It has been providing micro credit for solar energy, biogas etc. with partner organisations.	**M- BIRR***
Specialized Financial and Promotional Institution (SFPI)	• Established in 1997, SFPI is one of Ethiopia's first MFIs, and is supported by the Development Bank of Ethiopia to supply high-quality solar systems to rural communities, supporting them with energy loans totaling over $370,000	
Peace	• Peace has been providing integrated rural development activities for more than 40 years in Ethiopia	**M- BIRR***

Source: About M-BIRR (Link); GreenScene: Partners (Link) *M-Birr is a mobile money service that enables financial transactions through mobile phones, provided by MOSS ICT consultancy. Other mobile money services in Ethiopia include HelloCash by BelCash Technology Solutions PLC. and YenePay by YenePay Financial Technologies PLC.

Associations: Represent private sector interests, advocate policy issues to government

Organization	Work In Ethiopia

GOGLA (Global Off-Grid Lighting Association)	• Global association for the off-grid solar energy industry established in 2012, representing 150 members
	• Support members with the following services:
	  ▸ Market intelligence, building an understanding of market opportunities and impact.
	  ▸ Knowledge-sharing and networking through events and communications.
	  ▸ Advocacy, for building enabling policy and investment.
	  ▸ Creating and promoting industry standards and guidelines

Solar Energy Development Association	• Independent non-profit association that facilitates the growth and development of solar energy business in the country • Provides a platform for dissemination and exchange of information to increase levels of awareness of solar products, number of qualified practitioners, pro-renewable policies that provide an enabling business environment.
Energy Sector Gender Stakeholder Forum	• Launched in October 2018, to engage energy stakeholders on gender equality across EEU, EEP, EEA, and the Ethiopian Women Lawyers Association (EWLA)

Others: Global networks and associations are also enabling private sector players to leverage support services

Organization	Work In Ethiopia
Stiftung Solar Energy Foundation	• Solar villages • Solar power for health stations and schools • Solar water irrigation
Sendea	• Incubator for local solar entrepreneurs • Academy – training courses for solar technicians • Investment fund for project finance
Sun-connect news	• News platform • Database of companies, documents, countries
Mangoo Market Place	• Local prices and technical specifications • Extensive catalogue for off-grid products • User voting for products
SDS International GmbH	• Provides consulting services such as market development strategies, local management support, project management

Others: There are a number of research institutions, universities and consultants active in Ethiopia working to support the market

Organization	Work In Ethiopia
Addis Ababa University	• The university has various energy focused departments like the Centre for Energy & Technology • The Horn of Africa Regional Centre for Environment, an autonomous body under the university facilitates cooperation between members and various environmental actors
Arba Minch University	• Set up a solar competence center in cooperation with Sahay Solar Africa which trains engineers, electricians and rural Ethiopians on solar technologies • Runs an applied education entrepreneurship programme to develop off-grid business applications, in partnership with Neu-Ulm University of Applied Sciences
Woldia University	• Hosts a 100 MW/annum Solar PV minigrid manufacturing plant that has been built in partnership with Global Trade and Development Corporation and AIB Stimaken
Accenture Development Partnerships	• Consulting firm that provides technical assistance across all technology types including minigrids through its Energy Access for Development Impact (EADI) programme
Schneider Electric	• Access to Energy Programme that delivers technical and financial assistance for clean off-grid solutions
Plan International	• Provides energy access to rural communities through financing, local knowledge and logistical assistance during implementation of its programmes

Source: Minigrid Market Opportunity Assessment: Ethiopia, AfDB, April 2017 (Link)

ANNEXURE

Off-grid technologies in Ethiopia provide energy to Tier 0 to Tier 1 consumers. PV SHS and DC powered energy efficient appliances that provide access to Tier 3, 4, and 5 consumers are rarely available

	TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
Multi Tier Framework						
Appliances	Kerosene lamps Dry cell batteries	Task lighting, phone charging radio (e.g. solar lanterns , SLS)	Multipoint general lighting, TV, Computer, Printer, Fan (e.g. Entry level SHS)	Air cooler, refrigerator, freezer, food processor, water pump, rice cooker	Washing machine, iron, hair dryer, toaster, microwave	Air conditioner, space heater, vacuum cleaner, water heater, electric cookstove
Load Level		3-49 W	50-199 W	200-799 W	800-1999 W	2000 W or more

e.g. High capacity SHS and Minigrids

Increase In Size (kW)

Source: Ethiopia: Beyond Connections - Energy Access Diagnostic Report Based on the Multi-Tier Framework, World Bank, June 2018 (Link)

Private operators: The off–grid product enablers in Ethiopia are commonly divided into developers, assemblers, wholesalers and last mile distribution agents (1/3)

Company Name	Products	Activities	Contact details
Stiftung Solarenegie – Solar Energy Foundation	• Solar power for health stations and schools • Solar water irrigation pumps	• Assembly of solar products • Maintenance and supply of solar products	Harald Schutzeichel, Founder and President hs@stiftung-solarenergie.org
STM Solar Technologies Manufacturing SC	• Solar Lanterns • Pico SHS (plug & play)	• Assembly/Manufacturing of solar products • Wholesale distribution of solar products • Training of local technicians and helping them become entrepreneurs	Same as above
Sun Transfer	• Solar Lanterns • Pico SHS (plug & play) • Installed SHS with applications	• Wholesale distribution of solar products • Solar centers – consumers are taught how to install and use products, and can access consumer credit and after-sales service and maintenance support • PAYGO in partnership with Mobisol	Yonus Workeye, MD yonas@suntransfer.com
Beshah International Solar and Information Technology (BISIT) founded in 2004 and SIT	• SHS for lighting • Solar water pumping • Solar refrigeration • Solar Lighting for rural schools etc.	• Wholesale distribution of solar products	Tameru Beshah, General Manager tameru.beshah@bisitgroup.com

Private operators: The off-grid product enablers in Ethiopia are commonly divided into developers, assemblers, wholesalers and last mile distribution agents (2/3)

Company Name	Products	Activities	Contact details
Green Scene Energy Plc	• Solar Home systems – BioLite, Sunking, Fosera brands • Solar TV • Solar Lanterns • Solar energy powered systems for health centers, schools, water pumps and other community projects • Community minigrids	• Assembly of solar products • Wholesaler Distributor • PAYGO products enabled through mobile payments • Pay over time with an affordable loan through partner MFIs	Rekik Bekele, CEO info@greensceneethiopia.com
Hello Solar	• Solar Home Systems	• Wholesale distribution • PAYGO products	Mountaga Vince DIOP, Chairman Info@hellosolarint.com
Mobisol (Acquired by Engie)	• Solar Home Systems • Paygee Software Suite (Solar Hub Software Suite)	• Manufacturer/Assembler • PAYGO platform provider • Acquired by Engie	
Angaza	• Angaza Hub – digitize and automate distribution business and provide data insights • Angaza Activator – sales agents mobile tools to manage client accounts, process cash or mobile money payments, even when offline	• Technology platform provider	

Private operators: The off–grid product enablers in Ethiopia are commonly divided into developers, assemblers, wholesalers and last mile distribution agents (3/3)

Company Name	Products	Activities	Contact details
Green Light Planet	• Sun King products – SHS and Solar Lamp kits	• Design of solar home energy systems • Assembly of solar lanterns and SHS • Wholesale and Retail Supplier of lanterns and SHS	Anish Thakkar, Co-founder anish@greenlightplanet.com
LYDETCO PLC	• Solar Home Systems and components • Solar Water Heaters • Industrial inputs and machinery	• Developer/manufacturer • Linked distribution with Phaesun, Newlong and Linuo Ritter • Represents BP Solar (British Petroleum) and Phaesun GmBH (off-grid experts)	Derjee Walelign, Owner/MD dwalelign@lydecto.com.et
NIWA Solar	• Solar Home Systems • Solar Lighting and phone charging products	• Developer/Manufacturer • Wholesale distribution • Partnered with Sun Transfer in Ethiopia	Tiel Attar, Founder and Executive Director sales@niwasolar.com
Solar Tech	• Solar Home Systems • Electronics	• Wholesale distributor of products • Offer product installation, maintenance support, and consultancy services	
Azuri Technologies	• Azuri TV • Quad Solar Home System • PAYGO technology platform	• Developer/Manufacturer • PAYGO solar products enabled through mobile payments. • Azuri has partnered with M-BIRR in Ethiopia	Simon Bransfield-Garth, CEO sbg@azuri-technologies.com

Minigrids: Summary of on-going minigrid initiatives in Ethiopia

Dev. Partner	Organization	Project/ Initiative	Source of Fuel	Business & Institutional Model	Connections (actual projected)	Location	Cost (USD)
Power Africa	Ethio-Resource Group PLC	Six Wind power microgrids	Wind	Private Model	300 households, 20 enterprises, and 1 health clinic	Menz district, Amhara region	100,000 grant support through U.S. African Development Foundation, Energy Challenge Award
Power Africa	Rensys Engineering and Trading PLC	Solar minigrid system	Solar	Private Model	198 households, small businesses, and institutions	Deke (Lake Tana), Amhara region	100,000 grant support through U.S. African Development Foundation, Energy Challenge Award
DFID		Green Minigrid Regional Facility	N/A (TA)	Renewables	TA for developing mini grids . Work with GoE and EEU/EEP. Funding allocated to WB and AfDB		
EUD		SE4ALL TAF assignment			TA for developing mini grids tender documents with MOWIE/EEU		

* Costs includes 33% grid cost to be paid by the Reg. Government

Source: National Electrification Program 2.0, Federal Democratic Republic of Ethiopia, 2019 (Link)

Minigrids: Summary of on-going minigrid initiatives in Ethiopia

Dev. Partner	Project/ Initiative	Source of Fuel	Business & Institutional Model	Connections (actual projected)	Location	Cost (USD)
GIZ/EnDev	Engrin	Hydro	Cooperative	252 households	Amhara	124, 169 *
GIZ/EnDev	Abaye	Hydro	Cooperative	420 households	Amhara	206, 948 *
GIZ/EnDev	Timbil	Hydro	Cooperative	327 households	Amhara	124, 169 *
GIZ/EnDev	Idris	Hydro	Cooperative	170 households	Oromia	124, 169 *
GIZ/EnDev	Waro	Hydro	Cooperative	220 households	Oromia	103, 474 *
GIZ/EnDev	Naso	Hydro	Cooperative	320 households	Oromia	144, 863 *
GIZ/EnDev	Gibe	Hydro	Cooperative	256 households	Oromia	124 169 *
GIZ/EnDev	Ameka	Hydro	Cooperative	435 households	SNNPR	206 948*
GIZ/EnDev	Fuamo	Hydro	Cooperative	575 households	SNNPR	215 226 *

* Costs includes 33% grid cost to be paid by the Reg. Government

Under NEP, the following is being considered to enable minigrid development (in terms of regulation):

- Simplified licensing application processes for small minigrids (up to 5 MW of distributed power)
- Compensation clauses and related calculations for grid arrival and integration of minigrids into the main grid
- Transparent tariff calculation methodology for minigrid tariff setting (i.e. a fixed payment and a kWh based)
- Establishment of technical and service standards for grid integration; Safety, reliability and environmental protection

Source: National Electrification Program 2.0, Federal Democratic Republic of Ethiopia, 2019 (Link)

Financing models: Payment platforms, hardware and software features vary across different PAYGO service providers

PAYGO solar solutions available in the market consist of three key aspects w.r.t. how digital payments are used:

End-user payments are digitalised via mobile channels or through proof of payment codes via SMS

Hardware ties energy usage to payment

Software processes payments, manages communication with product, customer and agent

Mobile Money

Customers prepay via mobile money channels or buy digitized energy credits through agents. A software integrated with mobile money platforms enables receipt of payment, updation of customer accounts, and delivers proof of payment data. This is transferred to the solar device to unlock for usage, via direct data or SMS. E.g. Mobisol sends payment proof directly to the device. Angaza has a software that initiates a voice call to customer who holds it next to the device, communicating payment proof via audio tones

Energy Credits

In the absence of mobile money, companies deploy an "energy credit" agent model where customers pay cash to an agent to vend prepaid energy credits (unique 8–12-digit codes) later entered into the product (Azuri). Incase of Angaza, customers pay an agent who uses an app on his smartphone to record cash payments, which connects to the company's software updating the customer's account. The smartphone communicates proof-of-payment to the solar light via a data cable (Angaza) or wirelessly via Bluetooth

On Network

- Solar products are connected directly to the cellular network via M2M module + SIM
- Customers pay via mobile money; software sends a message directly to the solar device to "unlock" prepaid services via the network
- Typically requires a tight partnership with an MNO for SIM cards and access to discounted data/SMS/mobile money

Off Network

- PAYGO hardware does not connect with the GSM network
- Customers pay cash to appointed agents for prepaid energy voucher/credit/scratch card, which is validated via SMS
- Software generates unique usage code entered into solar device
- Does not require a formal relationship with an MNO

- PAYGO solar companies have developed proprietary software, often on cloud, to track end-customer data and payments. These platforms include an SMS or data gateway for automated communication with products, customers, and agents, and some integration with a digital payment platform to receive mobile payments. Some PAYGO solar products (Mobisol) track information on product performance and customer usage, sending data back to the central software hub on regular intervals via the GSM network
- Some companies deploy hardware and/or software on a B2B basis to enable other companies to deploy PAYGO products. E.g. Angaza Design has developed a platform for pico solar systems and solar lights, servicing various data transfer approaches (M2M, data cable + smartphone, keypad, audio tones) and multiple customer payment options (mobile money, energy credits)

Source: Access to Energy via Digital Finance: Overview of Models and Prospects for Innovation , CGAP, 2014 (Link)

About The Organizations

signify foundation

The Signify Foundation is dedicated to supporting underprivileged and underserved communities across the world by enabling access to light. When pursuing this mission, the Foundation expects to leverage Signify's expertise and knowledge to help develop and provide easily-accessible, sustainable lighting systems that have a meaningful impact on people's lives.

For more details please visit https://www.signify.com/global/our-company/signify-foundation

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Intellecap, a part of the Aavishkaar Group, is a pioneer in building enabling ecosystems and channelling capital to create and nurture a sustainable & equitable society. Founded in 2002, Intellecap works across critical sectors like clean energy, climate change, agriculture, livelihoods, financial services, gender and inclusion, healthcare, water and sanitation. The organization has delivered over 500 global engagements across 40+ countries and syndicated investments of over $500 Million USD in Capital. Intellecap through its presence in India and Africa, provides a broad range of consulting, research and investment banking services, to multilateral agencies, development finance institutions, social enterprises, corporations, investors, policy makers and donors.

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