ENERGY
CATALYST

Technical Guide: PUE for Services

September 2023

Technical Guide: Productive use of energy (PUE) for services

Source: Mercy Corps-Energy 4 Impact

The provision of energy is key to the socio-economic development of rural areas. While energy access alone is not enough to trigger economic development in rural areas, using energy for productive uses will generate income, and therefore spur development. The Alliance for Rural Electrification (ARE) and the National Renewable Energy Laboratory (NREL) define the productive use of clean energy as agricultural, commercial, and industrial activities that generate income and are powered by clean energy sources.

While the residential use of electricity improves communities' quality of life, productive uses of energy (PUE) increase productivity, economic growth and employment rates in rural areas. Besides facilitating socio-economic development, stimulating PUE also makes the provision of rural energy a more viable business model for energy providers. The rationale behind the promotion of productive uses in energy projects is therefore multi-layered:

- Productive use can maximise the economic and social benefits of energy access. Energy projects with productive use components are more likely to lead to rural economic development than projects that simply focus on the provision of electricity for non-productive uses.
- Incorporating a PUE focus into energy projects makes them more likely to contribute to the achievement of the SDGs.
- Rural electrification projects with a PUE component are more likely to achieve economic sustainability. Enterprises that generate profits through electricity use have a higher ability to pay for energy services than private households who use electricity for personal consumption.

PUE activities in rural settings can be broadly categorised, as shown in the table below.

Table 1. PUE activities by sector

Sector	Activities
Agricultural uses	Irrigation, fish chilling, grain processing, oil extraction, etc
Light manufacturing	Carpentry, welding, ice-making, textile processing, etc
Commercial and retail services	Retail shops, bars, food kiosks, hair salons, barbers, video shows, phone charging, etc

This guide will focus on the applications of PUE in the commercial and retail services sector as a separate guide focuses on applications in agriculture.

Energy and services overview

This guide will focus on the following typical PUE services being offered as part of commercial and retail services.

- Refrigeration and entertainment in bars, restaurants and shops
- Charging mobile phones and battery shops
- Hair salons
- Secretarial services and internet cafes
- Tailoring
- Transport by e-vehicles

Typical appliances used for these PUE services include refrigerators, TVs, fans, computers, sewing machines and e-vehicles. Such machines tend to be powered more by mini-grids or solar home systems (SHS), and less by stand-alone solar systems. To give a snapshot of demand for the whole of sub-Saharan Africa in 2021, sales volumes of TVs were at over 1.2 million, fans at around 250,000, and refrigerators at around 22,000 units[1]. However, the current sales volumes only account for a small percentage of the serviceable market, which is estimated at 700,000 units for cooling and 10 million for fans[2].

Companies that are already active with product offerings in this space can be separated into the following categories:

- Manufacturers going vertical (e.g. Koolbox, Imara Tech, SunCulture).
- Off-grid solar companies with existing sales and distribution businesses going upmarket into productive use (e.g. d.light, Bboxx).
- Mini-grid developers going into productive use to improve their business case (e.g. Equatorial Power, PowerGen).

Refrigeration

Refrigeration is crucial to the preservation of some food, such as fish and milk, and thus the reduction of post-harvest and capture losses. In rural areas, however, it is most commonly used in shops and bars to cool drinks. Refrigeration for milk and fish are dealt with in the *Productive Use of Energy in Agriculture* and *Fisheries* guides respectively.

There are various types of refrigerators that can operate in energy-constrained environments, as shown in the table below.

[1] *Off-Grid Solar Market Trends Report 2022: State of the Sector* (Lighting Global, 2022).

[2] This estimate derives from unpublished PUE analysis by Mercy Corps-Energy 4 Impact.

Table 2: Off-grid refrigerator types (source: Efficiency for Access)		
Refrigerator type	**Description**	**Power source**
Absorption refrigerators: operate on a heat cycle which requires a fuel or electric heat source.		
Gas or propane refrigerators	Use gas or propane as their primary energy source and have no moving parts. Consume high amounts of energy and pose potential fire and health risks from particulates.	Gas or propane fuel
Compression refrigerators: operates using compression cycle which requires electricity.		
DC household refrigerators and refrigerator-freezers	Designed to be used with a solar energy system and typically features more efficient design considerations, such as highly efficient compressors and motors, or thicker insulation.	Solar system, including PV panel and battery, or generator
Solar direct drive (SDD) refrigerators	Connect directly to a PV panel, and generally include an integrated thermal and/or electric battery to allow for autonomous operation at night or on cloudy days when there is no solar power. SDD technology uses solar energy to freeze water packs or other phase change materials. These ice packs keep the refrigerator cool.	PV panel
Conventional AC refrigerators	Intended for use with a grid power supply, but may be used with a solar system through an inverter. On average, they are less efficient than DC refrigerators, but are currently the most readily available option for most off-grid consumers.	Grid electricity, generator, or solar system with an inverter
Evaporative refrigerators: utilise water and evaporative effect to cool without a power source.		
Evaporative refrigerators	A simple design that utilises water and a porous membrane to cool through evaporation. Evaporative refrigerators are only effective in low-humidity areas and can only cool 10-15°C from the ambient temperature. Handmade clay pot coolers are one of the most common designs, but some companies have developed designs for the mass market, using an internal reservoir filled with water and lightweight membranes as insulation.	No power source needed

Conventional AC refrigerators typically found in retail markets use around 300-800W per day, which can lead to technical constraints, due to the limited amount of electricity provided by distributed energy systems. The load

profile of refrigerators tends to be balanced throughout the day, and requires a high reliability of electricity supply, as short interruptions can warm up and spoil the goods stored within. For example, the combined energy demand of inefficient appliances often overloads weak electrical systems, contributing to load shedding and power outages, and undermining the gains of energy supply investment and grid extension. In order to be viable in off-grid settings and suitable for rural customers, refrigerators must become considerably smaller, cheaper, and run on far less energy than most conventional products.

Off-grid refrigerators are smaller, on average, than those on the traditional on-grid refrigerator market. The capacity of off-grid refrigerators averages at about 130 litres, with the average capacity of refrigerator-freezer combination units being 27% larger. The most common capacity size for refrigerators is 50-99 litres, and for refrigerator-freezer combination units, it is 100-149 litres.

CLASP conducted research on this topic[3] and found that:

- For refrigerators currently available on off-grid markets, the daily energy consumption is 0.739 kWh/day at 32°C and 1.254 kWh/day at 43°C.
- The cost of refrigerators itself is a critical barrier inhibiting more off-grid consumers from accessing refrigerators.
- The cost of refrigerators varies significantly, from €200 to €2,500, and a higher price is not always associated with better energy performance or quality.

The average lifetime of refrigerators is estimated to be around 10 years in off- or mini-grid settings.

An off-grid energy supplier in Tanzania piloted the introduction of refrigerators, largely within retail contexts. It found that energy consumption in the field was considerably higher than was expected from the lab tests. One of the main reasons for this was the very high turnover of the cooled drinks in the fridge, requiring restocking with un-cooled drinks continuously. They also found that, although the monthly payments for the 18-month repayment plan and energy consumption were relatively high, the increase in sales did easily justify this.

This was confirmed by the Mini-Grid Innovation Lab, which found that the median daily consumption for mini-grid customers receiving fridges increased by 37% in East Africa and by 69% in Nigeria, according to its 2019 report[4]. However, in its 2021 report, the Lab found a decrease in average consumption per user (ACPU), by 1.8% in East Africa and 2.5% in Nigeria[5]. One study by 60 Decibels found a 22% decrease in income for refrigeration users after three years of usage[6]. However, another study by 60 Decibels and Efficiency for Access indicates that 72% of off-grid refrigerators customers experiences increased income and business growth[7].

Entertainment

Entertainment, in the form of music and television, is one of the first types of energy use that emerges with the extended availability of electricity. Bars, in particular, benefit from offering music and television alongside lighting and cooling (mostly in the form of fans), to attract additional revenue. Sometimes this entertainment is complemented by slot machines and other computer games.

[3] *Catalysing technology innovation in the off-grid market through appropriate product performance testing in the laboratory and field* (Nyamolo Abagi, Makena Ireri & Elisa Lai, CLASP, 2019).
[4] *Innovation Insight: Appliance Financing* (CrossBoundary & Energy 4 Impact, August 2019).
[5] *Appliance Financing 1.0 Innovation Insight* (CrossBoundary & Energy 4 Impact, April 2021).
[6] Appliances Impacts Over Time: Longitudinal insights from off-grid TV, refrigerators, & solar water pumps users (60 Decibels & Efficiency for Access, 2023)
[7] Key Long-Term Benefits of Off-Grid Refrigerators for Low-Income Users (60 Decibels & Efficiency for Access, 2022)

TVs are often offered in a kit together with a solar home system, though the TV sizes and prices vary greatly. Based on a report by Lighting Global, TV prices range from $34 to $325[8]. On average, TVs use 60-120W, depending on their size and technology, and last for four to seven years. The load distribution for TVs tends to peak in the evening, when people are back from work. In its 2019 report, Mini-Grid Innovation Lab found that TVs increase the median daily energy consumption by 125% in East Africa and by 67% in Nigeria, but in its 2021 report, it found no change to ACPU in East Africa and a 3.7% decrease in Nigeria.

Figure 1. Entertainment at a bar, connected to the Kiboto Island mini-grid in Uganda.

Fans use around 50W and range in price from $8 to $65. Their average lifetime is estimated at three to five years. Depending on the region and the business profile, they are either used mostly during the hottest hours of the day, or in the evening and night. They already make up the largest share of off-grid appliances and the market potential is expected to reach $25.2 billion by 2030, especially in Southeast Asia and West Africa, due to further rises in temperatures.[9] Their capacity to generate income as a stand-alone product is limited, but they are crucial in every shop and entertainment setting.

Battery charging

In developing countries' rural areas, many households do not have access to electricity, and instead power radios and phones with dry cell batteries or use candles and kerosene lamps for domestic lighting. Some employ car batteries for lighting and entertainment, charging them in stations.

Figure 2. Battery-charging station using old car batteries at the Tungu Kabiri mini-grid in Kenya.

More recently, energy service companies have started to add battery-charging services to their offerings, to ensure that households not reached by local mini-grids or solar home systems can access electricity.

Although the amount of energy that can be delivered by means of batteries is relatively small, it can considerably improve living conditions for its users. Electrically-powered lamps improve domestic working conditions at night, in particular for women, and can also improve studying conditions for children, not only because of the better light but also because they reduce fire hazards and do not emit noxious pollutants. Other services that are highly valued and only require 1-60W of electricity are radio and TV, for information and entertainment, and air circulation (fans) for basic cooling. Mobile phones, which are crucial for modern communication and help people in rural areas obtain information, can easily be charged off batteries, though they can also be charged directly at charging stations themselves.

The provision of energy services through battery charging can be achieved through different business models. It can work on a "fee-per-charge" basis, in which the customer brings in their own battery, which is charged for a fixed fee. Alternatively, the battery owner can be charged a flat monthly fee, then get the battery charged as and when required. This model will ensure a more predictable cash flow for the charging station operator, although at the risk of fluctuating energy consumption due to possible fluctuations in the number of charges per month. In another business model, the charging station operator owns the batteries and swaps empty batteries

[8] *Off-Grid Solar Market Trends Report 2022: State of the Sector* (Lighting Global, 2022).
[9] *Off-Grid Solar Market Trends Report 2022: State of the Sector* (Lighting Global, 2022).

for charged ones when the customer comes in. This requires investment in batteries, but will ensure that only technically compliant batteries are used with the charging devices. Additionally, the customer will not have to wait until the battery is recharged, but can be provided with a fully-charged battery instantly.

Regardless of the business model, funders require the operator to have a strategy for battery recycling, to ensure that old batteries do not end up as environmentally-damaging waste. Many companies have not yet engaged in these end-of-life considerations, but some have already put this in place. For example, d.light replaces, repairs and refurbishes products during their warranty times, and conducts recycling for plastic, metals and wires. The PV panels, PCBs and batteries are shipped to Europe for recycling[10].

Alongside battery charging, mobile phone charging can function as a stand-alone business or on the side of another business. Often, even households will charge mobile phones (for a fee) for people who live outside the electricity distribution area, and in doing so recoup part of their household's electricity connection fees.

Hair salons

Hair salons are one of the typical small-scale businesses associated with the provision of electricity, which is used for hair clippers and hair dryers. In the case of mini-grids, these small salons can be part of or attached to existing businesses or houses, while in the case of centralised energy provision through energy kiosks, a hair salon can be one of the businesses operating out of the kiosk.

Several mini-grid developers are offering rent-to-own schemes in which salon owners can get access to these electrical appliances. To date, however, no report has assessed the impact of hair salon appliances on beneficiaries.

Figure 3. Equipment at a hair salon on the Tungu Kabiri mini-grid in Kenya.

Secretarial services and internet access

Services around computers, printers and the internet can be classified as ICT offerings. These services include photocopying, typing of texts, and printing. They either operate on a stand-alone basis or are integrated in an energy kiosk. Internet services can be provided through a traditional internet café or through the provision of Wi-Fi in and around an energy kiosk; a local entrepreneur can sell access tokens to these services. To date, no report has assessed the impact of these appliances on beneficiaries.

Tailoring

Tailoring is a typical cottage industry that can substantially increase productivity by using electrical appliances, particularly sewing machines.. The availability of repair capacity is also important to maintain these appliances.

Energy kiosks

[10] *Off-grid solar e-waste: the industry is growing responsible in waste management* (GOGLA).

The energy kiosk business model provides electricity in a central location, where low-income households without electricity access can use services such as phone and lamp charging, internet access via a computer, and access to TVs, alongside other services and products. Findings on the economic viability of this model are mixed, with a lack of recent studies on the subject. One 2014 study found that it is difficult to make it economically viable and to scale it, due to high upfront investment costs, low revenues for charging services, operators' low levels of knowledge, and low and fluctuating levels of demand[11]. A 2019 impact assessment in Zambia, meanwhile, showed that kiosks improve access to electricity services such as refrigeration, lighting and mobile phone charging[12].

Sector challenges and opportunities

The PUE sector is facing various challenges, as outlined in the table below.

Table 3. Challenges in the mobile money sector

Challenge	Mitigation
Customers' lack of ability to pay: Productive use appliances are often costly and customers struggle to pay for them in one instalment.	It is crucial for productive use appliance (PUA) providers, mini-grid developers or energy access companies offer attractive credit terms for appliances to their customers. It is also important to provide a certain flexibility of payment depending on the customers likely income fluctuations.
Manufacturing and selling in small volumes is expensive: PUA companies face higher costs due to the market being nascent and off-grid or mini-grid customers being dispersed, requiring a costly distribution network.	It is crucial to find ways to scale PUA markets and financially support companies to pilot and scale their operations. There should also be support to set up distribution businesses or companies should partner with already existing distribution points.
Limited access to markets: The customers who purchase a productive use appliances will likely not be able to expand their market reach significantly in rural areas without further support. For example, a local store paying off the loan for a refrigerator will likely not receive massively more income, as its number of customers are capped and their ability to pay for products is low.	Where possible, companies in the PUE sector should provide more than just PUAs. They should also try to open up new markets for their customers or support them with setting up new businesses.
Lack of business and technical knowledge: Many customers are not able to make full use of their PUA due to their lack of maintaining and repairing it in case of problems and their lack of understanding of how to manage a business, calculate revenues and pay off their PUA loans.	Companies need to provide training to customers about how to use PUAs and what to take care off. They should consider giving them basic tools at to repair their appliances and/or have a local technicians available to support. Companies should also offer trainings around managing a business and book keeping. It is also crucial that companies explain the terms of their loans in an way that is clear and easily comprehensible to their customers.

[11] *The Energy Kiosk Model: Current Challenges and Future Strategies, Issue 01* (Endeva Business Model Library, October 2014).
[12] *Impact Assessment of Energy Kiosks in Rural Zambia* (IEEE, 2019).

Table 4. Active support programmes for productive use of energy	
Programme	**Main activities**
The Green Mini-Grid Help Desk	This is funded by the Africa Development Bank as part of the Green Mini-grid Market Development Programme (GMG MDP). Mini-grid developers receive technical assistance, from support on demand assessments to technical sizing, capital raising, procurement and installation support, commissioning, and optimisation of operations.
Efficiency for Access Research and Development Fund	This funds research and development (R&D) projects with the aim of accelerating the availability, affordability, efficiency, and performance of a range of low-energy inclusive appliances that are particularly suited to developing country contexts and promote social inclusion.
Innovations Against Poverty (IAP)	Through financial and non-financial services, IAP supports innovative and inclusive business models that deliver commercial benefits for the private sector and developmental benefits for low-income populations, while paying specific attention to gender equality and environmental sustainability. It is funded by Sweden Sverige and managed by SNV in collaboration with Inclusive Business Partners and bop inc.
Global LEAP Awards	The Awards, by Efficiency for Access, co-chaired by the Energy Savings Trust and CLASP, use a competition-based approach to drive innovation and performance in early-stage product markets for off-grid applications, while also building technical and commercial market infrastructure. Results of the Awards serve as core market intelligence for investors, donors, policymakers, solar distributors, and other off-grid market stakeholders.
Low-Energy Inclusive Appliances (LEIA) Programme	The LEIA Programme, run by Efficiency for Access and co-chaired by the Energy Savings Trust and CLASP, is a research and innovation programme that seeks to double the efficiency and halve the cost of a range of electrical appliances suited to off- and weak-grid household, small business, and industrial consumers. It delivers a range of activities to stimulate the sector, with five principal components that address key market barriers: 1. Market stimulation and incentives 2. Testing and quality assurance 3. Marketplace education, communications, and coordination 4. Market intelligence and technology road mapping 5. R&D co-investments
Energising Development (EnDev)	EnDev is funded by the German Cooperation, the Ministry of Foreign Affairs of the Netherlands, the Norwegian Agency for Development Cooperation (Norad) and the Swiss Agency for Development and Cooperation, and is coordinated by GIZ and the Netherlands Enterprise Agency. It promotes sustainable access to modern energy services for households, social institutions and small to medium-sized enterprises in developing countries in Africa, Asia and Latin America. The supported energy services meet the needs of the poor, i.e. they are long-lasting, affordable, and appreciated by users.
Powering Renewable Energy Opportunities (PREO)	PREO, supported by the IKEA Foundation and UKaid, and delivered by the Carbon Trust and Energy 4 Impact, stimulates energy demand in rural Africa as a way of creating sustainable jobs and reducing poverty through economic growth and empowering women.
Water & Energy for Food (WE4F)	WE4F is a joint international initiative by 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, Norad, 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.
Mini-Grid Innovation Lab	Implemented by CrossBoundary and funded by the Rockefeller Foundation, UKaid, the Shell Foundation, P4G, and Stichting DOEN, is testing different prototypes to make the mini-grid business model more economically viable. One prototype is financing productive use appliances, so that mini-grid developers can offer them on favourable loan terms to customers. Appliances include those for service and agricultural business models.
Universal Energy Facility (UEF): Standalone Solar for Productive Use	The programme provides results-based financing to solar companies that provide households and SMEs with electricity for productive use. The UEF is funded by the IKEA

	Foundation, Power Africa, Rockefeller Foundation, Shell Foundation, and UK Aid, and implemented by AMDA, Carbon Trust, GIZ, BMZ, GEAPP, and Good Energies.
Productive Use Appliance Financing Facility	This programme is being implemented by CLASP and Nithio and funded by GEAPP. To date, the first auction window has provided procurement subsidies to productive use appliance companies in the DRC, Ethiopia, Kenya, Nigeria, Sierra Leone, and Uganda. More rounds of different financial products for the PUA sector are planned.

Industry associations

There are no associations that look solely at PUE in general, or in services specifically. The **Alliance for Rural Electrification** (ARE), however, is a good starting point for PUE in rural electrification projects. For stand-alone applications, the **Efficiency for Access Coalition** can be approached. The Africa Mini-grid Developers Association (AMDA) looks at productive uses for mini-grid business models specifically. The above programmes, organisations and funders can also be contacted for further information.

References and further reading

Powering Productivity: Lessons in Green Growth from the EEP Africa Portfolio
https://eepafrica.org/bfd_download/productive-use-of-energy-study/

The Productive Use of Renewable Energy in Africa
https://www.ruralelec.org/publications/productive-use-renewable-energy-africa

Productive Use of Energy - PRODUSE: A Manual for Electrification Practitioners
http://www.produse.org/imglib/downloads/manual/euei_productive_use_manual_med.pdf

Productive Use of Energy in African Micro-Grids: Technical and Business Considerations
https://www.nrel.gov/docs/fy18osti/71663.pdf

Mapping of Cereals, Fisheries and other Productive Use Businesses for Village Mini-grids
https://greenminigrid.afdb.org/sites/default/files/pu_mapping_for_minigrids_in_africa_february_2019.pdf

Off-grid appliance performance testing: results and trends for early-stage market development
https://link.springer.com/article/10.1007/s12053-019-09793-z

Refrigerators: Solar Appliance Technology Brief: Refrigerators
https://www.clasp.ngo/wpcontent/uploads/2021/06/EforA_Solar_Appliance_Technology_Brief_Refrigerators_June2021.pdf

Capital required to maximise the productive use of energy in rural sub-Saharan Africa
https://www.preo.org/wp-content/uploads/2022/11/PRE_PUE-Report_update_Final-Oct-22.pdf

PREO Knowledge Guide: Equipment Procurement
https://www.preo.org/wp-content/uploads/2021/01/PREO-Knowledge-Guide_V3.1.pdf

The Power of the Productive Use of Energy: An impact investment frontier
https://www.preo.org/wp-content/uploads/2021/10/PREO_PUE-Opportunity-Report_Oct-2021.pdf

Kenya Consumer Experience Study: Insights on Solar Appliances
https://www.clasp.ngo/research/all/kenya-consumer-experience-study-insights-on-solar-appliances/

Appliances for All: Assessing the Inclusivity of the Solar Lighting and Appliances Sector
https://www.clasp.ngo/research/all/appliances-for-all-assessing-the-inclusivity-of-the-solar-lighting-and-appliances-sector/

Evaluating Appliance Performance in the Field: Results from Appliance Testing
https://www.clasp.ngo/research/all/evaluating-appliance-performance-in-the-field-results-from-appliance-testing/

Building Resilience in Low-Income Communities – The Role of Off-Grid Appliances
https://www.clasp.ngo/research/all/building-resilience-in-low-income-communities-the-role-of-off-grid-appliances/

Appliance Impacts Over Time
https://www.clasp.ngo/research/all/appliance-impacts-over-time/

Energy for Rural Industrialisation: Productive Use of Energy 2.0
https://www.get-transform.eu/wp-content/uploads/2022/08/Productive-Use-of-Energy-2-0_GET.transform2022.pdf

Scaling Productive Use of Energy Solutions in Sub-Saharan Africa: Market Scoping and Design of a Results-Based Financing Window for the PUE Sector
https://beyondthegrid.africa/wp-content/uploads/Nefco-PUE-Market-Assessment-March-2023.pdf

Promoting Productive Use of Energy in the Framework of Energy Access Programmes
https://sustainabledevelopment.un.org/content/documents/4738mayer.pdf

Powering Productivity: Lessons in Green Growth from the EEP Africa Portfolio
https://eepafrica.org/wp-content/uploads/2019/12/EEP_PUE_Digital-new.pdf

Productive Use of Energy – PRODUSE: Measuring Impacts of Electrification on Small and Micro-Enterprises in Sub-Saharan Africa
https://www.esmap.org/sites/default/files/resources-document/esmap_giz_bmz_aei_produse_study_fulltext_optimized_0-1_0.pdf

Selling productive use of energy products to last mile consumers: Lessons learned
https://infohub.practicalaction.org/bitstream/handle/11283/622928/GDC_Selling%20PUE%20products%20to%20last%20mile%20consumers_Lessons%20learned_July2022.pdf?sequence=1&isAllowed=y

The Market Opportunity for Productive Use Leveraging Solar Energy (PULSE) in Sub-Saharan Africa
https://www.lightingglobal.org/wp-content/uploads/2022/04/PULSE-Report.pdf

Powering Lives and Livelihoods: Scaling Productive Uses of Renewable Energy (PURE)
https://sun-connect.org/wpcont/uploads/Gogla_PURE-Handbook_for_Governments_Development_Partners.pdf

Financing and Scaling Productive Use of Energy: Challenges and opportunities for catalytic growth
https://sun-connect.org/wpcont/uploads/GET.invest_Financing-and-Scaling-PUE_202305.pdf

Off-Grid Solar Market Trends Report 2022: State of the Sector
https://documents1.worldbank.org/curated/en/099235110062231022/pdf/P175150063801e0860928f00e7131b132de.pdf

Useful contacts

Efficiency for Access Coalition
https://efficiencyforaccess.org/
info@efficiencyforaccess.org

Alliance for Rural Electrification (ARE)
https://www.ruralelec.org/
are@ruralelec.org

Africa Minigrid Developers Association (AMDA)
http://africamda.org/
communications@africamda.org

Please contact your Client Relationship Manager if you want help with introductions to specific individuals within these institutions.