GET.transform
Transforming Energy Sectors Globally

Mozambique Country Window

Energy System Transformation Outlook (ESTO)

GET.transform is supported by

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Sweden
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Ministry of Foreign Affairs of the Netherlands

Austrian Development Agency

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About GET.transform

About GET.transform

European technical assistance programme supporting **national and regional public partners in Africa and Latin America**

- To advance their power sector transformations; and
- To contribute to knowledge sharing and mainstreaming of country and regional experiences.

Long-Term Energy Planning

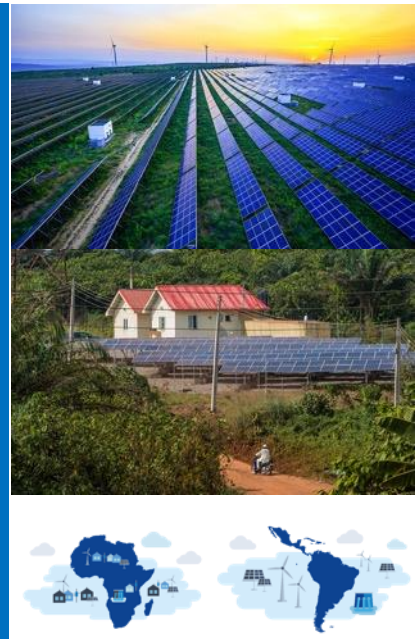
On-Grid Regulation and Market Development

Off-Grid Regulation and Market Development

Renewable Energy Grid Integration

Regulatory and technical ecosystem for power system transformation

Access to sustainable electricity



Our approach to Technical Assistance

Long-term Energy Planning

Developing least-cost, low carbon **capacity expansion and investment plans**, outlining development paths for power generation projects

On-Grid Regulation and Market Development

Supporting **institutional reforms** that allow for new market actors and renewable energy participation: market model design, non-discriminatory grid access, cost-reflective services

Design and management of **solicited auctions** as well as **market-driven mechanisms** for procuring on-grid energy

Off-Grid Regulation and Market Development

Developing **electrification pathways** building on socio-economic development and productive-use policies

Design and management of **award mechanisms** for procuring off-grid energy

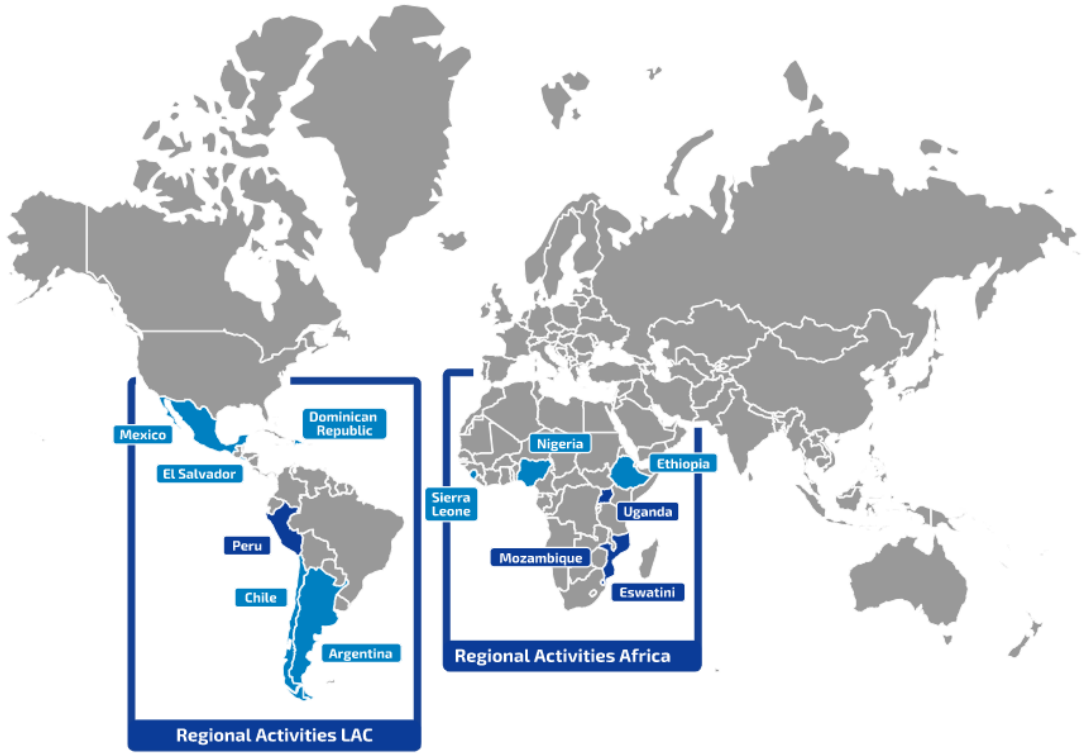
Renewable Energy Grid Integration

Updating of **technical power system planning and operational procedures** that enable the operation of renewable energy dominated power systems

Increased quantity and quality of policies, regulations and processes enabling large-scale investment into renewable energy

Visit our global *Activity Navigator*

Navigate Our Insights



Topics

Long-Term Energy Planning

On-Grid Regulation & Market Development

Off-Grid Regulation & Market Development

Renewable Energy Grid Integration

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Mozambique ESTO

Foreword

The purpose of the Energy System Transformation Outlook (ESTO) is to document a **high-level summary of the electricity landscape** in Mozambique and is the outcome of a high-level overview and assessment that followed a 'review, interview, identify' approach.

The review phase focused on a **desk-top review** of a multitude of publicly available energy and power sector publications.

The interview phase focused on further discussions with the key public sector actors (MIREME, ARENE, FUNAE and EDM) to identify potential needs, opportunities and gaps, and culminated in the **public sector actors formally expressing their key priority needs**.

The identify phase focused on **defining potential technical assistance and capacity building projects** that will strongly support the energy transition in Mozambique, and that GET.transform is well positioned to support. It also provides a starting point for further engagement with the public sector and other donor agencies.

The ESTO is not a prescription of what should be done by the country or the public sector actors.

We welcome feedback to enrich our understanding of the power sector and to align support activities with other donor and development agencies.

Status of Power Sector Transformation in Mozambique

Mozambique has the largest power generation potential in Southern Africa, and is a leading electricity exporter in the region. Total installed capacity currently stands at 2.8 GW and is estimated to reach 6 GW by the next 20 years. The largest power generation plant in the country is the Cahora Bassa hydro dam, operated by the government-owned Hidroeléctrica de Cahora Bassa (HCB). HCB sells 65% of its generation to South Africa, and the remaining 35% is sold to the northern regions of Mozambique and to Zimbabwe. Currently 78% of electricity generated come from Hydro, 16% from natural gas, 4% from fuel oil and 2% from solar. According to the integrated Master Plan for the power sector, Mozambique has the ambition to integrate 30% of its generation from renewables such as wind and solar in the next 20 years.

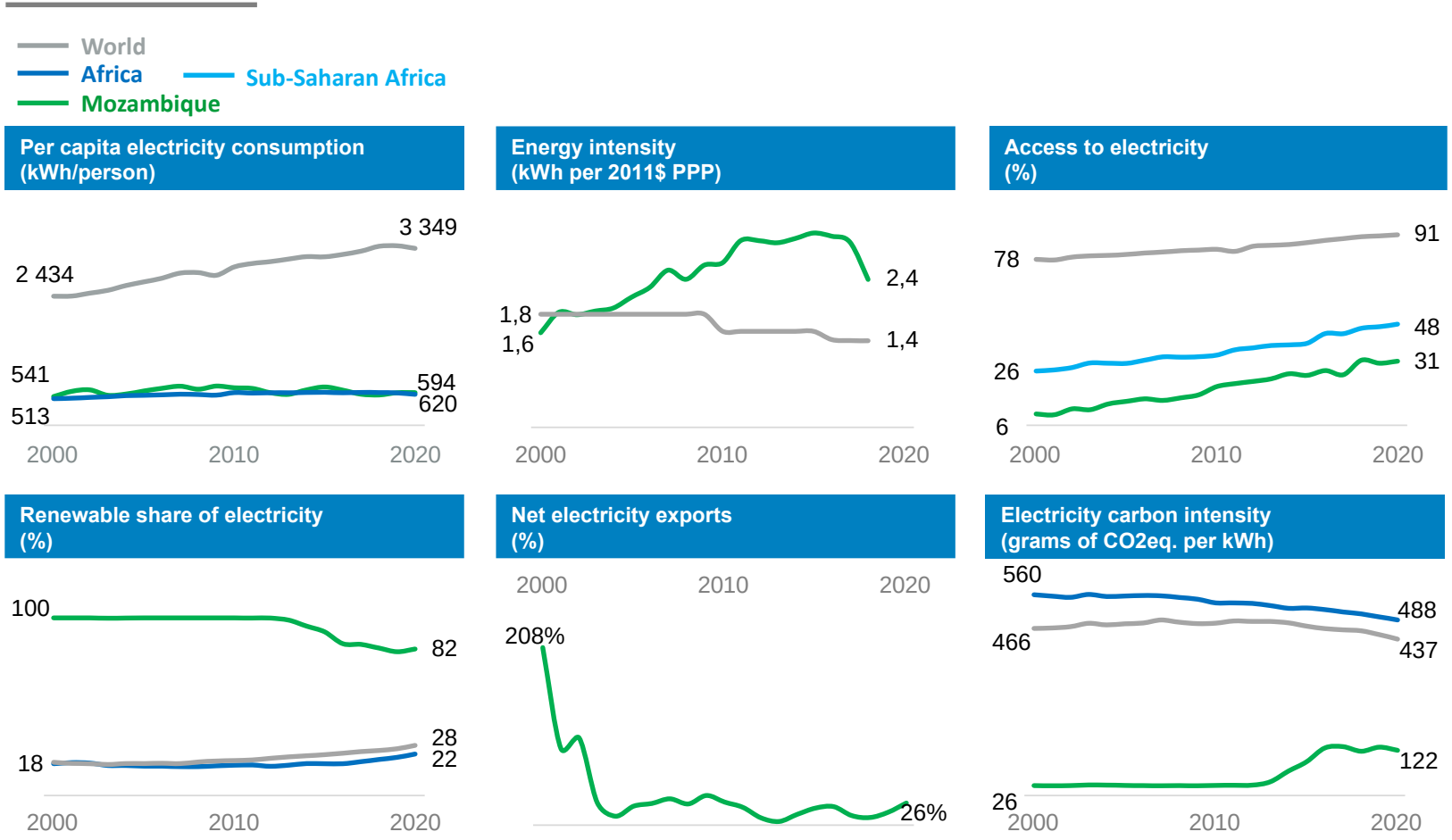
The national electrification rate is currently at 44%, and by 2030 it is expected that universal coverage is reached with 68% grid connected households, 19% via Solar Home Systems and 13% via mini-grids. The recent reform of the sector laws and regulations such as the new electricity law (passed 2022) and Regulation for Access to Energy in off-grid sites (2021) have created an enabling environment for private sector participation in electrification efforts. Challenges continue to exist related to the underdeveloped transmission and distribution network, the lack of fiscal incentives, lack of access to commercial financing at favorable rates as well as last mile distribution difficulties. Donor subsidy and technical assistance programs have filled in the gap by providing support to electrification efforts both by public and private entities.

The first Independent Power Projects (IPPs) in Mozambique came online in 2015. These projects have paved the way for future IPP negotiations and, more recently, auction mechanisms such as PROLER and Get.FiT. A total of 575 MW from 16 RE IPP projects are either developed or in pipeline for execution.

Current gaps that have been identified as the power sector transforms, include: Mechanisms to reduce off-taker risk for IPPs, planning and monitoring capacity for the government (specifically to define off-grid, on-grid and new generation sites), lack of distributed generation legal framework to foster development in this new market segment, solicited bid mechanisms for off-grid generation (similar to on-gird processes such as PROLER and Get.FiT) as well as the update of the Integrated Energy Masterplan since its development in 2017.

Source: GreenLight data 2023

Energy Snapshot



Source: OurWorldInData.org and data.worldbank.org

Source: OurWorldInData.org and data.worldbank.org

Key figures

Economy

Population: 32.08 million (2021)

GDP per capita (current US$): 491.9 (2021)

GDP growth: 2.4% (2021)

Environmental

CO2 emissions: 0.2 metric tons per capita (2019)

Electricity carbon intensity: 122 grams of CO2eq. per kWh (2020)

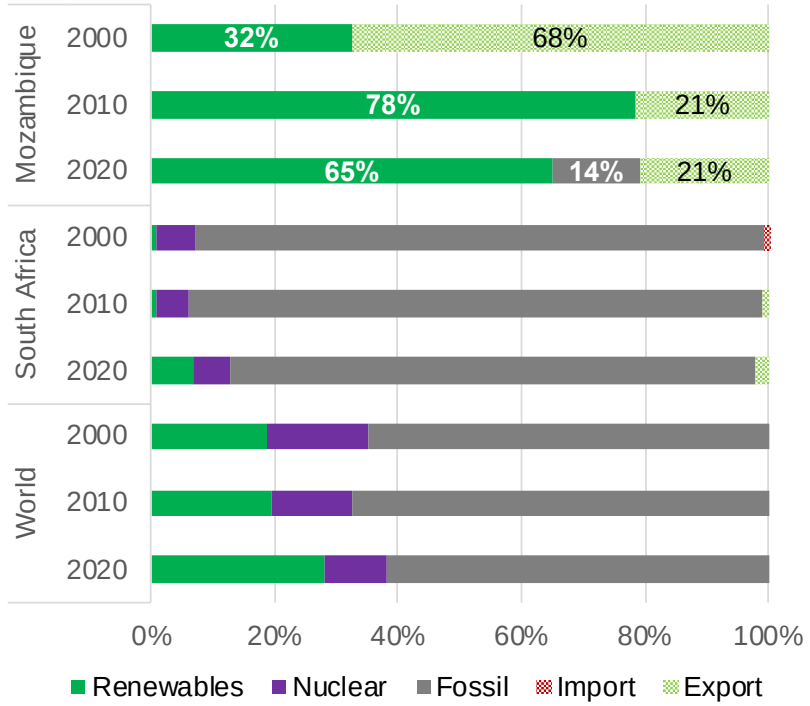
Energy

Per capita electricity consumption (kWh/person): 620 kWh/person (2020)

Access to electricity: 44% (2022)

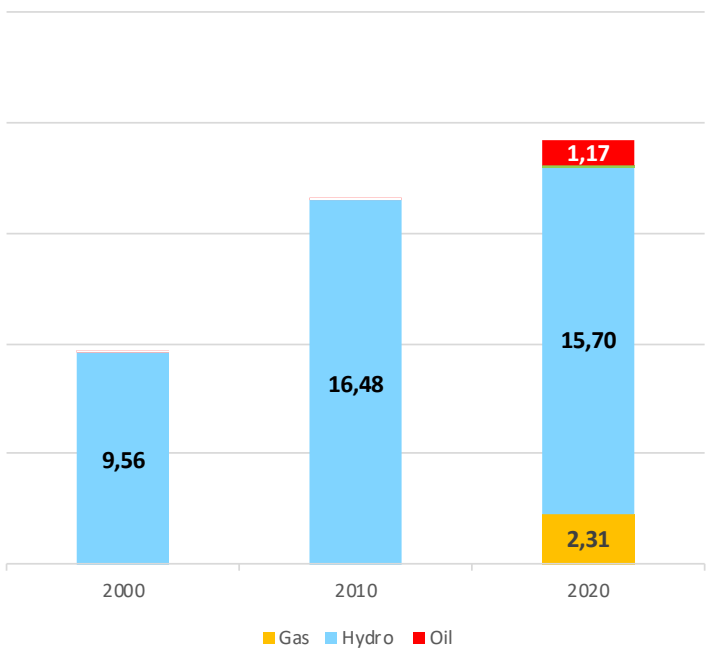
Generation mix & Imports / Exports

Power generation mix + imports/exports 2000-2020 (%)



Source: own elaboration based on OurWorldInData.org

Energy Generation in Mozambique 2000-2020 (TWh)



Key statistics for Eswatini (2021/22)

Key statistics for Mozambique (2021)

Electricity demand: 16.2 TWh

Local generation: 19.91 TWh

Exported energy: 3.67 TWh

Energy generated (2020):

- Hydro – 15.7 TWh
- Gas – 2.31 TWh
- Oil – 1.17 TWh
- Solar – 30 GWh
- Bioenergy – 130 GWh

Key stakeholders in current power supply market

Institution		Description
MIREME	MIREME	Ministry of Mineral Resources and Energy (MIREME) is the Government ministerial entity with oversight of the petroleum, electrical energy and mineral resource sectors including the development and setting of policies and strategies as well as oversight of public companies (such as ENH, EP, EDM, EP) and public regulatory institutions , including INP (Petroleum), ARENE (electricity and petroleum products) and INAMI (mineral resources).
	DNE	National Directorate of Energy; DPC (Dir. Planning and Cooperation) Others: DoE (Dir. of Economy), DNCH (Dir. for Coal and Hydrocarbons), DNPO (Dir. for Planning and Budget, under MEF) National
arene Autoridade Reguladora de Energia	Energy Regulatory Authority (ARENE)	ARENE is the regulatory authority which supervises, regulates, and sanctions electricity supply activity, sets/approves tariffs and prices for electricity, fuels and cooking gas as well as the administration of tenders in these sectors including the tenders under the PROLER and other donor programs.
FUNAE-FP Fundo de Energia	FUNAE Fundo de Energia	FUNAE is public agency responsible for promoting and implementing off-grid energy access and fuels distribution, with focus on Renewable Energy
Electricidade de Moçambique, E.P.	Electricidade de Moçambique, EP (EDM)	EDM is the national vertically integrated public power utility, responsible for generation, transmission distribution and commercialization of electricity in Mozambique. EDM is also responsible for the electrification program of Mozambique and for the Operation, Dispatch and Management of the National Transmission Network (RNT). EDM is subjected to the supervision of MIREME. EDM is governed by the following legislations: /list/
Hidroeléctrica de Cahora Bassa	HCB Other utilities/operators?	Mozambique has three transmission systems for electric energy. HCB (Hidroelectrica de Cahora Bassa): The northern system is fed from Cahora Bassa (Hidroeléctrica de Cahora Bassa, HCB). Manica in the center. Gabinete de Implentacao do Projecto Hirdoelectrico de Mphanda Nkuwa (GMNK) could be also a key SH.
	GSEN	GSEN or the Manager of the National Electricity System was created under Law 21/22 (Electricity Law), but has not yet been formally constituted which requires the approval by the Council of Ministers of its organizational charter. It is the first step in unbundling EDM which until now performs GSEN's functions which include market operation

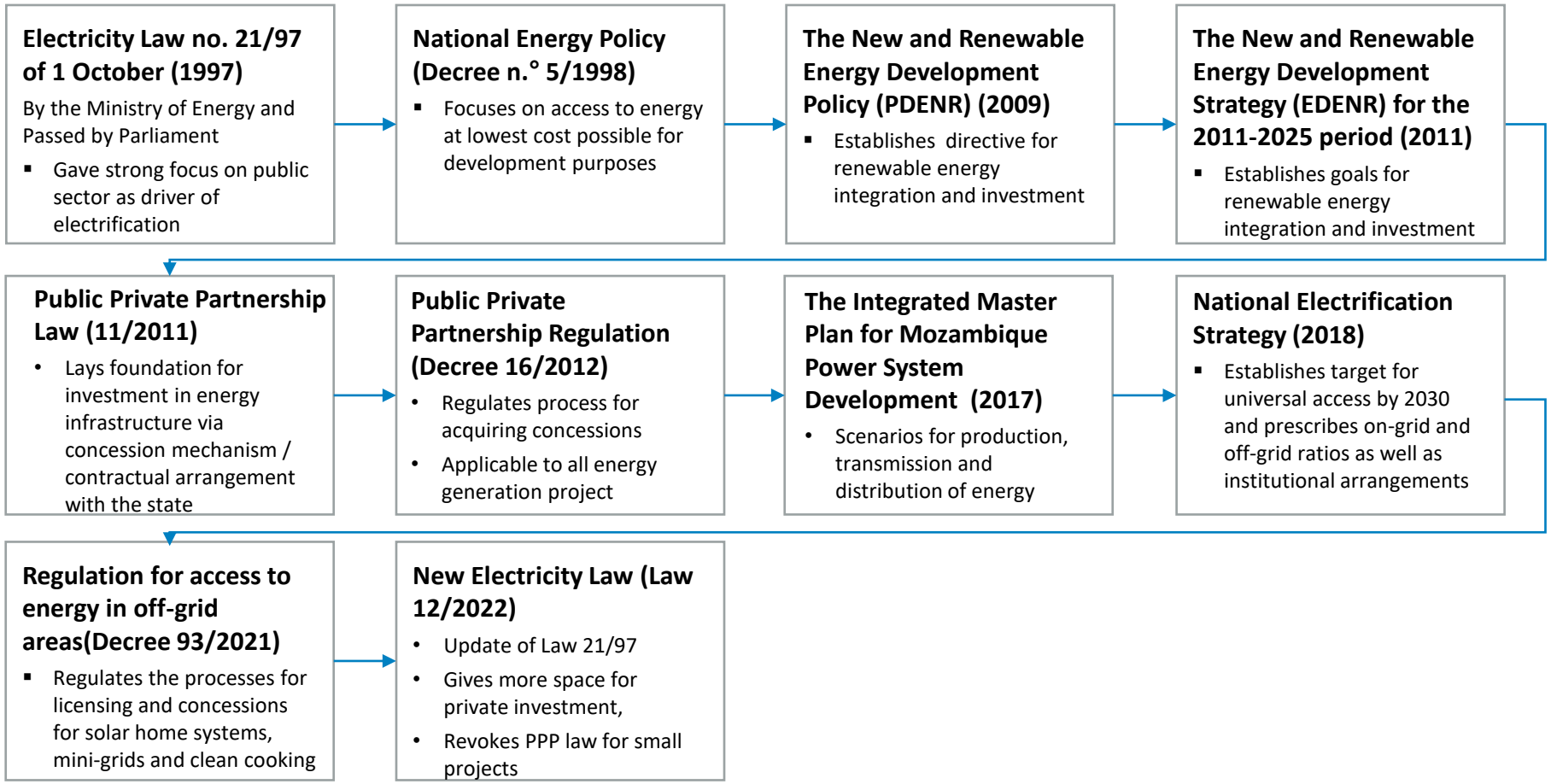
Source: own elaboration based on esera.org.sz and gov.sz

Key stakeholders in current power supply market

Institution		Description
	AMER & ALER	AMER is a national renewal energy association and ALER is a lusophone renewable energy association who are both key actors in the renewable energy sector in Mozambique. The Mozambican Renewable Energy Association (AMER) is a non-profit association whose mission is to promote renewable energy in Mozambique. ALER is a NGDO (Non-Governmental Development Organisation) with the mission to promote renewable energies in portuguese-speaking countries. The Association facilitates business opportunities by supporting the private sector and attracting financing and investment, by liasing with national and international authorities to create a favourable regulatory framework, and by coordinating all stakeholders, acting as a cooperation platform and the common voice of renewable energies in portuguese-speaking countries.
 	**Development Partners**	**EUD** **TAF** **ElectriFi** **GIZ MZ (and programmes under the energy cluster): GET.invest, EnDev, GBE…?** **KfW, GET Fit** **Other bilateral GET.donors: SE, NO, NL, AT** **AfDB** **WB** **SNV/BRILHO** **BE/Enabel** **Energy Sector Working Group → Group composed of diplomatic and donor entities with the purpose of coordination and alignment of programming AMER (currently chaired by SE and AfDB)** **EEP (and their donors?)** **UN**
	**Energy users / customers**	Customer and end energy users (household/private, commercial and industrial/productive), both rural and non, need to be represented in the just transition and their needs/challenges addressed. Academia (engineers and planners of tomorrow) should be captured and involved. Any CSOs relevant for energy/climate mitigation besides ALER/AMER?
	**Private Sector self-generators and/or IPP's**	Key private sector players include _____

Regulation and Energy Policy instruments

Timeline

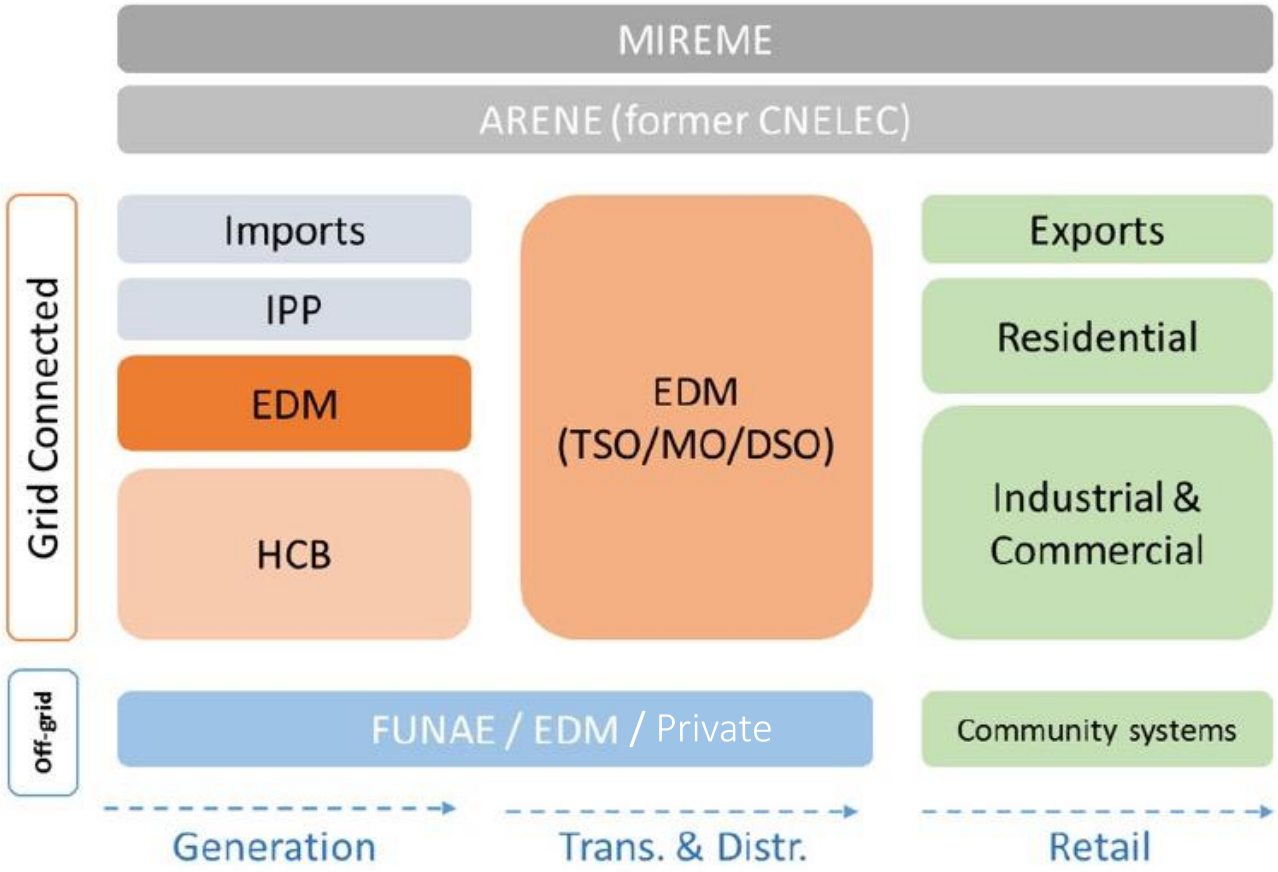


Source: own elaboration (GreenLight 2023)

Key takeaways

- The energy sector in Mozambique has been transforming from a public investment oriented sector (emphasized by the electricity law of 1997) to gradually promoting for private investment in generation for both on-grid and off-grid projects.
- Large scale power generation investments are encouraged to follow a public-private partnership structure (via the PPP law and regulation), while smaller generation projects (such as mini-grids) are now exempt from the application of the PPP law as highlighted in the off-grid energy regulation and the new electricity law approved in 2022.
- The regulatory framework puts a strong emphasis on the diversification of the energy matrix via new and renewable energy sources.
- Currently in process of approval are several specific regulations related to mini-grids such as: Regulation on concessions; Regulation on tariffs, Regulation on interconnection with main grid; Norms and standards as well as environmental and social guidelines.

Institutional and Market structure



MIREME: Ministry of Mineral Resources and Energy; **ARENE**: Energy Regulator; **EDM**: Elecrtricidade de Moçambique (Utility); **HCB**: Hydroelectric Cahora Basa; **IPP**: Independent Power Producers; **TSO**: Transmission Line Operator ; **MO**: Market Operator; **DSO**: Distribution System Operator

Source: National Electrification Strategy & Plan for Universal Access to Energy by 2030

Key takeaways

- The energy sector in Mozambique is supervised by the **Ministry of Mineral Resources and Energy**;
- The **Energy Regulator ARENE** ´s functions extend to Economic Regulation (Tariff-Setting), Technical regulation (Quality of Service), and driving public procurement process for energy concessions.
- The **national utility EDM** acts as the Transmission Line Operator, the Market Operator as well as the Distribution Systems Operator. Power is acquired from imports, IPPS, own production and the largest generator Cahora Bassa Hydro Eclectic Dam. Electricity is retailed to end users or exported in the SADC region.
- **IPPs** have developed projects via solicited bids (such as the PROLER program) or unsolicited application for concessions.
- For off-grid, the **Energy Fund (FUNAE)** has largely been responsible for investing and operating public mini-grids (97 to date) as well as some stand alone systems. EDM too has an off-grid directorate, however no projects have been developed to date. **Private sector** has worked mostly in the solar home system space, with around 5 PAYG operators. With the new off-grid energy regulation there is an enabling environment for private operators of Mini-Grids.

GET.transform framework

	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4
	Long-Term Energy Planning	On-Grid Regulation and Markets	Off-Grid Regulation and Markets	RE Grid Integration
Overarching activities	Capacity Building			
	Knowledge Products			
	Peer to Peer Exchanges			
	Technical Assistance			
Key Topics	Governance	Market Design	Electrification planning	Grid Codes
	Data Inputs	Investments	Stand-alone systems	Interconnection
	Modelling	Economic Regulation	Mini grids	Regional integration
	NDC Integration	Tariff Design	Business Models & Finan.	Flexibility

State of play

Long-term Energy Planning	On-grid Markets & Regulation	Off-grid Markets & Regulation	RE Grid Integration	Challenges & Opportunities
Integrated Energy Masterplan (2018-2043) The document formulates a comprehensive "National power system development master plan" for 25 years including power generation, transmission and distribution planning. The plan covers the entire supply chain: US$18bn is to be spent on upgrading energy generation, US$9bn on transmission and US$7bn on distribution. The plan forecasts a rise in installed generation capacity from existing levels of 2.6 GW to 17.7 GW by the time it expires. Of around 15 GW of capacity to be installed, 8.5 GW is forecast to be gas-fired generation. A mix of hydro (4.3 GW), coal (1.4 GW), solar (530 MW) and wind (150 MW) will provide the rest. **National Electrification Strategy (NES)** Encompassing both grid and off-grid solutions to achieve universal access to energy. NES funding requirements are USD 540 million annually. Electricity connections will need to ramp up from 165,000 a year in 2018 to 350,000 in 2020 and to 590,000 on average between 2025 and 2030 to achieve universal access by 2030, with an estimated investment of USD 6.5 billion. It is expected that 70% of the population will be connected to the grid while 30% will be provided with off-grid energy solutions. **Off-grid energy roadmap 2020-2030** Provides an Off-Grid Strategy in Support of Achieving Universal Access in Mozambique by 2030. It is estimated that approximately 7.2 million SHS will be deployed in Mozambique through 2030 with an investment of USD 1.8B. 13% of households in the country are expected to be connected via mini-grids and 19% via solar home systems.	❑ There is a need to **strengthen the planning capacity of MIREME**. The ministry has a lack of integrated planning and coordination; lack of criteria for prioritizing projects; and a need **to better coordinate activities between EDM and FUNAE**. This can be delivered via short term trainings, embedded support or software to facilitate planning and forecast energy needs/projects and priorities. ❑ There is a need to perform **a strategic environmental assessment** of the energy sector as a means to prioritize projects and develop a **clear strategy for development of the sector (environmental integrity).** ❑ There is a need to **update the Integrated Energy Masterplan** adopting a more integrated approach, introducing new project and projections since the last version was made in 2017, and updating the on-gird/off-grid areas ❑ There is a need **to transform the NES to a national electrification plan** (NEP) with clear targets, timelines, roles and responsibilities. ❑ The off-grid energy roadmap focuses most analysis on SHS. There is a **need to assess the investment requirement and investment plan for mini-grids** as well.		• Several programs are supporting MIREME with energy planning (most notably EU-ERC and Enabel), however the results are not visible yet. • Opportunity to develop **synergies with existing program such as EU-ERC** to provide short term technical assistance in specific outputs needed for **long term planning** (update of Integrated **Energy Masterplan**; development of a **National Electrification Plan**; A strategic **Environmental Assessment for the energy sector**, etc)

State of play

Long-term Energy Planning	On-grid Markets & Regulation	Off-grid Markets & Regulation	RE Grid Integration	Challenges & Opportunities
THE NEW ELECTRICITY LAW (NEL): The NEL's objective is to accelerate universal access and to promote competitiveness, efficiency and sustainability of and investment in power supply activities. The law takes account of the need to adjust the legal framework for the Mozambican power sector to the technological and financial evolution and the new sources of energy. It addresses the constraints and barriers regarding private investment and refers new policy and strategy documents prepared by the Government of Mozambique (GoM) such as the National Electrification Strategy. Among other reforms the NEL: (i) Revokes the application of the PPP law to smaller energy sector projects with the aim of reducing the period required for getting concessions and licenses significantly (ii)Simplifies the private investment procedures and clarifies taxes in order to make the Law coherent with NES (iii) Covers all needed regulations and administrative procedures in order to guarantee competitiveness, transparency, non-discrimination and predictability for private investment into power generation (iv) Caters for the restructuring of the power sector by underlining EDM's responsibility for transmission and distribution and the significance of independent power producers (IPPs) for power generation.	❑ There is a need to clearly **define fiscal incentives for IPPs**, **and simplify investment procedures** for developers (including exchange control and repatriation of funds) ❑ Continuous **support for government (ARENE) to** evaluate both solicited and unsolicited **proposals for IPP concessions**, as well as to develop more efficient **procurement processes**. ❑ **Distributed Generation is not yet regulated** in Mozambique. It features in the NEL as a sub-sector which still needs to be regulated. ❑ **Support the utility and regulator with tariff setting** study as a means to reach objective of cost reflective tariffs ❑ **Support EDM with a regional trade strategy** (SAPP energy market trade optimization) ❑ Assessment on quality of **service performance of the utility** to develop a **quality of service** strategy /regulation (EDM / ARENE) ❑ Develop a quality of service **code for on-grid** (EDM / ARENE)			• Several programs are already supporting on-grid markets and regulations such as AFD (via PROLER), EU (via ERC), AfDB via SEFA and KfW/SIDA (via NCC). • Gap is identified for **support with Distributed Generation (DG),** as no other program is covering this topic. DG is referenced in the NEL **and is a priority to regulate (including viability studies)**.

State of play

Long-term Energy Planning	On-grid Markets & Regulation	Off-grid Markets & Regulation	RE Grid Integration	Challenges & Opportunities
Regulation for access to energy in off-grid areas (decree 93/21) aims to create a positive environment for development of the off-grid energy projects such as mini-grids and solar-home systems. The regulation gives clear procedures for private investment in the sector. The main regulation is supported by more specific regulations that cover tariffs, interconnections with the national grid, norms and standards, environmental and social aspects, concessions, and registration of mini-grids and energy services.		❑ Support with geospatial **mapping of off-grid location and priority projects** is important. This information is critical for off-grid electrification planning purposes and attracting investment; ❑ The regulatory framework has already been established; however, it is important to **support the government in the implementation of this framework** (granting concessions, revising proposals and tariffs, monitoring of projects, etc) ❑ To reach targets of 13% of population electrified by mini-grids, it is necessary to **launch an ambitious procurement program** to attract investment for priority sites. The government requires a similar process used in on-grid projects (PROLER) which can be applicable to the context of off-grid. ❑ Support is required for **assessing the initial viability of selected off-grid locations** for mini-grid projects. This requires pre-feasibility studies to understand which needs to be the installed capacity, number of connections, types of connections (commercial, domestic, industrial) and estimated investment cost. This information is used **to prepare a possible tender** for the selected sites. ❑ **E-waste management strategy and supporting regulation for off-grid sector** (specifically focused on SHS components) is essential and not yet developed.	• Learn from the experience of PROLER (on-grid auction mechanism) and **develop a mini-grid tender mechanism** with a similar structure. → ongoing TA support by GET.transform, two-phased approach: design, piloting implementation incl. review • Support the government with technical **assistance to implement the practical administrative steps** as per the new regulation for access to energy in off-grid areas. • **Continued technical assistance with the tariff tool** (developed by GET.transform) will be needed as proposals (whether solicited or unsolicited) for mini-grids are received by ARENE.

State of play

Long-term Energy Planning	On-grid Markets & Regulation	Off-grid Markets & Regulation	RE Grid Integration	Challenges & Opportunities
According to the "Integrated Master Plan Mozambique Power System Development", of the 6,000 MW additionally installed capacities over the next 25 years, 30% that are generated come from RE such as solar and wind (10% for domestic power supply = 600 MW; 20% for regional consumption = 1,200 MW). Hydro energy will continue to play a leading role with existing Cahora Basa installed capacity and new generation from Mphanda Nkuwa, Cahora Bassa North, Lupata and Boroma (totaling 3,600 MW). The rest is projected to be fed by nationally explored natural gas. EDM has a directorate for RE and energy efficiency in order to dedicate itself exclusively to topics related to renewable energies. It is currently leading the renewable energy auction program (PROLER) launching 3 solar IPPs and 1 wind project as a means to integrate renewables into the grid. Similarly, the Get.fit program is to provide a top-up finance mechanism to plug in additional RE generation capacity. The National Energy Control and Dispatch Center (NCC) financed by KfW and Sweden will further contribute to the integration of RE into the grid due to automatic balancing of energy supply and demand.			❑ **Develop a standard for grid integration** for Embedded Generation (EG) ❑ Develop regulatory framework for **Energy Storage Systems** ❑ **Capacity Building on Renewable Energy Integration** ❑ Capacitation on **combined demand/load forecasting** with generation	• Collaboration with EDM is essential • Synergies with the National Control Center (NCC) project and capacity building will be important

Technical assistance requests from stakeholders

Ministry of Mineral Resources and Energy

- Support with the update of the Integrated Energy Masterplan;
- Support to develop an energy transition strategy for Mozambique;
- Capacity building in planning - possibly through the development of a National Electrification Plan (based on the National Electrification Strategy);
- Support in regulatory provisions for the implementation of the National Electrification Strategy
- Support with a digital platform for off-grid and on-grid project mapping, monitoring and planning purposes;
- Support with the development of a Mini-Grid Tender Mechanism (to be driven by ARENE)
- Support in Mini-grid site identification, mapping and planning for new sites
- Support with Distributed Generation regulations, training and capacity building;
- Support with energy efficiency regulation, training and capacity building
- Support to elaborate on energy sector NDCs

Mozambique Electricity Company (EDM)

- Request to be involved in the Mini-Grid Tender Mechanisms design process
- Support with training and capacity building for Distributed Generation;
- Request to participate in international exchange with peer utilities to learn from best practices.

Mozambique Energy Regulatory Authority (ARENE)

- Continued support and capacity building on the mini-grid tariff tool;
- Support to develop a Mini-Grid Tender Mechanism to be used by ARENE;
- Technical Assistance to implement the Mini-Grid Tender Mechanism;
- Support with Distributed generation regulatory frameworks, capacity building and training:
- Develop ad white paper on Distributed Generation

Mozambique Energy Fund (FUNAE)

- Request to be involved in the Mini-Grid Tender Mechanism development process;
- Request to consider compatibility of the Mini-Grid Tender Mechanism and existing FUNAE Mini-Grid procurement processes.;
- Support to explore private sector management models for existing publicly funded mini-grids and possible role of the mini-grid tender mechanism to incorporate existing FUNAE mini-grids in the “cluster of sites” for private sector operation.

3
Next steps

Key next steps

2023

- ❑ Draft ESTO MZ with key partners
- ❑ Develop/update country specific workplan until 2026
- ❑ Present ESTO and workplan MZ to partners for input and 2023 finalization

2023-2026

- ❑ Update and review of ESTO 1x yearly and/or ad-hoc
- ❑ Develop regional ESTO design
- ❑ Regional coordinators fill out regional ESTO