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Critical Minerals and Renewable Energy Value Chains in Madagascar: A Study of Actors and Initiatives

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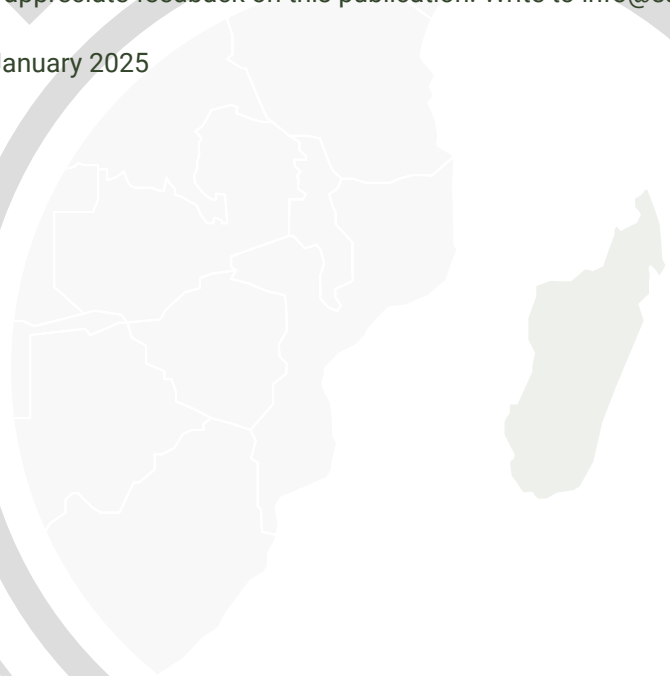

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TABLE OF CONTENTS

LIST OF ACRONYMS

AfDB	African Development Bank
AMDC	African Minerals Development Center
ASM	Artisanal Small-scale Mining
AU	African Union
AUF	University Agency of the Francophonie
CO_2	Carbon dioxide
COP	Conference of Parties
CSO	Civil society organisation
EITI	Extractive Industries Transparency Initiative
ESMAP	Energy Sector Management Assistance Program
EU	European Union
FESTII	Training and Higher Education for the Energy Transition in Island Territories and India-Oceania
FNE	National Electricity Fund
FNED	National Sustainable Energy Fund
GDP	Gross domestic product
GHG	Greenhouse gas
Gg CO2 eq.	Gigagram of carbon dioxide equivalent (measure of GHG emissions)
IEA	International Energy Agency
ILO	International Labor Organisation
IMF	International Monetary Fund
IP	Integrity pact
IRD	Research Institute for Development
IRENA	International Renewable Energy Agency
IST	Higher Institute of Technology
JETA	Just Energy Transition Africa
JIRAMA	Jiro sy Rano Malagasy
LPG	Liquid petroleum gas
MECIE	Accounting for Investments with the Environment decree
MEH	Ministry of Energy and Hydrocarbons
MESD	Ministry of Environment and Sustainable Development
MW	Megawatt
NAP	National Adaptation Plan
NDC	Nationally determined contribution
ND-GAIN	Notre Dame Global Adaptation Initiative Index
NEP	New Energy Policy
OECD	Organisation for Economic Cooperation and Development
OSCIE	Civil Society Organisation on Extractive Industries
PWYP	Publish What You Pay
SDG	Sustainable development goal
SHS	Solar Home Systems
UN	United Nations
UNDP	UN Development Programme
UNEP	UN Environment Programme
UNIDO	UN Industrial Development Organisation
US	United States

EXECUTIVE SUMMARY

Madagascar, with its vast mineral resources and renewable energy potential, is on the brink of a significant transformation. Despite being one of the most energy-insecure nations in Africa, with only 15 per cent of the population having access to modern electricity (5 per cent in rural areas), the country has the potential to leverage its critical minerals for a substantial economic shift while ensuring sustainability. This study, *Critical Minerals and Renewable Energy Value Chains in Madagascar: A Study of Actors and Initiatives*, explores the country's critical minerals and energy profile and the opportunity offered by the global energy transition.

As the world shifts to low-carbon technologies, demand for critical minerals such as graphite and nickel - key components in battery production - continues to rise. Madagascar is the world's third-largest supplier of natural graphite but it exports its minerals in raw form, missing opportunities for value addition, industrial growth and economic diversification. The absence of a national strategy on critical minerals (and associated legal and regulatory gaps) hinders sustainable resource development. The recently revised Mining Code does not address this issue. The 2014 National Mining and Petroleum Policy highlights the importance of coordinated use, improved governance, and transparent exploitation of the country's mineral resources. However, developing a national strategy for managing transitional minerals remains a challenge.

The study underscores the crucial role of a critical minerals strategy in optimising resource utilisation, enhancing investment attractiveness, and promoting local beneficiation. Integrating environmental, social, and governance (ESG) standards into legal reforms is paramount, ensuring that mining contributes to inclusive development while mitigating negative impacts. The laws and regulations in force are not always adapted to the challenges and needs linked to climate change and Madagascar's energy transition, and they are not correctly enforced. This situation leads to unsustainable exploitation of strategic mineral resources, increased pollution, and environmental degradation in mining areas. Using ESG standards and environmental and company laws to strengthen anti-corruption measures, judicial independence, and community participation is vital for improving transparency and accountability in the sector.

Madagascar's energy challenges, poverty and dependence on fossil fuels necessitate a just energy transition. This transition requires scaling renewable energy adoption and localising critical mineral value chains. Investments in solar, wind, hydropower, and infrastructure for energy storage solutions can help address energy poverty while reducing reliance on fossil fuels. Developing local expertise through green skills training and business incubation for artisanal miners and small enterprises will create jobs and enhance benefit sharing in the global energy transition.

The country must also strategically navigate the geopolitics of critical minerals. With increasing competition between global powers for mineral resources, Madagascar should pursue a non-aligned approach that prioritises its national development objectives. Like South Africa's model, engaging in just energy transition partnerships (JETPs) could mobilise international climate finance to develop minerals value chains while ensuring that resource extraction supports economic diversification and energy access.

To maximise the benefits of its critical mineral resource wealth, Madagascar must reform its mining governance framework to incorporate critical minerals exploration and development, incentivise value addition, and foster international partnerships. The strategies must be aligned with the country's climate action plans, such as the nationally determined contributions (NDC 3.0), due for revision by March 2025. By doing so, the country can transition from a raw material exporter to a key player in green technology manufacturing and value chains whilst ensuring a just, human-rights-based and inclusive energy transition for its people.

INTRODUCTION

With its abundance of critical minerals, Madagascar has the potential to become a key player in the global energy transition. As the third-largest producer of battery-grade graphite, the country is uniquely positioned to contribute significantly to the global transition to renewable energy. However, it currently battles with providing energy access for its population. To increase the supply of renewable energy, Madagascar has set ambitious goals in its 2022 nationally determined contributions (NDCs), covering a gradual transition to electric mobility, solar, and wind energy. Effective participation in this value chain will depend on imported green technologies. But there is a huge disconnect. While the country supplies raw materials for the global energy transition, it imports finished products at a high price due to a lack of local industrial capacity and beneficiation. This increases the cost of its transition to meet NDC targets. This paper explores this contradiction through the lenses of critical minerals, renewable energy value chains, and the theme of a just energy transition. The research aims to map existing initiatives, actors, and stakeholders in the renewable energy supply chain in Madagascar, highlighting the significant role the country can play in the global energy transition.

The research methodology used was based on the one hand on a literature review and a documentary analysis of secondary sources and, on the other hand, on interviews with a diverse pool of resource people from government agencies, the private sector, think tanks, the academic sector (universities and research centers), international development and cooperation agencies, non-governmental organisations and civil society organisations that are active in or around the renewable energy sector, extractive industries and climate change in general in Madagascar. Mapping of actors and initiatives was thus conducted upstream of this research and deepened by a documentary analysis, interviews, and two focus groups involving the various categories of actors identified.

The paper is subdivided into three main parts. The first part is dedicated to the country's climate ambitions and the clean energy transition. The second analyses Madagascar's critical or energy transition minerals, indicating the demand for minerals such as graphite in green technology manufacturing. This is followed by a section on the just energy transition, which leads to recommendations.

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2. MADAGASCAR'S CLIMATE CHANGE AMBITIONS AND CLEAN ENERGY TRANSITION

Madagascar is the fourth largest island in the world, with a land area of 597 000 km2. The country is one of the most vulnerable countries to the effects of climate change. As a party to the Paris Climate Agreements and other climate conventions, it has adopted national policies to guide its adaptation and mitigation actions. The country submitted its second NDC in September 2022. Led by the Ministry of Environment and Sustainable Development (MESD), the NDC is the country's main reference document regarding climate ambitions.

In terms of mitigation, the NDC targets a greenhouse gas (GHG) reduction of 24 per cent by 2030 and a strengthening of GHG absorption capacities by 20 per cent through additional sequestrations. Priority sectors affected by mitigation actions are energy, agriculture, forestry, and other land uses (fire control, conservation), sustainable waste management, industrial processes, and solvent use. The mitigation actions define the country's energy transition intentions. It is important to note that the NDC does not provide an apparent connection between the country's rich critical minerals and domestic manufacturing of green technologies within the context of energy transition. This means that in the near future, the country will rely on importing green technologies, solar panels, wind turbines, copper cables for electrification, and battery storage technologies. This weak nexus between critical minerals and the just energy transition will be discussed in later sections of this paper.

To tackle the effects of climate change and to optimally exploit existing renewable resources, Madagascar must first resolve the challenges and obstacles in this area before seizing the opportunities offered to the country to accelerate a just energy transition. These obstacles are not insurmountable but require political will, strategy, and a desire for collaboration between all stakeholders.

3. THE ENERGY CONTEXT

Madagascar's energy mix – the balance of energy sources in the supply – is important in understanding the weight of fossil fuels and low-carbon energy sources as the country plots its renewable energy path. The country is battling a lack of access to electricity, and widespread energy poverty.

3.1 LACK OF ACCESS TO ELECTRICITY AND ENERGY POVERTY

Energy poverty in Madagascar is a significant challenge, with most of the population lacking access to modern and reliable energy sources. The country has one of the lowest rates of electrification in Africa. Through traditional cooking and heating methods, households rely on unclean solid biomass fuels, such as wood and charcoal, resulting in deforestation and air pollution, primarily affecting the respiratory and cardiovascular health of women and children.

3.1.1 One of the Lowest Electrification Rates in Africa

Madagascar's electrification rate of 15 per cent is among the lowest in Africa. Access to electricity is better in urban areas (74 per cent) but falls to 5 per cent in rural areas where more than 70 per cent of the population resides. More than 18 million inhabitants are not connected to an electricity network, constituting a barrier to the quality of life of residents and the socio-economic improvement of the country and an obstacle to sustainable development. This places Madagascar 13th on the list of countries with the largest unelectrified population worldwide.[1]

This access rate, which is among the lowest in the world, partly explains Madagascar's poor ranking on the World Bank's *Doing Business* scale.[2] In 2020, the country ranked 161 out of 190 with a score of 47.7. Regarding business access to electricity,[3] Madagascar ranks 186th out of 190, with catastrophic scores. There are six procedures for accessing an electrical connection, giving a score of 24.1 out of 100. It would take an average of 450 days to obtain a connection, and the reliability of service provision and the transparency of the tariff index are rated 0 on a scale of 8.

3.1.2 Traditional Cooking and Heating

Over 99 per cent of the Malagasy population relies on traditional fuels such as wood (for heating and cooking), candles, and batteries to meet daily energy needs. Malagasy households mainly use solid fuels, regardless of their geographical location. Charcoal is the most widely used fuel source in urban areas, while in rural areas the primary fuel source is wood. Other solid fuels used by about 20 per cent of households (or less) include straw, grass, and agricultural residues. These cooking and heating sources have contributed to deforestation and public health issues. Biomass burning significantly contributes to household air pollution (including carbon emissions), primarily impacting women's and children's respiratory and cardiovascular health. The demand for fuelwood also stresses the environment as a significant driver of deforestation. The urgency of this situation cannot be overstated.

A study in the Sava region of northern Madagascar measured household air pollution and exposure in about 20 households, along with the amount of fuelwood extraction and the time and health burdens on the local population.[4] It found that household and individual exposure to particulate matter and carbon monoxide exceeded World Health Organisation (WHO) standards, with approximately 42 per cent of individuals suffering from hypertension.[5] Families consume an average of 3088 kg of fuelwood per year and walk an average distance of 3.3 kilometers three times a week to collect it.[6] These findings underscore the significant health and environmental issues associated with traditional cooking in energy-poor communities.

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[1] World Bank Group, "Madagascar Set to Expand Access to Renewable Energy and Digital Services thanks to $400 Million Credit" (World Bank Group, Press Release, April 7, 2023) <https://www.worldbank.org/en/news/press-release/2023/04/07/madagascar-afe-set-to-expand-access-to-renewable-energy-and-digital-services-thanks-to-400-million-credit> accessed 18 March 2024.

[2] World Bank Group, "Doing Business 2020, Economy profile of Madagascar, 2020" (World Bank Group, Comparing Business in 190 Economies,) <https://www.doingbusiness.org/content/dam/doingBusiness/country/m/madagascar/MDG.pdf> accessed 18 March 2024.

[3] In the sense of doing business, access to electricity refers to the procedures, time and costs of connecting to the electricity grid, the reliability of electricity supply and the transparency of tariffs.

[4] Klug, Thomas "Understanding the Impacts of Traditional Cooking Practices in Rural Madagascar and a Way Forward with Improved Cookstoves." (Honors thesis, Duke University, 2018). <https://hdl.handle.net/10161/17364> accessed 5 October 2023.

[5] Ibid

[6] Ibid

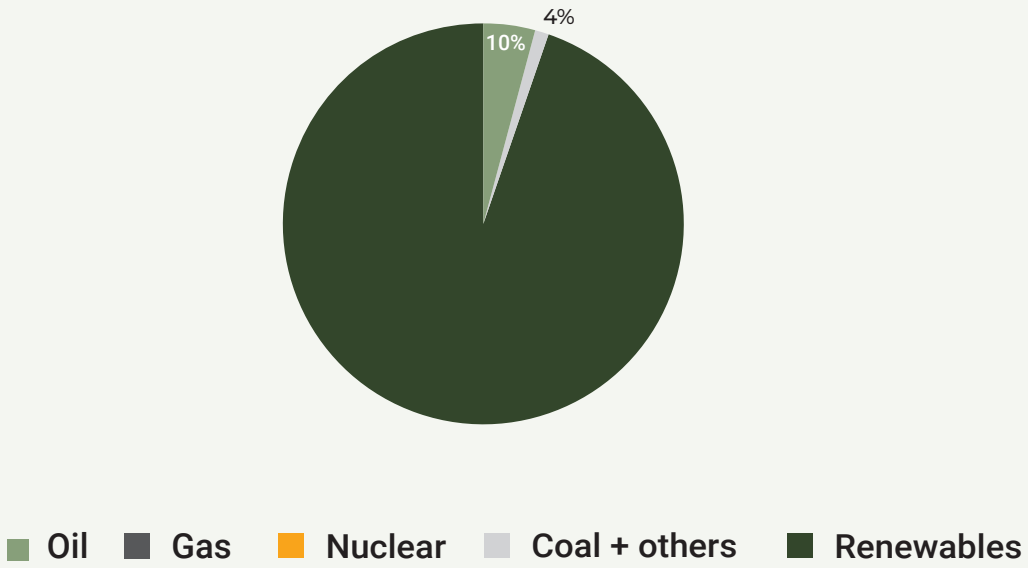
The use of cooking stoves and biodigesters is gaining widespread acceptance aimed at promoting sustainable energy solutions and reducing environmental impacts. Biodigesters can provide a clean fuel source for cooking stoves. They also aid the fight against energy poverty by increasing energy access and reducing reliance on firewood and associated effects on accelerating deforestation. Improved respiratory health conditions count as a significant health benefit associated with the bioenergy fueled cooking stoves. Furthermore, the efficiency of the stoves can lead to lower carbon emissions compared to traditional cooking methods. However, universal access is diminished by the economic reality that semi-industrial production of improved ovens that use biogas is only just beginning in Madagascar. Small producers scattered across the country dominate the cooking oven market, mainly producing artisanal ovens. But the cost is prohibitive. A few stove models are available on the market, ranging from US$20 to US$30. This is unaffordable for most Malagasy households.

There is high potential for Malagasy households to use biodigesters for heating and cooking. Again, the prohibitive cost of manufacturing the devices and the lack of companies and workers trained to build them correctly have prohibited the widespread adoption of the technology. For example, the cost of building biogas systems ranges from US$2500 to 3500 per 10 m3. Given that the average GDP per capita in Madagascar is currently around US$450 per year, the biogas production system's initial cost is beyond most households' financial capacity. However, biogas remains a potentially viable part of the country's future renewable energy mix.

3.2 MADAGASCAR'S ENERGY MIX

Madagascar's main commercial energy resources are hydropower, petroleum, and coal. The country's energy mix is dominated by hydro, biofuels and wastes (87%), with coal, oil and gas products (14%) and hydro accounting for the balance of the country's total energy supply.[7]

Figure 1: Energy Mix



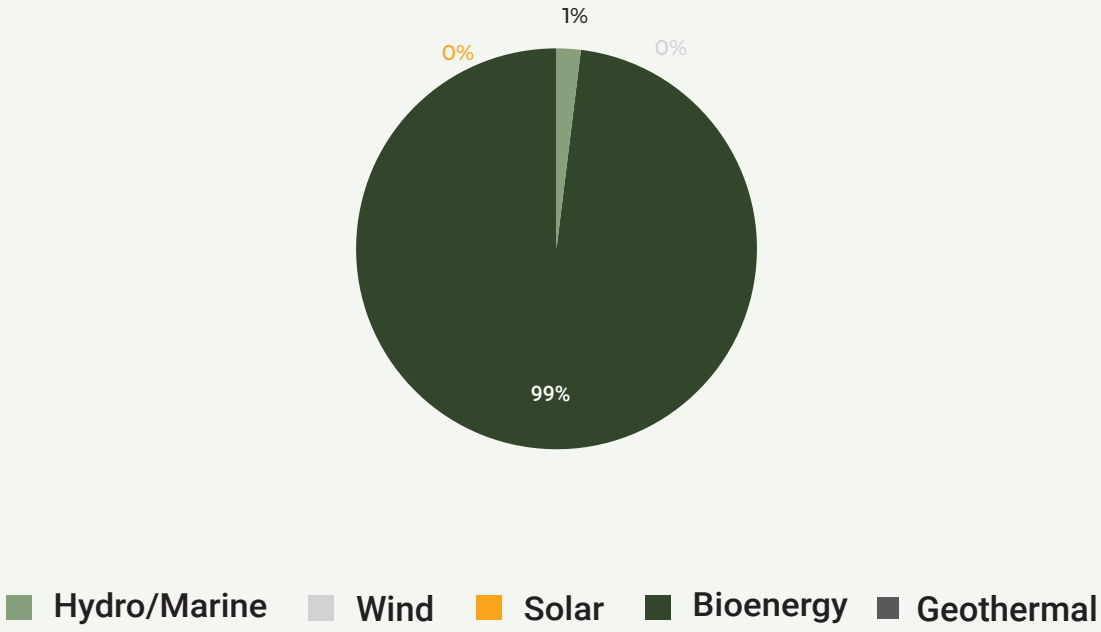
Source: IRENA[8]

[7] International Energy Agency, "Energy system of Madagascar" (IEA, n.d.)<https://www.iea.org/countries/madagascar> accessed 5 June 2024.
[8] See IRENA, "Energy Profile: Madagascar" (IRENA, 2024) < https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Madagascar_Africa_RE_SP.pdf> accessed October 2024.

3.2.1 Renewable Energy Component

Madagascar's renewable energy component is dominated by biomass energy, which accounts for 99 per cent of the total. The remainder is largely hydro/marine energy, with an insignificant portion of wind, solar, and geothermal energy (See Figure 2).

Figure 2: Renewable Energy Mix



Source: IRENA (2024)

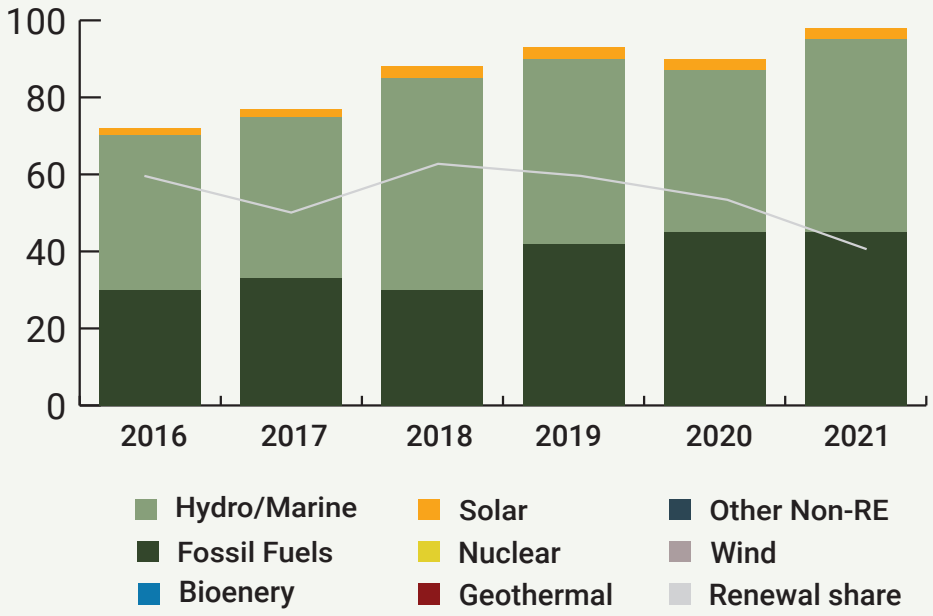
Bioenergy is, therefore, an important source of energy for Madagascar. However, as noted earlier, biomass use in Madagascar is unsustainable and unhealthy as it is mainly in the form of solid charcoal and wood and causes massive deforestation and environmental pollution.

3.2.2 Trends in Electricity Generation

In 2022, about 46% of the country's electricity production is of thermal origin (fossil fuels such as oil, and coal).[9] The apparent dependence on fossil fuels contradicts the spirit of Madagascar's New Energy Policy (NEP) 2015-2030, which advocates using more renewable energy sources in the country's energy mix.[10] Use of fossil fuels has disastrous financial and economic consequences for the country. The import of oil doubled (up 101 per cent) between 2016 and 2017.[11] Hydroelectric power constituted 31%.

[9] IRENA (n 9)
[10] The NEP sets as second priority access to sustainable energy for all, "thanks to the development of an electrification plan for rural, peri-urban and urban communities, through the creation of networks and the expansion of interregional networks which will be progressively interconnected, the use and combinations of different technologies and systems for the integrated development of REN according to the principle of least cost."
[11] Ministry of Energy and Hydrocarbons, "Madagascar: National energy balance 2017" (Ministry of Energy, n.d.) <http://www.ore.mg/Publication/Rapports/BilanEnergetiqueNational2019.pdf> accessed November 2023

Figure 3: Electricity Generation Trend



Source: IRENA[12]

The subsidies granted to Malagasy Electricity and Water Corporation (JIRAMA, the national power and water utility) – primarily used for fuel purchase – constitute a significant budgetary item that harms social sectors such as health, education, and social welfare. Despite the country's significant renewable energy potential, fossil fuel energy operations are mainly with diesel power plants (GO) or heavy fuel oil (HFO) thermal units. A policy shift is therefore needed if Madagascar is to fully realise its renewable energy potential to transition to a clean energy future as contemplated in its Paris Agreement emission reduction commitments.

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[12] Ibid

4. MADAGASCAR'S RENEWABLE ENERGY AMBITION

The NEP aims to increase the electricity access rate to 70 per cent by 2030, with 85 per cent of the energy mix supplied by renewable energy. This goal is aligned with the country's NDC. With an incident energy of around 2000kWh/m²/year, Madagascar has significant solar energy potential with 2800 hours of annual sunshine in almost all regions and an average incident solar energy of around 2000kWh/m²/year. The country also has a hydropower potential of almost 8000MW of which only 160MW are currently exploited,[13] and 2000MW of wind energy. However, the marketing and use of equipment promoting solar and wind energy remains modest. Due to the country's extreme poverty and weak infrastructure, national commitments favouring renewables and energy efficiency focus on access to electricity and clean cooking methods. A Guidance Note on Electricity Sector Policies and Reforms developed by the Ministry of Economy and Finance in November 2022 states: "Expanding electricity production to meet growing demand and reducing current load shedding requires the deployment of renewable energies, foremost among which is hydroelectricity. The summary of hydroelectric projects undertaken will increase production capacity by 380MW by 2026. Electricity production should increase by nearly 2700GWh, an increase rate of more than 100 per cent compared to the current situation". This ambition complements the objectives set by the NEP, which foresees that by 2030, 85 per cent of electricity generation will come from clean energy sources and 15 per cent from thermal power plants.

Madagascar's NDC envisages priority actions that include clean energy solutions, ranging from electric automobility, solar power and wind to hydro-energy. The country's vision is to establish by 2030 an energy sector that is resilient to climate change and part of a development trajectory that emits fewer greenhouse gases, on the one hand, and that contributes to sustainable development by integrating environmental dimensions into any energy project (generation, transport, and distribution), on the other.

4.1 THE ELECTRIC VEHICLES AMBITION

The NDC indicates a gradual shift from fossil fuel combustion engines to electric mobility. The starting point for this process is the policy intention to create a regulatory framework to regulate trade in the automotive sector. This relates to the importation of cars and the gradual introduction of hybrid and electric cars. The aim is to achieve energy efficiency. These initiatives will be followed by the progressive development of rechargeable vehicle fleets (electric and hybrid) and related charging infrastructure.

4.2 HYDRO ELECTRICITY INITIATIVES AND POTENTIAL

4.2.1 Volobe Hydroelectric Power Station and related initiatives

Major hydroelectric development projects are underway, offering advocacy opportunities for both energy transition and transition mineral issues. Among these are the construction of the Volobe Hydroelectric Power Station on the Ivondro River, located 40km from Toamasina; the Sahofika Hydroelectric Power Plant construction project, financed by the African Development Bank (AfDB); the installation of large-scale solar panels by Tozzi Green; graphite mining projects by Next Source Minerals (Molo) and BlackEarth Minerals (Maniry) in Southern Madagascar; a project in Ampasindava by Reenova Rare Earth Malagasy; and other mining companies already in operation, such as Tirupati Graphites and Ambatovy.

4.2.2 Development of Hydroelectric and Solar Mini-Grids

Madagascar faces substantial infrastructure challenges in transporting electricity to end users. The national grid does not have adequate reach in the country. Investment in extension is not economically viable as high capital expenditure is required. With low-income households consuming a small amount of power, it is fiscally difficult to extend the grid. As a result, the renewable energy electricity market and off-grid solutions constitute the main opportunity for universal access to affordable, reliable, and clean energy. According to the UN Development Programme (UNDP), distributed

[13] See UNDP, "Joint SDG Fund: Madagascar" <https://www.undp.org/sites/g/files/zskgke326/files/2023-12/cop28-sdg_fund_side_event.pdf> accessed 24 April 2024.

renewable energy (DRE) solutions are important for universal energy access.[14] DRE solutions include the installation of mini-grids or off-grid solar energy. Accordingly, Madagascar's NDC targets the development of hydroelectric and solar mini-grids in rural areas, with a total target of 10MW. This is envisaged to have a corresponding potential GHG emissions mitigation effect of 300Gg CO2 eq. In this regard, the country plans to increase the switch to renewable energies (solar, wind) through investment in energy infrastructure and operations. The construction of solar parks around the Antananarivo interconnected network is envisaged.

The solar power plants will include the installation of battery storage systems. The mini-grids and network extension will enhance energy access and accelerate rural electrification efforts. Furthermore, efforts are being made to promote battery storage systems to manage the intermittent nature of solar and wind energy.

4.2.3 The Insularity of Madagascar: An Obstacle to Connectivity in terms of REN

The insularity of Madagascar constitutes a handicap in its integration into the various regional and international networks promoting REN, such as the African Union's African Single Electricity Market supply and demand profile. This is immediately important when considering the role of the Southern Africa Power Pool and grid connection among SADC countries participating in the regional electricity market to stabilise their electricity, which is largely generated through hydropower from Cahora Basa in Mozambique. Indeed, the entry points for regional cooperation to improve the reliability of renewable energy systems are the interconnection of networks and energy pools. As Madagascar is outside the continent, connecting to these networks will be physically impossible. However, this physical impossibility does not hinder the country's possibilities to integrate and fully participate in the strategic and technological commitments taking place on the continent.

4.2.4 Access to Energy Finance through International Aid

Mini-grid developers in Madagascar experience energy finance challenges and often struggle to commission mini-grids as independent power producers. This is due to the low population densities and high poverty levels in most energy-underserved areas, making it impossible for the private sector to deliver these services purely commercially.[15] As a result, public sector funding, in the form of viability gap financing and performance-based grants, is required to close the gap between service provision costs and the target population's affordability levels. Those private power producers that are already operating face difficulties raising capital to install further capacity to connect new customers.[16] In this context, international aid has provided capital to a small number of small-grid energy producers. In November 2022, Power Africa awarded grants to three companies (out of 17 bids) to bring electricity to about 14 000 people from 5200 households and businesses in rural Madagascar.[17] The three companies are Autarsys Madagascar, Henri Fraise Fils & Cie, and Hydro Ingénierie Etudes et Réalisations (HIER). The grants totalled $1.2 million and were awarded through a United States Agency for International Development (USAID) facility.[18] The funds will allow the three companies to procure mini-grid equipment and conduct community outreach to expand their customer base. For a country that has skills challenges in engineering, science, and energy-related project management, USAID provided technical assistance to help the grantees to optimise their projects.[19]

4.2.5 Off-Grid Solutions and Energy Storage Systems

Madagascar is making significant strides in integrating advanced energy storage systems (ESS) to support its solar and wind energy projects. The following are notable examples.

[14] See United Nations Development Programme, "Financial Innovations for Clean Energy in Africa: Presenting the Seven Innovations Supported by UNDP's Climate Aggregation Platform" (UNDP, 2024) <https://www.undp.org/sites/g/files/zskgke326/files/2024-03/undp-financial-innovations-for-clean-energy-in-africa.pdf> accessed 10 November 2024.
[15] World Bank Group (n 3)
[16] Ibid
[17] Power Africa, "Power Africa Awards $1.2 Million in Grants for the Development of Mini-Grids in Madagascar" (PowerAfrica, Nov 23, 2020) <https://powerafrica.medium.com/power-africa-awards-1-2-million-in-grants-for-the-development-of-mini-grids-in-madagascar-44e464fefe8e> accessed 16 April 2024.
[18] Ibid
[19] Ibid

a. Hybrid Wind-Solar Project in Fort Dauphin

This project includes an 8MW solar photovoltaic (PV) plant and a 12MW wind farm connected to an 8.25MW lithium-ion battery storage system to ensure a stable and reliable network. It aims to cover 60 per cent of the Fort Dauphin mine's annual electricity consumption, significantly reducing GHG emissions through the reliance on heavy fuel oil. Furthermore, the company will supply the energy needs of most of the power it currently supplies to Fort Dauphin and the community of around 80 000 people with renewable energy.[20] An important aspect of the deal is that Rio Tinto signed a power purchasing agreement (PPA) for the renewable energy plant to power its operations at its subsidiary in Madagascar, QMM ilmenite mine. The power station has been operated by CrossBoundary Energy (CBE), an independent power producer, for 20 years.

It is important to note that the green technologies used for these projects are imported as finished goods. The materials required to construct the power station for the Fort-Dauphin initiative included a massive 18 000 solar panels, up to nine wind turbines, and a battery storage system. Although Madagascar has abundant minerals to produce the equipment (or certain components), the country neither processes its critical minerals nor manufactures green technologies such as wind turbines, solar panels, battery systems, or cables for electrification.

b. Off-Grid Solar Energy Storage in Marovato: Nickel-Cadmium Batteries

Schneider Electric's programme of social responsibility, called BipBop (Business, Innovation, and People at the Base of the Pyramid), is implementing an off-grid solar energy storage system in the village of Marovato, located on the island's east coast. A French multinational energy machines and solutions company, Schneider operates in Madagascar and serves the mining industry. It used this project as part of the company's scheme to provide safe and clean electricity to the residents of an isolated village. This system uses Saft's Sunica plus nickel-cadmium batteries, which are appropriately designed to store solar energy for night-time use. The project has resulted in the provision of reliable electricity to the village.[21] The battery storage system has been designed to operate in extreme temperatures, be suitable for photovoltaic applications. and have a long lifecycle. This is an ideal solution for providing electricity to remote locations.

These projects point to how Madagascar's energy transition can combine renewable energy with advanced storage solutions to increase people's access to energy. It is also important to note the potential role of the private sector and philanthropy in partnering with the government in its renewable energy vision to achieve clean energy access as set out in the NDC. The main barrier to private developers and operators capable of installing and operating mini-grid systems is that they struggle to enter and expand the mini-grid market because they lack access to project financing.[22] This area needs to be addressed within the broader climate finance framework under the UN Framework Convention on Climate Change (UNFCCC) mechanisms.

4.2.6 Waste-to-Energy Solutions: The Case of Analamanga

According to UNFCCC, "Waste-to-Energy (WtE) technologies consist of any waste treatment process that creates energy in the form of electricity or heat from several types of waste: from the semi-solid (e.g. thickened sludge from effluent treatment plants) to liquid (e.g. domestic sewage) waste." In this respect, WtE technologies that are widely used include the incineration method. The UNFCCC elaborates this process as involving "…direct combustion of municipal solid waste (MSW) and/or refuse-derived fuel between 750 and 1100ºC in the presence of oxygen that produces steam for electricity and/or heat generation in a boiler or steam turbine." The outputs can be the generation of heat or electricity or combined heat and power. In Madagascar, WtE initiatives are part of the country's energy mix, although at a low scale. One highlighted WtE initiative is the installation of a household waste incineration plant to produce electricity in Analamanga. Additional initiatives will include recovering energy from agricultural residues and waste (bagasse, rice husk, etc.).

[20] Rio Tinto, "Rio Tinto signs groundbreaking renewable energy agreement in Madagascar" (26 July 2021)<https://www.riotinto.com/news/releases/2021/Rio-Tin-to-signs-groundbreaking-renewable-energy-agreement-in-Madagascar> accessed 29 April 2024.
[21] Saft, "Innovative off-grid solar energy storage in Madagascar" <https://www.saft.com/case-studies/innovative-grid-solar-energy-storage-madagascar-0> accessed 2 April 2024
[22] Power Africa (n 18)

Most fundamentally, the renewable energy transition pathways are not coherent, and are therefore not based on a clear national development trajectory that links the full application of its critical minerals to green industrialisation and structural and climate-resilient socioeconomic transformation.

4.3 RENEWABLE ENERGY: MISSING THE CRITICAL MINERALS AND LOCALISED VALUE CHAINS NEXUS

Madagascar's drive towards renewable energy is on the rise. This is being achieved through the state's leverage of public resources and credit instruments such as credit guarantees, strategic partnerships with the private sector and philanthropies, and cooperation of development financial institutions such as the World Bank, African Development Bank, and Africa Export-Import Bank (Afrieximbank). However, public policy gaps exist in that some legal instruments are not current, others do not have to implement decrees, and others are entirely out of step with international trends. Most fundamentally, the renewable energy transition pathways are not coherent, and are therefore not based on a clear national development trajectory that links the full application of its critical minerals to green industrialisation and structural and climate-resilient socioeconomic transformation. The global energy transition is an opportunity for Madagascar to participate in the supply chains of minerals and add value to the minerals locally and manufacture green technologies.

5. ENERGY TRANSITION: GREEN TECHNOLOGIES AND MADAGASCAR'S CRITICAL MINERALS

5.1 THE GLOBAL ENERGY TRANSITION IS DEPENDENT ON A CRITICAL MINERALS MINING BOOM

In the current geopolitics of the transition to a clean energy future, a key issue is the availability of critical or energy transition minerals. This is a critical issue in renewable energy technologies, particularly the supply chains of these minerals. Critical minerals include graphite, copper, nickel, cobalt, and lithium. The demand for these minerals is expected to rise exponentially. To meet the UAE Consensus energy target set at COP28 (tripling renewables and doubling the rate of energy efficiency improvement by 2030) a record renewable energy growth (requiring a minimum of 16.4 per cent annual growth rate) must be significantly topped up in the remaining seven years.[23] The abundance of critical minerals has opened a window of opportunity for Madagascar to rethink its exports and localise production by integrating into downstream industries of the global energy transition value chains.

5.2 INDUSTRIAL LINKAGES: MINING SECTOR AND THE GREEN MINERALS ECONOMY

Madagascar is rich in mineral resources, but this wealth does not benefit most people. Between 2017 and 2019, the extractive industry sector's contribution to the Malagasy economy varied between 6.07 per cent and 6.41 per cent. Following the Covid-19 pandemic, the extractive sector's contribution to GDP fell by up to 3.58 per cent. Likewise, the weight of extractive industries in tax revenues fell to 1.07 per cent in 2020. As in similar mining countries, Malagasy extractive resources constitute both a potential source of development and a breeding ground for injustices if the wealth is not used for community benefit and environmental sustainability. Between 2017 and 2021, the sector officially employed only between 1.17 per cent and 1.80 per cent of workers legally registered with the National Social Insurance Fund (CnaPS).[24]

5.2.1 A Profile of Critical or Strategic Resources

Critical or strategic resources are exploited on a large and small scale in Madagascar. China is the leading destination for the country's transition minerals: graphite (38 per cent), chrome (94 per cent), and manganese (100 per cent). Nickel-dominated production constituted 42 per cent of extractions in 2020. Table 1 provides an inventory of known strategic minerals in Madagascar for 2020 to 2022.

Table 1: An Inventory of Madagascar's Critical Minerals

Mineral	Scale of Operation	Reserves	Mining (t/ year)	Smelting & Refining	Known Companies	Trade Value $ (2021-2022)	Regions Impacted	Potential Final Use
Graphite	Large and small (ASM)	26 m t (8% global)	61 406 t (2% global)	None	Ets Gallois, GraphMada, PR Global Resources Sarl	$37.6 M	Atsinanana, Vakinankaratra, Amoron'i Mania	Lithium-ion batteries, EV batteries
Nickel	Large	125 000 000 t	9908 t (0.4% global)	None	Ambatovy, MCM SA	$492 M	Atsinanana, Atsimo Andrefana	Stainless steel for low-carbon energy tech, batteries
Cobalt	Large	100 000 t	5 600 t (2% global)	None	Ambatovy, MCM SA	$119 M	Atsinanana, Atsimo Andrefana	Batteries, pigments, alloys
Chromium Ore	Large	2 000 000 t	2500 t	1000 t (2018)	Ambatovy, MCM SA, APC Mining Sarl	$2.77 M	Atsinanana, Atsimo Andrefana, Betsiboka, Sofia	Stainless steel for energy tech
Niobium, Tantalum, Vanadium, Zirconium Ore	Large	N/A	1% of global	None	APC Mining, Reenova REM	$18.8 M	DIANA (Ampasindava), Atsimo Andrefana	Wind turbines, EV motors

Sources: EITI Reports, 2020 and 2022; OEC World, 2021

[23] RIRENA, "Tripling Renewables by 2030 Requires a Minimum of 16.4% Annual Growth Rate" (IRENA Press Release 11 July 2024) <https://www.irena.org/News/press-releases/2024/Jul/Tripling-Renewables-by-2030-Requires-a-Minimum-of-16-point-4-pc-Annual-Growth-Rate> accessed July 2024.
[24] Data on informal workers in the mining sector is not available.

Madagascar's lateritic nickel mining, run by the mining company Ambatovy, ranks among the largest in the world.

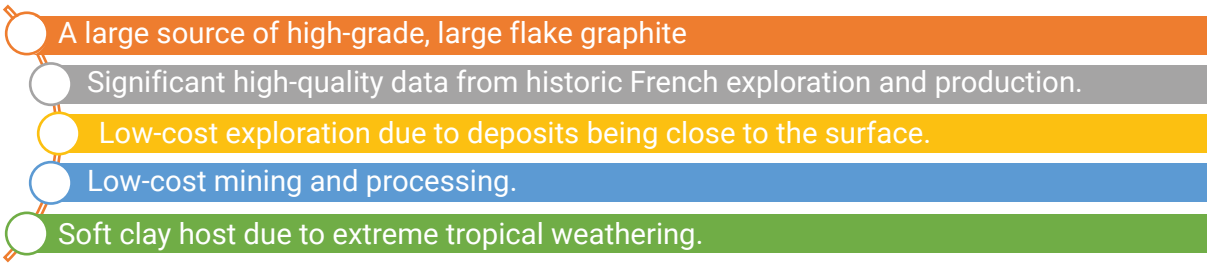
5.2.2 Top Three Global Producer of Graphite

Madagascar is becoming increasingly recognised as a significant source of graphite, a critical element in developing lithium-ion batteries (LIBs) and electric vehicles (EVs). Not only does Madagascar host large graphite resources, but the quality of its product is also highly sought after by LIB and other renewable energy developers. Graphite is essential for the anodes in lithium batteries, making it one of the most critical minerals in the EV battery market. Without graphite, the energy revolution and the trillion-dollar EV market might not exist.[25] Each EV battery contains between 20 and 30 per cent graphite, meaning that the demand for graphite will increase in tandem with EV demand.[26]

While EV manufacturers have been focusing on securing lithium sources globally, there are growing concerns about a graphite supply shortage. Both China and the US are experiencing a graphite squeeze. In 2019, the global graphite market was valued at US$14.9 billion, and it is expected to reach nearly US$22 billion by 2027. To meet this demand, there will need to be an increase in both synthetic and natural graphite production. Synthetic graphite, produced from petroleum coke, is used in applications where high purity is required, while natural graphite, mined from deposits, is preferred for its cost-effectiveness and environmental sustainability.

Due to these demands, significant attention is being turned to graphite-rich countries like Madagascar. According to Fastmarkets, Madagascar offers several key advantages, including high-grade and large flake graphite, which is closer to the surface and therefore low-cost.

Figure 4: Key Advantages of Madagascar Graphite



Source: Colin Sandell-Hay in the Assay (n.d.)[27]

With China restricting its graphite exports to the rest of the world, Madagascar, together with Mozambique, will play a significant role in providing this critical mineral to the EV battery market. But will the Malagasy population feel fiscal, industrial and developmental benefits? Before answering this question, an exploration of the key actors and initiatives in the graphite sector is made below.

5.2.3 Key Corporations in the Extraction and Export of Graphite in Madagascar

Several corporations have invested in graphite mining in Madagascar. These include Tirupati Graphite plc, BlackEarth Minerals, and Global Resources. Tirupati, headquartered in London, owns the Sahamamy Project, which is expanding its production capacity to 30 000 tonnes annually. The company aims to reach 84 000 tonnes by the end of 2024. BlackEarth Minerals has completed a definitive feasibility study (DFS) for its Maniry graphite project and is finalising offtake arrangements with battery anode manufacturers for its development. PR Global Resources has completed Phase 2 exploration at the Anjamanga Graphite Mine Project and has identified extensive graphite schist layers.

[25] Colin Sandell-Hay, "Madagascar Helping to Meet Global Graphite Demand", (The Assay, n.d.)<https://www.theassay.com/articles/analysis/madagascar-helping-to-meet-global-graphite-demand/> accessed 5 June 2024
[26] Ibid
[27] Ibid

Table 2: Key Graphite Mining Companies in Madagascar by Production Capacity

Company	Project	Location	Production Capacity
NextSource Materials Inc.	Molo Graphite	Southern Madagascar	17 000 tonnes per year
Tirupati Graphite plc	Sahamamy	Eastern Madagascar	30 000 tonnes per year
Energizer Resources Inc.	Green Giant	South-central Madagascar	11 000 tonnes per year
Bass Metals Ltd.	Graphmada	Eastern Madagascar	6000 tonnes per year
BlackEarth Minerals	Maniry	Southern Madagascar	Pending DFS completion
PR Global Resources	Anjamanga	Central Madagascar	Pending exploration results

Madagascar's graphite mining operations are crucial in ensuring a steady supply of high-quality graphite, supporting the global demand for EV batteries and facilitating the transition to cleaner energy solutions, positively impacting the environment.

Madagascar's high-quality graphite is primarily exported in raw form to key markets worldwide. These projects underscore Madagascar's strategic importance in the global graphite supply chain, positioning the country as a key player in meeting the growing demand for graphite in the EV battery market.

5.2.4 Export Destinations for Malagasy Graphite

Madagascar's graphite is highly sought after due to its suitability for use in lithium-ion batteries, which are essential for electric vehicles and renewable energy storage solutions.

Table 3: Export Destination by Region and Country

Region	Primary Countries	Usage
Asia	China, Japan, South Korea	Manufacturing of lithium-ion Batteries, electronics, and industrial applications
North America	United States, Canada	EV battery production, energy storage solutions
Europe	Germany, France, United Kingdom	Renewable energy technologies, automotive industry
Africa	South Africa	Industrial applications and emerging battery markets

The global demand for graphite continues to grow, driven by the increasing adoption of electric vehicles and renewable energy technologies.

5.3 POLICY INCENTIVES AND GAPS

5.3.1 Absence of a Critical Minerals List or National Plan

The fact that the Mining Code does not fully address the issue of transition minerals is problematic. Other crucial steps are the adoption of the decree implementing the national adaptation plan (NAP) to strengthen governance and integration of adaptation, implement a priority sector action programme, and finance adaptation to climate change; the national implementation texts of the African Mining Vision, including the African Minerals Development Centre (AMDC) of the African Union; and the decree implementing the new Mining Code. These reforms must involve the Commission on Mines and Strategic Resources of the National Assembly, the Extractive Industries Transparency Initiative (EITI) Madagascar, civil society organisations, and community representatives.

5.3.2 Fiscal Reform and Tax Incentives

On the tax front, the new Mining Code has revised mining royalties and rebates from 2 per cent to 5 per cent. This revision has sparked controversy because it favours the central government and its organs to the detriment of decentralised municipalities, regions, and provinces, which only receive 2 per cent. Once these rebates have been received, the decentralised entities encounter difficulties obtaining their respective shares. The OSCIE (a civil society organisation on extractive industries) considers this distribution key unreasonable and it does not bring the expected economic benefits to communities. If Madagascar is to enter the race for transition minerals, such imbalances must be avoided.

5.3.3 Financial Instruments to Support and Accelerate Madagascar's Energy Transition

Madagascar has introduced several financial instruments to support and accelerate its energy transition. These instruments include sovereign wealth funds and the National Sustainable Energy Fund (FNED), established as financing mechanisms designed as derisking facilities, arranging capital through concessional loans, supporting subsidies, or providing grants and guarantee funds. Under the Innovative Financial System for Promoting Sustainable Energy (2022-2026),[28] a joint project of the UN System and Malagasy government ministries, support is earmarked for 60 energy projects benefiting 800 000 people and building installed clean energy to reduce GHG emissions. Under this project, establishment of a sovereign development fund to financially support sustainable energy projects and create a financial derisking mechanism is a top priority.[29]

The development of Madagascar's marine spatial planning can integrate the mining dimension by minimising the impacts on sensitive marine ecosystems and fishery resources caused by strategic mineral extraction practices. Policy on natural resources management can integrate specific issues linked to transition minerals, in particular, the participation of stakeholders in the decision-making process, consultations, and negotiations in mining projects related to the energy transition.

5.3.4 Legal and Policy Reforms

Substantive legal and strategic reforms must be undertaken because they are essential to creating a favourable environment to encourage the deployment of renewable energy. An example is the adoption of the implementing decree of Law No. 2017-021 of 22 November 2017, transforming the National Electricity Fund into a National Sustainable Energy Fund intended to contribute to financing electricity infrastructure development projects in rural and peri-urban areas. Some of the challenges include the uneconomic extension of the national grid and the consequent need to install mini-grid infrastructure to supply electricity to hard-to-reach areas.

Finally, several legal instruments under discussion or revision offer essential opportunities to advocate for and promote more sustainable and responsible practices in the transition minerals sector. A revision is necessary of the MECIE decree (Investments Compatibility with the Environment), which is currently obsolete and no longer meets global standards for environmental and social assessment of large-scale investment projects. The development of Madagascar's marine spatial planning can integrate the mining dimension by minimising the impacts on sensitive marine ecosystems and fishery resources caused by strategic mineral extraction practices. Policy on natural resources management can integrate specific issues linked to transition minerals, in particular, the participation of stakeholders in the decision-making process, consultations, and negotiations in mining projects related to the energy transition.

[28] This initiative is co-funded by the Joint Sustainable Development Global Fund for US$7 733 345, with the contributions of the UNDP (US$1 000 000), UNIDO (US$150 000), and UN Climate Development Fund (US$100 000).
[29] The International Monetary Fund (IMF) defines SDFs as a subclass of sovereign wealth funds (SWFs) that "help fund socio-economic projects or promote industrial policies that might raise a country's potential output growth." (Also see FinReg Blog, "The Keys to Sovereign Development Fund Success" (FinReg Blog, September 19, 2023) https://sites.duke.edu/thefinregblog/2023/09/19/the-keys-to-sovereign-development-fund-success/) accessed 5 June 2024.

6. JUST ENERGY TRANSITION PARAMETERS

"Just energy transition" (JET) is an inclusive approach to transitioning to renewable energy that respects environmental, social, and governance (ESG) criteria, aligns with sustainable development goals (SDGs), and ensures that no one is left behind. JET addresses energy poverty, promotes gender equality, upholds labour standards and land rights, and emphasises the rights of mining-affected communities, indigenous people, and artisanal miners. The "J' in JET is about upholding human rights and the rule of law. If adhered with, JET principles mean pursuing a transition to a clean energy future in an orderly manner. Its result must be seen in the creation of equitable green job opportunities, ensuring benefit-sharing in mining-impacted areas and fostering sustainable livelihoods. What is the meaning of JET for Madagascar considering its developmental challenges, including technical skills shortage, low energy access, and therefore high levels of energy poverty, grid infrastructure challenges, etc?

6.1 TECHNOLOGICAL LIMITATIONS AND LACK OF QUALIFIED HUMAN RESOURCES

Madagascar often imports strategic personnel due to a shortage of qualified local human resources. This practice creates local tensions and reduces the population's involvement in renewable energy and mining projects. Strengthening local skills and capacities through, for example, Science, Technology, Engineering and Mathematics (STEM) education and training programmes is crucial for the country's energy transition with a focus on developing skills for value-added processing of critical minerals like graphite and nickel. This will create a more sustainable and locally beneficial mining industry that is thriving on the back of the global demand for energy transition minerals such as graphite and other minerals essential to manufacturing electric vehicle batteries, solar panels and other green technologies.

6.2 SELECTED INITIATIVES PROMOTING ENERGY ACCESS AND ADDRESSING ENERGY POVERTY

6.2.1 Off-Grid Solutions: The Case of Village Energy Networks Initiative in Diana Region

To combat load shedding and manage electricity production costs, new production means, particularly from renewable sources, could be developed with assistance from technical and academic players. Mini-grids can be powered by renewable energy sources like solar, wind, or hydropower, offering a sustainable solution to Madagascar's energy challenges. Off-grid solar technologies can address these needs, including installing solar power plants and solar kits.

Ensuring energy access in rural and remote areas is crucial to addressing energy poverty and promoting socio-economic development. Launched in 2020, the Village Energy Networks initiative is led by the French association Experts-Solidaires in association with JCI Antsiranana, Vahatra, and Manofy. It aims to develop three village energy networks in the rural commune of Mangaoka, Diana region,[30] focusing on renewable-energy-based electrification to support local economic activities. Donations were made of photovoltaic panels for solar installation. The initiative includes a suite of business support measures such as access to electricity, business premises, and training modules. The target group is young entrepreneurs in this rural community. The long-term goal is to achieve widespread electrification by 2036, enhancing rural livelihoods and improving the quality of life for the local population.

In the rural context, developing mini grids has proved to be essential to promoting energy access and fighting energy poverty in Madagascar. The small-scale power grids provide reliable, affordable, and clean electricity to rural and remote communities, contributing to SDG 7 (universal, affordable, clean, and reliable electricity). Furthermore, the project assists women in ways that are aligned with national objectives to empower women through access to energy and related opportunities and aligned with SDG 5 (gender equality). It is, therefore, important to invest in scaling isolated initiatives. Philanthropy and developmental finance are important in supporting public-private renewable energy initiatives.

[30] See French Development Agency, "Development of Village Energy Networks in Madagascar" <https://www.afd.fr/fr/carte-des-projets/developpement-reseaux-energies-villageoises-rev-madagascar> accessed 5 January 2024.

6.2.2 Public-Private and Philanthropy Partnerships

Public-private and philanthropic partnerships (PPPPs) play a vital role in supporting access to energy, especially for mining-affected and rural communities. These collaborations provide essential funding, expertise, and resources for developing energy infrastructure and ensuring equitable access to electricity. For instance, the SUNREF Madagascar Project (2021-2024), led by the EU in partnership with the French Development Agency (AFD) and SOLIDIS, aims to stimulate private-sector green investments. By offering a mix of technical support and financial incentives, this initiative promotes sustainable development by encouraging eco-friendly practices and technologies, thereby enhancing Madagascar's environmental and economic resilience. Through customised financial products and expert guidance, SUNREF Madagascar seeks to make significant strides in renewable energy, energy efficiency, and climate change mitigation within the private sector. By harnessing the strengths of various sectors, PPPPs can facilitate the implementation of renewable energy projects and foster social and economic development.

6.3 WEAK ESG PERFORMANCES AND STANDARDS

6.3.1 ESG Standards and JET

A key element of a JET outcome is strict adherence to human rights, environemntal regulatory enforcement and climate disclosures, in the case of this paper, in critical minerals and renewable energy value chains. According to the IEA's "clean energy transitions risk assessments," exposure to ESG and climate risks is one of the four major risk dimensions, which include supply risks, geopolitical risks, and the ability to respond to supply disruptions.[31] In the current policy and practice matrix, inconsistencies exist between regulations governing mines, land, and the environment, leading to legal uncertainty and potential stakeholder disputes. It may also limit the capacity to implement the integrated policies and strategies necessary for responsible and sustainable management of mineral resources and adequate environmental protection.

According to IEA's "clean energy transitions risk assessments," exposure to ESG and climate risks is one of the four major risk dimensions, which include supply risks, geopolitical risks, and the ability to respond to supply disruptions.

The public has difficulty understanding the regulations in force because of their complexity and because a large part of the population is illiterate. As a result, citizens' appropriation of these instruments remains difficult. At the institutional level, coordination between institutions and ministries responsible for the governance of mining and forestry resources, environmental protection, and land management is insufficient. On the Global Risk Profile's ESG Index (2020), Madagascar scored 70.18/100, which represents a high overall risk.

6.3.2 Environmental Standards

The Global Risk Profile's ESG Index (2020) ranks Madagascar 174 out of 180 countries in the Environmental sub-index. In practice, mining projects are subject to limited strategic environmental assessment. Monitoring environmental compliance with mining operators' activities is insufficient, and the National Office for the Environment's lack of independence is flagrant. As a result, international standards for respect for the environment are not correctly applied in Madagascar. If this is not addressed in the critical minerals dispensation, the old malpractices will adversely affect the natural environment. Yet Madagascar has committed to respect the environment under international conventions like the Kyoto Protocol, Nairobi Convention, UN Sustainable Development Goals (SDGs), and Ramsar Protocol. The net effect of the international treaties is that Madagascar is obligated to carefully manage the natural environment, including biodiversity and natural ecosystems. Mining activities for transition minerals must consider these obligations to prevent ecosystem degradation and biodiversity loss. Projects must also respect land rights for communities, ensuring that those displaced by renewable energy projects are adequately compensated and involved in decision-making processes.

[31] IEA, "Global Critical Minerals Outlook 2024" <https://origin.iea.org/reports/global-critical-minerals-outlook-2024> accessed June 2024.

International standards for respect for the environment are not correctly applied in Madagascar. If this is not addressed in the critical minerals dispensation, the old malpractices will adversely affect the natural environment.

6.3.3 Community Participation and Indigenous Rights

On another level, local and public consultations with communities affected by mining activities are not effective. The community's right to free, prior and informed consent is often violated. Consultations fail to include the voices of affected communities fully. Members of these communities are not adequately informed about mining projects or do not have the opportunity to express themselves and actively participate in decision-making. This leads to a loss of community confidence in authorities, mining companies, and decision-making processes; it calls into question the legitimacy of mining projects, and generates tensions and conflicts between the different parties.

Mining projects should include benefit-sharing mechanisms, where affected communities receive tangible benefits such as improved infrastructure (including schools and healthcare facilities). Building a community is vital for the holistic development of communities affected by renewable energy projects. These investments improve the quality of life and build trust and support for energy projects among local populations.

The free, prior, and informed consent (FPIC) principles must be upheld to ensure that communities have a say in projects affecting their lands and lives. This must be based on international law, norms, and standards. It it is not an issue of charity but of rights, including respect for socio-economic and cultural rights. Land rights and cultural heritage should be respected, ensuring that communities benefit from the development projects without suffering adverse impacts. Indigenous people must be included in the decision-making process for renewable energy and mining projects.

PWYP MADAGASCAR'S ADVOCACY PRIORITIES RELATED TO TRANSITION MINERALS

Priority 1. Advocacy for transparent management and equitable distribution of royalties and rebates to maximise the economic benefits of transition mineral exploitation projects within affected communities.
Priority 2. Ensure that all key stakeholders, including members of the Executive, Legislative, Judicial, Decentralised Territorial Authorities and the community, are made aware of the issues of energy transition and transition minerals.
Priority 3. Ensure the development and application of legal instruments on the multidimensional aspects of the fight against climate change, while strengthening the capacity of institutional entities to exercise effective control over these issues.
Priority 4. For the Malagasy government: launch an in-depth geological study to assess the mining potential – including transition minerals – of Madagascar.
Priority 5. Effectively implement the national plan on climate change in order to strengthen environmental protection measures and promote the transition to a more sustainable economy.

Antananarivo, 19 May 2023

6.3.4 Rights of Artisanal Miners

A just energy transition in Madagascar must respect the rights of artisanal miners, particularly those mining critical minerals like graphite. Ensuring fair labour standards and safety measures for these miners is essential. Child labour is still widespread, especially in artisanal mines. Due to their low level of education, local communities are considered incapable of making decisions related to mining activities. They are, therefore, marginalised while being the first victims of the potentially devastating effects of mining operations.

[29] The concept of an Integrity Pact appeared in the 1990s at the initiative of Transparency International. It is a legally binding agreement between the contracting agency and the private company executing the contract under the supervision of a third party from civil society. For private companies found guilty of corruption, typical consequences include exclusion, suspension, or deregistration from future government contracts and payment of damages in addition to those arising from the contract violation. Ultimately, an IP increases the costs of corruption for all parties involved. The external oversight involved in an IP also increases transparency in the actual operationalisation of a contract, increasing the likelihood that, if corrupt acts occur, the public will be informed. Also see Learning Review: Transparency International's Integrity Pacts for Public Procurement, Basel Institute on Governance, December 2015, page 3.

By enhancing energy access through mini grids powered by solar and wind, Madagascar can further its commitment to renewable energy. Promoting responsible mining practices and adhering to ESG standards within renewable energy value chains are crucial additional steps.

6.4 SUPPLY CHAIN TRANSPARENCY AND GOOD GOVERNANCE: THE THREAT OF CORRUPTION

Research conducted by Transparency International Madagascar in 2021 showcased the persistence of corrupt practices in the electricity sector, where part of the market is monopolised by "a diesel mafia" linked to influential officials. The country's score on the Corruption Perceptions Index (CPI) is 26 out of 100 (2022), far below the sub-Saharan Africa average score (32/100), making Madagascar one of the most corrupt countries in the world, a condition that hinders foreign investment. This increases the country's risk profile. However, funding from the World Bank, the AfDB, the European Union, and other donors continues to flow into Madagascar's energy sector. Improving energy and climate governance by enhancing the fight against corruption is therefore crucial. Adopting the Integrity Pact (IP)[32] as a tool for supervising public electricity markets is an actionable and low-cost solution.

6.5 CORPORATE ACCOUNTABILITY AND ENSURING COMPLIANCE WITH INTERNATIONAL STANDARDS

Promoting corporate accountability in line with the UN Guiding Principles on Business and Human Rights is crucial. This includes ensuring gender rights, upholding the Extractive Industries Transparency Initiative (EITI) values, and adhering to the "Publish What You Pay" standards for revenue transparency. Madagascar should adhere to international standards, such as the OECD Guidance on Due Diligence for Responsible Supply Chains of Minerals from Conflict or High-Risk Areas. Ensuring compliance with these standards will promote responsible mining practices and enhance international trust and investment.

6.6 A JUST TRANSITION REQUIRES A HOLISTIC APPROACH

In conclusion, a just energy transition in Madagascar necessitates a holistic approach encompassing policies and measures that uphold human rights, promote gender equality, support local economies, and ensure environmental sustainability. This transition should also prioritise the responsible use of critical minerals such as graphite and nickel to avoid the continuation of previous misgovernance of mining licenses. By enhancing energy access through mini grids powered by solar and wind, Madagascar can further its commitment to renewable energy. Promoting responsible mining practices and adhering to ESG standards within renewable energy value chains are crucial additional steps. These efforts will enable Madagascar to harness its renewable energy potential, drive sustainable development, and significantly improve the well-being of its population, creating a more inclusive and resilient future.

[32] The concept of an Integrity Pact appeared in the 1990s at the initiative of Transparency International. It is a legally binding agreement between the contracting agency and the private company executing the contract under the supervision of a third party from civil society. For private companies found guilty of corruption, typical consequences include exclusion, suspension, or deregistration from future government contracts and payment of damages in addition to those arising from the contract violation. Ultimately, an IP increases the costs of corruption for all parties involved. The external oversight involved in an IP also increases transparency in the actual operationalisation of a contract, increasing the likelihood that, if corrupt acts occur, the public will be informed. Also see Learning Review: Transparency International's Integrity Pacts for Public Procurement, Basel Institute on Governance, December 2015, page 3.

7. CONCLUSION AND RECOMMENDATIONS

The study explored critical minerals in the context of the demand created by the global energy transition. Apart from this demand, these minerals are used in other technologies such as smart devices and defence equipment, electrification, telecommunications, the medical sector, and transportation. The demand for critical minerals is, therefore, a high-growth sector. Madagascar has an abundance of these minerals and has become a significant player in natural graphite supply (being ranked number three globally). However, exporting these minerals in unprocessed form underscores the core concern underpinning the just energy transition debate. Madagascar must implement strategies to add value to its minerals and increase fiscal revenues to finance its development priorities, especially in addressing the Malagasy people's poverty. This includes the need to promote investments in energy projects to fulfil the promise to facilitate access to energy in line with the UN Sustainable Development Goals, especially Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all.

It is imperative that Madagascar immediately engages in higher renewable energy value chains. This involves adding value to its critical minerals, such as graphite and nickel, to enhance revenues, industrialisation, and job creation.

7.1 OPTIMISING THE CRITICAL MINERALS-ENERGY TRANSITION OPPORTUNITY

7.1.1 Policy, Law and Other Regulatory Reforms

Madagascar needs fundamental legal and strategic reforms to promote its critical minerals sector and renewable energy value chains. Sustainability elements favouring ESG fulfilment must be integrated into legislation and regulations, which are increasingly moving away from voluntary to statutory compliance. Climate framework laws and the overall decarbonisation agenda should guide more specific policy and regulatory reforms. In this respect, NDCs are key to the Paris Agreement. Madagascar must build on the current NDC 3.0 process to clarify its ambitions for critical minerals and the energy transition toward increased use of renewable energy sources.

In promoting policy and law reforms, implementation and review, the following factors must contribute to a climate where the rule of law reigns supreme:

a. Strengthen anti-corruption measures in mining contracts and tender adjudication.
b. Promote judicial independence and impartiality.
c. Uphold the governance checks and balances, particularly the integrity of parliamentary oversight.
d. Respect human rights in critical mineral value chains, especially for marginalised groups such as women, workers, indigenous people, persons with disabilities and youth. Everyone in Madagascar should be treated with dignity and worth. No one should be discriminated against in pursuit of mining or other interests in the energy transition.

7.1.2 Critical Minerals Strategy and Critical Minerals List

Madagascar's lack of a critical mineral strategy and list is a significant gap. It is crucial that the country develops a comprehensive critical minerals strategy to ensure the sustainability of mineral resources and as a catalyst for investment mobilisation and job creation.

7.1.3 Increase Mineral Exploration and Production

Madagascar's knowledge of its critical minerals, such as graphite and nickel, is currently limited. To fully exploit the potential of its mining sector, the country needs to significantly increase its national geoscientific capacity to map critical mineral deposits, estimate quantities, and support the development of new mines.

With mining expansion, Madagascar will be able to increase mineral production to scale up its supply, and therefore its market share of critical minerals. Strengthened geoscientific and technological cooperation can be achieved through regional collaboration in bodies such as SADC, with the support of pan-African bodies such as the AMDC and AfDB. Improved geoscientific data will also increase knowledge of the environmental dimensions associated with the exploration and mining of critical minerals. This allows for a better understanding of mineral development processes that ensure the use of environmental management systems in mining project cycles, including mining closures and land restoration.

7.1.4 Localisation of Critical Minerals and Renewable Energy Value Chain for Industrialisation and Economic Transformation

Developing renewable energy sources will not only create jobs but also generate economic activity in construction, installation, operation, and maintenance. Delving into local equipment manufacturing and repairs, like for wind turbines and solar panels, will be critical as Madagascar develops industrial policies and localises value creation. Madagascar must support vertical, horizontal and side-ways integration as part of the critical minerals-renewable energy value chain. It must produce an analysis and profile of the current and future critical mineral value chains supported by research and development spanning the exploration, extraction, processing, and recycling to promote circularity. It is essential to take a cue from Zambia and the DRC, who have invested in research on batteries in efforts to add value to their cobalt and copper minerals. Localisation means promoting and improving these efforts that aid the development of critical mineral value chains as close as possible to the extraction of the resource. If not national, these value chains can be regional under SADC mining and industrialisation protocols.

7.1.5 Developing A Green Skills Agenda

A technological and skills solution is essential for critical minerals mining and value addition. Madagascar must, therefore, emphasise the need for collaboration between higher education institutions, centres of excellence, mining companies, and other stakeholders in the development of technological investments and the necessary skills related to critical minerals development. This will ensure that cutting-edge metallurgical processes and the development of applied sciences at all stages of value addition are integrated into mineral development. Skills development should be broad enough to cover other disciplines such as law, management, environmental sciences, etc.

As part of a deliberate policy, it is vital to ensure that local populations benefit from skills development to ensure inclusion in green businesses and job opportunities. Initiatives like Training and Higher Education for the Energy Transition in Island Territories and India-Oceania (FESTII) should be supported and sustained to strengthen renewable energy skills and promote energy efficiency. The European Union has funded this €826 000 project through its Erasmus+ programme, which is supported by the Higher Institutes of Technology (IST) of Antananarivo and Antsiranana, in collaboration with the Institute of Research for Development (IRD), the Indian Ocean Commission, and the Agence Universitaire de la Francophonie (AUF).

As part of just transition frameworks, critical minerals value addition and renewable energy deployment should create green job opportunities, fostering economic growth and social equity. Training programmes must include local populations, especially marginalised groups, ensuring that the benefits of the energy transition are equitably distributed. This includes integrating artisanal miners and small businesses into value chains.

7.1.6 Enterprise and Supplier Development Programme and Business Incubation for Artisanal Miners and Other Small Businesses

Many artisanal miners and other small businesses must be integrated into supply chains. Through public infrastructure spending, financial access for local businesses, capacity building throughout the value chain, and local content incentives, viable local supply chains can be developed to meet the regional and global energy transition demand. The incentives vary and can be extended through business incubation initiatives, supplier development, and support to industrial innovation clusters. The purpose will be to nurture local business development into renewable energy value chains, sometimes in partnership with international companies in subcontracting or joint venture capacities. Further skills transfer in renewable energy technology can be developed through such approaches.

7.2 JUST ENERGY TRANSITION

7.2.1 Madagascar to Adapt IRENA Policy Framework for A Just and Inclusive Energy Transition

IRENA's comprehensive policy framework for a just and inclusive energy transition can guide Madagascar. The framework proposes that the equity and justice elements of the energy transition need to be more strongly addressed. The Collaborative Framework on 'Just and Inclusive Energy Transitions' promotes and supports just and inclusive energy transitions. Madagascar must adapt the policy framework as it introduces favourable policies for renewable energy, specific deployment policies, integration support within the energy system, and policies ensuring a just transition and fostering international and South-South cooperation.

7.2.2 Develop Tools for Consultation with Indigenous Communities Specific to the Mining Sector

Like the Aboriginal Community Consultation Policy Specific to the Mining Sector in Canada, Madagascar must develop a tool to better address the concerns expressed by indigenous communities interested in and affected by critical mining activities. These specific guidelines will assist companies in adhering to the Free Prior and Informed Consent norms and standards. Besides assisting mining companies, this will strengthen stakeholder relations and promote social dialogue between various spheres of government and indigenous communities. There is a need to develop mechanisms for benefit-sharing. This fosters the development of practices for meaningful participation of rights-holders and affected stakeholders across the mining lifecycle.

7.2.3 Energy Access: Fight Against Energy Poverty and for Energy Democracy

It is important to note that for most Malagasy, access to clean and affordable energy for household consumption is a key priority. As the world transitions to a clean energy future, expanding access to decentralised (off-grid) energy systems is vital if Madagascar is to win the battle against energy poverty and pursue energy democracy. Off-grid solutions such as mini-solar grids and battery storage systems (BSS) can address significant energy challenges and foster socio-economic development in agriculture, commerce, education, and communications. Local production or assembling of green technologies is key to expanding access to clean energy, especially for populations living in hard-to-reach areas for energy infrastructure such as the national grid.

7.2.4 Prioritising Human Rights and the Environment Over Profit and Adherence to International Diligence Standards for Responsible Value Chains

Human rights and environmental considerations must precede profit-driven exploitation of transition minerals. The energy transition should focus on people and the planet, with strengthened governance and anti-corruption measures to ensure equitable results globally. Compliance with rigorous standards in environmental protection and occupational health and safety is essential. International norms, such as the OECD Guidance on Due Diligence for Responsible Supply Chains of Minerals from Conflict or High-Risk Areas, can guide the exploitation of transition minerals, ensuring responsible practices amid Madagascar's instabilities.

7.3 A NON-ALIGNED POSITION ON THE GEOPOLITICS OF CRITICAL MINERALS: TOWARDS JUST ENERGY TRANSITION PARTNERSHIPS

The accessibility and availability of these mineral resources thus have a growing impact on political, commercial and economic relations between the major world powers. Countries such as the United States, Germany, France and Japan consider certain substances strategic for their financial, technological and military development. They are acting to diversify and secure access to CSM supplies. The battles for critical minerals, especially between China and the US, EU, and Japan, will undoubtedly affect Madagascar's international relations. However, based on a national critical minerals policy, Madagascar must be guided by its own national development priorities. It must pursue mining and renewable energy that is aligned with the attraction of foreign direct investment that promotes localisation or regionalisation of value chains. The best position where global powers fight for critical minerals is non-alignment with the major powers.

In these circumstances, international collaboration can help Madagascar achieve its climate ambitions through the extensive use of renewable energy. International partners like the World Bank, UNDP, and AfDB are investing in these sectors. Madagascar needs to consider a just energy transition partnership (JETP) modelled on South Africa's Just Energy Transition Investment Plan and Partnership with several industrialised countries.

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