USAID
FROM THE AMERICAN PEOPLE

POWER AFRICA
A U.S. GOVERNMENT-LED PARTNERSHIP

CAN ZAMBIAN HOUSEHOLDS AFFORD SHS? INSIGHTS FROM A LOCAL SURVEY

FINAL REPORT | JULY 2018

GLOSSARY

Term	Definition
Affordability	Ability of an household to self-finance acquisition of a solar home system based on the household's current lighting expenditure and/or self-stated willingness to pay
Current lighting expenditure	Calculation of the total amount unelectrified households currently spend on torch batteries and candles to light their homes
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 instalments paid over the duration of the "loan")
PayGo	A SHS payment option where households pay an upfront deposit and then settle the remainder via instalments 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 a 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 less than 224 kWh that typically has some lights and may have mobile phone charging and/or a small radio
Tier 2	A power solar system with annual power output of over 224 kWh that typically includes 6 lights, 2 mobile charging ports, a small radio and a small TV
Willingness to pay	The self-stated amount that survey respondents stated they would be willing to pay for a SHS

ACRONYMS

Acronym	Definition
DFS	Digital financial services
GDP	Gross Domestic Product
GOGLA	Global Off-Grid Lighting Association
JICA	Japan International Cooperation Agency
kWh	Kilowatt-hour
LCMS	Living Conditions Monitoring Survey
PayGo	Pay-as-you-go
REMP	Rural Electrification Master Plan
SHS	Solar home system
USAID SAEP	United States Agency for International Development Southern Africa Energy Program
USAID	United States Agency for International Development
USD	United States Dollar
V	Volt
ZESCO	Zambian Electricity Supply Corporation
UNCDF MM4P	United Nations Capital Development Fund Mobile Money for the Poor

EXECUTIVE SUMMARY (1/3)

Survey approach

Description of the sample

- The survey covers ~1,500 Zambian homes and provides a clearer understanding of rural homes (the largest, and least understood market segment)
  - The survey has nationwide coverage with over 100 respondents per provinces and 66% falling in rural areas
  - At the provincial level, rural households account for at least 55% of the total surveyed households
  - While all provinces are sampled, the survey covers only 67% of Zambian districts
- The survey categorizes the responses in four segments: those that are (i) Grid electrified, (ii) those that are SHS electrified / own solar products, (iii) those that do not own solar products but are aware of them, and (iv) those that do not own solar products and are not aware

Definition of ability & willingness to pay

- The survey estimates willingness and ability to pay in two ways: (i) current lighting expenditure and (ii) self-stated willingness to pay, and also conducts a sense check against payments made by current SHS owners:
  - Current lighting expenditure is estimated by gathering data on weekly household consumption on candles and torch batteries (given that national statistics indicate these to be the most common sources of lighting for unelectrified households)
  - For willingness to pay, respondents are asked to react to prices of SHS products that currently available in the Zambian market
  - As a sense check, the monthly payments incurred by present SHS owners are computed and compared to their income levels

Results and in-sights

- The survey creates transparency on three dimensions: (i) SHS awareness and ownership, (ii) mobile phone usage, and (iii) household expenditure and willingness to pay for SHS

SHS awareness and ownership

- Awareness of solar products is very high with 83% of surveyed households knowing about solar energy:
  - "Word of mouth" is the primary source of awareness for the majority of households (61% of total)
- 64% of surveyed households have access to an electricity connection and of those 40% already owned a SHS product
  - For a nascent market, solar product ownership is high (40% of total), particularly in rural areas at 48% of surveyed households
  - Most solar product owners (68%) purchased pico-lanterns or other Tier 1 products
  - Households typically pay a single amount (84%) rather than PayGo for these smaller products
  - SHS ownership (as % of surveyed population) is highest in Lusaka, Eastern, Central and Western provinces
  - Solar has a positive perception with 59% of households aware of solar preferring solar to ZESCO given its low cost and reliability

EXECUTIVE SUMMARY (2/3)

Results and in-sights

SHS awareness and ownership

- Lighting (63%) is the most valued feature among solar product owners
- 61% of households cite affordability as the main barrier to purchasing a SHS
- In Southern, Copperbelt and Muchinga, 15-20% of households are eager to purchase SHS but lack a service provider nearby
- Even in grid connected households, solar remains popular with only 31% stating that they do not need a solar product

Mobile phone usage

- Mobile phone penetration is near-universal among respondents (97%); however only half of mobile phone users use mobile money
- Once consumers are using mobile money, their transactions are generally sufficient to make a regular SHS payment

House-hold expenditure and willing-ness to pay for SHS

- 65% of households surveyed are low-income, spending less than USD 80 per month
- In all provinces, the survey has a higher distribution of low income households (<80 USD per month)
- Income volatility is high with >70% of households reporting that their income changes significantly during the year
- 18 – 35% of households are able to afford a basic SHS product (USD 7 per month) based on our two approaches and sense check
  i. 18% of Zambian homes can afford a SHS system at no additional cost (assuming sample is representative) based on current lighting expenditure
  ii. On a self-stated basis, 31% of Zambian households can afford SHS even if it means increasing their lighting spend in weekly instalments, and 35% of households report a one-time willingness to pay within range of current retail prices
  iii. As a sense check, SHS owners with monthly income >USD 40 incur a monthly cost that would cover a basic SHS product. Using this method, 34% of surveyed households are above the income threshold of USD 40 per month and therefore could afford SHS

Validation of the results

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

SHS awareness and ownership

- Awareness results in Zambia (83% aware) align closely to similar surveys conducted in Kenya (87% aware) and Senegal (89% aware)
- SHS ownership results in Zambia (40%) is in line with expected outcomes compared to Kenya (51%) and Senegal (35%) – accounting for the different levels of SHS market maturity in these markets
- Kenyan households cite affordability as the primary barrier to SHS ownership at a similar rate to Zambian homes (63% versus 61%)

EXECUTIVE SUMMARY (3/3)

D Validation of the results

Mobile phone usage

- Mobile phone penetration (97%) is higher than other existing data sources on Zambia (82%) while mobile money penetration is consistent with national statistics (42% versus 47%)

Household expenditure and willing-ness to pay for SHS

- Only 2 of the 10 provinces recorded income variations exceeding 5% when compared to external sources
- Affordability (lighting expenditure) differs from findings in Senegal and Kenya, but seems justifiable given Zambia's relative GDP/capita and income inequality
- Affordability (via self-stated willingness to pay) is slightly higher in Zambia compared to Kenya and Senegal, which can be explained by lower electrification in Zambia

E Implications

- The survey can help inform the activities of governments, donors, and SHS companies in a number of ways:
  - SHS companies can adapt their operating model in line with insights from the survey (e.g., leveraging high awareness and trust, moving consumers from smaller, cheaper products to larger units over time, doubling down on mobile money education and uptake, targeting large markets in Central, Eastern and Copperbelt provinces)
    - Central, Eastern and Copperbelt provinces present the largest addressable markets for SHS players
    - SHS players are already serving the largest markets, but could expand their reach in Western and Luapula
  - The total addressable market for SHS is 0.7-0.8 million unelectrified households based on their willingness to pay for SHS products
  - Even if SHS players were to address this full market, connections would fall short of the 2022 targets set by the Zambian Government (under the Rural Electrification Master Plan) by 0.3-0.4 million connections
  - Reaching Government 2022 SHS targets would require closing a funding gap of USD 1.4 million per month (i.e., USD 34 million over the two-year payment period under PayGo)
  - Reaching the ambition of universal access would require an even greater amount of USD 7.2 million with 2022 as a target year (i.e., USD 172.4 million over the two-year payment period under PayGo)
  - Government and cooperating partners could look to various financing mechanisms to close this gap

CONTEXT AND OBJECTIVE OF THE SURVEY

Solar Home Systems (SHS) is the least cost technology for ~75% of Zambian households (1.1 million households) – and likely the only solution to provide access to rural, sparsely populated areas

Today SHS penetration is still low (22,000 units sold in 2017) but growing, with over 15 players spread across over 60 locations in Zambia set up to capture the opportunity

To attain this scale, understanding affordability (i.e., current lighting spend and willingness to pay) for SHS is critical

USAID SAEP has undertaken a nationwide survey to better understand current and future SHS consumers

The survey provides significant new insight in addition to existing data sources for Zambia and other off-grid markets that can benefit SHS players in scaling up capacity

KEY ASSUMPTIONS

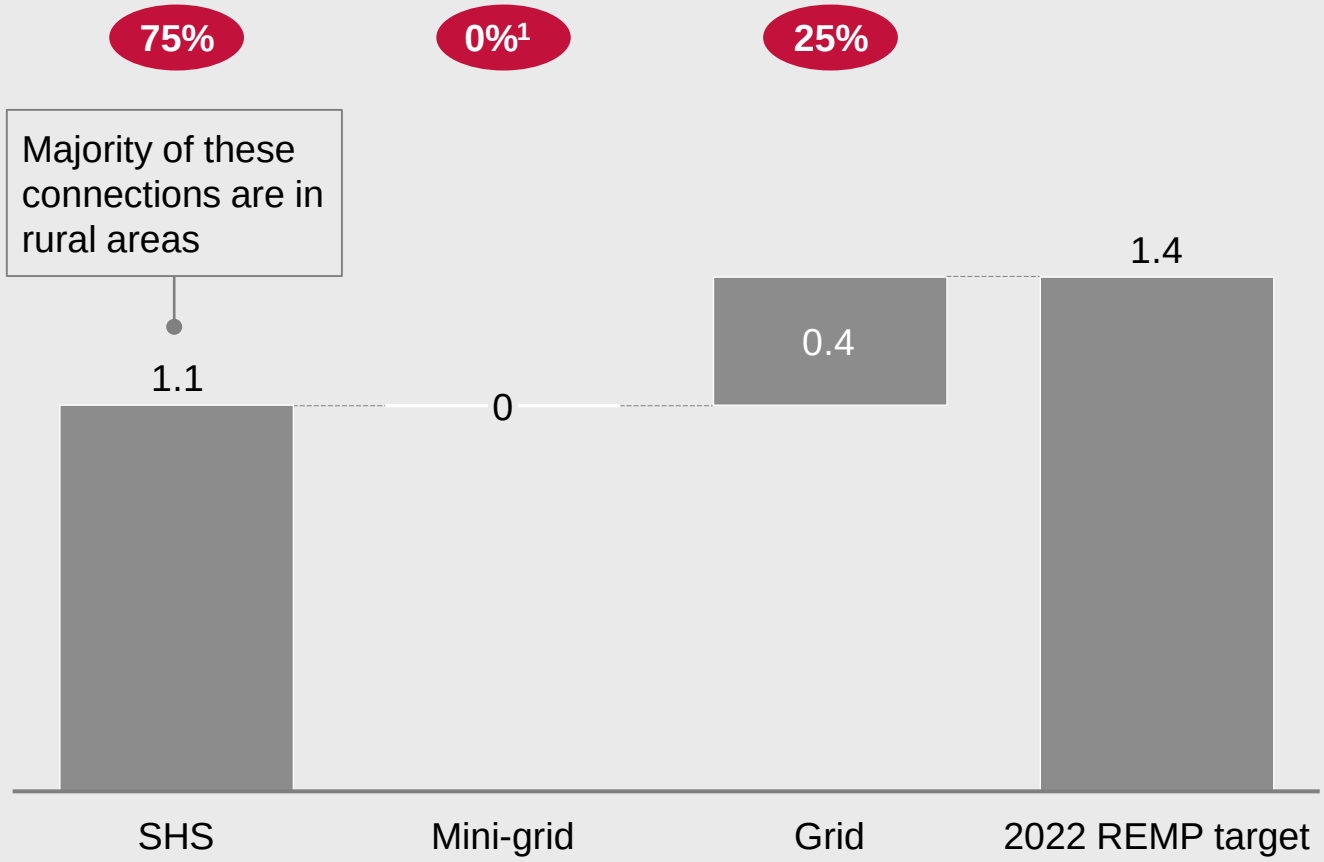
Assumption	Description
Rational decision making	▪ Report assumes that households will opt for higher quality energy provided no cost-barrier exists ▪ The report does not incorporate cultural beliefs and practices that, if present, may alter decision making
Statistical significance	▪ A sample size of 100 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 earns less than the LCMS-defined average income for rural households of USD 80 per month
Lighting expenditure	▪ In estimating lighting expenditure for unelectrified households, the report captures usage data on candles and torch batteries only – this is in line with national statistics indicating these as the most common sources of lighting for unelectrified households
Household heads	▪ Survey is restricted to heads of households (typically the husband/father or wife/mother in a home) and excludes dependents (e.g., children) on the assumption that acquiring SHS is a decision that would typically made by the head of a household
Market prices	▪ In all relevant instances, the report uses 2018 market prices (e.g., prices for candles and torch batteries)

CONTENTS

SOLAR HOME SYSTEM IS THE LEAST COST TECHNOLOGY FOR ~75% OF ZAMBIAN HOUSEHOLDS – AND LIKELY THE ONLY SOLUTION TO PROVIDE ACCESS TO RURAL, SPARSELY POPULATED AREAS

% % technology share on least-cost basis in 2022

Breakdown of 2022 REMP target by least-cost technology, million connections



- The least-cost share of SHS in total new connections by 2022 is 75%, which totals **1.1 million connections to reach the REMP target**
- The remaining REMP target – 0.4 million connections – would be least-cost connected via grid extension

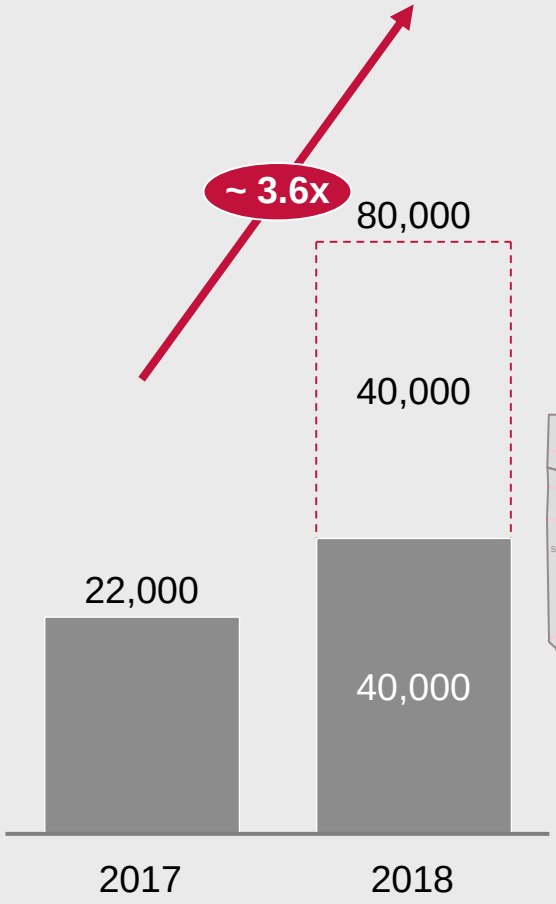
1 Mini-grids are not yet cost-competitive in 2022

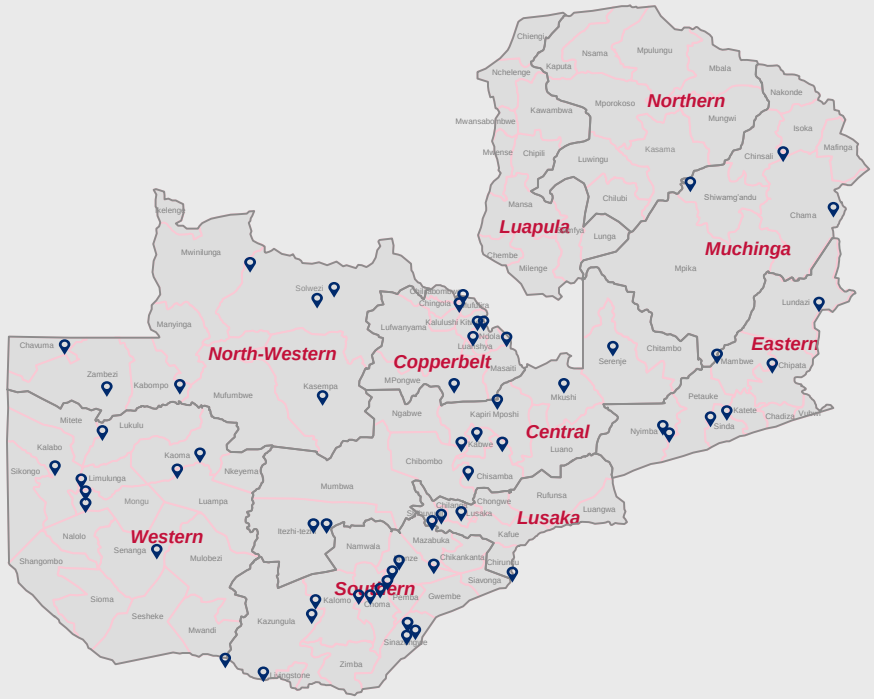
SOURCE: USAID SAEP geospatial model

TODAY SHS PENETRATION IS STILL LOW (22,000 UNITS SOLD IN 2017) BUT GROWING, WITH OVER 15 PLAYERS SPREAD ACROSS OVER 60 LOCATIONS IN ZAMBIA SET UP TO CAPTURE THE OPPORTUNITY

Location of SHS companies | Forecasted | Actual sales

Total SHS sales in Zambia, number of SHS units sold by year





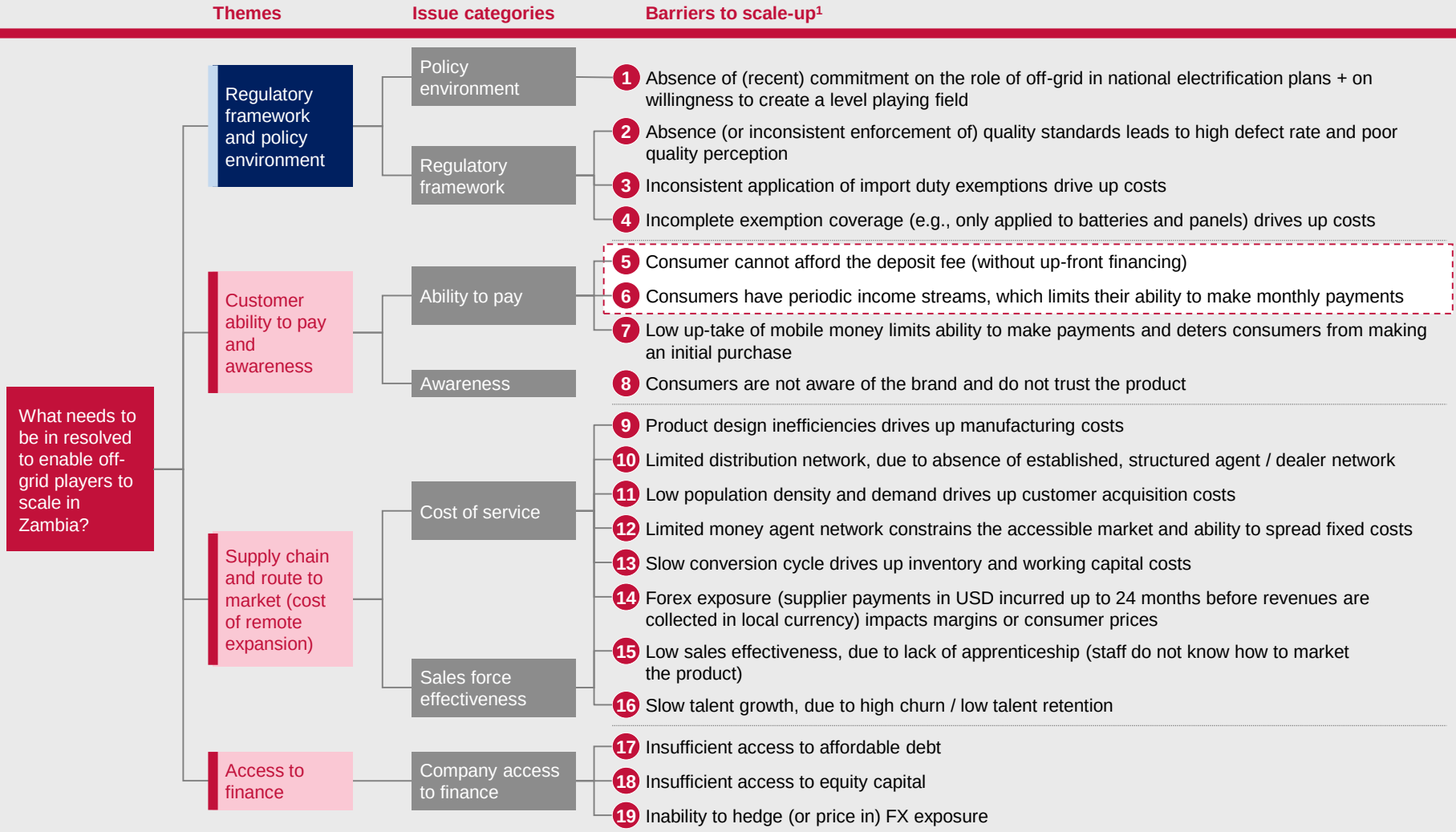
- SHS companies sold 22,000 units in 2017
- 2018 sales figures have shown a significant improvement with already ~40,000 units sold in the first half of the year
- This rise has largely been attributable to scaling up of operations by SHS companies in Zambia

SOURCE: SHS companies

TO ATTAIN THIS SCALE, UNDERSTANDING AFFORDABILITY (I.E., CURRENT LIGHTING SPEND AND WILLINGNESS TO PAY) FOR SHS IS CRITICAL

NON EXHAUSTIVE

Focus of this document | Affects specific companies | Sector-wide

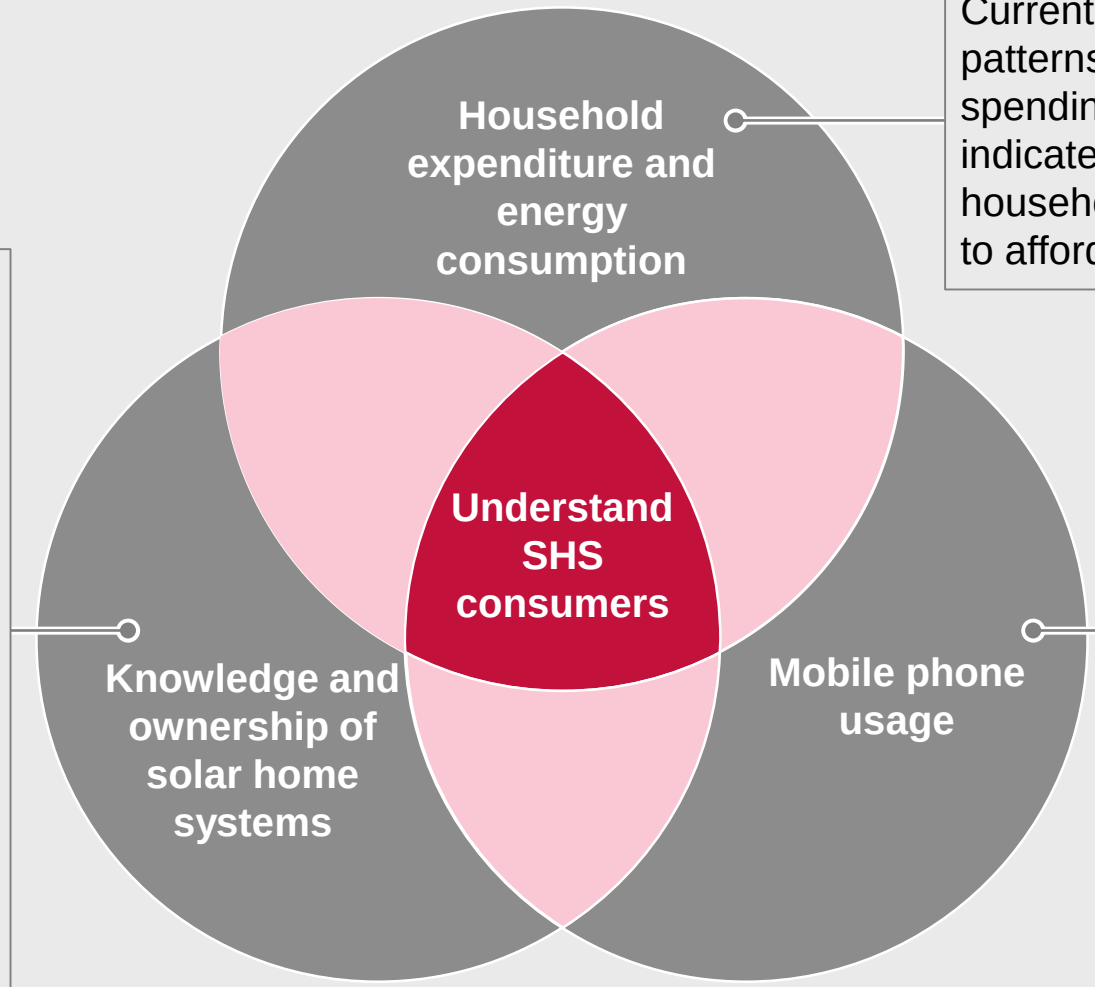


1 Comprehensive list that needs to be assessed for the Zambia context

SOURCE: Interviews with SHS providers

USAID SAEP HAS UNDERTAKEN A NATIONWIDE SURVEY TO BETTER UNDERSTAND CURRENT AND FUTURE SHS CONSUMERS

N = 1,486 households (full surveyed sample)



Current expenditure patterns, particularly spending on energy, indicate whether households would be able to afford a SHS product

Awareness of SHS, current purchasing patterns and barriers to SHS take-up 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

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

SOURCE: Internal analysis, SHS company interviews

THE SURVEY PROVIDES ADDITIONAL INSIGHTS TO PREVIOUS SURVEYS DONE IN ZAMBIA AND OTHER OFF-GRID MARKETS

✓ Covered ✓ Partially covered ✗ Not covered

		Year	Sample size, # households	Description	SHS awareness and ownership	Mobile phone usage	Household expen-diture and willing-ness to pay for SHS	Zambia specific data	Recent data[1]
Zambian sources	Living conditions monitoring survey (LCMS)	2015	12,251	Measure well-being of the Zambian population and is conducted by Central Statistics Office	✗	✗	✓	✓	✓
Zambian sources	UNCDF - DFS State of the Industry report	2016	N/A	Highlights customer adoption, usage and trends of digital financial services in Zambia by compiling supply-side data	✗	✓	✗	✓	✓
Sources from other African countries	USAID Power Africa Off-grid accelerator program	2016	1,245	Evaluates customer willingness to pay among Kenyan households at the base of the income pyramid	✓	✓	✓	✗	✓
Sources from other African countries	Senegal off-grid rural market research survey	2017	500	Evaluates customer willingness to pay for SHS in rural households in Senegal	✓	✓	✓	✗	✓
	USAID SAEP Household Survey (2018)	2018	1,486	Evaluates customer willingness to pay among Zambian households, with higher focus at the base of the income pyramid	✓	✓	✓	✓	✓
	Rural Electrification Masterplan for Zambia (2008 – 2030)	2008	N/A	Government commissioned masterplan identifying how to increase electrification rates in Zambia	✗	✗	✓	✓	✗

1 Data that is not more than five years old

SOURCE: Living Conditions Monitoring Survey (LCMS) (2015), 2016-UNCDF MM4P Annual Provider Survey, Power Africa Off-Grid Accelerator program

CONTENTS

THE SURVEY COVERS ~1,500 ZAMBIAN HOMES AND PROVIDES A CLEARER UNDERSTANDING OF RURAL HOMES (THE LARGEST, AND LEAST UNDERSTOOD MARKET SEGMENT)

Survey objectives

- Survey was conducted to test base of the pyramid customer segments
  - Evaluate consumer behaviour regarding energy consumption and expenditure
  - Test SHS appetite and knowledge, as well as willingness to pay
  - Understand mobile phone and mobile money usage

Survey approach

- We targeted ~1,500 households in Zambia
- The guiding principles in determining the sample size are as follows:
  - At least 60% rural[1]
  - Minimum sample size of 100 per province
  - Focus on decision-maker (head of household)

Survey coverage

Household expenditure and energy consumption

- Basic household demographics (e.g., where do you live?)
- Household expenditure data
- Energy consumption (past and current, where relevant)

SHS awareness and ownership

- Knowledge and ownership of solar home systems
- Willingness to pay for solar home systems
- Perceptions of solar home systems
- Barriers to solar home system uptake

Mobile phone usage

- Mobile phone and mobile money usage

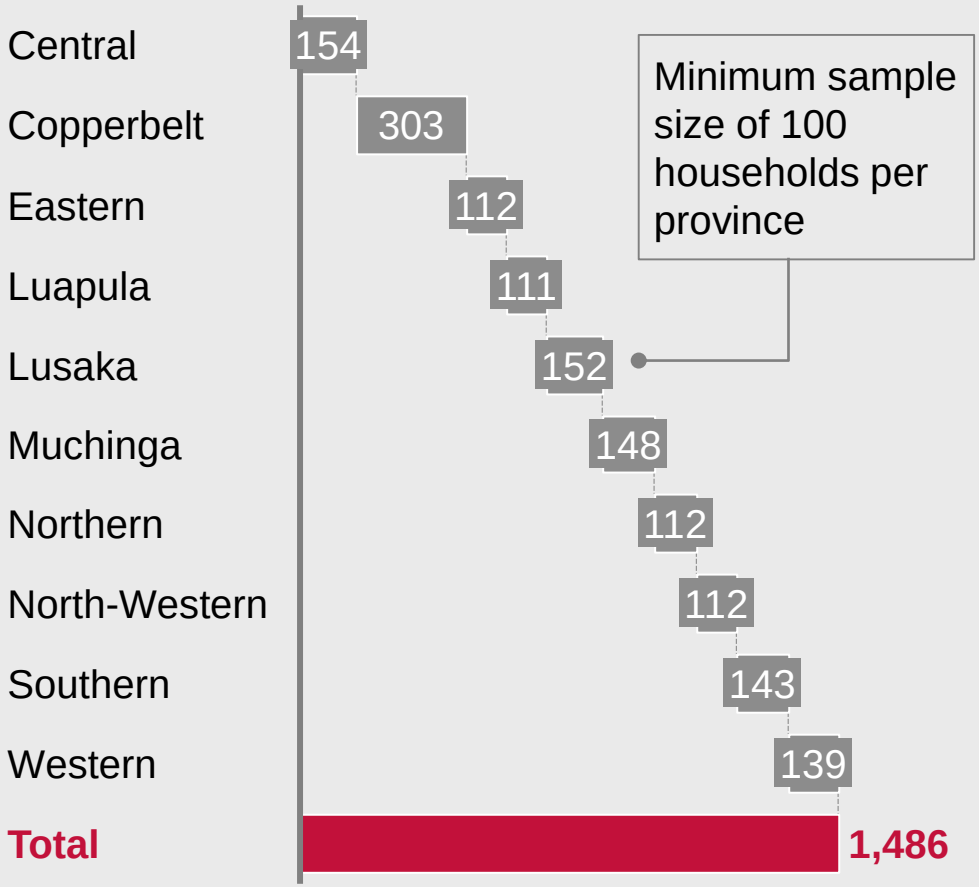
1 Living Conditions Monitoring Survey has a national rural-urban split of 58-42%

SOURCE: Internal analysis

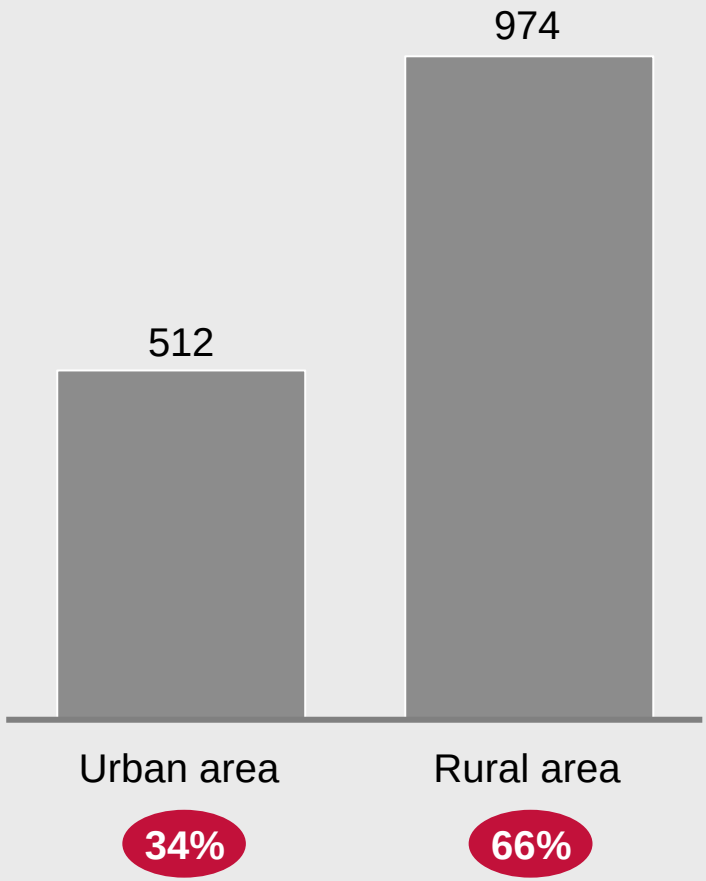
THE SURVEY HAS NATIONWIDE COVERAGE WITH OVER 100 RESPONDENTS PER PROVINCES AND 66% FALLING IN RURAL AREAS

% % of total respondents

Geographic distribution of the households, Number of households



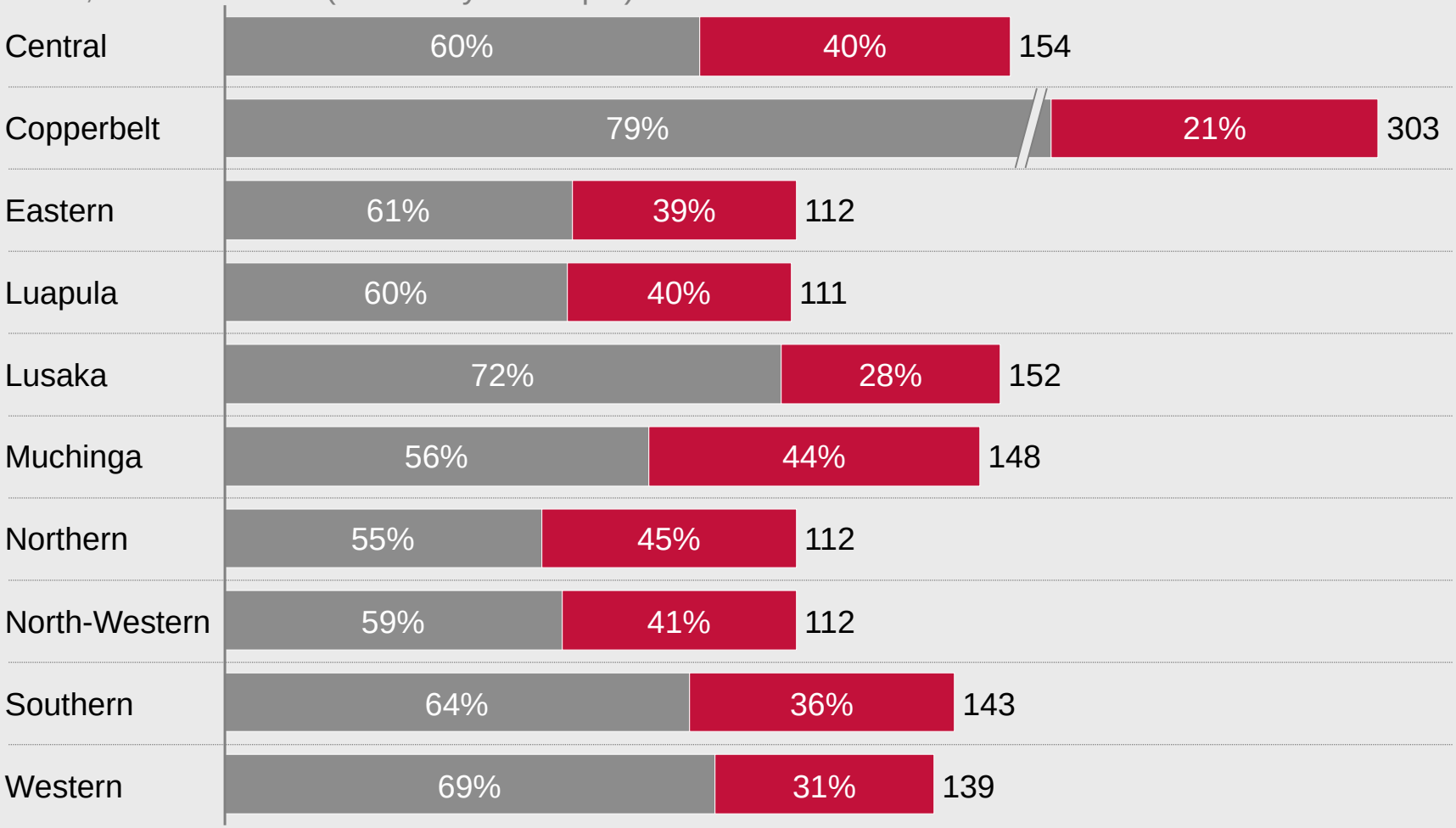
Split of households by area of residence, Number of households



AT THE PROVINCIAL LEVEL, RURAL HOUSEHOLDS ACCOUNT FOR AT LEAST 55% OF THE TOTAL SURVEYED HOUSEHOLDS

Number of household respondents by province and area of residence

N = 1,486 households (full surveyed sample)

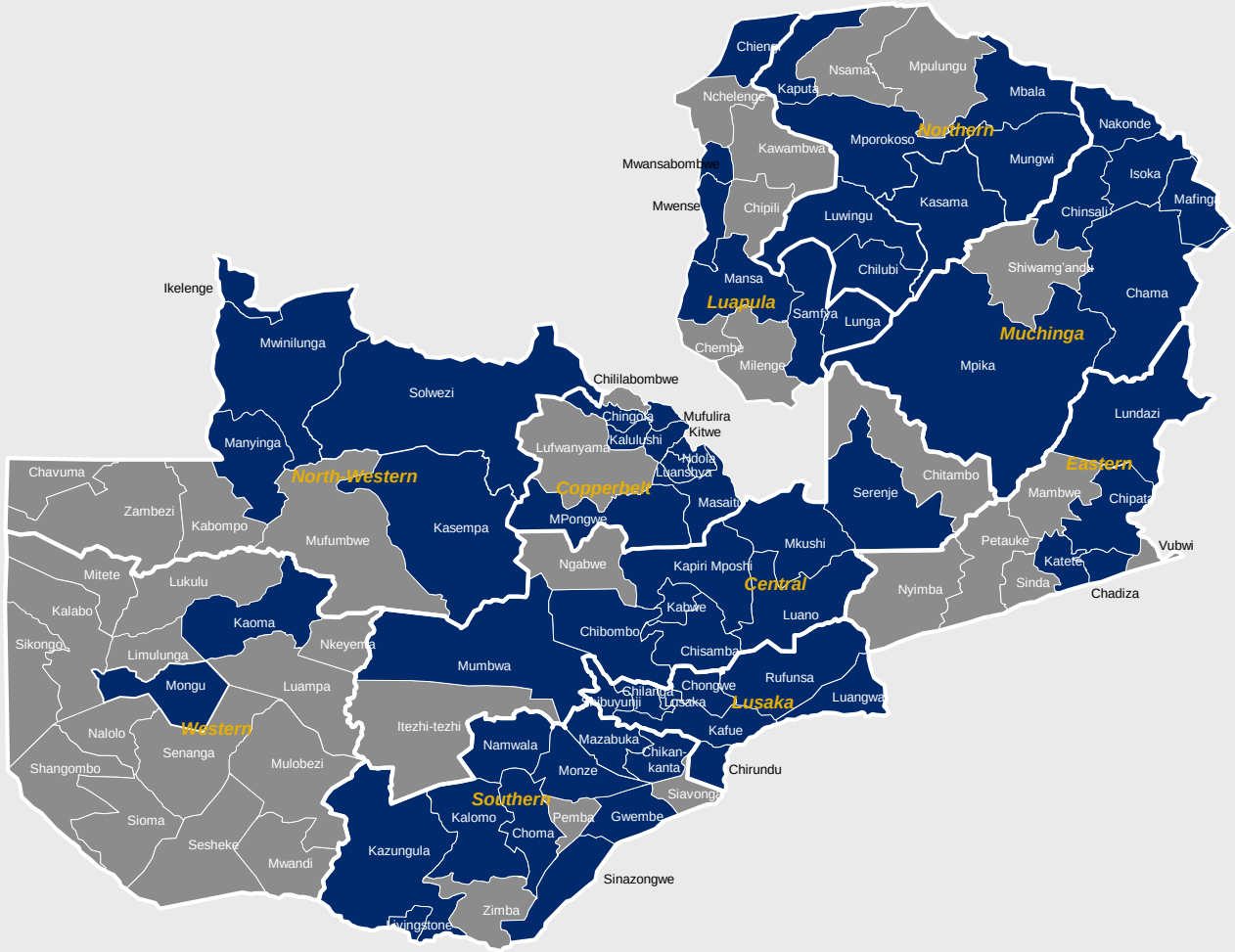


SOURCE: USAID SAEP Household Survey (2018)

WHILE ALL PROVINCES ARE SAMPLED, THE SURVEY COVERS ONLY 67% OF ZAMBIAN DISTRICTS

Breakdown of districts surveyed in Zambia[1]

District in which survey was conducted



- To ensure national representation, the survey covered all 10 provinces in Zambia
- In total, the survey was conducted in 68 districts out of the total 102 districts (67% of total)
- In Western province, the two surveyed districts (Mongu and Kaoma) account for 40% of the total SHS opportunity within that province

SOURCE: USAID SAEP Household Survey (2018)

THE SURVEY CATEGORIZES HOUSEHOLDS INTO FOUR SEGMENTS

N = 1,486 households (full surveyed sample)

X Number of households

Category		Description
Grid electrified	357	▪ Refers to households that have a grid connection i.e., ZESCO powered households
SHS electrified/own solar products[1]	594	▪ Refers to households that currently own a solar product (i.e., pico-lantern or more advanced solar systems)
Do not own solar products but are aware of them	283	▪ Households that currently lack any form of electrification but are aware of solar products
Do not own solar products and are not aware of solar products	252	▪ Households that currently lack any form of electrification and are not aware of solar products

The full survey questionnaire is available on request

1 Levels of SHS ownership vary from basic lighting to more advanced systems; no definition of 'electrified' is specified here

SOURCE: USAID SAEP Household Survey (2018)

CONTENTS

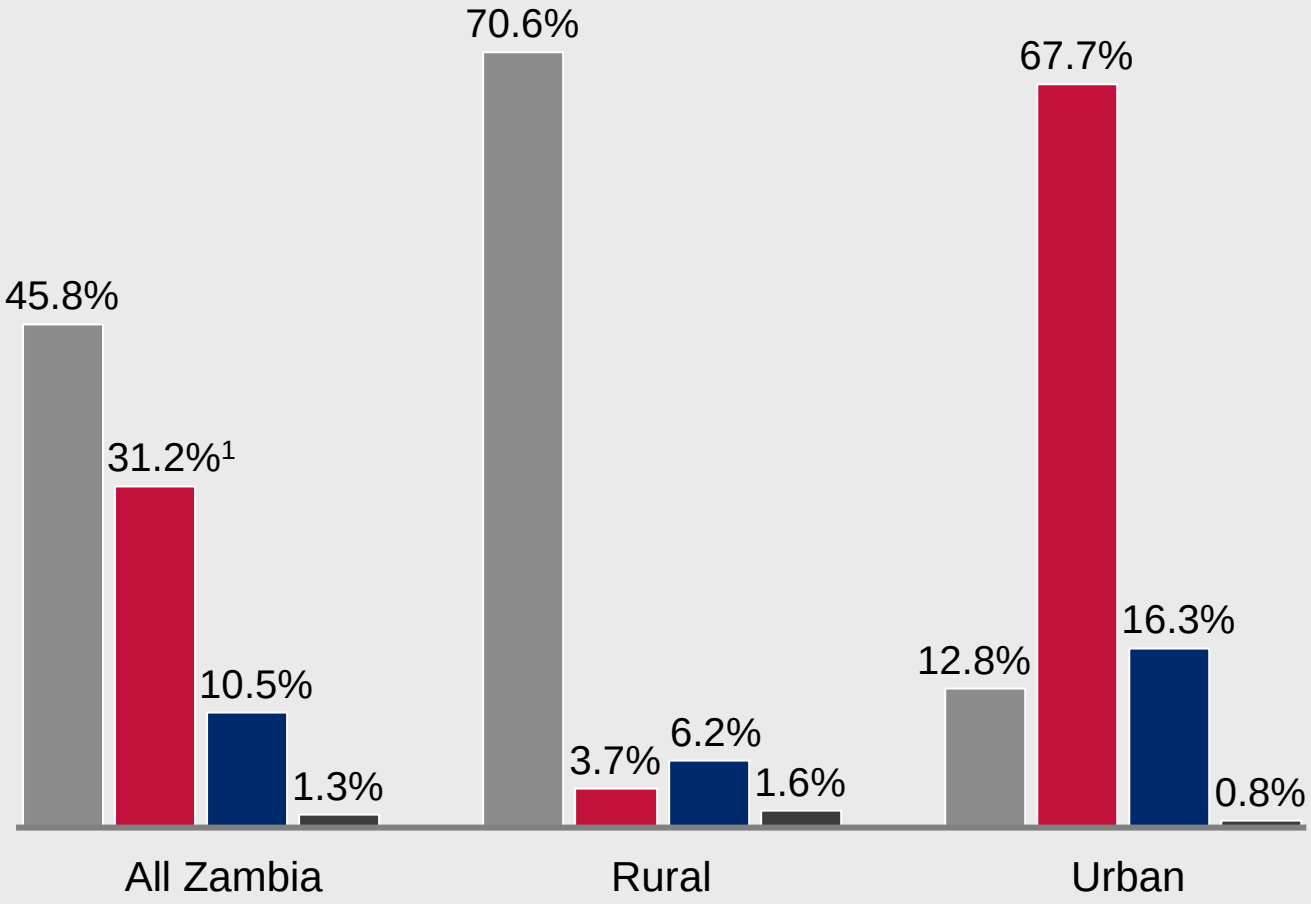
THE SURVEY ESTIMATES WILLINGNESS AND ABILITY TO PAY IN TWO WAYS, AND ALSO CONDUCTS A SENSE CHECK AGAINST PAYMENTS MADE BY CURRENT SHS OWNERS

Approach	Payment method	Description	Rationale
i Current lighting expenditure	PayGo/ Instalment	▪ Respondents were asked to estimate how many candles and torch batteries they use on a weekly basis ▪ A bottom-up calculation was then undertaken to estimate their current lighting spend	▪ Easy to estimate – majority of households have a good understanding of the frequency of such purchases (i.e., candles, torch batteries) ▪ Representative of the amount that could immediately be re-diverted to a SHS product from current spending
ii Self-stated willingness to pay	One-time payment	▪ Respondents were asked to state how much they would be willing to pay for a solar product with 3-lights and a pocket-sized radio if they were to pay in a single transaction	▪ May demonstrate willingness to pay a premium (over and above their current expenditure) as SHS is a higher quality lighting product
	PayGo/ Instalment	▪ Respondents were asked to state how much they would be willing to pay for a solar product with 3-lights and a pocket-sized radio if they were to pay in instalments over a 1-year period	
Sense-check			
Premium paid by low-income SHS owners	PayGo/ Instalment	▪ Monthly installment paid for current solar products compared to monthly expenditure to determine potential premium household is willing to pay above lighting expenditure	▪ Captures any premium that households may be willing to pay to acquire higher quality energy
Rural Electrifica-tion Masterplan for Zambia (2008 – 2030)	PayGo/ Instalment	▪ The 2009 Rural Electrification Masterplan sought to establish how many households would afford SHS at different price points	▪ REMP Analysis had similar objectives to the USAID SAEP survey

SOURCE: USAID SAEP Household Survey (2018), internal analysis

NATIONAL STATISTICS INDICATE THAT TORCHES AND CANDLES ARE THE MOST COMMON SOURCES OF LIGHTING FOR UNELECTRIFIED HOUSEHOLDS…

Main type of lighting energy in Zambia, %



- The most common source of lighting in urban areas is electricity
- In rural areas, households predominantly rely on torches and candles for lighting
- In estimating lighting expenditure, the survey focussed on these two main lighting sources (candles and torch batteries)

1 Slight variation from the national electrification rate of 27%. The 31.2% number is based on a different survey that was undertaken by the Central Statistics Office in 2015

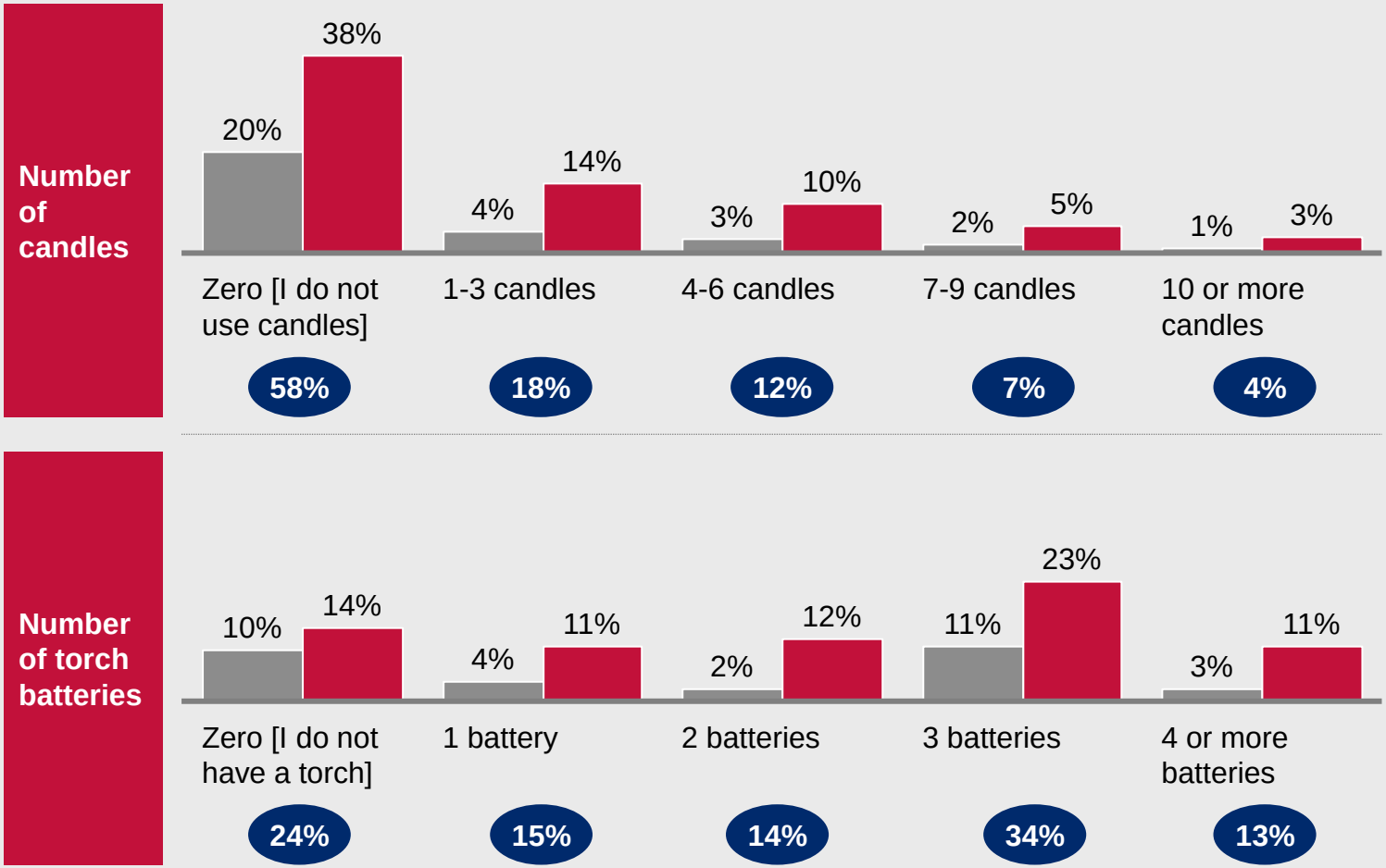
SOURCE: Zambia Living Conditions Monitoring Survey 2015

…THEREFORE CURRENT LIGHTING EXPENDITURE IS ESTIMATED BY GATHERING DATA ON WEEKLY HOUSEHOLD CONSUMPTION OF CANDLES AND TORCH BATTERIES

% % of total households Urban Rural

Weekly household consumption of candles and torch batteries, %

N = 530 households (restricted to unelectrified households)

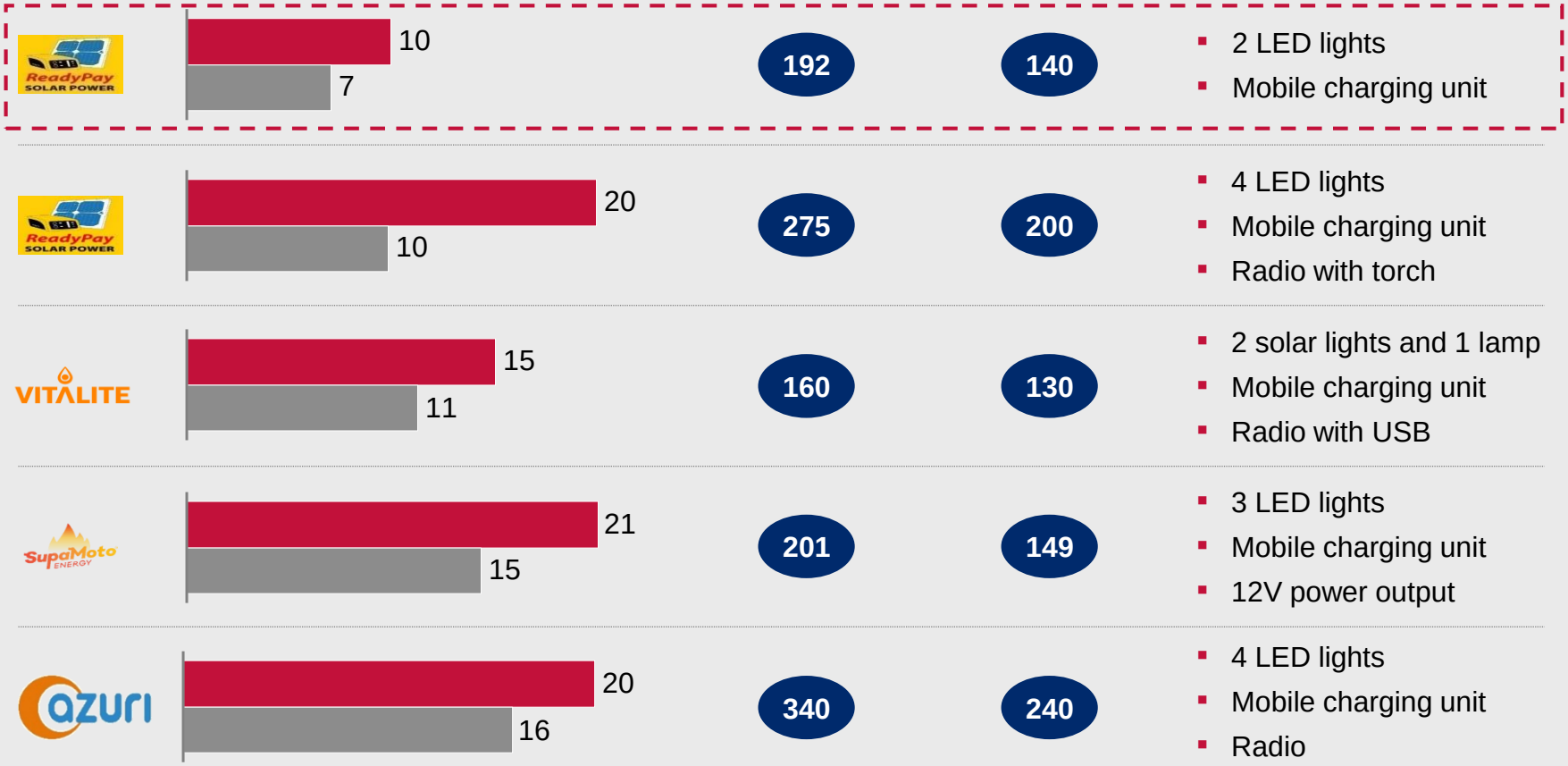


The majority of house-holds interviewed reported a preference for torch batteries over candles

SOURCE: USAID SAEP Household Survey (2018)

ii FOR WILLINGNESS TO PAY, RESPONDENTS ARE ASKED TO REACT TO PRICES OF SHS PRODUCTS THAT ARE CURRENTLY AVAILABLE IN THE ZAMBIAN MARKET

Benchmark used to estimate affordability | Deposit | Monthly fee



1 Assumes a 12 month instalment plan - exception: Azuri offers 20 months, ReadyPay offers 24 months
2 Summation of deposit plus total instalments paid over duration of "loan"
3 Amount payable for a single one-time payment

SOURCE: SHS companies

CONTENTS

THE SURVEY CREATES TRANSPARENCY ON THREE DIMENSIONS: SHS AWARENESS AND OWNERSHIP, MOBILE PHONE USAGE AND HOUSEHOLD EXPENDITURE AND WILLINGNESS TO PAY FOR SHS

SHS awareness and ownership

- Do people know and/or own SHS?
- How do people perceive solar energy?
- What prevents house-holds from purchasing SHS?

Mobile phone usage

- What is the penetration of mobile phones and mobile money?
- How much do house-holds transact on mobile money platforms?

Household expenditure and willingness to pay for SHS

- What is the average total household expenditure, and does it vary over time?
- Are households able to afford SHS products?

CONTENTS

SUMMARY OF INSIGHTS: SHS AWARENESS AND OWNERSHIP

Do people know and/or own SHS?

- Awareness of solar products is very high with 83% of surveyed households knowing about solar energy:
  - "Word of mouth" is the primary source of awareness for the majority of households (61% of total)
- 64% of surveyed households have access to an electricity connection and of those 40% already owned a SHS product
  - For a nascent market, solar product ownership is high (40% of total), particularly in rural areas at 50% of surveyed households
  - Most solar product owners (68%) purchased pico-lantern or other Tier 1 products
  - Households typically pay a single amount (84%) rather than PayGo for these smaller products
  - SHS ownership (as % of surveyed population) is highest in Lusaka, Eastern, Central and Western provinces

How do people perceive solar energy?

- Solar has a positive perception with 59% of households preferring solar to ZESCO given its low cost and reliability
- Lighting (63%) is the most valued feature among solar product owners

What prevents households from purchas-ing SHS?

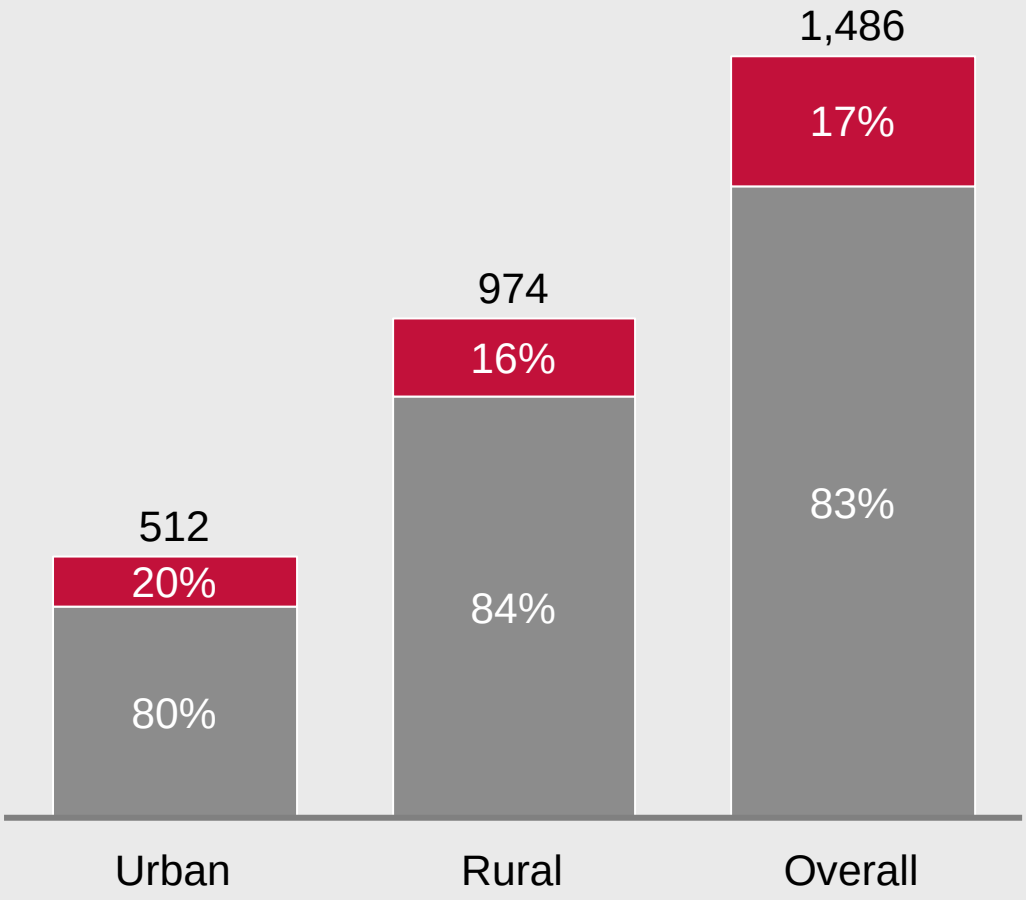
- 61% of households cite affordability as the main barrier to purchasing a SHS
- In Southern, Copperbelt and Muchinga, 15-20% of households are eager to purchase SHS but lack a service provider nearby

SOURCE: USAID SAEP Household Survey (2018), internal analysis

AWARENESS OF SOLAR PRODUCTS IS VERY HIGH WITH 83% OF SURVEYED HOUSEHOLDS KNOWING ABOUT SOLAR ENERGY

Awareness of solar products, % of households

N = 1,486 households (full surveyed sample)



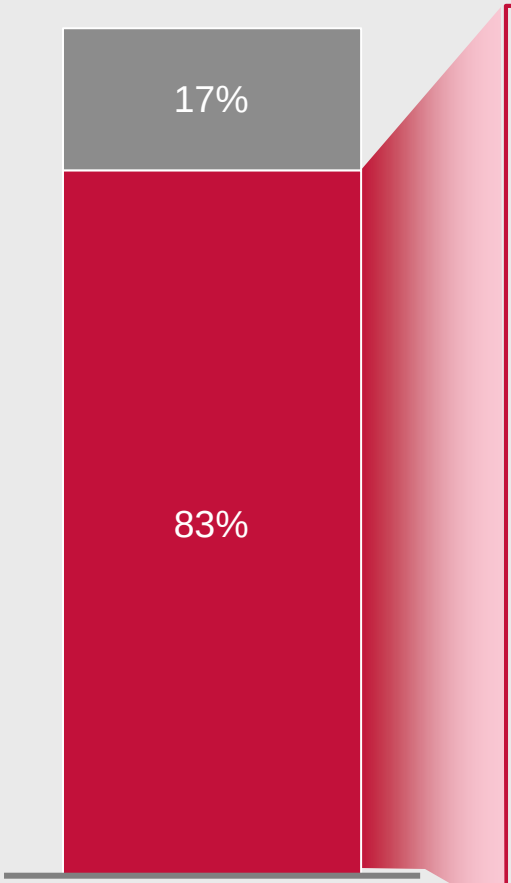
- 80% of surveyed households know about solar energy
- Awareness of solar in rural areas was marginally higher at 84% compared to 80% in urban areas

SOURCE: USAID SAEP Household Survey (2018), internal analysis

"WORD OF MOUTH" IS THE PRIMARY SOURCE OF AWARENESS FOR THE MAJORITY OF HOUSEHOLDS (61% OF TOTAL)

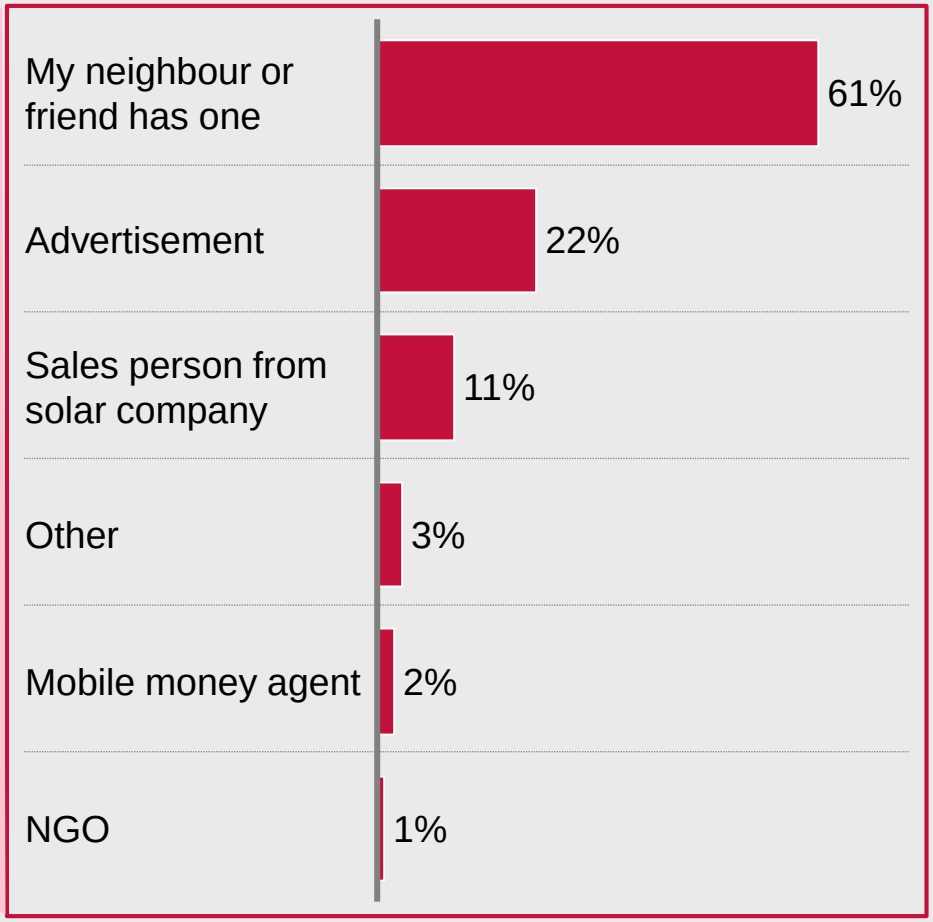
Awareness of solar,
% households

Not aware of solar
Aware of solar



Main source of awareness , % households

N = 1,230 households (restricted to households aware of solar products)



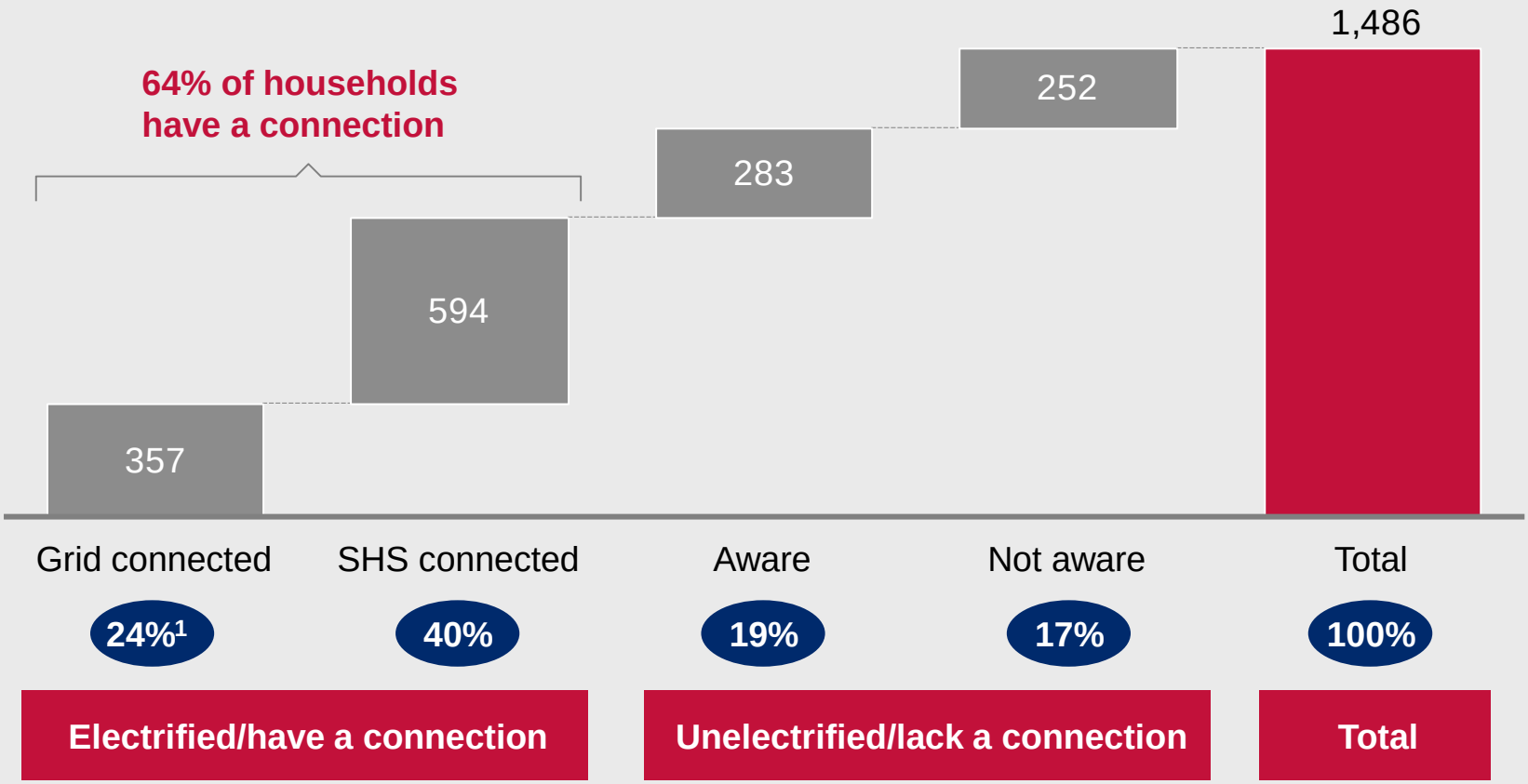
- The primary source of awareness is by "word of mouth" from close friends and relatives with 61% of surveyed households citing this as the source of awareness
- Sales agents are not a predominant form of raising awareness with only 11% of households citing sales agents as source of awareness

SOURCE: USAID SAEP Household Survey (2018)

64% OF SURVEYED HOUSEHOLDS HAVE ACCESS TO A CONNECTION AND OF THOSE 40% ALREADY OWNED A SHS PRODUCT

% % of total households

Level of electrification across surveyed households,
Number of households (full surveyed sample)

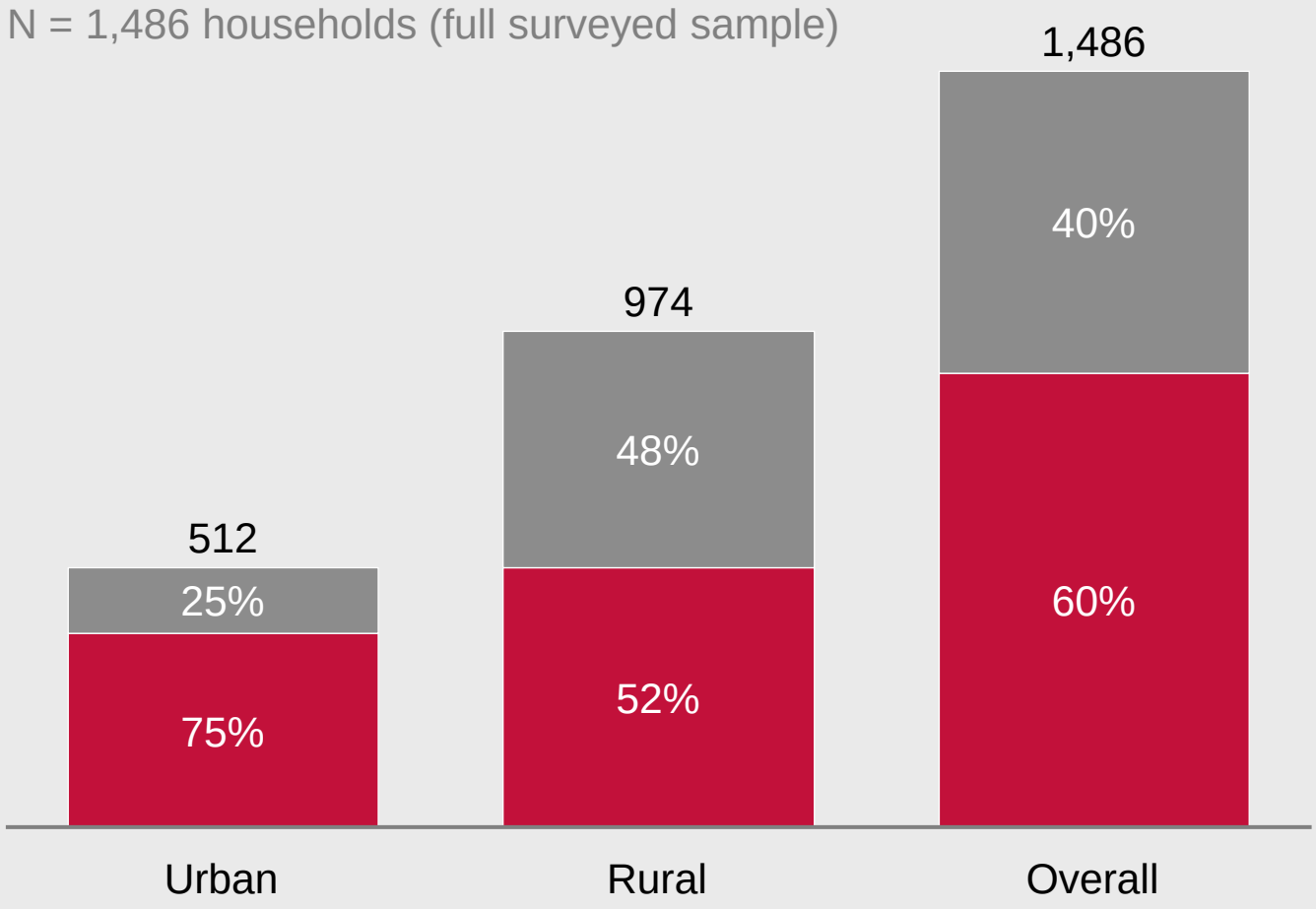


1 This is within range of the national electrification rate of 27%

SOURCE: USAID SAEP Household Survey (2018)

FOR A NASCENT MARKET, SOLAR PRODUCT OWNERSHIP IS HIGH (40% OF TOTAL), PARTICULARLY IN RURAL AREAS AT 48% OF SURVEYED HOUSEHOLDS

Ownership of SHS, % respondents



- Zambia's SHS market is nascent with only 22,000 units being sold in 2017
- However, ownership of a solar product is already high with 40% of surveyed households owning a product
- Ownership is higher in rural areas (48% of households)

1 World Bank ESMAP tier definitions used

SOURCE: USAID SAEP Household Survey (2018)

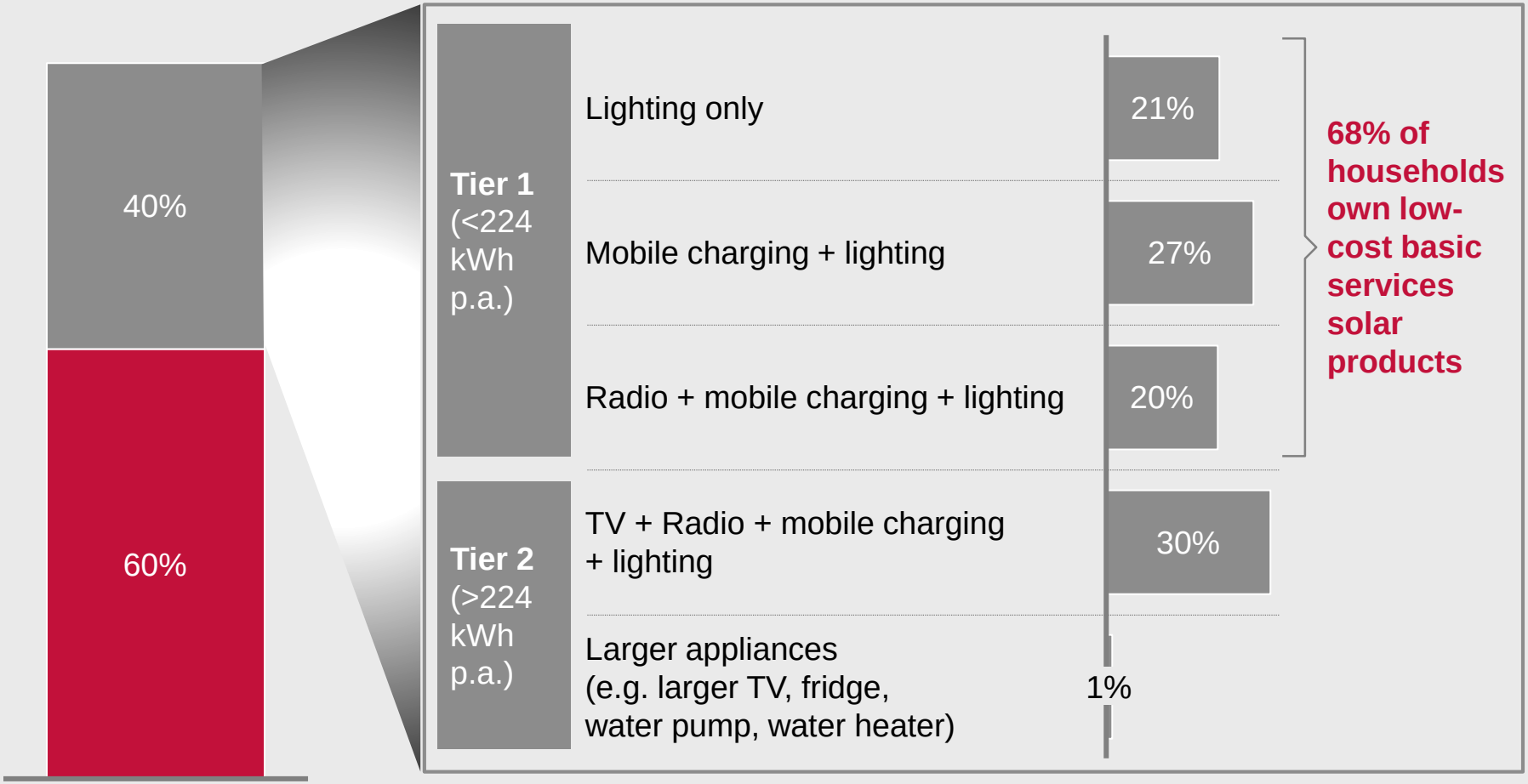
MOST SOLAR PRODUCT OWNERS (68%) PURCHASED PICO-LANTERN OR OTHER TIER 1 PRODUCTS

Has SHS Does not have SHS

Ownership of SHS
% respondents

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

N = 1,486 households (full surveyed sample)



1 World Bank ESMAP tier definitions used

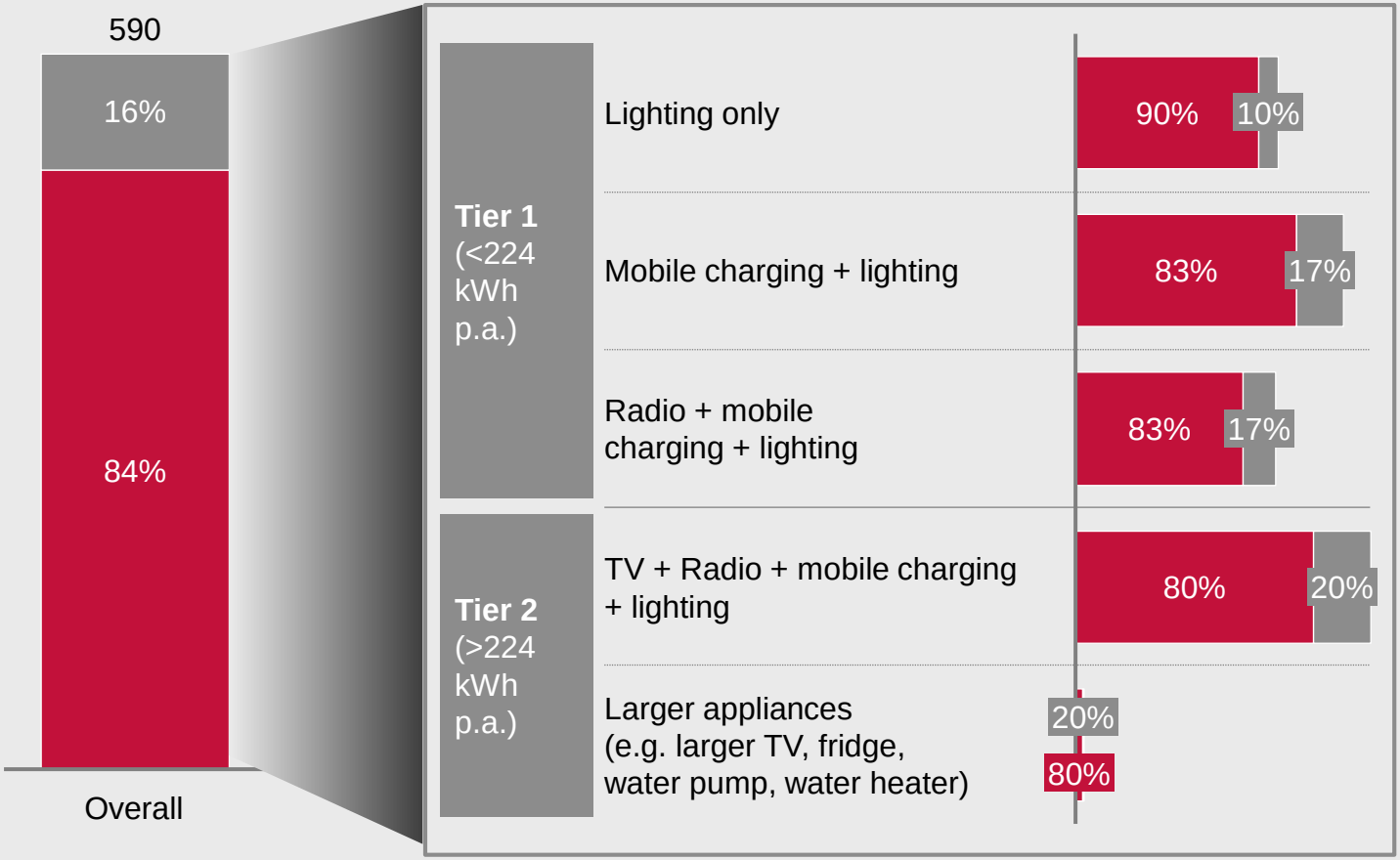
SOURCE: USAID SAEP Household Survey (2018)

HOUSEHOLDS TYPICALLY PAY A SINGLE AMOUNT (84%) RATHER THAN PAYGO FOR THESE SMALLER PRODUCTS

Payment method for SHS, % respondents

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

N = 590 households (restricted to households that own a solar product)



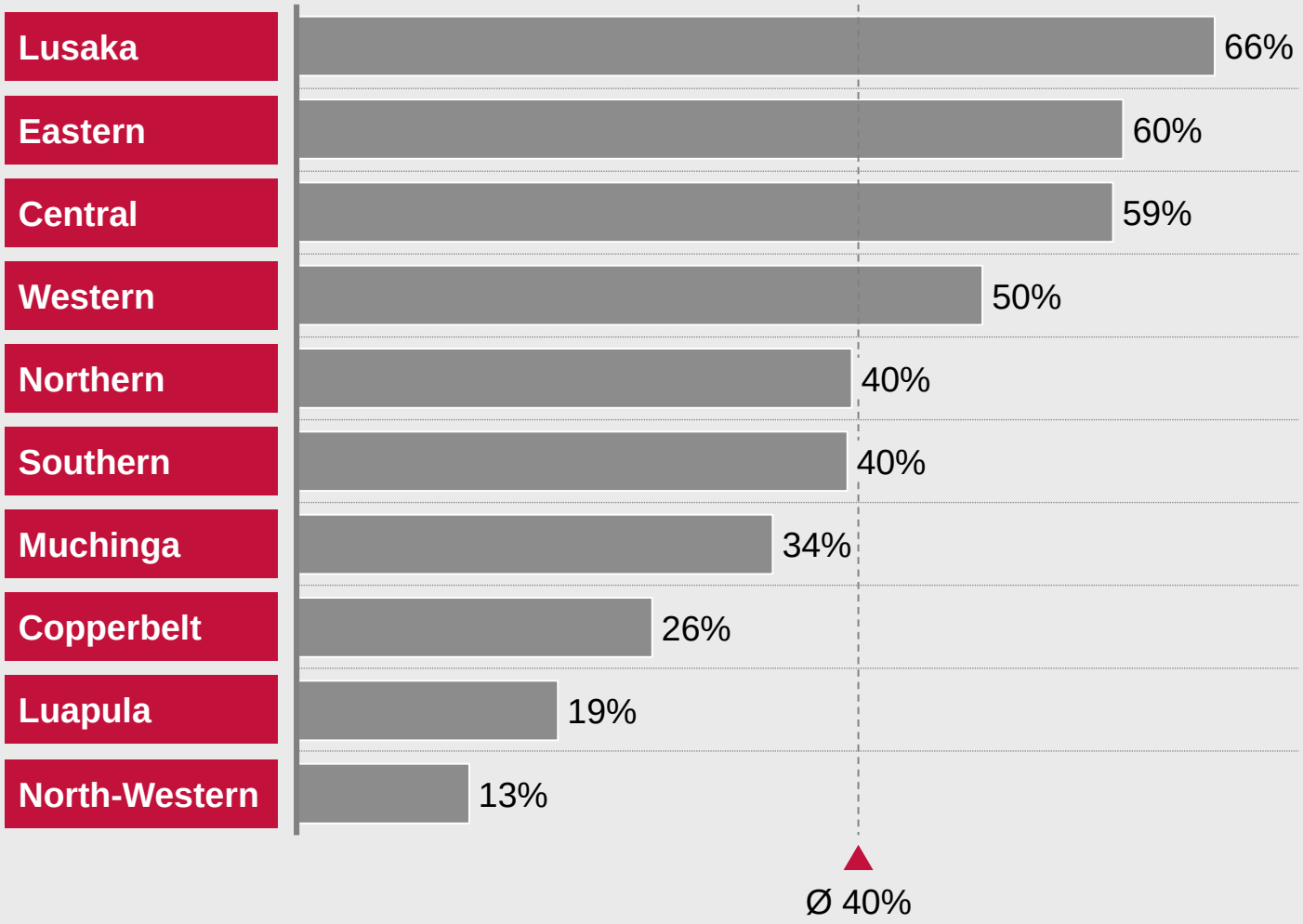
- Across all products, one-time cash payment is the most common method of payment
- There is a however a gradual increase in the use of PayGo for more advanced solar products – indicating that PayGo may potentially pay a significant role in enabling households migrate to more complex systems

SOURCE: USAID SAEP Household Survey (2018)

SHS OWNERSHIP (AS % OF SURVEYED POPULATION) IS HIGHEST IN LUSAKA, EASTERN, CENTRAL AND WESTERN PROVINCES

Solar product ownership by province, % households

N = 1,486 households (full surveyed sample)



- In Lusaka, Eastern, Central and Western, over 50% of surveyed households own SHS
- Lusaka and Central provinces are considered to be wealthier[1]

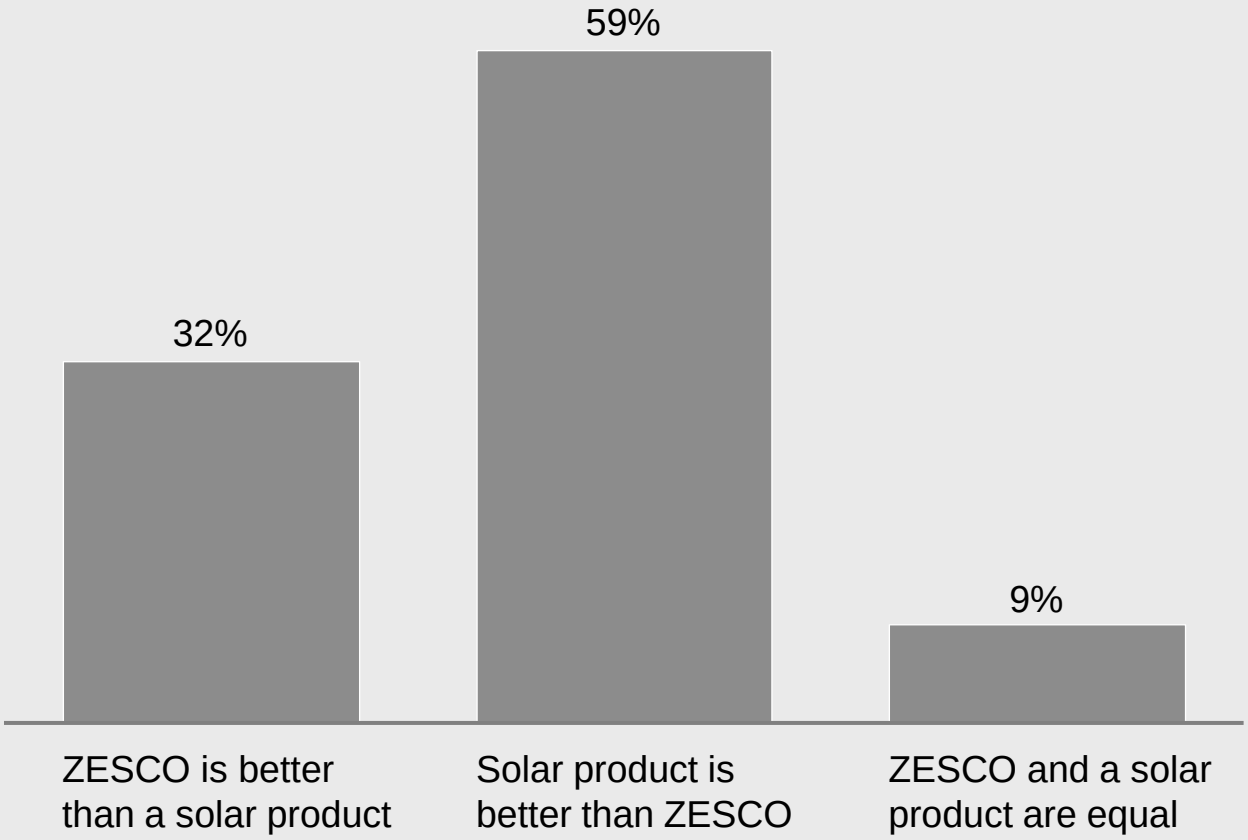
1 LCMS 2015 shows that the average income in Central and Lusaka provinces is above national average

SOURCE: USAID SAEP Household Survey (2018), Zambia Living Conditions Monitoring Survey 2015

SOLAR HAS A POSITIVE PERCEPTION WITH 59% OF HOUSEHOLDS PREFERRING SOLAR TO ZESCO GIVEN ITS LOW COST AND RELIABILITY

Perception of solar as a source of electricity, % households

N = 1,220 households (restricted to households that are aware of solar products)



- 59% of respondents stated that they preferred solar to ZESCO
- The main reasons cited in interviews included:
  - Solar is relatively cheaper than ZESCO
  - Solar is easier to acquire i.e., has less cumbersome installation process when compared to ZESCO
  - Once paid off, solar is free to use
  - ZESCO communal[1], the most common form of grid electrification in rural areas, is perceived to be unfair as bills do not reflect actual consumption

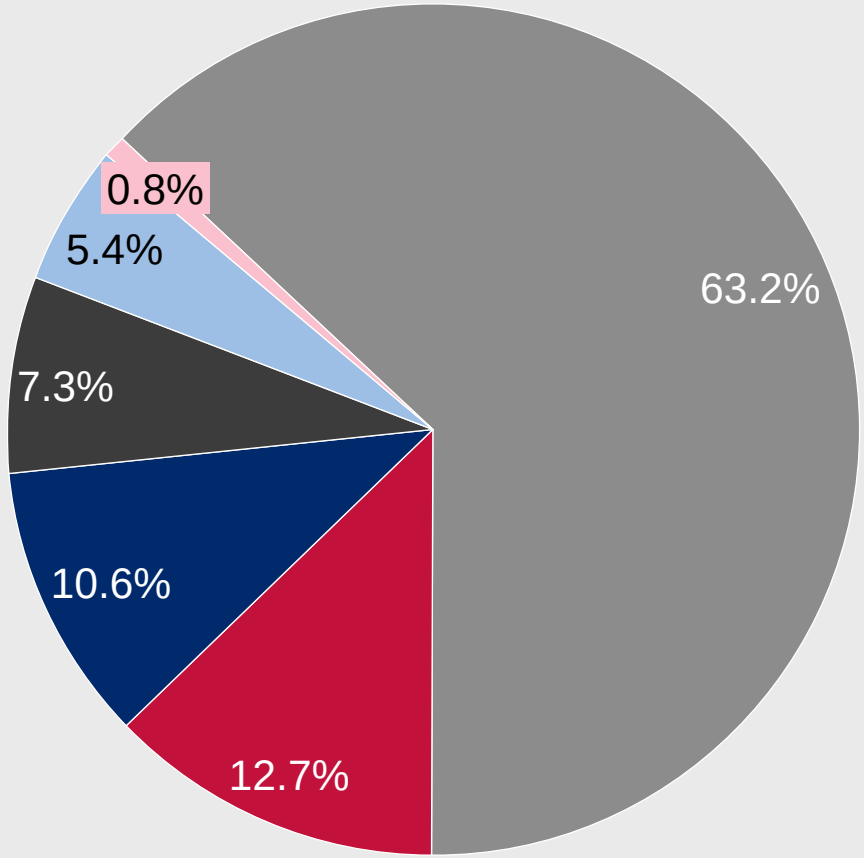
1 A ZESCO connection scheme where multiple households share a single meter and where the monthly bill is evenly split across the connected households - irrespective of varying degrees of usage across each household i.e., House A (high electricity consumer) and House B (low electricity consumer) evenly split the monthly ZESCO bill

SOURCE: USAID SAEP Household Survey (2018), survey results

LIGHTING (63%) IS THE MOST VALUED FEATURE AMONG SOLAR PRODUCT OWNERS

Most valued feature by type of solar product, % households

N = 592 households (restricted to households that own solar products)



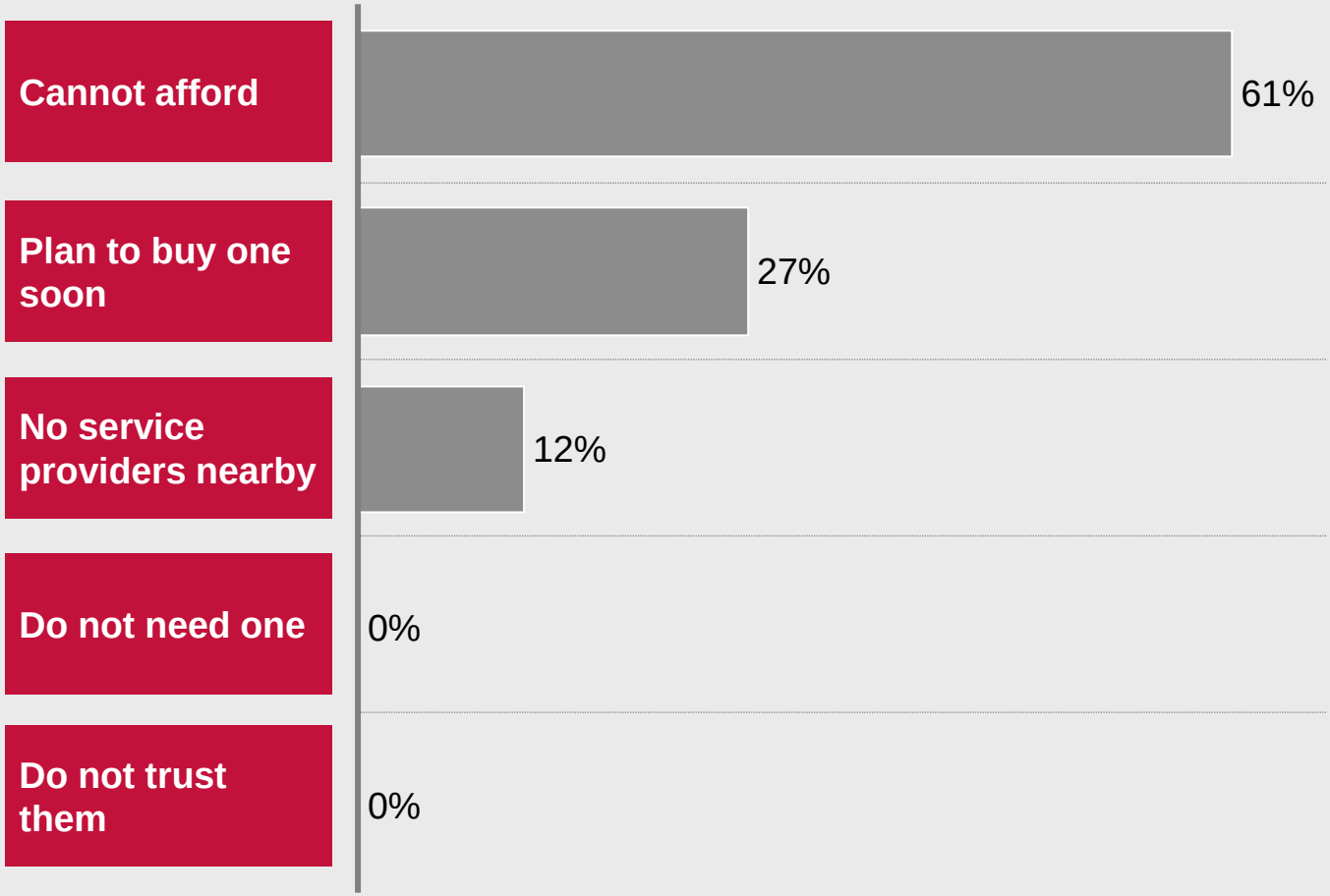
- Overall, 63% of households cite lighting as the most valued feature about their solar product
- Lighting may be seen as the 'essential' feature of solar products, whereas radio and TV are 'luxury' features that households value once they have become accustomed to the lighting component of their solar products

SOURCE: USAID SAEP Household Survey (2018), survey results

61% OF HOUSEHOLDS CITE AFFORDABILITY AS THE MAIN BARRIER TO PURCHASING A SHS PRODUCT

Reason for not owing a solar product, % households

N = 260 households (restricted to households that are aware of solar but do not own a solar product)



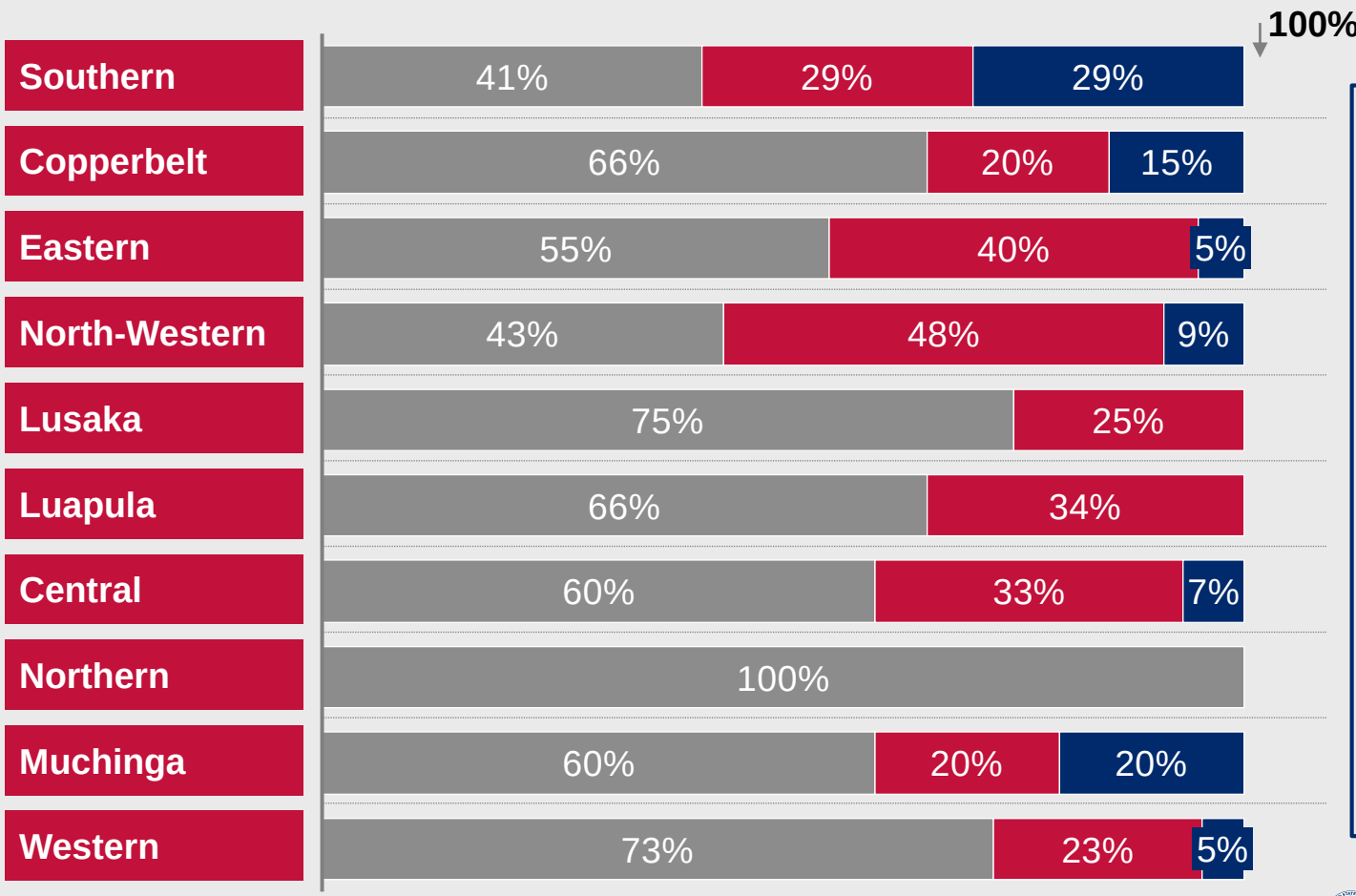
- 61% of unelectrified non-SHS owners who know about SHS cited affordability as the biggest barrier to ownership
- 12% of households stated that they are ready to acquire SHS but are unable to do so owing to lack of nearby sales agents
- No household cited trust (quality concern) as a barrier

1 Only includes unelectrified households currently aware of solar products

SOURCE: USAID SAEP Household Survey (2018)

IN SOUTHERN, COPPERBELT AND MUCHINGA, 15-20% OF HOUSEHOLDS ARE EAGER TO PURCHASE SHS BUT LACK A SERVICE PROVIDER NEARBY

Number of household respondents by province and area of residence,
N = 260 households (restricted to households that are aware of solar but do not own a solar product)



- Inability to afford is greatest in Lusaka, Northern and Western provinces
- Eastern and North-Western provinces have the highest number of households that are ready to acquire SHS
- Lack of nearby service providers is highest in Muchinga and Southern provinces

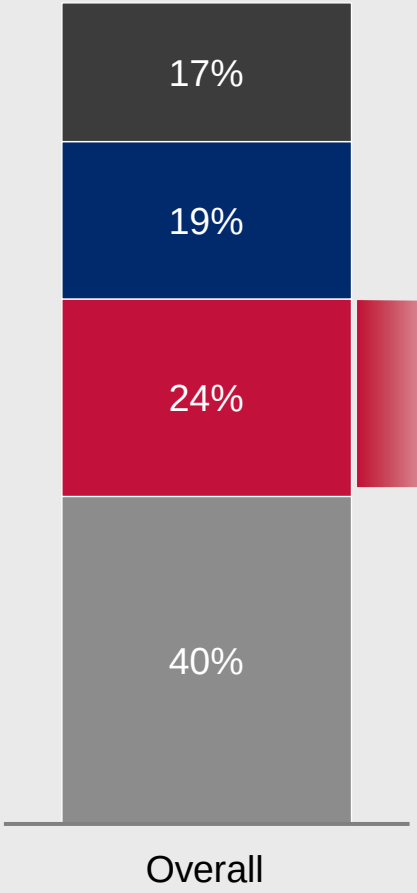
SOURCE: USAID SAEP Household Survey (2018)

EVEN IN GRID CONNECTED HOUSEHOLDS, SOLAR\ REMAINS POPULAR WITH ONLY 31% STATING THAT THEY DO NOT NEED A SOLAR PRODUCT

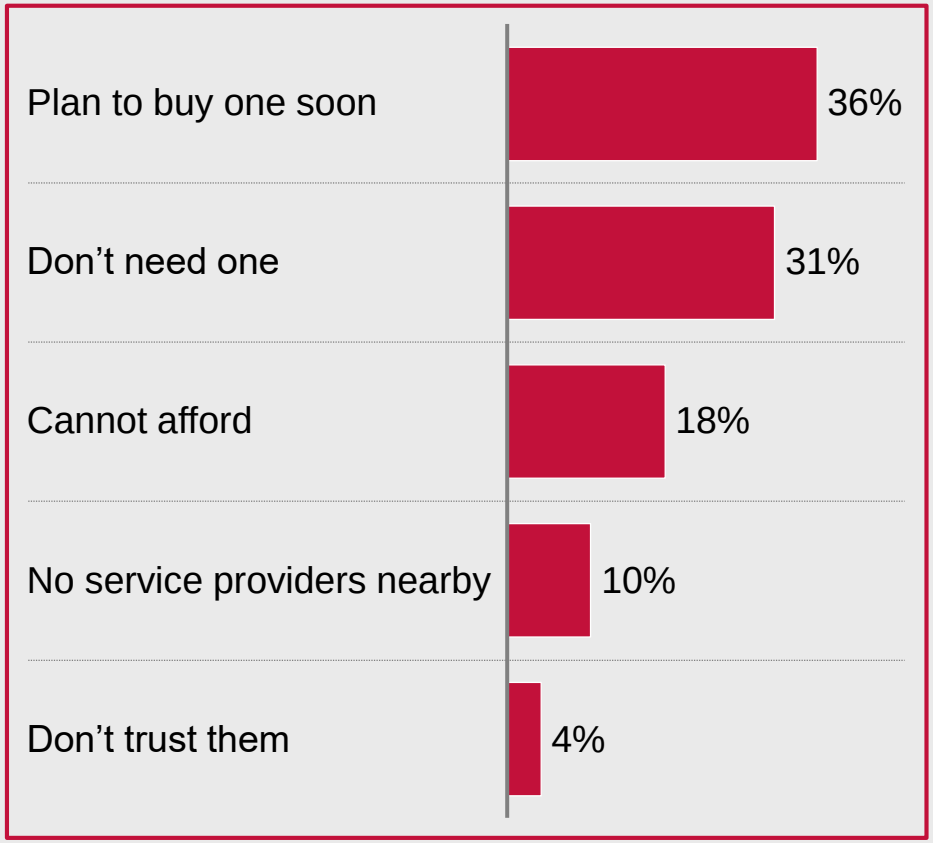
N = 1,486 households (full surveyed sample)

- Unelectrified and unaware of SHS
- Unelectrified but aware of SHS
- Grid connected
- SHS connected

Level of electrification, % households



Reason for not owning a solar product, % households



- SHS remains popular even in grid connected households - only 31% of grid connected households stated that they do not need a solar product
- This may indicate that extensions to the grid may not necessarily have an adverse effect on SHS companies

SOURCE: USAID SAEP Household Survey (2018)

CONTENTS

SUMMARY OF INSIGHTS: MOBILE PHONE USAGE

What is the penetration of mobile phones and mobile money?

- Mobile phone penetration is near-universal among respondents (97%); however only half of mobile phone users use mobile money
  - Mobile phone penetration is higher than external sources while mobile money penetration is consistent with national measures

How much do households transact on mobile money platforms?

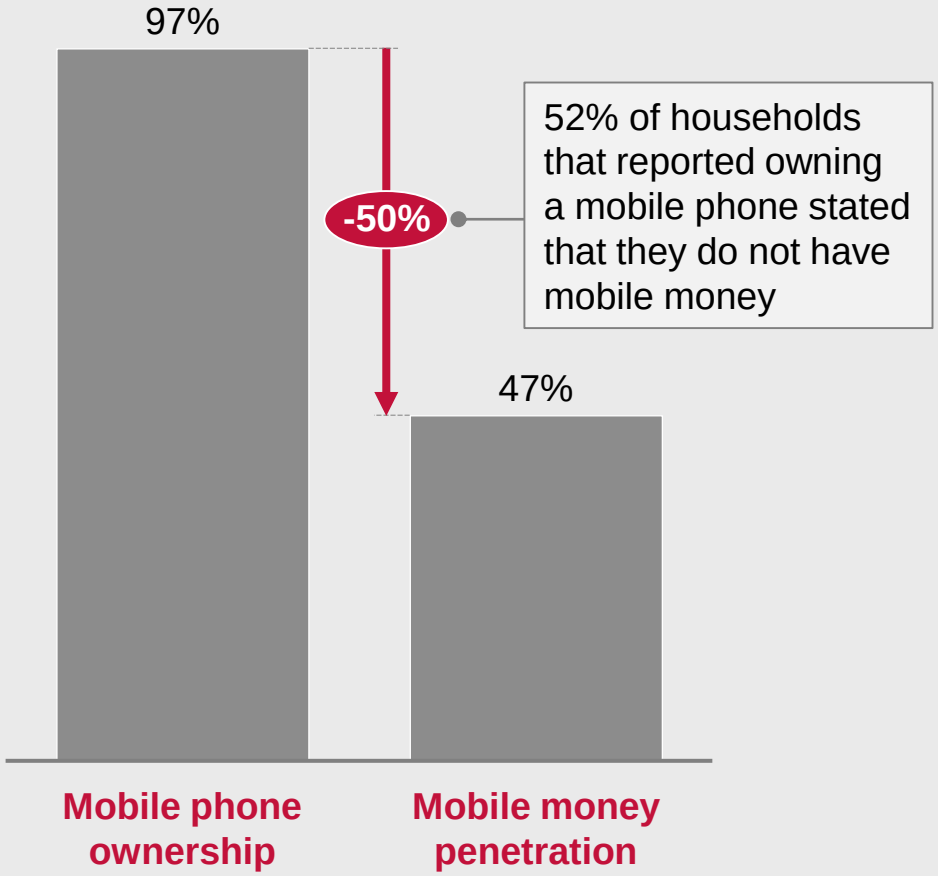
- Once consumers are using mobile money, their transactions are generally sufficient to make a regular SHS payment

SOURCE: USAID SAEP Household Survey (2018), internal analysis

MOBILE PHONE PENETRATION IS NEAR-UNIVERSAL AMONG RESPONDENTS (97%); HOWEVER ONLY HALF OF MOBILE PHONE USERS USE MOBILE MONEY

Mobile phone ownership and mobile money penetration, % households

N = 1,486 households (full surveyed sample)



> I know about Airtel and MTN money, but don't know what to use it for
>
> ***– Interviewee in Chongwe***

> I only use mobile money for talk time and to send money to my nephew who is in Lusaka
>
> ***– Interviewee in Masaiti***

> I don't have any bills to pay (ZESCO, GoTV) so I don't have any use of mobile money
>
> ***– Interviewee in Ndola***

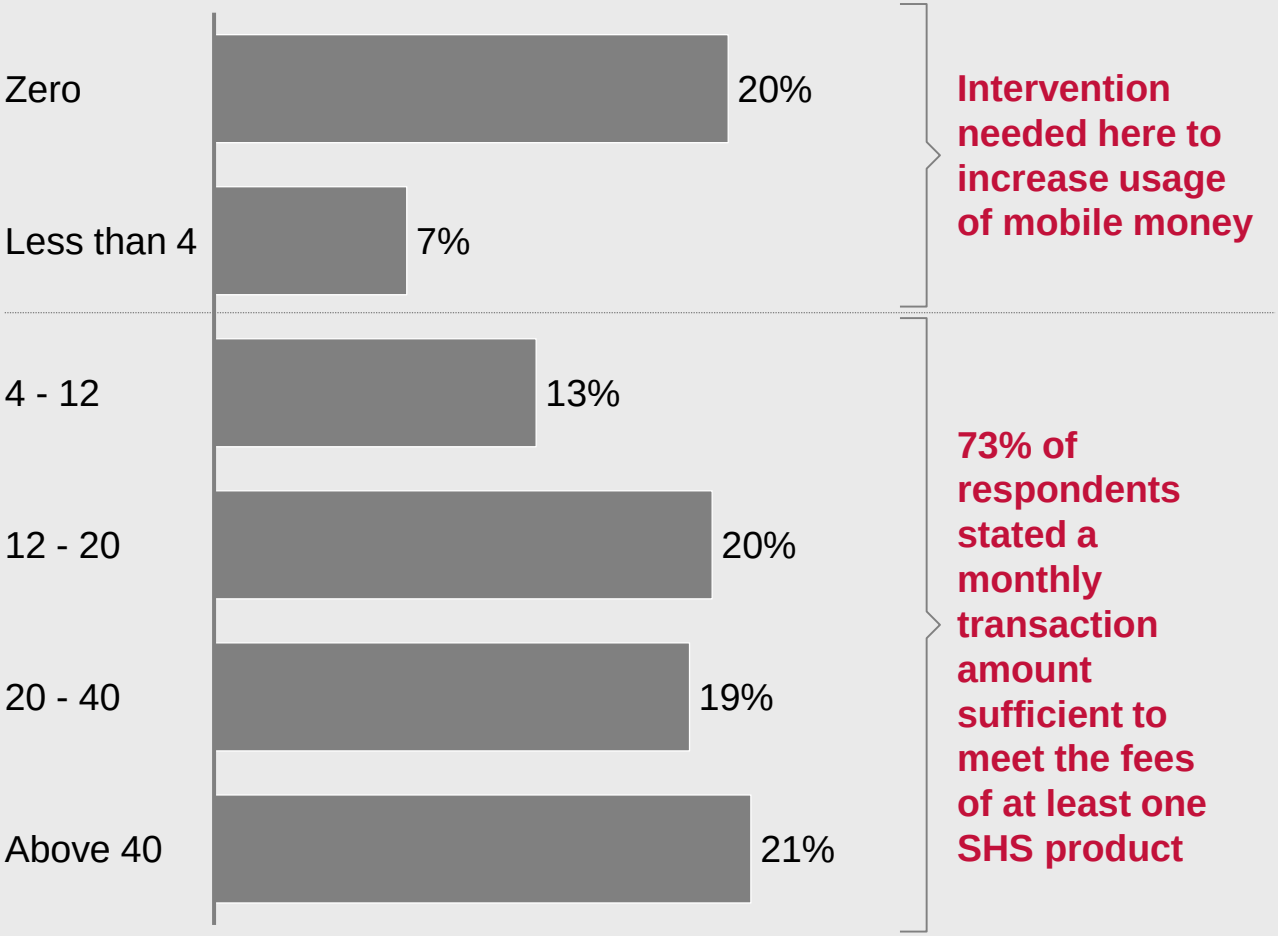
1 Inactive subscribers refers to mobile money users who have not made a transaction on mobile money in the past 90 days

SOURCE: USAID SAEP Household Survey (2018)

ONCE CONSUMERS ARE USING MOBILE MONEY, THEIR TRANSACTIONS ARE GENERALLY SUFFICIENT TO MAKE A REGULAR SHS PAYMENT

Average monthly transactions on mobile money, USD

N = 662 households (restricted to households that have mobile money)



- Once registered for mobile money, majority (73%) of consumers report a monthly transaction size that is sufficient to cover the fee of at-least one SHS product
- This may indicate that once a consumer is registered for mobile money, they trust the platform and minimal external effort is required to make these households transact over mobile money

SOURCE: USAID SAEP Household Survey (2018)

CONTENTS

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

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

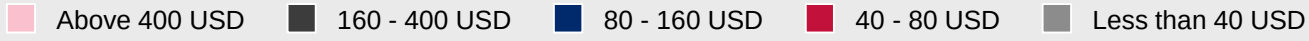
- 65% of households surveyed are low-income, spending less than USD 80 per month
- In all provinces, the survey has a higher distribution of low income households (<80 USD per month)
- Income volatility is high with >70% of households reporting that their income changes significantly during the year

Are households able to afford SHS products?

- 18 – 35% of households are able to afford a basic SHS product (USD 7 per month) based on our two approaches and sense check
  i. 18% of Zambian homes can afford a SHS system at no additional cost (assuming sample is representative) based on current lighting expenditure
  ii. On a self-stated basis, 31% of Zambian households can afford SHS even if it means increasing their lighting spend in weekly instalments, and 35% of households report a one-time willingness to pay within range of current retail prices
  iii. As a sense check, SHS owners with monthly income >USD 40 incur a monthly cost that would cover a basic SHS product. Using this method, 34% of surveyed households are above the income threshold of USD 40 per month and therefore could afford SHS

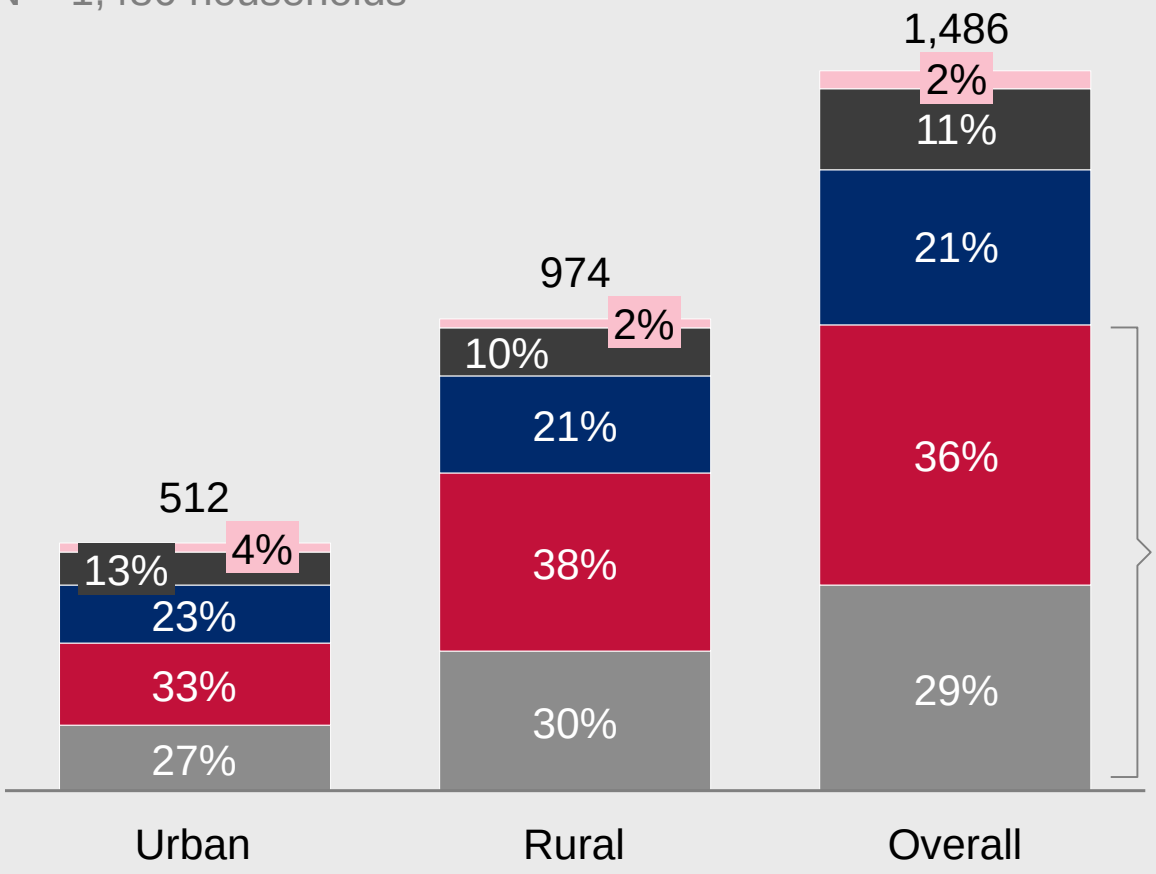
SOURCE: Internal analysis

65% of households surveyed are low-income, spending less than USD 80 per month



Self-stated monthly income[1] by area of residence, % of households

N = 1,486 households



65% of households earn less than USD 80 per month

- The majority of households interviewed were from the low income[2] segment
- There was a marginally higher concentration of low income households in rural areas

1 Household expenditure used as a proxy for income
2 Households that earn less than the LCMS defined average income for rural households (USD 81)

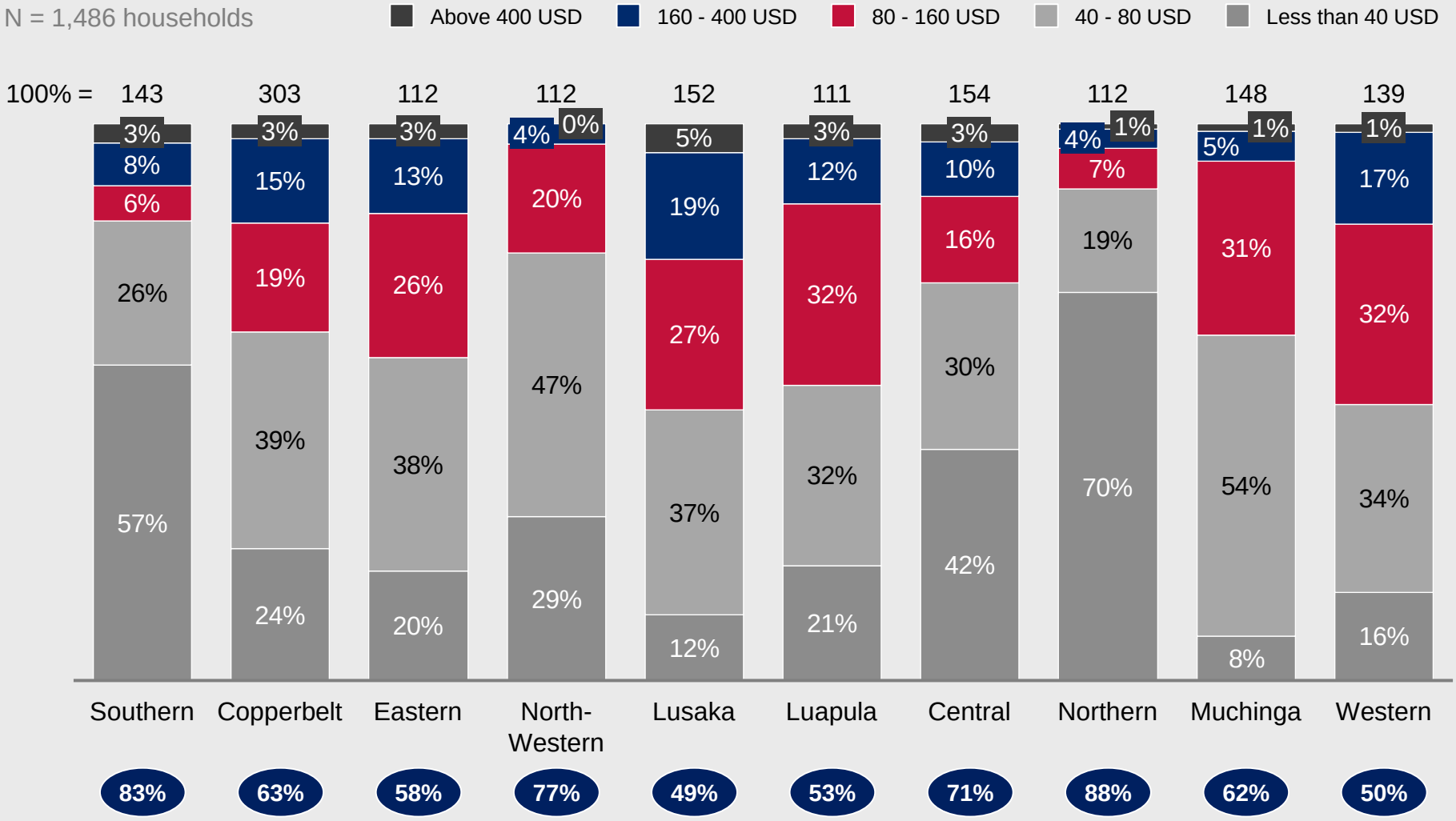
SOURCE: USAID SAEP Household Survey (2018), Living Conditions Monitoring Survey

IN ALL PROVINCES, THE SURVEY HAS A HIGHER DISTRIBUTION OF LOW INCOME HOUSEHOLDS (<80 USD PER MONTH)

% % of low-income households

Distribution of households by self-stated household expenditure at the provincial level, % of households

N = 1,486 households

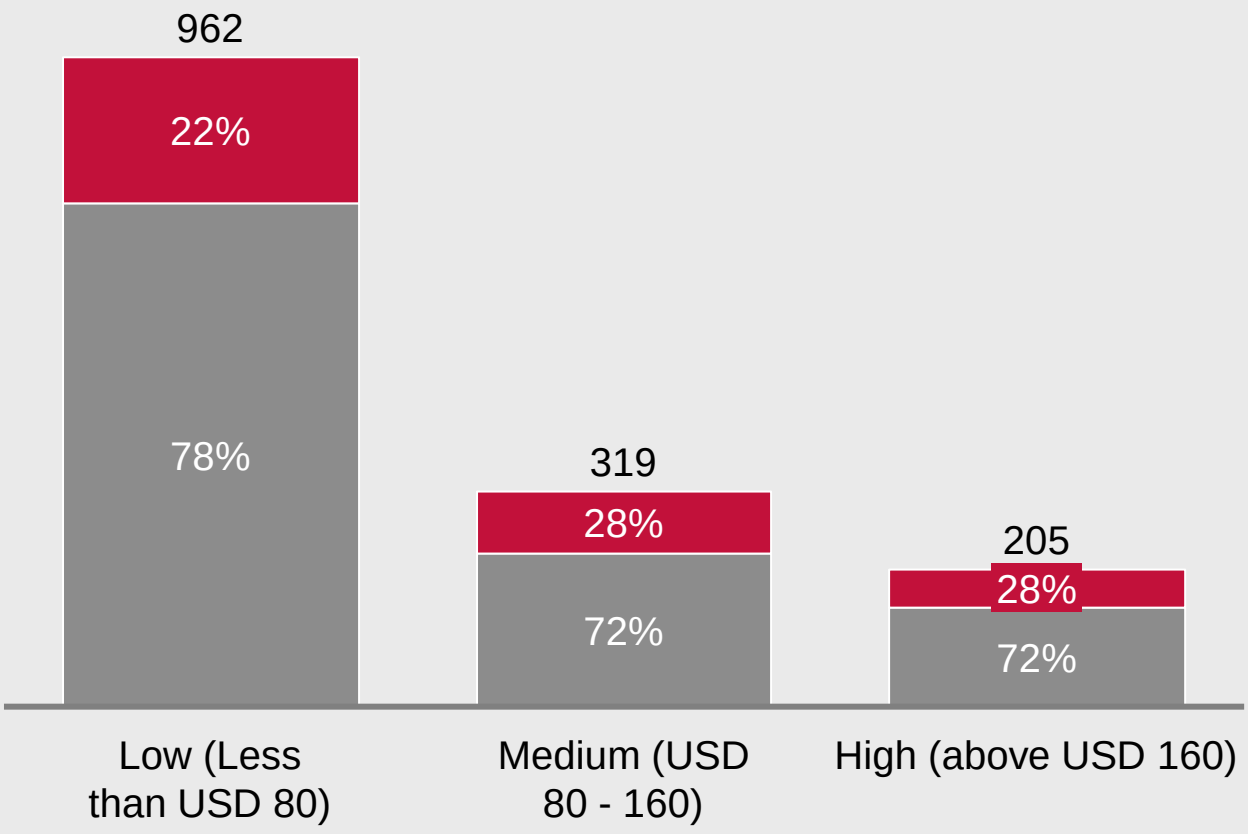


SOURCE: USAID SAEP Household Survey (2018), internal analysis

INCOME VOLATILITY IS HIGH WITH >70% OF HOUSEHOLDS REPORTING THAT THEIR INCOME CHANGES SIGNIFICANTLY DURING THE YEAR

Reported high income volatility, % respondents by area of residence

N = 1,486 households



- Reported income variability was high across all segments
- Variability is likely explained by:
  - Informal employment, especially in urban or peri-urban areas
  - Agricultural employment, especially in rural areas
- Such households may have difficulty sustaining regular payments required in a PayGo payment plan

SOURCE: USAID SAEP Household Survey (2018)

18% – 35% OF HOUSEHOLDS ARE ABLE TO AFFORD A BASIC SHS PRODUCT (USD 7 PER MONTH) BASED ON OUR TWO APPROACHES AND SENSE CHECK

% Estimates on ability to pay

% Sense-checks used to validate analysis

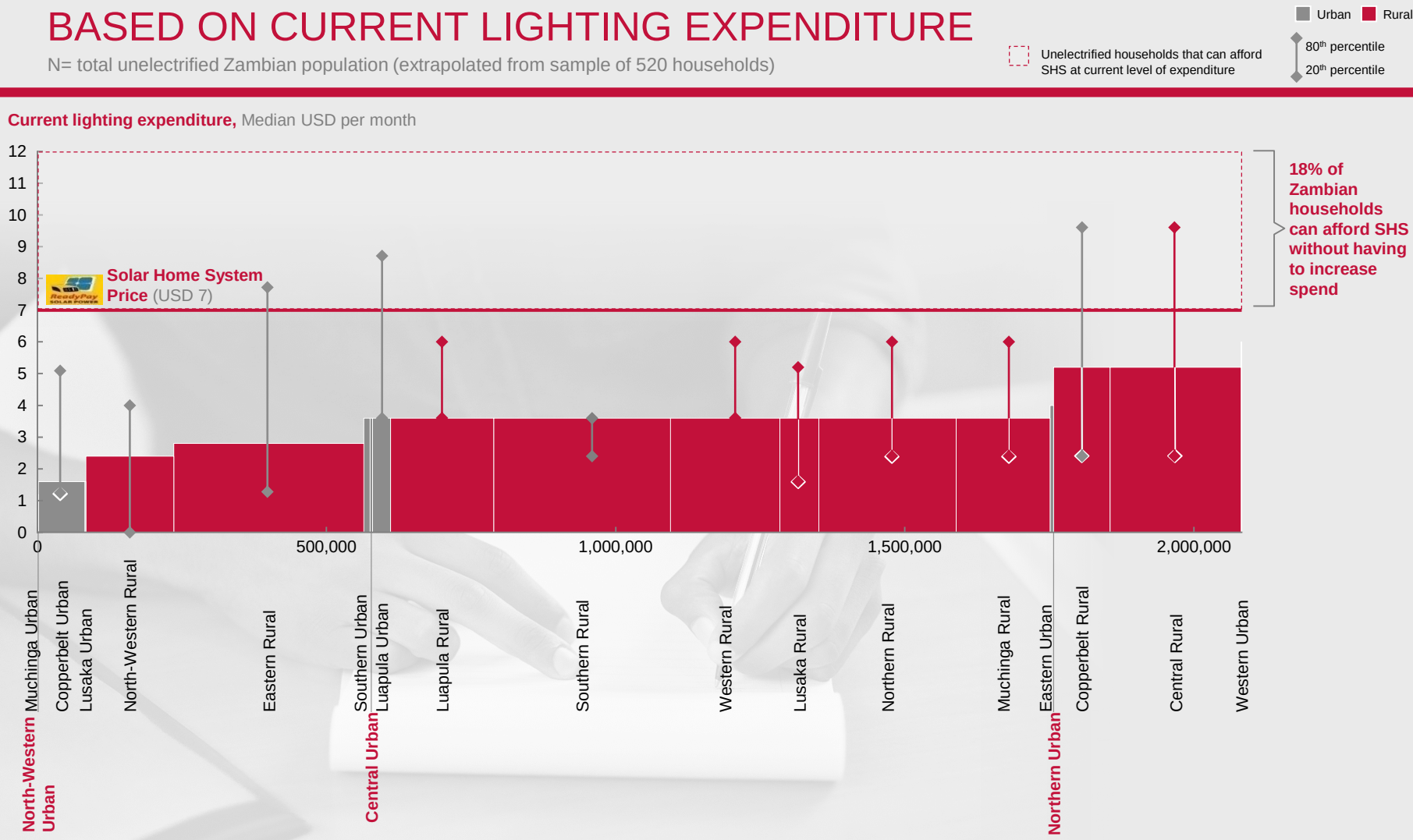
	i Current lighting expenditure	ii Self-stated willingness to pay		iii Sense-checks	
	One-time	One-time	PayGo	Current SHS premium	REMP analysis
Urban	18%	35%	27%	47%	
Rural	18%	35%	32%	33%	15%[1]
Overall	18%	35%	31%	34%	

1 The 2009 analysis established that 15% of households in rural Zambia are willing to pay USD 5 per month for SHS

SOURCE: USAID SAEP Household Survey (2018), internal analysis

18% OF ZAMBIAN HOMES CAN AFFORD AN SHS SYSTEM AT NO ADDITIONAL COST (ASSUMING SAMPLE IS REPRESENTATIVE) BASED ON CURRENT LIGHTING EXPENDITURE

N= total unelectrified Zambian population (extrapolated from sample of 520 households)



# of unelectrified households per province, (based on USAID SAEP Geospatial Model)

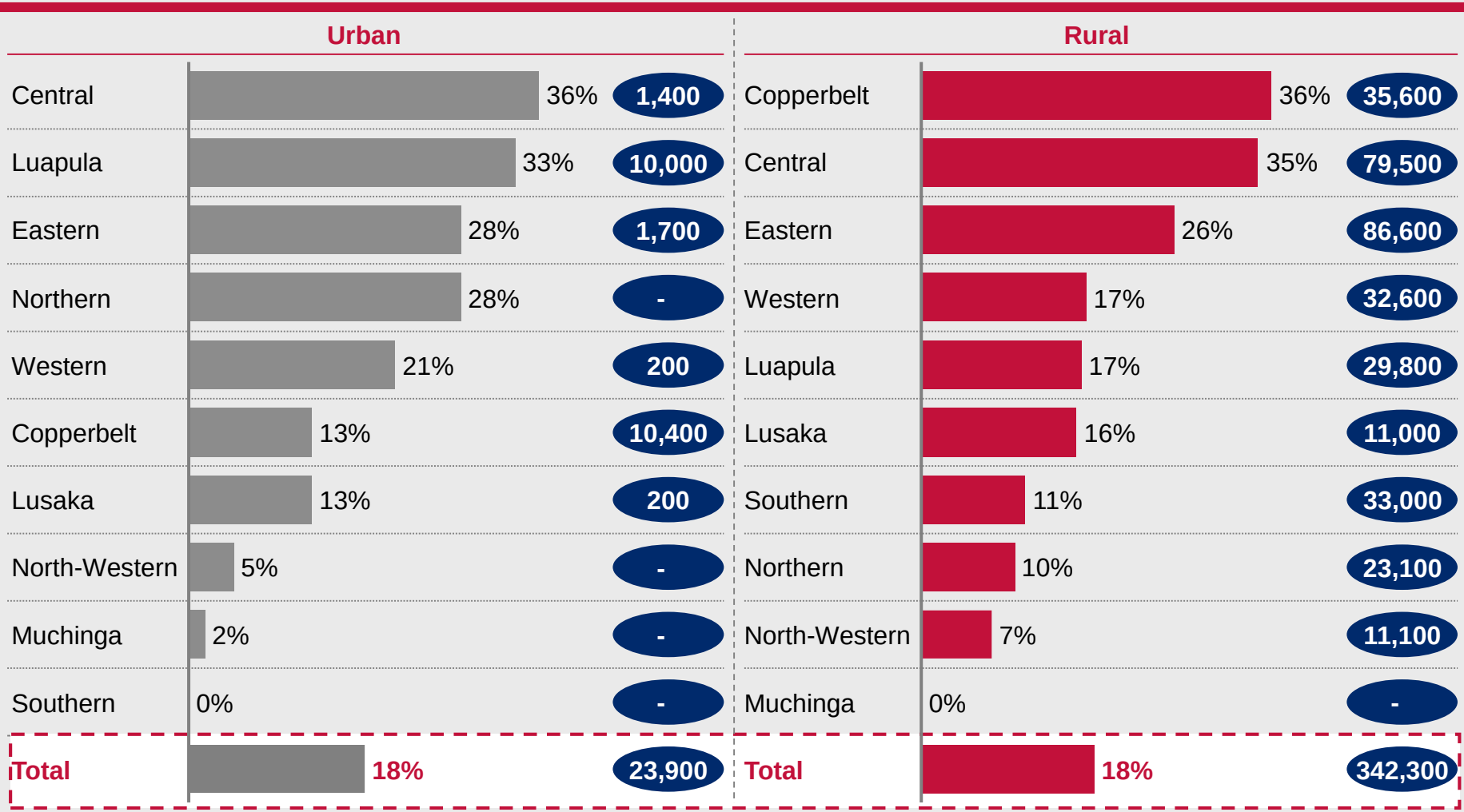
1 Analysis uses total unelectrified population split by urban and rural areas from the geospatial model in base case 2017

SOURCE: USAID SAEP Household Survey (2018), USAID SAEP Geospatial Model (2018)

LUAPULA URBAN AND EASTERN RURAL HAVE THE LARGEST NUMBER OF HOUSEHOLDS THAT CAN AFFORD SHS (BASED ON CURRENT LIGHTING EXPENDITURE)

Number of unelectrified households (2017)[1]

Distribution of unelectrified households by affordability based on current lighting expenditure, % of total population



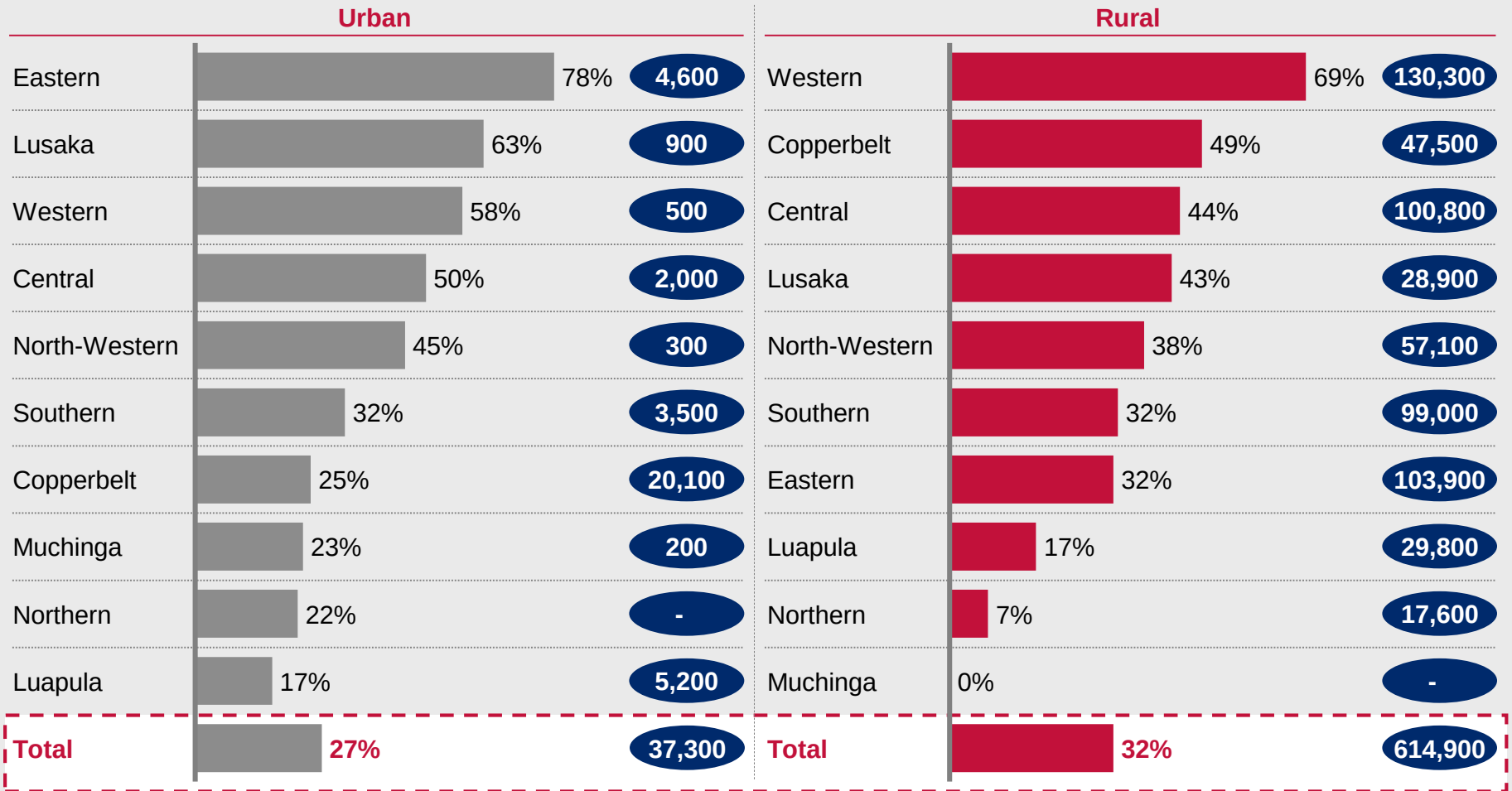
1 Proportion able to afford applied to the provincial rural and urban unelectrified population from the USAID SAEP geospatial model

SOURCE: USAID SAEP Household Survey (2018), USAID SAEP geospatial model

ii ON A SELF-STATED BASIS, 31%[1] OF ZAMBIAN HOUSEHOLDS CAN AFFORD SHS EVEN IF IT MEANS INCREASING THEIR LIGHTING SPEND

Number of unelectrified Households (2017)[2]

Distribution of unelectrified households by affordability based on self-stated (PayGo) willingness, % of total population



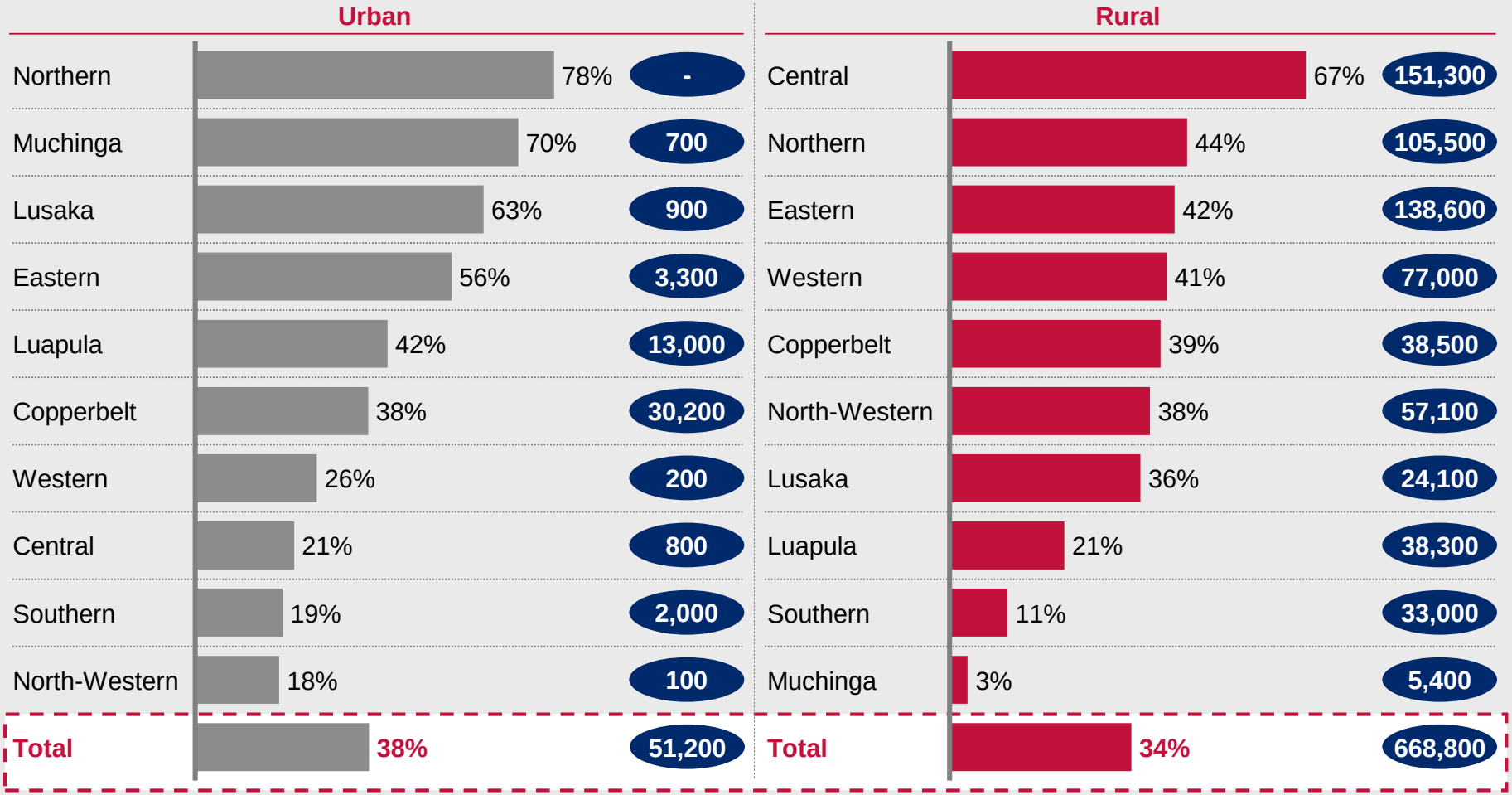
1 Average of both urban and rural households when combined
2 Proportion able to afford applied to the provincial rural and urban unelectrified population from the USAID SAEP geospatial model

SOURCE: USAID SAEP Household Survey (2018), USAID SAEP geospatial model

ii ON A SELF-STATED BASIS, 35%[1] OF HOUSEHOLDS REPORT A ONE-TIME WILLINGNESS TO PAY WITHIN RANGE OF CURRENT RETAIL PRICES

Number of unelectrified Households (2017)[2]

Self-reported one-time willingness to pay for basic SHS[3] for unelectrified households, % of total population



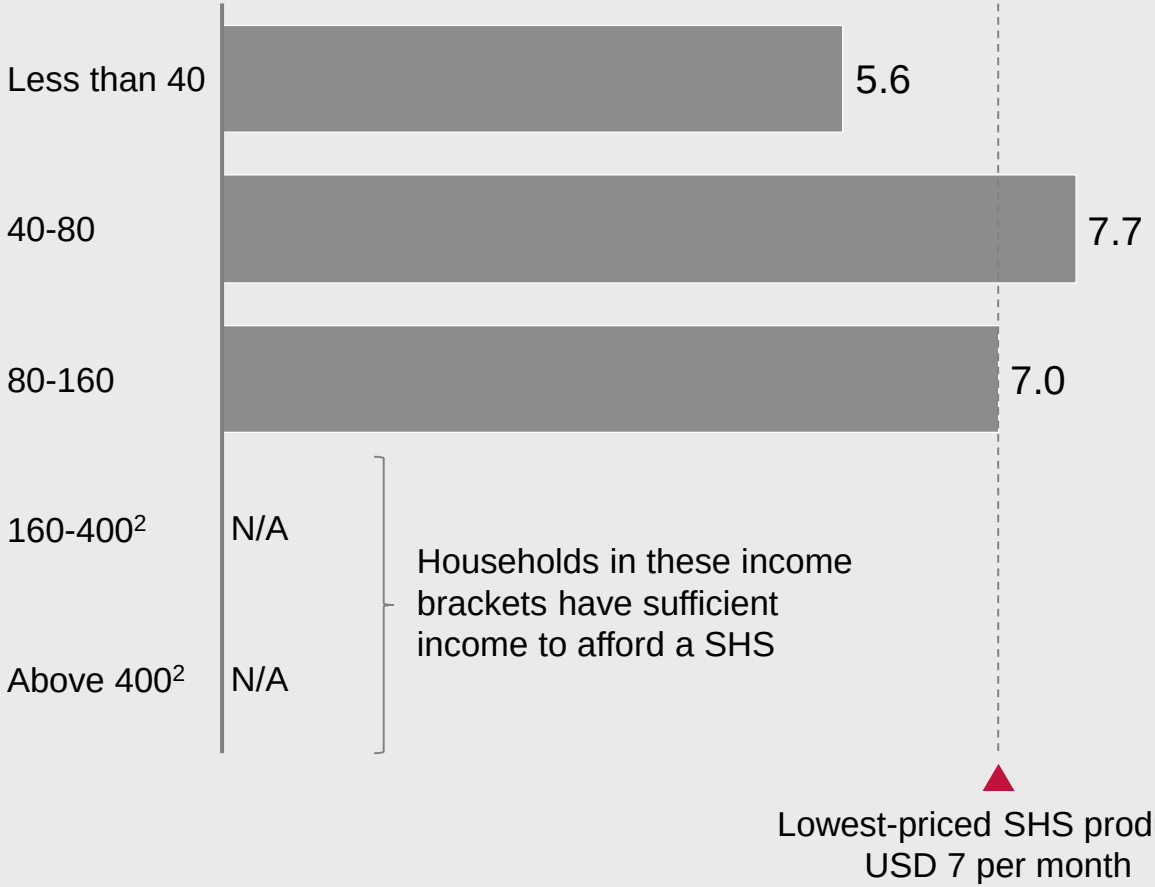
1 Average of both urban and rural households when combined
2 Proportion able to afford applied to unelectrified population data from USAID SAEP Geospatial analysis;
3 Threshold for affordability set at USD 130 – lowest priced basic SHS

SOURCE: USAID SAEP Household Survey (2018), USAID SAEP geospatial model

A SENSE CHECK SHOWS THAT HOUSEHOLDS WITH A MONTHLY INCOME EXCEEDING USD 40 PER MONTH ARE ABLE TO AFFORD A SHS PRODUCT

Current average monthly expenditure on SHS across different income levels[1], USD

N = 92 households (restricted to SHS owners who acquired their product via PayGo)



- As a sense check, we evaluate, for each income bracket, how much current SHS owners on average spend on their solar products
- Households in the lowest income bracket (<USD 40 per month) spend USD 5.6 on SHS payments per month, below the USD 7 threshold for a basic SHS product
- However, households in the USD 40-80 and USD 80-160 income brackets spend USD 7 or more on SHS products per month, indicating the ability to afford a SHS product

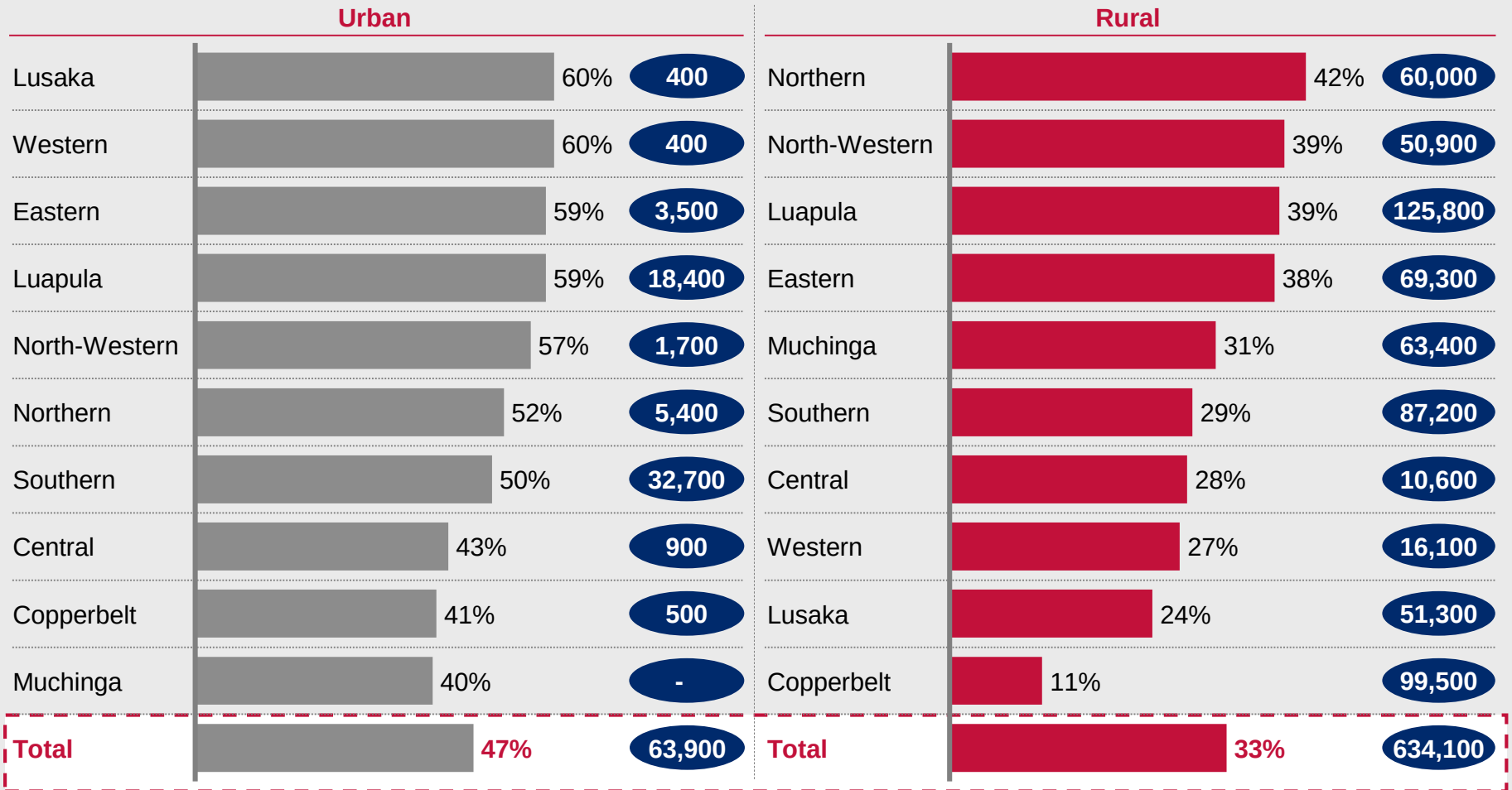
1 The average amount spent on SHS product per month is calculated for all SHS owners (on a PayGo scheme) in a given income bracket
2 Sample size of respondents too small to draw inference

SOURCE: USAID SAEP Household Survey (2018), internal analysis

ON THIS INCOME METHOD, 34%[1] OF UNELECTRIFIED HOUSEHOLDS COULD AFFORD SHS

Number of unelectrified Households (2017)[2]

Distribution of unelectrified households by affordability based on current lighting expenditure, % of total population

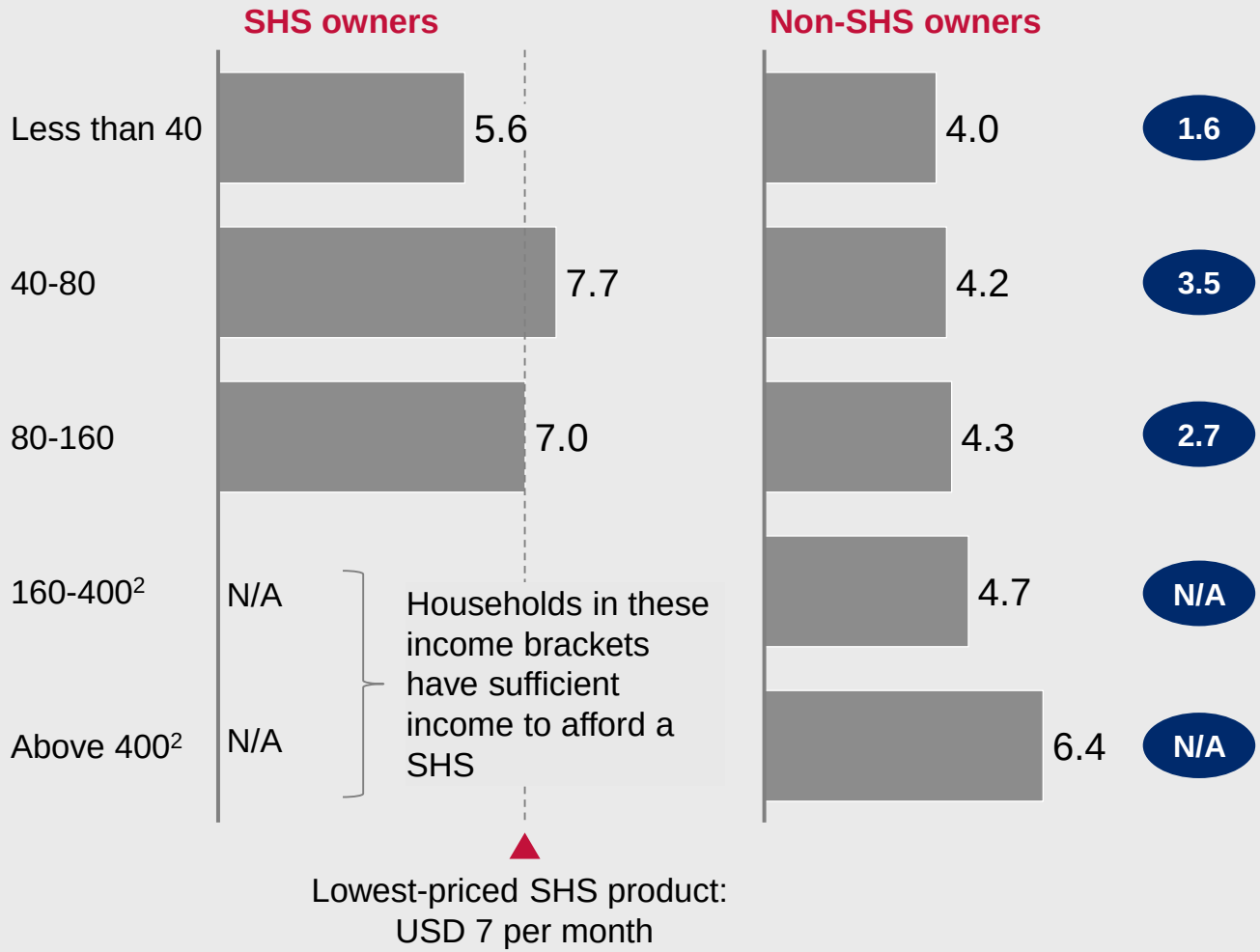


1 Average of both urban and rural households when combined
2 Proportion able to afford applied to the provincial rural and urban unelectrified population from the USAID SAEP geospatial model

SOURCE: USAID SAEP Household Survey (2018), USAID SAEP geospatial model

ACROSS ALL INCOME LEVELS, SHS OWNERS SPEND MARGINALLY HIGHER AS COMPARED TO NON-SHS OWNERS ON LIGHTING

Comparison of monthly lighting expenditure between SHS owners and non-SHS owners, USD/month



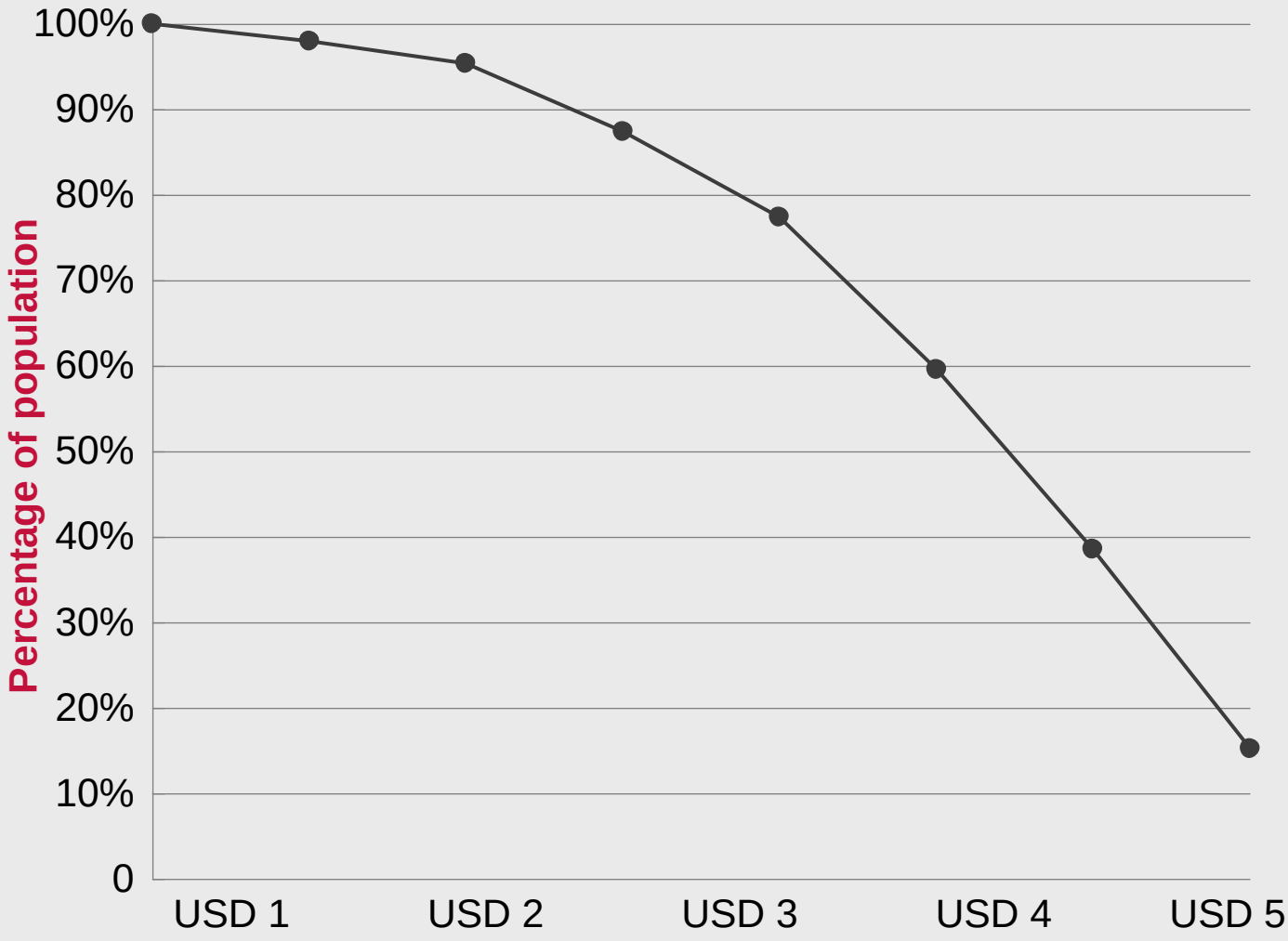
- In all income levels, SHS owners reported a higher lighting spend as compared to non-SHS owners within the same income bracket
- Household in the USD 40 – 80 income bracket reported the highest premium
- The increased spend is in line with findings from earlier analysis done by Gogla
- Gogla estimates that, on average, households increase energy spend by USD 2.5 for 3-10W solar home systems

1 The average amount spent on SHS product per month is calculated for all SHS owners (on a PayGo scheme) in a given income bracket
2 Sample size of respondents too small to draw inference

SOURCE: USAID SAEP Household Survey (2018), internal analysis, Gogla's Powering Opportunity: The Economic Impact of Off-Grid Solar report

REMP ANALYSIS ESTABLISHED THAT 15% OF HOUSEHOLDS IN RURAL ZAMBIA CAN AFFORD SHS AT A MONTHLY FEE OF USD 5

Distribution of willingness to pay for SHS at different price points by rural households



- The 2009 REMP analysis, prepared via a joint agreement between JICA and Government of Zambia, established that 15% of rural households can afford SHS if the monthly fee was pegged at USD 5

SOURCE: Rural Electrification Masterplan for Zambia (2008 – 2030)

CONTENTS

- Context
- Survey approach
- Results and insights
- **Validation of the results**
- Implications

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

-# Discrepancy exceeds 10 percentage points

○ No limitations to survey: results consistent or discrepancy justified

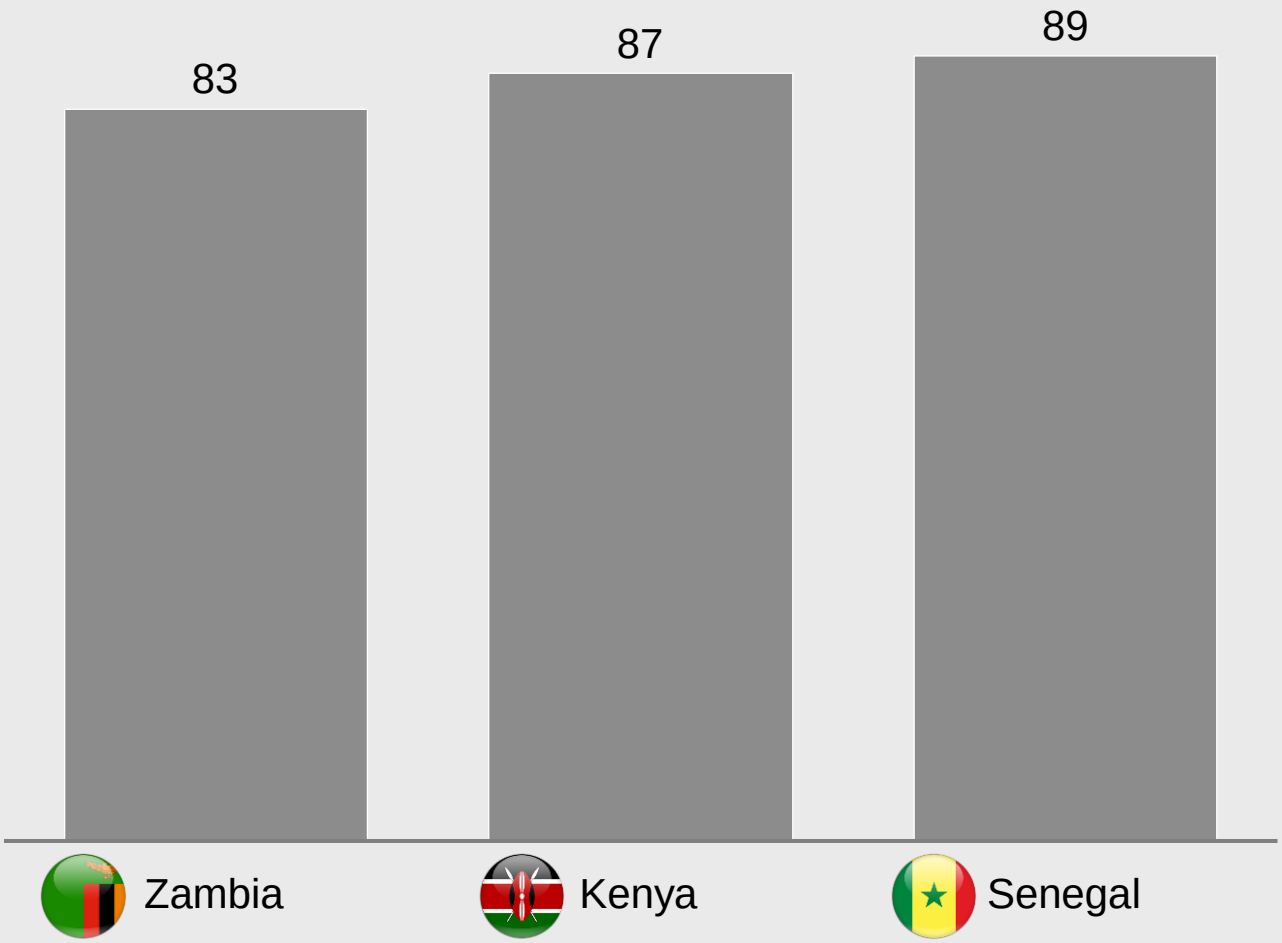
● Substantial limitations to survey: results inconsistent and discrepancy cannot be explained

	Data point	Survey result	External data point	Discrepancy	Data source(s) used	Discrepancy	Implications for survey
SHS awareness and ownership	Awareness of solar products (%)	83%	87%	-4pp	Kenya survey (2016)	○	None – awareness in line with Kenya survey
	Share of households owning a solar product (%)	40%	35-51%	-5 to 11pp	Kenya survey (2016) Senegal survey (2017)	◔	None – relative maturity of Kenyan market explains higher SHS ownership
	Affordability as greatest barrier to take-up of solar products (%)	61%	43-63%	-2 to +18 pp	Kenya survey (2016) Senegal survey (2017)	◔	Likely none – Senegalese market for SHS may differ from Zambian market
Mobile usage	Mobile phone penetration (%)	97%	82%	**-15pp**	Zambia Information and Communications Technology Authority	◔	Survey not representative for non-phone owners
	Mobile money penetration (%)	42%	43%	-1pp	UNCDF MM4P Annual Provider Survey (2016)	○	None – mobile phone penetration in line with external sources
Household expenditure and willingness to pay	Median household expenditure (USD per month)	USD 40-80	USD 60-80	Nil	Living Conditions Monitoring Survey (2015)	◔	None – similarity in income levels indicates survey is representative
	Share of unelectrified population able to afford solar products based on lighting expenditure (%)	18%	12-69%	**-6-51%**	Kenya survey (2016) Senegal survey (2017) Malawi survey (2014)	◔	None – higher affordability in Kenya and Senegal is explained by relative GDP/capita and income inequality
	Share of unelectrified population able to afford solar products based on self-stated willingness to pay (%)	31%	24-31%	-7-00pp	Senegal survey (2017)	○	None – self-stated willingness similar to Kenya and Senegal for SHS product

SOURCE: USAID SAEP Household Survey (2018), Zambia Living Conditions Monitoring Survey 2015

AWARENESS RESULTS IN ZAMBIA ALIGN CLOSELY TO SIMILAR SURVEYS CONDUCTED IN KENYA AND SENEGAL

Awareness of solar, % households



- Zambia's awareness results match closely to figures from the Kenya and Senegal surveys with >80% of surveyed households reporting familiarity with solar products

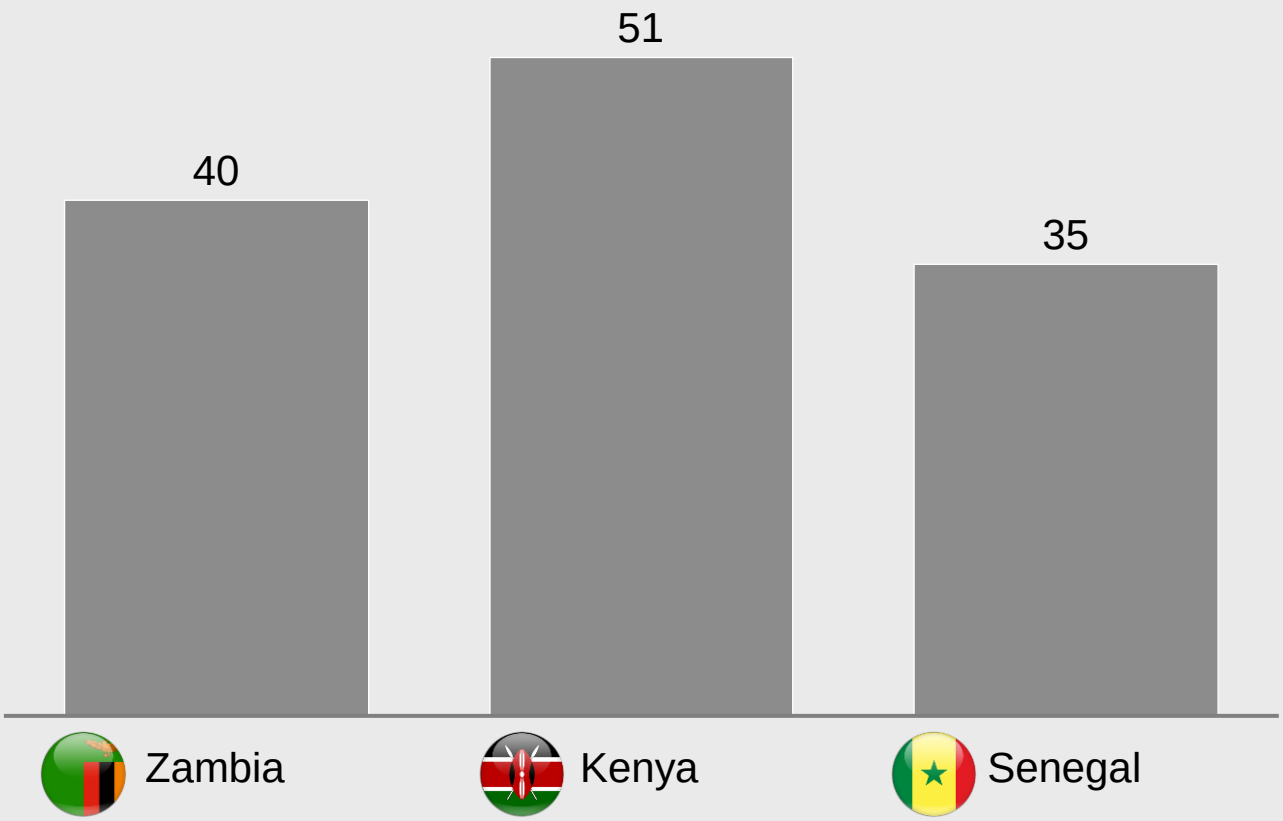
1 Awareness question not asked in Senegal survey

SOURCE: USAID SAEP Household Survey (2018)

SHS OWNERSHIP IN ZAMBIA IS CONSISTENT WITH KENYA AND SENEGAL GIVEN THE DIFFERENT LEVELS OF SHS MARKET MATURITY

OGS[2] units sold in 2017 (rounded to nearest '000)

Ownership of SHS, % respondents



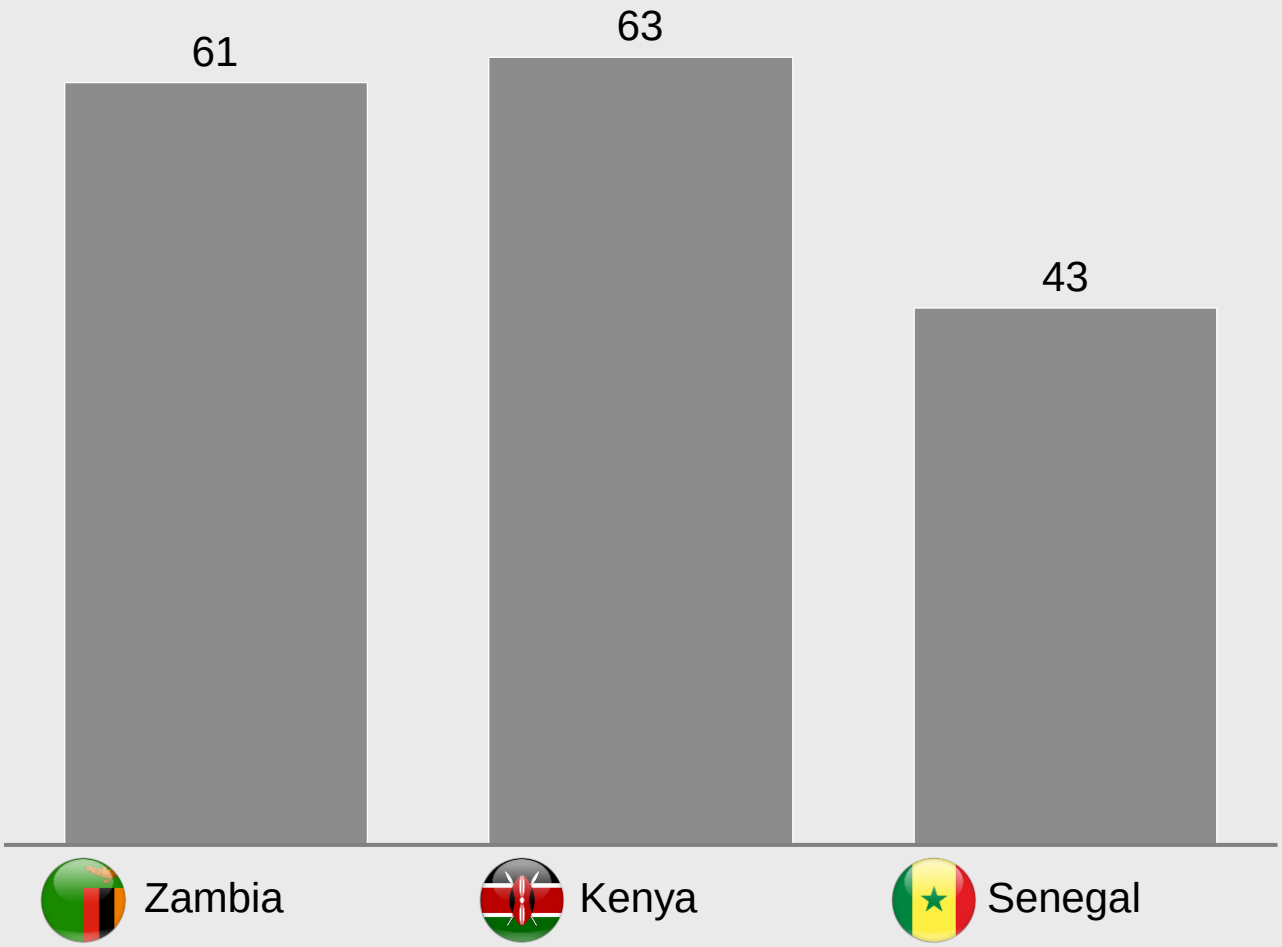
- SHS ownership in Zambia (40%) is higher than Senegal (35%) and lower than Kenya (51%)
- Ownership patterns align with the relative SHS market maturity in these countries based on 2016 sales volumes
- Sales volumes are high, especially in Kenya, due to inclusion of pico lanterns

1 World Bank ESMAP tier definitions used
2 Off-grid solar products: Includes all solar products sold, including pico-solar lanterns.

SOURCE: USAID SAEP Household Survey (2018), GOGLA data (2017)

KENYAN HOUSEHOLDS CITE AFFORDABILITY AS THE PRIMARY BARRIER TO SHS OWNERSHIP AT A SIMILAR RATE TO ZAMBIAN HOMES

Cite affordability as reason for not owing a solar product, % households



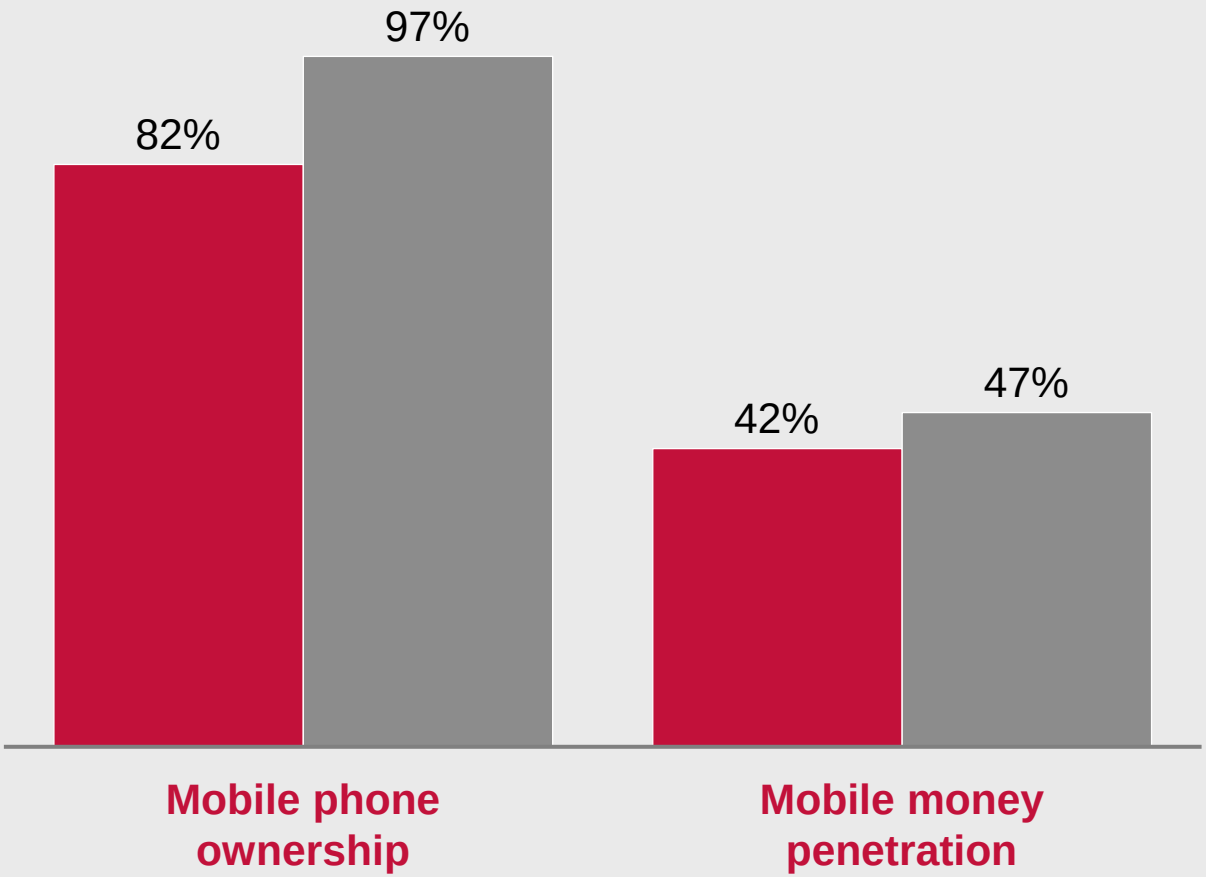
- The share of households citing affordability as their reason for not owning a solar product is very similar between Zambia (61%) and Kenya (63%)
- Senegalese households report a lower share (43%)

SOURCE: USAID SAEP Household Survey (2018), GOGLA data (2016)

MOBILE PHONE PENETRATION IS HIGHER THAN EXTERNAL SOURCES WHILE MOBILE MONEY PENETRATION IS CONSISTENT WITH NATIONAL MEASURES

Mobile phone and mobile money penetration, % respondents

N = 1,486 households (full surveyed sample)



- The survey results were marginally higher for mobile phone penetration, potentially because the most remote areas were inaccessible for interviewers
- However, mobile money penetration is fairly consistent with external sources

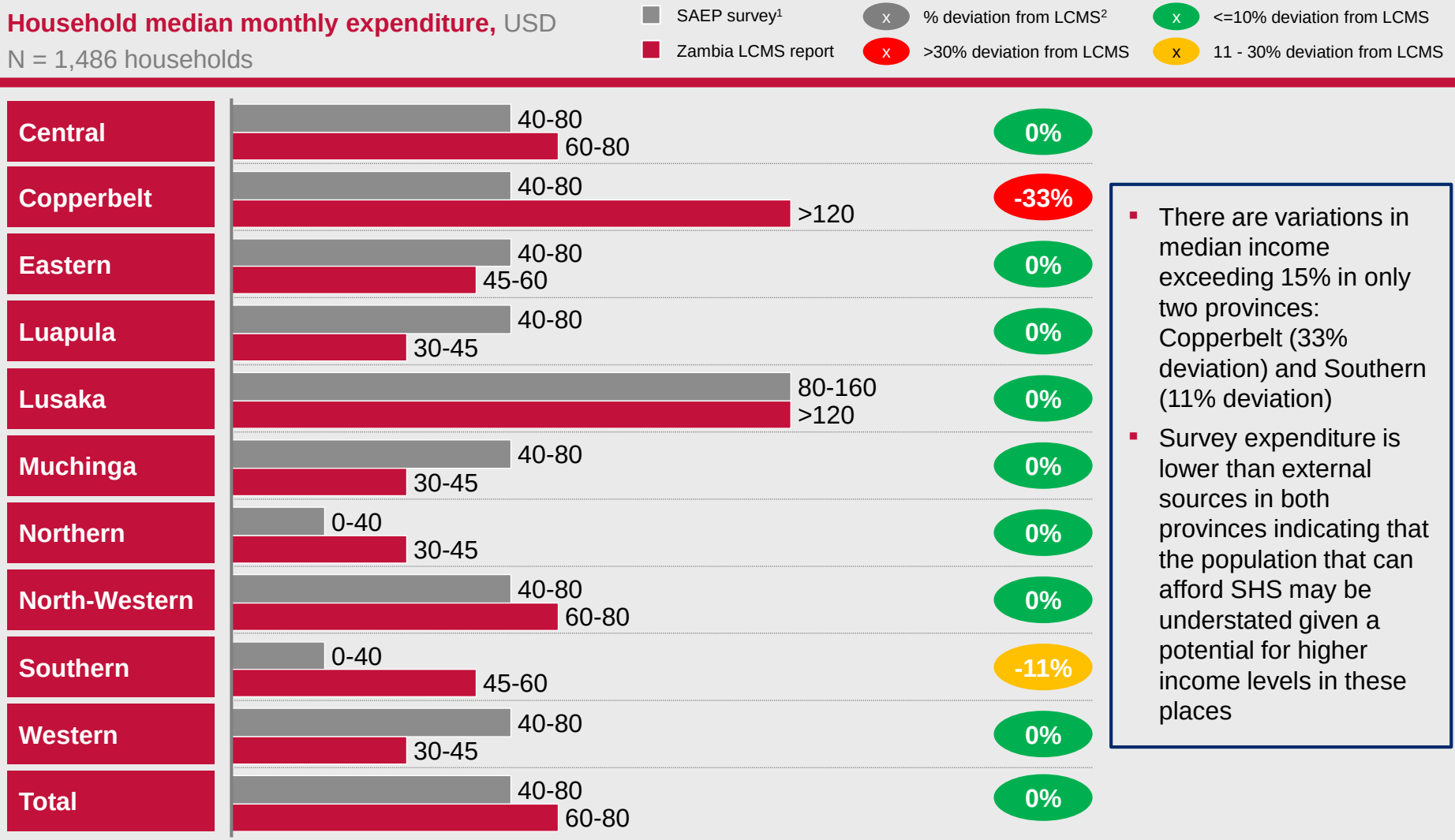
1 Inactive subscribers refers to mobile money users who have not made a transaction on mobile money in the past 90 days

SOURCE: USAID SAEP Household Survey (2018), Zambia Information and Communications Technology Authority, 2016-UNCDF MM4P Annual Provider Survey

ONLY 2 OF THE 10 PROVINCES RECORDED VARIATIONS EXCEEDING 5% WHEN COMPARED TO EXTERNAL SOURCES

Household median monthly expenditure, USD

N = 1,486 households



- There are variations in median income exceeding 15% in only two provinces: Copperbelt (33% deviation) and Southern (11% deviation)
- Survey expenditure is lower than external sources in both provinces indicating that the population that can afford SHS may be understated given a potential for higher income levels in these places

1 Ranges provided because respondents selected a ranged category

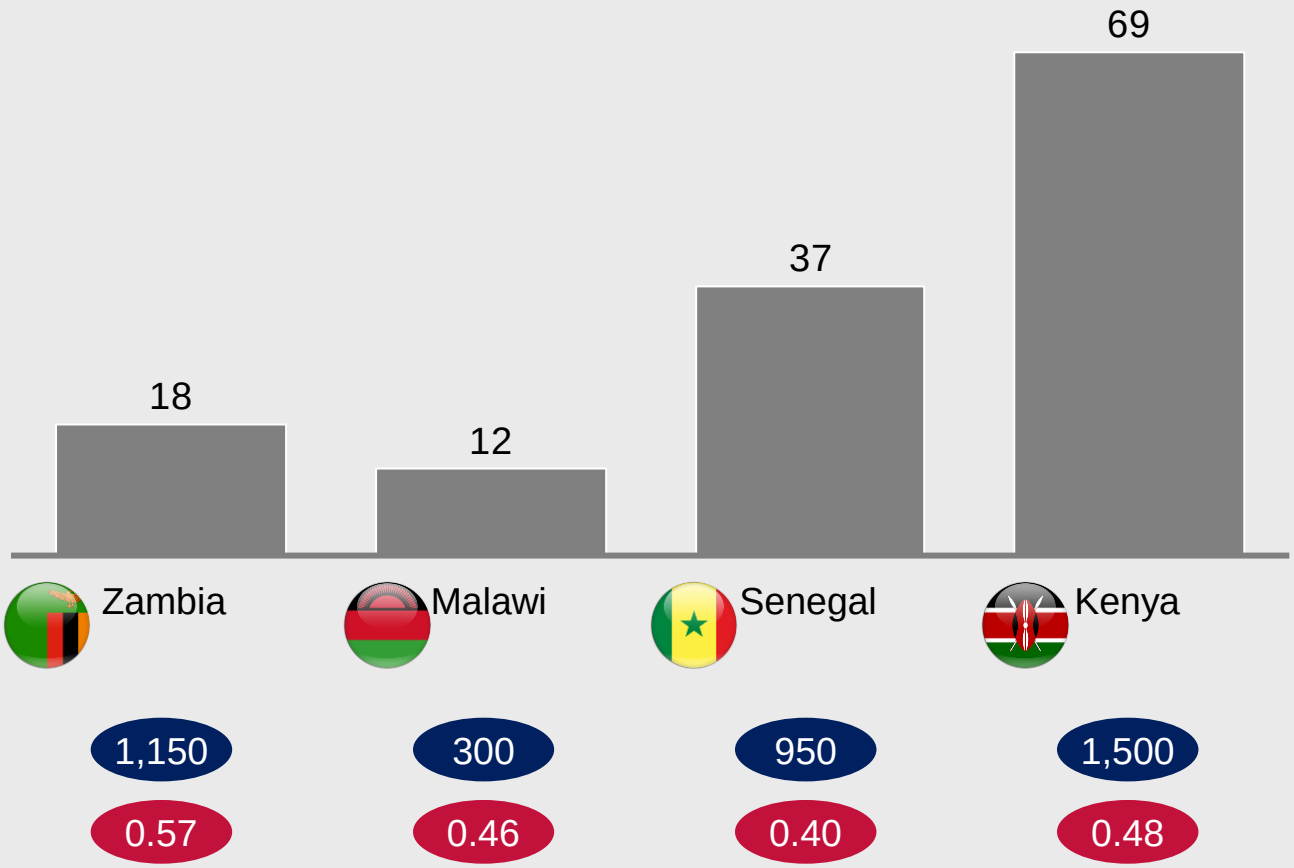
2 The percentage difference is calculated from the range boundary closest to the LCMS figure (e.g., for Copperbelt we compare upper range figure of USD 80 from the survey to LCMS figure of USD 120

SOURCE: USAID SAEP Household Survey (2018), Zambia Living Conditions Monitoring Survey 2015

AFFORDABILITY (VIA LIGHTING EXPENDITURE) DIFFERS FROM FINDINGS IN SENEGAL AND KENYA, BUT SEEMS JUSTIFIABLE GIVEN ZAMBIA'S RELATIVE GDP/CAPITA AND INCOME INEQUALITY

Gini-coefficient # GDP/capita (2016)[1]

Percentage of population able to afford SHS[2] based on current lighting expenditure[2], %



- The percentage of (unelectrified) population able to afford SHS is similar between Zambia and Malawi, however Zambia's GDP per capita is significantly greater
- Kenya and Senegal also have higher affordable segments at 69% and 37% respectively
- The higher affordability, especially in Senegal, may explained by lower income inequality (i.e., a lower Gini coefficient)

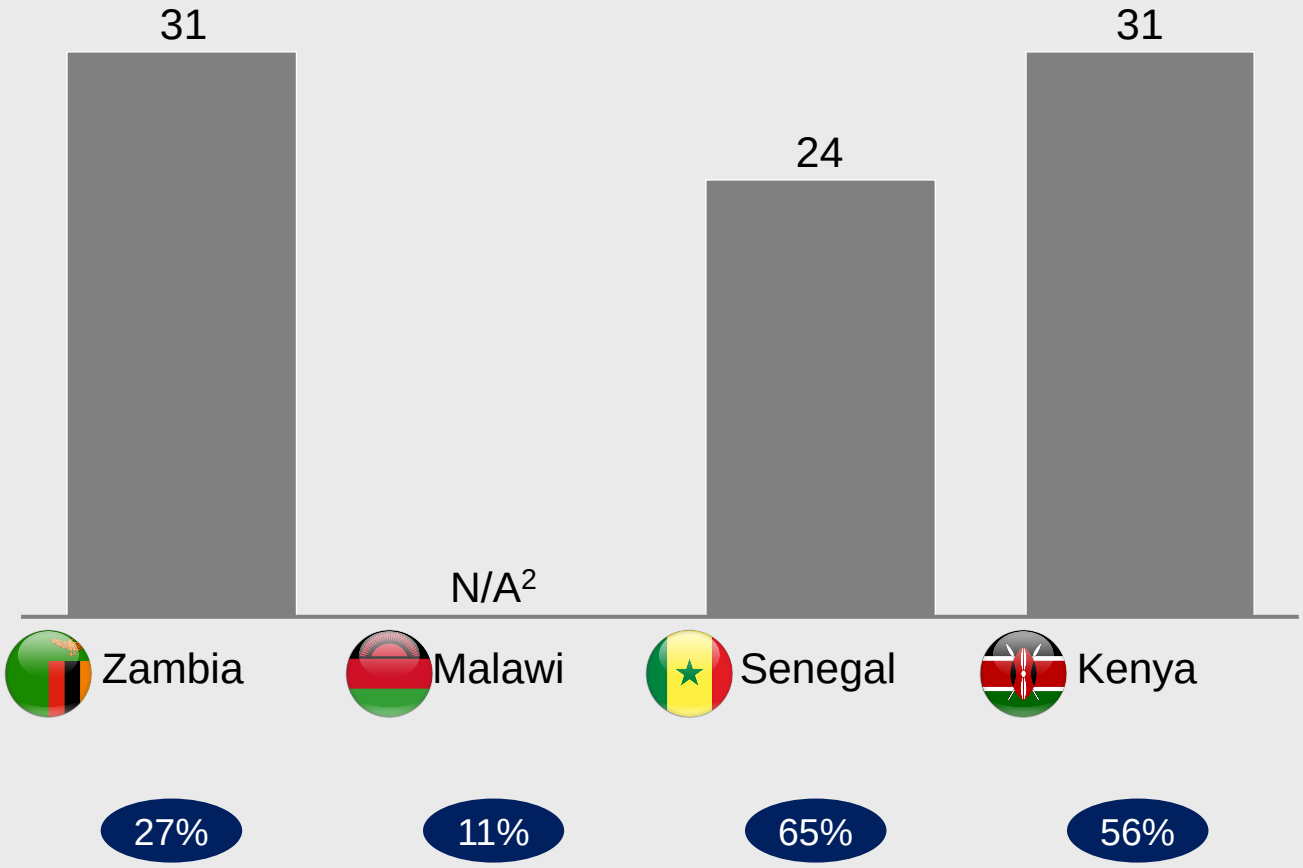
1 Rounded to the nearest USD 50
2 Kenya and Senegal shares adjusted to fit Zambia threshold of USD 7 per month for SHS product

SOURCE: Malawi National Household Survey (2014), Kenya SMS survey (2017), Senegal SMS survey (2017), Zambia survey (2018), World Bank

AFFORDABILITY (VIA SELF-STATED WILLINGNESS TO PAY) IS SLIGHTLY HIGHER IN ZAMBIA COMPARED TO KENYA AND SENEGAL, WHICH CAN BE EXPLAINED BY LOWER ELECTRIFICATION IN ZAMBIA

% Electrification rate (2016)

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



- Self-stated willingness to pay for a SHS product is in Zambia (31%) is equal to that in Kenya and higher than Senegal (24%)
- However, the discrepancy falls below 10% and therefore does not cause great concern

1 Kenya and Senegal shares adjusted to fit Zambia threshold of USD 7 per month for SHS product
2 Malawi household survey does not have data on self-stated willigness to pay for SHS

SOURCE: Malawi National Household Survey (2014), Kenya SMS survey (2017), Senegal SMS survey (2017), Zambia survey (2018), World Bank

CONTENTS

THE SURVEY RESULTS HAVE IMPLICATIONS FOR SHS PLAYERS, GOVERNMENT AND COOPERATING PARTNERS OPERATING IN THE OFF-GRID SPACE

i. Implications for SHS operations

SHS companies can adapt their operating model in line with insights from the survey (e.g., leveraging high awareness and trust, moving consumers from smaller, cheaper products to larger units over time, doubling down on mobile money education and uptake, targeting large markets in Central, Eastern and Copperbelt provinces)

- Central, Eastern and Copperbelt provinces present the largest addressable markets for SHS players
- SHS players are already serving the largest markets, but could expand their reach in Western and Luapula

ii. Implications for reaching electrification targets

The total addressable market for SHS is 0.7-0.8 million unelectrified households based on their willingness to pay for SHS products

Even if SHS players were to address this full market, connections would **fall short of the 2022 targets** set by the **Zambian Government** (under the Rural Electrification Master Plan) by 0.3-0.4 million connections

iii. Implications for financing SHS electrification

Reaching Government 2022 SHS targets would require **closing a funding gap of USD 1.4 million per month** (i.e., USD 34 million over the two-year payment period under PayGo)

Reaching the ambition of **universal access would require an even greater amount of USD 7.2 million** with 2022 as a target year (i.e., USD 172.4 million over the two-year payment period under PayGo)

Government and cooperating partners could look to various **financing mechanisms** to close this gap

SOURCE: Internal analysis

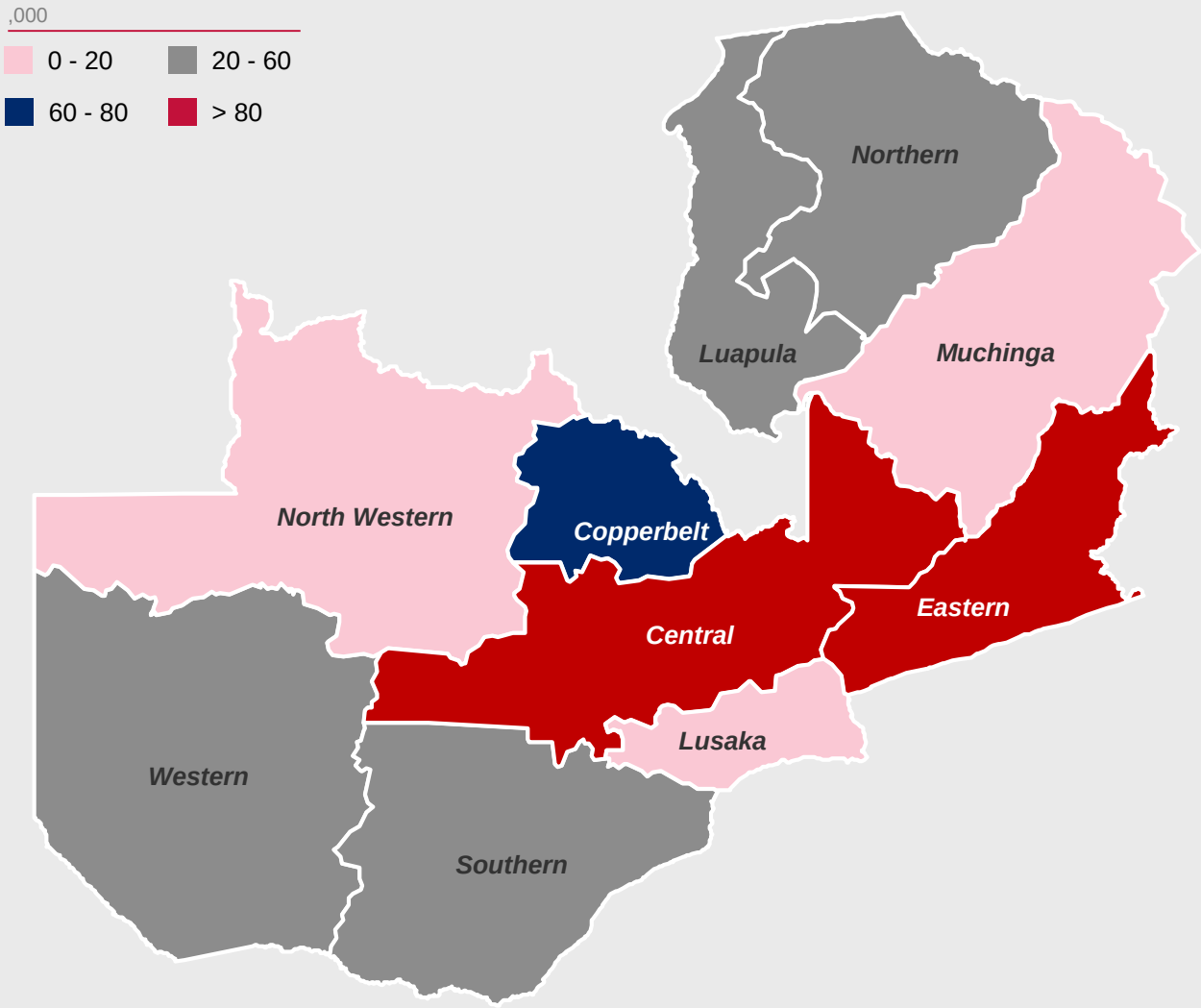
SHS COMPANIES CAN ADAPT THEIR OPERATING MODEL IN LINE WITH INSIGHTS FROM THE SURVEY

	Result and insight	Inference looking at 2022 forecasts
SHS awareness and ownership	1 Awareness of solar products in high with >80% of households knowing about solar energy (84% in rural areas)	▪ SHS companies should leverage the high level of awareness, positive perception and level of trust in solar products, and ensure that they deliver products to these "aware" households rapidly ▪ SHS players can quickly move to Eastern and North-Western, as well as Southern and Muchinga given the appetite for SHS in these areas ▪ Developing quick marketing tools to calculate current energy spend could demonstrate to households if SHS is affordable at no further cost (to address the large affordability barrier)
	2 Perception of solar is very positive (59% prefer solar to ZESCO), and levels of trust are high (no household indicated distrust as a barrier to purchase)	
	3 Affordability is cited as the highest barrier to SHS ownership (61%), but households in Eastern and North-Western plan to buy SHS soon, while Southern and Muchinga report a lack of nearby service providers	
	4 While product penetration is relatively high, product ownership is concentrated in entry level products (i.e., pico-lanterns and other tier 1 systems)	▪ Consumers often start with smaller solar products, paying a once-off fee, which is unsurprising given affordability constraints ▪ Over time, SHS companies should consider how to migrate these consumers to more sophisticated products ▪ Better communication on PayGo could increase affordability and help migrate households to more advanced systems
	5 Households typically pay a single amount (84%) rather than PayGo for these entry level products	
Mobile phone usage	6 Half of mobile phone owners are not registered for mobile money, which may impede ability to make payments under PayGo plan	▪ Mobile money education and uptake (with demonstrable use cases) should be a core part of operations to increase how to pay via a digital platform
Household expenditure and willingness to pay for SHS	7 Based on current lighting expenditure, only 18% of Zambian households can switch to SHS without needing to increase their lighting expenditure	▪ The estimated addressable market is 0.7-0.8 million households, with the largest opportunities in rural areas in Central, Eastern and Copperbelt provinces ▪ Higher self-stated willingness to pay indicates that households may be willing to pay a premium for higher quality energy
	8 Based on self-stated expenditure, affordability increases to ~31-35%	
	9 The largest markets (Central, Eastern and Copperbelt) are already served by SHS players; however mid-level markets of Western and Luapula could be further penetrated	▪ SHS companies should double down on currently served areas in Central, Eastern and Copperbelt ▪ Expansion to more locations in Western and Luapula may be attractive

SOURCE: Internal analysis

USING 2022 FORECASTS, CENTRAL, COPPERBELT AND EASTERN PROVINCES PRESENT THE LARGEST ADDRESSABLE MARKETS FOR SHS PLAYERS

Number of unelectrified households able to afford SHS product based on lighting expenditure, Number of households



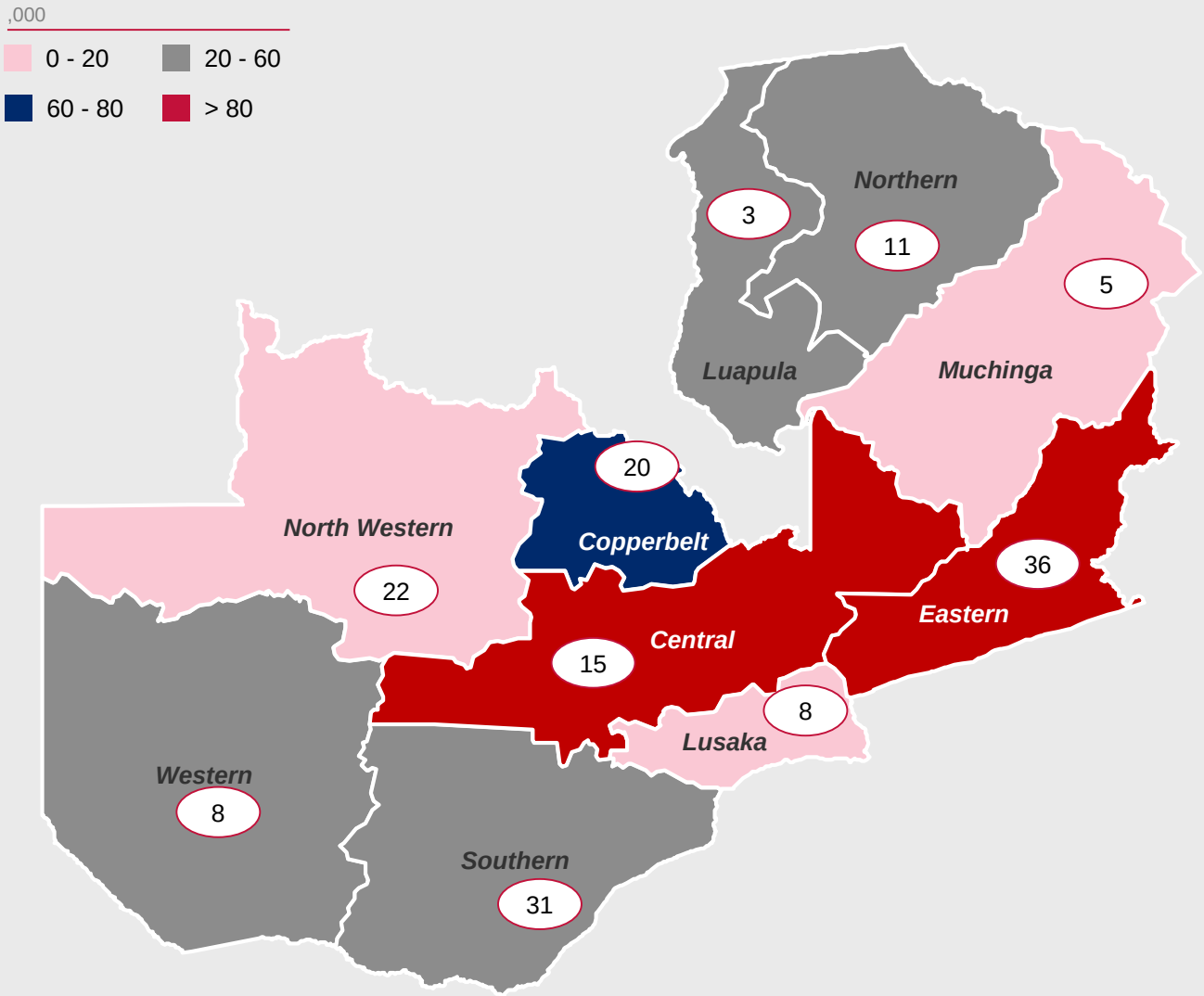
Province	,000 Urban	Rural	Total
Eastern	98	1	99
Central	91	-	91
Copperbelt	65	3	68
Luapula	38	2	40
Southern	38	-	38
Western	37	-	37
Northern	26	-	26
Lusaka	12	-	12
North-Western	12	-	12
Muchinga	-	-	-

SOURCE: USAID SAEP Household Survey (2018), USAID SAEP geospatial model

SHS PLAYERS ARE ALREADY SERVING THE LARGEST MARKETS, BUT COULD EXPAND THEIR REACH IN WESTERN AND LUAPULA

Map of addressable market size and SHS locations, Number of households

(#) Number of service centres/agents in province



,000

Province	Total	Number of service centres/agents
Eastern	99	36
Central	91	15
Copperbelt	68	20
Luapula	40	3
Southern	38	31
Western	37	8
Northern	26	11
Lusaka	12	8
North-Western	12	22
Muchinga	-	5

SOURCE: USAID SAEP Household Survey (2018), USAID SAEP geospatial model

ii THE SURVEY INDICATES THAT THE MAJORITY OF SHS CONSUMERS (>60%) WOULD LIKELY REQUIRE FINANCING SUPPORT TO PURCHASE A SHS TODAY

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

X % of total households

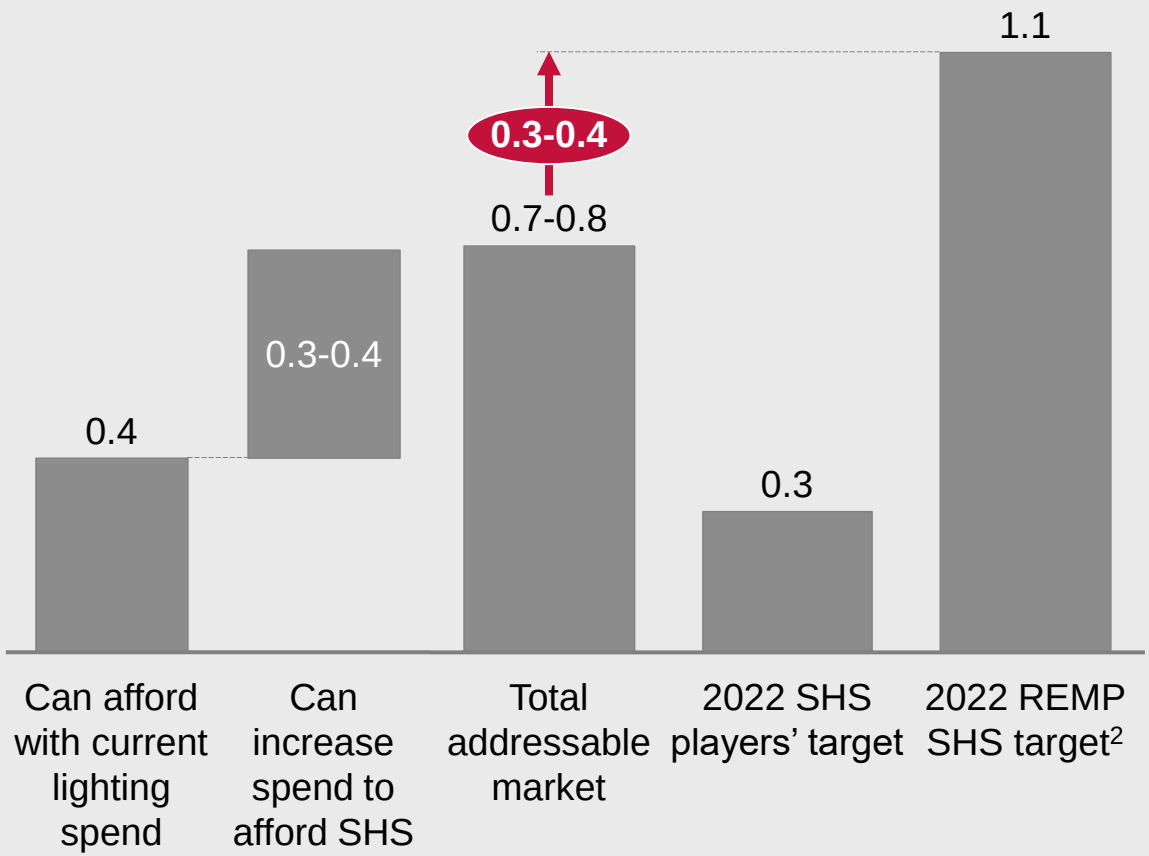
		Key locations	Description
Can afford **to SHS** without increasing spend	0.4 **18%**	▪ Central ▪ Copperbelt ▪ Eastern	▪ Households whose current lighting spend is above or equal to the fee charged by at least one SHS provider
Are willing to increase their spend **to switch to SHS**	0.3-0.4 **13-17%[1]**	▪ Copperbelt ▪ Eastern ▪ Lusaka ▪ Western	▪ Households whose self-stated expenditure is above or equal to the fee charged by at least one SHS provider, or whose income is > USD 40 to be able to afford SHS
Intervention required **to facilitate switch**	1.5-1.6 **65-69%**	▪ North-Western ▪ Muchinga	▪ Households whose current lighting expenditure is insufficient to afford SHS, self-stated willingness to pay is not within range of SHS fees and whose total income is less than USD 40
Total	2.3		

1 Self-stated willingness differential (31% less 18% can afford on lighting expenditure used as lower bound of 13%; income threshold of >USD 40 used for upper threshold (38% less 18% can afford on lighting expenditure equals 17% differential)

SOURCE: USAID SAEP Household Survey (2018), USAID SAEP geospatial model

ii THE ADDRESSABLE MARKET SIZE (0.7-0.8 M CONNECTIONS) FALLS SHORT OF GOVERNMENT'S ELECTRIFICATION TARGETS FOR 2022 BY 0.3-0.4 M CONNECTIONS

Unelectrified households, # million households[1]

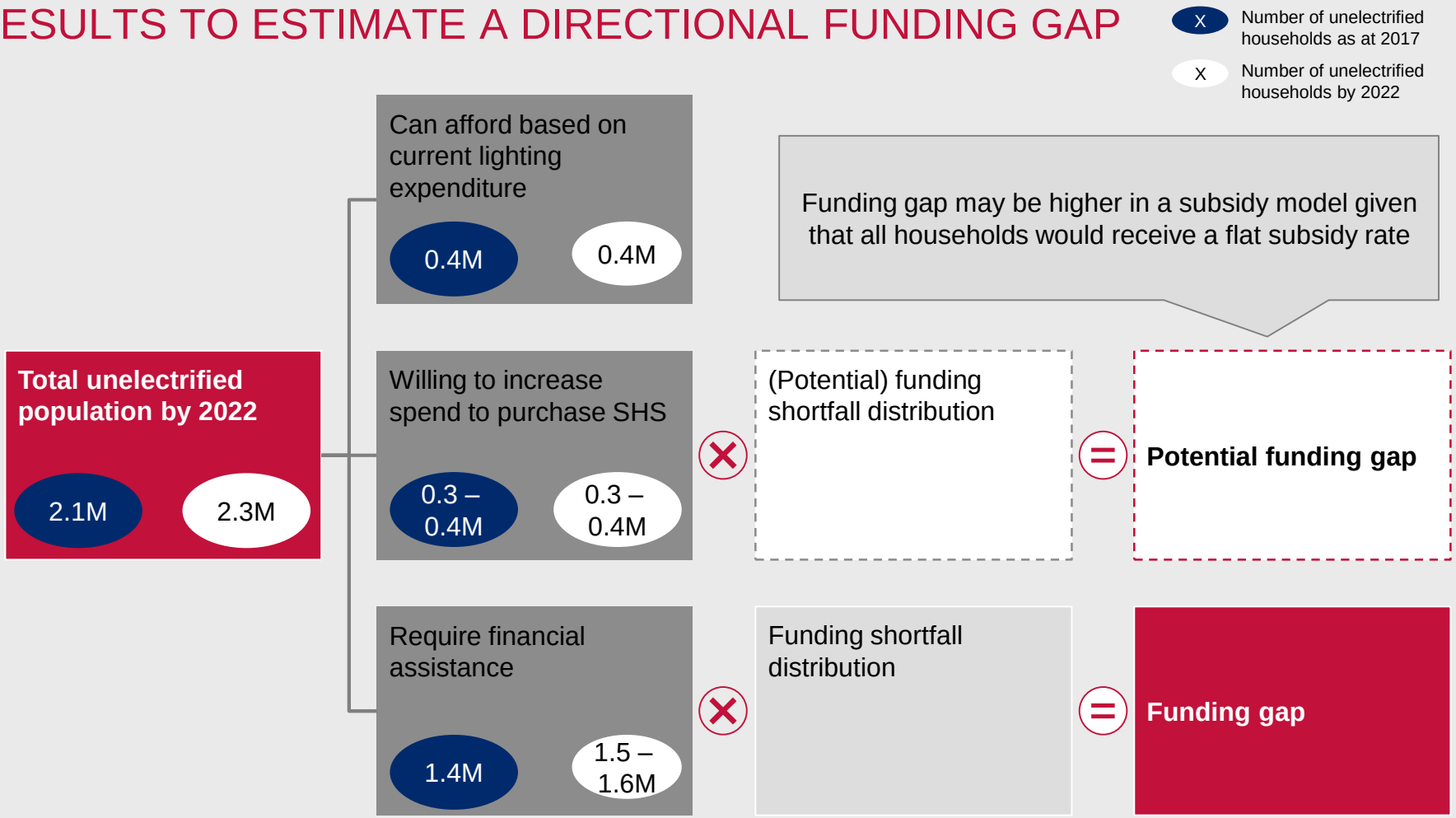


- Based on 2022 forecasts, ~0.7-0.8 million households can afford SHS without requiring any external intervention
- **SHS players could be more ambitious** in their targets given that this market size far exceeds their 2022 targets (0.3 million connections)
- However, even if SHS players could service the full addressable market, a **shortfall of 0.3-0.4 million households** would not be able to afford SHS to **meet the Government of Zambia's 2022 SHS target** (1.1 million connections)

1 All figures rounded to nearest hundred thousand
2 USAID SAEP least-cost geospatial model SHS share (75%) applied to REMP target of 1.4 million connections

SOURCE: USAID SAEP Household Survey (2018), USAID SAEP geospatial model

THE SURVEY RESULTS CAN BE COMBINED WITH GEOSPATIAL MODEL RESULTS TO ESTIMATE A DIRECTIONAL FUNDING GAP



SOURCE: USAID SAEP Household Survey (2018), USAID SAEP geospatial model, internal analysis

THE TOTAL AFFORDABILITY GAP IS ESTIMATED IN THE RANGE OF USD 7.2 M IF ALL UNELECTRIFIED HOUSEHOLDS WERE TO TAKE UP SHS FOR ONE MONTH

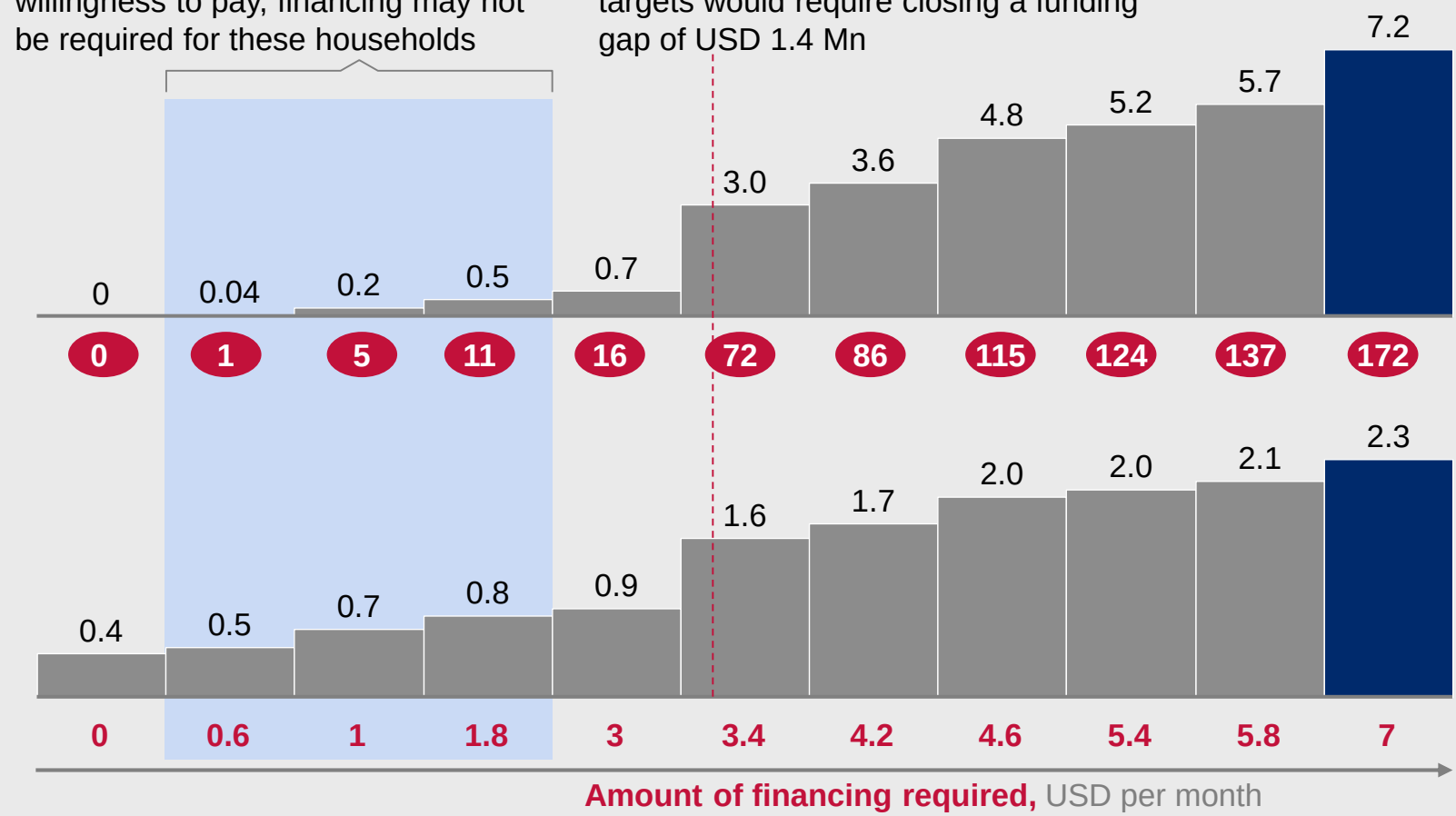
x Cumulative financing need over two-year PayGo period, USD Mn

Universal access (SHS connections)

Distribution of households by level of financing support required[1]

Depending on accuracy of self-stated willingness to pay, financing may not be required for these households

Reaching Government 2022 SHS targets would require closing a funding gap of USD 1.4 Mn



1 Assumes there will be no start-up capital requirement by SHS players

SOURCE: USAID SAEP Household Survey (2018), USAID SAEP geospatial model, internal analysis

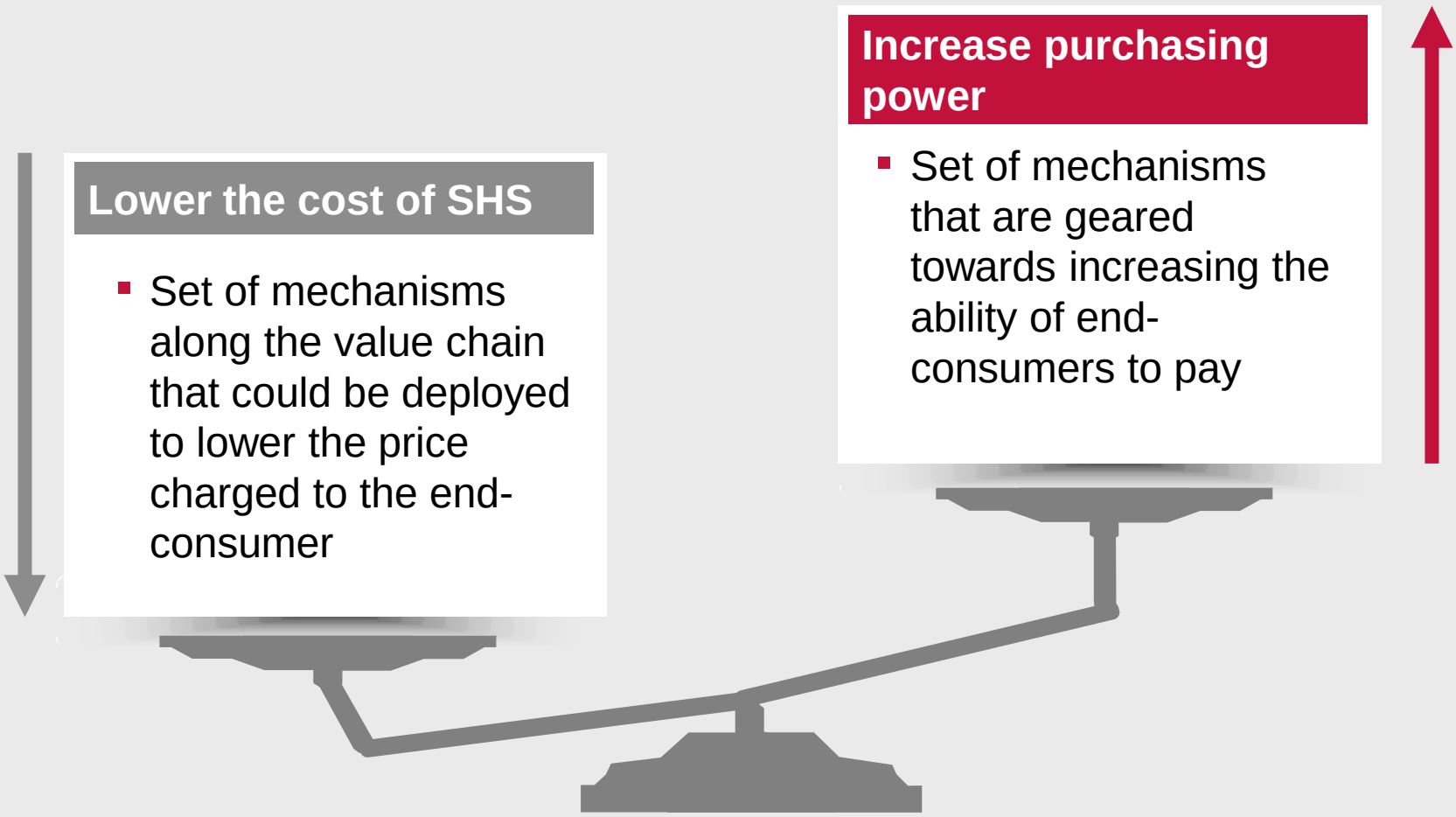
FINANCING MECHANISMS COULD EITHER BE GEARED TOWARDS LOWERING COST OF SHS OR INCREASING THE PURCHASING POWER OF END-CONSUMERS

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: Internal analysis

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

Focus of this document

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 the – 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, govern-ment)	▪ 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	A Support for microfinance bodies via a credit line B Create a credit scoring system using household-fed data C Consumer financing for bottom of the pyramid

SOURCE: Internal analysis

iii THERE ARE SOME KEY QUESTIONS THAT NEED TO BE ANSWERED IN ORDER TO DETERMINE THE SUPPORT REQUIRED FOR CONSUMER FINANCING

FOR DISCUSSION

Key questions to answer

A Support for microfinance bodies via a credit line

- What Micro Finance institutions are present in Zambia?
- Do they offer credit lines for SHS? If not, what would make them consider?
- What is the total pool of credit that would be available – and how does this compare to the identified financing gap

B Create a credit scoring system using household-fed data

- What is the current credit scoring system used by players within the Zambian financial sector?
- How do we improve credit scoring for low-income households, majority of whom may currently be unbanked?
- Who are the relevant stakeholders required to make such a credit scoring system work?

C Consumer financing for bottom of the pyramid

- Is there an official definition for low-income households in Zambia?
- How do we identify low-income households?
- How would potentially subsidies be deployed (without distorting the market)?

SOURCE: Interviews, Internal analysis

BACK-UP

ASSUMPTIONS IN ESTIMATING AFFORDABILITY

Category		Approach	Parameter	Sources
Can afford **to SHS** without increasing spend	X	Determine the lowest-priced monthly fee for a basic SHS product	▪ USD 7 per month	▪ SHS companies
	X	Compute current spend on candles per month	▪ Candle unit price: 20 US cents	▪ Site visits
	X	Compute current spend on torch batteries per month	▪ Torch batteries unit price: 30 US cents	▪ Site visits
	X	Aggregate total lighting spend per household per month (candle + torch batteries)		
	X	Compare lighting spend to price of basic SHS product to determine the funding gap	▪ Minimum spend of USD 7 per month on lighting	
	X	Set a minimum sample size threshold per province and by area of residence i.e., urban or rural[1]	▪ At least 30 responses in rural areas	
	X	Determine share of households that can afford based on total lighting spend per province split by urban and rural	▪ Base case 2017 unelectrified household figures: 2.1Mn	▪ USAID SAEP Zambia Geospatial model
	X	Apply affordability share to unelectrified households per province split by urban and rural		
	X	Determine share of unelectrified population that can afford		
Are willing to increase their spend **to switch to SHS**	X	Determine the lowest-priced monthly fee for a basic SHS product	▪ **One-time**: At least USD 130 ▪ **PayGo:** At least USD 7 per month	▪ SHS companies
	X	Compare self-stated amounts to prevailing retail prices for SHS	▪ **One-time**: Willing to spend at least USD 100 per month ▪ **PayGo:** Willing to spend at least USD 20 per month	
	X	Set a minimum sample size threshold per province and by area of residence i.e., urban or rural[1]	▪ At least 30 responses in rural areas	
	X	Determine share of households that can afford based on total lighting spend per province split by urban and rural	▪ Base case 2017 unelectrified household figures: 2.1Mn	▪ USAID SAEP Zambia Geospatial model
	X	Apply affordability share to unelectrified population per province split by urban and rural		
	X	Determine share of unelectrified population that can afford		

1 In Lusaka, Central and Northern provinces, survey used averages of neighbouring provinces as the sample size was below the set threshold

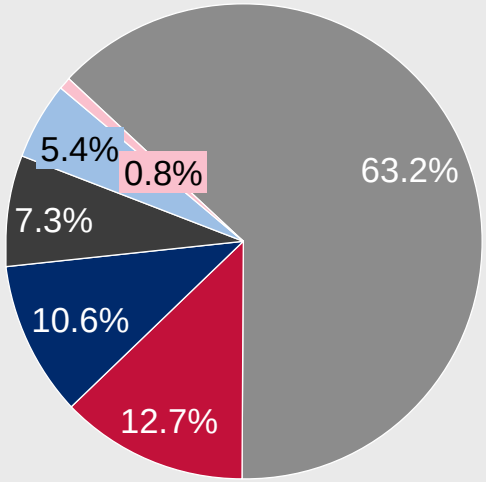
SOURCE: Internal analysis

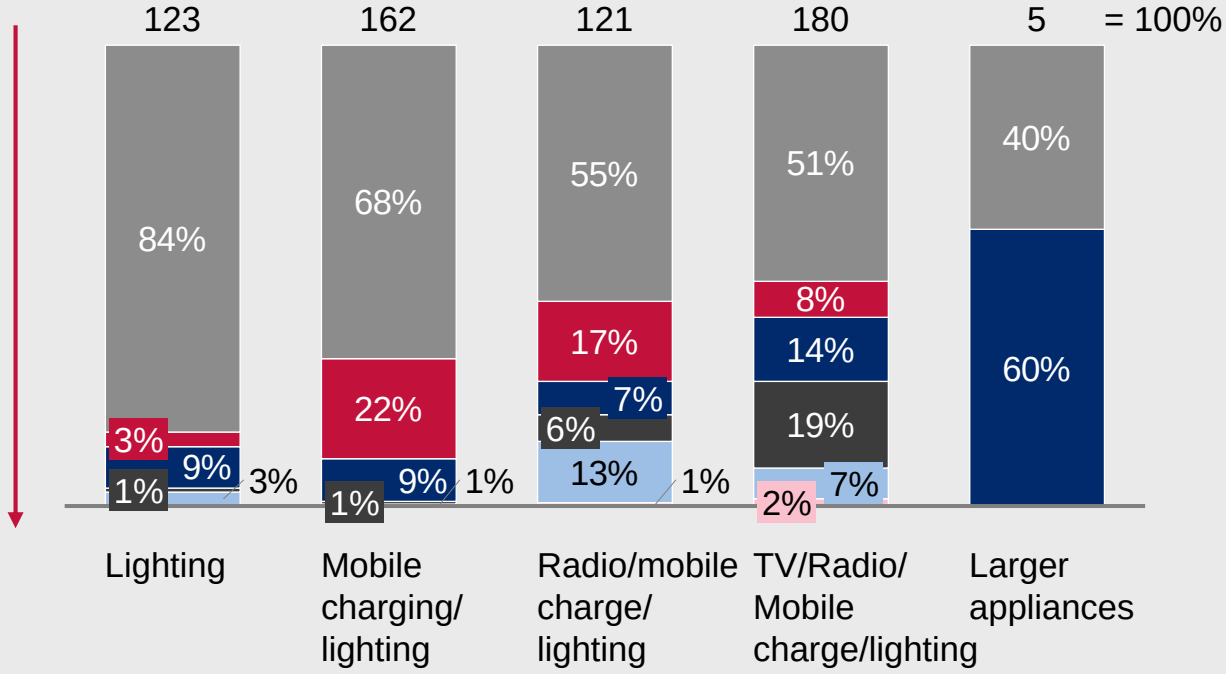
LIGHTING (63%) IS THE MOST VALUED FEATURE AMONG SOLAR PRODUCT OWNERS

Gives me light
Cheaper than others
Gives me radio
Allow phone charging
Gives me TV
Earns me money

Most valued feature by type of solar product, % households

N = 592 households (restricted to households that own solar products)





- Overall, 63% of households cite lighting as the most valued feature about their solar product
- When this result is split by the type of product owned, the share of households valuing radio and television increases
- Lighting may be seen as the 'essential' feature of solar products, whereas radio and TV are 'luxury' features that households value once they have become accustomed to the lighting component of their solar products

SOURCE: USAID SAEP Household Survey (2018), survey results