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CAN MOZAMBICAN HOUSEHOLDS AFFORD SHS? INSIGHTS FROM A LOCAL SURVEY

FINAL REPORT | APRIL 2020

THANKS TO THE ORGANIZATIONS THAT HELPED US CONDUCT AND VALIDATE THIS SURVEY

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GLOSSARY

Term	Definition
Affordability	Ability of a household to self-finance acquisition of a solar home system (SHS) based on the household's current lighting expenditure and/or self-stated willingness to pay
Current lighting/ power expenditure	Calculation of the total amount unelectrified households currently spend on torch batteries, candles and kerosene to light their homes, mobile charging and transport to obtain these
Digital financial services	Range of formal financial services accessible via digital channels (e.g., mobile money)
Lifetime cost	Total amount payable under a PayGo payment plan (i.e., summation of upfront deposit and total installments paid over the duration of the "loan")
PayGo	An SHS payment option where households pay an upfront deposit and then settle the remainder via installments over a pre-agreed duration
Premium	Increased expenditure that households are willing to incur over and above their current average lighting spend
Retail price	Amount payable for a single one-time payment for an SHS product
Solar home system (SHS)	Standalone photovoltaic system that offers a cost-effective mode of supplying electricity for lighting and powering appliances
Tier 1	Low power solar system with annual power output of 1 to 20 Watts that typically has some lights and may have mobile phone charging and/or a small radio
Tier 2	A solar system with annual power output of 20 to 200 Watts that typically has some lights, radio and TV
Tier 3	A solar system with annual power output of 200 to 2000 Watts that typically has some larger appliances included, e.g., fridge, water pump, water heater
Willingness to pay	The self-stated amount that survey households stated they would be willing to pay for a SHS

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

ACRONYMS

Acronym	Definition
EDM	Electricidade de Mozambique
GDP	Gross Domestic Product
GOGLA	Global Off-Grid Lighting Association
HH	Households
kWh	Kilowatt-hour
NES	National electrification strategy
NGO	Non-government organization
MZN	Meticals
PayGo	Pay-as-you-go
SHS	Solar home system
SAEP	Southern Africa Energy Program
USAID	United States Agency for International Development
USD	United States Dollar
V	Volt

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

ABSTRACT

Survey objectives and overview

- SAEP conducted a **Solar Home System affordability-and-willingness-to-pay survey** to inform the plans and strategies of the players in the electrification program of Mozambique. Survey results are of interest to the Government of Mozambique, SHS companies, and Cooperating Partners
- **Focus areas** included (a) household expenditure and willingness to pay; (b) SHS awareness, ownership and perception; and (c) mobile phone and mobile money usage
- Survey estimated the **ability and willingness to pay for SHS** in two ways: (1) through data collected on **weekly spend/consumption** of candles, kerosene, torch batteries, mobile phone charging and transport; and (2) through **self-reported willingness to pay**

Key Findings

Affordability & willingness to pay

- **Higher than expected in Mozambique** – even allowing for differences in calculation, surpassed affordability levels in Zambia and Kenya, both of which have higher GDP
- **22% of HHs (824,000) can afford basic SHS today** at USD $7.50 per month
- As many as **45% of HHs may be able to afford basic SHS** if they can **pay a premium**
- **75%** of those who own solar products bought them through a **one-time payment**
- Gradual **increase in payment via installments** as products get **larger/more advanced**
- 85% of those who pay in installments spend more than USD $7.50 per month

Awareness & ownership

- **Awareness & ownership is high** for an early-stage market – 68% of HH have heard of solar products and 27% of HH already own and use them
- **72% of HH own Tier 1** products, while **28% have a TV or larger appliance** (i.e. Tier 2-3)

Mobile phone and money usage

- **Usage consistent with comparable markets** – 83% of HHs use a mobile phone and 44% use mobile money
- **Typical mobile money transaction for 56%** of households is over USD $8.00 – **higher** than the average **SHS monthly installment** of USD $7.50

Estimated Funding Need to Achieve Universal Access

- An estimated **4.2 million HHs will not have access to the grid** in 2024 – **2.5 million of these HHs need financing support** to purchase SHS today
- **Total financial support required** to bridge the affordability gap is approximately **USD 350 million**
- SHS companies and Cooperating Partners should aim to work together to close this gap

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

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EXECUTIVE SUMMARY (1/6)

Survey objectives and overview

- SAEP conducted this survey to provide **SHS companies**, **Cooperating Partners** and the **Government of Mozambique** with critical **information to inform strategies** (such as scale-up and marketing strategies) and **decision making** (including on consumer affordability program design)
- This **survey specifically targets**, and is therefore representative of, the **markets of interest to SHS companies** – it does not represent national wealth or income data
- SAEP designed the survey around **three focus areas**: i) household **expenditure and willingness to pay**, ii) SHS **awareness**, ownership and perception and iii) mobile **phone** and **mobile money usage**.
- **~2,700 households** participated in face-to-face interviews across **9 provinces** (excluding Niassa and Maputo City Provinces) and 55% of districts, covering a greater proportion of the country, and larger sample size, than previous similar surveys. Of these households, **67% are rural**, **91% without access to grid** power, and **61%** respondents were **women**

Key findings and implications for SHS companies

How many households can afford SHS? What is the affordability gap?

- **22-45%** of households can afford SHS
  - **22%** can afford SHS without financing as they currently **spend over USD $7.50 on lighting and power** – the average monthly SHS instalment – but many more have the tendency to overstate their ability to pay
  - This equates to **~824,000 households,** with the **largest market** in **Nampula** at **~300,000** households
  - **62%** of these households are in **Nampula, Cabo Delgado and Manica** – these are the provinces with highest monthly energy spend
  - An **additional ~0.8 million (23%)** may be able to afford SHS if they can **pay a premium**
- Based on energy expenditure, a **price drop** of **USD $2.50 per month** could **double** the households **who can afford** SHS
- **Inhambane** and **Zambezia** have the **highest** proportion of **children in school**, a **proxy** for **willingness to pay**

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

EXECUTIVE SUMMARY (2/6)

Key findings and implications for SHS companies

What is the average total household expenditure and does it vary over time?

- **81% of households** surveyed are low-income, **spending less than USD $62.50 per month** (~USD $2.00 per day)
- The **wealthiest households are in Maputo and Manica**, where 42% and 41% of households respectively spend over USD $62.50 a month – the **poorest are in Zambezia** where 94% of households spend less than USD $62.50 a month
- **47%** of houses have **mud walls** and are understood to be in the **lowest income bracket**
- **55%** of households state their **monthly expenditure is stable**
- **~60%** of households report their **income is not stable** - **Inhambane and Maputo have the highest proportion of households with stable income** at 63% and 51% respectively
- **Income predictability** is higher than expected, with **59% of surveyed households** receiving a **weekly or a monthly income**

SHS awareness, ownership and perception

- **Awareness of solar products is high** – **68%** of surveyed households have heard of solar products
- Most households (51%) know about solar products because **their neighbors or friends own one**
- For an early-stage market, **more households than expected own solar products (27%) – informal products** make up **~40%** of the market
- **Nampula, Maputo and Cabo Delgado** have the highest proportion of households that own solar products at 51%, 34% and 30%, respectively
- **72% of households that own a solar product own a Tier 1 product** whilst 28% have a TV or larger appliance (Tier 2-3)
- Most households that own a solar product (**75%**) bought them through a **one-time cash payment**
- There is a gradual **increase in payment in installments** (primarily PayGo) as **products get more advanced / move into higher Tiers**
- **85%** who pay for solar products in installments pay more than USD $7.50, the average SHS monthly installment
- Solar has a **relatively poor perception** compared to the grid – only 30% prefer solar to a grid connection

EXECUTIVE SUMMARY (3/6)

Key findings and implications for SHS companies

SHS awareness, ownership and perception

- The most **common reason for buying** a solar product is for **lighting / power**, instead of an EDM connection
- **23%** of households plan to buy a solar product because it is **safer or cleaner** than their current energy source
- **41%** of households that do not own a solar product say they **cannot afford** one, with the highest proportions in **Tete**, **Gaza** and **Sofala**
- **25%** state they **plan to buy one soon**, with the large proportions in **Cabo Delgado**, **Maputo** and **Nampula**
- In **Cabo Delgado** and **Manica,** the most common reason for not owning a solar products is that there are **no nearby service providers**

Mobile phone & money usage

- Mobile **network access** (from the house) is **high at 75%**. Vodacom is the leading network provider – **82% have Vodacom access**
- Household **mobile phone ownership is high at 83%.** Half of these households use **mobile money,** of which **94% use M-Pesa**. Access to mobile money is highest in Maputo and Cabo Delgado at 63% and 60% of households
- **50%** of households surveyed **are less than 30 minutes from the nearest mobile money agent**
- The **typical mobile money transaction for 56%** of households is over USD $8.00 – **higher** than the average **SHS monthly installment** of USD $7.50
- **Over half** the households **use mobile money** at least **every other day**
- The **largest mobile money transaction** in the past **month** was **higher** than an average monthly **SHS installment** for **66%** of households

1. World Bank (2018)

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

EXECUTIVE SUMMARY (4/6)

Validation of the results

- **Validating** survey results against other datasets provides **reassurance on the findings** along the three dimensions of SHS awareness, ownership and perception, mobile phone and money usage, and household expenditure and willingness to pay

Household expenditure and willing-ness to pay

- **Affordability** in Mozambique is **higher than expected** when **compared with Zambia** (22% vs 18%), given the much lower GPD per capita, but the **methods used to calculate energy expenditure were different** – for Zambia, this included only torch batteries and candles, whereas mobile charging, kerosene and transport to obtain these were also included for Mozambique
- **Affordability** via **self-stated willingness to pay** is **very high in Mozambique** (60%) **compared to Zambia and Kenya** (both 31%) – indicating that there is a tendency for households across Mozambique to be **over-optimistic about their ability to spend** on SHS

SHS awareness and ownership

- **Awareness** of SHS (68%) is **lower** than **Zambia** (83%), **Kenya** (87%) and **Senegal** (89%), which is expected, given the **nascency of the SHS market**
- **SHS ownership** in Mozambique (27%) is likewise also **lower** than that in **Zambia** (40%), **Kenya** (51%) and **Senegal** (35%), which can again be explained by the **nascency of the SHS market**
- In **Mozambique**, **41%** households **say the main reason they do not own** a solar product is because they **cannot afford** one. This is **low compared to Zambia** (61%) and **Kenya** (63%), indicating that Mozambican households may have an **over-optimistic perception** of their ability to afford SHS

Mobile phone and money usage

- **Mobile phone use** in **Mozambique** (83%) is **lower than that in Zambia**, which can be explained by Zambia's GDP per capita being higher than Mozambique's. **Mobile money use in the two countries is similar** (46% and 44%), as expected, given these mobile money markets started growing at the same time (2010 Zambia and 2011 in Mozambique)

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

EXECUTIVE SUMMARY (5/6)

Estimated funding need

- Findings indicate that **58-78% consumers need financing support** to purchase SHS today
- During the **transition to full grid extension** between 2020 and 2030, SHS is the best solution for the majority of off-grid households. An estimated **4.2 million** households will **not have access to the grid** in **2024 – SHS companies** and **Cooperating Partners** should aim to **work together to close this gap**
- **~2.5 million** of these households will **need funding** to be able **to afford SHS.** The total financial support required to bridge the affordability gap for these households is **USD ~$350 million** (under a two-year PayGo arrangement at USD $7.50 per month)

Key implications **SHS companies**

- Be **ambitious in scale-up** plans, especially in terms of deepening market reach in Nampula and expanding into the **safe** areas of **Cabo Delgado** and **recovering** / **less-affected** areas in **Manica**
- Zambezia is not an attractive market – only **8% can afford** SHS, but the **market may be larger** than this, just be **cautious about the risk of default**
- Work to find **lower cost product alternatives** without compromising quality – VAT and/or duty exemptions could help achieve tihs
- **Focus marketing efforts** on selling SHS to **aware households**, intentionally **building trust** in solar through advertising and sales agent outreach, whilst focusing on **what solar can bring** to households (including being cleaner and safer than alternatives) especially **during the transition** timeline before the grid is expected to reach all
- **Mobile money education** (i.e., explaining how to pay via a digital platform, giving examples of other uses of mobile money aside from SHS installments), and **uptake through agents** should be a **core focus** of marketing efforts

EXECUTIVE SUMMARY (6/6)

Key implications

Cooperating Partners

- Access to **working capital financing** is likely the greatest constraint for SHS companies to reach the current addressable market
- The proportion of households that may be willing to pay a premium should be **monitored** to **understand** the implications for the **overall consumer financing need**
- There is **room for multiple parties** to fund SHS scale-up but **absorption capacity** of the private sector needs to be assessed and it is important to take a **phased approach** to take into account **reasonable scale-up speed**
- **Incentives** can be **designed to target** specific **consumer affordability profiles**

Government

- **SHS** is likely to be a **large component** of **achieving universal access**
- There is a **significant access gap** that can be meaningfully **addressed** through **government-led initiatives to increase affordability** (e.g., facilitating ability of SHS companies to register for investment project authorization) **and accessibility**

Survey approach

Description of the sample

- The survey targeted
  - **9 provinces**[1], with at least **>210 households per province**.
  - >50% districts[2]
  - **65% rural** and **85-90% off-grid**
  - 85-90% off-grid households

Definition of ability & willingness to pay

- The survey **estimates ability and willingness to pay for SHS** in two ways: i) estimated by gathering data on weekly household consumption of candles, kerosene, torch batteries, mobile phone charging and transport and ii) by capturing self-stated willingness to pay for SHS, by asking how much they are willing to pay for a basic SHS with radio
- A sense check of these two findings was then conducted against external sources, including World Bank data, Mozambique national statistics and a previous affordability survey conducted in Mozambique[3]

1. Niassa and Maputo City excluded as these are not priority for the four main SHS companies; 2. Apart from Sofala, where 38% districts were covered owing to security issues 3. See appendix for analysis – uses data from the World Bank Mozambique Poverty Assessment (2018) and the Mozambique Family Budget Survey 2014/2015;

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POWER AFRICA BRINGS PARTNERS TOGETHER WITH THE AIM OF HELPING 60 MILLION HOUSEHOLDS ACCESS POWER

Our goal:

To enable electricity access by adding…

60 million
new electricity connections

30,000 megawatts
of new and cleaner power generation

Power Africa brings together technical and legal experts, the private sector, and governments from around the world to work in partnership to increase the number of people with access to power

126
Transactions financially closed

10,471
megawatts financially closed

SOUTHERN AFRICA ENERGY PROGRAM (SAEP) ADDRESSES CONSTRAINTS TO INVESTMENT IN THE ENERGY SECTOR

Program duration

March 2017 – March 2022

11 target nations

Components

Program components designed to address the five key constraints to investment in the Southern African energy sector include:

1. Improving Regulation, Planning, and Procurement for Energy
2. Improving Commercial Viability of Utilities
3. Improving Regional Harmonization and Cross-Border Trade
4. Demonstrating and Scaling Renewable Energy and Energy Efficient Technologies and Practices
5. Increasing Human and Institutional Capacity

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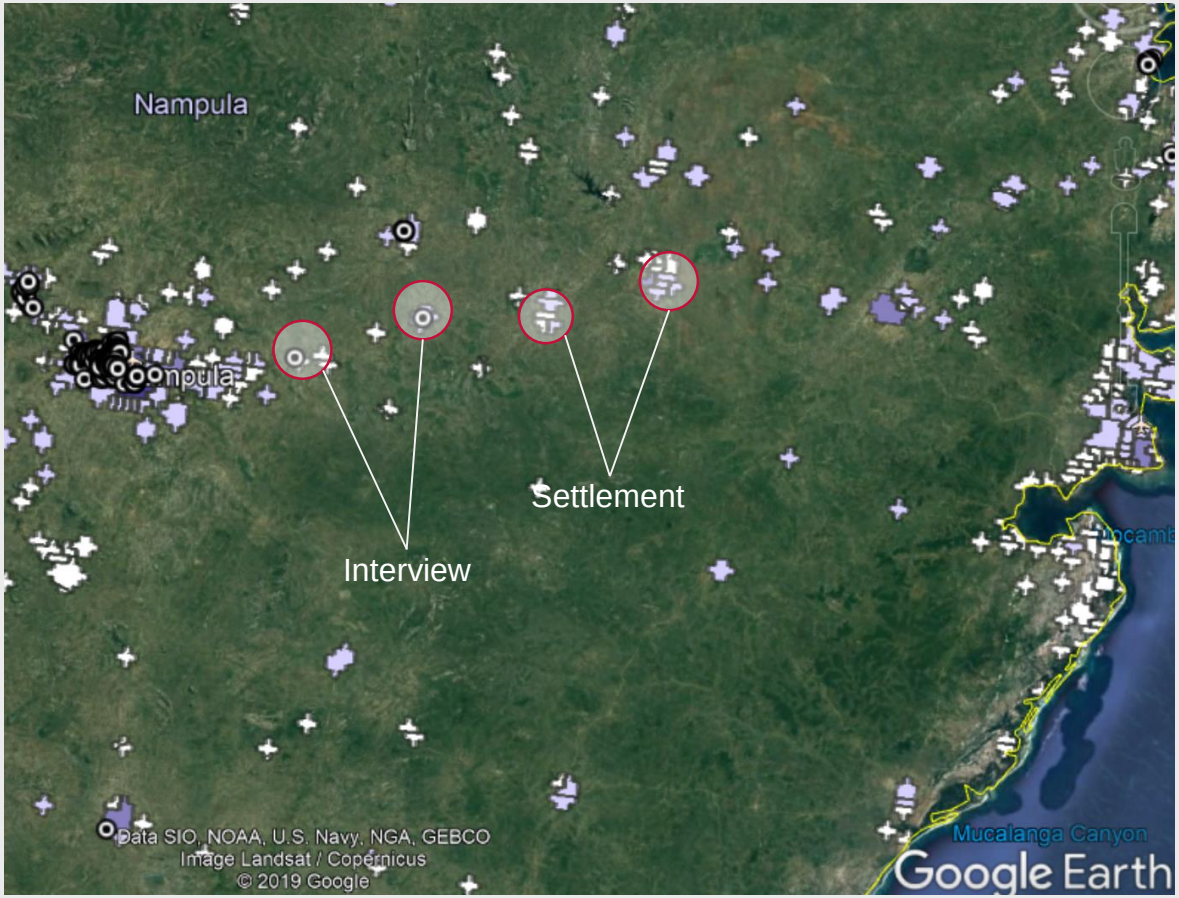
OBJECTIVES OF THE SURVEY CONDUCTED BY SAEP

SAEP conducted this survey to provide key stakeholders…	…with critical information..	…to inform strategies and decision-making
Solar Home Systems (SHS) companies	An estimate of the **number** of households that **can afford SHS** in each province	Scale-up strategies
	A clear view of how **aware households are** of solar products, **what they think** of solar and **what products they own**	Marketing strategies
	An understanding of the proportion of households that **have mobile phones** and **use mobile money** across the provinces,	PayGo[1] strategies
Cooperating partners	An estimate of the **funding need** in the **next 5 years** for **off-grid households** in Mozambique to **afford SHS**	Design of programs which aim to bridge the consumer affordability gap
Government & Off-grid partners (e.g., FUNAE)	A view on the **trajectory to achieving universal access** and potential market **interventions** required to facilitate this	Prioritization of interventions to facilitate SHS scale-up

1. Pay-as-you-Go typically involves paying for SHS in regular installments using a digital finance platform, usually a mobile money service

SAEP DESIGNED THIS SURVEY TO BE REPRESENTATIVE OF TARGET MARKETS OF SHS COMPANIES



SAEP designed this survey to be **representative of target markets** of SHS companies, so results are **not expected to reflect** or be a source of **national statistics**. The two key sample biases are:

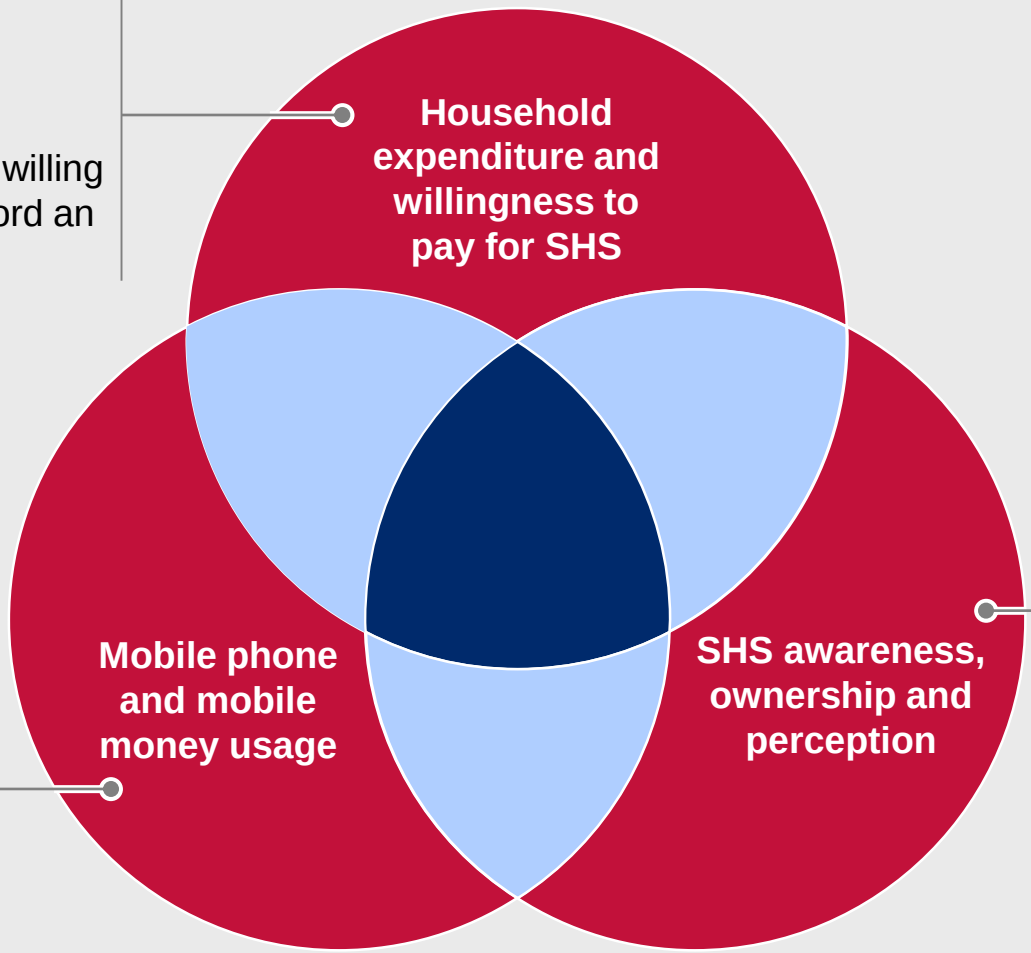
- The same covered a purposefully **high number of off-grid** households (comprising 91% of the sample)
- Interviews in rural areas were conducted **in and around rural settlements** (shaded white or purple on the map[1]), **not in the very low density**, **deep rural areas** where households are "standalone" [2] (green areas on the map),

1. Areas marked with circles on the map show interview locations Areas shaded in shades of white or purple denote settlements
2. The standalone areas are European Commission Urbanicity category 11. See the USAID SAEP Route-to-Market tool for more information on urbanicity categories

Source: USAID SAEP Mozambique Consumer Affordability survey 2019

THE SURVEY ANCHORS ON THREE FOCUS AREAS

Current expenditure patterns, particularly spending on energy, indicate whether households would be willing to pay and able to afford an SHS product



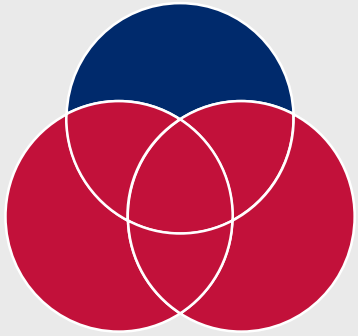
Mobile phone penetration and uptake of digital financial services are key indicators of market potential for SHS companies given the ease of payment via mobile platforms

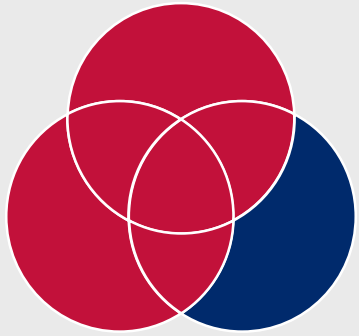
Awareness of SHS, current purchasing patterns and barriers to adoption provide an understanding of the current reach and appeal of the market, where varying levels of market development will require a different sales approach by SHS players

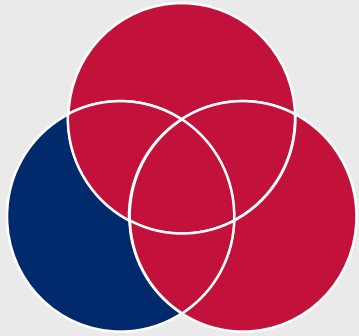
THE QUESTIONNAIRE AND ANALYSIS WERE BUILT AROUND 8 CORE QUESTIONS

Basis of survey questions

Basis of post-survey analysis







Household expenditure and willingness to pay for SHS	SHS awareness, ownership and perception	Mobile phone and mobile money usage
How much do households spend on lighting and power?	Do people know about and/or own solar products?	How many households have mobile phones and use mobile money?
What are households willing to pay for SHS?	How do people compare solar products to the grid?	How much do households send or receive on mobile money platforms?
How many households can afford SHS? What is the affordability gap?	What is stopping households from owning solar products?	

THE SURVEY COVERED ~2,700 HOUSEHOLDS IN 9 PROVINCES, OF WHICH 67% ARE RURAL AND 91% ARE OFF-GRID

~2,700 households
(face-to-face interviews)

9 provinces
(excluding Niassa and Maputo City)

55% districts

67% rural
(villages / settlements – not standalone / deep rural areas)

91% without grid power

61% women

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SUMMARY OF INSIGHTS: HOUSEHOLD EXPENDITURE AND WILLINGNESS TO PAY FOR SHS

How many households can afford SHS? What is the affordability gap?

- **22-45%** of households can afford SHS
  - **22%** can afford SHS without financing as they currently **spend over USD $7.50 on lighting and power** – the average monthly SHS instalment – but many more have the tendency to overstate their ability to pay
  - This equates to **~824,000 households,** with the **largest market** in **Nampula** at **~300,000** households
  - **62%** of these households are in **Nampula, Cabo Delgado and Manica** – these are the provinces with highest monthly energy spend
  - An **additional ~0.8 million (23%)** may be able to afford SHS if they can **pay a premium**
- Based on energy expenditure, a **price drop** of **USD $2.50 per month** could **double** the households **who can afford** SHS
- **Inhambane** and **Zambezia** have the **highest** proportion of **children in school**, a **proxy** for **willingness to pay**

What is the average total household expenditure, and does it vary over time?

- **81% of households** surveyed are low-income, **spending less than USD $62.50 per month** (~USD $2.00 per day)
- The **wealthiest households are in Maputo and Manica**, where 42% and 41% of households respectively spend over USD $62.50 a month – the **poorest are in Zambezia** where 94% of households spend less than USD $62.50 a month
- **47%** of houses have **mud walls** and are therefore understood to be in the **lowest income bracket**
- **55%** of households state their **monthly expenditure is stable**
- **~60%** of households report their **income is not stable** - **Inhambane and Maputo have the highest proportion of households with stable income** at 63% and 51% respectively
- **Income predictability** is higher than expected, with **59% of surveyed households** receiving a **weekly or a monthly income**

1. See appendix for analysis – uses data from the World Bank Mozambique Poverty Assessment (2018) and the Mozambique Family Budget Survey 2014/2015

SOURCE:USAID SAEP Mozambique Consumer Affordability survey 2019; World Bank (November 2018); Family Budget Survey Mozambique, 2014/15: Mozambique Poverty Assessment; Off-Grid Solar Market Assessment in Mozambique (GreenLight, December 2018)

SUMMARY OF INSIGHTS FOR THE TOP 4 PROVINCES OF INTEREST TO SHS COMPANIES

Top 4 provinces of interest	Summary of findings
Nampula	▪ **Largest addressable market**, **~300,000** households, based on ~840,000 unelectrified households and **36% affordability – the highest proportion** of households that can afford SHS (spending over USD $7.50 per month on lighting and power) ▪ Household **monthly expenditure is mid-range**, with 20% households spending more than USD $63.00 per month (~USD $2.00 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	▪ **3rd largest** addressable market 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% households spending more than USD $63.00 per month, and **willingness to invest in family wellbeing** is **high**, with **65%** children in school ▪ **Income stability is mid-range**, with **38%** of households reporting stable income
Sofala	▪ **4th largest** addressable market of **~80,000** households based on ~280,000 unelectrified households and **28% affordability** based on current spend on lighting and power ▪ However, Sofala has **low household expenditure**, with 7% households spending more than USD $63.00 per month, and a midrange **proportion of children in school**, at **58%** ▪ **Income stability is low**, with **30%** of households reporting stable income
Zambezia	▪ **6th largest** addressable market of ~**76,000** households, with ~950,000 unelectrified households and one of the **lowest affordability rates**, with only **8%** of households who can afford SHS based on current spend on lighting and power ▪ Despite household **expenditure** being **lowest** across all provinces, with 6% spending more than USD $63.00 per month, **willingness to invest in family wellbeing** is **second highest** with **66% of children in school** ▪ **Income stability is high**, with **50%** of households reporting stable income

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

SUMMARY OF INSIGHTS FOR OTHER PROVINCES WITH LARGE SHS MARKETS

Other provinces to highlight	Summary of findings
Cabo Delgado	▪ **2nd highest** addressable market of ~**130,000** households based on ~325,000 unelectrified households and **40% affordability – the highest proportion** of households that can afford SHS (spending over USD $7.50 per month on lighting and power) ▪ Household **monthly expenditure** is **mid-range**, with **28%** households spending more than USD $63.00 per month, and **willingness to invest in family wellbeing** is **mid-range**, with **61%** of children in school ▪ **Income stability is low**, with **28%** of households reporting stable income
Tete	▪ **5th highest** addressable market of **~78,000** households based on ~490,000 unelectrified households but **low affordability** with only **16% households able to afford SHS**, based on current spend on lighting and power ▪ Despite this, household **expenditure** is **3rd highest** across all provinces, with **31%** spending over USD $63.00 per month and **willingness to invest in family wellbeing** is **relatively low**, with **56%** of children in school ▪ **Income stability is mid-range**, with **44%** of households reporting stable income

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

AFFORDABILITY IS ESTIMATED IN TWO WAYS, AND VALIDATED USING SENSE CHECKS

SAEP survey | Sense checks

Approach	Description
Current lighting expenditure	▪ Respondents estimated how much **kerosene**, **candles** and torch **batteries** they use on a **weekly** basis, plus how much they spend on **mobile charging** and **transport** for these items ▪ SAEP ran a **bottom-up calculation** to estimate current lighting spend
Self-stated willingness to pay	▪ Respondents **stated how much they would be willing to pay** for a basic SHS kit with radio if they were to pay **in installments** over a 1-year period
Outside-in analysis[1]	▪ SAEP used data from the **World Bank** poverty assessment and Mozambique **National Electrification Strategy** on **monthly energy expenditure** for each **income quintile** to estimate the percentage of households able to afford SHS ▪ SAEP took **GOGLA's** estimate of the **monthly premium[2]** households are able willing to pay for SHS and added this to the monthly expenditure in the above analysis to estimate the percentage of households willing to pay a premium for SHS (i.e., self-stated willingness to pay)
Direct benchmarking	▪ **GreenLight** conducted a survey in 2018 to asses **household willingness to pay** for different SHS systems across Manica, Maputo and Zambezia

1. See appendix for analysis – uses data from the World Bank Mozambique Poverty Assessment (2018) and the Mozambique Family Budget Survey 2014/2015
2. Over and above their average expenditure on energy

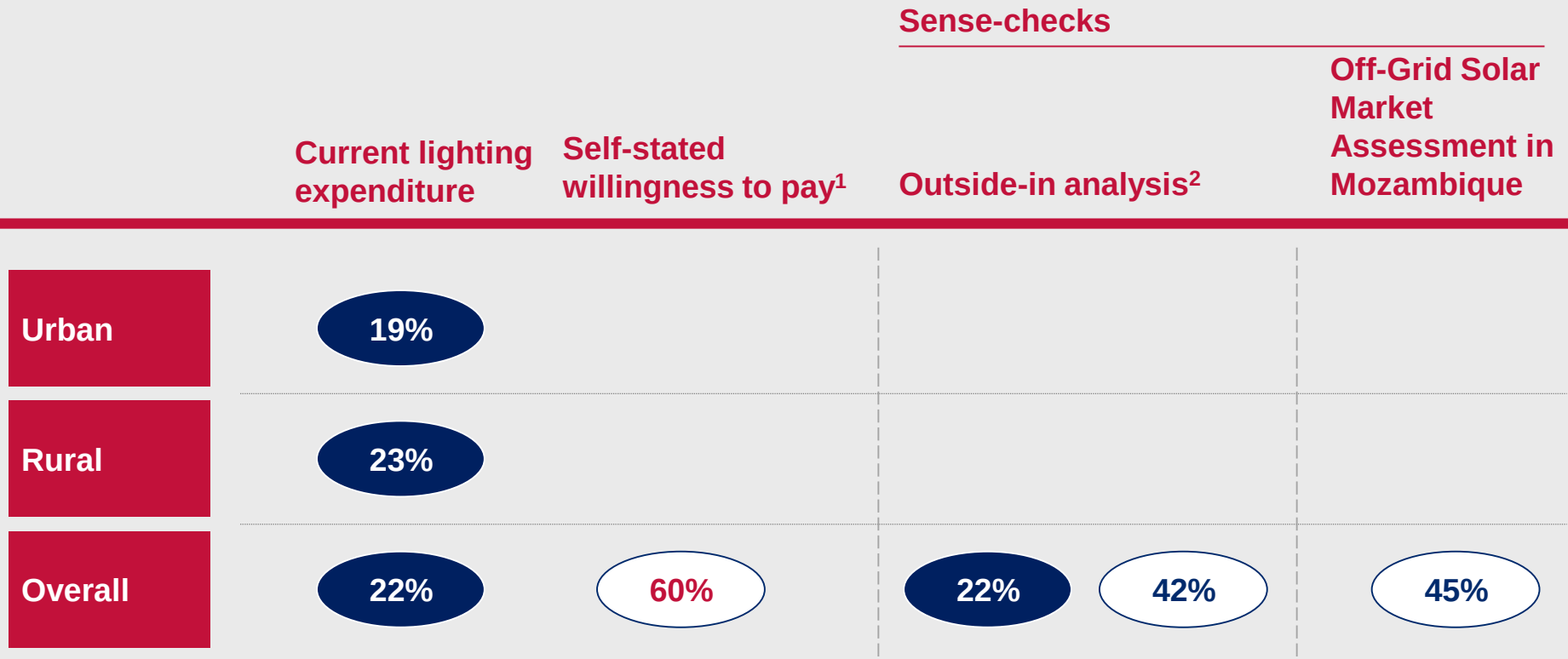
SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; Family Budget Survey Mozambique, 2014/15; Off-Grid Solar Market Assessment in Mozambique (GreenLight, December 2018); World Bank Mozambique Poverty Assessment (November 2018)

22-45% OF HOUSEHOLDS CAN AFFORD BASIC SHS AT USD $7.50 PER MONTH

% Affordability based on energy expenditure

% Affordability based on self-stated willingness to pay

% Outlier



1. This estimates willingness to pay above USD $12.50 for a basic SHS kit with radio; 2. See appendix for analysis – uses data from the World Bank Mozambique Poverty Assessment (2018), the Mozambique Family Budget Survey (2014/2015) and the Mozambique National Electrification Strategy (2017)

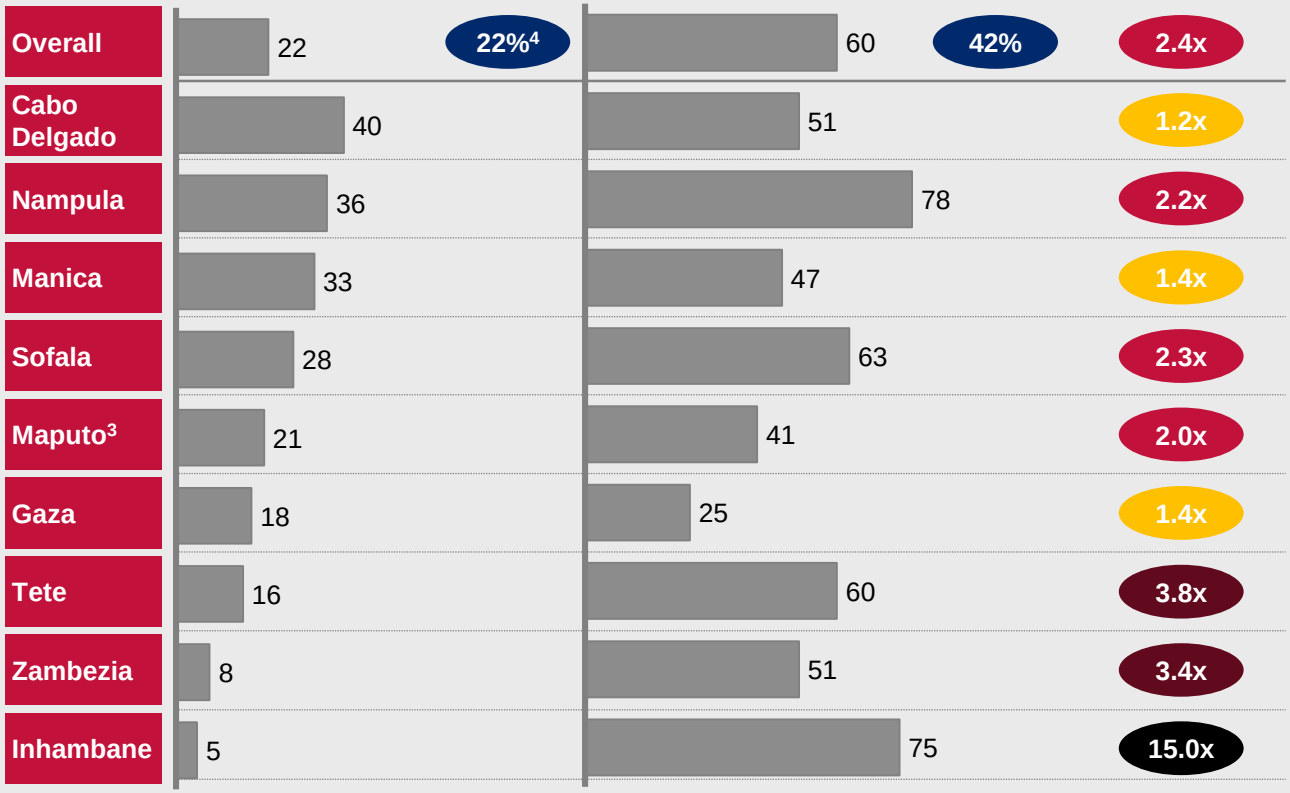
SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; World Bank (November 2018) Mozambique Poverty Assessment; Mozambique Family Budget Survey (2014/15); Off-Grid Solar Market Assessment in Mozambique (GreenLight, December 2018), Mozambique National Electrification Strategy (2017)

22% HOUSEHOLDS CAN AFFORD SHS BASED ON THEIR CURRENT EXPENDITURE; BUT MANY OVER-ESTIMATE THEIR ABILITY TO PAY

xx 1-1.9x xx 3-3.9x xx Outside-in analysis
xx 2-2.9x xx >4x

Validation of self-stated willingness to pay based on actual expenditure on lighting, %

Unelectrified households that can afford basic SHS



22% HH can afford SHS based on what they spend on lighting and power. This is fully in line with **outside-in analyses.**

However, as many as **60% state they can afford SHS**. Outside-in analysis shows this number **should be a maximum** of **42%.**

In four provinces, over double the number of HH that can actually afford SHS based on expenditure state they are willing to pay for SHS, with **over triple in Zambezia** and **Tete** and **15x in Inhambane**.

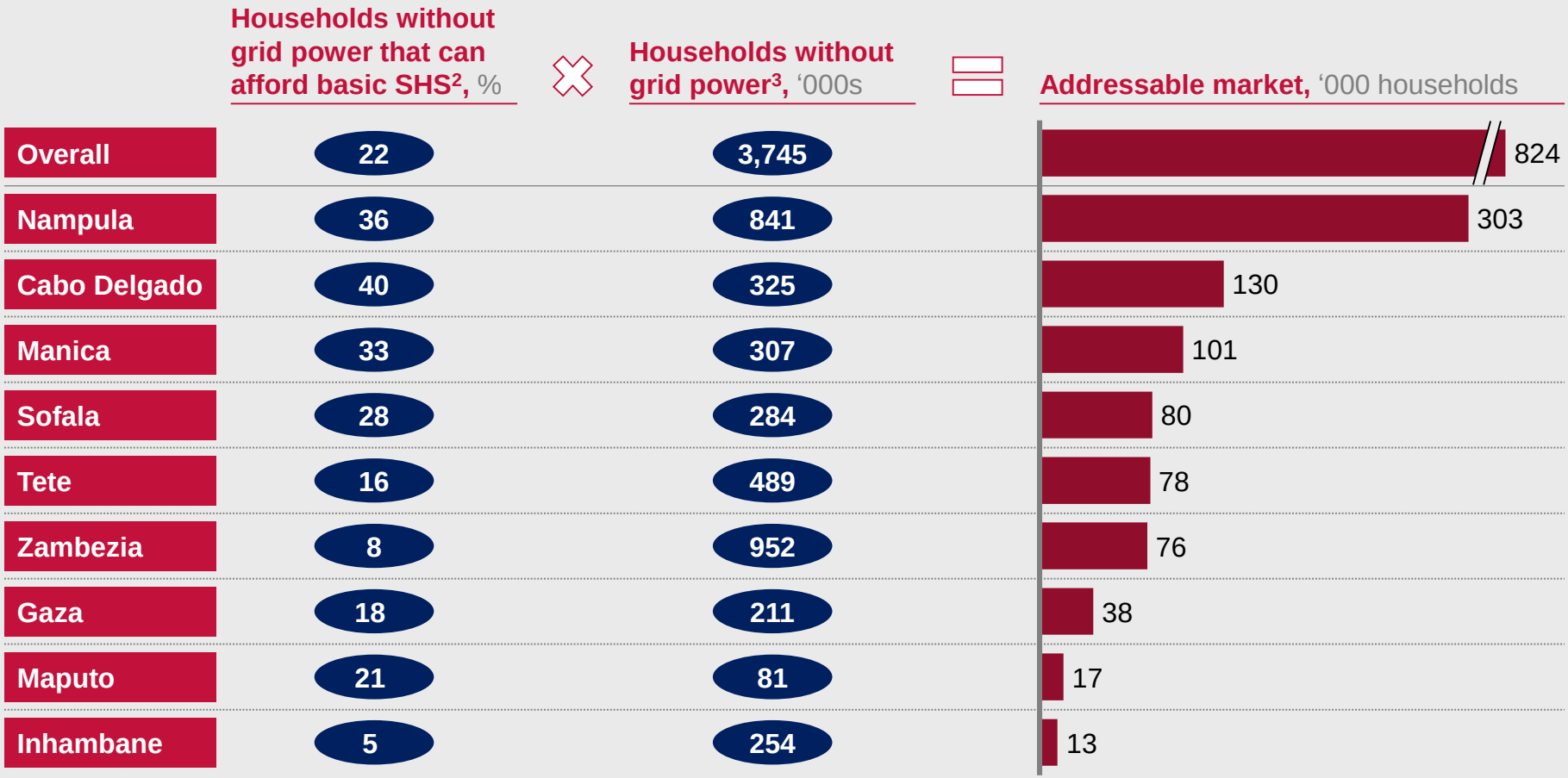
This implies **households in most provinces are overstating their ability** to spend on SHS.

1. Based on a USD $7.50 per month threshold, including expenditure on lighting (candles, torches, kerosene), mobile phone charging and the transport to obtain these items/services; 2. For a basic SHS unit including a radio at USD $12.50 per month; 3. Excluding Maputo City province; 4. Outside-in analysis estimates 22% HHs can afford SHS, using national statistics and benchmarking from GOGLA (see appendix for full analyses)

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

~824,000[1] HOUSEHOLDS WITHOUT GRID POWER CAN AFFORD SHS; THE LARGEST MARKET IS NAMPULA

Households without grid power that can afford basic SHS based on energy spend[1], households

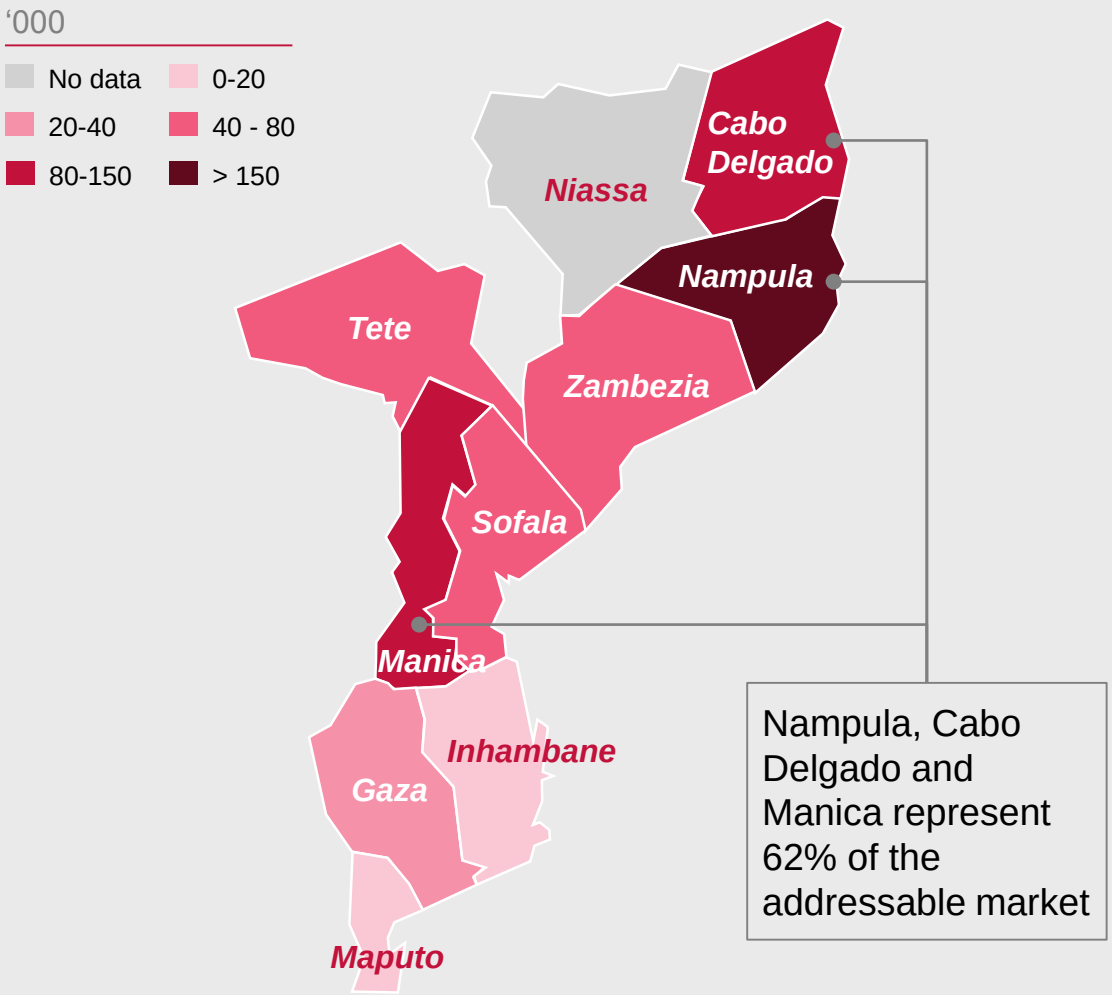


1. Does not include Niassa and Maputo City provinces; 2. Based on households that spend more than USD $7.50 on lighting and power per month, excluding households that already have EDM connection; 3. From USAID SAEP's Mozambique geospatial route-to-market (RTM) tool) analysis, 2015 and 2016 data

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; USAID SAEP geospatial model (2019)

NAMPULA, CABO DELGADO AND MANICA REPRESENT 62% OF THE ADDRESSABLE MARKET

Households without grid access that can afford SHS based on lighting expenditure, Number of households

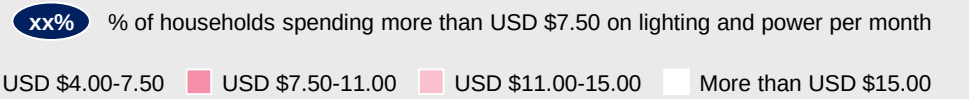


Nampula, Cabo Delgado and Manica represent 62% of the addressable market

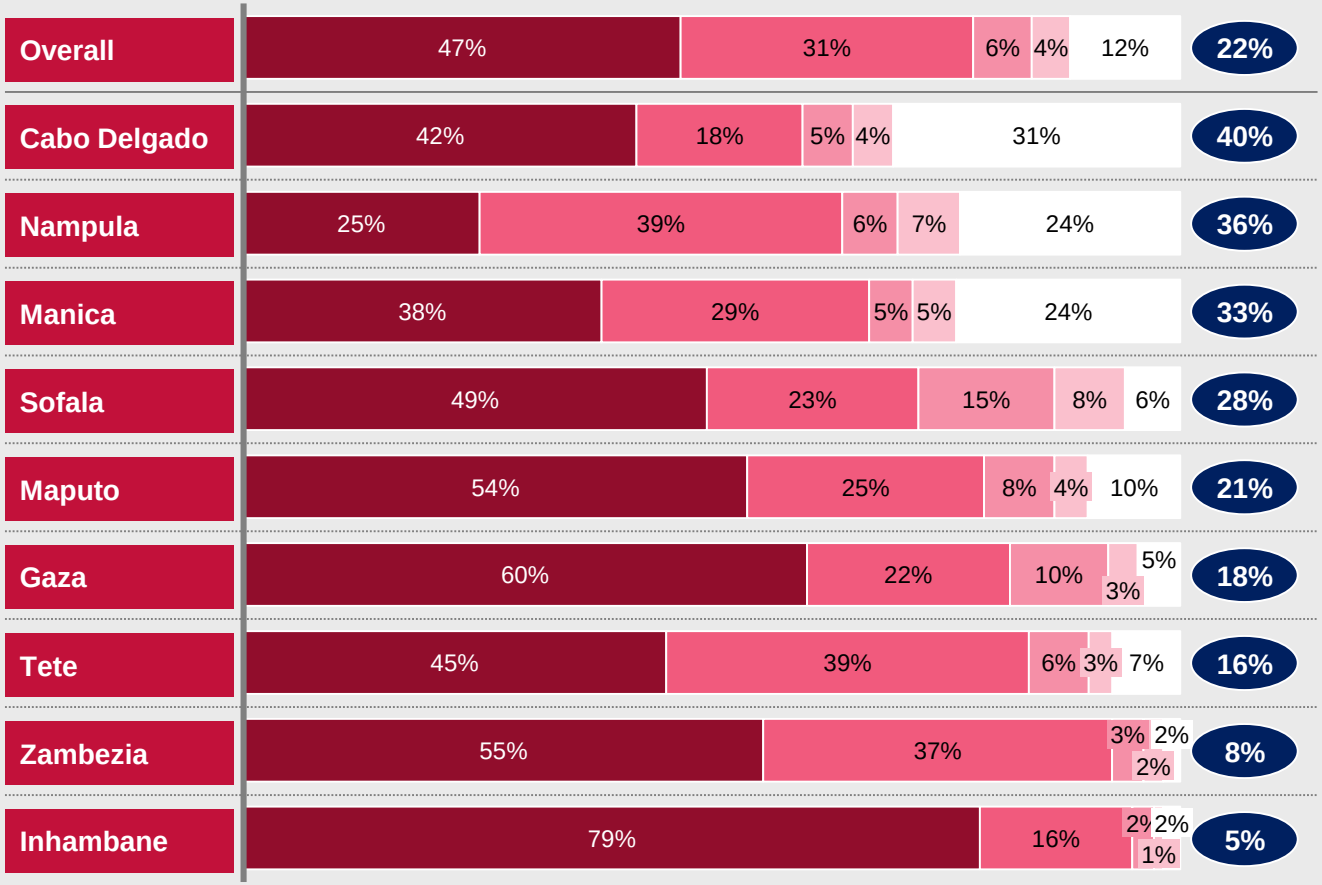
Province	,000 Total
Nampula	303
Cabo Delgado	130
Manica	101
Sofala	80
Tete	78
Zambezia	76
Gaza	38
Maputo	17
Inhambane	13
Total	824

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

PROVINCES WITH HIGHEST ENERGY SPEND ARE CABO DELGADO, NAMPULA AND MANICA



Monthly household spend on lighting and power[1] (for off-grid households),
% of households, N = 2,392 households (households that do not have EDM connection)



- Household expenditure on lighting and power is **less than USD $7.50** a month for **78%** of all households
- Expenditure is **highest in Cabo Delgado** and **Nampula** where **40%** and **36%** households spend **more than USD $7.50** per month on lighting and power
- Expenditure is **lowest in Inhambane** and **Zambezia** where **95%** and **92%** of households spend **less than USD $7.50** per month
- **Cabo Delgado** spends ~35 percentage points more on **transport** to obtain energy than the Mozambican average[2]
- **In Nampula** households are paying **15-35** percentage points more for each item (**candles, kerosene, mobile charging** and **transport** to obtain these) **than Zambezia**[3]

1. Includes expenditure on candles, torch batteries, kerosene, mobile charging and transport to obtain all these. See Assumptions page for average costs; 2. 64% of households in Cabo Delgado spend >USD $6.32 a month on transport to obtain lighting and power versus 27% of households overall; 3. In Nampula compared to Zambeiza, 15 pp more households spend >USD $0.17 on a candle, 36 pp more households spend >USD $1.11 on a liter of kerosene, 28 pp more households spend >USD $6.32 a month on transport to obtain energy and 24 pp more households spend >USD $1.42 a month on mobile charging

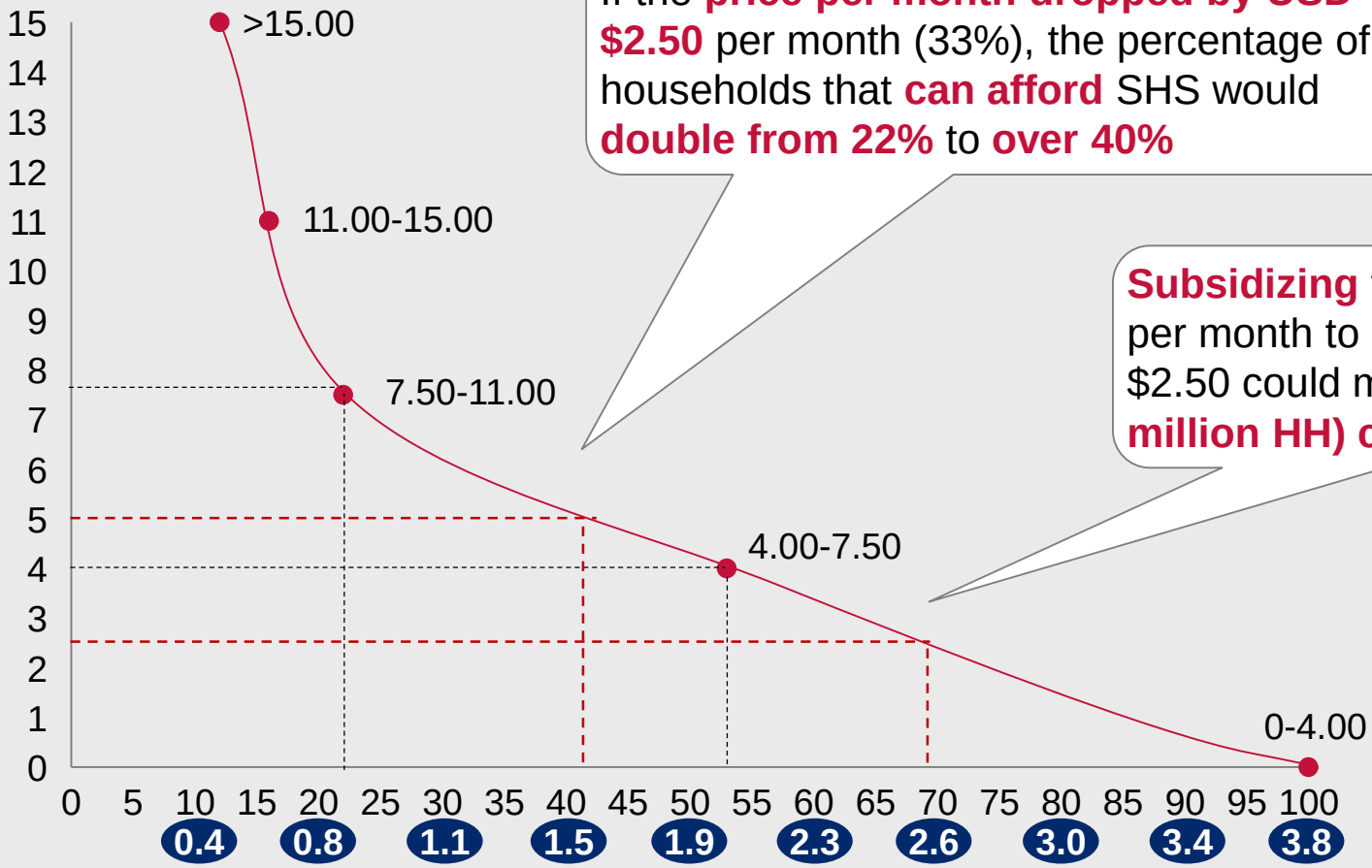
SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

BASED ON ENERGY EXPENDITURE, A PRICE DROP OF USD $2.50 A MONTH COULD DOUBLE THE HOUSEHOLDS WHO CAN AFFORD SHS

X Absolute number of households, million

Off-grid households that can afford SHS at different price points

Monthly cost of SHS (USD $)



Households that spend this amount on lighting and power (%)

If the **price per month dropped by USD $2.50** per month (33%), the percentage of households that **can afford** SHS would **double from 22%** to **over 40%**

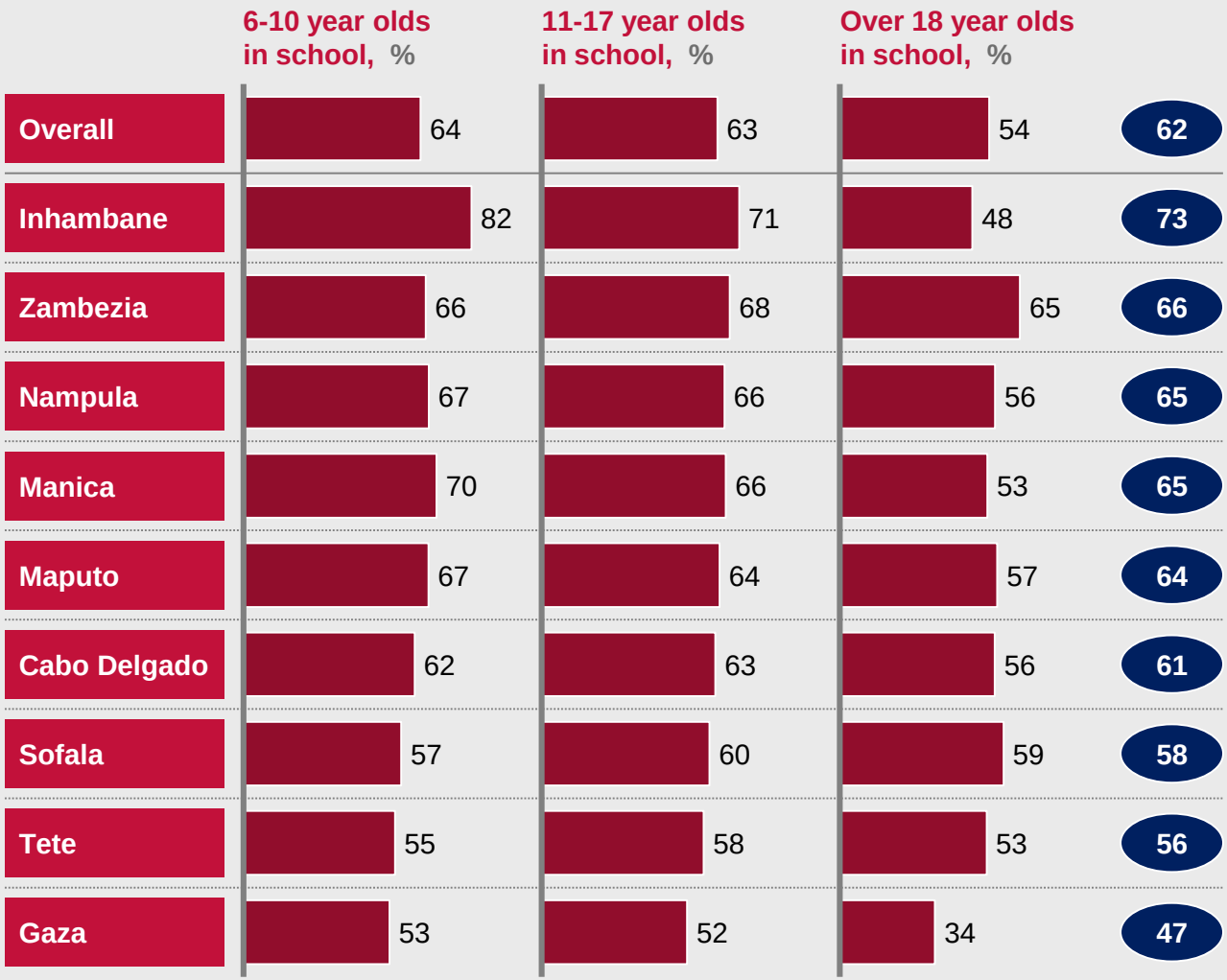
Subsidizing the cost by USD **~$5** per month to bring it to USD $2.50 could mean **~70% (2.6 million HH) can afford SHS**

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019;

INHAMBANE AND ZAMBEZIA HAVE THE HIGHEST PROPORTION OF CHILDREN IN SCHOOL, A PROXY FOR WILLINGNESS TO PAY

Proportion of children in school, % of children, N = 3,067 children

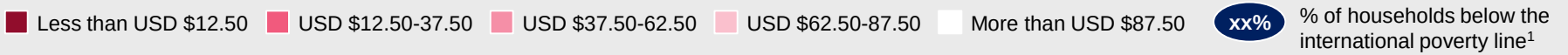
xx% Average % children in school



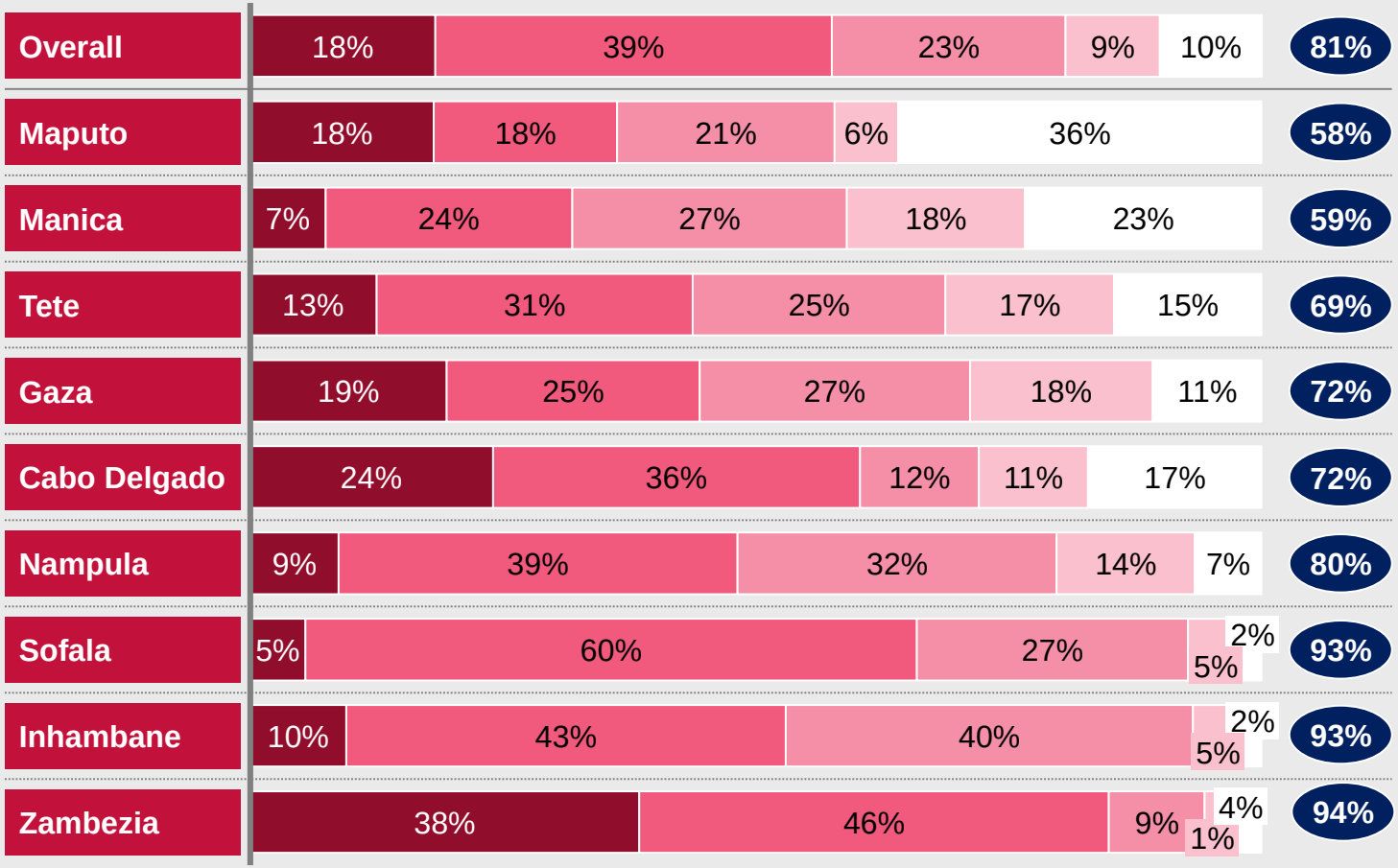
- How many children a household is educating is an **indicator of willingness to invest** in family wellbeing and improving living standards
- Overall, **education levels are low,** especially given primary education is free
- One explanation for a fairly **high enrolment among over 18s** is that many may be **completing secondary** school or still state they are in school when they have stopped mid-way through and are **waiting for sufficient funds to re-start e.g., technical school**
- **Inhambane** and **Zambezia** are **most likely** to **invest in family wellbeing** as they have the highest proportion of children in school across all age ranges (avg. 65-73%)
- **Gaza** and **Tete** are **least likely to invest** as they have the lowest proportion of children in school across all age ranges (avg. 47-56%)

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

THE WEALTHIEST HOUSEHOLDS ARE IN MAPUTO AND MANICA – THE POOREST ARE IN ZAMBEZIA



Distribution of households by monthly household expenditure,
% of households, N = 2,497 households



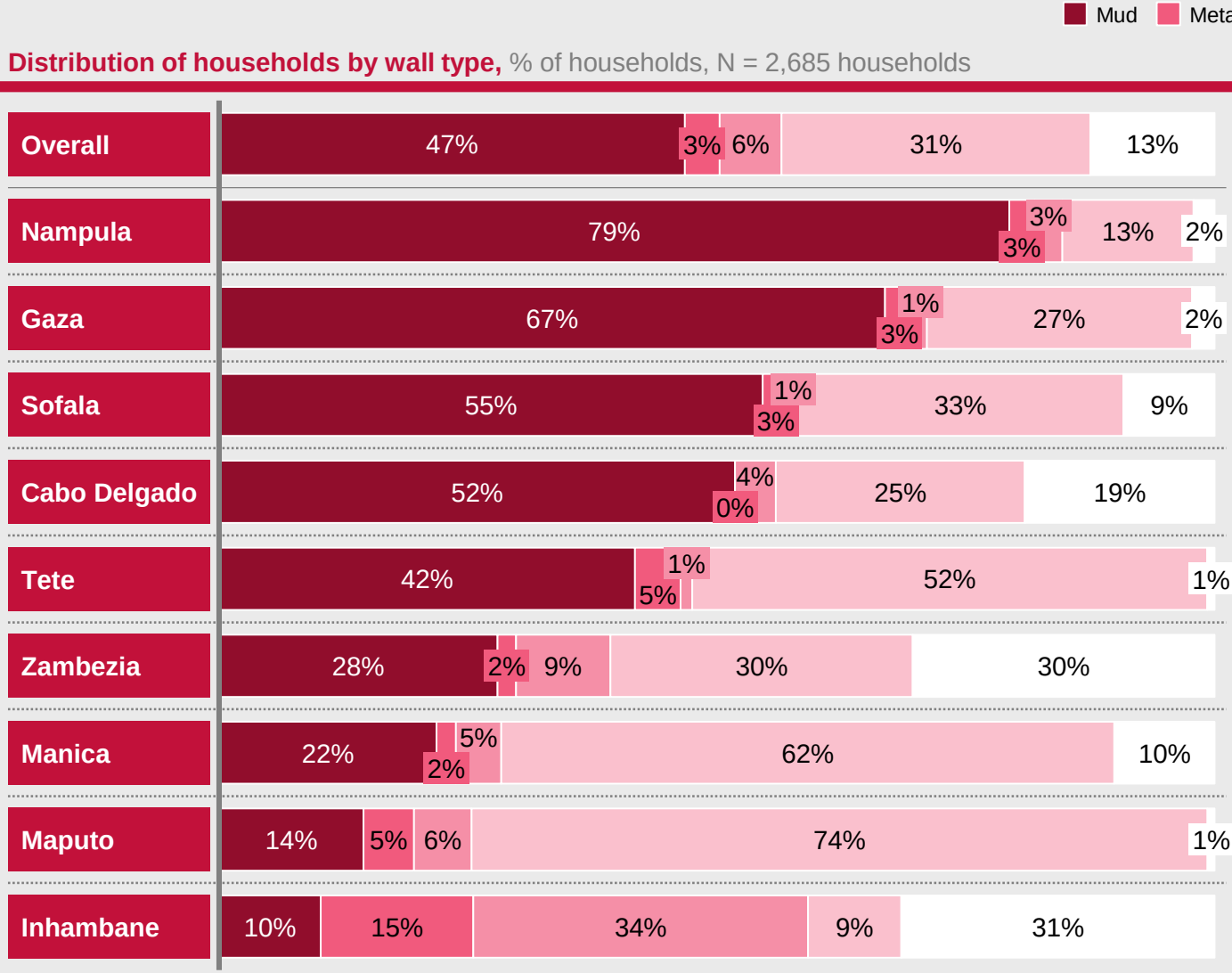
- Household expenditure is **less than USD $62.50** a month for **81%** of all households
- Expenditure is **highest** in **Maputo** and **Manica**, where 42% and 41% households spend more than USD $62.50 per month
- Expenditure is **lowest** in **Zambezia**, **Inhambane** and **Sofala** where 94%, 93% and 93% of households spend less than USD $62.50 per month

1. USD $2.00/day

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

47% OF HOUSES HAVE MUD WALLS AND ARE THEREFORE UNDERSTOOD TO BE IN THE LOWEST INCOME BRACKET

Distribution of households by wall type, % of households, N = 2,685 households



- Nampula, Gaza and Sofala have the **highest percentage of houses with mud walls** at 79%, 67% and 55%. This is **representative of lower income households** – as per national statistics, 55% of Mozambican households in the lowest expenditure quintile have mud walls[1]
- Maputo, Manica and Tete have the **highest percentage of houses with brick/stone walls** at 74%, 62% and 52%. This is **representative of higher income households** – as per national statistics, 70% of Mozambican households in the highest expenditure quintile have brick walls[2]
- "**Other**" is likely to represent **reeds** in **Inhambane** and **Zambezia**, whilst in mountainous **Manica**, "other" likely means **stones** (not stone building blocks)

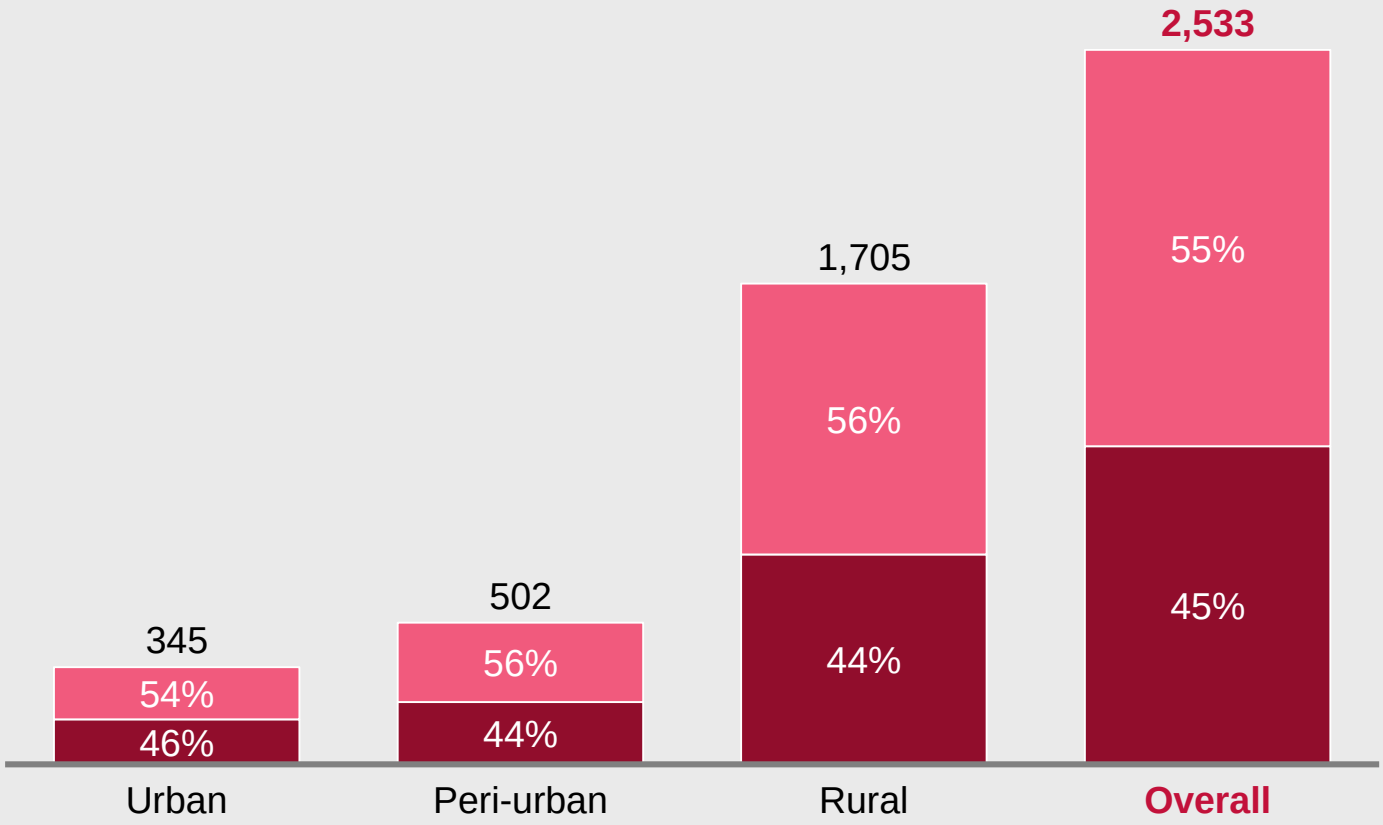
1 As per the Mozambique Family Budget Survey 2014/2015

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; Mozambique Family Budget Survey 2014/15

55% OF HOUSEHOLDS STATE THEIR MONTHLY EXPENDITURE IS STABLE

Reported stability of household expenditure, % households by settlement type

N = 2,552 households



- **55%** households state that their expenditure is **stable** during the year
- This **does not vary significantly** across rural, peri-urban and urban households

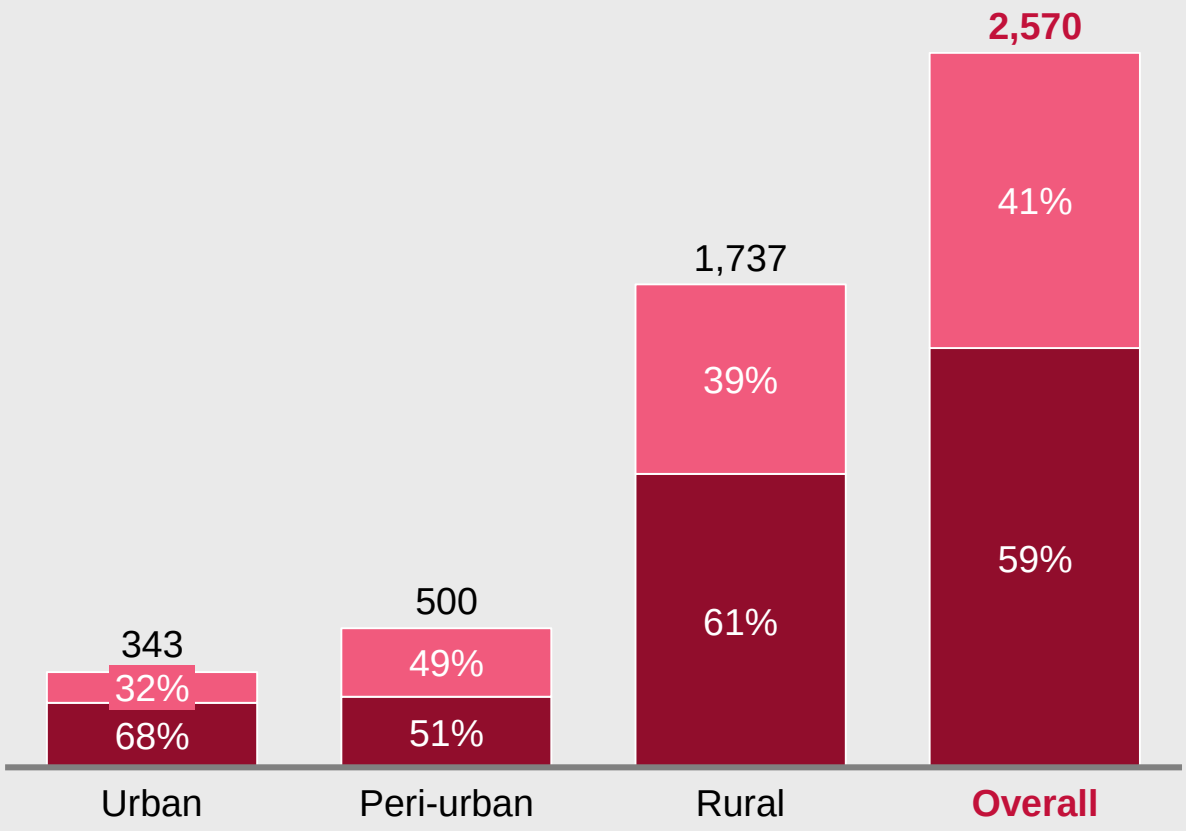
1. Stable expenditure: Reported to change rarely or not at all during the year; 2. Volatile expenditure: Reported to change frequently or very frequently during the year

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

~60% STATE THEIR INCOME IS NOT STABLE, AS EXPECTED GIVEN HIGH DEPENDENCE ON AGRICULTURE

Reported income stability, % households

N = 2,580 households[3]



- **~60%** state their household income is **not stable**
- This is likely due to **high dependence on agriculture and informal labor**, especially in rural areas
- **Inhambane** and **Maputo** have the **highest proportion** of households with **stable** income at 63% and 51% respectively – these two provinces also rank in the top three provinces for GDP per capita

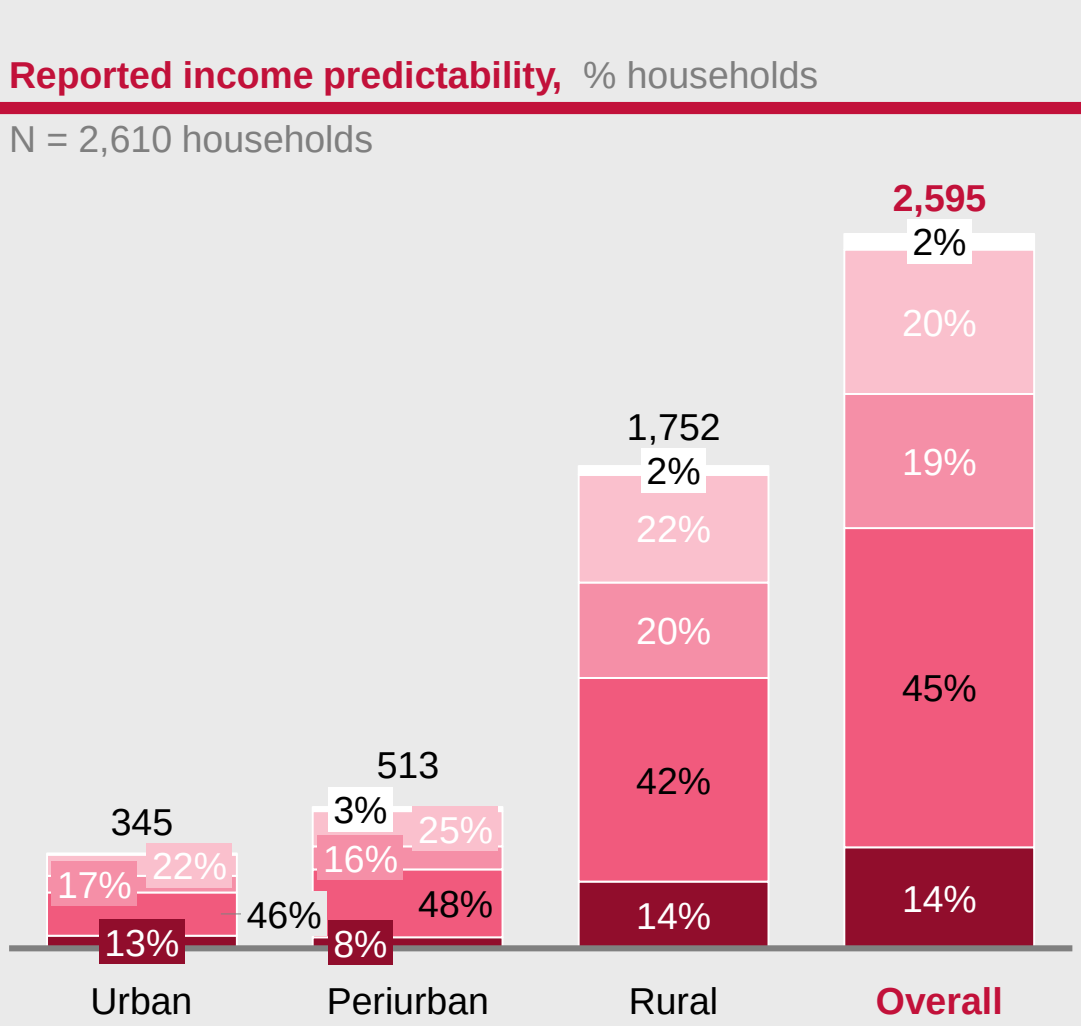
1. Stable income: Households state that whenever they earn money it is roughly the same amount; 2. Unstable income: Households state that whenever they earn money it is a different amount

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

59% OF HOUSEHOLDS RECEIVE INCOME ON A WEEKLY OR MONTHLY BASIS

Reported income predictability, % households

N = 2,610 households



- **Income predictability is relatively high** – 59% receive income on a weekly or monthly basis
- Predictability is even higher for **Nampula**, where **73%** of households receive a **weekly or monthly income**
- One explanation may be that, even though 80%[1] of the population rely on seasonal agricultural income, households may be receiving **regular remittances** from family members either from within Mozambique or South Africa, and/or they successfully find **other means to regularly supplement their agricultural income**, such as making charcoal

1. USAID Mozambique agriculture and food security profile, October 2019

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

WHAT DOES THIS MEAN FOR SHS COMPANIES? (1/2)

Result and insight	Conclusion for SHS companies
▪ **One in five** households, a total of **~824,000**, **can afford SHS** without financial assistance	▪ Be **ambitious in scale-up** plans
▪ **Nampula** has **~300,000 households that can afford SHS –** by far the **largest**; **willingness to invest** in family well-being is **high** (as evidenced by 65% children in school), there is a high percentage of households that are **ready to acquire SHS** and it is the province with the **best perception of SHS**	▪ SHS players are already serving **Nampula**, but **could deepen market reach**
▪ Households in **Zambezia do not spend much on energy** – they spend ~**30% less** on average than those in **Nampula** – but their **willingness to invest** in family well-being is **high** and self-stated **willingness to pay is high**	▪ Zambezia is not an attractive market – only **8% can afford** SHS, but the **market may be larger** than this, just be **cautious about the risk of default**

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

WHAT DOES THIS MEAN FOR SHS COMPANIES? (2/2)

Result and insight	Conclusion for SHS companies
▪ **Cabo Delgado** has faced security issues and **Manica** was affected by the cyclone, but these two provinces present an opportunity given their **large market size,** each **over 100,000** households. Ownership is also currently very low in Manica	▪ **Consider expanding** into the **safe** areas of **Cabo Delgado** and **recovering / less-affected** areas in **Manica**
▪ **Self-stated willingness to pay is inflated**	▪ Be cautious about the **risk of default**, especially in Inhambane, Zambezia and Tete
▪ **Demand** for SHS is **price-elastic**, with a **~2x increase** in the percentage of households that can afford SHS following a **USD $2.50 drop (~33%)** in price	▪ Work to find **lower cost alternatives** without compromising quality ▪ **VAT and import duty exemptions** could help achieve this

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

CONTENTS

SUMMARY OF INSIGHTS: SHS AWARENESS, OWNERSHIP AND PERCEPTION

Do people know and/or own SHS?

- **Awareness of solar products is high** – **68%** of surveyed households know about solar energy
- Most households (51%) know about solar products because **their neighbors or friends own one**
- For an early-stage market, **more households than expected own solar products (27%) – informal products** make up **~40%** of the market
- **Nampula, Maputo and Cabo Delgado** have the highest proportion of households that own solar products at 51%, 34% and 30%, respectively
- **72% of households that own a solar product own a Tier 1 product** whilst 28% have a TV or larger appliance (Tier 2-3)
- Most households that own solar product (75%) bought them through a one-time cash payment
- There is a gradual **increase in payment in installments** (primarily PayGo) as **products get more advanced / move into higher Tiers**
- **85%** who pay for solar products in installments pay more than USD $7.50, the average SHS monthly installment

How do people perceive solar energy?

- Solar has a **relatively poor perception** compared to the grid – only 30% prefer solar to a grid connection
- The most **common reason for buying** a solar product is for **lighting / power**, instead of an EDM connection
- **23%** of households plan to buy a solar product because it is **safer or cleaner** than their current energy source

What prevents households from purchasing SHS?

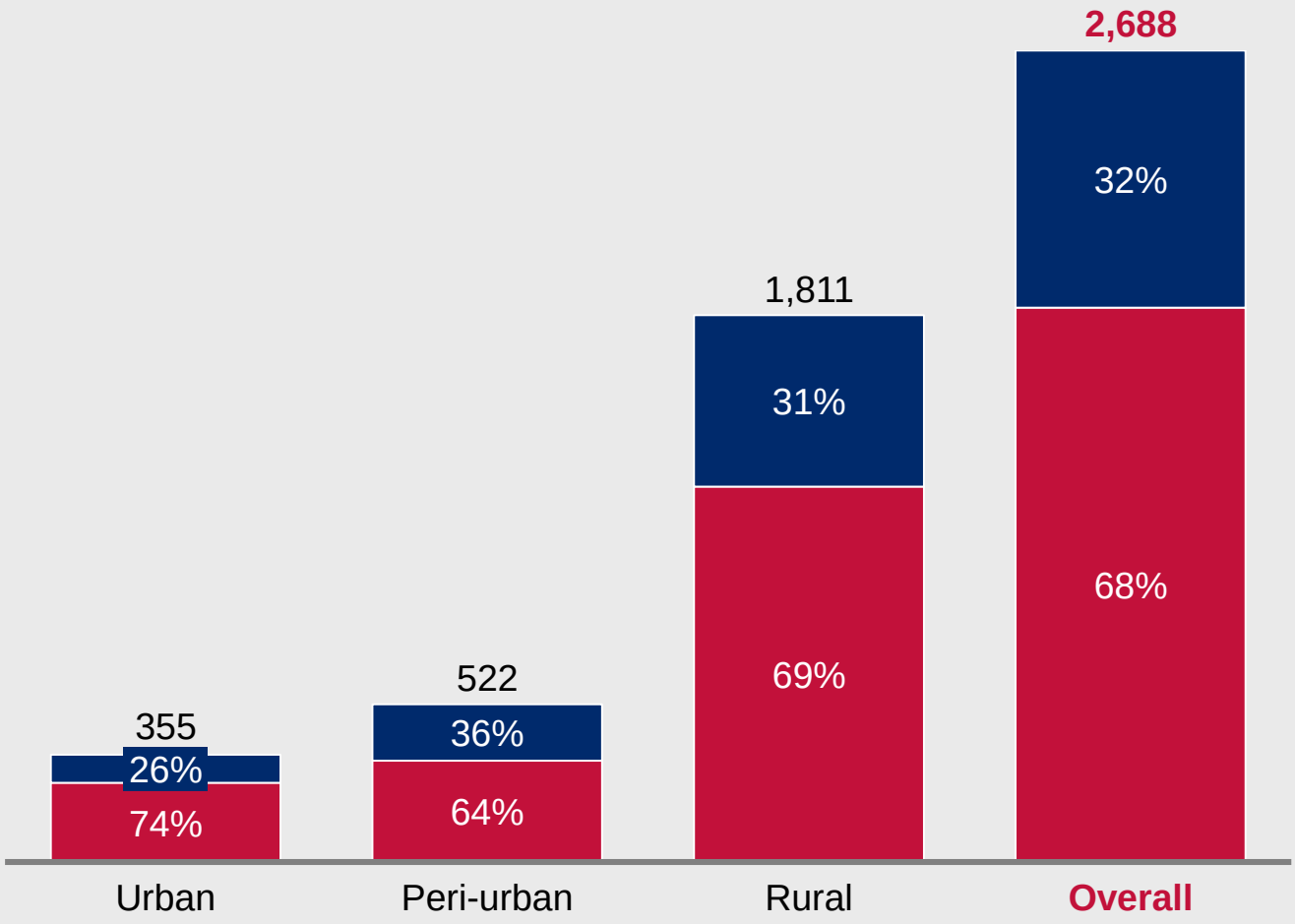
- **41% of households** that do not own a solar product say they **cannot afford** one, with the highest proportions in Tete, Gaza and Sofala
- **25%** state they **plan to buy one soon**, with the large proportions in Cabo Delgado, Maputo and Nampula
- **In Cabo Delgado and Manica,** the most common reason for not owning a solar products is that there are **no nearby service providers**

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

AWARENESS OF SOLAR PRODUCTS IS HIGH – 68% HOUSEHOLDS HAVE HEAD OF SOLAR PRODUCTS

Awareness of solar products, % of households

N = 2,688 households (full surveyed sample)



- **68%** of all surveyed households **know about solar energy** – with approximately the same percentage in rural areas
- This is **lower than awareness in Zambia** (83%), **Kenya** (87%) and **Senegal** (89%), as expected, given that these markets are less nascent
- Awareness of solar products is **highest in Nampula and Sofala** Provinces at 82% and 80% respectively and **lowest in Tete** at 47%

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

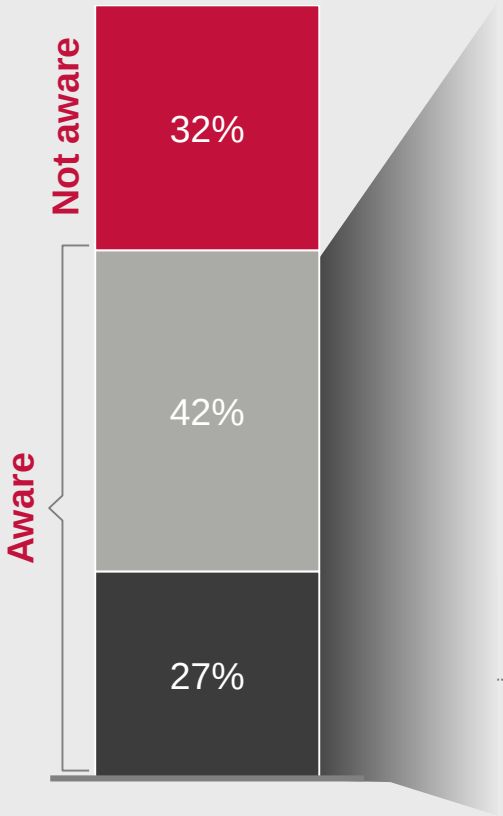
AT LEAST A THIRD OF HOUSEHOLDS SAY THEY HEARD OF SOLAR THROUGH ADVERTISING OR A SALES AGENT

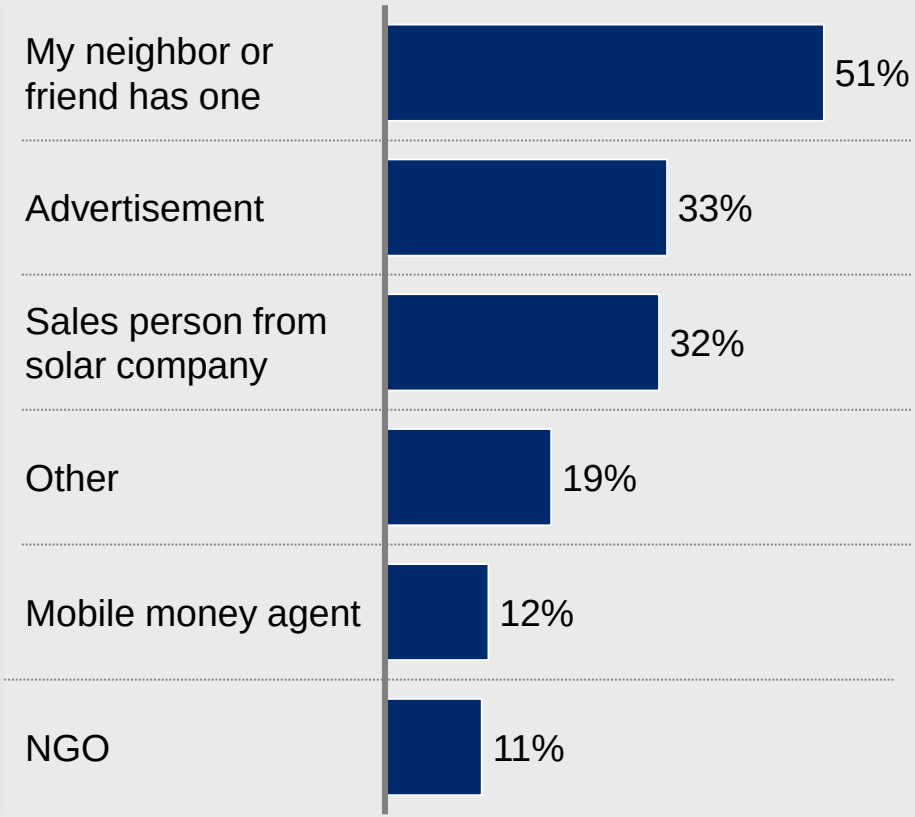
Not aware of solar | Aware of solar and do not own solar product | Aware of solar and own solar product

Awareness of solar, % households

Main source of awareness , % households[1]

N = 1,821 households (restricted to households aware of solar products)





- **51%** households cited they know about solar products because **their neighbors or friends own one**
- Households also hear about solar products from **advertisements** (33%) or directly from a **sales person from a solar company** (32%)
- Of those aware, less than half own a solar product

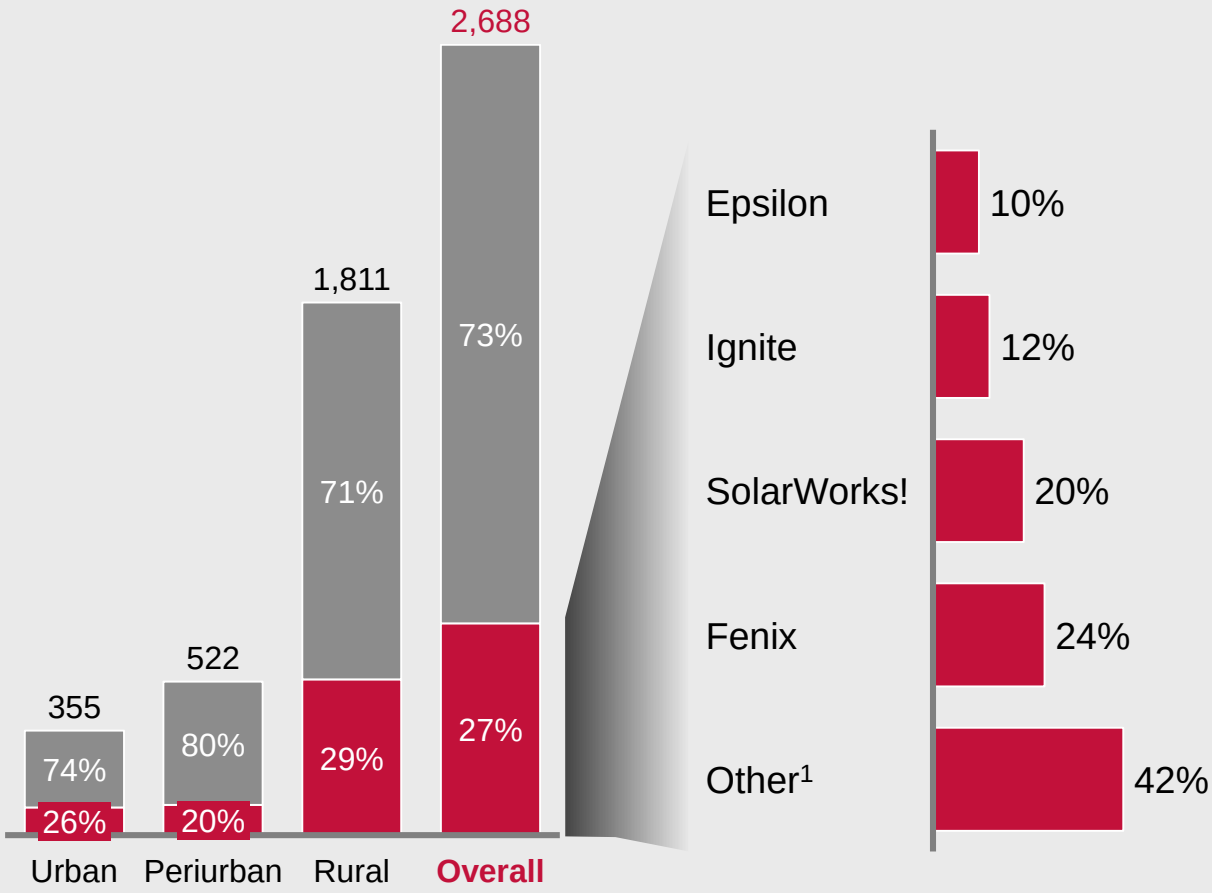
1. Adds up to more than 100% as this question allowed for selection of more than one answer

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

27% OF HOUSEHOLDS SURVEYED OWN A SOLAR PRODUCT – MORE THAN EXPECTED GIVEN THIS IS AN EARLY-STAGE MARKET

Ownership of solar products and brand of solar product owned, % households

N = 2,688 households (full surveyed sample); N= 608 households for brand ownership



- Mozambique's **solar market is nascent** – the four dominant SHS companies have only been operational for maximum 3-4 years
- Already, **27% own** a solar product – **>50%** of these are **in Nampula**
- **42%** households bought solar products from **brands outside of the dominant four**, which can be explained by the presence of an active informal market
- The brands with greatest ownership are **Fenix and SolarWorks**, at 24% and 20% households

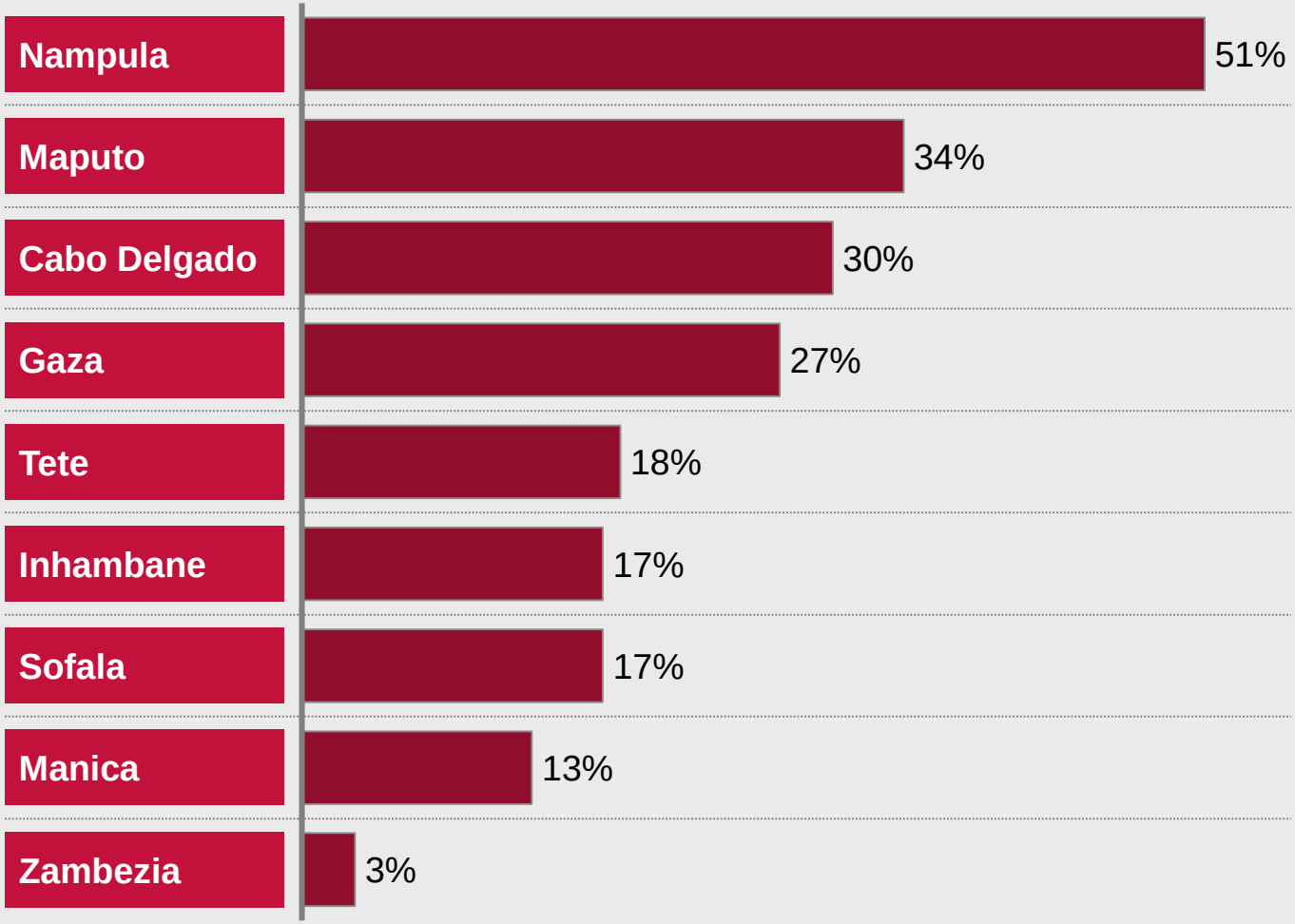
1. See appendix for details

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

SOLAR PRODUCT OWNERSHIP IS HIGHEST IN NAMPULA, MAPUTO AND CABO DELGADO

Solar product ownership, % households

N = 2,688 households (full surveyed sample)



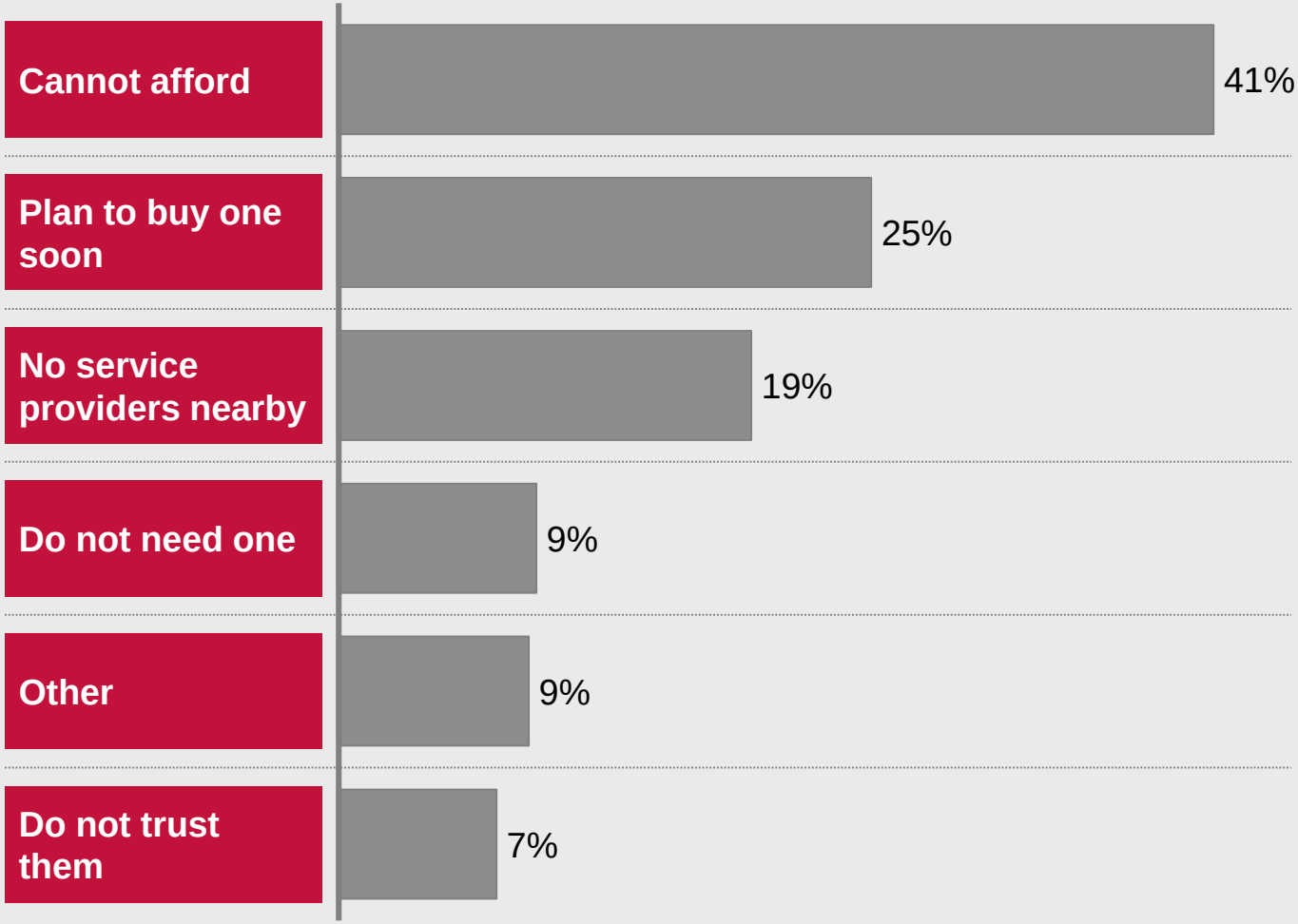
- Solar product ownership is highest in Nampula, Maputo and Cabo Delgado, where 51%, 34% and 30% surveyed households, respectively, own solar products
- Ownership is lowest in Zambezia and Manica, where 3% and 15% surveyed households, respectively, own solar products

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

41% OF HOUSEHOLDS SAY THE MAIN REASON THEY DO NOT OWN A SOLAR PRODUCT IS THAT THEY CANNOT AFFORD ONE

Reason households do not own a solar product, % households[1]

N = 1,104 households (restricted to households that are aware of solar but do not own a solar product)

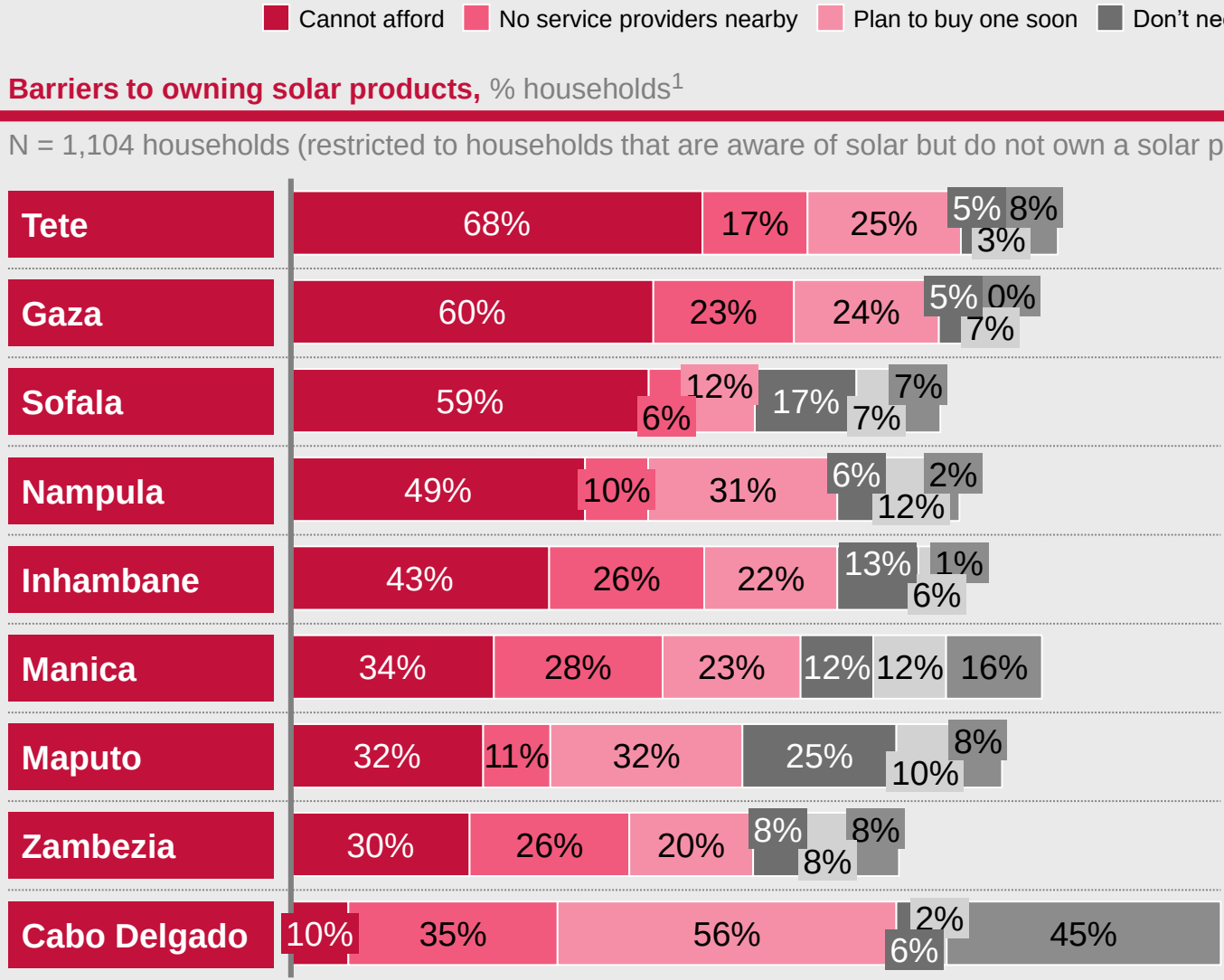


- **41%** said the main reason they do not own an SHS is they **cannot afford** to buy one
- **19%** said they do not own a solar product because there are **no nearby service providers**
- **Trust** of solar products is **relatively intact** – only **7%** say they **do not trust** them

1. Adds up to more than 100% as this question allowed for selection of more than one answer

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

TETE, GAZA AND SOFALA HAVE THE HIGHEST PERCENTAGE OF HOUSEHOLDS THAT SAY THEY CANNOT AFFORD SOLAR



- **Affordability** is the most prevalent barrier to owning SHS is in **Tete, Gaza, and Sofala** (68%, 60% and 59%)
- **Lack of access to nearby service providers** is of highest concern in **Cabo Delgado and Manica** (35% and 28%)
- **Cabo Delgado, Maputo, and Nampula** have the highest percentage of households that are **ready to acquire SHS** (56%, 32% and 31%)

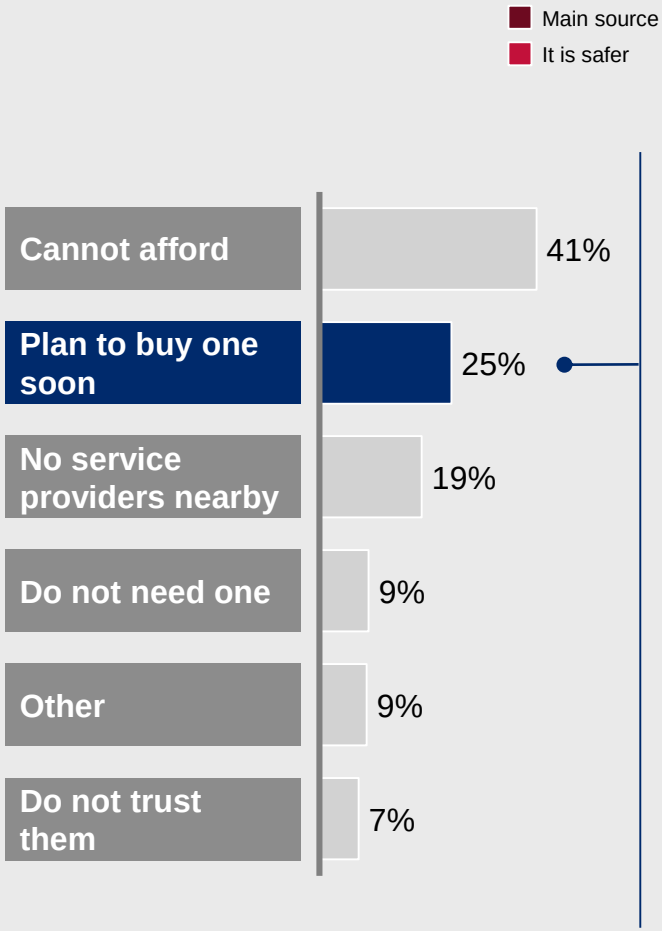
1. Adds up to more than 100% as this question allowed for selection of more than one answer

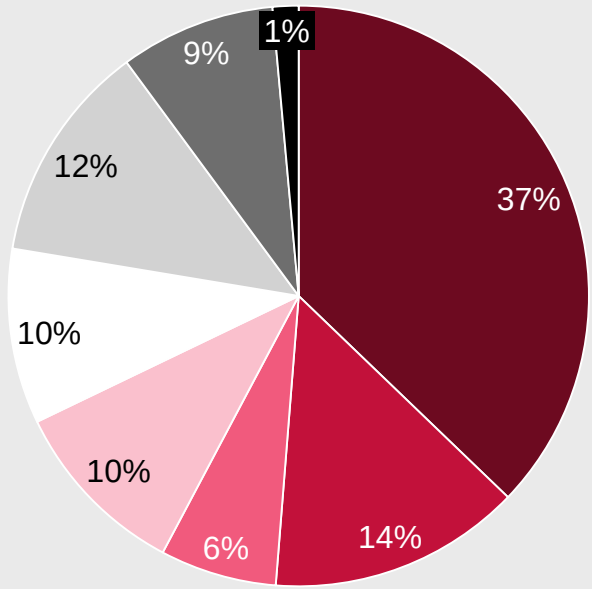
SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

37% OF HOUSEHOLDS PLAN TO BUY A SOLAR PRODUCT AS A MAIN SOURCE OF POWER, INSTEAD OF A GRID CONNECTION

Reason for not owning a solar product and main reason to buy solar product, % households

N = 277 households (restricted to households who stated that they plan to buy solar products)





- Despite the comparatively poor perception of solar vs EDM, **37%** of households plan to buy a solar product as a **main source of power/lighting,** instead of a grid (EDM) connection, most likely because they are not able to access an EDM connection
- Power/lighting may be seen as the 'essential' feature of solar products, but **23%** of households plan to buy a solar product because it is **safer or cleaner**[1] than their current energy source
- Only **12%** cite using solar products to **earn additional income** as their main reason to buy a solar product

1. Cleaner for the health of household using the solar product as opposed to cleaner for climate change

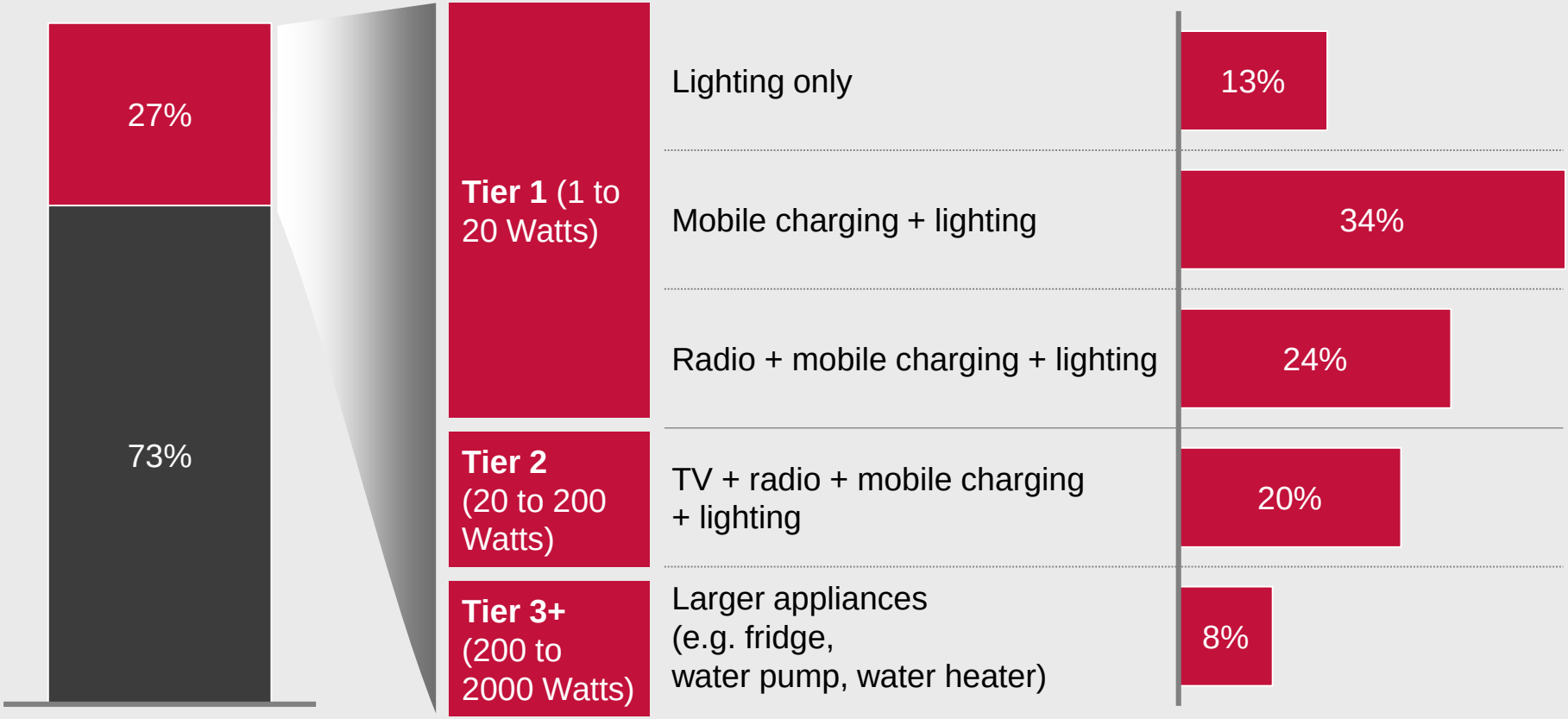
SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

72% OWN A TIER 1 PRODUCT, 24% HAVE A RADIO AND 28% HAVE A TV OR LARGER APPLIANCE (TIER 2-3)

Ownership of solar products, % households

Type of solar product by tier[1] and appliances , % of households

N = 2,688 households (full surveyed sample)

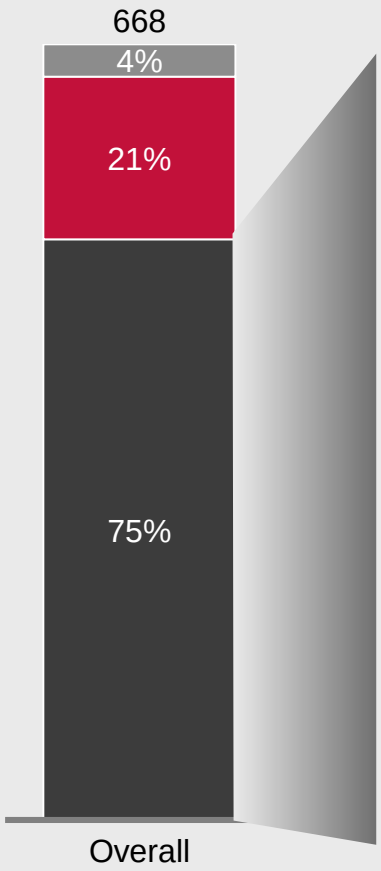


1. USAID tier definitions used (https://www.usaid.gov/energy/mini-grids/economics/cost-effectiveness/tiers-of-service/)

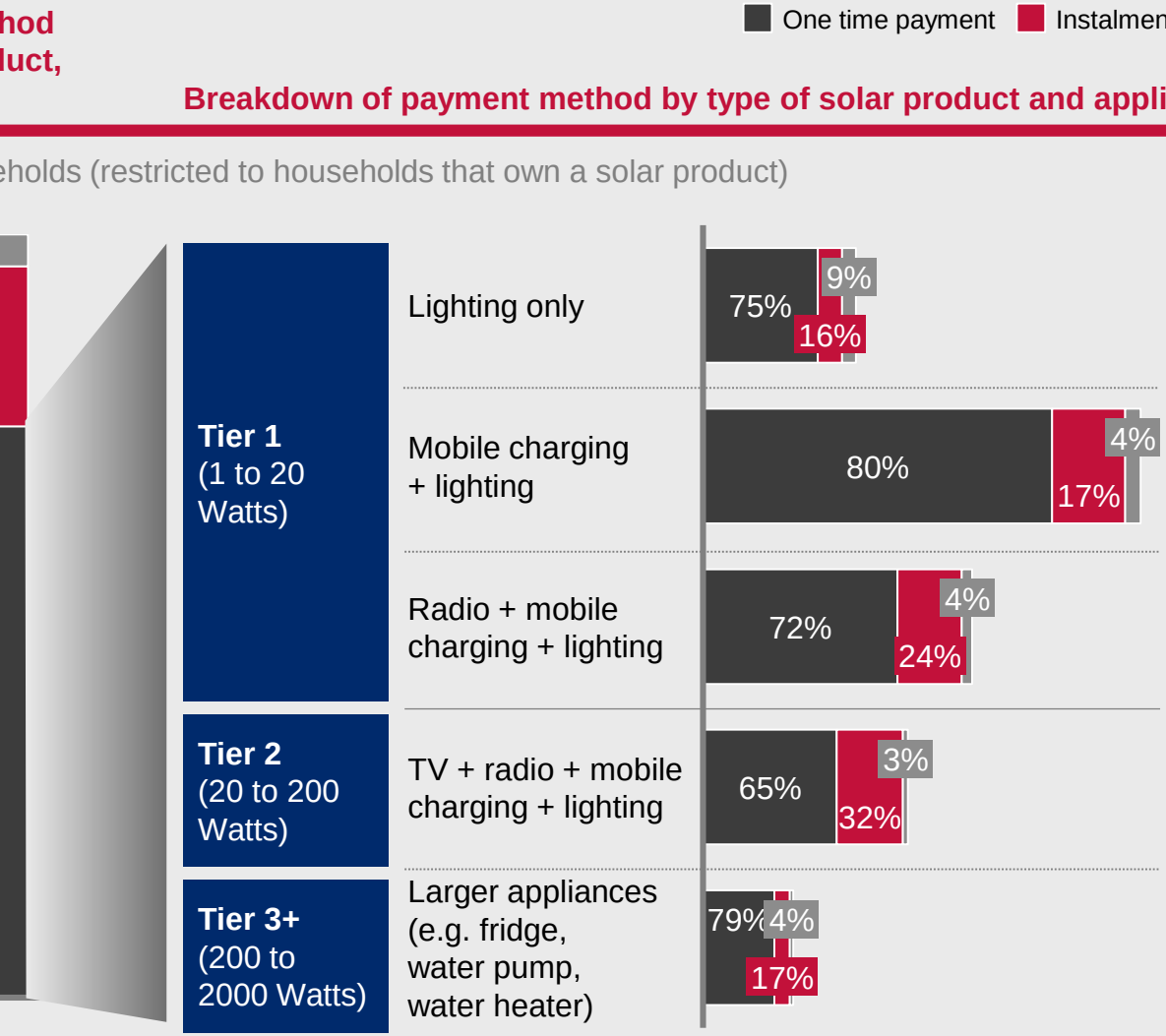
SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

ALMOST ALL OWNERS BOUGHT SHS THROUGH ONE-TIME CASH PAYMENT, REGARDLESS OF THE TYPE/TIER OF THE PRODUCT

Payment method for solar product, % households



Breakdown of payment method by type of solar product and appliances, % of households



N = 668 households (restricted to households that own a solar product)

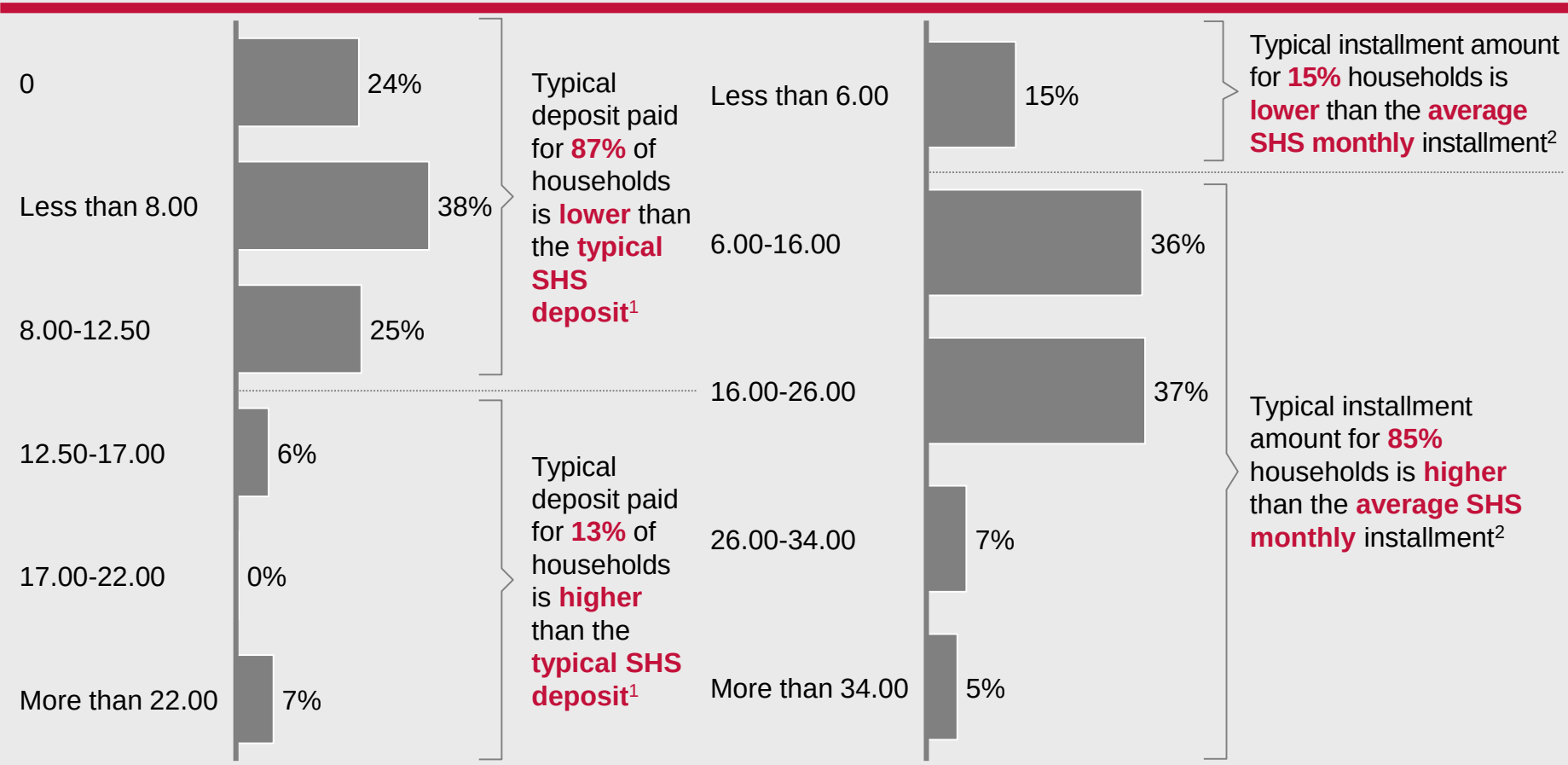
- Across all products, **one-time cash payment** is the most common method of payment
- There is a **gradual increase in payment in installments** (e.g., PayGo, micro-finance, laway[1]) for **more advanced solar products** – indicating that PayGo may play a significant role in enabling households to upgrade their systems, or that customers buying the more advanced products have better access to these financial instruments

1. Deposit paid to a shop to then pay installments

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

85% WHO PAY FOR SOLAR PRODUCTS IN SMALL AMOUNTS PAY MORE THAN USD $7.50, THE AVERAGE SHS MONTHLY INSTALLMENT

Typical deposit and weekly installments for solar products



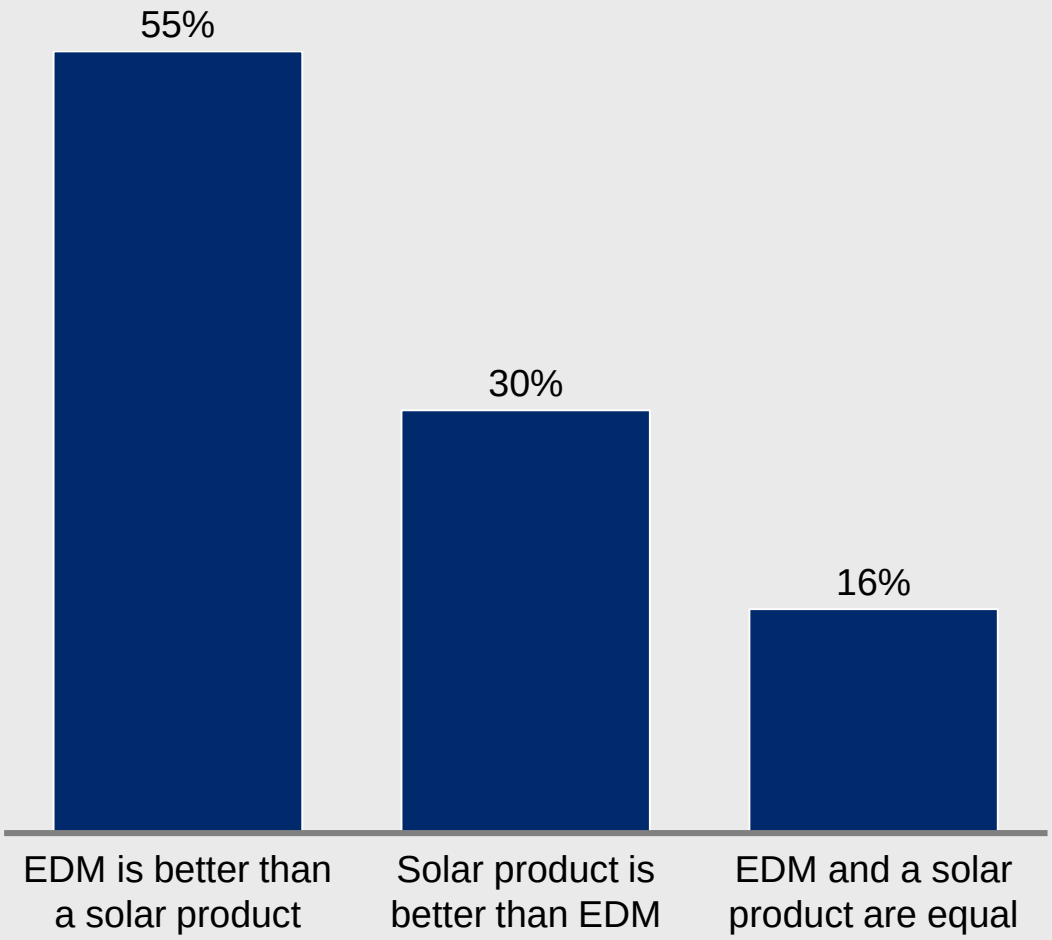
1. Estimated at USD $12.00-14.00; 2. Estimated at USD $7.50

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

MOST HOUSEHOLDS THINK THE GRID IS BETTER THAN SOLAR; ONLY 30% PREFER SOLAR

Perception of solar as a source of electricity, % households

N = 1,783 households (restricted to households who are aware of solar products)



- **Perception of solar is poor**, with only **30% of households** prefer solar to grid (EDM)
- On a province level, the **perception of solar is most positive** in **Nampula**, and **least positive** in **Maputo**, with 54% and 11% of surveyed households, respectively, stating that they prefer solar to EDM
- **EDM** has a **relatively good perception** with 55% of households stating that they prefer EDM to solar (compared with 32% in Zambia) and **80% of households** without EDM stating that they **would like to have an EDM connection**. This is likely because there is no load shedding in Mozambique (compared with Zambia where there are currently 12+ hours of load shedding daily) and grid power offers more versatility

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

WHAT DOES THIS MEAN FOR SHS COMPANIES?

Result and insight	Implication for SHS companies
▪ **Awareness is high** and **trust is strong** (advertising and sales agent outreach are working), but people **still prefer** the idea of having access to the **grid**	▪ **Focus marketing efforts** on selling SHS to **aware households**, intentionally **building trust** in solar through advertising and sales agent outreach, whilst focusing on **what solar can bring** to households especially **during the transition** timeline before the grid is expected to reach all
▪ Nearly a quarter of households **care** that SHS is **safer or cleaner**	▪ **Sales messaging** should include that SHS are **cleaner and safer than alternatives**
▪ **Cabo Delgado** and **Manica** have **strong demand** for SHS but say there are **no service centers** nearby	▪ Focus on **scaling up** in **Cabo Delgado** and **Manica**
▪ **Most households own Tier 1,** entry level products and households typically buy solar products through a **one-time payment** rather than PayGo, but those who pay installments **pay over USD $8** per month	▪ Over time, SHS companies should consider how to **migrate these consumers** to more sophisticated products, especially through **better communication on PayGo**

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

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SUMMARY OF INSIGHTS: MOBILE PHONE AND MOBILE MONEY USAGE

What is the penetration of mobile network, mobile phones and mobile money?

- Mobile **network access** (from the house) is **high at 75%**. Vodacom is the leading network provider – **82% have Vodacom access**
- Household **mobile phone ownership is high at 83%.** Half of these households use **mobile money,** of which **94% use M-Pesa**. Access to mobile money is highest in Maputo and Cabo Delgado at 63% and 60% of households
- **50%** of households surveyed **are less than 30 minutes from the nearest mobile money agent**

How much do households transact on mobile money platforms?

- The **typical mobile money transaction for 56%** of households is over USD $8.00 – **higher** than the average **SHS monthly installment** of USD $7.50
- **Over half** the households **use mobile money** at least **every other day**
- The **largest mobile money transaction** in the past **month** was **higher** than an average monthly **SHS installment** for **66%** of households

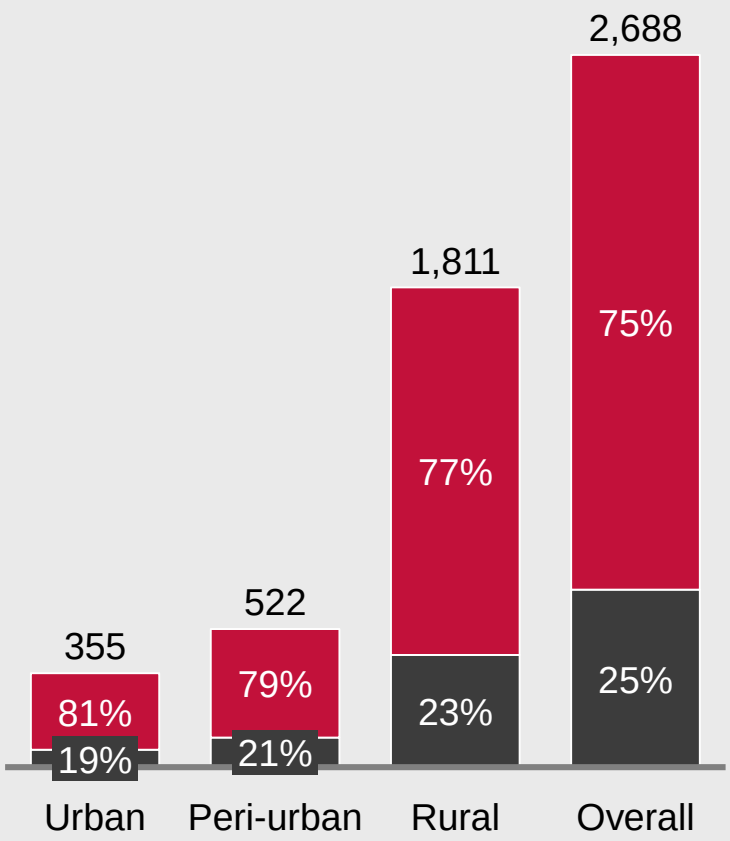
SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

75% OF HOUSEHOLDS SURVEYED HAVE ACCESS TO A MOBILE NETWORK; 82% OF THESE USE VODACOM

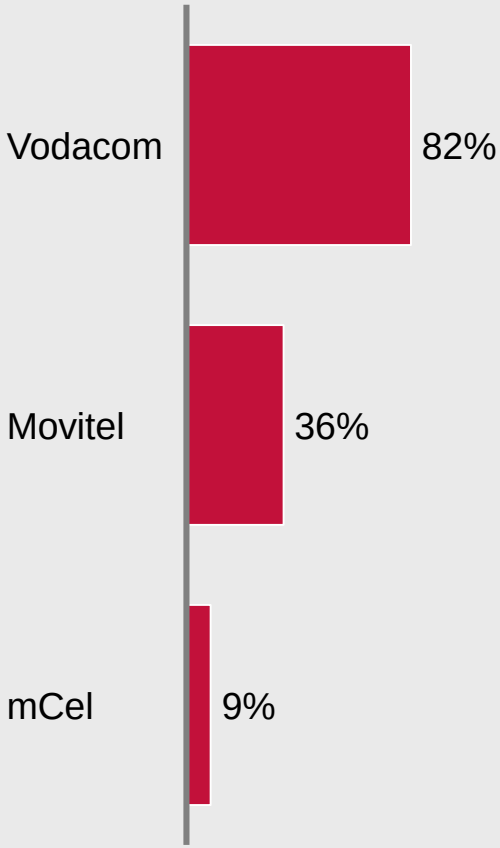
Access to a mobile network | No access to a mobile network

Mobile network access, % households

N = 2,688 households (full surveyed sample)



Mobile network provider, % households[1]



- **75%** have **access** to a **mobile network** (but even more – 83% – have a phone)
- Mobile network access is higher in urban areas at 81%
- **82%** use **Vodacom**, the most prevalent network across all provinces
- **Movitel** use is **highest** (>50%) in **Cabo Delgado** and **Zambezia** (not shown)

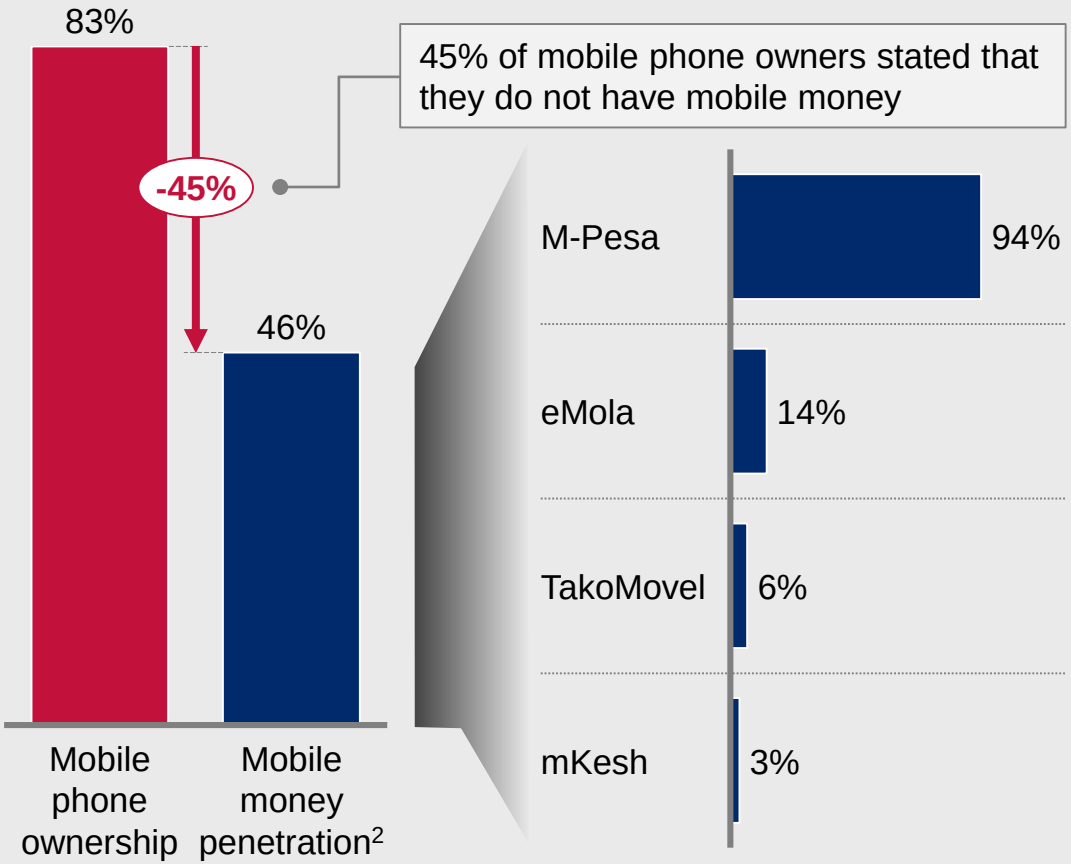
1. Access to network adds up to >100% as some households have access to more than one mobile network

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

55% OF HOUSEHOLDS THAT OWN MOBILE PHONES USE MOBILE MONEY – PRIMARILY M-PESA (94%)

Mobile phone ownership and mobile money penetration, % households[1]

N = 2,585 households



- Mobile phone ownership is high – **83%** of households **own a phone**
- Almost **half** (46%) **use mobile money** – this falls to 39% in rural areas (not shown)
- Mobile money use is **highest** in **Cabo Delgado** and **Maputo** at over 60% and **lowest** in **Inhambane** and **Tete** at ~20%
- While GSMA finds only 42% Mozambicans own a phone and the Global Findex database report that 22% have mobile money, the findings in this survey that 83% households own a phone and 46% use mobile money are **critical for SHS companies**, given **only one phone is required per household** to **manage PayGo** for an SHS connection
- **M-Pesa dominates** with 94% mobile money users choosing M-Pesa

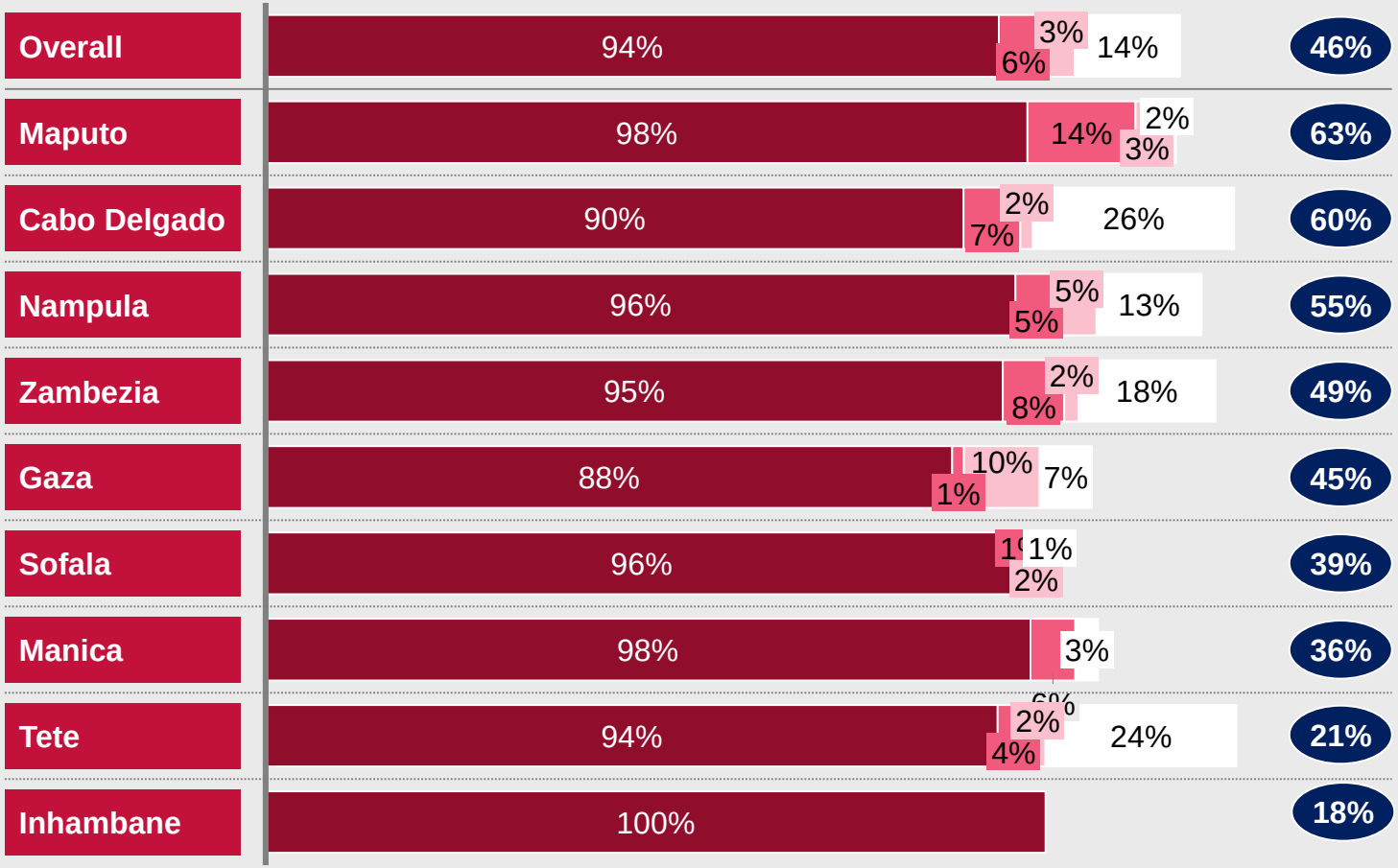
1. Adds up to more than 100% as this question allowed for selection of more than one answer

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; Global Findex database (2017); GSMA (Q2 2019)

MAPUTO AND CABO DELGADO HAVE HIGHEST ACCESS TO MOBILE MONEY

M-Pesa | TakoMovel | mKesh | eMola | xx% % of all surveyed households that have mobile money

Distribution of households by mobile money provider[1],
% of households, N = 1,133 households

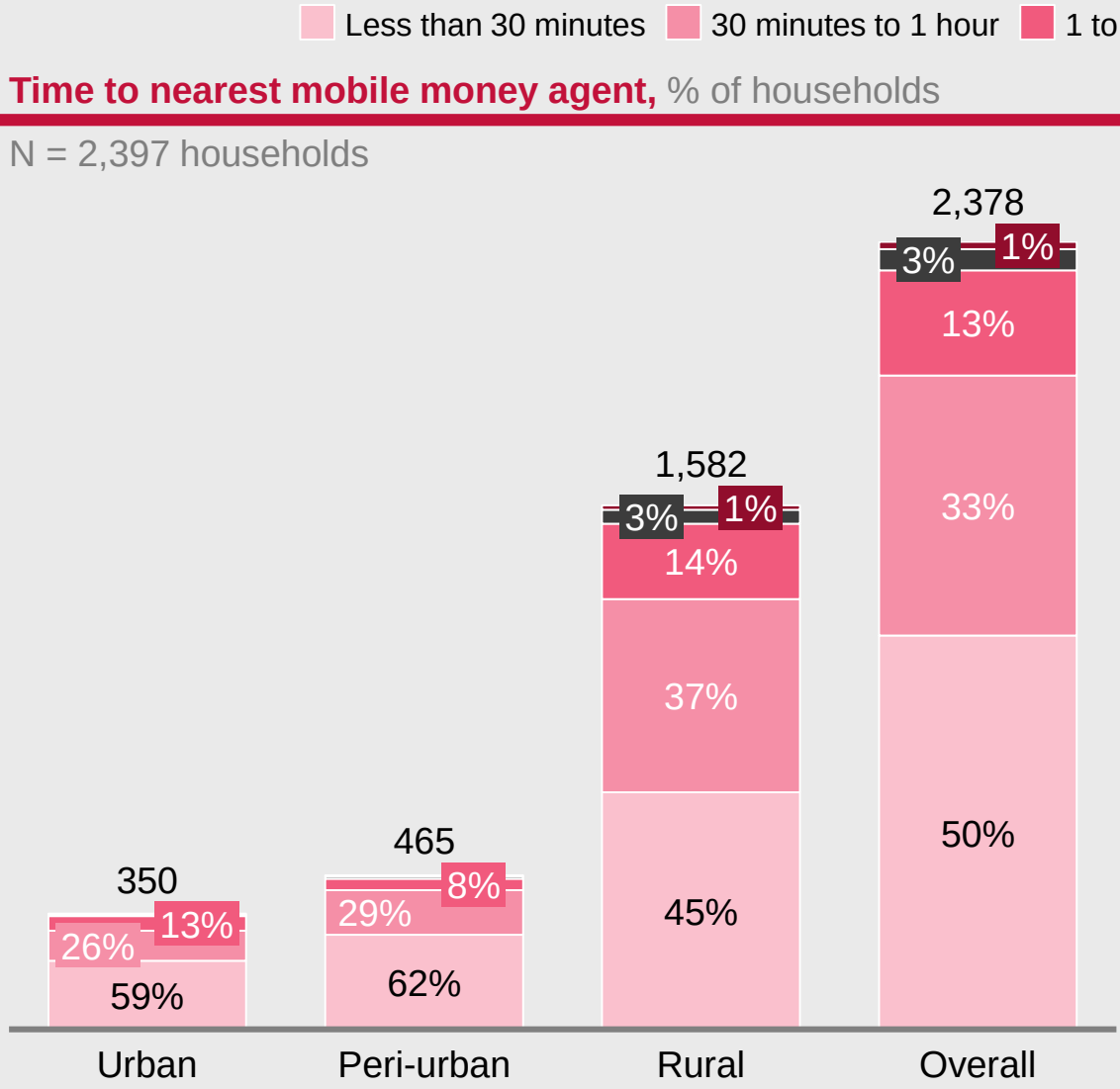


- Access to mobile money is highest in Maputo and Cabo Delgado at 63% and 60% of surveyed households respectively and lowest in Inhambane and Tete at 18% and 21% of surveyed households
- Across all provinces, majority households use M-Pesa – M-Pesa usage is highest in Inhambane whilst eMola usage is highest in Cabo Delgado and Tee

1. Choice of mobile money provider adds up to more than 100% as some households have access to more than one mobile money provider

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

50% OF HOUSEHOLDS SURVEYED ARE LESS THAN 30 MINUTES FROM THE NEAREST MOBILE MONEY AGENT



- More than 80% of households surveyed are less than one hour from the nearest mobile money agent, while only 32% of households surveyed are less than one hour from the nearest bank and 83% of households surveyed are less than one hour from the nearest trading center (not shown)
- In rural areas, 45% of households are less than 30 minutes from the nearest mobile money agent
- This is likely a reflection of the survey design, given it excluded deep rural, standalone areas and targeted settlements in rural areas

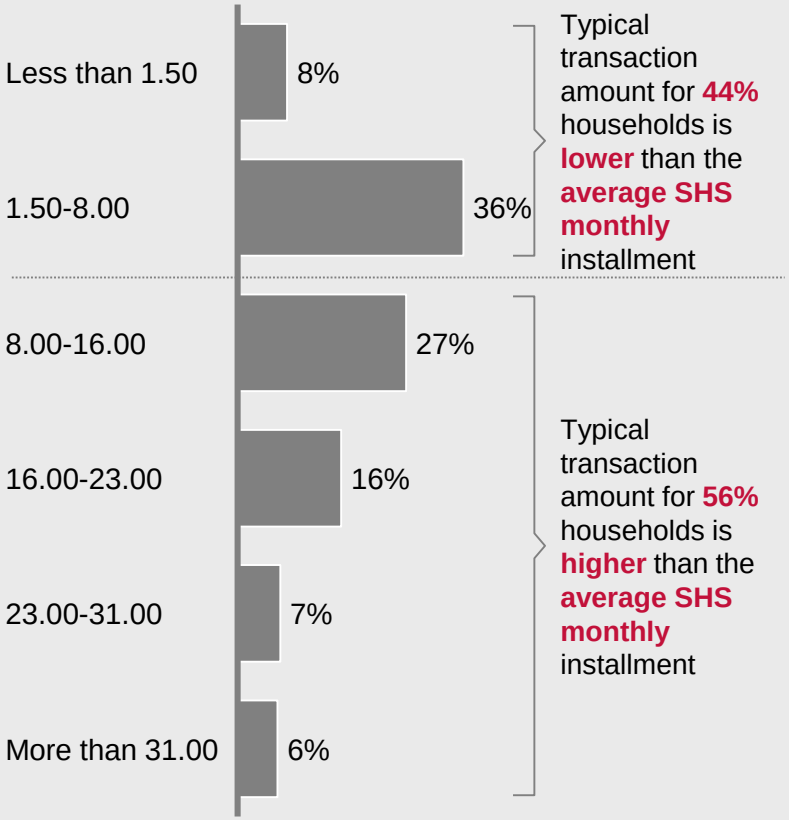
SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

THE TYPICAL MOBILE MONEY TRANSACTION[1] FOR 56% OF HOUSEHOLDS IS OVER USD $8.00

Typical transaction amounts and frequency of mobile money transactions

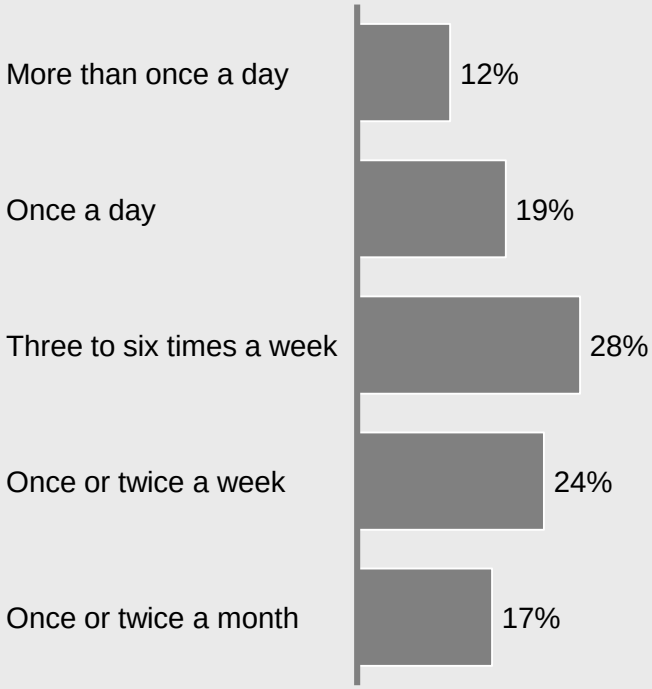
Typical mobile money transaction amount

USD $, N = 1,083 households (restricted to those that have mobile money)



Typical mobile money transaction frequency

N = 1,067 households (restricted to those that have mobile money)



Over half (59%) households **use mobile money** at least **every other day**

- Frequent transactions are likely **purchase of airtime** – this is significant for SHS companies as households are **familiar with** and have **access to** mobile money
- Large transactions may be **remittances being received and disbursed**
- Results may be skewed because this survey was conducted in **November and December** when end year **remittances are large**

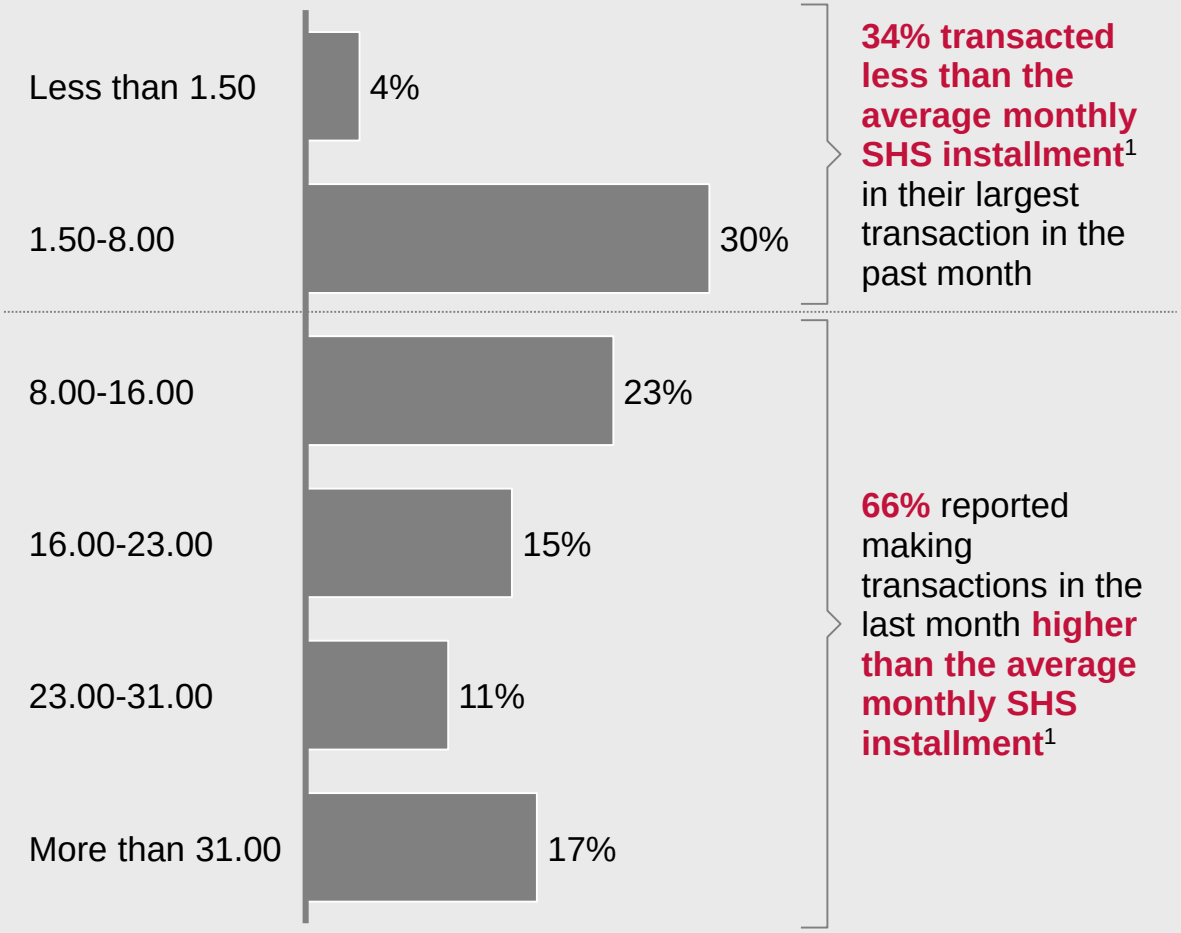
1. Transaction could mean sending or receiving of money

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

THE LARGEST AMOUNT SENT OR RECEIVED IN THE PAST MONTH VIA MOBILE MONEY WAS OVER USD $7.50 FOR 66% HOUSEHOLDS

Size of largest mobile money transaction in the previous month, USD $

N = 1,058 households (restricted to households that have mobile money)



34% transacted less than the average monthly SHS installment[1] in their largest transaction in the past month

66% reported making transactions in the last month **higher than the average monthly SHS installment**[1]

- The **largest mobile money transaction** in the last month was **over USD $7.50** (the average monthly SHS installment) for **66%** of households – indicating that they are **willingly using mobile money** to send/receive these amounts
- **Remittances** are most likely behind the surprising result that the **largest transaction** in the past month for **17%** was **over USD $31.00**
- These **results may be skewed** given this **survey was conducted** in **November** and **December** 2019 when end-year remittances (from South Africa and within Mozambique) are likely to be larger

1. Estimated at USD $7.50

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

WHAT DOES THIS MEAN FOR SHS COMPANIES?

Result and insight	Implications for SHS companies
▪ Nearly **half** the households **use mobile money** and **most have a phone**; and **50%** say they are **within 30 minutes** of a mobile money **agent**	▪ **Mobile money education** (i.e., explaining how to pay via a digital platform, giving examples of other uses of mobile money aside from SHS installments) and **uptake through agents** should be a **core focus** of marketing efforts
▪ **M-Pesa** is the **dominant** mobile money platform, with **over half** the households sending or receiving money at least **every other day**, with typical **amounts higher** than the **average SHS installment**	▪ Marketing efforts can **reference the habits** of existing mobile money customers to demonstrate **ease of making payments** and **affordability** of SHS

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

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VALIDATION OF THE SURVEY RESULTS AGAINST OTHER DATASETS PROVIDES REASSURANCE ON THE FINDINGS

\# Discrepancy exceeds 10 percentage points

● Results consistent or discrepancy justified

● Results inconsistent and discrepancy cannot be explained

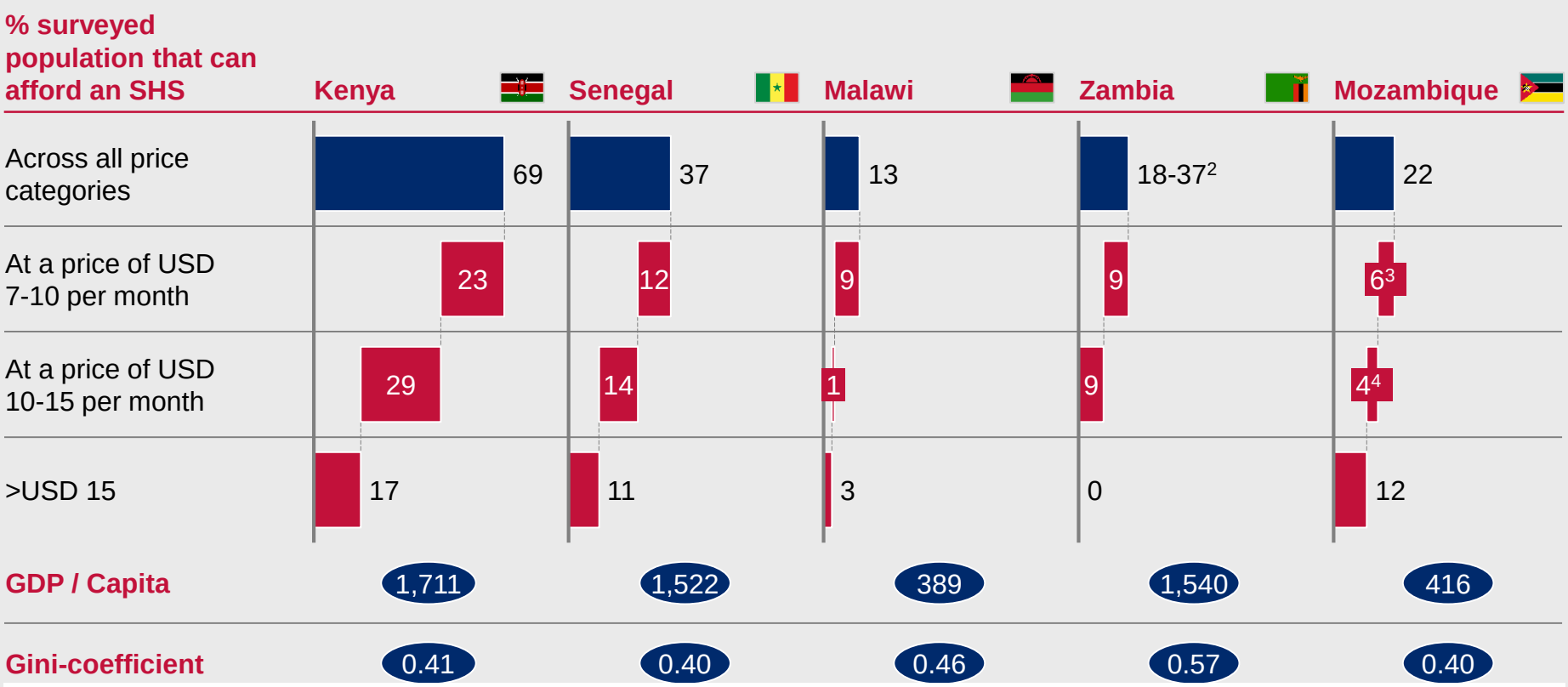
	Data point	Survey result, %	External data points, %	Discrepancy, pp	Discrepancy	Implications for survey	Data sources
Household expenditure and willingness to pay	Share of unelectrified population able to afford solar products based on lighting expenditure	22	22 18	0 5	●	None – affordability as found in this survey is in line with external findings	USAID SAEP outside-in analysis[2] USAID SAEP Zambia (2018)
	Share of unelectrified population able to afford solar products based on self-stated willingness to pay	60[3]	45 31	**15** **29**	●	Self-stated willingness to pay will not be used as the primary determinant for measuring affordability as it appears to be overstated in this survey	GreenLight Mozambique (2018) USAID SAEP Zambia (2018)
SHS awareness, ownership and perception	Awareness of solar products	68	83	**15**	◔	None – the lower awareness than Zambia can be explained by the nascency of Mozambique market	USAID SAEP Zambia (2018)
	Share of households that own a solar product	27	40 35	**13** 8	◔	None – relative maturity of Zambian and Senegalese market explains higher SHS ownership in these countries	Power Africa Senegal (2017) USAID SAEP Zambia (2018)
	Affordability as greatest self-stated barrier to owning a solar product	41	63 61	**22** **20**	◔	Perception of affordability seems distorted in Mozambique compared to other countries – given the much lower GDP per capita, one would expect more households to cite affordability as the greatest barrier in Mozambique than in Kenya or Zambia – this ties in with the overstated willingness to pay (see above)	Power Africa Kenya (2017) USAID SAEP Zambia (2018)
Mobile usage	Mobile phone penetration	83	97	**14**	◔	None – relative GDP/capita (USD $416 vs USD $1,178[1]) explains why Mozambique has a lower mobile phone ownership than Zambia given	USAID SAEP Zambia (2018)
	Mobile money penetration	46	45	1	●	None – mobile money was introduced to both these markets within 24 months (took off in 2010 in Zambia and introduced in 2011 in Mozambique)	USAID SAEP Zambia (2018)

1. World Bank, 2018; 2. See appendix for analysis – uses data from the World Bank Mozambique Poverty Assessment (2018) and the Mozambique Family Budget Survey 2014/2015; 3. Based on self-stated willingness to pay USD $12.50 for basic SHS with radio

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; USAID SAEP Zambia Consumer Affordability survey 2018; Power Africa Kenya off-grid innovation lab mobile survey results (2017); Power Africa Senegal rural off-grid market research (2017)

AFFORDABILITY IS HIGHER THAN EXPECTED WHEN COMPARED WITH ZAMBIA, BUT THE METHODS USED TO CALCULATE ENERGY EXPENDITURE WERE DIFFERENT

Consumer ability to afford SHS monthly payments, % surveyed population[1]



The affordability analysis based on energy expenditure for Zambia included only torch batteries and candles, whereas mobile charging, kerosene and transport to obtain these were also included for Mozambique, explaining Mozambique's unexpectedly higher affordability (22% compared with 18%), given the country has far lower GDP per capita

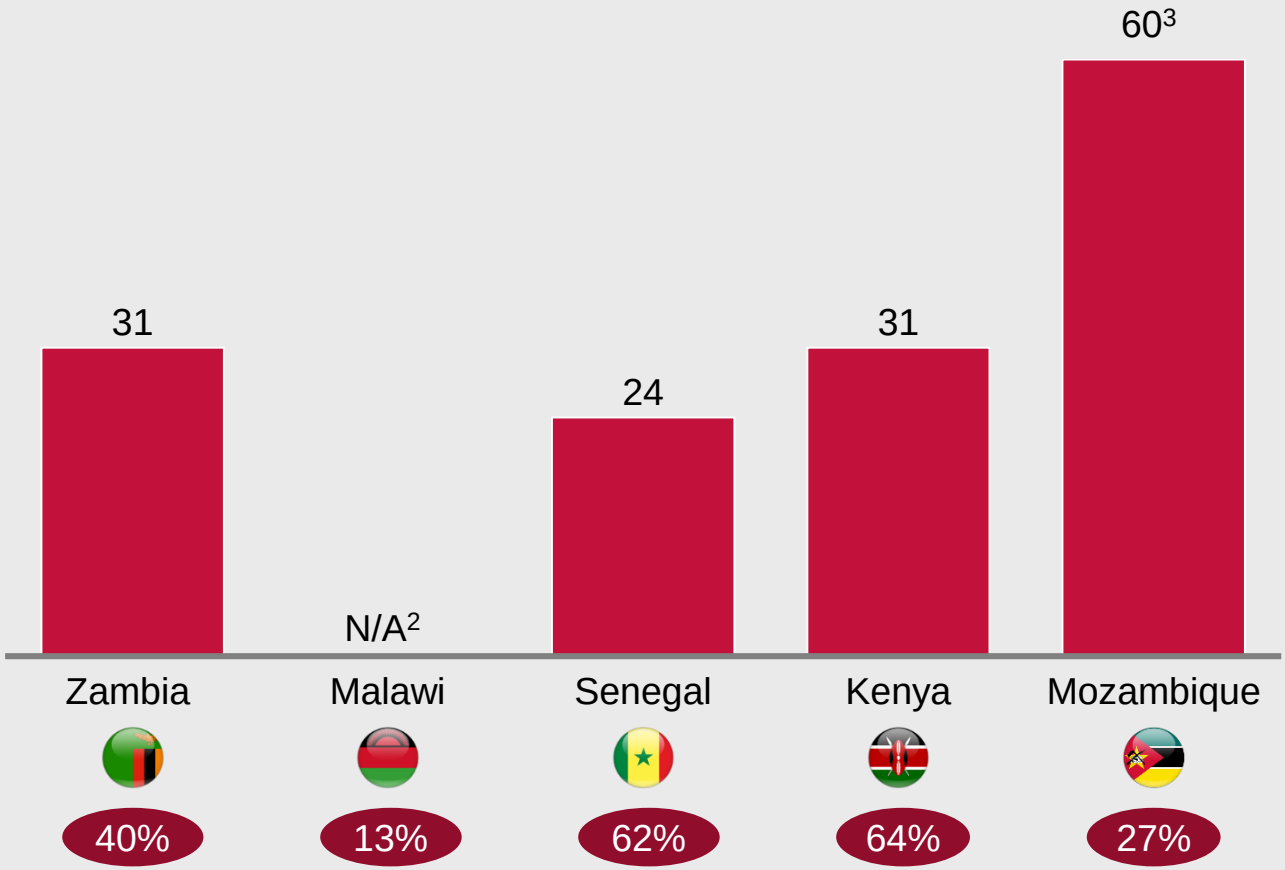
1. Household expenditure surveys used in Kenyan, Malawi and Zambia; SMS survey used for Senegal; 2. 18% based on current household spend on lighting (batteries, kerosene lamps, torchlights), 37% based on self-reported willingness to pay for a system; 3. 6% between USD $7.50- 11.00; 4. 4% between USD $11.00-15.00

SOURCE: Malawi Integrated Household Survey 2014; Power Africa Senegal SMS-based survey (2017); World Bank (2018); USAID SAEP Zambia Household Survey (2018); USAID SAEP Mozambique Consumer Affordability Survey 2019

AFFORDABILITY (BASED ON SELF-STATED WILLINGNESS TO PAY) IS MUCH HIGHER IN MOZAMBIQUE THAN IN KENYA AND ZAMBIA

Households able to afford SHS based on self-stated willingness to pay[1], %

% Electrification rate (2016)



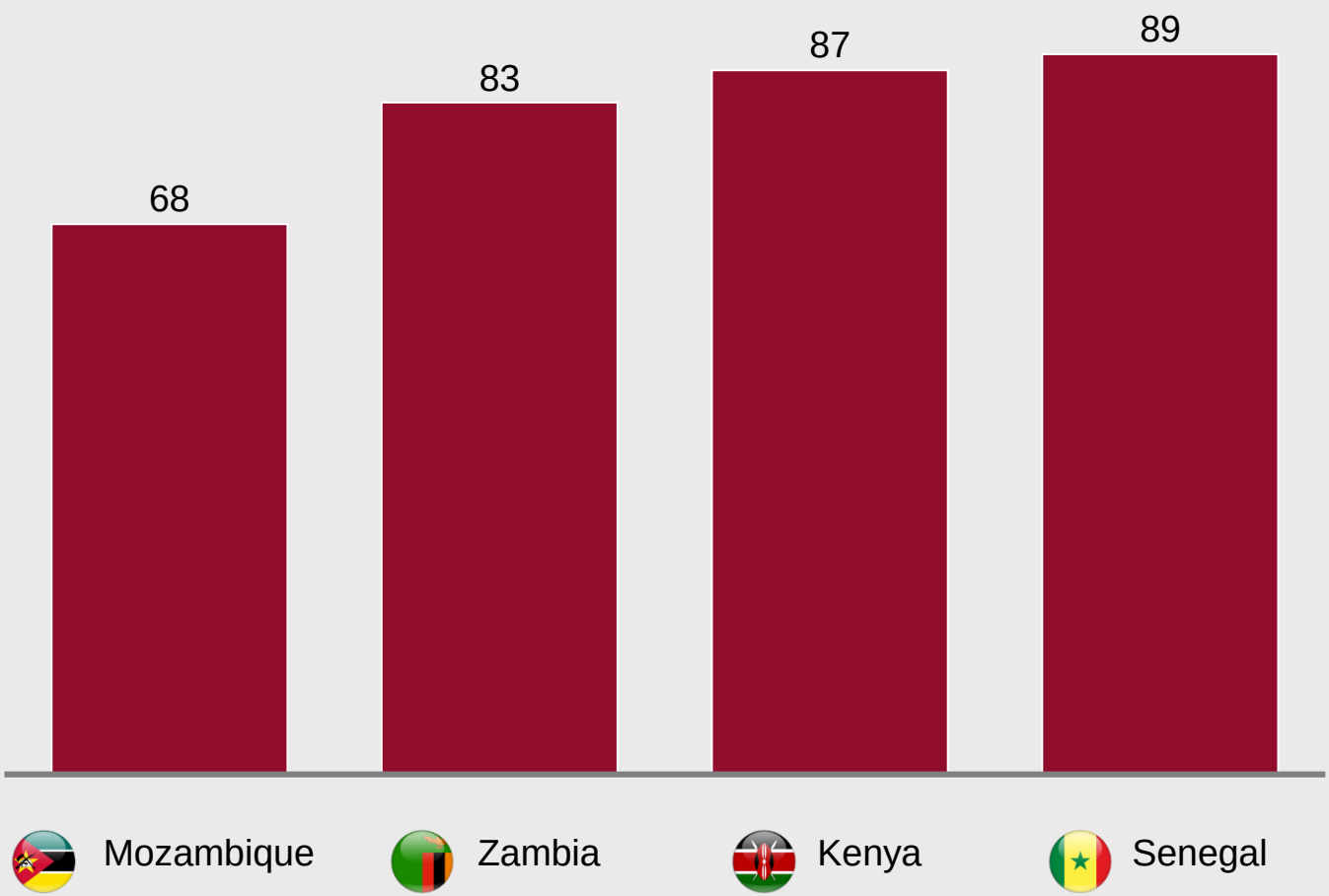
- Affordability based on self-stated willingness to pay for a basic SHS product is much higher in Mozambique (60%) than Kenya and Zambia (both 31%)
- Households in provinces may be optimistic about their ability to afford SHS, or be unfamiliar with making regular installments so overestimate their ability to maintain monthly installments

1. Kenya and Senegal shares adjusted to fit Zambia threshold of USD $7.00 per month for SHS product; 2. Malawi household survey does not have data on self-stated willingness to pay for SHS; 3. Mozambique data is for a USD $12.50 per month threshold, and would therefore be even higher for a unit at USD $7.50. Willingness to pay is similar in Mozambique to that in Uganda, although products in Mozambiaque are ~2 times more expensive

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; Malawi National Household Survey (2014); Power Africa Kenya Off-grid innovation lab survey (2017); Power Africa Senegal rural off-grid market research (2017); USAID SAEP Zambia Consumer Affordability survey 2018

AS EXPECTED, AWARENESS OF SOLAR PRODUCTS IN MOZAMBIQUE IS LOWER THAN IN ZAMBIA, KENYA AND SENEGAL

Awareness of solar, % households

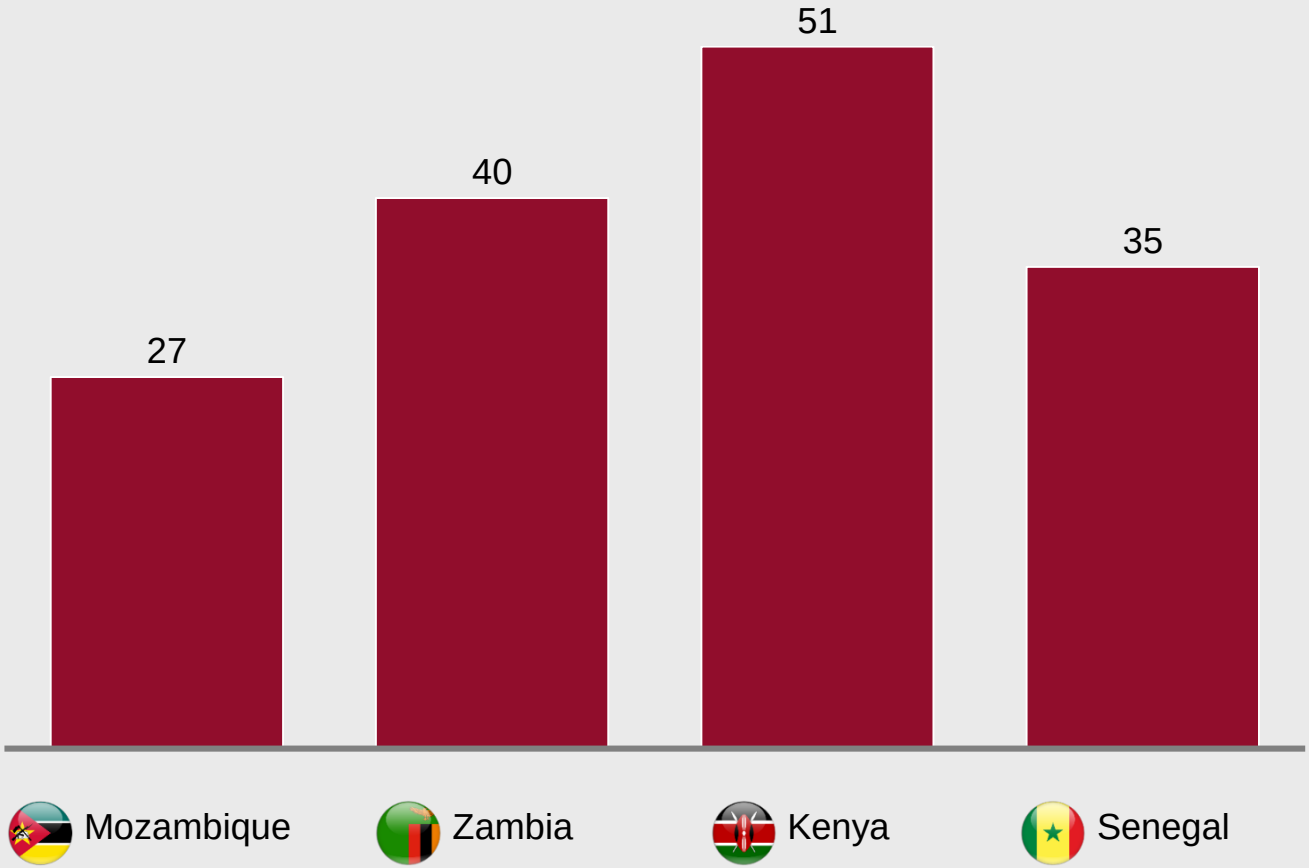


- Awareness of solar products is lower in Mozambique than in Zambia, Kenya or Senegal – this can be explained by the nascency of the market

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; USAID SAEP Zambia Consumer Affordability survey 2018; Power Africa Kenya off-grid innovation lab survey (2017); Power Africa Senegal rural off-grid market research (2017)

SOLAR PRODUCT OWNERSHIP IN MOZAMBIQUE IS LOWER THAN IN ZAMBIA, KENYA AND SENEGAL

Ownership of solar products, % households



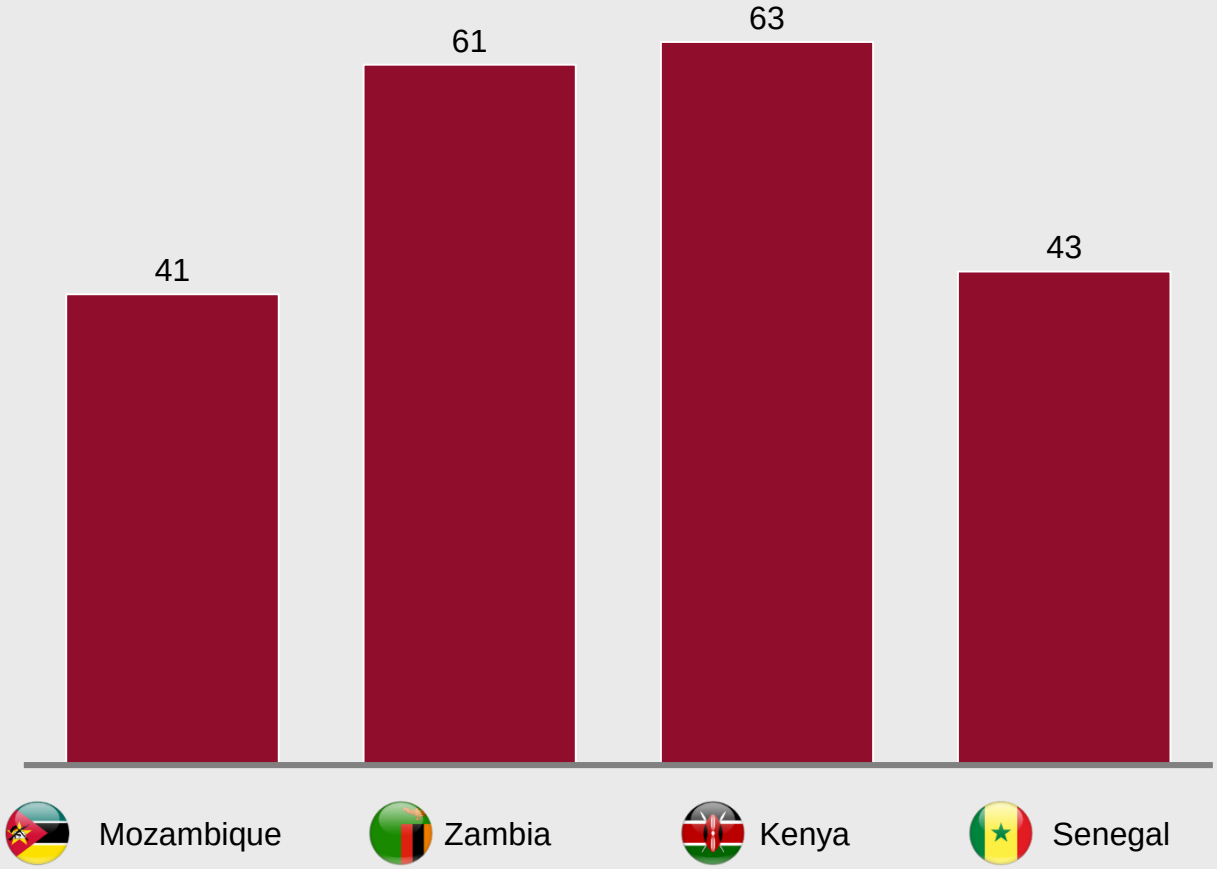
- As expected, ownership of solar products is lower in Mozambique (27%) than in Zambia (40%), Kenya (51%) or Senegal (35%), where the solar markets are more mature

1 World Bank ESMAP tier definitions used

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; USAID SAEP Zambia Consumer Affordability survey 2018;; Power Africa Kenya off-grid innovation lab survey (2017); Power Africa Senegal rural off-grid market research (2017)

ONLY 41% MOZAMBICAN HOUSEHOLDS SAY THEY CANNOT AFFORD SHS, WHILST ~60% SAY THIS IN KENYA AND ZAMBIA

Affordability is the main reason for not owing a solar product, % households



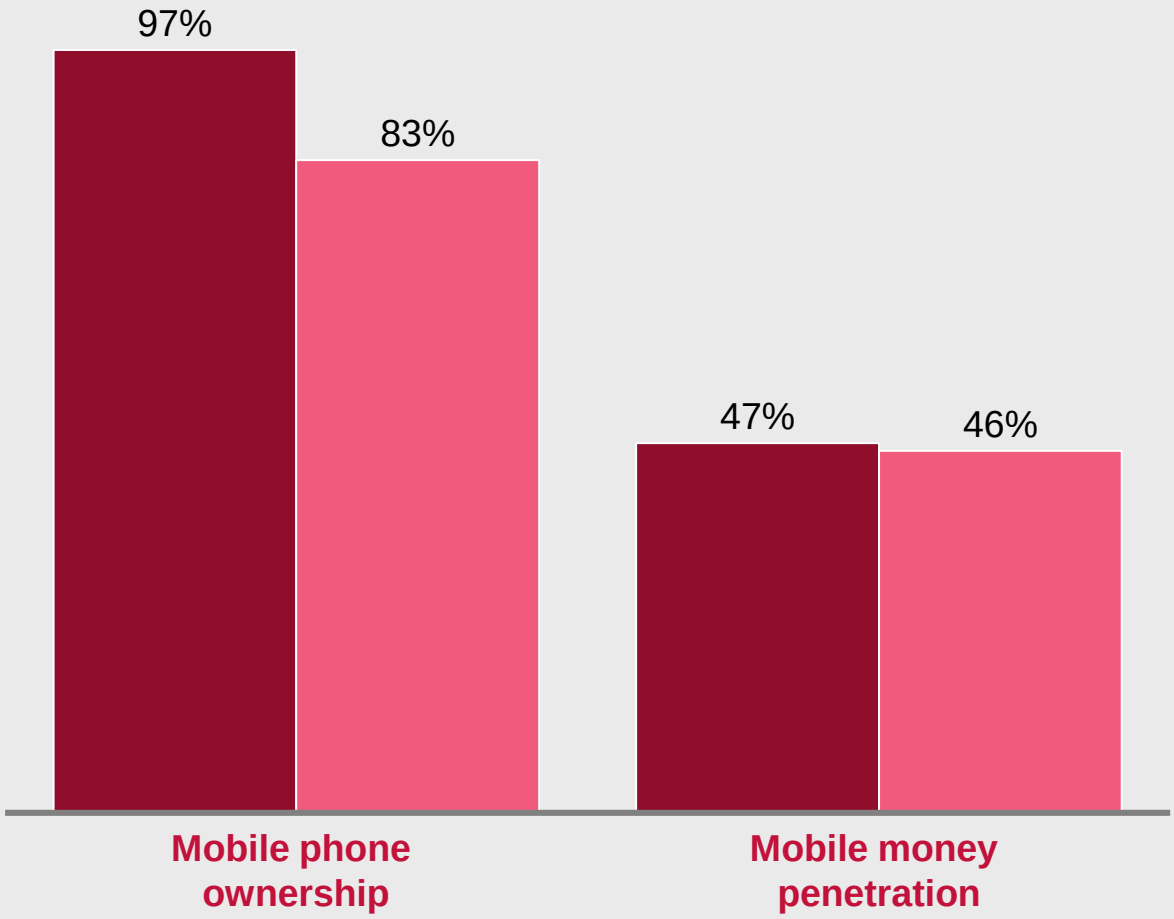
- Only 41% of households in Mozambique state the main reason for not owning SHS is they cannot afford one
- The expectation is that this percentage would be higher than in Kenya and Zambia, given their far higher GDP per capita
- There could be an optimistic view of affordability in Mozambique, or a perception that solar products are cheaper given the active informal market (compared to e.g., Kenya, where the market is more regulated

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; USAID SAEP Zambia Consumer Affordability survey 2018 Off-Grid Solar Market Assessment in Mozambique (GreenLight, December 2018); Power Africa Kenya off-grid innovation lab survey (2017); Power Africa Senegal rural off-grid market research (2017)

MOBILE PHONE OWNERSHIP IN MOZAMBIQUE IS SLIGHTLY LOWER THAN ZAMBIA BUT MOBILE MONEY USE IS SIMILAR

Mobile phone and mobile money penetration, % households

N = 2,585 households (full surveyed sample)



- Mobile phone ownership in Mozambique (84%) is lower than in Zambia (97%) – GDP per capita in Zambia (USD $1,540) is higher than Mozambique (USD $416) that explains the difference
- Mobile money penetration in Mozambique (44%) is similar to that in Zambia (47%), which is logical given the growth trends in each country (mobile money was introduced into Zambia in 2003 but was not widely used till 2010 – mobile money was introduced in Mozambique in 2011 (mKesh) with M-Pesa entering the market in 2013)

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; USAID SAEP Zambia Consumer Affordability survey 2018; World Bank (2018)

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SUMMARY OF INSIGHTS

What is the funding need to bring SHS to Mozambicans without grid in the next 5 years?

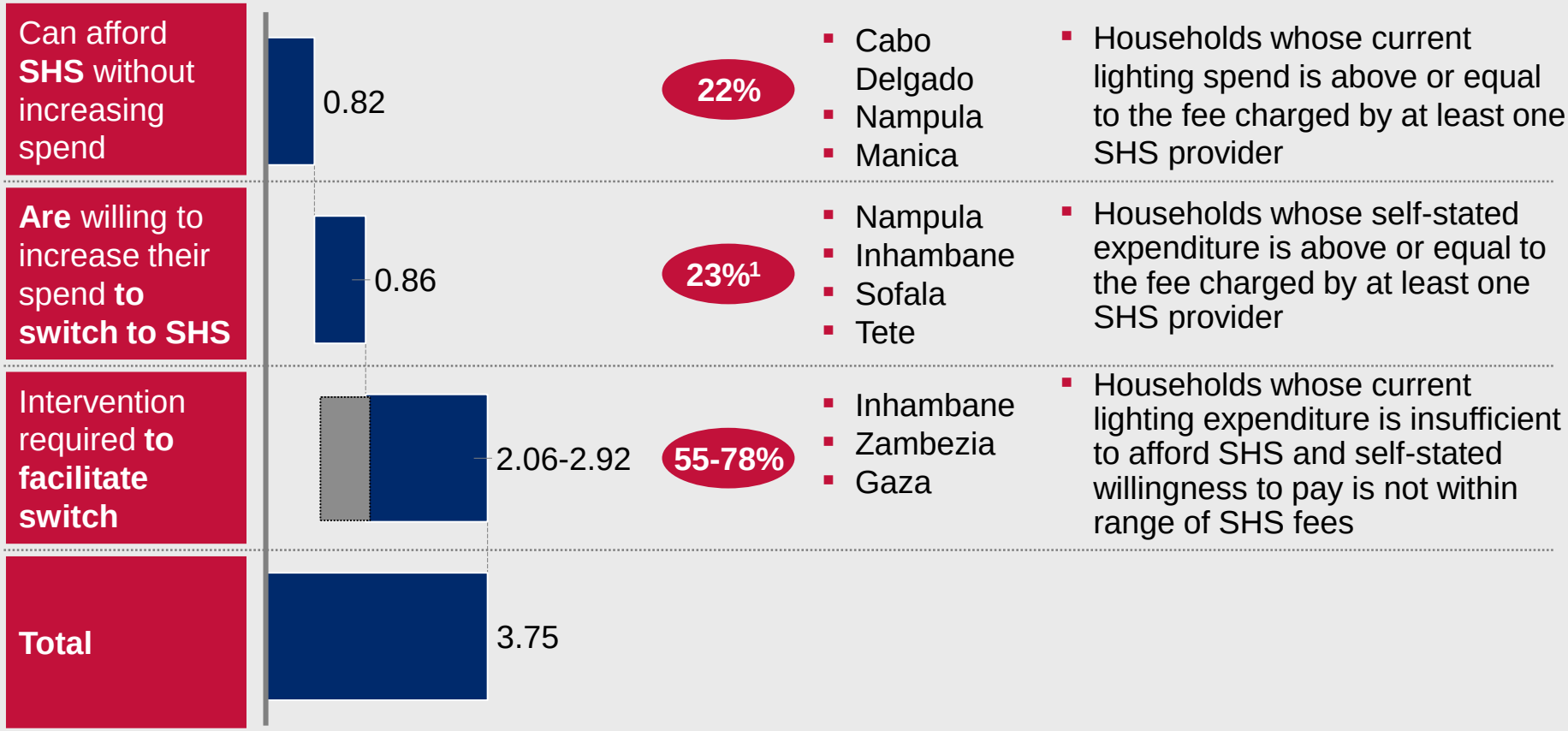
- These findings indicate that **58-78% consumers need financing support** to purchase SHS today
- During the **transition to full grid extension** between 2020 and 2030, SHS is the best solution for the majority of off-grid households. An estimated **4.2 million** households will **not have access to the grid** in **2024 – SHS companies** and **Cooperating Partners** should aim to **work together to close this gap**
- **~2.5 million** of these households will **need funding** to be able **to afford SHS.** The total financial support required to bridge the affordability gap for these households is **USD ~$350 million** (under a two-year PayGo arrangement at USD $7.50 per month)

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

THESE FINDINGS INDICATE THAT 58-78% CONSUMERS NEED FINANCING SUPPORT TO PURCHASE SHS TODAY

X % of total households

Split of households based on affordability,
million unelectrified households (2022)

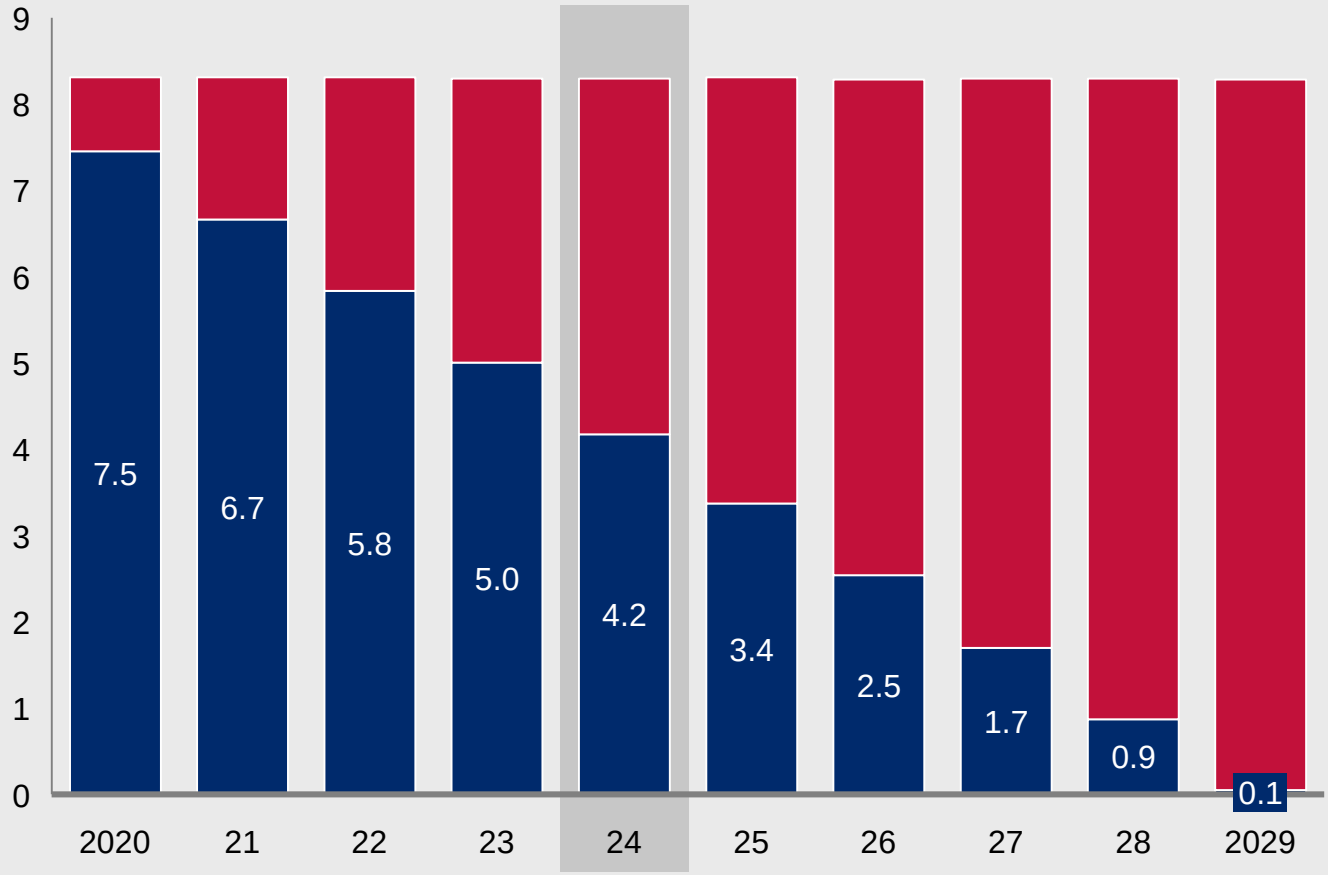


1 Self-stated willingness differential (45% less 22%, based on national statistics which shows up to ~42% HH could afford SHS if willing to pay a premium can afford on lighting expenditure, and GOGLA estimates that, on average, HH increase energy spend by USD $2.85 for 3-10W SHS)

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

THE WORLD BANK PROJECTS THERE WILL BE 4.2 MILLION HOUSEHOLDS WITHOUT ACCESS TO GRID IN 2024

Mozambique least-cost electrification by technology type, # million households

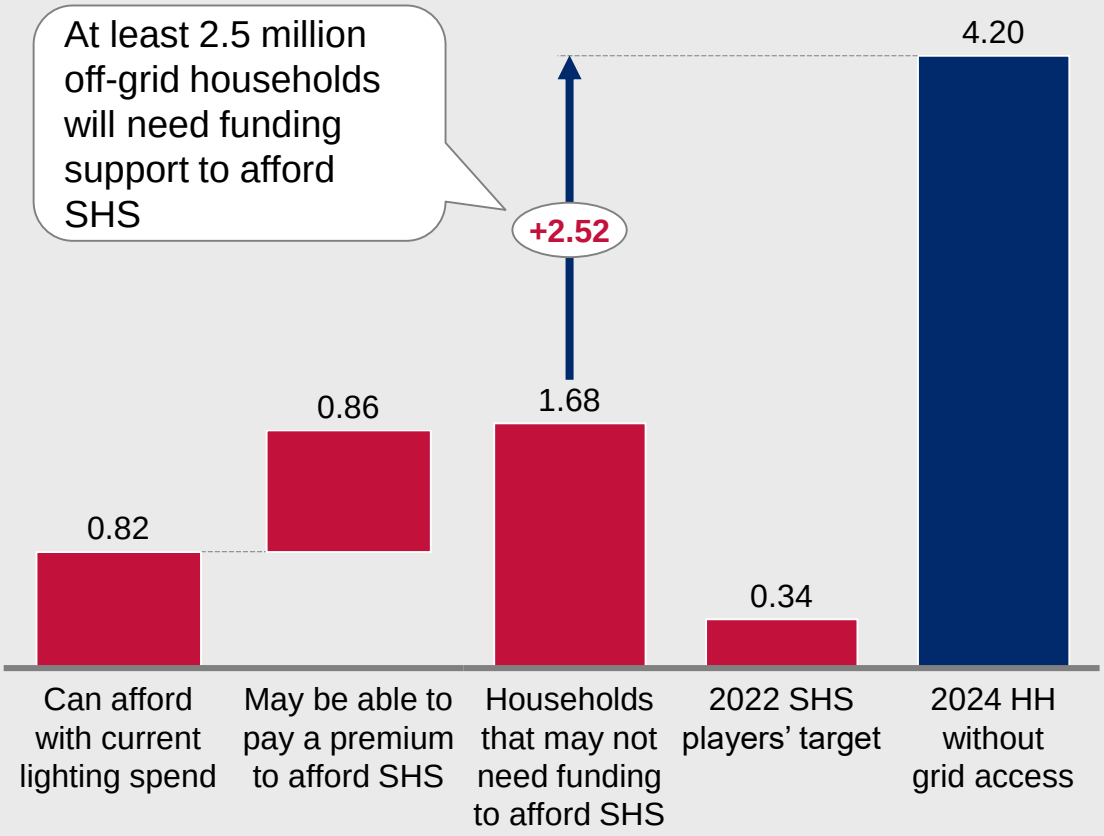


- At the mid-point of transition to full grid extension in 2030, the World Bank estimates that **4.2 million** households will not yet have access to the grid
- This number **will decline** as the grid extends in the following 5 years, but illustrates the potential **mid-term need for SHS distribution**

SOURCE: World Bank October 2019, Mozambique Geospatial Options Analysis Towards Universal Electrification

SHS COMPANIES CAN INCREASE THEIR TARGETS, BUT IN 2024 AT LEAST 2.5 MILLION HOUSEHOLDS WILL NEED SUPPORT TO BUY SHS

Households without access to the grid, # million households



- The number of **households that can afford** SHS (824,000) is **large compared** with the **2022 SHS company targets** (335,000)
- **4.2 million** households will still be **off-grid in 5 years** – SHS is the most logical technology choice for these households
- **At least 2.5 million** of these households will **need funding support to afford SHS**

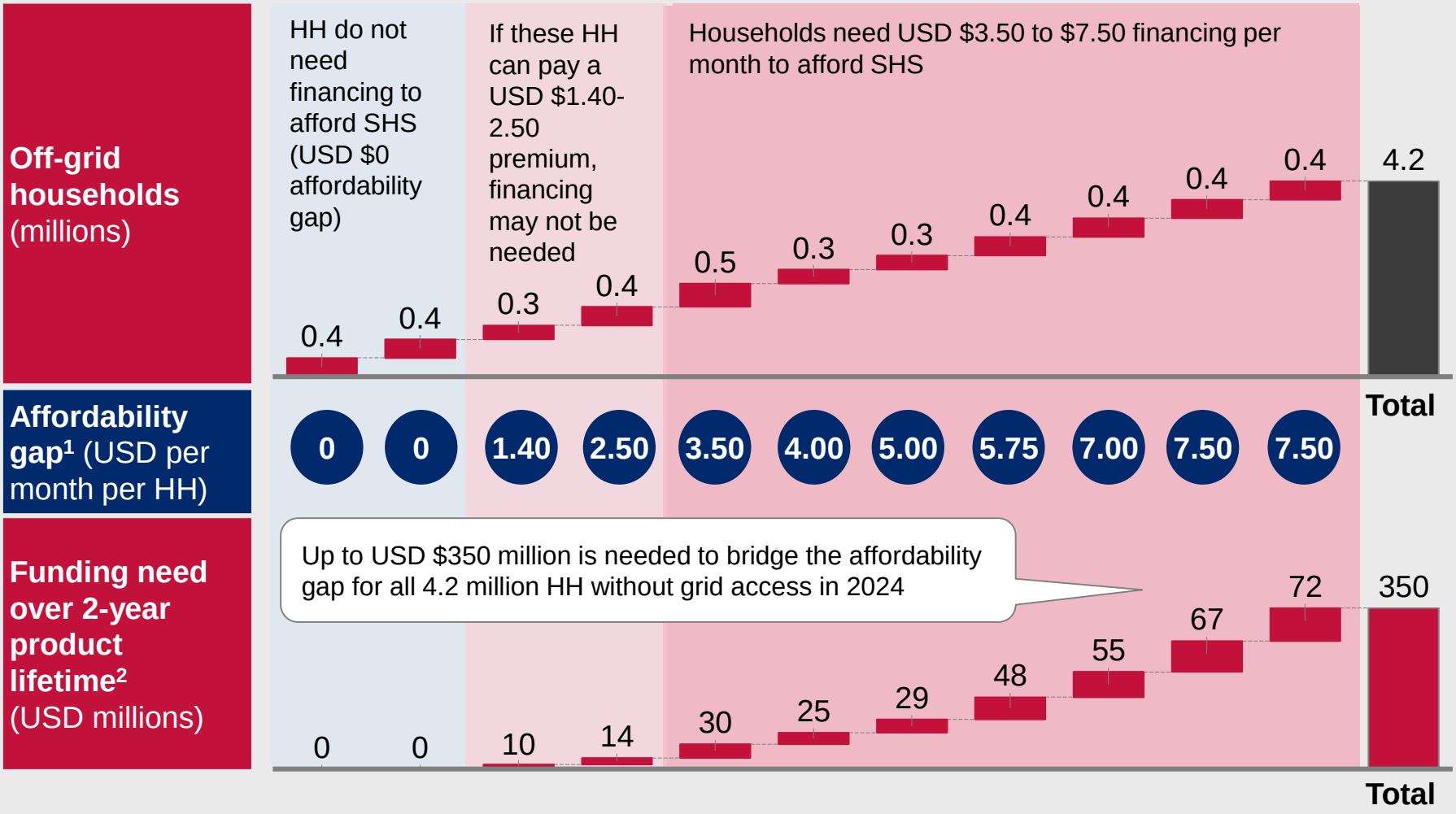
1 Assumptions from the World Bank's 2019 Mozambique Geospatial Options Analysis Towards Universal Electrification, which estimates an unmet need for SHS of 4.2 million households in 2024 as the grid extension plans are rolled out

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; World Bank October 2019, Mozambique Geospatial Options Analysis Towards Universal Electrification

UP TO USD $350 MILLION IS NEEDED TO BRING 4.2 MILLION HOUSEHOLDS ACCESS TO SHS

2024 total households without grid access

Investment required to make SHS affordable to all off-grid households in 5 years



1. Assumes a USD 7.50 per month charge for a basic SHS unit
2. Off-grid households x affordability gap x 24 months. Does not take into account the start-up capital requirement by SHS players

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; EDM; World Bank

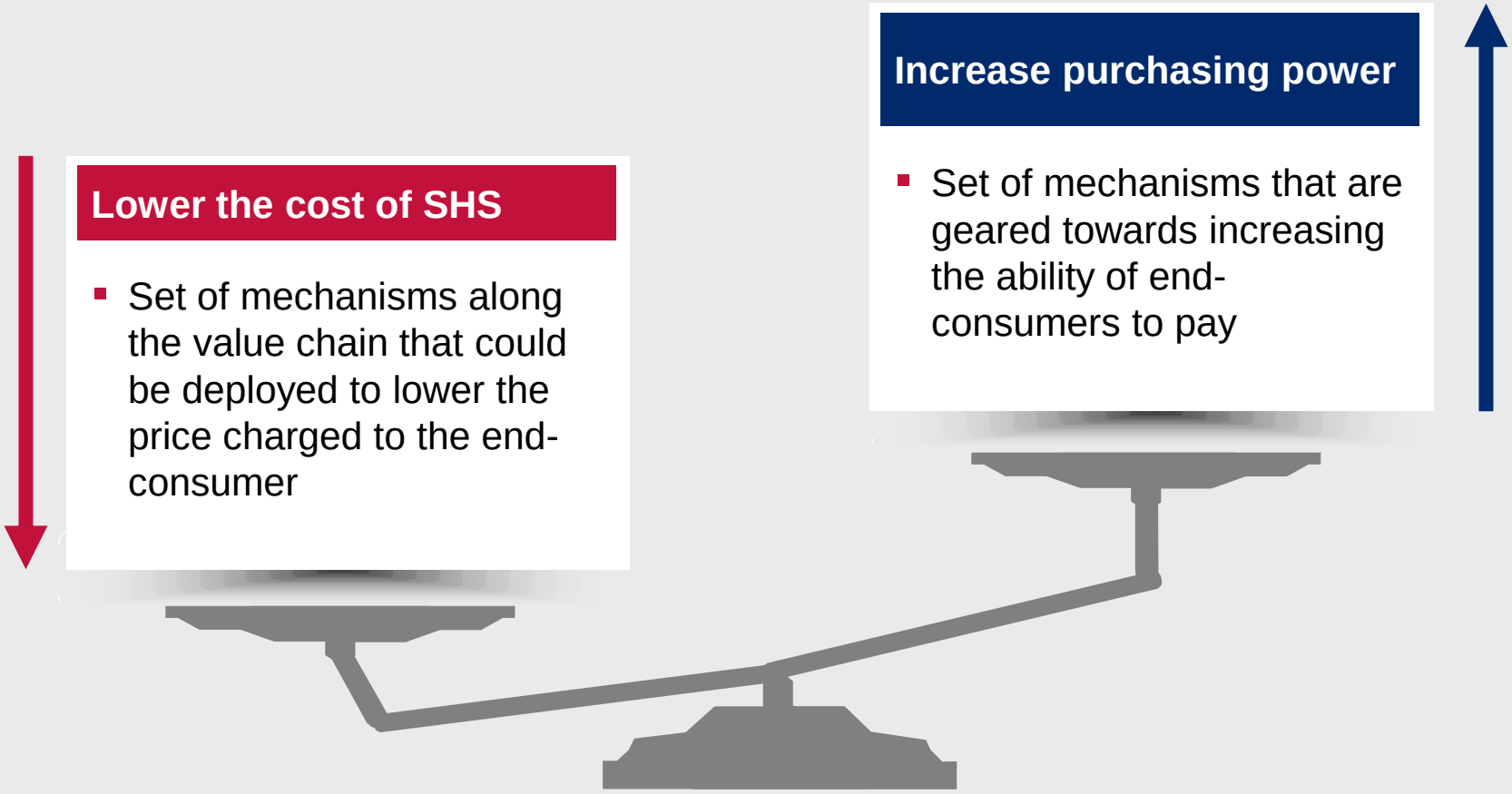
FINANCING MECHANISMS COULD EITHER BE GEARED TOWARDS LOWERING COST OF SHS OR INCREASING THE PURCHASING POWER OF END-CONSUMERS

Lower the cost of SHS

- Set of mechanisms along the value chain that could be deployed to lower the price charged to the end-consumer

Increase purchasing power

- Set of mechanisms that are geared towards increasing the ability of end-consumers to pay



SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

THERE IS A MIX OF FINANCING MECHANISMS THAT COULD BE DEPLOYED ACROSS THE ENTIRE VALUE CHAIN

Role throughout the value chain

	Kit financing	Distribution and logistics	Sales and marketing	Payment	Repair and battery replacement	Consumer credit
SHS companies	▪ Self and debt financing from – Parent company – Commercial banks – Financial backers	▪ Shared logistics platform across different players	▪ Self marketing of products ▪ Agent management with sales incentives	▪ Monitoring of payment collection from consumers ▪ Monitor credit score to reduce risk premium	▪ Technician training to fix components rather than replacing entire system	▪ N/A
Public sector (e.g., donors, government)	▪ Credit line	▪ Fiscal exemptions and standardized importation procedures	▪ Public awareness campaign ▪ Training and supply of sales agents ▪ Provision of market data e.g., geospatial analysis	▪ Awareness of digital financial services ▪ Support aggregators in scaling operations	▪ Solar academies and technician training ▪ Network of local technicians	▪ Support for microfinance bodies via a credit line ▪ Create a credit scoring system using household-fed data ▪ Consumer financing for bottom of the pyramid

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

WHAT DOES THIS MEAN FOR COOPERATING PARTNERS?

Result and insight	Implication for Cooperating Partners
▪ The number of **households that can afford** SHS is **large compared** with the **SHS company targets**	▪ Access to **working capital financing** is likely the greatest constraint for SHS companies to reach this market
▪ **~0.86** million households **may** be **willing to pay a premium** for SHS	▪ This market should be **monitored** to **understand** the implications for the **overall consumer financing need**
▪ This is described as a **crowded space** but, to date, there is a **gap** of USD $x million **to reach** the **USD $350 million consumer financing need**	▪ There is **room for multiple parties** to fund SHS scale-up
	▪ **Absorption capacity** of the private sector needs to be assessed
	▪ It's important to take a **phased approach** to take into account **reasonable scale-up speed**
	▪ **Incentives** can be **designed to target** specific **consumer affordability profiles**

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

WHAT DOES THIS MEAN FOR THE GOVERNMENT OF MOZAMBIQUE?

Result and insight	Implications for Government
▪ **~1.68 million** households **can currently afford SHS**, accounting for **40%** of the **off-grid** households in **2024**	▪ **SHS** is likely to be a **large component** of **achieving universal access**
▪ **~2.5 million** households **cannot afford SHS** at current costs and are unlikely to gain access to the grid in the next 5 years	▪ There is a **significant access gap** that can be meaningfully **addressed** through **government-led initiatives to increase affordability,** e.g., fiscal incentives, consumer-targeted subsidies, results-based-financing for private sector, facilitating ability of SHS companies to register for investment project authorization, **and accessibility,** e.g., incentivizing mobile operators to include full capability for mobile money across their networks, enforcing registration of SHS entities to allow for accurate energy access tracking and planning

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

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THE SURVEY TARGETED 9 PROVINCES, WITH AT LEAST 65% RURAL AND 85-90% WITHOUT ACCESS TO THE GRID

	Dimension	Approach	Result
Survey Sample	**Size of sample**	▪ The **1-sample t-test**, recommended to us through consultation with IDinsight, was used to **determine a sample size** that would be statistically significant, with a **+/- 5% margin of error**	▪ A minimum **sample size of 210** is required **per province** ▪ Maximum **+/-5% margin of error** (lower at district level)
	Geographic Spread	▪ **Cover key provinces of interest to SHS companies, whilst** ensuring nation-wide relevance ▪ **Stratified** sample at **province** and **district** level, with **half the districts** in each province surveyed **at random**[1] (except Cabo Delgado and Sofala where districts were selected according to safety parameters)	▪ Survey **covers 9 provinces** (excludes Maputo City and Niassa) ▪ **55% districts covered at national level** (76 of 138, with ~50% districts covered per province[2])
	Rural/urban split	▪ Ensure **representation of the national rural/urban split** at **national** and provincial levels (35% urban/peri-urban and 65% rural) ▪ Sample taken from **areas of interest for market development** for SHS companies, using definitions for rural/urban/peri-urban as follows: - **Rural**: **>10km from the epicenter of an urban area or town center**, with low population, and has an urbanicity[2] definition of '**village or small settlement**' - **Peri-urban**: transition area between urban and rural **but <10km from the epicenter of an urban area or town**, and has an urbanicity definition of '**semi-dense town or semi-dense medium settlement**' - **Urban**: town/city with high density population and advanced infrastructure, with an urbanicity definition of '**dense town or dense medium settlement**' or '**suburbs or semi-dense area near a medium or large settlement**'	▪ The overall sample includes **35% urban/peri-urban** and **65% rural** participants ▪ Survey targets **urban outskirts** and **rural settlement** areas (but **not deep rural** / standalone households, urbanicity category 11)[3]
Respondents	▪ The survey targets **85-90%** households with **no access to grid electricity** ▪ The **head or decision maker** of the households answered the survey ▪ The survey targets a minimum of **30% women**		

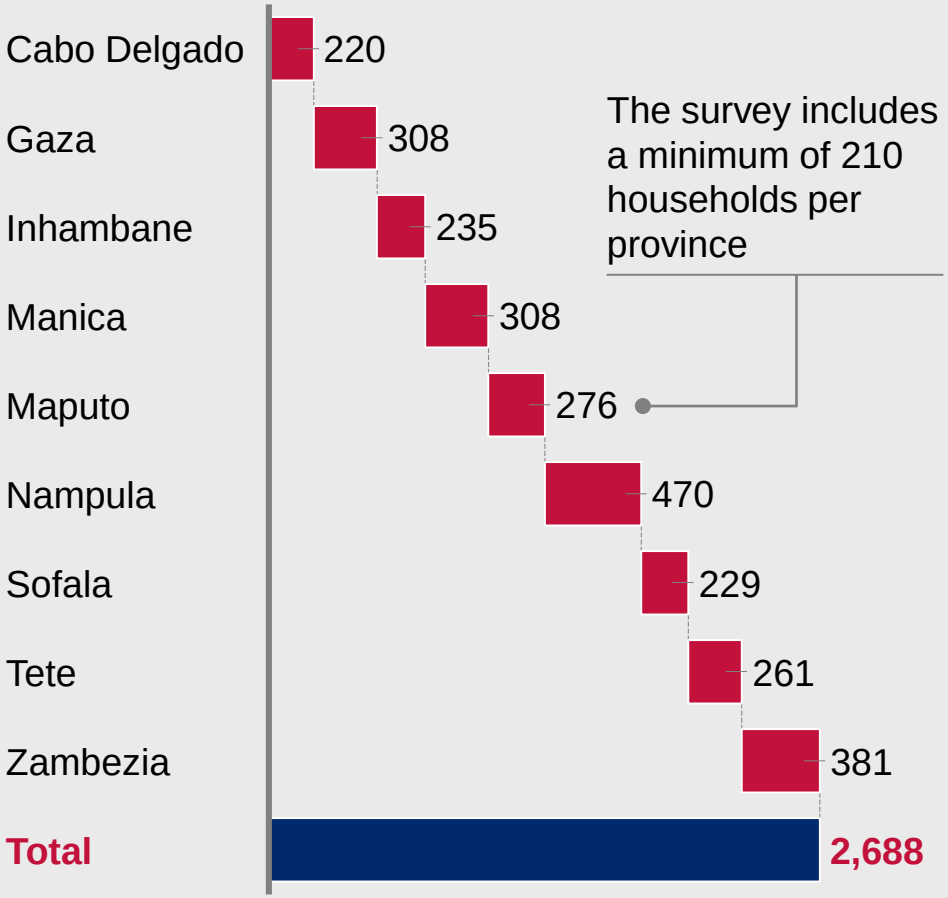
1. Districts surveyed chosen by survey team; 2. Urbanicity defines the degree to which a given geographical area is urban as per the European Commission; 3. See the appendix for a map showing the location of interviews overlaid with rural settlements and "deep rural" areas (standalone households, urbanicity category 11)
2. Except Sofala where 5 out of 13 (38%) districts were surveyed

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

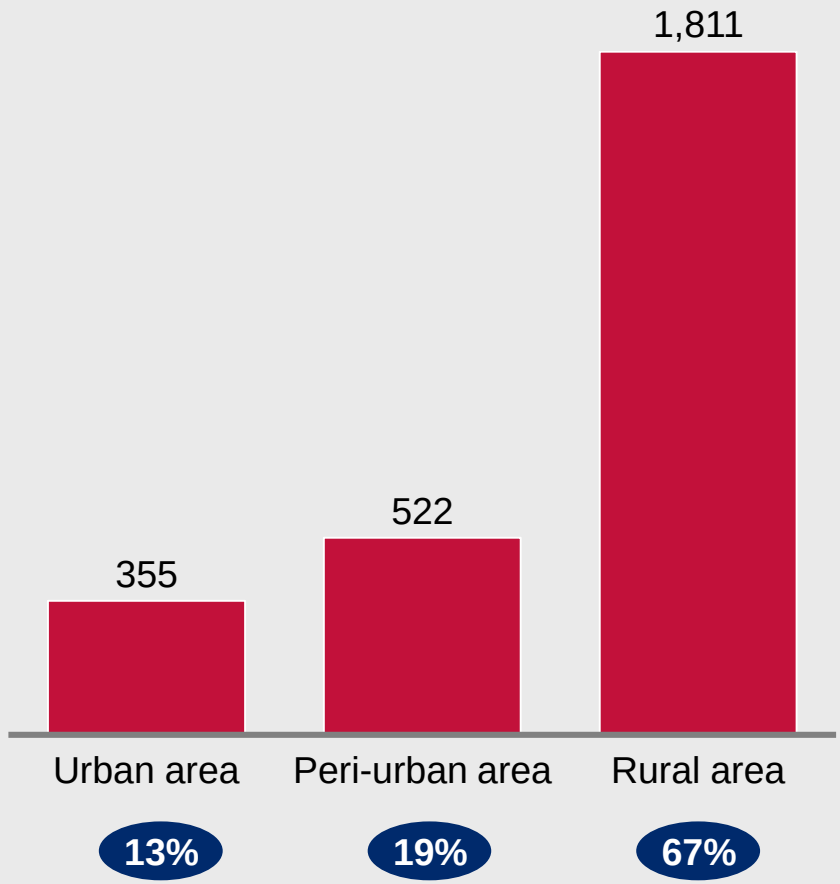
THE SURVEY TARGETED >210 HOUSEHOLDS PER PROVINCE AND INCLUDES >65% HOUSEHOLDS IN RURAL AREAS

% % of total households

Geographic distribution of the households,
Number of households



Split of households by settlement type[1],
Number of households

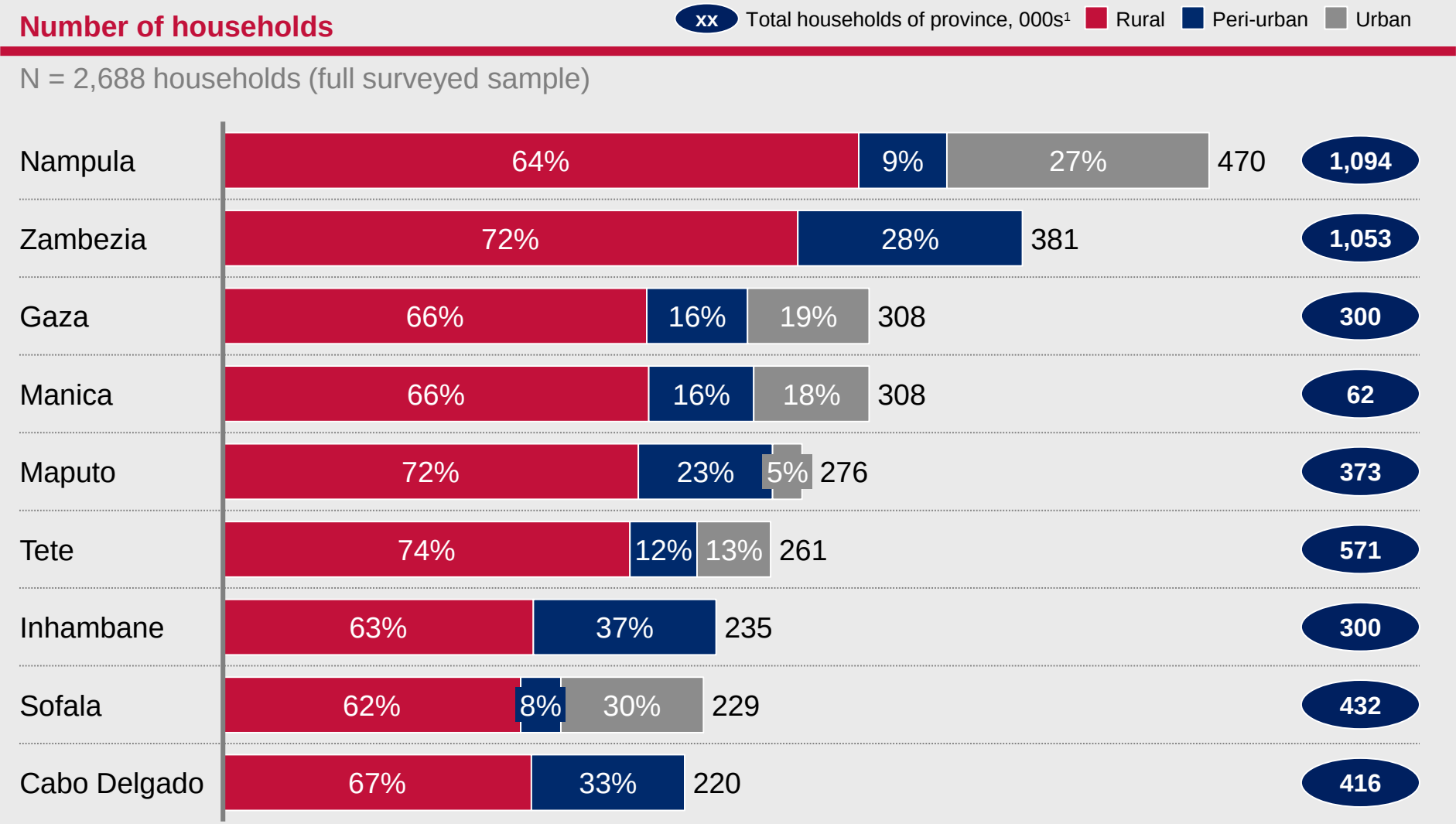


1. The urban-rural split was designed according to the urban-rural split in Mozambique overall, which is 65% rural and 35% urban/per-urban according to the World Bank (2018)

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

IN EACH PROVINCE, AT LEAST 62% OF THE TOTAL SURVEYED HOUSEHOLDS ARE IN RURAL AREAS

Number of households

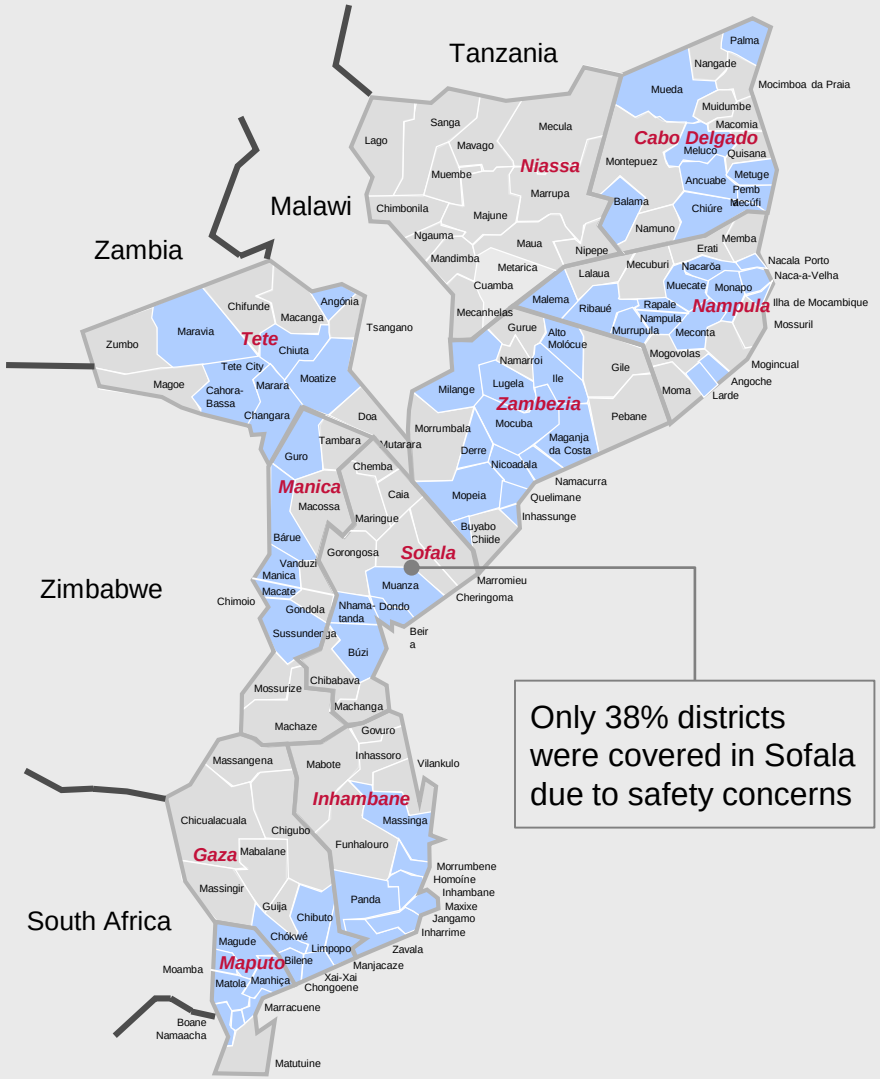


1. Total households from Columbia University's Center for International Earth Science Information Network, with assumption that 1 household = 5 people.

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; Columbia University Center for International Science Information Network

THE SURVEY TARGETED AT LEAST 50% DISTRICTS IN 9 PROVINCES

Breakdown of districts surveyed in Mozambique

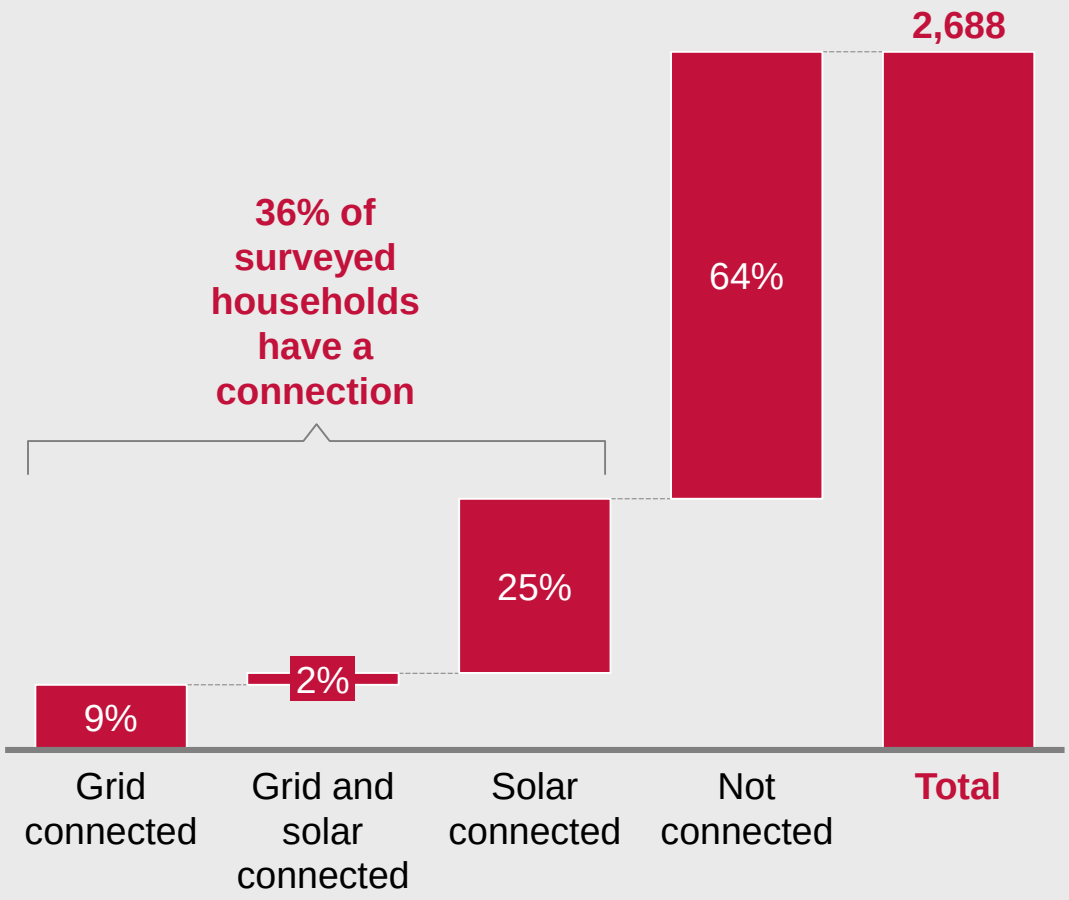


Province	Districts covered in survey	Total districts	District coverage, %
Cabo Delgado	8	17	47
Gaza	7	14	50
Inhambane	9	14	64
Manica	8	12	67
Maputo	7	8	88
Nampula	14	23	61
Sofala	5	13	38
Tete	7	15	47
Zambezia	11	22	50
Total	**76**	**138**	**55**

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

THE SURVEY TARGETED 85-90% OFF-GRID HOUSEHOLDS – ONLY 9% HOUSEHOLDS ARE GRID-CONNECTED WHILST 25% HAVE SOLAR

Level of electrification across surveyed households,
Number of households (full surveyed sample, N = 2,688)



- **36% of households have either a grid or solar connection**, compared with a national energy access rate of 28% (6% in rural and 54% in urban areas) – this makes sense given that the survey was not conducted in deep rural areas that are likely to have lower electrification rates[1]
- The survey is **skewed towards households without an Electricidade de Mozambique (EDM) connection** (targeting 85-90%) as this is the target market for SHS companies

1. See the appendix for a map showing the location of interviews overlaid with rural settlements and "deep rural" areas (standalone households, urbanicity category 11)

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

THE SURVEY CATEGORIZES HOUSEHOLDS INTO FOUR SEGMENTS

Category	Description
Grid electrified	▪ Grid (EDM) connected households
SHS electrified and grid electrified	▪ Grid (EDM) connected households that also currently own a solar product (i.e., pico-lantern or more advanced solar systems)
SHS electrified but not grid electrified	▪ Off-grid households that currently own a solar product (i.e., pico-lantern or more advanced solar systems)
Not electrified	▪ Households that currently lack any form of electrification

The full survey questionnaire is available on request

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

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KEY ASSUMPTIONS

Assumption	Description
Rational decision making	▪ Report assumes that households will opt for higher quality energy provided no cost-barrier exists ▪ The report does not incorporate cultural beliefs and practices that, if present, may alter decision making
Statistical significance	▪ A sample size of 210 households per province is considered to be statistically significant and robust enough to draw inferences
Low-income households	▪ Report defines a low-income household as any household that spends less than the USD $62.50 per month (~USD $2.00 per day)[1]
Household heads	▪ Survey is restricted to heads of households (typically the husband/father or wife/mother in a home) and excludes all dependents on the assumption that acquiring SHS is a decision that would typically made by the head of a household
Lighting and power expenditure	▪ To calculate energy expenditure, the survey asks households - Quantities of torch batteries, candles, kerosene used per week - Amount spent per week on candles, kerosene, mobile charging and transport. The average amount paid for each of these items is as follows: Candles USD $0.20-0.25; Torch batteries USD $0.11; Kerosene USD $1.08-1.16; Monthly mobile charging USD $1.20-1.54; Monthly transport to obtain all these USD $1.56-1.98. USD $0.11 is used as average price of torch batteries
Monthly installments for SHS	▪ The average monthly installment for a basic SHS kit is USD $7.50 based on conversations with the main SHS players in Mozambique
Exchange rate	▪ USD $1.00 = MZN 63.99 (December 2019)

1. https://datahelpdesk.worldbank.org/knowledgebase/articles/193308-there-are-multiple-international-poverty-lines-wh

RANGES FOR MONTHLY HOUSEHOLD AND LIGHTING EXPENDITURE WERE CHOSEN TO BE IN LINE WITH INTERNATIONAL STANDARDS AND SHS COSTS

Metric	Ranges used, USD $	Rationale
Monthly household expenditure	▪ Less than 12.50 ▪ 12.50 - 37.50 ▪ 37.50 - 62.50 ▪ 62.50 - 87.50 ▪ More than 87.50	▪ The mid-point, USD $62.50, is the international poverty line, USD $2.00 per day or per month[2] ▪ Ranges were arranged either side of this in logical intervals in Meticals – these were similar ranges used in the USAID SAEP Zambia Consumer Affordability survey
Monthly household expenditure on lighting and power[1]	▪ Less than 4.00 ▪ 4.00 - 7.50 ▪ 7.50 - 11.00 ▪ 11.00 - 15.00 ▪ More than 15.00	▪ The mid-point, USD $7.50, is the average monthly cost of a basic SHS ▪ Ranges were arranged either side of this at logical intervals to reflect low-cost, basic SHS and higher cost SHS products

1. Includes expenditure on candles, torch batteries, kerosene, mobile charging and transport to obtain all these
2. World Bank (2018)

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

STATISTICAL METHODOLOGIES

	Description
Weighting	▪ Overall results are weighted according to the population of the provinces. As a result, overall results may not equal the sum of the results for individual provinces
Exclusion of responses	▪ Households that selected ‘do not know’ or refused to answer for a particular question are excluded from corresponding analyses

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

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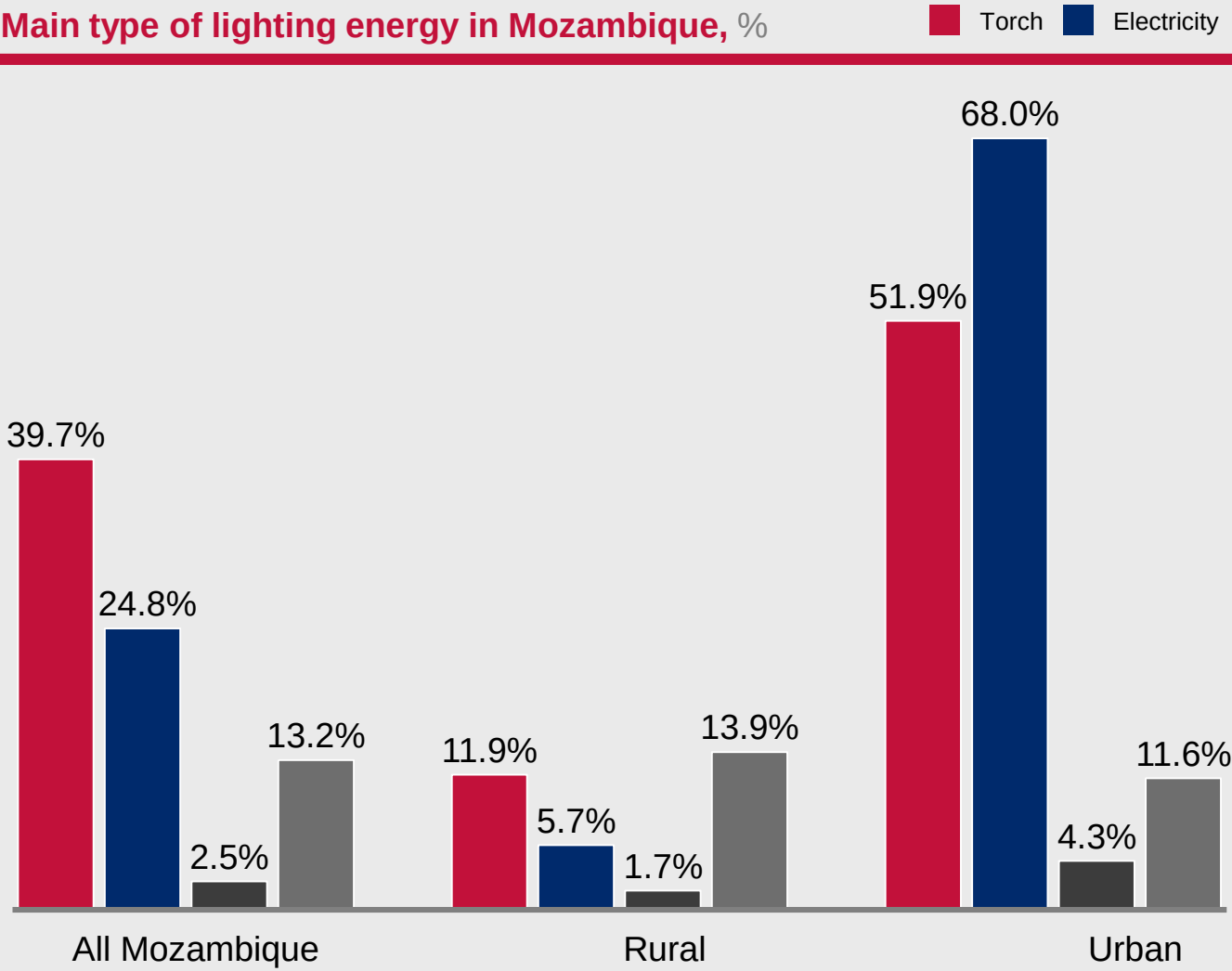
NATIONAL STATISTICS INDICATE THAT TORCHES AND KEROSENE ARE THE MOST COMMON SOURCES OF LIGHTING FOR RURAL HOUSEHOLDS

Main type of lighting energy in Mozambique, %



- Torches are the most common source of lighting across Mozambique, mostly driven by urban households
- Kerosene is the most common type of lighting in rural areas
- Electricity use dominates in the urban areas
- Candles are used by <5% of the population

SOURCE: Mozambique Family Budget Survey 2014/15

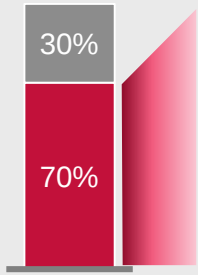
ABILITY TO PAY IS DEFINED BY EXPENDITURE ON LIGHTING, INCLUDING TORCH BATTERIES, CANDLES, KEROSENE, MOBILE CHARGING AND TRANSPORT

Weekly household consumption of candles, torch batteries, and kerosene, %

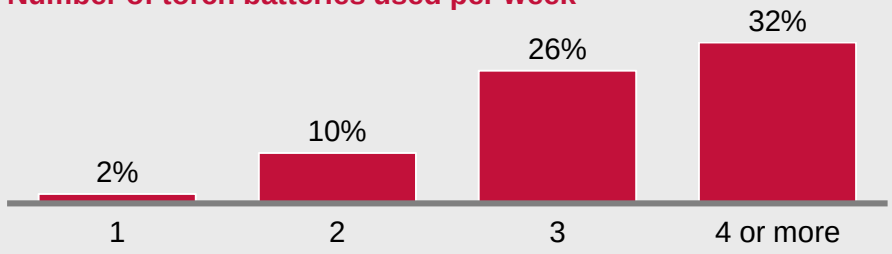
HH do not use energy source
HH use energy source

N = 2,392[1] households (restricted to unelectrified households)

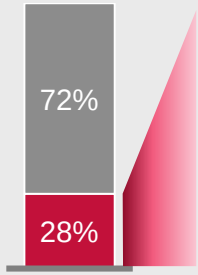
Torches
N=2,346



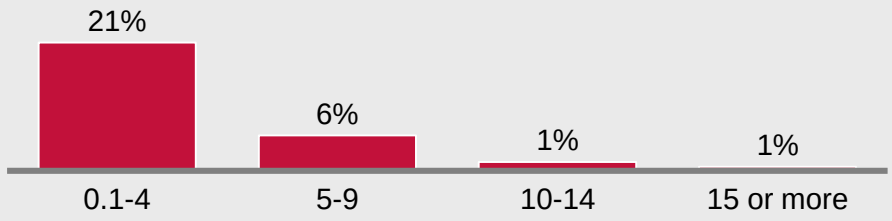
Number of torch batteries used per week



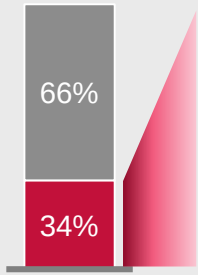
Kerosene
N=2,330



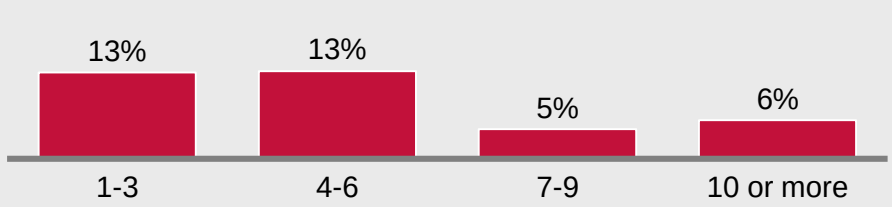
Number of liters of kerosene used per week



Candles
N=2,343



Number of candles used per week



- Torches are the main source of lighting (in 70% households), with the greatest proportion of torch owners (32%) using 4 or more batteries per week
- Candles and kerosene are not used in the majority of households (66% and 72%, respectively)
- Kerosene use is very low - kerosene has since been replaced by low-cost alternatives (e.g., pico and other solar products)
- The average amount paid for each of these items is as follows: Candles USD $0.20-0.25; Torch batteries USD $0.11; Kerosene USD $1.08-1.16; Monthly mobile charging USD $1.20-1.54; Monthly transport to obtain all these USD $1.56-1.98. USD $0.11 is used as average price of torch batteries

1. The number of households differs for the three alternate energy sources due to exclusion of households that did not know or refused to answer

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; Interviews with stakeholders

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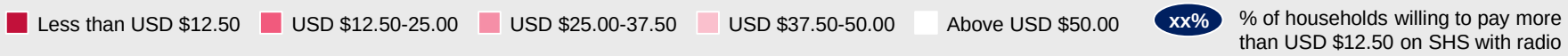
SAEP'S CONSUMER AFFORDABILITY SURVEY COVERS GREATER GEOGRAPHY AND SAMPLE SIZE THAN PREVIOUS SURVEYS

Value addition of the SAEP survey

	Market attractiveness analysis and demand assessment for mKopa solar systems in Mozambique	Mozambique off-grid assessment	Mozambique consumer affordability survey
Analytic lead	▪ GreenLight	▪ GreenLight	▪ McKinsey
Organization lead	▪ mKopa	▪ World Bank	▪ SAEP
Year	▪ 2016	▪ 2018	▪ 2019
Geographic reach	▪ Mbamba district in **Maputo province**	▪ **Maputo province** (2 districts) ▪ **Manica province** (5 districts) ▪ **Zambezia province** (2 districts)	▪ **9 provinces** (all provinces excluding Maputo city provincial area and Niassa)
Sample size	▪ 80 households	▪ 400 households	▪ 2,688 households
Parameters/key questions	▪ **Market willingness to pay** for mKopa services ▪ Household **energy habits and expenditure** ▪ **Awareness** and understanding of **solar** products ▪ **Awareness** and usability of **mobile payment** systems ▪ Other **energy related behavioral aspects**	▪ **Affordability** (user ability to purchase good or service) ▪ **Awareness** (knowledge interviewees have of a product or service itself and information of how to use it most effectively) ▪ **Potential benefits** (perceived potential benefits of users with regards to goods and services) ▪ **Quality** (how well a product or delivered service conforms to client expectations) ▪ **Accessibility** (ease/difficulty of obtaining good or service at the time and place needed)	▪ **SHS awareness, ownership and perception** – Do people know about and/or own SHS? – How do people perceive solar energy? – What prevents households from purchasing SHS? ▪ **Mobile phone and mobile money usage** – What is the penetration of mobile phones and mobile money? – How much do households transact on mobile money platforms? ▪ **Household expenditure & willingness to pay for SHS** – What is the average household expenditure, and does it vary over time? – Are households able to afford SHS products? – How much are households willing to pay for SHS products?
Methodology	▪ Combination of household questionnaires and focus group discussions ▪ Survey administered using electronic tablets	▪ In person interviews ▪ Survey administered using electronic tablets	▪ Computer assisted personal interviewing (CAPI) survey conducted on sample of 2,688 randomly selected households

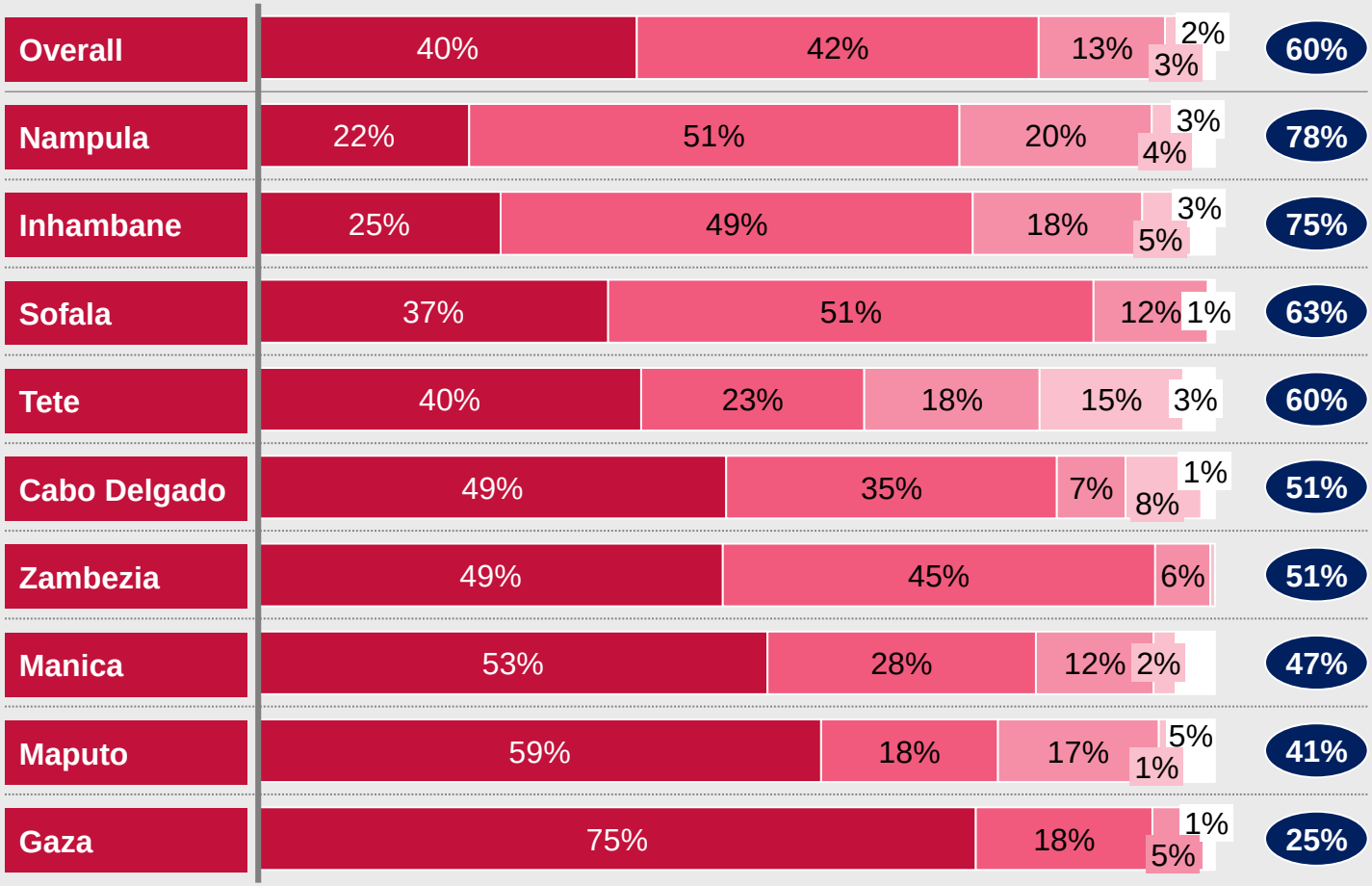
SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

60% OF HOUSEHOLDS SAY THEY CAN AFFORD OVER USD $12.50 PER MONTH FOR AN SHS WITH RADIO



Self-stated willingness to pay for SHS, % ,

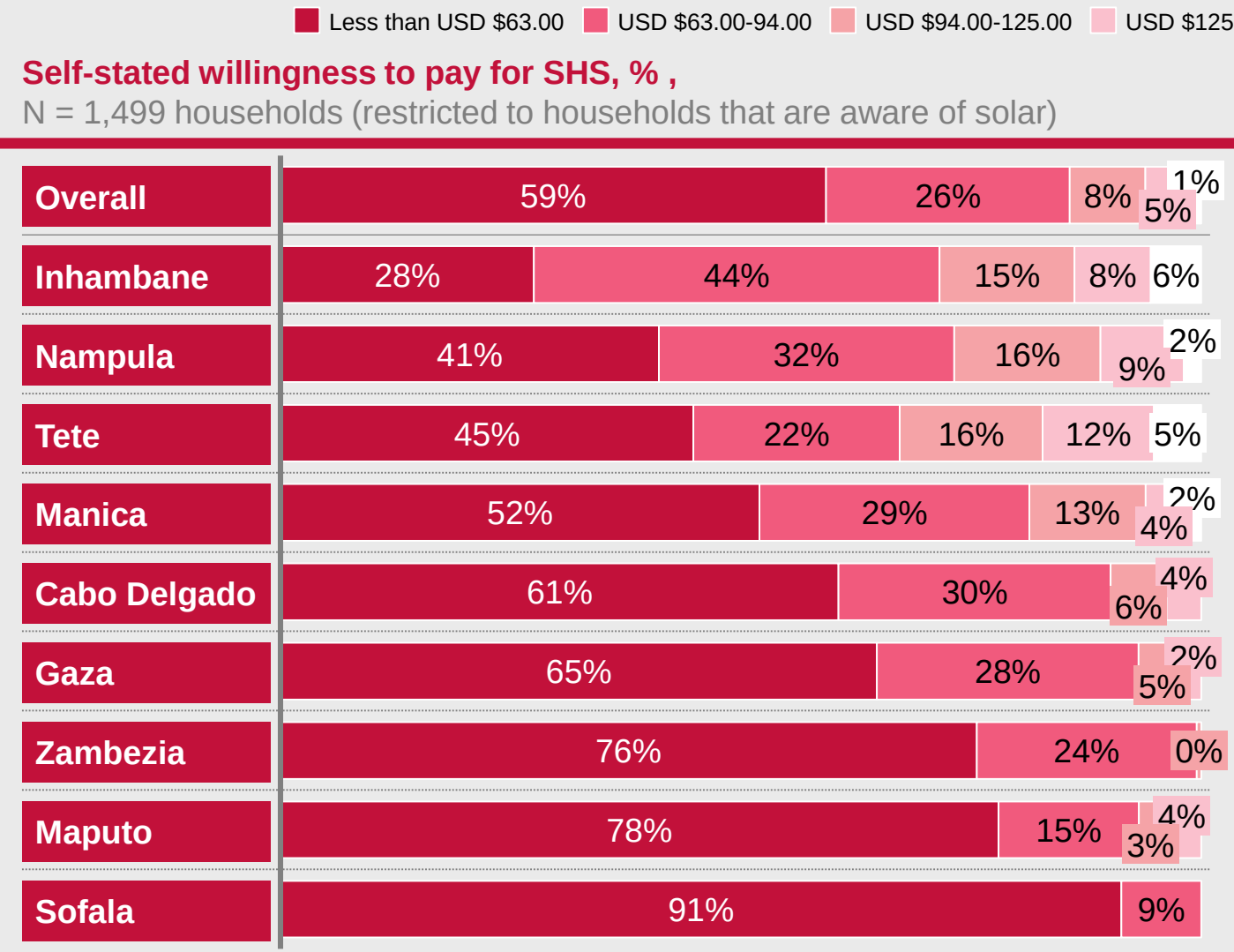
N = 1,441 households (restricted to households that are aware of solar)



- Overall, 60% of households can afford SHS based on self-stated willingness to pay
- Affordability of SHS is highest in Nampula, Inhambane and Sofala, where 78%, 75% and 63% of households are willing to pay more than USD $12.50 monthly for an SHS kit with radio
- Self-stated willingness to pay is likely to be higher because the survey was conducted in November and December 2019 when remittances are likely to be higher

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

41% OF HOUSEHOLDS SAY THEY CAN AFFORD MORE THAN USD $63.00 FOR A SOLAR POWERED TV



Self-stated willingness to pay for SHS, % ,

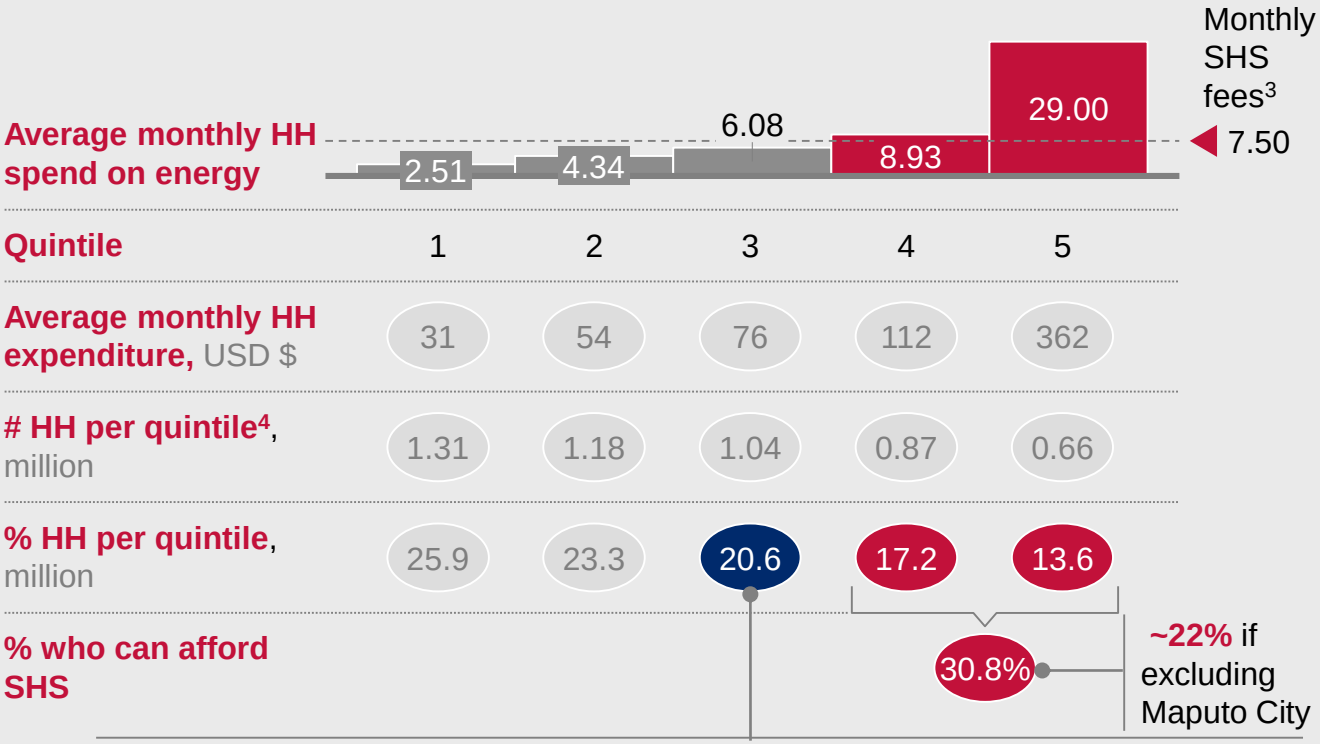
N = 1,499 households (restricted to households that are aware of solar)

- Overall, at least 41% of households can pay at least USD $63.00 (MZN 4,000) for a solar power TV
- Affordability of solar powered TVs is highest in Inhambane, Nampula and Tete, where 72%, 59% and 55% of households are willing to pay more than USD $63.00 for a solar powered TV

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

A SENSE CHECK USING NATIONAL STATISTICS SHOWS THAT 22% HOUSEHOLDS CAN AFFORD SHS – AND UP TO 42% COULD AFFORD IF WILLING TO PAY A USD ~$3 MONTHLY PREMIUM

Households (HH) that can afford SHS, by income quintile[1,2]



If HHs in Quintile 3 are willing to **pay a premium of USD $2.85 per month**, ~50% can afford SHS – NB this includes Maputo City, which the SAEP survey excludes. Deducting ~9% from Quintile 5 for Maputo City, this reduces to **~42%**

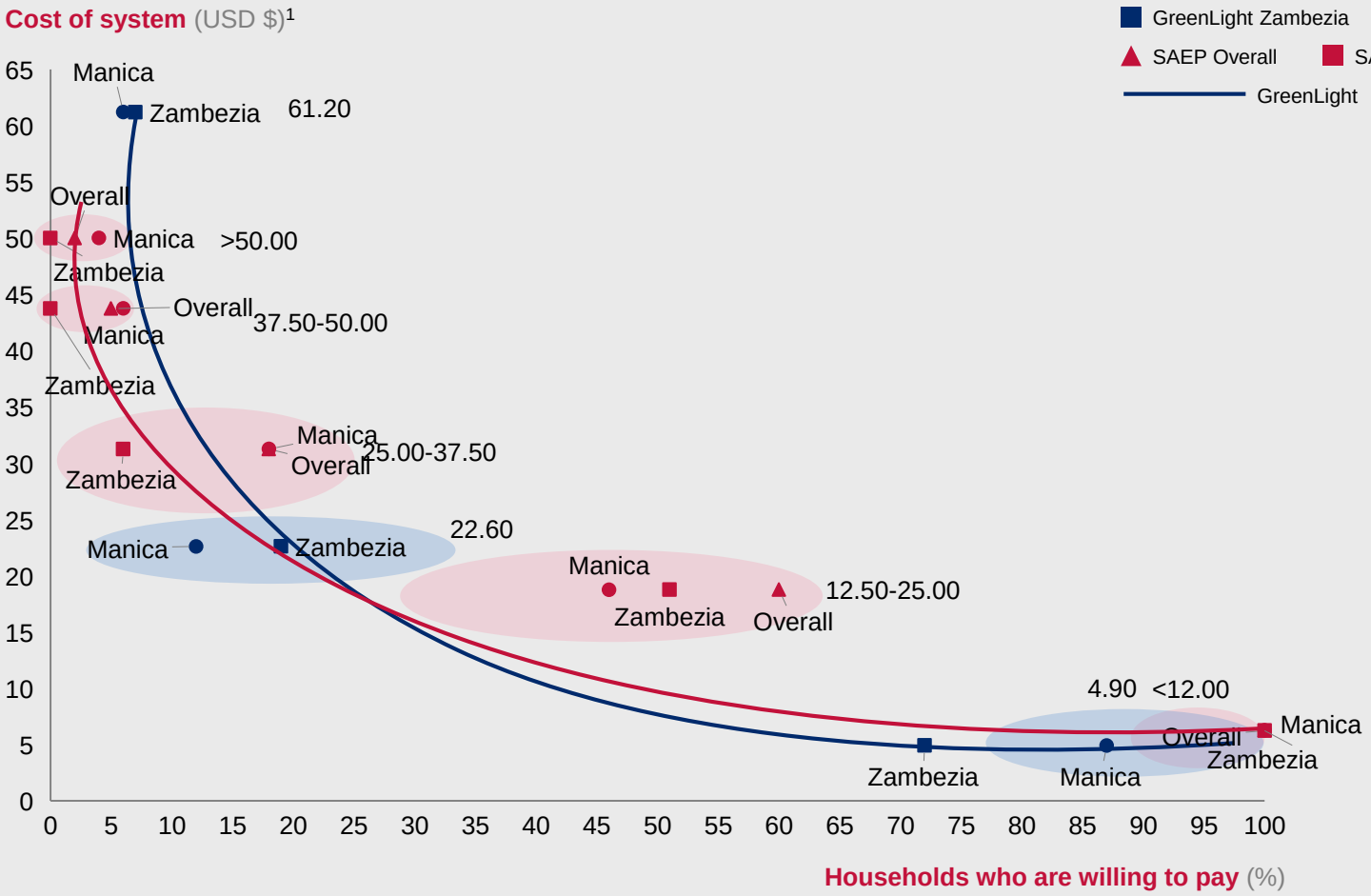
- Households with **<USD $94 monthly income** (lowest 3 quintiles), **spend below the USD $7.50** threshold for a basic SHS product[2]
- **22% HH can afford SHS**, based on average monthly energy expenditure[4] (aligned with this survey finding of 23%)
- **42% can afford SHS** if Quintile 3 are willing to **pay a premium**[4] (compared with this survey finding of 56%)
- **Average premium paid** by SHS owners in this income bracket in **Zambia is USD $3.50**; **GOGLA** estimates that, on average, HH increase energy spend by **USD $2.85** for 3-10W SHS

1. Income quintiles from bottom (1) to top (5); 2. Assumes 8% average spend on energy as quoted in Mozambique NES (2017) – also a midpoint of the World Bank range of 5-10%; 3. Monthly fee is based on syndication with all 4 SHS companies in Mozambique; 4. Family Budget Survey Mozambique, 2014/15; 3 Excluding Maputo City, estimated to account for ~9% total HH (having deducted 3% from total HH that are described as below the poverty line)

SOURCE: World Bank Mozambique Poverty Assessment (2018) Family Budget Survey Mozambique, 2014/15; USAID SAEP Zambia Consumer Affordability Survey; Gogla's Powering Opportunity: The Economic Impact of Off-Grid Solar (2018)

SELF-STATED WILLINGNESS TO PAY FOUND IN THIS SURVEY INCLUDES A SIGNIFICANT OUTLIER AT USD $12.50-25.00

Household self-stated willingness to pay for SHS



SAEP's affordability findings based on self-stated willingness to pay include a significant outlier for the USD $12.50-25.00 range

1. GreenLight's analyses evaluates willingness to pay for different systems – system; 2. at USD $4.90 per month, system; 3. at USD $22.60 per month and system; 4. at USD $61.2 per month for 24 months. The GreenLight survey only covered Maputo City, Manica and Zambezia – results for Manica and Zambezia Provinces are shown here for both GreenLight and SAEP. SAEP results also show overall results from the survey, which is a weighted average across 9 provinces.

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; World Bank Mozambique Poverty Assessment (2018); Off-Grid Solar Market Assessment in Mozambique (GreenLight, December 2018)

MOST HOUSEHOLDS ACROSS ALL PROVINCES ARE OVER-OPTIMISTIC ABOUT THEIR ABILITY TO SPEND ON SHS

Household median monthly energy expenditure[1], USD $

	Median expen-diture	# HH per province, '000	% unelec-trified	# unelectrified HH per province, '000	% of total HH in Mozam-bique
Cabo Delgado	4-7.50	467	85%	397	8%
Nampula	4-7.50	1,221	77%	941	21%
Manica	4-7.50	382	79%	300	7%
Sofala	4-7.50	444	62%	275	8%
Maputo3	0-4	50	100%	501	9%
Gaza	0-4	289	54%	156	5%
Tete	4-7.50	553	85%	470	10%
Zambezia	0-4	1,022	88%	894	18%
Inhambane	4-7.50	299	80%	238	5%

For each province, **most households** gave **expenditure** information that **indicates they cannot afford SHS**, i.e., in brackets of USD $0-4 or $4-7.50 per month

This indicates that **HH in most provinces** are **over-optimistic about their ability to spend** or state they are willing to spend an **unsustainable amount** on SHS.

Given this inconsistency, from this point forward, **this document refers to affordability based on expenditure on lighting**

1. Ranges provided because households selected a ranged category

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; World Bank Mozambique Poverty Assessment (2018)

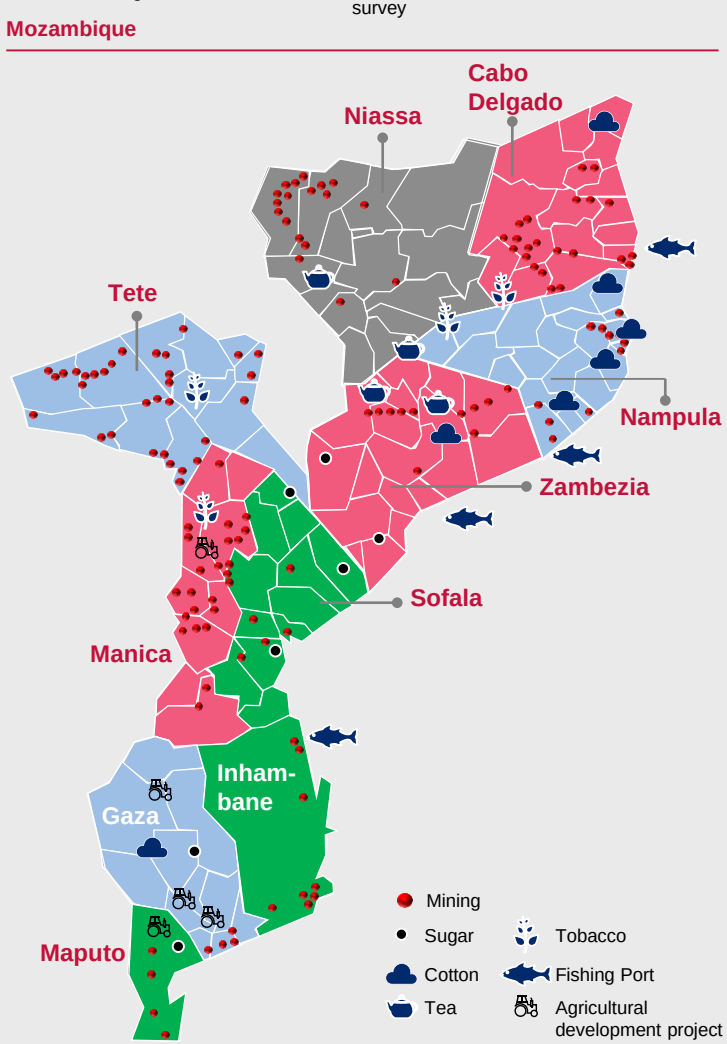
THE MOST PRODUCTIVE PROVINCES ARE MAPUTO, INHAMBANE AND SOFALA

Wealthiest 3 provinces according to metric

Middle 3 provinces according to metric

Poorest 3 provinces according to metric

xx % of households with monthly expenditure <USD $62.5 as per this survey



Tete	GDP pc. $337	69%	Poverty 41%
▪ Mining – coal			
▪ Agriculture			
– Corn (mn USD)			245
– Tobacco (‘000 tn)			59
– Livestock			

Manica	GDP pc. $225	59%	Poverty 37%
▪ Mining – gold, precious stones			
▪ Agriculture			
– Corn (mn USD)			423
– Cotton (‘000 tn)			23
– Livestock			

Gaza	GDP pc. $385	71%	Poverty 44%
▪ Agriculture			
– Food crops[1] (‘000 tn)			745
– Cash crops[2] (‘000 tn)			29
– Other vegetables			

Maputo province	GDP pc. $821	58%	Poverty 12%
▪ Agriculture			
– Cash crops[1] (‘000 tn)			3,435
– Corn (‘000 tn)			244
– Other vegetables			

Cabo Delgado	GDP pc. $256	72%	Poverty 50%
▪ Industry			
– Natural gas			559,957
▪ Agriculture			
– Cassava (mn USD)			32
– Cotton (‘000 tn)			

Nampula	GDP pc. $306	80%	Poverty 65%
▪ Industry			
– Ilmenite mining (‘000 tn)			988
▪ Agriculture			
– Cassava (mn USD)			2,146
– Cotton (‘000 tn)			46

Zambezia	GDP pc. $222	94%	Poverty 62%
▪ Industry			
– Plastic articles (10^3 Und)			2,205
▪ Agriculture			
– Cassava (mn USD)			949
– Soy (‘000 tn)			46

Sofala	GDP pc. $579	93%	Poverty 50%
▪ Agriculture			
– Fishing			950
– Cereals (‘000 tn)			263
– Sugar cane (‘000 tn)			

Inhambane	GDP pc. $738	93%	Poverty 35%
▪ Industry			
– Natural gas			193,161
▪ Agriculture			
– Cassava (mn USD)			507
– Fish (‘000 tn)			29

1. Horticulture (reno potato, tomato, kale, lettuce – individual quantities not found; 2 Cotton, cashews and sugar - individual quantities not found

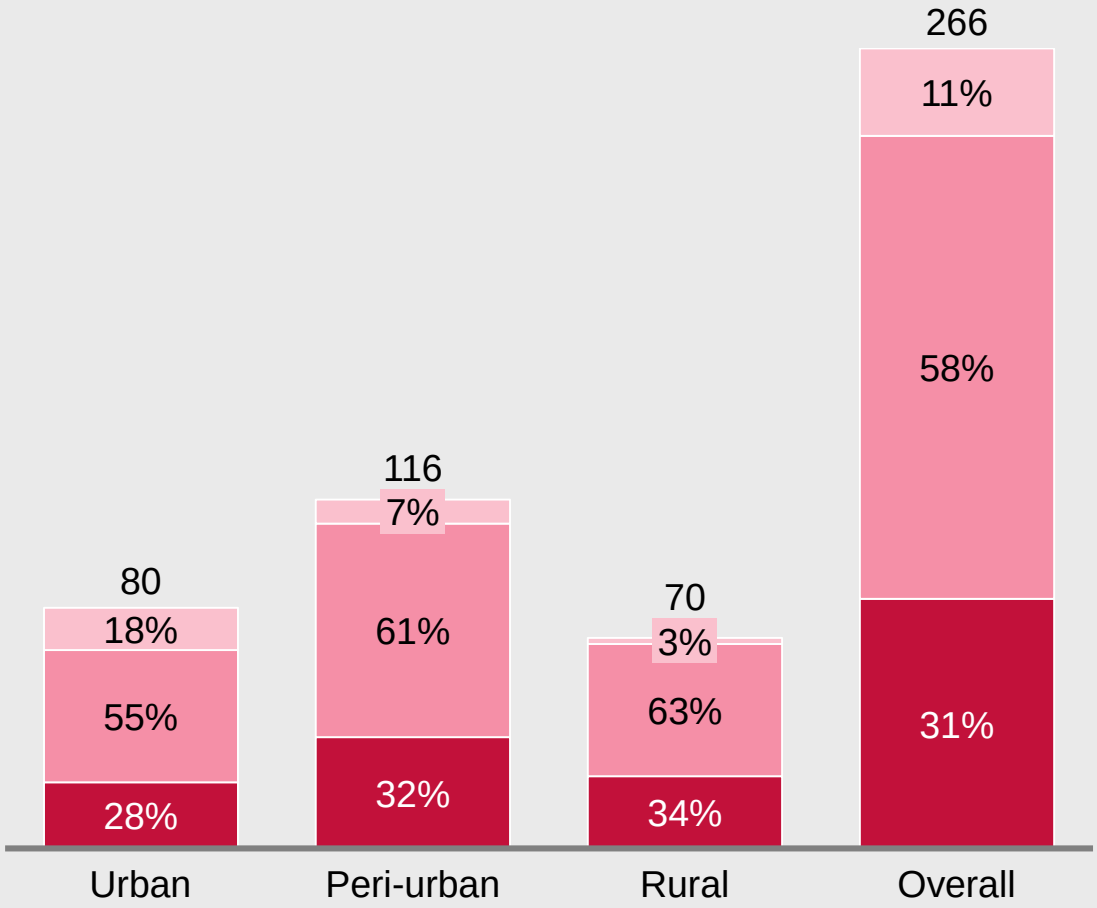
NOTE: GDP per capita was calculated based on 2017 current prices and 2017 population data, data for Manica and Cabo Delgado are from 2017, the others are from 2018

SOURCE: World Bank (2018) Mozambique Poverty Assessment, Population Census (2017), Institut National de Estatica, INE Leaflet 2017 and 2018

69% OF HOUSEHOLDS PAY MORE THAN USD $6.00 PER MONTH FOR THEIR GRID CONNECTION

Monthly expenditure on electricity (EDM grid connection), % households by settlement type

N = 266 households (households with EDM connection)



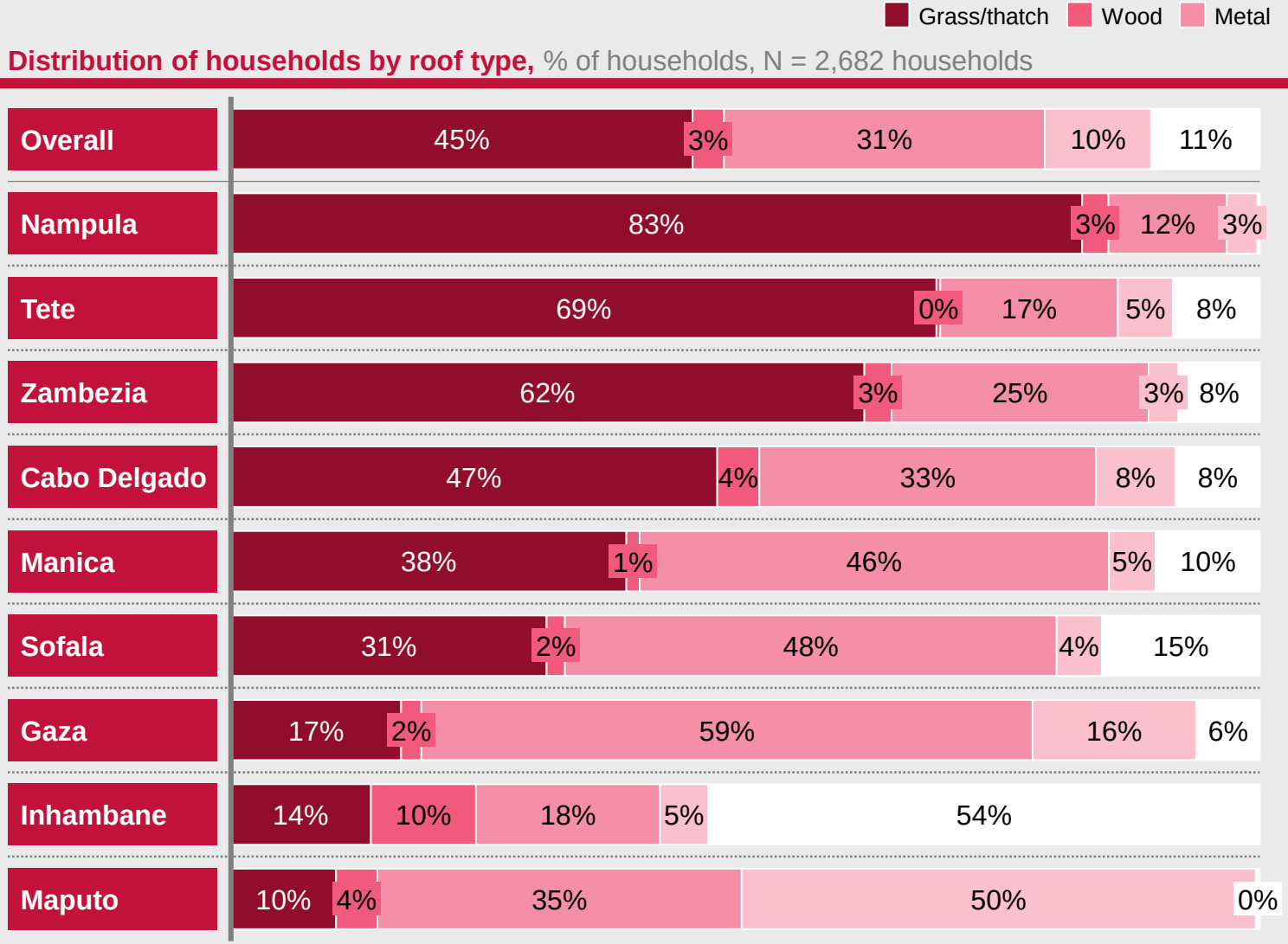
- 69% of households pay more than USD $6.00 per month for their electricity bill (EDM connection)
- This would imply that at up to 69% of households can afford SHS, given the average monthly fee for a PayGo SHS unit is USD $7.50
- This proportion is relatively consistent across rural, peri-urban and urban populations
- With average household consumption of electricity in Mozambique at ~1,950 kWh/year, these results show that 31% of households surveyed use less than 550 kWh/year, 58% use between 550 and 1,750 kWh/year and 11% use more than 1,750 kWh/year[1]

1. Assuming MZN 8.44/kWh

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; WorldData.info

45% OF HOUSES IN MOZAMBIQUE HAVE GRASS/THATCH ROOFS REPRESENTATIVE OF LOWER INCOME HOUSEHOLDS

Distribution of households by roof type, % of households, N = 2,682 households



- Nampula, Tete and Zambezia have the highest percentage of houses with grass/thatch roofs at 83%, 69% and 62% which are representative of lower income households
- Maputo, Gaza and Cabo Delgado have the highest percentage of houses with tile/concrete roofs at 50%, 16% and 8% - representative of higher income households

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

DETAILS OF 65 HOUSEHOLDS WHO OWN 'OTHER' SOLAR PRODUCT

Detail of 'other' brand[1]	Number of households	Detail of 'other' brand[1]	Number of households
Bought in a store	18	Letpower Technologies Co	1
Solarlite Ltd	6	Samsung	1
Imported From Germany[2]	5	Superpower	1
Sundaya	5	Sony	1
Sunshine Solar Ltd	4	Peak Power	1
Bought in the Market place	4	Firehong	1
Golite	3	Lanterna	1
Philip's	2	Pessoal	1
Omega	2	Solar jiabao	1
Solar power solutions	2	Sol	1
Sun connect	2	Yuegan	1
Pmax	1		

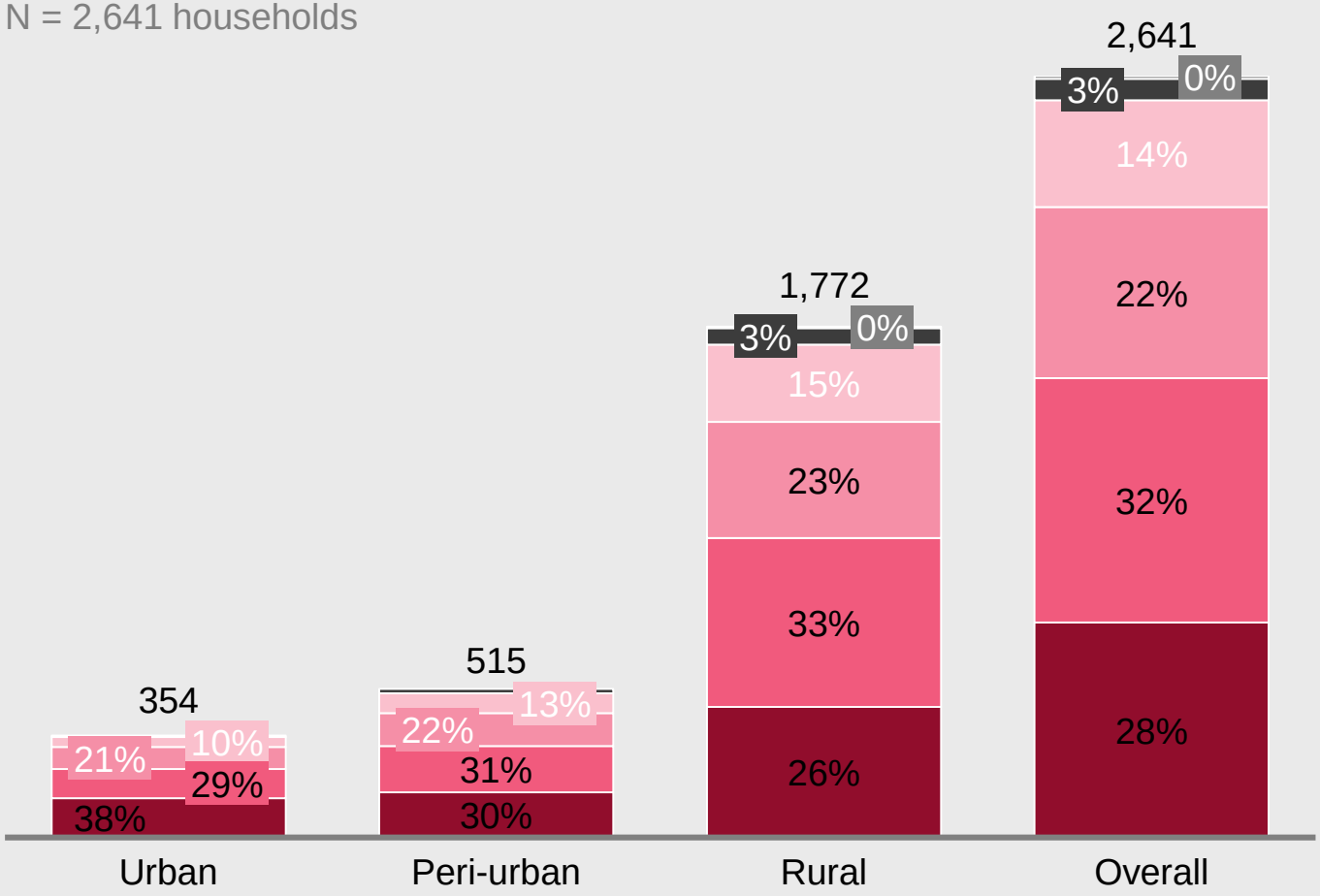
1. GreenLight's study also found a number of brands aside from the four main brands in Mozambique including Omega and Sunshine Solar; 2. Likely to be products market "German technology"

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019;

60% OF HOUSEHOLDS SURVEYED ARE LESS THAN 30 MINUTES FROM THE NEAREST TRADING CENTER

Time to nearest trading center, % of households

N = 2,641 households



- 60% of households surveyed are less than 30 minutes from the nearest trading center
- In rural areas, 26% of households are less than 15 minutes from the nearest trading center

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

LIGHTING EXPENDITURE ANALYSIS IN MOZAMBIQUE INCLUDES MORE COMPONENTS THAN ZAMBIA SURVEY HENCE HIGHER EXPENDITURE AND CORRESPONDING WILLINGNESS TO PAY

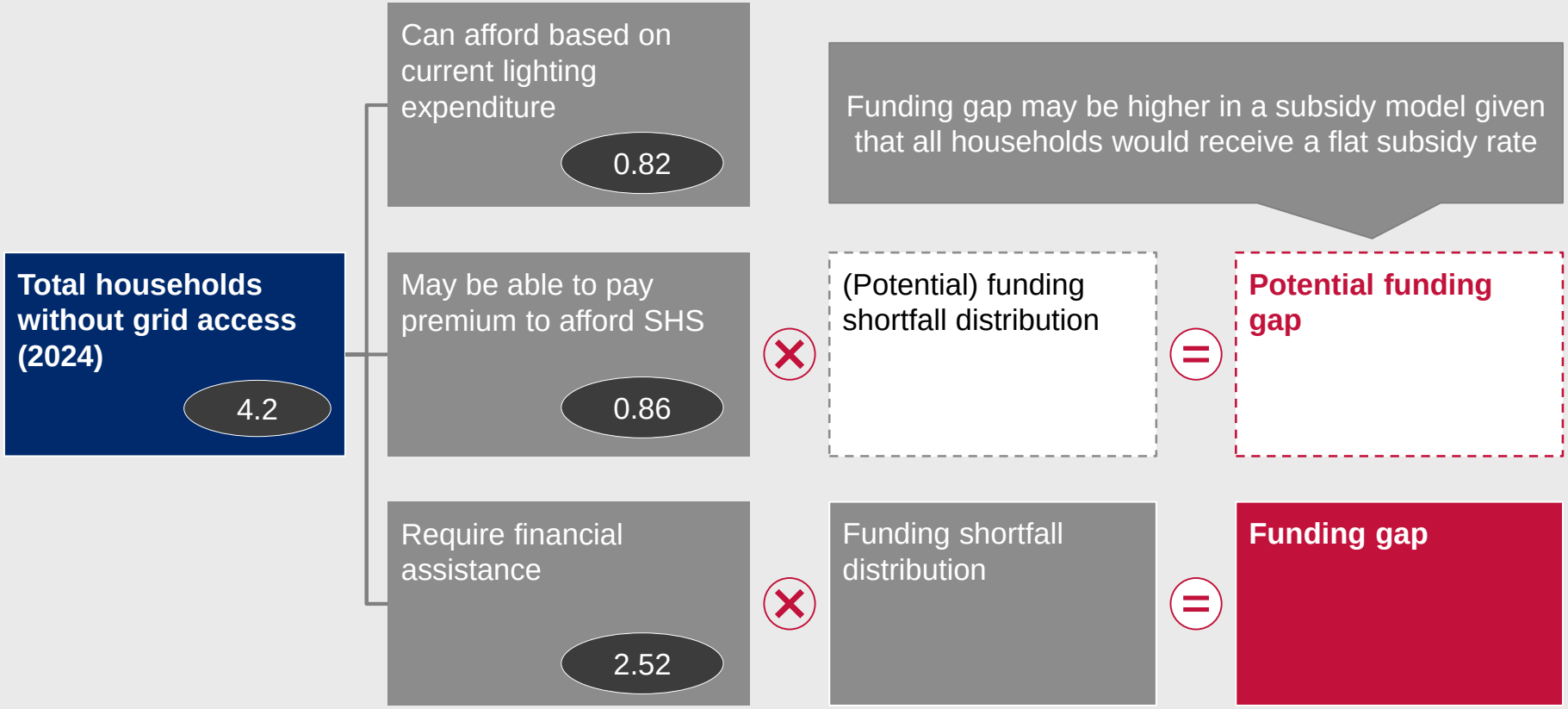
Lighting and power component	Included in Zambia survey	Average expenditure	Included in Mozambique survey	Average expenditure
Candles	✓		✓	
Torch batteries	✓		✓	
Kerosene	✗		✓	
Mobile charging	✗		✓	
Transport	✗		✓	
Average expenditure		USD $4.20		USD $5.60
% difference			33%	

Lighting expenditure analysis in Zambia included candles and torch batteries – lighting expenditure analysis in Mozambique also includes kerosene, mobile charging and transport, hence average household expenditure on lighting and power and corresponding affordability is higher in Mozambique

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019; USAID SAEP Zambia Consumer Affordability survey 2018

METHODOLOGY FOR CALCULATING THE FUNDING GAP

X Million HH, 2024



Dataset used

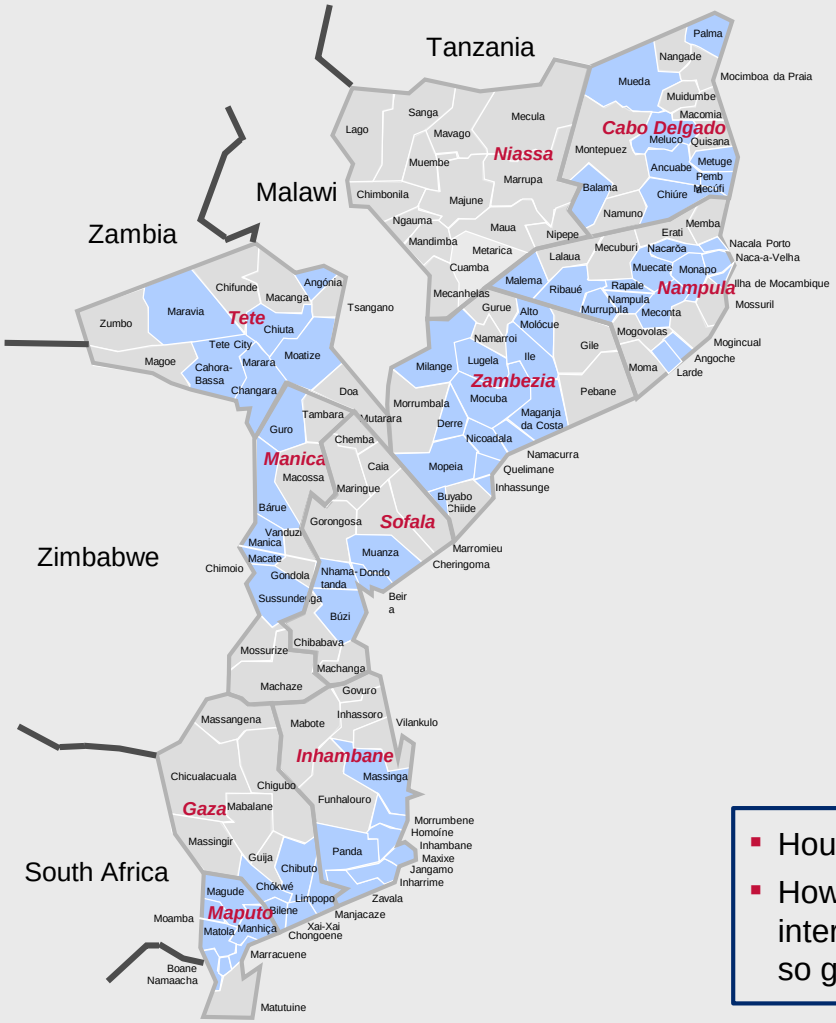
Mozambique Geospatial Options Analysis Towards Universal Electrification	USAID SAEP Mozambique Consumer Affordability Survey	USAID SAEP Mozambique Consumer Affordability Survey	Calculation

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019

GEOTAGS DO NOT NECESSARILY REPRESENT INTERVIEW LOCATIONS DUE TO CONNECTIVITY ISSUES

- Geotagged locations of interviews
- District in which the survey was conducted

Breakdown of districts surveyed in Mozambique



- Households surveyed were geotagged
- However, due to connectivity issues with tablets used for interviews, many locations synced once the tablets were in service so geotags are not fully representative of geographic coverage

SOURCE: USAID SAEP Mozambique Consumer Affordability survey 2019