



# COUNTRY PRIORITY PLAN AND DIAGNOSTIC OF THE ELECTRICITY SECTOR

## Mozambique





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# Abbreviations

<b>AEMP</b>	Africa Energy Market Place
<b>AFD</b>	Agence Française de Développement
<b>AfDB</b>	African Development Bank
<b>ALER</b>	Lusophone Renewable Energy Association (Associação Lusófona de Energias Renováveis)
<b>AMER</b>	Mozambican Renewable Energy (Associação Moçambicana de Energias Renováveis)
<b>ARENE</b>	Agencia Reguladora de Energia (Regulatory Agency for Energy)
<b>CAGR</b>	Compound Annual Growth Rate
<b>CCS</b>	Clean Cooking Solutions
<b>CENELEC</b>	Conselho Nacional de Electricidade
<b>CPP</b>	Country Priority Plan
<b>FCDO</b>	Department for International Development - UK.GOV
<b>DNER</b>	National Directorate of New and Renewable Energy
<b>DSO</b>	Distribution System Operator
<b>DTCE</b>	Division of transport centre
<b>DTCN</b>	Division of transport North
<b>DTSU</b>	Division of transport South
<b>EAPP</b>	Eastern Africa Power Pool
<b>EDM</b>	Electricidade de Moçambique
<b>ELSGAPI</b>	Enabling Large Scale Gas and Power Investments
<b>Enabel</b>	Belgian Development Agency
<b>ERI</b>	Electricity Regulatory Index
<b>EU</b>	European Union
<b>ESKOM</b>	The national electricity utility in South Africa
<b>FUNAE</b>	Fundo de Energia
<b>GNP</b>	Gross National Product
<b>GoM</b>	Government of Mozambique
<b>GW</b>	Gigawatt
<b>GWh</b>	Gigawatt Hour
<b>HCB</b>	Hidroeléctrica de Cahora Bassa
<b>IDA</b>	International Development Association
<b>IEA</b>	International Energy Agency
<b>IFC</b>	International Finance Corporation
<b>IHA</b>	International Hydropower Association
<b>IPP</b>	Independent Power Producer
<b>KfW</b>	Kreditanstalt für Wiederaufbau (German Development Bank)
<b>km</b>	Kilometer
<b>kV</b>	Kilovolts
<b>kVA</b>	Kilovolt-amps
<b>kWh</b>	Kilowatt Hour
<b>LNG</b>	Liquefied Natural Gas

<b>MIREME</b>	Ministério de Recursos Minerais e Energia (Ministry of Mineral Resources and Energy)
<b>MO</b>	Market Operator
<b>MOTRACO</b>	The Mozambique Transmission Company - joint venture of Mozambique Electricity (EDM) , Eskom Holdings Limited ( Eskom ) and Swaziland Electricity Company (SEC)
<b>MOZAL</b>	Aluminium Smelter
<b>MW</b>	Megawatt
<b>MWh</b>	Megawatt Hour
<b>MZN</b>	Metical
<b>NESP</b>	National Electrification Strategy and Plan
<b>OGS</b>	Off-Grid solar Sector
<b>PAYGO</b>	Pay-As-You-Go
<b>PPA</b>	Power Purchase Agreement
<b>PPP</b>	Public Private Partnership
<b>PROENERGIA</b>	Mozambique Energy for All Project (Projecto Energia para Todos)
<b>PROLER</b>	Promoção de Leilões de Energias Renováveis (Promotion of Renewable Energy Auction)
<b>PV</b>	Photovoltaic
<b>RBF</b>	Results-Based Financing
<b>RE</b>	Renewable Energy
<b>RERD</b>	Liquefied Natural Gas
<b>RES</b>	Renewable Energy Sources
<b>SAIDI</b>	System Average Interruption Duration Index
<b>SAIFI</b>	System Average Interruption Frequency Index
<b>SAPP</b>	Southern African Power Pool
<b>SHS</b>	Solar Home Systems
<b>SIDA</b>	Swedish International Development Cooperation Agency
<b>TANESCO</b>	Tanzania Electric Supply Company Limited
<b>TBI</b>	Tony Blair Institute for Global Change
<b>T&amp;D</b>	Transmission & Distribution
<b>TA</b>	Technical Assistance
<b>TSO</b>	Transmission System Operator
<b>USAID</b>	U.S. Agency for International Development
<b>USD</b>	United States Dollar
<b>VAT</b>	Value Added Tax
<b>VRE</b>	Variable Renewable Energy
<b>WB</b>	World Bank



# Purpose of this document

The **Mozambique Country Priority Plan** (“CPP”) will be the reference document adopted by the Government of Mozambique (“GoM”) and the African Development Bank (“AfDB”) to summarize the priority reforms and projects that will be presented during the fifth edition of the Africa Energy Market Place (“AEMP”).

The AEMP is a flagship AfDB forum that is held every year and to showcase investment opportunities in the energy sector of selected African countries and facilitate dialogue on key policy and regulatory challenges. AEMP is an output focused event which leverages AfDB’s convening power to bring together the public and private sector along with development partners to propose solutions and advance funding to deliver priority investments and reforms.

In preparation for this event, the AfDB have asked the Tony Blair Institute for Global Change (“TBI”) to coordinate the development of Priority Plans for the selected countries. These plans consist of two parts:

1. The **identification of AEMP Priorities** (investments and reforms) to be advanced through the AEMP process.
2. A **Sector Diagnostic** providing background on the sector including statistics, successes and challenges to ensure a common understanding across AEMP participants and provide for richer dialogue during the AEMP event.







# Executive Summary

In 2021, only 40% of the population in Mozambique (36% on grid and 4% off grid) has access to electricity. Mozambique has set significant targets for the development of its electricity sector: at least 2,300 MW of new installed capacity by 2030 and about 5 million new connections, both on grid and off grid, to achieve universal access to electricity by 2030. Mozambique's pipeline of generation projects will bring the installed capacity above that which is necessary for domestic consumption. The Mphanda Nkuwa dam alone would suffice. The country's strategy is to leverage its endowment of low-cost energy resources to reinforce its position of regional power exporter. To do so, the GoM and EDM must be prepared and invest in the necessary infrastructure that ensure the availability of quality and reliable energy supply necessary to meet the expected demand, as well as improve operational capacity and the respective legal and regulatory frameworks so they are aligned and contribute for the sector strategic goals. Considering the planned energy surplus, it will be equally important to define a power energy trade approach that does not harm security of supply and that contributes to the financial sustainability of the sector.

At the AEMP, the GoM and EDM present a list of priority projects to achieve the ambitious policy objectives, and the key reforms that will facilitate their execution.

- On the supply side, the **Mphanda Nkuwa** hydro power plant is the key priority. The overall cost of the dam is estimated in the range of 4.5 billion USD and the GoM are committed to identifying a developer and financiers in a transparent and competitive manner. AEMP could be a forum for market sounding on strategic aspects of the project (such as approach to financing the required transmission investment), strategic aspects, bankability issues, investment regime or the risk allocation and procurement approach.

At this stage the GoM is also looking for technical assistance to launch a transaction advisory support to advance the project to the next stage.

- As for **Transmission & Distribution, three main HV lines have been identified**, that will contribute to integrate the Mozambique transmission system and allow for a deeper integration of the country into the SAPP delivering wider regional benefits. The overall cost of these infrastructure is estimated at around USD335M. **A new dispatch centre is also required. The GoM has already identified 45 of the 60 m USD necessary for the project and counts on the AEMP for completing the envelope.**
- To achieve the ambitious target of universal access to electricity by 2030, the GoM will use AEMP to dialogue around targets and galvanise further support to the Energy for All electrification program; In 2019 GoM launched Proenergia program, which aimed to increase energy access and meet the UN goal number 7 of providing universal access to electricity by 2030 through on grid and off grid solutions. This program was granted in a first stage (Proenergia 1) with US\$82M from the World Bank and US\$62M from a Multi-Donor Trust Fund administered by the World Bank and financed by Sweden, Norway and the EU. Today, Proenergia 2, is under approval phase. The program will grant on the following components USD110M to support on-grid electrification plus USD35M for off-grid electricity access and clean cooking solutions.
- Finally, the GoM is aware of the need of **structural reforms** with the main target of enhancing the **financial and operational performance of the sector** to transition away from subsidies and help attract capital required to the sector. For these reasons,

the GoM would like to use AEMP to present and consult on its plans to **reform the sector** through: i) Institutional Reform to establish a fully Independent National Power System Managing Entity (to perform market and transmission operator functions, which in an initial stage will remain under EDM responsibility), ii) Clarifying the Power System Operator role, particularly with respect to regional power trade and the envisaged path to financial sustainability of EDM.

In tandem with these reforms, the Government of Mozambique would like to take measures to ensure that all future investment in the sector

is undertaken in a **coordinated and least cost manner**. These measures will include: i) the clarity of roles and responsibilities with regard to planning and procurement and the **establishment of a new Integrated electrification planning and coordination unit**; ii) an **update of the Electrical Infrastructure Master Plan** including developing national capacity for its continuous refinement. A key part of the masterplan update will be a **re-evaluation of the planned investments in coal generation** both that it remains a least cost option and how it aligns with the country NDC plans and targets ; and iii) support the implementation of the renewable energy auctions programme (Proler)".



# SECTION 1: Country Priority Plan



# Country Priority Plan

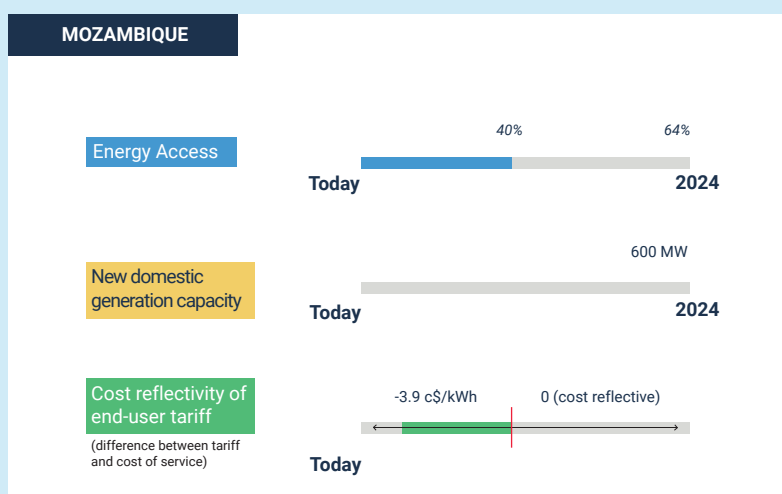
## Government strategies and targets

The GoM has an overarching National Strategy that guides all development policies and decisions, that was adopted in 2015: National Development Strategy for 2015-2035 (2015). At the energy sector level, the GoM currently has adopted the following strategies:

- Biofuels Policy and Strategy (2009)
- New and Renewable Energy Development Strategy for the 2011-2025 (2011)
- National Determined Contribution
- National Electrification Strategy (2017)
- Electrical Infrastructure Integrated Master Plan 2018-2043.

The main policy objectives - and their current progress as of today until 2024 - are reported in the following chart:

FIGURE 1 - MOZAMBIQUE POLICY TARGETS



Source: TBI

More in detail:

- **Energy Access:** The GoM aims at achieving universal access (100%) by 2030, 70% through grid connected systems and 30% off-grid. Intermediate targets specific for this mandate (2020-2024) are:
  - a. Achieve 64% of access rate by 2024
  - b. Connect 1.5 million Mozambicans through off-grid systems until 2024
- **Increase generation capacity** by 600 MW, whereby 200 MW is variable renewable energy (solar and wind) and the remaining 400 MW are from Temane Gas Combined Cycle powerplant **Variable RES Generation:** 20% of the generation mix from solar and wind by 2040
- **Financial Viability:** The GoM wants to reach the cost reflective tariff for grid consumers.
- **Emission Abatement:** In Mozambique's latest Nationally Defined contribution (NDC) submitted in 2018, the country committed to reduce its emissions by 76.5 MtCO<sub>2</sub>eq between 2020 and 2030, with respect to its baseline emission scenario. To achieve this ambitious goal, the country will require significant financial assistance and technology transfers from its financial and technical partners.



# Proposed priorities for discussion at AEMP

The table below sets out in detail the reforms and enabling environment activities along with specific Investments. It is proposed are advanced through the AEMP process. It is on these proposals we are specifically seeking feedback..

#	Project and importance	Objective of AEMP presentation
Reforms and enabling environment		
1	<p><b>Address planning issues through the update of the Integrated Master Plan and capacity building.</b></p> <p>The government of Mozambique has established two fundamental goals in the electricity sector, to provide access to energy for the entire population by 2030 and to become an energy hub in the SSA region. To achieve those targets, it is crucial to update the least cost masterplan covering the whole electricity value chain and both on and off-grid electrification. In the same line the Government needs to build internal planning capacity in order to coordinate and closely monitor the progress of the ambitious national electrification program to meet the intermediate targets that will lead to the 2030 goal.</p> <p>Address legal and regulatory issues to attract more private sector participation.</p>	<p>Policy dialogue on:</p> <ul style="list-style-type: none"> <li>• Optimal institutional arrangements to link planning to procurement.</li> <li>• Balancing global climate needs with Mozambique's needs to develop with a focus on Issues such as Mozambique's right to develop Its gas resources and effective use of climate finance.</li> </ul> <p>Secure funding for:</p> <ul style="list-style-type: none"> <li>• Integrated Least Cost Masterplan - 2 m USD;</li> <li>• Establishment of integrated planning unit - 5 m USD;</li> <li>• Clean Cooking Results Based Finance Program from the Government – 15 m USD.</li> </ul> <p>Policy dialogue on:</p> <ul style="list-style-type: none"> <li>• Discuss the major legal and regulatory challenges that contribute to the low participation of the private sector in the sector.</li> <li>• Legal and regulatory reforms/ transformations needed to attract private sector</li> <li>• Legal and regulatory Challenges to achieve 100% access by 2030</li> </ul>



#	Project and importance	Objective of AEMP presentation
2	<p><b>Improvement of EDG Financial Performance.</b></p> <p>Improving EDM's Financial performance is essential for the reform and sustainability of the electricity sector in Mozambique.</p>	<p>Policy dialogue on:</p> <ul style="list-style-type: none"> <li>• Restructuring utility expensive short-term commercial debt – assess different options;</li> <li>• How to mitigate the rapid electrification program's impact on the utility's financial performance along with how to manage the risks and opportunities of captive solar generation;</li> <li>• How to tackle commercial losses? (collection, commercial systems.</li> </ul> <p>Secure funding for a commercial loss reduction Program:</p> <ul style="list-style-type: none"> <li>• Measuring theft/illegal connections</li> <li>• Increase revenue collection</li> <li>• Improve commercial systems.</li> </ul>
3	<p><b>Power Sector Institutional Reforms.</b></p> <p>Introduce a progressive institutional sector reform to establish the National Power System Managing Entity EDM will temporarily keep these functions.</p>	<p>Policy dialogue on:</p> <ul style="list-style-type: none"> <li>• How to define a progressive institutional sector reform to establish the Power System Operator Benefits of establishing a National Power System Managing entity and perimeter of activity</li> </ul> <p>Secure Funding for:</p> <ul style="list-style-type: none"> <li>• Implementing separation of accounts (generation, transmission, and distribution);</li> <li>• The remaining 15 musd to build the national dispatch center.</li> </ul>

#	Project and importance	Objective of AEMP presentation
Generation Projects		
4	<p><b>Mphanda Nkuwa 1,500 MW Hydro Project.</b></p> <p>The Project will increase the power available in the SAPP by 1,500 MW, benefiting both the domestic market and countries in the region with sustainable and reliable baseload power to match with the national and regional demand forecasts.</p>	<p>Policy Dialogue on:</p> <ul style="list-style-type: none"> <li>• A “market sounding” on strategic questions such as approach to transmission finance, risk allocation, key bankability issues and proposed procurement approach</li> <li>• Mphanda Nkuwa role in stimulating the regional trade and in decarbonizing the regional power system</li> <li>• Large hydro roles in powering a green industrialization in Africa</li> <li>• Hydro Environmental and Social Sustainability Tools/Standards.</li> </ul> <p>Secure funding for:</p> <ul style="list-style-type: none"> <li>• Mphanda Nkuwa Transaction Advisor Support</li> </ul>
5	<p><b>Tsate 50MW Hydro project.</b></p> <p>Increase Generation Capacity to strengthen the energy supply availability and the central system stability in the Beira corridor, and to reduce the interrupted power supply (Matambo-Catandica-Chibata)</p>	<p>Policy Dialogue on:</p> <ul style="list-style-type: none"> <li>• Optimal approach to project development.</li> </ul> <p>Secure funding for:</p> <ul style="list-style-type: none"> <li>• Tsate 50MW – 250 m USD funding (grants, concessional funding)</li> </ul>

#	Project and importance	Objective of AEMP presentation
HV Transmission Projects		
6	<p><b>400 kv High Voltage Transmissison Line Chimura – Nacala (Phase II).</b></p> <p>Project aiming to increase power transmission capacity, grid stability and reliability, and redundancy in the northern and central regions; and to allow the interconnection of new generation projects in Zambézia, Nampula and Niassa provinces.</p> <p><b>Status:</b> Feasibility and Technical studies concluded.</p>	<p>Policy Dialogue on:</p> <ul style="list-style-type: none"> <li>The scope for private sector investment and the role of the Regional Interconnections to boost SAPP energy market and in the regional integration process.</li> </ul> <p>Secure funding for:</p> <ul style="list-style-type: none"> <li>160 m USD (grants / concessional funding)</li> </ul>
7	<p><b>110 kv High Voltage Transmission Line Nampula – Angoche.</b></p> <p>The project will increase the northern system reliability, and the power availability to Angoche District to enhance the connection of new customers under Energy for All programme as well as, supply mining and fisheries projects.</p> <p><b>Status:</b> Feasibility and Technical studies concluded.</p>	<p>Policy Dialogue on:</p> <ul style="list-style-type: none"> <li>The scope for private sector investment and the role of the Regional Interconnections to boost SAPP energy market and in the regional integration process.</li> </ul> <p>Secure funding for:</p> <ul style="list-style-type: none"> <li>55 m USD (grants / concessional funding)</li> </ul>
8	<p><b>400kv High Voltage Transmission Line Songo - Matambo - Phase II).</b></p> <p>The project will contribute to increasing the power availability and reliability transported to Malawi, contributing to the regional interconnection.</p> <p><b>Status:</b> Feasibility and Technical studies concluded.</p>	<p>Policy Dialogue on:</p> <ul style="list-style-type: none"> <li>The scope for private sector investment and the role of the Regional Interconnections to boost SAPP energy market and in the regional integration process.</li> </ul> <p>Secure funding for:</p> <ul style="list-style-type: none"> <li>120 m USD (grants / concessional funding)</li> </ul>

#	Project and importance	Objective of AEMP presentation
9	<p><b>National Dispatch Centre and ancillary services market.</b></p> <p>As the Mozambique electricity market is developing, the management of the system will be more complex and EDM will need to rely on a modern dispatching centre to ensure its stability. In addition, with the further integration in the SAPP, there will be a need to adhere to regional regulation and a forthcoming ancillary services market.</p>	<p>Policy Dialogue on:</p> <ul style="list-style-type: none"> <li>• Requisite to impose to the new power plants to ensure the participation to the future ancillary service market</li> <li>• Integration of Mozambique in the wider SAPP market and how to perform ancillary services.</li> </ul> <p>Secure funding for:</p> <ul style="list-style-type: none"> <li>• Build the national dispatch centre (15 m USD)</li> <li>• Capacity building for EDM to manage the Dispatching Centre and ancillary services.</li> </ul>
<b>National Electrification Programme “Energy for All”</b>		
10	<p><b>On-Grid Electrification.</b></p> <p>Contribute to the intermediate on-grid electrification targets contained in the National Electrification Strategy in particularly achieve the 450.000 new connections/year that will allow compliance with the Government intermediate access rate target of 64% by 2024.</p>	<p>Policy Dialogue on:</p> <ul style="list-style-type: none"> <li>• How to unlock more funding to meet the Universal Access 2030 target</li> <li>• The transformative power of gas: The role of gas in the Universal Access 2030 goal (in electrification and as a clean cooking source), as an enabler of variable renewable energy in the energy mix and in fighting deforestation.</li> <li>• Secure funding for:</li> <li>• ProEnergia 2: 1,076 m USD (total), of which 222 m USD were already mobilized;</li> <li>• Design and implementation of electrification RBF programmes;</li> <li>• Electrifying the remaining on-grid Administrative Posts.</li> </ul>

Each of these priorities has been assessed for the Impact It will deliver and the time It will take to deliver this Impact In the table on the following page. This is intended to facilitate further prioritization conversations. A long list of potential capital investments and their current status along with the potential sector reforms Is set out in the annex.

#	Project and importance	Objective of AEMP presentation
National Electrification Programme “Energy for All”		
11	<p><b>Off-Grid Electrification.</b></p> <p>Contribute to the achievement of universal access, as 30% of new connections by 2030 are expected to be off-grid; By 2030 the Government needs to mobilize additional resources to connect 1,800,000 new households, representing approximately 9,000,000 people through solar home systems and mini grids. FUNAE and the World Bank will establish a Financing facility to launch Government RBF programs for SHS and clean cooking solutions. On the side of the mini grids, ARENE is working on the studies of the Tariff schemes and the concessions.</p>	<p>Policy Dialogue on:</p> <ul style="list-style-type: none"> <li>• Off-grid roadmap and regulation to unlock the potential of off-grid electrification</li> <li>• The impact of tax incentives measures in the electrification of low-income population</li> <li>• Accelerating Mini-Grid Programmes.</li> <li>• Support affordable consumer financing</li> </ul> <p>Secure funding for:</p> <ul style="list-style-type: none"> <li>• Electrifying the remaining off-grid Administrative Posts</li> <li>• Preparation and structure of tenders for mini-grid concessions in the priority areas</li> <li>• Subsidize SHS and clean cooking programmes through RBFs programs launched by the Government).</li> </ul>

FIGURE 2 - PRIORITY PROJECTS PRESENTED AT AEMP 2021



Source: TBI elaboration



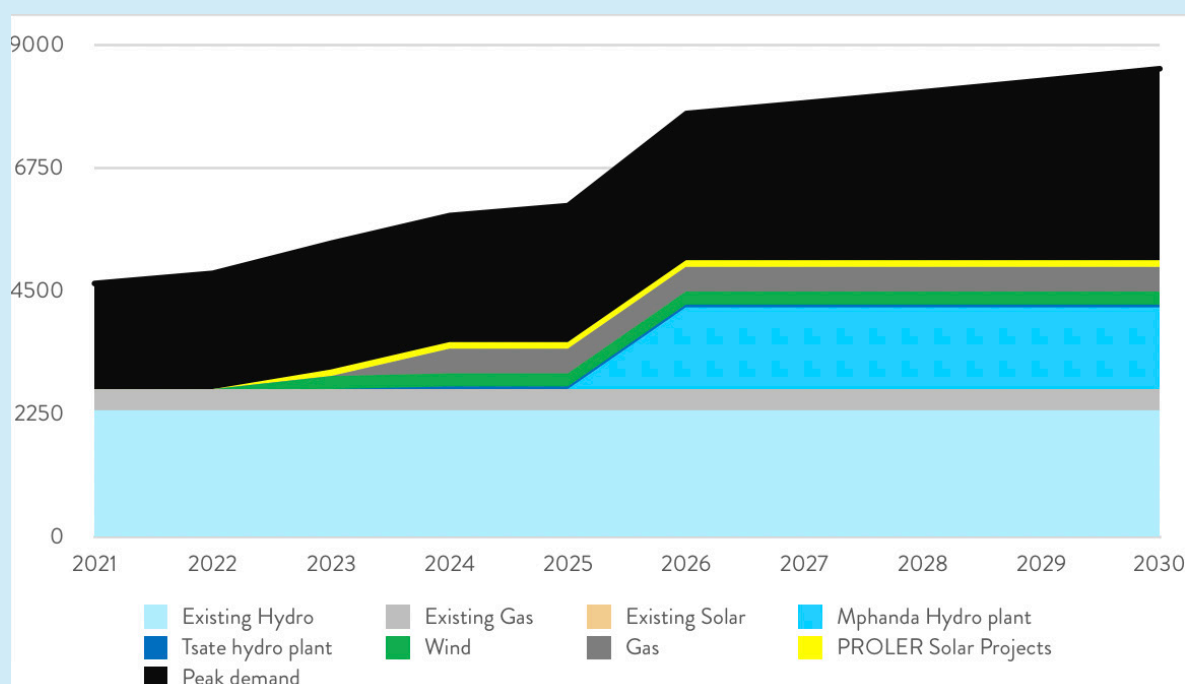
# Summary of sector outlook

## Generation Outlook

Today, Mozambique accounts for 2.7GW of installed capacity, 79% from the hydropower plant Cahora Bassa, 16% gas, 4% HFO and 1% from solar power. 2030 forecasts account for more than double installed capacity but remaining the hydropower as the main source.

Mozambique's demand is expected to grow at an average annual rate around 7 to 8 % in the next decade and this means the necessity to add about 1,500 MW to the generation fleet by 2030, as shown in the chart below.

FIGURE 3 - EXPECTED EVOLUTION OF THE INSTALLED CAPACITY



Source: TBI elaboration on Master Plan data

To achieve this, the Government has identified five priority interventions:

- 1. Mphanda Nkuwa Hydropower plant**, the most structuring investment, which would add 1,500 MW of generation capacity. This Project, as indicated In the Masterplan, with an estimated investment of 4.4 billion USD, will benefit both the domestic market and countries in the SAPP region. As of now, it is expected that between 40% to 60% of the energy produced will be destined for Mozambique, contributing significantly to the energy availability and competitiveness, to accelerate the country's economic development and

to laying foundations for the national industrialization process. The remaining energy produced will be exported to SAPP, contributing to the Government objective to position Mozambique as an energy hub in the region, tackling the SAPP electricity deficit and reducing dependence on widespread coal-powered generation, particularly in South Africa, thus granting a positive carbon footprint

2. The construction of the **50 MW Tsate Hydropower plant** to be commissioned by 2025, which aims at strengthening the energy supply in the Beira corridor, increase the central system stability and reduce the impact of black-outs when the 220kv HV line (Matambo - Catandica - Chibata) is unavailable.
3. **The renewable energy auctions program (PROLER)**, which will provide a cumulative 130 MW solar and wind capacity (3x30 MW solar + 40 MW wind) at an estimated total cost of about 200 M€, 37 M€ of which will be co-funded by the European Union (EU) and the remaining will come from the selected private investors. The first auction has been launched in November 2020, and the process is ongoing. In 2022, two more solar PV plant auctions of 40 MWp will be tendered, located in Lichinga and Manje, and in 2023 also a windfarm of 50MWp will be auctioned through this programme;
4. **The Temane Combined Cycle Gas Project**, a 450 MW gas-fired power project located at Temane in Inhambane Province of Mozambique, in a public-private partnership between EDM and Globeleq as the lead developer. EDM selected the Temane Consortium in December 2017 as part of a competitive bidding process. The project is currently under construction and is expected to be commissioned in 2024.

It is important to note that, if all the priority projects will be completed as indicated in the Master Plan, the total amount of new MW developed by 2030 will exceed the domestic needs. It is therefore critical that, especially with the development of Mphanda Nkuwa, the Government ensures the export outlets in terms of bilateral agreements or spot market. As an alternative, it will be necessary to further stimulate the electricity demand in order to avoid the country to enter into a situation of oversupply, that might risk to cost a lot to EdM and the GoM public finances.

It is also worth mentioning that the discovery of natural gas in the Rovuma basin has fundamentally changed Mozambique's economic outlook and opened unprecedented development pathways for the country. Projected LNG investments of US\$ 55 billion, equivalent to four times the size of the country's GDP, constitute the largest foreign direct investment in Africa of recent times. The combined output of the two areas already put out for concession to date will produce 30 million tons of LNG per annum. Up to a quarter of the gas has been set aside for use in Mozambique. LNG exports are expected to increase annual GNP by \$10 to \$14 billion and make Mozambique a global energy player. Further than being exported, this gas could fuel power plants for both domestic and export uses. However, given the finance and security challenges that the country is facing, in the main development scenario it is assumed that the largest share of new capacity addition will come from Renewable Energy Sources. Plans to develop coal generation capacity have to be re-evaluated as part of the development of a new least cost plan, with particular consideration given to Mozambique's climate commitments.

# Transmission Outlook

The Mozambique HV transmission network is still fragmented into two main sections. It is a top priority of the Government to integrate and expand it, both for increasing the energy access rate but also to allow for a better integration of VRES, such as solar and wind. The Government plans to pursue several extensions projects for which it is seeking the support of the Development Partners and the possible interest of the private sector:

1. **400 kv High Voltage Transmissison Line Chimura – Nacala (Phase II):** Project aiming to increase power transmission capacity, grid stability and reliability, and redundancy in the northern and central regions; and to allow the interconnection of new generation projects in Zambézia, Nampula and Niassa provinces.
2. **110 kv High Voltage Transmissison Line Nampula – Angoche** - The project will increase the northern system reliability, and the power availability to Angoche District to enhance the connection of new customers under the Energy for all programme as well as, supply mining and fisheries projects.
3. **400kv High Voltage Transmissison Line Songo - Matambo - Phase II)** - The project will contribute to increase the power availability and reliability transported to Malawi, contributing to the regional interconnection.
4. **400kV Tanzania interconnector** - EDM and TANESCO, Tanzanian power utility signed Inter Utility Memorandum of Understanding to conduct a feasibility study for development of interconnector to energize gas-fired generation enhancement in Rovuma area, border between Tanzania and Mozambique. With this interconnector, EDM will be keen to feed power generated at northern area to Eastern Africa Power Pool (EAPP) through TANESCO grid. The project is currently in the feasibility phase.

In the next years, the complexity of the Mozambican network will increase significantly, due to the consolidation of the national grid, its integration in the wider SAPP with more volumes exchanged with neighbor countries and with the integration of VRES. In addition, EDM will need to comply with N-1 security regulation and start manage ancillary services to enhance the quality of supply and the security of the electricity system. To do this, the construction of a dispatching centre with the training of the relevant resources is of paramount importance.

# Energy access and Off-grid electrification Outlook

The national electrification program, Energy for All, has set objectives for new off-grid connections: 1.8 million households (or approximately 9 million people) by 2030. The GoM and its partners must escalate their efforts if they want to succeed and new projects should be prepared and executed in the near future.

To tackle this challenge, the GoM and the World Bank are discussing the new Proenergia 2 programme, which aims to increase access to energy and broadband services and strengthen the financial performance of the power sector. Around USD150M of the total USD205M will be allocated to on-grid peri-urban and to off-grid energy and broadband service delivery. It is estimated that under ProEnergia 2 additional 1,400,000 people will be connected through on and off-grid energy services.

Still part of Proenergia 2, \$US35m dedicated to Improve EDM Financial Performance and USD10M to develop a Clean Cooking Strategy and RBF.

FUNAE is the public institution established in 1997 to promote energy access and

**FIGURE 4 - DONORS' PROGRAMS TO INCREASE THE ENERGY ACCESS IN MOZAMBIQUE FROM RENEWABLE ENERGY SOURCES BOTH ON-GRID AND OFF-GRID SOLUTIONS**

Programa de apoio Support programme	Segmento / Segment							Tipo de Apoio / Type of support		
	LIGADO À REDE ON-GRID		FORA DA REDE OFF-GRID			COZINHA LIMPA CLEAN COOKING		AT TA	Subvenção Grant	Outro Other
	PIE IPP	C&I C&I	Mini-redes Mini-grids	SSC SHS	Usos produtivos Productive uses	FM ICS	Combustíveis Sustentáveis Sustainable Fuels			
BGEA			•	•				•	•	
BBILHQ			•	•	•	•	•	•	•	
Centro de Recursos UE EU Resource Centre	•		•					•		
ELSGAPI	•							•		
EnDev				•	•	•	•	•	•	•
GET.FIT	•							•	•	•
GET.invest	•	•	•	•	•	•		•		•
GPE			•		•			•	•	•
ILUMINA			•	•		•			•	
ProEnergia	•		•	•				•	•	
PROLER/PROLER+	•							•	•	•
REACT SSA			•	•		•	•	•	•	
RERD 2			•		•			•	•	
SEFA			•					•		
Small Scale Solar PV Portfolio	•									•
SPEED+ / Power Africa	•		•	•	•			•		
TSE4ALLM					•		•			•

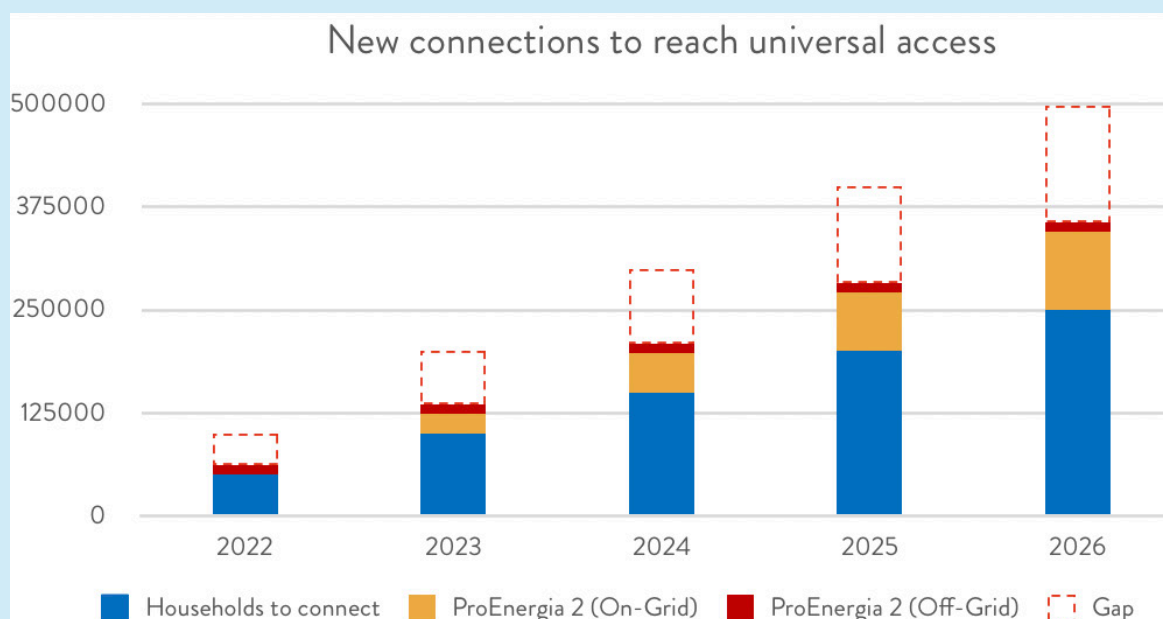
Source: "2021, renewable energy briefing" ALER, AMER, 2021

administer funds to support public and private generation and distribution initiatives. This agency is working with various development partners to launch off-grid projects and with 17 donors' programs to increase the energy access in Mozambique from renewable energy sources both on-grid and off-grid solutions (see the picture below).

Among the 17 programs: Multi-donor partnership Energising Development (EnDev), financed by Germany, the Netherlands, Norway, Switzerland and the EU, has been the first programme to work in energy access, off-grid electrification and improved cookstoves in Mozambique since 2007. EnDev has facilitated access to energy to 1.9 million people and has set up the RBF fund FASER. the BRILHO Programme, funded by the UK FCDO and Implemented by SNV, aims at accelerating the off-grid energy market In Mozambique by supporting financially and technically selected business initiatives and supporting the GoM in developing its regulatory framework; Beyond the Grid (BGFA) to provide electricity access for underserved people in rural and peri-urban areas as direct funding to Energy Service Providers; the AECF REACT Mozambique Country Window financing 61 m USD to catalyze the private sector to increase supply of cleaner fuels, raise awareness of dangers from indoor air pollution and provide evidence on challenges in policy formulation and implementation; the Rural Energy for Rural Development (RERD) program (Phase 2), implemented by the Belgian Development Agency (Enabel), aims to invest in the construction of five mini-grids, three in Zambezia and two in Nampula, and support FUNAE in improving its capacity in off-grid energy planning and project management, as well strengthening processes that increase sustainability such as the introduction of remote metering, monitoring and payments systems.

As of now in fact, only the ProEnergia project (ProEnergia 2) has indicated quantifiable targets, 237.000 new households connected through on-grid solutions and 60.000 new households connected through off-grid solutions as shown in the chart below:

**FIGURE 5 - MOZAMBIQUE POLICY TARGETS**



Source: TBI elaboration on Master Plan data

## Mini grids and solar home systems

To meet universal access to electricity in 2030, 30% of the new connections will have to be reached through solar home systems and mini grids.

For Mozambique to boost mini-grids and SHS, it is however necessary that the GoM introduced a clear policy framework, including identification of the most suitable areas where to deploy these solutions, a transparent and stable licensing and procurement process, the definition of the quality standards for the imported equipment and fiscal incentives to make them more affordable for the level of purchasing power of the rural areas. BRILHO is supporting the GoM in the development of the complete off grid regulatory framework. Last week the Government approved by decree, the Regulation for off grid Energy Access. Currently we are working in the specific regulations to address the following areas; Concessions; Tariffs; Interconnection, Standards, Commercial Relations and Environmental and Social elements.

**FIGURE 6 - SOLAR HOME SYSTEMS**

Name	Systems available	Date operations started in Moz	Number of units sold
 <b>solarworks!</b> Power by Design	<b>20-155 W</b> Fabrico Próprio In-house production	<b>01/2017</b>	<b>40k+</b>
 <b>MySol</b> Mais Sol, Mais Vida. A company of ENGIE	<b>10-50 W</b> Fabrico Próprio In-house production	<b>07/2019</b>	<b>52k+</b>
 <b>Ignite</b>	<b>12-400 W</b> Revendedores Resellers	<b>01/2020</b>	<b>3000+</b>
 <b>EPILON</b> ENERGIA SOLAR	<b>6 W</b> Revendedores Resellers	<b>02/2018</b>	<b>2500+</b>
 <b>DIGITECH</b>	<b>4-400 W</b> Revendedores Resellers	<b>08/2020</b>	<b>500+</b>

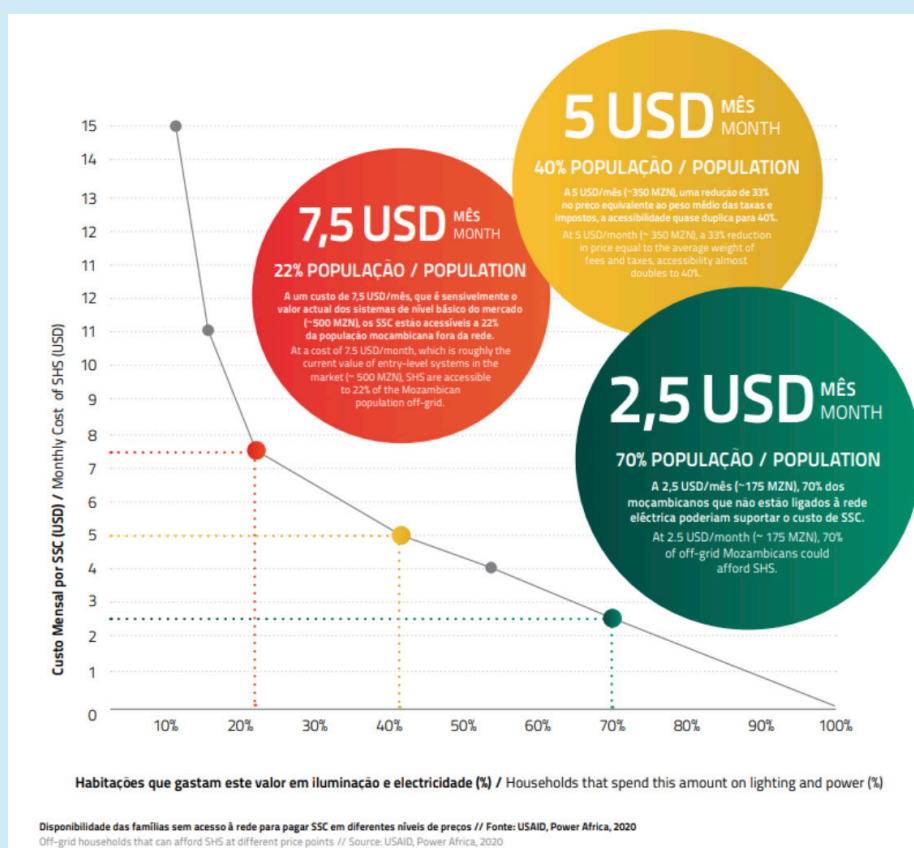
Source: "2021, Renewable Energy Briefing" ALER, AMER 2021 and Internal data

Since 2017, private operators have started selling SHS under a PAYGO scheme, having sold more than 100,000 systems. Today, Solar works and Mysol, lead the sales on SHS. The EnDev programme was the one that most promoted the development of a sustainable PAYGO market through tailor-made Technical Assistance and access



to financing mainly via the RBF fund FASER. Since of 2020, BRILHO has supported a large diversity of SHS PAYGO initiatives, which by Sept 2021 have already deployed over 50,000 SHS connections. BRILHO provides RBF funding together with catalytic grants. Besides, other support programmes have been added to this market segment all based on an RBF logic, which will certainly increase the capacity of current operators and attract new operators to the Mozambican market.

**FIGURE 7 - OFF-GRID HOUSEHOLDS THAT CAN AFFORD SHS AT DIFFERENT PRICE POINTS**



Source: USAID, Power Africa, 2020

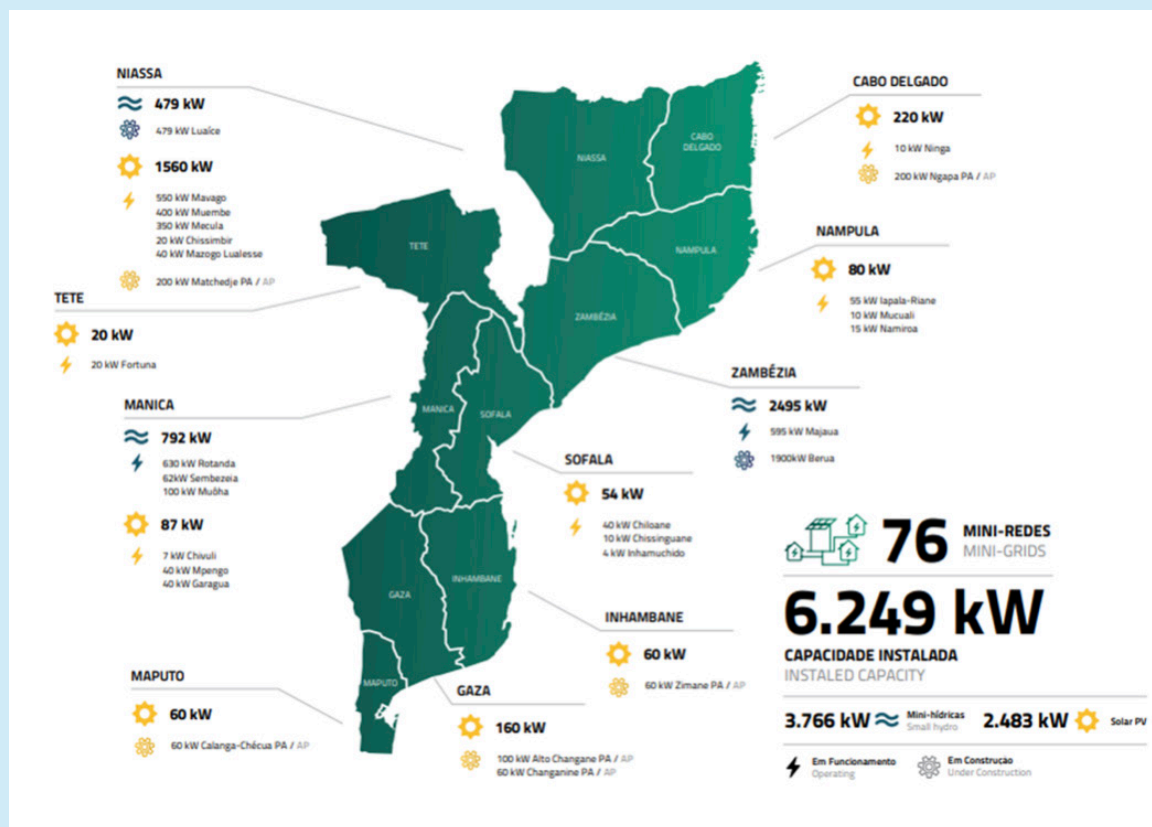
According to USAID, the market potential of SHS would increase potentially if price was reduced from today's USD7.5/month. The figure above, was published in a 2020 report from USAID Power Africa and shows the impact of price reduction.

- Initiatives to reduce the price of SHS have proposed exemption from customs fees and VAT (or 0% taxation to allow companies to deduct VAT) for household products that use renewable energy
- Neighbouring countries like Ethiopia, Zambia and more recently Malawi have already implemented exemption from customs duties and VAT for PV equipment.

In the mini-grid segment, the involvement of the private sector is still very small, mainly due to regulatory limitations. The installed capacity of mini grids accounts for a little bit more than 6MW.

The picture below shows the mini-grid projects in operation and under construction.

**FIGURE 8 - MINI-GRID PROJECTS IN OPERATION AND UNDER CONSTRUCTION**



Source: "2021, renewable energy briefing" ALER, AMER, 2021

The recent approval of the new off-grid regulation and the revision of the electricity law to adapt it to new challenges, is aiming to open space for the adoption of all types of energy sources to achieve universal access in 2030. The review of the law, which is due to be submitted to the Mozambican parliament, will prioritise the use of renewable energy sources. The off-grid regulation will simplify the concession and licensing, clarify operating tariff issues and the limits of action of each entity.

Therefore, FUNAE's 76 mini-grids, corresponding to more than 6 MW, currently in operation or under construction, could soon be joined by new projects with greater participation from the private sector.

Support programs for mini-grids are the following: BRILHO, GPE, RERD2, PROENERGIA, BGFA, REACT SSA and ILUMINA.

## Summary of the main challenges to address

The power sector in Mozambique is going through several challenges.

At **institutional level**, the main issue is the absence of a high-level Energy Policy (the Energy Policy is an ongoing assignment funded by AFDB) umbrella covering the different strategic targets, including on energy mix and how the different natural resources will contribute to the power sector. On a similar note, the need to strengthen the planning capacity of MIREME and to update the Integrated Masterplan 2018-2043 adopting a more integrated approach has been observed. The Regulator Authority ARENE, with the technical advisory support of BRILHO, is working on a study for the tariff scheme and the concessions for the minigrids. The aim of the study is to set tariffs and enforce technical and quality standards, and to introduce specific regulations for defining the PPAs' tariff. The improvement of the financial stability of the sector remains of paramount importance: it is vital to review the tariff structure to achieve cost reflectivity while introducing social tariffs only for low-income households.

As for **power generation**, the main uncertainty refers to the structure and the evolution of the generation mix. Investments have deviated from the current masterplan and a new plan is needed to guide future investment. Updating the integrated masterplan including an evaluation of whether coal remains a least cost and environmentally viable Investment option will need to be prioritised. Beyond simply updating the plan, the structures and systems need to be put in place to link the plan to procurement and advance the priority Investments set out in the updated plan in a structured, transparent and competitive manner. The system operator will need strengthening to take a lead role in enhancing quality of supply, but also the long-term system planning.

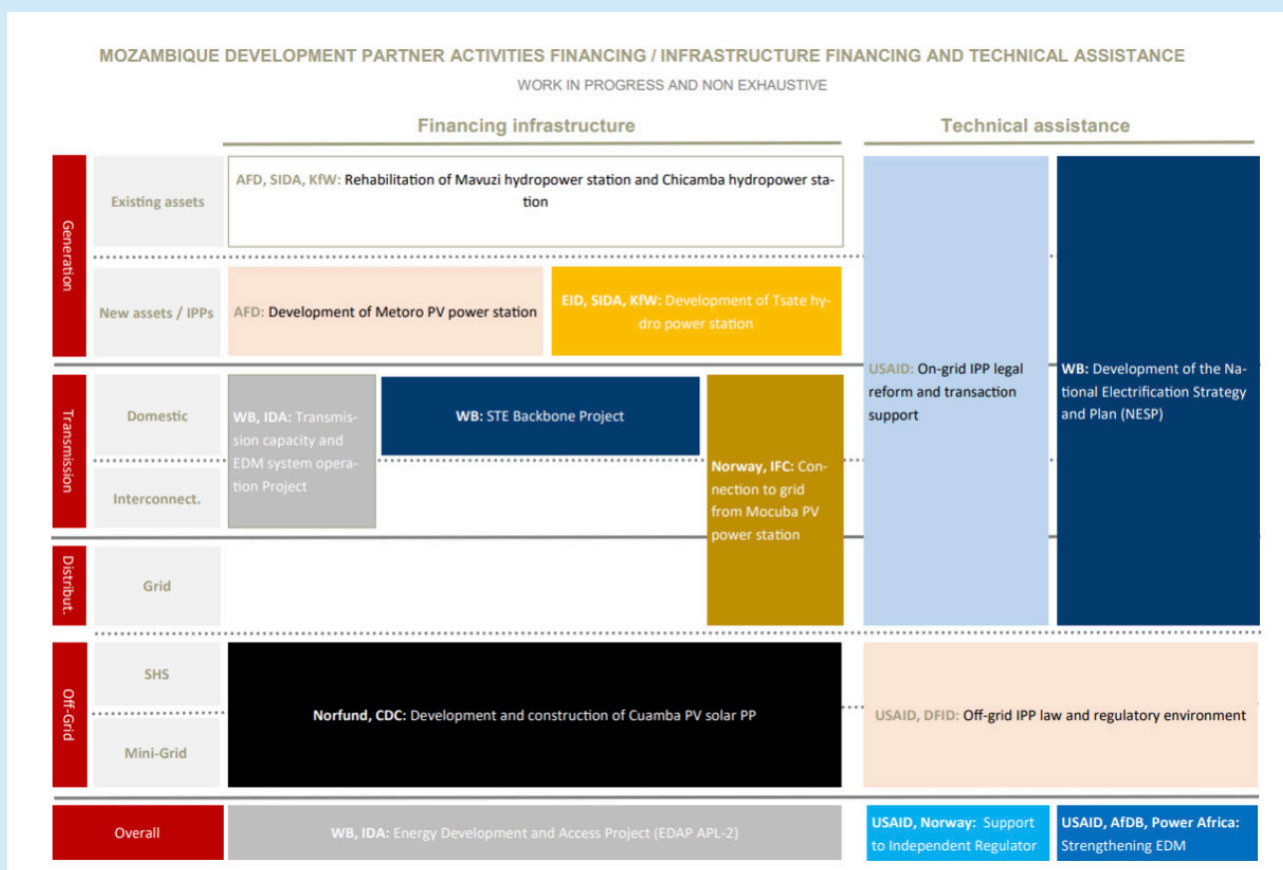
At **Network level**, EDM technical and commercial losses are still very high (~30%) and need to be tackled to improve its profitability. A glide path to cost reflectivity needs to be put in place which combines efficiency improvements and loss reduction with tariff adjustments. Improvements to EDM's credit worthiness will be vital to attracting more capital to the sector. A parallel financial separation of the various business units within EDM is also required to provide greater financial transparency and help drive efficiencies.

For the transmission system to become fully interconnected (south center and north regions) it is essential to build the transmission system project from Caia to Nampula and Nacala with a total line length of 750 km, which will strengthen the connection between the central system and the Norte system and the Transmission Backbone project consists of a double transmission line from the Tete Province in Center Mozambique, where Cahora Bassa is located (and in the future, Mphanda Nkuwa) to Maputo (HVAC) and the Southern African Power Pool (SAPP) interconnected power network (HVDC). Mozambique still lacks a national dispatch centre, although currently the technical studies are ongoing and EDM already secured 45 MUSD of the 60 MUSD necessary to build this key facility. Finally, significant rehabilitation of the existing network and invest in new equipment are needed to reduce the high technical losses of the sector.

In the **off-grid** segment, it is observed that MIREME's limited planning capacity is delaying the structuration/implementation of electrification projects. It seems of paramount importance to strengthen the Integrated Electrification Planning and Coordination Unit possibly via embedded advisory and a program of capacity building, alongside clarifying the policy framework, and developing competitive procurement processes. USAID-SAEP together with BRILHO are already jointly working to provide support to the GoM on import duties on equipment for rural electrification, which also represents a huge challenge since it is necessary to review the taxation scheme to boost the deployment of solar products for the low income population, by making them more affordable for rural households. Nowadays the study is on an early stage of quantifying the impact of Duty and VAT exemptions on the affordability of SHS and the contribution to the Universal Access goals on an early stage. Finally, testing capabilities of National laboratories to ensure products certification for rural electrification and clean cooking must be significantly enhanced.

Always in this space, there is no clear policy with regards to providing **clean cooking** solutions to the Mozambican population. As a reminder, 80% of the Mozambican households still rely on biomass and wood. To face this issue, according to the World Bank Project Information Document (December 2020), the Sub-component 3c will set up a clean cooking RBF window to subsidize purchases of clean cooking solutions (CCS) by eligible households in Mozambique to address energy and health challenges associated with the use of traditional stoves for cooking, benefiting women in particular who are disproportionately exposed to these risks. This Sub-component is expected to be co-financed by the World Bank (US \$10 million).

**FIGURE 9 - SUMMARY OF DONORS SUPPORT TO THE ENERGY SECTOR**



Source: TBI





## SECTION 2: Sector Diagnostic



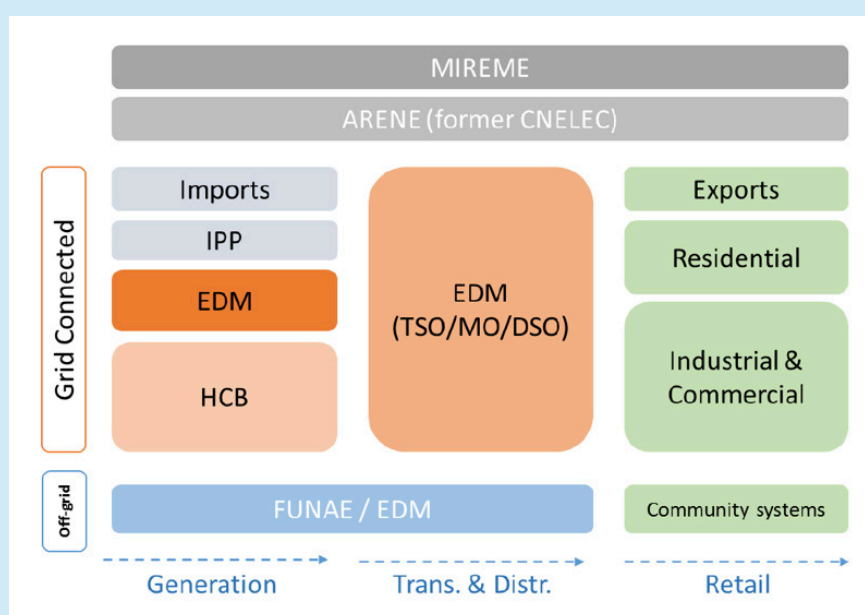
# Section 2: Diagnostic of the sector

## Institutional arrangement in the sector

The energy sector in Mozambique is regulated and supervised by the Ministry of Mineral Resources and Energy (MIREME). MIREME formulates Energy Policy and monitors policy implementation. However, there are other key institutions within the government structure whose functions and objectives have a direct impact on the sector and on the implementation of relevant measures concerning its development. For the electricity and energy access sector, the most relevant institutions are the Energy Regulatory Authority (ARENE), the Electricity of Mozambique (EdM) and the Energy Fund (FUNAE).

The Energy Regulatory Authority (ARENE) was established by Law 11/2017, September 8, 2017. ARENE's mission comprises the supervision, regulation, representation, control and sanctioning of all electricity operators (ERI 2020 Mozambique Country Profile Note). ARENE's regulatory functions extend to Economic Regulation (Tariff-Setting), Technical regulation (Quality of Service), Institutional Capacity, and Energy Efficiency Development. ARENE has a public website that provide public access to key regulatory documents such as license application procedures, laws, tariff methodology, providing a first comprehensive overview of the sector to prospective investors.

FIGURE 10 - INSTITUTIONAL ARCHITECTURE OF THE ENERGY SECTOR



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



In Mozambique there are two main electricity companies: Electricidade de Moçambique (EDM), which is the national power utility company responsible for part of the generation, for transmission and distribution, and Hidroelétrica de Cahora Bassa (HCB), responsible for the management of one of the biggest hydropower systems in Africa, with an installed capacity of 2,075 MW.

The Energy Fund (FUNAE) created pursuant to Decree 24/97 of 22 July, added by Decree 23/2002 of 16 October has legal status and administrative and financial autonomy, and was created to promote the development, generation and use of several forms of energy at low cost to supply rural and urban areas inhabited by low-income households and to ensure a rational and sustainable management of energy resources. The Fund is under MIREME's authority and develops its activity at national level; additionally, its Board of Directors may decide to open or close branches or other forms of representation and appoint other institutions to act on its behalf.

With an Electricity Regulatory Index (ERI) of 0.382 in 2020, Mozambique is among the worst performing countries in Africa in terms of electricity sector regulation (average ERI of 0.485 in Africa). As recommended Short-term Interventions (1-2 years) by the Electricity Regulatory Index for Africa 2020 report, the country will have to develop tariff methodology (already ongoing), develop simplified licensing framework for off-grid and small size systems, develop and implement quality of service regulation or code, develop model technology specific PPA, develop technical standards for standalone systems, develop energy efficiency legislation or policy, develop loss reduction target/action plan, build capacity in areas tariff in of setting, build capacity in areas of utility performance analysis, and undertake customer satisfaction surveys, though the forthcoming electricity law (to be approved in Q4 of 2021 which should correct some of these weaknesses as recommended Medium-term interventions (3-5 years), the country should create specialized and independent mechanisms/bodies to contest the regulator's decisions, modify the electricity law or adopt regulatory texts to enhance regulatory independence (vis-à-vis the executive and stakeholders) by making provision for: (i) staggering of terms of commissioners and (ii) independent source of funding through levies, develop and adopt labeling system for electrical equipment, and set and enforce ceilings on SAIDI and SAIFI as quality of service indicators.

# Generation

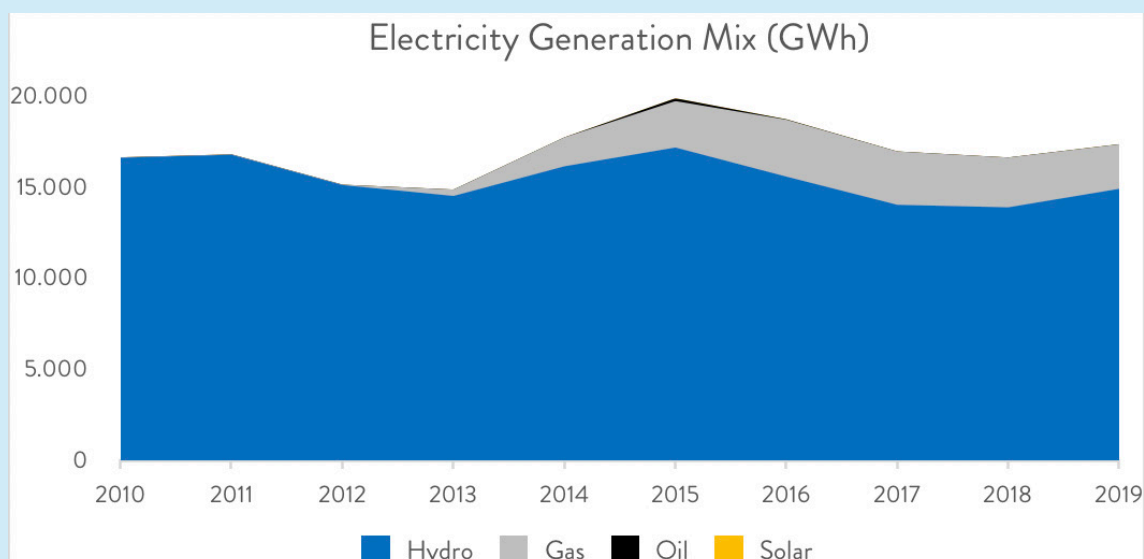
## Overview

Total energy production has been growing rapidly since the nineties (an exceptional growth of more than 260% between 1990 and 2018, i.e. from 5.61 Mtoe in 1990 to 20.23 Mtoe in 2018). In 2019, total energy production stood at 22.96 Mtoe. (IEA Database).

Mozambique also has the greatest potential for electricity generation of any country in Southern Africa. With its solar, hydro, coal, gas, and wind resources, the country could generate up to 187 GW of electricity. At present, most of the electricity is generated with hydropower facilities. In the immediate future, the Government has plans to increase the share of coal and gas generation. Natural gas-fired power plants are expected to provide 44% of total electricity generation by the end of this decade.

The graph below shows the evolution of the generation mix between 2010 up to 2019.

**FIGURE 11 - RECENT EVOLUTION OF THE GENERATION MIX**



Source: Enerdata

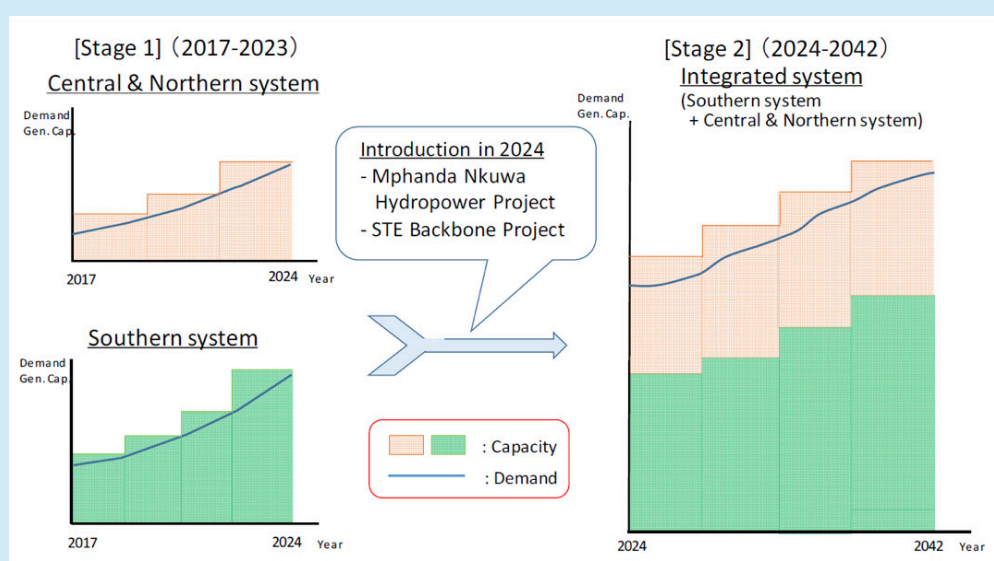
At the end of 2018, the total installed power capacity stood at 2,700 MW (including the Cahora Bassa dam, for which South Africa has a reserved capacity of 1.5 GW, expiring in 2029). Peak demand was 1,850 MW in 2018 (including Mozal) and is expected to reach 2,752 MW in 2025.

With an estimated hydroelectric potential of 12,500 MW, Mozambique has one of the largest hydroelectric potentials in sub-Saharan Africa (International Hydropower Association). More than 80% of this potential is in the Zambezi Valley, which is home to the Cahora Bassa dam (2,075 MW), the largest hydropower facility in Africa.

There are currently six hydroelectric plants supplying the country's national grid: the Cahora Bassa plant - operated by Hidroelectrica de Cahora Bassa, an independent power producer, Mavuzi (52 MW), Chicamba (44 MW), Corumana (16.6 MW), Cuamba (0.9 MW) and Lichinga (0.73 MW) - all operated by public national company, Electricidade de Moçambique (EDM). The GoM owns 82% of Hidroelectrica de Cahora Bassa, which provided about 69% of generation in 2018. Only about 500 MW is supplied to Electricidade de Moçambique (EDM), the national utility, and the rest is exported to South Africa.

In the next years, Mozambique's generation is expected to increase considerably to meet growing electricity demand and to keep the Country a reliable exporter in the Region: electricity exports already contribute 14% to its overall exports. Given that Mozambique's electricity system is currently subdivided into two independent systems (Central and Northern System & Southern System), the current generation development plan takes this distinction into account, i.e. a short- to medium-term projection (stage 1: horizon 2023) for each of the Systems (Central and Northern & Southern) and a long-term projection (stage 2: horizon 2042) for the Integrated System.

**FIGURE 12 - PLAN FOR NETWORK INTEGRATION**



From a climate change perspective, it must be pointed out that the current Master Plan for Mozambique still envisages a 1.7 GW coal-fired capacity, providing almost 2 TWh per year of electricity up until 2042. However, from one side International Financing Institutions are swiftly moving away from supporting carbon-intensive projects, and on the other the GoM gave itself important targets for carbon emission abatement, hence, sustained coal-fired generation could be unfeasible in reality.

## Challenges

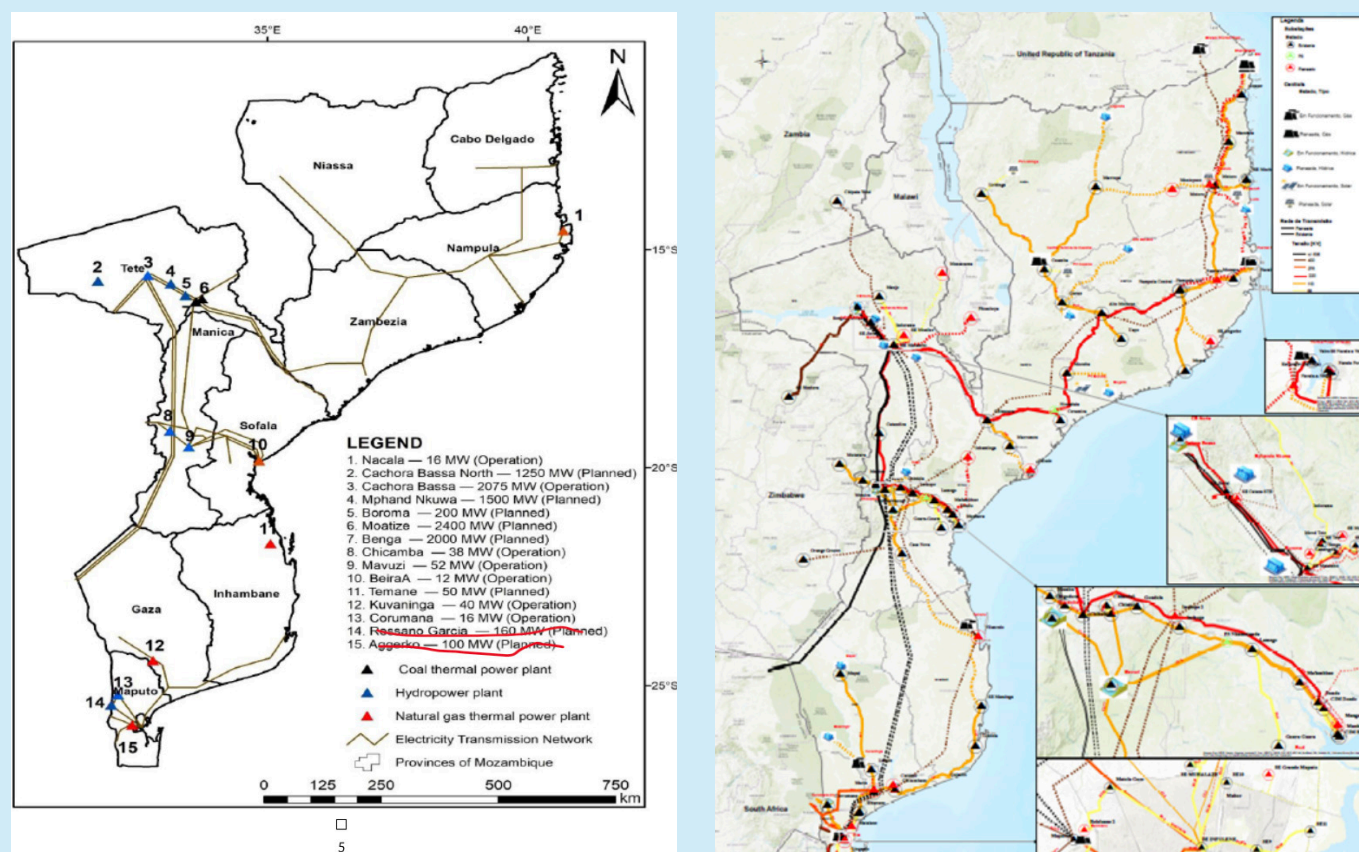
Type of challenge	Description	Bridging the Gap
Institutional	Uncertainty over structure and evolution of the generation mix in the light of CO2 emission abatement targets	Update the integrated masterplan and verify the viability of coal-fired generation as well as alternative plans without coal.

# Transmission and distribution

## Overview

Mozambique national grid is made of three main separate systems, that are reported in the image below, together with existing or planned large power plants. .

FIGURE 13 - MAP OF MOZAMBIQUE ELECTRICITY NETWORKS



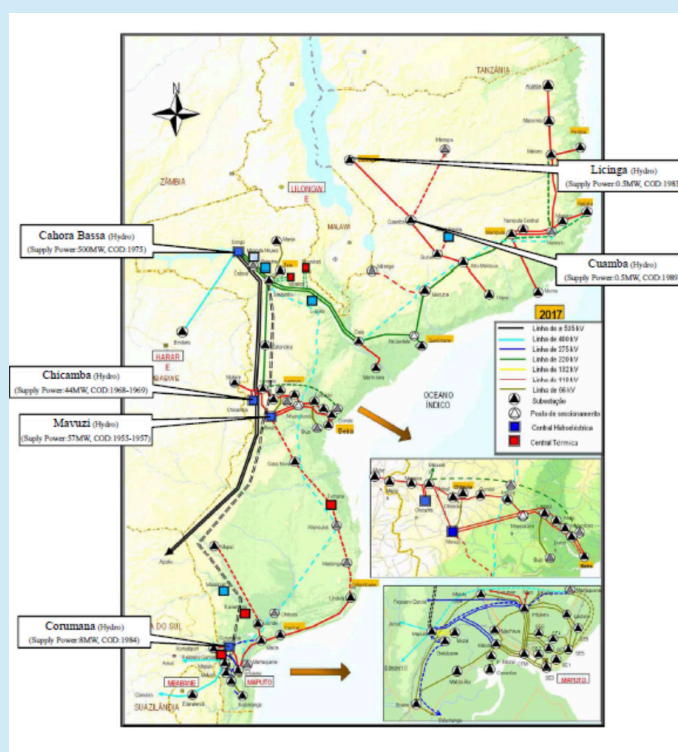
Source: EDM

In terms of electricity transmission, EDM operates most of the country's transmission infrastructure. According to the Final Energy report for Mozambique, Mozambique's national electricity transmission network is subdivided into three parts. The northern region has a 220 kV transmission system covering approximately 1,000 km from the Songo substation to Nampula and continuing at 110 kV to the city of Nacala. A separate 220 kV system (operated at 110 kV) runs from Tete to the central region at Chibata. The central region has a 110 kV system linking the Chicamba and



Mavuzi hydroelectric plants to the load centres of the Beira-Manica corridor. The southern region has a 110 kV system extending from Maputo to XaiXai, Chokwe and Inhambane, as well as a 275 km single circuit line from Maputo to Komatipoort, where it connects to the system operated by the South African company ESKOM. Hidroelectrica de Cahora Bassa (HCB) operates part of the (remaining) transmission network transporting power from the Cahora Bassa hydroelectric plant to South Africa. Finally, The Mozambique Transmission Company (MOTRACO) transports power from South Africa to the Mozal aluminium smelter.

**FIGURE 14 - SITE LOCATIONS OF EXISTING HYDROPOWER GENERATION**



Source: Master Plan 2018

Two transmission projects started the construction this year:

- The construction of the first section of the transmission backbone of the national electricity grid at 400 kV connecting Temane (Inhambane Province) to Maputo is ongoing and will be concluded until 2024, with a total length of 563 km.
- The High Voltage 400 kv line connecting Chimuara (Caia) to Nacala, will be responsible for supplying the Northern system from the main productive center. The first section of this 400 kv HV is already under construction connecting Caia to Alto Molócuè, with a total length of 367 Km, and will be concluded until 2022, ensuring the increase in energy volumes from Cahora Bassa (and, in the future, from Mphanda Nkuwa) to the north of the country.

**FIGURE 15 - EXTENSION PLAN FOR THE TRANSMISSION NETWORK**



Source: Master Plan 2018

As for power distribution, EDM is the company that operates the interconnected distribution networks. Because of low population density and the geographical dispersions of load centers, transmission and distribution activities face complex challenges and result in high technical losses.

Investment in transmission and distribution are of paramount importance for the Mozambican electricity sector. The integration of the different systems as well as the densification of clients will unlock investment in generation and will increase EDM's customer base.



## Challenges

Type of challenge	Description	Bridging the Gap
Technical	Lack of National Dispatch Centre	Currently the technical studies are ongoing and EDM already secured 45 MUSD of the 60 MUSD necessary to build the national dispatch centre.
Technical	High technical and commercial losses	Need to rehabilitate existing network and invest in new equipment

# Off-grid electrification

## Overview

Mozambique faces important challenges on rural electrification: nearly two-thirds of the country's 29 million people living in dispersed off-grid communities do not have access to electricity. Access rates are very low in these rural areas, where most of the country's population lives. Although access rates have improved, the national electrification rate in 2018 was 31%, a large disparity remains between access rates in urban (72%) and rural (8%) areas. One of the main explanations would be that there are a number of barriers to expanding access to on-grid electricity, including a limited transmission and distribution system with high technical and commercial losses, and dependence on fuels that are subject to volatile commodity prices. In the off-grid space, In September, the cabinet meeting of Mozambique approved both, the new regulation for the off-grid sector and the revision of the electricity law to adapt it to new challenges, aiming to open space for the adoption of all types of energy sources to achieve universal access in 2030. The review of the law, which is due to be submitted to the Mozambican parliament, will prioritise the use of renewable energy sources.

Rural electrification is led by FUNAE, the agency for rural energy access which focuses on small off-grid projects of less than 10 MW. . There is a growing number of private initiatives in off-grid electrification in Mozambique where the potential market is estimated at around 4 million households (Final Energy report for Mozambique). FUNAE is so far the main actor in the development of these decentralised (off-grid) systems. Strengthening the institutional capacity of the implementing agencies, such as FUNAE, including clear mandates for off-grid development would accelerate the expansion of the sector.

Nevertheless, Mozambique has undertaken significant steps to improve its electrification rate. From 19% in 2010, the national electrification rate has reached 30% in 2019 (IEA database) to 40% in 2021. However, access to energy has mainly improved only in urban areas. Rural electrification remains low (5% in 2019, compared to 73% over the same period in urban areas). For rural people, the main source of energy is still charcoal and traditional biomass, which poses health issues while also perpetuating gender disparities as collection is mainly carried out by women. From an environmental perspective, reliance on traditional biomass is causing deforestation and soil erosion.

Mozambique aims to provide universal access by 2030: 70% of the new connections will be through on-grid and the remaining 30% through off-grid. This will imply ~ 450.000 new annual on-grid (urban) connections. In fact, according to the latest demographic projections, Mozambique will have 8 million households in 2030 (almost 41 million people). If 50% of these households will be supplied with electricity from the EDM national grid, and the other % will need to access electricity through off-grid solutions, Mozambique will need 4 million off-grid connections by 2030. A report published by AMER estimates that 24% of those 4 million households already

own solar home systems. The same report theorizes that 29% of those 4 million households will probably not be able to purchase a SHS under any circumstances due to poverty. For simplicity, we will round up and down these numbers and conclude that the commercially achievable off-grid solar market in Mozambique is equivalent to 2 million households.

It is important to highlight that, by following the dynamics observed between 2010 and 2019, Mozambique will not achieve the goal of connecting all its households to electricity before 2065.

Meeting this ambitious target by 2030 requires additional efforts from the authorities in Mozambique (increase the number of households to connect per year, additional expenditure etc.) over the next years.

To achieve universal access to energy by 2030, the country will need approximatively to connect between 450,000 and 550,000 households each year (for a total cost between 4 and 5 billion USD, approximatively). Unfortunately, the current pace of new connections falls short when comparing with the numbers planned in the National Electrification Strategy therefore, the Government must quickly redouble its efforts to achieve the objective, through a greater private sector participation and find additional support of International Financial Institutions such as the African Development Bank, the World Bank, as well as bilateral institutions.

According to data from Get.Invest.eu, at the end of 2015, FUNAE has installed about 70 diesel-based mini-grids operated by local communities, and about 1,500 solar home systems (SHS) across the country. It also manages the 50 Solar Vilas project, which aims to install 4 kW solar power plants with battery backup to electrify rural institutions, microenterprises, and households in 50 villages. In addition, FUNAE has installed about 60 solar irrigation systems between 2006 and 2016. Energising Development (EnDev) programme, which has been active in the country since 2007, has pioneered on- and off-grid RBF in Mozambique, among them activities in grid densification, improved and clean cookstoves, pico- and micro-hydro (PHP and MHP), solar home systems and small-scale PV systems.

In 2019, the GoM launched a new energy access project through ProEnergia 1. ProEnergia 1 received USD 80 million in funding over a five-year period and includes three components: the first component supports the utility, EDM, with grid expansion, densification and improvements; the second component supports FUNAE in developing off-grid electrification solutions; and the third component provides technical assistance and implementation support to both EDM and FUNAE. In May 2020, FUNAE launched a solicitation for private IPPs to develop mini-grid projects in 11 villages in the provinces of Niassa, Nampula, Tete, Sofala and Manica under a PPP arrangement with EDM as the off-taker. ProEnergia program has identified more than 500 settlements to be electrified across approximately 20 districts across the country, three-quarters of which are in rural areas. The project expects to connect an estimated 250,000 households nationwide, with about half of these connections to be made in the five poorest provinces – Niassa, Nampula, Zambézia, Cabo Delgado and Sofala – with more than 85,000 connections expected to be made in Nampula.

The rapid expansion of these off-grid systems (mini-grids) is partly explained by the great rural development potential of these solutions. According to the Mini-grid market opportunity assessment - AFDB - 2017, removing institutional constraints

(lack of a formal regulator or mini-grid specific policies, (challenges already overcome) would accelerate the electrification of rural and remote areas in Mozambique. In the same vein, The SEforALL Africa Hub, hosted by the African Development Bank, published in April 2017 the first report assessing the potential of green mini-grids in Mozambique. According to the report's findings, for 22% of the country's population, or 5.6 million people, the best electrification solution would be mini-grids. The report also indicates that the most promising sites for mini-grids in the country are located on the northern coasts of Cabo Delgado, Nampula, Zambezia and Inhambane, as well as inland in Tete and Zambezia, near the border with Malawi, particularly near the town of Vila Coutinho (Tete).

The results from the FUNAE Energy Atlas highlight a total of 452 sites with hydro or biomass potential, corresponding to 743 MW for priority projects and 2,366 MW for non-priority projects. As for solar power, Mozambique has a potential of 23 TWp, but only 2.7 GW are near existing substation, while the remaining capacity is available for off-grid projects. As for wind, the northern and coastal regions of Maputo and Gaza have the highest wind speeds (above 7 m/s), but significant wind resources are also available in the provinces of Sofala, Cabo Delgado, Zambezia, Inhambane and Tete.

The agency's estimated costs are around 550 USD/MWh for biomass projects for the 10,000 off-grid villages assessed. The cost for hydropower projects is very site-specific and it ranges from 100-200 USD/MWh for 1.4 GW of the Atlas priority sites 400 per USD/MWh for the remaining 1GW of estimated Atlas capacity. The average cost of off-grid solar solutions in the 10,000 villages assessed is about US\$ 375 per MWh for hybrid solar systems and US\$ 600 per MWh for 100% solar-battery systems. The estimated cost for wind-hybrid solutions is the same as for solar-hybrid, but for wind-only systems, they increase significantly to USD 1,550 per MWh due to the cost of large batteries needed to manage the intermittency of the wind (SEforALL Africa Hub, 2017).

Currently FUNAE and MIREME are exploring ways for further improving the legal and regulatory framework for off-grid electrification and crafting a national strategy for clean cooking. In Mozambique, cooking energy is currently dominated by traditional stoves and fuels, as in most other sub-Saharan African countries. It is estimated that 80% of urban and peri-urban households use charcoal in the urban market and most rural households use firewood with traditional stoves (World Bank, 2019). Nevertheless, the market of clean stoves with proven efficiency faces the same barriers as off-grid stand-alone solar solutions in the country, including tariffs and VAT, as well as cost. Alternative cooking fuels, such as LPG, ethanol and electricity, are also emerging, but so far they have mainly served middle- and high-income urban users due to affordability and distribution constraints. However, there is a renewed interest in clean cooking solutions from public and private actors. SHS distributors in Mozambique are exploring the possibility of including energy efficient stoves in their product portfolio, beyond SHS.

## Challenges

The main barrier to achieving this target is affordability. The ongoing off-grid roadmap presents the development of the off-grid planning instrument to achieve universal access by 2030 through minigrids and SHS. Together with the roadmap, a financing facility will be established to support the development of SHS and clean cooking solutions.

Type of challenge	Description	Bridging the Gap
Financial	29% of 4 million households will never be able to purchase a SHS due to poverty	Making SHS more affordable for rural households (by exempting solar products from taxes during implementation of the Roadmap and by providing subsidies for SHS sales). Because their high costs are largely driven by the cumulative impact of VAT on goods and service, duties, VAT and fees on import and high fixed costs which require high volume sales to recover.
Institutional	Lack of a consistent mini-grid framework	<p>Unpack the Off-grid roadmap into different groups of projects</p> <p>Define the mini-grid concession framework, Addressed by the GoM with support from BRILHO</p> <p>Define a list of priority mini-grid projects with pre-feasibility studies;</p> <p>Define engineering quality standards for mini-grids, Addressed by the GoM with support from BRILHO;</p> <p>Structuring public tender programs to award concessions to private individuals to build and operate mini networks;</p>
Institutional	Lack of planning capacity from MIREME delaying the structuring / implementation of electrification and generation projects	Creation of a unit dedicated to planning, coordinating and supervising the definition and implementation of electrification policy and targets.

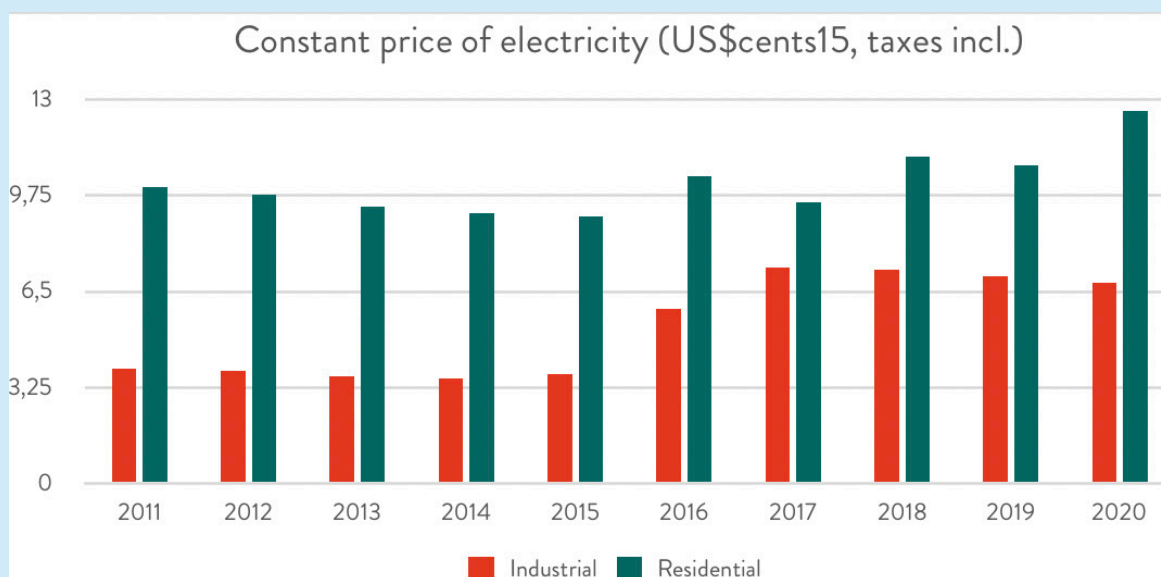
		<p>The Integrated Electrification Planning and Coordination Unit will have a central role in the electrification agenda, under an integrated approach (on grid and off grid), leading electrification planning, providing centralized coordination, monitoring, evaluation and reports on the progress of electrification activities, supporting strategic decision-making to ensure quality and equity in the provision of electricity services.</p> <p>Achieving this balance requires the incorporation of processes, systems and technical, economic and financial skills and, therefore, requires the interaction of various disciplines and the adoption of technological tools and platforms that would support decision-making based on data and evidence, such as geospatial mapping tools and information management system</p>
Institutional	Policy uncertainty to provide clean cooking solutions to the Mozambican population. 80% of the Mozambican households still rely on biomass and wood.	Government RBF clean cooking donor funded programmes to massify the use of clean and sustainable sources of energy for cooking
Institutional	Import duties on equipment for rural electrification	Review duties and taxation system for the rural electrification sector. Addressed by the GoM with support from BRILHO, jointly with the USAID-SAEP project
Institutional	Product certification for rural electrification and clean cooking	Improve testing capabilities of National laboratories

## Financial viability of the power sector

The electricity sector remains quite heavily subsidized (a significant budgetary burden for public finances). Despite this high energy subsidy, per capita energy consumption, at around 0.36 toe and 440 kWh of electricity in 2019, is still quite low, but about 50 kWh higher than the average for sub-Saharan Africa. Nevertheless, there has been an encouraging trend in overall energy consumption in the country, with an average growth of 2% since 2000 to reach 11 Mt in 2019. As for final electricity consumption, it has increased significantly in recent years (3.4% average growth over the last 10 years, from 2010 to 2019). However, industrial use dominates electricity consumption by sector, accounting for over 85% of total electricity consumed (Get. Invest.eu).

Rules for setting and approving tariffs for electricity supplied through the national interconnected system are those provided for in Decree 42/2005 of 29 November. Consumers are divided into consumption categories: low voltage, medium voltage, medium voltage for the agricultural sector and high voltage. Electricity tariffs for low-voltage domestic consumers are also subdivided into four subcategories, namely: social tariff, household tariff, agricultural tariff, and general tariff. GoM recently approved new tariffs in August 2017 corresponding to a 35% increase. The social tariff, on the other hand, did not undergo an increase to protect the most vulnerable consumers. In November 2015, GoM had already approved another tariff increase of 40%. After these two tariff increases, Mozambique's tariffs are in line with the regional average, but EDM is still selling at a loss.

**FIGURE 16 - EVOLUTION OF THE AVERAGE END-USER ELECTRICITY TARIFF**



Source: Enerdata



The graph below shows the evolution of the average tariff for Industrial and residential users at constant 2015 USD.

Another round of tariff reform is needed to increase the financial viability of EDM. Moreover, EDM needs to set out further programs to increase its collection rate and reduce commercial losses and thefts. According to USAID's baseline report on Mozambique's electricity sector (July, 2015), it is difficult to establish the value of EDM's losses given the lack of accessible data. In 2011, publicly available documents report that illegal connections, illegal use of electricity, fraud on electricity installations, corruption of electricity meters and other non-technical losses amounted to about 26 MUSD. In addition to commercial losses, EDM also attributed a further 2 MUSD to vandalism of distribution and transmission infrastructure in the same year. In 2014, EDM reported 50 separate cases of theft and sabotage of electrical equipment.

EDM is also currently restructuring its commercial arrears, which would reduce the interest payment and hence more flexibility to carry out new investments.

As for the energy regulator, as recommended by the ERI 2020, Mozambique must improve its level of regulatory development, which currently ranks as very low in the AfDB index. ARENE lacks sufficient budget to operate, and the tariff-setting process is yet to be fully developed.

EDM financial performance is structurally weak due mainly to the practice of low energy placement fees, which have not been sufficient to cover the costs of power supply, operational and financial. On the other hand, the company debt levels are quite high, and debt service has been a significant burden on the company treasury.

Moreover, the ambitious scenario anticipated by the company in 2019 is revised downwards due to the COVID19 pandemic (reduction of economic activity, reduction of energy consumption, reduction of electrification programs and reduction in export volumes due to the "lockdown" of neighbouring countries).

Also, the recent tariff measures taken by the government do not help the company's finances. These are mainly the measures such as reduce the tariff applicable to customers by 50% with Social category, deferred payment of the fixed rate and 10% reduction in the energy bill general tariff customers, large low voltage and medium voltage consumers for Industrial, Commercial, Agricultural, Services, Hotel, Restaurant, Education and Facilities sectors Sports and Cultural.

Under the baseline scenario, EDM net results are expected to worsen by about 86% by 2024, while operating results grow 64% by 2024.

This improvement in operating results is substantially determined by (i) the ability to grow revenue in the three customer segments (Regulated Customers, Non-Regulated Customers and the Export Market, (ii) capacity and quality of infrastructure distribution, (iii) availability of energy in the supply sources, and (iv) ability to obtain financial resources to meet the investment needs to improve the conditions of energy supply and delivery.

EDM has planned and is implementing initiatives to reduce energy losses. The energy balance is expected to improve over the next 5 years, with a cumulative decrease of approximately 6.4%. This reduction in losses has a substantial impact on the

company's operating margins and operating results.

The expected growth in results, demand and supply of energy will only be possible if EDM has a capable and efficient operational and production capacity, including generation, transmission and distribution infrastructure. To this end, EDM plans capital investments of 1,162M USD over the next 5 years to strengthen operational and productive capacity.

## Challenges

Type of challenge	Description	Bridging the Gap
Institutional	Not cost-reflective tariffs	Review tariff structure to achieve cost reflectivity while introducing social tariffs only for low-income households. The ongoing tariff methodology study include Pricing arrangements (prices by different services, multi-year pricing regime), and Revenue requirement (allowed revenue, required revenue).
Institutional	Accountability and technical capacity of the Energy Regulator ARENE	Enable the Regulator the set and enforce cost reflective tariffs and empower the regulator to set and enforce technical and quality standards
Institutional	High commercial losses	Introduction of smart and pre-paid meters (It was introduced to address customer debt, curb electricity theft and improve EDM's cash flow. EDM decided to make prepayment the default system for all residential and small business customers) Improve the company's commercial systems to improve customer tracking and improve debt recovery rate.

## AfDB involvement in the power sector

As of 31st July 2020, the Bank had approved in Mozambique loans and grants amounting to a cumulative commitment of about UA 1.8 billion. Its lending operations in Mozambique started in 1977 and since then the Bank has approved a total of 112 loans and grants, in various sectors. The Bank has been a close partner for the GoM and the private sector. The Bank has positioned itself as a key partner in infrastructure, agriculture and for the country's green growth and resilience agenda. The Bank's increase in private sector investment in a country in transition like Mozambique was made possible by a substantial investment in project preparation and aggressive use of risk participation facilities. The Bank is swift on responding to Mozambique's emergency needs, supporting the GoM to deal with the impacts of Cyclones IDAI and Kenneth in 2019 as well as the COVID-19 pandemics.

Energy access has increased from 26% in 2018 to 32% in 2020, on track to achieve the 35% by 2022. The Bank has contributed, under the Enabling Large Scale Gas and Power Investments (ELSGAPI) to design and approve new electricity tariffs. With more than 1.350 kms of power distribution lines financed, facilitating access for more than 822.000 people, the Bank is an active player in strengthening the electricity sector. It is supporting with a UA10m Technical Assistance (TA) on reforming of the energy sector utilities and prepare the new pipeline of projects large scale energy projects. The Bank approved in 2019 supporting the Temane-Maputo transmission line, a crucial part of the backbone that will create an integrated national grid. Through SEFA fund, the Bank provides advisory on private sector participation framework in renewable energy including a feasibility study for construction and operationalization of a 60 MW grid-connected wind farm (the first one in Mozambique), support to implementation of the Renewable Energy Tariff Law, a Rural Electrification Strategy and the Regulatory Framework for the National Transmission Grid.

#	Project name	Fin. Inst.	App. Date	Entry Into Force Date	Final Disb. Date	Progress
1	Mozambique Lng Area 1	Loan	21/11/2019	11/06/2020	15/03/2025	0%
2	Multi-Country Covid-19 Response Support Program For Mozambiq	Grant	22/07/2020	28/07/2020	30/04/2021	0%
3	Multi-Country Covid-19 Response Support Program For Mozambiq	Grant	22/07/2020	28/07/2020	30/06/2021	0%

#	Project name	Fin. Inst.	App. Date	Entry Into Force Date	Final Disb. Date	Progress
4	Enabling Large Scale Gas & Pwr Investmnt	Loan	18/12/2013	03/02/2015	30/06/2022	63%
5	Post Cyclone Idai Emergency Recovery And Resilience Programm	Grant	05/06/2019	20/08/2019	30/12/2023	21%
6	Post Cyclone Idai Emergency Recovery And Resilience Programm	Grant	05/06/2019	20/08/2019	31/12/2023	33%
7	Post Cyclone Idai Emergency Recovery And Resilience Programm	Grant	05/06/2019	20/08/2019	31/12/2023	21%
8	Temane Transmission Project (Ttp)	Grant	19/07/2019	29/08/2019	31/12/2023	0%
9	MEFA-Mozambique energy for All <sup>9</sup>	Grant	8/04/2021	NA	30/03/2026	0%

## Donor engagement and coordination

Table 2 - Main electricity projects funded by Donors

PROJECT	CHAIR OF GROUP	PARTNERS PARTICIPATING
Development of the National Electrification Strategy and Plan (NESP)	WB	
Energy Development and Access Project (EDAP APL-2)	WB	IDA
STE Backbone project	WB	
IDA (International Development Association) Project to increase the transmission capacity and to improve the system operation of EDM	IDA	WB
On-grid IPP legal reform, and legal and transaction support	USAID	
Off-grid IPP law and regulatory environment	BRILHO	BRILHO program leads the support on the development of the off grid energy regulatory framework. They collaborate with USAID-SAEP, AfDB, etc
Support to Independent Regulator	USAID	Norway

PROJECT	CHAIR OF GROUP	PARTNERS PARTICIPATING
Strengthening EDM	USAID	AfDB, Power Africa
Transaction support, finance, and policy / regulatory design and reform	Power Africa	United States Embassy Economic Section, USAID, U.S. Trade and Development Agency, U.S. Foreign Commercial Service
Energy IV Project including CAIA-NACALA Electricity Transmission Project		
Rehabilitation of Mavuzi hydropower station and Chicamba hydropower station	AFD	SIDA, KfW
Connection to grid from Mocuba PV power station	Norway/IFC	
Development of Metoro PV power station (40MW)	AFD	
Development of Tsate hydro power station	EIB	SIDA, KfW
Development and construction of Cuamba PV solar PP	NORFUND / CDC	

# NOTE

<sup>1</sup> The construction of the Mphanda Nkuwa dam and hydroelectric plant will require an investment of US\$2.4 billion. In addition, the construction of a transmission line will bring the overall cost of the project to US\$4.4 billion

<sup>2</sup> According to EDM, Edm, Strategy 2018–2028

<sup>3</sup> Edm, Strategy 2018–2028

<sup>4</sup> Mozambique has now two separated systems, that could be interconnected from 2024. The simulations are based on existing power generation and on the development plan. Each project has been modeled based on the information provided on the progress (conceptual, feasibility study, under construction, etc.) and the expected operation start year.

<sup>5</sup> This graph should be updated with the power plants below.

- CTRG(170MW)Operation
- Gigawatt(100MW)Operation
- CTM(100MW)Operation
- Karpower(48MW)Operation;
- Temaninho(11MW) Operation;
- Mocuba Solar(41MWp).

<sup>6</sup> A new concept for dividing responsibility for electrification distinguishes Own Expansion Areas (OSA) from Non-Own Expansion Areas (Non-OSA). An OSA is an area within 100 meters of a main low voltage line.

<sup>7</sup> GET.invest is a European programme that mobilises investment in renewable energy in developing countries.

<sup>8</sup> FUNAE Energy Atlas is a study sponsored by the FUNAE, together with the National Directorate of New and Renewable Energy (DNER), carried out between the years 2011 and 2013.



## REFERENCES

- [1] IEA, Enerdata
- [2] International hydropower association (IHA)
- [3] Privacy Shield Framework
- [4] Get.Invest.eu
- [5] Renewables in Mozambique – National Status Report / October 2017
- [6] Final Energy report Mozambique
- [7] National Electrification Strategy & Plan for Universal Access to Energy by 2030
- [8] Mini-grid market opportunity assessment Mozambique – AFDB – 2017
- [9] SEforALL Africa Hub, 2017
- [10] Electricity Regulatory Index for Africa, 2020

## Annex I: Detailed description of priority projects

The following table lists all the priority projects in the power sector in Mozambique that are in search of funding. These projects are gathered by type (Generation, Transmission, Distribution) and by nature (Capital investment, Studies and Technical assistance). For each project, we indicate the organisation in charge, a short description, the expected impact of the project and the estimated cost of the project in millions of USD.

### Priority Investments - Generation

Project	Capacity	Brief description	Estimated cost	Technical feasibility	Financial feasibility	Financing	Implementation
Mphanda Nkuwa Hydropower plant	1500 MW	The Project will increase the power available in the SAPP by 1,500 MW, benefiting both the domestic market and countries in the region	4.4 B USD				
Tsate hydropower plant	50 MW	Project aiming to strengthen the energy supply availability and the central system stability in the Beira corridor, and to reduce the interrupted power supply (Matambo-Catandica-Chibata)	250 M USD				
Solar PV Project in Dondo, Province of Sofala	30 MW	Phase I of the PROLER, which is a programme of solar photovoltaic and wind projects to be developed through an Independent Power Producer (IPP) approach for a total capacity of around 120 MW	38 M USD			EDM stake of 10% financed by EU and the remaining 90% by winning bidder once selected	
Solar PV in Lichinga, Province of Niassa	30 MW	Phase II of the PROLER	40 M USD			EDM stake of 10% financed by EU and the remaining 90% by winning bidder once selected	
Solar PV in Manje, Province of Tete	30 MW	Phase III of the PROLER	40 M USD			EDM stake of 10% financed by EU and the remaining 90% by winning bidder once selected	
Namaacha Wind Farm (Eleqtra)	120 MW	Namaacha wind project approved in 2018. Framework agreement signed between EDM and EleQtra. USTDA awarded a grant to EleQtra to carry out feasibility study.	280 MUSD				

Technical feasibility refers to feasibility and environmental impact studies. Economic feasibility is reached upon government approval of the kWh tariff (or EPC contract). Financing indicates achievement of financial close (including necessary guarantees). Implementation includes all actions aimed at advancing projects after financial closure, including land expropriation, permits, construction. LEGEND - **Green**: phase completed; **Amber**: phase ongoing; **Red**: phase not started or lack of information.

Project	Capacity	Brief description	Estimated cost	Technical feasibility	Financial feasibility	Financing	Implementation
Namaacha Wind Farm (Source energy and Globeleq)	120 MW	Namaacha Wind project approved in 2018. Framework agreement signed between EDM and Globeleq. The Project development phase is fully concluded.					
Inhambane Wind	30 MW	Phase IV of the PROLER	45 M USD			EDM stake of 10% financed by EU and the remaining 90% by winning bidder once selected	

### Priority Investments - Transmission network

Project	Capacity	Brief description	Estimated cost	Technical feasibility	Financial feasibility	Financing	Implementation
High Voltage Transmission Line Nampula – Angoche	110 kV	The project will increase the northern system reliability, and the power availability to Angoche District to enhance the connection of new customers under PROENERGIA programme as well as, supply mining and fisheries projects.	55 MUSD				
High Voltage Transmission Line Chimura – Nacala (Fase II)	400kV	Project aiming to increase power transmission capacity, grid stability and reliability, and redundancy in the northern and central regions; and to allow the interconnection of new generation projects in Zambézia, Nampula and Niassa provinces.	160 MUSD				
High Voltage Transmission Line Vilanculos - Massingao , 110 kV	110 kV	Project aiming to interconnect the southern and central systems and allowing the transport, at 110kV, of the power produced in the central system to the southern region.	40 MUSD				
High Voltage Transmission Line Songo - Matambo - Phase II)	400 kV	The project will contribute to increase the power availability and reliability transported to Malawi.	120 MUSD				
High Voltage Transmission Line Matambo - Inchope - Vilanculos (STE - Phase II)	400 kV	The project will increase the interconnection between the center and southern systems and contribute to the increase in power transport capacity and the establishment of the north-south backbone at 400kV.	650 MUSD				

Project	Capacity	Brief description	Estimated cost	Technical feasibility	Financial feasibility	Financing	Implementation
National Dispatching Centre		With the integration of the national transmission systems and the further integration in the SAPP regional network, it is of paramount importance that EdM is able to control the electricity system thanks to a best-in-class dispatching centre.	60 MUSD				
Nacala Port Substation	(2x40MVA, 110/33kV)	This project aims at increasing transforming capacity at the existent Nacala Port substation, increasing availability and reliability of supply in Nacala city, thus unlocking the demand increase in Nacala and surrounding areas and finally to allow the expansion of grid distribution projects to connect new domestic and industrial clients to the national grid.	60 MUSD				
Triunfo Substation	(2x40MVA, 66/33kV)	This project will contribute to decongest the SE5 (Campus UEM) and SE 11 (Costa do Sol) substations, with the interconnecting with the planned Matalane substation (under construction). It will also enable the demand increase in the main urban neighbourhoods around Maputo, improving redundancy in the 66kv system.	18 MUSD				
Língamo Substation	(2x40MVA, 66/33kV)	This project will increase the power system reliability and availability for Matola city and surroundings and allow load transfers between the Matola Rio, Machava and CTM substations.	15 MUSD				
Manga Substation:	(2x40MVA, 220/22kV)	This project will improve the availability and reliability of power supply to the City of Beira and create its second power injection point, allowing the expansion of the port and industrial activity.	62 MUSD				
ProEnergia (Distribution grid extension component)		The project aims to ensure the universal access by 2030, to reduce losses, to improve customer service and EDM revenue.					

### Priority Investments - Decentralized Electrification

Project	Capacity	Brief description	Estimated cost	Technical feasibility	Financial feasibility	Financing	Implementation
ProEnergia (Energy for all electrification programme) – Off-Grid component		The Project aims to Electrify the remaining administrative posts and to Implement SHS and Mini-Grid programmes (RBF, competitive tender).					

## Key Sector Reforms

Proposed reform	Issue
Update the integrated masterplan and evaluate whether coal remains a priority.	Uncertainty over structure and evolution of the generation mix in the light of CO2 emission abatement targets
Adoption of National Strategy containing envisaged energy mix, clear targets, contribution of different natural resources to the power sector, etc.	Absence of a clear Energy Policy Umbrella Strategy
Coordination of inter-ministerial actions	Lack of planning capacity within the Ministry of Mineral Resources and Energy
Institutional progressive reform to establish a fully independent power system operator, a major political reform which aiming to create an entity that will manage the transmission system, and an entity that will manage the distribution (market operation and system operator functions).	Absence of a National Grid Manager entity responsible for market operator and system operator functions; Electrification planning does not have an integrated approach; Lack of clarity regarding the Off-grid planning
Update the Master Plan	Electrical Infrastructure – Integrated Masterplan 2018-2043 is outdated
Support EDM in increasing its financial performance (Cost reflective tariff, Introduction of smart and pre-paid meters, etc.)	Difficulty in obtaining financial guarantees for long-term PPAs
Support the development of the Novas Energias programme	
Support EDM in increasing its financial performance (Cost reflective tariff, Introduction of smart and pre-paid meters, etc.)	Lack of revenues to pay for transmission investment
Need to rehabilitate existing network and invest in new equipment	High technical and commercial losses



Proposed reform	Issue
Electrification unit skills enhancement, embedded advisory, building capacity. Developing and structuring competitive tender processes.	Lack of planning capacity from MIREME delaying the structuring / implementation of electrification and generation projects
Evaluate VAT exemptions for solar equipment in order to make them more affordable for low-income households	Low income population can hardly afford the Solar Home Systems
RBF clean cooking donor funded programmes to massify the use of clean and sustainable sources of energy for cooking	Policy uncertainty to provide clean cooking solutions to the Mozambican population. 80% of the Mozambican households still rely on biomass and wood.
Review duties and taxation system for the rural electrification sector	Import duties on equipment for rural electrification
Improve testing capabilities of National laboratories	Product certification for rural electrification and clean cooking
In process of developing regulations on mini-grids	Nearly two-thirds of the country's 30 million people live in dispersed off-grid communities (limited transmission and distribution system)
Making SHS more affordable for rural households (by exempting solar products from taxes during implementation of the Roadmap and by providing subsidies for SHS sales)	29% of 4 million households will not probably be able to purchase a SHS due to poverty
Develop simplified licensing framework for off-grid and small size systems	Lack of licensing framework
Develop and implement quality of service regulation or code	Quality of service remains quite weak
Develop technical standards for standalone systems	To reduce, Technical issues relevant to the development and operation of stand-alone power systems (SAPS), Reliability, Frequency, Stability, Safety etc.
Undertake customer satisfaction surveys	To improve Quality of service permanently
Create specialized and independent mechanisms/bodies to contest the regulator's decisions	To monitor bodies in charge of regulatory reforms

Proposed reform	Issue
Review tariff structure to achieve cost reflectivity while introducing social tariffs only for low-income households	Not cost-reflective tariffs
Reduce technical losses (investment in new equipment), and commercial losses (Introduction of smart and pre-paid meters); implement cost reflective tariff	EDM operational and financial performance (high cost of service mainly due to the IPPs, non-cost reflective tariffs, 30% of losses (technical + commercial)
Ongoing Revenue Requirement Study: Draft Tariff Methodology prepared by Mercados – Aries International (MAI) and Estudios Energéticos Consultores (EEC) at the request of ARENE	Lack of regulatory clarity on the tariff structure
Enable the Regulator the set and enforce cost reflective tariffs and empower the regulator to set and enforce technical and quality standards	Accountability and technical capacity of the Energy Regulator ARENE
Introduction of smart and pre-paid meters	High commercial losses





### **Contacts**

African Development Bank Group  
Avenue Joseph Anoma  
01 BP 1387 Abidjan 01  
Côte d'Ivoire

Some Bank operations are located at  
Immeuble du Centre de commerce International d'Abidjan CCIA  
Avenue Jean-Paul II  
01 BP 1387  
Abidjan 01, Côte d'Ivoire  
Phone (Standard): +225 2720263900

<https://www.afdb.org/en>

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