



**LAGOS STATE  
MINISTRY OF  
ENERGY & MINERAL  
RESOURCES**



## **DRE DESK TECHNICAL ASSISTANCE PROJECT, LASG**

**Lagos – Norway Energy Exchange Conference**  
Nordic Hotel, Victoria Island, Lagos, Nigeria

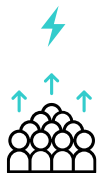
17 APRIL, 2023



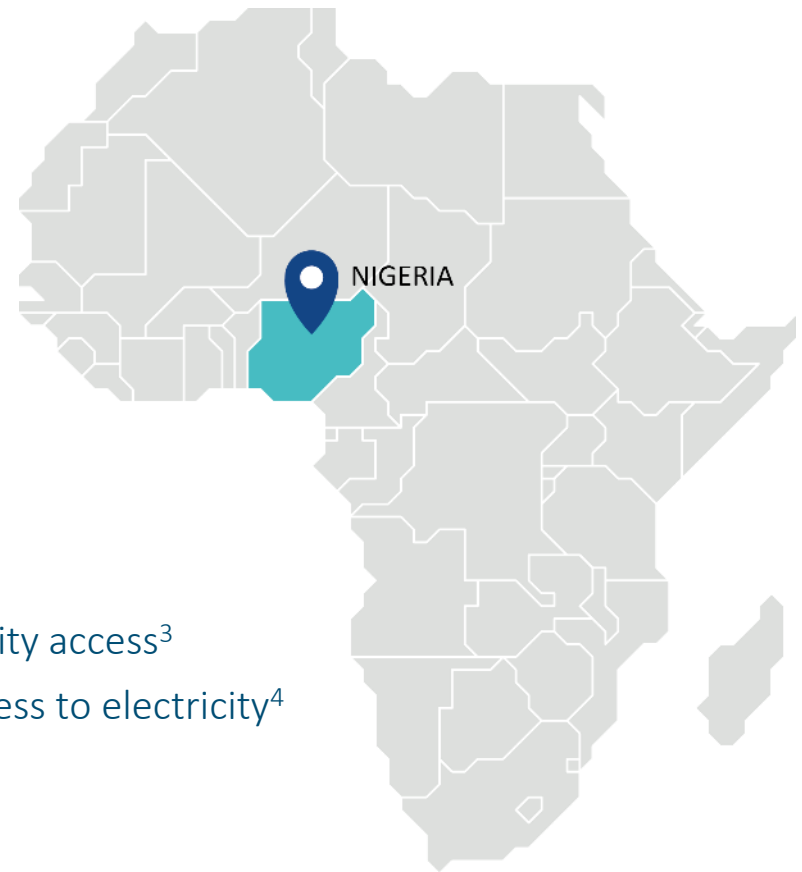
# Overview of Energy Access Status - Nigeria



**55%** Electricity access rate<sup>1,4</sup>  
**84%** Electricity access rate (urban)<sup>1</sup>  
**25%** Electricity access rate (rural)<sup>1</sup>



**206** Population (total in millions)<sup>2</sup>  
**2040** Target year for universal electricity access<sup>3</sup>  
**92** Population (in millions) without access to electricity<sup>4</sup>



1. World Bank (2020). Open Data

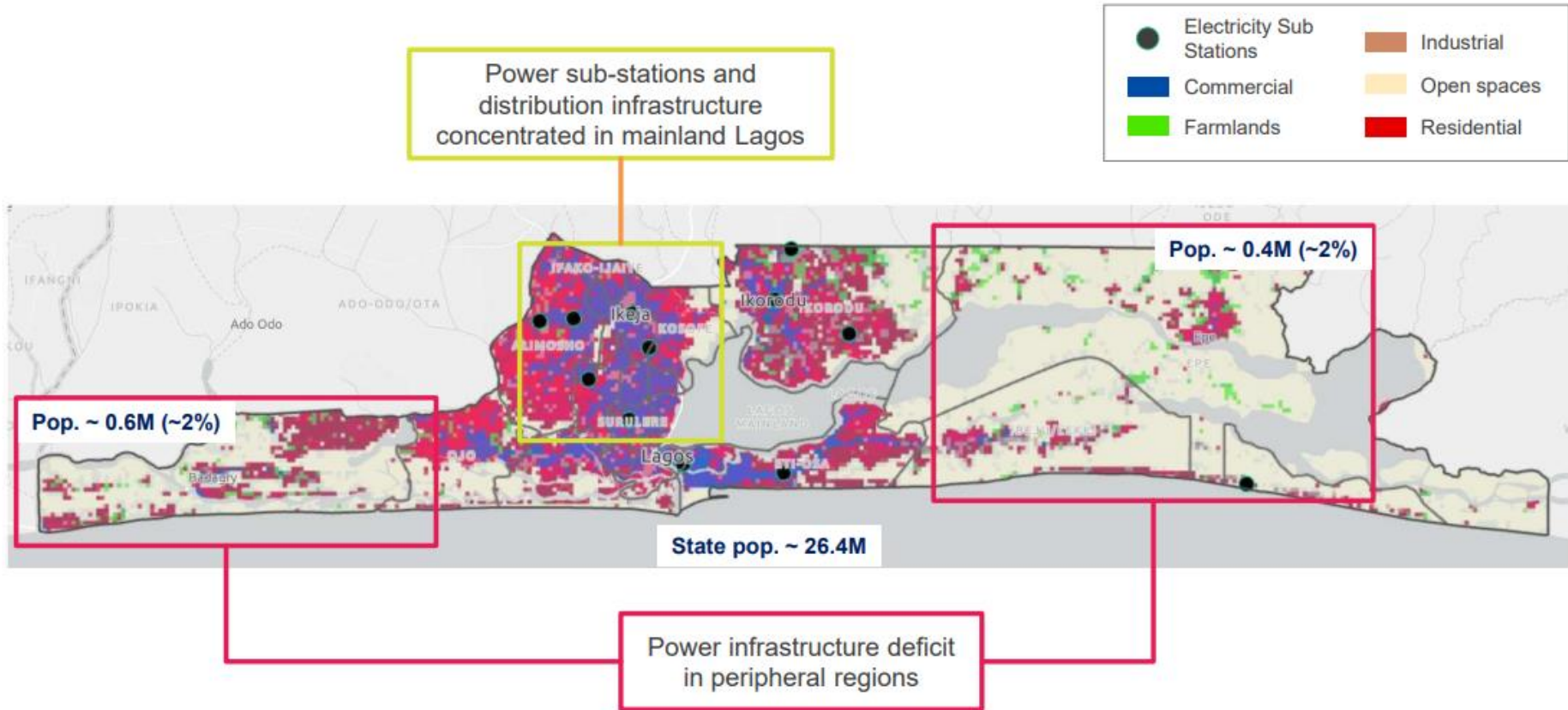
2. World Bank (2020). Open Data

3. Rural Electrification Strategy and Implementation Plan (RESIP) (2016)

4. IEA, IRENA, UNSD, World Bank, WHO (2022). Tracking SDG 7: The Energy Progress Report. 2020 statistics



# Lagos - 95%+ of Population Near Grid Infrastructure



Source: BCG Gamma Geospatial Analysis, Transmission Company of Nigeria Distribution Map



# The Market – Lagos

- Energy supply is currently Lagos State’s single biggest infrastructure and developmental challenge
- Receives only 1GW daily for average of 12 hours, against required 9GW
- Self-generation of 15GW in Lagos with over 80% of the population relying on generators
- \$14 to \$33 billion is required to fund investment in energy generation by 2030 depending on technology
- 200,000 engineers will be required for the energy sector over the next 15 years
- 100% access to electricity by 2030



Demand

Unconstrained electricity demand in Lagos State is estimated to be **~30-40TWh (~3-5GW)** per annum currently

**Commercial and industrial segment accounting for majority of demand with ~65% (31% and 34%) of total demand**



Supply

**Most of the population of Lagos (~95%+) are close to grid infrastructure with the exception of primarily low-population areas of Epe and Badagry**

**Of the population near grid infrastructure, ~30% (1.4 million households) are connected to the grid and only a small fraction (~10% or 0.6 million households) receive steady, reliable supply (>8 hours per day)**

**Supply from the grid in 2020 amounted to ~7.5TWh (~20% of demand) by both IE and EKEDC**



Demand-grid supply

**Although most of the population of Lagos are close to grid infrastructure, demand-grid supply gap remain at 23 – 33 TWh**



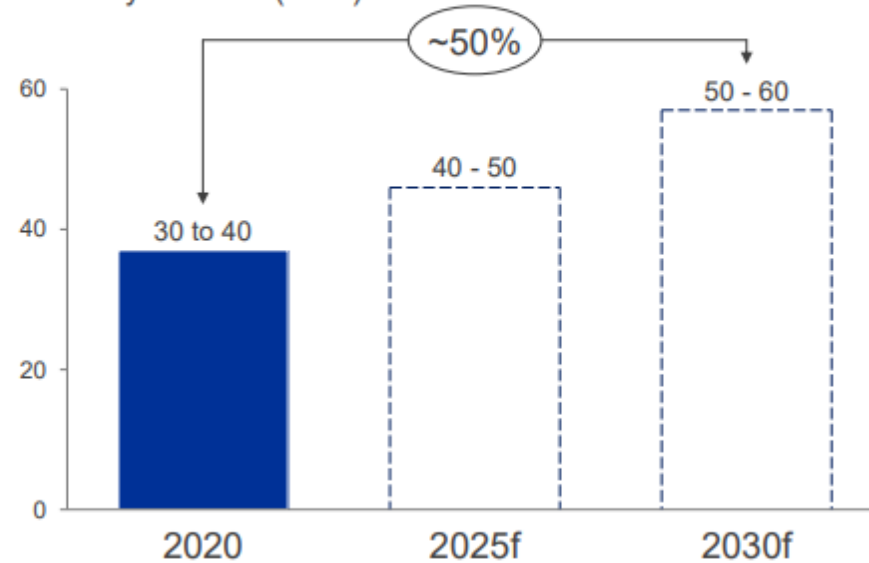
# The Market – Lagos Projected Growth in Demand

Estimates	2025	2030	Assumptions
Population size (million)	32	37	<ul style="list-style-type: none"> <li>Annual growth rate = 3.2% (LBS<sup>1</sup>)</li> </ul>
GDP per capita, US\$, PPP	\$8,572	\$8,995	<ul style="list-style-type: none"> <li>Annual GDP growth rate = 4.2% (LBS<sup>1</sup>)</li> <li>Nigeria 2020 PPP conversion factor = 144 (LCU<sup>2</sup> per international \$; WB)</li> </ul>
Electricity use per capita (kWh)	1,455	1,580	<ul style="list-style-type: none"> <li>Obtained from regression trend line</li> </ul>
Total electricity demand (TWh)	46	57	<ul style="list-style-type: none"> <li>Total demand = Population x Electricity use per capita (kWh)</li> </ul>

1. Lagos Bureau of Statistics, 2. Local Currency Unit

## Projected Electricity demand in Lagos State for 2025, 2030 (TWh)

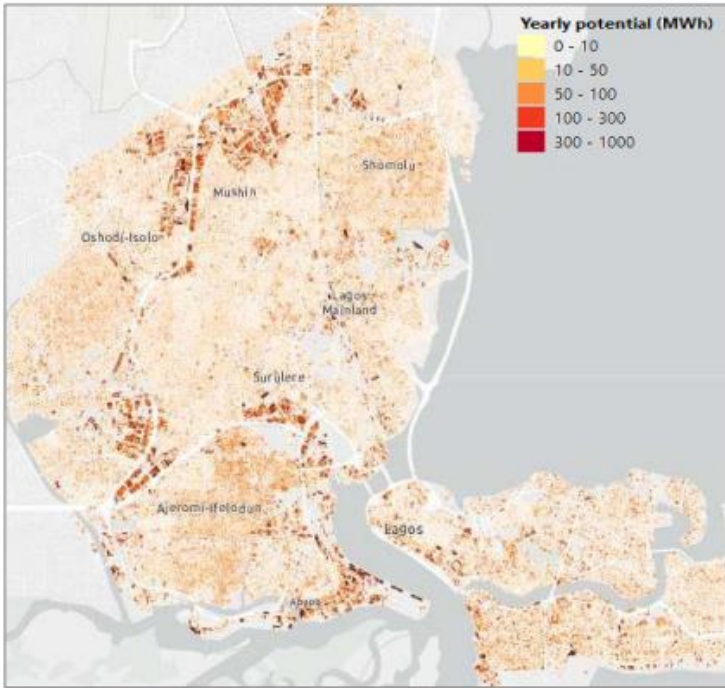
Electricity demand (TWh)



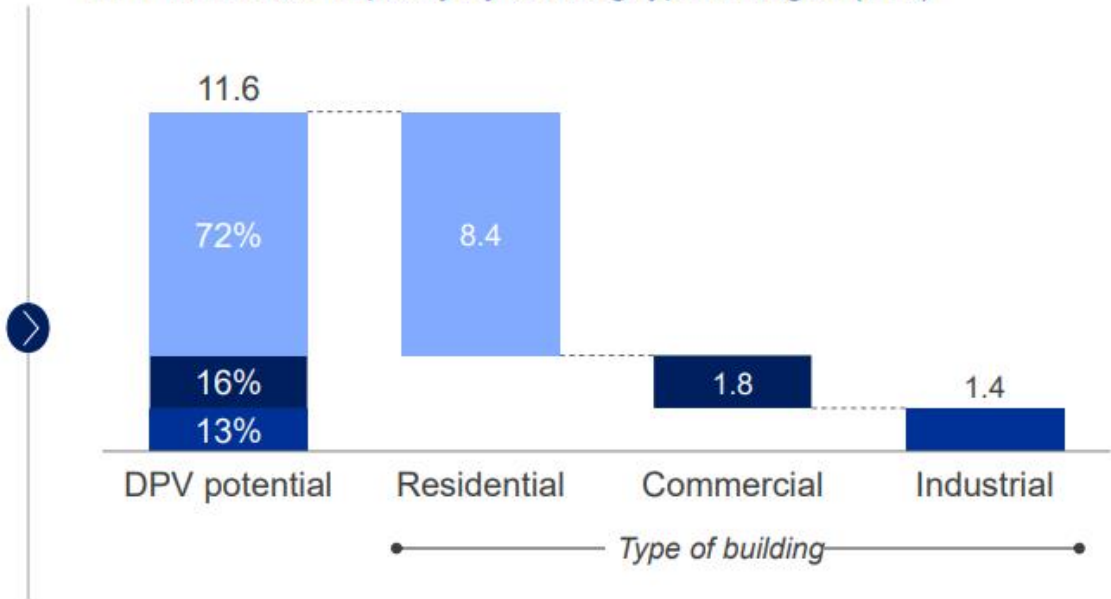
Source: Lagos Bureau of Statistics, World Bank, Consultants



# 12GW DPV Potential in Lagos, 72% Residential - Geospatial



DPV installable capacity by building type in Lagos (GW)



Note: 1. Geospatial conducted by ESMAP team focused on 11 or 20 LGAs in Lagos – Total potential of Lagos scaled up to get range of 10-15Twh/Yrs. 2. Approach to geospatial assessment includes estimating total rooftop area from satellite imagery, classification of rooftops based on Google Map labels and estimating generation potential of rooftop based on roof tilt and local irradiation levels

Source: World Bank ESMAP



## Waste-2-Energy Generation – Potential Sites in Lagos

<b>Location</b>	Ojota (Olusosun)	LASU-Iba	Epe
<b>Year of Establishment</b>	1992	2006	2010
<b>Estimated capacity</b>	2.1 million T/yr	820,000 T/yr	12,000 T/yr
<b>Size</b>	43 hectares, 18 m deep	8 hectares	80 hectares
<b>Proximity to</b>	Five million people within 10 km radius	Four million people within 10 km radius, 200 m from the nearest dwellings, and close to the Alimosho General Hospital	Two kilometers from the Osogbo River and seven kilometers from Lekki Lagoon

Based on an analysis conducted by Oando, the following holds for integrating biomass into the grid:

Average throughput for Lagos: 10,000

2,469 tonne/815,000 tonne/year (using 25% of residual waste)

Design assumptions: 1 T = 750 kWh, 246 9T/day, 25% plant capacity

Electricity generation capacity: 1,851,750 kWh/day @ 25% plant capacity (net electrical efficiency)



# Customer Types – Data from Geospatial Analysis and Discos



Off-grid



On-grid (Well-served)



On-grid (Underserved)



Under-grid

## Definition

Population with no grid infrastructure close them (>2km) and not connected to the grid

Population connected to the grid and getting electricity supply of greater than 8 hours in a day

Population connected to the grid and getting electricity supply of less than or equal to 8 hours in a day

Population in close proximity to grid infrastructure (~<=2km), but not connected to the grid

## Source

Derived from geospatial analysis of population far away from substations

Derived from data shared by EKEDC and IE on number of customers they have

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Derived from the difference between the total population and sum of on-grid & off-grid

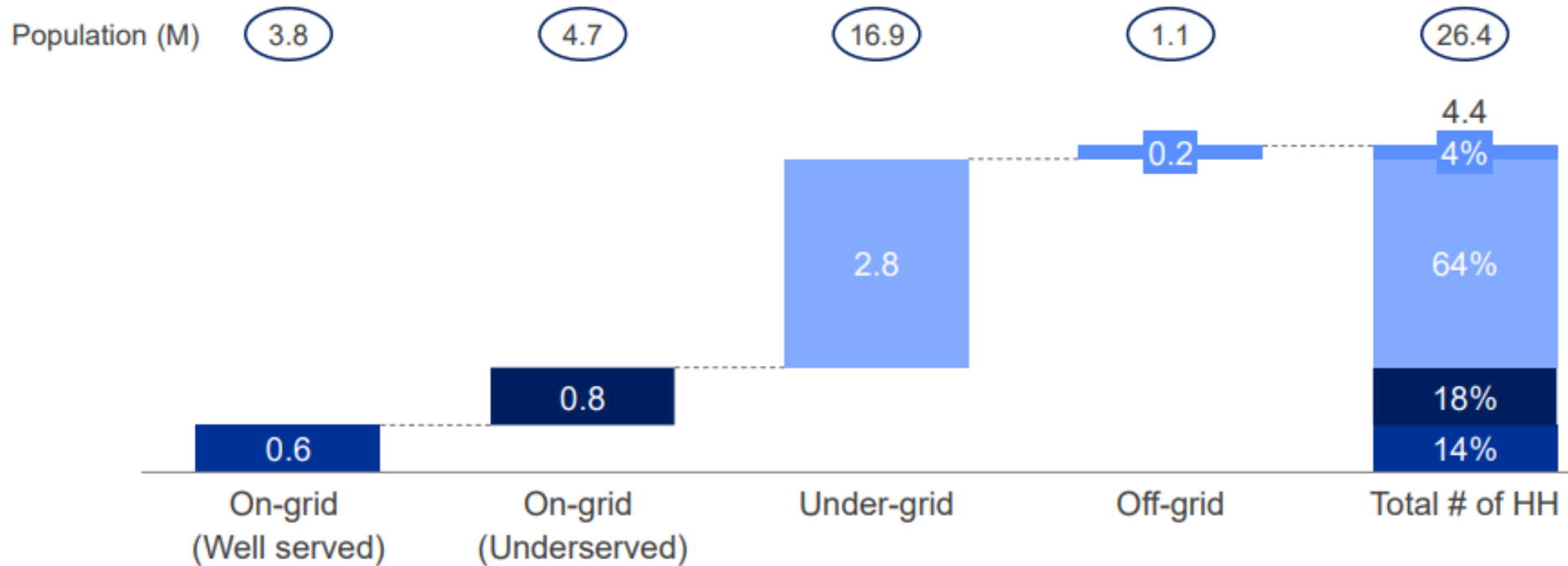
Note: All customers use generator sets to meet demand





# Residential Potentials – 60% of Lagos Population Under Grid

Energy access in Lagos state split by households (Millions)



Source: ESMAP, Based Lagos State energy survey of ~2000 respondents; EKEDC, IE, Consultant Analysis



## Registered Customers – Ikeja & Eko EDC (~40% of 4.4 HH)

# of customers in each power distribution zone in Lagos state in 2019





Customer class	IE	EKEDC	Lagos state
Residential	826,111	452,446	1,278,557
Commercial	226,641	84,972	311,433
Industrial	5,008	468	5,476
Special <sup>1</sup>	140,190	17,230	157,420
Street Lighting	15,883	434	16,317
<b>Total # of customers</b>	<b>1,213,833</b>	<b>555,550</b>	<b>1,769,203</b>
<b>Total # of HHs in region</b>	<b>2,311,391</b>	<b>2,094,511</b>	<b>4,405,902</b>
<b>% of connected HHs</b>	<b>53%</b>	<b>27%</b>	<b>40%</b>

1. MDAs and others

Source: USAID Power Africa Nigeria Power Sector Program; Consultant Analysis



## 4 Viable Use Cases with 2.3GW DPV Potentials in Lagos

Customer use case	 Small residential	 Large residential	 Small commercial	 Large C&I
Indicative system size (kW)	<1	1-10	<1	10-10K
Total # of HHs	<ul style="list-style-type: none"> <li>2.9M lower-income households</li> </ul>	<ul style="list-style-type: none"> <li>1.5M higher-income households and multi-family residential buildings</li> </ul>	<ul style="list-style-type: none"> <li>3.2M micro-enterprises</li> <li>88K lock-up shops &amp; stalls in 284 markets</li> </ul>	<ul style="list-style-type: none"> <li>1K bank branches</li> <li>11.6K SMEs</li> <li>18K public sector buildings</li> <li>9.9K industrial facilities</li> </ul>
# of HHs for DPV (<8 hrs supply daily)	1.5M	0.8M	1.6M	40.5 K
# of potential DPV customers (25-50% adoption)	0.4-0.8M	0.2-0.4M	0.4-0.8M	10-20K
Total DPV demand (MW)	520-1040	450-900	410-820	250-510
Largest markets (LGAs) in Lagos	<ul style="list-style-type: none"> <li>Alimosho</li> <li>Surulere</li> <li>Oshodi-Isolo</li> </ul>	<ul style="list-style-type: none"> <li>Eti-Osa</li> <li>Ikeja</li> <li>Lagos Island</li> <li>Oshodi-Isolo</li> </ul>	<ul style="list-style-type: none"> <li>Eti-Osa</li> <li>Apapa</li> <li>Surulere</li> <li>Alimosho</li> </ul>	<ul style="list-style-type: none"> <li>Eti-Osa</li> <li>Surulere</li> <li>Ikorodu</li> <li>Oshodi-Isolo</li> </ul>
Preferred business models	<ul style="list-style-type: none"> <li>Pay-as-you-go</li> <li>Lease-to-own</li> </ul>	<ul style="list-style-type: none"> <li>Direct cash sales</li> </ul>	<ul style="list-style-type: none"> <li>Pay-as-you-go</li> <li>Direct cash sales</li> </ul>	<ul style="list-style-type: none"> <li>Energy-as-a-service</li> <li>Direct cash sales</li> </ul>

Source: Lagos State Residential and Non-Residential Electricity Customer Survey; World Bank ESMAP Lagos Rooftop Geospatial Study (2021); SMEDAN 2013 National Survey; LAWMA website; Consultant Analysis



# Viable Use Cases – Proven and Tested in Nigeria

## Residential

## Commercial & Industrial



Small residential customers

Indicative System size: 0.05-0.5 kW

- Off-grid HHs
- Lower-income HHs



Large residential customers

>0.5-1 kW

- Higher-income HHs
- Multi-family buildings



Small commercial customers

>1-10 kW

- Market stalls
- Micro-enterprises



Large commercial & industrial customers

>10-100 kW

- Public sector buildings
- Banks
- SMEs
- Industrial facilities

Data sources for use case sizing: Power Africa 'Load Forecast – Lagos State' (2021); EKEDC and IKEDC Performance Improvement Plans (2019); Lagos State Waste Management Authority Markets Survey (2016); Small and Medium Enterprises Development Agency (SMEDAN) and National Bureau of Statistics Collaborative Survey (2013); BCG Lagos Residential Electricity Customer Survey (2020); BCG Lagos Non-Residential Electricity Customer Survey (2020)



## The Leveraging Energy Access Finance (LEAF) Framework

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- The African Development Bank (AfDB), as part of the Leveraging Energy Access Finance Framework (LEAF), in partnership with the Lagos State Ministry of Energy and Mineral Resources (MEMR), developed the DRE Desk Technical Assistance project, to scale DRE.
- Leveraging Energy Access Finance Framework LEAF is a US\$900+ million financing programme developed by the AfDB with the overarching objective to unlock local currency debt and overcome market barriers to support the growth of DRE.
- In particular, the Framework, via a US\$334.9 million funding contribution from the Green Climate Fund and AfDB, aims to:
  - (i) enhance local markets by de-risking the DRE space through guarantees and subordinated debt, unlocking local currency debt finance and scaling up investments; and
  - (ii) provide technical assistance (TA) grants to create capacity within local banks and financial institutions to engage and finance DRE businesses, structure strong financing transactions, and support governments to create enabling policies and frameworks to scale DRE.



## Key Objectives of the DRE Desk TA Project

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- The DRE Desk Technical Assistance project aims to promote the deployment and use of DRE in unserved and underserved areas of Lagos State to increase energy access and provide affordable, clean, and reliable energy solutions to achieve Nigeria's sustainable energy goals.
- More specifically, the project will:
  - 1) increase access to information by aggregating data and mapping energy demand and needs.
  - 2) map and connect private sector stakeholders, developers, financiers, and the wider ecosystem.
  - 3) build capacity and knowledge transfer within the Ministry.
  - 4) support enabling policies for DRE private sector investments - ultimately to develop a portfolio of DRE projects and to deliver scalable DRE solutions.



## The Outcomes

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- Create a one-stop-shop for DRE investment and deployment in Lagos
- Mapping and domiciliation of industry data at the MEMR
- Improve enabling environment to scale DRE project investments and deployment
- Develop a robust ecosystem to support scaling of DRE in Lagos
- Identify and develop DRE project pipeline of bankable projects – Ambition 1GW
- Design and facilitate knowledge sharing workshop for stakeholders and build capacity of staff of the MEMR
- Connect private sector stakeholders, finances and wider ecosystem to support identification, development and financing of DRE projects in Lagos



# The Outlook







# The Outlook



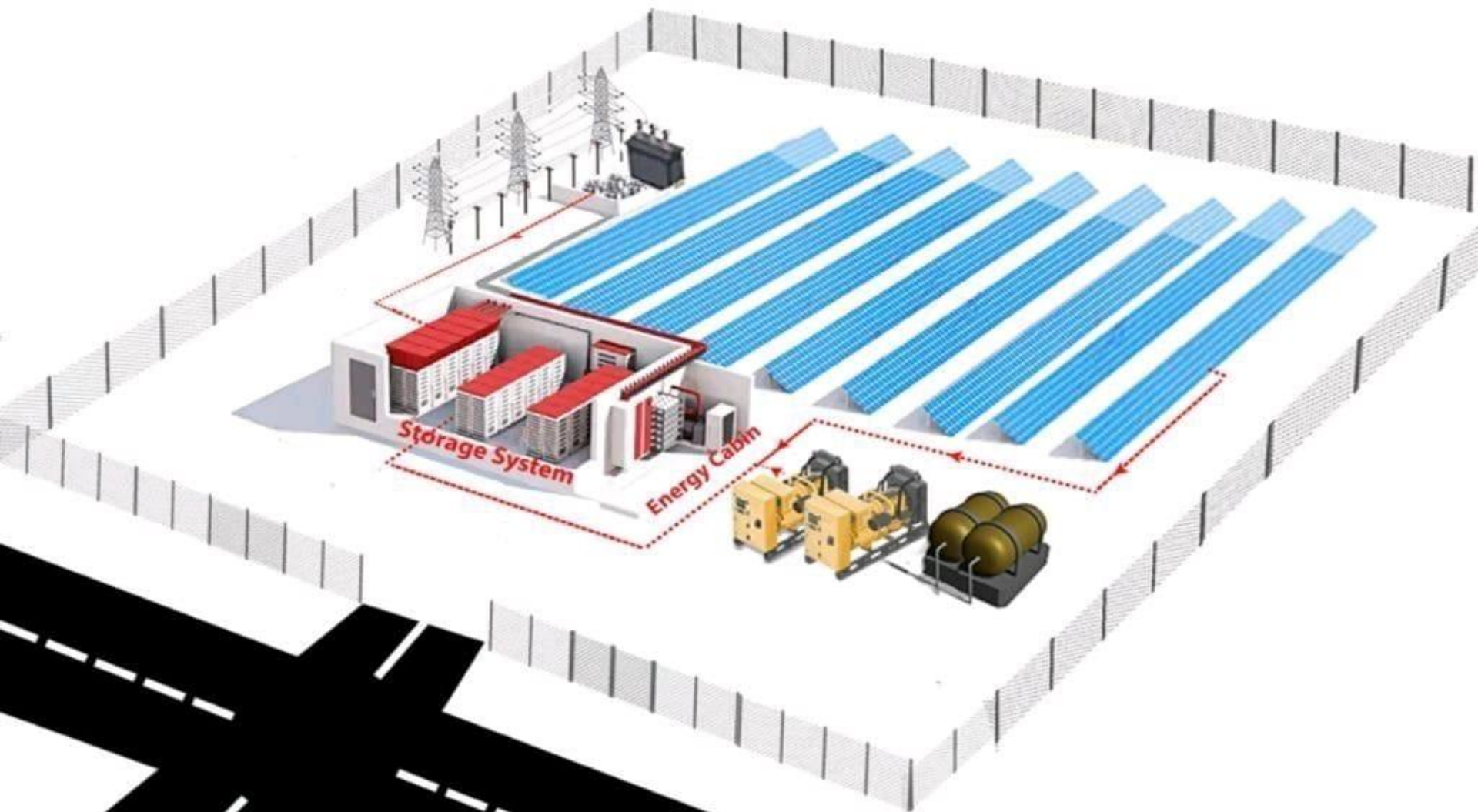


# The Outlook



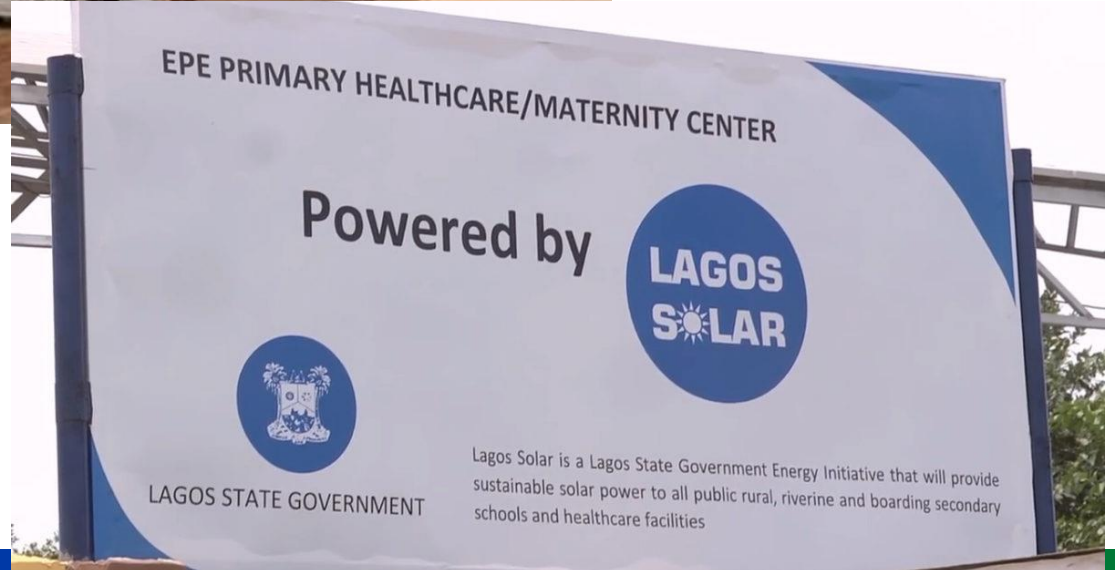
**0.88MW SOLAR HYBRID INTERCONNECTED  
MINI-GRID POWER PLANT**

**PROJECT SITE ONABOKUN AREA  
ODOSHIWOLA , EREDO LGA, EPE LAGOS STATE**





# The Outlook





# The Outlook

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# The Outlook





# The Outlook





# The Outlook







# The Outlook

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# The Outlook

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## The Ambition

### Lagos DPV potential ambition:

To be the reference case for solar deployment in urban environment in SSA

Note: 1. Average share of DPV in target electricity mix of benchmark cities (15%) multiplied by estimated unconstrained energy demand for the State by 2030. We estimate that unconstrained electricity demand in Lagos State is ~50-60TWh (~6.5GW) by 2030. Assuming conventional generation with a capacity factor of 100% (1 GW = 8760 GWh = 8.76 TWh);



~1GW<sup>1</sup>

Solar PV generation  
by 2030



# The Impacts

**1.6M**

Households  
Supported



**175K**

SMEs  
Supported



**40K**

Jobs  
created



Note: Assuming 20% capacity factor, GW to GWh conversion rate=8760. 1GW = 1.8TWh; Per capita household consumption p.a = 3,000kWh; per capita SME consumption p.a = 6,000kWh, Electricity allocated based on generation potential of determined from the World Bank Geospatial Analysis (HH = 70%, SME = 15%); Assuming 100GW to generate 1M FTE Jobs based on job multiplier effect of solar calculated by India's National Research Development Corporation  
Source: IRENA, Lagos Power Africa Report, World Bank Geospatial Analysis, BCG Analysis



## The Goal

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**A Desk,  
A One-Stop-Shop,  
An Ecosystem,  
To scale DRE in Lagos**

# THANK YOU

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**LAGOS STATE GOVERNMENT**

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