CICSA
CLEAN CAPTIVE INSTALLATIONS FOR INDUSTRIAL CLIENTS IN SUB-SAHARA AFRICA

Clean Captive Installations in sub-Sahara Africa

Focus: Industrial clients in Kenya

Kick-off meeting presentation

FS-UNEP Collaborating Centre

September, 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	**Kenya might have an over-supply of electricity**	▪ As of June 2018, peak demand was 1,802 MW against effective capacity of 2,278 MW (reserve margin of 21%) ▪ To address potential over-supply issue, **govt. may start to delay new generation projects** and **is promoting demand growth** (incl. through incentives to increase industrial production), while power export opportunities are also being considered
2	**Time-of-Use tariff may or may not affect demand for captive power**	▪ Uptake as of June 2018 for TOU tariff that was introduced for large C&I electricity customers was around 26%. **Implications of this TOU tariff for clean captive power will need to be understood.**
3	**Captive PV is currently competitive and tariffs are expected to go up**	▪ Retail tariffs are likely to go up based on LCPDP forecasts, albeit at a slower pace ▪ **Based on current electricity tariffs, PV plants with levelized costs below USD 0.12-0.14/kWh will be attractive to a number of industrial users**
4	**Simplified regulatory environment for self-consumption plants below 1MW**	▪ Captive plants <1MW installed capacity and 100% self-consumption do not require any electricity licensing or energy regulatory approval ▪ Need to understand rules around **projects >1MW that supply captive electricity to 3rd parties** (under a PPA)
5	**Clean captive power uptake in Kenya is strong and growing; good potential market in manufacturing industry**	▪ At least 100 captive power solar PV systems above 10-15 kWp at commercial, industrial and institutional/ non-profit establishments constructed or under construction. ▪ **Theoretical universe of clean captive power users with >USD 1m/year turnover in manufacturing sector is >800**
6	**Some bank financing is available thanks in large part to donor support**	▪ Ongoing AfD funded programme called SUNREF includes green credit line for commercial banks and has enabled > USD 70m in lending to 30 RE and EE projects (vast majority of them are either clean captive plants or involve process and efficiency improvements in manufacturing facilities
7	**Active ecosystem of captive power players including private financiers and ESCOs**	▪ Financing models for captive PV – estimated 70-80% of systems being implemented are outright purchases by owners (some cases in tandem with bank financing or grants from donors); **also models that are rent-to-own, operating leases and potentially "PPA" arrangements and joint ventures are being offered on the market, they need further investigation**

Preliminary findings from the desk study

What have we understood so far

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Kenya might have an over-supply of electricity

- As of June 2018, peak demand was 1,802 MW against effective capacity of 2,278 MW (reserve margin of 21%)
- By 2030, total installed capacity is expected to grow to about 7,000 MW (LCPDP[1] medium-term plan); peak demand is expected to grow as govt. pushes for growth in manufacturing, agriculture and other economic sectors under the big 4 agenda
- However, **the rate of increase in installed capacity is expected to ensure no supply shortage and the country may face an oversupply in the near future depending also on export opportunities**
- To address potential over-supply issue, **govt. could start to delay new generation projects** and is **promoting demand growth** (incl. through incentives to increase industrial production).

Is there a need for captive solar PV?

- **Kenya experiences frequent grid down time** due to weather conditions, equipment failure, vandalism and planned interruptions
- **>80%** of 1,011 surveyed[2] **manufacturing & service firms reported power outages** on an **average of 3.8 times per month**
- These outages lead to **losses equivalent to 5.4% of annual sales**
- Hence **over half of all surveyed firms and nearly all large enterprises use generators as power back-up** for outages that last a **weighted average of 5.8 hours**
- Manufacturing industries: **textile & garments** (74.2% back-up generator ownership; 8.7% loss of annual sales); **food** (70%); **chemicals, plastics & rubber** (52.6%); others (74.6%)

Electricity grid outages and back-up power in Kenya

Parameter	Small	Medium	Large	Average
Percent of firms experiencing electrical outages	81.4	85.8	86.6	82.8
Number of electrical outages in a typical month	3.5	4.5	5.2	3.8
If there were outages, average duration of a typical electrical outage (hours)	6.0	4.7	6.9	**5.8**
If there were outages, average losses due to electrical outages (% of annual sales)	5.3	5.8	4.6	5.4
Percent of firms owning or sharing a generator	57.1	80.5	93.7	65.6
If a generator is used, average proportion of electricity from a generator (%)	15.4	22.3	18.3	17.8
Percent of firms identifying electricity as a major constraint	20.2	23.8	19.2	21.0

1. Least Cost Power Development Plan
2. World Bank Enterprise Survey Report (2018)

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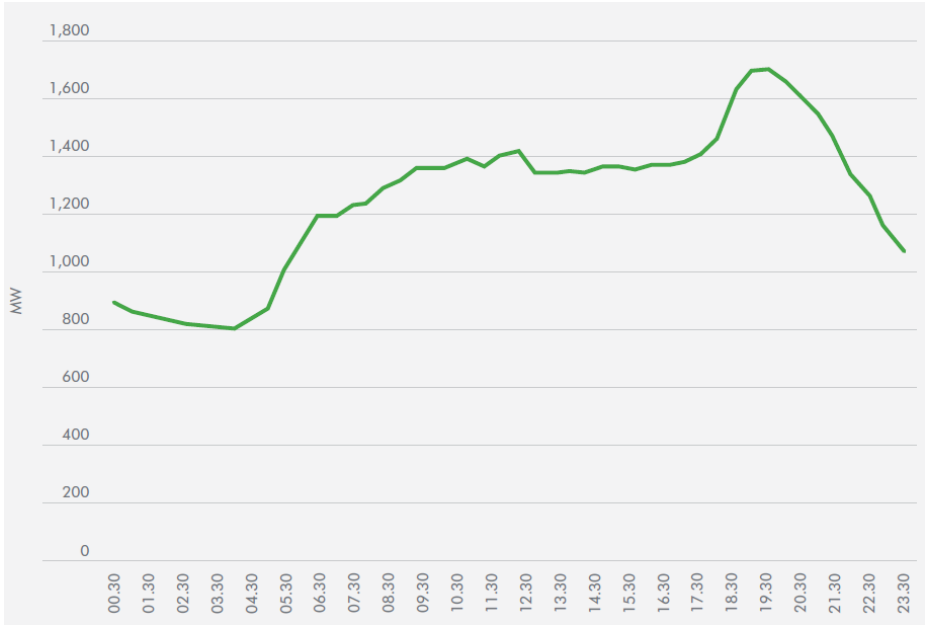
2 **Time-of-Use tariff may or may not affect demand for captive power**

- Uptake as of June 2018 for TOU tariff that was introduced for large C&I electricity customers was around 26%. **Implications of this TOU tariff for clean captive power will need to be understood.**

Why was ToU tariff introduced and where does it stand today?

- **ToU tariffs** were **introduced in Dec 2017** with the **aim of stimulating growth in the manufacturing sector through discounted electricity tariffs during off-peak hours**
- ToU tariffs are expected to boost off-peak consumption **by load-shifting** and increase the consumption of C&I customers
- At the same time, **demand shifting is expected to enable optimal utilisation of base load capacity** mainly from cheaper generation sources such as geothermal resources whilst minimising usage of thermal energy generation during peak time
- **Only 26% of the 3,120 eligible customers opted for the ToU tariff** in the seven month period ending June 2018, during which 91 GWh was sold through the scheme
- The **slow uptake** may be **attributed to unwillingness of manufacturers to shift production to off-peak hours** (due to associated costs) and **strict eligibility criteria** in place **for firms to qualify for the discount**

Daily load curve (2017)



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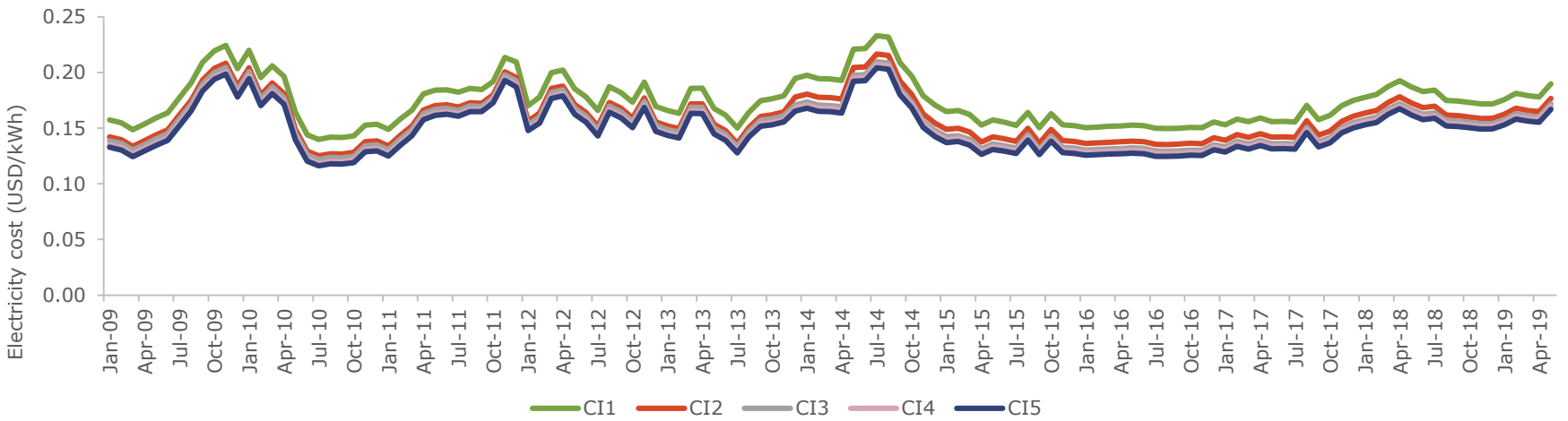
   - Retail tariffs are likely to go up based on LCPDP forecasts, albeit at a slower pace
   - **Based on current electricity tariffs, PV plants with levelized costs below USD 0.12-0.14/kWh will be attractive to a number of industrial users**

C&I tariff charges

- **Typical charges paid by large C&I** category customers over the last decade, range **from USD 0.12/kWh and USD 0.20/kWh**
- Hence, captive PV plants with levelized costs of between USD 0.12/kWh and USD 0.14/kWh (or less) should be competitively priced for industrial facilities

Historic electricity prices for C&I tariff categories including surcharges



Preliminary findings from the desk study

What have we understood so far

4

Simplified regulatory environment for self-consumption plants below 1MW

- Captive plants <1MW installed capacity and 100% self-consumption do not require any electricity licensing or energy regulatory approval
- Need to understand rules around **projects >1MW that supply captive electricity to 3rd parties** (under a PPA)

Captive power plant electricity license holders as at February 2019

Licensee	Country	Technology	Licence type	Size (MW)	Date
Pwani Oil Products Ltd	Kilifi	Biomass	Generation	1.5	Jan 2018
Oserian Development Co. Ltd	Nakuru	Solar PV	Generation	1.0	Aug 2018
Pan African Paper Mills (E.A.) Ltd	Webuye	Cogeneration	Generation	9.0	2004
Kenya Petroleum Refineries Ltd*	Mombasa	MSD	Generation	8.5	Feb 2011
Cemtech Ltd* [cement factory]	West Pokot	Coal	Generation	30	Jul 2015
Kwale International Sugar Co. Ltd**	Kwale	Cogeneration	Generation	18	Feb 2016
Devki Energy Co. Ltd [steel maker]	Kajiado	Coal	Generation	15	May 2016
Butali Sugar Mills Ltd	Kakamega	Cogeneration	Generation	11	Dec 2016
Chemilil Sugar Co. Ltd	Kisumu	Cogeneration	Generation	3.0	Dec 2016
Sony Co. Ltd [sugar mill)	Migori	Cogeneration	Generation	8.7	Apr 2017
Ofgen Power Ltd***	Nairobi & Taita Taveta	Solar PV	Generation	0.455	Apr 2017
Strathmore University** ***	Nairobi	Solar PV	Generation	0.6	Apr 2017
James Finlay** [tea estate/factory]	Kericho	Hydro & diesel	Generation, distribution & supply (GDS)	6.7	Apr 2005
Sotik Highlands Tea Estate Ltd	Kericho	Diesel	GDS	1.5	Apr 2005
Unilever Tea Kenya Ltd	Kericho	Hydro & diesel	GDS	4.66	Dec 2008
Imenti Tea Factory Company Ltd**	Meru	Hydro	GDS	0.92	Apr 2010
Two Rivers Power Company Ltd^	Nairobi	Solar & diesel	GDS	12	Sep 2015
Biojoule Kenya Ltd**	Naivasha	Biogas	GDS	2.6	Dec 2015
Metumi Power Co. Ltd* **	Murang'a	Hydro	GDS	5.6	Mar 2016
Oserian Development Co. Ltd	Nakuru	Geothermal	GDS	3.7	Apr 2017
Nyakwana Power Company Ltd**	Kisii	Hydro	GDS	2.0	Jun 2017
Gura Power Company Ltd**	Nyeri	Hydro	GDS	5.8	Jun 2017

Source: Electricity and Petroleum Regulatory Authority (2019)

* Note 1: defunct, not operational or not yet built

** Note 2: also supplying excess to the national grid

*** Note 3: It is not known why Ofgen Power obtained a generation permit or licence for a captive plant below 1 MW, as it is not required. Strathmore University obtained a permit or licence because it also supplies the grid under a PPA

^ Note 4: Two Rivers is a shopping mall and commercial and residential complex. The facility has a licence for 2 MW solar PV and 10 MW diesel captive power as well as a licence to purchase 35 MW from KPLC for sale to its tenants and residents

Preliminary findings from the desk study

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5 **Clean captive power uptake in Kenya is strong and growing; good potential market in manufacturing industry**

- At least 100 captive power solar PV systems above 10-15 kWp at commercial, industrial and institutional/ non-profit establishments constructed or under construction.
- **Theoretical universe of clean captive power users with >USD 1m/year turnover in manufacturing sector is >800**

Comments

- **Table on the right represents existing captive PV systems with >15 kWp in Kenya by user type**
- There are at least **17 systems with >50 kWp capacity each totalling >10 MWp found in the industrial sector (manufacturing)**
- Largest captive PV system is 2,000 kWp at the Kenya School of Monetary Studies in Nairobi (under construction)
- Largest captive PV system in the industrial sector is 1,500 kWp at Kapa Oil Refineries in Nairobi, although Mabati Rolling Mills (steel manufacturing) may have larger captive PV plant (details unavailable)
- **Turnover is assumed as a reasonable proxy for potential uptake** as: 1. firms with high turnover **spend more on electricity and/or back-up power to reduce costs**; 2. these firms have **ability to pay for captive systems**; 3. such firms also **have better experience with capital investments, maintenance, contracts and financing**
- As such, **potential universe for clean captive power users with >USD 1m/year turnover in manufacturing sector is >800 (2016)**

Type of facility	PV captive systems (no.)	PV capacity (kWp)	Average system size (kWp)
Flower farm	25	3445	138
Tourist lodge	12	1494	124
Factory (non-food)	7	2711	387
Food processing	6	5675	946
Shopping mall	5	2763	553
Non-profit (mostly office building)	7	1845	264
School	6	2977	496
Institution (mostly office building)	4	212	53
Tea factory	4	1904	476
Warehouse	3	1011	337
Office	3	127	42
Water pumping	3	86	29
Airport	2	605	303
Warehouse/office	2	1024	512
Industrial park	1	940	940
Hospital	2	55	27
Bank	1	103	103
Flower & fish farm	1	202	202
	***94**	****27,178**	**289**

* Note 1: total number of captive PV projects double-counts some projects where an expansion system was added on the same premises after the first once was installed. On the other hand, at least 13 captive PV systems that are known to exist on schools, factories, offices and other facility types are not included as no details are publicly available.
** Note 2: installed capacity does not include systems where the size is known but the facility type is unknown

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6 **Some bank financing is available thanks in large part to donor support**

- Ongoing AfD funded programme called SUNREF includes green credit line for commercial banks and has enabled > USD 70m in lending to 30 RE and EE projects (vast majority of them are either clean captive plants or involve process and efficiency improvements in manufacturing facilities

Comments

Commercial Banks

- Projects related to Renewable Energy (RE) captive power installations are **not well understood and are still perceived as high risk**
- Only **a handful of pioneering commercial banks** (Diamond Trust Bank, Commercial Bank of Africa and Cooperative Bank of Kenya**) lend financing to clean captive projects**, in partnership with AfD and SUNREF programs
- Indication that **other commercial banks** (Equity Bank, Kenya Commercial Bank) **are becoming interested in RE captive power**

Co-operative Bank disbursements under SUNREF, 2016

Project name	Type	Technology	Size (MW)	Loan amount (USD million)	CAPEX (USD million)
KTDA Gura	RE	Mini-hydro captive & grid	5.00	10.140	16.0
KTDA Chania	RE	Mini-hydro captive & grid	1.00	1.625	4.3
KTDA North Mathioya / Metumi	RE	Mini-hydro captive & grid	5.00	9.941	15.9
Strathmore University	EE	Solar PV captive & grid	0.50	1.300	1.2
Gen Pro Terem	RE	Mini-hydro grid	5.00	11.593	13.4
Meru Central Dairy	EE	Industrial process improvement & retrofits	0.17	2.300	3.0
Alpha Knits Ltd	EE	Industrial process improvement & retrofits	0.08	1.100	1.1
Lean Energy Solutions	EE	Biomass captive	5.30	1.000	1.5
Total			**22.05**	**38.99**	**56.4**

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7 **Active ecosystem of captive power players including private financiers and ESCOs**

- Financing models for captive PV – estimated 70-80% of systems being implemented are outright purchases by owners (some cases in tandem with bank financing or grants from donors); **also models that are rent-to-own, operating leases and potentially "PPA" arrangements and joint ventures are being offered on the market, they need further investigation**

List of main captive PV financing/ESCO firms active

Name	Location	Overview
SunFunder	Based in USA, with presence in Kenya	Established USD 1.2m working capital debt facility for Questworks (Kenya developer/EPC) in June 2018
Maris	Based in Mauritius, office in Kenya	Diversified holding company. Co-owns Equator Energy (Kenyan/German EPC), which enables EPC to offer financing
Solarise Africa	Based in Kenya	Set up by former director of responsAbility. Has financed three captive projects, one of 1 MW
Cross-boundary Energy	Based in USA, with head office in Kenya (and offices in other countires)	Part of the Crossboundary Group. USD 8m equity raised for Crossboundary Energy Fund 1 in 2015. USD 6m debt facility with OPIC since 2018. Financed and manage 1.5 MW of captive PV in Kenya to date. Has a partnership with leading EPC Solarcentury
SolarAfrica/NVI Energy	Based in South Africa	Captive PV financing platform and partner of Crossboundary
Ecoligo	Based in Germany, with history in Kenya	Crowd-funded debt sourced in EUR for individual projects under leasing/PPA. Financed 700+ kW in Kenya. Often works with Kenyan EPC Harmonic Systems
Ariya Capital	Based in Kenya	Provides leasing finance, fund management and invests in IPPs. On leasing side has partnered with African Solar Designs
Berkeley Energy	Based in London, office in Kenya	Recently started investing in captive power (e.g. Azimuth Power developer/EPC)
responsAbility	Based in Switzerland, large office in Kenya	USD 3b+ AUM globally. Provides both equity and debt through various vehicles and has a RE project development arm in Kenya. Has financed a captive power developer in Ghana but not in Kenya (yet)
Faber Capital	Based in Dubai, with presence in Kenya	Part of an international group of companies, including Premier Solar Solutions (Kenyan EPC) and can offer financing

Stakeholder consultations

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

1. **Kenya might have an over-supply of electricity**
2. **Time-of-Use tariff may or may not affect demand for captive power**
3. **Captive PV is currently competitive and tariffs are expected to go up**
4. **Simplified regulatory environment for self-consumption plants below 1MW**
5. **Clean captive power uptake in Kenya is strong and growing; good potential market in manufacturing industry**
6. **Some bank financing is available thanks in large part to donor support**
7. **Active ecosystem of captive power players including private financiers and ESCOs**

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?

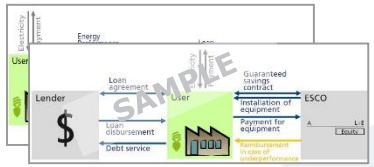
1

Development of tools

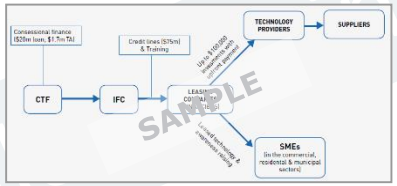
- identifying business models
- selecting financing mechanisms

A. Ownership model

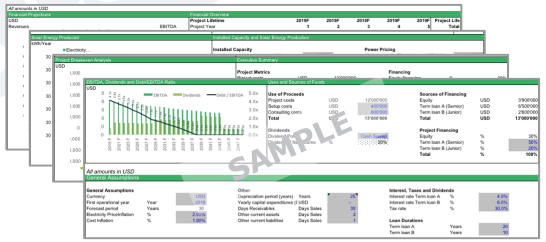
B. ESCO financing model



C. Equipment leasing model



Financing mechanisms



2

Identifying relevant & key partners

Public institutions

MoE

EPRA

Commercial banks

DTB · Diamond Trust Bank · cba · KCB · Equity Bank · Co-operative Bank · Go Bank

EPCs/suppliers

Questworks · Equator Energy · OFGEN energy simplified · Astonfield · solarcentury · Knights Energy

Industry associations

KAM Kenya Association of Manufacturers · Kenya Bankers Association · KEPSA · KEREA Kenya Renewable Energy Association

Private financiers/ESCOs

SunFunder · Maris · solarise africa · SOLARAFRICA · ecoligo · CrossBoundary Energy

Existing industrial users

burn life · saving · stoves · Kuwait · KAYSALT

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

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Thank you for your patience!

For further information please visit:

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