ROOFTOP SOLAR SOLUTIONS

NIGERIA
MARKET ASSESSMENT

Build • Compete • Grow

IFC | International Finance Corporation
WORLD BANK GROUP

Creating Markets, Creating Opportunities

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INTRODUCTION & METHODOLOGY

IFC undertook an extensive market study to determine the potential for solar solutions to energy access and cost issues facing commercial, industrial, and residential customers in Nigeria. This presentation shares that study's main findings.

The analysis focused on identifying and understanding the market dynamics, sizing, segmentation, and obstacles restricting the growth of Nigeria's rooftop solar market. These focal points are critical to designing interventions to accelerate a budding market.

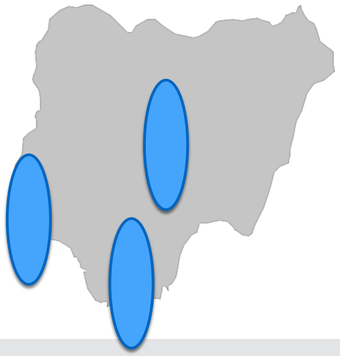
We also briefly explore solar project economics, which are increasingly favorable in Nigeria and many other markets. If key barriers can be overcome, then the stage could be set for rapid rooftop solar market growth.

Photo credit: Dominic Chavez IFC

We deployed four main research activates to provide a holistic view of the market

APPROACH	KEY ACTIVITIES	OUTCOMES
 Desk Research	An extensive search for relevant information via secondary sources was conducted	An understanding of the relevant macro and sectoral trends impacting demand and supply of solar solutions
 Marketplace Discussion	Marketplace discussions with the key stakeholders across the value chain	Sourced insights not available via secondary sources and cross validated desk research findings
 Consumer Analysis	Survey with existing and potential customers of solar solutions in residential and commercial segments	Purchase decision making process, factors influencing their purchase decision making, satisfaction level with the existing products and identification of gap areas between demand and supply
 Analysis	Corroborated, synthesized and analysed information sourced from desk and primary research	Findings on key factors impacting the market, estimation of future growth, detailed need gap analysis

PRIMARY RESEARCH: WHO DID WE TALK TO?



- Abuja
- Lagos
- Port-Harcourt

RESIDENTIAL SECTOR

70%

Male

30%

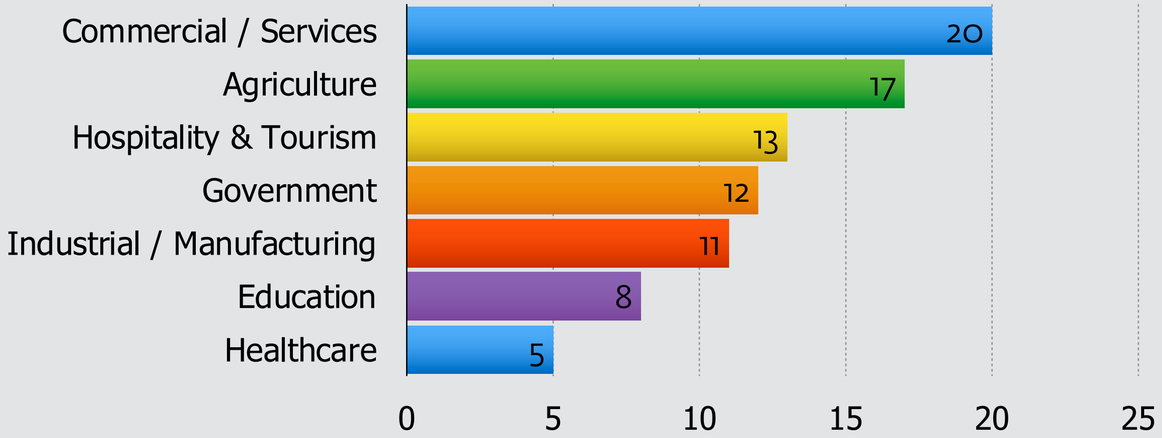
Female

Split of Residential users

48% Current Solar Users

52% Non Users

COMMERCIAL & INDUSTRIAL SECTOR



Decision makers within their organizations regarding:

54% Electrical Energy Solutions

46% Goods & Services

ENERGY SECTOR IN NIGERIA

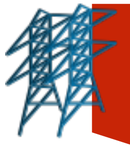
NIGERIA CURRENTLY FACES A HUGE ELECTRICITY SUPPLY DEFICIT

HIGH
Energy Demand

19,000 – 20,000 Mw

Huge Supply-Demand Gap

HIGH COST
of infrastructure development means the supply-demand gap is unlikely to be resolved quickly.



LOW
Grid Capacity

4,000 – 5,000 Mw

What's currently being used?

Mostly over-sized and expensive diesel generators

RUNNING COSTS INCLUDE

- Cost of fuel (which changes depending on currency fluctuations) – in some cases can reach $10,000 per month for businesses (for a 200 KVA Generator for ~10 hours per day).
- Operation and maintenance of up to $3,000 per month (depending on the size of business).
- Short replacement cycles every four to five years due to constant use.

Inference: There is opportunity for more economically distributed energy solutions across all demand sectors/segments than what is currently being utilized.

Inference: The use of generators is prevalent and synonymous with the grid as a primary source of energy.

The energy deficit in Nigeria has given rise to a massive fleet of privately owned fossil fuel generators that service the country's energy needs.

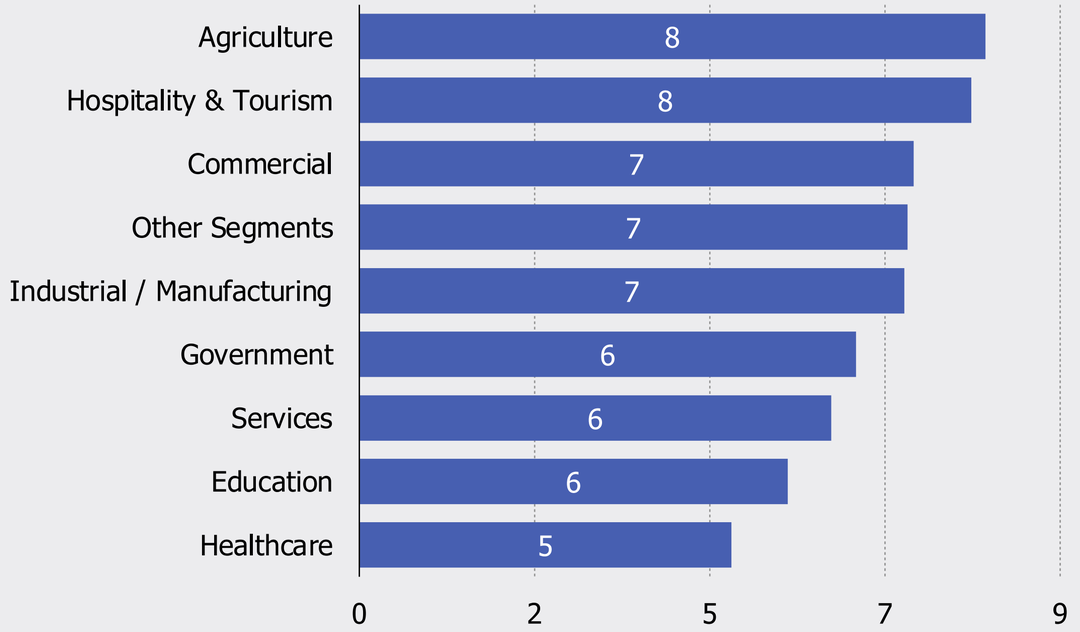
Conservative estimates suggest that there are nearly 3 million generators in Nigeria, from small petrol to large diesel units, supplying 15-20 GW of energy demand to supplement the grid deficiencies.*

*IFC, 2019', The Dirty Footprint of the Broken Grid.

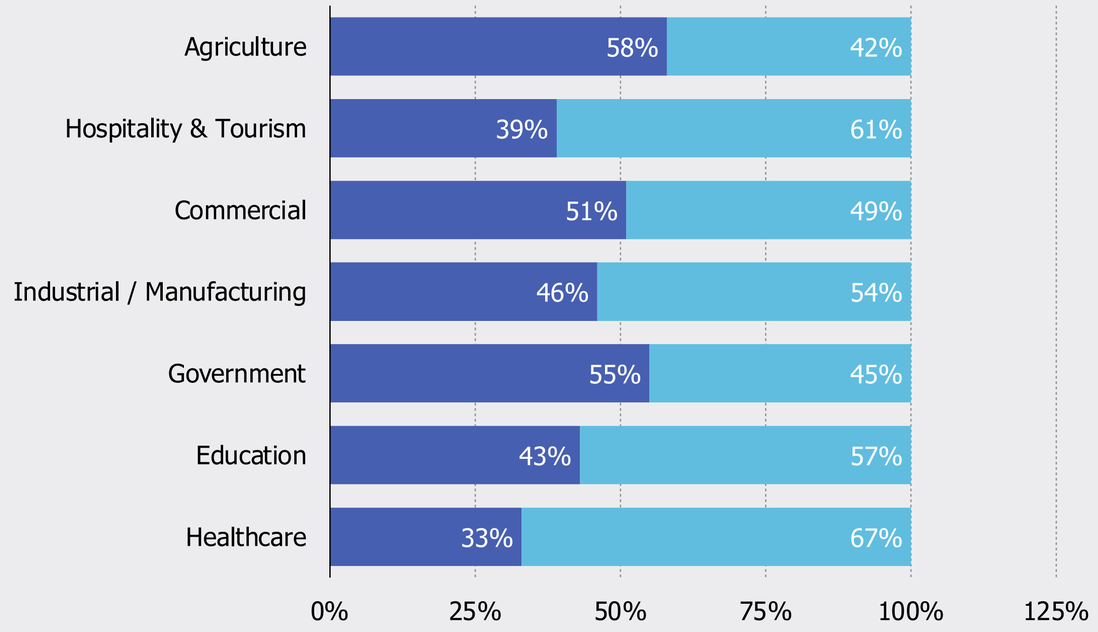
A limited electricity supply from the grid forces industry to self-generate electricity.

Most sectors have less than half the required operational number of hours available from the grid.

AVERAGE HOURS OF GRID AVAILABILITY PER DAY, BY INDUSTRY



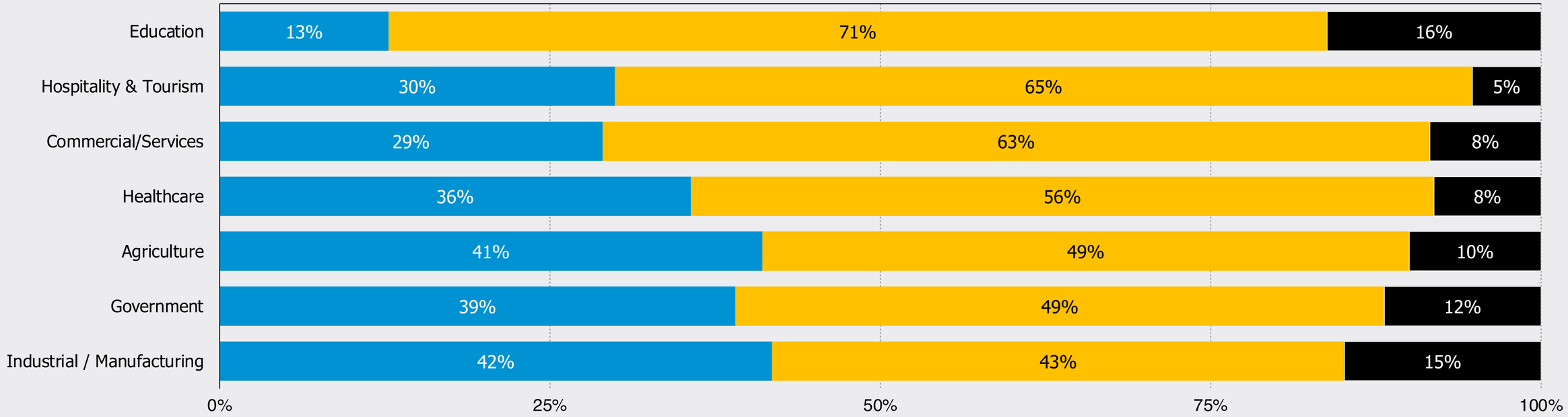
ENERGY DEFICIT PER DAY, BY INDUSTRY
As a % of total number of operational hours



Grid Alternative Sources

Petrol & diesel fuel represent ~ 60 percent of energy costs across segments. Generators produce energy for a substantially greater* cost versus the grid, on average.

Spending on electrical energy by sector



Monthly charge for grid electricity | Diesel/Petrol purchase for generator | Servicing/maintenance fees

*Does not include: PHCN fixed charges and service charge to third party power suppliers

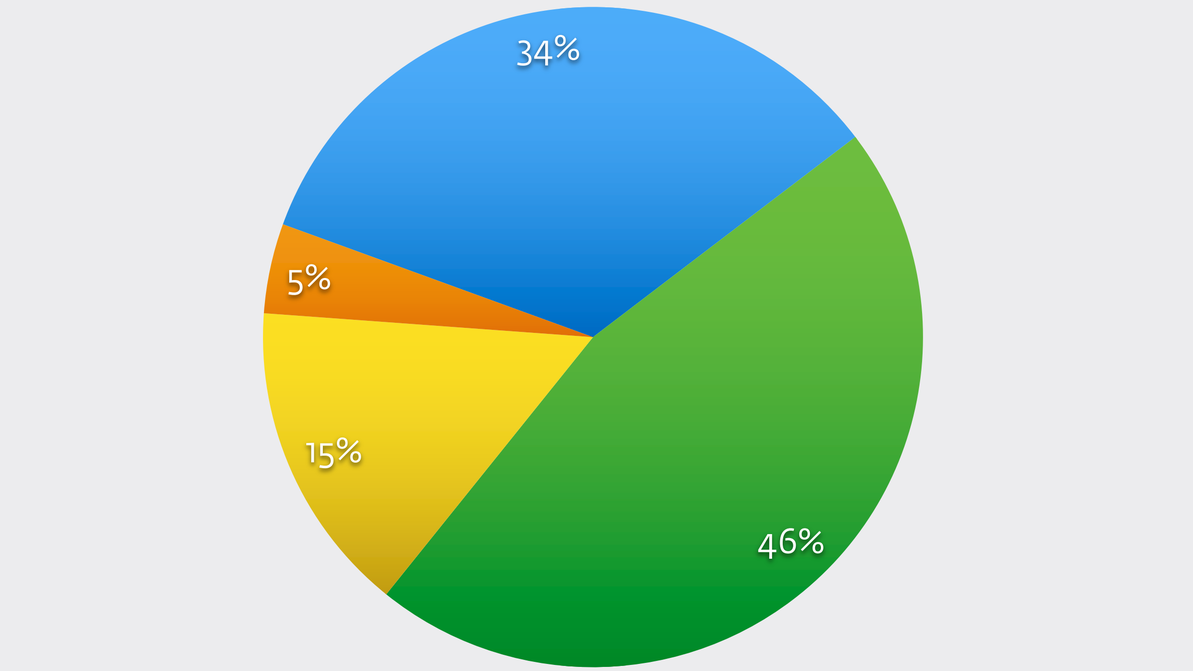
*Generator LCOE = $0.30-0.60 / kWh versus the grid at ~$0.11 / kWh, and solar PV ~$0.10-0.20 / kWp

Source: Ipsos customer survey

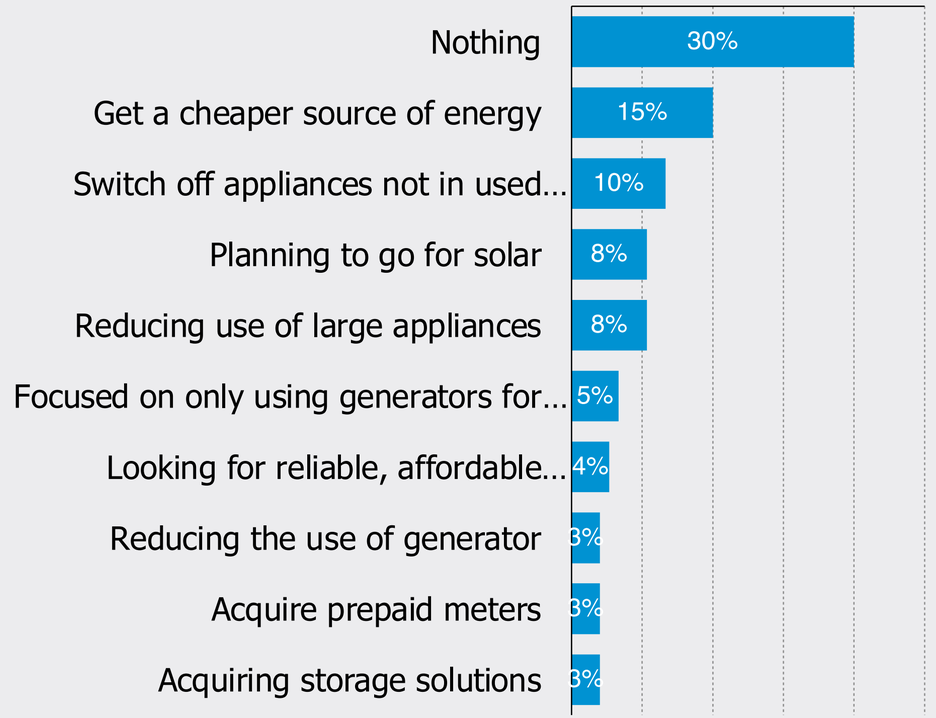
While energy costs are substantial, Commercial and Industrial (C&I) customers have no consistent approach in place to manage energy spend.

SPENDING ON ALL SOURCES OF ELECTRICAL ENERGY

C&I customer's perception at country level



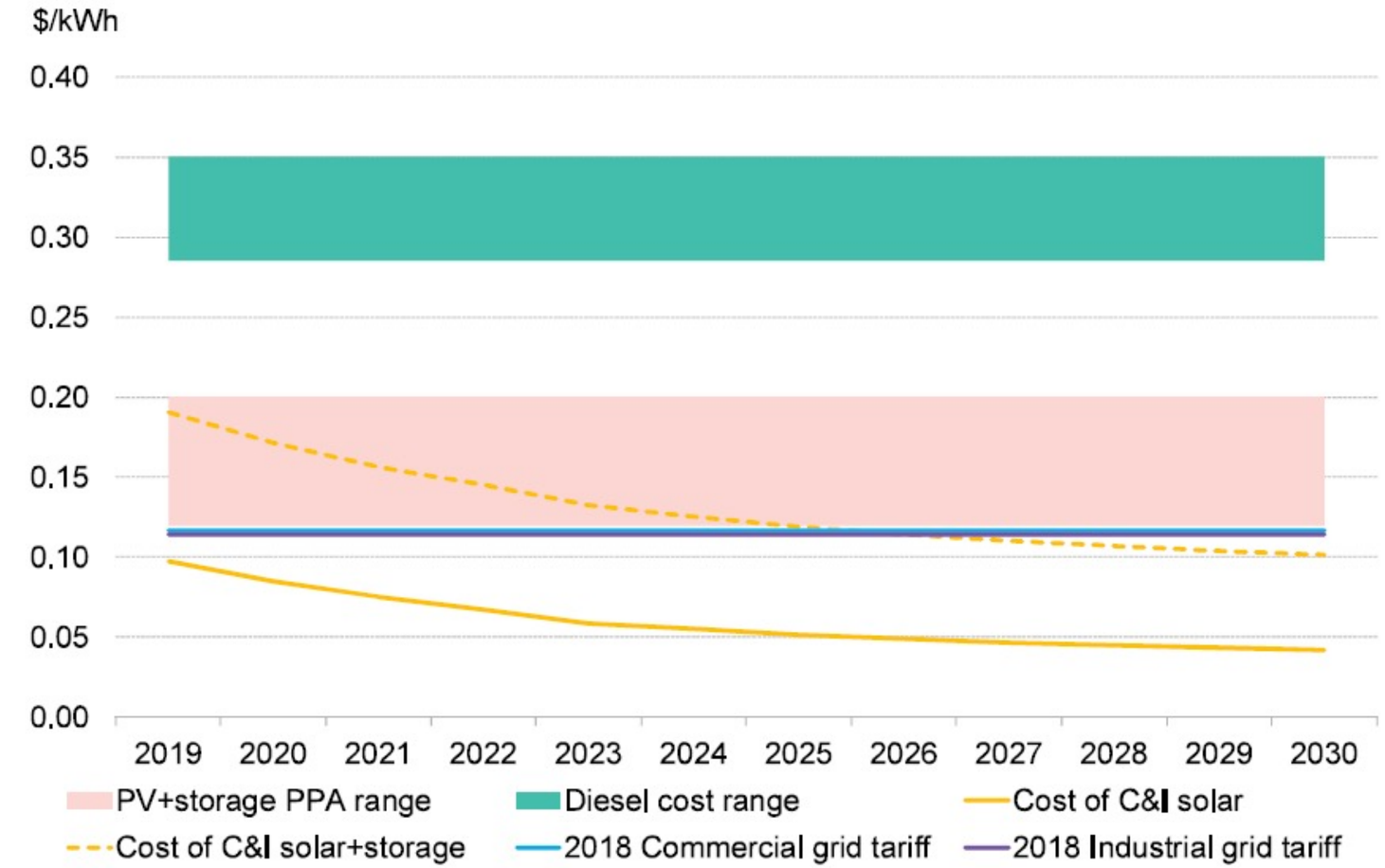
PLAN TO MANAGE SPENDING ON ELECTRICAL ENERGY



Source: Ipsos customer survey

Solar economics are projected to be increasingly favorable into 2030 and beyond.

Figure 31: Nigeria cost of C&I solar forecast versus 2018 electricity tariffs



Source: BloombergNEF

Rooftop solar solutions offer an economically viable way of mitigating energy challenges for C&I customers in Nigeria.

Overview of Solar Economics

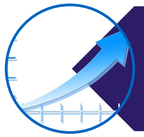
Solar project economics vary across developer offerings and customer segments.

Generally, on-balance sheet acquisitions can yield payback periods from less than 12 months to more than 7 years, depending on many drivers with battery bank size as the primary determinant.

If interest rates can be kept in check, consistently decreasing component costs increase the value proposition year-by-year.

IPP models that offer pure OPEX savings to customers are the prevailing option today, realizing 20+ percent in energy savings. But developers face the risk of currency devaluation if they access hard currency loans to finance assets.

Sample Solar Economic Drivers



Provider economies of scale and related procurement and commissioning advantages

Interest rates for developer or off-taker

Site location, transport and related O&M cost

Availability of affordable land or roof space

System configuration (eg. pure PV solar, solar / generator / grid hybrid, and storage sizing)

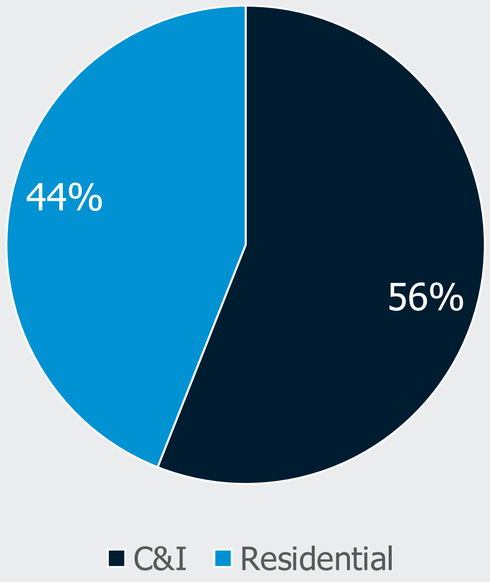
Quality of components

COMMERCIAL & INDUSTRIAL

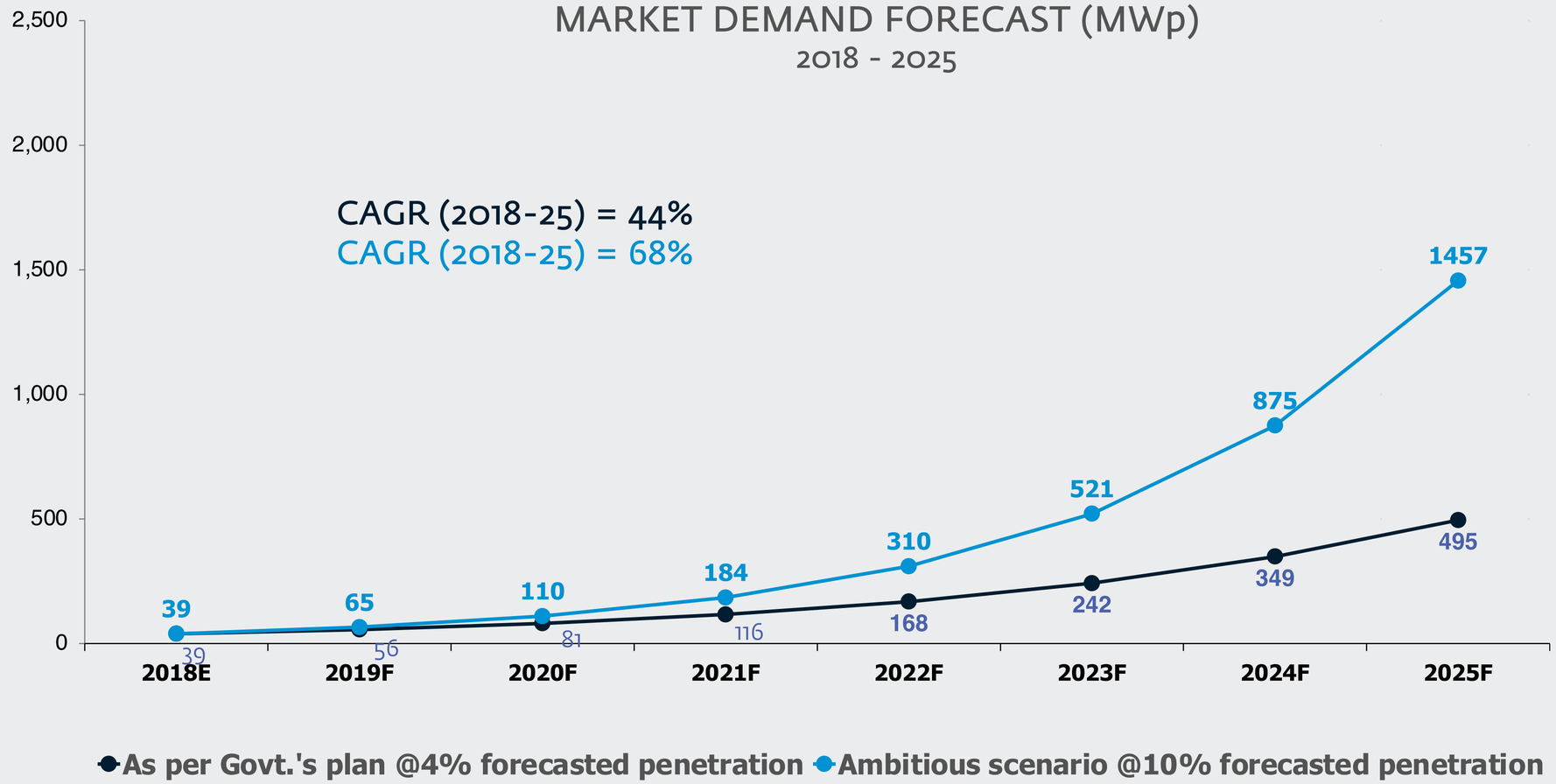
DEMAND SIDE ANALYSIS

As of 2018, there is an estimated 39 MWp of solar installations in Nigeria for C&I and residential customers. This is expected to reach between 494 MWp and 1,457 MWp by 2025

ESTIMATED MARKET SIZE
39 MWp in 2018



~39 MWp



There are several attractive customer segments for solar developers to target.

Photo credit: Arne Hoel World Bank

SEGMENTS	DESS Installed base, 2018	Sector Value 2018	Share of Total Installed Base (DESS)	Market Potential (Volume), 2025	Market Potential (Value), 2025
Commercial	16.02 MWp	$ 37.6 Million	41.2%	169 – 543 MWp	$371 – 633 Mn
Hospitality & Tourism	0.26 MWp	$ 0.6 Million	0.7%	7 - 18 MWp	$16 - 21 Mn
Healthcare	0.54 MWp	$ 1.3 Million	1.4%	7 - 16 MWp	$16 - 19 Mn
Education	0.98 MWp	$ 2.3 Million	2.5%	30 - 49 MWp	$43 - 57 Mn
Agriculture	0.02 MWp	$ 0.04 Million	0.05%	0.5 – 1.2 MWp	$1.1 – 1.4 Mn
Government	0.48 MWp	$ 1.1 Million	1.2%	5 - 16 MWp	$11 - 19 Mn
Industrial	3.44 MWp	$ 8.1 Million	8.8%	69 - 172 MWp	$151 -200 Mn
Residential	17.61 MWp	$ 41.4 Million	44.1%	218 - 642 MWp	$481 - 749 Mn
TOTAL	38.88 MWp	$ 91.4 Mn	100%	495 – 1,457 MWp	$ 1,090 – 1,699 Mn

HOSPITALITY AND TOURISM

Estimated installed base of 0.26 MWp and $1.5 Mn in 2018. Potential to reach up to $21 Mn by 2025.

11,800
Number of small, medium and large enterprises

Typical Electricity Requirement

10 to 70 kWp

Enterprises

10-20 kWp — 2,360 Small

20-30 kWp — 7,080 Medium

40-70 kWp — 2,360 Large

DESS installed base, 2018

0.26 MWp

DESS potential, 2025

Penetration

@4% 7 MW

@10% 18 MWp

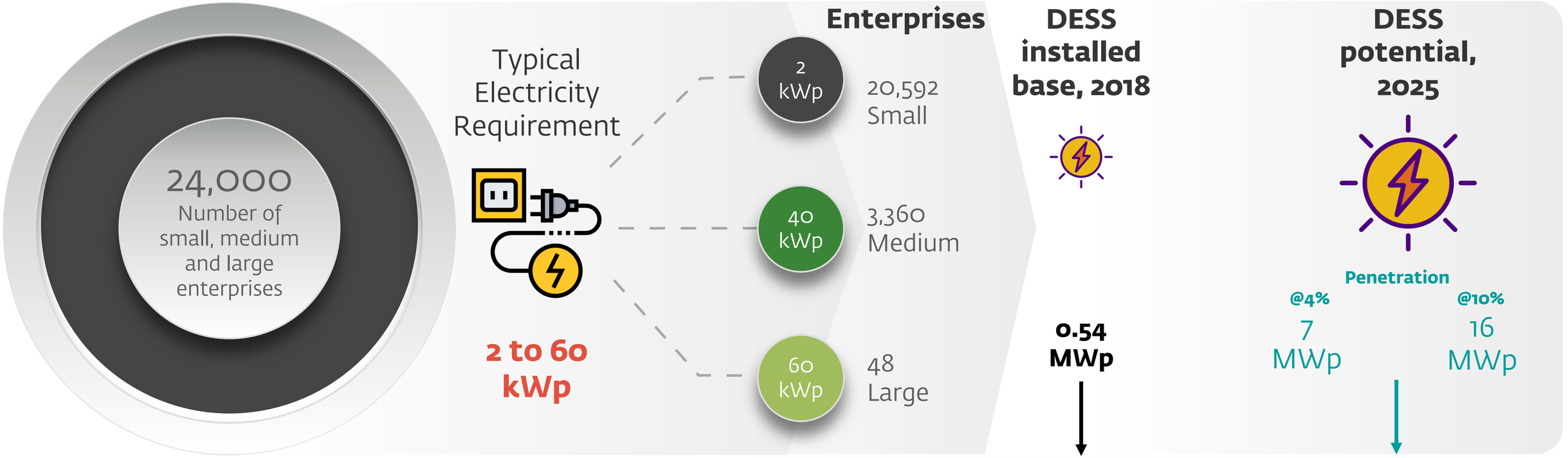
SECTOR VALUE	$0.6 Mn	**$16 - 21 Mn**

Notes:

- ~4% penetration rate based on govt.'s renewable energy vision for the year 2025. However, if prices decrease by 47% during 2018-25 as per International Renewable Energy Agency (IRENA) forecasts, the penetration rate may increase further. The assumed rate of penetration is 10% in the illustrated opportunity.

HEALTHCARE

Estimated installed base of 0.54 MWp and $1.3 Mn in 2018. Potential to reach up to $19 Mn by 2025.

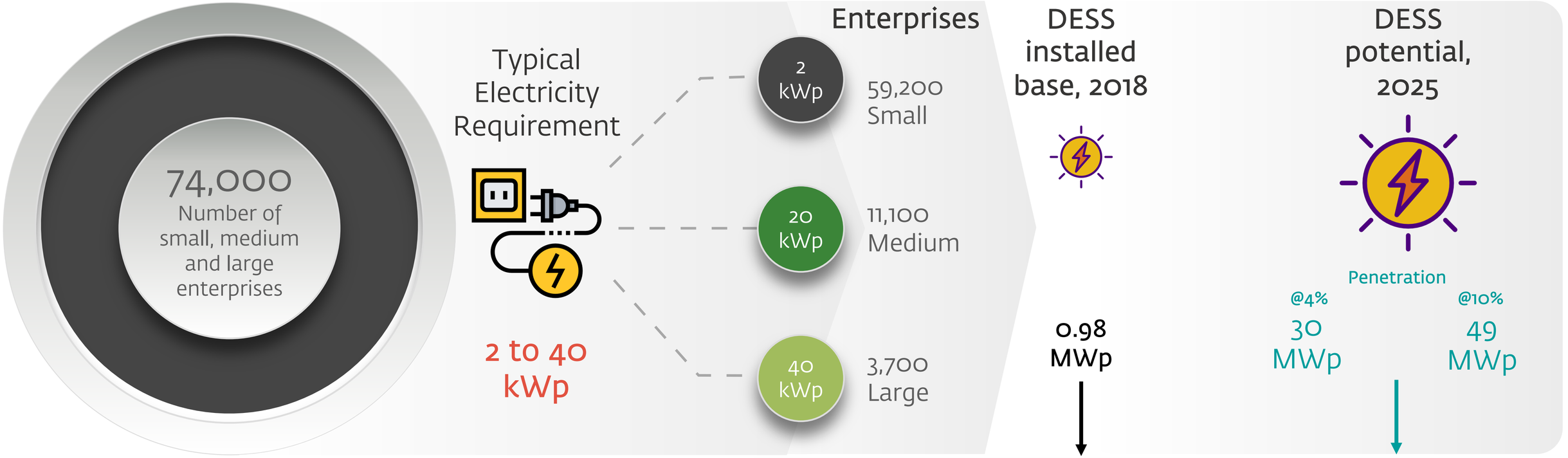


Notes:

- ~4% penetration rate based on govt.'s renewable energy vision for the year 2025. However, if prices decrease by 47% during 2018-25 as per International Renewable Energy Agency (IRENA) forecasts, the penetration rate may increase further. The assumed rate of penetration is 10% in the illustrated opportunity.

EDUCATION

Estimated installed base of 0.98 MWp and $2.3 Mn in 2018. Potential to reach up to $57 Mn by 2025.

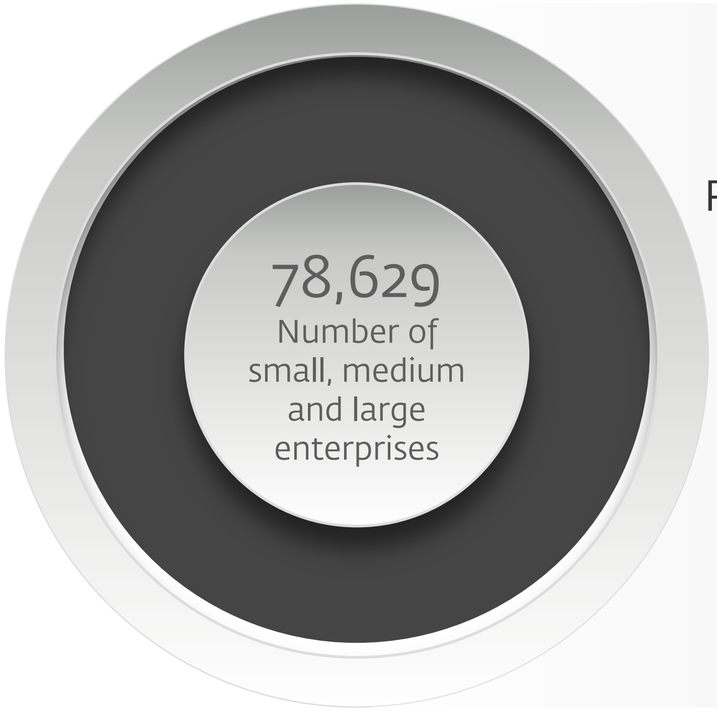


Notes:

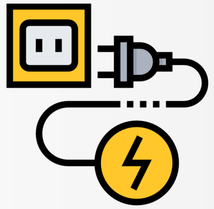
- ~4% penetration rate based on govt.'s renewable energy vision for the year 2025. However, if prices decrease by 47% during 2018-25 as per International Renewable Energy Agency (IRENA) forecasts, the penetration rate may increase further. The assumed rate of penetration is 10% in the illustrated opportunity.

AGRICULTURE

Estimated installed base of 0.02 MWp and $0.04 Mn in 2018. Potential to reach up to $1.4 Mn by 2025.



Typical Electricity Requirement



2 to 40 kWp

Enterprises

- 2 kWp — 77,053 Small
- 20 kWp — 1,424 Medium
- 40 kWp — 152 Large

DESS installed base, 2018

0.02 MWp

DESS potential, 2025

Penetration

@4%	@10%
0.5 MWp	1.2 MWp

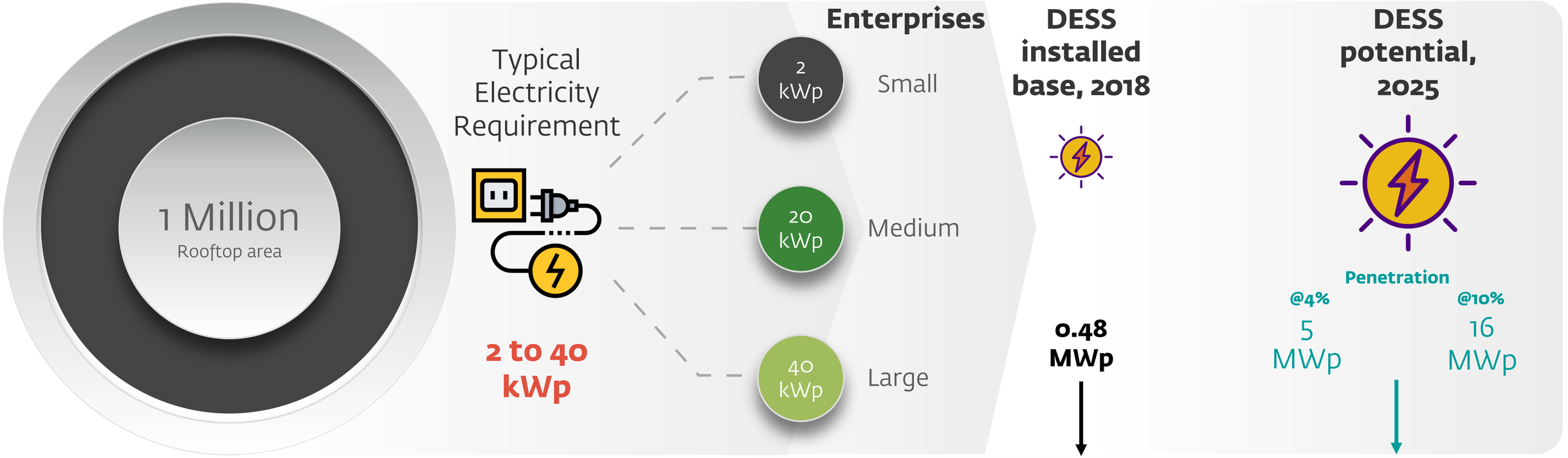
SECTOR VALUE	$0.04 Mn	**$1.1 – 1.4 Mn**

Notes:

- ~4% penetration rate based on govt.'s renewable energy vision for the year 2025. However, if prices decrease by 47% during 2018-25 as per International Renewable Energy Agency (IRENA) forecasts, the penetration rate may increase further. The assumed rate of penetration is 10% in the illustrated opportunity.

GOVERNMENT

Estimated installed base of 0.48 MWp and $1.1 Mn in 2018. Potential to reach up to $19 Mn by 2025.



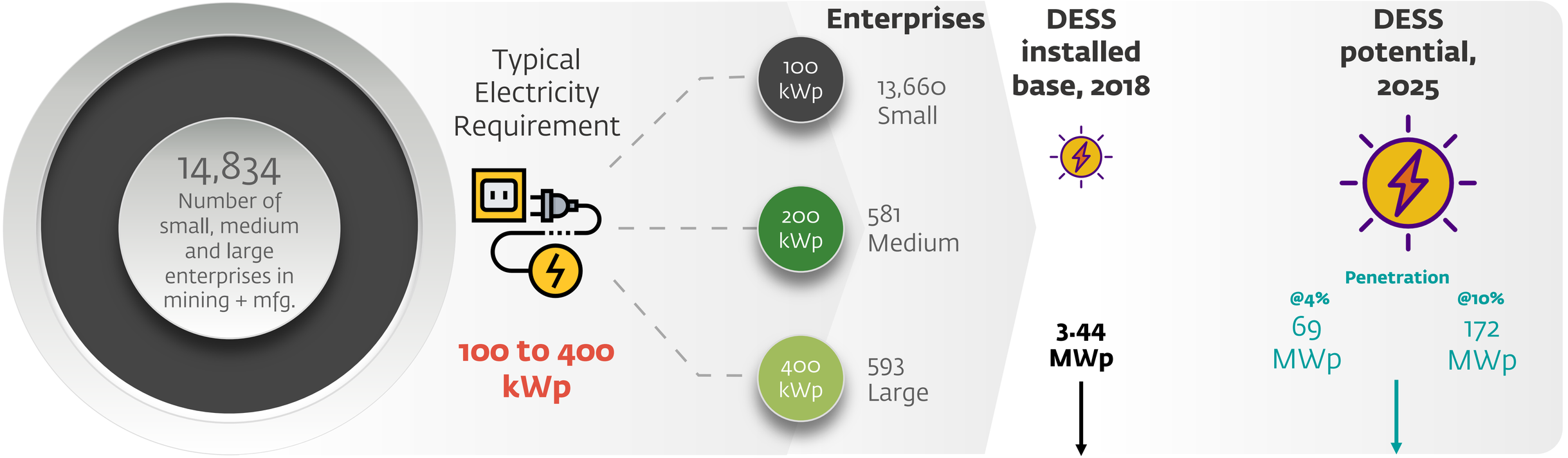
SECTOR VALUE	$1.1 Mn	$11 - 19 Mn

Notes:

- ~4% penetration rate based on govt.'s renewable energy vision for the year 2025. However, if prices decrease by 47% during 2018-25 as per International Renewable Energy Agency (IRENA) forecasts, the penetration rate may increase further. The assumed rate of penetration is 10% in the illustrated opportunity.

INDUSTRIAL

Estimated installed base of 3.44 MWp and $8.1 Mn in 2018. Potential to reach up to $200 Mn by 2025.



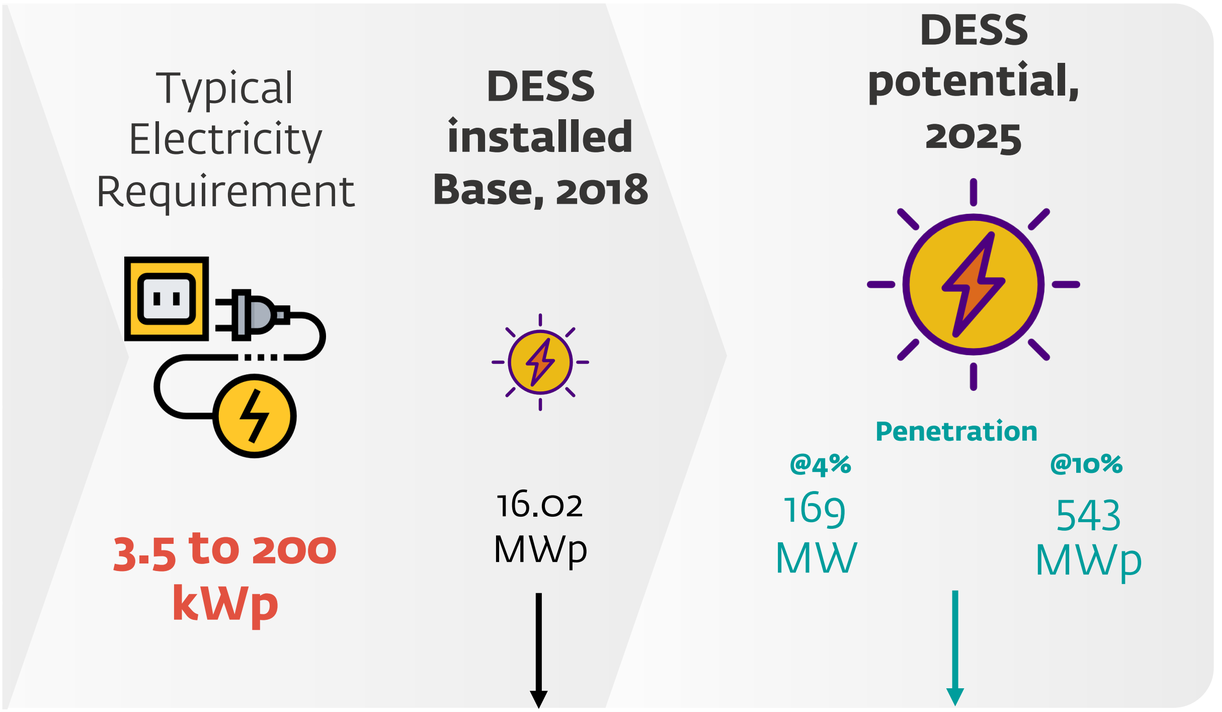
Notes:

- ~4% penetration rate based on govt.'s renewable energy vision for the year 2025. However, if prices decrease by 47% during 2018-25 as per International Renewable Energy Agency (IRENA) forecasts, the penetration rate may increase further. The assumed rate of penetration is 10% in the illustrated opportunity.

COMMERCIAL / SERVICES

Estimated installed base of 16.02 MWp and $37.6 Mn in 2018. Potential to reach up to $633 Mn by 2025.

Banking			Petrol filling stations	Trade / wholesale & retail	Transport & storage	Telecom towers
Commercial bank branches	Microfinance bank branches	ATMs				
5,446	2,197	17,594	26,679	16,152	896	27,576
Small - 15%	80%	80%	20%	94%	92%	80% Single located
Medium - 80%	15%	20%	50%	2%	4%	20% Co-located
Large - 5%	5%	0%	30%	4%	4%	-



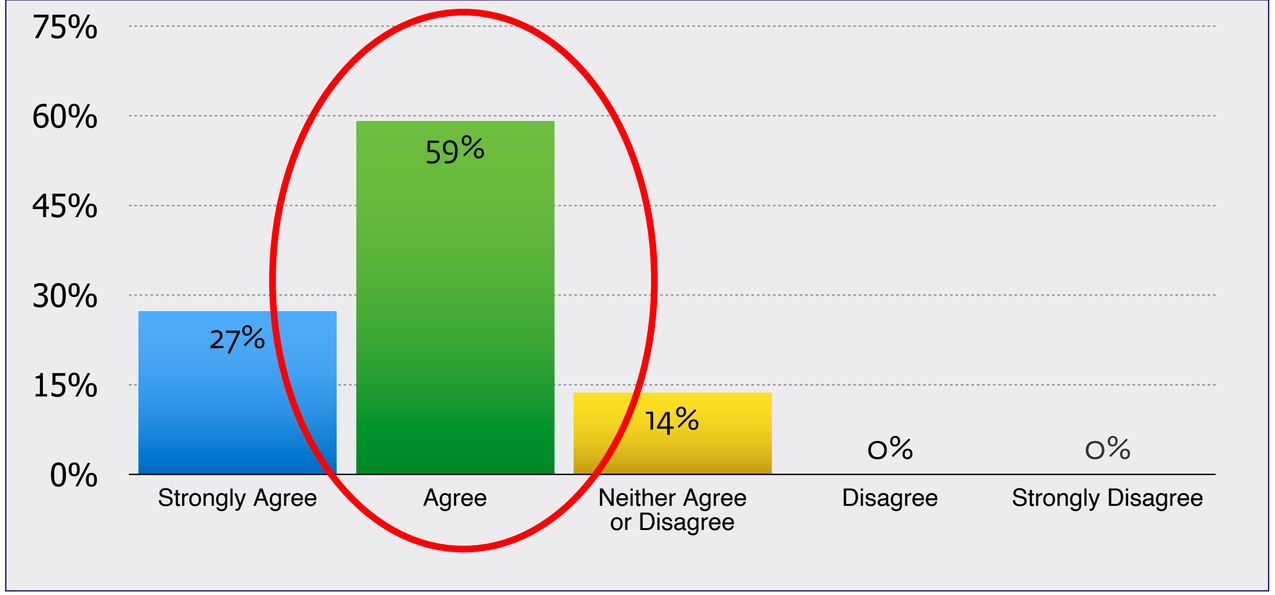
SECTOR VALUE	$37.6 Mn	$371 – 633 Mn

Notes:

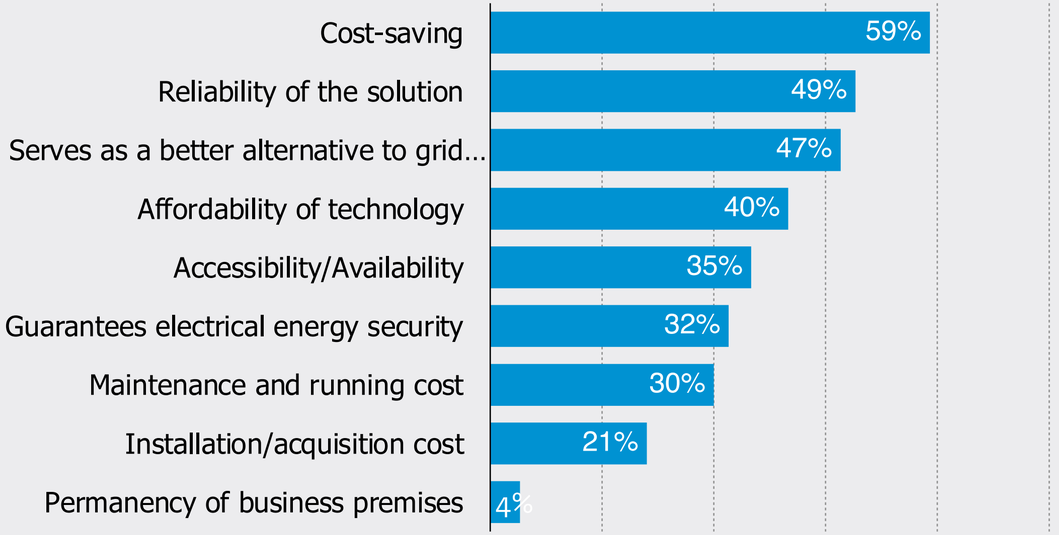
- ~4% penetration rate based on govt.'s renewable energy vision for the year 2025. However, if prices decrease by 47% during 2018-25 as per International Renewable Energy Agency (IRENA) forecasts, the penetration rate may increase further. The assumed rate of penetration is 10% in the illustrated opportunity.

Existing solar users are satisfied.
Many non-users indicate willingness to adopt the solution.

USERS OF SOLAR PV AND ENERGY STORAGE SOLUTIONS
Value for Money



DRIVERS FOR ADOPTION
Solar non-users



LIKELIHOOD FOR ADOPTION

About 59% of commercial and industrial businesses in Nigeria who do not currently use rooftop solar PV and energy storage solutions are willing to give the solution a try.

24%	35%	33%	8%	-%
Definitely will try it	Will try it	Might or might not try it	Will not try it	Definitely will not try it

Despite promising opportunities and good user experiences, the market is constricted by several barriers.

Photo credit: Nyani Quarmyne IFC

Scaling rooftop solar uptake for consumers is hindered by several market barriers.

The cost of solar solutions was the most cited reason for both C&I and residential non-users to forego adoption. Concern about sourcing genuine equipment was a lesser cited, but notable, issue (cited by non-users: 27% in C&I, 55% in residential). Other barriers include:

1 LIMITED AWARENESS

There is very limited awareness across residential and C&I segments about solar's value proposition. This is impacted by incorrect understandings generated by hearsay or sub-optimal experience.

2 MARKET LACKS QUALITY ASSURANCE STANDARDS

The market faces performance risks due to a lack of quality standards for procurement, engineering and commissioning of assets. Standards should be verified by a third-party provider.

3 HIGH COST OF CAPITAL

High bank interest rates, in addition to the non-recognition of solar as an 'asset class,' limit the market's potential.

4 FRAGMENTED ECO-SYSTEM

Developers lack standardized solutions and value propositions.

5 LIMITED CLARITY ON PAY-BACK

Lack of consistency in IRR metrics on solar projects versus known IRR for the incumbent solution (generator hybrid).

6 POTENTIAL VESTED INTERESTS

Potential resistance from incumbent energy solution providers who may not wish to see solar succeed.

7 NO FRAME OF REFERENCE OR EXPERIENCE

For the C&I segments, most procurement teams have no experience dealing with IPP or solar EPC contracts.

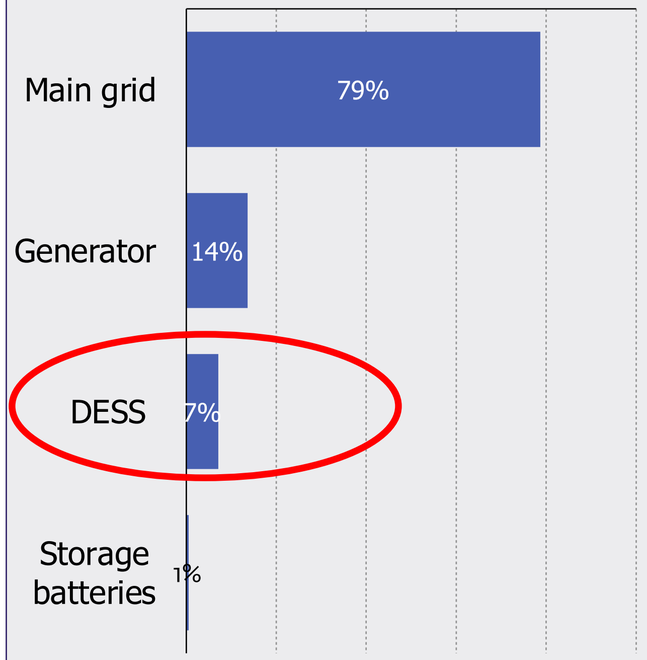
8 OPEX POSSIBLY LOW ON BUSINESS PRIORITY

For C&I segments, there is a long decision cycle and low accountability/ownership on reducing OPEX energy spending.

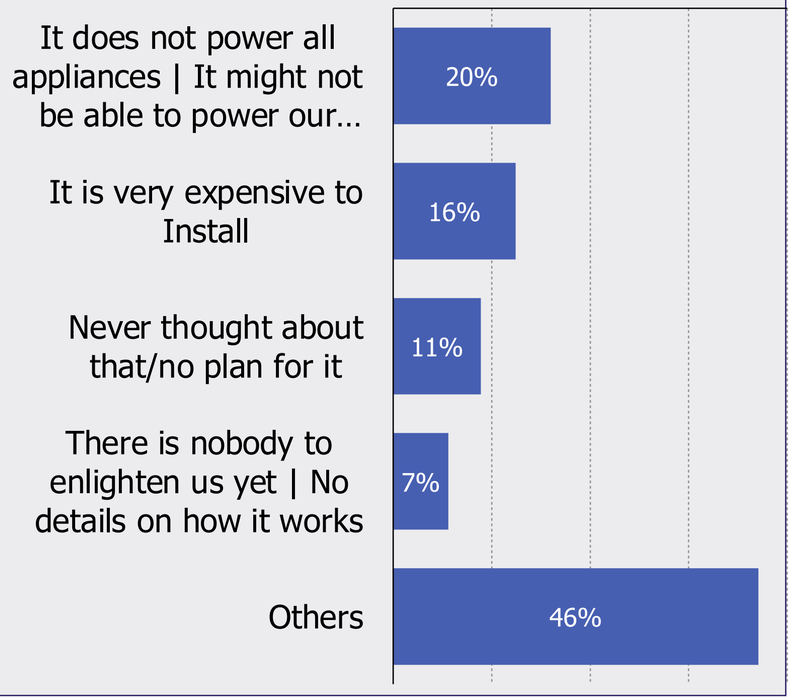
The C&I sector is characterized by a lack of awareness and incorrect information about solar's value proposition.

LOW-AWARENESS AND PERCEPTION OF SOLAR FROM NON-USERS

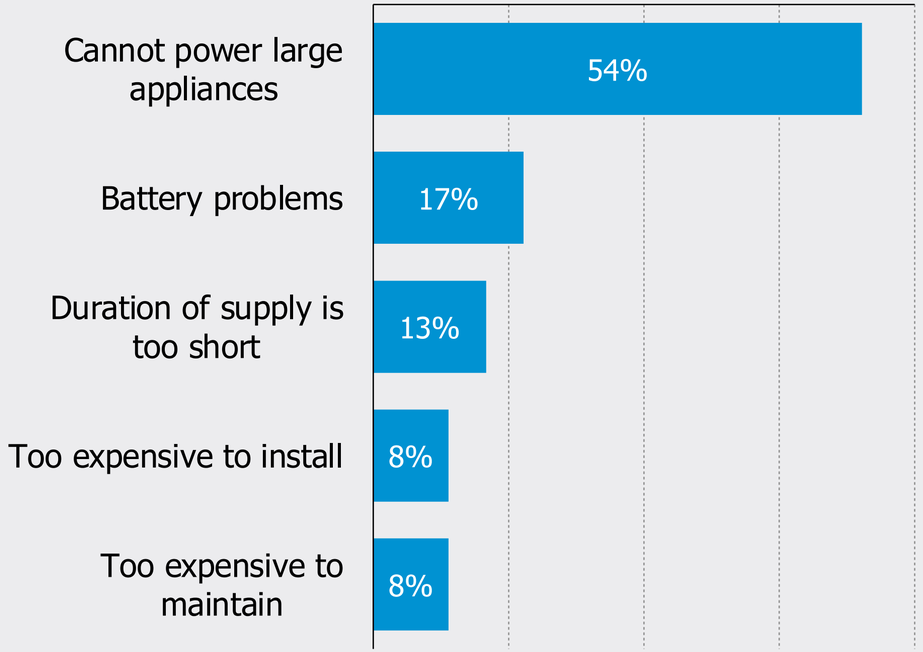
Top of the mind responses for where non-solar users primarily access electricity



Primary responses from non-users on perceptions of solar technology



KEY CHALLENGES PERCEIVED BY USERS
Experience using solar PV/panel & storage batteries



The biggest motivations to adopt solar are cost–saving and the reliability of the solution to meet needs.

Source: Ipsos customer survey

The initial CAPEX requirement limits adoption of solar PV solutions.

Despite the level of dissatisfaction with utility service and generators,
the biggest barrier to adoption of solar is the initial capital investment faced by new customers.

SATISFACTION WITH CURRENT ENERGY SOURCES

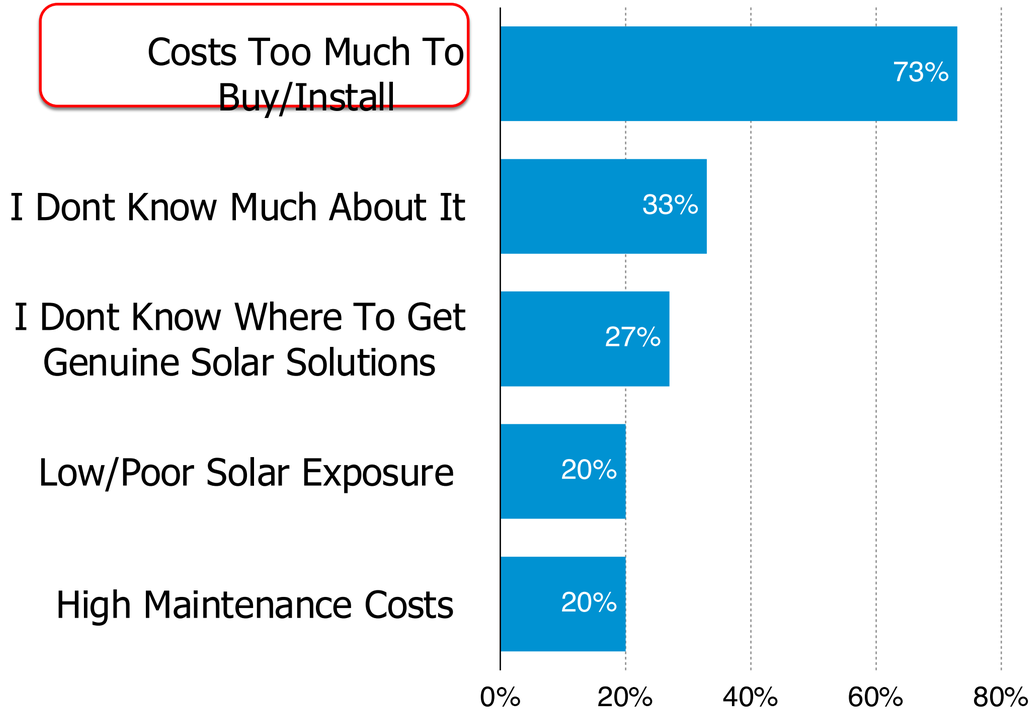
Electricity from main grid

13%

Generator

29%

REASONS HAMPERING ADOPTION OF ROOFTOP SOLAR PV AND ENERGY STORAGE SOLUTIONS GIVEN BY NON-USERS



Source: Ipsos customer survey

RESIDENTIAL

The residential market segment in Nigeria is vast and valuable. By a conservative estimate, nearly 3 million 0-4 kVA petrol generators currently supply this segment. Larger bungalows and high-rise buildings account for hundreds of thousands more diesel generators.

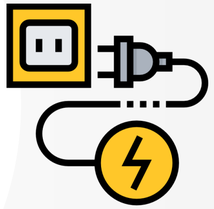
Electricity produced by fossil fuel generators costs at least 3x more than the grid, and solar is already cost competitive.

RESIDENTIAL

Estimated installed base of ~17.61 MWp and $41.4 Mn in 2018. Potential to reach upto $749 Mn by 2025.

34 Million
Households

Typical Electricity Requirement



1 to 10 kWp

35% Small

55% Medium

10% Large

DESS installed base, 2018

17.61 MWp

DESS potential, 2025

Penetration

@4% 218 MWp

@10% 642 MWp

SECTOR VALUE	$41.4 Mn	**$481 - 749 Mn**

Notes:

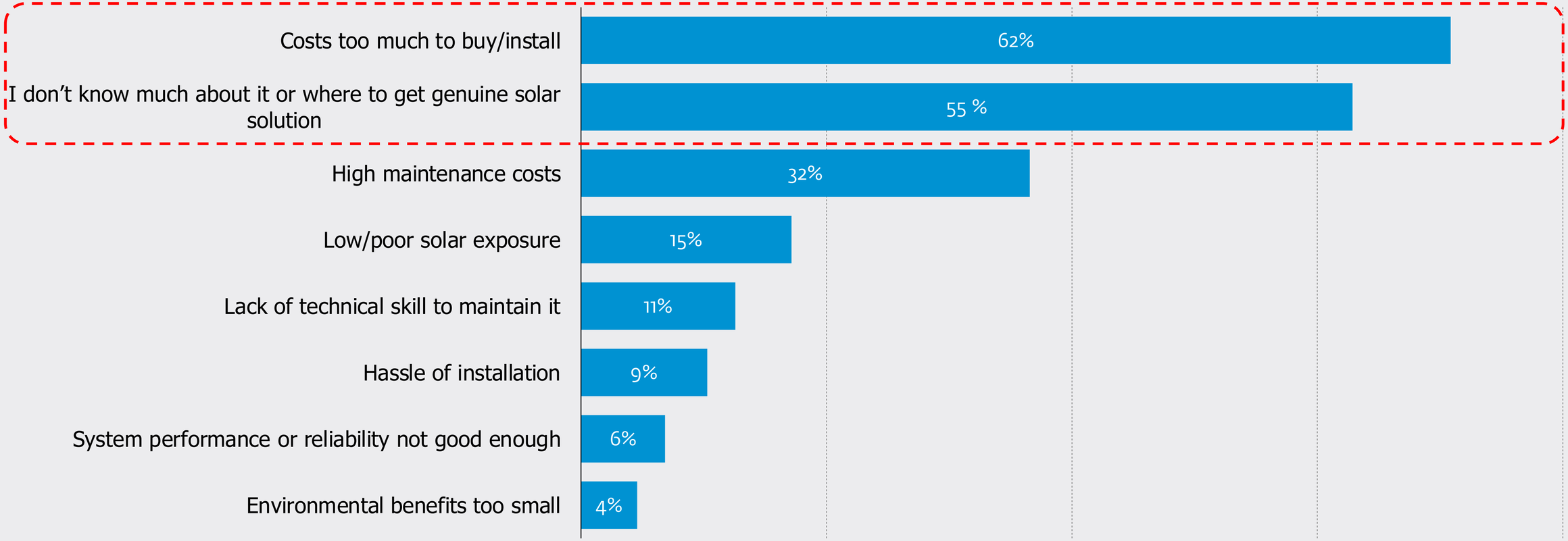
- ~4% penetration rate based on govt.'s renewable energy vision for the year 2025. However, if prices decrease by 47% during 2018-25 as per International Renewable Energy Agency (IRENA) forecasts, the penetration rate may increase further. Assumed rate of penetration is 10% in the illustrated opportunity. Also, we have only considered households from the 'Upper Upper' and 'Upper Lower' socio-economic classes for estimating current installed base given their affordability and chances to off-load their diesel generator usage to solar base system.

Despite an attractive market size and opportunities for developers, the residential customer segment faces significant market barriers.

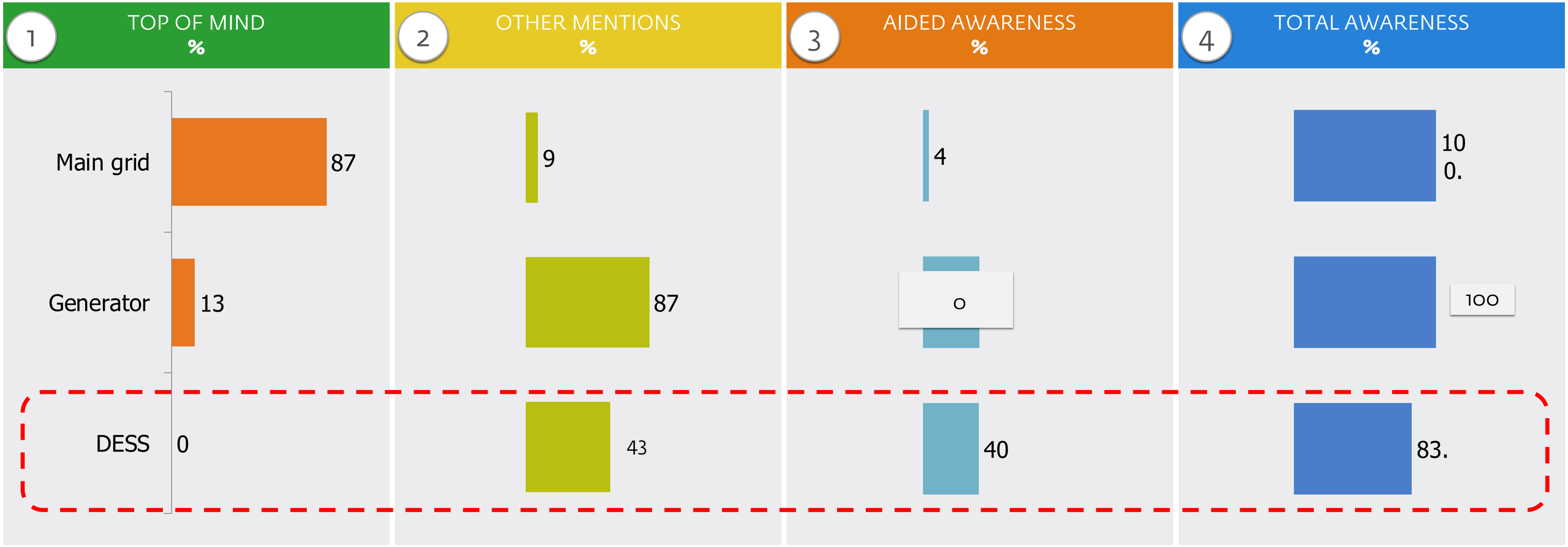
Photo credit: World Bank

Residential barriers to adoption hamper the market's potential.

The main barriers to adoption of solar are capital investment and poor knowledge about the solution.
More than half of the survey respondents did not have enough information about solar or where to get genuine solutions.



Our survey revealed that solar solutions are not primary sources for electricity access for residential customers.



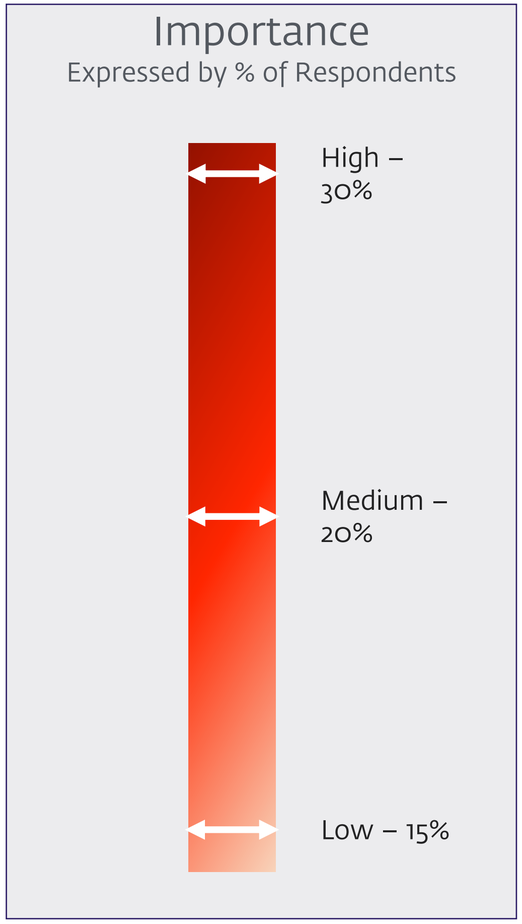
1.1. Based on the different types of electrical energy sources available in Nigeria that your household could possibly use, which source of electrical energy comes to your mind first?
1.2. Again, based on the different types of electrical energy sources available in Nigeria that your household could possibly use, are there any other source(s) of electrical energy that you are aware of?
1.3. Are you aware of these other sources of electrical energy?.

Source: Ipsos customer survey

There are also challenges facing current residential solar users.

Solar users cited installation costs and quality of battery solutions as key issues.

Major Challenges	Description
Installation Cost	Solar users surveyed reported paying a substantial percentage of the overall asset value for the installation of the solution. A one-time, full solution installation can cost users USD $400, or 23 percent of the total cost of the average solution. In addition, maintenance can cost users in the range of USD $28-111 per visit.
Quality	85 percent of users whose expectations were not fully met cited battery issues as a re-occurring problem. These are homeowners with batteries more than one year old.
Limited Power Output	Other experiences of users surveyed included some reports of "not getting the results that were expected." This result may imply that some customers exceeded the capacity of the system after installation, some components used were subpar, or some combination thereof. The lack of standardization in system design and the quality of solar components sold remains a challenge to scaling the market.

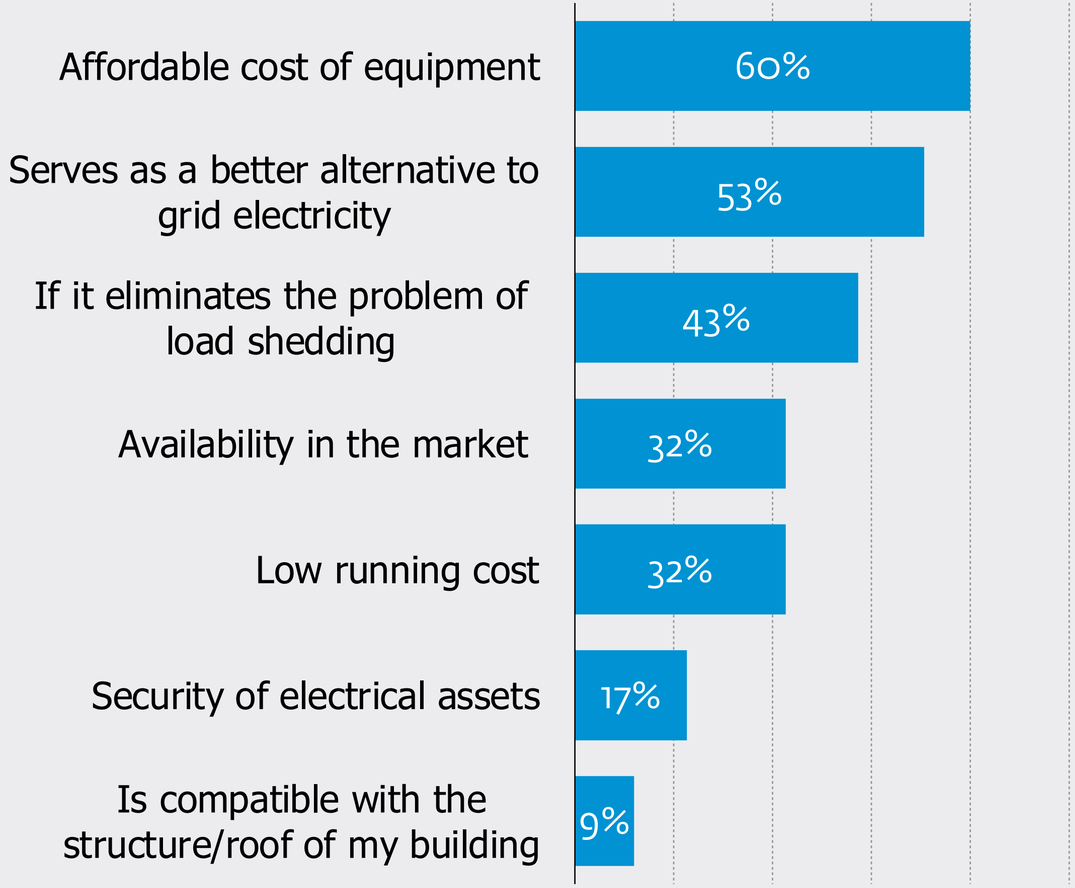


3.12a. What is the main challenge you experience with your Distributed Energy and Storage Solutions?
3.12b. What other challenges have you experienced with your Distributed Energy and Storage Solutions?

Source: Ipsos customer survey

Despite an early stage market with little to no presence of customer education and awareness campaigns, many non-users are willing to adopt rooftop solar solutions if the cost of equipment is affordable and a better alternative to the grid.

DRIVERS FOR ADOPTION
Solar non-users



*Respondents could provide more than one answer

LIKELIHOOD FOR ADOPTION

About 49% of homeowners who do not currently use rooftop solar PV and energy storage solutions are willing to give the solution a try.

49% Open for Solar purchase

51% Not considering Solar purchase

Residential barrier focal point: batteries are costly or inferior.

With peak usage requirements during evening hours, storage remains critical, yet is also the weakest component within the solar proposition. The associated storage costs will continue to remain the main factor limiting adoption at scale for this segment.

85%

Of potential users surveyed, battery costs are reported as the main issue with a solution purchase.

- Expensive batteries deter customers from acquisition.
- Cheap batteries fail at rates that prolong and/or negate payback benefits, and often last less than a year.

Higher quality Lithium batteries are seldom sold or bought due to the cost to the average customer.

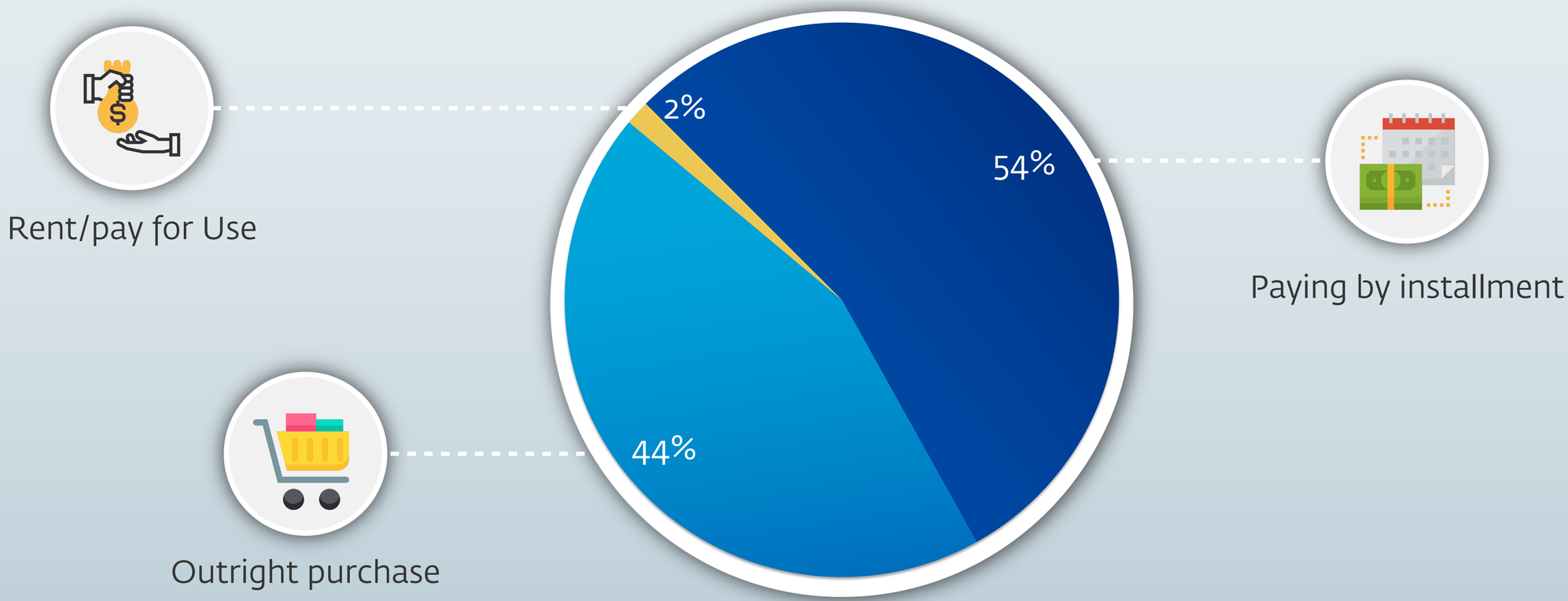
The residential segment most likely to purchase solar solutions outright will likely fit the following parameters:

- Is affluent and can self-finance the solution.
- Views generators as an inconvenience.
- Potentially has a positive word of mouth influence within their social circle.

Residential customers have a preferred mode of procurement.

Prospective residential buyers would prefer to pay through installment payment plans.
44% would consider an outright purchase.

% MODE OF PURCHASE

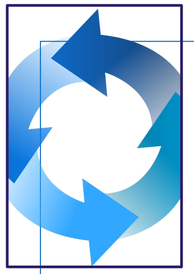


2.5. If solar energy solutions such as Distributed Energy and Storage Solutions were to be made available through a solar energy provider, how would you like to pay for the solution?

ISSUES AND CHALLENGES FACING SOLAR SUPPLIERS

There are key, early-stage issues hampering the growth of solar firms.

Large demand for capital

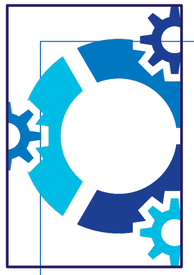


Long sales cycles tie up liquidity, forcing providers to offer short-term loans of 3-6 months

Absence of standardization for solution designs

Challenges of prioritizing customer segments

Lack of universal quality standards and certification



Lack of standard operations & maintenance practices and service level agreements

Large Demand for Capital

Companies struggle to meet growth aspirations due to high cost of local currency debt.

Many start-up firms interviewed reported struggling to meet growing demand due to their inability to tap local currency debt. The sales pipeline was reported to be strong, but debt and/or project financing were scare. Asset collateral and client lending history were the two top reasons reported behind the inability to access loans from local financial institutions.

A handful of firms sought to reconcile these domestic shortages by tapping foreign sources such as crowdsourcing platforms and early stage venture capital.

While interest rates from European crowdsourced debt were favorable, averaging between 9–11%, foreign exchange (Fx) risk remains.

Photo credit: Nyani Quarmyne IFC

Long Sales Cycles Tie Up Liquidity, Forcing Providers to Offer Short-Term Loans of 3–6 Months

Without local currency debt, many firms take consumer financing into their own hands – but at a cost.

Many firms reported offering 3–6-month loan tenors on a percentage of the overall asset value (after a down payment) to broaden their residential sales and support consumer financing.

However, performing customer credit checks, managing repayment performance and mitigating customer loan delinquency were said to be both expensive and inefficient for solar companies.

Furthermore, redirecting sales margins to cover consumer financing instead of circulating them back into procurement was reported by firms to have a negative impact on expanding their customer base. This in turn led many firms to restrict customer financing to both a limited number of customers, as well as skewing tenors closer to 3 months than 6.

Photo credit: Nyani Quarmyne IFC

Absence of Standardization for Solution Designs

Few companies reported a standardized approach for system design, configuration, and sales to meet demand from targeted customer segments.

Many companies would benefit from a streamlined, standardized approach to their procurement, engineering, and sales strategies. By prioritizing customer segments and narrowing the configuration options for customers with less variation in load profile (e.g. petrol stations, franchised enterprises, bank branches), companies could leverage economies of scale in procurement and create cost and performance efficiencies for asset commissioning.

Most companies interviewed used a more ad-hoc approach to procuring, sizing, selling, and commissioning rooftop solar assets. The lack of standards likely increases the overall cost to both the provider and customer.

Photo credit: Dominic Chavez IFC

Challenges Prioritizing Customer Segments

Few companies articulated a clear and strategic prioritization of customer segments mapped to corresponding value propositions and firm-level strategic advantages.

Most companies interviewed struggled to articulate how they have strategically prioritized customer segments. In turn, they have not developed compelling value propositions to both meet customer objectives and outperform competitors.

While these symptoms are typical of any early stage market, where the focus is on capturing early adopters and rotating capital, there is a lot of room for companies to grow their market strategy.

Prioritizing where and how a firm competes, including clear value propositions to customers and barriers to entry for competitors, would help many firms distinguish themselves in the market. These strategies would create cost efficiencies as well as reduce opportunity cost derived from a fractured sales approach.

Photo credit: John Hogg

Companies & customers alike would benefit from market level universal quality standards.

Lack of Universal Quality Standards and Certification

To build a solar industry that offers a consistent and quality user experience, the industry needs to adopt and abide by procurement, sizing, and installation quality standards, with independent certification to ensure they are followed.

These standards will ensure that customer experiences and perceptions are positively reinforced through uniform and predictable asset performance. In turn, asset performance predictability will drive the development of local bank lending as the risks associated with the asset and customer repayment discipline are decreased.

Photo credit: Dominic Chavez IFC

Lack of Standard Operations & Maintenance Practices and Service Level Agreements

Both at the firm and market level, there is a lack of standards for operating and maintaining rooftop solar assets that restricts the market's growth.

Interviews with firms reveal there is a wide range of practices for supporting solar asset operations and maintenance (O&M). The inconsistency of O&M practices jeopardizes the rapid uptake of solar due to the impacts on customer perceptions when O&M practices are subpar, and customer experiences are poor.

Interviews with firms also reveal that there is a wide variance of Service Level Agreements (SLAs) for rooftop solar solutions, adding to the existent disparity of potential customer experiences and overall asset performance.

By agreeing to industry level standards for O&M and SLA, all solar firms will benefit from a more uniform customer experience.

Photo credit: Dominic Chavez IFC

MARKET INSIGHTS

The following section contains market insights derived from multiple in-depth interviews with pv solar solution providers, developers, financiers, and other stakeholders.

Photo credit: Nyani Quarmyne IFC

SUCCESS STORIES ARE LIMITED

The market experience with solar is remarkably small. Success stories are limited to:

1. IPP models where the end-user has limited or no CAPEX investment.
2. Select multinational firms.
3. Early adopting residential users.
4. Developers who have captive segments where the parent company provides economies of scale for the OPEX/IPP offering through its family of companies.

IPP MODEL OFFERS FIRST MOVER BENEFITS, BUT COMES WITH RISKS

In most cases, the IPP model has been easier for developers to sell, but brings significant risk, including:

1. The contract/commitment for the monthly pay-as-you go arrangement may be difficult to enforce over the duration of the contract (10-15 years in most cases).
2. Developers need to manage foreign exchange risk when borrowing in hard currency.
3. To grow their business, developers needs to continuously raise more capital.

MULTINATIONAL COMPANIES ARE AN ATTRACTIVE, BANKABLE TARGET GROUP,BUT HAVE THEIR LIMITS

The volume market is local industry. However, there is no ‘critical mass’ for significant investment in the solar industry if MNC’s are the only target. There are also some risks to limiting the target customer segment to multinationals:

a. There are indications of limited local market executive authority – i.e. many multinational executives in market defer investment/CAPEX decisions to global counterparts.

b. There is a potential lack of trust from multinational HQs about decisions made in local markets – i.e., motivations are questioned.

c. Lack of incentive to make changes to energy strategy – "why upset the apple cart?"

Photo credit: Jonathan Ernst WB

FINANCIAL INSTITUTIONS ARE AN IDEAL ROUTE TO MARKETS OFFERING LOCAL CURRENCY LENDING, BUT CURRENTLY FACE AN UPHILL BATTLE

Points to consider when examining a financial institution route to market:

1. Banks appear under-motivated and require education on the market and product development support.

2. The target customers are all exposed to local market currency pricing and risks – which limits the base of prospects who are willing to be exposed to hard currency-denominated loan repayment commitments.

3. If hard currency exposure is a motivating lever, then multinational firms or domestic companies dealing in hard currencies are potentially the immediate viable targets.

4. While customers need different financing products, one of the critical questions to be answered is: at what interest rate can lenders, borrowers and providers all make out well?

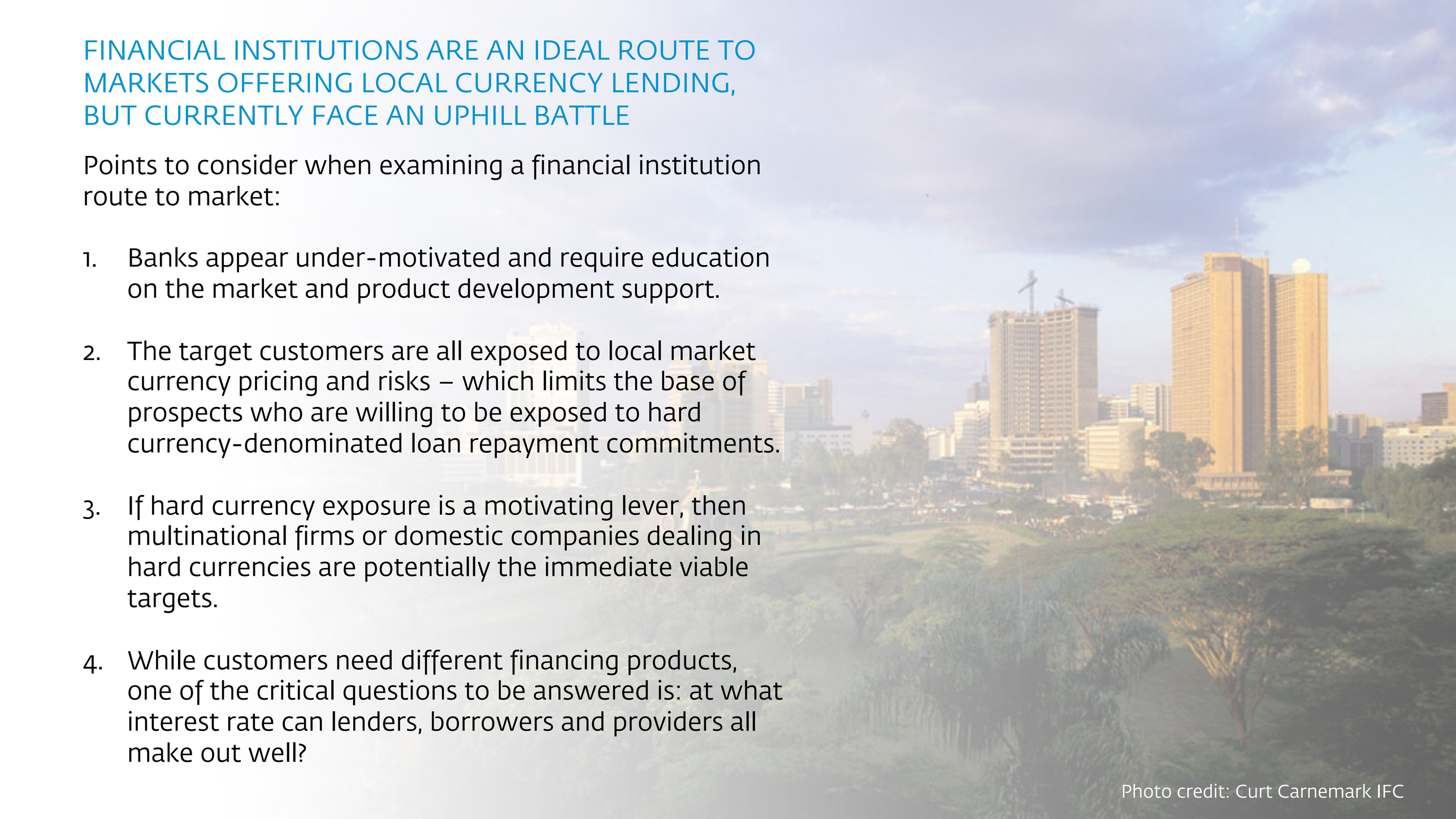


Photo credit: Curt Carnemark IFC

THERE ARE A FEW KEY STEPS TO IMPROVE THE VALUE PROPOSITION FOR FINANCIAL INSTITUTIONS (FI) TO INCREASE LENDING

1. Create standards that promote awareness and accountability of what constitutes quality in order to addresslower quality “fly-by-night” solar firms.

2. Build customer awareness and demand with preferred bank clients. Target customers who have a good, long-term standing and credit history with the FI.

3. Provide guarantees (e.g. contract SLAs) on the quality of solar components used and their warranty and replacement terms.

4. Help banks recognize the merits of promoting solar for a client/FI “win-win” – i.e. increasing business viability by reducing client OPEX, while reducing FI transaction costs through “top-up” loans to create more customer stickiness.

Photo credit: A'MelodyLee

Nigeria presents an attractive market for commercial, industrial, and residential rooftop solar solutions. These measures can mitigate the crippling effects of a dysfunctional grid, and related dependence on costly fossil fuel generators.

The economics of solar solutions are already favorable in Nigeria. As cost curves continue to decline and innovations in generation and storage technology advance, more customer segments will open to scale.

However, this study's findings reveal several barriers that hinder the growth of the market in Nigeria — barriers that are inherent to the early stage nature of the market's development. These obstacles create additional costs for first mover solution providers, slowing what could otherwise be a bullish market.


In Memoriam
Margery Reibold Sommer
289
Magnone Brothers
Stanley & Allen Magnone
302
Alexandra and
Sidney Sheldon
315
Enery R. Williamson
328
Sony Pictures
Entertainment
341
Wilbur and Jane Ouse
354
Miss Pamela R. Terry
290
Helena Bessie Wing
1919-1994
"Rounded with a sleep."
303
The
Pacific Stock Exchange,
Inc.
316
Dennis Kinnaird &
Connie McCreight
329
342
355
Pacific Bell
Awards Dinner
1996, 1997, 1998, 2000
317
Rockwell
Patron
330
ARCO
Awards Dinner
1996, 1997, 1998, 1999, 2000
343
356

ANNEXES

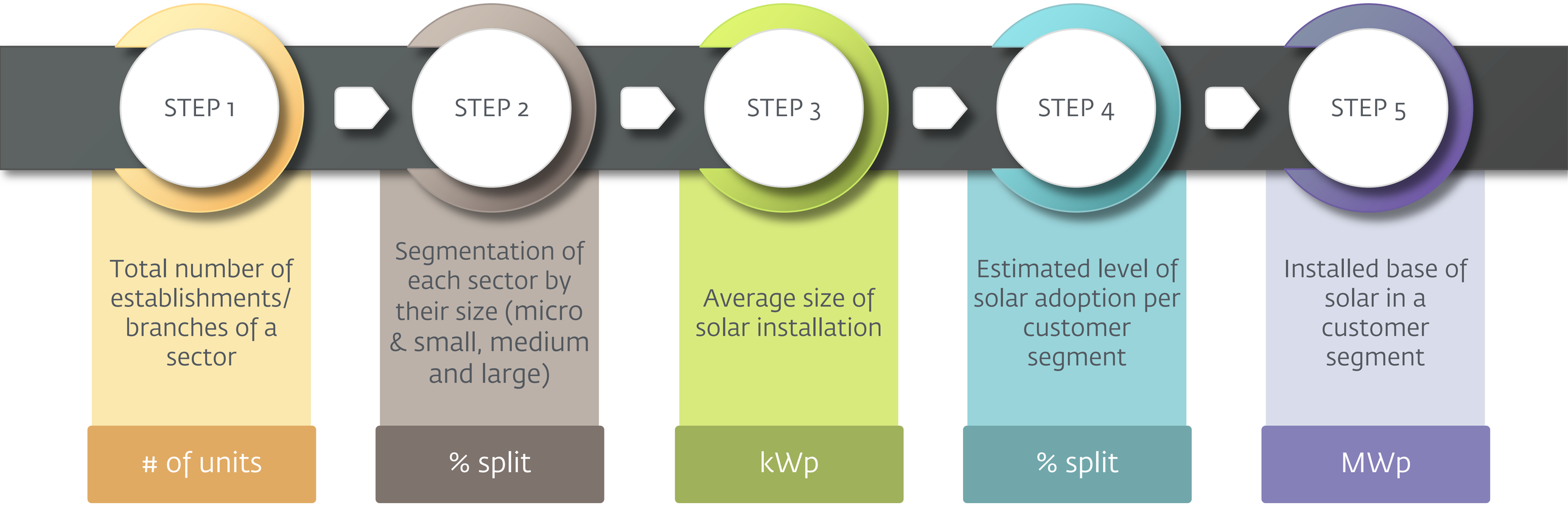
Glossary

1	DESS	Distributed Energy & Storage Solutions
2	kWp	Kilo Watt Peak
3	MW	Megawatt
4	MWp	Megawatt Peak
5	IPP	Independent Power Producer
6	REMP	The Renewable Energy Masterplan
7	NREEP	National Renewable Energy Efficiency Policy
8	EPC	Engineering, Procurement, and Construction
9	PHCN	Power Holding Company of Nigeria
10	KW	Kilo Watt

ANNEXURE 1

APPROACH FOR MARKET SIZING (1/2)

A five-step approach was taken to estimate the installed base of the solar market across sectors, gathering input from both in-depth desk research as well as key stakeholders



ANNEXURE 4

APPROACH FOR MARKET SIZING (2/2)

However, for estimating installed base for the office segment we used alternative approach based on number of office-going workforce and proportion of rooftop space on which DESS can be deployed

APPROACH FOR ESTIMATING DESS INSTALLED BASE FOR OFFICE SEGMENT

48 Mn
Total workforce

X

3.5 Mn
Workforce going to office

=

14 m^2
Avg. space/ employee

%

49Mn m^2
Gross office floor area

14Mn m^2
Gross rooftop area (exc. large buildings)

30%
Solar suitable rooftop area

10 m2
Area required to generate 1kWp

=

17-25MWp
Solar energy potential
(assuming a maximum penetration rate of 4-6%)

- Given an average solar radiation level of about 5.5 KWh/m^2/day around 10m2 of solar panel area is required to generate 1KW of electricity. Using this assumption, total generation potential is ~417MWp per annum.
- Once we arrived at total deployable size, i.e. 414MWp, a ball-park percentage of adoption rate was used to estimate installed base as of 2018.
- Foreseeable challenge to implementation are:
  - Adjacent buildings likely to limit efficiency of solar panels.
  - Limited rooftop space is likely to put a cap on the amount of energy generated per site.

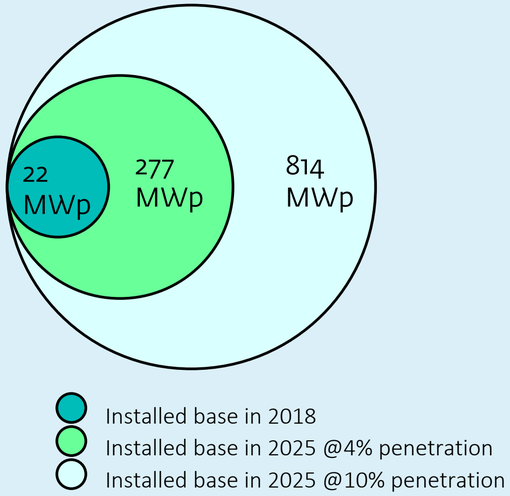
DEMAND SIDE ANALYSIS – INCLUDING MSMEs

Size of Market

If we include micro enterprises in the overall universe of DESS, total addressable market of C&I segment is expected to reach 394 – 961MWp; valued at USD867 – 1,121 Mn by 2025

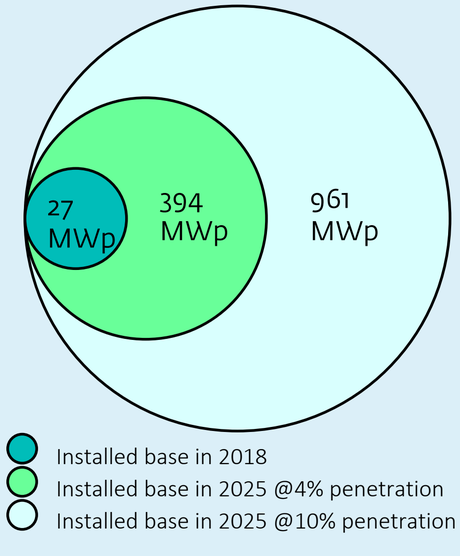
Scenario considering only small, medium & large enterprises

Size of C&I segment in 2025, MWp



Scenario including micro-enterprises

Size of C&I segment in 2025, MWp



Notes:

- ~4% penetration rate basis on govt.'s renewable energy vision for the year 2025. However, if prices decrease by 47% during 2018-25 as per International Renewable Energy Agency (IRENA) forecasts, the penetration rate may increase further. Assumed rate of penetration is 10% in the illustrated opportunity
- Typical installation size of micro enterprises ranges between 0.1 to 3 kWp across commercial; up to 5kWp in industrial customer segment.
- As per the latest census available for Nigeria, the number of micro enterprises across customer segments are: wholesale & retail: 702,228; transport and storage: 74,142; hotels / accommodation: 55,667; health service: 50,900 ; education: 28,532 ; mining: 9,562 and manufacturing: 173,213

SEGMENTS	Small; medium & large enterprises			Including micro enterpriuises	
	Installed base, 2018	Market (Volume), 2025	Market (Value), 2025	Market (Volume), 2025	Market (Value), 2025
 Commercial	16.02 MWp	169 – 543 MWp	**$371 – 633 Mn**	244 – 588 MWp	**$537 – 686 Mn**
 Hospitality & tourism	0.26 MWp	7 - 18 MWp	**$16 - 21 Mn**	10 - 23 MWp	**$21 - 27 Mn**
 Healthcare	0.54 MWp	7 - 16 MWp	**$16 - 19 Mn**	7 - 18 MWp	**$16 - 21 Mn**
 Education	0.98 MWp	20 - 49 MWp	**$43 - 57 Mn**	20 - 49 MWp	**$43 - 57 Mn**
 Agriculture	0.02 MWp	0.5 – 1.2 MWp	**$1.1 – 1.4 Mn**	1 – 2 MWp	**$2 Mn**
 Government	**0.48 MWp**	5 - 16 MWp	**$11 - 19 Mn**	7 - 18 MWp	**$16 - 21 Mn**
 Industrial	3.44 MWp	69 - 172 MWp	**$151 -200 Mn**	105 - 263 MWp	**$ 231 -306 Mn**
 Residential	17.61 MWp	218 - 666 MWp	$481 - 749 Mn	218 - 646 MWp	**$481 - 749 Mn**
TOTAL	**38.88 MWp**	**495 – 1,457 MWp**	**$ 1,090 – 1,699 Mn**	**613 – 1,604 MWp**	**$ 1,348 – 1,870 Mn**

POLICY & REGULATORY ENVIRONMENT

The National Renewable Energy Efficiency Policy (NREEP)

The policy has set out a provision of capital grants, tax holidays, exemptions, and other incentives for renewable energy projects.

TAX INCENTIVES

- A five-year tax holiday for new companies entering the renewable energy space.
- A portion of the cost of renewable energy technologies can be deducted from income tax or community levies, ranging from 10 percent for costs < NGN 0.1m ($600) to 25 percent for those > NGN 5m ($30,000). However, the total rebate amount is capped at 10 percent of the cost of the renewable energy technology.
- Individuals and companies of renewable energy technologies should be granted a waiver of initial purchase taxes (e.g. VAT) on renewable energy technology equipment purchases.

IMPORT DUTY EXEMPTIONS

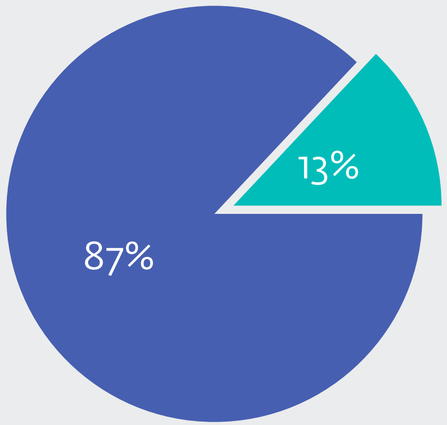
- 0 percent import duty on PV modules
- 5 percent duty on PV systems
- Lithium batteries, however, attract 20% import duty tariff.
- 5 percent duty on solar powered pumps

Importers and developers have, however, struggled to secure the 0 percent duty on PV panels due to the solar panels being imported as a combined unit thus leading to lengthy processing times and non-enforcement.

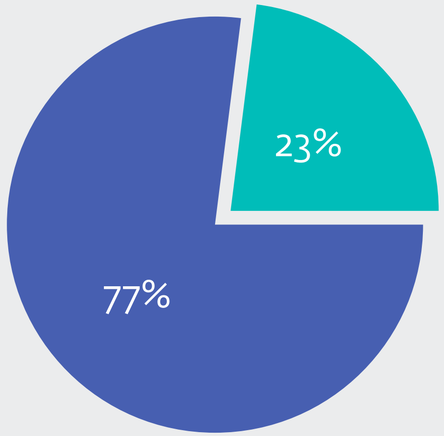
POLICY & REGULATORY ENVIRONMENT

THE RENEWABLE ENERGY MASTERPLAN (REMP)

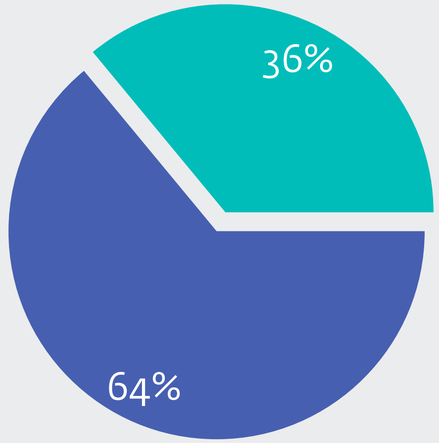
2015



2025



2030



REMP has also set the target to enhance the installed capacity by 2025

Electricity from renewable sources

Electricity from conventional sources

NREEP OBJECTIVES WRT SOLAR SOLUTIONS

- To increase the percentage contribution of solar energy to the total energy mix and to ensure a minimum electricity contribution of 23% by 2020 and 36% by 2030.
- To increase the share of solar water heating technologies for social services, commercial, and industrial processes.
- Establishing micro-credit facilities for entrepreneurs, especially women, to aid in the establishment and operation of commercial solar energy facilities in remote and off-grid areas.
- Establishing incentives for the domestic development of energy storage technologies.