SARW
Southern Africa Resource Watch

Resource Insight
CRMREN06/022025

Critical Minerals and Renewable Energy Value Chains in Mozambique

A Study of Actors and Initiatives

THIS REPORT IS PUBLISHED BY THE SOUTHERN AFRICA RESOURCE WATCH (SARW)

41 Holt Street
Parkmore
Johannesburg
South Africa
2196
www.sarwatch.co.za

Editorial Team: Dr Claude Kabemba and Davie Malungisa

We appreciate feedback on this publication. Write to info@sarwatch.org.

ACKNOWLEDGEMENTS

This publication is based on the findings of a research project called *Critical Minerals and Renewable Energy Value Chains in Southern Africa: A Study of Actors and Initiatives.* This study report focused on Mozambique and was commissioned by the Southern Africa Resources Watch (SARW). The study is part of SARW's *Strategic Minerals and the Energy Transition in Southern Africa Research Series.*

Grateful appreciation is expressed to the researchers. In particular, the research effort of
Germano Brujane and Dr Boaventura Monjane, and additional research support of Davie Malungisa and Dr Claude Kabemba's editorial guidance.

TABLE OF CONTENTS

LIST OF ACRONYMS

AfCFTA	African Continental Free Trade Area
ARENE	Mozambique independent energy regulator authority
DGML	Deccan Gold Mines Limited
DGMOZ	Deccan Gold Mozambique
DRC	Democratic Republic of Congo
EDM	*Electricidade de Mocambique*
ESG	Environmental, social and governance (standards)
EU	European Union
EV	Electric vehicle
FDI	Foreign direct investment
FPIC	Free prior and informed consent
FUNAE	Mozambique energy fund institute
GDP	Gross domestic product
GHG	Greenhouse gas
JET	Just energy transition
HCB	*Hidroeléctrica de Cahora Bassa*
HDI	Human Development Index
IEA	International Energy Agency
IPP	Independent power producer
IRENA	International Renewable Energy Agency
LNG	Liquefied natural gas
MW	Megawatts
NDC	Nationally determined contribution
PPA	Power purchase agreements
PPP	Public-private partnership
REE	Rare earth element
SADC	Southern African Development Community
SAPP	Southern Africa Power Pool
SME	Small or medium enterprise
SWF	Sovereign wealth fund
TNC	Transnational corporation
UK	United Kingdom
US	United States

EXECUTIVE SUMMARY

Mozambique is at the centre of the global transition towards a sustainable energy and climate-resilient future, headlined by the country's substantial graphite reserves. This report delves into the multifaceted aspects of graphite and other critical minerals, emphasising the actors and initiatives involved in renewable energy value chains.

The strategic importance of Mozambique in the global energy transition cannot be overstated. In addition to its battery-grade natural graphite, it has aluminium and rare earth elements. Mozambique's potential for lithium discoveries is high. Corporations such as Firefinch Limited, an Australian mining company, and Jindal Steel and Power, an Indian mining company, have driven the exploration and development of lithium resources. Mozambique is, therefore, strategically positioned as a supplier of electric battery-grade minerals, and investors are in a rush to grab a share of its critical raw materials.
However, its graphite is exported in raw form to destinations such as the US, Japan, and China. Jobs and wealth are, therefore, externalised. The country's leadership has stated that it must exploit opportunities to add value and industrialise. While recommending local manufacturing, the study notes Mozambique's low industrial capacity. The country should explore participation in regional value chains within the Southern African Development Community (SADC), where countries like the Democratic Republic of Congo (DRC), South Africa, Mozambique, and Zimbabwe possess massive deposits of critical minerals, and regional coordination is required to create a hub of green technology value chains.

Energy is crucial to mining and other industrial processes. In this respect, the report explores Mozambique's energy generation and supply mix. The electricity sector is dominated by renewable energy sources – hydropower, supplemented by emerging solar and wind energy installations. Several renewable energy initiatives are highlighted in the report.

Mozambique has a vast natural gas economy. This fossil industry is highlighted as a contradiction when compared to the country's contribution to supplies of critical minerals, its clean energy from hydropower, and its solar potential. The possibility of using the natural gas revenue-backed Sovereign Wealth Fund to fund the energy discussion is hinted at. Furthermore, the report suggests harnessing revenues from critical minerals into the sovereign fund.

Increased mining will create further challenges for socio-economic and environmental stewards. Therefore, a focus on sustainability is explored. The social and ecological risks of extracting critical minerals need to be addressed. This is a call to action to mitigate adverse impacts on local communities and ecosystems. Mining companies must respect environmental, social, and governance (ESG) standards and enabling laws. This includes the need to obtain a social licence to operate, placing at its core the rights of mine workers and communities, transparent decision-making processes, credible benefit-sharing agreements, and the establishment of grievance redress mechanisms.

In conclusion, Mozambique's effort to craft an equitable and resource-based industrialisation path must be based on a sound Critical Minerals Strategy and Critical Mineral List following the example of Zambia and developed countries such as Australia and Canada. This list, which categorises minerals based on their criticality and strategic importance to public policy and the broader stakeholder universe, is not just a suggestion but a necessity for strategic planning.

1. INTRODUCTION

In the early 2000s, Mozambique experienced a natural resources boom, particularly beginning with large coal explorations and mega projects in the province of Tete. Coupled with recent discoveries of liquid natural gas (LNG), the expectation for the country to transition to resource-driven, and sustainable, development became real. The legitimate projections that the country would finally and unequivocally rise from the ranks of impoverished and indebted nations was based on a genuine use of the country's abundant natural resources.[1] However, this promise remains unfulfilled. In the current climate-change-driven global transition to clean energy sources, Mozambique has an endowment of minerals that are key to the manufacturing of green technologies such as solar panels, wind turbines and electric batteries. These minerals include Mozambique's graphite and rare earth elements (REEs). Because of the concentration of the minerals in a few countries, the high demand to secure supplies has placed countries like Mozambique at the centre of the scramble for energy transition minerals.

This study explores the various dimensions linking energy transition minerals, renewable energy initiatives, and a just transition in Mozambique.

[1] See Anselmo Matusse, "Extractive Enchantment:" Unveiling the Dynamics of Resource Governance in Mozambique" (Kujenga Amani, SSRC, 24 October 2023)<https://kujenga-amani.ssrc.org/2023/10/24/extractive-enchantment-unveiling-the-dynamics-of-resource-governance-in-mozambique/> accessed 5 April 2024.

2. METHODOLOGY

This report involved a comprehensive desk review focusing on a wide array of reports from diverse institutions, particularly those published by development agencies, civil society organisations, academic institutions, government bodies, and the media. In addition to the documentary analysis, semi-structured interviews were conducted with representatives from the private sector, civil society organisations and government departments. The interviews focused on actors and initiatives involved in energy transition minerals and renewable energy value chains. These interviews provided valuable insights and complemented the data obtained from the documentary sources, ensuring a well-rounded and robust foundation for the report's findings and recommendations.

It is important to note that countries that are resource-rich (like Mozambique) are faced with a double dilemma: 1) how to transition national energy supply from fossil fuels to clean energy, and 2) how to ensure that energy transition minerals, and especially the mining sector, manage a transformation process that facilitates value addition for the manufacturing of green technologies for renewable energy. Underlying the double dilemma is the need to ensure that the transition is just. In this context, this paper addresses the issue of Mozambique's energy mix, then the minerals economy, and the question of a justice energy transition. This is followed by recommendations and the conclusion.

3. SOCIO-ECONOMIC SITUATION: CLIMATE VULNERABILITY AND ENERGY POVERTY

Mozambique has a population of about 33 million people (2022), two-thirds of whom live and work in rural areas. Between 2014/15 and 2019/20, Mozambique's national poverty rate increased from 48.4 per cent to 62.8 per cent (i.e., from 13.1 to 18.9 million people). Inequality is high with education and health services unevenly distributed, disproportionately affecting women and girls.

In the past, the country experienced a civil war which ended in 1992. After a period of peace, the country has again recently been war-torn due to the insurgency in the gas-rich province of Cabo Delgado. The resource-driven conflict in Cabo Delgado has resulted in loss of lives and displacement. The consequent humanitarian crisis has been multi-fold and peace-building efforts are required to stabilise the situation. Of significance has been the conflict's impact in LNG projects in Cabo Delgado.

Mozambique is one of the most climate-vulnerable countries due to its geographical location. Natural hazards, such as droughts and cyclones, have persistently affected the country. Stretching over 2700 km, Mozambique's low-lying coastal areas have exposed its population to flooding. Tropical cyclones, climate loss and damage are among the highest in the world. In intervals of about three years, Mozambique has experienced droughts that have resulted in agricultural losses and food insecurity.

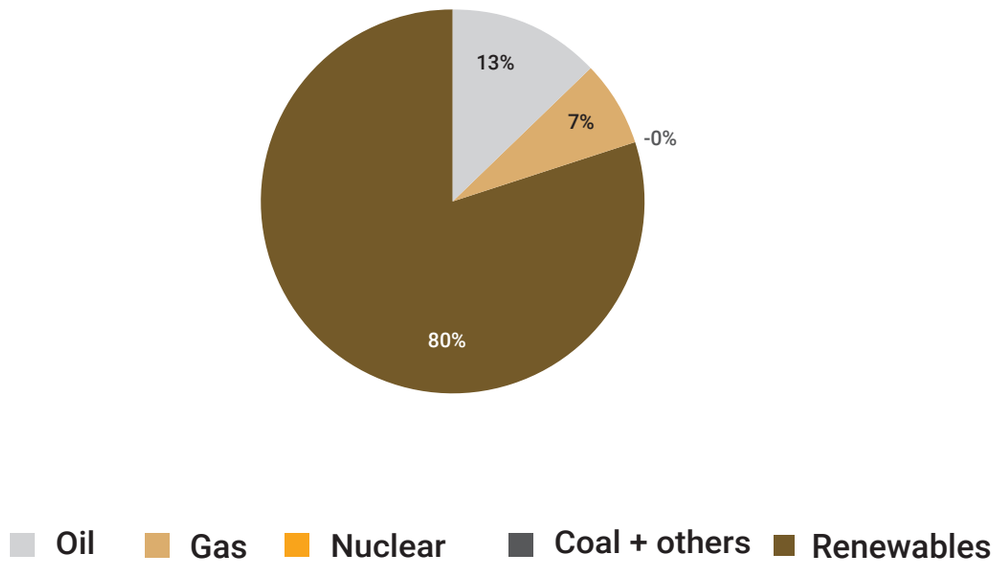
Mozambique faces severe challenges in its electrification programmes. This has resulted in shortcomings in energy access regarding the provision of reliable and affordable electricity for most of the country's population. Access to electricity in Mozambique stands at 41 per cent, and additional work is needed to reach the entire population.[2] The government has made a concerted effort to triple the connection rate through the National Energy for All Programme, increasing from the historical average of 100 000 connections per year until 2018 to an average of 320 000 connections per year starting from 2022. This is an important policy to address energy poverty in Mozambique. At the current rate of electrification, Mozambique will connect 6.2 million users, reaching 63-65 per cent of its population by 2030, through grid connections.[3] Given the tension between fossil fuels and renewable energy in the country's energy mix, most of the progress will depend on its energy policies.

[2] Grupo Banco Mundial "Cima e Relatório de Desenvolvimento de Moçambique." (Washington, EUA, December 2023). <https://documents.worldbank.org/en/publication/documentsreports/documentdetail/099113023154021937/p1771520fcab7a0930aca102c9d7107d4cc> accessed 7 March 2024
[3] Ibid

4. ENERGY MIX

Mozambique has the potential to become the Southern African region's energy hub. It is a net energy exporter, and to maintain this position the government has embarked on policies that are market-orientated to attract foreign investment into the sector. However, state presence in the sector remains significant through public-private partnerships (PPPs). As far back as 2021, in terms of the energy capacity of all countries in the Southern Africa Power Pool (SAPP), Mozambique has been ranked as having the highest energy capacity in the region. Its total energy capacity is estimated at 187 000MW and is composed of coal, hydroelectricity, natural gas, oil, solar energy, and wind power.[4] The country's technically feasible hydropower potential is 6600MW, covering 92 per cent of the current electricity demand. Mozambique's capacity is 2889MW, of which 80 per cent is supplied by hydroelectric power, 17 per cent by gas, 6 per cent by oil, and 1 per cent by solar energy.

Figure 1: Total Energy Supply of Mozambique in 2020



Source: IRENA 2023

Table 1: Installed Hydropower Capacity in Mozambique

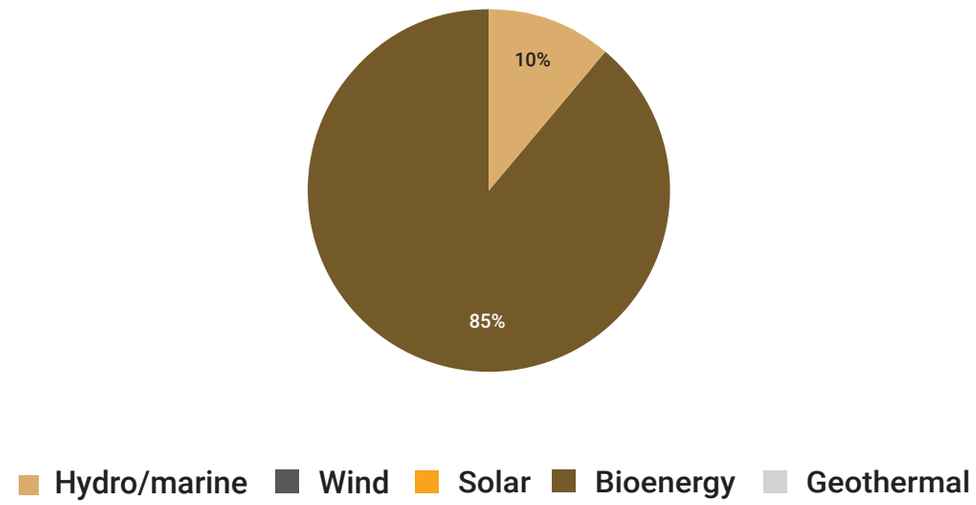
Plant	Installed Capacity (MW)	Location	Operator
Cahora Bassa	2075	Tete	HCB
Mavuzi	52	Manica	EDM
Chicamba	44	Manica	EDM
Corumana	166	Maputo	EDM
Cuamba	1.09	Niassa	EDM
Lichinga	0.73	Niassa	EDM

Source: See https://database.earth/energy/power-plants/hydro-power/mozambique

[4] See Privacy Shield, "Mozambique Country Commercial Guide" (Privacy Shield, n.d.) <https://www.privacyshield.gov/ps/article?id=Mozambique-Energy> accessed 5 April 2024.

The Hidroeléctrica de Cahora Bassa (HCB) power station on the Zambezi River provides over 90 per cent of all hydroelectric power generated for the country which has a peak demand of about 1850 MW. More than 70 per cent of Mozambique's electricity is exported to South Africa, Mozambique, Zimbabwe, and Botswana who are members of SAPP.[5] The SAPP, created in August 1995 by SADC member governments (excluding Mauritius), is a regional power pool that was initiated through an inter-governmental memorandum of understanding. Three Mozambican electricity companies are part of SAPP: Electricidade de Mozambique (EDM), HCB, and Mozambique Transmission Company (Motraco). As shown in Figure 2 below, hydroelectric and biomass dominate renewable energy consumption in Mozambique.

Figure 2: Renewable Energy Supply in 2020



Source: IRENA 2023

Mozambique's woodlands have abundant firewood with a biomass potential of over 2GW. Both charcoal and firewood constitute an essential fuel for cooking and heating. As shown in Figure 2 above, biomass constitutes about 85 per cent of Mozambique's renewable energy supply. However, wood fuel contributes to health and environmental hazards. Respiratory diseases and deforestation are some of the effects of the unsustainable use of biomass. In the context of climate change, biomass emits greenhouse gases (GHGs) that must be curbed using clean energy, a task that Mozambique's National Directorate of New and Renewable Energy is committed to, mainly through the Biomass Energy Strategy of 2012.

[5] The SAPP is a cooperation of the national electricity companies of Southern Africa under the auspices of the Southern African Development Community (SADC). SAPP members have set up a common electricity grid between their countries and a common market for electricity in the SADC region.

5. RENEWABLE ENERGY INITIATIVES

5.1. PUBLIC POLICY INCENTIVES

Mozambique's energy sector is poised for significant shifts toward renewable energy sources in the coming years (Simelane, 2023). This shift is crucial for the nation's economy given the substantial foreign exchange earnings derived from energy exports. Governmental commitment to extending renewable energy access to all citizens is evident in Resolution No. 62/2009, underlining the importance of political backing for this transition. As outlined by the Mozambican government,[6] the nation's energy strategy revolves around four key elements: 1) bolstering clean energy production via hydroelectric, solar, and wind projects to reduce reliance on fossil fuels; 2) fostering green industrialisation, particularly within industrial corridors like the Nacala corridor; 3) advancing initiatives for universal energy access by 2030, including clean cooking technologies and solar mini-grids; and 4) encouraging eco-friendly transportation by introducing electric vehicles, expanding gas-powered vehicle usage, and promoting biofuels. Mozambique's new electricity law has created incentives to ease the licensing and permitting of new electricity projects in support of independent power producers (IPPs). Trade policy incentives include a fiscal policy law that exempts Value Addition Tax (VAT) on the importation of equipment for electrification.

The new independent regulator, the Energy Regulatory Authority (ARENE), has commenced its work and is fulfilling the critical role of fostering private sector investment while ensuring consumer protection. The new regulation for off-grid energy producers was a recent milestone that resulted from ARENE's work. The government has ambitious energy policy targets, such as universal access to electricity for the entire population by 2030 and a newly approved electricity law that provides an enhanced legal framework for IPPs and renewable energy production. The energy reforms regulate private sector participation in markets previously limited to state-owned enterprises.

5.2.1. Mphanda Nkuwa Hydroelectric Project

Recently, Mozambique announced the consortium led by Electricité de France (EDF, which includes TotalEnergies, Sumitomo Corporation, and Kansai) as the preferred bidder in the tender for the selection of the strategic partner for the development of the Mphanda Nkuwa Hydroelectric Project valued at US$4.5 billion. The chosen consortium will hold a 70 per cent stake in the project, with the remaining 30 per cent distributed among the state-owned companies EDM and HCB. The project includes the development of a dam, a hydroelectric power plant with a capacity of up to 1500 Megawatts, and a 1300km high-voltage electricity transmission line from the project site in Tete Province to Maputo. It is a run-of-the-river hydroelectric facility on the Zambezi River. The project is scheduled for completion in 2031.

5.2.2. Micro-Hydro Energy Projects and Off-Grid Solutions

Mozambique's national grid does not reach most rural areas. This is because of long distances, inadequate infrastructure, and poverty, which prevents poor populations from affording electricity user fees. In this context, more localised solutions are required. These have been characterised by off-grid solutions such as micro-hydropower plants. Several initiatives are seeking to explore the possibilities of small-scale hydroelectric generation to provide off-grid access to electricity. This has resulted in using rivers to install electricity generation plants. The Mozambique Energy Fund Institute (FUNAE) has been a critical actor in this regard. FUNAE focuses on small (less than 10MW) off-grid energy projects.

[6] See Africa Development Bank, "COP28: Mozambique's $80 billion energy transition will leverage its vast renewable resources, says President" <https://www.afdb.org/en/news-and-events/press-releases/cop28-mozambiques-80-billion-energy-transition-will-leverage-its-vast-renewable-resources-says-president-66710> accessed 29 April 2024.

5.2. NEW HYDRO ENERGY INITIATIVES
5.3. SOLAR ENERGY PROJECTS

There are several solar energy projects in Mozambique. These are shown in Table 2 below and are under various phases from tender through construction to operating stage.

Table 2: Large Scale Solar Projects in Mozambique

Solar Plant	Description	Status
30MW, Mocumba, Zambezia	Photovoltaic (PV) facility owned by EDM and two Norwegian IPPs: Scatec Solar and KLP Norfund Investments. The facility will supply electricity to about 175 000 households as part of a 25-year power purchase agreement with EDM.	In operation since 2019
30MW, Metoro, Cabo Delgado	Owned by the French IPP Neoen (75% share) and EDM (25% share), this initiative has capacity to add 69% GW/hr per year electricity to the national grid. Neoen has already signed a 20-year power purchase agreement with EDM.	In operation since 2019
30MW Dondo, Sofala	Total Eren is responsible for design, financing, construction and operation of this project under a public-private partnership model. Total Eren will also sign a power purchase agreement to sell to EDM.	On April 2022, ARENE awarded the tender to Total Eren.
30MWp, Chimuara	SolarCentury Africa, Renewable Energy Services Africa (RESA) and Checunda Investimentos are jointly developing this plant and the electricity will be sold to EDM.	Land secured and will be built in phases with the first phase having the capacity of 30MWp.
19MWp solar plant with a 2MW (7MWh) energy storage system, Cuamba, Niassa	Globeleq and Source Energia are responsible for constructing this plant and the generated electricity will be sold to EDM using a 25-year long power purchase agreements (PPA). The companies will also upgrade the existing Cuamba sub-station as part of their agreement with EDM.	Under construction

The 30MW Mocuba solar project was commissioned as part of the government Economic and Social Development Plan (2015/16). The investment is owned by EDM and two Norwegian IPPs with a target to supply electricity to about 175 000 when in full operation. An important aspect is how EDM has been able to partner with foreign investors to mobilise capital for solar projects. This has been through public-private partnerships (PPPs) and the signing of off-take agreements in the form of power purchase agreements (PPAs) for about 25 years. An example is Globeleq and Source Energia, which is constructing a 19MWp solar plant with a 2MW (7MWh) energy storage system in Cuamba, Niassa, based on a 25-year PPA signed with EDM.

Since 2016, the global partnership Energizing Development (EnDev)[7] has supported companies to provide access to sustainable energy to over 2.3 million Mozambicans through grid densification, village mini grids based on hydropower plants, solar lanterns, home solar systems, and improved stoves. Green People's Energy encourages productive energy use in small or medium enterprises (SMEs), social infrastructure, capacity development in renewable energies for the private and public sector, and the development of specialised curricula for higher and technical education and technical team training. The German Development Cooperation, implemented through KfW for financial co-operation (FC) and GIZ for technical cooperation (TC), is supporting the Mozambican government with various programmes to advance the reform process further and bring it to life. The GET FiT Mozambique (FC) aims to install 130MW of dispatched renewable energy, such

[7] EnDev's projects are supported by several countries, including Germany, the Netherlands, Norway, Sweden, the United Kingdom, and Switzerland, with additional co-funding from Ireland and the European Union. See EnDev, "Energising change" (EnDev n.d.) <https://endev.info/about-endev/> accessed 5 March 2024.

as photovoltaic solar energy plus storage and small hydropower plants, each project ranging from 4 to 15MW. Based on the experience of Uganda and Zambia, GET FiT aims to unlock private investments in erenewable energy projects by reducing risks, improving the attractiveness of the investment environment, increasing institutional capacity, and building a track record of successfully implemented projects. The programme's comprehensive toolbox finances tariff top-ups, grid integration, single buyer guarantees, and technical support. Similar to the PROLER dual programme, funded by the EU and managed by AFD, projects under GET FiT will be selected through a two-phase auction process for lower tariffs. GET FiT also has an off-grid component aimed at installing mini-grids with a total capacity of 3MW based on photovoltaic solar energy plus storage, divided into 10-16 projects. The implementation of the programme has just begun.

In addition to the above large-scale solar generation projects, there has been a surge in the individual use of solar panels to generate electricity at a local level. Households in Mozambique are appreciating the use of clean energy as it is off-grid and easily accessible through retail shops. The solar panels are placed on rooftops to capture the abundant sun in Mozambique. These developments are important as they are climate-smart and offer households a degree of energy independence.

5.4. WIND ENERGY

With a potential wind energy capacity of 4.5GW, Mozambique's renewable energy sources are abundant, and the provinces of Tete, Maputo, Sofala, Gaza, and Inhambane possess the most potential. The highest wind speed is an average of 80km/h. However, there are only a few wind projects in Mozambique. Two planned projects have installed energy capacity of 170MW. This consists of a 50MW plant in the Inhambane province and a 120MW project in Namaacha near Maputo to be operated by a private company, EleQtra, based on a PPA to sell the electricity to EDM. Like solar projects, private capital investments are prominent in Mozambique's new renewable energy projects.

Mozambique is a net exporter of electricity and has great potential to add more hydro, solar, and wind energy sources to its exports to SAPP. However, with abundant natural gas, Mozambique's renewable energy success story is under threat. The country is expected to increase the installation of gas-powered stations. This will dilute Mozambique's clean energy potential, yet the government authorities argue that gas is a practical and economical energy resource that must be promoted for the country's socio-economic development. On the other hand, Mozambique's minerals economy has an abundance of energy transition minerals, such as graphite, that are exported raw with little beneficiation. It is, therefore, essential to explore how Mozambique's energy and minerals situation will shape the country's decarbonisation agenda, looking at opportunities and challenges.

As noted in individual households' increasing use of solar panels, micro-wind turbines are a feature of Mozambique's off-grid energy landscape. There is great potential to promote and harness wind power in Mozambique's search for universal energy and affordable energy access. The government has put in place incentives to promote the import of electricity products, and this points to a lack of local manufacturing capacity for renewable energy technologies such as solar panels, wind turbines, and energy storage systems such as lithium batteries.

6. THE CONTRADICTION OF LNG AND A CLEAN ENERGY FUTURE

6.1. THE ROVUMA BASIN AND LIQUEFIED NATURAL GAS (LNG)

The hydrocarbon sector is one of the largest economic sectors in Mozambique. Mozambique is the tenth largest coal exporter in the world. However, the new focus is now on LNG projects that have attracted substantial foreign direct investment (FDI) in recent years. In the context of a global energy transition, gas has been a controversial fuel in that its proponents advocate for the classification of gas as a transition fuel. According to Dr Fatih Birol, Executive Director of the International Energy Agency (IEA), "Natural gas is one of the mainstays of global energy. Where it replaces more polluting fuels, it improves air quality and limits emissions of carbon dioxide." Supported by the African Union, the Mozambican government has placed gas as a critical fuel in its energy mix and an economic growth catalyst through FDI.

The role of energy and mining sectors in the economy has been further amplified by the LNG mega-projects. The Rovuma Basin in Mozambique is one of the largest natural gas reserves in the world, attracting significant attention from major multinational corporations such as TotalEnergies (France), ExxonMobil (USA), and Eni (Italy). The development of natural gas projects in the Rovuma Basin is anticipated to drive substantial GDP growth and attract considerable foreign investment, thereby playing a pivotal role in the country's economic development and integration into the global energy market.

Cabo Delgado, a province rich in natural gas, has become a focal point of geopolitical competition. The discovery of vast offshore natural gas reserves has attracted significant interest from international energy companies and foreign governments. The governments of Italy, China, France, and the USA have shown active interest in supporting their national oil and gas companies through diplomatic and financial means. This support includes negotiating terms favourable to their national corporations and providing security assistance.

6.2. GAS AND THERMAL POWER STATIONS

Gas is vital to Mozambique's energy mix and is expected to reach about 44 per cent share, overtaking hydropower in the next decade. Most thermal power plants in operation in Mozambique are powered by gas. Gas-powered plants include: 1) Central Termica de Ressano Garcia (CTRG), a 175.14MW thermal power project located in Maputo commissioned in 2014. The project was developed by South Africa's Sasol New Energy Holdings, which jointly owns the project with EDM. It uses natural gas as its source of fuel. 2) Karadeniz Powership Mehmet Bey is a 125MW thermal power project in Nampula commissioned in 2018. The project is a subsidiary of the Turkey-based Karadeniz Energy Group. The power plant uses a combination of fossil liquids (fuel oil) and fossil gas (LNG) for power generation. It is the first LNG-to-power project in sub-Saharan Africa. 3) The Ressano Garcia Gas Fired Power Plant Phase II is a 122MW thermal project commissioned in 2013 and owned by Aggreko in Maputo. 4) The Karadeniz Powership on the ship Irem Sultan has a capacity of 115MW and was commissioned in 2016 and developed by Karpowership. The plant is in Nampula and vital to the Nacala-Porto Special Economic Zone and is a floating power station docked in Nacala port. 5) The Ressano Garcia Gas Fired Power Plant started its operations in 2012 and is a 107.50MW thermal project developed by Aggreko and jointly owned with South Africa's Shanduka Group.

The largest gas-powered station, the Temane Thermal Power Station, will start operating in 2024. This 450MW facility was developed by an IPP, Globeleq, in partnership with South Africa's Sasol and Mozambique state-owned company EDM. (See news article in Figure 3). Based on the role played by LNG-to-power projects in Mozambique, it is arguable that gas is a critical part of Mozambique's energy mix, and particularly of the coun-

try's energy security.

Figure 3: The Temane Thermal Gas-Powered Station

- **The Temane Thermal Power Station in Mozambique will commence operations this year, boosting the country's electricity generation by 16% while fostering job creation and industrial growth.**
- **Construction of the 450 MW facility started in March 2022 and reached 65% completion in December 2023, according to Carlos Zacarias, Mozambique's Minister of Mineral Resources and Energy.**
- **The $650 million project is Mozambique's largest gas-fired power plant and will use gas extracted from the Pande, Temane and Inhassoro fields to generate electricity. The plant will provide power to 1.5 million households.**
- **The project is developed through a public-private partnership led by independent power producer Globeleq, global chemicals and energy firm Sasol, and Mozambique's state utility Electricidade de Moçambique.**
- **At a cost of $400 million, a 563 km-long power transmission line is under construction to facilitate the transportation of electricity from the project within Mozambique and across the region. The project is in line with Mozambique's Energy Transition Strategy as well as the country's Universal Access to Energy by 2030 Program.**

Source: https://energycapitalpower.com/mozambique-thermal-power-plant-temane/

7. MOZAMBIQUE'S CRITICAL MINERALS-ENERGY COMPLEX

This section examines supply chains and value addition in Mozambique's critical minerals and energy sectors, and how these two sectors are related.

7.1. CRITICAL MINERALS PROFILE

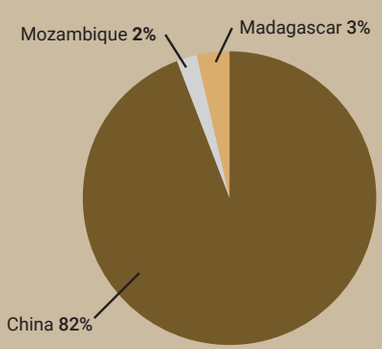
Mozambique's critical minerals remain under-explored and, in the absence of a clearly articulated strategy, the sector is largely driven by geo-politics.

Mozambique is endowed with an array of minerals critical to the global energy transition (including graphite, titanium, and lithium), positioning the country as a critical player in the supply chain for energy transition minerals. It is important to note that two distinct groups of actors are involved in the supply of critical minerals. The first group to which Mozambique belongs is the resource-rich and emerging economies. These include a significant number of Southern African countries such as the DRC, Namibia,South Africa, Tanzania, Zambia, and Zimbabwe. The second group of interest is the industrial economies of Japan, the USA, the EU, and China.

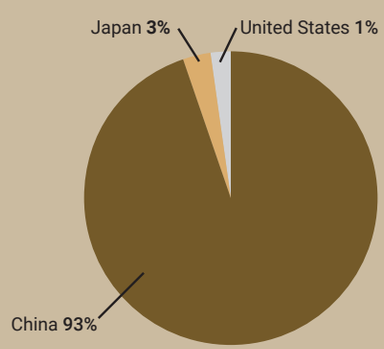
The developed countries are dependent on imports of critical minerals. According to the domestic interests of these countries, the metals or minerals are identified as 'critical' based on well-developed critical minerals strategies and critical minerals lists, which have been developed and supported by clear legislation and regulations that consider the security of supply, among other strategic considerations. The security of critical minerals supply has been officially on the European Union agenda since 2008. At that time, 14 minerals were on its list; now, the list has grown to about 27. With China in the lead, it is essential to note that significant powers are in an aggressive race for the control of these minerals based on well-articulated policies, alliances, and investment strategies.

The strategic clarity of industrialised countries is not apparent in Mozambique and other African countries, where a huge policy lacuna exists. Furthermore, Mozambique cannot explore the full range of its mineral resources; it does not know precisely how much of these energy transition minerals are found within its territory. This is complicated by the fact that critical minerals are typically recovered as by-products during the processing of primary minerals.

7.1.1. Globally, the Second Largest Producer of Graphite



Total supply (all grades)



Battery grade supply

Source: IEA, 2024

Figure 4: Top 3 Graphite producers by 2030

Mozambique had around 3% of global production, rising rapidly from 300 tonnes in 2017 to 30,000 tonnes in 2021. The country also has the fifth highest level of reserves, totalling 25 million tonnes located in regions such as Balama and Ancuabe. In 2014, the mining company Triton Minerals announced the discovery of the largest graphite deposit. Located in Balama district, province of Cabo Delgado, the Balama North Project has an estimated 115.9 million tons of ore. Graphite is used as an anode material in lithium-ion battery fuel cells and nuclear reactors, and the surge in global demand for the metal, driven by the global energy transition, is projected by the IEA to increase by 500 per cent by 2050 (IEA, 2024).[10]

With some of the highest graphite deposits worldwide, Mozambique and Madagascar are poised to play a central role in supplying the global market, with several high-impact projects leading the charge. This follows the restrictions introduced by China on the export of graphite, posing global supply risk given the insurgency in Mozambique's Cabo Delagado province. In this context, the US International Development Finance Corporation provided funding to Twigg Exploration and Mining Limitada (Twigg) for its project in northeastern Mozambique, aimed at extracting and processing material used in electric vehicle batteries and nuclear reactors. Twigg is a subsidiary of Syrah Resources Ltd, headquartered in Melbourne, Australia, and is the largest graphite producer globally outside of China.[11] The company is listed on the Australian Stock Exchange. Since 2017, Twigg Exploration and Resources has been running two open-pit mines in Balama, Cabo Delgado province, for graphite extraction. Syrah swiftly entered the energy transition sector and has emerged as a leading participant in the graphite market. Syrah's biggest customer is Tesla, a company that uses graphite as its primary raw material to supply a factory in Vidalia, in the US State of Louisiana.[12] In the deal between the International Development Finance Corporation and Twigg, graphite from Mozambique will be exported to Syrah's processing facility in Louisiana. The facility received a $102.1 million loan from the US Department of Energy's Loan Programs Office in 2022.[13] It produces graphite-based active anode material, a key material used in lithium-ion batteries. In terms of its sustainability practices (i.e., environmental, social, and governance or ESG standards), Twigg was recognised for its contribution to Mozambique's mining sector at the 10th edition of the Mozambique Mining and Energy Conference, held in May 2024, a platform for key government officials and industry leaders. It received an award which, inter alia, considered the company's safety record, workforce development through training and skills development, community development, and "strong exceptional commitment to environmental sustainability."[14]

Given Chinese dominance in the global critical minerals supply chains, it is not amiss to have Chinese companies involved in Mozambique's graphite mining and processing. DH Mining Development Co. Ltd (DH) is a Chinese company involved in graphite mining and processing in the Munich region of Nipepe district, Niassa Province. The graphite reserves in the province are estimated at 50 million tonnes. The graphite mined by DH is battery grade and is for use in the EV industry and electrical equipment manufacturing. The company's processing plant is 80 per cent complete. Local economic benefits associated with the project include the creation of 800 direct jobs linked to graphite production.

7.1.2. Lithium Deposits and Alto Ligonha Pegmatite Belt

[8] The Climate Mineral Explorer, "Mozambique" (The Climate Mineral Explorer, n.d.)<https://www.climateminerals.org/countries/MOZ> accessed 25 January 2024.
[9] Ibid
[10] See IEA, "Graphite: Outlook for key energy transition minerals" (IEA, Global Critical Minerals Outlook 2024) <https://www.iea.org/reports/graphite> accessed 5 May 2024.
[11] Paul Burkhardt, "US steps up efforts to access Africa's critical minerals" (Mining.com 23 October, 2023), <https://www.mining.com/web/us-steps-up-efforts-to-access-africas-critical-minerals/> accessed 6 April 2024.
[12] See Benchmark Source, "Tesla secures US graphite supplies with Syrah deal" (Benchmark Source, 23 December 2021) <https://source.benchmarkminerals.com/article/tesla-secures-us-graphite-supplies-with-syrah-deal> accessed 5 April 2024
[13] See NS Energy, "Syrah gets $102m loan from US DOE for expansion of Vidalia facility (NS Energy)) <https://www.nsenergybusiness.com/news/syrah-resources-102m-doe-loan-vidalia-aam-facility/> accessed 3 May 2024.
[14] See Syrah Resources Limited, "Twigg Awarded Mining Company of the Year for 2024 at the Mozambique Mining and Energy Conference" (Syrah Resources Limited, n.d.) <https://www.syrahresources.com.au/news/mining-company-of-the-year-for-2024> accessed 5 December 2024.

Mining corporations such as Firefinch Limited, an Australian mining company, and Jindal Steel and Power, an Indian mining company, have driven the exploration and development of lithium resources. The Xiluvo Lithium Project, led by Firefinch Limited, is exploring and developing significant lithium deposits in the Xiluvo area. These activities position Mozambique as a supplier of electric battery-grade minerals. In June 2024, Deccan Gold Mines Ltd (DGML), India's sole listed gold exploration and mining company, announced that it had expanded its operations into Mozambique's lithium sector after an acquisition of a majority stake in five lithium blocks.[15] The concession blocks are part of the Alto Ligonha pegmatite belt, renowned globally for its abundant lithium-cesium-tantalum (LCT) pegmatites, crucial for the extraction of lithium, tantalum, and beryllium.[16] DGML acquired the stake from its wholly owned subsidiary, Deccan Gold FZCO (DGFZCO), based in the United Arab Emirates (UAE). DGML is in a joint venture partnership with Mozambique's Magnifica Group in the lithium deal. DGML owns 51 per cent equity of the joint venture company, Deccan Gold Mozambique Ltd (DGMOZ), with an option to increase this to 70 per cent, with Magnifica holding the balance. DGMOZ seeks to establish a small-scale processing plant (100 tonnes per day) to refine lithium, tantalum, and other mineral concentrates.[17]

7.1.3. Rare-Earth Elements or the Magnet Metals

Mozambique has rare earth elements (REE) for technology applications in aerospace components, lasers, superconductors, and magnets. The Monte Muambe REE Project is in Tete Province, northwestern Mozambique. The project is a joint venture involving Altona, which acquired 70 per cent in June 2021. Exploration began in August 2021, including soil sampling surveys and other ground geophysics processes. The company published its maiden mineral resource estimate (MRE) in October 2023, which included 42 500 tons of neodymium (Nd) and praseodymium (Pr) oxides. The elements at the Monte Muambe project count among the most wanted 'magnet metals', which are vital in the manufacture of power drivetrains for EVs and wind turbines. For the EV market, the sustainable sourcing of magnet metals (Nd and Pr) is as essential as battery minerals (lithium, graphite, and cobalt).

In 2022, an Australian company, MRG Metals, applied for three exploration licenses for REEs and uranium deposits in the central Mozambican coastal city of Quelimane. Listed on the Australian Securities Exchange, MRG Metals used an airborne geophysical survey and received positive signs

7.2. GREEN MINERAL BENEFICIATION AND VALUE ADDITION

Mozambique's mining experience has mainly followed the pattern of most commodity-dependent developing economies that export raw metals. Combined with insufficient investment in research and development, mineral beneficiation has been low. The African Mining Vision has promoted mineral beneficiation to break with the past in Africa. In the energy transition context, there is an emerging consensus to support green minerals-led industrialisation. This is supported by the creation of pan-African institutions such as the Africa Minerals Development Centre, which has developed a draft of the Green Minerals Development Strategy. The strategy seeks to, among other things, promote effective African participation in the global battery and electric vehicle value chain. In southern Africa, the DRC and Zambia (producers of copper and cobalt) have signed a cooperation agreement to manufacture electric vehicle batteries. Such initiatives point to a commitment to add value to energy transition minerals. In this context, it becomes a point of reflection as to the policy intent of Mozambique to participate in the electric vehicle value chain. Will Mozambique join the green minerals beneficiation bandwagon with its graphite, lithium, and REEs? The answer is that Mozambique mining corporations are engaged in mineral processing, but this has not progressed to the production of finished green technologies such as EV batteries.

[15] See Battery Metals Africa, <Deccan Gold Mines Expands into Mozambique's Lithium Sector"(BMA, n.d.)<https://batterymetalsafrica.com/deccan-gold-mines-expands-into-mozambiques-lithium-sector/> accessed 8 August 2024.
[16] Ibid
[17] Ibid

from radiometric spectrometer data. It then sought to explore several hard-rock and sedimentary targets.

Mozambique's future in REE exploration hinges on its ability to invest in mining technologies. The country's potential, as demonstrated by the promising initiatives of foreign mining companies, can only be fully realised with increased investment in the technologies and capacity of relevant state bodies.

7.3. MOZAMBIQUE-JAPAN COOPERATION ON BATTERY MANUFACTURING AND EV ASSEMBLING

The growing EV battery market represents an opportunity for Mozambique to participate in the lucrative EV supply chain. Since 2023, Mozambique has been negotiating with the Japanese government to build a battery manufacturing factory. The factory site will be in the province of Cabo Delgado, which is rich in graphite. As noted above, Mozambique's graphite is battery grade and supplies Tesla with the feedstock for manufacturing its EV batteries. Localising the production will bring more value to the Mozambican economy as it plans to assemble electric vehicles. Furthermore, Mozambique aims to introduce electric mobility in the decarbonisation of the public transport sector. The country has a programme to import electric buses. Mozambique's green industrialisation pathway is strategic in the growing EV market, which Bloomberg NEF (BNEF) projects to be $46 trillion by 2050.

Mozambique is already developing the necessary infrastructure for battery exports. Through a $300 million loan from the World Bank, it has invested in upgrading the Nacala port and corridor. Once production begins, this infrastructure will be critical for exporting minerals and EV batteries.

7.3.1. Exploration of Regional Green Technology Manufacturing Hubs and Markets

However, it is essential to note that Mozambique needs an industrial strategy to develop a commercial-scale battery manufacturing sector. It is, therefore, essential for the country to assess its options to build battery factories. With South Africa as a central automotive manufacturing hub, the DRC-Zambia battery initiative, and Zimbabwe's intentions to manufacture lithium-ion batteries, it is trite that domestic efforts to manufacture batteries be considered within the context of regional green mineral chains. This may result in the creation of regional green technology manufacturing hubs based on SADC industrial policy. In addition to global chains, Mozambique needs to explore the opportunities emerging under the African Continental Free Trade Area (AfCFTA) to promote intra-Africa markets. African market integration presents a massive market for EV batteries, battery storage systems to store solar and wind energy, and powering of micro-tools that can improve tillage systems in rural areas.

7.3.2. Plans to Beneficiate Rare Earth Elements in Monte Muambe

The Monte Muambe project design envisages processing ore through a beneficiation plant. This process will produce rare earth concentrate after crushing, milling, and flotation.[18] A hydrometallurgical plant that targets an average production of 15 000t/y of rare earth concentrate will involve a weak acid gangue leach, followed by rare earth leaching and purification.[19] However, no further value will be added to the concentrate, which will then be exported. The plans to beneficiate REE are a strategic shift from China's more than a decade-long refinery domination.

Mozambique is already developing the necessary infrastructure for battery exports. Through a $300 million loan from the World Bank, it has invested in upgrading the Nacala port and corridor. Once production begins, this infrastructure will be critical for exporting minerals and EV batteries.

[18] See Darren Parker, "Scoping study proves Altona's Mozambique rare earths project viable" (Mining Weekly, 18th October 2023) <https://www.miningweekly.com/article/scoping-study-proves-altonas-mozambique-rare-earths-project-viable-2023-10-18> accessed 5 May 2024.
[19] Ibid

8.KEY RENEWABLE ENERGY VALUE CHAIN STAKEHOLDERS

Mozambique's energy transition is dependent on external support, such as investors and markets. Without a regional and international support framework, local beneficiation will remain slow. South Africa's role is essential, as it has mobilised international support through a comprehensive Just Energy Transition Investment Plan, followed by a Just Energy Transition Partnership. Such a framework is at the core of South Africa's transition away from coal to a renewable energy future.

The role of foreign direct investment (FDI) is essential. Companies from Australia, India, and China have been active in the upstream part of the energy transition minerals value chain. There has been a preoccupation with sourcing raw materials for export. The US has been actively supporting the Australian-owned mining company Twigg in securing graphite exports to the USA. The graphite is supplied to Tesla for EV battery manufacturing. In this regard, a lot of value, including jobs, is exported to the USA. As shown by the EV battery partnership negotiation between Mozambique and Japan, there is scope for manufacturing the batteries in Cabo Delgado.

It is essential that development finance institutions actively support renewable energy projects in Mozambique. Combined with philanthropy and non-profit initiatives, off-grid power generation is on the increase. Stakeholders such as the Bloomberg philanthropies are invested in the processes. However, there is no link between these initiatives and local suppliers of renewable energy technologies. Solar panels, for example, are imported from China.

For Mozambique to achieve the goals of a just energy transition (JET), external stakeholders must be aligned through a JET partnership for Mozambique. This effort will integrate into a JET investment plan that must be aligned with the country's national development priorities. At the core of the partnership must be a strategy to transform Mozambique's energy transition minerals into finished products. In this context, the negotiations between Mozambique and Japan to produce EV batteries point to a beneficial partnership that keeps value (such as jobs, industrial infrastructure, and higher products) in developing mineral-producer economies.

9. JUST ENERGY TRANSITION

Figure 5: External Stakeholders

9.1 RESOURCES CURSE AND THE REALITY OF AN EXTRACTIVIST DEVELOPMENT MODEL

A critical issue underpinning Mozambique's mining sector is the extractivist development model, which dominates the sector. This model is characterised by an emphasis on extracting and exporting raw materials, driven by transnational corporations (TNCs) whose primary focus is profit accumulation. This approach has significant drawbacks, including limited local benefits, environmental degradation, and social inequities. TNCs often operate with substantial autonomy, immune to national regulations, which perpetuates harmful practices like illicit financial flows and wage evasion.

The absence of inclusive economic growth and widespread poverty in Mozambique is not coincidental. Economic growth has been driven mainly by megaprojects and FDI in extractive industries, with modest benefits for poor and vulnerable populations and limited fiscal linkages with the rest of the economy. The country is one of the 10 poorest in the world. In 2021, its Human Development Index (HDI) was 0.461 points, placing it in 183rd position out of 191 countries and territories.[20] Poverty in Mozambique is overwhelmingly concentrated in rural areas, with a large part of the population still involved in informal rural activities, predominantly small-scale agriculture, especially in the northern provinces.

For a just transition outcome to be realised, Mozambique requires an ambitious, nationally determined plan in the form of a social contract.

Figure 6: Harnessing National Stakeholders for a JET Outcome

[20] See Action on Poverty, "Mozambique", (Action Against Poverty n.d.) <https://actiononpoverty.org/our-impact/where-we-work/mozambique/#:~:text=Mozambique%20is%20one%20of%20the%20poorest%20countries%20in,of%20189%20countries%20on%20the%20Human%20Development%20Index.> accessed 5 December 2023.

Community needs must be at the centre, and a social license to operate (SLO) must be obtained through meaningful public participation for all energy transition mineral projects and renewable energy initiatives. The right of indigenous people is a fundamental international human rights law imperative under the doctrine of free, prior and informed consent (FPIC). FPIC is aimed to establish bottom-up participation and consultation of indigenous populations before the start of project development on ancestral land or using natural resources. The consultation must continue throughout project implementation, including decommissioning at the end of life of a project. A JET outcome must ensure that all stakeholders are adequately consulted and there must be a shift from mere 'government' to genuine democratic governance.

9.2. NAVIGATING THE RISK OF STRANDED ASSETS: THE SOVEREIGN WEALTH FUND

In terms of revenue, Mozambique's GDP and the fiscal contribution of the gas sector are at risk due to the potential fall in gas prices in a net-zero global scenario, posing transition risks to a Mozambican economy that aims for development based on gas revenues. Despite this, estimates show that even in a world heading towards net-zero emissions by 2050, there is the belief that the gas sector could generate significant tax revenues as part of the country's energy transition trajectory. In December 2023, Mozambique passed legislation to create a sovereign wealth fund to address the risk of stranded assets. The most successful sovereign wealth fund (and the largest) is that of Norway. Established in the 1990s, the purpose of the fund was to invest surplus oil and gas revenues. Today the Norwegian fund has invested in about 8500 companies in 70 countries. A similar model for Mozambique is justified.

The Sovereign Wealth Fund (SWF) of Mozambique as a Climate Domestic Capital Financing Mechanism

In December 2023, the Assembly of the Republic (AR) approved the Sovereign Fund Law (LFS), establishing guidelines for managing expected revenues from LNG exports from the Rovuma Basin. The LFS predicts that during the first 15 years, 60% of revenues will go to the state budget and the remaining 40% to the sovereign wealth account (rules would change to a 50%/50% distribution after the sixteenth-year operation).

Using the 40%, the LFS states that if a public calamity leads to the declaration of a State of Siege or Emergency/War, the resources from the Sovereign Fund can be transferred to support the state budget. However, it is necessary to define clear mechanisms for managing and using these funds to ensure they are executed consciously and transparently. Using the 60% channelled to the state budget will align with the country's National Development Strategy. With this instrument currently under review, it is an opportunity to present clear guidelines for financing Mozambique's energy transition plans, including climate change adaptation and mitigation actions. The Fund can be broadened to harness resources beyond LNG export earnings, including revenues from graphite, rare-earth elements, and other high-market-value ores. With little value addition taking place in Mozambique and considering the vulnerability of the mining sector to the adverse impacts resulting from fluctuations in commodity prices in international markets, revenues from non-renewable commodities such as critical minerals must be channelled into the SWF.

With the discovery of vast natural gas reserves in Mozambique, the government perceives significant potential for national transformation through the revenues generated from their exploitation. It is believed that these reserves could yield tens of billions of dollars in state revenue, offering a unique opportunity to bolster investment in human and physical capital. Enilde Sarmento (2024), the national director of economic

[21] Nomvuto Turner, "Mozambique: Energy Transition Must Take into Account a country's reality" (ESI Africa, 3 May 2022), <https://www.esi-africa.com/renewable-energy/mozambique-energy-transition-must-take-into-account-realities-of-a-country/> accessed 5 May 2024.

Combining practical and precise monitoring and supervision mechanisms is essential within the scope of the sovereign wealth fund. This fund, if combined with institutional development and prudent macroeconomic management, has the potential to help the country achieve short-term stabilisation and long-term savings for future generations and can address the risks related to the natural resource curse.

9.3. ADDRESSING EXPOSURE TO ESG RISKS

policy and development at the Mozambican Ministry of Finance, underscores that such transformation hinges on prudent expenditure aimed at benefiting both present and future generations. Recognising the volatility of these resources and their potential to render Mozambique susceptible to external shocks, the establishment of a sovereign wealth fund has been proposed.

9.3.1. Social and Environmental Risks in Critical Minerals Mining Areas

In recent years, multinational companies have invested billions of dollars in Mozambique, and the government estimates that it will attract an additional fifty billion dollars in investment over the next decade. Without adequate safeguards, the explosive growth of the mining sector could lead to human rights violations, environmental degradation, and missed opportunities to reduce widespread poverty. In the province of Tete, known for its rich coal resources, local communities have reported various environmental rights violations, notably water and air contamination and vibrations causing cracks in homes. Moreover, poorly conducted resettlements have been documented, with numerous complaints regarding compensation and livelihood restoration. The lack of technical and financial capacity of the state to oversee these processes, coupled with corruption and the absence of accessible decision-making mechanisms, are cited as the leading causes of these challenges. If this framework persists, similar scenarios are foreseen in the critical resource exploitation process. For example, there are reports of small-scale environmental rights violations in the Balama district, home to Mozambique's largest graphite mining project. Local communities have reported bad corporate conduct. If these challenges are mismanaged, they could breed discontent among communities, potentially leading to social conflicts. To address this dilemma, public institutions need to strengthen monitoring capacity, establish participation and conflict and grievance handling mechanisms, and combat corruption.

9.3.2. Mining Projects and Population Displacements

Studies conducted on natural gas and graphite extraction in Cabo Delgado revealed that many individuals displaced from the natural gas extraction sites migrated to the vicinity of graphite extraction areas, facing challenges in accessing essential resources for their livelihoods. Consequently, the adverse socioeconomic impacts observed in the gas project areas also extended to communities residing in the graphite project areas (Namaganda, 2023).

With global low-carbon trends accelerating, transition risks in the hydrocarbons and critical minerals sectors need to be managed, and other opportunities for green growth need to be promoted. Given the decline in financing and increasing restrictions in international markets, this gives an opportunity for the government to transition away from coal extraction and export while also considering the social implications. Driven by the clean energy transition, Mozambique is well-positioned to capitalise on its endowment of critical mineral resources.

Despite the considerable potential to transition towards clean energy sources, the government of Mozambique is reluctant to implement such measures, citing the necessity of aligning with the nation's contextual realities.[21] This reluctance is indicative of the government's hesitancy in refraining from further coal extraction and oil exploration, as critical minerals and renewable energy sources offer promising prospects for short-term revenue generation and funding national development initiatives. However, the continued reliance on coal is attributed to its provision of tangible revenues, posing a challenge to adopting sustainable energy practices.

10. RECOMMENDATIONS

Having considered Mozambique's energy transition and critical minerals complex, the paper now offers recommendations focusing on the development of reliant energy and mining systems for a just transition.

10.1. INVEST IN CRITICAL MINERALS EXPLORATION, BENEFICIATION AND PARTICIPATION IN REGIONAL VALUE CHAIN

Mozambique must invest in the documentation of the country's geology to ensure increased mineral exploration. Such mapping will assist Mozambique to develop a comprehensive National Critical Mineral Strategy and a Critical Minerals List. The mineral strategy must be linked to processing and beneficiation initiatives. For example, Mozambique's graphite can be linked to regional value chains to support the manufacturing of EV batteries on the continent either in Zambia, DRC or South Africa.

10.2. CONSOLIDATING LEGAL AND INSTITUTIONAL FRAMEWORK

Mozambique's legal and institutional framework must be strengthened to guide climate action to mobilise and attract investment into critical mining and renewable energy sectors. This offers an opportunity to effectively integrate climate change action into the country's development strategy. A key recommendation is the creation of framework legislation on climate change.

10.3. INSTITUTIONAL CAPACITY BUILDING FOR DATA HANDLING

Institutional capacity to improve data availability and quality needs to be strengthened, particularly to position Mozambique to mobilise additional climate finance sources that require robust monitoring, reporting, and verification of GHG emissions.

10.4. ESTABLISH FISCAL LINKAGES BETWEEN ENERGY TRANSITION MINERALS AND DOMESTIC RESOURCE MOBILISATION

Broadly, there is a need to ensure that there is revenue transparency in the mining of energy transition minerals. This should be part of fiscal linkages between green minerals and domestic resource mobilisation through taxation, mining royalties, etc.

10.4.1. Linking Mozambique's Sovereign Wealth Fund (SWF) to Energy Transition Minerals

A solid institutional framework is crucial for integrating the exploitation of energy transition minerals into Mozambique's SWF. There is a need to manage future LNG revenue streams to support a just energy transition in Mozambique. This should include financing the infrastructure for EV deployment and manufacturing green technologies. Mozambique should learn the success of Norway's sovereign wealth fund.

10.4.2. Stronger Customs and Revenue Management

Mozambique must increase transparency in revenue flows from energy transition minerals. This should be complemented by budget tracking by civil society organisations. Tax reforms and combatting illicit financial flows from green minerals trade should be a priority for public administration, from revenue authorities to border controls.

10.4.3. Energy Transition, Energy Democracy, and Access for All to Defeat Energy Poverty

Mozambique has undoubtedly made significant strides in energy production and distribution over the past decade, yet a concerning portion of its population still lacks access to affordable and reliable electricity and clean energy. Electricity needs to be treated as a public good, distinct from industrial needs, to ensure equitable access for all.

10.4.4. Community Participation in Decentralised Energy Transition Programmes

Within the Just Energy Transition Framework, public, private sector, and philanthropic programmes need to address issues of energy poverty and universal access through decentralised energy production systems. Such programmes should be limited to increasing clean energy access and ensuring the empowerment of communities in energy production through active citizenship participation in localised supply chains. This involves implementing an industrialisation plan to establish small- to medium-scale energy transformation industries within Mozambique. Collaboration with countries with advanced progress in decentralised energy production, particularly in solar, wind power, and small-scale hydro projects, can facilitate this process and pave the way for a more sustainable energy future for Mozambique.

10.5. DEVELOP LOCAL EXPERTISE AND SKILLS DEVELOPMENT

This needs to be accompanied by more significant efforts in personnel training and equipment modernisation for regulation, monitoring, and enforcement. The training should be extended to include national workforce skills development in geological, engineering, socioeconomic, legal, and policy issues.

10.6. ENDING GREEN RHETORIC AND MANAGING THE POSSIBILITY OF STRANDED ASSETS

Mozambique's contradictory discourse and practices regarding energy transition are evident. While the government professes a commitment to global climate action initiatives such as promoting the energy transition and encouraging foreign investments in fossil fuel exploration and extraction, it epitomises 'green' rhetoric when promoting fossil fuel interests. Mozambique should develop a Just Energy Transition Partnership to mobilise international support for a shift away from coal and other fossil fuels towards renewable energy uptake. This will ensure that Mozambique's transition does not result in stranded assets in the form of its coal plants and fossil fuel infrastructure in the gas economy.

10.7. BUILD CONFLICT AND PEACE RESOLUTION INTO ENERGY TRANSITION POLICIES

There is a need to increase grievance handling and conflict prevention mechanisms in renewable energy value chains. Social exclusion and inequality have been associated with Mozambique's minerals complex. Mega infrastructure projects in hydro, coal, gas, lithium, and graphite mining have produced adverse socioeconomic effects, resulting in armed conflicts, insurrection, land grabbing, and corruption. Poor and marginalised communities, and especially women and girls, have been disproportionately affected. Displacements such as those witnessed in the graphite mining district of Balama are an example.

10.8. INTERNATIONAL JUST ENERGY TRANSITION PARTNERSHIPS

Mozambique should clarify its energy transitional minerals supply-side capacity and constraints, as well as its industrial strategy to transform the minerals into finished products. A structural linkage with the country's national development priorities needs to be established as part of a holistic solution that encompasses the country's Paris Climate Accord commitments, as spelled out in its NDC.

11. CONCLUSION

In conclusion, Mozambique stands at a critical juncture in its journey towards sustainable development and a just energy transition. The nation boasts abundant reserves of critical minerals crucial for the global shift towards clean energy, presenting significant opportunities for economic growth and regional integration. With substantial deposits of graphite, tantalum, titanium, and other transition minerals, Mozambique is strategically positioned to capitalise on the increasing demand for renewable energy technologies.

However, realising this potential requires concerted efforts to address various challenges and seize opportunities across multiple fronts. From legal and institutional reforms to capacity-building initiatives and sustainable financing mechanisms, Mozambique must adopt a holistic approach to navigate the complexities of the energy transition. Consolidating the legal and institutional framework, enhancing human resources capacity, and strengthening data handling capabilities are fundamental steps towards fostering an enabling environment for sustainable development.

Moreover, Mozambique must effectively manage the extraction and exploitation of critical minerals to mitigate environmental risks, safeguard human rights, and promote social inclusivity. By prioritising conflict resolution mechanisms, decentralising energy production, and prioritising access to clean energy for all, Mozambique can foster inclusive growth and address the pressing challenges of energy poverty and social inequality.

11.REFERENCES

African Development Bank Group. (2023). COP28: Mozambique's $80 billion energy transition will leverage its vast renewable resources, says President. [Online] Retrieved from https://www.afdb.org/en/news-and-events/press-releases/cop28-mozambiques-80-billion-energy-transition-will-leverage-its-vast-renewable-resources-says-president-66710 (Accessed: May 31, 2024).

AME Trade. (2023). Mozambique's Natural Gas Resources and the Quest for Economic Development. [Online] Retrieved from https://ametrade.org/newsroom/mozambiques-natural-gas-resources-and-the-quest-for-economic-development/ (Accessed: May 29, 2024).

Banco, M. (2021), Atualização Económica de Moçambique, Contexto: A Fase para a Recuperação, Washington, DC. [Online] Available at https://blog-pfm.imf.org/en/pfmblog/2024/03/the-establishment-of-a-sovereign-wealth-fund-in-mozambique. (Accessed: May 31, 2024).

Banco Mundial. (2022). Portal de Conhecimento sobre Mudanças Climáticas - Perfil de Moçambique. Washington, DC.
Centro para a Democracia e os Direitos Humanos (CDD). (2023). Avaliação da Mobilização de Recursos Internos no Sector Extractivo de Moçambique para o Financiamento Climático , Maputo.

Diário Económico. (2022). Energia: Governo Reitera que Projecto de Interligação entre Moçambique e Maláui Estará Concluído até Finais de 2023. [Online] Retrieved from diarioeconomico.co.mz/2022/10/13/oilgas/energia/governo-reitera-que-projecto-de-interligacao-entre-mocambique-e-malaui-estara-concluido-ate-finais-de-2023/ (Accessed: May 31, 2024).
Diário Económico. (2023). Como Transformar o Potencial em Desenvolvimento? [Online] Retrieved from https://www.diarioeconomico.co.mz/2023/09/11/desenvolvimento-2/como-transformar-o-potencial-em-desenvolvimento/ (Accessed: May 28, 2024).

Diário Económico. (2023). Governo Assina Hoje Acordo Que Viabiliza o Projecto Hidroeléctrico de Mphanda Nkuwa. [Online] Retrieved from https://www.diarioeconomico.co.mz/2023/12/13/oilgas/energia/governo-assina-hoje-acordo-que-viabiliza-o-projecto-hidroelectrico-de-mphanda-nkuwa/ (Accessed: May 27, 2024).

ESI Africa. (2023). Moçambique: A Transição Energética tem que ter em conta as necessidades do país. [Online] Retrieved from https://www.esi-africa.com/renewable-energy/mozambique-energy-transition-must-take-into-account-realities-of-a-country. (Accessed: May 31, 2024).

Governo de Moçambique (2021), Atualização da Primeira Contribuição Nacionalmente Determinada para a Convenção-Quadro das Nações, Maputo. Retrieved from https://www.ctc-n.org/sites/www.ctc-n.org/files/2022-09/NDC_PT%20_Final%20%281%29.pdf

Grupo Banco Mundial (2023). Clima e Relatório de Desenvolvimento de Moçambique, Washington, EUA. Retrieved from https://www.worldbank.org/pt/country/mozambique/publication/mozambique-afe-country-climate-and-development-report-ccdr

Instituto Nacional de Estatística (2022), IV Recenseamento Geral da População e Habitação: Indicadores Sócio-Demográficos de Moçambique , Maputo. Retrieved from https://www.ine.gov.mz/web/guest/d/iv-recenseamento-geral-da-populacao-e-habitacao-2017-indicadores-socio-demograficos-mocambique

Massuque J, Matavel C andTrugilh F,P. (2024) "Perspectives for the biomass energy sector in Mozambique: Policies and their challenges" (Journal of Energy in Southern Africa Vol. 32, No. 4) < https://journals.co .za/doi/full/10.17159/2413-3051/2021/v32i4a11936 > accessed January 5, 2024.

Marzoli (2007) Inventário Florestal Nacional . Ministério da Agricultura, Cooperação Italiana e Agroconsultoria, SL. Retrieved from https://biblioteca.biofund.org.mz/wp-content/uploads/2019/01/1548752956-F226.National%20Forest%20Inventory_Mozambique.pdf

Ministério da Terra, Ambiente e Desenvolvimento Rural (MITADER) (2018), Nível de Referência de Emissões Florestais em Moçambique para Reduzir Emissões da Desflorestação em Florestas Naturais, Maputo . Retrieved from https://fnds.gov.mz/mrv/index.php/documentos/relatorios/27-nivel-de-referencia-de-emissoes-florestais-de-mocambique/file

Mombauer , D. e Wijenayake , V. (2021), Relatório Nacional : Pontos de Entrada para a Formulação de um Plano Nacional de Adaptação para Moçambique. Vozes do Sul sobre Adaptação, SL.

Monjane, B (2015), Mozambique: an energy-rich country in the dark, Paper presented to the University of Illinois at Urbana-Champaign Center for African Studies conference: Power Africa: Promises, Potentials, Pitfalls, and Possible Alternatives, March 2 - 4, 2015. Retrieved from https://www.academia.edu/30933149/Mozambique_an_energy_rich_country_in_the_dark

Matusse, A. (2023), Extractive Enchantment:" Unveiling the Dynamics of Resource Governance in Mozambique. [Online]. Available at https://kujenga-amani.ssrc.org/2023/10/24/extractive-enchantment-unveiling-the-dynamics-of-resource-governance-in-mozambique/ (Accessed: May 31, 2024).

Namaganda, E., et. al., 2023, Understanding the cumulative socioenvironmental impacts of energy transition-induced extractivism in Mozambique: The role of mixed methods, Journal of Environmental Management 338, PAGE 8.
Sarmento, E. (2024). The Establishment of a Sovereign Wealth Fund in Mozambique. IMF Public Financial Management Blog. Retrieved from https://blog-pfm.imf.org/en/pfmblog/2024/03/the-establishment-of-a-sovereign-wealth-fund-in-mozambique.

Statista. (2023). Mozambique: GDP distribution across economic sectors. [Online] Available at: https://www.statista.com/statistics/507266/mozambique-gdp-distribution-across-economic-sectors/ (Accessed: May 31, 2024).

Sylvia Blom et al (2022). Exposição ao calor e nutrição infantil: evidências da Cornell University West Africa , SL.

Instituto de Recursos Mundiais. (2022), Vigilância Climática : Emissões Históricas Globais, Washington, DC.
Instituto de Recursos Mundiais (2016), Climate Data Explorer (CAIT) , SL.

World Bank. (2023). Overview [PDF]. Retrieved from World Bank Documents: https://documents1.worldbank.org/curated/en/559501644990138275/pdf/Overview.pdf (Accessed: May 31, 2024).

Zagema, B., Kowalzig , J., Walsh, L., Hattle , A., Roy, C., & Dejgaard, HP (2023). Relatório Sombra sobre Financiamento Climático 2023: Avaliando o cumprimento do compromisso de US$ 100 bilhões . Oxfam Internacional.

Legal Instruments

1. Law 15/2022: Mines Law
2. Law 16/2022: Petroleum Law
3. Sovereign Fund Law Proposal
4. Law 19/97: Land Law
5. Law 20/1997: Environmental Law
6. Law 12/2022: Electricity Law
7. Law 05/2017 Biodiversity Conservation Law
8. Resolution No. 1/1994: Convention on Climate Change
9. Resolution No. 23/2017: Ratifies the Paris Agreement on Climate Change, adopted in Paris, France, on December 12, 2015.

Strategic Documents

10. National Climate Change Adaptation and Mitigation Strategy (2013-2025)
11. National Electrification Strategy
12. National Development Strategy
13. Nationally Determined Contribution Partnership Plan
14. Master Plan for Disaster Risk Education
15. National Development Plan
16. National Agricultural Investment Plan
17. 2018 Electrical Sector Master Plan
18. National Adaptation Action Plan
19. National Energy for All Program

SARW
Southern Africa Resource Watch

SOUTHERN AFRICA RESOURCE WATCH
41 Holt Street, Parkmore, Sandton, Johannesburg 2196, South Africa
Tel: +27 10 745 4572 | **Email:** info@sarwatch.org
www.sarwatch.org