CLEAN CAPTIVE INSTALLATIONS FOR INDUSTRIAL CLIENTS IN SUB-SAHARA AFRICA

Clean Captive Installations in sub-Sahara Africa

Focus: Industrial clients in Nigeria

Kick-off meeting presentation

FS-UNEP Collaborating Centre

November, 2019

Supported by:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
based on a decision of the German Bundestag

Frankfurt School
FS-UNEP Collaborating Centre
for Climate & Sustainable Energy Finance

UN environment
United Nations Environment Programme

Overview of project

Snapshot of the various stages in the project

Initiating the project

1

Desk study
- through research
- in-house & consultative expertise

2

Stakeholder consultation
- scoping missions
- relationship building

Assistance from FS-UNEP

3

Development of tools
- identifying business models
- selecting financing mechanisms

4

Identifying relevant & key partners

5

Selection of replicable designs (best model); designing selection criteria for national showcase project

Expected outcomes

6

Implementing the best chosen showcase project and replicating the model

- ✓ Awareness creation within both public and private stakeholders, whose feedback will be integrated into project design

- ✓ Design process to monitor and verify performance of chosen model and showcase viability of said model for easy access to public

- ✓ Understanding best practices & replicability by increasing uptakes
- ✓ Help countries meet climate and development goals according to the Paris Agreement

Preliminary findings from the desk study

What have we understood so far

1	**Nigeria has poor national and regional grid electricity**	▪ Only 31% of total installed generation capacity (14.2 GW in 2018) is available for supply ▪ Due to ageing grid infrastructure, insufficient availability of gas, structural inefficiencies in transmission and distribution systems
2	**Nigeria suffers from poor transmission and distribution systems**	▪ Frequent system collapses and forced outages ▪ Transmission capacity (~5GW) far below total installed generation capacity of 14.2GW ▪ Almost 46% of energy lost through technical, commercial and collection issues
3	**Nigeria has one of the lowest electricity consumption per capita in the world**	▪ Peak electricity consumption per capita recorded so far 156kWh (2012) ▪ Global minimum average electricity consumption per capita for developing economies at 500 kWh
4	**Captive generation used in many industries exceeds the available grid-connected capacities**	▪ Widespread self-generation of power from alternative sources, mainly off-grid diesel and gas-generators (8-14GW est. capacity) ▪ This represents 96% of energy consumed by Nigerian industries
5	**Nigerian government aims to achieve 30GW of electricity capacity by 2030 with 30% share of RE**	▪ To achieve its electricity targets, the government of Nigeria published a FiT regulation in 2015. No project has been completed yet
6	**Mini-grid uptake in Nigeria is strong and growing**	▪ Mini-grids pipeline has been increasing since the launch of the mini-grid regulation in 2017 and inventions like the Nigeria Electrification Program, the Rural Electrification Fund Program ▪ Most projects under 100kW, but many companies position themselves in the C&I segment with an estimated 20MW installed capacity

Preliminary findings from the desk study

What have we understood so far

1

Nigeria has poor national and regional grid electricity

A. Critical energy situation - hindering its economic development

B. During the most peak periods, only 31% of installed capacity of 14.2GW **available for supply**

C. Ageing grid infrastructure, insufficient availability of gas, **structural inefficiencies** in transmission and distribution systems

D. Electricity demand has increased 7% annually over the past decade due to population growth and economic growth, but **little investment into generation capacity**

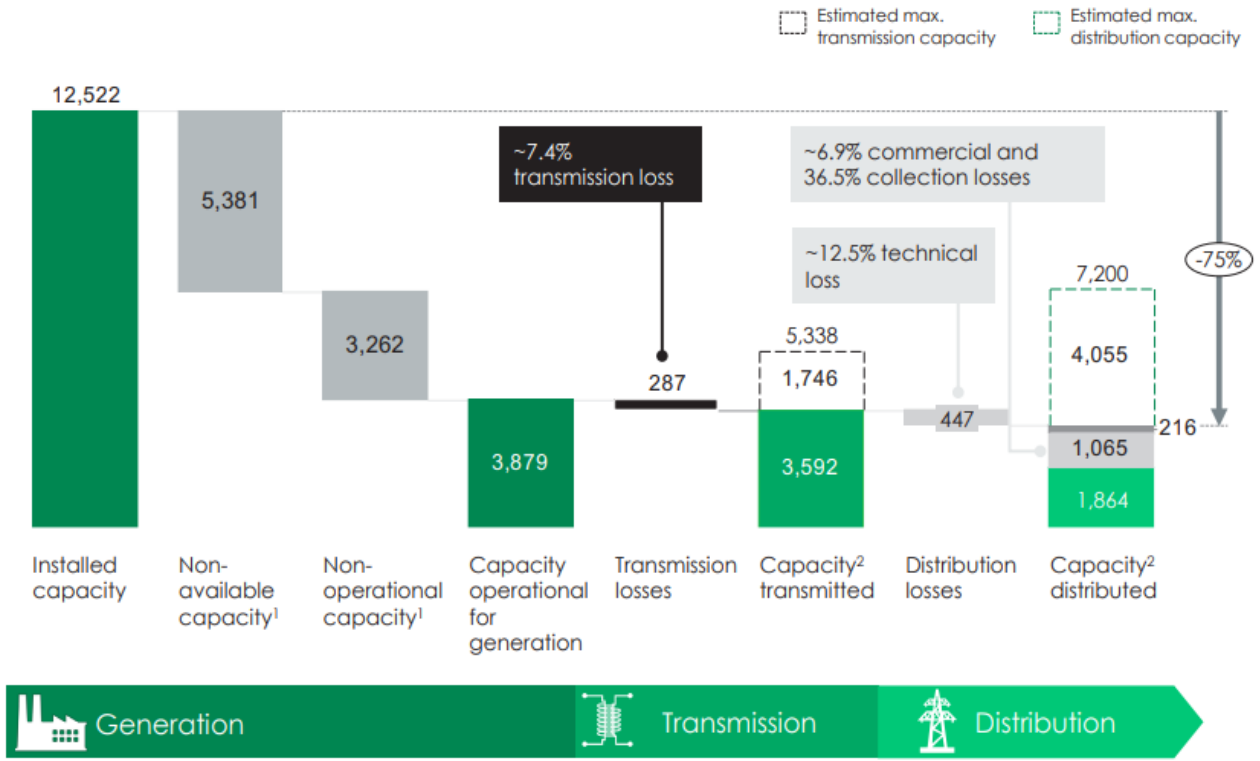
E. High usage of **diesel gensets**

Preliminary findings from the desk study

What have we understood so far

2

Nigeria suffers from poor transmission and distribution systems



1 Refers to average daily capacity of units non-available and non-operational from Jan to Aug 15 2015; assumes peak demand
2 Effective capacity for transmission and distribution post-losses; assumes peak demand

- **Transmission capacity ~5GW** (operational generation capacity ~4-5GW) far below total installed generation capacity of 14.2GW; **average transmission losses as high as ~8.8%**
- Almost **46% of energy lost through technical, commercial and collection issues**
- Distribution network capacity has increased from 3,000 MW to 5,000 MW, but distribution network can not distribute >57% of available electricity; **currently ~2,000 MW of stranded capacity**

DisCos operating losses in 2015

10NGN/kWh

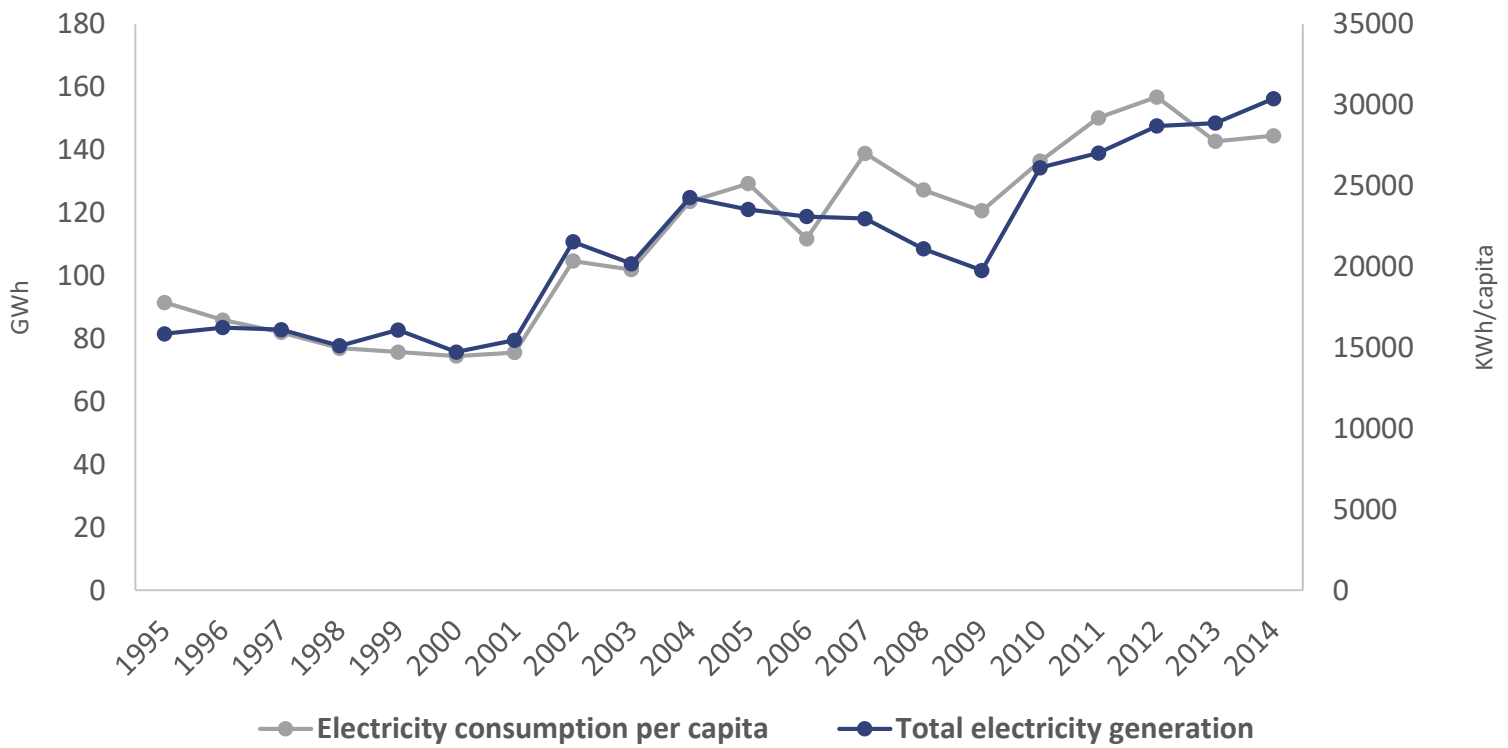
Preliminary findings from the desk study

What have we understood so far

3

Nigeria has one of the lowest (on-grid) electricity consumption per capita amongst developing economies

Evolution of power consumption per capita and generation (1995 to 2014)



Nigeria's **156kWh in 2012 vs.** developing economies average of **500 kWh**

Residential electricity consumption has been the most pronounced over the last decade as this sector consumes most electricity **from on-grid connected electricity**

Future increase in electricity demand will need to be matched with additional investment in generation, rehabilitation and expansion of the existing grid

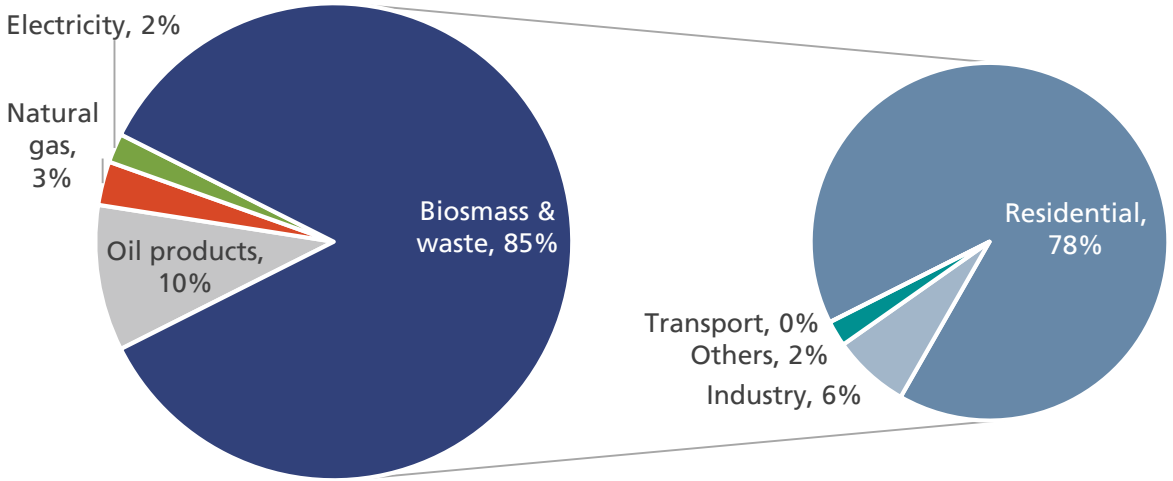
Preliminary findings from the desk study

What have we understood so far

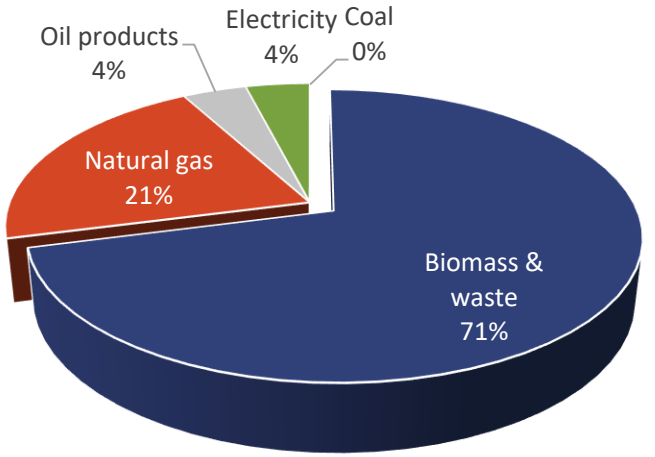
4

Captive generation used in many industries exceeds the available grid-connected capacities

Total on-grid energy consumption in Nigeria by different economic sectors



Final energy consumption of Industry sector



- Gas/diesel gensets c. **8-14 GW capacity**
- **86% companies** own/share generators

96% of the electricity consumed by the industry sector is from privately owned capacity, self-generated from natural gas, diesel, biomass and waste – **on-grid electricity consumed by the industry sector is only 4%**

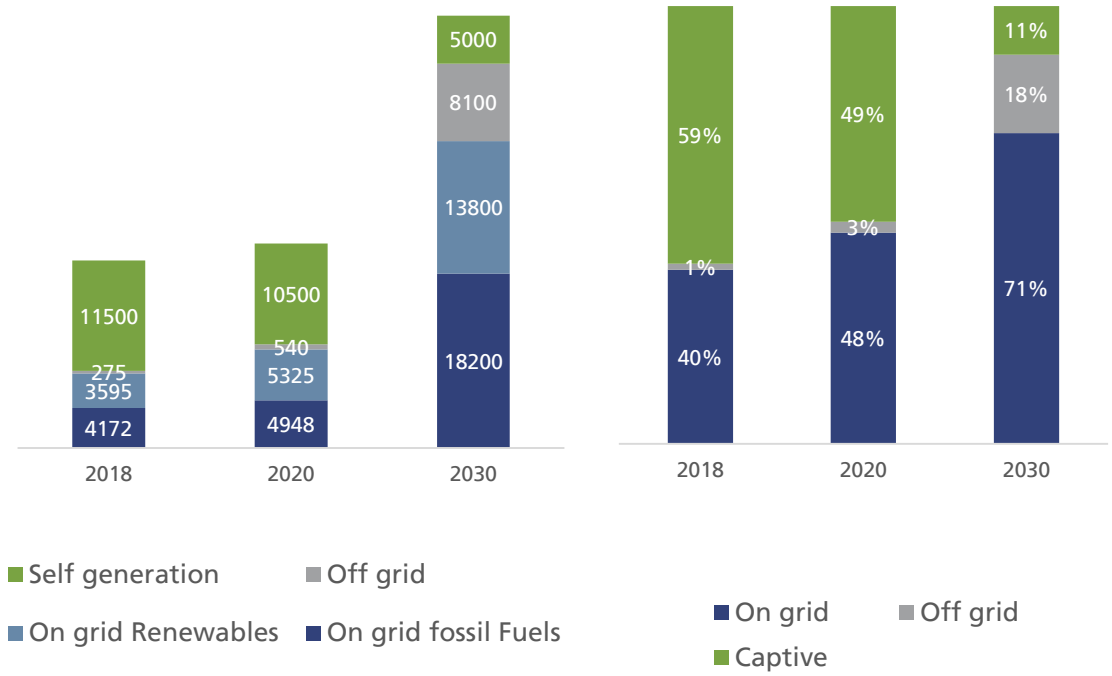
Preliminary findings from the desk study

What have we understood so far

5

Nigerian government aims to achieve 30GW of electricity capacity by 2030 with 30% share of RE in the mix (Electricity vision 30:30:30)

Nigeria generation capacity targets 2030



RE targets by capacity per technology

Technology	Target by 2020	Target by 2030
Small Hydro	265MW	1,200MW
Solar PV	2,000MW	5,000MW
Solar Thermal	50MW	1,000MW
Onshore Wind	170MW	800MW
Biomass	300MW	1,100MW
Mini-grids	180MW	5,414MW
Solar PV (home + streets)	360MW	2,786MW

- Economically, C&I solar is already cheaper than grid electricity tariffs in Nigeria
- At least **20MW of C&I solar installed in Nigeria as of November 2018**, most installations <30kW

Source: NERC

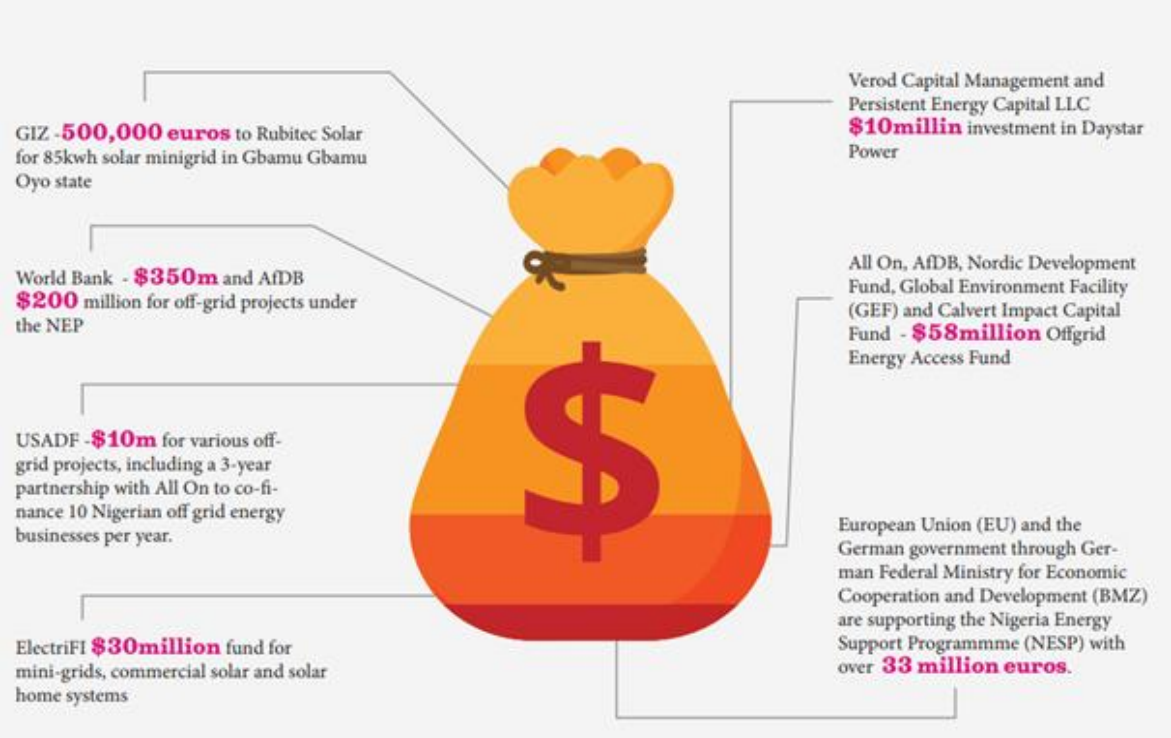
Preliminary findings from the desk study

What have we understood so far

6

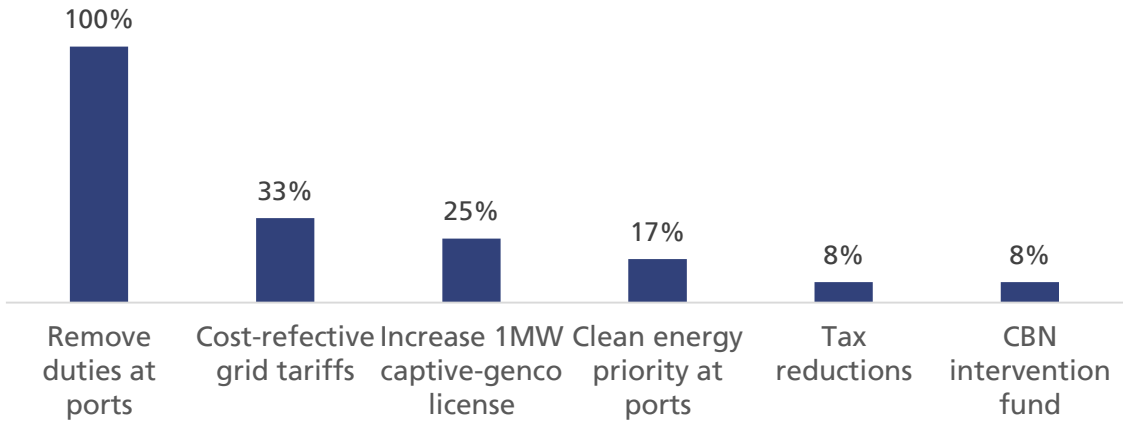
Major barriers to having more C&I solar in Nigeria are mostly financial

Financing and investment of off-grid programs



Source: The Nigerian Energy Report, 2019

Reform wishes by Nigerian C&I solar developers



Source: BNEF, 2019

Developers perceive the major barriers to more C&I solar in Nigeria as financial, **from debt availability to credit risk, foreign exchange hedges and high import tariffs**

Stakeholder consultations

What information do we need to streamline the process of installing captive PVs

1. **Nigeria has poor national and regional grid electricity**
2. **Nigeria suffers from poor transmission and distribution systems**
3. **Nigeria has one of the lowest electricity consumption per capita in the world**
4. **Captive generation used in many industries exceeds the available grid-connected capacities**
5. **Nigerian government aims to achieve 30GW of electricity capacity by 2030 with 30% share of RE**
6. **Mini-grid uptake in Nigeria is strong and growing**

Bridge gap in data and information…

… through customised and tailored approach in reaching out to potential stakeholders

Energy policy

- What the government's general policy or position is in regards to clean captive systems?

Energy laws and regulations

- We are aware of various laws and regulations that apply to captive power systems, e.g. in the energy sector

Captive power licencing and approvals

- For a captive system <1 MW for self consumption only, even if the power was distributed around a commonly

Private financiers/ESCOs

- Please give us a brief overview of your business

SUNREF going into the future

- We are aware AFD secured GCF financing under Transforming Financial Systems for Climate Project, which is

EPCs/suppliers

- Please give us a brief overview of your business
  - When was it established and for how long have you have been operating in Kenya?
  - Are you a Kenyan company or an international business with operations in Kenya? Other countries of operations if any?
  - Who are usually your target customers?
  - If an EPC, what types of systems do you work on, e.g. hybrid (diesel/solar), battery storage, other RE technologies
  - If an EPC please give us your record of accomplishment in terms of number of projects you have done, size and if possible client and plus the projects you have in the pipeline.

Streamlining the process

How does the FS-UNEP collaborating centre help?

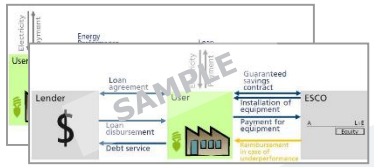
1

Development of tools

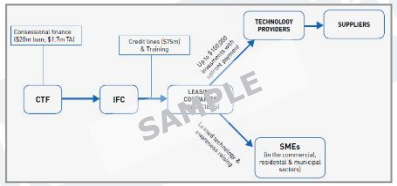
- identifying business models
- selecting financing mechanisms

A. Ownership model

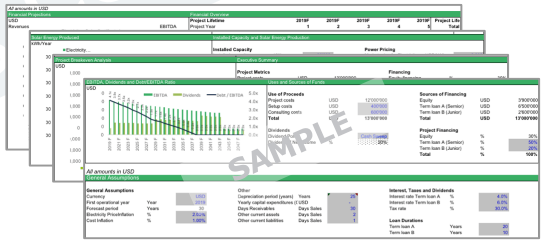
B. ESCO financing model



C. Equipment leasing model



Financing mechanisms



2

Identifying relevant & key partners

Banks

DBN Development Bank of Nigeria · Ecobank The Pan African Bank · THE WORLD BANK · Sterling Bank · BANK OF INDUSTRY ...transforming Nigeria's industrial sector

Government/Agencies

NAPTIN · NEMSA · TCN · NBET Nigerian Bulk Electricity Trading PLC · Federal Ministry of Works & Housing (FMWH)

Private Sector Developers

solarcentury · enerwhere · pirano · IPT Integrated Power Technologies Ltd. · GV

Fin. institutions/supporters

VEROD Capital Management · bettervest · giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH · EDFI · ElectriFI

Genset suppliers/off-grid IPP

JMG From Power to Plug · Clarke Energy Engineer - Install - Maintain · TPN · CETPower · Cummins

Solar IPPs

QUAINT · KVK · Pan Africa Solar

3

Selection of replicable designs (best model); designing selection criteria for national showcase project

- Currently, there is a **lack of monitoring and verification of installed captive PV projects**
- There is also **not enough publicly available information** explaining the advantages of captive solar PV and potential risks that exist (e.g. for industrial users: payback period of installations, savings per year, etc.)
- Implementing one project to **showcase it as a replicable model** will **improve transparency** in this captive PV market. **Monitoring performance** of the selected model will **prove it to be used as a viable design** for other industrial users

Final expected outcomes and timeline

Project will run from 2019 - 2023

2019
Component 1: Baseline studies and awareness raising

2019 - 2020
Component 2: Economic and financial tools and assessments

2020 - 2023
Component 3: Realisation of one showcase project per country

2019 – 2023
Component 4: Knowledge dissemination and outreach

CICSA

CLEAN CAPTIVE INSTALLATIONS FOR INDUSTRIAL CLIENTS IN SUB-SAHARA AFRICA

Thank you for your patience!

For further information please visit:

www.captiverenewables-africa.org

Tobias Panofen
Email: t.panofen@fs.de

Madhumitha Madhavan
Email: m.madhavan@fs.de

Supported by:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
based on a decision of the German Bundestag

Frankfurt School
FS-UNEP Collaborating Centre
for Climate & Sustainable Energy Finance

UN environment
United Nations Environment Programme