

Stand Alone Solar (SAS)

MARKET UPDATE

Mozambique

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Africa Clean Energy
Catalysing Africa's Solar Markets



TETRA TECH
International Development





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The Mozambique Stand-Alone Solar Market Update is one of a series of 14 national briefings published by the Africa Clean Energy (ACE) Technical Assistance Facility (TAF) to give stakeholders a snapshot of recent developments in the stand-alone solar sector, including those arising from the COVID-19 pandemic.

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ABBREVIATIONS AND ACRONYMS

| Acronym | Definition |
|------------------|--|
| ALER | Lusophone Renewable Energy Association |
| AMER | Mozambican Renewable Energy Association |
| ARENE | National Energy Regulatory Authority |
| BCI | Banco Comercial e de Investimentos (Commercial and Investment Bank) |
| COVID-19 | Coronavirus Disease 2019 |
| COVID-PAY | Relief Scheme for Companies Vulnerable to Increased Default Payments |
| EnDev | Energising Development |
| EUR | Euro |
| FCDO | Foreign, Commonwealth and Development Office |
| FUNAE | National Energy Fund |
| GDP | Gross Domestic Product |
| GIZ | German Corporation for International Cooperation |
| GOGLA | Global Off-Grid Lighting Association |
| KfW | German Development Bank |
| MIREME | Ministry of Energy and Mineral Resources |
| MZN | Mozambique Metical |
| PAYG | Pay-As-You-Go |
| PV | Photovoltaic |
| RTM | Route-To-Market |
| SAEP | Southern African Energy Program |
| SAS | Stand-Alone Solar |
| SHS | Solar Home Systems |
| UNIDO | United Nations Industrial Development Organization |
| USAID | United States Agency for International Development |
| USD | United States Dollar |



EXECUTIVE SUMMARY

The growth of the Mozambican economy has declined over the last one and a half years, with the Gross Domestic Product (GDP) growth rate dropping from 2.3 per cent in 2019 to 1.3 per cent in 2020. This is due to various internal and external shocks – mainly a rise in conflict, natural disasters and the impact of the COVID-19 pandemic. Mozambique is currently involved in two internal conflicts: the Islamic extremist attacks in Cabo Delgado Province that has displaced over 530,000 people, and the opposition militia attacks in Sofala Province. The conflict in Cabo Delgado is of high importance to Mozambique since billions of dollars are being invested in the natural gas deposits in the area. The country has also been devastated by cyclones Idai, Kenneth and Eloise which hit its shores between 2019 and 2021. These cyclones caused flooding, loss of life and destruction of property in the central and northern regions of the country.

On March 22, 2020, approximately one year after Idai hit, Mozambique reported its first COVID-19 case. As of March 8, 2021, the country had registered 62,703 positive cases of disease and 698 deaths.¹ The pandemic prompted the government to impose lockdown restrictions that have affected the economy and the daily lives of Mozambicans. During the COVID-19 pandemic companies reported that customers had reduced purchasing power, and this translated into reduced sales compared to the forecast for this period. Importation of products took longer as supply chains were disrupted.

Awareness of stand-alone solar (SAS) products has increased in Mozambique, with 68 per cent of respondents in a 2019 study reporting they had heard of solar products. A further 22 per cent of households could afford solar home systems (SHS) without any financial assistance.² A survey of six active SAS companies showed total sales figures of 21,252 units in 2019, and 46,802 units in 2020, demonstrating that the sales figures have doubled.³ In terms of productive use of solar, Global Off-Grid Lighting Association (GOGLA) reported that 2,843 solar powered appliances were sold between July 2019 and June 2020. Currently Solarworks and Digitech are the only companies selling solar productive use systems, but other companies have shown interest.

Two key legislations are currently being drafted: the revised Electricity Law, which guides the entire electricity sector, and the General Regulation for Off-Grid Energy. The latter is spearheaded by the Foreign, Commonwealth and Development Office (FCDO) funded BRILHO programme and will be the key legislation in the SAS sector. It will be accompanied by supplementary regulations on tariffs, interconnections, norms and standards, environmental and social aspects as well as concessions and registry of mini-grids and energy services.

The major challenges that have been relayed by market stakeholders are the lack of adequate funding for the high-risk off-grid sector, especially from local commercial financing institutions, the lack of specific legislation, especially to alleviate the tax burden on the growing market. Currently, only two financing schemes are being implemented in the SAS sector by the United Nations Industrial Development Organization (UNIDO) and the German Development Bank (KfW), through the Banco Comercial e de Investimentos (BCI). It is expected that the revised Electricity Law and the Off-Grid Energy Regulation will help address these barriers.



Awareness of stand-alone solar (SAS) products has increased in Mozambique, with 68 per cent of respondents in a 2019 study reporting they had heard of solar products. A further 22% of households could afford solar home systems (SHS) without any financial assistance.

3. Survey conducted by author.



Energising Development (EnDev) created a payment assistance service in response to the COVID-19 pandemic called COVID-PAY (Relief Scheme for Companies Vulnerable to Increased Default Payments) to provide financial support to customers and pay-as-you-go (PAYG) companies during the pandemic. The scheme offers funding to PAYG companies that can maintain service provision to customers by finding innovative ways to maintain customer revenue, such as promotional discounts (e.g., pay for one month and get one month free). EnDev has an additional support scheme called COVID-PLUS, which seeks to continue its support of companies and households in a post-pandemic Mozambique.



Photo courtesy: www.oneacrefund.org/blog/loan-and-light/



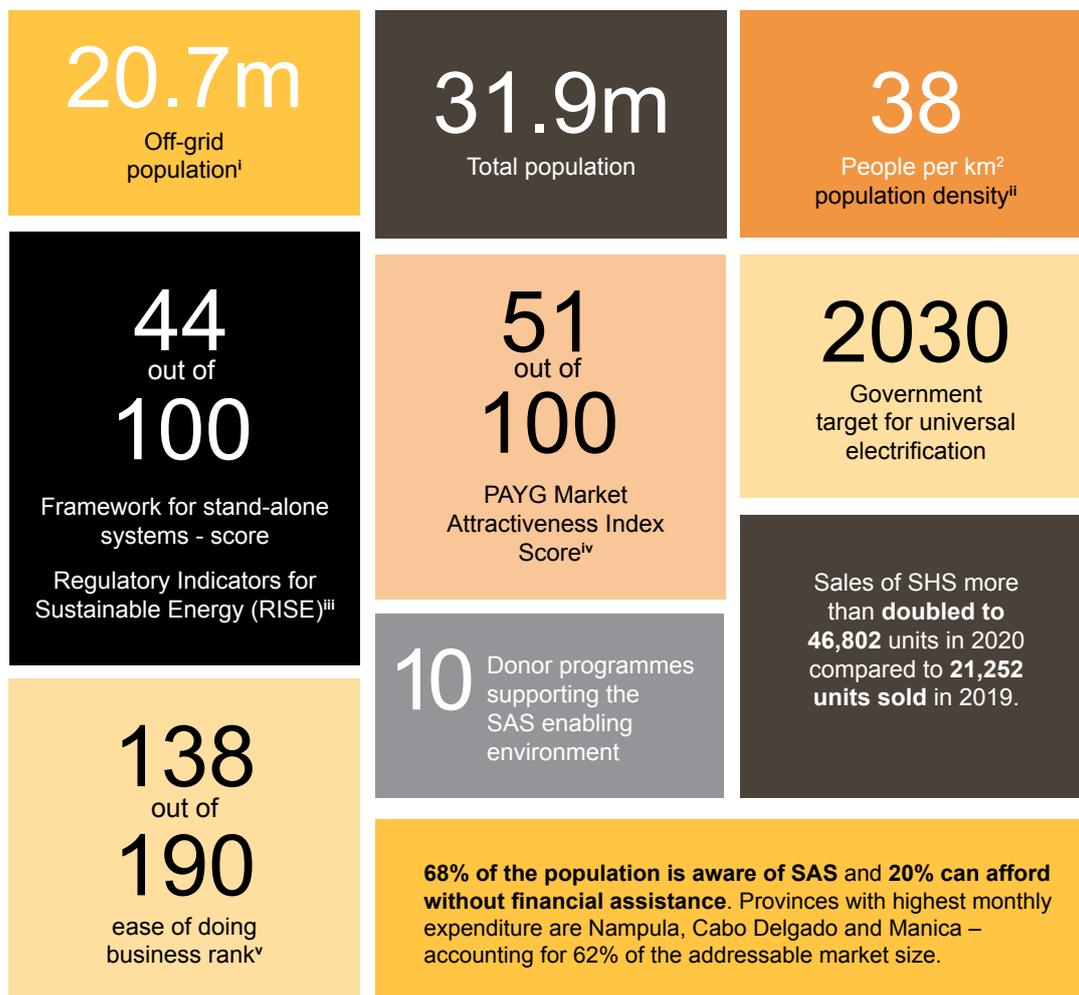


Figure 1: Mozambique at a glance

i. Government of Mozambique

ii. World Bank (2018) Population data

iii. ESMAP (2019) Regulatory Indicators for Sustainable Energy

iv. Lighting Global (2019) Pay-As-You-Go Market Attractiveness Index Report

v. World Bank (2018) Population data

1. NATIONAL OVERVIEW

1.1 Current Context

Mozambique's population density is low at an average of 38 people per km². About 67 per cent of the population lives in the rural areas, majority of them currently not connected to the national electric grid.⁴ With large discoveries of natural gas and increasing investor confidence, Mozambique registered an average Gross Domestic Product (GDP) growth rate of 3.7 per cent between 2016 and 2018. This reduced to 2.3 per cent in 2019 on the back of two catastrophic cyclones and the lingering effects of the hidden debt scandal. It further declined to 1.3 per cent in 2020, due to the COVID-19 pandemic.⁵ The country was ranked number 138 out of 190 economies in the 2020 World Bank Doing Business Report, dropping three spots from the 2019 rank.⁶

In March 2019, Mozambique was devastated by Cyclone Idai, which hit the central and northern regions of the country, causing flooding, loss of life and destruction of property, most notably in the port city of Beira.⁷ One month later, Mozambique was hit by Cyclone Kenneth, which affected the northern region of the country. A post-cyclone reconstruction cabinet was created to assess damages and coordinate rehabilitation. A report on the Cyclone Idai impact concluded that USD2.3 million would be needed to rehabilitate 227 solar photovoltaic (PV) systems that were used to power crucial public services and households, and that a higher investment in off-grid renewable energy should be implemented to increase the resilience of the cyclone affected areas, which currently rely on the vulnerable national grid.⁸

Various organisations such as the United Nations High Commissioner for Refugees (UNHCR⁹) and UN Habitat¹⁰ and companies such as Fenix International¹¹ provided aid in the form of solar powered lamps and solar home systems (SHS) to cyclone affected communities. Recipients of these systems reported an increase in

safety at night and that the added light allowed them to work, study, cook/eat and congregate at later hours of the day. GOGLA noted that solar-powered lamps are not stocked in large quantities for disaster situations and therefore do not feature in the initial relief kits provided by aid organisations, but it stated that a strong solar market in Mozambique would be able to provide these lamps locally.¹² There is therefore an opportunity for companies to provide solar lanterns and other off-grid solar systems to organizations supporting the relief efforts towards internally displaced people (IDPs).

In late January 2021, Mozambique was once again hit by another Cyclone Eloise, which made landfall in the same area as Idai.

Mozambique reported its first COVID-19 case on March 22, 2020. As of March 8, 2021, the country had recorded around 62,703 positive cases of COVID-19 and 698 deaths.¹³ The government imposed several restrictions, which included closing down educational institutions, limiting the number of people at the workplace and mandatory 14-day quarantine for anyone entering the country. There were also flight restrictions and land border transit restrictions, which affected trade and movement of people. From August to December, the restrictions had eased, but with summer approaching, cases began to rise to unprecedented levels.¹⁴ In early February 2021, the President announced a stay-at-home curfew would be imposed between 9PM and 4AM in an attempt to slow down the progression of the virus.¹⁵

The Mozambican General Election was held in October 2019. The President and the Mozambican Liberation Front (FRELIMO) party were re-elected. The elections were contested but the Constitutional Council upheld the results. One major change was the implementation of a new decentralisation law pushed by the President, which created the position of Provincial Secretary of

State in each province (appointed by the president), with the office holder overseeing/working with the elected governors of the provinces. This move caused confusion as to the duties of the secretaries and governors and seniority.¹⁶ This was resolved when most of the provincial powers were restored to the elected governors, but the secretaries still have the ear of the President.

Mozambique is currently involved in two internal conflicts. There are the Islamic extremist attacks in Cabo Delgado Province and the opposition militia attacks in Sofala Province. The conflict in Cabo Delgado has garnered international attention due to its proximity to the large natural gas deposits discovered a few years ago. Billions of dollars are being invested in the region and there is a hope that the oil and gas sector will benefit the Mozambican economy and people greatly. Over 530,000 people have been displaced by this conflict.¹⁷ Similar to the energy needs at resettlement sites in central Mozambique as a result of the flooding, it is expected that the IDPs in Cabo Delgado will also require access to energy in the form of solar lanterns and other off-grid technology. Here it is also important

to consider productive use of energy as a catalyst for livelihoods restoration and economic development of the communities which have been resettled into safer areas.

In Sofala, the conflict is between the National Defence Force and the self-proclaimed Mozambican National Resistance (RENAMO) military junta, which separated from the leading opposition party and has been conducting armed attacks in and around the province. This has affected essential transport corridors that connect the south and north of the country, affecting tourism, free movement of individuals and the transit of goods.¹⁸ Both conflicts have stunted the growth of the Mozambican economy and do not have an end in sight.

1.2 Energy Access

Approximately 65 per cent of Mozambique's 31.9 million people do not have access to the power grid. In rural areas, only 15 per cent of the population are on the grid. The electrification rate for urban areas is estimated at 72 per cent.¹⁹ The table below shows the estimated off-grid population divided among urban and rural areas.

Table 1: Energy access

| | | | |
|---|---|----------------------------|---------------------------|
| Electricity access (%) | 35% | | |
| Population off-grid | 20.7 million (65%) | Rural – 17.5 million (85%) | Urban – 3.2 million (28%) |
| Households off-grid | 4.1 million | Rural – 5.4 million | Urban – 0.6 million |
| Electricity tariff per kWh | MZN14.75 (0.21 USD) | | |
| Electricity consumption per capita in kWh/year | 200 kWh (2016 value as most recent official figure) | | |

A 2019 study conducted across 30 off-grid villages showed average monthly expenditure on energy (light, phone charging and radio battery costs) to be USD9, equivalent to 18 per cent of household monthly expenditure. Battery operated torches are the most common source of energy (used by 53 per cent), followed by solar (24 per cent).²⁰ Most solar energy systems have been acquired through the informal market and are not Lighting Africa certified.²¹

Acknowledging the important role that access to clean forms of electricity can play in the development of the country, the government has joined the Sustainable Energy for All (SE4ALL) initiative and committed to achieving universal access to electricity by 2030. However, according to current projections, only 50 per cent of the population in 2030 will have access to the grid.²² Therefore, off-grid systems can complement the efforts to meet the universal access target.

20. Field research, survey data from ECA and Greenlight Africa (2018). *Off-Grid Solar Market Assessment in Mozambique*.

21. Based on field research and survey data from GreenLight Africa for the 30-sites feasibility study conducted for FUNAE and financed by FCDO (2019).

2. DEMAND-SIDE: CONSUMER INSIGHTS

The potential market size for stand-alone solar (SAS) is considerable, even when taking into account low rural disposable incomes. Modelling for the Mozambican government's Integrated Master Plan on Energy projected that three million households (or 18 million people) would benefit from off-grid energy services by 2030, rising to four million by 2042.²³

A 2019 survey by the United States Agency for International Development Southern Africa Energy Program (USAID SAEP),²⁴ indicated that up to 45 per cent of households across Mozambique can afford SHS products at current market prices, which include grant-based subsidies from donor programmes. It further showed that 22 per cent can afford them without

financing as they currently spend over USD7.50 on lighting and power per month (the average monthly SHS instalment). This indicates that one in five households can utilise the systems without financial assistance, a total of about 824,000.

Still from the study, it was noted that the provinces with the highest monthly energy expenditure are Nampula, Cabo Delgado and Manica – accounting for 62 per cent of the addressable market size. It also showed that based on current energy expenditure, a price drop of USD2.50 in monthly instalments could double access. The table below highlights the main insights from the top four provinces that are of interest to SHS companies.

Table 2: Summary of findings from 2019 SAEP consumer affordability survey

| Province | Summary of findings |
|----------|---|
| Nampula | <ul style="list-style-type: none"> • Largest addressable market is ~300,000 households, based on ~840,000 unelectrified households and 36% affordability (the highest proportion of households that can afford SHS, spending over USD7.50 per month on lighting and power). • Monthly household expenditure is mid-range, with 20% of households spending more than USD63 per month (~USD2 per day), but willingness to invest in family wellbeing is high, as evidenced by the 65% of children in school. • Income stability is mid-range, with 38% of households reporting stable income. |
| Manica | <ul style="list-style-type: none"> • Third largest addressable market²⁵ of ~101,000 households based on ~307,000 unelectrified households and 33% affordability based on current spend on lighting and power. • Household expenditure is second highest across all provinces, with 41% of households spending more than USD63 per month, and willingness to invest in family wellbeing is high, with 65% of households having children enrolled in school. • Income stability is mid-range, with 38% of households reporting stable income. |
| Sofala | <ul style="list-style-type: none"> • Fourth largest addressable market of ~80,000 households based on ~280,000 unelectrified households and 28% affordability based on current spend on lighting and power. • Has low household expenditure, with 7% households spending more than USD63 per month, and a midrange proportion of children in school at 58%. • Income stability is low, with 30% of households reporting stable income. |
| Zambézia | <ul style="list-style-type: none"> • Sixth largest addressable market of ~76,000 households, with ~950,000 unelectrified households and one of the lowest affordability rates, with only 8% of households able to afford SHS based on the current lighting and power spend. • Despite household expenditure being lowest across all provinces with 6% spending more than USD63 per month, willingness to invest in family wellbeing is second highest with 66% of households having children enrolled in school. • Income stability is high, with 50% of households reporting stable income. |

25. Cabo Delgado is second largest addressable market, however due to current conflict it has been left out due to difficulty of doing business at the moment.

A different market assessment in Zambézia, Manica and Maputo provinces revealed a potential national market size for small-scale solar of up to 4.4 million, based on the peri-urban and rural communities' willingness and ability to pay.²⁶ The study differentiated tiers of SHS

starting from a single light point and phone charger to a unit with capacity to power a refrigerator. The PAYG monthly costs are based on the average prices among companies that operated in Mozambique during 2018.

Table 3: Cost, affordability and projected addressable market size of SHS²⁷

| System | Monthly cost (over 24 months) | Affordability (households) | Projected national market size |
|---|-------------------------------|----------------------------|--------------------------------|
| Single light and phone charger | USD0.80 | 86–94% | 4.4 million |
| Multiple lights, phone charger, radio | USD4.90 | 72–87% | 3.5 million |
| Multiple lights, phone charger, radio, TV | USD22.60 | 12–22% | 645,000 |
| Multiple lights, phone charger, radio, TV, refrigerator | USD61.20 | 6–11% | 276,000 |

USAID-SAEP has more recently introduced the Route-to-Market tool (RTM).²⁸ This publicly available tool uses geospatial data to create an interactive map that shows population density, electrification and road infrastructure. The purpose of the tool is to help SAS companies to identify areas and markets that have the highest potential for growth and the ones that still need

some support. This way, companies can better target their resources and investments. Table 4 shows a sample dataset that is used in the tool for the provincial level. The tool has data for all administrative levels, with 11 provinces, 159 districts, 411 administrative posts, and 7815 individual settlements.

Table 4: Dataset for the provincial level taken from the RTM tool

| Province | Manica | Nampula | Sofala | Zambézia |
|---|-----------|-----------|-----------|-----------|
| Population | 1,945,982 | 5,758,902 | 2,259,248 | 5,164,726 |
| Households | 389,182 | 1,151,800 | 451,842 | 1,032,961 |
| Area (km ²) | 62,273 | 77,953 | 67,664 | 102,884 |
| Populated area (km ²) | 343 | 1,003 | 281 | 1,086 |
| Electrified area (km ²) | 470 | 1,009 | 686 | 448 |
| Unelectrified population | 1,452,237 | 4,429,291 | 1,486,536 | 4,670,729 |
| Unelectrified households | 290,426 | 885,870 | 297,308 | 934,155 |
| Electrified population (%) | 25 | 23 | 34 | 10 |
| Province electricity access (%) | 21.5 | 22.9 | 38.2 | 12.5 |
| Province monthly energy expenditure (USD) | 6.7 | 4.1 | 5.4 | 4.1 |
| Province poverty rate (%) | 37.2 | 64.8 | 49.6 | 61.8 |
| Province affordability (%) | 33 | 36 | 28 | 8 |
| Addressable market (HHS) | 95,840 | 318,902 | 83,248 | 74,713 |
| Schools | 410 | 244 | 75 | 1224 |
| Health centres | 62 | 126 | 73 | 105 |

27. *ibid.*

Impact of COVID-19

EnDev found that 69 per cent of households earn their living through informal commercial activities, and that COVID-19 has negatively impacted their incomes. In a survey of 700 households in May 2020,²⁹ 80 per cent of respondents felt that their sales had reduced significantly, 11 per cent said they were almost bankrupt, 7 per cent said that they went into bankruptcy while only 2 per cent said that they experienced no change. The survey also found that 65 per cent of households felt that their family income reduced significantly, 70 per cent said that their expenditures had increased, 39 per cent had difficulty paying their PV system bills and 9 per cent said that they were already in default for the last two months.³⁰ Such economic impact to the household could translate into lower uptake of SAS products as well as further default on monthly payments.

Public awareness and perception of solar

Insights from a World Bank study in 2018³¹ indicate that households had mixed perceptions about solar energy. Most households in the study were exposed to sub-standard solar products that develop faults within a few months, have no warranties and installation guidance is rarely offered. This has lowered consumer trust in SAS products.

When questioned about **affordability**, 58 per cent of the households interviewed believed that solar energy is expensive. However, it was found that households are not fully aware of their monthly energy expenditures and have not done a comparison of the

financial savings and benefits that could be realised by switching to solar energy. This suggests that many households underestimate their ability to afford solar energy. Although respondents were sceptical about using PAYG plans, most of them agreed that these plans would make solar energy more affordable to them. It was also found that financial conditions may not be the only barrier to households' purchase of solar products: lack of knowledge and confidence in using solar technologies, perception of quality and awareness of the benefits could have a more significant impact in decision-making.

In terms of **accessibility**, it was found that despite the limited availability of solar technologies, solar energy is, in general, accessible to most households interviewed. Moreover, it was found that solar energy companies, such as Epsilon Energia and Solarworks³² have significantly contributed to making solar systems more accessible and introducing variety in terms of the technologies offered in the market. A factor that could influence purchase decisions is the fact that over half of respondents believed that it would be difficult to find someone to fix their solar system when it breaks.

A more recent study by USAID-SAEP³³ across all provinces in Mozambique shows that 68 per cent of households have heard of solar products. This is lower than **awareness** in Zambia (83 per cent), Kenya (87 per cent) and Senegal (89 per cent). The study shows that familiarity with solar products is highest in Nampula and Sofala provinces at 82 per cent and 80 per cent respectively and lowest in Tete Province at 47 per cent.



EnDev found that 69% of households earn their living through informal commercial activities, and that COVID-19 has negatively impacted their incomes.



It was found that solar energy companies, such as Epsilon Energia and Solarworks³² have significantly contributed to making solar systems more accessible and introducing variety in terms of the technologies offered in the market.

29. The study was conducted at the start of the pandemic in Mozambique, and may reflect effects of other economic stresses as well.

30. EnDev (2021). The Role of demand-side subsidies – COVID-PAY in Mozambique.

32. Companies present in the study regions at time of data collection.

3. SUPPLY-SIDE: STAND-ALONE SOLAR COMPANIES

3.1 Pico-solar and Solar Home Systems (SHS)

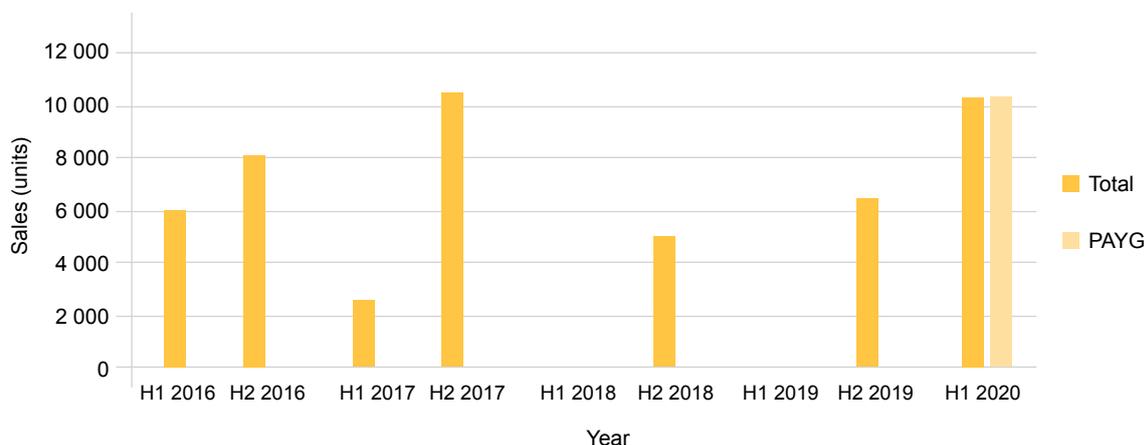


Figure 2: Certified off-grid solar sales (Source: GOGLA³⁴)

Official data on SHS sales from GOGLA³⁵ shows peaks in sales in the second half of 2016 and 2017 and the first half of 2020, with the highest sales achieved in the second half of 2017 (10,523 units). Although these sales are low compared to other leading markets in Africa, ownership levels have been steadily increasing over the past five years, and 27 per cent of households now own a solar product. USAID-SEAP estimates that 42 per cent of households bought their products from brands outside the dominant four Lighting Global certified firms.

Table 5 shows sales data provided by six SHS companies currently active in the Mozambican market. When compared with the GOGLA results (Figure 1), the data provided by the companies for 2016 and 2017 is much lower, but increases for 2018, 2019 and 2020.³⁶ Because data on SHS sales is very scarce and not regularly updated, both data sources should be viewed more as representing incremental growth of the sector.

Table 5: Total sales in Mozambique for six SAS companies, provided by each company

| Year | Company 1 | Company 2 | Company 3 | Company 4 | Company 5 | Company 6 | Total |
|--------------|------------|--------------|--------------|--------------|---------------|---------------|---------------|
| 2016 | 60 | N/A | 0 | N/A | N/A | 13 | 73 |
| 2017 | 16 | 500 | 0 | N/A | N/A | 3,197 | 3,713 |
| 2018 | 6 | 1,200 | 0 | 1,700 | N/A | 13,844 | 16,750 |
| 2019 | 24 | 1,700 | 524 | 500 | 3,000 | 16,028 | 21,776 |
| 2020 | 424 | 2,000 | 3,053 | 1,500 | 24,000 | 18,878 | 49,855 |
| Total | 530 | 5,400 | 3,577 | 3,700 | 27,000 | 51,960 | 92,167 |

34. Data for Mozambique was not available for H1 2018 and H1 2019. PAYG data for Mozambique was only available for H1 2020.

36. Results show an increase in sales despite the Covid pandemic. This might be as a result of the grant funding windows that have supported the companies during this period. According to the survey with the companies, the sales figures were lower than those forecasted and the capacity of clients to pay their monthly instalments for PAYG was reduced, with higher default rates.

In many parts of the country, the market for pico-solar and SHS is dominated by informal trading, providing low-cost but low-quality equipment. The systems are often purchased from electronics shops for resale, from neighbouring countries or via traders importing from

China. The cost can be as low as USD50, compared to USD125 for a quality-verified system in the formal economy. It is probable that taxes and import duties are often not paid on these systems.³⁷

Table 6: SAS companies currently operating in Mozambique

| Company | Brand | Business Model | Comments |
|---------------------|----------------------------|--------------------|---|
| Digitech | Sun King, Mobisol | PAYG/Direct sale | Sells systems with TVs. Also sell locally assembled units. |
| Dynamiss Trading | Omnivoltaic | PAYG/Direct sale | Sales agent for SolarWorks! in Southern Mozambique. |
| Ignite Moçambique | Greenlight Planet, SunKing | PAYG/Direct sales | Door to door sales, soon to start introducing productive use systems and equipment. |
| Epsilon Energia | Greenlight Planet | PAYG / Direct Sale | Door to door, a series of individually owned shops and third-party resellers |
| Fenix International | Fenix Power | PAYG | Sells systems with TVs |
| SolarWorks! | SW | PAYG/Direct sale | A series of individually owned shops and third-party resellers |

Impact of COVID-19

Overall, the pandemic has forced the closure of over 1,175 companies in Mozambique (all sectors).³⁸ EnDev conducted a survey of 14 companies and retailers (SHS and improved cook stoves), as well as 90 charcoal vendors between April and May 2020 and found that 62 per cent of respondents faced financial constraints in maintaining their businesses during the state of emergency, 21 per cent stated that they had financial resources to keep their business going for more than 6 months and 31 per cent were facing serious financial problems.

Sales volumes were not as forecasted as customer priority shifted toward basic commodities and goods. Of the companies surveyed, 21 per cent noticed behavioural changes in their customers who were weary of visitations from companies' representatives due to the pandemic, making it increasingly difficult to promote their products.³⁹

Overall, SAS companies reported the following impacts as a result from the COVID-19 pandemic:⁴⁰

- ♦ Reduced purchasing power among costumers.

- ♦ Drop in sales volumes and collection rates.
- ♦ Reduced service delivery and business expansion.
- ♦ Imported goods taking longer to enter the country and cost more thus leading to increased product prices.

3.2 Productive Use Systems

Productive use of renewable energy is growing in Mozambique as public awareness and market support increase, but the rate at which it is growing is hard to state since not much data is available.

The agriculture sector presents the largest opportunity for productive use of off-grid renewable energy in the southern nation. The sector accounts for 26 per cent of the country's GDP and is sustained by 78 per cent of the Mozambican labour force. Despite its importance to the economy, over 30 per cent of total crop production is lost due to large distances between harvest locations, distribution points and markets, lack of cold storage, and lack of proper transportation.⁴¹

Mozambique has 3.9 million farms – 99 per cent of them smallholder farms – and only 3 per cent of the total irrigation potential is capitalised.⁴² Off-grid renewable

39. EnDev (2021) *The Role of Demand-Side Subsidies – COVID-PAY in Mozambique*

40. Information gathered through questionnaires with Digitech, Dynamiss Trading, Epsilon Energia, Fenix International and SolarWorks!

energy, and more specifically solar-powered irrigation, provides an opportunity to reduce running costs and increase yield over time.

A handful of companies offer solar water pumps (Bluezone, Water Irrigation Solutions, Moz and SolarWorks to start sales soon). UNIDO has provided technical expertise and financial support for the installation of PV systems for productive uses and rural development as part of the Towards Sustainable Energy for All project. As of March 2020, 80 PV irrigation systems have been installed, servicing 31 hectares of farmland and benefiting 4,000 farmers.⁴³

Off-grid grain mills, either powered directly by solar or connected to a mini-grid, are another opportunity in the agriculture sector. Most smallholder farmers use small-scale mills with a daily output of less than five milled tonnes. These small-scale mills are found in small towns and rural areas and are powered by diesel or electricity (wherever available).

Cold storage for fishing and agriculture is another significant opportunity for productive use of off-grid renewable energy. Half a million Mozambicans rely on small-scale fisheries for employment, and fish products represent half of the animal protein intake in Mozambican diets. Unfortunately, there are high rates of catch loss due to inefficient cold storage and lack of ice production, especially in off-grid areas.⁴⁴ A number of donor-supported projects are underway to facilitate cold storage.⁴⁵ The Sweetpotato Action for Security and Health in Africa (SASHA) programme, headed by the International Potato Center (CIP), has been testing the conservation of various sweet potato varieties by means of solar-powered cold storage containers. In a trial period that lasted four months, the programme reported positive results, indicating that the marketable root weight after this period was over 70 per cent of the initial weight.⁴⁶

Solarworks sells solar-powered fridges, sewing machines and water pumps ranging from USD500 to USD2,000. Digitech sells solar kits that are used to power fridges, as well as water pumps for irrigation and portable water distribution. Fenix International, Epsilon Energia and Ignite are interested in getting into this business in the near future. In January 2021, Epsilon Energia ran pilot installations of cold storage units powered by 18 PV panels with a 19.6 kWh battery, reaching a minimum temperature of 4°C.⁴⁷

3.3 Mozambican Renewable Energy Association (AMER)

Associação Moçambicana de Energias Renováveis (AMER) is the first industry association dedicated to the promotion of renewable energy in Mozambique.⁴⁸ It was created in 2017. AMER works closely and partners with government institutions with the aim of creating an enabling environment for the renewable energy private sector in Mozambique.

In 2020, despite the COVID-19 pandemic, AMER was able to successfully organise four online webinars featuring various key stakeholders in the Mozambican renewable energy sector. Key topics discussed were:

- ♦ How to confront COVID-19: A discussion on essential services and support initiatives.⁴⁹
- ♦ Applications of Renewable Energy in the Commercial and Industrial Sectors.⁵⁰

In late March 2021, AMER, in partnership with the Lusophone Renewable Energy Association (ALER) hosted the Renewables in Mozambique: Europe-Mozambique Investment Forum, which created a networking platform for renewable energy stakeholders in Europe and Mozambique, hopefully driving investments in the latter.⁵¹

45. *ibid*; Winrock International (2019). *Keeping fish fresh in Mozambique*.

47. *Information gathered through questionnaires with SHS companies*.

4. POLITICAL FRAMEWORK

4.1 Government Institutions

The institutional environment governing the SAS sector has not changed recently. This, however, may change with the upcoming updates to the Electricity Law and the

new Off-grid Energy Regulations (see Table 8). These new policies are expected to drive private investment by fostering an enabling environment.

Table 7: Main institutions that govern the SAS sector

| Institution | Description and recent activity |
|---|---|
| Ministry of Energy and Mineral Resources (MIREME) | Oversees the energy and extractive industries. The National Directorate for Energy (DNE) is responsible for the SAS sector. |
| National Energy Regulatory Authority (ARENE) | The entity that is responsible, within the scope of regulation and development of the energy sector, to instruct and process the public tender processes for the award of concessions for the production, transportation, distribution, and sale of electricity, issue the respective approval, as well as the requests for transmission of the concessions. ARENE is also responsible for tariff setting and maintaining a register of energy projects in the country. |
| National Energy Fund (FUNAE) | Fund tasked with promoting greater access to sustainable energy for the social and economic development of Mozambique. FUNAE is primarily responsible for off-grid energy development and coordination of funds in the sector. |

4.2 Policy and Regulatory Environment

Following a request from the Minister of Mineral Resources and Energy, new regulations for the off-grid energy sector are currently being drafted with the support of the BRILHO programme, in coordination with MIREME, ARENE and FUNAE. The drafting of the regulations began in the second half of 2020 and stakeholders plan to finalise them by the end of July 2021. It will consist of the main regulation with a set of more detailed specific regulations:

General regulation:

General Regulation for Off-Grid Energy (Regulamento Geral de Energia Fora da Rede).

Specific regulations:

- ♦ Regulation on concessions and registry for mini-grid and energy services (including SAS).

- ♦ Regulation on tariffs.
- ♦ Regulation on interconnections.
- ♦ Norms and standards for service quality and commercial relations.
- ♦ Regulation on norms and standards for quality and safety.
- ♦ Environmental and Social regulation.

Along with the new regulation, the BRILHO programme is developing the “Caixa Piloto”, a pilot programme that seeks to support private investment for the development of mini-grids and SAS, and to monitor, evaluate and learn from the pilot programme to make better informed decisions for the Mozambican off-grid sector. The practical learnings from the pilot will support the regulatory development process, bringing useful context specific insights to policy-makers during the drafting period. A set of recommendations will also be developed to promote fiscal incentives for renewable energy and rural electrification initiatives.

Other relevant policies and regulations for the sector are listed and described in the following table.

Table 8: Relevant legislation and policies in the SAS sector

| Policy / Regulation | Description and recent activity | Relevance to SAS sector |
|---|--|---|
| Electricity Law (Law 21/97 of 7 October) | Currently under review and soon to be replaced by a new one. | Law that oversees electrification and all accompanying sectors and activities (including SAS). |
| The Energy Strategy (2009) | Aims to create adequate conditions to sustainably increase access to energy through diverse sources. The strategy divides energy consumption into three levels: rural, urban and peri-urban. | The strategy mentions renewable energy as a priority and two specific regulatory instruments have been designed to focus on the sector. |
| The National Electrification Strategy (2018–2030) | Aims to bring energy to all Mozambicans by promoting private and public sector investment in both on- and off-grid energy in rural, urban and peri-urban areas. | The strategy supports the use of SHS to electrify rural populations. It is also the lead document in promoting universal energy access by 2030. |

E-waste management is regulated through Decree no. 83/2014 of 31 December, which covers electrical waste but is not specific regarding treatment other than it is to be disposed of in proper treatment facilities, of which there is currently only one in the south of Mozambique (Mavoco).

The Gender Equality Policy and Implementation Strategy (2006) was updated in 2018. It pushes for inclusion of women in decision-making processes

that lead to access to energy, water and relevant infrastructure, as well as resilience to climate change impacts. The Belgian Development Agency - Enable, is currently conducting an assessment on mainstreaming gender in the promotion of sustainable access to energy for all in Mozambique. It is expected that this will have a positive effect down to the companies operating in the sector, including possible incentive mechanisms to promote access to energy in a more equitable manner.



Photo courtesy: www.proinso.net/sm100-solar-light/

5 FINANCING

5.1 Supply Chain Financing

At the moment, only BCI is providing funding specifically for the SAS sector. The bank collaborated with KfW to establish the credit line in 2018 and is currently supported by UNIDO to introduce the BCI SUPER credit line (Sustainability and Productive Use of Renewable Energy) financed by the Global Environment Facility (GEF).

The Mozambican National Institute for Social Security (INSS) was very active during the pandemic in trying

to reduce the impact on companies, some of which were on the brink of shutting down. This was done through a MZN600 million (USD8.3 million) fund for small and medium sized companies at an interest rate of 4 per cent.⁵² Under Decree 23/2020 of 27 April, the Mozambican government outlined temporary tax breaks for companies that made under MZN2.5 million (USD34,000) in 2019, as well as other tax breaks on essential goods, but no specific tax breaks were made for the SAS sector during this time.

Table 9: Specific funding for the SAS sector from main banks, investors and funds

| Type | Financier | Conditions |
|--------------------|--|--|
| Loan | BCI with KfW financing | EUR3 million (USD3.54 million) for renewable energy and energy efficient appliances suppliers. The loan term can be up to 5 years, with the limit for individuals up to MZN5 million (USD 69,000) and for companies up to MZN20 million (USD 276,000) at a 15% fixed rate. |
| Loan ⁵³ | BCI with UNIDO financing (Global Environment Facility – GEF) | USD1 million for productive use of renewable energy systems. Focus on solar energy projects as well as biomass-waste-to-energy for productive uses in small-scale industry and agriculture sectors. |

5.2 Consumer Financing

About 54 per cent of Mozambican adults have some form of financial access, whether it is through a bank (21 per cent), another form of formal financial service (22 per cent), or from an informal source (11 per cent). The remaining 46 per cent of Mozambicans are excluded from any financial services.⁵⁴ There has not been much development with regards to consumer financing for SAS and it remains low. The only support is through PAYG services.

Micro-finance Institutions (MFIs)

There are 529 savings and credit unions, 12 savings and loans organisations, nine micro-banks, nine credit unions and three electronic money institutions in Mozambique.⁵⁵ The main MFIs in Mozambique are located in the large cities across the country, making access to financial services in rural households much more difficult. Specific credit lines for SAS products are not yet established in these institutions.

52. Club of Mozambique (2020). INSS credit line to assist SMEs affected by COVID-19: Interest rate of 4%, at BNI – Mozambique.

Mobile money networks

The Mozambican mobile money networks are M-Pesa, mKesh and e-Mola, operated by Vodacom, T-Mcel, and Movitel, respectively. In 2019, 29 per cent of adults had a mobile money account, while around 55 per cent of Mozambican adults have access to a cell phone. Some key barriers to using mobile money services are lack of access to a mobile phone and not knowing enough about the service. About 35 per cent of all money transactions are conducted through mobile money transfer compared to 19 per cent through banking institutions and 6 per cent through MFIs and post offices. At 91 per cent, cash withdrawals are the most used service in mobile money

networks, followed by cash deposits at 81 per cent. About 27 per cent of consumers use the service to pay their utilities.⁵⁶

Remittances

Remittances do not make up a large part of the income of families in Mozambique, but for those that do receive them, it helps to ease financial pressure. The bigger chunk of remittances come from South Africa. About 68 per cent of adult Mozambicans do not send remittances of any kind, while 80 per cent of those who send/receive remittances, have done so through mobile money networks.⁵⁷

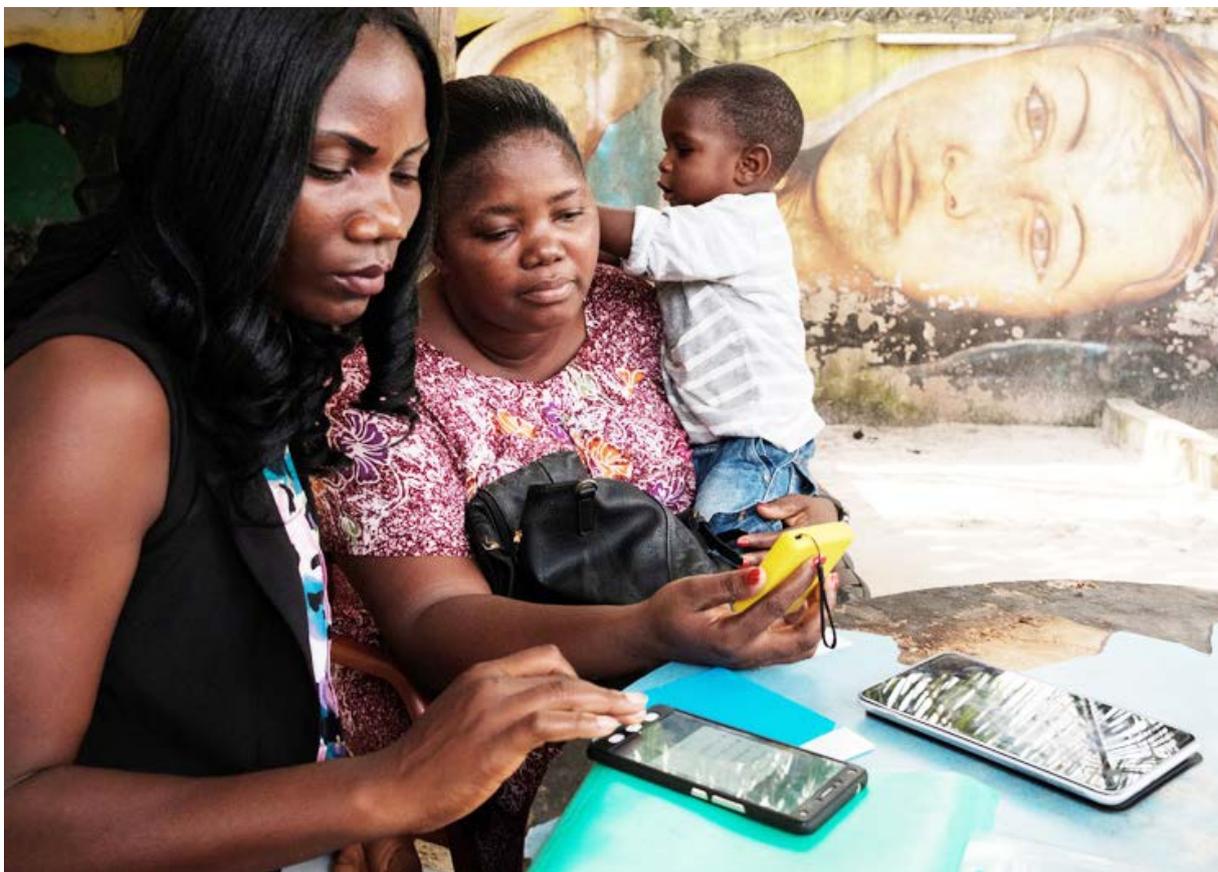


Photo courtesy: www.ifc.org

57. *ibid.*

6 MARKET SUPPORT

6.1 Development Partners

Given the incipient stage of the off-grid energy market in Mozambique, there are several donor-funded programmes that provide support to the sector. Grant-based financing is dedicated to both technical assistance

(to government and local companies) as well as project financing in the form of catalytic grants, results-based financing (RBF) and other subsidies. The table below lists all the SAS-focused programmes currently active.

Table 10: List of sector support programmes.

| Funder: Programme | Implementing agency | Allocated value and type of support | SAS focus areas | Period |
|--|--|---|--|------------------------------------|
| FCDO: Africa Clean Energy Technical Assistance Programme (ACE-TAF) | Tetra Tech | Technical assistance to government | Institutional capacity building; SAS quality standards; sector information dissemination and coordination | 2018–2022 |
| FCDO: BRILHO | SNV in collaboration with PAC, MARGE, GreenLight and Catalyst | GBP22.8 million (USD31.5 million) Grant and technical assistance | Funding (private sector) SHS Technical assistance (government): Off-grid energy regulatory development and institutional capacity-building; sector coordination | 2020–2024 |
| Swedish International Development Cooperation Agency (SIDA): Beyond the Grid Fund for Africa (BGFA) | Renewable Energy and Energy Efficiency Partnership (REEEP) Nordic Environment Finance Corporation (NEFCO) | EUR6.7 million Grant and technical assistance | Funding (private sector) SHS Technical assistance (government): Off-grid site data collection; monitoring and verification of energy service connections; capacity building | 2022–2026 (Launched February 2021) |
| SIDA: Renewable Energy, Adaptation and Climate Change Technology sub-Saharan Africa (REACT SSA) | Africa Enterprise Challenge Fund (AECF) | USD6.5 million Grant | Funding (private sector) SHS | 2019– 2023 |
| Norway: Institutional Cooperation MIREME- Norwegian Water Resources and Energy Directorate Programme (NVE) | MIREME | Technical assistance to government | Regulatory support and capacity development to MIREME and ARENE | 2017–2023 |

Table 10: List of sector support programmes (Continued)

| Funder: Programme | Implementing agency | Allocated value and type of support | SAS focus areas | Period |
|--|--|---|---|-----------|
| Enabel: Renewable Energy for Rural Development (RERD) 2 | Enabel FUNAE | EUR22 million (USD26 million) Grant and technical assistance | Funding for solar-powered irrigation systems. Technical assistance (government): Off-grid renewable energy planning; support the technical and administrative capacity of FUNAE central and provincial delegations; tariff study; market willingness to pay studies; feasibility studies | 2018–2024 |
| Enabel: Capacity Strengthening MIREME/ARENE | Enabel | Technical assistance to government | Planning and information management capacity training; data collection; information dissemination; gender mainstreaming support | 2018–2022 |
| European Union: Energy Resource Centre | Application Européenne de Technologies et de Services (AETS) | Technical assistance to government | Technical assistance (government): Provide ARENE and MIREME with expertise and facilitate public projects | TBD |
| Multi-donor: EnDev (EU, Germany, UK, Norway, Netherlands, Switzerland) | German Corporation for International Cooperation (GIZ) | EUR27.5 million (USD32.5 million) Grant | Funding (private sector) SHS | TBD |
| Multi-donor: Get.Transform (European Union, Germany, Sweden, Netherlands, Austria) | GIZ | Technical assistance to government | Technical assistance (government): Policy, legal and regulatory framework support | 2020–2022 |
| Multi-Donor: Get.Invest (EU, Germany, Sweden, Netherlands, Austria) | GIZ | Technical assistance to private companies | Technical assistance (private sector): Investment mobilisation, business development support, market information, matchmaking | TBD |
| Italian Cooperation Agency (AICS): ILUMINA | AVSI COSV FUNAE | EUR5.1 million (USD6.02 million) Grant | Funding (private sector) SHS | TBD |
| World Bank: ProEnergia | FUNAE | USD10 million Grant and technical assistance | Funding (private sector) SHS Technical assistance (government): Institutional roadmap support, tariff setting methodologies, off-grid activity mapping | 2021 |

6.2 COVID-19 Response Financing

EnDev's COVID-PAY was set up to provide financial support to the customers and PAYG companies during the pandemic. According to EnDev, all active PAYG companies in the country signed up for the scheme, but less than half of the companies were awarded funding. The awarded companies hold 90 per cent of the Mozambican PAYG market. It subsidises up to EUR10 (USD 12) per customer for a maximum period of six months.⁵⁸

6.3 Training Institutions, Incubators, Accelerators

While there are a number of institutions providing training in renewable energy,⁵⁹ one of the most recent ones is

the Logos Training Centre in Maputo, a partnership between Logos Industries GREEN Solar Academy.⁶⁰ AMER and other renewable energy institutions will also make trainings available via online courses or through short workshops and seminars.

Most of the training institutions focus more on engineering and electrical skills training. Other skill sets pertinent to companies distributing SAS systems, which include sales, marketing, management, customer service and operation of PAYG platforms, are not yet part of the curricula in these institutions.

Some of the recent data sources in the sector include:

- ◆ Routes to Market Tool.
- ◆ USAID (2020). Can Mozambican households afford SHS? Insights from a local survey.



EnDev's COVID-PAY was set up to provide financial support to the customers and PAYG companies during the pandemic.



While there are a number of institutions providing training in renewable energy, one of the most recent ones is the Logos Training Centre in Maputo, a partnership between Logos Industries GREEN Solar Academy.

59. Logos Industries (2020). Maputo's own solar training academy.



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