



**REPORT**

---

# OPPORTUNITIES AND OBSTACLES RELATED TO ENERGY TRANSITION IN AFRICA



**JUIN 2024**

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Emmanuel UMPULA  
Executive Director / AFREWATCH

## ABBREVIATIONS AND ACRONYMS

|                       |  |
|-----------------------|--|
| <b>ACTEDD</b>         | : DRC's Agency for Ecological Transition and Sustainable Development |
| <b>IEA</b>            | : International Energy Agency  |
| <b>AGMS</b>           | : African Green Minerals Strategy                                    |
| <b>AMCEN</b>          | : African Ministerial Conference on the Environment                  |
| <b>ADBG</b>           | : African Development Bank Group                                     |
| <b>Inhab</b>          | : Inhabitant   |
| <b>IRES</b>           | : Moroccan Royal Institute for Strategic Studies                     |
| <b>ISS</b>            | : Institute for Security Studies                                     |
| <b>kWh</b>            | : kilowatt-hour  |
| <b>LED</b>            | : Light Emitting Diode   |
| <b>MW</b>             | : Mega Watt  |
| <b>OECD</b>           | : Organization for Cooperation and Economic Development              |
| <b>UN</b>             | : United Nations   |
| <b>DRC</b>            | : Democratic Republic of Congo                                       |
| <b>Toe</b>            | : Tonne of Oil Equivalent  |
| <b>Toe per capita</b> | : Tonne of Oil Equivalent per capita                                 |
| <b>UA</b>             | : African Union  |

# SUMMARY

## GENERAL CONSIDERATIONS

### 1.1. What is energy transition?

Energy transition refers to all the changes made to the energy production, distribution and consumption system in a given area, with the aim of making it more environmentally friendly. In practical terms, energy transition aims to transform an energy system to reduce its environmental impact. An essential part of the ecological transition concept, the energy transition has three main components:

- The transformation of the energy production system, which involves moving from an energy system based essentially on fossil fuels and pollutants to one based on renewable energies and less pollutants;
- Energy efficiency, which involves improving the energy yield of our energy systems;
- Energy sobriety, which involves reducing our energy needs through structural changes and a transformation of our consumption patterns.

### 1.2. What does it mean for the African countries?

It represents an opportunity for development, given that these countries possess the mineral resources needed for this energy transition. These are mainly mineral resources used in the manufacture of batteries for electric vehicles and other green energy production technologies (wind energy, solar energy, etc.). Global demand for these mineral resources far exceeds supply, representing a huge market of potential sellers.

In addition to these mineral resources, African countries also have other major assets: agricultural and forestry capacities, energy and human potential. These resources offer the Africa, particularly the sub-Saharan region, the opportunity to bring about a beneficial economic transformation for its people and to play a major role in the world economy.

### 1.3. What opportunities are available to Africans?

The energy transition offers enormous opportunities for the African countries. The main ones are:

- Making up for the energy deficits suffered by their populations;
- Developing the immense mineral resources needed for energy transition;
- Becoming a champion and leader in the green transition that the whole world is calling for;
- Reconciling energy transition with economic transformation and mapping out new paths to prosperity.

The opportunities that Africa must seize if it is not to miss the turning point in energy transition rest on three main pillars:

- Availability of abundant reserves of green minerals and metals;
- Growing demand for the metals needed for the energy transition;
- Availability of renewable energy sources.

#### **1.4. What stops Africa from taking advantage of these opportunities?**

There are a lot of problems stopping the African countries from taking advantage of these opportunities. They include poor governance, the lack of an appropriate sectoral energy policy, a poor business climate, a mismatch between vocational training and the industrial needs associated with energy transition, and dependence on traditional energy sources.

### **2. PROBLEMS IN AFRICAN COUNTRIES (Barriers)**

African countries are faced with various problems that constitute barriers or obstacles that need to be resolved as a matter of priority in order to take advantage of the opportunities offered by energy transition. These are mainly poor governance, the lack of a coherent sectoral energy policy, the absence of adequate regulation, corruption and a poor business climate.

These obstacles are compounded by a number of challenges, including dependence on low-quality traditional energy sources, inequalities between and within countries and regions, and insufficient regional integration.

### **3. WHAT AFRICAN COUNTRIES MUST DO (Priorities)**

To take advantage of this energy transition, here is what African countries need to do: improve governance, accelerate energy transition, promote the strategy of exploiting green minerals and metals, and adapt vocational training.

#### **3.1. Accelerating energy transition**

Concordant studies show that Africa is moving slowly towards energy transition. Almost half of Africans (46%) still do not have access to electricity at home. To accelerate this energy transition, we need to

- Promote universal access to reliable, sustainable and affordable energy by 2030;
- Gradually move away from fossil fuel-based technologies towards solar, wind, hydro-electric, geothermal and other renewable energy sources, and above all build African capacity to manufacture and develop these technologies;
- Improve energy efficiency by replacing more energy-intensive equipment with less energy-intensive equipment;
- etc.

#### **3.2. Promoting a strategy for exploiting green minerals and metals**

An African strategy for the exploitation of green minerals and metals is already being developed and even discussed at the level of the African Union. Africa must promote this strategy and anchor it in the Africa Mining Vision to guide African countries in maximizing the benefits of the green minerals and metals value chain.

#### **3.3. Adapting vocational training**

African countries need to adapt vocational training to a changing technological environment in order to develop high-level skills that meet the needs of industry in the context of the energy transition. A strategy is needed to identify and develop new skills related to the production of renewable energies, improved energy efficiency, the production of high added-value green metals, the manufacture of batteries or their precursors for electric vehicles, etc.

### **3.4. Improving the legal framework, the business climate and governance**

Mining policies, laws and regulations need to be improved to facilitate investment by mining companies. This includes streamlining the authorization process, offering tax incentives and guaranteeing property rights. It also involves harmonizing national laws to bring them into line with the African Mining Governance Framework. In particular, the pillars dealing with the legal and institutional frameworks for contracts and licenses and the tax and revenue management regimes for contracts, transparency and financial flows, including illicit financial flows.



# 1.CONTEXT OF ENERGY TRANSITION

## 1.1. Overview of the concept

Energy transition refers to the transformation of an area's energy production, distribution and consumption system in order to make it more environmentally friendly (Raineau, 2011; Dubois, 2009). In concrete terms, energy transition aims to transform an energy system to reduce its environmental impact (Louis & Fahad, 2019). An essential part of the ecological transition concept, energy transition has three main components:

- The transformation of the energy production system, which consists of moving from an energy system based essentially on fossil fuels and pollutants to another system based on renewable and less polluting energies;
- Energy efficiency, which consists of improving the energy yield of our energy systems;
- Energy sobriety, which consists of reducing our energy needs through structural changes and a transformation of our consumption patterns.

## 1.2. Africa's socio-economic context

Africa holds between 20% and 90% of the world's reserves of 11 minerals needed for energy transition, such as platinum group metals, cobalt, chromium and zircon. These are the mineral resources used in the manufacture of batteries for electric vehicles and other green energy production technologies (wind power, solar energy, etc.). Global demand for these mineral resources far exceeds supply, representing a huge market of potential sellers.

In addition to its rich subsoil, Africa also has significant assets in terms of its agricultural and forestry capacities, and its energy and human potential. These resources offer the African continent, particularly the sub-Saharan region, the opportunity to bring about a beneficial economic transformation for its people, and to play a major role in the global economy.

With an estimated annual growth rate of 2.58% in 2023, Africa has the fastest-growing population in the world. The continent's total population is estimated at 1.43 billion, and according to UN forecasts, in an intermediate scenario, the continent's population should reach 1.7 billion in 2030 and practically 2.5 billion in 2050 (Countrymeters, 2023; IRES, 2018). Africa's share of the world's population would therefore rise from 16% today to over 25% in 2050. This demographic dynamic is illustrated by an age pyramid that shows the very young nature of the continent's population (with 40% under the age of 15). This youthful population, joining the ranks of the working-age population, will eventually provide crucial support to boost economic growth.

## 1.3. Africa's energy context

Africa is rich in energy resources, but its capacity to exploit and use these resources remains relatively low. Many African countries are facing acute energy crises, with limited access to modern forms of energy, and electricity that is inaccessible, unaffordable and unreliable for most of the population. Against this backdrop, reducing fuel poverty is at the heart of issues relating to the continent's socio-economic development, and is often at the top of the list of

priorities for governments and other political and economic decision-makers (IRES, 2018).

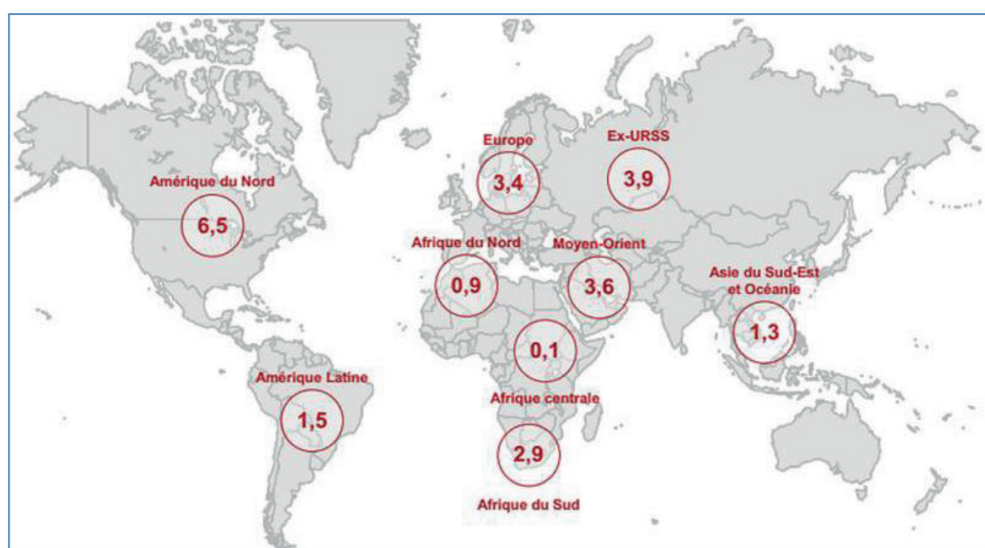
Africa is a continent of energy divides. While the continent as a whole is a low consumer of energy, this observation masks great diversity, at both regional and local levels. The energy divide between Africa and the rest of the world conceals significant regional and local differences. While only 30% of Africa's population lives in North Africa or South Africa, these two regions account for almost 80% of the energy consumed by the continent as a whole (Euro Group Consulting, 2015).

Urbanization, population growth and economic growth are driving up demand for energy. In particular, electricity demand has been rising rapidly in most Sub-Saharan African countries, and notably exceeds 7% in Nigeria and East Africa. According to modelling by the International Energy Agency (IEA), the continent will need to increase its electricity production by 4% a year between now and 2040 to meet this demand.

Per capita electricity consumption in sub-Saharan Africa (excluding South Africa) is 180 kWh, compared with 13,000 kWh per capita in the United States and 6,500 kWh in Europe (GBAD, 2023). An examination of Africa's energy statistics compared with other regions of the planet shows that the continent's overall consumption is in the region of 720 Mtoe, or 4% of global consumption. This percentage has fluctuated between 3.5% and 4% over the last 10 years, even though Africa accounted for 16.4% of the world's population in 2016. Sub-Saharan countries account for 77% of total energy consumption on the continent.

Despite its demographic weight, Africa currently contributes very little to global energy consumption: an African consumes an average of 0.3 toe (tonnes of oil equivalent) per year, compared with almost 7.8 for an American and 4 for a European. Given the relatively higher consumption in North Africa (0.9 toe/capita) and South Africa (2.9 toe/capita), an inhabitant of sub-Saharan Africa consumes around 0.1 toe per year.

Today, Africa is the continent that consumes the least electricity, and access to electricity in Africa is a key issue for the continent.



**Figure 1.1. Per capita energy consumption across the world (Toe/per capita)  
(Source : IRES, 2018)**

North America: 6.5; Latin America: 1.5; Europe: 3.4; Ex-USSR: 3.9; North Africa: 0.9; Central Africa: 0.1; Southern Africa: 2.9; Middle East: 3.6; South-East Asia and Oceania: 1.3.

## 1.4. The DRC case

The DRC has resources containing minerals and metals that can be used to develop green energies.

These resources are either in the form of recoverable deposits or in the form of showings likely to be the subject of geological research. They include

- Solar energy technology: Cu, Al, Sn, Ge, Cd, Zn, Ag, Ga, etc.
- Wind energy technology: Cu, Al, Fe, Cr, Pb, REE, etc.
- Energy storage technology: Co, Li, C, Ni, Mn, Pb, etc.

The state-owned companies likely to be involved in exploiting these resources are:

- Gécamines: all Co, Cu, Ge and Cd reserves and resources are in joint ventures. Significant showings are still present in areas that have not been sold off.
- Miba: the Nkonko and Lutshiatshia Ni and Cr deposits are undocumented and poorly studied.
- Kisenge-Mn: Mn deposits totally depleted. No research capacity due to lack of financial and technical means.
- Cominière: Li reserves held by foreign companies, including tantalum and columbium.
- Somikivu: Major rare earth and niobium deposits held by Russians and Germans (in disagreement).
- Sakima: Many tin, niobium and tantalum deposits, pyrochlore dispersed without any documented study.

Tables I.1 and I.2 give, respectively and for each metal, the holders of the mining rights and the number of the permit as well as its location.

**Table 1.1. Holders of mining rights for strategic metals in the DRC**

| N° | Metal     | Holders    |                              | Work phases       |
|----|-----------|------------|------------------------------|-------------------|
|    |           | Public     | Private                      |                   |
| 1  | Lithium   | COMINIÈRE  | DATHCOM & AVZ                | Feasibility study |
| 2  | Cobalt    | GECAMINES  | Kamoa, Mumi, Sicominès, etc. | Production        |
| 3  | Manganese | KISENGE-Mn | -                            | Reopening         |
| 4  | Nickel    | MIBA       | -                            | Exploration       |
| 5  | Aluminium | -          | Kwango Mines                 | Feasibility study |

According to statistics, the production is 2,394,000 tonnes of copper in 2022, with a 31% increase compared to 2021. The country is thus the leading producer in Africa and 3rd in the world. The same statistics indicate that cobalt production in 2022 will reach 115,371 tonnes, compared with 93,010 tonnes in 2021. This level of cobalt production in the DRC represents almost 70% of world production in 2022. All this cobalt production is exported as concentrate (cobalt hydroxide or salt), i.e. without sufficient added value.

Copper and cobalt are only produced in the Haut-Katanga and Lualaba provinces. Table I.1 lists some of the companies producing copper and/or cobalt in Lualaba, along with their mining rights references. Estimated revenues from the mining sector for the DRC are 5.3 billion euros for 2023.

**Table 1.2: Some of the DRC's strategic metals mining rights holders, license references and locations**

| N° | Holder              | Metal     | Type            | N° license                     | Location                        |
|----|---------------------|-----------|-----------------|--------------------------------|---------------------------------|
| 1  | Gécamines           | Cobalt    | Mining License  | 1076, 120 & 530                | Lualaba/Mutshatsha Haut-Katanga |
| 2  | Kamoto Copper       | Cobalt    | Mining License  | 4963, 4961, 4960, 11601, & 525 | Haut-Katanga/ Kambove           |
| 3  | Boss Mining         | Cobalt    | Mining License  | 463, 467, 468, 469, & 2589     | Lualaba/Lubudi                  |
| 4  | Kisenge Mn          | Manganèse | Mining License  | 32                             | Lualaba /Dilolo                 |
| 5  | MIBA                | Nickel    | Research Permit |                                |                                 |
| 6  | Gécamines           | Lithium   | Mining License  | 121                            | Haut-Lomami/ Bukama             |
| 7  | Gécamines           | Lithium   | Mining License  | 122                            | Haut-Lomami/ Bukama             |
| 8  | AVZ                 | Lithium   | Research Permit | 4029 & 4030                    | Tanganyika/Manono               |
| 9  | COMINIÈRE & DATHCOM | Lithium   | Research Permit | 13359                          | Tanganyika/Manono               |
| 10 | Kwango Mines        | Aluminium | Research Permit | 1304 & 1305                    | Kongo Central/Luozi             |

Although global cobalt production is dominated by the DRC, with over 70% of total supply in 2022, the country is not the only one producing cobalt on the African continent, since the latest Cobalt Institute report also mentions four other African countries. These include Madagascar, which ranks second among the African producers in 2022, ahead of Morocco, which is home to the continent's unique cobalt-only mine. This African top 5 is completed by Zambia and South Africa, two countries where cobalt is a by-product of the mining of other metals such as copper and nickel. Unfortunately, all the production of this African top 5 is exported without sufficient added value. However, by pooling their efforts, they can take advantage of this situation.

In this respect, the example of the DRC and Zambia is interesting. Both countries have been working to transform their production locally in order to capture more income in the value chain. Just recently (February 8, 2024), the Africa Finance Corporation, a pan-African multilateral development finance institution, announced the signing of an expression of interest to provide \$100 million in financing to Kobaloni Energy. The funds will be used to build Zambia's first cobalt sulfate plant for electric vehicle batteries on the African continent. When it comes

on stream, the plant is expected to produce 6,000 tonnes a year of cobalt sulfate, using cobalt from industrial mines in Zambia and the DRC. Meanwhile, a project to create a cross-border DRC-Zambia special economic zone for the establishment of battery manufacturing plants for electric vehicles is under development in the DRC. It is through such collaborations that African countries can take advantage of the opportunities offered by energy transition.

## 2. OPPORTUNITIES FOR AFRICA

The energy transition offers enormous opportunities to bridge Africa's energy deficits. Africa's immense mineral resources should make it the champion of the green transition that the whole world is calling for. Reconciling energy transition and economic transformation, and charting new paths to prosperity, should be the ambition of Africa's leaders.

The opportunities that Africa must seize in order to avoid missing the turning point in Energy Transition rest on three main pillars:

- Abundant reserves of green minerals and metals;
- Growing demand for the metals needed for energy transition;
- Available renewable energy sources.

### 2.1. Availability of abundant reserves of green minerals and metals

Africa is home to 30% of the world's critical mineral reserves, many of which are essential for renewable and low-carbon technologies. To meet the expected increase in global demand, production of minerals and metals such as lithium, graphite and cobalt will need to increase by almost 500% by 2050 (ISS, 2023).

Critical minerals and their role in Africa's energy transition raise important considerations relating to non-renewable resources, environmental impacts and the need

for a just transition. African countries possess abundant reserves of critical minerals, and it is vital that the management of these resources is sustainable. The distribution of critical mineral resources is not uniform, but geographically concentrated. Only a handful of countries on the continent possess these minerals, and they face significant global competition. As a result, the development of critical minerals in key sectors, including clean energy and electric vehicles, faces significant geopolitical risks, but also offers commercial opportunities.

Africa is already a major producer of several critical minerals and metals, including cobalt, copper, lithium, manganese and rare earths. The growth of Africa's clean energy sector should boost demand for critical minerals. Africa could become a major supplier and active user of critical minerals on the world market. Here's how the situation looks for these strategic substances:

- Cobalt: it is an essential component of lithium ion batteries used in electric vehicles and renewable energy storage systems. Africa is home to around two-thirds of the world's cobalt reserves, and the Democratic Republic of Congo (DRC) is the largest producer;
- Copper: it is used in wiring and other components of electrical equipment. Africa is home to around 10% of the world's copper reserves, and Zambia is the largest producer;

- Lithium: it is used in lithium-ion batteries, making it crucial for electric vehicles and energy storage. Africa is home to around 30% of the world's lithium reserves, and the DRC and Zimbabwe are the largest producers;
- Rare earths: a group of minerals used in various green technologies, such as wind turbines, solar panels, electric vehicle components and a wide range of technologies, including magnets, sensors and lasers. Africa is home to around 15% of the world's rare earth reserves;
- Graphite: it is a critical mineral used in lithium-ion batteries and indispensable for electric vehicles and energy storage systems. Representing over a fifth of the world's reserves, the combined graphite reserves of Madagascar, Mozambique and Tanzania will play a central role in the development of lithium-ion batteries, with the essential mineral serving as a crucial element in the development of electric vehicles and batteries;
- Manganese: Africa accounts for around 30% of the world's manganese reserves. This makes Africa the world's leading manganese producer. Manganese is essential for a number of industrial applications, including the production of steel, batteries and fertilizers. As demand for these products increases, so will demand for manganese.

## 2.2. Growing demand for the metals needed for energy transition

For African commodity producers, the growing visibility of critical mineral resources promises higher mining revenues, but there's a far greater opportunity to be seized. Here is a window of opportunity to harness mineral wealth to support sustainable growth and large-scale socio-economic development, to channel mineral raw materials into industries manufacturing the products needed by Africa, and to break the pattern of mineral value chains that end with the export of raw materials. Mining can be more deeply integrated into regional economies by increasing the local content of mining inputs, creating mining value chains to manufacture renewable energy equipment that harnesses the continent's vast renewable energy potential to provide clean energy to over 600 million inhabitants deprived of modern energy services.

Africa's minerals are used in the basic sectors of mining, agriculture, industry, construction, transport, water and electricity, but they are also essential inputs for the new green industries. Africa now has the opportunity to develop a strategy for the minerals mined on the continent, which are crucial in the age of clean energy technologies. The minerals listed below have been grouped under the collective term "green minerals" with the aim of stimulating the

development of green industries and broader industrialization through a unified development approach called the African Green Minerals Strategy (AGMS).

### 2.3. Availability of renewable energies

There are a lot of renewable energy sources in Africa. The continent has vast photovoltaic solar energy potential, huge hydroelectric potential, significant onshore and offshore wind energy potential, huge bioenergy potential (mainly in well-watered regions between the tropics) and opportunities to enter new energy industries such as hydrogen using renewable energies.

Central Africa's water basins, the Rift Valley fault<sup>1</sup>, and the continent's sunshine in general, are sources of hydraulic, geothermal and solar energy that have few equals in the rest of the world. Currently, however, only a tiny fraction of this potential is exploited: only 7% of hydraulic capacity, less

than 1% of geothermal capacity, and photovoltaic initiatives are still in their infancy (OECD, 2023).

- 21 countries out of 53 are said to be in a position to profitably harness hydropower in Africa, but only 7% of this potential is exploited (mainly in Egypt, Mozambique, Zambia, Nigeria and Ghana);
- The Rift Valley provides access to geothermal capacities of the order of 9,000 MW, of which only 45 MW and 9 MW are extracted in Kenya and Ethiopia respectively;
- Average annual solar radiation in Africa ranges from 5 to 7 kWh/m<sup>2</sup>, on a par with the Arabian Peninsula, northern Australia and northern Chile. However, Africa has only 1.3% of the world's photovoltaic production capacity.

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<sup>1</sup> In geology, a fault is a tectonic structure consisting of a plane or zone of rupture along which two blocks of rock move relative to each other. This plane divides a volume of rock into two compartments that have slipped relative to each other under conditions of brittle deformation.



## 3. OBSTACLES AND CHALLENGES

Concordant studies show that Africa's progress towards the energy transition is slow, due to a number of obstacles, including poor governance, the lack of a coherent sectoral energy policy, the absence of adequate regulation, corruption and a poor business climate (Burhama, 2023). These obstacles are compounded by a number of challenges, including

- Dependence on traditional, low-quality energy sources;
- Inequalities between and within countries and regions;
- Insufficient regional integration;
- Capacity constraints;
- Commonalities and differences across Africa;
- Rapid population growth and demographic change.

### 3.1. Technological challenges

Africa needs to catch up technologically to meet its energy needs more effectively and accelerate its energy transition. Despite being a major producer of critical minerals, Africa often exports raw materials without significant added value. This situation locks the continent into the lower end of global value chains and limits the economic benefits it derives. For example, the export of concentrates to China prevents the development of a local industry with high added value. China and OECD countries have been developing green mining machinery and equipment (such as railless electric mining vehicles) and they intend to export them to Africa. So, these countries may not be interested in supporting the development of a green mining supply chain in Africa. Rapid technological advances in battery production cause risks of technological obsolescence, particularly for companies entering the battery manufacturing sector that rely on licensed technology (OECD, 2023).

This is the case, for example, with the DRC, which holds the lithium used in the manufacture of Li-ion batteries for electric mining vehicles. If the DRC is to start manufacturing this type of battery today, it must do so under license. As the technology is constantly evolving, notably with the trend towards substitution of lithium by sodium, there is a risk of obsolescence.

### 3.2. Legal and political challenges

The absence of a specific energy transition policy and legislation is an obstacle that needs to be overcome if the opportunities offered by the energy transition are to be seized. Legislation specific to energy transition must set out the path to be followed to achieve a successful energy transition. It must specify, for example, that buildings must be renovated to save energy, the price of electricity must be lowered, clean means of transport must be developed, the use of renewable energies must be encouraged, etc. African countries need their

own energy transition policy, which can be global, sub-regional or national (Bonnie, 2005). African countries and pan-African institutions must clearly act, individually and collectively, to overcome structural and regulatory obstacles and make universal access to modern energies and decarbonization<sup>1</sup> a reality; and governments must get involved. They can do this by creating, at national and/or regional level, structures with the specific vocation of designing and proposing conventions, laws and policies related to the energy transition, following the example of the European Union's regulations on strategic materials. The DRC has already embarked on this path, notably by setting up the Congolese Agency for Ecological Transition and Sustainable Development (ACTEDD) in 2020, tasked with designing, coordinating and implementing public policies relating to ecological transition.

### **3.3. Economic challenges**

The challenge of reconciling economic development and energy transition is an acute one for the African continent. Reconciling economic development and energy transition is a complex equation for Africa. The choice is between exploiting the many existing oil and gas blocks and preserving the climate. The case against fossil fuels is not only made on behalf of the climate. It is also based on decades of experience, after which several million Africans remain without access to electricity and in an environment polluted by the exploitation of fossil fuels.

Access to clean, affordable energy in Africa remains one of the greatest challenges facing the continent. There are still around 900 million people in Africa without access to clean, modern cooking infrastructure, and over 600 million without access to electricity. The situation is even more alarming for populations living in remote and rural areas, where there are infrastructure gaps and difficult access to financing (Bellocq et al., 2021). Macroeconomic conditions (inflation, moderate growth and heightened debt vulnerabilities) and structural constraints (energy reliability, infrastructure deficits, trade barriers, access to finance and leakage of mining rents due to weak governance).

### **3.4. Environmental and social challenges**

Mining that provides access to green minerals and metals generally brings about environmental and social impacts. These impacts include habitat and landscape destruction, water and air pollution, human rights concerns and labor issues (CMAE, 2023). It is therefore increasingly necessary to adopt sustainable practices and ensure responsible sourcing throughout the supply chain. Environmental standards of due diligence and traceability are essential to ensure that environmental sustainability and human rights are prioritized in the

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<sup>1</sup> Decarbonation or decarbonization? These two words are synonymous and refer to the reduction of carbon emissions. However, the use of decarbonation is preferred. The same goes for French words *décarbonation* and *décarbonisation*.

minerals supply chain. Key interventions in this area include post-closure habitat restoration, pollution control, sustainable resource management and circularity.

The situation is exacerbated in Africa by the lack of health, safety and social protection standards. The rights of populations to a healthy environment are not sufficiently guaranteed. Relocation standards are not sufficiently developed. Best environmental and social practices are not sufficiently known and disseminated, especially among the personnel responsible for implementing or monitoring these practices. If these obstacles are not removed, Africa's energy transition risks leading to chaos and environmental and social disaster. African countries, through their Ministries of the Environment, must take ambitious and concerted measures to prevent and reduce to the strict minimum the adverse environmental effects that could result from the extraction of critical minerals on the continent (CMAE, 2023; Nelson, 2020).

## **4. ACTION TO BE TAKEN**

### **4.1. Accelerating the energy transition**

In order to take advantage of energy transition, it is first necessary to strategically adopt an energy sector transition to develop more efficient renewable energy resources (IRES, 2018). To achieve this, several strategies need to be implemented:

#### **4.1.1. Promoting access to energy**

Almost half of all Africans (46%) still do not have access to electricity in their homes. Efforts to achieve universal access to affordable, reliable and sustainable energy services by 2030 must therefore be primarily energy transition strategies designed to effectively combat poverty, expand economic opportunities and promote equality (OECD, 2023). The speed with which modern, renewable energy-based solutions can be deployed will depend on a balanced mix of conventional grid, mini-grid and off-grid for unserved and underserved populations, and must also address the challenges of security of supply, economic viability and affordable access (Nelson, 2020).

#### **4.1.2. Development of the renewable energy sector**

Africa must build its energy transition on a green energy model. African countries must be able to seize the opportunity to move away from fossil fuel-based technologies (decarbonization of the energy sector) to pursue a climate-friendly, needs-driven energy strategy aligned with the Paris Agreement and low-carbon growth, to harness Africa's great potential for solar, wind, hydro, geothermal and other renewable sources, and to build African capacity to manufacture and develop these technologies.

### **4.1.3. Improving energy efficiency**

The aim here is to design energy efficiency programs for buildings, industry and transport in African countries. These programs must include the local manufacture of efficient equipment, as well as regulatory and behavioral interventions.

Improving energy efficiency involves replacing more energy-intensive equipment with less energy-intensive equipment (Philippe, 2022). A LED bulb can consume up to ten times less energy than a tungsten filament lamp. Improving a vehicle's shape (aerodynamics) can reduce its energy consumption. The use of digital technology and artificial intelligence can significantly improve a vehicle's energy efficiency. The automatic gearbox, which replaces the hand on the gearshift, and cruise control, which replaces the foot on the gas pedal, make it possible to avoid permanent changes in engine speed, and therefore improve a vehicle's energy efficiency (Philippe, 2022). This improvement can be further optimized by connecting the gearbox to an on-board computer that has topographical information about the route to be travelled (gradient and curvature of the road, for example), as well as a 3D navigation system and cameras. Real-time analysis of this data can be very effective in increasing energy consumption.

### **4.1.4. Promoting innovation in the energy sector**

It's all about long-term strategic planning for smart, people-centric, interconnected and distributed renewable energy systems, in order to adapt quickly to the current development and falling costs of new renewable energy technologies, which are opening up numerous prospects for the transition to, and design of, the energy systems of the future. It's all about implementing a systematic, continent-wide approach to innovation.

The energy systems of the future involve innovation and the use of artificial intelligence in a number of fields, including building, transport and industry. For example, smart building involves the installation of innovative devices in a building to control all its equipment (electricity, air conditioning, ventilation, security, etc.) in real time and remotely (Philippe, 2022). In industry, digital technologies such as robotization and 3D printing will optimize energy consumption while reducing the amount of waste generated, floor space and weight of manufactured parts.

In transportation, the energy systems of the future will make it possible to design even lighter vehicles, by replacing steel with carbon fiber, for example.

### **4.1.5. Creating of an African power grid**

The aim is to develop an integrated African power grid, which would considerably reduce the average cost of electricity on the continent and increase energy sustainability and security.

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#### **4.1.6. Creating a regional energy market**

African countries need to set up a regional electricity market and develop long-term cooperation in the energy sector, the free movement of energy and the intensification of cross-border trade.

### **4.2. Promote the operating strategy for green minerals and metals**

An African green minerals and metals strategy is already being developed (African Union, 2023). Africa must promote this strategy and anchor it in the Africa Mining Vision to guide African countries in optimizing the benefits of the green minerals and metals value chain. There are several aspects to this strategy:

#### **4.2.1. Improving the legislative framework and the investment climate**

Mining policies, laws and regulations need to be improved to facilitate investment by mining companies. This includes streamlining the permitting process, offering tax incentives and guaranteeing property rights. It also involves harmonizing national laws to bring them into line with the African Mining Governance Framework. In particular, the pillars dealing with legal and institutional frameworks for contracts and licenses, tax and revenue management regimes for contracts, transparency and financial flows, including illicit financial flows. There is also a need for provisions in relation to mining licenses that ensure that mineral raw materials are available to regional consumers at export parity prices in order to improve their competitiveness and ensure the development of the local or regional supply chain (local-regional content).

#### **4.2.2. Promoting local processing to the detriment of imported concentrates**

African countries need to develop their capacity to process and refine critical minerals and metals locally. Much has been done to end the export of mining products in their raw state; however, further efforts are needed to end the export of concentrates as well. To date, many African countries continue to export critical minerals and metals in concentrate form, without any significant added value. This situation locks the continent into the lower end of global value chains, limiting its economic benefits and bargaining power. African countries must now invest in the development of processing and refining facilities. This will enable them to manufacture higher-value products, such as batteries and magnets, which are in high demand for renewable energy technologies.

#### **4.2.3. Improved governance of mineral resources**

It is not possible to derive maximum profit from the exploitation of mineral resources without sound and effective governance. Inequality in the distribution of wealth and a lack of transparency on the part of African leaders are all elements that undermine African economies

and reflect a serious lack of governance. It is therefore essential to improve the governance of mineral resources in order to derive maximum benefit from them in the context of the energy transition (Bonnie, 2005). The government authorities responsible for promoting, regulating and managing mining revenues must be people of integrity and proven moral probity. Effective governance of mining revenues along value chains is an important channel through which resource exploitation can deliver sustainable development.

Environmental governance must also be strengthened. It is essential to assess and minimize the impacts of extraction and processing on the environment, on water sources, on biodiversity (including protected areas and endangered species) and on frontline communities. Sound environmental legislation, regulations and policies are essential to protect the environment and human well-being.

African countries still need to incorporate a number of provisions into their legislation to better protect the environment and, above all, avoid missing out on the energy transition. These include, for example, the obligation to decarbonize the industrial sector, and mining in particular. Decarbonization of the mining and industrial sectors involves gradually abandoning the use of fossil fuels and replacing them with green energy. This decarbonization is possible in areas with immense hydroelectric resources, such as the DRC.

While the sector cannot be completely decarbonized, it is possible to reduce carbon emissions and switch from fossil fuels to green energy through hydroelectricity and the use of solar and wind power. This is in line with the Paris Agreement, which is an invitation to the whole world to switch from fossil fuels as an energy source to green energy sources. What's more, the international community is committed to a carbon-free world by 2050. If African countries do not update their legislation to bring it into line with this global commitment, industrial exploitation, particularly mining, will have a very severe negative impact on the environment.

Another aspect that needs to be taken into account in the legislation of developing countries is the obligation to inventory greenhouse gases. To date, several mining regulations do not require greenhouse gas (GHG) inventories. This is the case for Congolese mining regulations. And yet, in the process of reducing GHG emissions, the first step is to inventory the level of emissions. If regulations require GHG inventories to be drawn up, for example, when environmental plans are drawn up or when annual environmental reports are presented, this can provide information on the sector's carbon footprint and contribute to its improvement.

#### **4.2.4. Improving geological knowledge of green ores**

This involves strengthening earth science institutions and undertaking geological mapping. African countries need to strengthen and modernize their geoscientific institutions.

#### **4.2.5. Creating a local and regional market for green minerals and metals**

This strategy involves linking local and regional industrial sectors manufacturing or using green minerals and metals with local mining supply chains. The aim is to convert, at local or regional level, mineral raw materials into machinery, equipment and renewable energy plants. In practice, this will require an approach aimed at developing competitive manufacturing industries at regional level, rather than trying to cover all sectors at once. The long-term aim is to develop these value chains and all their associated links to leverage green mineral resources for green industries to serve regional and continental markets.

### **4.3. ADAPTING VOCATIONAL TRAINING**

African countries need to adapt their vocational training to a changing technological environment, in order to develop high-level skills in line with the needs of industry in the context of energy transition. A strategy is needed to identify and develop new skills linked to the production of renewable energies, improved energy efficiency, the production of high value-added green metals, the manufacture of batteries or their precursors for electric vehicles, etc. An employment policy must be conducted for local communities to enable them to take advantage of energy transition for their own development (ISS, 2023). Building-related trades (including building envelope trades) and HVAC trades (installation and maintenance) need to be taken into consideration, in both construction and renovation, to meet the imperatives of improving energy efficiency, which are: energy reduction, the quest for performance, the use of low-consumption materials, the obligation to treat waste and recycle materials, taking new regulations into account, etc.

## 5. RECOMMENDATIONS

Africa has a golden opportunity to boost its development thanks to massive global demand for its immense mineral deposits, which the world needs to fuel its green energy transition. Africa must seize this opportunity or risk letting it slip through its fingers. It risks missing out on this opportunity if it does not fully exploit its critical resources, or if it continues to allow them to be exploited by third countries without its populations benefiting sufficiently. African countries must therefore:

1. Develop a strategy for the exploitation of green minerals and metals;
2. Use mineral resources to support growth, development, industrialization and job creation by fully developing intersectoral links;
3. Take advantage of the window of opportunity offered by the focus on critical minerals to rapidly build regional and continental value chains;
4. Make the mining sector an engine for large-scale development by developing local mining capital;
5. Expand the technical skills base and resources for research, development and innovation in renewable energies and green minerals (develop human and technological capacities);
6. Develop the local production industry for components for batteries, electric vehicles and renewable energy equipment, and increase local content over time;
7. Encourage local processing and value-added in the green minerals and metals sector;
8. Invest in geological research, particularly for green minerals;
9. Improve the legislative framework, the business climate and governance.

These recommendations are addressed to African countries through the following structures:

| N° | Recommendations  | Structures  | Remarks  |
|----|--|---|--|
| 1  | Develop a strategy for the exploitation of green minerals and metals   | African Union and Governments                             | For African Union this strategy is already under development |
| 2  | Use mineral resources to support growth, development, industrialization and job creation by fully developing intersectoral links             | Governments (Ministries of Mines, Industry and Portfolio) | e.g., take equity stakes in mining projects                  |
| 3  | Take advantage of the window of opportunity offered by the focus on critical minerals to rapidly build regional and continental value chains | Governments (ministries of Mines, Industry and Portfolio) | e.g., prioritize projects based on regional value chains     |
| 4  | Make the mining sector an engine for large-scale development by developing local mining capital  | Governments (Ministry of Mines)                           | e.g., give substance to corporate obligations                |



|    |   |  |  |
|----|---|--|--|
| 5  | Expand the technical skills base and resources for research, development and innovation in renewable energies and green minerals (develop human and technological capacities) | Governments (ministries of Education [technical, vocational, higher and university education] and scientific research) | e.g., adapt teaching and scientific research programmes                |
| 6  | Develop the local production industry for components for batteries, electric vehicles and renewable energy equipment, and increase local content over time                    | Governments (Ministries of Industry, Scientific Research and Education (Higher and University Education)               | e.g., promote research into battery technology                         |
| 7  | Encourage local processing and value-added in the green minerals and metals sector  | Governments (Ministries of Mines and Industry)   | e.g., give priority for license to projects that increase value.       |
|    |   |  |  |
| 8  | Invest in geological research, particularly for green minerals  | Governments (Ministry of Mines)  | e.g., allocate a substantial budget to geological research.            |
|    |   |  |  |
| 9  | Improve the legislative framework   | Parliaments  | e.g., draw up laws that give priority to projects that increase value. |
|    |   |  |  |
| 10 | Improve the business climate and governance   | Governments (Ministry of Mines)  | Respect the law and avoid red tape and corruption                      |

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