ESECA Africa

European Sustainable Energy Cluster partnership for Africa

ESECA Networking workshop
Milan, 14 November 2022

Analysis of key Sub-Saharan African markets in renewable energy and smart grids sectors

Market reports from Ghana, Senegal, Kenya, Tanzania and Rwanda

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Co-funded by the COSME programme of the European Union

The ESECA project has received funding from the European Union's COSME Programme under Grant Agreement 101035882.

1

What is ESECA?

2

- **European Sustainable Energy Cluster partnership for Africa** (ESECA) is a partnership formed by five European clusters (ACE, MEDEE, LE2C, MetaIndustry4 and ECPE) from **Spain, France, Italy, and Germany**. Together, we gather around 550 organizations and 290 SMEs.

- ESECA project is funded by the European Commission, with a duration of **36 months** (starting in September 2021) and approximately 600 k€ of budget. The project aims to contribute **positioning European companies from the sustainable energy sector in sub-Saharan African markets**.

2

Consortium

3

3

Main objectives

4

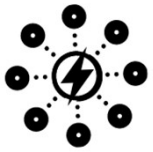
(1) Intensify business network collaboration among European companies from the renewable energy and electrical power generation, distribution and transmission sectors …

- Foster clusters & SMEs trans-regional cooperation and partnership building
- Help SMEs identify business and internationalisation opportunities
- Position SMEs into trans-European consortiums

(2) Develop a joint internationalisation strategy plan with common goals towards Sub-Saharan African markets.

4

Technology Market



Distributed Energy Resources

Smart Grids

Solar, Wind & Bio Energy

Energy Storage

Innovative metering and digital solutions

5

Activities

10 Sub-Saharan countries considered in a high-level report

5 In-depth analysis of selected markets introduced during a webinar

4 Exploratory trips to establish contact with key stakeholders

4 Direct missions with SMEs to the targeted countries

1 Reverse mission from targeted countries to Europe

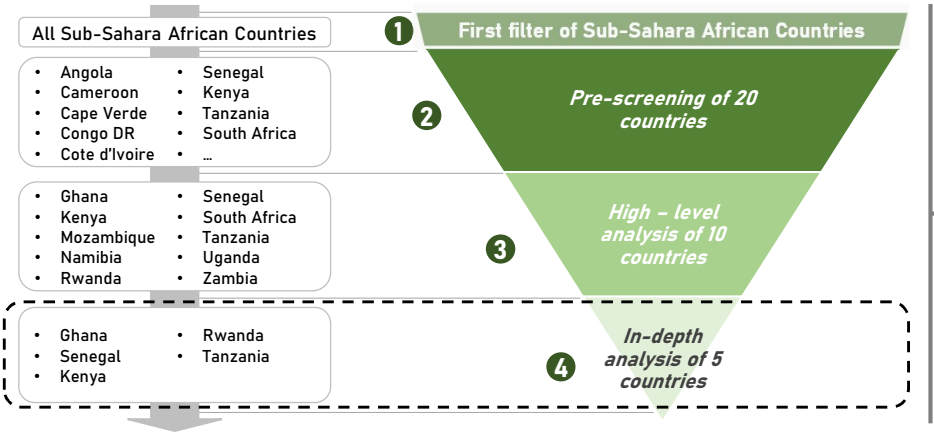
3 European Networking Events organized by consortium members

4 Cooperation Projects between ESECA Partners and international clusters

12 Business agreements signed between European and African SMEs

6

The structure of the analysis of key Sub-Saharan African markets was structured in 4 phases and divided in 5 axes



5 axes for the analysis

- Socio-Economic Context
- Regulatory Framework
- Current RE Market and Energy Mix
- Key Stakeholders
- Research & Development

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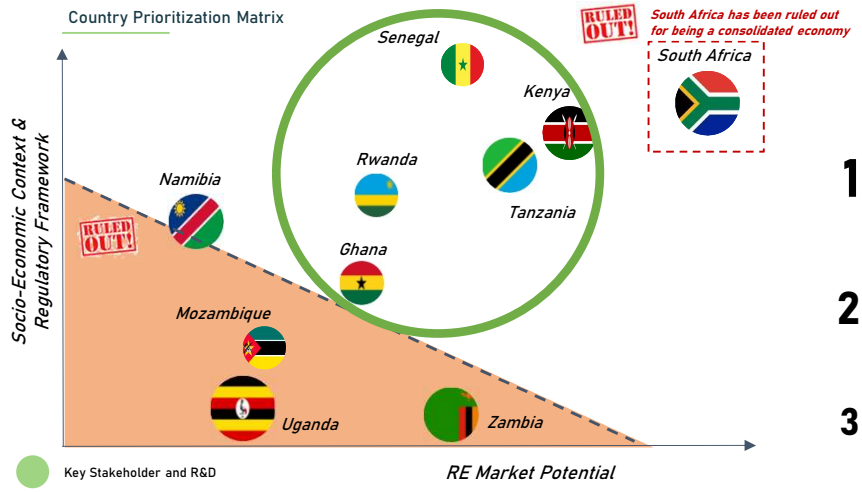
7

Prioritization of 5 African countries

8

The 5 countries prioritization process has taken into account the 5 axes of the high-level analysis, but with different levels of importance



RULED OUT — *South Africa has been ruled out for being a consolidated economy*

South Africa

PRIORITIZATION CRITERIA

1. **Current RE Market & Energy Mix**
   RE Installed Capacity, Energy Mix Diversification, Mini and off-grids opportunities, battery storage systems opportunities, etc
2. **Socio-Economic Context, Regulatory Framework**
   Macroeconomic issues, COVID, energy sector structure, RE national strategy, market incentives, etc.
3. **Key Stakeholders and R&D**

The prioritized 5 countries are Kenya, Tanzania, Senegal, Rwanda and Ghana

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8

ub-Saharan African markets
rgy and smart grids sectors

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a, Senegal, Kenya, Tanzania and Rwanda

Content

01. 5 Sub-Saharan African countries

- Kenya
- Tanzania
- Rwanda
- Senegal
- Ghana

02. Conclusions and next steps

9

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KENYA

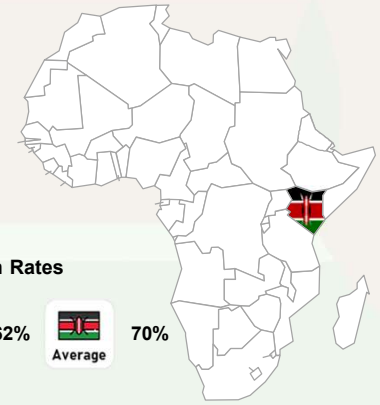
10

REPUBLIC OF KENYA

Population	53,771,300 inhabitants
Human Development Index	0.601
GDP (CAGR 10'-20')	8.3%

Ease of doing business index
56th

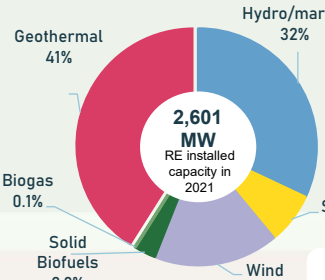
Global competitiveness index
95st



National Electrification Rates

Urban 91% Rural 62% Average 70%

12 operational plants

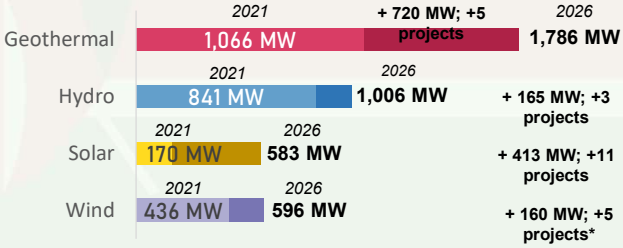


10 operational plants

4 operational plants

2 operational plants

Current Plants + Planned / Under Construction Projects (MW, 2021-2026E)



*Bubisa and Lamu Power Plants' MW are not included in the chart

11

Future energy-related projects will be more related to smart grids, as well as the development of RE electrical equipment market

- **Public initiatives** as well as **private companies** are currently launching mini grids projects in Kenya, **scattered throughout the country**, with more than **150 new solar powered mini-grids** expected to be developed in the medium term
- Kenya presents a **good context for the development of smart grids**, having both public institutions and private companies' initiatives for grid digitalization
- **Automation** and **digital control systems** as the most interesting technologies
- Within Sub-Sahara Africa region, **Kenya has one of the most developed BESS (Battery Energy Storage Systems) markets**, and it is expected to be highly supported in the next decade
- Kenya is the country within the 5 analysed with the highest amount – in USD - of **electrical equipment imports** due to their **grid modernization** and **development plans**

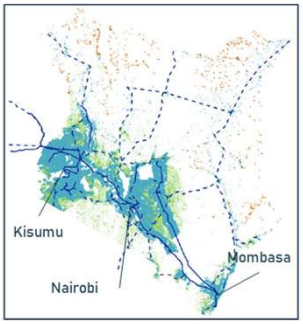
Mini-Grids & Off-Grids

Smart Grids

Energy Storage

Electrical Equipment

Kenya planned electricity connections by 2030



On-grid
Mini-grids
Off-grid systems
Existing transmission lines (>69kV)
Planned lines

+15% (2015-2019) +16,174,000 People connected to solar mini and off-grid systems

+1% (2015-2019) +98,000 People connected to hydro mini and off-grid systems

+15% (2015-2019) +85,000 People connected to bioenergy mini and off-grid systems

Energy Access: supporting innovation between Europe and Africa
15.09.2022

12

Geothermal energy is the main activity among Kenyan stakeholders, as well as solar energy

Regulatory Framework

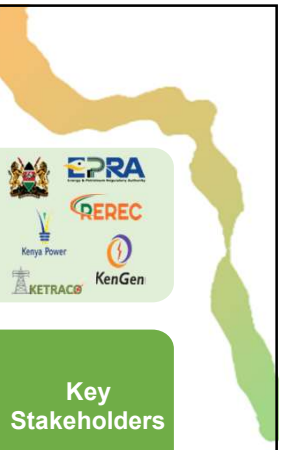
- The Energy sector is mainly structured around the **Ministry of Energy and monopolized by state-owned companies**
- The **Kenya National Electrification Strategy** (2018) is the most relevant current document for the country's energy sector and Market incentives in RE have been recently included

Key Stakeholders

- **High number of agents** specialized in geothermal energy
- Most important stakeholders in renewable energies are in the **public sector**
- **Universities and RE associations** are numerous and active in RE, with continuous collaboration with R&D centres

Research & Development

- The **number of R&D centres active** in renewable energies is **much higher** in Kenya than in other African countries
- A large part of the country's RE R&D centres have emerged from **universities and public authorities**
- **Geothermal** is the most advanced RE in R&D, since it has specific R&D centres, yet **solar** has also relevant R&D activities



13

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TANZANIA

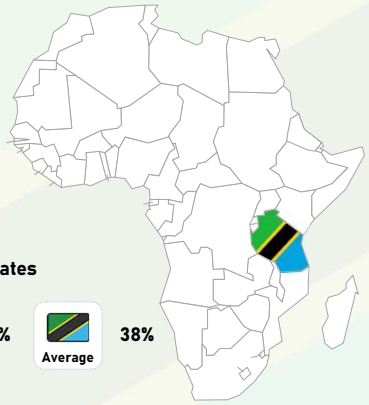
14

UNITED REPUBLIC OF TANZANIA

Population	59,734,213 inhabitants
Human Development Index	0.529
GDP (CAGR 10'-20')	6.9%

Ease of doing business index
132th

Global competitiveness index
N.d.

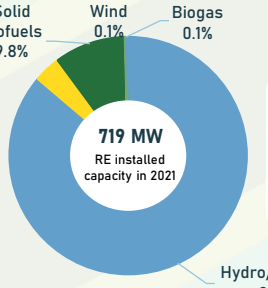


National Electrification Rates

Urban 73% | Rural 19% | Average 38%

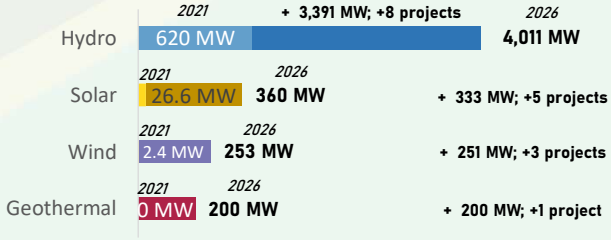
1 operational plant

No utility-scale solar plants, all the installed capacity from mini- and off-grid systems



9 operational plants

Current Plants + Planned / Under Construction Projects (MW, 2021-2026E)



*No Biogas and Solid Biofuels utility-scale projects planned for the next 5 years

15

Mini grids and small energy storage systems linked to renewables are the most interesting technologies to be developed in Tanzania

Tanzania is the Sub-Sahara African country with **the most opportunities for the development of mini and off grid** systems, specially in the **northern regions**

Although off-grid great potential in Tanzania, **smart grids market is very limited** currently as electrification rates are low and the technology is still **incipient**

There is a **growing activity regarding BESS** in Tanzania, mainly because the use of **photovoltaic** (PV) and **battery storage systems** is one of the most viable options for electrification in rural areas

Electrical equipment market is very **limited**, and mainly concentrated **around Dar-es-Salaam**
Even though **imports** of electrical equipment have increased significantly in recent years, they are **insufficient**

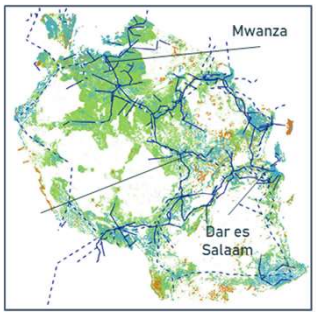
Mini-Grids & Off-Grids

Smart Grids

Energy Storage

Electrical Equipment

Tanzania planned electricity connections by 2030



+ 3,551,000 People connected to solar mini and off-grid systems (-67% (2015-2019))

+ 52,000 People connected to hydro mini and off-grid systems (0% (2015-2019))

+ 27,000 People connected to bioenergy mini and off-grid systems (+8% (2015-2019))

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16

Numerous stakeholders with activities in renewable energies, standing out hydro and solar in relation to R&D activities

Regulatory Framework

- Among the public companies, **TANESCO** is the most relevant, responsible for a large part of the **generation** (78%), and the **monopoly of transmission**
- **National RE policies** and strategies are **not very recent**, and the framework for Action is not very concrete

Key Stakeholders

- **Stakeholders map relatively dense** compared to other East African countries
- **Universities and R&D centres** are very active in renewable energies
- **TAREA** stands out as the most active and important association in the RE sector
- **Private companies** focused on **hydro** (IPPs) and **solar** (installers and distributors)

Research & Development

- **Not very developed R&D activities** compared to other Sub-Saharan African countries
- **Renewable Energy Technology Centre (RETC)** and the renewable energy associations are the most active agents
- **Hydropower** is the most developed technology in recent years, with the focus on small-scale projects

17

18

Exploratory mission – Kenya and Tanzania

26 – 28 June Nairobi (KE)

Meetings:

- 2 Universities
- 2 Associations
- 1 Accelerator

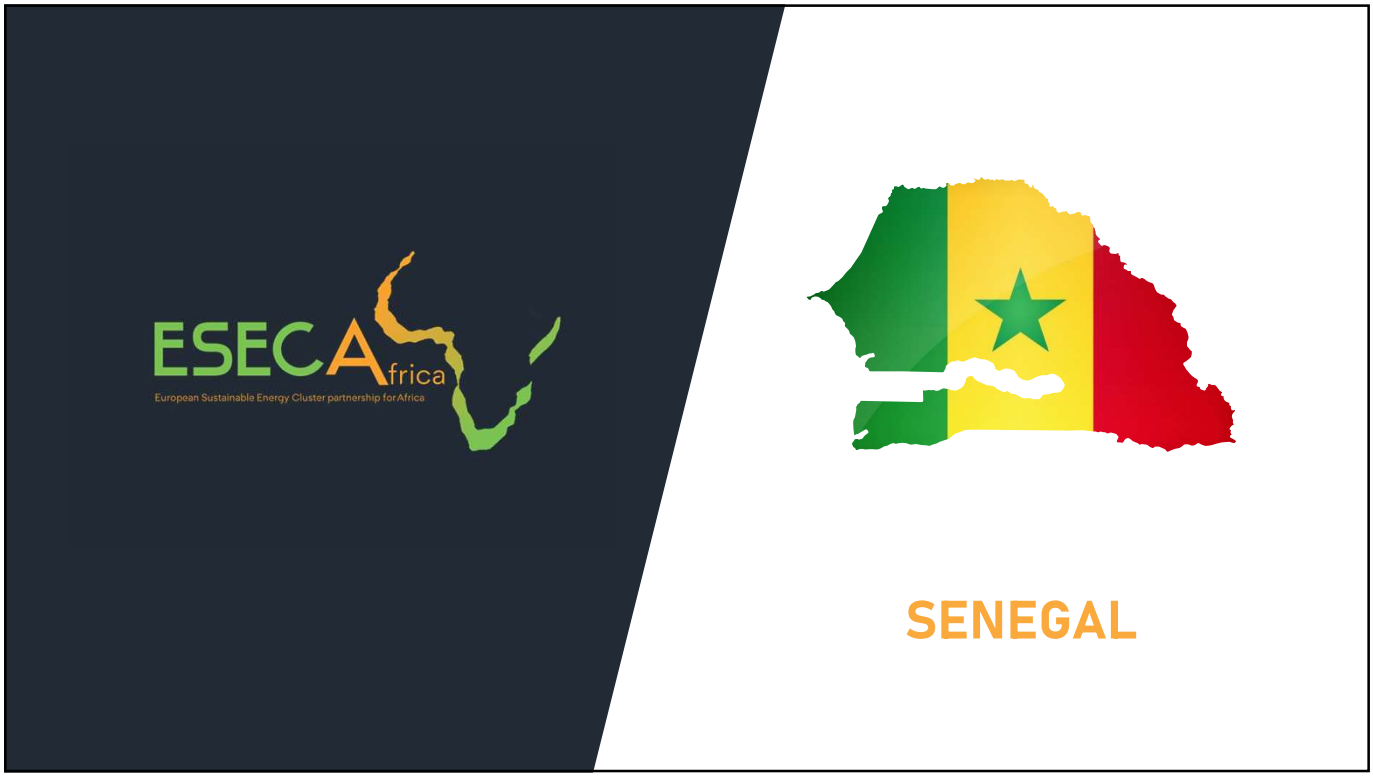
29 June – 1 July Dar Es Salaam (TZ)

ARE Energy Access Investment Forum

Meetings:

- 1 University
- 2 Consultancies
- 4 Associations
- 5 Companies
- 1 R&D

18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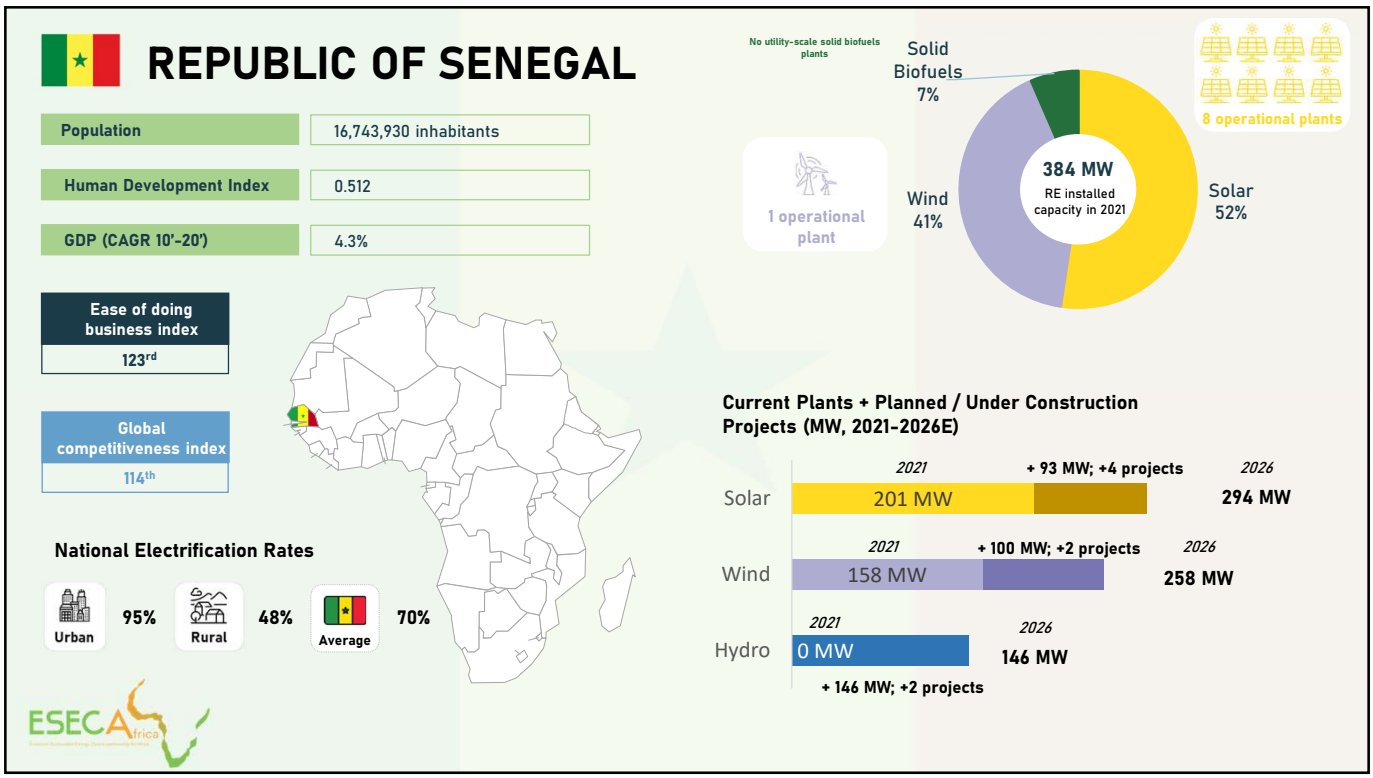
SENEGAL

19


REPUBLIC OF SENEGAL
Population
16,743,930 inhabitants
Human Development Index
0.512
GDP (CAGR 10'-20')
4.3%
Ease of doing business index
123rd
Global competitiveness index
114th
National Electrification Rates
Urban
95%
Rural
48%
Average
70%
No utility-scale solid biofuels plants
Solid Biofuels 7%
1 operational plant
Wind 41%
384 MW
RE installed capacity in 2021
Solar 52%
8 operational plants
Current Plants + Planned / Under Construction Projects (MW, 2021-2026E)
Solar
2021
201 MW
+ 93 MW; +4 projects
2026
294 MW
Wind
2021
158 MW
+ 100 MW; +2 projects
2026
258 MW
Hydro
2021
0 MW
2026
146 MW
+ 146 MW; +2 projects

20

Strong growth of mini grids is expected despite high electrification rates, as well as several initiatives in smart grids and energy storage

Despite the **high electrification rates**, by 2021 Senegal was the **second country worldwide with the highest number of planned mini grids**, being more than 1,200 new mini grid connections

Smart grid projects in Senegal **have begun to be deployed in the last 3 years** in order to integrate renewable energies, improve access to electricity and avoid technical losses

First utility scale Battery Energy Storage System project under development in the **Taiba N'diaye Wind Farm** (40 MW battery system), yet the **activity** in relation to **energy storage** in Senegal is still **incipient**

Although the equipment related to solar installations is the most developed in recent years, it is **insufficient to meet the current demand**, thus having to **import large quantities** of equipment (mainly from China)

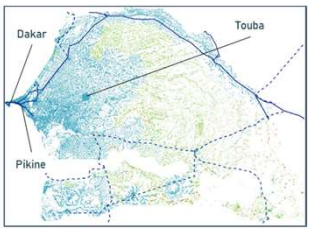
Mini-Grids & Off-Grids

Smart Grids

Energy Storage

Electrical Equipment

Senegal planned electricity connections by 2030



+ 1,440,000 (+75% 2015-2019)
People connected to solar mini and off-grid systems

+ 69,000 (+130% 2015-2019)
People connected to bioenergy mini and off-grid systems

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Cluster Energía · Mi4 MetaIndustry4 · LE2C · Cluster Power electronics · MEDEE

21

The involvement of some agents in the renewable energy sector in order to develop R&D activities in Senegal is limited

Regulatory Framework

- **Well-organized** electricity sector, with clear division of responsibilities
- **SENELEC has a monopoly** in **transmission and distribution**, but in production it reaches power purchase agreements with IPPs
- **VAT exemptions** on renewable energy products is the most interesting market incentive

- Public and **governmental agents**, the **public company** (SENELEC) and the **IPPs**, are the most relevant stakeholders in the RE sector
- There is **no large associative movement** around renewable energies in Senegal
- **Private companies** are mainly focused on **solar** (IPPs, installers and EPCs), yet **wind** is having a growing activity

Key Stakeholders

Research & Development

- Existence of public agents with **clear R&D guidelines**
- **Lack of involvement** of SENELEC and other RE agents in R&D activities
- **Solar** is the technology that is generating the most research and development activity

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22

23

Exploratory trip SENEGAL

17 July – 22 July Dakar

20th APUA Congress (Association of Power Utilities of Africa)

Meetings:

+ 25 contacts made during the conference

5 visits :

- 2 Renewable energy production sites
- 1 Laboratory
- 1 Training Center
- 1 Company
- 2 National Agencies

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Cluster Energía · Mi4 MetaIndustry4 · LE2C Lombardy Energy Cleantech Cluster · Cluster Power electronics · MEDEE

23

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RWANDA

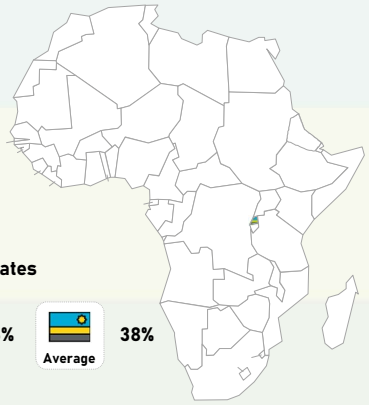
24

REPUBLIC OF RWANDA

Population	12,952,209 inhabitants
Human Development Index	0.543
GDP (CAGR 10'-20')	5.4%

Ease of doing business index
38th

Global competitiveness index
100st



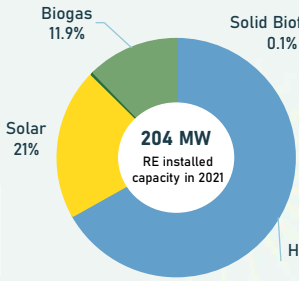
National Electrification Rates

Urban 93% | Rural 26% | Average 38%

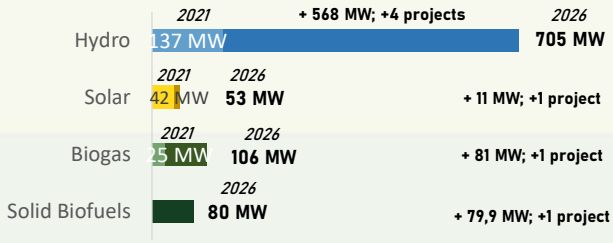
1 operational plant

5 operational plants

6 operational plants



Current Plants + Planned / Under Construction Projects (MW, 2021-2026E)



25

As electrification rate is still very low in Rwanda, public institutions' priority is to develop mini and off-grids in order to achieve universal access to electricity

Due to Rwanda's **hydropower resource potential** and **geographical characteristics**, small and medium hydro power plants will be much **developed in the coming years**

Rwanda is **facing significant challenges** for the implementation of **smart grids**, yet there are some ongoing projects

In the last 5 years, there is a **growing activity related to energy storage** solutions in Rwanda, driven mainly by **foreign private companies**

Rwanda's **electrical equipment** market is still **very low**, since the Ministry of Infrastructure has set out several **initiatives** to spur the sector, which is also driven mainly by **foreign private companies**

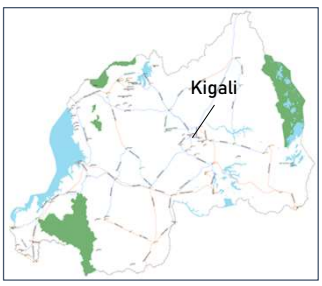
Mini-Grids & Off-Grids

Smart Grids

Energy Storage

Electrical Equipment

Rwanda planned electricity connections by 2030



Existing

Ongoing

Planned

+ 2,513,000 (+44%, 2015-2019)
People connected to solar mini and off-grid systems

+ 32,000 (+7%, 2015-2019)
People connected to hydro mini and off-grid systems

+ 47,000 (+27%, 2015-2019)
People connected to bioenergy mini and off-grid systems

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26

Low number of stakeholders in renewables compared to the other analysed countries, and there is a lack of a network dedicated to RE research and development

Regulatory Framework

- There is **no ministry with exclusive regulatory competencies in Energy**, yet there is an Energy Directorate
- The **National Energy Policy of 2015** has a clear tendency to encourage private investment
- **Not very attractive market incentives scheme** (only some Duty & VAT exemptions and F-i-T for small-hydro)

Key Stakeholders

- **Lower number of stakeholders** in RE within the 5 countries, but relatively high considered Rwanda's size
- **IPPs are a relevant** stakeholder and exploited, in 2021, around 51% of the country's total installed capacity
- **Universities** are **not relevant stakeholders** in terms of knowledge and technology transfer, and **private companies are focused on solar** (installers) and hydro (IPPs)

Research & Development

- There is **not a R&D centres network** dedicated to **renewable energy**
- The **African Centre of Excellence in Energy for Sustainable Development** is the only R&D centre exclusively dedicated to renewable energies
- **Smart grids** have been identified by the Government as one of the destinations for RE R&D due to their relevance

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27

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GHANA

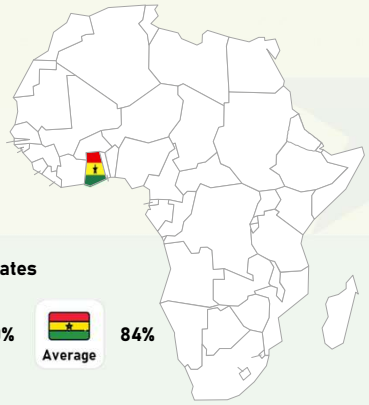
28

REPUBLIC OF GHANA

Population	31,072,945 inhabitants
Human Development Index	0.611
GDP (CAGR 10'-20')	7.8%

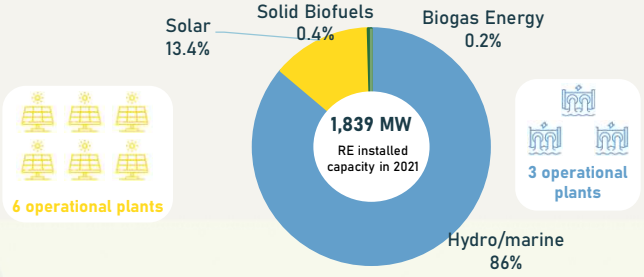
Ease of doing business index
118th

Global competitiveness index
111st

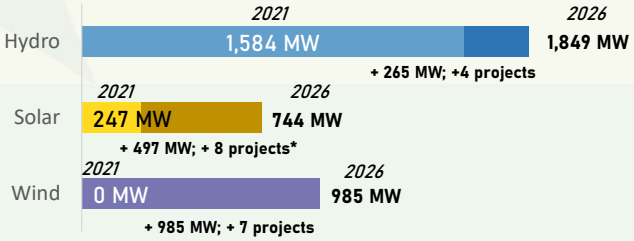


National Electrification Rates

Urban 94% | Rural 70% | Average 84%



Current Plants + Planned / Under Construction Projects (MW, 2021-2026E)



*1,000 MW Huawei/Meinergy Solar Power Plant's MW is not included

29

As electrification rate has grown significantly in the last 15 years, grid digitalization and energy storage solutions are expected to be developed in the near future

Limited ongoing mini and off grid projects in Ghana compared to other Sub-Sahara African countries, as electrification rates are already high

Ghana's electric grid uses **old technology**, not having incorporated new digital technologies extensively, and there are currently **few ongoing projects**

Despite having **little activity in energy storage**, several projects have been announced recently, and **energy storage-related regulatory framework** development is expected for the coming years

Equipment related to renewable energies is mainly focused on **solar**, and in particular in Solar Lightning, yet there is a **need to import more electrical equipment** to modernize the existing electrical equipment

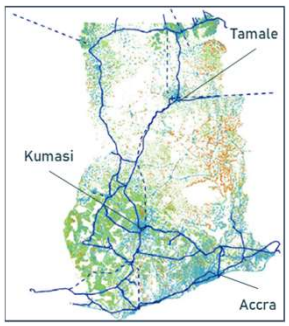
Mini-Grids & Off-Grids

Smart Grids

Energy Storage

Electrical Equipment

Ghana planned electricity connections by 2030



+ 525,000 (x 3 (2015-2019))

People connected to solar mini and off-grid systems...

... being the 83% connected to low-power Solar Lights, and the remaining 17% to solar mini grids

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30

Universities and R&D Centers are the most numerous stakeholders, and there are several agents with R&D activities

Regulatory Framework

- **Coexistence of two bodies** with regulatory activity in the sector
- **National Energy Policy** has sufficient mechanisms in order to achieve electrification targets in the medium term
- Significant number of **market incentives** and **public funding programs** to encourage the growth of renewable energy

Key Stakeholders

- The main **stakeholders** are still **public**, yet the RE market tends to liberalize
- **University and R&D centres** are the most numerous stakeholders in the country, without significant knowledge-transmission activities
- **Private companies** mainly focused on **solar** (installers, distributors and EPCs)

Research & Development

- Significant number of agents with **research and development functions** in Ghana, but their activity and involvement in the renewable energy sector is **not very high**
- In terms of R&D in specific technologies, **BESS** (with some innovative projects such as Huaweii, the largest BESS in Africa), in **wind**, and some **bioenergy** projects, stand out

31

Prioritization of 5 African countries

Finally, the 5 prioritized countries for further analysis in Phase 2 are Senegal, Kenya, Tanzania, Rwanda and Namibia

5 prioritized countries

Senegal

- **Diversified energy mix**, with significant utility scale and small-scale projects
- **+100 off grid electrification projects** launched recently
- Good **organization** in terms of **R&D**

Kenya

- Good **business** and **competitiveness indicators**
- **Well regulated** and structured sector
- **Highly diversified energy mix** and good context for **grid digitalization** and **storage systems**
- **Large number of stakeholders** related to RE

Tanzania

- **Sustained GDP** and good levels of **security**
- **Excellent environment** for the development of **mini- and off-grid systems**
- Relevant number of **Universities and R&D center** involved in RE, well organized

Rwanda

- **Best country** in Sub-Saharan Africa in **Ease of Doing Business Index** (38th)
- Country with the **most advanced vaccination** of all the countries analyzed
- **More than 60% of Rwandans are in off-grid areas**, great opportunities for mini and off-grids systems

Ghana

- **Pre-selected country:** the partners and the companies are already familiar with it
- **One of the highest GDP growth** and good levels of **security**
- **Solar Energy** installed capacity has **increased by +24.6%** annually since 2015
- **Good prospects in R&D** of **BESS and minigrids in the medium term**

32

To sum up, the 5 Sub-Saharan African countries have great development opportunities in the discussed areas

Overall conclusions of the market reports

Socio-Economic Context

- In general, all 5 are **highly populated or dense** countries, with high annual GDP growth (Kenya, Tanzania and Ghana)
- In addition, they stand out among other sub-Saharan countries in terms of **Ease of Doing Business** (Rwanda), **development and security levels** (Kenya, Ghana) and **stable currency** (Senegal, Rwanda)

Regulatory Framework

- The **institutional and legal framework** of the energy sector is correct in all the selected countries
- In terms of **market incentives**, Kenya, Ghana and Tanzania are ahead of Senegal and Rwanda
- In general, all countries have facilities in the **consenting process** for small scale projects

Current RE Market and Energy Mix

- Kenya and Tanzania are the countries with the most **RE resource potential**, yet Kenya has made further progress
- Kenya and Ghana as the countries with the largest number of **planned projects**
- Tanzania and Rwanda are the most interesting countries for the development of **mini and off-grid systems**

Key Stakeholders

- Tanzania is the country with the highest **number of stakeholders** related to renewable energies
- In Rwanda and Senegal, **IPPs** stand out as a relevant stakeholders, while in Ghana **universities and R&D centres**, and in Kenya the specialization of some **stakeholders** (Geothermal)

Research & Development

- Generally, R&D activities in the RE sector are **occasional and isolated**
- Kenya is the country with the most **R&D activity in RE technologies**
- Senegal also stands out, thanks to the **University**, which is quite active

33

Develop a joint internationalisation strategy plan

34

Identify and analyse potential target markets

Analyse in depth these target markets

Develop specific market reports

Prioritisation on 5 countries + Exploratory Visits
- Ghana
- Kenya
- Rwanda
- Senegal
- Tanzania

NEXT STEPS

Define an internationalisation strategy plan

Organise direct and reverse missions

Sign Cooperation Agreements with relevant African associations

34

NEXT STEPS

35

ESECA SECOND INTERNATIONAL NETWORKING EVENT
MARCH 22 & 23 2023, GIJÓN, SPAIN

- **NETWORK** with European stakeholders interested in African markets
- **LEARN** about success stories of Asturian companies in the energy sector
- **DISCOVER** programs to support collaborative innovative projects between Europe and Africa

Will follow:
2 Missions in Africa in 2023
2 Missions in Africa in 2024

FINANCIAL SUPPORT AVAILABLE TO PARTICIPATE!

ESECA Africa — European Sustainable Energy Cluster Partnership for Africa

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35

THANK YOU VERY MUCH FOR YOUR ATTENTION!

36

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36