AFRICAN PERSPECTIVES OF A JUST TRANSITION TO LOW-CARBON ECONOMIES

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Preface

The global transition towards emission reductions consistent with 1.5°C pathways imply a certain quantum and rate of decarbonisation. The implications of the transition for African economies which are poorly diversified, and dependent on a few primary sectors and resources is not well understood. With the implications not well understood - from domestic effort and those of others - the risk of further under-development setbacks for African countries from indebtedness, trade conditions, cost of capital, amongst others may lead to an unjust transition. Furthermore, there is no shared African framework/perspective of what a Just Transition means, including quantifying potential impacts/opportunities for development. This work would therefore be important in informing African countries in their transition engagements.

The report presents ideas, perspectives, and evidence of what a Just Transition to low-carbon economies means for Africa. Parameters of the energy transition that are fair and equitable for Africa are identified. The report further broadens the knowledge base on the implications of the transition focusing on:

1. understanding and quantifying the development needs of the continent, and what the transition to low carbon economies mean for Africa.
2. economic implications of the transition with regards to fossil fuel exploitation and trade in primary agricultural products for export.
3. implications of the proposed transition, and to seek opportunities for equitable pathways for Africa towards net-zero emissions.
4. jobs implications of energy transition in study countries to indicate the potential economic impact for different scenarios that could be considered in Africa.
5. maximising opportunities for equitable transition finance and trade to support economic development.

This work initiates a discourse on what a Just Transition means for African countries; by informing domestic policy-making in the respective countries- e.g. LEDS, IRPs and NDCs - as well as engagement in other processes, including under the UNFCCC. It presents a basis upon which African countries engage not only in the UNFCCC process, but also on just transition packages with donor countries as well as in domestic policy making, including climate finance and energy discussions in other fora's and assist African Member States in planning their transition to low carbon emission pathways.

The key stakeholders for this work, therefore, include Energy, Agriculture and Environment ministries in respective African countries. Other African intergovernmental organisations, civil society on finance, energy, trade, may also benefit from the project. Beyond the UNFCCC negotiations on the global stocktake, response measures and Just Transition Work Programme, the work informs climate finance, trade, environment, and energy discussions in other fora for African Member States planning their transition to low carbon emission pathways.

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Executive Summary

Just Transition Framework

The African sustainable development context suggests that in the transitions to low-emission, and climate-resilient development, global trade policies and finance flows should contribute to the reduction of structural, socio-economic, and technological inequalities between developed and developing countries as the present day structural inequalities cannot deliver a 'just transition'.

The needs of African countries from a quantum of finance perspective are considerable, while the conditions of raising finance and borrowing risk leading to a transition that deepens indebtedness. Hence at the center of fair transitions, effective interventions should include the restructuring of the global finance system.

Climate justice is at the center of 'just' transitions and the principles relevant for this study programme, hence responding to questions on each of the transition pathways and associated dimensions. The proposed climate justice principles are restorative, distributive, and procedural justice. The underlying factors in the justice equation should recognise the structural limitations posed by global economic and finance systems, in respect of enabling conditions for countries to achieve both their climate and development objectives. The transition cannot be looked at only in terms of energy or climate risk, rather in the context of sustainable development for the African continent.

Trade Implications on the Just Transition
Trade and investment rules have created structural deficiencies for African economies, which denies them equity in opportunity and prevents them from enjoying shared prosperity that would arise from of energy transition. As most of the African economies were not signatory to the original GATT legal text of 1947 which forms the basis of much of WTO and FTA rules, they had neither participation nor any role in the formulation of these rules. Procedural justice demands that these iniquitous, asymmetric, imbalanced and unfair rules be amended to address the concerns of the African economies.

There is a need for a new global compact that would allow African economies to override existing commitments under various trade and investment agreements and allow them to take measures for facilitating industrialisation based on processing of critical minerals, and facilitating its own growth in demand for the transition.

Economic Implications on the Just Transition
For a variety of reasons African countries are vulnerable to the global energy transition, and neither the Green Climate Fund nor the Loss and Damage Fund is likely to provide African countries with the quantity or the type of investment they need to benefit from the global energy transition. Annual investment of $280 billion per year is required between 2020 and 2030 to implement Africa's NDCs, but current investment in climate resilient development is just $30bn. However, where African countries use the global energy transition and climate crisis to advance their climate resilient development, this transition represents a rare opportunity to enhance their economic competitiveness. It is possible for African countries to harness the global energy transition to secure the technologies, finance and partnerships that will reduce energy poverty and serve their domestic interests in the context of its development path and demand.

Mitigation Implications on the Just Transition
Limiting Africa's Just Transition to solely focus on a "Just Energy Transition" (JET) would not be an accurate approach and could significantly underplay the prominence of non-energy emission sources in Africa's Just Transition. In fact, evidence has shown that non-energy emissions from land-based activities account for more than half of the continent's annual GHG emissions, with the main driver being deforestation and clearing of land for agricultural purposes, not so much for harvesting of wood for energy purposes. As such, the implementation of smart agriculture interventions, reducing emissions from deforestation and land degradation and restoring forests are just as important to the continent's just transition as is the deployment of low carbon fuels and technologies. The energy transition component from Africa can only be considered from an avoided emissions perspective noting the current lack of access to modern energy sources.

Jobs Implications on the Just Transition
The African electricity demand is expected to increase by approximately 75%, from 680 TWh to 1,180 TWh by 2030 and Africa's population and the projected domestic energy demands call for the eradication of excessive export of raw materials and importation of labour. For shared opportunities in the transition, this implies that Africa's energy transition needs local manufacturing, funding, and skill development at a country and regional levels. Failure to address these policy gaps and bottlenecks is likely to limit the economic benefits that would be generated from the adoption of clean energy technologies in the African continent, thus affecting job security and hindering industrialisation opportunities. Moreover, the lack of skills in the low carbon energy multiplier sectors might have unintended consequences if the African continent does not adopt policies that would guarantee the acceleration of energy component manufacturing in the continent. Therefore, the African continent policymakers and the global community need to rethink how can the climate change risk be utilised to drive optimal inclusive economic growth that would create jobs and accelerate and industrialise low carbon energy technologies manufacturing in the continent.

Finance Implications of the Just Transition
Between 2020 and 2030 Africa will require an additional USD 2.5 trillion to implement its NDCs for that time period, however, there is an 88% shortfall. Despite UNFCCC processes pushing for greater ambition in climate action, the global financial architecture leaves Africa with unsustainable debt levels and high finance costs, reliant on developed countries and China for 90% of its climate action finance. The status quo is low quality, inappropriate, insufficient and undignified finance that does not match the region's needs or recognise its assets. This dependency gives international counterparts significant influence over Africa's climate response and ambitions. Furthermore, financing needs for African countries depend on their relationship with fossil fuels and their asset base of critical mineral resources. Policymakers should consider their country's relationship with fossil fuels, their resource endowment of critical minerals, and the social and environmental imperatives triggered by shifting to low-emission development pathways. These factors can enable African countries to develop sustainable financing strategies to leverage their needs; and advocate for the essential reforms to the current global financial architecture to ensure it offers finance flows that embed justice, equity and dignity.

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JUST TRANSITION FRAMEWORK

By Xolisa Ngwadla

1. Climate and Development for Africa

This section gives an overview of the development context of the African continent, as the transition pathways have a direct bearing on the continent's ability to pursue sustainable development, as well as its mitigative and adaptive capacity. 'The section also gives context to the development priorities of the continent, hence a perspective of climate action that is equitable and just.

1.1 Sustainable development in Africa

The African continent is a region with the greatest development challenges in the world. As of 2021, only Seychelles and Mauritius had a Human Development Index (HDI) above the world average of 0.732, at 0.785 and 0.802 respectively UNDP, 2023). Data shows that a number of Southern African countries have a Gini coefficient that is in the high 50s, with South Africa breaking the 60 barrier. This context suggests that, African countries must achieve the reduction of poverty and extreme poverty in some sectors of the population, while simultaneously exiting fossil fuel intensive activities and responding to climate impacts (Figure 1.1).

The struggle for African countries to achieve their development objectives has a historical and structural context. According to the Independent Expert Group on Just Transition and Development (IEG 2023), African economies suffer at least three structural deficiencies that constrain their development potential, viz. a lack of food sovereignty; a lack of energy sovereignty; and low-value-added content of exports relative to imports. These deficiencies in turn contribute to structural trade deficits, weakened African currencies and pressure to issue debt denominated in foreign currencies, resulting in indebtedness.

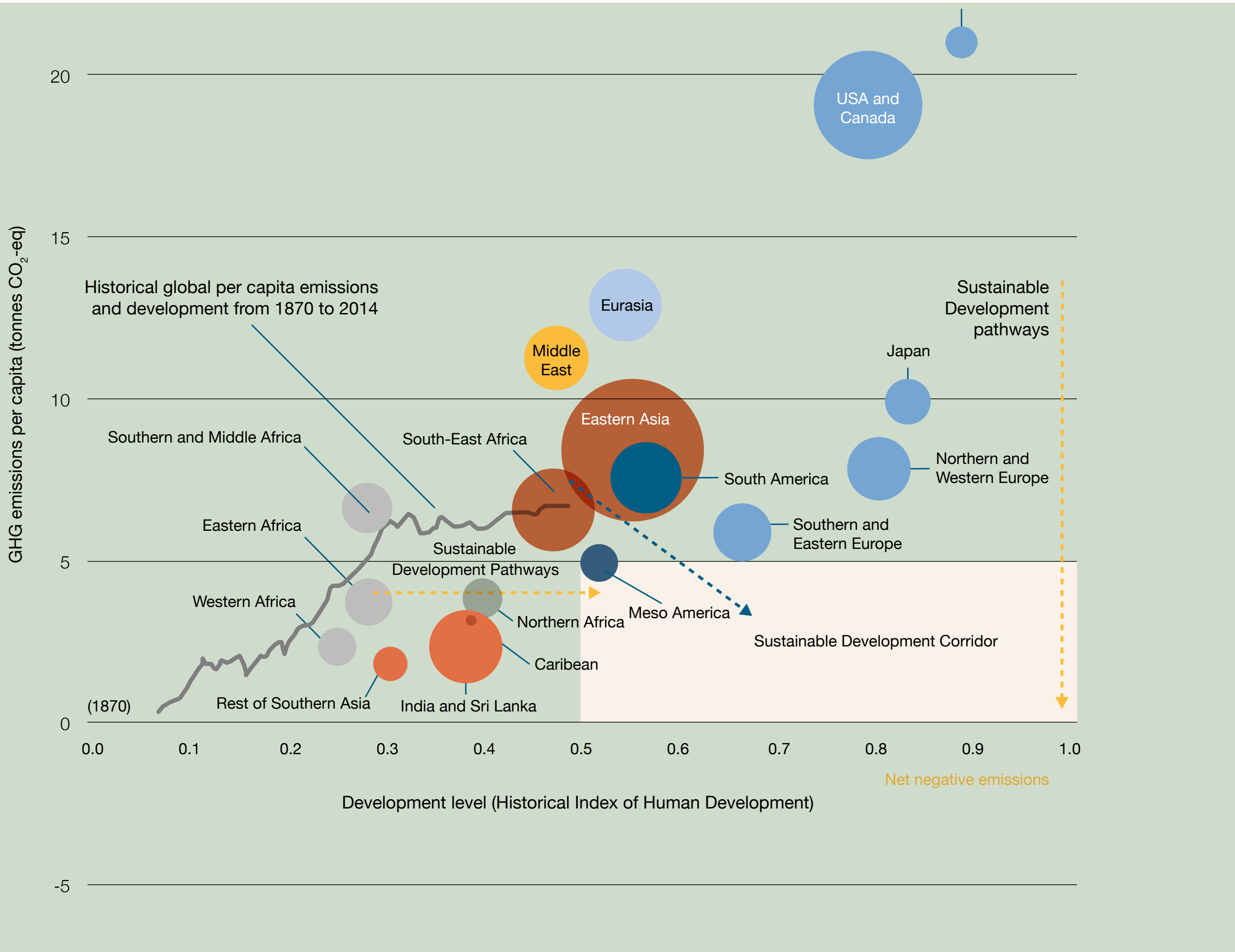
These structural challenges extend to the global financial architecture that translates to excessively high costs to access climate and development finance compared with other emerging economies and developed countries. The global trade regime, places African countries in commodity dependence, and provision of goods at the lowest end of value addition in the global value chains, leading to volatile financial flows (UNCTAD, 2023).

The global financial architecture therefore reinforces the drivers of debt accumulation in developing countries, particularly Africa. The link between the global financial architecture and global climate response was made explicit at the summit for a "New Global Financial Pact": Towards more commitments to achieve the 2030 Agenda, which was hosted in Paris in July 2023. One of the sessions of this event focussed on 'Restoring fiscal space to countries facing short-term difficulties, especially the most indebted countries'. This development signals growing recognition by political leaders of the negative effect of the global financial architecture on the climate response of African states.

In the context of the UNFCCC negotiations, COP 27 decided on a Just Transition Work Programme. A perspective that can inform African engagement should take into account, the preamble of the Framework Convention on Climate Change (FCCC) and its Article 3.4 which affirm the development imperative in climate action, and that it should take full account of the legitimate priority of developing countries to sustain economic growth and eradicate poverty, and that economic development is central to a climate change response. Whereas preambular language of the Paris Agreement outlines the just transition of the workforce imperative in climate action, and further puts it in the context of national development priorities. Decision 1/CMA.4, does not only scope the transitions, but in its preamble it asserts that '… enhanced effective climate action should be implemented in a manner that is just and inclusive while minimizing negative social or economic impacts that may arise from climate action'.

The African sustainable development context suggests that in the transitions to low-emission, and climate-resilient development, global trade policies and finance flows should contribute to the reduction of structural, socio-economic, and technological inequalities between developed and developing countries as the present day structural inequalities cannot deliver a 'just transition'. Furthermore the transition should recognise that, different countries face different challenges as aptly shown by the IPCC in Figure 1.1 below.

Figure 1.1: Sustainable development pathways towards fulfilling the Sustainable Development Goals. Pathak, et al (2022)



The figure shows the different challenges countries face in the transition towards low carbon development. It further shows the relationship between the relationship between development and emission, where it identifies a sustainable development corridor where historical HDI is at 0.5 and above, and emissions per capita that are below 5 tons.

With the exception of Southern and Middle (Central) Africa, African countries have always been within range of sustainable emissions per capita, with the common challenge across all African countries being how to close the development gap. It is therefore unsurprising that the majority of African countries prioritise increasing the availability of modern energy, where 600 million people, or 43% of the total population lack access to electricity (IEA, 2020), and 970 million Africans lack access to clean cooking energy (IEA, 2023). On the other hand, Southern and Middle (Central) Africa have the dual challenge of both reducing emissions per capita whilst pursuing sustainable development goals.

This is a strong rationale for differentiated pathways in the energy transition, noting that developing countries (particularly Africa) have a wider development gap than developed countries, with the latter's challenge being a reduction in consumption, rather than advancing development objectives.

1.2 Scoping a JT for Africa

The concept of the 'just transition' has its origins in the labour movement, however, the concept has evolved in a number of important aspects. The International Labour Organisation (ILO) has been advancing the concept to include a response to environmental challenges, and define it as … greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind (ILO, 2023). In the climate action context it involves maximising the social and economic opportunities of climate action, while minimizing and carefully managing any challenges relating to fundamental labour principles and rights.

In the context of the UNFCCC, particularly in implementing decision 1/CMA.4, the decision itself, and views espoused by developing countries advance a comprehensive rather than the limited scope. That view hinges on a developmental understanding of a 'just transition' which goes beyond workforce transition and domestic consideration. According to UNCTAD (2023), the developing country view is informed by the recognition of different starting points, different development needs and differing capabilities, with the UNFCCC principle of equity and CBDR-RC at the core.

a) Low-carbon pathways

Poverty and low economic development are linked to low absolute energy consumption levels, and a lack of household access to modern energy services. As of 2021, 600 million people (43%) in Africa still lacked access to electricity, and 970 million (64%) lacked access to clean cooking (IEA, 2023). This report notes that for a universal access to affordable electricity, achieved by 2030 in the Sustainable Africa Scenario, requires bringing connections to 90 million people a year, triple the rate of recent years, whereas achieving universal access to clean cooking fuels and technologies by 2030 requires shifting 130 million people away from dirty cooking fuels each year (IEA, 2023).

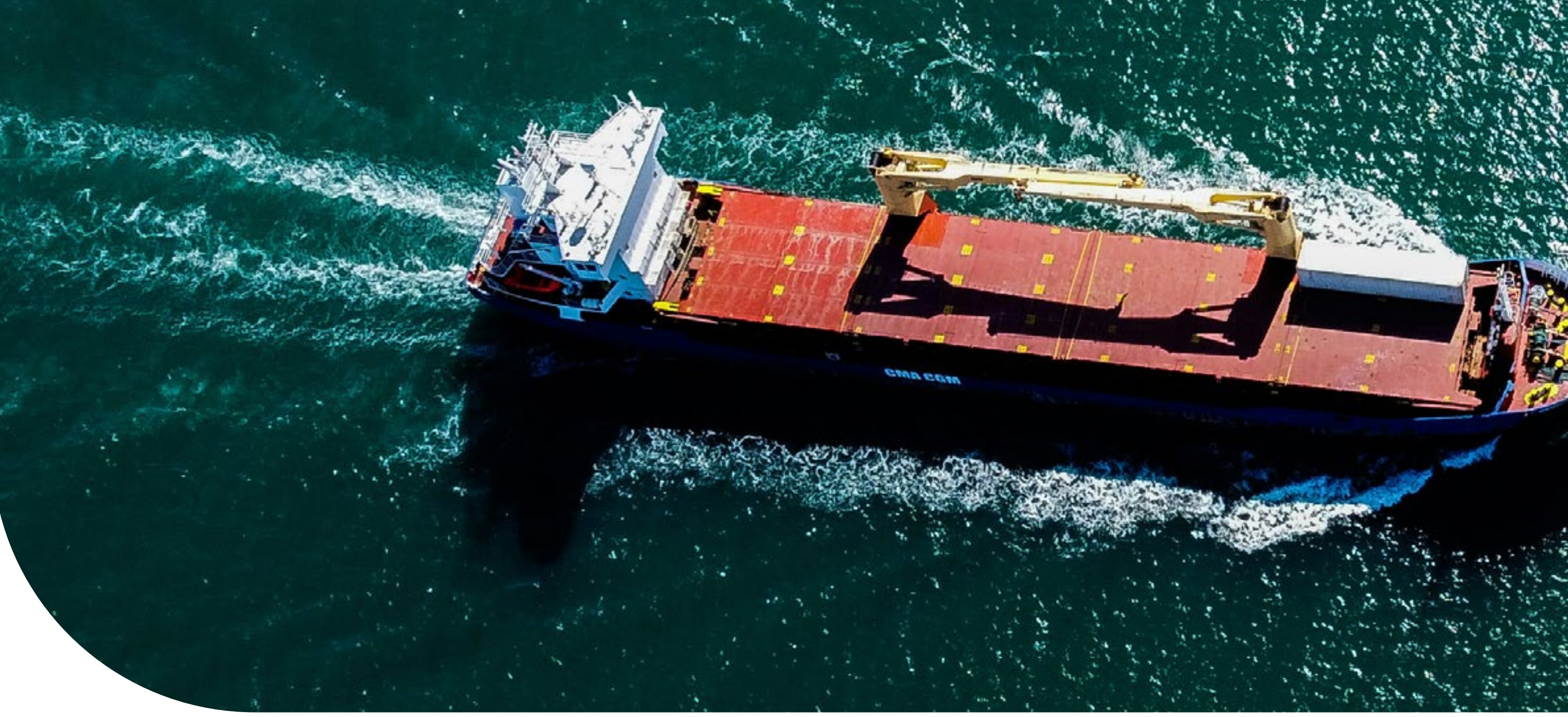
Africa currently has 147 GW of installed capacity, a level comparable to the capacity that China installs in one or two years. Average per capita electricity consumption in sub-Saharan Africa (excluding South Africa) is just 153 kWh/year (IRENA, 2023). In illustrating the disparities, the installed capacity in OECD countries is just shy of 11 million Gigawatt-hours (OECD, 2023). The primary consumption per capita of energy has remained stagnant at about 14-15 Gigajoule per capita in Africa for the period between 1982-2022. While Asia-pacific was at a similar level in 1965 at 8-10 Gigajoule per capita, however by 2022 the latter reached 65 Gigajoule per capita. Furthermore, aggregated primary energy data fuel type suggests Africa has a 90% reliance on fossil fuels for electricity generation (Energy Institute, 2023).

The flat energy consumption per capita in Africa for the last 40 years is a proxy indicator of the state of economic development. However, the reliance on fossil fuels for primary energy, which is only second to the Middle East region suggests a potentially much deeper and widespread impact of the energy transition on African economies. The low base from which the energy transition of the African continent suggest a need for accelerated energy access, and considerable potential to deliver the required economic development. Increased energy provision therefore can enhance the continent's mitigative and adaptive capacity. Concomitant advantages for the African energy transition include: the potential to decouple energy consumption with economic development, installation of renewables would decouple energy consumption from GHG emissions , and the favourable state of global energy technologies and supply.

b) Climate-resilient pathways

More than 110 million people on the continent were directly affected by weather, climate and water-related hazards in 2022, causing more than US$ 8.5 billion in economic damages. There were a reported 5 000 fatalities, of which 48% were associated with drought and 43% were associated with flooding, but the true toll is likely to be much higher because of under-reporting (WMO, 2023). With African economies highly dependent on natural resource based economic sectors, the GDP loss attributed to climate change is in the order of 5 to 15% of its GDP per capita growth according to the AfDB (2022). This is significant as these commodities are primarily for export as such the loss is not only in livelihoods, but also opportunities to earn foreign exchange.

With impacts of climate change already being felt, it would suggest that the immediate priority for African countries would be the protection of people, livelihoods and the economy, hence a prioritisation of adaptation and loss & damage. Paragraph 39 of decision 1/CMA.4 recognizes that the GGA will contribute to reducing the risk of climate change impacts, and should be cognisant of needs and priorities and in the context of sustainable development and poverty eradication. The pathways of adaptation action and support should therefore adequately address the needs of developing countries, particularly Africa.



c) Finance pathways

The development gap and inequality within, and across countries of the world pose a threat to the ability for many developing countries to vigorously invest in the transition to low-carbon and climate resilient economies. Climate change impacts risk a reversal of development gains in African countries through (i) a diversion of resources from health, education, infrastructure to address immediate impacts, (ii) GDP loss from natural resource dependent economic sectors, (iii) increasing risk due to a changing climate system (UNDP, 2022).

The global economic, trade and financial structure, as argued earlier, translates to indebtedness, and a low fiscal capacity, small capital markets to drive climate action investments. As a matter of fact, these structural challenges lead to a state where in 2022, the Bloomberg's Sovereign Debt Vulnerability Ranking identified countries at risk of debt default in 2023 to be developing countries with the exception of Turkey and Mexico. More than half of these vulnerable countries are African states. Furthermore African economies with significant emission reduction potential are at risk of debt default. For example Ghana (11th in emissions) is ranked 2nd in likelihood of default; Tunisia (7th in emissions) ranked 3rd in likelihood of default; Egypt (2nd in emissions) ranked 5th in risk of default; Kenya (12th in emissions) ranked 6th in risk of default; South Africa (1st in emissions) ranked 15th in risk of default; Nigeria (5th in emissions) ranked 24th in risk of default.

The higher cost of capital for African countries, which is largely driven by perception, further drives indebtedness. African sovereign entities issue bonds at high discount rates, and borrow at high interest rates as they are considered riskier. However, a look at objective facts show that even African countries with less than the IMF benchmark of 60% debt-to-GDP ratios are classified as sub-investment grade. Bonds from African countries such as Ethiopia, Nigeria, Zambia trade at 6.6%, 9.1%, 38% compared to the global average of 0.74%. On the other hand, Italy with a debt-to-GDP ratio of 134.8% pays less than 0.9% on its 10-year sovereign bond at the height of the pandemic downturn. Even for countries with a similar credit rating, e.g. Namibia and Greece (Ba3) the former's 10-year dollar denominated bond has a 481.6 spread vis a vis the latter at 222.6 basis point spread (Fofack, 2021).

The implications of these global finance conditions are captured in Mbatia, et al 2023. These authors suggest that, total energy sector investment across Africa was slightly under $100 billion in 2019 and fell to $73 billion in 2020. A closer look shows that 70% of the investments were in oil and gas; electricity sector investments totalled only around $30 billion per year on average between 2016-2020, of which only around $5 billion per year on average flowed to renewable energy investments. This would suggest that Africa is falling behind in the energy transition and increasing energy access and consumption towards economic development.

Whereas on adaptation, adaptation finance flows in Africa only reached $11 billion annually in 2019-2020 (GCA, CPI, 2023). At the current growth rate of adaptation finance, Africa will receive only about USD 180 billion by 2035, with doubling of adaptation finance by 2025, translating to $40 billion. The type of finance also matters as more than half (54%) of the adaptation finance commitments in 2019-2020 to Africa were channelled through debt, suggesting that Africa is paying back the majority of adaptation finance flows.

Faced with the structural impediments discussed in Section 2.1, a picture emerges where African countries have limited adaptive and mitigative capacity. The needs of African countries from a quantum of finance perspective are considerable, while the conditions of raising finance and borrowing risk leading to a transition that deepens indebtedness. Hence at the center of fair transitions, effective interventions should include the restructuring of the global finance system.

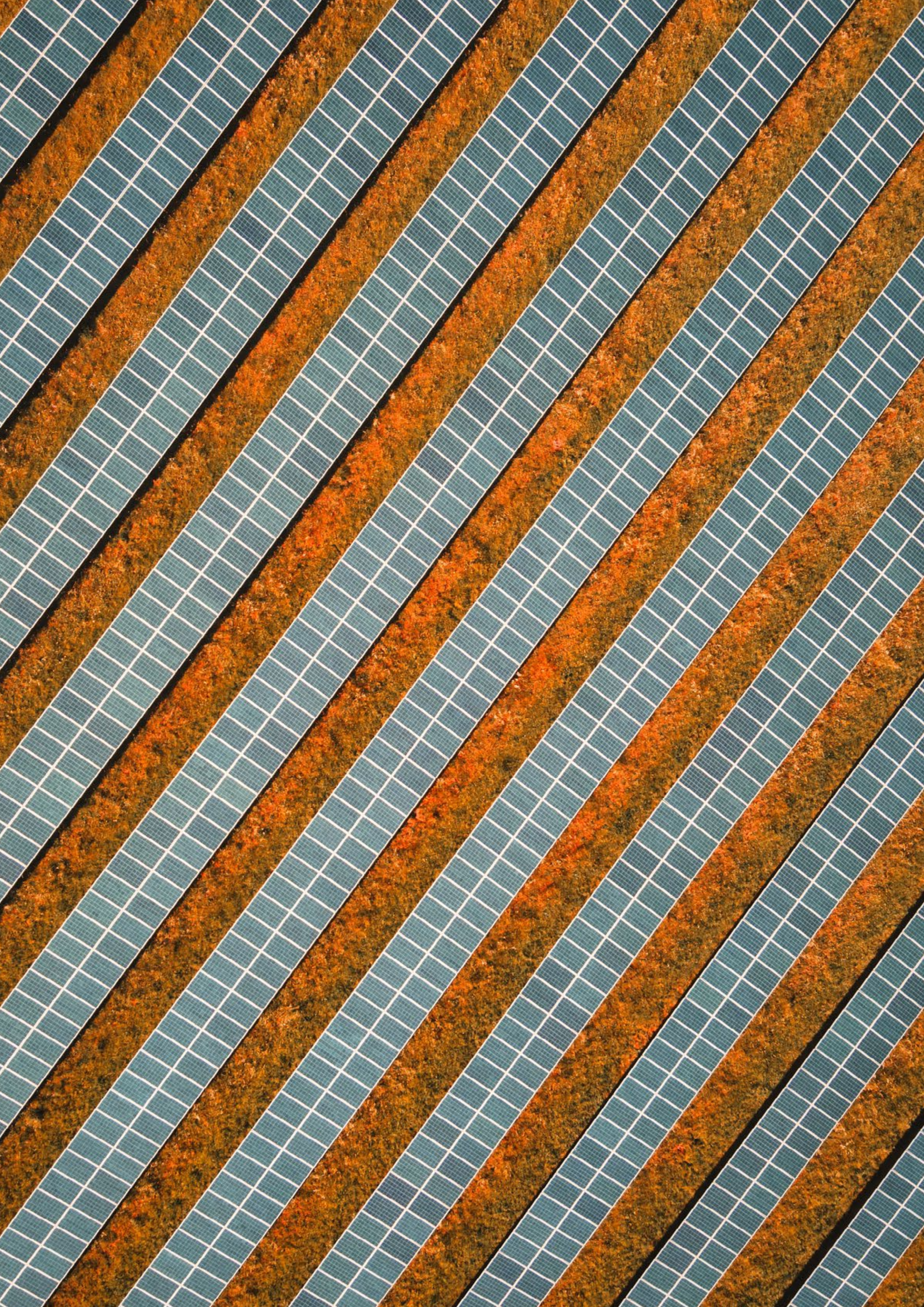
d) Social and economic dimensions of the transition

The pathways to be considered in the JT-WP have been clearly identified as towards low carbon, climate resilience, and finance pathways consistent with 1.5°C'. There are other dimensions that are relevant for adaptation and mitigation, as well as finance instruments that require scrutiny as to their 'justness'. In order to understand the justness of those dimensions, the environmental outcomes of the pathways should be assessed against social and economic outcomes of the transition. Critical to the understanding of these outcomes within and across nations are:

Workforce-job considerations of the transition should consider both the net benefit in technical capacity and number of employment opportunities created in transitioning the workforce to future economic sectors, without increasing socio-economic disparity and job distribution across nations. This is particularly important in transitioning to renewable energy generation technologies as the distribution of value chains are embedded in various countries, with limited value addition in African countries. From an adaptation perspective the consideration of climate vulnerable sectors, such as agriculture, should not consider only the workforce, but livelihoods, which is consistent with ILO guidelines (ILO, 2009). This is particularly important for Africa as self-employment represents about 70% of urban informal employment in Sub-Saharan Africa, 62% in North Africa. On the other hand, 60 % of Africans are engaged in subsistence farming which contributes up to 23% of the continent's GDP (MasterCard Foundation, 2022).

Trade considerations of the energy transition can be understood based on the understanding that technologies critical for the transition are protected, with 86% owned by developed countries, and originate in those countries. Secondly, environment-related actions by others such as the European Union's Carbon Border Adjustment Mechanism (CBAM) and Deforestation Regulations are likely to limit export of products from African countries. Thirdly, trade rules on lowering or eliminating customs duties on environmental products towards low carbon development, global standards of environmental protection and mining can contribute to a reduction of the policy space for African countries to develop productive capacities for domestic manufacture of green products. Lastly, the share of fossil fuel products in overall export basket exceeds 40% for fossil fuel producing countries in Central, Western and Northern Africa, which can lead to significant impacts on foreign exchange earnings

Economic considerations of the transition noting that energy consumption is a requirement of economic activity. Over the past four decades, per capita energy consumption in Africa has stagnated between 14-15 gigajoules/person/annum, the lowest in the world,. Furthermore fossil fuels account for almost 90% of modern primary energy consumption in Africa, the second highest after Middle-East. The high dependence on fossil fuels mean that economic, political and social impact of the transition to renewable energy is likely to be deeper, more widespread and possibly more disruptive in this continent than in other regions. Whereas the trade regime pose a significant threat to Africa being able to earn foreign exchange and invest in the transitions, potentially exacerbating and food scarcity; limited opportunities for local beneficiation of minerals critical to the energy transition.



2. Conditions Necessary for a Just Transition for Africa

This section identifies some indicative policy statements for the assessment of 'justness' of the transitions in the JT-WP. These policy statements are guided by climate action justice principles, and equity provisions of the FCCC and its Paris Agreement. The first part therefore identifies applicable justice principles, whereas the second part proposes policy statements that are relevant for each pathway and associated dimensions.

2.1 Principles and Policy Framework

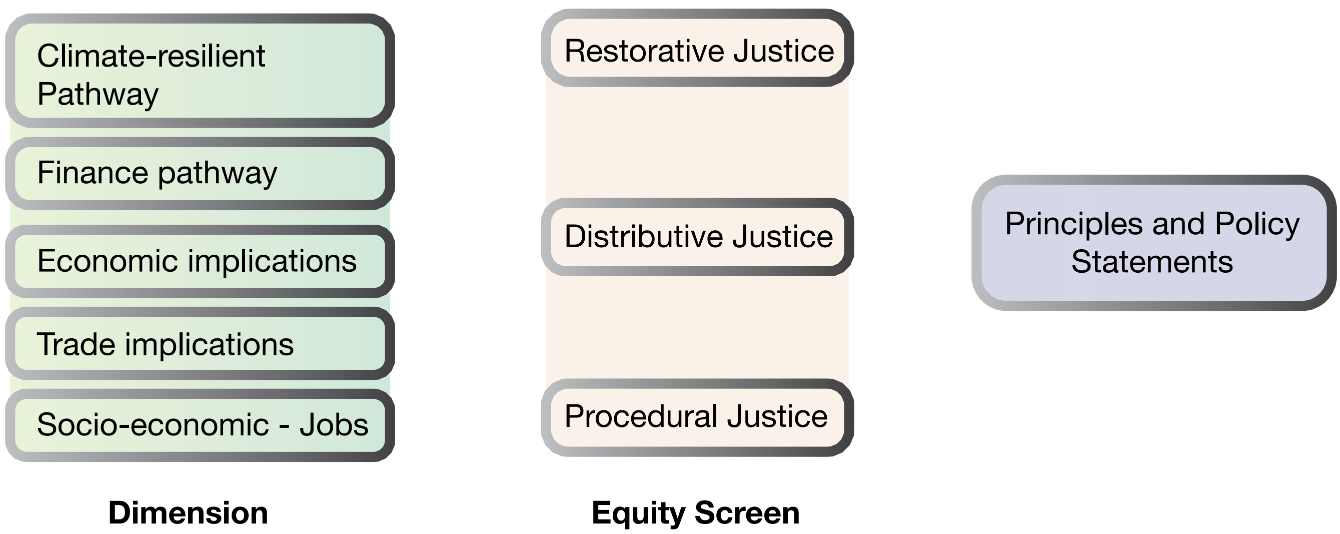
Climate justice is at the center of 'just' transitions and the principles relevant for this work programme, hence responding to questions on each of the transition pathways and associated dimensions. The proposed climate justice principles are restorative, distributive, and procedural justice. Taking a learning from the South African Presidential Commission on Climate Change (PCC, 2022), these principles are understood as follows:

- **Restorative justice,** which is the responsibility for the breakdown in the climate system, as well as repair of the damage caused/being caused by historical emissions. This is primarily driven by industrialisation of developed countries, which however results in climate impacts that disproportionally affect developing countries.
- **Distributive justice** which recognises the importance of a transition distributes benefits fairly across the globe. This would include how the remaining carbon space is utilised, as well positive opportunities in the energy transition and addressing lost opportunities from climate impacts.
- **Procedural justice,** addressing responses to the climate challenge that have fair, transparent processes, opportunity for developing countries to be part of decision making processes. This would apply to multilateral vs minilateral/unilateral responses to the challenge.

Some have argued that a just transition is not possible, if the underlying system is unjust. Therefore, the underlying factors in the justice equation should recognise the structural limitations posed by global economic governance, global finance systems in respect of enabling conditions for countries to achieve both their climate and development objectives. The transition cannot be looked at only in terms of energy or climate risk, rather in the context of sustainable development for the African continent.

For each of the pathways, e.g. low carbon, trade, etc; these need to be assessed from an equity lenses, such as restorative justice - how are the responsibilities shared, distributive justice - ability of Africa to achieve development objectives; procedural - how the multilateral system employs fair tools and instruments, as shown in Figure 1.2.

Figure 1.2: Just Transition Assessment Matrix



For low-emissions pathways, the key issues in the transition pertain to depth and rate of emission reductions, particularly level of ambition in NDCs, as well as the pursuit of Net Zero and Fossil-Fuel Phaseout. Whereas for adaptation, the key issues are the adequacy of adaptation action and support, the unfair transfer of the adaptation burden to developing countries. On financial flows and climate finance, the key issues pertain to inadequate finance to meet expressed needs of developing countries, as well as sources, types and quality of finance. On the social, economic, and trade aspects of the transition, the global economic and financial governance can potentially undermine developing country adaptive and mitigative capacity. The fairness of climate action inadvertently requires some reforms in global governance beyond the UNFCCC processes if structural limitations are to be addressed. In the current configuration, of the global governance system (e.g. global trade, global financial arrangements) the starting point is from a biased and prejudicial to development aspirations of many developing countries, especially African countries.

2.2 Policy Statements

In respect of energy and mitigation, the priority African countries is universal access to modern energy and to increase installed capacity to drive economic development. The pursuit of Net Zero and Fossil Fuel Phasedown as mooted decision 1/CMA.3 should recognise the differentiated pathways for African countries. That is, developed countries should achieve these targets well ahead of African countries. This would open-up the policy space for the transition, noting the opportunity for African countries to tunnel through the Kuznets curve through investments that are aligned with the future energy systems.

Emissions from the land sector, which are significant for several African countries, have another dimension, namely, countries with high emissions from the land sector have a significant sink capacity. However, the current structure of the landuse based carbon markets does not compensate for existing sink capacity, rather rehabilitation of degraded land. The degraded land focus can be a perverse incentive for land degradation, whilst not compensating African countries for pursuing more sustainable development paths.

Table 1.1: Low emission pathway policy statements

Low Emission Pathways	
Restorative Justice	Developed countries should take the lead in emission reduction, achieving Net Zero and Phaseout of fossil fuels and subsidies by 2035. Differentiated pathways that allow the policy and fiscal space for developing countries to achieve sustainable development.
Distributive Justice	The transition should offer opportunities for high-end manufacturing in developing countries, through instruments such as local content requirements, and not reduce African countries to suppliers of raw materials, particularly critical minerals for the transition; noting the overriding priority of increasing access to modern energy.
Procedural Justice	International cooperation on the deployment of low-carbon technologies should be pursued in multilateral and minilateral fora on equal partnership, and decision-making that takes into account needs and interest of African countries in pursuit of sustainable development.

The fundamental basis for climate resilient pathways is the alignment of action and support to address climate impacts associated with risks at 1.5°C temperature goal. However, the global level of mitigation ambition going to the mid-century is more consistent with 2°C global average temperature increase. This is particularly important as it increases the risk of climate impacts on livelihoods and natural-resource-dependent economic sectors, which typify the economies of most African states.

The investment in adaptation should also be understood in the context of the role of climate impacts eroding development gains. The development gains are eroded through loss and damage response, and also where national development budgets are diverted to climate change adaptation. The global adaptation action should bring to bear paragraph 39 of decision 1/CMA.4 which suggests a needs-based regime that is reflected in the form of targets in the GGA Framework, noting that inadequate support of African countries internalises the costs of impact, whereas the driver is external.

Table 1.2: Climate resilient pathways policy statements

Climate Resilient Pathways	
Restorative Justice	Developed countries should take the lead in providing climate finance for adaptation action on a public grant basis to support adaptation action in developing countries. This is informed by their primarily responsibility in the breakdown of the climate system.
Distributive Justice	The transition to climate resilient development should take into account the economic and livelihood role of nature based resources of African economies and people; the action should not translate to undermining the socio-economic role of those sectors.
Procedural Justice	International cooperation on climate resilience should be pursued in multilateral and minilateral fora on equal partnership, and decision-making that takes into account needs and interest of African countries in pursuit of sustainable development.

In respect to finance pathways that have to be considered as part of the JT-WP, the quantum of finance, the quality of finance and the instruments of mechanisms of mechanisms of delivering that finance are all relevant. On the quantum of finance, adequate financing for both climate adaptation and mitigation is critical for achieving the global climate goals. The Intergovernmental Panel on Climate Change (IPCC) in its 1.5 Special Report estimates that to adequately finance climate change measures in line with 1.5°C US$ 1.6 trillion to US$ 3.8 trillion is required annually, until 2030, whereas the OECD suggests as of 2020, climate finance 'provided and mobilized' amounted to US$ 83 billion dollars.

The quality of finance has come under scrutiny in light of fairness in the distribution of finance and financing terms. While the developed countries are looking at innovative sources of finance as the primary delivery vehicle, public grant finance should form the cornerstone source of finance. As much as emerging instruments such as JETPs provide another avenue for the flow of climate finance, multilateral guidance by the UNFCCC towards equitable financing terms and needs of African countries must be emphasised, rather than be based on donor priorities and interests.

Innovative sources of finance for implementing the JT-WP in Africa could include closing loopholes on tax regimes. For example, a 2%, 3%, 5% wealth tax of millionaires below $50m, +$50m, and billionaires respectively could raise and over $2.52 trillion per year. Reducing illicit financial flows from Africa could help, where the current state of illicit financial flows from Africa are estimated upwards of $89bn as of 2013-2015, with Africa losing about $17bn from corporate tax abuse.

The developmental needs of African countries should be taken into account as the region transitions to cleaner energy sources. For example some African countries have a high dependence on revenues from fossil fuel exports. Other African states have new fossil fuel finds and exploring options for exploitation to support the global market whilst investing in future energy sources for domestic consumption. The stability of global supplies could therefore come from African countries in the context where there is an immediate and complete phaseout of fossil fuel exploration in developed countries.

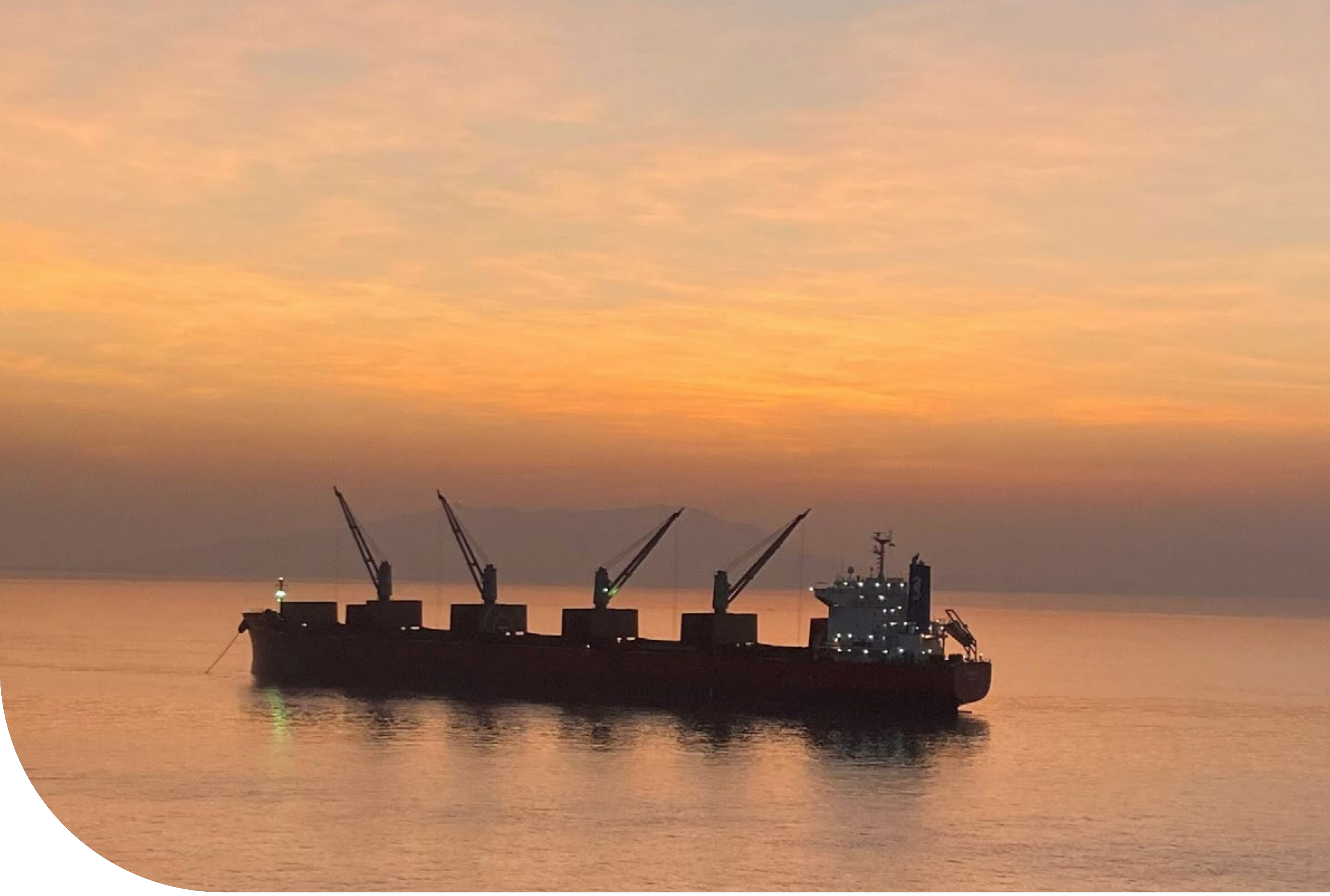
Table 1.3: Finance flows and MoI pathways

Finance Flows Pathways	
Restorative Justice	The quantum of finance available to developing countries should be commensurate with adaptation-mitigation needs of developing countries in line with the temperature goal; climate finance is delivered primarily through public sources.
Distributive Justice	The finance arrangements for climate action should take into account the development context of African countries; climate finance should not lead to further indebtedness by virtue of instruments and finance terms; no net incidence of developing countries on global taxation and levies.
Procedural Justice	Reform of the multilateral finance system, including representation, and decision-making processes in the provision of climate finance towards transformational climate flows.

Table 1.4: Economic, Social, Trade dimensions

Economic, Social and Trade Dimensions	
Restorative Justice	The transition should translate into shared prosperity where African countries are not trapped in the structural role of providing raw materials to patent owners of green technologies, rather included in advanced manufacturing to enhance the countries' mitigative and adaptive capacity.
Distributive Justice	Upward mobility of citizens of African countries is a priority, as such the transition should not lead to a net reduction in decent employment OR global value chains that export high-end jobs outside of the continent, leaving only low-paying jobs as an option.
Procedural Justice	Global climate action should be based on a multilateral agreed rules; avoid unilateral measures that prejudice and distort the competitive landscape.

Lastly, African states, being rich in critical minerals for the energy transition lack national policies to ensure maximum gains (economic, social, political) that could accrue from processing mineral wealth. This risks exploitative trade and investment regimes that perpetuate structural injustices of the past. Furthermore, other measures such as the Carbon Border Adjustment Mechanism (CBAM) and EU Forestry Regulations, and environmental standards have the potential of undermining the ability of African economies to grow and earn the required foreign exchange to drive the transitions.



CHAPTER 2 : TRADE IMPLICATIONS OF THE ENERGY TRANSITION

By Abhijit Das and Sachin Sharma

1. Background

The transition away from fossil fuels (coal, oil and gas) to clean energy sources (wind, solar, geothermal, hydro, ocean, biomass and nuclear) has become a key consideration in the pursuit of a sustainable future and for meeting climate change objectives. International trade has been viewed as an important channel for climate mitigation. Phasing out exports of fossil fuel products, imposition of carbon border taxes and restricting trade of products based on deforestation are some of the options being contemplated by many countries for reducing greenhouse gas emissions through measures related to international trade. Further, discussions/negotiations on the following rules in international trade agreements for supporting low carbon transition are relevant: lowering/eliminating customs duties on environmental products; liberalising services involved in waste management; mandating that countries adopt high standards of environmental protection and mining; harmonising product standards; non-discriminatory treatment in government procurement of products and equipment relevant for renewable energy etc.

From the trade perspective, the imperative to shift from fossil fuels to sources of renewable energy is likely to result in a severe crunch in foreign exchange reserves in the African countries whose export basket is dominated by fossil fuel products. This problem is likely to get compounded by other environment-related measures that would restrict exports from some African countries, particularly exports of the so-called deforestation products. However, the quest for decarbonisation also provides opportunities for Africa, as significant quantities of the minerals needed for the energy transition and green industries are found in the continent (Approach Paper towards preparation of an African Green Minerals Strategy. 2022). The minerals critical to the energy transition include copper, lithium, nickel, manganese, cobalt, graphite, chromium, molybdenum, zinc, silicon and rare earth elements (Approach Paper towards preparation of an African Green Minerals Strategy. 2022).

Despite its vast resources, Africa's share in the global exports of critical minerals remains low with 8.3% for raw, and 3.8% for processed critical minerals, respectively. While the necessity for Africa to progress toward more value-added economic activities based on critical minerals has been generally recognised, what has gone almost unnoticed is how some of the existing trade rules under the WTO pose considerable challenges. In addition, if a few of the obligations that are emerging in some trade agreements become the norm in international trade agreements involving African countries, then these could create additional hurdles for these countries to emerge as prominent players in the value-added segments of manufacturing.

What are the implication of the emerging trade landscape for a Just Transition for Africa? As discussed in the first chapter, a Just Transition must not only maximise environmental impacts, but also socio-economic outcomes. Two of the guiding principles of Just Transition are particularly relevant in the trade context. First, equity in opportunity should result in shared prosperity, as well as fair regimes for African countries in line with their national development priorities. However, the trade scenario, as it appears to be emerging in the context of the shift from fossil fuel products to renewables and the limitations imposed by trade rules on developing countries climbing up the value-added manufacturing value chain, is likely to have negative implications for socio-economic prosperity for African economies. Consequently, if Just Transition has to result in shared prosperity, there appears to be little option other than the global system of trade rules being required to change to make it more fair. Such a transformation should be to the benefit of African economies and their people, as well as be aligned with another principle of Just Transition – creating a fair global system that delivers fair outcomes.

Each section subsequently discussed in this chapter initially focuses on one broad issue, followed by a brief discussion of what could be done to addresses the problem highlighted in the section and create opportunities for African economies. Thereafter, the section examines the constraints imposed by existing rules under GATT/WTO and other trade agreements, as well as new disciplines that are emerging in trade agreements, in implementing some of the measures identified in the preceding sub-section. Subsequently, the section identifies the likely scenarios of ambition related to energy transition and finally provides policy recommendations.

In order to comprehend the internal challenges for African economies in their transition to renewable energy sources, it is relevant to compare the per capita energy consumption of this continent with other regions and the constituent sources of energy. Section 2.2 undertakes this brief analysis. Section 2.3 examines the export basket of African economies from the perspective of their dependence on exports of fossil fuel products, and discusses the likely impact on foreign exchange reserves of various economies if these exports are phased out. In the context of decarbonisation some economies, particularly the European Union, have been at the forefront of formulating and implementing trade measures that would impede the exports of rest of the world. Instruments such as carbon border adjustments mechanisms which have been studied to a large degree, including by the African Climate Foundation and the London School of Economics (ACF, LSE. 2023).

As a case study, Section 2.4 analyses the EU's Deforestation Regulation and assesses the likely impact on exports of "deforestation products" of African economies and the consequent implications for their foreign exchange reserves. Sections 2.3 and 2.4 taken together suggest that African economies are likely to see substantial erosion in their foreign exchange reserves on account of measures taken by other countries for decarbonisation. This is likely to make it more difficult for the African economies to have the necessary foreign exchange for importing technologies that would be essential for their green transition. In this context, Section 2.5 undertakes a brief discussion of the origin of green technologies.

The transition to renewable energy sources provides considerable opportunities for African economies as significant quantities of the minerals needed for the energy transition and green industries are found in the continent. Section 2.6 provides a bird's eye view of Africa's mineral endowment in so far as this relates to critical minerals. This can be an important channel for Just Transition, if the African economies are able to progress to value-added downstream processing based on critical minerals. This section concludes with many relevant recommendations seeking to ensure that African economies are not denied the opportunity of progressing into value-added and processed products on account of trade rules.

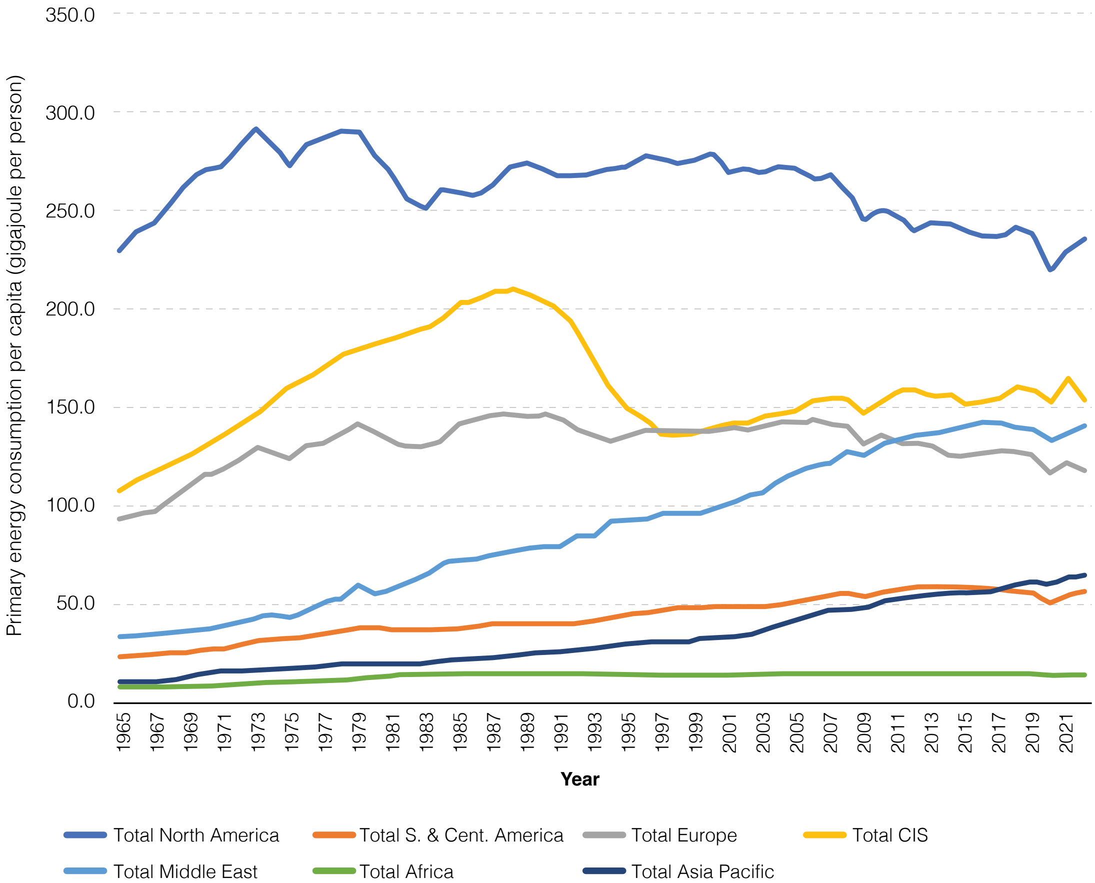
2. Brief Analysis Of Africa's Profile Of Energy Consumption

The starting point for a meaningful discussion on the transition from fossil fuel energy to renewable energy needs to focus on the following two dimensions: first, primary energy consumption per capita; and second, energy consumption by fuel category.

2.1 Primary energy consumption per capita

Historically, among different geographical regions in the world, Africa has had the lowest primary energy consumption per capita (see Figure 2.1). While availability of energy, climate and culture could be some of the reasons for the vast diversity in primary energy consumption per capita across regions, the most important reason is the level of economic development. Countries at a high level of economic development tend to have substantially higher demands for energy for households, agriculture and industry, than countries at the lower end of the development spectrum. It is also relevant to note that while this indicator has shown an increasing trend in most years for most regions, it has remained almost stagnant in Africa (14-15 gigajoule per person during 1982-2022). While Africa and Asia-Pacific regions were at similar levels of primary energy consumption per capita in 1965 (8-10 gigajoule per capita), by 2022 the latter had reached 65 gigajoule per capita. The implication of these trends for Africa are clear. For the continent to transcend to the trajectory of higher economic development, primary energy consumption per capita will have to increase substantially over the historical levels.

Figure 2.1: Primary energy consumption per capita: By region



Source: Energy Institute Statistical Review of World Energy 2023

2.2 Primary energy consumption by fuel category

The share of fossil fuels in a country's energy consumption will be a crucial determinant of the likely impact of the transition from fossil fuels to renewable energy sources; higher the share of fossil fuels in a country's energy mix, higher is likely to be the impact of the transition. Detailed country-level data by fuel category for most countries in Africa is not available. However, more aggregated data at the regional level suggests that the share of fossil fuels in Africa's energy mix is very high at 89.89% (see Table 2.1). This is next only to the Middle East region. Consequently, the economic, political and social impact of the transition to renewable energy is likely to be deeper and more widespread in Africa as compared to most other regions. It may be noted that Primary Energy Consumption is a fossil fuel metric. However, as data on Final Energy Consumption is not available, this study uses Primary Energy Consumption.

Table 2.1 Primary energy: Consumption by fuel category (2022)

Primary energy: Consumption by fuel category (2022)									
Exajoules	Oil	Natural Gas	Coal	Nuclear energy	Hydro electric	Renew-ables	Total	Share of fossil fuels	Share of non-fossil fuels
Total North America	44.53	39.58	10.51	8.19	6.50	9.46	118.78	79.66	20.34
Total South & Central America	12.37	5.82	1.19	0.20	7.00	3.53	30.11	64.37	35.63
Total Europe	28.72	17.96	10.07	6.68	5.32	11.06	79.81	71.10	28.90
Total CIS	9.10	19.84	4.87	2.08	2.33	0.14	38.36	88.14	11.86
Total Middle East	17.97	20.18	0.37	0.24	0.12	0.26	39.13	98.43	1.57
Total Africa	8.39	5.85	3.97	0.09	1.47	0.49	20.26	89.89	10.11
Total Asia Pacific	69.61	32.65	130.50	6.65	17.94	20.24	277.60	83.85	16.15

Source: Energy Institute Statistical Review of World Energy 2023
Note: Fossil fuels include the following: Oil, Natural Gas and Coal.

2.3 Addressing the problems and creating opportunities in enhancing the share of non-fossil fuels

The shift away from non-fossil fuel category of energy towards renewable energy sources can create economic opportunities for African economies. Solar power can help Africa "reduce emissions and widen access to electricity, but the continent is only in the early stages of building its solar resources" (https://www.weforum.org/agenda/2022/09/africa-solar-power-potential). Africa leads the world in solar power potential, but most of the potential remains untapped (https://www.weforum.org/agenda/2022/09/africa-solar-power-potential). Solar power accounts for less than 1% of Africa's energy mix (Africa Energy Review 2021, PwC). While solar additions in Africa still only represent 1% of the global additions, Africa is now home to more than 16 GWp of solar (https://www.afsiasolar.com/wp-content/uploads/2024/01/AFSIA-Annual-Solar-Outlook-2024-Part-1-final-2.pdf). By the end of 2023, South Africa was home to at least 7,781 MW of solar, representing almost 47% of all installed capacity in the continent (https://www.afsiasolar.com/wp-content/uploads/2024/01/AFSIA-Annual-Solar-Outlook-2024-Part-1-final-2.pdf). Solar capacity in the region has witnessed a growth of over 50% in recent years, with the potential for solar power generation reaching up to 1100 gigawatts. By 2021, while 37 countries across the world had already installed more than 1 GW of solar, only 2 were in Africa – Egypt and South Africa (Africa Solar Outlook 2021). Other African economies set to join the 1 GW mark include Algeria, Morocco, Zimbabwe, Zambia, DRC, Angola, Namibia, Ethiopia and Botswana.

The solar PV value chain comprises five main segments – (i) quartz or silica extraction; (ii) manufacture of solar grade silicon (polysilicon); (iii) polysilicon moulded into ingots and sliced into wafers; (iv) manufacture of solar cells; and (v) assembly of solar cells for creating solar modules. At this juncture the participation of African economies in the solar PV is rather limited. Africa imports most of its renewable energy technologies, such as solar PVs, with renewable energy businesses being primarily involved in imports, sales, and services of renewable energy technologies (The Solar PV value chain: An assessment of opportunities for Africa in the context of energy transition and the African Continental Free Trade Area. Benjamin Boakye and Charles Gyamfi Ofori. 2022). Solar-grade silicon or polysilicon requires high purity levels of at least 99.9999% silicon.

South Africa is the only African country with significant production volumes of silicon metals. In addition, Africa has reserves of copper, bauxite, chromium and manganese, which are required for manufacturing PV cells. While African economies do not have any significant presence in stages (ii) –(iv) of the PV value chain, some entities exist in the final stage of the value chain. The ENF solar directory indicates that 20 solar module-producing companies are active in Africa – Egypt (5), Nigeria (4), South Africa (4) and the rest in Ghana, Algeria and Tunisia (The Solar PV value chain: An assessment of opportunities for Africa in the context of energy transition and the African Continental Free Trade Area. Benjamin Boakye and Charles Gyamfi Ofori. 2022).

The large number of solar energy-based projects at various stages of planning, construction and implementation in Africa present some commercial opportunities, particularly in the final stage of the value chain. What role can trade and trade policy play? African economies with capabilities in assembling PV cells into modules could consider using tariffs to regulate imports of PV modules, while keeping a tariff free regime for PV cells. Economies that lack the capability would need to allow imports of PV modules at low/zero tariffs. Further, solar energy projects involving government procurement could mandate domestic procurement of PV modules.

2.4 Constraints imposed by existing and emerging trade rules

Most African economies have retained the policy space to impose customs duties on PV modules, as well as mandating purchases from domestic suppliers in government procurement. However, it should be noted that under the rules of GATT/WTO, procurement from domestic suppliers can be mandated only in respect of those products that are procured by the government for its own use and not for commercial purposes. Further, if the government purchases electricity, it cannot mandate purchase of PV modules from domestic sources. It is also relevant to point out that some rules emerging in free trade agreements that have been recently negotiated by the developed countries curtail the flexibility in respect of government procurement, by mandating non-discriminatory procurement of renewal energy products and the equipment required in their manufacture. What could be the two scenarios related to energy transition from the trade perspective? What could be their implications? These questions are discussed below.

2.5 Scenarios of Ambition and Implications for African Economies

Scenario 1: A high ambition scenario for Rest of the World and low ambition for Africa

This scenario would have the following elements: first, high standards of environmental protection adopted by Rest of the World (ROW) and Africa (in contrast to adequate standards of environmental protection) in mining of minerals required for renewable energy products, such as PV cells and modules; second, all countries agree to eliminate customs duties on renewable products and equipment relevant for their manufacture; and third, all countries agree to provide non-discriminatory treatment in government procurement of renewable energy products and equipment relevant for their manufacture. This scenario would have the following implications: high standards of environmental protection in mining would result in mining firms from outside Africa to secure mining contracts; increased import dependence on renewable energy products and their associated equipment; and African economies unable to implement an industrial policy for indigenization of renewable energy products.

Scenario 2: A high ambition scenario for Rest of the World and high ambition for Africa

This scenario would have the following elements: high standards of environmental protection (in contrast to adequate standards of environmental protection) adopted by ROW, but adequate standards of environmental protection in Africa for mining; ROW agrees to eliminate customs duties on renewable products and equipment relevant for their manufacture, but Africa retains the policy space on this issue; and ROW agrees to provide non-discriminatory treatment in government procurement of green products and equipment relevant for renewable energy, but Africa retains the policy space on this issue. This scenario would have the following two implications: African entities can secure some of the mining contracts in the continent; and African economies can gradually increase domestic value addition in renewable energy products.

2.6 Policy recommendations

Having analysed the two scenarios related to energy transition, we next turn to discussing relevant policy recommendations. From the perspective of domestic and intra-Africa actions, African economies could consider implementing programmes for building skills necessary for after sales services of equipment required for renewable energy production. African economies with capabilities in assembling PV cells into modules could consider using tariffs to regulate imports of PV modules, while keeping a tariff free regime for PV cells. Economies that lack the capability would need to allow imports of PV modules at low/zero tariffs. Further, solar energy projects involving government procurement could mandate domestic procurement of PV modules. Further, under the ACFTA, they could consider having an open trade regime for PV modules and after sales services relevant for renewable energy, thereby enabling countries with domestic capabilities in these two sectors to benefit from the continent-wide market and economies of scale.

From the perspective of international collaboration, in international trade negotiations African economies should seek to retain the policy space in respect of government procurement. Further, with the objective of enhancing upstream and downstream linkages they should seek changes in trade and investment rules to permit them to mandate the following: (i) local sourcing of inputs, parts and components; (ii) enterprise’s purchases or use of imported products be limited to an amount related to the volume or value of local products that it exports; (iii) the importation by an enterprise of products used in or related to its local production, generally or to an amount related to the volume or value of local production that it exports; (iv) foreign exchange balancing between outflows for imports and inflows attributable to exports of the enterprise; (v) subsidies contingent on use of domestic inputs over imported inputs; and (vi) in respect of government procurement, mandating domestic procurement of any inputs that are used in the production of the final product procured by the government.

3. Africa's Trade In Fossil Fuel Products And Its Likely Implications For Transition To Renewable Energy Sources

In the context of transition to renewal energy sources, the following two important questions need to be addressed: what is the share of fossil fuel products in the export basket of countries in Africa; and what is the contribution of exports of fossil fuel products to the overall foreign exchange reserve of these countries? The list of products included in this analysis has been provided in Annex 2.1.

3.1 Share of fossil fuels in export basket of African countries

Most countries in Africa do not have a diversified export basket. Countries that are substantially dependent on fossil fuels for their export earnings would be adversely impacted by the shift to renewable energy sources. As shown in Table 2.2, the share of fossil fuel products in overall export basket exceeds 40% for countries in Central, Western and Northern Africa. On the other hand, fossil fuel products do not constitute a significant share in the export basket of countries in Eastern and Southern Africa.

Table 2.2: Exports of fossil fuel and merchandise goods by the geographic regions of Africa in 2021

	USD Million		Percent
Geographic Region	Export of total Fossil fuels products to the World	Export of total merchandise goods to the World	Share of fossil fuel export in total merchandise goods
Central Africa	20,940.28	48,876.90	42.8
Eastern Africa	1,539.46	34,803.97	4.4
Northern Africa	80,373.97	172,140.69	46.7
Southern Africa	44,289.18	230,243.37	19.2
Western Africa	55,034.81	119,857.86	45.9

Source: Based on WITS database using HS 2017 version.
Note: Mirror data has been used to capture export data for African Country with the World for fossil fuel trade and merchandise trade. For Fossil fuel all 4-digit product codes are captured and for merchandise goods all chapters are captured.

Analysing the export data at a more disaggregated level, Table 2.3 provides details of countries in which fossil fuels comprise at least 25% of the export basket by value. As the demand for fossil fuel products are likely to decline, these countries are likely to be more severely impacted by the transition from fossil fuels to renewable energy sources through the trade channel. It may be noted that in addition to the countries listed in Table 2.3, in respect of Seychelles the share of fossil fuels was almost 30% in 2021. However, in other years the share was much lower.

Table 2.3: Countries with share of fossil fuel products in total export basket exceeding 25%

Country	Share of fossil fuel exports in total merchandise goods (%)					
	2017	2018	2019	2020	2021	2022
South Sudan	99.3	94.7	94.4	82.8	95.3	99.3
Angola	95.5	92.8	93.9	93.1	91.5	96.7
Chad	94.1	88.6	76.2	80.9	69.0	95.2
Libya	96.9	95.7	94.5	76.4	95.8	92.9
Nigeria	92.6	92.5	92.9	91.6	91.0	89.7
Equatorial Guinea	85.9	87.6	89.2	90.2	90.0	88.9
Algeria	95.6	94.1	93.1	89.0	88.1	85.8
Congo, Rep.	73.1	70.4	68.5	56.2	59.6	84.7
Cameroon	44.3	45.1	50.4	47.9	56.0	71.7
Gabon	67.2	64.1	67.9	53.1	63.6	61.2
Mozambique	44.0	45.8	41.7	29.5	30.8	42.4
Ghana	24.1	29.2	29.5	24.0	28.7	36.6
Egypt, Arab Rep.	26.0	30.6	30.0	22.3	31.5	33.8
Togo	19.7	51.8	54.4	36.4	47.4	30.3
Sudan	41.2	34.3	24.9	9.1	8.0	24.9

Source: Based on WITS database using HS 2017 version.
Note: Mirror data has been used to capture export data for African Country with the World for fossil fuel trade and merchandise trade. For Fossil fuel all 4-digit product codes are captured and for merchandise goods all chapters are captured.

3.2 Contribution of exports of fossil fuels to foreign exchange reserves

With the foreign demand for fossil fuel products likely to decline on account of the transition to renewable energy sources, this is likely to result in eroding the foreign exchange reserves of many countries in Africa. Table 2.4 provides details of countries with the contribution of earnings from exports of fossil fuels to the total foreign exchange reserves exceeded 25% for at least one year during the period 2017-2022. Contribution to foreign exchange reserves is calculated on the basis of exports of fossil fuel products as a percentage of total foreign exchange reserves. It may be noted that data on foreign exchange reserves was not available for the following countries for even one year during the period 2017 - 2022: Guinea-Bissau, Mali, Niger, Senegal, Somalia and Togo. As the transition from fossil fuels to renewable energy sources will happen over a number of years, exports of these products will gradually get reduced to zero. However, the foreign exchange reserves of countries in Table 2.4 appear to be vulnerable to huge erosion on account of the energy transition. Unless new sources of foreign exchange inflows are found, these countries would find it extremely difficult, if not totally impossible, to have the foreign exchange to import green technologies and green products for facilitating their transition to a low carbon emission economy.

Table 2.4: Contribution of exports of fossil fuel products to total foreign exchange reserves

Country Name	2017	2018	2019	2020	2021	2022
Cameroon	46.15	62.15	na	na	na	na
Gabon	356.26	327.33	354.38	na	na	na
Guinea	28.03	8.37	6.27	3.77	na	na
South Sudan	3932.03	4518.19	434.17	386.01	na	na
Sudan	373.86	na	na	na	na	na
Equatorial Guinea	9098.22	12020.37	10977.14	4633.87	10396.39	na
Chad	13432.82	1075.11	327.04	346.94	970.93	na
Congo, Rep.	1148.46	1925.90	755.45	357.48	749.36	na
Angola	190.33	272.56	215.32	161.95	211.93	331.74
Nigeria	97.57	137.22	137.12	95.71	118.61	145.59
Algeria	29.66	44.53	45.81	32.59	60.58	75.53
Mozambique	70.64	99.26	64.67	35.29	60.10	137.79
Ghana	37.70	74.77	60.46	42.24	42.96	na
Seychelles	3.05	2.28	20.04	14.62	41.14	0.81
Libya	21.29	34.67	32.42	8.92	39.46	40.11
Egypt, Arab Rep.	16.09	21.26	20.37	14.89	32.16	39.58
Congo, Dem. Rep.	62.10	68.07	46.69	60.08	21.58	na
Zimbabwe	4.66	30.88	14.38	113.14	14.62	15.11

Source: Data on exports of fossil fuel products is based on WITS database. Data on foreign exchange reserves has been taken from World Bank Development Indicators. Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities.

3.3 Mitigating impact on imports of fossil fuel products

It could be argued that the phasing out of fossil fuel products could ease the forex exchange position of African countries where these imports constitute a substantial share of the foreign exchange. However, this argument makes the following assumption: the renewable energy sources to replace fossil fuel products would be either substantially obtained from domestic sources or the imports of renewable products would be at prices lower than those of fossil fuels. Whether this assumption will be justified is difficult to foresee. Assuming that this argument holds, Table 2.5 shows countries whose foreign exchange reserves might ease if imports of fossil fuels are replaced by use of cheaper imported renewable energy products. The data in the table has been considered only for those countries who had a negative trade balance in respect of fossil fuel products. One possible approach to soften the impact of phase-out of the exports of fossil fuel products could be to a seek long transition period for doing it.

Table 2.5: Contribution of imports of fossil fuel products to total foreign exchange reserves

	2020	2021	2022
Country	Imports of Total Fossil Fuels as % of Forex Reserve	Imports of Total Fossil Fuels as % of Forex Reserve	Imports of Total Fossil Fuels as % of Forex Reserve
Botswana	12.48	16.70	31.96
Burundi	17.91	4.81	5.08
Cape Verde	15.31	12.35	21.37
Central African Republic	2.03	0.78	na
Comoros	3.16	3.64	2.90
Djibouti	61.68	358.81	29.76
Eswatini	30.53	40.60	64.59
Ethiopia	4.28	na	na
Gambia, The	5.02	4.52	2.39
Guinea	9.42	na	na
Kenya	20.47	29.43	25.00
Liberia	439.29	na	na
Madagascar	9.42	6.28	16.13
Malawi	4.50	na	na
Mauritania	3.82	4.61	na
Mauritius	1.80	5.36	4.59
Morocco	9.96	17.89	23.50
Mozambique	47.51	72.47	126.54
Namibia	15.14	14.62	25.77
Rwanda	2.35	1.27	1.10
Sao Tome and Principe	2.54	2.61	na
Sierra Leone	3.02	7.64	8.87
Tunisia	14.92	31.52	32.52
Zambia	8.19	4.46	8.58
Zimbabwe	854.99	46.26	71.15

Source: Data on imports of fossil fuel products is based on WITS database. Data on foreign exchange reserves has been taken from World Bank Development Indicators. Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities.

3.4 Scenarios of Ambition and Implications for African Economies

What could be the two scenarios regarding phasing out of fossil fuel products exports? The two scenarios discussed below are based on the time available to the African economies for eliminating these exports.

Scenario 1: A high ambition scenario for Rest of the World and low ambition for Africa

Under this scenario all countries agree to phase out exports of some fossil fuel products. This scenario would have the following two important implications: first, a sharp decline in foreign exchange reserves of some African economies; and second, insufficient foreign exchange being available for importing renewable energy products and their associated technologies.

Scenario 2: A high ambition scenario for Rest of the World and high ambition for Africa

Under this scenario ROW agrees to expeditiously phase out exports of fossil fuel products, but African economies get a transition period of at least 10-15 years for doing it. This scenario would result in gradual, and not sudden, decline in foreign exchange will soften the impact. Further, the African economies can utilize the long transition period to diversify their export basket away from fossil fuel products.

3.5 Policy recommendations

Based on the impacts of the two scenarios discussed above, African economies dependent substantially on exports of fossil fuel products could consider negotiating with other countries to secure a long transition period of 10-15 years for phasing out exports of fossil fuel products. Further, economies that face balance of payment problems on account of phasing out of exports of fossil fuel products, should be allowed by the WTO Members to take either price-based measures or quantitative restrictions for a limited duration. The African economies have not contributed to the problem of increasing carbon emissions and climate change. Thus, restorative justice demands that those who have created the problem must have the responsibility to address it. Suggestion for longer transition periods for African economies to comply with initiatives such as eliminating exports of fossil fuel products would be an appropriate articulation of restorative justice.

4. Likely Impact Of Environment-Related Actions By Other Countries On Africa's Exports: Case Study Of EU's Proposed Deforestation Regulation

Recently, the European Union (EU) has introduced a regulation for identified products associated with deforestation and forest degradation 2023/1115 dated 31 May 2023. The regulation seeks to ensure that the following 7 identified commodities placed in the EU market will not contribute to deforestation and forest degradation in the EU and elsewhere in the world: cattle, cocoa, coffee, oil palm, rubber, soya, and wood. In order to be placed on the EU market, these 7 categories of products have to fulfill the following three requirements: (a) they are deforestation-free; (b) they have been produced in accordance with the relevant legislation of the country of production; and (c) they are covered by a due diligence statement. The regulation will be operational from December 2024 for the exports of the listed deforestation-free commodities. It is apprehended that as most developing countries will not be able to comply with these requirements, their exports to the EU of the 7 categories of products is likely to decline sharply. In this context, it is relevant to analyse the existing profile of exports of these 7 categories of products ('Deforestation products) and their contribution to total foreign exchange reserves. Table 2.6 provides details of exports of Deforestation products by different regions in Africa. Western Africa is likely to be most adversely impacted by the EU's Deforestation Regulation.

Table 2.6: Exports of Deforestation products from Africa (2021): By region (mn. USD)

Geographical Region	Export of Deforested products to the EU	Export of Deforested products to the World	Total merchandise exports to the EU	Total merchandise exports to the World	Share of exported deforested products to the EU in exported global deforested products (%)	Share of Deforested products exported to the EU in total merchandise good exported to the EU (%)	Share of Deforestation products exported to the EU in Merchandise good exported to the world (%)
Central Africa	1334.77	3240.85	8615.80	48876.90	41.19	15.49	2.73
Eastern Africa	1001.59	3332.04	5718.67	34803.97	30.06	17.51	2.88
Northern Africa	910.51	2426.26	94802.40	172140.69	37.53	0.96	0.53
Southern Africa	287.38	5084.61	34696.58	230243.37	5.65	0.83	0.12
Western Africa	5866.04	13521.19	29717.32	119857.86	43.38	45.50	24.79

Source: (1) Based on WITS database and HS codes based on Annex I in the regulation (EU) 2023/1115 dated 31 May 2023 (2) Merchandise trade based on WITS database using HS 2017 version.
Note: Mirror data has been used to capture export data for African Country to the EU and the World for the total identified Deforestation regulation products and all merchandise goods.

4.1 Contribution of exports of Deforestation products to total foreign exchange reserves

It is relevant to examine the contribution of exports of Deforestation products to total foreign exchange reserves of the African economies. Table 2.7 provides details of contribution of exports of Deforestation products to the EU to the country's total foreign exchange reserves. Details have been reported for those countries for which this exceeded 15% in at least one year during the period 2017-2022. It may be noted that no data on foreign exchange was available for the following countries: Benin, Burkina Faso, Cote d'Ivorie, Guinea-Bissau, Mali, Niger, Senegal, Somalia and Togo. It is apprehended that the total foreign exchange reserves of the countries listed in this table could be severely adversely affected by the EU's Deforestation regulation.

Table 2.7: Contribution of exports to the EU of Deforestation products to total foreign exchange reserves

Country Name	Contribution of exports to the EU of Deforestation products in Total foreign exchange reserve (%)					
	2017	2018	2019	2020	2021	2022
Cameroon	23.48	21.55	na	na	na	na
Gabon	19.49	13.43	12.10	na	na	na
Liberia	9.30	12.38	17.36	19.86	na	na
Sao Tome and Principe	15.01	17.03	13.96	8.77	19.34	na
Ghana	18.05	22.30	17.15	14.97	13.44	na
Equatorial Guinea	29.78	21.98	21.94	12.89	12.74	na
Congo, Rep.	19.66	20.49	8.49	6.54	11.78	na
Burundi	23.89	39.96	26.21	21.04	9.28	10.07

Source: Data on exports of fossil fuel products is based on WITS database. Data on foreign exchange reserves has been taken from World Bank Development Indicators. Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities.

Assuming that the exports of deforestation products from Africa was not based on deforestation in the first place, the main constraint for African countries would be to comply with the due diligence certification requirements. This additional cost could erode the cost competitiveness of Africa's exports to the EU. African economies may be required to institute a mechanism that makes it less costly for its exporters to comply with the conditionalities.

It is relevant to mention that whether the Deforestation Regulation complies with the existing trade rules at GATT/WTO, is unclear. There are considerable grounds to raise questions on it. In particular, there is no certainty that countries are allowed to discriminate on the basis of the method of production of a product. WTO rules need to be clarified so that countries do not discriminate on the basis of the method of production of a product. This would impart greater certainty to GATT/WTO rules and allow for a predictable trading regime.

4.2 Scenarios of Ambition and Implications for African Economies

From the perspective of trade, two scenarios are considered regarding the Deforestation Regulation based on the ambition level of African economies and Rest of the World.

Scenario 1: A high ambition scenario for Rest of the World and low ambition for Africa

Under this scenario trade-related measures aimed at protecting the environment (CBAM, Deforestation Regulation etc.) become increasingly common and get adopted by ROW; and exports from Africa have to promptly comply with the requirements of the trade-related measures, such as EU's Deforestation Regulation. This scenario would result in a sharp decline in foreign exchange of African countries dependent on exports of Deforestation products.

Scenario 2: A high ambition scenario for Rest of the World and high ambition for Africa

Under this scenario trade-related measures aimed at protecting the environment (CBAM, Deforestation Regulation etc.) become increasingly common in ROW, but not adopted by Africa; and African economies negotiate a long transition period of 10-15 years for complying with the requirements of the trade-related measures. This scenario is likely to result in a gradual, and not sudden, decline in foreign exchange. This will soften the adverse impact, as the African economies can utilise the transition period to put in place a cost-effective mechanism for meeting the requirements mandated by the trade-related measure, and seek to diversify their export basket away from deforestation products.

4.3 Policy recommendations

Two main policy recommendations are relevant. First, African economies need to institute suitable mechanisms for complying with the conditions mandated by trade actions, such as the EU's Deforestation Regulation. Second, as part of international collaboration, African economies should negotiate with other countries to secure a long transition period of 10-15 years for complying with the requirements of measures such as the EU's Deforestation Regulation.

5. Origin Of Green Technologies: Implications For Africa

It is a reality that new environmental products are more likely to emerge and get commercialised by business entities in countries with a strong ecosystem for innovation – mostly the developed countries. There is considerable data to back this assertion. To illustrate, in the period 2012-2017, based on the OECD Statistical Database (www.stats.oecd.org search for "patents in environment-related technologies"), 90,762 patents were filed by applicants from OECD countries out of 105,110 patent applications worldwide (86.35%). The implication for Africa is clear – it will have to pay high royalties for importing environment-related technologies required for the transition to a low carbon emission economy. This will require Africa to have adequate foreign exchange to purchase these technologies – as discussed earlier, an extremely difficult proposition.

How can this situation be remedied? One option could be to leverage access to critical minerals for entering into licensing agreements to transfer technology on terms favourable to the African economies. Another option could be to explore additional sources of financing for generating the foreign exchange that might be required for importing technology related to renewable energy. Existing trade agreements are not envisaged to pose a constraint in leveraging access to critical minerals for entering into licensing agreements to transfer technology on terms favourable to the African economies.

5.1 Scenarios of Ambition and Implications for African Economies

From the perspective of trade, two scenarios are considered regarding different level of ambition in respect of origin of green technologies and payments for them.

Scenario 1: A high ambition scenario for Rest of the World and low ambition for Africa

This scenario would have the following elements: first, on account of various trade actions discussed above, African economies do not have adequate foreign exchange to import green technologies; second, African economies are unable to negotiate technology transfer on more favourable terms; and third, no substantial source of additional finance are found for importing green technologies. This scenario would result in a sharp decline in foreign exchange of African countries, which would pose a severe hindrance in their trajectory to a low carbon economy.

Scenario 2: A high ambition scenario for Rest of the World and high ambition for Africa

This scenario would have the following elements: first, African economies succeed in negotiating technology transfer on more favourable terms; and additional sources of finance found for importing green technologies. This scenario would result in partially mitigating the barriers arising on account of precarious foreign exchange reserves. This would, to some extent, allow African economies to import green technologies.

5.2 Policy Recommendations

Two key policy recommendations from the perspective of international collaboration are proposed for consideration of the African economies. First, African economies could consider negotiating with the developed countries for the latter to provide incentives to IPR holders in their territories to transfer green technology to the African economies. Second, with respect to patents required for energy transition the following options should be considered for enhancing the access of green technologies for the African economies: access to green technologies without patents; term of patent protection for green technologies to be limited to 5 years; cap on royalty payment for imported green technologies; and less complex mechanism for compulsory licensing of green technologies by developing countries.

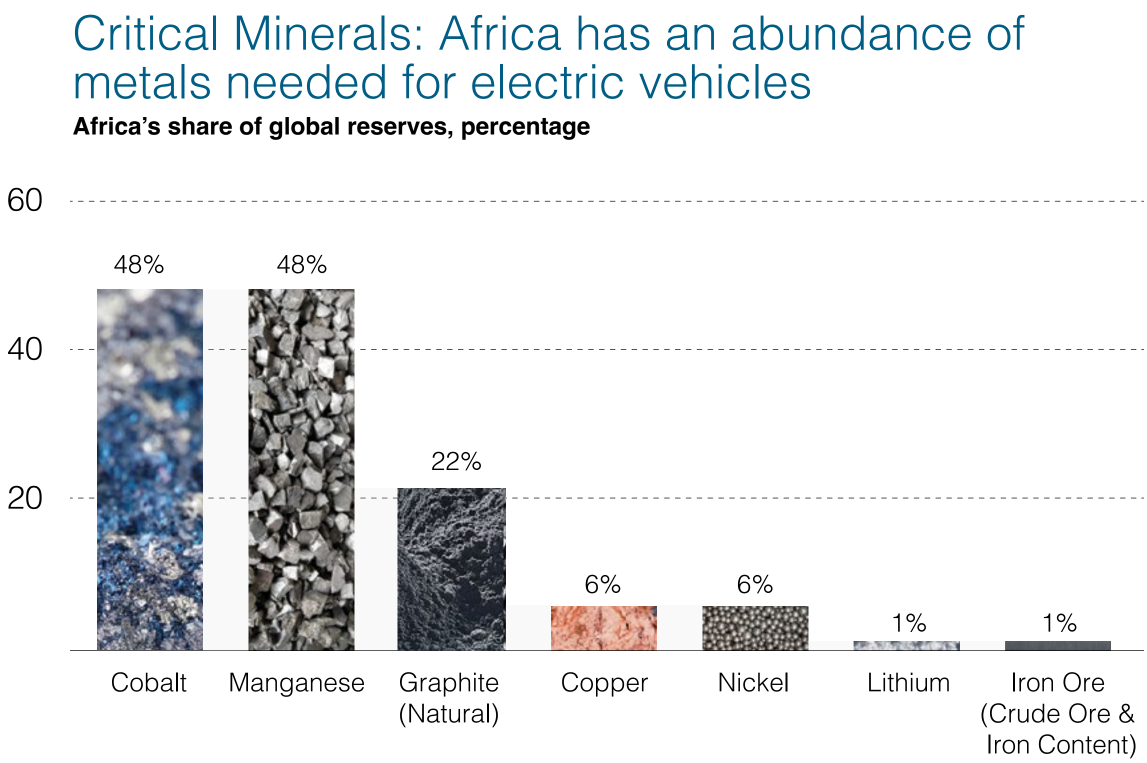
6. Opportunities for Africa in energy transition and the role of critical minerals

In the transition from fossil fuels to renewable sources of energy, the metals and minerals used in electrification, renewable energy generation, electric mobility and new forms of energy storage are required in far larger quantities than has hitherto been the case (African Green Minerals Development Strategy Approach Paper. 2022). Based on existing technology, lithium-ion batteries are poised to become a key driver in this transition. The surge in demand for it will substantially increase the demand for metals used for energy storage - copper, aluminium, phosphorus, iron, manganese, graphite, nickel, cobalt, and lithium. It has been forecasted that by 2030, batteries would require an average of 5.5 times more of these metals than their consumption in 2021 (Bloomberg NEF. (2021). The Cost of Producing Battery Precursors in the DRC. London: BloombergNEF. Cited in African Green Minerals Development Strategy Approach Paper. 2022).

6.1 Africa has the critical minerals required for decarbonisation

The African continent has substantial shares in the world production of some critical minerals. To illustrate, in 2021, the global reserves of cobalt was estimated at 7.1 Mt, with more than 50% (3.6 Mt) concentrated in the Democratic Republic of Congo (Source: USGS. 2021. “Mineral Commodity Summaries 2021”, https://pubs.usgs.gov/periodicals/mcs2021/mcs2021.pdf). Some of the other critical minerals, in which Africa has substantial shares include the following: manganese (South Africa and Gabon), copper (the Democratic Republic of Congo and Zambia), chromium (South Africa and Zambia), zirconium (South Africa, Mozambique, and Senegal), tantalum (the Democratic Republic of Congo, Nigeria, and Rwanda), phosphates (Morocco), PGM platinum (South Africa), and bauxite (Guinea) (Source: https://tradebriefs.intracen.org/2023/9/spotlight , OECD’s database for production and reserves of critical minerals (2022)). According an estimate Africa hosts 6% of copper, 53% of cobalt, 25% of bauxite, 21% of graphite, 46% of manganese, 35% of chromite, 79% of phosphate rock, and 91% of platinum group metals (USGS, 2022). These estimates are broadly in line with the figures contained in a recent report of UNCTAD, as shown in figure 2.2.

Figure 2.2: Africa’s share of global reserves of some critical minerals



Source: UNCTAD April 2024. Critical minerals boom: Global energy shift brings opportunities and risks for developing countries. Available on the following link https://unctad.org/news/critical-minerals-boom-global-energy-shift-brings-opportunities-and-risks-developing-countries.

Despite its vast resources, Africa's share in the global exports of critical minerals remains low with 8.3% for raw, and 3.8% for processed critical minerals, respectively (https://tradebriefs.intracen.org/2023/9/spotlight). This is manifested in Africa being part of the global value chains for green and transition minerals, but its role being largely confined to their start through exploration, extraction, and some processing. The relatively low degree of processing relegates the African countries to being price takers in global trade. The economic implications of African economies progressing from mining to refining and local processing can be comprehended from the experience of the Democratic Republic of the Congo. According to UNCTAD by refining and processing cobalt locally, the country boosted "the mineral's unit price from $5.8 per kilogram at extraction to $16.2 per kilogram after processing. With this initial move up the value chain, the African nation's exports of processed cobalt reached $6 billion in 2022, compared to just $167 million in exports of unprocessed cobalt" (UNCTAD April 2024. Critical minerals boom: Global energy shift brings opportunities and risks for developing countries. Available on the following link https://unctad.org/news/critical-minerals-boom-global-energy-shift-brings-opportunities-and-risks-developing-countries).

6.2 Addressing problems related to critical minerals

No doubt policymakers and other stakeholders are cognizant of the need to create conditions to use Africa's green minerals to industrialise and achieve economic diversification. It is also relevant to note that the African Union Commodity Strategy (AUCS) adopted by the Ministers of Industry and Trade in September 2021 envisages harnessing Africa's natural resource endowment for resource-based industrialisation and comprehensive development. It is built on the following four pillars: linkages and diversification; skills development and research, development and innovation (RDI); commodity markets and pricing; and governance and enabling environment. Another important document titled African Green Minerals Development Strategy Approach Paper, has been prepared by the African Development Bank in 2022, as the precursor study for a fully-fledged African Green Mineral Strategy. The vision for the strategy is to "guide Africa to strategically exploit the continent's green mineral resources for industrialisation and to assert control over its destiny to create an African presence in emerging green technologies" (African Green Minerals Development Strategy Approach Paper. 2022). It explicitly recognises that the Green Minerals Strategy should make "value addition, through building forward and backward linkages into manufacturing, a central objective" (African Green Minerals Development Strategy Approach Paper. 2022).

In the context of driving the industrialisation of renewable energy equipment value chains, the approach paper envisages that this can be achieved by "developing explicit policies to acquire technology and successively increase local content requirements for large projects to build the capacity and demand for equipment manufacturing industries". Further, it is pragmatic in its acknowledgement of the weakness that there are few African-based exploration and mining companies, which creates the linked issue of a dependence on imported technology. It recommends overcoming these weaknesses through "upgrading science, technology, engineering and innovation systems among member states". Finally, given the dynamic nature of technologies that are commercially successful, it recognises the threat of substitution of cobalt by other minerals would weaken producer-power of African economies.

It is relevant to note that while the approach paper recognises the need for value addition, creating forward and backward linkages and increasing local content requirement, the constraints posed by the trade rules of the WTO in securing these objectives through policy interventions by governments appear to have gone almost unnoticed. Further, the possibility that high prices for the critical minerals in the global market may result in substantial exports of unprocessed minerals, thereby creating domestic shortages for downstream processing, has not been addressed in the approach paper. It is important to address this problem as attempts are being made by advanced economies to enhance their access to critical minerals through trade agreements.

6.3 Constraints imposed by existing and emerging trade agreements

Given the imperative of enhancing domestic availability of critical minerals, creating upstream linkages relevant for mineral exploration, mining and processing (inputs required, such as capital equipment, services, utilities, and consumables) and stimulating downstream value-added processing, what role can trade policy play in facilitating the triple objectives? We address this question and examine how some of the existing rules at the WTO impose constraints on countries that seek to enhance downstream processing and domestic sourcing. We also briefly discuss how some of the advanced economies are seeking to negotiate new rules in trade agreements, which could impose additional restrictions on government initiatives aimed at enhancing upstream and downstream linkages.

As mentioned earlier, clean energy transition is driving up the demand for critical minerals. However, in respect of many of these minerals the reserves are localised in a handful of countries, which are hard put to meet the surging demand from the advanced economies. Left to market forces, much of the critical minerals mined in the African economies are likely to get exported, creating a huge shortage for downstream value-added processing. Suitable policy interventions can play an important role in addressing this situation.

Article XI of GATT 1994 allows countries to impose temporary restrictions on exports of products essential to the exporting country, provided the restriction is applied to prevent or relieve critical shortages of these products. Further, most developing countries, including the African economies have retained the right to impose export taxes on raw materials. Temporary export restrictions and export taxes enable developing countries to enhance domestic availability of natural resources for downstream processing and value addition, instead of it getting exported to rich countries and advanced processing facilities. To illustrate, Namibia has banned the export of unprocessed lithium and other critical minerals. Furthermore, in 2014, Indonesia successfully employed an export ban to develop downstream value-added nickel products for the stainless-steel supply chain. In 2020 Indonesia again prohibited the export of nickel ore. This appears to be a "continuation of its industrial policy to produce downstream materials and products in the nickel and EV battery supply chain" (https://www.nbr.org/publication/indonesias-nickel-export-ban-impacts-on-supply-chains-and-the-energy-transition/).

The African economies rich in critical minerals could consider using temporary export restrictions and export taxes for tapping into opportunities that have opened for processed critical minerals in clean energy transition. As discussed above, temporary export restrictions and export taxes are not prohibited by WTO rules. However, as temporary export restrictions can be imposed only in respect of products essential to the exporting country, African economies may struggle to meet this requirement, if their temporary export restrictions were to be challenged under the Dispute Settlement Mechanism of the WTO. What can constitute an essential product for an exporting country? Two important disputes at the WTO have provided some guidance on this question. In the dispute China – Raw Materials the definition of essential product in the context of temporary export restriction "may include a product that is an 'input' to an important product or industry" (Panel Reports, China – Raw Materials, para. 7.282). In another dispute Indonesia – Raw Materials, the panel understands that the flexibility to impose temporary export restrictions "is not meant to enable Members to impose restrictions upon the export of a raw material in order to protect or promote a domestic industry" (Panel Report, Indonesia Nickel, para. 7.100, WT/DS592/R).

It is relevant to note that in the latter dispute, which was raised by the European Union, Indonesia was unable to demonstrate that nickel was an essential product for it. Overall, there is considerable uncertainty whether African economies would be able to legally justify temporary export restrictions on critical minerals. However, they have a legitimate right to impose export taxes on critical minerals, provided they have not given any commitment at the WTO not to do so. While considerable apprehensions have been expressed by many economists regarding market distortions created by export taxes, at this juncture there does not appear to be any other effective policy instrument to prevent exports of unprocessed critical minerals on account of high prices prevailing in the global market.

It is also relevant to mention that in their endeavour to restrict exports of critical minerals, African economies might consider imposing a minimum export price. However, in a WTO dispute a minimum export price was found to “inherently” constitute a restrictive measure (Panel report, China –Raw Materials , para 7.1081, WT/DS394/R). In addition, licensing requirements, which are discretionary and not for gathering information for statistical purposes or monitoring are prohibited (Panel report, China –Raw Materials , paras 7.916 and 7.921 , WT/DS394/R).

While WTO commitments do not prohibit African economies from imposing export taxes on critical minerals, many of these economies would find it more difficult to impose such taxes on account of their commitments under the Economic Partnership Agreements with the European Union. While export taxes may not be required to be eliminated by some of the EPAs, but the introduction of new ones will be subject to certain limitations. To illustrate, Article 15.1 of the Economic Partnership Agreement between the European Community and its Member States, of the one part, and the Central Africa Party, of the other part provides the following: “No new customs duties on exports shall be introduced in trade between the Parties, nor shall those already applied be increased, as of the date of this Agreement’s entry into force”.

Turning to downstream processing, WTO rules impose considerable restrictions on policy interventions aimed at mandating a minimum level of domestic processing of raw materials as a condition for allowing its exports. This has been clarified in the WTO dispute Indonesia- Raw Materials. In this dispute one of the questions before the panel was whether Indonesia domestic processing requirements with regard to certain raw materials, notably nickel ore and iron ore, prior to them being exported, was in accordance with WTO rules. It may be noted that domestic processing requirements imposed by Indonesia obliged mining companies to enhance the value of the relevant raw materials through the conduct of certain processing and/or purification operations in Indonesia before exporting them. The panel concluded that Indonesia’s domestic processing requirement was inconsistent with Article XI:1 of the GATT 1994 (Panel Report, Indonesia Nickel, para. 8.3, WT/DS592/R).

An important objective of many developing countries in attracting investment in a sector is to enhance positive spillovers in other domestic sectors by creating jobs upstream through mandating that the investor source its inputs and raw materials domestically. However, GATT/WTO provisions prohibit countries from mandating local sourcing of inputs that are goods (See, for example, Article III:4 of GATT 1994 and paragraph 1 (a) of Annex to the Trade-related Investment Measures agreement). The implications of this prohibition for African economies is that in mining contacts, governments cannot mandate local sourcing of capital equipment and consumables. However, depending on its commitments in respect of various services, a country has some flexibility to mandate local sourcing of specific services, provided it has not taken a commitment to provide national treatment in respect of that service.

In the context of attracting investment, another important objective of developing countries is to impose requirements related to transfer of technology. The rules at the WTO do not prohibit countries from mandating transfer of technology as a condition for allowing investment. Further, African economies may wish to provide preferential treatment to their domestic mining entities as compared to foreign mining companies. Unless a country has explicitly taken a commitment to provide national treatment, it can discriminate in favour of its domestic mining companies. In addition, in respect of government procurement of mining services, a country can give preferential treatment to its domestic entities. However, this flexibility is circumscribed by the requirement that the services purchased should be for governmental purposes and not with a view to commercial resale or with a view to use in the supply of services for commercial sale (Article XIII.1 of GATS).

Overall, the rules at the WTO would allow African economies to impose export taxes for ensuring domestic availability of critical minerals for downstream value addition and processing. But these would be constrained by the commitments of African economies in their EPAs with the European Union. They can also impose technology transfer requirements as a condition for investment. Further, subject to their sector-specific commitments, most African economies can discriminate in favour of domestic service suppliers for mining and other services related to mining. Finally, in respect of procurement by governments of goods and services of its own use and not for commercial purposes, African economies can accord favourable treatment to their domestic producers and service suppliers. However, each of these flexibilities are sought to be curtailed in new generation trade agreements – the subject of the subsequent examination in this section.

In some of the recent free trade agreements and similar other trade agreements, attempts are being made to negotiate new commitments ostensibly to supporting decarbonisation. At this juncture most of the African

economies are not parties to these new generation trade agreements. However, if some of the emerging rules on international trade are made applicable to the African countries in future through their inclusion in the WTO rulebook or through FTAs, it could hamper these countries from climbing the value chain of processed products. In this sub-section we discuss some of these new rules as they are emerging in trade agreements.
First, some of the recent FTAs prohibit export taxes (See, for example Article 2.16 of the Trans-Pacific Partnership Agreement; Article 2.7 of the Interim Agreement on Trade between the European Union and the Republic of Chile; Article 17 of EU Algeria Association Agreement). Second, the flexibility to impose technology transfer requirements on foreign investors has been curtailed in some FTAs (See, for example Article 9.9 of the Trans-Pacific Partnership Agreement). Third, in some FTAs the parties have agreed to accord non-discriminatory treatment in government procurement of products and equipment relevant for renewable energy. Fourth, in respect of an authorisation to explore for or produce energy goods - hydrocarbons and electricity- and raw materials, in its ongoing FTA negotiations, the EU has sought that Party shall ensure that such authorisation is granted based on objective criteria following a public procedure that is non-discriminatory between entities of each Party (See, for example Article X.7.1 of European Union's (EU) proposal for a legal text on Energy and Raw Materials in the EU-India trade agreement). This would curtail the flexibility available to African economies to give preference to their domestic mining firms.

Fifth, mandating that countries adopt high standards of environmental protection and mining (in contrast to adequate standards), and in some instances harmonisation of standards with those being implemented by some advanced economies. It would be extremely difficult for domestic enterprises in African economies to comply with high product standards. This would not only prevent them from exporting to advanced economies, but also prevent them from even selling their products in their domestic markets. Further, less productive firms in African economies that produce mainly for home market may not be able to comply with the more demanding standards and will no longer be able to provide inputs to exporting firms. This will have an adverse effect on domestic production linkages and reduce the domestic value-added content of exports. High environmental standards in mining is likely to result in domestic mining firms being gradually replaced by foreign firms as the former are unlikely to be in a position to comply with the onerous standards prevailing in advanced economies.

A special mention needs to be made of the agreement on Supply Chain Resilience under the overall Indo Pacific Economic Framework for Prosperity (IPEF), has been signed by fourteen countries on 14 November 2023. Two provisions of this agreement are relevant for the discussion on export restrictions and export taxes. First, under provisions of Article 3.1 of the agreement each Party has committed to "minimizing unnecessary restrictions or impediments creating barriers to trade" affecting IPEF supply chains. Second, under provisions of Article 12.3 each IPEF country has committed to "supporting another Party's response to a supply chain disruption or an imminent supply chain disruption to the extent possible, in accordance with its domestic law, respect for market principles, and the goal of minimizing market distortions". These provisions would curtail the flexibility available to developing countries to impose temporary export restrictions and export taxes. It could be argued that since export taxes are impediments creating barriers to trade, these are covered in the scope of Article 3.1. Thus, the use of export taxes on raw materials will be subject to the necessity test, which will be almost impossible for developing countries to comply with. Similarly, resource-rich countries will find it very difficult to impose temporary export restrictions on raw materials, which is permitted under Art XI of GATT 1994.

Further, Article 12.3 of the IPEF creates a pressure point on resource rich countries to continue to export their raw materials and not get into downstream value-added processing. No doubt, African economies are not parties to the agreement on Supply Chain Resilience. However, as the IPEF is led by the US, there is a high possibility that it could become a template for WTO members to agree to similar provisions. If this were to happen, then the African countries would not be able to use export taxes and temporary export restrictions as policy instruments for enhancing domestic availability of raw materials for nurturing a vibrant downstream processing industry of critical minerals.

Overall, existing trade and investment rules have created structural deficiencies for African economies, which denies them equity in opportunity and prevents them from enjoying shared prosperity that would arise from the energy transition. Further, it is apprehended that adoption and implementation of some of the new rules by African economies discussed above will erode their policy space for creating productive capacities for domestic manufacture of green products. To illustrate, some of the new rules could compel countries in Africa, which are rich in critical minerals, to remain exporters of the primary products and not enter into the value-added downstream segment of production. This would limit the ability of resource-rich countries from exporting value-added products and earning the much- needed foreign exchange for importing green technologies and products relevant for low carbon emission transition.

6.4 Scenarios of Ambition and Implications for African Economies

From the perspective of trade, two scenarios are considered based on the ambition level of African economies and the Rest of the World.

Scenario 1: A high ambition scenario for Rest of the World and low ambition for Africa

This scenario would have the following elements: first, high standards of environmental protection (in contrast to adequate standards of environmental protection) are adopted by ROW and African economies; second, ROW and African economies agree to eliminate customs duties on green products; third, ROW and African economies agree to provide non-discriminatory treatment in government procurement of green products and equipment relevant for renewable energy; and fourth, ROW and African economies sign on to new rules in international trade agreements, which accord primacy to access to critical minerals and prevent African economies from embarking on a path of industrialisation based on value-added downstream processing of critical minerals.

This scenario would have the following implications: first, high standards of environmental protection adversely impacts exports and domestic sales of African countries; second, increased import dependence of 'green products'; third, new trade rules weaken the leverage of African countries for attracting investments in downstream processing of critical minerals; and fourth, African economies are likely to remain exporters of unprocessed critical minerals, without progressing to the value-added segment.

Scenario 2: A high ambition scenario for Rest of the World and high ambition for Africa

This scenario would have the following elements: first, high standards of environmental protection (in contrast to adequate standards of environmental protection) in ROW, but adequate standards of environmental protection prevail in African economies; second, ROW agrees to eliminate customs duties on green products, but not the African economies; third, ROW agrees to provide non-discriminatory treatment in government procurement of green products and equipment relevant for renewable energy, but not African economies; and fourth, ROW signs on to new rules in international trade agreements, which accord primacy to access to critical minerals, but African economies refrain from it.

This scenario would have the following implications: first, high standards of environmental protection would adversely impacts exports of African countries, but not their domestic sales; second, increased import dependence of 'green products' in African economies; third, African economies retain the leverage for attracting investments in downstream processing of critical minerals; forth, African economies create vibrant value-added downstream industry based on critical minerals, and also become prominent exporters of the processed products; and fifth, African countries are likely to face foreign exchange crunch for paying for imported technologies for green transition, but this is likely to be mitigated by export earnings from processed critical minerals and value-added products based on critical minerals.

6.5 Policy recommendations

Gains from energy transition based on critical minerals must not be skewed against the African economies, who may be compelled to remain exporters of the primary commodities and without progressing into value-added and processed products. Further, Just Transition must include the following two fundamental tenets: gains from trade-related mitigation measures should be distributed more evenly among countries, and not remain concentrated in a handful of countries; and developing countries must be allowed to preserve policy space so that the transition to renewable energy does not make Africa overwhelmingly dependent on imports.

From the perspective of domestic and intra-Africa action, African economies could consider the following recommendations: first, leverage foreign investment policies to facilitate the importation of advanced technology and machinery, managerial skills and expertise needed for domestic manufacturing of value-added products based on critical minerals; second, create robust financial support for critical minerals industry by focusing on research and development to enhance technological capabilities in the processing and commercial application of critical minerals; third, develop new critical minerals based supply chains in domestic, regional and global markets; and fourth, leverage African Continental Free Trade Agreement to overcome the limitations of small domestic markets for exports of products and equipment relevant for renewable energy.

From the perspective of international collaboration many recommendations are key to the African economies being able to benefit from their reserves of critical minerals. First, in trade negotiations, these countries should seek to retain the right to take WTO-consistent policy measures for enhancing downstream processing of critical minerals – export taxes. Second, they should endeavour to ensure that the Panel on Critical Energy Transition Minerals, established at the COP28 climate summit by UN Secretary-General António Guterres and launched on 26 April 2024 promotes African interests in critical minerals by highlighting the problems in the existing and emerging trade agreements and the need to make changes to the rules of the international trading system.
Third, they should seek changes in trade and investment rules for promoting downstream value-addition based on critical minerals and permit countries to mandate the following: (i) local sourcing of inputs, parts and components; (ii) enterprise's purchases or use of imported products be limited to an amount related to the volume or value of local products that it exports; (iii) the importation by an enterprise of products used in or related to its local production, generally or to an amount related to the volume or value of local production that it exports; (iv) foreign exchange balancing between outflows for imports and inflows attributable to exports of the enterprise; and (v) subsidies contingent on use of domestic inputs over imported inputs.

Fourth, at the WTO and in their bilateral trade engagements, African economies should seek a recognition of the following policy instruments: first, economies are not prevented from mandating the availability of critical minerals for downstream processing at prices that are lower than the export price of the same product; second, economies should have the flexibility to mandate a minimum level of domestic processing of raw materials as a condition for allowing its exports; third, economies should have the flexibility to mandate domestic sourcing of inputs, both goods and services, required for mining and domestic processing of raw materials relevant for energy transition; fourth, economies should have the flexibility to discriminate in favour of its domestic mining companies and provide them preferential treatment; fifth, in procurement by government, economies should have the flexibility to provide preferential treatment to their domestic goods and services, irrespective of whether or not and the procurement is with a view to use in the supply of other goods and services for commercial sale; sixth, government must be allowed to provide preferential treatment to domestic producers and suppliers of all goods and services that are used for the ultimate good/service procured by the government; and seventh, economies should not be prohibited from mandating transfer of technology as a condition for allowing investment.

As the adverse impacts of existing international agreements on trade and investment arise from a network of agreements at the WTO, FTAs, EPAs etc., a comprehensive solution to the problem is required that would override the specific rules in different platforms. Thus, a global compact is required to address this problem. The scope of the compact should be confined to commitments that are relevant for the transition to renewable energy and the flexibilities should be available for a limited duration. Measures taken under the compact should be exempt from action under the dispute settlement mechanism of the WTO, FTA, Investment Agreement, EPA etc.

The need for a new global compact on trade and investment rules, addressing these recommendations, is a pressing imperative for African economies. As most of the African economies were not signatory to the original GATT legal text of 1947 which forms the basis of much of WTO and FTA rules, as such neither participated or played any role in the formulation of these rules. Procedural justice demands that these iniquitous, asymmetric, imbalanced and unfair rules be amended to address the concerns of the African economies. The new paradigm of trade rules proposed in this chapter seeks to ensure that African economies are not denied the opportunity of progressing into value-added and processed products on account of trade rules. This would not only create the opportunity for critical mineral-based industrialisation in Africa, but also reflect in concrete terms the concept of distributive justice. It is in the hands of African economies to strive for the new trade paradigm.

ANNEX 2.1: LIST OF FOSSIL FUEL PRODUCTS

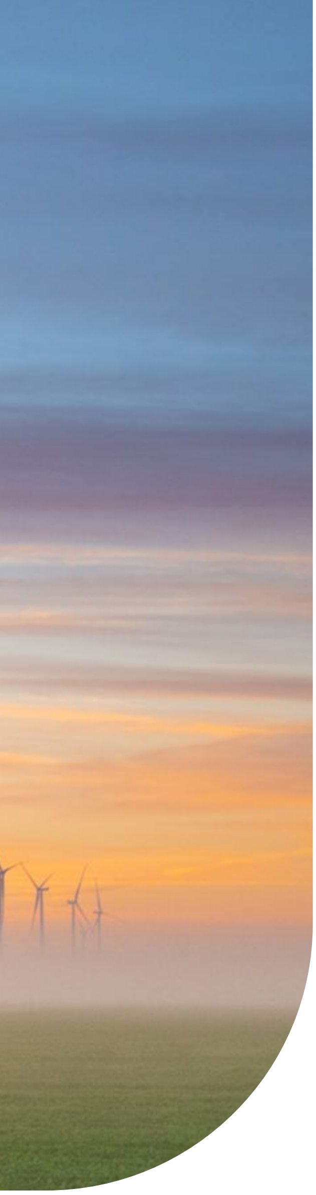
HS Product code	Product Description
2701	Coal; briquettes, ovoids and similar solid fuels manufactured from coal.
2702	Lignite, whether or not agglomerated, excluding jet.
2703	Peat (including peat litter), whether or not agglomerated.
2704	Coke and semi-coke of coal, of lignite or of peat, whether or not agglomerated; retort carbon.
2705	Coal gas, water gas, producer gas and similar gases, other than petroleum gases and other gaseous hydrocarbons.
2706	Tar distilled from coal, from lignite or from peat, and other mineral tars, whether or not dehydrated or partially distilled, including reconstituted tars.
2707	Oils and other products of the distillation of high temperature coal tar; similar products in which the weight of the aromatic constituents exceeds that of the non-aromatic constituents.
2708	Pitch and pitch coke, obtained from coal tar or from other mineral tars.
2709	Petroleum oils and oils obtained from bituminous minerals, crude.
2710	Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70 % or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations; waste oils.
2711	Petroleum gases and other gaseous hydrocarbons.
2712	Petroleum jelly; paraffin wax, micro-crystalline petroleum wax, slack wax, ozokerite, lignite wax, peat wax, other mineral waxes, and similar products obtained by synthesis or by other processes, whether or not coloured.
2713	Petroleum coke, petroleum bitumen and other residues of petroleum oils or of oils obtained from bituminous minerals.
2714	Bitumen and asphalt, natural; bituminous or oil shale and tar sands; asphaltites and asphaltic rocks.
2715	Bituminous mixtures based on natural asphalt, on natural bitumen, on petroleum bitumen, on mineral tar or on mineral tar pitch (for example, bituminous mastics, cut-backs).
2716	Electrical energy.

CHAPTER 3 :
ECONOMIC IMPLICATIONS OF THE ENERGY TRANSITION

By Anton Cartwright

1. Introduction

Energy is critical for all human development and the quest of African countries to advance their economies is contingent upon their ability to secure more energy. African countries are undertaking this quest at a time of growing climate change impacts and an associated energy revolution. More than 70% of global greenhouse gas emissions come from the energy sector and limiting warming to 2°C above the 1850-1900 baseline requires "rapid and far-reaching change" in the world's energy systems (IPCC, 2023). The 2°C threshold, requires one-third of the existing oil reserves, half the gas reserves and over 80% of known global coal reserves to remain in the ground. It also requires emissions from existing fossil fuel activities to be captured and stored using as-yet-unproven and expensive technologies. Under the less-damaging 1.5°C threshold there is a greater urgency, more dependence on carbon capture and storage and no accommodation of coal-fired power in the global energy mix beyond 2050 (IPCC, 2018). The same temperature targets require a ramping-up of investment in clean energy, new construction materials, circular material flows and climate resilient agriculture, not to mention heightened need for disaster risk management.



Current energy sector trends are not aligned with the temperature targets. In 2023, global demand for coal increased by 1.4%, and India, Indonesia, Russia, Colombia, Australia and South Africa have plans to increase coal production between 2021 and 2030 (IEA, 2023), while the Russia-Ukraine war has seen European countries explore for novel gas resources. The misalignment between sector trends and the measures required to avoid significant climate change damage, makes a disruption of economic and development progress inevitable: either unabated emissions will demand the ability to cope with temperatures that are unprecedented in the past 100,000 years, or a massive, rapid, reallocation of global capital will have to be affected in the next two decades (McKinsey, 2023).

Energy landscapes have always influenced economic and development landscapes and it will be no different during the global energy transition (Castan Broto, 2017). This chapter maps the economic implications of the energy transition for African countries. It draws on the trade, labour, mitigation and finance chapters, to explore answers to the following questions (from the terms of reference):

- What are the implications of the global transition on energy and commodity markets and the development prospects of African countries?
- What economic development options do African countries have in the global transition towards climate change resilience, and which of these options offer the best economic prospects?
- What are the implications and options resulting from the global energy transition and effort to curb emissions for specific 'sectors' on the African continent: rare earth minerals, oil and gas, and forest and agricultural sectors and cities?

The chapter evaluates different economic narratives around Africa's climate transition with reference to the available data. The focus is two-fold: (i) understanding the default implications of the transition – how risks and opportunities are likely to be apportioned under existing strategies; (ii) exploring how African countries might avoid climate transition risks and seize opportunities.

Section 2 of the chapter outlines the risks associated with the global energy transition. It contains a normative description of the disparate global socio-economic context, including Africa's energy poverty and relative contribution to greenhouse gas emissions. In the language of a just energy transition this section outlines the "distributive" injustice of the status quo as a means of foregrounding the scale of the economic challenge for African countries seeking to draw benefit from the global transition (Patel, 2022).

Section 3 provides the global economic context before describing two common African narratives, 'development before climate responsibility' and 'leapfrog to low-carbon competitiveness', neither of which is likely to offer African economies what they need.

Section 4 focuses on opportunities, outlining a 'playing smart' strategy that combines economic pragmatism with the principles of "restorative", "redistributive" and "procedural" justice (Patel, 2022). 'Playing smart' transcends the idea of African countries as the victims of the global energy transition and instead outlines what African countries can offer the global economy as they navigate this transition, enhancing their economic bargaining power in the process.

Section 5 of the chapter outlines policy recommendations. It describes the preconditions that African leaders can put in place to enable the 'playing smart' strategy, as well as the sector-specific opportunities (oil and natural gas, forestry and agriculture, strategic minerals and cities and infrastructure) associated with this strategy.
The analysis has a continental focus but is mindful of the differences across and within African countries. Section 6 draws distinctions between 7 different types of country economies that are identified in Section 2, as well as factoring the dynamic implications of different global responses to the energy transition and climate change.

2. The African Challenge in the Global Energy Transition

African countries were quick to sign the Paris Agreement in the hope of attracting finance and funding. Within United Nations Framework Convention on Climate Change (UNFCCC) negotiations, the same African countries have supported the idea of a 'just climate transition' emphasising that the three pillars of Article 2 of the Paris Agreement ('mitigation', 'adaptation' and 'means of implementation') only cohere under a transition that is underpinned by social justice and financial transfers to low and middle-income countries (UNFCCC, 2023). The importance of a just transition and financial transfers for avoiding catastrophic climate change is reiterated by the Intergovernmental Panel on Climate Change (IPCC's) (Text Box 3.1).

Originating in labour movements in the 1980s and reinvigorated by South Africa's President at COP26 (Glasgow 2021), the idea of a 'just climate transition' continues to evolve (Evans and Phelan, 2016; Patel, 2021). Definitions range from (i) minimal decarbonisation with social protection for employees in "stranded assets" – assets that devalue prior to the end of their economic lifetime (UNU-IRA, 2019), to (ii) decarbonisation with the social protection and upstream manufacturing of green technologies, and (iii) climate resilience in a post-capitalist economy that is low carbon, resource efficient and socially inclusive. Common to all interpretations of a just transition is the idea that unless global efforts to cut greenhouse gas (GHG) emissions and adapt to a perturbed climate are linked to the pursuit of the Sustainable Development Goals, they will not achieve the rate and scale of decarbonisation required to avoid catastrophic climate change (Roy et al., 2018). This thinking is captured by the "leave no one behind" slogan of the SDGs and Agenda 2030. It requires the foregrounding of people and a redressing of the structural "unfreedoms" that reproduce inequality and poverty if the climate transition is to succeed (Sen, 2009). The principle of "leav(ing) no one behind" is particularly applicable to the energy sector. The viability of the SDGs and the global climate response depends on these efforts extending access to clean, affordable energy to the 600 million Africans that currently rely on biomass, candles and coal.

Box 3.1 | IPCC text on a just transition and financial transfers

Scaled-up public grants for mitigation and adaptation funding for vulnerable regions, especially in Sub-Saharan Africa, would be cost-effective and have high social returns in terms of access to basic energy. Options for scaling up mitigation in developing countries include: increased levels of public finance and publicly mobilised private finance flows from developed to developing countries in the context of the USD 100 billion-a-year goal; increased use of public guarantees to reduce risks and leverage private flows at lower cost; local capital markets development; and building greater trust in international cooperation processes. A coordinated effort to make the post-pandemic recovery sustainable over the longer-term can accelerate climate action, including in developing regions and countries facing high debt costs, debt distress and macroeconomic uncertainty. (high confidence).

Source: IPCC's 6th Assessment Report (SPM) text on financial support for African countries

The contingency of the United Nations' climate goals on poverty alleviation and socio-economic progress is intuitive to most Africans. If a family does not know how to feed their children tonight, they will not (and should not) refrain from chopping down forests, making charcoal or burning paraffin. The farmer protests to proposed cuts in fuel subsidies in Germany, early 2024, and the mouvement des gilets jaunes in France 2018 suggest that the centrality of livelihoods and people applies equally, albeit in different ways, in high income countries. In South Africa, the shift away from coal towards independent power producers and renewable energy was protested by the 'Coal Transport Forum' in 2017. The implications of a just transition for the global energy sector are particularly acute. The sector has to transition to low-carbon technologies under all viable climate scenarios, but the transition cannot afford to limit energy supply, create widespread unemployment or escalate prices if it is to retain political support. Vested interest groups and populists are quick to portray the winding up of hydrocarbon projects and "anti-development" and the benefits of a low carbon climate resilient economy as "out-of-touch liberal-elite fantasies" (Kyte, 2023).

In 2023, wind and solar energy contributed more new energy to the global energy mix than any other source (Energy Institute, 2024). The need to ensure that the global energy transition translates into more and better energy services, is critical in African countries. Global energy consumption continues to increase, and reached 29.925 TWh in 2023 (Energy Institute, 2023). Despite this, most African countries engage in the energy transition from a position of acute energy poverty, and demand from African countries dropped by 0.4% in 2023, relative to 2022 (Energy Institute, 2023). Mean per capita energy consumption in Africa is 14-15 gigajoules per person, in contrast to the global mean of 75 gigajoules and the mean in the United States of America (USA) of 300 gigajoules (Jackson et al., 2022); the average USA citizen consumed 120 times more electricity in 2021 than the average Tanzanian; in oil producing Nigeria the average energy consumption (in barrels of oil equivalent) was just 0.72 per capita in 2021 compared with 7.02 barrels of oil equivalent in the United States (and Nigeria imports all its petrol). Globally, 775 million people lack access to reliable electricity and 600 million of these people live in Africa. Largely as a result of the continent's energy poverty, Africa was responsible for just 8.8% of global greenhouse gas emissions in 2022 (CAIT, 2023) and just 3.9% of the CO_2 emissions from fossil fuels (up from 3.5% in 2000), despite being home to 19% of the global population (World Bank Data, 2023).

Meeting the 'net zero by 2050' target requires per capita emissions to be 1.4 tCO_2e - 2.0 tCO_2e per annum in 2050, assuming a population of 10.5 billion and retention of major global carbon sinks in the ocean and forests. Sub-Saharan African emissions were reported at 1.88 tCO_2e per capita per annum in 2022 if AFOLU emissions are included, but only half of these were from fossil fuels. The global average per capita is 6.95 tCO_2e, while for EU-27 countries it is 6.62 tCO_2e per capita. It is the continent's energy poverty and lack of industry that account for African country's low emissions, relative to countries on other continents. Perversely, poverty is associated with slash and burn agriculture, charcoal and wood burning, that accounts for half of Africa's emissions, even though these emissions are very low.

Within the continent, emissions are correlated with multidimensional poverty and economic progress: Niger, Burkina Faso, Chad and Mozambique in which per capita emissions are lowest, are also those in which multi-dimensional poverty is highest (Alkirk et al., 2021). The same poverty and weak institutional capacity in many African countries means these countries experience disproportionate damage from climate change. In 2022, African countries lost an estimated $7 bn –$15 bn from climate change, and this is projected to climb to $50 bn by 2030 (Adesina, 2023).

If the challenges of universal access to safe energy, poverty alleviation and avoiding catastrophic climate change (associated with more than 450 ppm of CO_2 in the atmosphere) are understood to be conjoined, then a “sustainable” world requires every ton of CO_2e emitted to generate $7,500 in GDP (Beinhocker et al., 2008). In 2008 the world’s “carbon productivity” ratio was at $740 per ton. By 2022 it had increased to $1,898 for the world, $5,627 for the EU-27 countries, but just $890 per ton for Sub-Saharan Africa due to low GDP per capita. In this sense, the climate challenge for OECD countries involves cutting greenhouse gas emissions while maintaining productivity and GDP. For African countries, the challenge involves finding ways to significantly increase GDP (employment, household income and energy access) without major increases in greenhouse gas emissions.

The very different starting points and pathways in the global energy transition between African countries and the rest of the world cannot be dismissed. There is no moral case for asking African countries (with the exception of South Africa) to forgo GDP growth, trade or the securing of foreign direct investment in order to cut their emissions. The only question for African countries is how they might engage the global energy and climate transitions to boost energy supply, enhance GDP above the prevailing mean of $1,690 per capita, for Sub-Saharan Africa in 2022 increase their share of global trade above 3% and attract more than the 5% of global foreign direct investment (FDI) reported in 2022 (just 2.5% of global FDI without South Africa).

The means of this ‘harnessing’ will vary across African countries. The concluding section of this report presents options disaggregated for:

- Least developed and conflict-affected countries, most of whom have per capita emissions well below 1 tCO_2e per annum and limited capacity to institutionalise the global energy transition, despite some of them exporting key commodities (Mozambique, Somalia, Sudan).
- The 6 Congo Basin countries and their responsibility for the world’s latest carbon sink (DRC, Republic of Congo, Niger, Cameroon, Central African Republic).
- Countries with strategic mineral (‘rare earth’) deposits (DRC, South Africa, Namibia, Malawi)
- Countries whose economies are dependent on oil, coal and mining exports (Angola, Nigeria, Niger, Zambia).
- Countries with newly discovered natural gas and oil resources (Tanzania, Namibia)
- Land abundant countries dependent on the agricultural sector (Sudan, Uganda, Eritrea)
- Countries with relatively diverse economies (South Africa, Morocco, Egypt).

A key requirement for all African countries involves stronger economic narratives that take the unavoidable A key requirement for all African countries involves stronger economic narratives that take the unavoidable reality of climate change and the energy transition into account and seize on the opportunity for climate resilient development. Converting these narratives into economic reality, requires financial, regulatory and political support. It is non-negotiable that Africa’s energy and climate transition must support economic diversification and electricity to the 600 million Africans that do not currently have a secure electricity supply and are exposed to both energy poverty and indoor air pollution. Similarly, the continent’s response to climate change has to improve food security for the 278 million Africans that are under-nourished or the 55 million children under the age of five that are stunted due to malnutrition, if it is to be just (Oxfam, 2023).

Sections 3 and 4 of this chapter explore the economic options available to African countries as they seek to harness the global energy transition to achieve domestic development outcomes.

3. Global context and two dominant, but flawed, narratives

Viable options for African countries will take cognisance of trends in the global economy and global responses to climate change. Economic forecasts have been tenuous, and mostly wrong, in recent times (Kay and King, 2019). It remains useful, however, to describe perceived trends when discussing policy options. At the risk of over-generalisation, African countries confront the global energy transition in the following context:

- Global economic growth in the world's major economies remains modest, as the rate of growth in China drops below 5% and fiscal policy swings into contraction in the US, Canada, Eurozone and the United Kingdom. Given uncertainty caused by climate change, culture wars, actual wars and geopolitical flux, monetary policy remains restrictive and capital remains expensive as Central Banks struggle to make sense of the volatile, uncertain, complex and ambiguous (VUCA) world. Pockets of uneven growth will continue to emerge for short periods (e.g. India, Mexico and Ethiopia in 2024).
- Multilateral free trade ambition is exposed by culture wars and growing climate change fears. Major restrictions on multilateral trade and increasing protection of their national economies by OECD countries, driven by nationalist leaders, are likely and will be justified on grounds of carbon pricing and the need to protect domestic industries and their workers from emerging economy exports. This trend is important as African economies begin to expand their manufacturing capacity. The global economic windfall generated by cheap Chinese manufacturing will remain under pressure due to trade restrictions and rising prices in China.
- Technological innovation will continue to attract more economic value than commodities. The global energy transition - a shift from a commodity based sector to a technology and innovation based sector - is just one part of a broader economic trend that rewards technology innovators. The availability of abundant cheap (renewable) energy, energy storage and green hydrogen will drive new local economic activity and development progress in those emerging and low-income economies that can access the technology.
- The world's 20-year moving average temperature increase is likely to breach 1.5°C well ahead of 2040. This will spark alarm and a radical shift to dump fossil fuel assets and price greenhouse gas emissions into all transactions, in an effort that will only gather traction when it is too late, i.e. when long-standing vaults of greenhouse gases in the permafrost, oceans and forests have been released. Climate change will become a central political economy issue in all major economies and 'carbon credits' and 'decarbonisation' will emerge as new economic sectors. Concatenated environmental disasters generated by sea-level rise, more intense rainstorms, drought and fire will become more frequent, fuelling migration and a diversion of aid resources from development to disaster management and conflict resolution. Inevitably, the economic growth that does occur will be in low-carbon sectors and geographies and in support of resource efficient circular economic activities. Efforts that capture and store greenhouse gases safely will attract an economic premium to prevent environmental collapse while the slower shift to low-carbon economies takes place.
- The reach of the financial sector will continue to expand as the United States of America's (USA) public sector debt exceeds 100% of USA's GDP. This mode of financialisation reaches households and governments around the world, but renders them unstable as financial strategies become entangled in geo-economic shifts. The Global North's debt, combined with increasing ownership of this debt by emerging economies with an export surplus, will reconfigure the global financial architecture creating new risks and opportunities. China will continue to dominate global trade in the short term and the United States will control capital accounts (stocks and bonds), but this will change as the dollar component of global forex reserves declines below 50% and the US imposes trade restrictions (Powell, 2023). China's property market and financial sector will remain volatile, particularly as OECD countries put up import barriers to China's manufactured goods. De-dollarisation will continue and the dollar will be replaced with a basket of currencies and tokens depicting essential environmental assets and low-carbon technology and manufacturing capacity. The shift away from a dollar-based global economy will be slow and disruptive. The finance sector will look to underpin its activities with the environmental assets (including carbon credits) on which all society depends, as opposed to debt instruments or gold. In the transition, the financially leveraged middle-class in all countries will find itself under pressure due to the shift, and will shrink in relation to the super-rich and the poor, generating political instability.

- Despite increasingly enclaved flows of trade and finance, economic growth opportunities will continue to move East (and slightly South) within the global economy (McKinsey/ Angus Maddison, 2024). This is driven by aging populations in the Global North, a youth dividend in the Global South and rapid rates of urbanisation in Asia-Pacific and Africa. The African continent will become 50% urban in the mid-2030s.

Given this context, current climate and energy strategies in Africa coalesce around one of two stylised narratives, neither of which offer sustainable economic opportunity.

3.1 Economic development before climate responsibility

The narrative being most vocally advanced, and implicit in the African Union's African Common Position on Energy Access and Just Energy Transition adopted by the Executive Council in July 2022 (AU 2022), rests on the moral right of African countries to extract the hydrocarbon energy feedstocks they have and increase their greenhouse gas emissions as part of their pursuit of socio-economic progress. This narrative draws on Africa's historically small contribution to GHG accumulation in the atmosphere to assert the right to economic development ahead of any responsibility for emissions reductions. Proponents of the narrative point out that since 1750, African countries have contributed just 2.9% of the cumulative greenhouse gas emissions in the atmosphere (Sub-Saharan Africa just 1.9%). Furthermore, the contribution to global emissions by African countries pursuing fossil fuel intensive strategies will not be a material influence on climate change ahead of 2050 (Hausman, 2022). The same proponents highlight that it was the economic advance of high-income countries during the industrial revolution that initiated anthropogenic warming, and that low- and middle-income countries should not be denied the same opportunity. This position is often combined with the insistence on loss and damage compensation (IPCC, 2023; UNFCCC, 2023). The narrative receives support from Africa's political elites, keen to continue extracting rents from conventional fossil fuel activities (Schücking et al., 2023). It also suits international financiers. Between 2016-2022, banks (predominantly in the United States, China and Europe) advanced $1.8tn to companies running projects that, individually, emit more than a gigaton of CO_2e each, and 48 African countries received finance for continued fossil fuel exploration and extraction in 2022 (Niranjan, 2023; Schücking et al., 2023).

While there is no moral or climate change case for African countries to forgo the burning of fossil fuels, continued reliance on hydrocarbon extraction is unlikely to provide African countries with viable economic development pathways. The choice between economic development and the burning of fossil fuels is likely to prove a false one, and insisting on the right to keep mining and burning fossil fuels would expose African countries to limits and challenges:

- **Loss of low carbon competitiveness**. The strategy risks African countries foregoing a rare opportunity to enhance their terms of trade and competitive advantage in a global economy that will be carbon constrained. Most African countries are still building their energy and manufacturing systems, and have the opportunity to do this while retaining their low-carbon status and their globally significant carbon sinks. It is prudent for African countries to protect this potential in order to both attract the investment for domestic infrastructure and services and to secure competitive advantage in the global economy that will inevitably have to become low carbon. At stake is a share of the $5.0 - 9.2 trillion that will be invested annually to ensure liveable global climates by 2050 (World Bank, 2023; McKinsey, 2023). This investment will accrue to households, companies and countries generating and protecting climate sinks, supplying renewable energy and renewable energy technologies, supplying low-carbon construction materials and promoting resource efficiency through circular material flows (UNEP, 2023). African leaders need to recognise the potential and resist the efforts of multinational companies and global financiers to lock African countries into high-carbon development pathways that face a tenuous future (Gueskens and Butjen, 2022; Schücking et al., 2023).

- **Higher long-term costs of energy.** Dependence on fossil fuels will forego the cost and time savings offered by renewable energy as African countries invest in energy security. In 2023, globally installed renewable energy capacity increased by 50%, to 510GW. The growth was led primarily by China, but reflects the low levelized costs of solar and wind energy relative to coal and nuclear, and the speed with which this form of energy can be installed relative to fossil fuel and nuclear alternatives. Storage technologies have advanced similarly, negating the intermittency challenges of renewable energy. Failure to embrace this technology trend will lock African countries into high cost energy and commodity price fluctuation, and forego the opportunity to extend electricity to everyone on the continent (Birol, 2023).
- **Locked into commodity exports and excluded from the types of finance that Africa needs.** African countries account for a fifth of the global population, but attract only 2%-3% of global energy investment (AfDB/ IEA, 2023). The continent requires $2.8 trillion between 2020-2030 ($277 billion per annum) to implement its Nationally Determined Contributions under the Paris Agreement (CPI, 2022). Currently, the scale of climate finance flowing to African countries is just $30 billion per annum, and this investment generates low economic multipliers and limited development. Without unambiguous climate resilient development strategies, African countries will struggle to raise the scale or type of finance they need (CPI, 2022). On energy alone, the continent requires $133 billion annually between 2026–2030 to meet SDG targets, but received just $29 billion per year for fossil fuels and $9.4 billion per year for renewable energy in 2019/2020.

  The current investment and financing of fossil fuels comes from countries and companies that have proven unreliable when it comes to sustainable development in Africa. These partners will drop their support for Africa abruptly at some stage in the next two decades as global climate pressures intensify. In September 2021, China announced it would no longer build coal fired power stations outside of the country (Jinping, 2021); as of January 2022, the European Investment Bank ceased granting loans for coal or oil projects; all banks are under mounting pressure not to lend to fossil fuel projects and an estimated 36 coal power plants around the world, representing nearly 36 gigawatts (GW) of capacity, have been cancelled or moth-balled since September 2021 (CREA, 2023).

- **Entrenched economic dependence and high costs of capital.** An African economic development strategy that depends on the benevolence of high-income countries or China, is not secure. Niger's experience with uranium exports to France and the DRC's experience with cobalt exports to China provide the recent examples in a long history of skewed benefits from collaboration. It is improbable that either the Green Climate Fund or the Loss and Damage Fund will mobilise adequate amounts of capital for the right types of projects in a timeous manner, making exclusive dependence on them risky. The fossil fuel finance, roughly $29bn per annum, that is being extended to African countries, is channelled through multinational companies, and focused on exporting the extracted resources (IEA, 2022; Schücking et al., 2022). The default for this mode of finance is to leave African countries with the environmental damage of fossil fuel extraction, very little energy for domestic use and a lock-in to a commodity-based economy. This finance will not support existing innovators or economic diversification, and will not provide the infrastructure and value addition that African countries require for sustained economic growth. As the African Development Bank Chairman points out, "The fastest way to poverty is through exporting raw materials, but the highway to wealth is through global value chains …. We must add value" (Adesina, 2023).

  Dependence on donor aid and multinational company investment not only undermines sovereign decision making and economic diversification, but condemns the continent to laggard status and higher costs for capital (Swilling et al., 2022). The same dependency will see Africa's rapidly expanding cities remain landing-pads for extractive multinational companies rather than flourishing places of innovation, manufacturing and development (Pieterse, 2023).

- **Relies on untenable development pathways.** Perhaps most importantly, the strategy rests on the assumption that the development pathways used by European, American and Asian countries, in which workers progress through "stages of development" from farm to factory to offices, remain available to African countries (Cohen, 2024). This is simply not the case for market and climate reasons. The traditional export-led manufacturing that African countries have tried, largely unsuccessfully, to secure represents a shrinking part of the global economy. China controls at least one third of the world's manufacturing, forcing smaller countries to compete with cheap labour for the remainder of the market. This type of competition contributes little to domestic development (Baldwin, 2024).

  African countries, such as South Africa and Ghana, that have tried to drive industry off the back of fossil-fuel powered energy now face more precarious access to capital and restrictions on trade in carbon intensive goods. Increasing damage from storms, floods, health crises and crop failure will see the global political economy, and consumers, turn against emitters at some stage in the next two decades, regardless of where they are located or the development consequences. African countries should avoid the inevitability of the associated developmental cul-de-sac.

3.2 Leap-frog to a new climate economy

At the other end of the spectrum is the idea that African countries will take advantage of their laggard status to 'leap-frog' to economic competitiveness in a carbon constrained global economy. It is this thinking that informs the NDC clauses that condition most African country's climate strategies on financial and technology transfers (IPCC, 2023; UNFCCC, 2023). In the process African countries would secure their share of the "new climate economy" generating an estimated $26 trillion in global economic benefits (2018-2030) (NCE, 2015; Garrido et al., 2018). In some aspects African countries are 'leap-frogging'. Telecoms have relied heavily on mobile technologies rather than landlines and workers are moving straight from rural primary industries to urban tertiary (often informal) sectors, without the more conventional secondary industry employment phases in factories (Cohen, 2024). These are not the sort of leap-frogs that drive country-wide climate resilient development, however. Whilst a compelling idea, the assumption that a full economic leap-frog will happen automatically or easily faces its own challenges:

- **Economic 'leap-frogs' require investment, political stability and coordinated multi-level governance.** The African continent has experienced nine coup de'tads since 2020, but even where governance is sufficient to prevent civil conflicts, institutional deficits remain an impediment to structural reform of the economy. Africa is urbanising late, fast and at relatively low levels of income ($1,690 per capita for 40% urban across all Sub-Saharan African countries). In addition, revenue collection is weak and predominantly the responsibility of National Governments. This context has made it difficult for governments, and urban governments in particular, to provide the low-carbon energy and infrastructure that would link urbanisation and industrialisation in a carbon constrained world (Swilling et al., 2021; Turok, 2023). Without electricity, basic infrastructure and services it is very difficult for African countries to take advantage of their low-carbon status by exporting goods and services. In theory, loan finance should allow African countries to overcome their fiscal paucity and capitalise on their low-carbon status. In reality, the same fiscal constraints and institutional deficits that underpin them are punished by financial markets and make borrowing more expensive (Haas et al., 2023). Despite being home to the world's best renewable energy resources, 17% of the global population and over 3% of the global GDP (in nominal terms) Africa secured just 0.4% of the $400bn global green bond market in 2022 (Brookings Institute, 2022). In the absence of deep domestic financial markets and governments able to issue bonds, the finance that African countries have received, has proven difficult to direct to the infrastructure and basic services that would unlock productivity and enable an economic leapfrog.
- **Economic leap-frogs require cohesion and political support.** Political power has co-evolved with fossil fuel extraction in countries such as South Africa, Ghana, Nigeria, Algeria and Angola (Niranjan, 2023; Schücking et al., 2023). Ethiopia has presented a set of climate resilient development projects and has embraced renewable energy, but this is the exception on the continent. Most national leaders in African countries have shown limited appetite for supporting a climate 'leap-frog'. On the contrary, collaborating with multinational companies, African leaders have continued to pursue gas, oil and coal projects alongside renewable energy, and have done little to advance climate resilience in agriculture or in urban infrastructure and design. The result is a set of mixed messages to investors and a failure to mobilise the type of "country platforms" capable of (i) securing and maintaining political agreement; (ii) coordinating public finance from multiple donors; and (iii) harnessing private investment in support of leap-frogs (Hadley et al., 2022).

- **Economic leap-frogs are risky.** African countries have struggled to diversify, even where they have embraced digital technologies. Most African economies have not undergone the agricultural "green revolution" that benefited countries such as India, and they are not able to build manufacturing capacity off the back of agricultural surpluses. As such, structural reform and diversification of African economies and the breaking of commodity dependencies remain risky in themselves, particularly where countries have high levels of debt (the African Development Bank considers debt in excess of 80% of GDP to be problematic). Ghana provides a good example of a country that, in trying to diversify away from cocoa, oil and coal, and in seeking to diversify its energy mix through independent power providers, incurred debt and downgrades from rating agencies.
- **Economic leap-frogs require bargaining power.** For historic reasons, most African countries do not have the trade or financial power to influence the global economic "rules of the game" in their favour (Iyoha, 2005; Edeme and Mumuni, 2023). Of the $650 billion drawing rights issued to the 190 members of the IMF, for example, the 54 African countries received just 4.5% (Haas et al., 2023). The small, open to the global economy, debt laden nature of many African economies, sees them unable to exert agency over their trade and finance options, and buffeted by political instability, global economic volatility and climate change disruptions. Ahead of COP 27, 20 highly climate-exposed countries threatened to suspend payments on their collective $685bn in debt until the climate finance pledged under the Paris Agreement was forthcoming but, typical of their status, these countries had no leverage to implement their threat. Whilst subaltern institutions such as BRICs and the BRICS Bank are emerging, these are yet to gain influence in the global economy. It is essential that African countries recognise the global economic shift towards technology innovation. However, assumptions that African countries will easily and automatically be able to access this technology is naive to the protections being established to guard it. In the interim, African countries have limited, and expensive, access to financial resources and many of the clean technologies required to affect an economic leap-frog (Das and Sharma, chapter 2, 2024).

4. Playing smart for a just transition

For the reasons cited in Section 3, the two extremes – insisting on the right to continue emitting for the sake of development on the one hand and leap-frogging to a thriving low-carbon economy on the other - hold limited economic potential for African countries.

A third way is possible based on African countries anticipating, and supplying, the needs of the global economy over the next two decades on their own terms. This strategy offers African countries the chance to attract a greater share of the $5 - $9.2 trillion that will be invested every year to ensure “liveable climates” by 2050 (World Bank 2023; McKinsey, 2023). Under this strategy, the issue for African countries is not so much what they can do to reduce emissions but how they can harness the global decarbonisation effort and associated fast-growing industries as part of their socio-economic development (Hausman, 2022). This would see African countries switching from commodity-led (and debt-laden) growth strategies that have delivered so little over the past three decades, to deploying their renewable energy resources, carbon sinks, rare earth minerals, low-carbon manufacturing and youthful labour force and innate resilience to support the global energy transition and advance their domestic priorities. Such an approach would require political, financial, educational, environmental, agricultural, industrial, and trade reforms to deliver employment intensive climate resilient development (Kaboub 2007, 2012; Pickard and Schweitzer 2012). The specific reforms will be bespoke to each African country, and should be curated under “country platforms” that represent domestic priorities (Hadley et al., 2022), but continent-wide features of this approach include:

- **New economic narratives.** African countries advancing economic narratives that transcend the “jobs versus environment” dichotomy and instead target the jobs and investment offered by climate resilient development (Kleemann et al., 2017). These narratives will build on Agenda 2063 to profile Africa as a place of youthful innovation, expanding consumer power and hard-won resilience. They will combine the global necessity of investing in Africa’s carbon sinks, strategic minerals and low-carbon industry with the implicit threat to the global economy of African countries replicating carbon intensive development, unless international investment is forthcoming. The investment that African countries need, and the global economy cannot afford to withhold, will avoid the stranding of assets and labourers in fossil fuel sectors. Instead, it will give these workers enough time (20 years) to exit their respective sectors, while creating employment in programmes that enhance soil, forest and grassland carbon sinks, supply clean energy to African industries and households, generate circular material flows complete with industrial symbiosis and recycling programmes, build compact and connected cities and regenerative (carbon sequestrating) agriculture that doubles grain yields to 3 tons per hectare. In North America, grain yields per hectare are 7.6tons per hectare and in China 6.2 tons per hectare in 2021.

- (World Bank, 2024). The global energy transition provides a fertile context in which to develop these narratives and offer unambiguous modes of economic growth. At COP 28, Sultan Al Jaber announced the "Africa 50" investment platform between UAE and African countries, with investment available to any African government with "clear transition plans, robust regulatory frameworks and a real commitment to putting the necessary grid infrastructure in place".

- **Implementation of Global Stocktake commitments as a platform for Just Transition Transactions.** The 2023 Global Stocktake (GST) provides a comprehensive summary of conditions for the global transition (UNFCCC, 2023). It is reasonable that African countries insist on the implementation of the GST, COP26 and COP27 climate finance pledges, greater transparency around the allocation of climate finance, disbursements of the Green Climate Fund and stricter adherence by the private sector to UNEP's "Principles of Responsible Investing". These efforts should, however, be complemented by debt for carbon swaps and concessionary finance for renewable energy options. These Just Transition Transactions overseen by multilateral climate finance institutions, such as the Climate Investment Fund, would free up fiscal space in African countries (Steyn et al., 2021).

  Similarly, loss and damage funds should be dispensed to low-income and most vulnerable countries, preferably through the AfDB's African Development Fund. In keeping with "common but differentiated responsibilities (with respective capabilities)" and attention to multilateralism, African countries should collectively insist that any Carbon Border Adjustment Measure be implemented through the World Trade Organisation, or not at all.

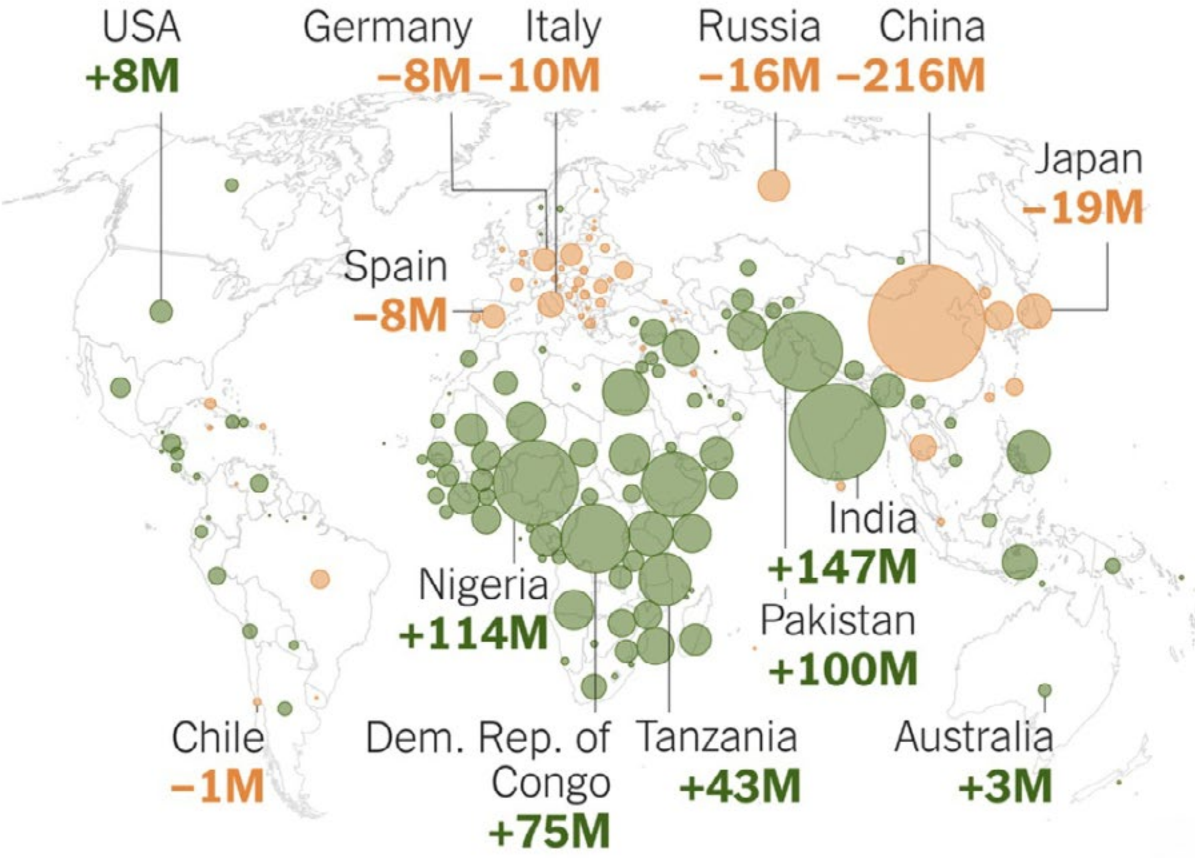
- **Mobilising finance.** While upholding the GST and Paris Agreement pledges is necessary to retain trust, the needs of African countries exceed, and are more urgent, than what is likely to emerge from the GCF or L&D funds. The continent needs $250 - $280bn per year to implement existing Nationally Determined Contributions and a reasonable share of the $9.2 trillion a year required to create a "liveable climate" in 2050 (McKinsey, 2023).

- In the context of tight global monetary policy, the most effective way for African countries to attract international investment to the right types of projects is through the mobilisation of domestic and regional finance, however meagre this is. Africa has a growing savings pool, 20 sovereign wealth funds, and a steady supply of remittances from outside the country (AfDB, 2023). To date the continent has not had the institutional capacity to direct this money to infrastructure and services, but this is changing, as demonstrated by the growth in the African Development Bank's capital from $93 billion in 2019 to $208 billion in 2023 (AfDB, 2023b; EIB, 2023; FSD-Africa, 2023). Local institutions, lending in domestic currencies and allocating capital in line with local knowledge and needs, are able to overcome incorrect perceptions of risks and highlight opportunities for international capital (Haas et al., 2023). To achieve this, African cities and countries will have to develop and cost portfolios of climate resilient development projects and programmes - country platforms - that direct the domestic fiscus and attract blended finance; a step that has been largely lacking from both the NDCs and the project-based investment into Africa to date (Hadley et al., 2022; Haas et al., 2023).

- **Linking urbanisation with low-carbon industrialisation and manufacturing.** Between 25-35 million people will be added to Africa's towns and cities every year for the next two decades. Urban incomes are higher than national incomes and have historically increased more quickly than rural incomes regardless of educational attainment (Spence et al., 2009). Where African countries are able to link their commodities with manufacturing efforts and supply food, construction material, medicines and services to Africa's rapidly growing cities, they are likely to find growing and secure offtake and give impetus to the Africa Continental Free Trade Agreement signed in May 2019. African countries are already manufacturing affordable vaccines, turning recycled plastic waste into paving bricks, bio-based construction materials, advancing household-scale energy solutions and beginning to improve agricultural productivity (UNEP, 2023). As the Trade chapter of this study points out, in the absence of global trade reform, African countries will encounter critical foreign exchange pressures if they import the clean technologies and low-carbon building materials required by climate resilient development (Das and Sharma, 2024). Instead, African countries could draw on domestically produced materials and services to make the energy and climate transition, supporting economic diversification in the process. The stability of urban demand relative to international commodity markets and the enhanced terms of trade when manufacturing is designed around the needs in local cities, ensures macro-economic benefits (GDP, income and employment) of this approach relative to industrialisation around Special Economic Zones and the export of commodities (Cloete et al., 2019, Cloete et al., 2020; UNEP, 2023).

- **Electrify with renewable energy.** The levelized cost of renewable energy, and the growing number of private sector companies able to supply quality renewable energy infrastructure on the African continent, make it possible to extend electricity to many of the 600 million Africans that lack secure supply, in quick time and at low cost. The modular scale of renewable energy outlets enables infrastructure to be designed around the needs of specific communities and industries. Extending access to safe and renewable electricity will unlock latent economic potential and free up some of the fiscal resources currently allocated to Emergency Power Producers. It would also reduce the poor health and environmental damage that is a feature of existing energy feedstocks such as charcoal. The continent's existing hydro-power resources provide a valuable renewable energy resource, as well as critical pumped-storage for the smoothing of supply curves. Reconciling supply from renewable resources with demand for electricity would be enhanced by the gradual integration of the continent's five power pools. For countries such as Algeria, which emits 99.76tCO_2e per megajoule of primary energy produced, South Africa (94.5tCO_2e per megajoule) and Morocco (77.55tCO_2e per megajoule), the incorporation of renewable energy is essential to retain trade competitiveness relative to countries such as Brazil (37.73tCO_2e per megajoule) and Norway (17.85tCO_2e per megajoule) (Energy Institute, 2024).
- **Adapt through domestic resilience.** A UNEP report published in late 2023 indicated that "Developing countries required 10-18 times more adaptation funding than they were receiving" (UNEP, 2023). African countries are unlikely to receive this quantum of investment in the current economic context. Instead, they should build economic narratives around the resilience they have developed through a century of economic, governance and environmental disasters. Examples of the type of adaptation measures developed by Africans and with the potential to scale, include the multiple "hybrid" water, sanitation, energy and mobility services that citizens in Africa have developed in the absence of government services, bio-based building materials and new digital tech capacity that enables food markets, links artisans with work and reports infrastructure failures (Bekker et al., 2021; Cirolia, 2023). The perception that African countries are 'risky' and therefore warrant higher costs of capital can be countered by the risk to global financiers if Africa does not adapt – the risk of climate catastrophe, biodiversity loss, migration and political instability.
- **Take advantage of the geoeconomic interregnum.** In geoeconomic terms, power is shifting East and South, offering new opportunities to African countries (Quah, 2021). Historically, economic influence has been difficult for Africa's small, open economies. Economic bargaining power will be hard won, but African countries have the opportunity to use the geo-economic transition to improve their bargaining power by collaborating eclectically and strategically with both traditional and emerging economic powers on trade and finance (UNGA, 2022). India has demonstrated this by positioning itself between the US and China, and Turkey has similarly positioned itself between the US and Russia.
- This bargaining power is a prerequisite for ensuring the continent's rare earth minerals and in-tact carbon sinks (most obviously the Congo Basin's forests and peatlands) deliver reasonable benefits for the countries that house them. Focussing on how the benefits of these "resources" are valued and shared, offers an opportunity to boost Africa's economic significance.
- Africa's rapidly evolving cities will, similarly, provide some of the few sites of expanding population and economic demand ahead of 2050, and will gain economic prominence as places where consumer numbers are increasing not decreasing. 113 million consumers are expected to be added to the global economy in 2024 and only 4% of these will be in the West, while an estimated 35 million will be in Africa. The same demographic trends will see African countries able to provide 477 million people between the ages of 15 and 35 (and 1.7 billion working age people in total) to economies in which the workforce is shrinking (Figure 3.1). Markers of Africa's bargaining power will include not just flows of trade and investment, but voting (and veto) rights in the IMF and World Trade Organisation and the UN Security Council, and the share of US debt that is held by China and other Global South countries.

Figure 3.1: Change in 'working' population size (16-64), including migration, 2023-2050.



Source: U.N. World population prospects 2022 | Working-age people are those between the ages of 15 and 64, an age group commonly used by demograpers. | The New York Times

- **Leverage the continent's 'carbon credit' through Article 6 rulebooks.** As the climate catastrophe becomes more acute focus will, inevitably, shift to carbon capture and storage. The Global North will look to sell expensive carbon capture and storage technologies, but African countries are already home to many of the globally significant carbon sinks that currently remove roughly half the GHGs emitted by people. Under Article 6 of the Paris Agreement, African countries have the opportunity to place their carbon sinks on their national accounts and develop carbon markets that secure full value for the protection of the continent's forest, grassland and soil carbon sinks, while also providing finance for the clean energy and energy efficiency services that African countries desperately need (Swilling and Mebratu, 2024). Failure to deliver these rulebooks will see carbon market revenues accrue to the various standards, project developers and consultants that emerged under the "voluntary carbon market" in the post-Kyoto Protocol (post-2012) period, an outcome that African countries should seek to avoid at all costs. UNEP documents the "pipeline" of projects listed in Article 6 "Internationally Transferable Mitigation Outcome" (ITMO) agreements. As of November 2023 there were 136 listed projects under 64 Bilateral Agreements between 6 different "buyers" and 41 "sellers". Only seven African countries had engaged this opportunity however: Ethiopia, Kenya, Tunisia, Senegal with Japan; Kenya, Morocco and Ghana with Singapore; Gabon, Ghana with South Korea; Ghana with Sweden; Malawi, Morocco; and Ghana, Senegal with Switzerland, and the terms of these agreements are not yet known. A significant majority of the listed projects are for clean energy that will serve the continent well (UNEP, 2023). Article 6 rulebooks offer African countries rare agency and an opportunity to develop "rules of the game" in ways that meet the respective needs of African countries.

5. Enabling conditions and sector-specific opportunities for 'playing smart'

Behind the 'playing smart' option is the assumption that, despite the SDGs and the UNFCCC, the global Behind the 'playing smart' option is the assumption that, despite the SDGs and the UNFCCC, the global development effort is unlikely to provide the type or the scale of development that African countries require. This sobering reality foregrounds the steps that African countries need to take to 'play smart' and draw down economic benefit from the global energy transition. This is a perspective that places agency back in the hands of African leaders. What is it that African leaders can do in the short term, and independently of global leaders, to support 'playing smart' and enable benefits?

The obvious precondition includes unambiguous economic narratives, aligned to Agenda 2063, that place 20-year timelines on the phasing out of fossil fuels, and commit to investments in renewable energy, circular economies, nature enhancing infrastructure and liveable cities. In the context of global economic uncertainty, there are rewards for any country that can signal clear intent and the direction of economic growth. This is only possible for African countries, however, if the continent's leaders are able to imagine development pathways that decouple development from fossil fuels in particular and commodity exports in general. In support of these narratives, African countries will be required to clamp down on the $80-$100bn a year in illicit capital flows between Africans and multinational corporations (Adesina, 2023) and to use the allocation of their domestic public and private resources (however meagre) to support the narrative and signpost the opportunities to international investors. This use of domestic finances to crowd-in international investment and donor support, offers significant advantages over the current dependence on international financiers and their expensive and misplaced capital allocations.

While looking to domestic options in navigating the global energy transition, African countries would do well to strengthen the ACFTA both in terms of governance and volumes of trade. The region offers growing and urbanising populations and trade within the region would strengthen bargaining power prior to African countries negotiating trade opportunities elsewhere in the world (such as AGOA). ACFTA can be strengthened by developing the value chains required to feed urban demand on the continent. Similarly, integrating the continent's five power pools would not only smooth the supply from Africa's growing renewable energy plants, but also all the continent's considerable hydropower resources to serve as pumped-storage assets.

In terms of attracting finance, African countries must work harder at mobilising domestic fiscal and financial resources through enhanced revenue collection and the closing of loopholes that currently enable 'illicit capital flows' from African countries, most obviously through inaccurate trade invoices. A country's fiscal strategy - how it raises and allocates revenue - is still the best indicator of what it hopes to become, and Africa's fiscal strategy should support and shed light on its respective narratives around climate resilient development. International finance will be necessary, but the terms of this finance could be strengthened in favour of African countries by "country platforms" supported by costed portfolios of climate resilient development projects and the respective fiscal strategies of African countries (Hadley et al., 2022). Where African countries have included their significant ecological assets and carbon sinks in their National Accounting inventories, they can offer these to financiers as a form of collateral for investment and loans, and simultaneously factor these assets into development planning.

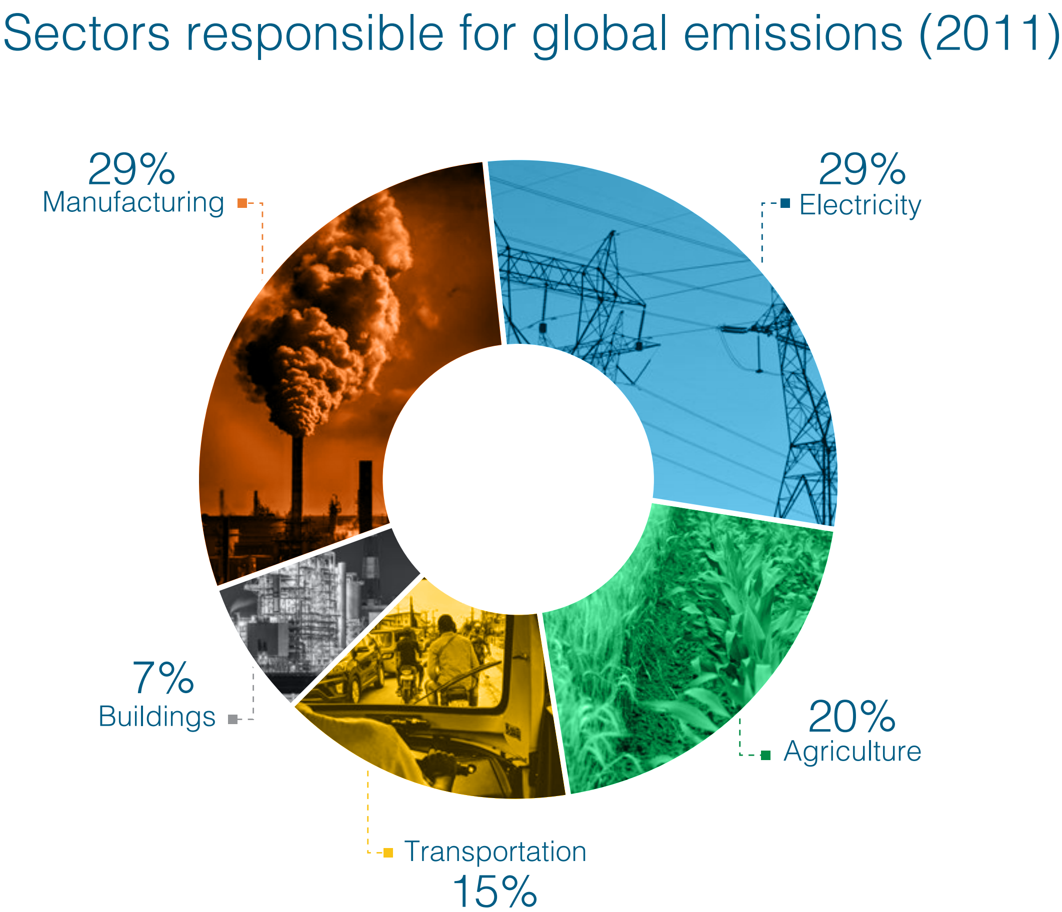
The bankability of urban climate resilient development projects would be enhanced by African countries applying the 2014, African Charter on Values and Principles for Decentralisation, Local Governance and Local to develop National Urban Policies that support sustainable cities and urbanisation, and provide clarity on fiscal transfers and which tier of government is responsible for the respective components of climate resilient development. Similarly, African countries that develop effective Article 6 Rulebooks with domestically or regionally agreed 'rules of the game' for what constitutes a carbon credit and project 'eligibility lists' that align with domestic economic ambition, will be able to marshal carbon market revenue to their domestic development priorities. Eligibility lists should include the need for renewable energy investment and grid extensions to displace charcoal burning.

Innovative approaches to attracting finance should not detract from the need for Africa's Central Banks to undertake the fiduciary steps that will allow them to borrow in their domestic currencies. The same Central Banks should support African credit rating agencies capable of more accurate calibrations of risk and opportunities.

Country platforms should seek out partnerships with those existing service delivery innovators in the energy, water and sanitation and mobility sectors, that are enabling climate resilient development. African countries hold the rare advantage of being able to draw eclectically from innovations. The growing range of low-carbon bio-materials, for example, offer new ways to construct the cities that the continent needs (UNEP, 2023). There are similar technologies available to the farming sector that could support the continent-wide effort to improve food security. The challenge for African countries in seeking 'playing smart' economic advantage, involves combining international and local innovations in ways that are affordable and appropriate to the local context (Das and Sharma, Trade Implications on Just Transition, 2024).

Drawing down economic advantage from the global energy transition will require these enabling conditions, as well as sector-specific innovations (Figure 3.2). The efforts and technologies emerging to cut emissions are all dependent on clean, affordable, energy. The sector-specific challenges requiring navigation are described below.

Figure 3.2: Sources of GHG emissions by sector



5.1 Oil and gas

As exploration for fossil fuel reserves has increased in Africa, significant new resources have been discovered, including at least 115.34 billion barrels of oil and 21.05 trillion cubic metres of technically recoverable liquified natural gas (LNG) (UNEP, 2017). Between 2011 and 2018, 41% of new LNG discoveries were in Africa and in 2022, 48 African countries were either exploring for or extracting fossil fuels (UNU-IRA, 2019; Ganswind et al., 2023). New finds of liquified natural gas (LNG) in Tanzania, Mozambique, Algeria, Egypt, Equatorial Guinea and Nigeria, coupled with Europe's demand for new sources of gas due to the war in Ukraine, generated $281 billion in profits for the 'big-five' fossil fuel companies in 2022/23 (Global Witness, 2024). These developments brought Africa's long-standing relationship with fossil fuels into sharp focus and divide opinion. Historically, Russia has been the greatest exporter of fossil fuels. In 2022, Europe imported an extra 50bn cubic metres of gas to offset the Russian shortfall. Compare, for example, pro-LNG arguments on behalf of the World Economic Forum and the African Development Bank (Thurber and Moss, 2020; AfDB, 2023) with the analysis of the dire impacts of Africa's gas industry by UNICEF (Nakate, 2023), "Africa will continue to deploy all forms of its abundant energy resources, including renewable and non-renewable energy to address energy demand." The point is often made that even if Africa was to triple its dependence on natural gas, this would contribute less than 1% increase to global GHG emissions (Moss and Kincer, 2020). This observation misses the point that oil and gas extraction on the continent has done little for socio-economic development.

There are exceptions, such as Botswana (diamonds) but, "Overall the economies of resource rich countries are in a surprisingly poor state" (AfDB, 2007; Adesina, 2023). Between 1980 and 2000 Africa's 'resource poor countries' grew their economies faster than the well-resourced countries. Since 2005 the outcomes are more varied, but there are conspicuous examples of oil spills and conflict around fossil fuel resources and pipelines, that have damaged country's economies in the Niger Delta, Cabo Delgado in Mozambique and Sudan (Asal et al. 2016; Paine 2019). Nigeria's oil revenue's per capita increased 10-fold in the four decades after 1965, while its GDP per capita increased just five-fold and per capita income remained the same. Since 2005, Nigeria's oil production has decreased while per capita income doubled again.

In an attempt to avoid the "commodity curse" (a curse that does not have to manifest where governance is effective) Angola created a sovereign wealth fund that, although tainted by allegations of corruption, aims to take advantage of the country's oil revenues. Similarly, Nigeria has used oil revenues to diversify its economy into services and banking and Tanzania's oil and gas discoveries appear to be boosting the national economy and local economic development around Tanga. The actual merits of gas are likely to differ across countries depending on cost of extraction and what gas is displacing in the domestic energy mix – typically LNG emits half to a third the amount of greenhouse gas that coal does and has many benefits relative to charcoal.

There is no place for coal in the energy mix of any country hoping to avoid stranded assets ahead of 2050 (UNU-IRI, 2019). Where LNG and oil resources are utilised, this has to avoid the replication of energy governance in which hydrocarbon extraction benefits only multinational companies and African political elites without contributing to economic diversification or sustainable economic development; Ghana is just the most recent example of how a fossil fuel dependency can usher-in the vagaries of commodity cycles at the expense of economic diversification causing macro-economic instability (AfDB, 2022). In country's utilising LNG and oil, interim revenues have a crucial role to play in supporting domestic electrification and the financing of zero-carbon energy, whether that is through renewable energy or carbon capture and storage.

The governance issues are complex, but African countries have the opportunity to improve existing financing, terms of trade and social and environmental benefits when pursuing new energy options. Of the 500-plus oil and gas companies active across Africa in 2018, only six were Africa-owned (UNU-IRA, 2019). None of the top 23 institutional investors in new fossil fuel companies in Africa were based on the continent (a list topped by BlackRock and Vanguard in the United States and the Norwegian government pension fund). Among the commercial banks BNP Paribas, Société Générale, Crédit Agricole and BPCE have all made significant loans to fossil fuel companies or projects at interest rates well above what they are able to secure in their home territories. Unless ownership structures and the business model is changed, it is these companies not the citizens of African countries that will draw down the benefits of gas exploration. More importantly, many oil and gas companies have better renewable energy options. African countries have more than 60% of the most viable solar (10TW), hydropower (35GW), wind (110GW) and geothermal (15GW) resources on the planet, providing the continent with comparative advantage in the global transition (IEA, 2022). Instead of capitalising on this comparative advantage and competing for the $2tn per annum that will be invested in renewable every year by 2030 under existing climate pledges (Gates, 2023), African countries are celebrating the "planned" $245bn in oil and gas infrastructure that will lead these countries into an economic cul de sac within 10 years.

5.2 Rare earths and strategic minerals

African countries are home to 73% of the cobalt, 83% of the platinum, 76% of the manganese and 32% of the bauxite, that are critical to the generation of renewable energy, green hydrogen and battery storage that the global energy transition requires (UNU-IRA, 2019). As the trade chapter highlights, however, Africa's share of rare-earth mineral exports is just 8.3%, and just 3.8% of processed critical minerals, despite these resources not being abundantly used on the continent (Das and Sharma, chapter 2, 2024). The key for African countries involves utilising these reserves in ways that build in-country processing capacity and support Africa's renewable energy and electric vehicles sectors, while exporting more refined versions of these minerals. The DRC, alone, holds almost half the world's known cobalt reserves, and has the land and power to convert this into "precursor cathodes" more cheaply than the United States, China or Poland (BNEF, 2021). The cost competitiveness arises from DRC's relatively cheap land and electricity, but utilising this advantage will require the type of governance that understands the potential of the global climate transition and is able to enforce the trade-offs for African countries to draw down benefit.

It need not be the case that strategic mineral mining has to damage forest resources and aquifers that feed the continent's cities. New discoveries of strategic minerals offer the opportunity for new technologies and business models, but this is only possible where African countries have the governance in place to enforce not just new mining models, but also new ownership and beneficiation processes.

5.3 Forests and agriculture

Africa's growing population will require feeding if it is to contribute to economic development and climate resilience. Providing this food is expected to become more difficult under climate change. Without deliberate programmes, weather related losses, which accounted for 5% of agricultural output between 1991-2021 (the equivalent of $123 billion per annum) are set to undermine food security (FAO, 2023).

Average yields of cereals and grains across Sub-Saharan Africa (excluding high income countries) was just 1.59 tons per hectare in 2021 (World Bank, 2024). The world average was 4.20 tons per hectare, in China the average was 6.2 tons per hectare and the North American average was 7.14 tons per hectare in 2021, leaving considerable room for productivity gains through investment in the right agricultural innovations in Africa (World Bank, 2024). In the context of global decarbonisation, African farmers will attract investment in agriculture that sequestrates soil carbon and avoids the destruction of ecological infrastructure through excessive use of chemicals. The same soil carbon holds the key to doubling yields through the prevention of erosion and improved uptake of nutrients (fertilisers) (Thomas, 2020).

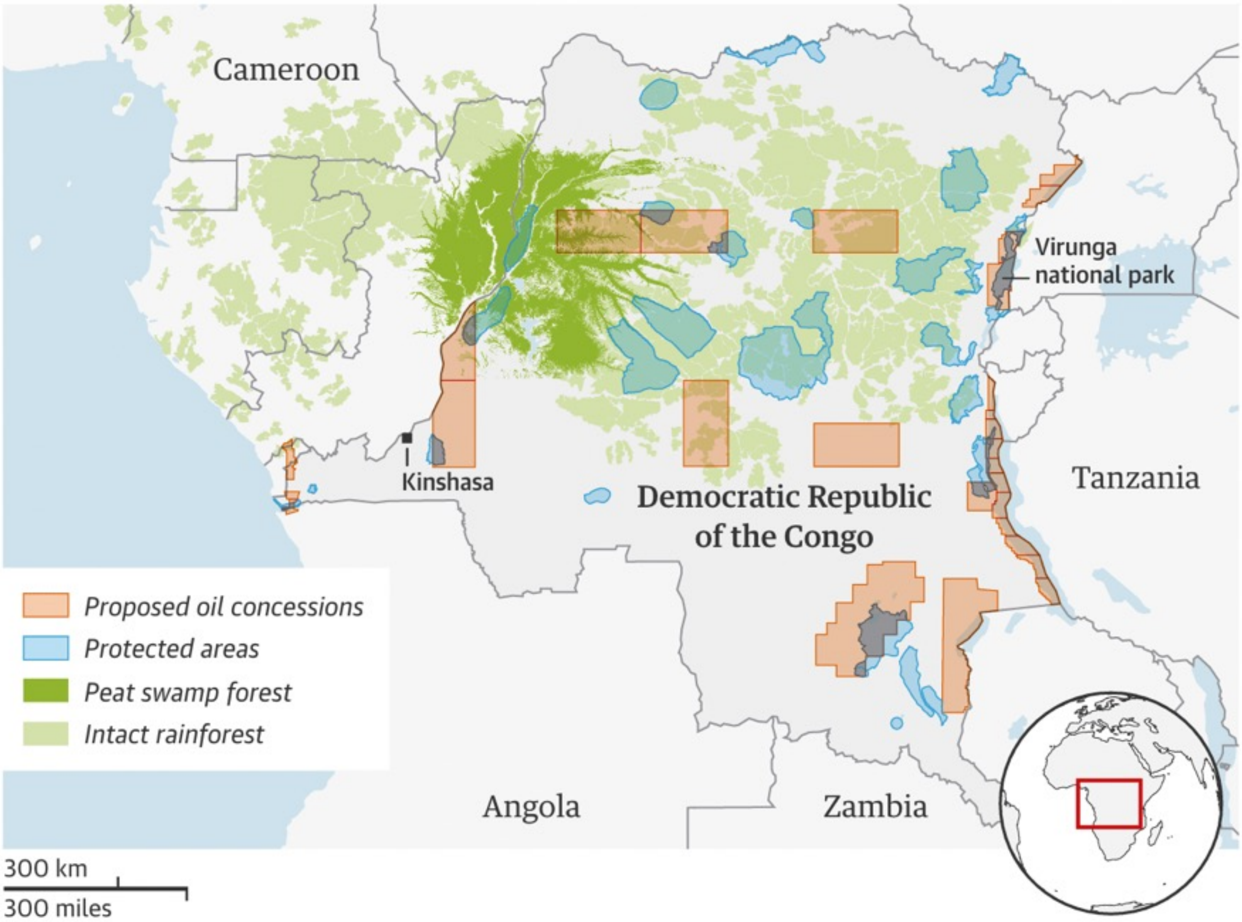
The West African Food Systems Resilience Programme provides one example of how technology, innovation, weather and climate data and trade can be deployed to increase yields and buffer food security against climate change. Conversely, the European Green Deal, including carbon border adjustment measures (C-BAMS) and the EU-Deforestation regulations (2023/1115) that ensure any beef, cocoa, coffee, palm oil, rubber, soya or wood products entering the European Union do not contribute to deforestation, will make it difficult for African farmers to trade in products whose production is either carbon intensive or associated with deforestation. These are not particularly onerous demands for African farmers and foresters. Even in the carbon intensive South Africa, C-BAMS are likely to be adverse for industry but reward those farmers that have begun adopting renewable energy and soil carbon sequestrating practices (PCC, 2023). Compliance could be used to secure competitive advantage over producers that have invested capital in production modalities that are now difficult to change if they want to comply.

Given the abundance of land, and the constraint of under-investment, there is a strong case for producing biofuels in countries that have adequate rainfall. Unlike Europe where almost all arable land is utilised, biofuel investment in Africa could increase productivity and food security, rather than usher-in "food-vs fuel" trade-offs (Prasad and Ingle, 2019; Sparkman et al., 2023).

Similar programmes are required in the forest sector. The estimates vary, but the 269 million hectare Congo Basin stores roughly 30.6bn tonnes of carbon (mostly in peatlands), distributed equally above and below ground. This is the equivalent of 224.6bn tCO_2e, or roughly 10 years of net emissions by the global economy (Lewis, 2009; CAFI, 2022). Whilst there are pockets of intense deforestation, in general the rates of deforestation across the forest are 0.3%, an order of magnitude lower than deforestation rates experienced in the Amazon Basin in recent years. The forest is a globally significant carbon asset, but it is also a source of valuable timber, agricultural real estate and beneath the forest lie oil, natural gas and rare earth deposits.

Figure 3.3 below, illustrates what has been framed as a 'zero-sum' trade-off between the revenues and jobs that could be created by mining oil reserves in the DRC and the greenhouse gas sequestration in the Congo Basin peat forests. What this depiction misses, is the possibility to create value and jobs in new, and globally important ways, through more innovative mining, forestry and agricultural practices, in the basin.

Figure 3.3: Identified carbon and forest sinks in relation to existing oil concessions in the Congo Basin



Guardian graphic. Sources:CongoPeat Project, University of Leeds. Crezee et al. (2022). Global Land Analysis & Discovery, Global Forest Watch

A ‘playing smart’ strategy for the Congo Basin involves high-income countries incentivising the six countries in the Basin to steward the forest in ways that support forest livelihoods without threatening the underlying carbon sink. Similarly, sustainable forestry, complete with timber certification and higher prices for timber, can be combined with agriculture and biofuel production without destroying the role of forests and grasslands in flood buffering or carbon sequestration. As UNECA assert, “Investing in environmental standards should be seen not as an obstacle to competitive manufacturing, but as underpinning competitiveness, making more efficient use of energy, and decoupling resource use from output growth” (UNECA, 2016). In the process these countries could integrate their financial and natural capital accounting and planning systems. Dar es Salaam is one city that has suffered from upstream deforestation (for charcoal) and surface sealing and is now exposed to regular floods. The DRC president, Félix Tshisekedi, made the point in 2022 that the ability of DRC to play its part in the global effort was contingent upon support, “The world needs to realise the Congo Basin forest is a global asset and must help [DRC] protect it. We have never said we are going to put the planet in danger … [but] Nobody is helping us.”

5.4 Cities

Cities are where the majority of the African population will live by 2050 and cities have the potential to offer economic growth. Cities also concentrate climate change risks and opportunities. How Africa’s cities are built in the next two decades will set the template for economic progress (or otherwise) for the remainder of the century.

With notable exceptions, most national governments have been slow to devolve power and budgets to urban authorities, and insufficient and inappropriate investment in Africa’s cities has seen them unable to keep up with the influx of people (Cartwright et al., 2018). Currently, the majority of the 25-35 million people being added to Africa’s urban spaces every year, settle on unplanned and unserviced sites. They adopt a hybrid mix of formal and informal services and energy feedstocks, many of which contribute to negative externalities (Cirolia, 2021). Where governments anticipate the urbanisation megatrend and invest proactively in urban infrastructure and services, they will harness the aggregation of young, economically ambitious urban dwellers as both an economic and a climate adaptation force.

Planned and funded African cities will provide the markets that could drive value-addition of existing value chains on the continent. As the last region of the world to undergo an urbanisation phase, the building of African cities has the advantage of adopting low-cost renewable energy, the latest transport technologies and low-carbon (or in some instances carbon absorbing) and bio-based building materials (UNEP, 2023). For example, it is now possible to produce steel, glass and cement using clean energy and to repurpose discarded aggregates into building material (Saint Gobain, 2022; Gates, 2023). There is also a growing body of work involving construction with bio-based materials, many of which are already grown in Africa (UNEP, 2023). In this way, Africa’s cities will be transformed from extractive bases for multinational companies, into places of inclusive and sustainable living that generate the knowledge and the industry to export low-carbon goods and services around the world. Certainly, there is no way in which the global climate transition will be politically or environmentally sustained, unless it impacts positively on Africa’s rapidly evolving cities. The same cities will provide the remaining sites of demand-growth for investors and companies, in the run-up to 2050.

6. Factoring-in country differences and the global response

There is no single strategy that can be advocated or applied to all African countries, but based on the six categories of countries described in Section 2, 'playing smart' can be disaggregated as follows:

- The least developed and conflict-affected countries, together with the land abundant agricultural economies, have per capita emissions well below 1tCO_2e per annum. There should be no carbon constraints on energy policy or development in these countries, but every effort to draw in Loss and Damage Funding and build new social compacts around the investment opportunities that are available to countries pursuing climate resilient development.
- For the 6 Congo Basin countries a large part of the challenge involves securing full value for the forest and peatland carbon sinks in the basin to support forest livelihoods and sustainable timber offtakes while preventing deforestation rates in excess of 0.5% per annum. These countries should be offered 'debt-for-carbon' and 'debt-for-nature' swaps in which their debt servicing obligations are cut in exchange for retaining their globally significant carbon sinks.
- Countries with strategic mineral ('rare earth') deposits face the challenge of accessing these minerals without damaging their forest sinks and in ways that support local value chains, inclusive low-carbon development and access to domestic energy.
- For countries whose economies are dependent on oil and coal exports, the task requires avoiding stranded assets and labour while using recent fossil fuel windfalls to finance the transition away from coal to renewable energy over the next 20 years (UNU-INRA, 2019).
- The countries with newly discovered natural gas and oil resources confront, perhaps, the most difficult challenge. It involves using their oil and natural gas reserves as a transition fuel, to diversify their local economies and usher in renewable energy while using natural gas to reverse the damage being done to forest and soil carbon by the current dependence on wood, charcoal and slash and burn agriculture.
- South Africa, Morocco, Egypt, Tunisia, all of which have diverse urbanising economies, confront the challenge of low-carbon economic development and their respective energy mixes. To a large degree this will play out in the countries' cities, where a Just Urban Transition, offers the opportunity for new technologies, partnerships and finance to support much-needed service delivery infrastructure (Cartwright et al., 2023).

The optimal strategy in each of these sectors above is likely to be country-specific. It will also be dynamic and dependent on the strategies pursued by the global community, its progress towards net-zero by 2050, and its willingness to share technology and climate finance with Africa.

Table 3.1: Stylised representation of scenarios and sectors

	Scenario 1: Business as usual, carbon is not Africa's problem	Scenario 2: Assumed leapfrog to new climate economy	Scenario 3: Playing smart for a just transition
Agriculture and forestry	Short term gains through timber extraction accrue to agribusiness and logging companies, but increasing barriers for 'uncertified timber'. Longer term liabilities through flood damage and commodity price fluctuations. Growing meat consumption and production is good for agriculture, but problematic for GHG inventories.	Climate adaptation funds are used to boost existing agricultural practices and food security, but investment is insufficient to generate a surplus or for agribusiness development.	Initial lags as green economy institutions are established. Carbon and biodiversity revenue begin to flow to local institutions. Green economy value chains emerge over time. Regenerative agriculture contributes to drought resilience and food security. Trees are seen as more valuable than timber, but some certified timber offtake delivers high value. The success of Africa's forestry and agriculture attracts funds and investment that is used for local beneficiation.
Rare earth minerals	Rare earths are auctioned and extracted through existing mining structures. Governments secure licencing revenue but little protection of ecological resources. Local employment benefits for mine employees, but also migrant labour.	Rare earths are auctioned as part of climate strategies and NDC commitments, but no strategy for local beneficiation sees weak terms of trade.	Strategic use of rare earths does not destroy ecological buffers but does bring-in export revenue. The full extent of this resource is not mined as ecological buffers are protected and alternative forms of investment are sought. Rare earths are used to support local renewable energy and industry.
Natural gas	Gas is extracted where it is found with little strategy for economic transition or a structural economic shift towards green economy. Existing multinationals secure the bulk of gas rents with lesser gains for host countries.	Gas is proposed as a transition fuel but without structural economic reforms ends up replicating existing divisions of patronage, labour and benefit. Commitment to gas undermines leap-frog on an adequate scale.	Existing natural gas resources are well-managed and revenue is used to finance the economic transition to an inclusive green economy with sustainable bulk infrastructure.
Cities	Under-investment in rapidly growing cities sees sprawling unplanned settlements dependent on charcoal and highly vulnerable to climate change. These cities make no contribution to industrialisation or value addition of existing value chains. Carbon emissions remain low due to poverty and lack of services, but the cost of capital remains high.	Smart cities promise a lot but deliver only elite enclaves. Informal urbanisms remain the dominant feature of city life. Imported, high-tech infrastructure proves difficult to maintain.	Africa's cities become renewable energy hubs that then attract industries seeking low carbon manufacturing. Finance flows towards low carbon, resource efficient and socially inclusive urban development. Cities have lower emissions per capita than countries, despite higher levels of income.

7. Conclusion

This chapter draws on the long history of interlocking energy and economic systems to explore the economic impact on African countries of the global energy transition. This transition will, unavoidably, be disruptive and create a new set of economic winners and losers in the global economy. Countries such as China and Brazil are already taking advantage of the opportunities, but the question for African countries is whether they can exploit the disruption to alter their status as laggards in the global economy. Given the global disparity and the structural disadvantages with which African countries enter the global transition, the default - and difficult to avoid - economic impact is for the global energy transition to be economically damaging to African countries. This default is likely despite calls for a ‘just transition’.

In seeking to avoid this damage, the chapter problematises two common views – (i) that African countries need not concern themselves with greenhouse gas mitigation while pursuing economic development, and (ii) that African countries will “leap-frog” to low-carbon economic competitiveness.

The chapter finds that positive economic prospects from the global energy transition hinge on African countries anticipating the needs of the global economy and using this transition as the basis for industrial strategies that forges their own ‘just transition pathways’. These pathways would transcend the false ‘economy versus climate’ or ‘climate versus jobs’ trade-offs and develop employment intensive local value chains in support of the sustainable cities, globally significant carbon sinks and abundance of renewable energy for households and industries that both the world and African countries need (Hausman, 2022). The disruptions created by geo-economic shifts and climate change, offer precisely the type of context in which advancing the right economic narrative can provide much needed certainty and economic benefits.

While African countries should insist that the principles of ‘Common but Differentiated Responsibilities, and Respective Capabilities’ responsibilities for climate change are upheld, and that pledges around the Green Climate Fund and the Loss and Damage Fund are fulfilled, this money will not be enough and high-income countries have proven unreliable when it comes to the interests of African countries in the energy transition. Economic development strategies based on ‘admissions of guilt’ or the benevolence of those countries responsible for historical greenhouse gas emissions are unlikely to succeed.

‘Playing smart’ for African countries involves drawing on what respective African countries can offer the global economy as it grapples with the climate transition. In documenting the risks, opportunities and options available to African countries, this chapter goes beyond the tropes of ‘Africa is vulnerable to climate change’ and ‘Africa needs investment’. It also seeks to avoid a situation, where, in 2035 Africa points to known economic injustices in the global economy but sits with the consequences of these injustices and little agency to correct them. Rather it outlines how African countries might, in the context of the energy transition, draw on their existing knowledge and assets to mobilise domestic and regional finances and crowd-in international finance around the climate resilient infrastructures and services that African countries need.

That all human endeavour is ultimately enabled by energy and the functioning of the natural world, is something that many African people recognise and appreciate. African countries are well-placed to translate this understanding into economic development strategies that provide their domestic economies and the global economy with what they desperately need in the next decade to make the required climate transition: the sustainably mined rare earth minerals, the forest sinks and the sustainable forest products and foods, bio-based construction materials, expanding markets for renewable energy and cities in which materials are upcycled and recycled, and a young and economically active labour force.

Where African countries can position their development pathways as valuable to the global climate and energy transition, they will attract investment on their own terms (Williams et al., 2023). Section 2 of this chapter set out the challenge for African countries confronting the global energy transition as, ‘finding ways to significantly increase GDP (employment, household income and energy access) without major increases in greenhouse gas emissions.’ In the case of African countries, actively harnessing the global energy transition for the purpose of domestic development, could shift the default outcome of this transition from an additional burden on socio-economic progress to a rare opportunity to gain economic bargaining power and accelerate progress. This is not only the best, and least risk, ‘low-regrets’, development pathway available to African countries, but it may be the only durable pathway ahead of 2050.

CHAPTER 4 : MITIGATION IMPLICATIONS OF THE ENERGY TRANSITION

By Thapelo Letete (PhD) and Lungile Manzini

1. Introduction

1.1 Background

According to the special report on 1.5 degrees by Intergovernmental Panel on Climate Change (IPCC), global net anthropogenic emissions must reach net zero by 2050 if exceedance of a 1.5ºC temperature increase above pre-industrial levels is to be avoided. As of March 2022, more than 80 countries had committed to reach net zero by 2050 at the latest. At that time, 53 African countries had submitted their Nationally Determined Contributions (NDCs) under the Paris Agreement, 12 of which have either reached net zero already or pledge to do so by 2070 at the latest. While African NDCs are mostly dependent on financial, capacity building and technology transfer support, if fully implemented, they collectively have the potential to mitigate annual GHG emissions by ±550 million tCO_2e by 2030, compared to their respective business-as-usual baseline scenarios.

The implications of this envisaged transition to lower carbon economies by African countries which are poorly diversified, and dependent on a few primary sectors/resources, however, is not well understood. While it is understood that this transition needs to be just, there is no common and globally acceptable definition of a Just Transition, nor is there a shared African framework or perspective of what a Just Transition means for the continent. According to the African Development Bank (2023) and the United Nations Development Program (2022), a just transition must affirm Africa's right to development based on the Convention and its Paris Agreement-negotiated language of equity and the principle of common but differentiated responsibilities (CBDR) and respective capabilities (RC), in light of different national circumstances, which means making the right transition choices, managing the trade-offs and achieving both the continent's development and social objectives. This report covers the following objectives:

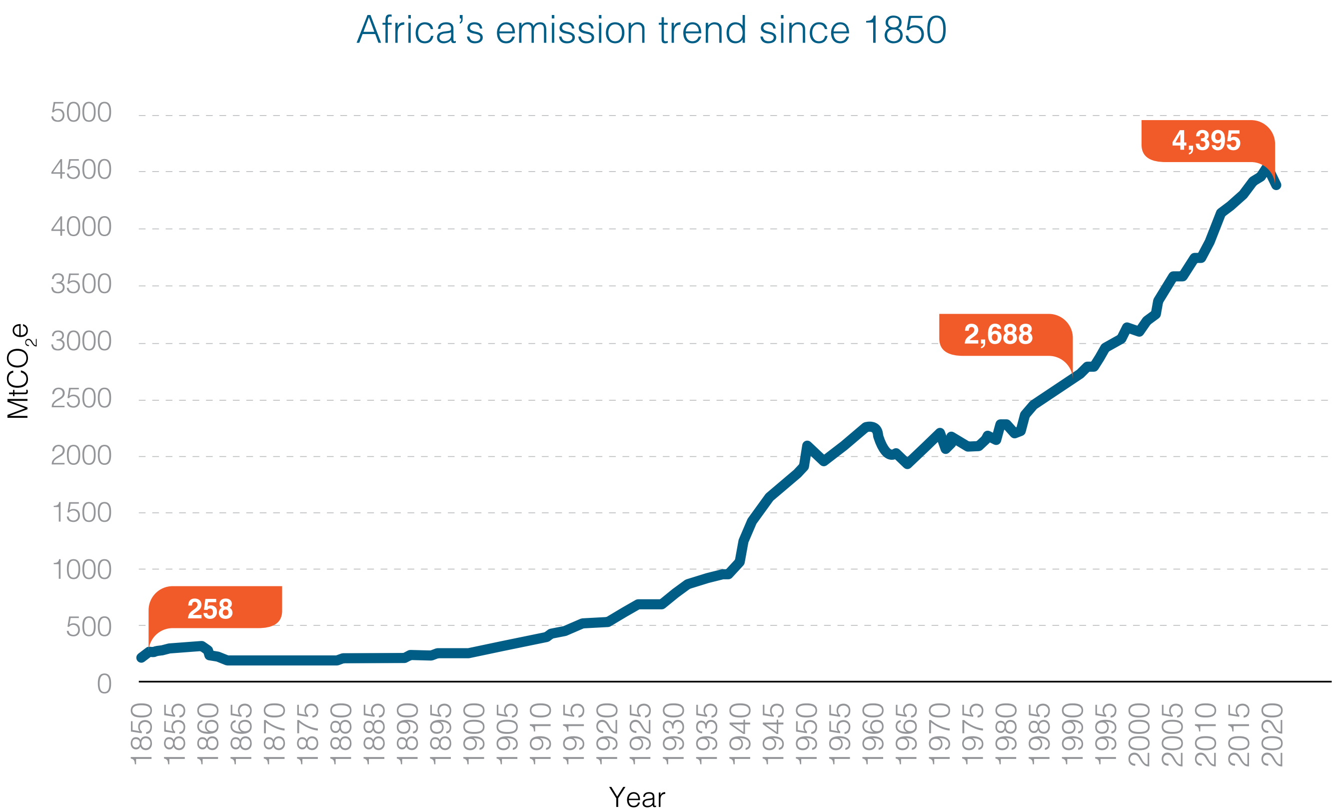
- The continent's current and historical emissions profile, together with the associated energy system and an articulation of the key mitigation sectors. These emissions are then projected to 2050 based on the same energy system – thereby producing the baseline trajectory.
- The overview of two mitigation scenarios for Africa: the first is the theoretical net-zero scenario by 2050 modelled with a top-down approach to align with the global net-zero requirement by science, while the second is a bottom-up lowest cost mitigation scenario that ensures that Africa achieves its key developmental objectives.
- The role of carbon sinks in Africa's low-carbon development, and Just Transition as well as what it may take for Africa to get maximum benefit from its carbon sinks.

2. Africa's current and historical emissions

2.1 Total emissions

Africa's total GHG emissions, including emissions from Land Use, Land Use Change and Forestry (LULUCF), were estimated at 258 $MtCO_2$-equivalent ($MtCO_2e$) in 1850, after which they remained fairly constant until the early 1900s, only growing by 37$MtCO_2e$ (14%) over the 50 years between 1850 and 1900. It is only from around 1950, when global emissions grew rapidly (See Figure 4.2), that Africa's GHG emissions also began to grow rapidly. By 1990 Africa's emissions had reached 2,688 $MtCO_2e$, while in 2020 they were estimated at 4,395 $MtCO_2e$. This is shown in Figure 4.1 below.

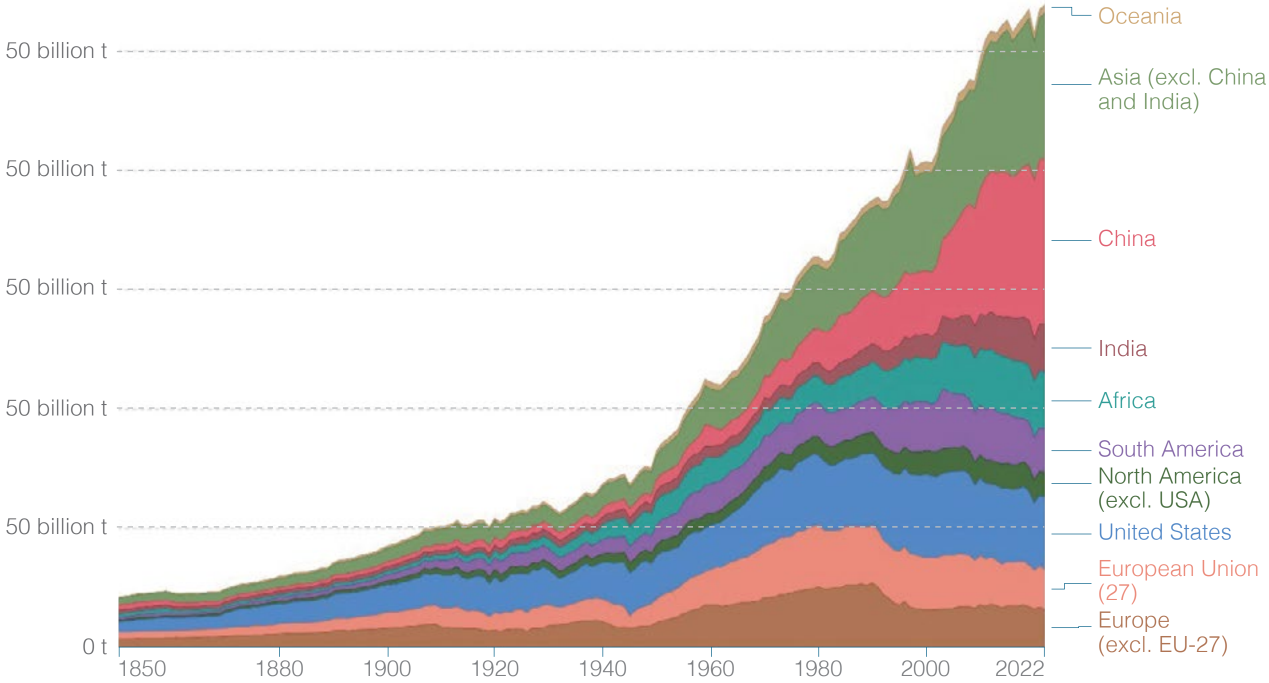
Figure 4.1: Africa's annual GHG emissions since 1850



Source: Author generated, based on data from Our World In Data (Ritchie, Rosando, & Roser, 2023) and Climate Watch (World Resources Institute, 2022)

Figure 4.2: below shows that Africa's emissions, however, have not grown nearly as fast as those of other parts of the world, particularly the developed regions and countries like China.

Figure 4.2: Global GHG emissions, dis-aggregated by region



Source: OurWorldInData.org (Ritchie, Rosando, & Roser, 2023a)

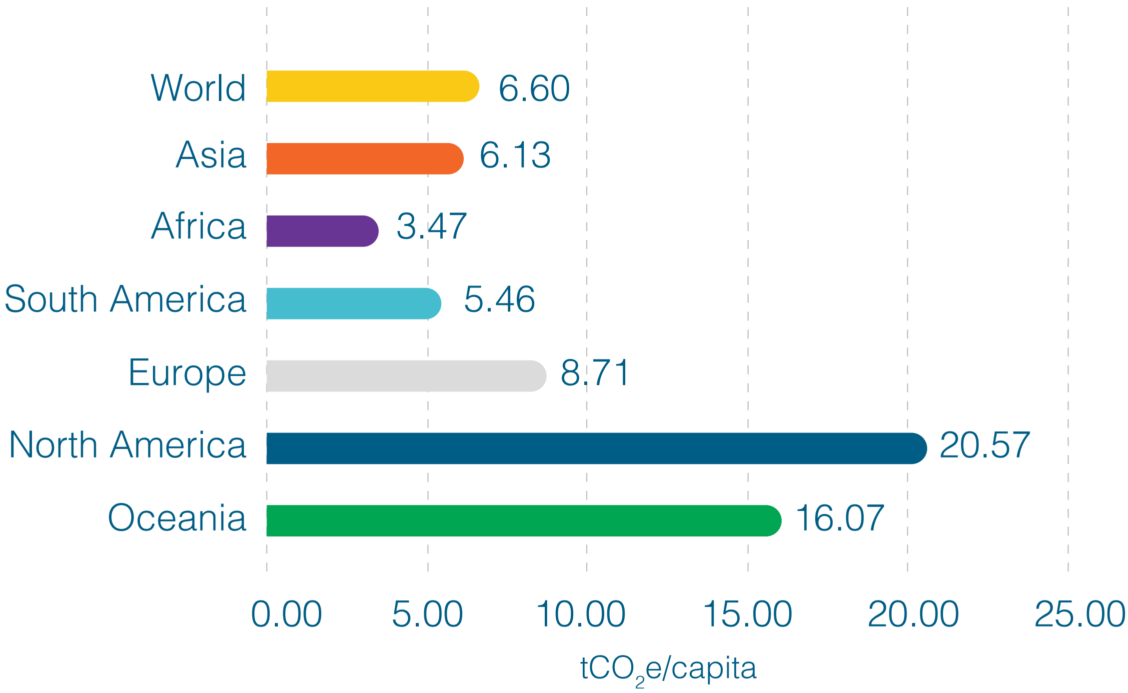
The Figure also shows that Africa's contribution to global emissions has also remained fairly low throughout the timeseries, starting off at 6.11% in 1850 and reaching 8.54% in 2020. In total the results show that Africa has cumulatively contributed about 7.5% to global GHG emissions since 1850. As such, viewing this from the UNFCCC's "common but differentiated responsibilities and respective capacities" principle, Africa's historical responsibility for the observed and future climate change resulting from historical emissions is relatively low compared to the developed regions and the likes of China.

Another useful indicator of the scale of Africa's emissions in comparison with other continents as well as the world is that of emissions per capita. Figure 4.3 below shows that in 2020 Africa's emissions per capita were the lowest among all continents at 3.47 tCO_2e/capita, compared to the global average of 6.6 tCO_2e/capita and North America at 20.57 tCO_2e/capita.

From the above, the following conclusions can be drawn:

- Supporting Africa's efforts to respond to climate change thorough finance, technology transfer and capacity building by developing countries or regions is a critical historical responsibility issue and should not be viewed as favour done by those countries and regions for the African continent.
- While this paper does not view equity in terms of equal rights for every global citizen to emit the same amount of carbon into the atmosphere (also known as equitable access to carbon space), it can be argued from the results above that equity requires that during the global transition to a low carbon state and ultimately carbon neutrality, if it remains necessary for the world to explore, exploit and make use of carbon intensive energy resources, regions with the lowest historical responsibility and emissions per capita like Africa should be given the first priority to explore, exploit and make use of such resources.

Figure 4.3: 2020 regional emissions per capita (tCO_2e/person)

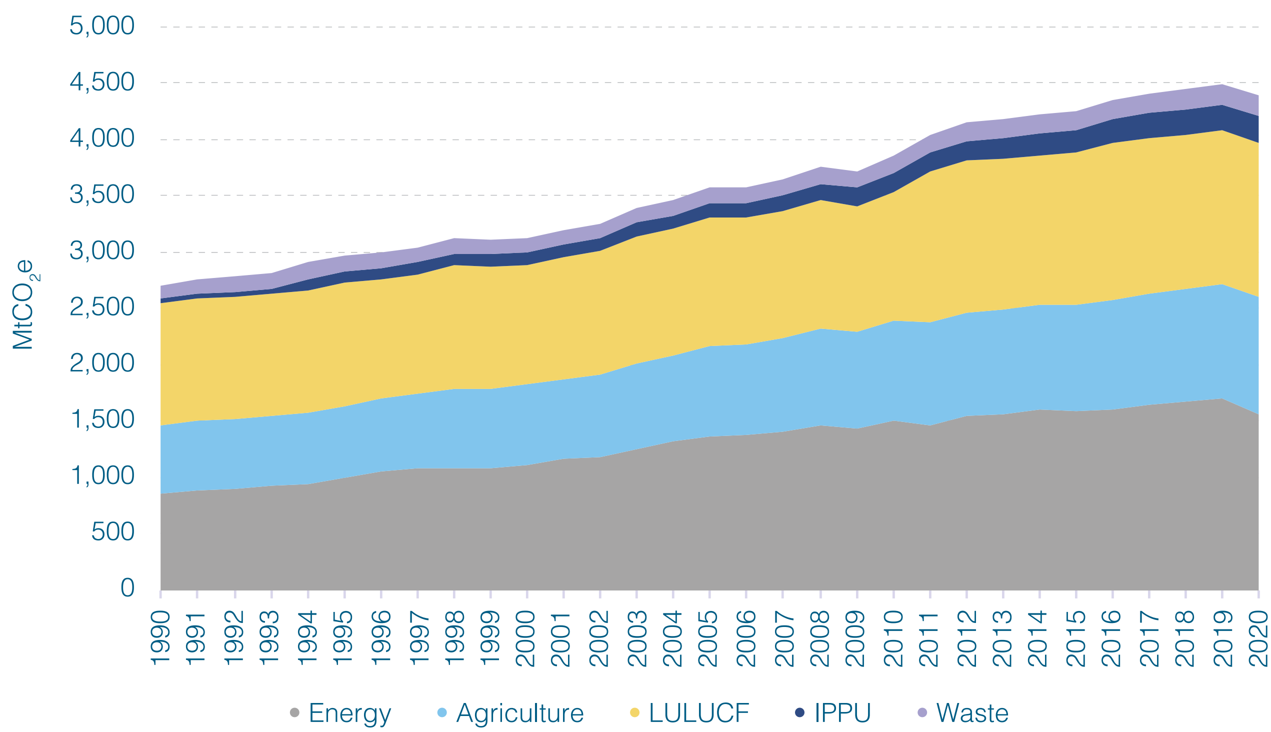


Source: Author generated, based on data from Ourworldindata (Ritchie, Rosando, & Roser, 2023) and Statistica (Dyvik, 2024)

2.2 Africa's Emissions Profile

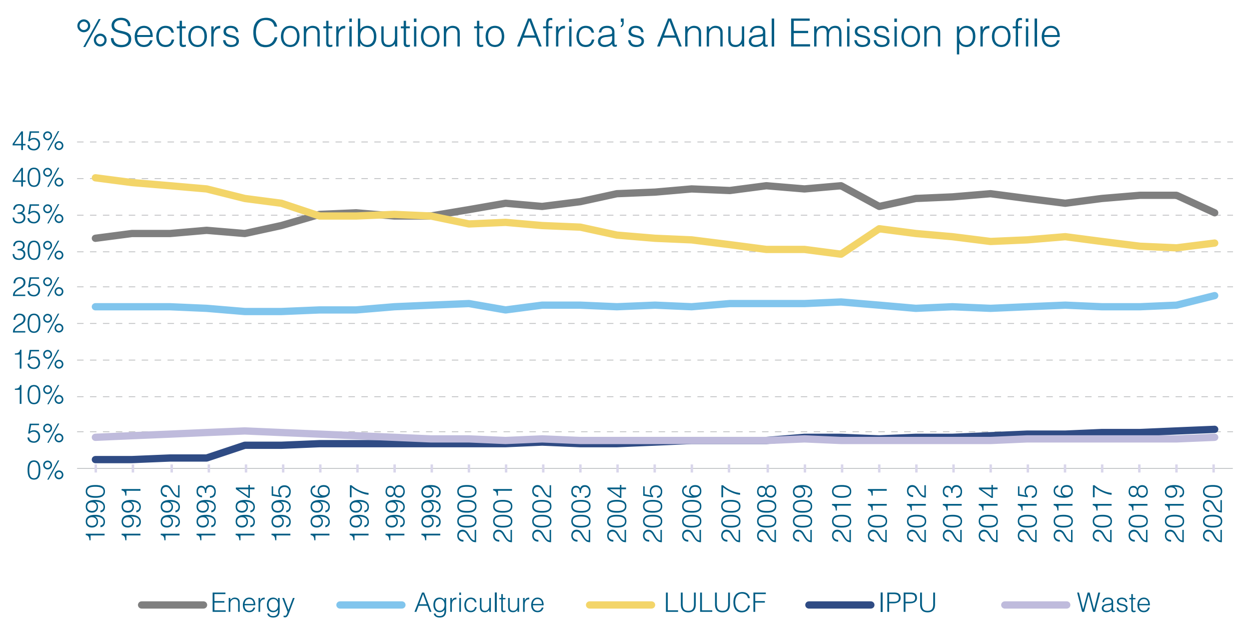
Figure 4.4 and Figure 4.5 below present Africa's emission profile since 1990. From 1990 to 1999 the Land Use, Land Use Change and Forestry sector (LULUCF) was the highest contributor to the continent's emission profile, accounting for between 35% and 40% of the emissions. Since 2000, however, the energy sector has taken over the majority share of the emissions, averaging 37.5%. Currently LULUCF is the second largest contributor at 31%, followed by the agriculture sector with a contribution of 23.9%. Waste sector emissions have remained relatively constant over the years, averaging 148 million tCO_2e per annum and 4.2% contribution, while emissions from Industrial Process and Product Use (IPPU) have grown slowly from a mere 34.3 $MtCO_2e$ in 1990, surpassing waste sector emissions and reaching 233.7 $MtCO_2e$ by 2020.

Figure 4.4: Africa's GHG emission profile since 1990



Source: Author, based on data from Climate Watch (World Resources Institute, 2022)

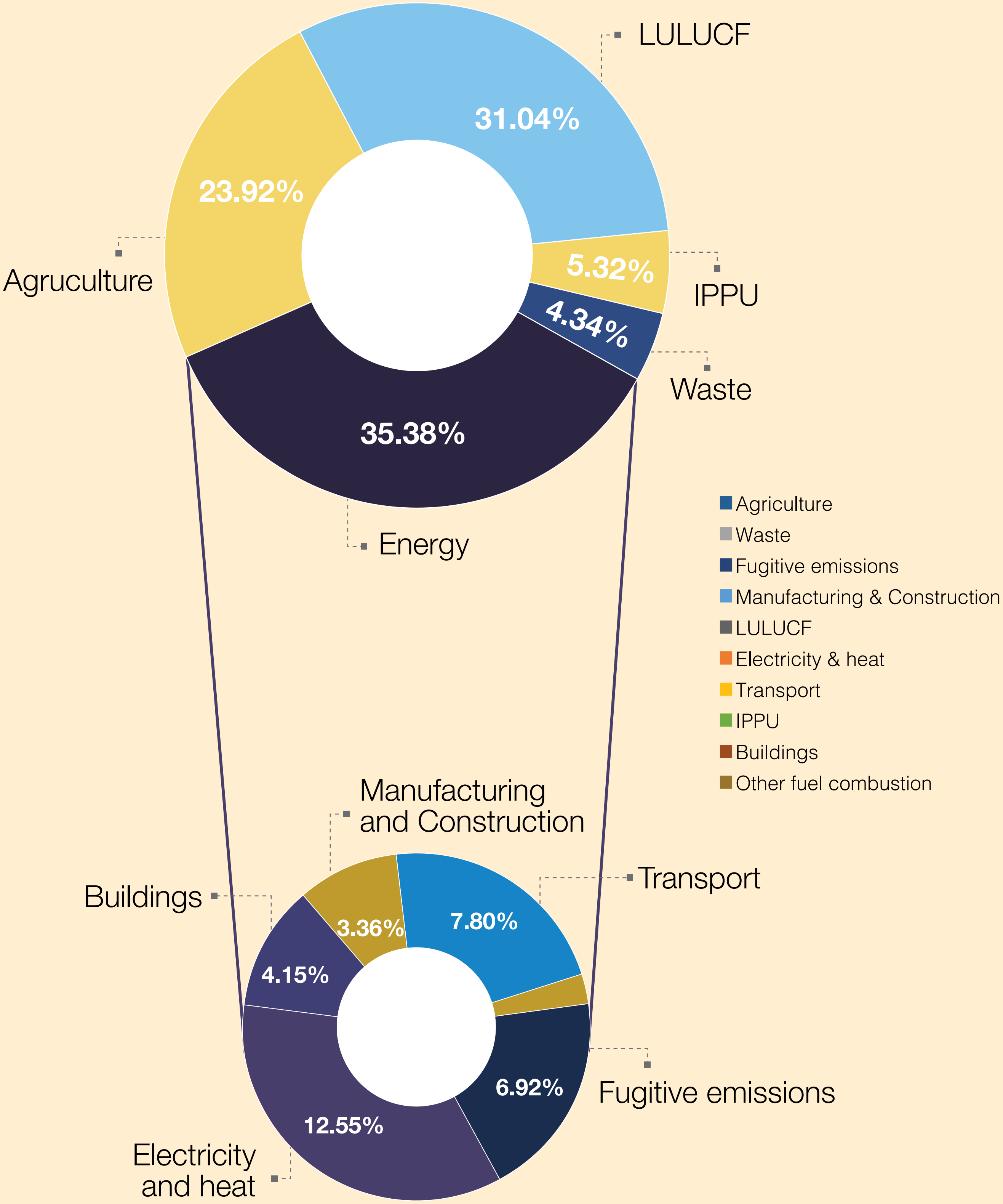
Figure 4.5: Sector contribution to Africa's emissions



Source: Author generated, based on data from Climate Watch (World Resources Institute, 2022).

Africa's 2020 emissions have been disaggregated further in Figure 4.6 below.

Figure 4.6: 2022 sectoral emissions



Source: Author generated, based on data from Climate Watch (World Resources Institute, 2022)

Figure 4.6 shows that land-based emissions from agriculture and LULUCF account for about 55% of the continent's annual GHG emissions. This shows that, while there is often some link between the energy sector and the Agriculture, Forestry and Land Use sectors (AFOLU) in Africa due to the cutting of trees for energy purposes, equating Africa's Just Transition to only the "Just Energy Transition" (JET) is not accurate, and can potentially underplay the importance of non-energy emission sources in Africa's Just Transition. In fact, evidence has shown that the main driver of deforestation and land degradation in Africa is the clearing of land for agricultural purposes and not so much for energy purposes. As such, for Africa implementing smart agriculture interventions, reducing emissions from deforestation and land degradation and restoring forests are just as important to the continent's just transition as is the deployment of low emission fuels and technologies. This is further shown in Section 6 of this Chapter.

The results further show that electricity generation, transportation and fugitive emissions are the largest contributors to energy sector emissions at 12.6%, 7.8% and 6.9% respectively.

Box 4.1 | Deforestation

Context

Deforestation is one of the most pressing global problems, as its impact on climate change, rural livelihoods, biodiversity loss and other environmental services provided by forests has been on the spotlight lately.

What is causing deforestation?

The most significant driver of forest loss in Africa is industrial activities such as subsistence agriculture rather than human activities. If the continent had to tackle deforestation, then they would need to solve the issue of commercial logging, charcoal production, effective government policies and the expansion of agricultural land. Indirect causes include socio-economic, environmental and trade conditions. The absence of clear rules on land tenure, weak sustainability provisions in trade agreements, or failure to support or incentivise forest conservation and sustainable agriculture, may ultimately increase deforestation.

Why is deforestation a problem in Africa?

Continuous deforestation in Africa can result into damage to habitats, biodiversity and ecosystem services that are essential for planetary health and human wellbeing. Deforestation is a particularly complex challenge in Africa due to land ownership rights, as in many countries, there is little privately owned land, with most land owned by the state. Given the lack of clear rights and documentation, there's little clarity on the type and location of the land use change.

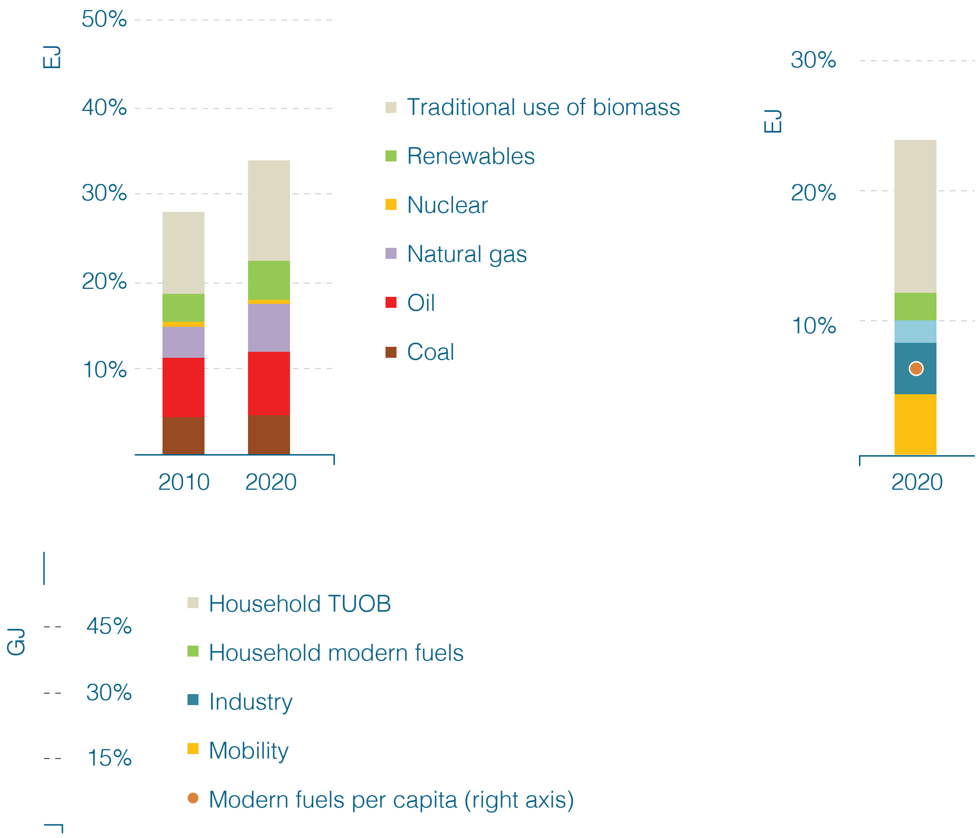
What is the solution?

Improved farming methods and agroforestry technologies could help ease the pressure on land use. Investment to drive food security and move away from inefficient, inequitable, and unsustainable land-use models is key. Local specific policies and strategies that considers diversity, culture, and local conditions. A blended approach in finance by both public, and private funding. Continued international climate negotiations that aim to creative effective mechanisms to address deforestation while ensuring food security, economic development, considers the seven safeguard principles and creates jobs.

2.3 Associated Current Energy System

This section summarised Africa's current energy system associated with the energy-related emissions presented in the preceding section. Figure 4.7 below summarises Africa's current energy system.

Figure 4.7: Africa's current primary energy supply by energy type (a) and consumption by sector.



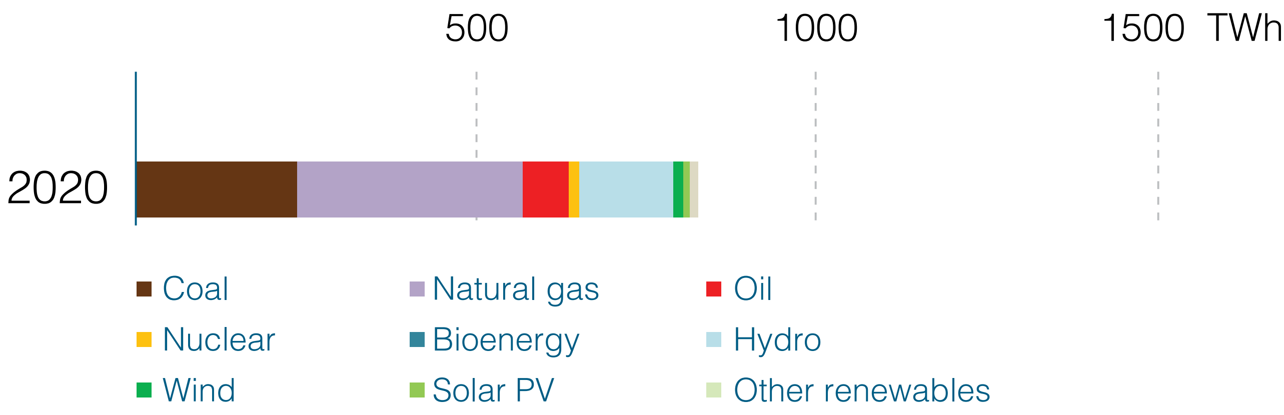
Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

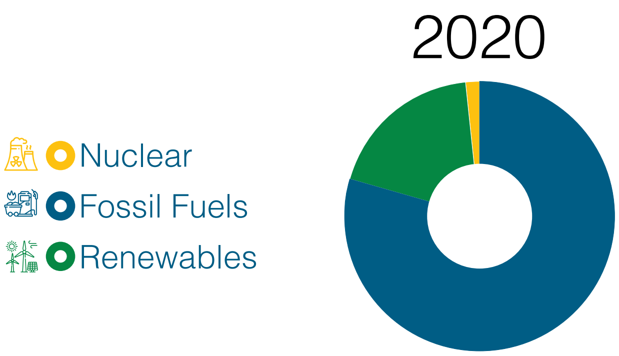
The figure shows that traditional use of biomass dominates Africa's energy supply and consumption, particularly the residential sector in sub-Saharan Africa, with more than 80% of the population relying on it. Over the 10-year period between 2010 and 2020 the consumption of traditional use of biomass increased from about 10 EJ to about 13 EJ.

Oil is the second largest source of energy in Africa and is mostly used for mobility. Coal, and natural gas are the third, fourth and fifth largest sources of energy in the continent, with coal concentrated in South Africa and natural gas in North Africa.

Currently many African countries rely on domestic oil, gas or coal resources to generate electricity, while others depend on imported fuels, leaving them vulnerable to volatile international markets. In 2020, natural gas was the largest source of electricity generation, contributing about 40% of total power generation, followed by coal at 30% (Figure 4.8).

Figure 4.8: Current electricity generation by source.





Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

Hydropower is the largest source of renewable electricity generation in Africa, making up about 20% of the total power generation in the continent in 2020.

Overall, reducing reliance on fossil fuels, which currently provide over three quarters of all the electricity generated in Africa, will be central to cutting CO_2 emissions and improving energy security (IEA, 2023).

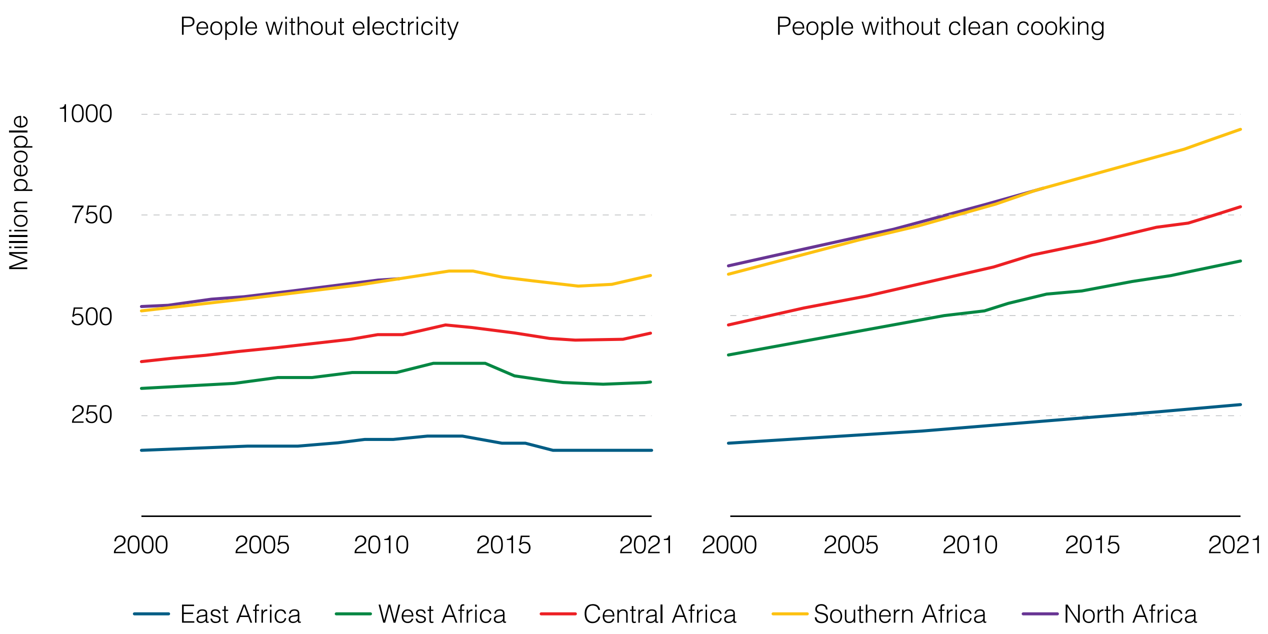
3. Baseline assessment

3.1 Definition of the baseline scenario

As stated in the introductory chapter of this report, a just transition must affirm Africa's right to development and industrialisation, ensuring that the continent achieves its development and social objectives. This view is also shared by four, randomly chosen, respondents who were interviewed on their perspectives of Africa's just transition during the recent 28th Conference of Parties to the UNFCCC held in Dubai. It is on this basis that Africa's baseline emission trajectory has been developed in this study.

Inspired by the United Nations Sustainable Development Goal 7 (SDG 7) which seeks to "ensure access to affordable, reliable, sustainable and modern energy for all" by 2030, one of Africa's main developmental goals is universal access to electricity and clean energy by 2030. It is estimated that in 2021, around 600 million people in Africa (about 43% of the population in the continent) – still lacked access to basic electricity. In the same year, it is also reported that more than 970 million people (about 67% of the population in Africa) – did not have access to clean cooking facilities. Figure 4.9 below shows the Africa population without access to electricity and modern clean energy services over time, disaggregated by region.

Figure 4 9: Population without access to electricity and modern energy services in Africa



Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

The figure shows that new electricity generation infrastructure that has been built in within the continent has barely kept up with population growth and has not reduced the number of people without access to electricity in the continent. On the other hand, the graph shows how rapidly the number of people without clean cooking facilities has been growing, especially in East and West Africa.

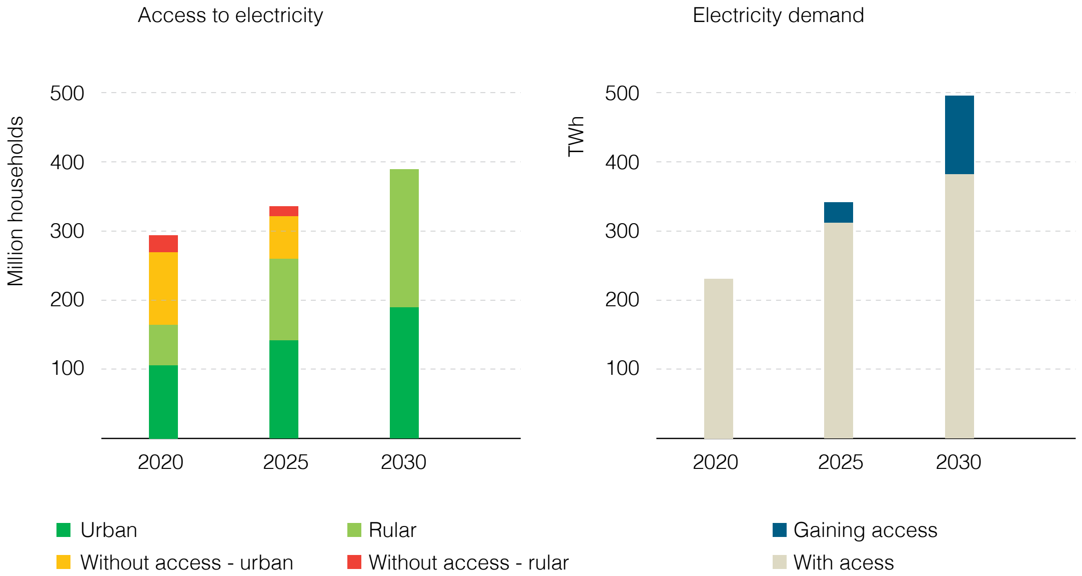
According to the International Energy Agency, achieving universal access to electricity and to clean energy is central to all other aspects of Africa's developmental goals. This is because it leads to the scaling up and improvement of energy services infrastructure, which in turn allows for an increase in energy service demands from industries and business, thereby stimulating economic development and job creation – both of which are also developmental goals of the continent.

Africa's baseline trajectory, therefore, projects a scenario where the continent achieves its developmental goals of universal access to electricity, economic development and job creation by 2030, but these are achieved through the same energy system and decisions that have been used in the past. As such the baseline trajectory can be seen as a low ambition scenario where the continent does not focus on climate change mitigation at all.

3.2 Africa's baseline emissions

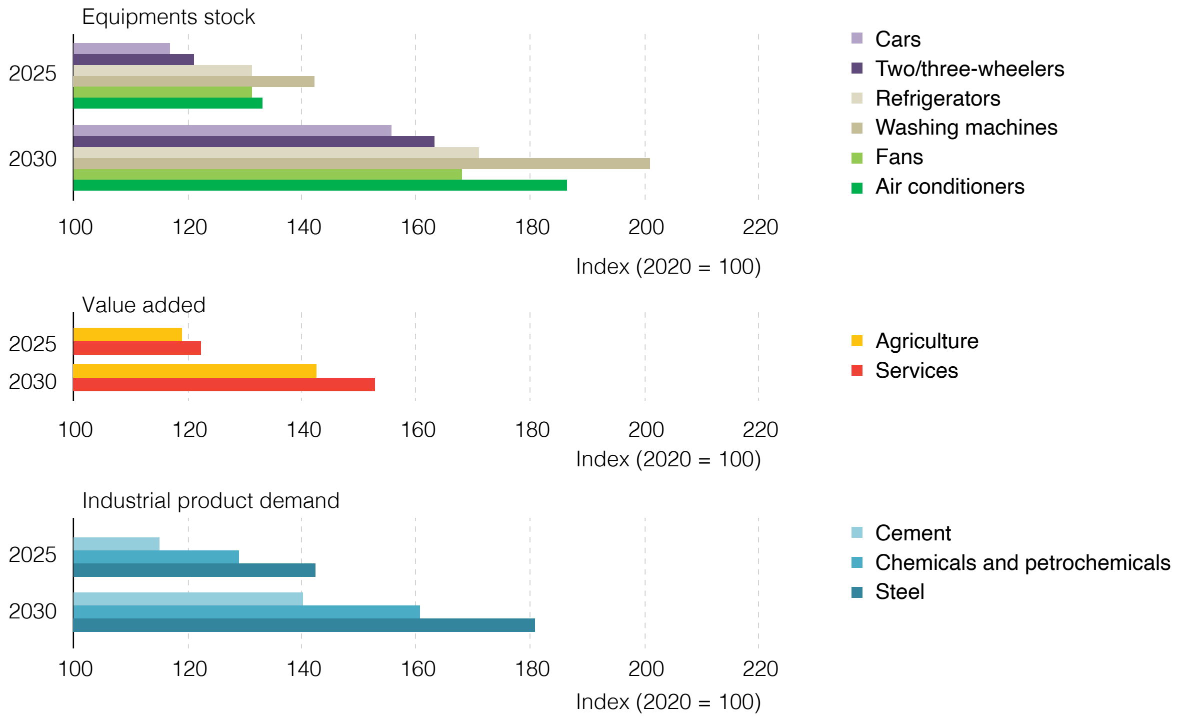
Figure 4.10 and Figure 4.11 below show the current and projected electricity access, current and projected electricity demand and growth in energy-related economic industries under baseline conditions.

Figure 4.10: Projected electricity access and electricity demand for households (including improved energy efficiency)



Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

Figure 4.11: Projected growth in energy-related economic industries between 2020 and 2030



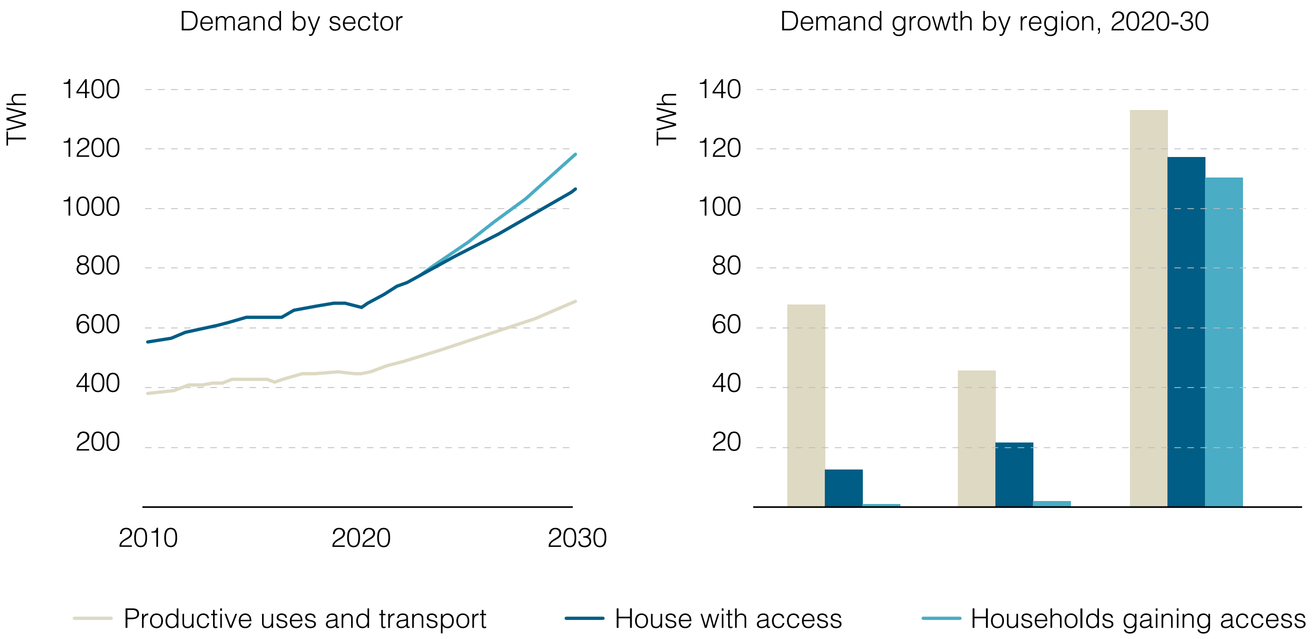
Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

The figures show that of the 300 million households in Africa in 2020, 120 million of them lacked access to electricity. To achieve universal access to electricity by 2030, growth in levels of access to electricity needs to outpace population growth in the decade from 2020 to 2030. As such, household electricity demand is expected to increase threefold between 2020 and 2030 in the absence of energy efficiency (Note: it would have doubled if energy efficiency also increased).

Furthermore, the figures show that under baseline conditions Africa's demand for industrial products is projected to rise by at least a third between 2020 and 2030, due to increase in construction and increased industrial activity. Equipment stock is projected to increase by between 40% and 100%, while value added services like agriculture are projected to increase by about 50% on average.
The assessment also shows that a rapid expansion in the vehicle fleet, especially cars and trucks, would be expected to take place in the baseline scenario, driving up transport energy demand which will continue to be dominated by oil-based fuels.

With all these increases in household energy access and use as well as economic activities, total baseline electricity demand within the continent is expected to increase by more than 100% from 680 TWh in 2020 to 1,410 TWh in 2030 in the absence of energy efficiency (to 1,180TWh if energy efficiency increases) (Figure 4.12).

Figure 4.12: Current and projected electricity demand by sector and region

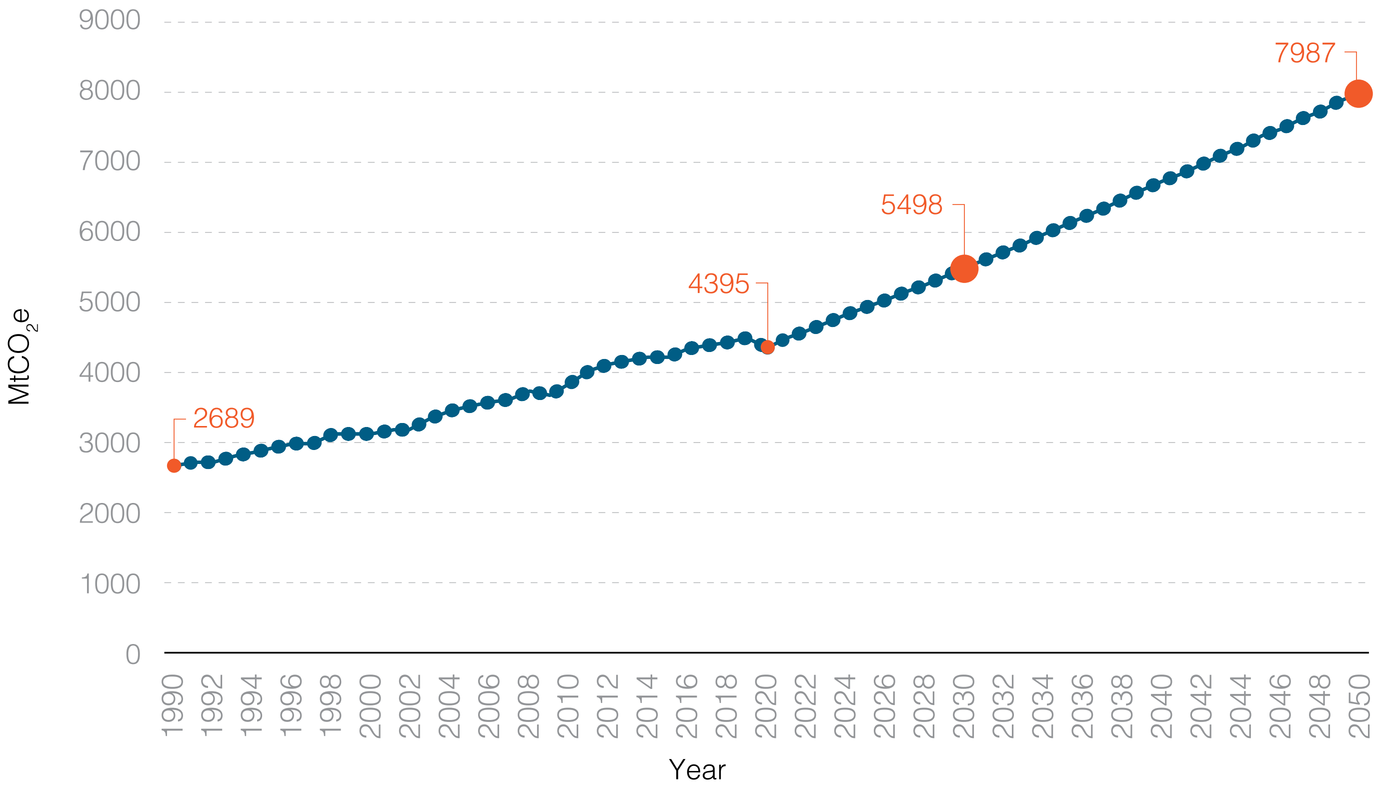


Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

The figure above shows that growth in electricity demand is expected to increase mostly in Sub-Saharan Africa where access to electricity is currently the lowest in the world. In this baseline scenario, total per capita electricity demand is expected to grow from 500 kilowatt-hours (KWh) in 2020 to 824 kWh in 2030 but remains far below that of other developing regions around the world.

Based on all these projected energy and economic demands for Africa under the baseline scenario, GHG emissions under this scenario are projected to increase from 4,395 $MtCO_2e$ in 2020 to 5,498 $MtCO_2e$ in 2030 and reaching 7,987 $MtCO_2e$ by 2050. This is an 82% increase over 30 years. Figure 4.13 below shows the projected baseline emission scenario for Africa.

Figure 4.13: Africa's projected GHG emissions baseline to 2050



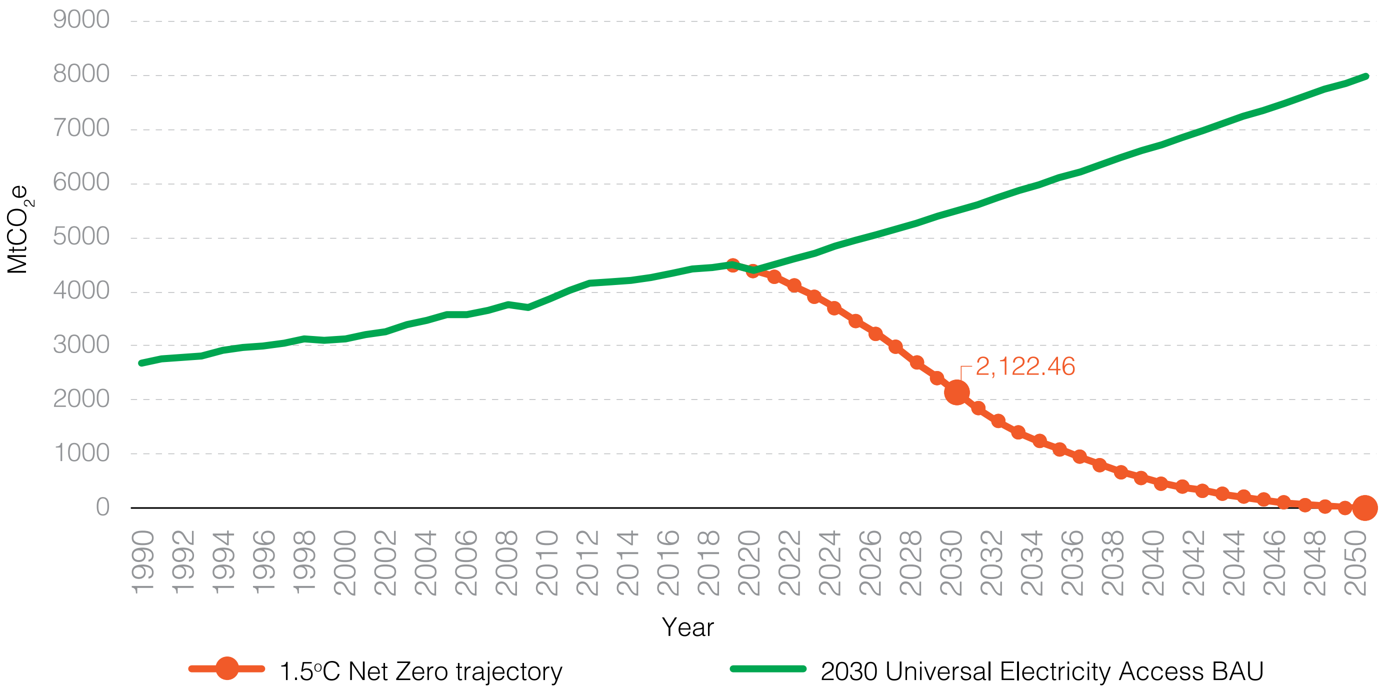
The baseline scenario was modelled to achieve Africa's goals of universal access to electricity, economic and social development by 2030 and maintaining that achievement up to 2050.

4. Required by Science

Having modelled the baseline scenario in the preceding chapter, this chapter turns to the scenario required by science to limit the global temperature increase to no more than 1.5°C. This scenario portrays a situation where Africa and the rest of the world demonstrate the highest mitigation ambition. According to the IPCC's 2018 Special Report on 1.5 degrees, global net anthropogenic CO_2 emissions need to decline by about 45% from 2010 levels by 2030 (40–60% interquartile range) and reach net zero around 2050 (2045–2055 interquartile range). Most countries have interpreted this to mean that each country, and indeed region, needs to achieve net zero by 2050 at the latest and have therefore set long-term net zero strategies accordingly. However, it could also be interpreted to meant that in accordance with the UNFCCC's principles of CBDR and RC in light of different capacities, some countries and regions should be allowed to continue increasing their emissions, especially those with low historical emissions, while those that have historically emitted large quantities of GHGs are the ones that need to reduce their emissions and enhance their sinks such that the net global effect of the activities of these two groups result in net zero by 2050.

In line with the concept of equitable access to sustainable development put forward by Winkler, Marquard and Letete (2013) which operationalises equity based on equitable access to sustainable development mostly through the human development index instead on simply using carbon space, this report has adopted the former interpretation of the IPCC's 2018 report findings. For Africa, a pathway consistent with 1.5ºC means that emissions should reach 2,122 tCO_2e by 2030 and net Zero by 2050 as shown in Figure 4.14.

Figure 4.14: Projected Net Zero scenario for Africa, as required by science.



5. Sustainable Africa Scenario

5.1 What is the Sustainable Africa Scenario?

In its 2022 Africa Energy Outlook, the International Energy Agency (IEA) has modelled a Sustainable Africa Scenario (SAS) which achieves all of Africa's developmental goals as defined in the baseline scenario, including universal access to electricity and clean energy by 2030, economic and social goals. However, this scenario seeks to achieve these goals in the most climate friendly and sustainable manner, ensuring that all of the NDCs and announced net zero emission pledges are achieved on time and in full. It also takes into consideration international financial flows consistent with African countries' conditional NDCs as well as national and corporate commitments to increase climate finance flows, and to stop financing fossil fuel projects. This scenario further assumes that all announced global commitments to reach net zero are fully implemented.

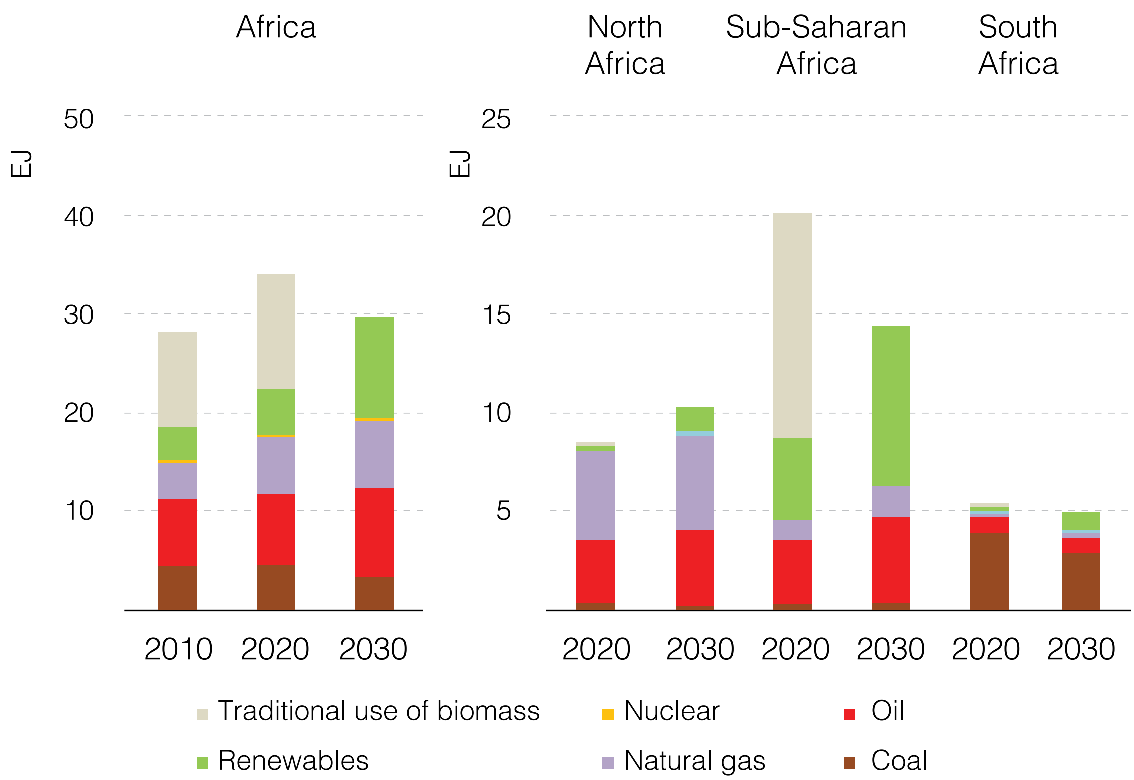
The SAS prioritises the most cost-effective solutions that are readily available and applicable to the African context and those that are able to attract the required means of implementation, especially finance.
In this study, this scenario was adopted as one most representative of Africa's just transition. Similar to the baseline scenario, it was modelled such that it achieves Africa's goals by 2030 and then those achievements are simply maintained up to 2050.

In the next section, the characteristics of the energy system under the Sustainable Africa Scenario are presented.

5.2 SAS Energy System

Under the Sustainable Africa Scenario, economic and population growth drive an increase in the consumption of all primary fuels, with the exception of traditional use of biomass and coal (IEA, 2023). Modern primary energy supply increases at an average annual rate of 3% between 2020 and 2030, while total primary energy supply (including the traditional use of solid biomass) falls by 13% by 2030. Renewables meet more than three-quarters of the increase in modern energy supply and become the leading fuel category by 2030 (ibid). This primary energy supply under the SAS is presented in Figure 4.15.

Figure 4.15: Total primary energy supply by fuel and region in the SAS

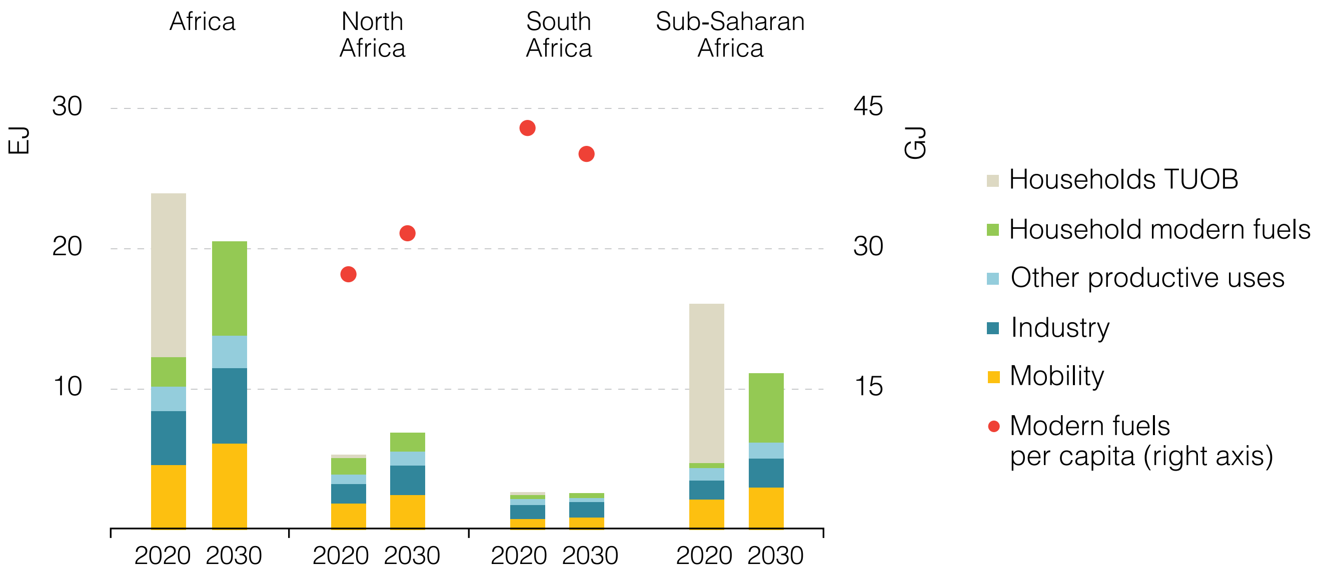


Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

The figure shows that under SAS renewables are expected to grow rapidly in all regions to 2030 while traditional use of biomass is completely eliminated, but oil and gas continue to dominate the fuel mix in the North Africa, while coal continues to dominate the energy mix in South Africa.

The results also show that eradicating inefficient biomass for cooking in sub-Saharan Africa halves total household energy in the continent by 2030, while the use in other sectors increases in most regions (Figure 4.17).

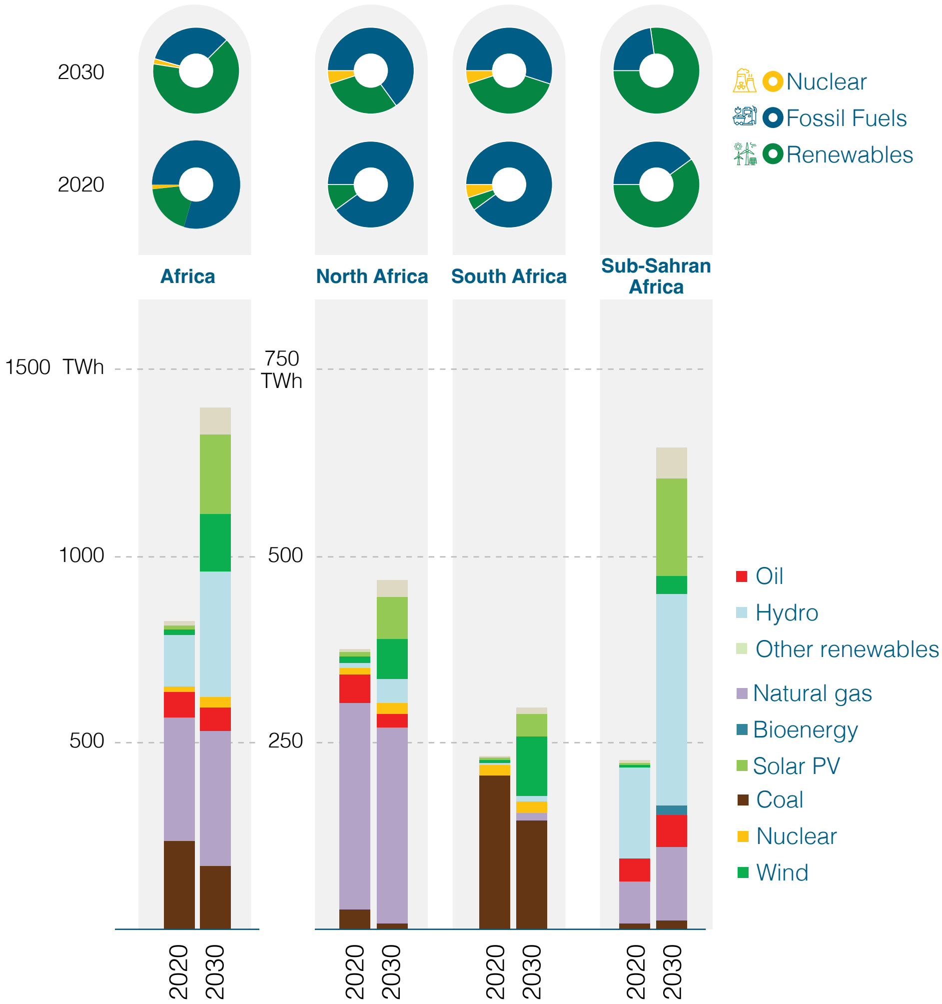
Figure 4.16: Total final energy consumption by sector and modern fuel use per capita by region under SAS



Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

Figure 4.17 below provides a summary of Africa's electricity system under the SAS, disaggregated by energy source and region.

Figure 4.17: Electricity generation by source and region in 2030, in SAS



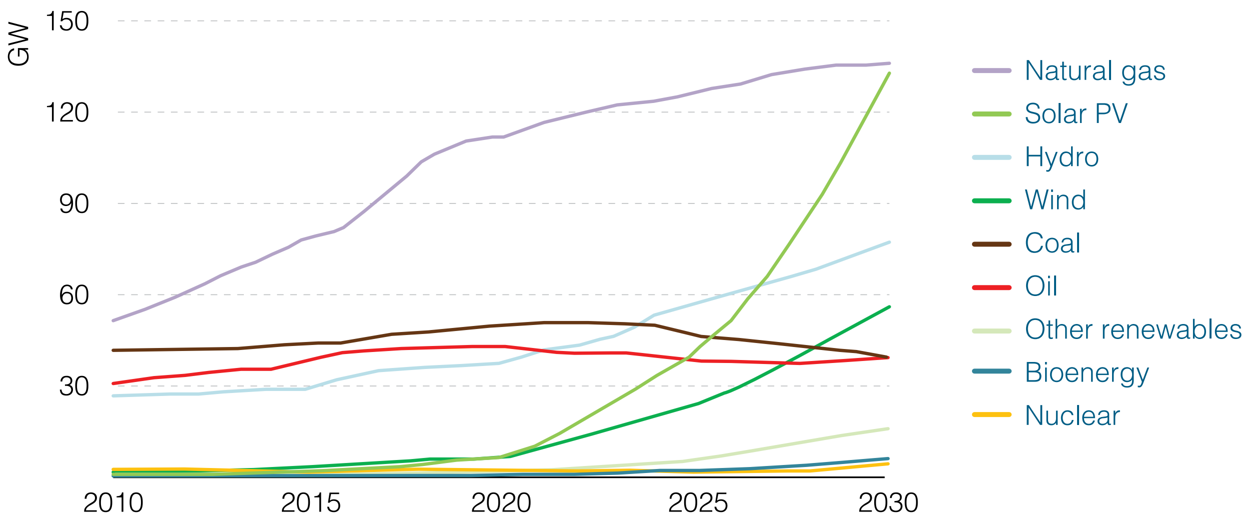
Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

The shares of natural gas and coal, neither of which are abated at present, fall over the 2020-30 period in the SAS, offset by rising shares of hydropower, wind and solar PV. The shift to renewables is driven by a continuing fall in relative costs and policies to promote low-carbon energy, which increase opportunities to exploit Africa's huge domestic potential for renewables. Africa is home to the most abundant solar resources in the world, hence under SAS, by 2030, solar PV and wind combined contribute to 27% of power generation – eight-times more than in 2020 – with major implications for the operation of power systems to ensure the balance of supply and demand at all times (IEA, 2023).

In North Africa, fossil fuel plants remain the main sources of generation through to 2030, though output from each source falls; this is more than offset by much higher output from renewables and the start of nuclear power production. In South Africa, a fall in coal output is more than compensated by a big increase in renewables, their share in total generation jumping from 5% in 2020 to nearly 45% by 2030 (ibid).

In terms of installed capacity, the capacity in the continent doubles in the Sustainable Africa Scenario, from 260 gigawatts (GW) in 2020 to 510 GW in 2030, with a profound shift in the type of power plants built across the continent. Once the projects currently under construction are completed, coal loses ground, while among renewables, solar PV overtakes hydropower before 2030 and challenges natural gas as the largest source of power generation capacity (Figure 4.18). The relative stability of the oil-fired plant fleet hides different regional dynamics, with an increase in capacity related to expanded access in sub-Saharan Africa offset by a decline in North Africa, where about 5 GW of oil plants over 30-years old are retired in the period to 2030 (ibid).

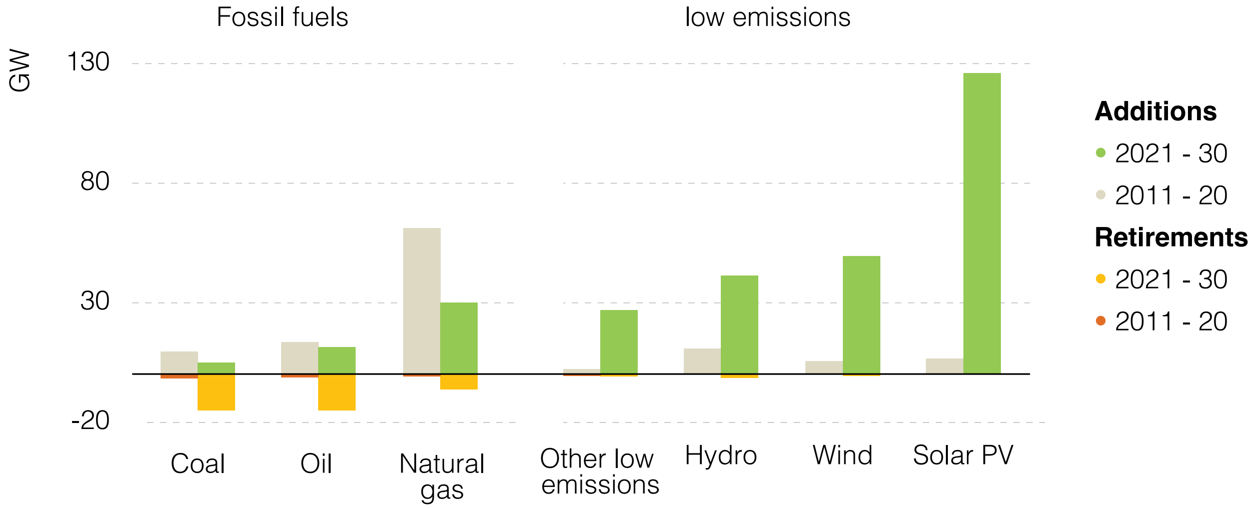
Figure 4.18: Installed electricity generation capacity by source in SAS



Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

Renewables account for 80% of the 290 GW of capacity additions to 2030, while the commissioning of new fossil fuel plants is halved relative to the previous decade (Figure 4.19) (IEA, 2023).

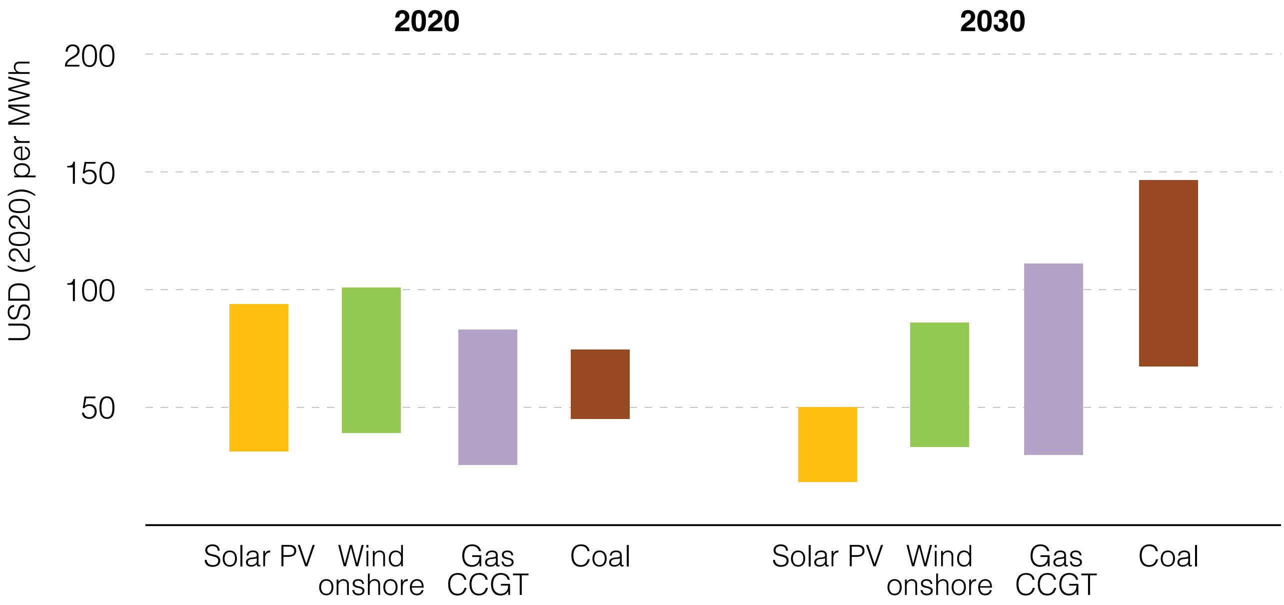
Figure 4.19: Power generation capacity additions and retirements by source in SAS



Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

According to the IEA (2023), the evolution of Africa's electricity system will be shaped by expected ongoing reductions in the relative cost of renewables, which are already the cheapest generating option in many locations across the continent Figure 4.20.

Figure 4.20: Levelized cost of electricity for selected sources in SAS.



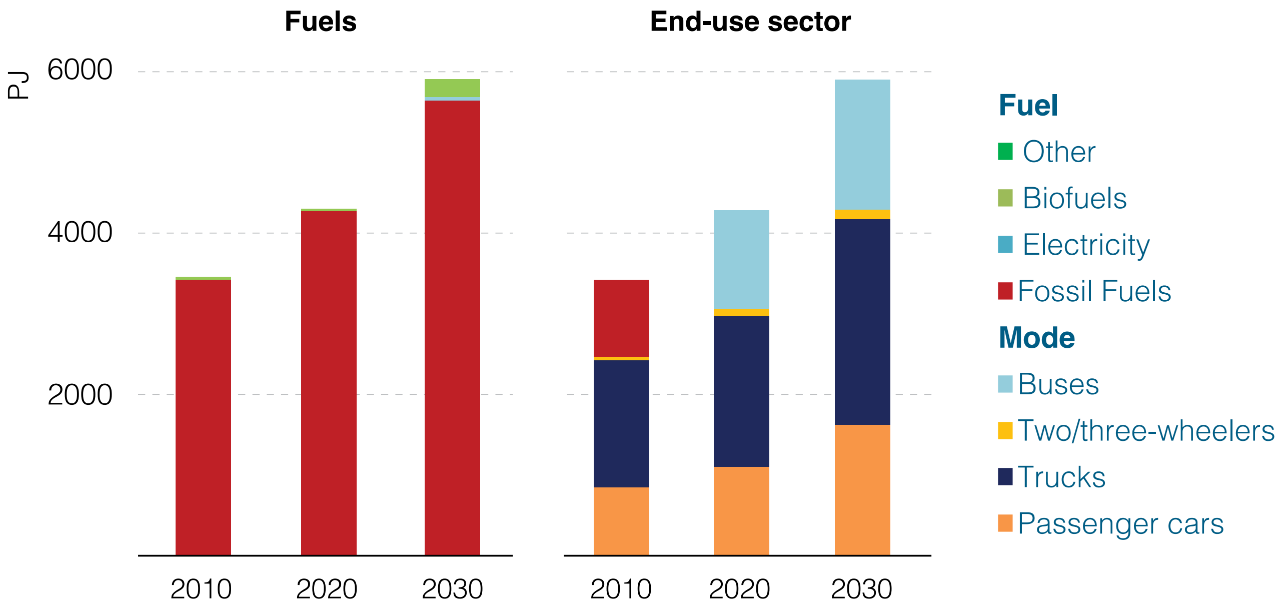
Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

The IEA projects further significant declines in the levelised cost of electricity – the average net present value of the cost of generation for a plant over its operating lifetime – for renewables-based technologies, particularly solar PV. By contrast, the cost for gas- and coal-fired plants is projected to rise substantially, in part due to higher carbon penalties, which reach USD 40 per tonne of CO_2 in South Africa by 2030. Under SAS Mini grids meet 65% of new connections in Sub-Saharan African communities located more than 20 km from grid and stand-alone systems.

In general, the projected expansion of generating capacity across Africa in the SAS strongly hinges on the ability to raise finance, most of which will hopefully come from the climate finance by the developed countries as part of their international commitments and historical responsibility. The SAS projections require annual power sector investment to ramp up to around USD 80 billion per year on average over the period 2021-30, compared with USD 30 billion over the previous decade (IEA, 2023).

For the transport sector, what is noteworthy from Figure 15 is the significant increase in energy consumption for mobility in 2030. In fact, the results shows that transport, particularly road transport which takes the lion's share of transport energy consumption, will continue to be fueled by oil up to 2030 (Figure 4.21). This means that emissions from this sector will continue to grow, almost unabated.

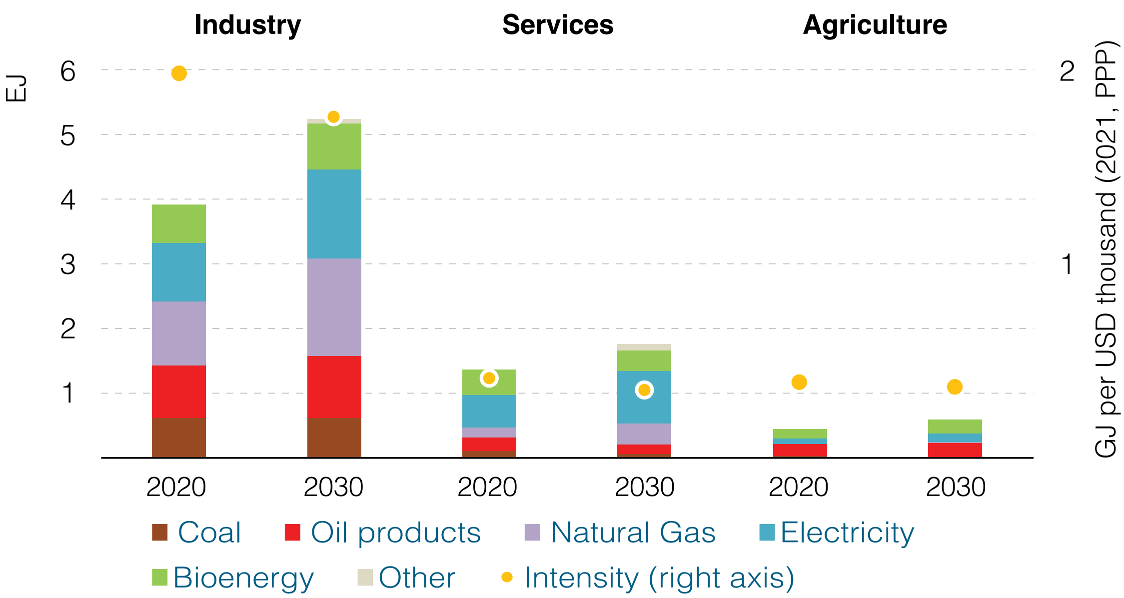
Figure 4.21: Road transport energy demand by fuel and mode under SAS



Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

For other sectors of the economy total energy consumption for productive uses rises by 33% over 2020-30 in the SAS, with the use of almost all major fuels increasing in all three productive sectors – industry, services and agriculture (Figure 4.22).

Figure 4.22: Energy consumption in productive uses by sector and fuel in SAS

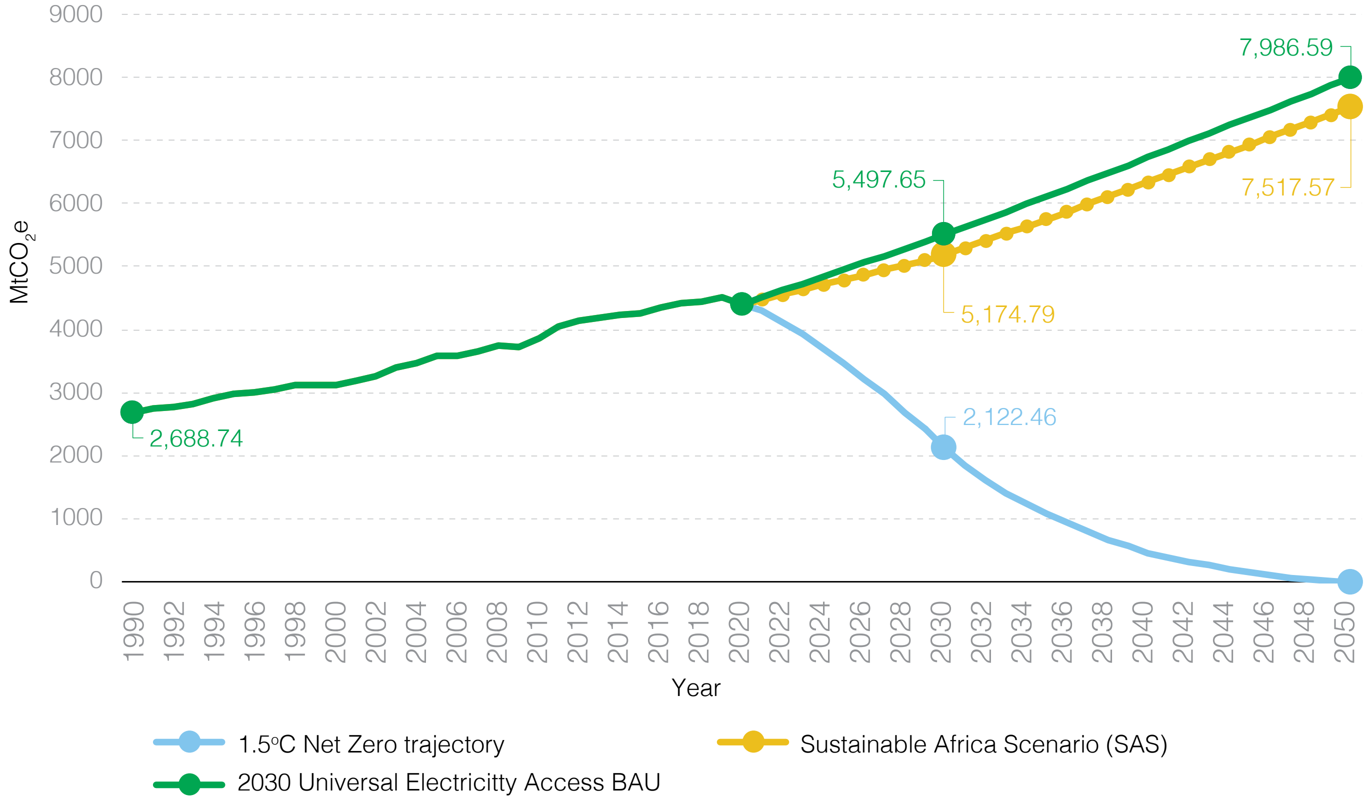


Source: IEA's Africa Energy Outlook 2022 (IEA, 2023)

5.3 SAS GHG Emissions

Figure 4.23 below presents a projection of Africa's emissions under the Sustainable Africa Scenario and shows that the scenario does not achieve much GHG emission reductions through to 2050.

Figure 4.23: Africa's projected emissions under the Sustainable Africa Scenario



The figure shows that by 2050 emissions under the Sustainable Africa Scenario are expected to reach 7,517 $MtCO_2e$, which is only 5.9% below the baseline emissions and still far from the net zero required by science. There are a few reasons for this:

a) The Sustainable Africa Scenario focuses primarily on electricity and heat where it achieves large emissions reductions, but these reductions are almost entirely offset by rapidly increasing and unabated emissions in the transport sector. This shows that while transport emissions are currently lower than those from electricity and heat, they are potentially a big problem for the future for which solutions need to be implemented immediately.

b) Secondly, because of its primary focus on electricity and heat, which only makes up 12.55% of Africa's current emissions, it has left most of the emissions untouched. Of particular interest are the emissions from Agriculture and LULUCF which make up 55% of the continent's emission profile. The section that follows tries to address this point by including the mitigation impact of the agriculture and LULUCF measures already pledged by African countries in their NDCs.

5.4 SAS+ Scenario

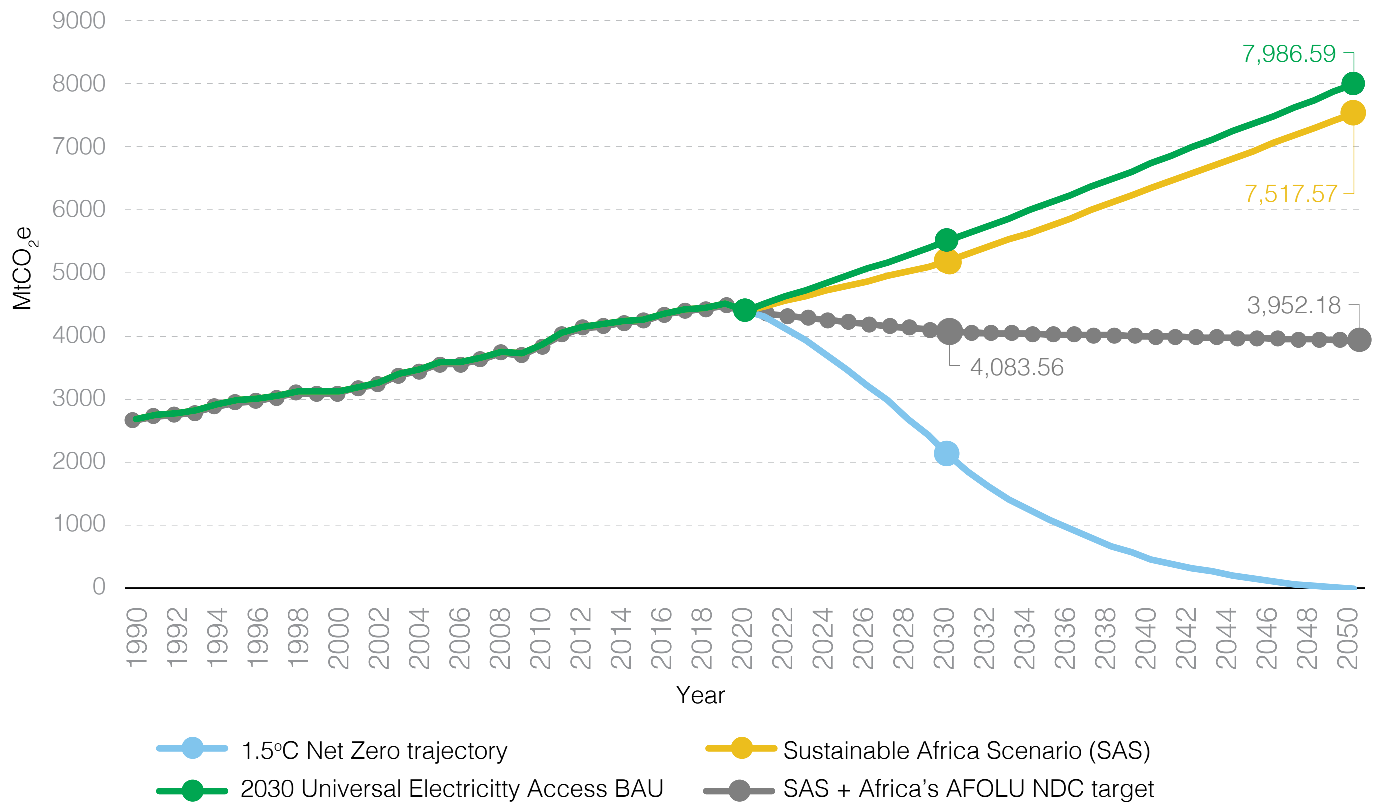
In this scenario the GHG reduction potential of the main mitigation measures in the agriculture, forestry and land sectors pledged by African countries in their latest NDCs are added to the SAS to come up with a SAS+ scenario.

It is worth nothing that while the mitigation measures of the largest countries contributing to Africa's agriculture and LULUCF emissions have been included, there were a few countries for which inclusion was not possible because of several reasons, including:

- the NDCs had not clearly disaggregated their impact.
- the impact of individual mitigation measures was not stated in the NDCs, and
- language barriers.

Figure 4.24 below presents the projected SAS+ scenario as defined above.

Figure 4.24: Africa's projected emissions under Sustainable Africa Scenario-plus



While the SAS scenario could only reduce annual emissions from the baseline by 5.9% by 2050, the results show that just the inclusion of pledged agriculture and LULUCF mitigation measures has the potential to reduce the emissions by a further 44.6% resulting in a 50% overall reduction of emissions from the baseline.

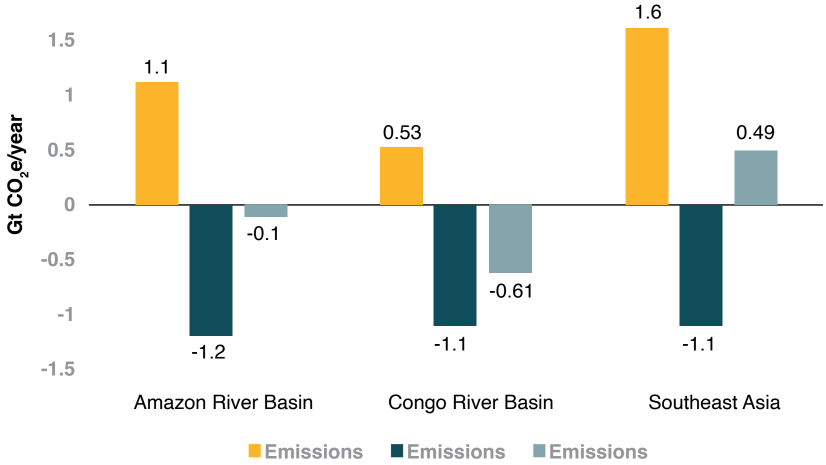
The section that follows discusses how land sector emissions can further contribute be Africa's GHG mitigation just transition agenda and how the sector can be converted into carbon sinks that offset the emissions from other sectors and hopefully close that 50% mitigation gap by 2050.

6. Carbon Sinks' potential role in Africa's Just Transition

6.1 The largest carbon sink in Africa

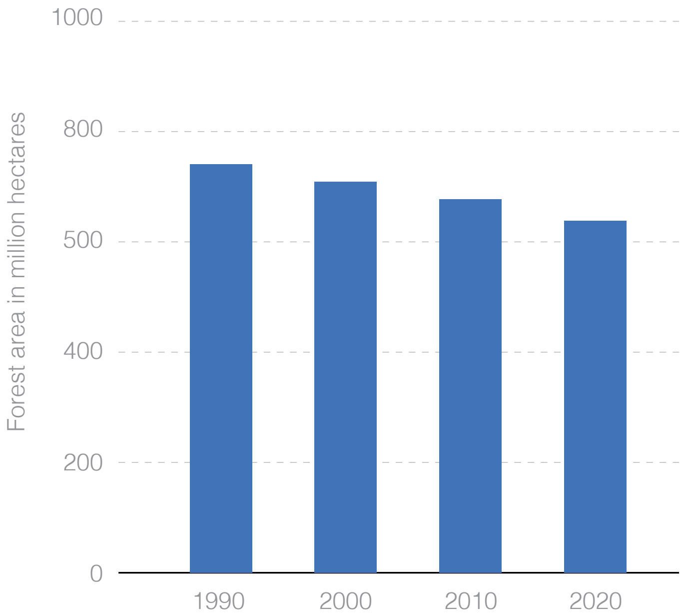
The figure below shows that global GHG emissions including land-use change were at ±50 $GtCO_2e$ in 2020. To put this into perspective, forests store ±485 $GtCO_2e$, which is over 10 years' worth of emissions. Forests have also removed carbon through sequestration as illustrated in the figure below, over the past 30 years.

Figure 4.25: Carbon removals and emissions due to change in land use (including deforestation), 1990-2021



(Source: Carbon Brief)

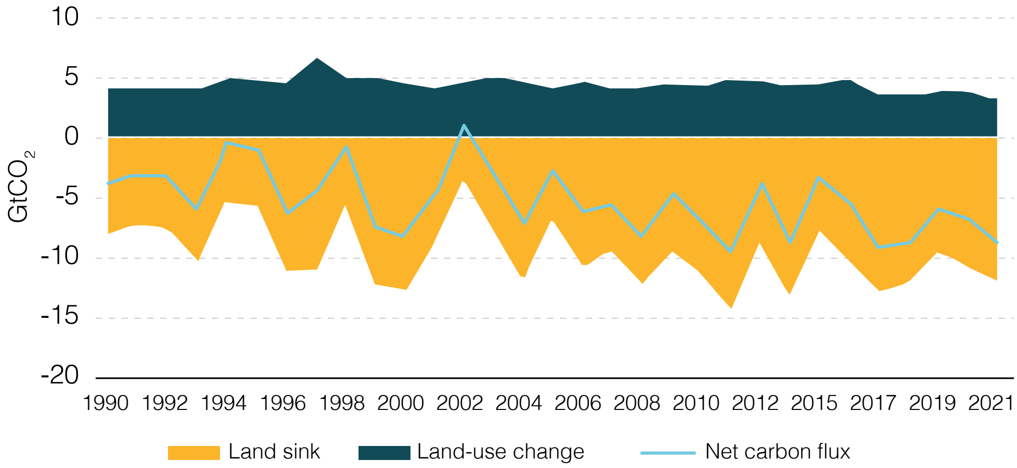
Figure 4.26: Forest area in Africa (in million hectares)

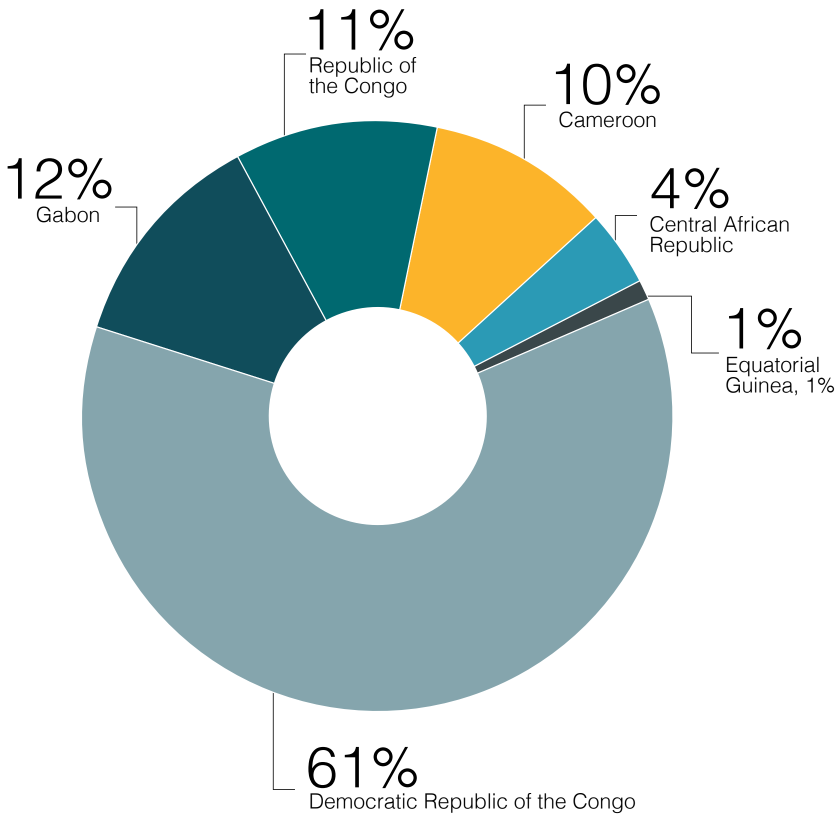


Important to note is, while there are wide uncertainties on these estimates, studies have repeatedly illustrated that tropical rainforests are important in the process of sequestering more carbon than any other types of forest. The three largest tropical forests; the Amazon River Basin, the Congo River Basin, and Southeast Asia collectively account for 44% of annual sequestration by forests. The Southeast Asia forest is emitting more than it removes due to deforestation and a net contributor of carbon—while the Amazon River Basin and the Congo River Basin are still net carbon sinks, removing more carbon than they emit.

According to Galal (2024), Africa's forest area is 674 million hectares accounting for ±23% of Africa's land area. The continent lost ±39 million hectares of forest area in comparison to 2010. Humid forests are particularly important in Central Africa, with the Congo Basin being the second largest tropical forest in the world. These forests remove ±1.1 Gigatonnes of CO_2 from the atmosphere annually.

Figure 4.27: Annual average carbon fluxes of the three main tropical rainforests, 2001-2019 (Harris et al. 2021)





Spanning over six countries, the Congo Basin is Africa's largest carbon sink. The forest conservation of the Congo Basin forests is not only vital for Africa, but also the world. The Congo basin plays an important role in storing GHG emissions that are already in the atmosphere and preserving these forests comes at a cost for the ±575 000 indigenous people that are depending on these forests for survival. Global efforts to tackle the effects of climate change and biodiversity loss will depend on preserving this rich ecosystem. This then presents a dilemma that needs to be resolved; (a) should the communities in these high density forests be subjected to poverty in the noble objective of maintaining the permanence of carbon stocks or (b) should the communities continue to be reliant on the forests for their livelihoods through unsustainable practices which are leading to the rapid degradation and deforestation or (c) should developed countries within the context of common but differentiated responsibility fund the preservation of these forests as an important global carbon sink while ensuring that the communities continue to survive and rely on the forests in a manner that is sustainable. This section attempts to respond to some of these questions through research; and provides policy-based and technical recommendations.

6.2 The value of forest conservation as carbon sinks in Africa

At COP26, 141 leaders committed to halt and reverse forest loss and degradation by 2030. The role that tropical forests play in partially offsetting GHG emissions is highly valuable to servicing the global climate ambitions. This essentially means that the world should be committing with funds to ensure that these valuable carbon stocks are conserved and maintained while adhering to the safeguard principles. Carbon removal as an asset is distinct in that it is a global public good, one which all benefit from. Quantifying a cost or benefit of an ecosystem service ensures that it is properly valued. Several studies have attempted to price or estimate the social cost of a tonne of emissions for forests. In a paper by the US Interagency Working Group on Social Cost of GHG emissions suggests, with assumptions about when climate damage peaks and how much we discount, the future emissions had a social cost of just over $50/tonne in 2020. Applying a social benefit of carbon of US$50/tonne to the global forest carbon gross removal calculated by Harris et al. (2021) suggests that the annual value of gross global carbon removal is ±US$770 billion, or ±1% of the world's GDP. Between 2001 and 2019, the average annual emissions resulting from deforestation amounted to 8.1 Gt, worth ±$400 billion per year, leaving a net removal value of ±US$370 billion. Still, it's perhaps misleading to consider only the value of net removals, as this would substantially understate the value provided by forests.

The forests in Central Africa store more than 50,000 tonnes of carbon per km2. The Congo River Basin Forest has contributed more net carbon removal than any other tropical forest in the decade. With an annual gross removal of ±1.1 Gt between 2001 and 2019, the ecosystem service the Congo River Basin provides to the world is immense. At a price of US$50/tonne of carbon in 2020, this represents a service with an annual value of some ±US$55 billion (Harris, et al., 2021). Deforestation not only destroys a forest's ability to remove carbon, but also releases significant quantities of stored carbon into the atmosphere. In the Congo Basin forest, the value of carbon removal is significantly offset by deforestation worth ±US$25 billion per year, with the net removal valued at ±US$30 billion per year (Harris, et al., 2021). Deforesting a relatively small proportion of the forest can have carbon impacts that outweigh the value of the forest's carbon removal.

One of the main mechanisms for supporting the Congo Basin is CAFI. The funding for CAFI totals just over US$230 million since 2015, and therefore is well-short of even one year's value of the climate service provided, which is estimated at US$55 billion per year. Total funding then is less than half of 1% of the annual value. Therefore, the mobilisation of adequate and predictable financial flows persistently presents a major impediment towards the attainment of the Paris Agreement targets. The high value of carbon removal and avoiding deforestation contrasts bluntly with the level of public finance provided to support forests. If we analyse the finance provided to African countries for the forest, it shows that the support reached its peak at US$321 million in 2020 in the past decade or so. The value of the carbon removal service by Congo Basin forests is ±150 times the average level of international public finance for Africa's forests (US$170 million in the 10 years to 2020), even after taking account of deforestation. With these limited incentives and these ecosystem services largely unfunded, it is perhaps not surprising that African countries are pursuing deforestation. While it is possible that countries could position forests into a financial asset where offsets are sold to the private sector, the urgency of the situation suggests that there is a need for international public support to provide substantial payments to countries to preserve their forests and avoid deforestation.

6.3 The cost of carbon sinks in Africa

The African development Bank estimates that the continent requires as much as $2.8 trillion through 2030 to implement its climate commitments set out in countries' national targets under the Paris Agreement. However, Africa's climate finance inflows remain very low, at 3% of global climate finance, and tend to focus on small-scale, fragmented, and uncoordinated operations. While evidence points to a significant increase in climate finance in recent years, it is still far short of the estimated needs and priorities. In 2019, the total climate finance flows to developing countries were roughly US$70 billion against an estimated annual requirement of US$100-300 billion. The amount of equity financing for climate change in Africa is much lower than in other regions and the International Finance Corporation (2018) estimates that this may reach US$2.5 trillion by 2040.

In addition, most climate finance flows are in the form of loans, rather than grants, which can reinforce debt burdens for developing countries. There is also a lack of transparency and accountability in the way climate finance is allocated and disbursed. On the other hand, the current financial architecture and governance arrangements under the Paris Agreement are yet to support countries in addressing climate related loss and damages which are predicted to become more frequent and intense in the coming decades. Evidently the countries that are home to the Congo River Basin are providing a valuable service to the world and if they are not rewarded or funded for that service then there is little to no incentive to maintain it. Considering the low influx of funds to these countries, it is only fair that the countries are pursuing economic opportunities that come with deforestation. There have been long-standing efforts to protect forests and their carbon removal with financial aid. This is controversial as removing global emissions alone has very little direct benefit for the recipient country and, by definition, aid, specifically official development assistance (ODA), must promote and specifically target the economic development and welfare of developing countries. Forestry projects may also have local benefits, and these may justify the categorisation as aid. ODA remains the main financial mechanism for supporting forests. ODA to forests remained mostly flat in the last decade despite a push in 2020, mainly driven by additional multilateral funding. Hence, in 2020, ODA to forestry reached its highest in a decade, above $1.1 billion.

Among bilateral donors, Germany, the United Kingdom, and France are particularly active in aiding for forest protection, representing almost two-thirds of total ODA to forests provided by donors. On the multilateral front, there are various initiatives, many funding work on REDD+. Such initiatives include UN-led work, and others including, the Forest Carbon Partnership Facility, the Congo Basin River Fund, and the Biocarbon Fund. Next to ODA, other official flows, which do not meet the ODA criteria. The high-quality evaluation evidence on the effectiveness of climate aid is currently limited. Given the magnitude of the funding requirements at stake, public money alone is not sufficient. Governments have tried to mobilise private sector finance to contribute to forest protection. Between 2012 and 2020, amounts mobilised have not increased and remained stable at around $100 million a year. Private sector mobilisation has therefore amounted to under 10% of ODA resources for forests overall and within Africa, suggesting that the efforts to catalyse private finance have had limited results.

6.3 African countries: GHG net emissions/removals by LULUCF / LUCF emissions in $GgCO_2e$

According to the 2021 Africa Energy Review, Africa's annual CO_2 emissions are estimated at 1.62 billion (4% of global emissions) of CO_2e. Most of the African countries have published their net GHG emissions/removals by LULUCF / LUCF emissions apart from a few countries. The table below gives an overview of GHG emissions/removals by LULUCF / LUCF in $GgCO_2e$:

Table 4.1: GHG net emissions/removals by LULUCF / LUCF emissions in $GgCO_2e$

	Algeria	Angola	Benin	Botswana	Burkina Faso	Burundi	Cabo Verde	Cameroon	Central African Rep	Chad	Comoros
Year 1	8 586	- 3 048	- 47 523	- 38 734	- 1 390	- 2 998	- 70	22 186	- 39 315	-46 441	- 895
Year 2	- 7 880	1 908	- 11 333	- 22 680	47 115	- 1 285	22	- 76 581	- 1 745 925	7	- 3 174
	-192%	-163%	-76%	-41%	-3491%	-57%	-131%	-445%	1153%	-100%	255%

	Congo	Cote d Ivoire	DRC	Djibouti	Egypt	Equatorial Guinea	Eritrea	Eswatini	Ethiopia	Gabon	Gambia
Year 1	-69 861	- 19 847	-176 840	- 604	-9 900	-	1 676	- 3 253	- 31 810	-	-49 983
Year 2	-82 066	- 18 377	-178 779	- 2 454	-	-	-	-	25 505	71 453	389
	17%	-7%	1%	306%	-100%	#DIV/0!	-100%	-100%	-180%	#DIV/0!	-101%

	Ghana	Guinea	Guinea-Bissau	Kenya	Lesotho	Liberia	Libya	Madagascar	Malawi	Gabon	Gambia
Year 1	-26 052	- 17 597	- 11 288 401	-28 000	1 261	-96 811	-	- 238 971	19 901	-	-49 983
Year 2	5 566	-443 971	- 10 718	21 156	- 1 378	-20 407	-	- 96 191	17 516	71 453	389
	-121%	2423%	-100%	-176%	-209%	-79%	#DIV/0!	-60%	-12%	#DIV/0!	-101%

	Sierra Lionne	Somalia	South Africa	South Sudan	Sudan	Tanzania	Togo	Tunisia	Uganda	Zambia	Zimbabwe
Year 1	-	-	- 16 982	2 761	17 776	-	14 076	- 1 773	8 253	3 458	- 62 239
Year 2	-	-	- 18 616	2 761	9 381	-	18 139	- 2 142	10 494	-	- 83 000
	#DIV/0!	#DIV/0!	10%	0%	-47%	#DIV/0!	29%	21%	27%	-100%	33%

	Mali	Mauritania	Mauritius	Morocco	Mozambique	Namibia	Niger	Nigeria	Rwanda	Sao Tome & Principe	Senegal	Seychelles
Year 1	- 9748	- 749	- 221	- 4 511	- 61 054	- 5 708	6 106	105 010	- 7 010	- 358	-10 522	- 833
Year 2	- 244 799	- 1 319	- 407	4 360	33 721	10 572	-34 571	98 003	- 8 545	- 321	-11 401	- 825
	2411%	76%	84%	-197%	-155%	-285%	-666%	-7%	22%	-10%	8%	-1%

Total Year 1 = - 12 309 004 GgCO_2e
Total Year 2 = - 2 751 079 GgCO_2e

Note:

- Year 1 data is based on the first GHG inventories publicly published by African countries, therefore the years vary between 1990s to 2000s.
- Year 2 data is based on the 2nd GHG inventories published by the various African countries; therefore, the years vary between 2004 to 2016.
- The data is sourced from the UNFCCC database.
- The GHG emissions/removals data availability varies by country.
- This is the best source of data thus far, and therefore it is assumed that it has been calculated/estimates correctly, or rather the closest data that can be used to estimate the carbon sinks in Africa.
- The data is based on 5bis. Land-Use Change and Forestry category: 5bis.A. Changes in Forest and Other Woody Biomass Stocks; 5bis.B. Forest and Grassland Conversion; 5bis.C. Abandonment of Managed Lands; 5bis.D. CO_2 Emissions and Removals from Soil and 5bis.E. Other

A high-level analysis of the inventory shows that most of the African countries have published their net GHG emissions/removals by LULUCF / LUCF emissions apart from a few countries such as the Equatorial Guinea, Libya, Gabon, Sierra Lionne and Somalia. This does not mean that these countries did not submit or publish their GHG emissions, it means that when it came to the assessment of the LULUCF / LUCF emissions category, the emissions/removals were either not estimated or reported. Based on the inventory's information, earlier GHG emissions and removal inventories shows that Africa has a carbon sinks potential of 12,309,004 GgCO_2e. However, over the years, the carbon sinks have significantly declined to an alarming 2,751,078 GgCO_2e.

6.4 Mechanisms to protect carbon sinks in Africa.

a) Reducing Emissions from Deforestation and Degradation
Notwithstanding the controversy of the programme, the REDD+ has been widely recognised to address environmental degradation by assigning value to intact forest ecosystems. The one concern is that REDD+ faces many challenges related to implementation. The main issues range from permanence (forest carbon savings are not permanent, i.e. cases of deforestation) to leakage (when carbon conservation in one area drives deforestation in another area) to baseline data establishment (measure historic deforestation to establish a baseline for calculating reduction). Further questions over land rights as well as how local communities will benefit (the cost of registering and establishing a REDD+ project may top US$50,000) are also valid. There are concerns that REDD+ is perceived as an attempt to limit economic development in countries with rainforests. Some forest-rich countries that have low deforestation rates have expressed concern that they risk being excluded from the process since their forests are not under immediate threat.

b) UN-REDD programme
UNEP, UNDP, and FAO collaborated in the establishment of the UN-REDD Programme, a fund that allows donors to provide funding to reduce global emissions from deforestation and forest degradation in developing countries. Since the programme was launched in 2008, the UN-REDD Programme has been supporting 65 partner countries across Africa and has been the largest international provider of REDD+ readiness assistance in terms of funding, expertise, and geographical scope.

c) The Forest Investment Program
The Forest Investment Program (FIP) is a targeted programme of the Strategic Climate Fund (SCF) within the Climate Investment Funds (CIF). The FIP supports developing countries' (23 countries) efforts to reduce deforestation and forest degradation (REDD+) and promotes sustainable forest management that lead to emission reductions and the protection of carbon reservoirs. Concerns raised about this programme include the following:

- Civil society and private sector observers have expressed concerns that the FIP criteria for country selection, which are almost exclusively technical, fail to consider recipient countries' governance capacities.
- Although the FIP's operational guidelines were revised to reference the UN Declaration on the Rights of Indigenous Peoples (UNDRIP), specific criteria to comply with UNDRIP have not been incorporated.
- The Forest Peoples Programme raised concerns that the FIP investment plans excluded stakeholder engagement, particularly of indigenous communities.

d) Clean development mechanism
The Clean Development Mechanism (CDM), is a project-based, offset system that came into effect under the Kyoto Protocol. It has the objective of reducing the global cost of GHG mitigation by opening the market for those countries with legally binding emission reduction targets to gain from trade with countries that do not have legally binding targets. Thus, carbon credits can be purchased from projects developed in non-industrialised nations (non-Annex 1) by industrialised (Annex 1) countries. To a lesser degree, the CDM has also been used by some countries to promote sustainable forestry and agricultural activities.

A major inhibiting factor to the growth of the CDM in Africa is the limitation on types of activities currently eligible for the CDM. The land use sector holds the greatest potential for carbon finance in most African countries. However, under the current rules, project activities implemented in forestry are limited to narrowly defined afforestation/ reforestation activities. The absence of forestry projects under the Kyoto Protocol owes primarily to the fact that rules and methodologies for crediting these activities are very complex and forest credits are not currently considered an eligible asset. Another concern is that carbon credits associated with carbon-removal technologies are generally costed at between US$100-US$400/MtCO_2e in developed countries while contributions to preserve Africa's rainforests (that have multiples benefits) are often estimated to be worth US$5/Mt$CO_2$e or less. This discrepancy is quite concerning and must be resolved as a matter of urgency to ensure that there is a fair and equitable carbon price for Africa.

e) Voluntary carbon market
The voluntary carbon market follows a similar project cycle to CDM, with the main difference that the credits are not uniformly issued or regulated by the UN and are typically sold in volumes that appeal to retail clients seeking a smaller number of reductions to offset their carbon emissions. While carbon credits have the potential to reduce emissions by funding sustainable forest management, the estimated carbon savings from conserving forests and reducing deforestation have been generally overstated. The calculations used to quantify the saved carbon have promised greater emissions reductions and inflated conservation successes. Another concern is the potential for greenwashing, where corporations and governments purchase carbon credits without making significant efforts to reduce their carbon footprint. Another challenge with forest carbon credit markets is ensuring that the credits accurately measure the carbon sequestration potential of forests. Finally, there are concerns that some governments' accounting practices may allow companies to sell offsets generated from replanting efforts when they were the ones that cleared the forest in the first place.

f) Forest Carbon Partnership Facility
The Forest Carbon Partnership Facility (FCPF) is a World Bank multi-donor fund of governments and non-governmental entities, including private companies, and consists of two separate but complementary funding mechanisms, namely a Readiness Fund and a Carbon Fund. The FCPF was created to assist developing countries to reduce emissions from deforestation and forest degradation, enhance and conserve forest carbon stocks, and sustainably manage forests. Launched in 2008, the FCPF works with 47 developing countries across the world and 17 donors. An external evaluation of the FCPF in 2011 confirmed that the FCPF has made significant progress, specifically in building in-country capacity and disseminating lessons learned. However, the report was critical of the pace of financial commitments and disbursements from the Readiness Fund, the inflexibility of rates to adjust to country needs, the lack of in-country procurement capacity and the limited country level involvement of World Bank staff. In a report by the Forest Peoples Programme and FERN, the World Bank was criticised for failing to uphold commitments on human rights. The Centre for International Environmental Law criticised the FCPF's safeguard approach for not being sufficiently rights-based.

g) Central African Forest Initiative
Launched during the 2015 United Nations General Assembly, the Central African Forest Initiative (CAFI) is a collaborative partnership that gathers UNDP, FAO, the World Bank, six Central African partner countries and a coalition of donors. It aims to support governments in the African region to implement reforms and enhance investments to halt drivers of tropical deforestation. CAFI's objectives are to catalyse high-level policy dialogue and scaled-up funding to support ambitious reforms and on the ground action to reduce forest-related emissions and poverty.

h) Lowering Emissions by Accelerating Forest finance (LEAF) coalition
Lowering Emissions by Accelerating Forest finance (LEAF) coalition offers significant economic incentives for protecting tropical forests by selling carbon credits for avoided deforestation. The initiative was launched by Norway, the U.K and the U.S, LEAF is a public-private alliance that also involves companies including Amazon, Nestle and Airbnb among others. The purpose of the coalition is to provide a platform and function as an intermediary buyer, to speed up and standardise the credit-buying process for both forest-nation sellers and international buyers.

6.5 Key takeaways

- In the Congo River Basin Forest, one of the few tropical rainforests still acting as a significant net carbon remover, funding does not match the price of climate service at $55 billion, or $30 billion after taking account of deforestation, while a total ODA for forestry in Africa only reached $170 million on average over the last decade.
- Financial aid and private sector mobilisation for forest protection are still quite small considering the value of the climate service provided by African forests to the world. While the total annual funding for forest protection barely reaches US$1billion, the carbon removal service provided by forests would be close to 300 times this amount.
- With valuable and long-term incentives, the countries that are home to the Congo River Basin Forest can get the opportunity to not only be incentivised for maintaining the world's largest carbon sink but would be less likely to contribute to further deforestation.
- The international community has attempted to create a carbon market for forests. However, without concrete success so far, leaders should take this reality into consideration to design a clear market mechanism to enable a fair price to incentivise developing countries to preserve forests and their carbon absorption capacity.
- The protracted debates on climate financing at the annual COP meetings, the non-fulfilment of pledges made by developed country Parties as well as impediments on access to the available climate finance, all point to the dire need for a paradigm shift in approach. This should entail leveraging innovative financing instruments to attract private climate financing in Africa (a blended finance).
- There are various mechanisms that serve as instruments to drive the protection of forests. However, there are various implementation challenges that prevent the flow of funds into African countries for this purpose. The very nature of carbon sinks is that they are characterised by inherit issues that include permanence, leakage, baseline data and land rights issues among others.
- An independent assessment of these funding mechanisms has indicated that most of these do not take into consideration the safeguard principles and ignore the requirements of a formalised stakeholder engagement process.
- CDM generally does not include forestry projects and as a result has been limited in the African continent. An alternative could be the voluntary carbon market mechanism however there needs to be standardised and uniform processes to assess forestry-based carbon credits.

CHAPTER 5 : JOBS IMPLICATIONS OF THE ENERGY TRANSITION

By Stanley Semelane and Emily Olifant

1. Background

The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC), dealing with greenhouse gas emissions mitigation, adaptation, and finance. As part of this agreement, various nations have committed to National Determined Contributions (NDCs) that aim to reduce emissions, improve emissions reporting and strategic planning that aims to improve national contributions to climate change mitigation. While the climate change risk is a key driver of low carbon technology adoption worldwide, it is important to note that the African continent still has a significant amount of fossil minerals that are not exploited due to their environmental impact. Moreover, low carbon technologies such as solar, wind, electrolysers and low carbon feedstock boilers are generally not manufactured in the African continent.
African countries have ratified the Paris Agreement and subsequently developed Nationally Determined Contributions (NDCs) aimed at driving climate change mitigation and adaptation initiatives in individual countries. In 2020, Individual African countries revised their NDCs for the period 2020 – 2030 as a commitment to make their fair contribution towards managing the climate change risk.

The global requirements that are driving African nations to adopt more cleaner and sustainable economic growth policies. This involves changing the way energy is produced and used on a global scale. This is encapsulated by the energy transition concept and has driven various nations to develop extensive planning frameworks to accommodate the economic and socio-economic changes associated with the transition. These planning frameworks aim to mitigate economic and socio-economic losses whilst capitalising on benefits created by more sustainable energy sources both technical and economic. It is crucial to ensure that African vulnerable countries experience a just transition. Figure 5.1 shows the countries that are considered in this study.

The development of planning frameworks in the least and developing economies such as eSwatini, Equatorial Guinea, Ghana, Democratic Republic of Congo (DRC) and Botswana is important, especially since these countries are expected to contribute to low carbon economic development in the absence of industrial development policies. Local manufacturing of low carbon technologies is one policy instrument that could be adopted to drive African industrial development. However, dependence on imported low carbon technologies perpetuates a transition that is not aligned with the principles of just transition, particularly, in regions that have grown their economies through fossil-based development.

Figure 5.1: Countries considered in this study

The African continent requires extensive research into the current energy structure and implications of future commitments made as part of the Paris Agreement. Therefore, there is a need to further build capacity and provide decision support for the assessment of the socio-economic development impacts of the implementation of NDCs. In anticipation of the negative and low economic impact that the African country would experience as it responds to climate change, there is a need to understand the job implications associated with the adoption of low carbon technologies to achieve NDCs commitments made by the African nations.
Sector job resilience plans for African nations' value chains and priorities for piloting (coal, metals, petroleum-based transport, agriculture, and tourism) that would either be adopted or phased down between now and 2030 need to be understood and quantified.

According to the (International Labour Organisation, 2018), the transition to a low carbon economy will affect various aspects of how goods and services are provided. Likewise, the Paris Agreement aims to ensure that environmental sustainability through the adoption of an accelerated decarbonisation agenda is achieved. As a result, jobs created through the value chains of the technologies that each country would adopt need to be evaluated. The three principles that a just transition needs to recognise are decent jobs, poverty alleviation and a path towards environmental sustainability. For this reason, it is important to optimise jobs created from sustainable technologies. The deployment of matured locally produced technologies would play a significant role in growing new skills and driving low carbon economic development in that African region.

As such, this chapter would assess job implications associated with the adoption of sustainable technologies in line with the 2020 NDCs commitments. This would entail assessing the following:

i. Energy transition jobs implications on baseline scenarios (fossil fuel industries).

ii. Jobs and employment implications profiles based on various emission profiles and scenarios.

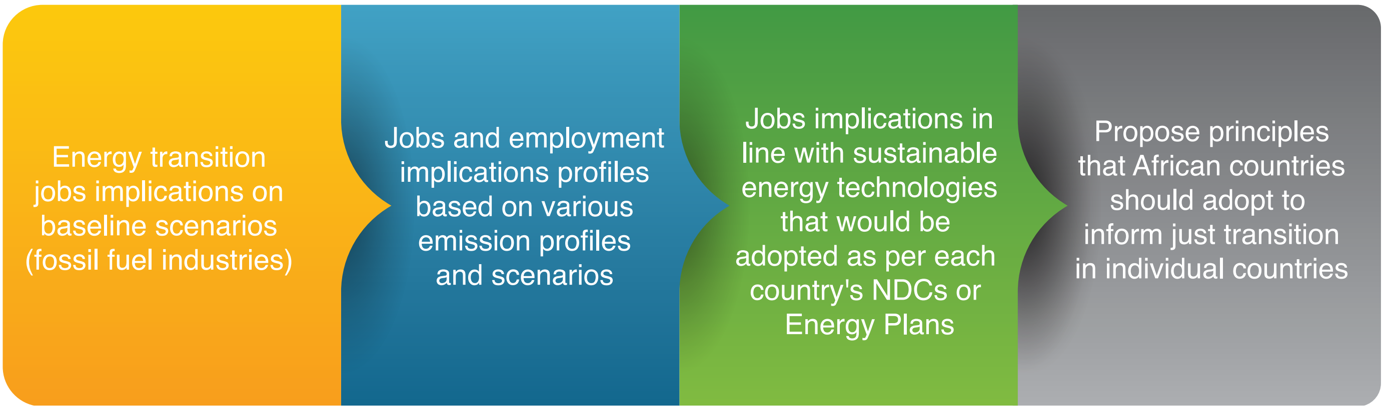
iii. Jobs implications are in line with sustainable energy technologies that would be adopted as the country's NDCs (JEDI Modelling). In countries where energy transition policies are non-existent the sustainable energy resources available in a specific country would be used to determine jobs and employment potential.

1.1 Job implications

The envisaged outcomes for this chapter aim to evaluate job implications that could be derived from the African continent Just Energy Transition through a case study of eSwatini, Botswana, DRC, Equatorial and Ghana. These estimates would be quantified on the basis that there would be positive economic benefits that will be generated from the adoption of local production of sustainable energy technologies.

1.2 Objectives and envisaged outcomes

Figure 5.2: Project objectives and envisaged outcomes



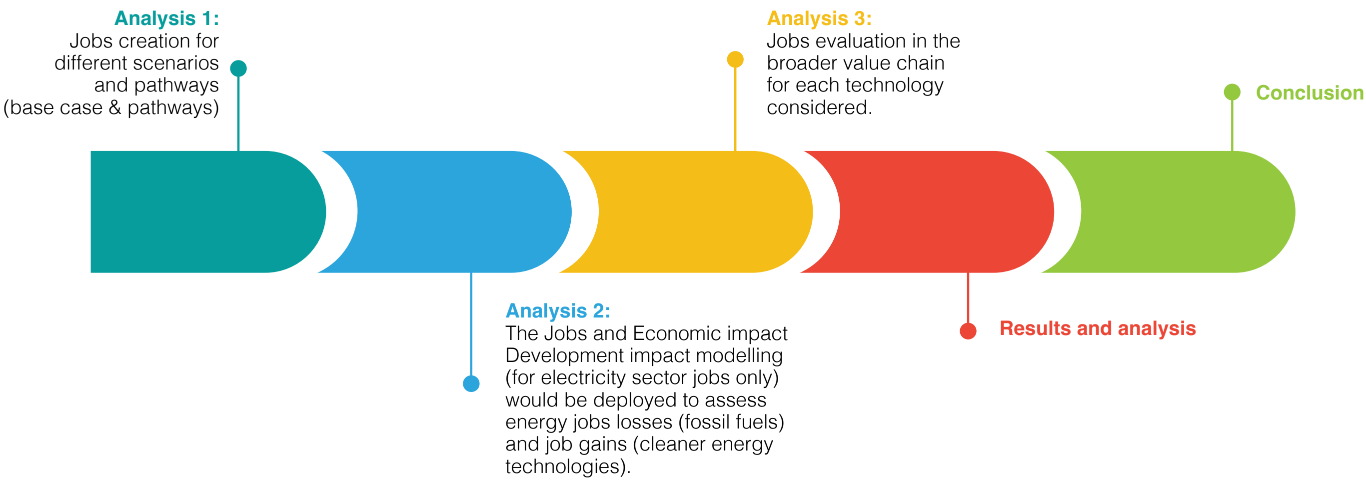
2. Methodological approach

2.1 Energy jobs analysis per individual country

The study would assess traditional and non-traditional job creation from energy industries in the case study countries. This task entails energy jobs baseline assessment in order to determine whether the scenarios and pathways that the study would adopt will have positive or negative impacts.

No direct contact would be held for this task, the baseline data sourcing would be gathered from the literature. Appropriate and sufficient data analysis would inform the job estimates for various energy technologies. Desktop analysis and qualitative and quantitative methods will be applied to determine the job implications.

Figure 5.3: Study layout approach



- **Analysis 1:** Jobs creation for different scenarios and pathways (base case and pathways).
- **Analysis 2:** The Jobs and Economic Impact Development Impact Modelling (for electricity sector jobs only) would be deployed to assess energy job losses (fossil fuels) and job gains (cleaner energy technologies).
- **Analysis 3:** Jobs evaluation in the broader value chain for each technology considered.

Base case scenario – This scenario is a real representation of the actual number of MWs installed to date on both utility and embedded generation scales (based on the latest reports and literature).

Jobs acceleration – To be analysed through increased local manufacturing scenarios (irrespective of whether the technical capability exists in individual countries.

2.2 Model description

According to (Goldberg & Milligan, 2004), the JEDI model is a user-friendly tool that evaluates the economic impacts of constructing and operating power plants. The JEDI model can analyse the energy impacts of wind, biofuels, concentrating solar power, geothermal, marine and hydrokinetic power, coal, and natural gas power plants. JEDI is an Input-out (IO) model based on a set of simultaneous equations that measure the sectoral linkages within an economy, producing the Leontief inverse matrix (Allan et al., 2020). The JEDI model is developed using information from national and regional economic IO data. The IO data provides a view of the economy within an area for a set time frame (usually a year) and current the financial value of all these transactions. This describes the output of individual sectors within an economy. In this case study, we simulated all technologies that would be deployed in the sample countries as per the LCRs scenarios. Figure 5.4 shows the key parameters utilised to estimate the economic output and the associated impact on GDP.

Figure 5.4: Project objectives and envisaged outcomes

Results to be obtained from the model — Country Specific

GDP = C+ β1<u>RE</u> + β2<u>Employment</u> + β3<u>ECI</u> + β3<u>EP</u>+ β3<u>Earnings</u>+ μ

Where:

- GDP captures economic growth
- RE is the share of renewable energy from electricity generation,
- Employment is FTE jobs created
- EC is electricity consumption and
- Earnings is the value added due to renewable energy investment
- EP is electricity sector employment
- C is the constant term,
- β is the coefficient for each variable, and
- μ is the error term

The input of capacity new build into the model will yield estimates on employment, earnings, gross domestic product (GDP), and gross output impacts for all 3 scenarios. Results from the 3 scenarios specific empasis on job creation.

JEDI modelling framework will be utilised to undertake analysis of economic impacts associated with selected scenarios (high, moderate and low energy transition scenarios)

2.3 JEDI Model limitations

As a result, the JEDI model has common shortfalls and limitations with any other OI model. The JEDI results indicate the gross impacts and not the net impacts. Lastly, the JEDI model does not reflect various other economic impacts that could emerge in the real world, for example, component manufacturing that might be produced through artificial intelligence and robotics. Furthermore, vitality in exchanged rate and electricity cost changes are not taken into account (NREL, 2020).

2.4 Application of the JEDI model

The JEDI model has been implemented since 2004, many scholars have deployed the JEDI model to quantify employment and the economic impact that can be generated from the deployment of renewable energy (Barbose et al., 2016; Brown et al., 2020; Faturay et al., 2020; Füllemann et al., 2019; Jacobson et al., 2020; Jenniches, 2018; Milani et al., 2020; Woo et al., 2020). However, this study uses the JEDI model to optimise LCR scenarios. The JEDI model is used in this study due to its ability to estimate the number of employment and economic impacts in a specific area STLM in support of just energy transition. The JEDI model estimates the number of employment opportunities that can be created during the construction of a new power plant. Moreover, employment, earnings, and economic output are disseminated across the three areas listed below (Lantz et al., 2013).

- Project Development and Onsite Labour Impacts
- Local Revenue and Supply Chain Impacts
- Induced Impacts

The JEDI model data used is country base economic data. The economic multipliers contained within the model results from the Minnesota IMPLAN Group's IMPLAN accounting software and state data files (Goldberg and Milligan, 2004). The JEDI models run in Excel, all JEDI models apply the same basic user interface. The author acquired the appropriate JEDI model where the specific plant information was processed, this included basic information about a project, including the country, location, year of construction, and plant size. The model then estimates the project costs (i.e., specific expenditures), and the economic impacts in terms of employment, earnings (i.e., wages and salary), and output (i.e., the value of production) resulting from the project.

2.5 Modelling assumptions

In these analyses, we projected using energy technologies that would be deployed in the sampled African countries. The project sizes are directly sourced from the country's energy plans or the NDC commitments. The local share calculated for the base case assumed a 30% LCRs scenario, this is followed by a 60% LCRs scenario that this study simulates except for hydropower and geothermal. The detailed assumptions are included to demonstrate insights on how the job estimates were quantified in Appendix 3.

When it comes to quantifying the employment impact of energy generation technologies, a common method is to normalize jobs created by calculating the ratio of jobs to installed capacity (Aldieri et al., 2020):

Index of Direct Jobs = Σ (Employment) / (Installed capacity)

Table 5.1: Potential Jobs per megawatt by technology:

Energy Technology	Job years/ MW	Mean Job years/ MW
Onshore Wind	2.7 – 12.5	7.7
Offshore Wind	10.7 - 24	17.4
Solar PV	3.1 – 11	6.9
Solar Thermal	4	-
Biomass	0.4 – 5.3	2.9
Geothermal	3.89	-
Coal	3.5	-
Gas	1	-
Nuclear	1.3	-

The renewable energy technologies value chain is different from that of fossil fuels, this means that in the energy transition process, the sun and wind would displace mining jobs. Moreover, 80 – 90% of jobs created by renewable energy deployment are generated during construction which lasts for approximately 12 – 24 months. The full-time equivalent (FTE) jobs are mainly generated by operations and maintenance (O&M). Therefore, increased LCR would yield a significant economic impact as clean energy projects are implemented. In addition to sectors that are directly and indirectly impacted by the clean energy value chains, it is important to recognise that the overall economic impact of clean energy investments would generate cash that would circulate throughout the country's economy and thus create additional value in the overall country's economic performance.

3. Setting the scene on job implications

According to (Vijay et al., 2015), energy development is an essential element for stimulating economic growth, social development, human welfare and improving the standards of living. This means that we can ascertain that energy development in the African continent is likely to drive economic development. Over the years, dependence on fossil fuels has driven economic development and employment opportunities, particularly, in the global north.

In the past decade, concerns about climate change risk have intensified due to scientific reports that indicate the risk associated with not managing greenhouse gas emissions. With this context, it is significant to assess job implications associated with global energy transitions ratified through the adoption of the Paris Agreement that has prompted an uptake of renewables and other low carbon sources of energy technologies.

The energy transition in Africa presents both opportunities and challenges in terms of job implications. As countries in Africa strive to shift their energy systems towards cleaner and more sustainable sources, such as renewable energy, there will be significant impacts on employment across various sectors. Below we detail some job implications for the energy transition in Africa. As the global community drives and adopts climate mitigation measures, such as reducing carbon emissions and transitioning to renewable energy sources, this action has both positive and negative effects on job creation in the African continent and other least-developed nations. The impact is dependent on several factors such as the nature of the mitigation measures, the level of investment finance, and the existing economic and social conditions in African countries. As such, the following potential scenarios could materialize.

3.1 Scenarios facing African countries in the energy transition process

Adopting a multi-faceted approach that considers economic, social, and environmental dimensions, African countries can harness the potential of the energy transition to drive economic development, create jobs, improve energy access, and contribute to global efforts to combat climate change.

Job creation in clean energy sectors: A high energy transition ambition would result in a shift in employment sectors. Traditional sectors such as coal mining and oil extraction, would experience job losses as the demand for fossil fuels declines. Workers in these sectors would need support to transition into new roles in clean energy or other industries.

Substantial job creation: Clean energy sectors such as renewable energy (solar, wind, hydro), energy efficiency, and green technology development would increase, this is subjective to local manufacturing policies. Investment in innovation and green technology will lead to the growth of high-tech industries, driving job creation in research, development, and implementation of cutting-edge solutions. The sustainability of local manufacturing of low carbon technologies and renewable energy components could be influenced by several factors, including supply and demand dynamics, economic considerations, technological expertise, and global trade relationships. While local manufacturing can provide economic and environmental benefits, the ability to sustain it might be affected if the African Continental Free Trade Area (AfCFTA) is not implemented to drive domestic demand in the African continent.

3.2 Positive Effects

The sustainability of local manufacturing of low carbon technologies and renewable energy components in the global North could be influenced negatively if the African continent refrains from importing these components. The global North component manufacturing could be for its own utilisation or it might need to seek new markets to maintain the supply and demand dynamics. While local manufacturing can provide economic and environmental benefits, the ability to sustain it might be affected if the global North does not supply these technologies to the African continent. The sustainability of local manufacturing in the global North is dependent on cost competitiveness. If local manufacturing is economically viable compared to importing from other countries, then it's more likely to be sustained regardless of external markets. However, key renewable energy raw materials such as steel and silicon are sourced from the African continent, which means that increased export duties on these raw materials can create difficulty for low carbon and cleaner energy technology manufacturing in the global North.

Renewable Energy Sector: Increased investment in renewable energy technologies, such as solar, wind, and hydropower, can lead to job creation in Africa. The continent has significant untapped renewable energy potential, and a shift towards cleaner energy sources could create jobs in construction, maintenance, manufacturing of equipment, and research and development. However, (Semelane et al., 2021), demonstrate that most of the employment opportunities created by renewable energy technologies in the global South are mainly restricted to construction jobs (i.e., not full-time equivalent). For example, operations and maintenance jobs account for less than 10% of direct jobs created in the South African renewable energy sector (Semelane et al., 2021).

Manufacturing and Supply Chain: As demand for renewable energy technologies increases, there will be opportunities for local manufacturing of solar panels, wind turbines, and other components, fostering economic growth and job creation. However, African policymakers have to be cognizant that local manufacturing is not automated unless local content policies are adopted to safeguard against an influx of important renewable energy and other sustainable energy technologies.

Energy Efficiency: Efforts to improve energy efficiency in buildings, industries, and transportation can generate jobs in areas such as energy auditing, retrofitting, and the production of energy-efficient appliances. [This is driven by being a new economic activity which is indifferent from the source of energy, i.e. fossil fuels or renewables] so it's a no-brainer for any government.

Infrastructure Development: Climate mitigation efforts often involve building and upgrading infrastructure, such as public transportation systems, energy-efficient buildings, and sustainable urban planning. These projects can generate jobs in construction, engineering, architecture, and related sectors that benefit from indirect jobs created through various value chains. This is particularly important for African countries with their low public service infrastructure which is denoted in the Economic Implication Chapter. The projected urbanisation and infrastructure development requirements as the African continent "leap-frogs" towards a low carbon future provided an opportunity to industrialise, however, adequate policies with measurable targets need to be in place to guarantee the African continent's economic growth achievement. This is not going to be automatic, deliberate policies that would ensure that the generated growth benefits Africa need to be monitored cautiously.

Agriculture and Land Management: Some mitigation measures might focus on sustainable land use and reforestation, which can create employment opportunities in sectors like agroforestry, sustainable agriculture, and ecosystem restoration. Half of the emissions in the African continent come from the land sector, as such an important aspect of the transition for African economies would be from the agriculture-based economies where innovation would be accelerated to advance low carbon economic development.

3.3 Negative Effects

Transition for Fossil Fuel Workers: Many African countries still rely on fossil fuels for energy generation. Transitioning away from these industries could lead to job displacement for workers in sectors like coal and oil. Just transition strategies are needed to support these workers in finding new employment opportunities. A link with the RE manufacturing value chains may be relevant here.

Investment and Infrastructure: While the energy transition presents opportunities, it also requires significant investment in infrastructure and technology. Without proper funding and planning, the potential for job creation may be limited. However, the finance chapter of this report analyse and makes reccomendaions on the African energy transition finance landscape.

Export Demand: Climate mitigation efforts in the global north are likely to result in reduced consumption of goods and services that are traditionally exported from Africa. Some industries are going to suffer job losses due to the decreased demand for carbon intensive products. For example, if demand for fossil fuel-related products declines, countries heavily reliant on exporting coal and oil will be confronted with economic challenges.
Competitive Pressure: As global markets transition to cleaner technologies, African industries that do not adapt quickly enough might face increased competition from more environmentally friendly products and services, potentially affecting job stability in these sectors. This means that while renewable energy can create jobs, there might be challenges related to skill gaps and training needs for the emerging green economies.

Industrialisation interruption: industrialisation interruption refers to various scenarios where the process of industrialisation is halted, delayed, or disrupted. This interruption can occur due to several reasons: Some climate mitigation technologies and strategies could place additional demand on certain resources, potentially leading to increased raw material resource exports and scarcity which may affect the African continent's industrialisation growth opportunities. Factors such as political Instability, Natural disasters and technological constraints can disrupt industrialisation efforts. These events often divert resources away from industrial development towards infrastructure repairs and reconstruction or stabilization efforts.

Economic Dependency: African countries might become dependent on technology, funding, and expertise from the global North to implement climate mitigation measures, which could limit their agency and control over their own development. Also impacts the balance of payments; and also, the interest collected from higher capital costs.

3.4 African Countries Outlook

African countries vary widely in terms of their economic development levels, industries, and energy sources. Some are still largely agrarian economies, while others have emerging industries and service sectors. Many African countries are particularly vulnerable to the impacts of climate change due to their dependence on agriculture and limited resources. Adaptation strategies and just transition efforts should be tailored to the specific challenges faced by each country.

3.5 Just Transition Challenges

In several African countries, a fair transition may involve enhancing access to clean and dependable energy sources. This could result in the creation of jobs in the renewable energy sector. Additionally, a significant portion of African economies operate within the informal sector, where workers lack job security and social protections. When striving for a just transition, it is crucial to consider the needs of these informal workers. Furthermore, given the significance of agriculture in many African countries, it is essential to promote sustainable and climate-resilient farming practices in order to facilitate a just transition and safeguard the limited natural resources in the region.

A Just Transition requires a combination of policy measures, social support systems, education and training programs, and strong stakeholder engagement. The specific strategies will depend on each country's unique circumstances and development priorities. Collaboration between governments, industries, civil society, and regional partners will play a crucial role in achieving a fair and sustainable transition that benefits all segments of society.

3.6 Key considerations

Collaboration between developed and developing countries could lead to technology transfer and capacity-building initiatives, potentially enhancing skills and expertise among local populations. This means that for technology transfer and capacity building to benefit the global South countries such as eSwatini, Equatorial Guinea, Ghana, Democratic Republic of Congo (DRC) and Botswana there is a need to strengthen dedicated technology transfer partnerships with countries that lead and hold intellectual property in sustainable energy technology development. There is a need to negotiate for mutual benefits and manage the risk of an "unjust energy transition" where African countries would lose jobs and export raw material and mineral resources that will be used to develop sustainable energy technologies.

It is important to ensure that everyone, including marginalized communities and rural areas, can access the benefits of the energy transition. This is crucial for fair development and creating jobs. To achieve this, we need clear and supportive policies that encourage investment in renewable energy and create an environment where jobs can grow. Collaboration between governments and the private sector can lead to new business models that create jobs and drive the energy transition forward. Additionally, involving local communities in decision-making processes and empowering them to participate in renewable energy projects can improve social acceptance and create local jobs.

Overall, the energy transition in Africa has the potential to drive sustainable economic growth and job creation while addressing energy access challenges and contributing to global efforts to mitigate climate change. However, careful planning, stakeholder engagement, and a focus on just transition principles are essential to maximise the positive impacts on jobs and communities. To maximise the benefits of energy transition in Africa, governments, communities, and stakeholders need to adopt a holistic approach that combines economic growth, social equity, environmental sustainability, and technological innovation.

3.7 Conclusion

It's important to note that while a moderate energy transition ambition might result in balanced job implications, the collective efforts of all regions would play a significant role in achieving global climate goals and sustainable development. Collaboration, technology transfer, capacity building, and financial support for Africa would be required to guarantee an equitable and effective energy transition that could maximise job creation, economic growth and environmental benefits between Africa and developed countries that hold Intellectual Property (IP) of clean energy technologies. Moreover, the concept of just transition justice is centred around ensuring fair treatment for workers, communities, and regions that are impacted by changes in industries or economies, especially those moving away from unsustainable practices. It emphasises the need to support workers and communities through retraining, job creation, and social protections to prevent anyone from being left behind. Additionally, just transition justices extend to broader principles of social justice, aiming to prevent vulnerable or marginalized groups from bearing a disproportionate burden of economic or industrial changes. This involves promoting policies that enhance equity, inclusivity, and fair access to opportunities and resources. Furthermore, environmental justice is a key component, seeking to address disparities in the distribution of environmental benefits and burdens. Just transition justices in this context involve policies that prioritize the well-being of communities impacted by environmental degradation or pollution, particularly during transitions to more sustainable practices. Finally, just transition justices encompass legal and institutional frameworks necessary to uphold these principles, which may include laws, regulations, and policies mandating fair treatment and support for affected workers and communities, as well as mechanisms for accountability and redress. As a result, the African transition process has to embrace these principles which aim to ensure fairness, equity, and justice during economic, industrial, and environmental transitions, particularly concerning workers, communities, and vulnerable populations. These principles are vital for managing societal changes in a manner that minimizes social and economic disruptions and promotes sustainable development.

4. Analysis for five African countries

4.1 Botswana results

The jobs and economic impact outputs for Botswana as per energy technology that would be deployed between the years 2021 and 2030 are shown in sections 4.1.1 – 4.1.4. The study found that 30% LCR for solar PV creates 39,084 direct and indirect employment during construction, operations and maintenance for the 1300 MW that would be deployed between 2021 and 2030. The economic impact derived from construction, operations and maintenance under a 30% LCR is estimated to be USD32 billion for the 2021 – 2030 period. Other scenarios of job creation and the overall impact are shown in the summary table for all the technologies that the sampled countries have included in the energy plans.

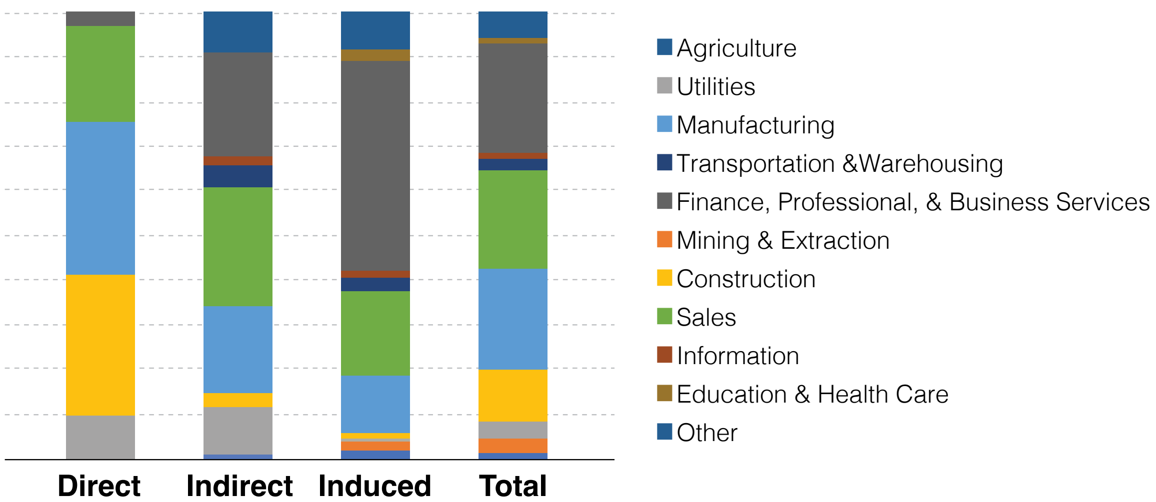
a) Botswana base case summary results for solar photovoltaics jobs

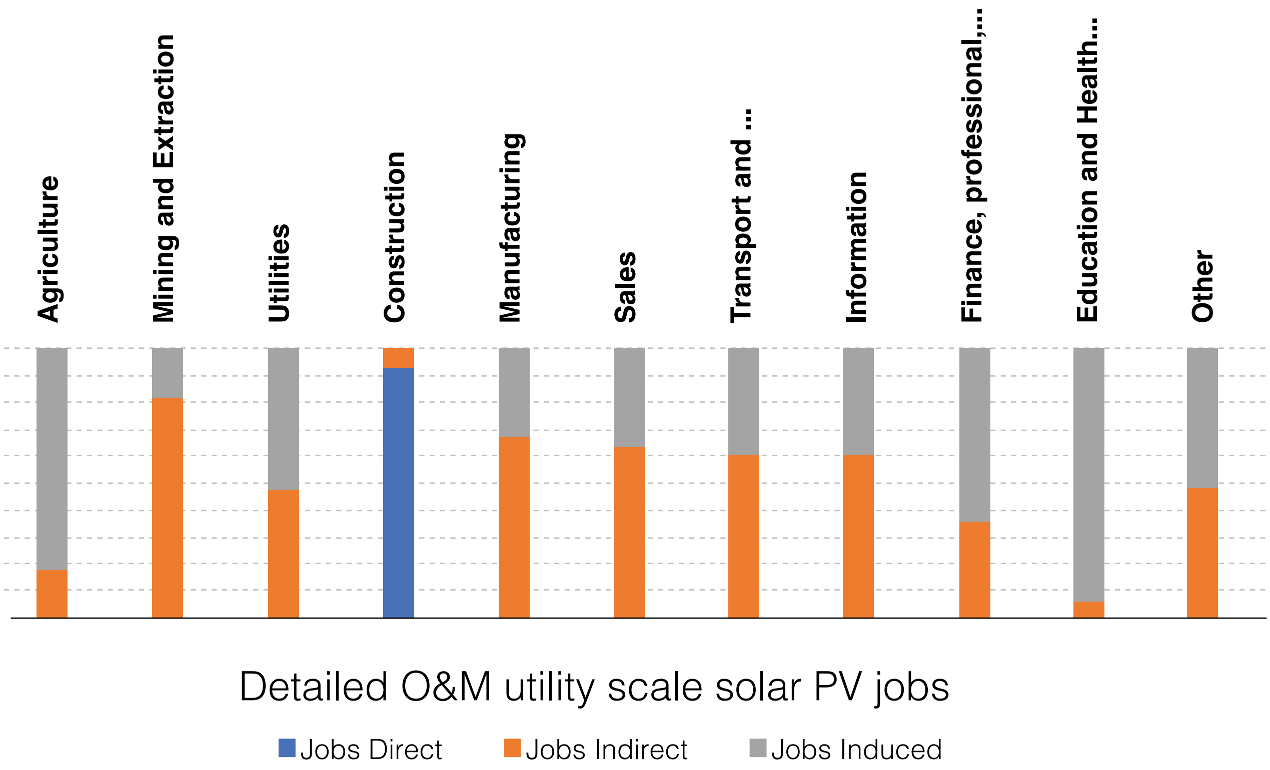
Figure 5.5: Detailed solar PV construction and O&M jobs estimate in Botswana

Detailed Impacts Construction				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	46	253	299
Mining & Extraction	-	1049	199	1248
Utilities	1162	276	160	1598
Construction	4030	371	107	4508
Manufacturing	4314	2398		8504
Sales	2711	3164	2505	8380
Transportation & Warehousing	0	623	460	1083
Information	-	236	189	425
Finance, professional, & Business	420	2825	6316	9561
Education and Health Care	-	20	361	381
Other	-	1077	1121	2199
Total	**12637**	**12085**	**13463**	**38184**

Detailed Impacts O&M				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	1.2	5.6	6.8
Mining & Extraction	-	20.3	4.4	24.7
Utilities	-	3.2	3.6	6.8
Construction	253.8	18.0	2.4	274.2
Manufacturing	-	84.1	39.7	123.8
Sales	-	96.2	55.5	151.7
Transportation & Warehousing	-	15.5	10.2	25.7
Information	-	6.4	4.2	10.5
Finance, professional, & Business	-	79.1	140.1	219.1
Education and Health Care	-	0.5	8.0	8.5
Other	-	22.9	24.9	47.7
Total	**253.8**	**347.3**	**298.5**	**899.6**

Detailed construction utility scale solar PV jobs





Evidently, 12,637 direct construction jobs would be created, accounting for 33% of the total construction jobs while indirect and induced construction jobs account for 32% and 35% respectively. Comparatively, a significant number of jobs in construction would be created compared to O&M jobs. Consequently, the biggest drawback of construction jobs is job insecurity due to its short-term employment nature. As the renewable energy industry reaches its peak of development, various jobs in construction may be lost, leading to increased unemployment rates. Additionally, factors such as downsizing to adapt to unexpected fluctuations in market demands and financial crisis are more likely to affect construction jobs (Mathebula et al., 2015).

The base case in Figure 5.5 further shows that solar PV O&M jobs only generate direct jobs in the construction sector. Jobs in various sectors will be generated, however, these jobs will only be indirect and induced. Furthermore, more O&M jobs would be created in the construction sector, finance, professional and business services sector, sales sector and manufacturing sector respectively. Subsequently, African countries such as Botswana, have limited manufacturing infrastructures and capabilities, thus, local manufacturing capacity is needed to practically create jobs in the construction sector. This can be achieved by investing in foreign knowledge and technology transfer which would be driven by effective policies. Therefore, initial manufacturing jobs created, particularly those that require high level skills, may be occupied by foreign personnel (Gebreslassie, 2021). The study further found that 60% LCR for solar PV creates a total of 50 979 direct, indirect and induced jobs during the construction phase. This means that 12 795 more jobs would be created for the 60% LCR scenario.

The economic impact in terms of earnings under the 30% and 60% Local Content Requirement (LCR) scenarios is projected to result in total earnings of USD658 million and USD879 million, respectively, representing a 25% growth rate increase. In terms of total input, the economic outcome is expected to yield USD3.7 billion and USD4.9 billion for the 30% and 60% LCR scenarios, respectively. Furthermore, the value added is anticipated to be USD1.3 billion and USD1.7 billion for these respective scenarios.

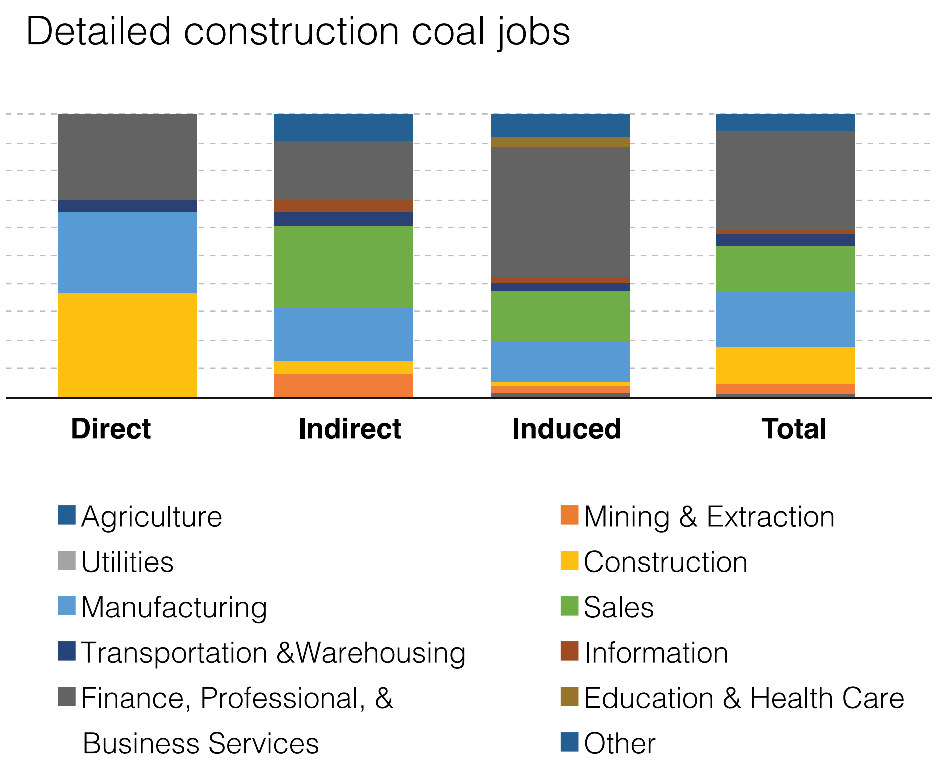
b) Botswana base case summary results for coal jobs

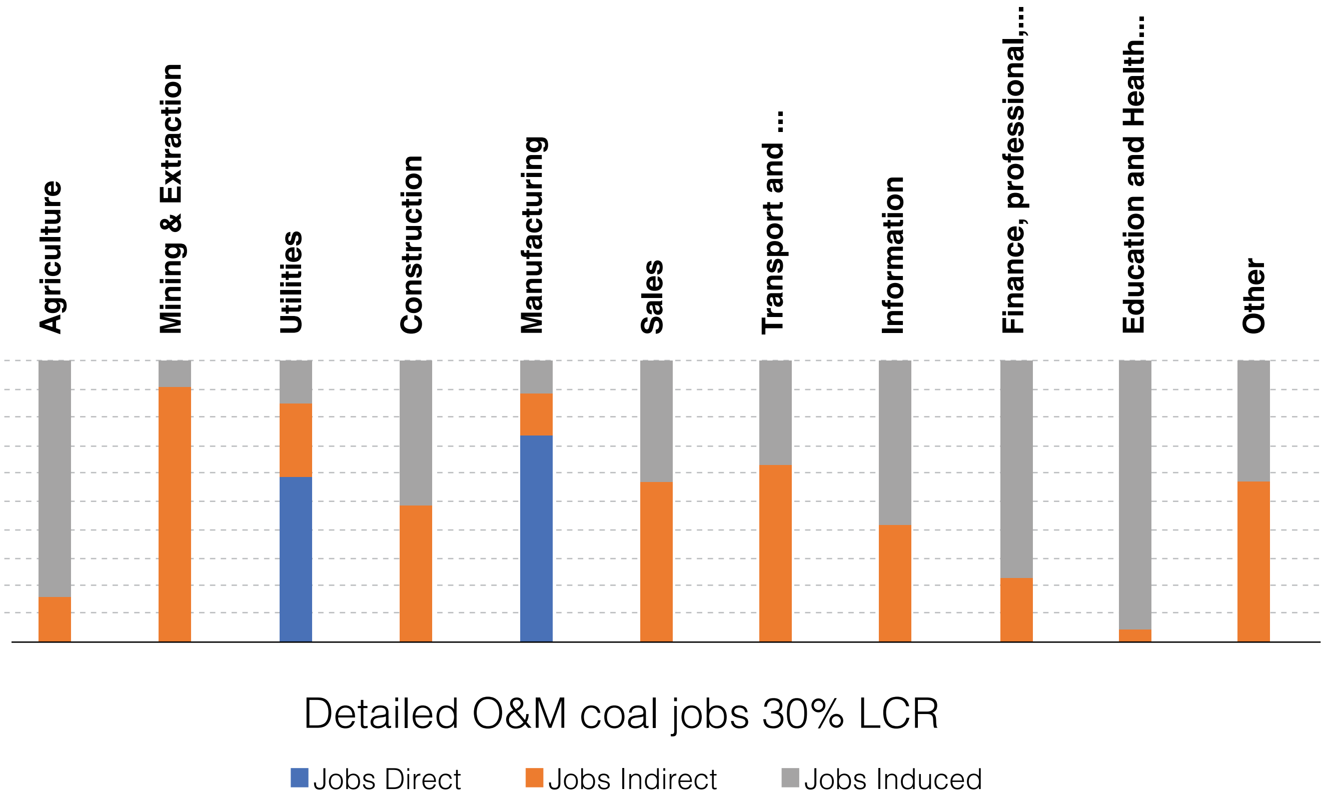
The base case relating to Botswana coal jobs as 1500 MW is deployed shows that 30% LCR creates a total of 71,467 construction jobs which constitute 31% of direct jobs, 34% indirect jobs, and 35% induced jobs across various sectors. Similarly to the solar PV jobs, the finance, professional and business services sectors, the manufacturing sector and the sales sector would produce more construction coal jobs respectively as shown in Figure 5.6. As a country that is currently dependent on coal power, Botswana has planned to maintain some coal despite its global transition toward cleaner sources of energy. Therefore, more coal jobs would be produced compared to other energy sources.

Figure 5.6: Detailed coal construction and O&M jobs estimate in Botswana

Detailed Impacts Construction				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	100	474	574
Mining & Extraction	-	1582	372	1954
Utilities	-	301	300	602
Construction	8215	840	201	9256
Manufacturing	6149	4918	3360	14427
Sales	-	6851	4696	11547
Transportation & Warehousing	968	1183	862	3013
Information	-	536	354	890
Finance, professional, & Business	6811	5232	11843	23887
Education and Health Care	-	85	676	761
Other	-	2453	2103	4556
Total	**22143**	**24080**	**25243**	**71467**

Detailed Impacts O&M				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	1	4	4
Mining & Extraction	-	29	3	32
Utilities	9	4	2	15
Construction	-	1	2	3
Manufacturing	158	32	26	215
Sales	-	47	36	84
Transportation & Warehousing	-	12	7	18
Information	-	2	3	5
Finance, professional, & Business	-	27	91	118
Education and Health Care	-	0	5	5
Other	-	22	16	38
Total	**167**	**177**	**194**	**538**





Although a significant number of coal construction jobs would be created, fewer O&M jobs would be created at 30% LCR. Although the O&M produces the same trend compared to the construction jobs, the sectors in the O&M would produce significantly fewer jobs within the finance, professional and business services sectors, manufacturing sectors and sales sectors. Interestingly, no direct O&M jobs would be created in the construction sector, however, as shown in Figure 5.6 only 9 direct jobs and 158 direct jobs would be created in the utilities sector and the manufacturing sector respectively. In addition, the economic impact derived from the 60% LCR would create a total of 90 141 construction jobs while the overall total number of construction jobs and O&M jobs would be 72,005 at 30% LCR.

The economic benefits derived from coal construction jobs are projected to result in significant growth when comparing the 30% and 60% LCR scenarios. Total earnings are expected to increase by 30%, increasing from USD111 million to USD158 million. Similarly, output is anticipated to grow by 29%, from USD633 million to USD899 million. Additionally, the value-added component is projected to encounter a 29% increase, from USD211 million to USD296 million. Both scenarios collectively show immense economic benefits for the labour force and Botswana's economy over the adoption period of 2021-2030.

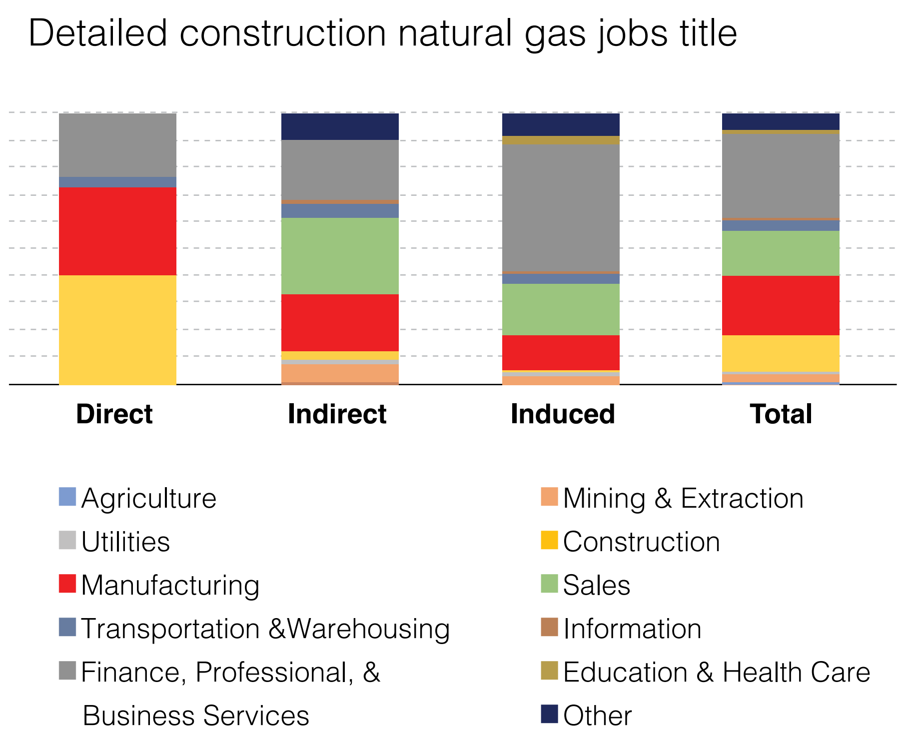
c) Botswana base case summary results for natural gas jobs

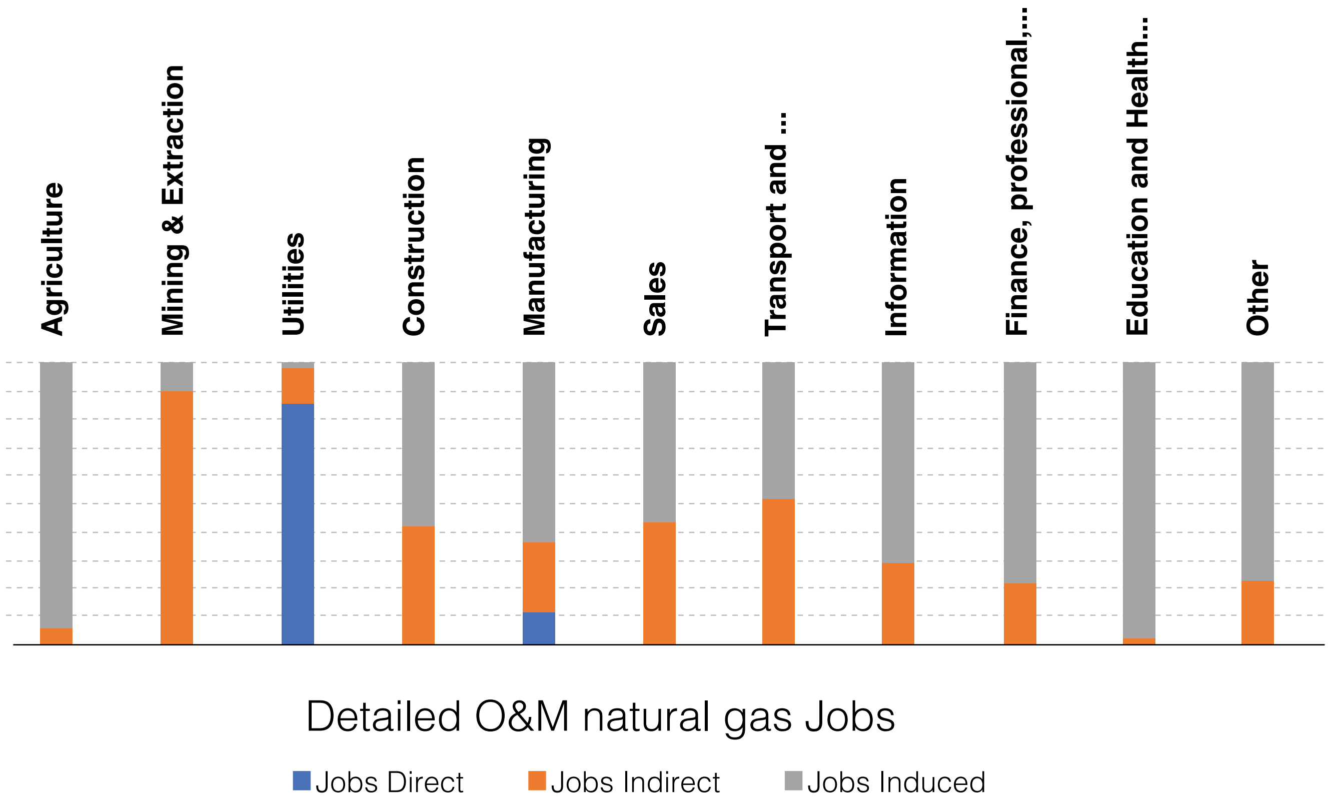
The Botswana natural gas deployment would generate 625 construction jobs, which is significantly fewer jobs generated compared to other technology counterparts. This is due to the deployment of only 60 MW. Amongst 625 generated jobs, direct and indirect jobs collectively account for 65% of the jobs while induced jobs account for 35%. Moreover, more construction jobs would be created in the finance, professional and business sectors compared to other sectors shown in Figure 5.7.

Figure 5.7: Detailed natural gas construction and O&M jobs estimate in Botswana

Detailed Impacts Construction				
	Jobs			
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	1	4	5
Mining & Extraction	-	16	3	19
Utilities	-	3	3	5
Construction	77	7	2	86
Manufacturing	63	45	29	138
Sales	-	61	41	101
Transportation & Warehousing	7	10	7	25
Information	-	4	3	7
Finance, professional, & Business	45	45	103	193
Education and Health Care	-	1	6	7
Other	-	22	18	40
Total	**192**	**214**	**219**	**625**

Detailed Impacts O&M				
	Jobs			
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	0	7	7
Mining & Extraction	-	54	5	60
Utilities	195	27	4	227
Construction	-	2	3	5
Manufacturing	9	20	49	79
Sales	-	53	69	122
Transportation & Warehousing	-	14	13	26
Information	-	2	5	7
Finance, professional, & Business	-	50	174	224
Education and Health Care	-	0	10	10
Other	-	9	31	40
Total	**204**	**233**	**371**	**808**





The deployment of 60 MW of natural gas would generate a total of 1,433 jobs while for the 30% LCR. Only 400 direct jobs are generated, as shown in Figure 5.7. This trend is similar to the O&M coal direct jobs output where direct jobs would only be generated in the utilities sector and the manufacturing sector as shown in Figure 5.7. Interestingly, the finance, professional and business sector would generate 45 direct jobs, 95 indirect jobs and 277 induced jobs while the utility sector would generate 195 direct jobs, 30 indirect and 7 induced jobs. This output is expected as the development, operation and sustainability of the energy sector relies on the finance sector. Moreover, national financial sectors determine the deployment rate of energy generation and supply, particularly in renewable energy (Ngcobo & Wet, 2024).

The 30% LCR for natural gas economic impact generates total earnings of USD1.3 billion in earnings, USD7.4 and 2 billion in outputs and value added respectively, across the investment. The 60% LCR for natural gas total earnings are estimated at USD1.8 billion, while the output and value-added account for USD10.1 billion and USD2.7 respectively.

d) Botswana base case summary results for wind jobs

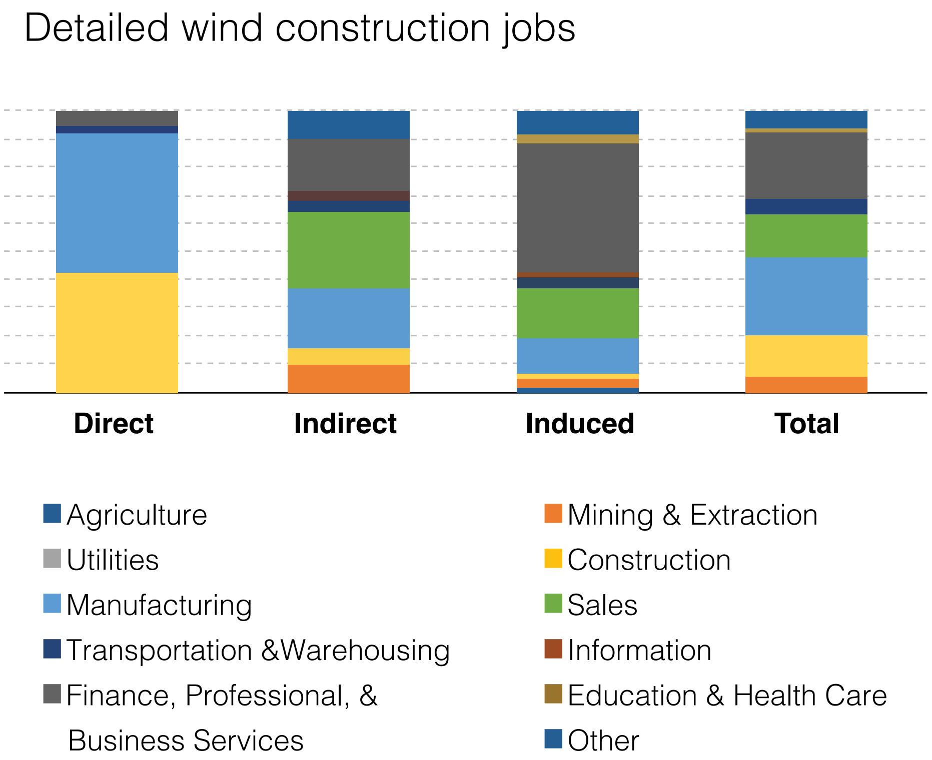
Botswana has planned to deploy 200 MW of wind energy at a later stage from 2027 – 2030. As shown in Figure 8, the study shows that 30% of LCRs for wind would create 6 604 construction jobs of which direct construction jobs would account for 30% of the total construction jobs. The manufacturing sector would create 1,800 construction jobs, which is the highest number of jobs alongside the finance, professional and business sector and sales sector which would produce 1,607 and 1,067 respectively. Although it is ideal to create opportunities for the local manufacturing sector in African countries such as Botswana, the lack of local development and manufacturing capabilities for renewable energy technologies remains a challenge. This issue must be addressed to enable African countries to create sustainable jobs for their citizens.

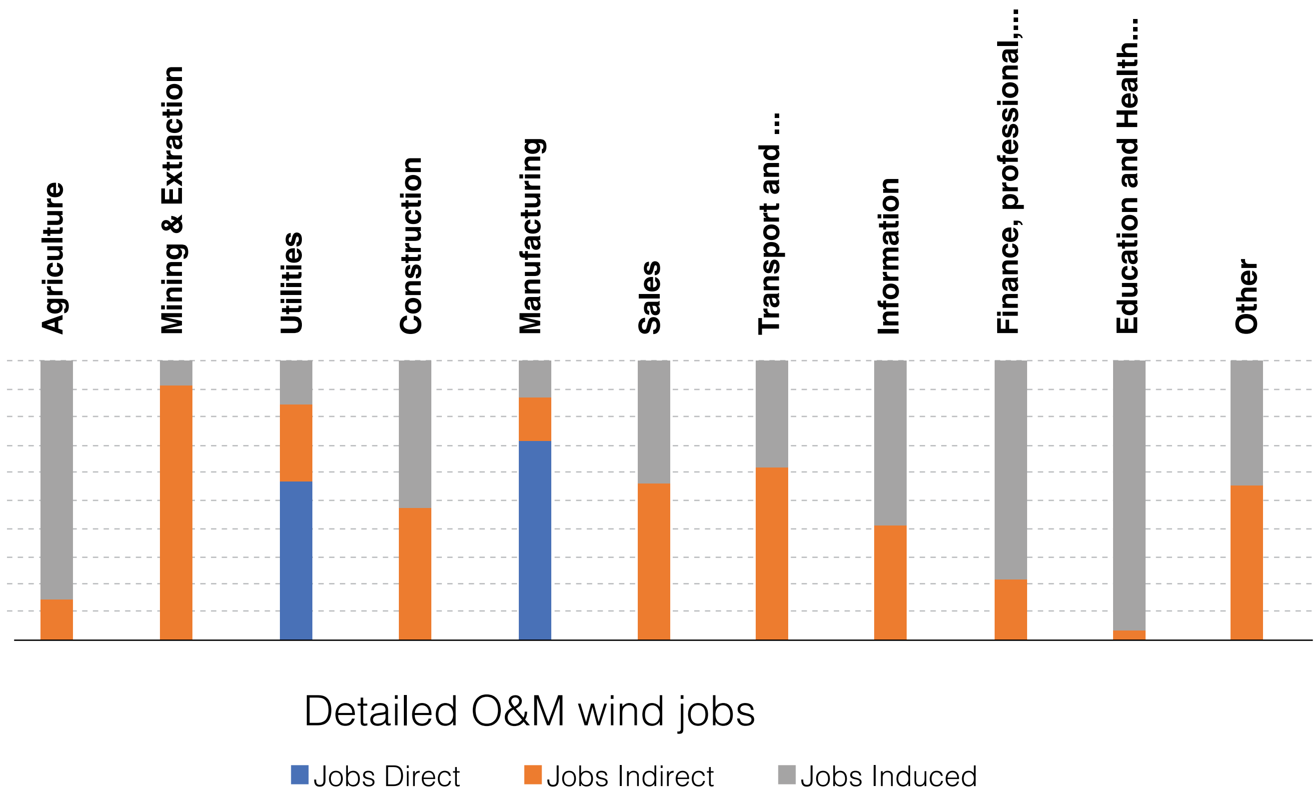
Comparatively, as shown in Figure 5.8, O&M jobs for wind deployment would create the same number of O&M jobs for coal-based energy deployment as shown in Figure 5.6. However, the total O&M jobs for wind are significantly less than the construction jobs with a total job number disparity of 6,066 jobs. Among the different sectors, the manufacturing sector is the only sector that would generate over 200 O&M jobs as Botswana implements wind energy.

Figure 5.8: Detailed wind construction and O&M jobs estimate in Botswana

Detailed Impacts Construction				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	9	43	51
Mining & Extraction	-	224	34	257
Utilities	-	28	27	55
Construction	866	74	18	958
Manufacturing	989	509	303	1800
Sales	-	643	424	1067
Transportation & Warehousing	65	115	78	259
Information	-	38	32	70
Finance, professional, & Business	85	454	1069	1670
Education and Health Care	-	4	61	65
Other	-	224	190	414
Total	**2004**	**2322**	**2278**	**6604**

Detailed Impacts O&M				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	1	4	4
Mining & Extraction	-	29	3	32
Utilities	9	4	2	15
Construction	-	1	2	3
Manufacturing	158	32	26	215
Sales	-	47	36	84
Transportation & Warehousing	-	12	7	18
Information	-	2	3	5
Finance, professional, & Business	-	27	91	118
Education and Health Care	-	0	5	5
Other	-	22	16	38
Total	**167**	**177**	**194**	**538**





The 60% LCRs for wind would create 9,298 total construction jobs which precedes total construction jobs and O&M jobs at 30% LCR by 2 156 jobs. Furthermore, when assessing the economic impact of wind construction jobs under the 30% and 60% LCR scenarios, the 60% LCR scenario is projected to generate an additional USD46 million in earnings when compared to the 30% LCR scenario. The output is expected to be USD255 million higher, while the value-added component is expected to increase by USD84 million under the same scenario comparison.

As reported in Botswana's IRP, the projected Power Build Programme has planned to produce a total of 3,660 MW between 2021 and 2030 from wind, solar PV, natural gas, and coal (Government of Botswana, 2020). The deployment of the energy sources within the specified period is assumed to create 36,976 and 792 direct construction and O&M jobs respectively, resulting in a sub total of 119,664 direct jobs at 30% LCR. Overall, a total of 116,880 construction jobs and 2,785 O&M jobs would be created thus equivalent to 98% of construction jobs and 2% of O&M jobs. Therefore, during the deployment of various energy sources, a cumulative total of 119 664 jobs would be created at 30%.

4.2 Ghana results

According to the Ministry of Energy (2019), Ghana has committed to deploy 1353,63 MWp of renewable energy between 2015 and 2023. As such, the analysis conducted for Ghana focuses on the transition jobs for the period 2021 – 20230. The electricity capacity that Ghana will deploy for various energy technologies is illustrated in Appendix 5.11. Solar PV utility scale is estimated to be 295 MW while distributed solar is projected to be 968 MW. Wind power is estimated to be 327 MW and Hydropower that would be deployed is 203 MW.

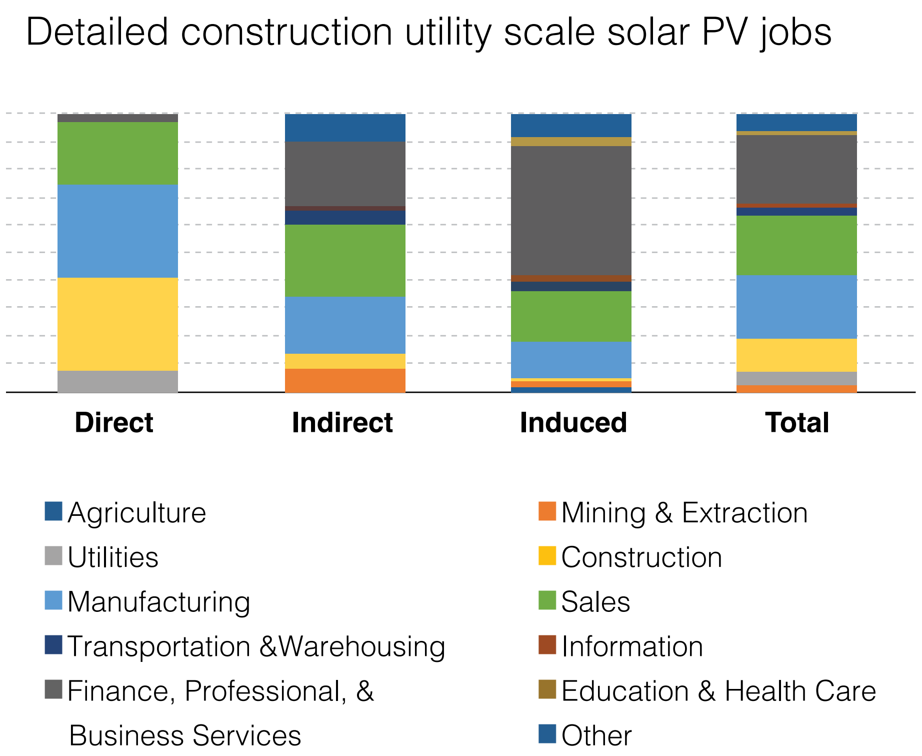
a) Ghana base case summary results for utility scale solar PV jobs

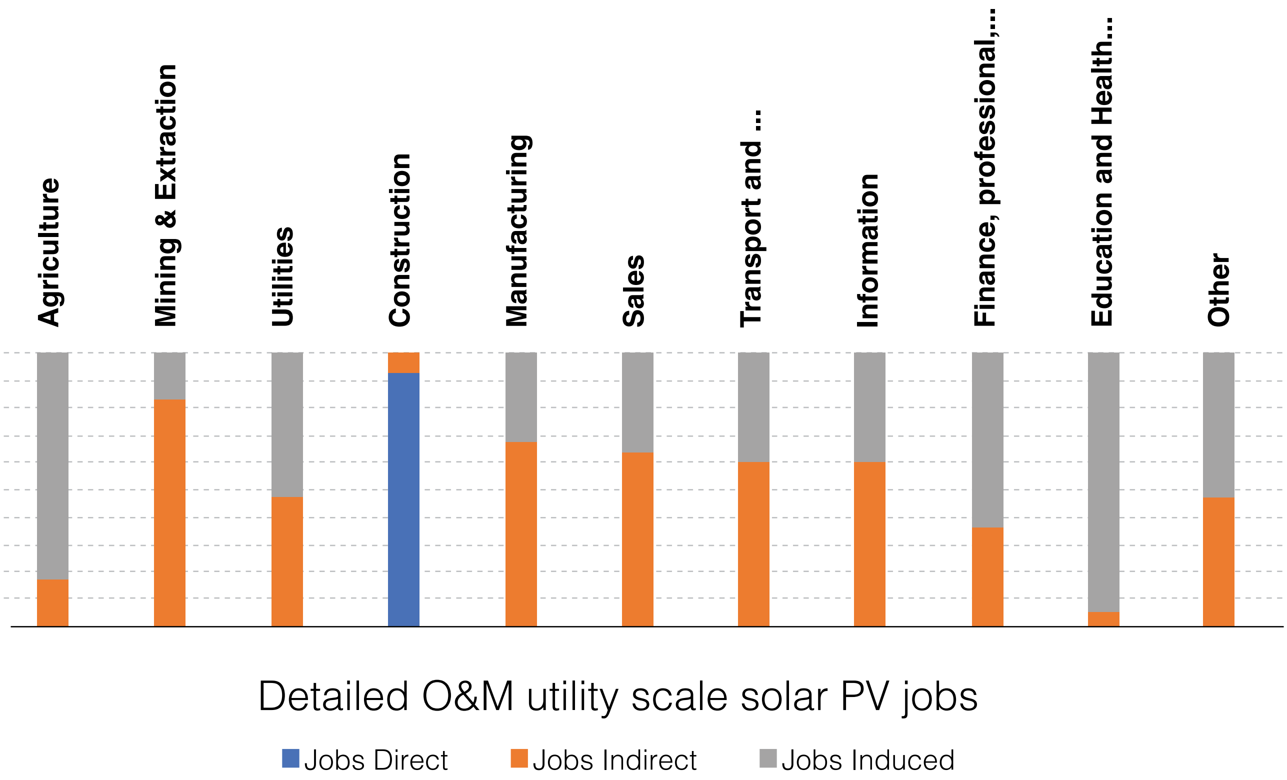
The Ghana utility scale solar sector shows that for the 30% LCR, a total of 8,665 construction jobs would be created and the O&M jobs are estimated to be 204 as shown in Figure 5.9, this makes a total of 8,870 jobs that would be created in Ghana as the energy master plan is implemented. However, direct construction jobs that would be created from the 295 MW solar PV utility scale would be implemented on 2,868 jobs.

Figure 5.9: Detailed utility scale solar PV construction and O&M jobs estimate in Ghana

Detailed Impacts Construction				
	Jobs			
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	10	57	68
Mining & Extraction	-	238	45	283
Utilities	264	63	36	363
Construction	915	84	24	1023
Manufacturing	979	544	407	1930
Sales	615	718	568	1902
Transportation & Warehousing	-	141	104	246
Information	-	54	43	96
Finance, professional, & Business	95	641	1433	2170
Education and Health Care	-	5	82	86
Other	-	244	2554	499
Total	**2868**	**2742**	**3055**	**8665**

Detailed Impacts O&M				
	Jobs			
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	0.3	1.3	1.5
Mining & Extraction	-	4.6	1.0	5.6
Utilities	-	0.7	0.8	1.5
Construction	57.6	4.1	0.5	62.2
Manufacturing	-	19.1	9.0	28.1
Sales	-	21.8	21.6	43.4
Transportation & Warehousing	-	3.5	2.3	5.8
Information	-	1.4	1.0	2.4
Finance, professional, & Business	-	17.9	31.8	49.7
Education and Health Care	-	0.1	1.8	1.9
Other	-	5.2	5.6	10.8
Total	**57.6**	**78.8**	**67.7**	**204.1**





This means that direct jobs only account for 33% of construction. However, both indirect and induced construction jobs account for 5,797 jobs. For O&M utility scale solar deployment, a total of 204 jobs would be created as depicted in Figure 5.9. The direct jobs created for the 30% LCR scenario are only 58. Although construction jobs are generally high in this scenario, it is important to note that energy construction projects are usually based on short term contracts which normally last between twelve and twenty-four months in most cases.

The economic impact of utility scale solar PV jobs is expected to substantially influence the country's GDP. Specifically, under the scenario of doubled local content, earnings and output are projected to have a growth rate increase of 25%, while value-added is anticipated to rise by 23%. In this scenario, earnings and value-added and output are estimated to reach USD199 million and USD393 million respectively, with output projected to hit the billion mark at USD1.1 billion, respectively.

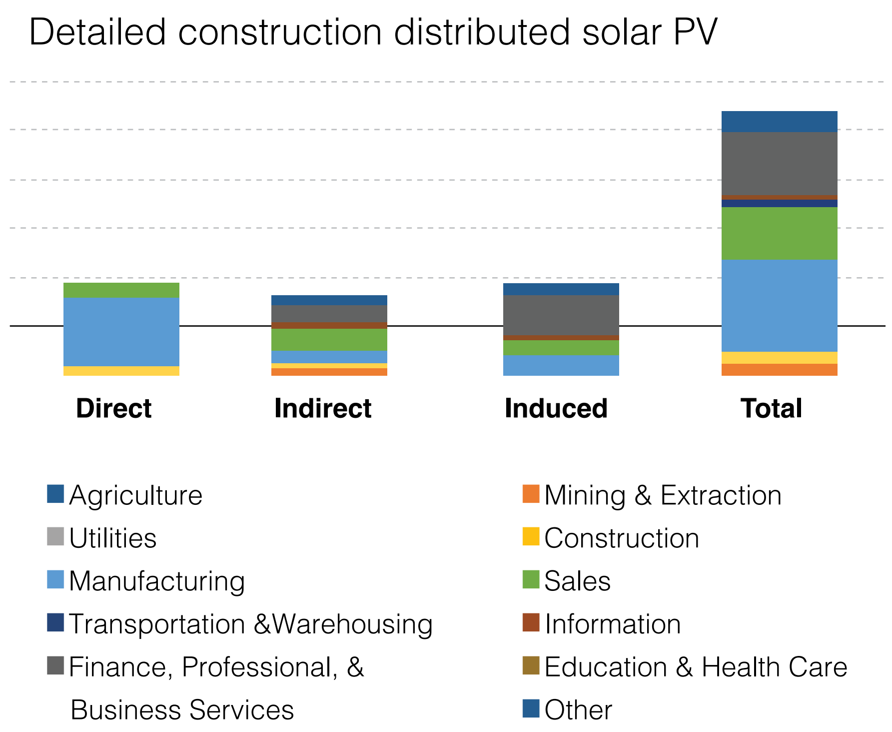
b) Ghana base case summary results for distributed/ standalone solar PV jobs

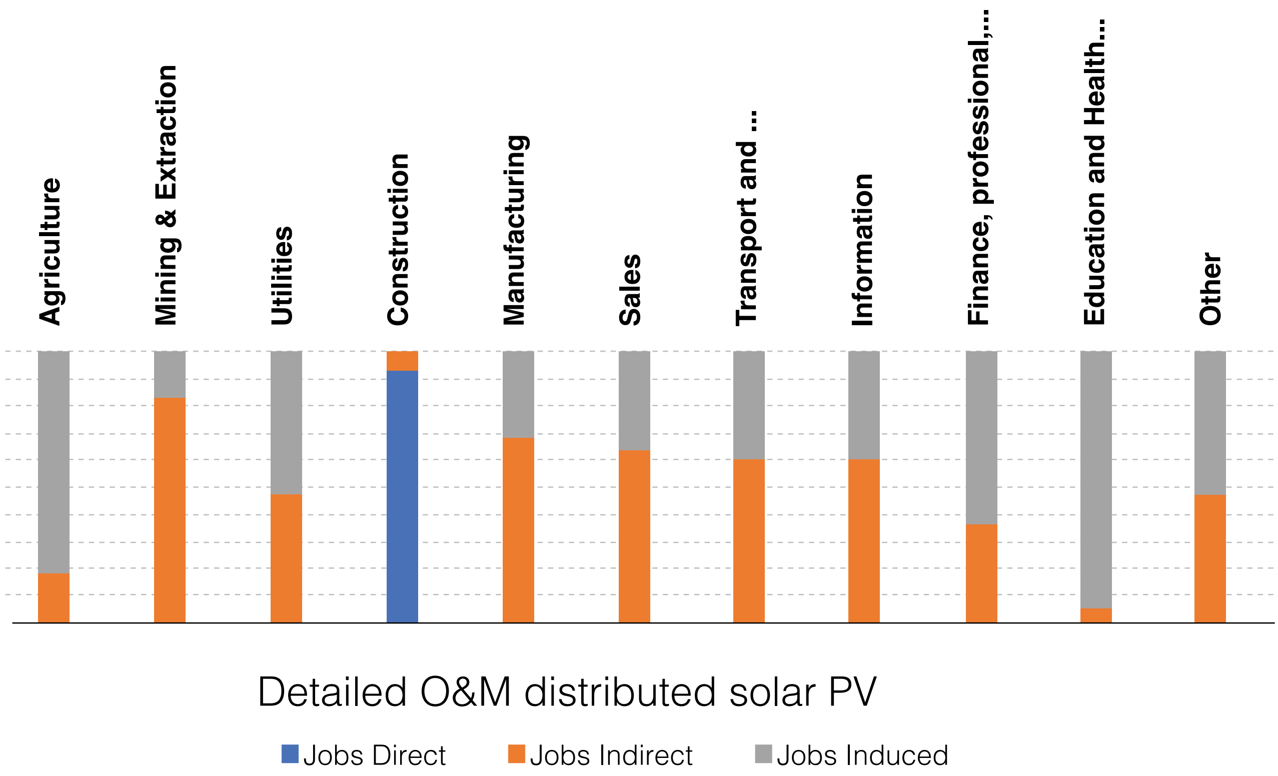
Unlike other countries, Ghana has specified various solar PV projects in their energy deployment plan. As shown in Figure 5.10, the distributed and standalone solar PV will be separate projects that would create a total of 12 276 jobs at 30% LCR of which the manufacturing sector, finance, professional, and business sector, and sales sector would account for 77% of the total jobs while the rest of the sectors would account for 33% of the total jobs. As seen throughout the assumptions of various countries, the manufacturing sector, finance, professional, business sector, and sales sectors consistently generate the highest number of jobs in both construction and O&M.

Figure 5.10: Detailed distributed/ standalone solar PV construction and O&M jobs estimate in Ghana

Detailed Impacts Construction				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	15	80	95
Mining & Extraction	-	298	63	361
Utilities	201	67	51	319
Construction	549	78	34	661
Manufacturing	2095	669	569	3333
Sales	1336	921	795	3052
Transportation & Warehousing	28	196	146	370
Information	-	77	60	137
Finance, professional, & Business	220	858	2005	3083
Education and Health Care	-	7	115	121
Other	-	388	356	744
Total	**4428**	**3573**	**4275**	**12276**

Detailed Impacts O&M				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	1	4	5.2
Mining & Extraction	-	15	3	18.4
Utilities	-	2	3	5.0
Construction	189	13	2	204.1
Manufacturing	-	63	30	92.2
Sales	-	72	41	113.0
Transportation & Warehousing	-	12	8	19.1
Information	-	5	3	7.8
Finance, professional, & Business	-	59	104	163.1
Education and Health Care	-	0	6	6.3
Other	-	17	19	35.5
Total	**189**	**259**	**222**	**669.9**





The O&M jobs are estimated to be 670 as depicted in Figure 5.10, in addition to the construction jobs, this makes a total of 12,946 jobs that Ghana would create as the energy master plan is implemented throughout the specified period. The distributed and standalone solar PV would only generate 189 O&M direct jobs in the construction sector while the rest of the sectors would not generate any direct employment, this led to fewer total jobs generated compared to construction jobs. Thus, construction jobs that would be generated would be 95% more than O&M jobs.

National economic impact during the adoption of distributed and standalone solar PV would be inevitable. Thus, in addition to the adoption of utility scale solar PV which would sum to 485 MW of solar energy adopted; Ghana would accelerate its socio-economic development, especially under scenarios of doubled local content (60%). In these scenarios, it is projected to generate USD316 million in earnings, USD1.7 billion in output, and USD603 million in value-added. This scenario forecasts a 34% increase in both earnings and output and a 32% increase in value-added. Since the country has planned more solar energy projects compared to other technologies, it is important to ensure that policy mechanisms that would enable a successful implementation of local manufacturing are put in place, this will contribute to reducing the country's unemployment rate of 4.7% (Yirenkyi et al., 2023).

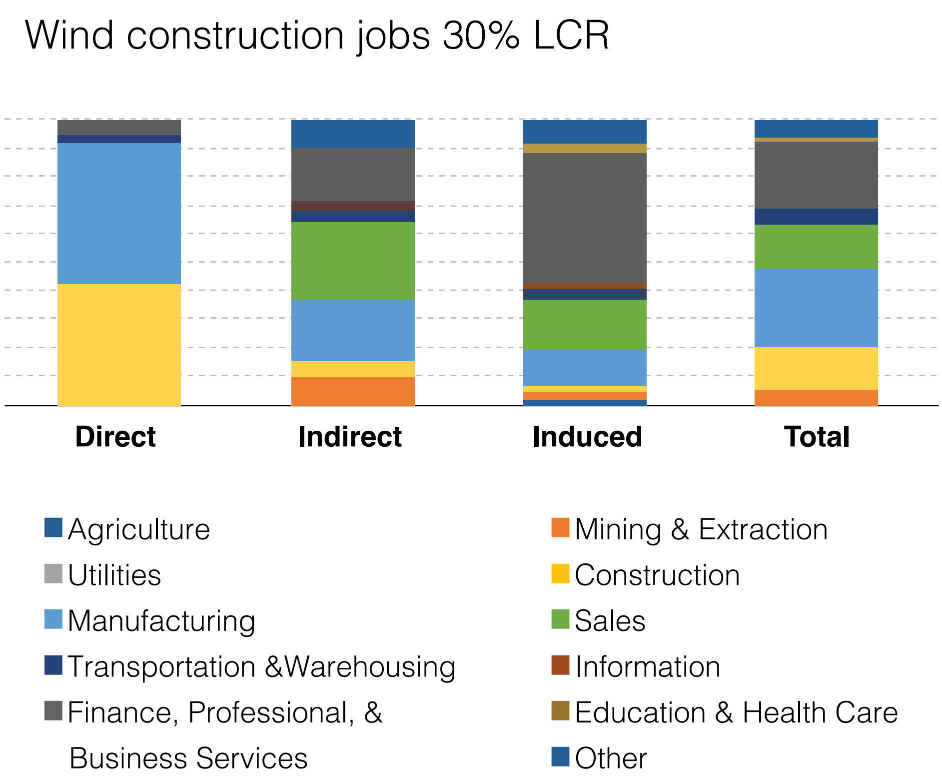
c) Ghana base case summary results for wind jobs

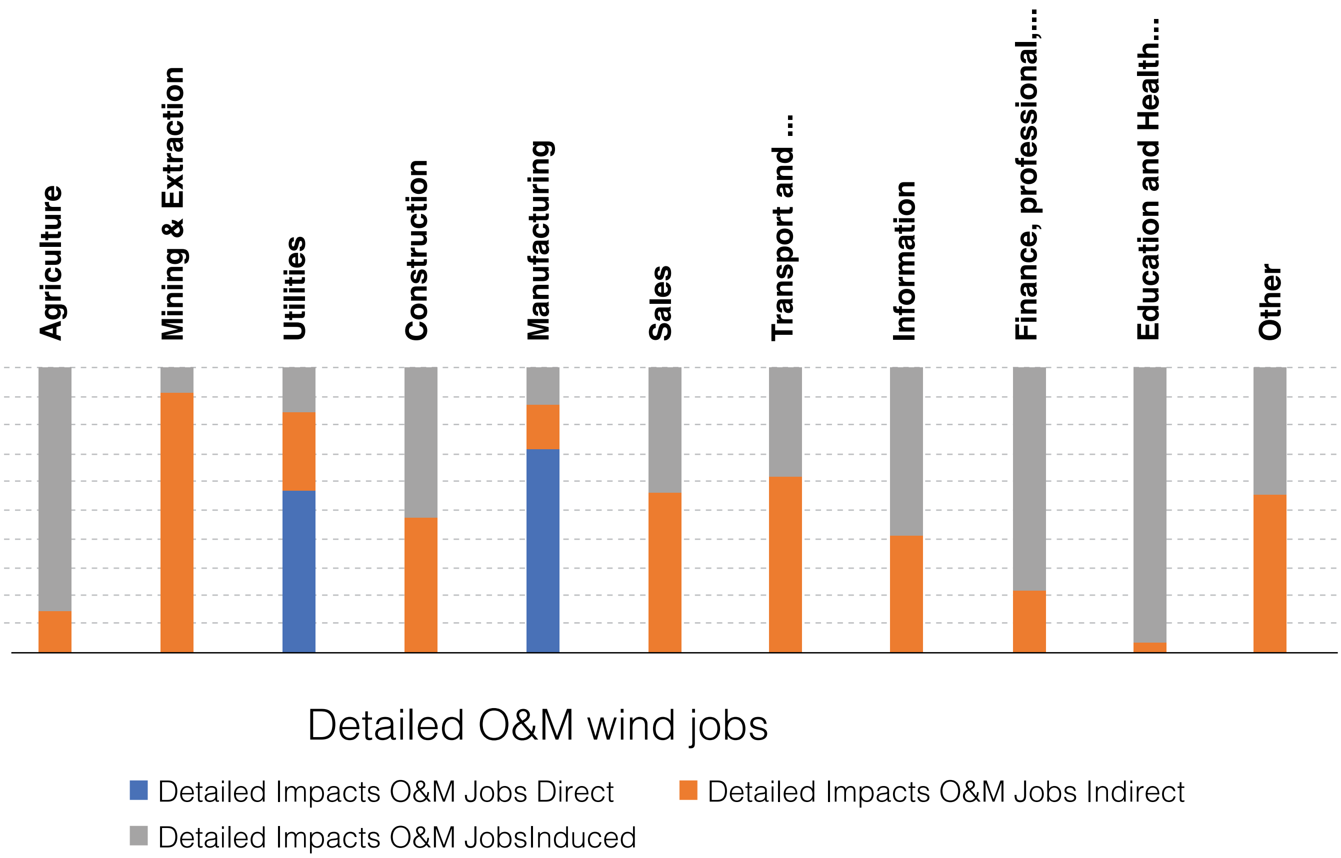
The Ghana wind sector shows that for the 30% LCR, a total of 10,797 construction jobs would be created. Moreover, the O& M jobs are estimated to be 879, this makes a total of 11,677 jobs that Ghana will create as the energy master plan is implemented. Comparatively, construction and O&M jobs account for 30% and 31% of direct jobs, this demonstrates that indirect and induced jobs impact could represent about two thirds of the total employment created. Furthermore, the total construction jobs would generate over 3000 direct, indirect, and induced jobs independently, however, each category would not exceed 4000 jobs as shown in Figure 5.11.

Figure 5.11: Detailed wind construction and O&M jobs estimate in Ghana

Detailed Impacts Construction				
	Jobs			
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	14	70	84
Mining & Extraction	-	366	55	420
Utilities	-	46	44	91
Construction	1416	122	30	1567
Manufacturing	1616	831	496	2943
Sales	-	1051	696	1744
Transportation & Warehousing	107	189	127	423
Information	-	62	52	114
Finance, professional, & Business	138	742	1747	2627
Education and Health Care	-	7	100	107
Other	-	367	310	677
Total	**3277**	**3796**	**3724**	**10797**

Detailed Impacts O&M				
	Jobs			
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	1	6	7
Mining & Extraction	-	48	5	53
Utilities	15	7	4	25
Construction	-	2	3	5
Manufacturing	258	52	42	352
Sales	-	78	59	137
Transportation & Warehousing	-	19	11	30
Information	-	3	4	8
Finance, professional, & Business	-	44	149	193
Education and Health Care	-	0	8	9
Other	-	35	26	62
Total	**273**	**290**	**317**	**879**





Unlike wind energy construction employment which would generate over 10 000 jobs, wind energy O&M would generate less than 1000 jobs across various sectors as shown in Figure 5.11. This pattern of high construction job quantity and low O&M job quantity output is consistent across the various energy technology deployments in studied countries. This phenomenon reveals the dependency of O&M jobs on construction jobs which mostly dominated during the early developments of various energy technology adoptions.

The economic outlook for Ghana wind construction jobs at doubled LCR (60%) would generate an additional USD76 million, USD418 million and USD138 million for earnings, output and value-added respectively, compared to the scenarios of 30% LCR. Despite the temporary nature of construction work during the development of various energy technologies, more economic impact is predicted to occur through construction compared to O&M type of jobs across various sectors.

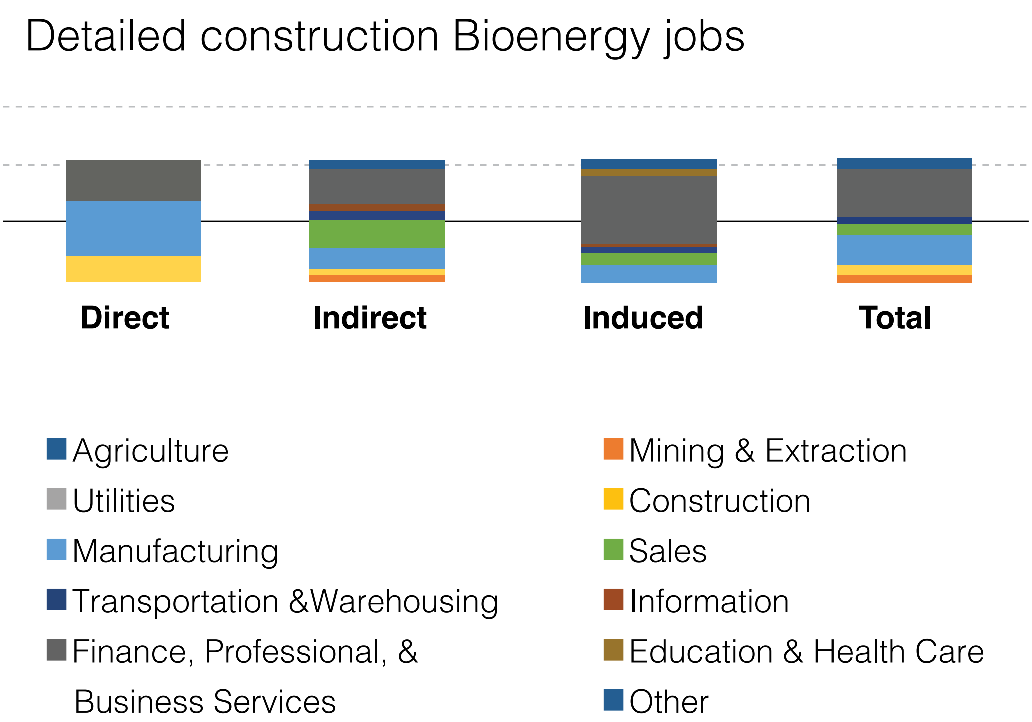
d) Ghana base case summary results for bioenergy jobs

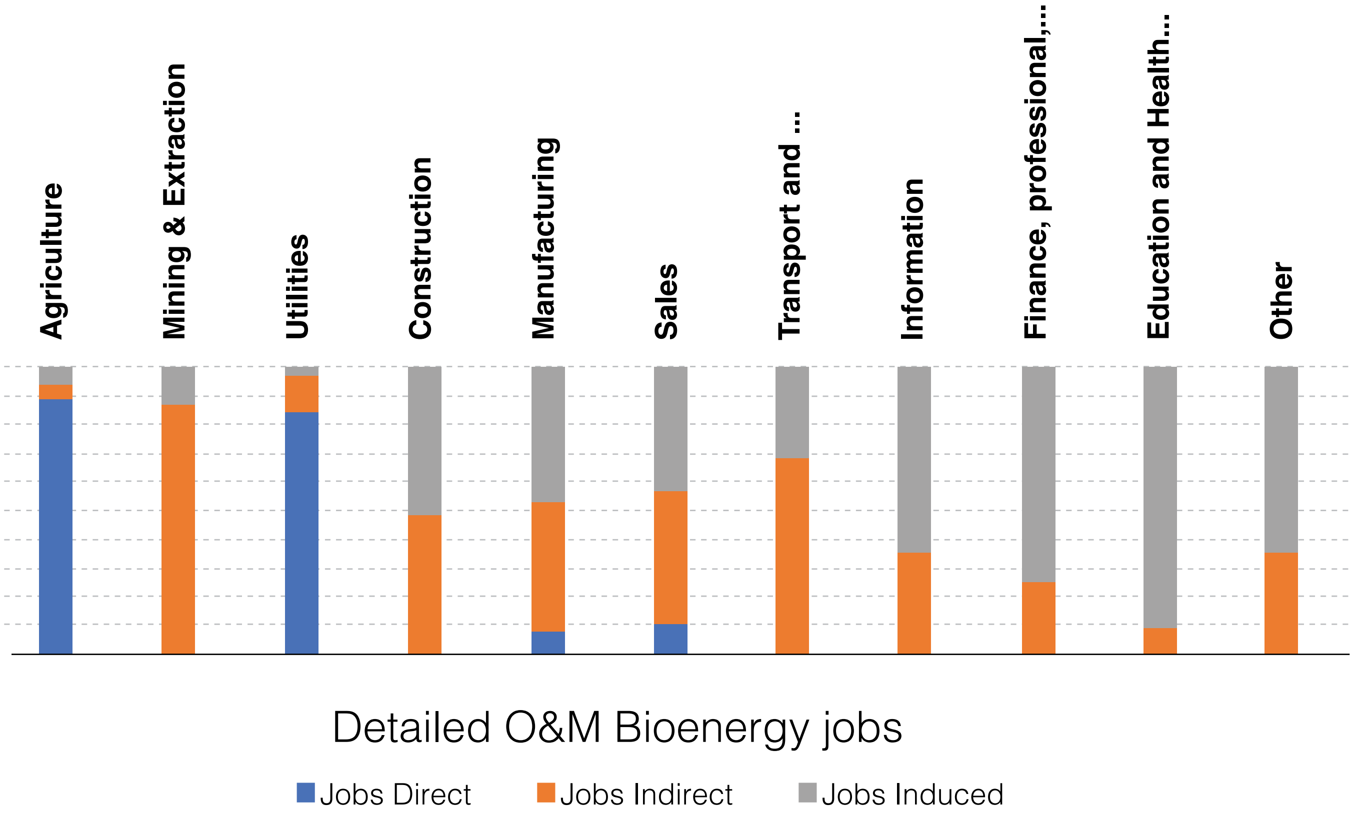
Unlike Botswana, Ghana has planned to deploy Bioenergy which would generate 8,722 total construction jobs of which 395 or 38% are direct jobs as depicted in Figure 5.12. From the total direct construction jobs, the manufacturing sector would account for 47%, the finance, professional, and business sectors account for 32% and the construction sector would account for 21%. The total number of construction jobs would be higher as O&M jobs would only generate a total of 472 jobs across the sectors, this means that construction jobs that would be generated would be approximately 18 times more than O&M jobs.

Figure 5.12: Detailed bioenergy construction and O&M jobs estimate in Ghana

Detailed Impacts Construction				
	Jobs			
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	11	54	65
Mining & Extraction	-	64	14	78
Utilities	-	26	26	51
Construction	684	143	47	873
Manufacturing	1544	386	308	2238
Sales	-	494	361	855
Transportation & Warehousing	-	200	156	356
Information	-	84	59	143
Finance, professional, & Business	1068	588	1887	3543
Education and Health Care	-	31	258	289
Other	-	121	108	229
Total	**3295**	**2149**	**3277**	**8722**

Detailed Impacts O&M				
	Jobs			
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	49	2	4	55
Mining & Extraction	-	19	3	22
Utilities	63	10	2	75
Construction	4	1	2	7
Manufacturing	9	25	26	60
Sales	-	39	36	75
Transportation & Warehousing	-	14	7	21
Information	-	1	3	4
Finance, professional, & Business	-	30	92	122
Education and Health Care	-	1	5	6
Other	-	9	16	25
Total	**124**	**152**	**195**	**472**





Ghana's bioenergy deployment would generate 124 direct jobs of which 51% would be in the utilities sector. The O&M jobs would collectively generate 347 indirect and induced jobs of which 35% would be in the finance, professional and business sector, 22% would be in the sales sector, 15% in the manufacturing sector while 28% of total direct and induced jobs would be distributed across the rest of the sectors.

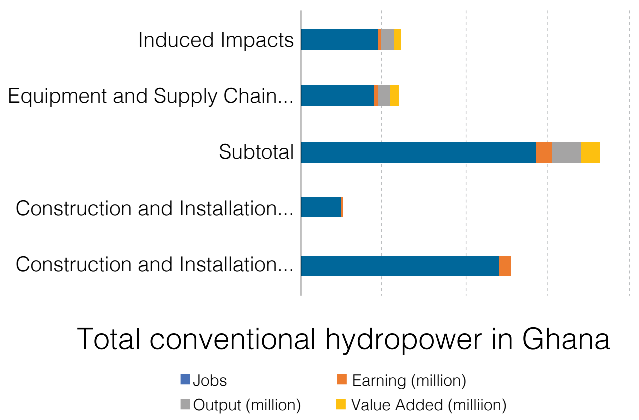
Similarly to other energy technologies, the deployment of bioenergy will have an impact on the economy of Ghana. Under a 30% LCR, earnings are expected to reach USD154 million, with the 60% LCR scenario contributing an additional USD36 million. In terms of output and value-added, the 30% LCR scenario is projected to generate USD930 million and USD398 million, respectively, while the 60% LCR scenario is expected to add an extra USD213 million in output and USD89 million in value-added. This denotes that waste-to-energy remains significantly relevant to the African economy despite its heavy dependence on Biotechnology and other pertinent new technologies which would require financial investments, a skilled labour force as well as the active participation of policy makers (Kalogiannidis et al., 2023).

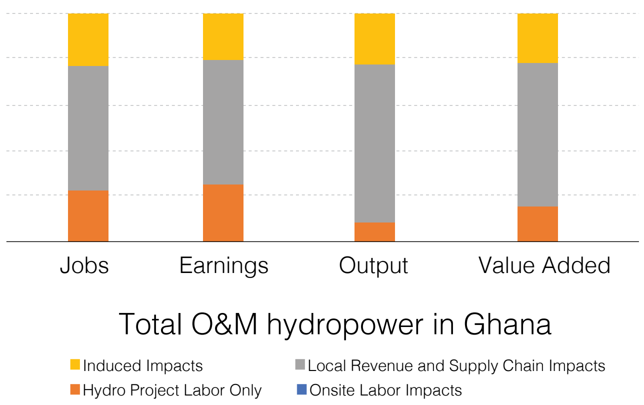
e) Ghana base case summary results for hydropower jobs

The jobs estimate for conventional hydropower in Ghana is estimated to create 4,790 jobs. In the construction sector, direct jobs that would be created are approximately 2,874 while indirect and induced jobs are estimated to be 888 and 923 respectively. Construction direct jobs account for 60% of direct jobs created. The O&M is estimated to create 87 direct jobs while induced jobs would be 23.

Figure 5.13: Total conventional hydropower jobs in Ghana

Detailed Impacts construction				
During construction and installation period	**Jobs**	**Earnings (million)**	**Output (million)**	**Value Added (million)**
Project Development and Onsite Labor Impacts				
Construction and Installation Labor	2398.92	156.55	0.00	0.00
Construction and Installation Related Services	475.10	26.57	0.00	0.00
Subtotal	**2874.02**	**183.12**	**351.52**	**225.23**
Equipment and Supply Chain Impacts	888.19	52.57	157.31	89.05
Induced Impacts	927.78	52.81	155.38	89.68
Total Impacts	**4690.00**	**288.50**	**664.22**	**403.97**
Detailed Impacts O&M				
During operating years	**Jobs**	**Earnings**	**Output**	**Value Added**
Onsite Labor Impacts				
Hydro Project Labor Only	22.68	1.60	1.60	1.60
Local Revenue and Supply Chain Impacts	54.45	3.47	12.16	6.52
Induced Impacts	23.26	1.35	3.98	2.30
Total Impacts	**100.39**	**6.42**	**17.74**	**10.42**





4.3 Democratic Republic of Congo results

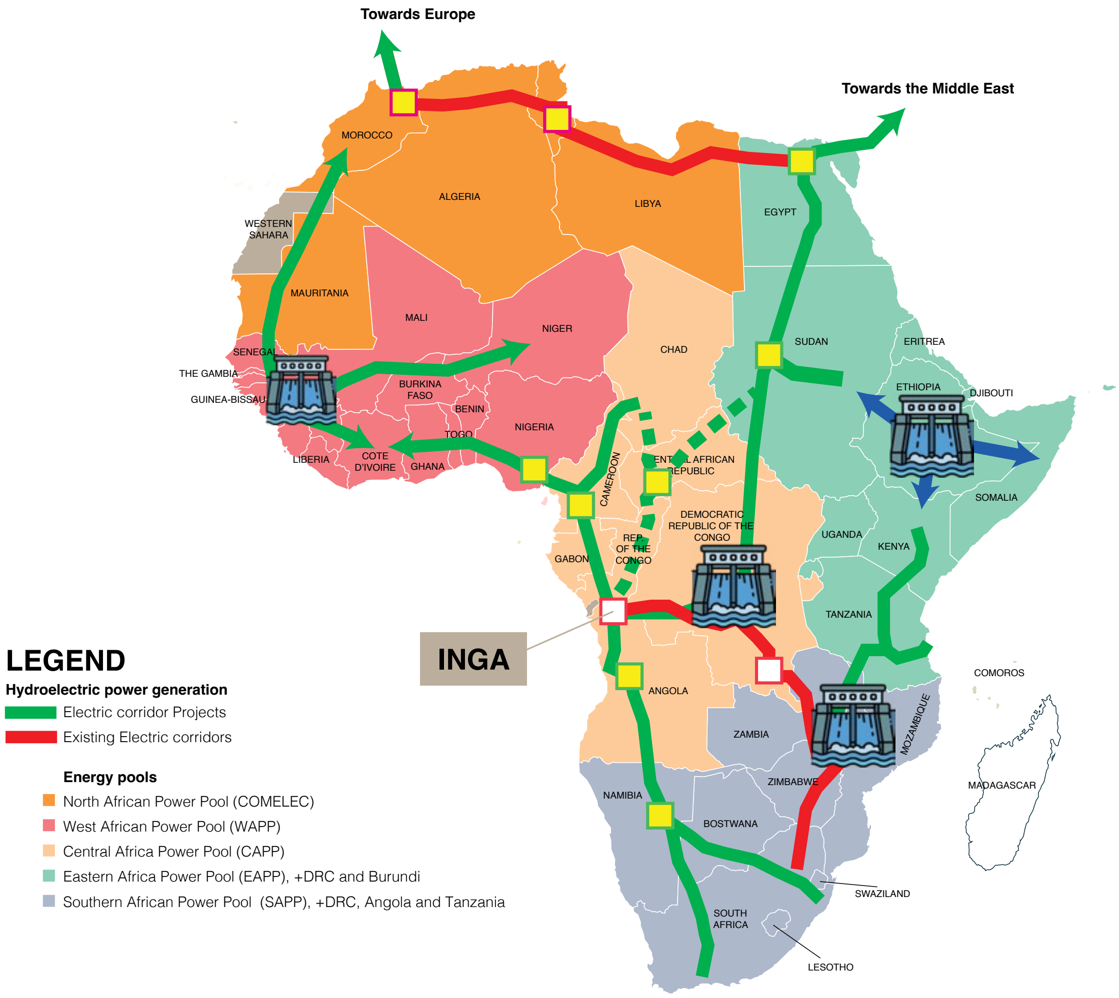
According to the Global Energy Alliance for People and Planet (2023), DRC is the second largest unelectrified country in the world. The DRC crosses approximately 2.35 million square kilometres and has a population record of 102 million persons, however, the country's transmission and distribution network only covers 6,975km, mainly in the south east of DRC. As a result, the DRC government has set a target to electrify 20 million citizens by 2024 through the installation of adoption of microgrids. This target requires a funding of at least 1 billion USD. DRC is endowed with water resources and holds the potential to generate 40,000 MW of hydropower. Moreover, the country has the potential to develop other forms of renewable energy in the areas of bioenergy, solar and wind (Ministry of Planning, 2024). Additionally, the DRC NDC report updated in 2021 shows planned power installation for the period 2021 – 2023 (Ministry of Environment and Sustainable Development, 2021).

- Increase the 3GW of hydropower to 4GW by 2030;
- Wind, solar and geothermal increase from 2,900 MW to 42,700 MW by 2030.

As a result, we model the commitments made on the updated NDC report where wind and solar PV are estimated to generate 10,000 MW respectively. We assume the remaining 18,900 MW would be from geothermal.

Figure 5.14 shows the Grand Inga project has the potential to generate 100 GW of hydropower, this means that if this project could be implemented, most of the electrification challenges in DRC would be resolved.

Figure 5.14: Potential of the Grand Inga project (Ministry of Planning, 2024)

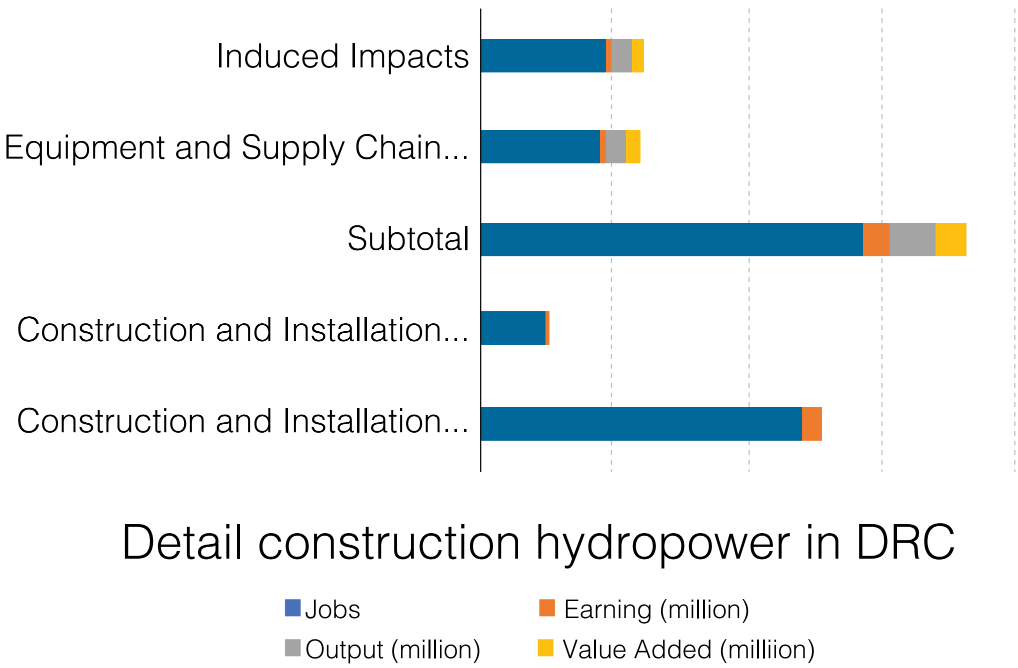


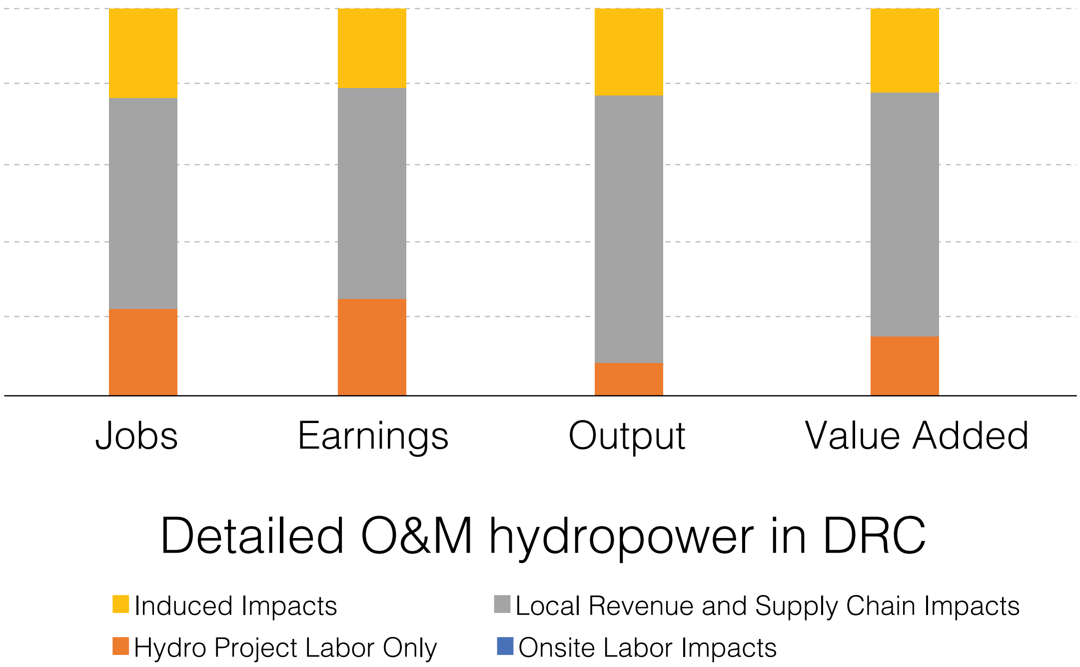
a) DRC base case summary results for hydropower jobs

The jobs projected for conventional hydropower in DRC are estimated to create 24,463 jobs. In the construction sector, direct jobs that would be created are approximately 14,669 while indirect and induced jobs are estimated to be 1,506 and 3,487 respectively. Construction direct jobs account for 62% of direct jobs created. Direct O&M jobs account for 2% of the jobs created and these are long term sustainable employment opportunities.

Figure 5.15: Summary result for hydropower adoption in DRC

Detailed Impacts construction				
During construction and installation period	**Jobs**	**Earnings (million)**	**Output (million)**	**Value Added (million)**
Project Development and Onsite Labor Impacts				
Construction and Installation Labor	12232.17	797.93	0.00	0.00
Construction and Installation Related Services	2436.42	136.23		
Subtotal	**14668.59**	**934.16**	**1797.76**	**1150.13**
Equipment and Supply Chain Impacts	4541.58	268.83	804.48	455.39
Induced Impacts	4738.87	269.69	793.52	458.00
Total Impacts	**23949.04**	**1472.68**	**3395.76**	**2063.52**
Detailed Impacts O&M				
During operating years	**Jobs**	**Earnings**	**Output**	**Value Added**
Onsite Labor Impacts				
Hydro Project Labor Only	116.31	8.21	8.21	8.21
Local Revenue and Supply Chain Impacts	279.22	17.80	62.34	33.42
Induced Impacts	119.28	6.94	20.41	11.78
Total Impacts	**514.82**	**32.94**	**90.96**	**53.41**





Although the is a massive potential that the Grand Inga project holds, as the DRC updated NDC of 2021 shows, the country has only committed to implementing 1 000 MW of hydropower for the period 2021 – 2030 (Ministry of Environment and Sustainable Development, 2021).

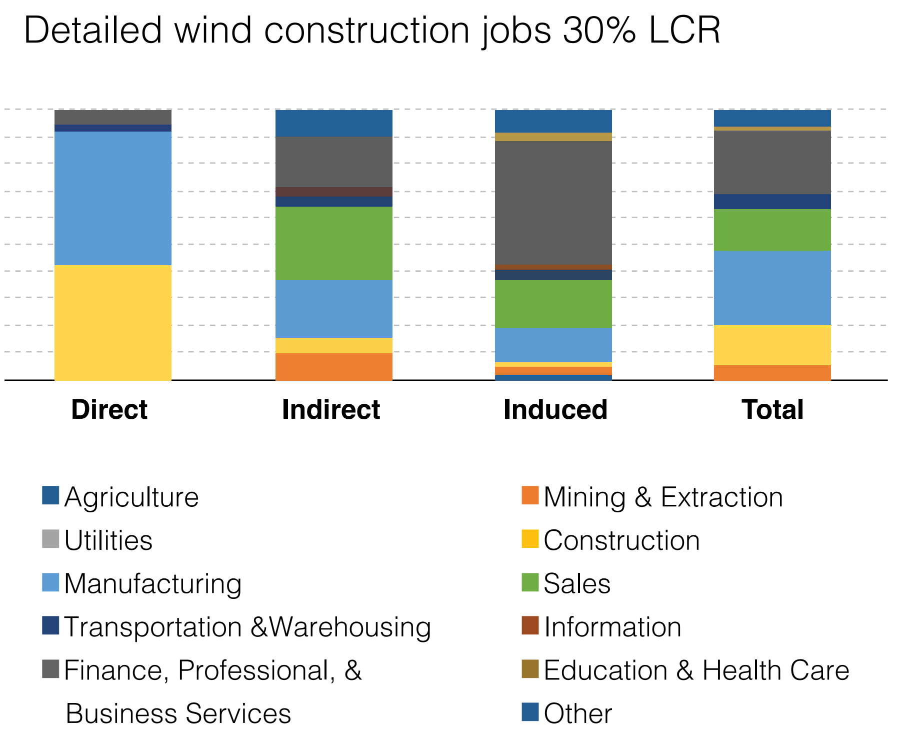
b) DRC base case summary results for wind jobs

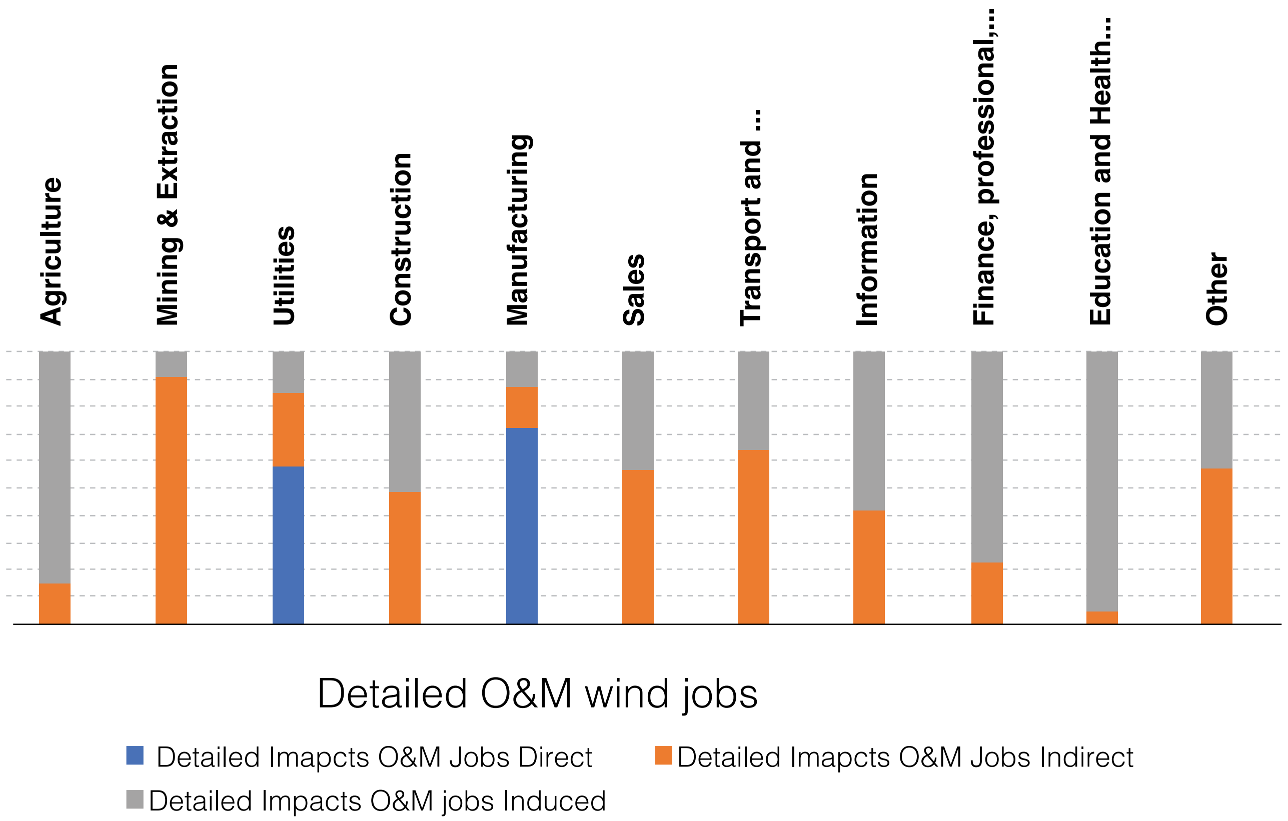
The DRC has immense plans for hydro energy, however, wind energy, amongst other energy technologies, will also be deployed to the energy mix. The country's planned wind energy generation is estimated to generate 330 194 construction jobs at 30% LCR to propel reaching its carbon mitigation targets. The DRC job outputs for wind construction jobs are relatively high compared to those of Botswana and Ghana. Furthermore, 100 224 direct construction would be generated, of which 93% would be generated in the construction and manufacturing sector while 2% of the jobs would be distributed across the transport and warehousing sector and finance, professional, and business sectors. Although direct jobs would not be generated in other sectors, indirect and direct jobs will be distributed across all sectors.

Figure 5.16: Detailed wind construction and O&M jobs estimate DRC

Detailed Impacts Construction				
	Jobs			
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	428	2140	2569
Mining & Extraction	-	11 178	1680	12 858
Utilities	-	1414	1355	2769
Construction	43 288	3725	908	47 921
Manufacturing	49 429	25 425	15 159	90 013
Sales	-	32 140	21 189	53 329
Transportation & Warehousing	3274	5766	3890	12 930
Information	-	1889	1598	3487
Finance, professional, & Business	4233	22 685	53 433	80 351
Education and Health Care	-	212	3051	3263
Other	-	11 217	9487	20 704
Total	**100 224**	**116 080**	**113 890**	**330 194**

Detailed Impacts O&M				
	Jobs			
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	33	182	215
Mining & Extraction	-	1466	143	1609
Utilities	450	207	115	772
Construction	-	73	77	150
Manufacturing	7886	1589	1291	10766
Sales	-	2372	1804	4176
Transportation & Warehousing	-	581	331	913
Information	-	99	136	235
Finance, professional, & Business	-	1352	4549	5901
Education and Health Care	-	13	260	273
Other	-	1075	808	1883
Total	**8336**	**8860**	**9696**	**26 893**





The total O&M jobs would be generated would be significantly smaller compared to construction, exhibiting 26 893 which is equivalent to 8% of the total construction jobs. Interestingly, direct jobs would only be generated in the manufacturing sector and utilities sector as shown in Figure 15.6. On the contrary, no direct construction jobs in the utilities sector would be generated. Furthermore, the manufacturing sector would generate 40% of the total O&M jobs, thus exhibiting the highest number of jobs generated among other sectors. The DRC's ambitions towards the deployment of wind energy should be of more priority as the country possesses good wind energy potential with various hotspots around the country reaching wind speeds between 6 to 6.6 m/s (Kusakana, 2016). The deployment of wind energy in the DRC is projected to generate remarkable economic benefits. Under a 30% LCR scenario, earnings are expected to reach USD5.6 billion, with output and value-added projected at USD31.7 billion and USD10.6 billion, respectively. The 60% LCR scenario would result in a 30% increase in earnings and a 29% increase in both output and value-added.

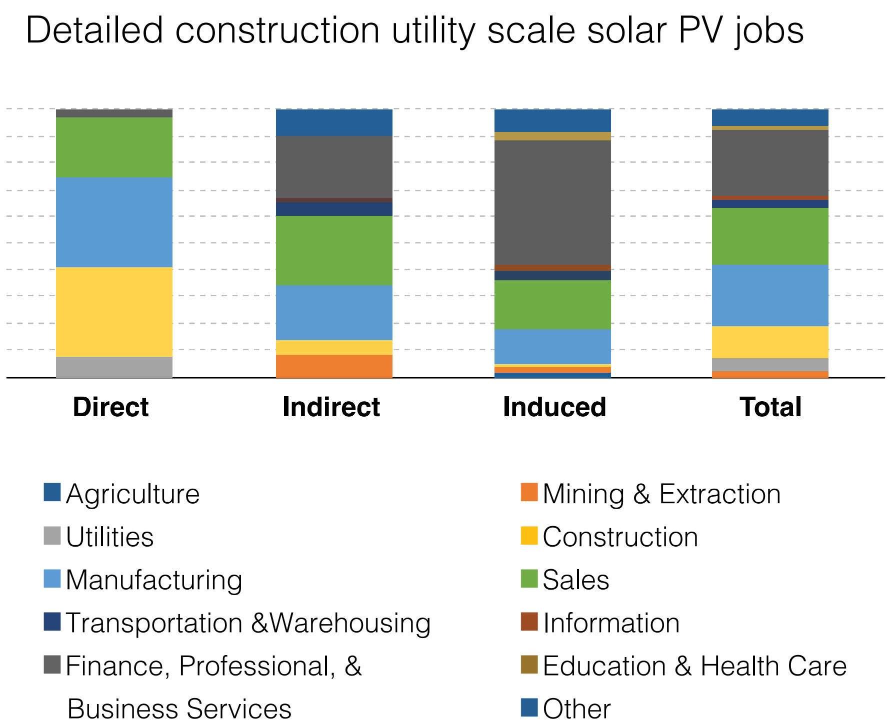
c) DRC base case summary results for utility scale solar PV jobs

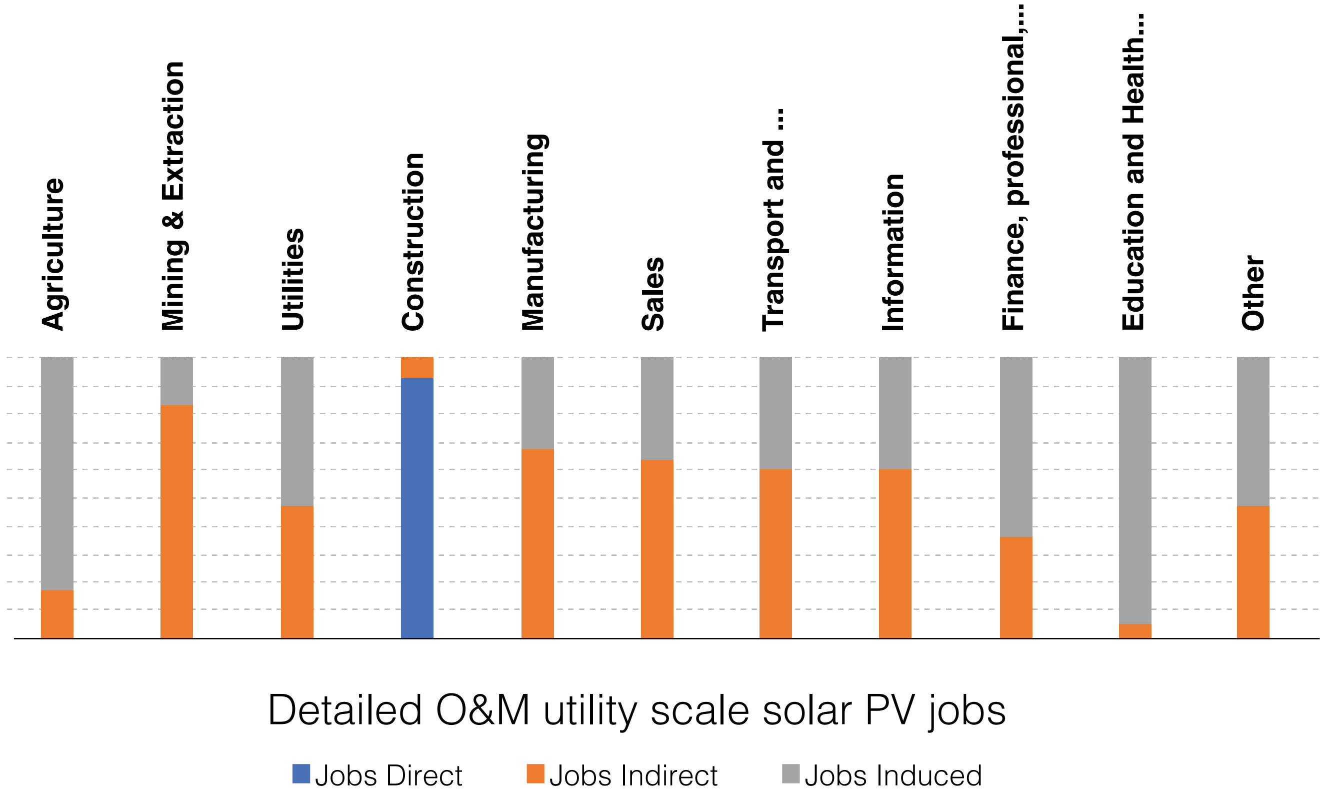
The DRC is also aiming to deploy utility scale solar PV as part of their decarbonization strategy. The country has high solar radiation of up to 6.0 kWh/m2 per day in areas that are in close proximity to the equator (Kusakana, 2016). Similarly to the wind jobs, the utility scale solar PV construction jobs would generate high quantities of jobs compared to the O&M jobs. A total of almost 300 000 construction jobs as shown in Figure 5.17 would be generated and the sector that would generate the highest number of total construction jobs would be the finance, profession, and business sectors accounting for 25% of the total construction jobs for utility scale solar PV.

Figure 5.17: Detailed utility scale solar PV construction and O&M jobs estimate DRC

Detailed Impacts Construction				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	353	1946	2300
Mining & Extraction	-	8069	1528	9597
Utilities	8938	2124	1232	12 294
Construction	31 001	2850	826	34 677
Manufacturing	33 184	18 448	13 784	34 677
Sales	20 854	24 340	19 267	65 416
Transportation & Warehousing	0	4790	3537	64 461
Information	-	1814	1454	3267
Finance, professional, & Business	3228	21 731	48 587	73 547
Education and Health Care	-	153	2774	2927
Other	-	8287	8627	16 913
Total	**97 205**	**92 959**	**103 562**	**293 726**

Detailed Impacts O&M				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	9.4	43.2	52.5
Mining & Extraction	-	155.8	33.9	189.7
Utilities	-	24.8	27.3	52.1
Construction	1952.3	138.4	18.3	2109.0
Manufacturing	-	647.0	305.6	952.6
Sales	-	740.1	427.2	1167.3
Transportation & Warehousing	-	119.3	78.4	197.7
Information	-	48.8	32.2	81.1
Finance, professional, & Business	-	608.1	1077.3	1685.4
Education and Health Care	-	3.9	61.5	65.4
Other	-	175.9	191.3	367.2
Total	**1952.3**	**2671.4**	**2296.3**	**6920.0**





The total O&M job estimate would be 6 920, with direct jobs only being generated in the construction sector while indirect and induced jobs would be generated in all the sectors as shown in Figure 5.17. Although direct jobs would only account for 28% of the total O&M jobs, 72% would be accounted for by indirect and induced jobs thus contributing to the overall employment plan of the country to generate green jobs and boost the economy.

The value-added at both 30% LCR and double scenario shows immense utility scale solar PV potential, however, efforts from the government pertaining to policies would drive investments and boost the country's socio-economic outlook. If realized, the 30% LCR scenario in the DRC could generate USD5.1 billion in earnings and USD28.6 billion in output. These figures could increase by 25% under a doubled LCR scenario. Additionally, the 30% LCR scenario is projected to generate USD10.3 billion in value-added, with a 23% increase under the doubled LCR scenario.

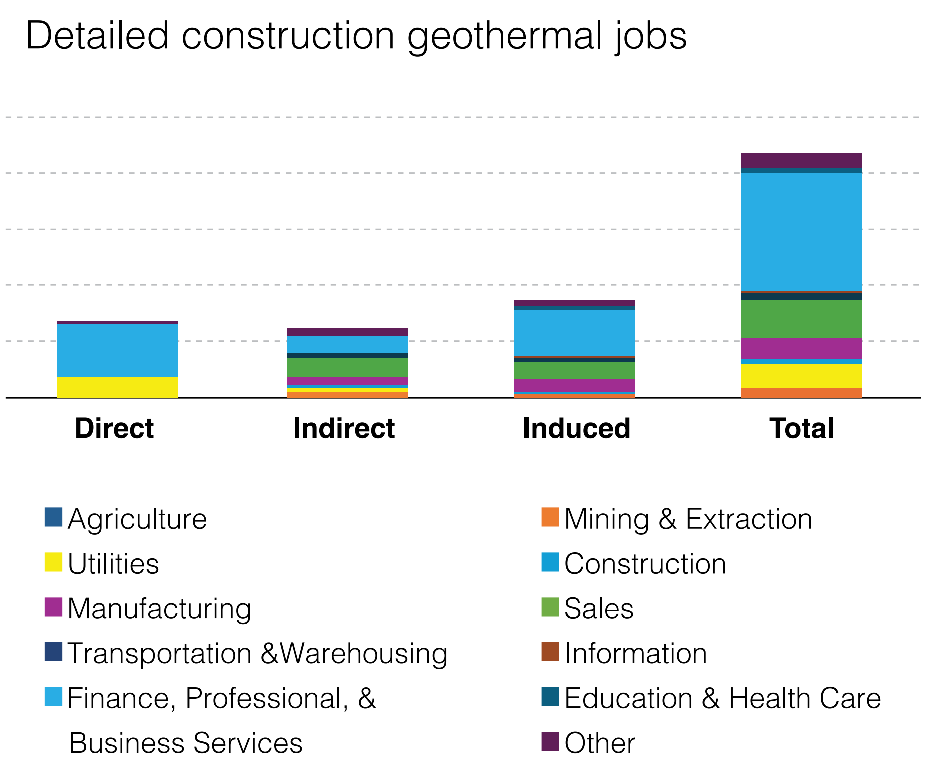
d) DRC base case summary results for geothermal jobs

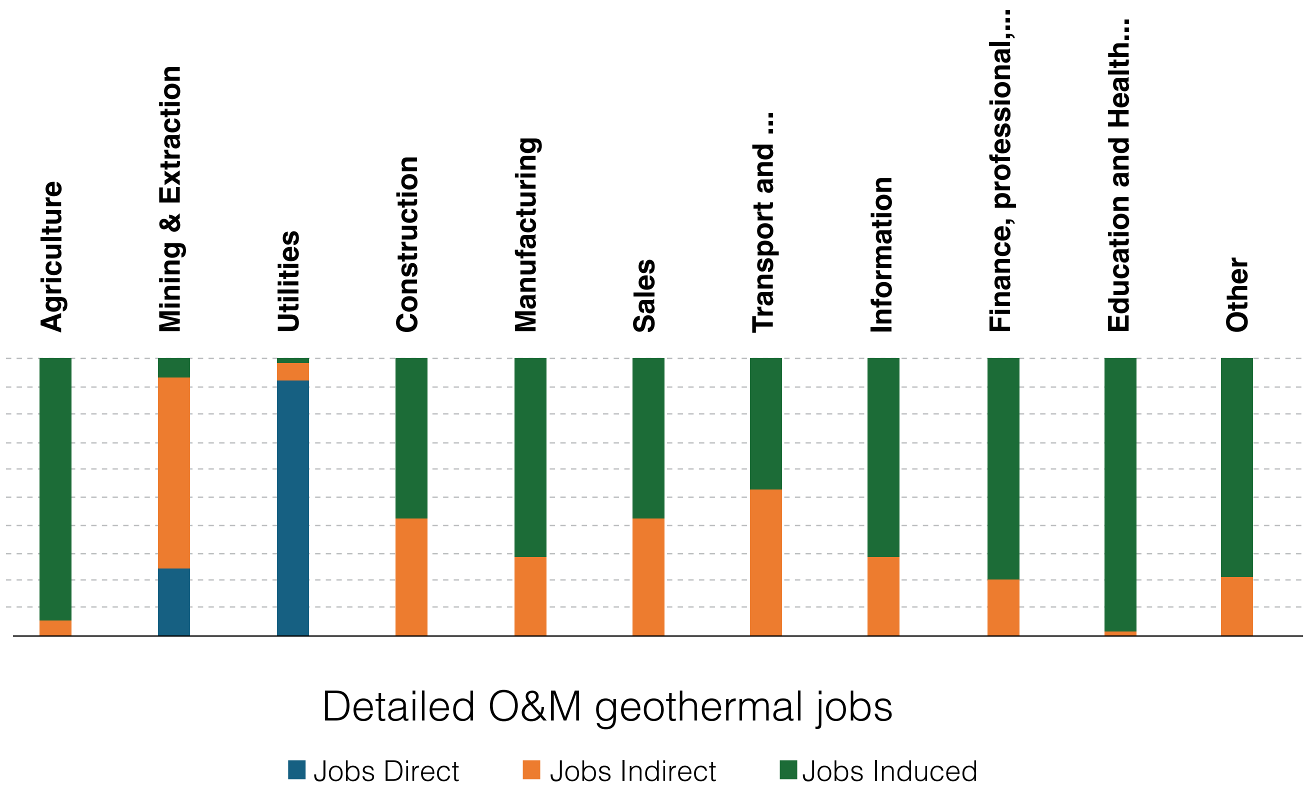
The DRC is amongst the few African countries that have communicated their carbon mitigation plans with the inclusion of geothermal energy. Although not exploited, the country has excellent geothermal sources predominantly in the eastern part of the country (Makuku, 2019). The geothermal energy potential would generate a total of 218 832 construction jobs with the finance, professional and business service sector accounting for 48% of the total construction jobs.

Figure 5.18: Detailed geothermal construction and O&M jobs estimate DRC

Detailed Impacts Construction				
	Jobs			
	Direct	Indirect	Induced	Total
Agriculture	-	275	1675	1950
Mining & Extraction	71	5643	1315	7029
Utilities	18 273	3264	1060	22 596
Construction	-	1388	710	2098
Manufacturing	7	7560	11 860	19 428
Sales	-	17 880	16 579	34 459
Transportation & Warehousing	-	3329	3044	6373
Information	-	1833	1251	3084
Finance, professional, & Business	48 468	15 072	41 807	105 347
Education and Health Care	-	414	2387	2802
Other	3	6242	7423	13 667
Total	**66 821**	**62 901**	**89 110**	**218 832**

Detailed Impacts O&M				
	Jobs			
	Direct	Indirect	Induced	Total
Agriculture	0	0	1	1
Mining & Extraction	4	10	1	15
Utilities	62	5	1	67
Construction	0	0	0	0
Manufacturing	0	2	4	5
Sales	0	10	13	23
Transportation & Warehousing	0	2	2	5
Information	0	0	1	1
Finance, professional, & Business	0	9	32	41
Education and Health Care	0	0	2	2
Other	0	2	7	9
Total	**65**	**39**	**63**	**167**





The O&M jobs estimate for geothermal deployment shows fewer jobs compared to the construction. Unusually, as depicted in Figure 5.18, 4 direct construction jobs in the mining and extraction sector would be generated throughout the development, the same sector would generate 9% of the total O&M sector.

4.4 Kingdom of eSwatini results

The (NDC Partnership, 2024) shows that the Kingdom of eSwatini has committed to installing 55.85 MW of solar PV, 80 MW of hydropower and 95 MW of bioenergy. As such, for the Kingdom of eSwatini, we analysed the job implications for implementing the country's NDC commitments. For this country, it is important to note that the population size is approximately 1.2 million (World Meter, 2024a).

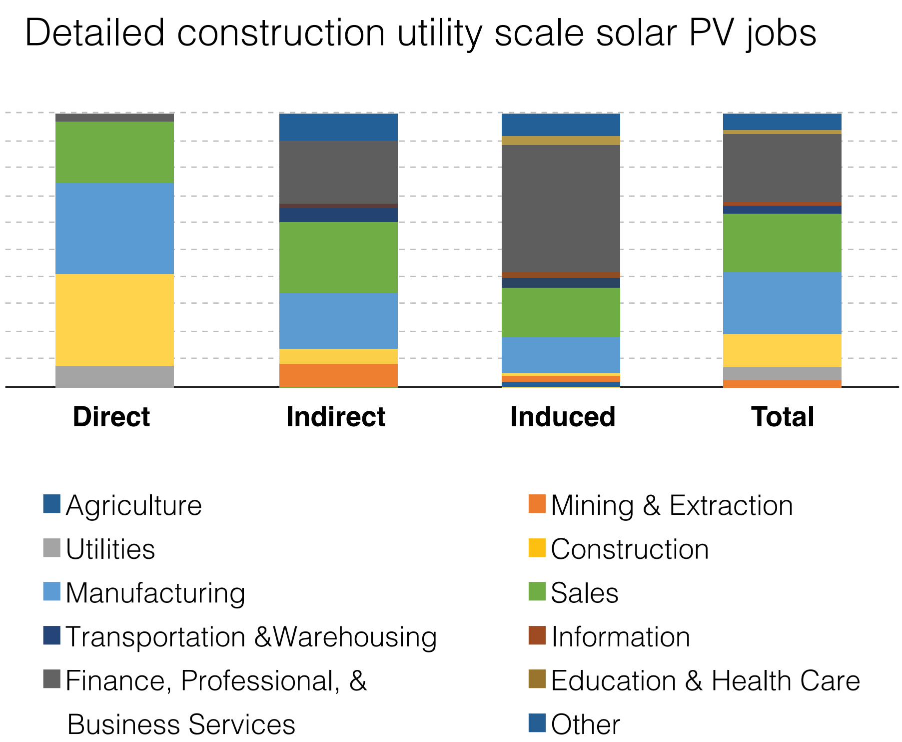
a) eSwatini base case summary results for utility scale solar PV jobs

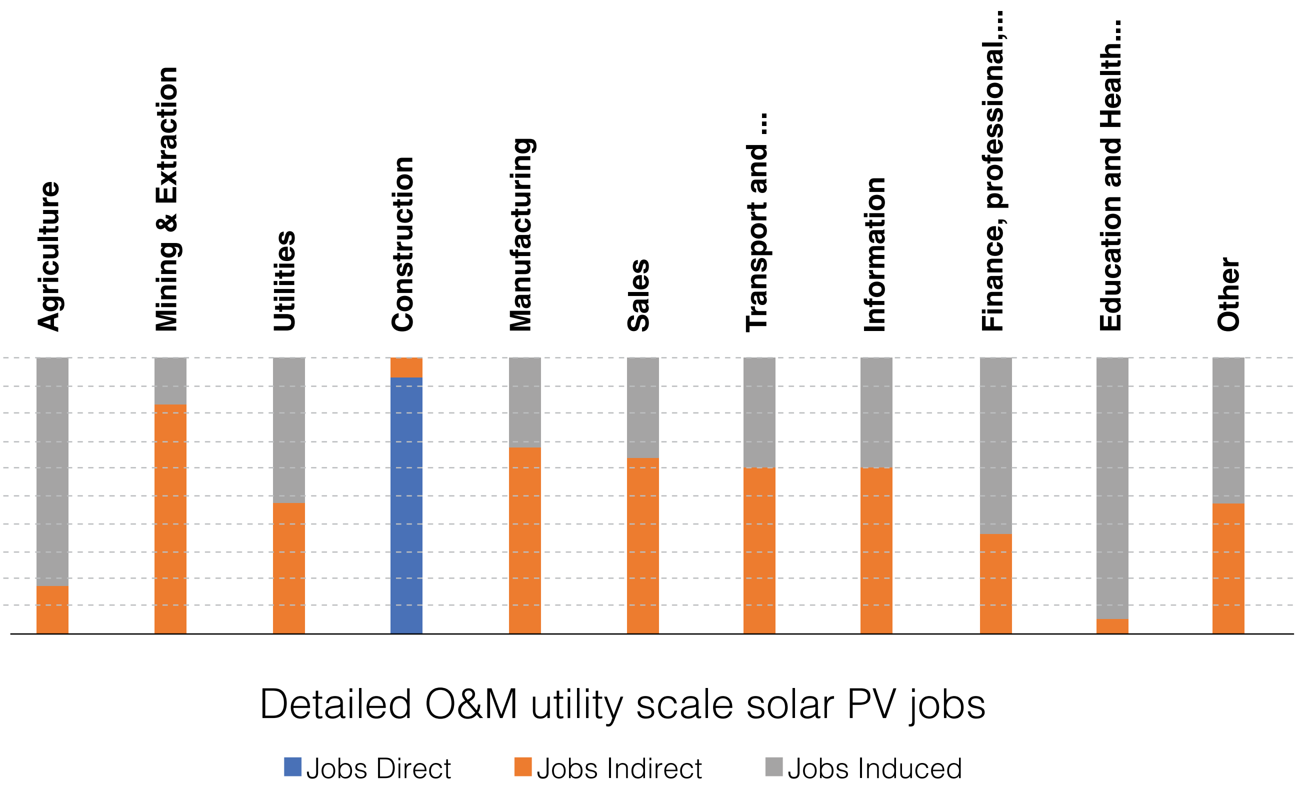
As per energy deployment plans, eSwatini would generate 1 640 total construction jobs with direct jobs accounting for 33%. Utility scale solar PV jobs are relatively smaller as less MW would be generated compared to hydropower MW and bioenergy MW. Although the construction jobs are seemingly fewer, total O&M jobs are significantly fewer at less than 40 across all the sectors.

Figure 5.19: Detailed utility scale solar PV construction and O&M jobs estimate for eSwatini

Detailed Impacts Construction				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	2	11	13
Mining & Extraction	-	45	9	54
Utilities	50	12	7	69
Construction	173	16	5	194
Manufacturing	185	103	77	365
Sales	116	136	108	360
Transportation & Warehousing	-	27	20	47
Information	-	10	8	18
Finance, professional, & Business	18	121	271	411
Education and Health Care	-	1	15	16
Other	-	46	48	94
Total	**543**	**519**	**578**	**1640**

Detailed Impacts O&M				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	0.1	0.2	0.3
Mining & Extraction	-	0.9	0.2	1.1
Utilities	-	0.1	0.2	0.3
Construction	10.9	0.8	0.1	11.8
Manufacturing	-	3.6	1.7	5.3
Sales	-	4.1	2.4	6.5
Transportation & Warehousing	-	0.7	0.4	1.1
Information	-	0.3	0.2	0.5
Finance, professional, & Business	-	3.4	6.0	9.4
Education and Health Care	-	0.0	0.3	0.4
Other	-	1.0	1.1	2.1
Total	**10.9**	**14.9**	**12.8**	**38.6**





Thus far, the O&M jobs potential in the utility scale solar PV would only generate 11 direct construction jobs as Figure 5.19 highlights. This may be due to the amount of solar MW to be deployed which is driven by the size geographical and population size of the country. From the 11 direct construction jobs that would be generated, only 1 job would be generated in a 30% LCR.

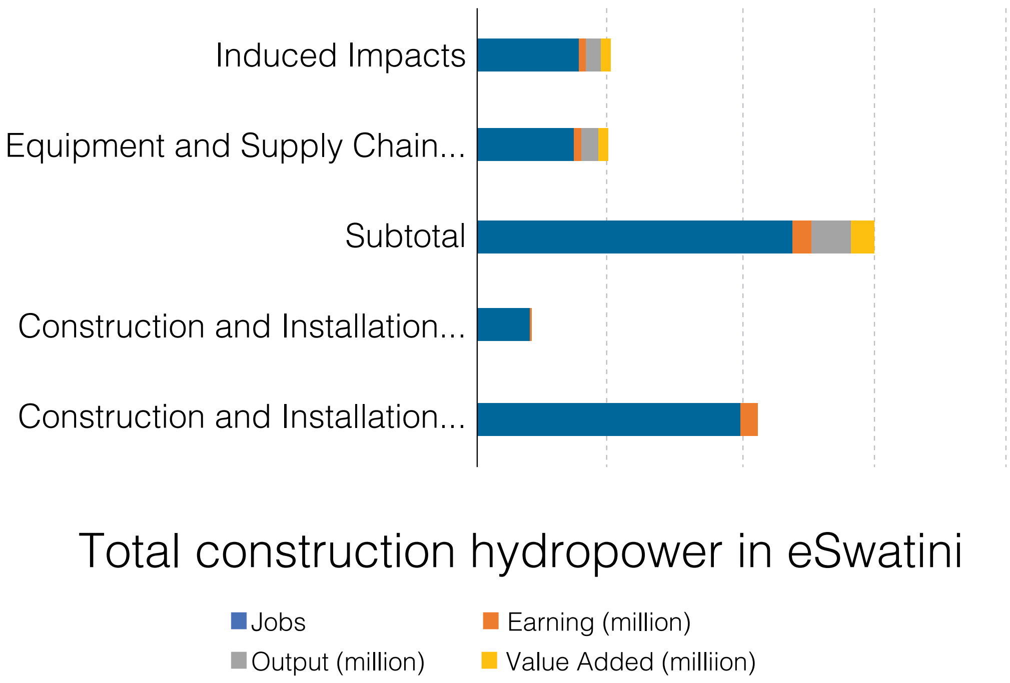
The total earnings and output that would be generated at 30% LCR for construction jobs would be USD28.3 million and USD160 million with a 25% increase potential at a 60% LCR scenario. Additionally, the value added would generate USD57.3 million with a 23% increase potential at a 60% LCR scenario. Although the earnings and value-added of eSwatini may seem relatively smaller than those of other countries, an immense economic shift can be achieved in a country as small as eSwatini.

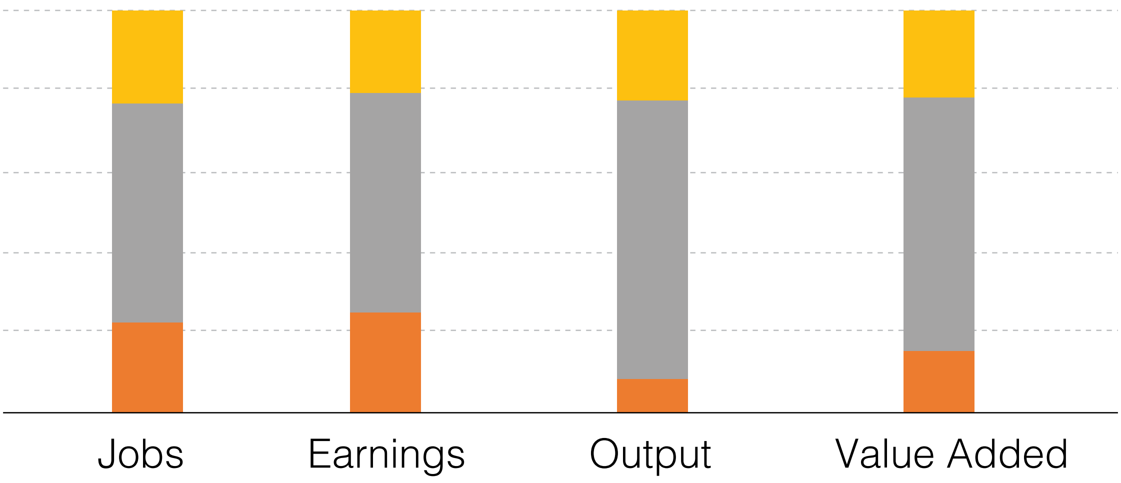
b) eSwatini summary results for hydropower jobs

The deployment of 80 MW of hydropower is projected to generate a total of 3 169 construction and O&M jobs across all sectors. Moreover, both job categories would generate a total of 393 induced jobs. The deployment of hydropower in eSwatini would contribute to the country's economic growth and create jobs depending on locally available required skills. In addition, there is a lack of required technology development and skills in the majority of Africa countries that have committed to energy transition, especially in low carbon technology manufacturing. Although it has been reported that tertiary qualifications are adequate in some parts of the African region, more efforts should be directed toward developing skills (SANEA, 2023).

Figure 5.20: Detailed utility hydropower construction jobs for eSwatini

Detailed Impacts construction				
During construction and installation period	**Jobs**	**Earnings (million)**	**Output (million)**	**Value Added (million)**
Project Development and Onsite Labor Impacts				
Construction and Installation Labor	994.17	64.93		
Construction and Installation Related Services	194.91	10.90		
Subtotal	**1189.09**	**75.83**	**144.92**	**93.10**
Equipment and Supply Chain Impacts	366.29	21.68	64.87	36.72
Induced Impacts	383.39	21.83	64.23	37.07
Total Impacts	**3127.85**	**195.16**	**274.01**	**166.90**
Detailed Impacts O&M				
During operating years	**Jobs**	**Earnings**	**Output**	**Value Added**
Onsite Labor Impacts				
Hydro Project Labor Only	9.30	0.66	0.66	0.66
Local Revenue and Supply Chain Impacts	22.34	1.42	1.63	2.67
Induced Impacts	9.54	0.55	1.63	0.94
Total Impacts	**41.19**	**2.64**	**7.28**	**4.27**





Total O&M hydropower in eSwatini

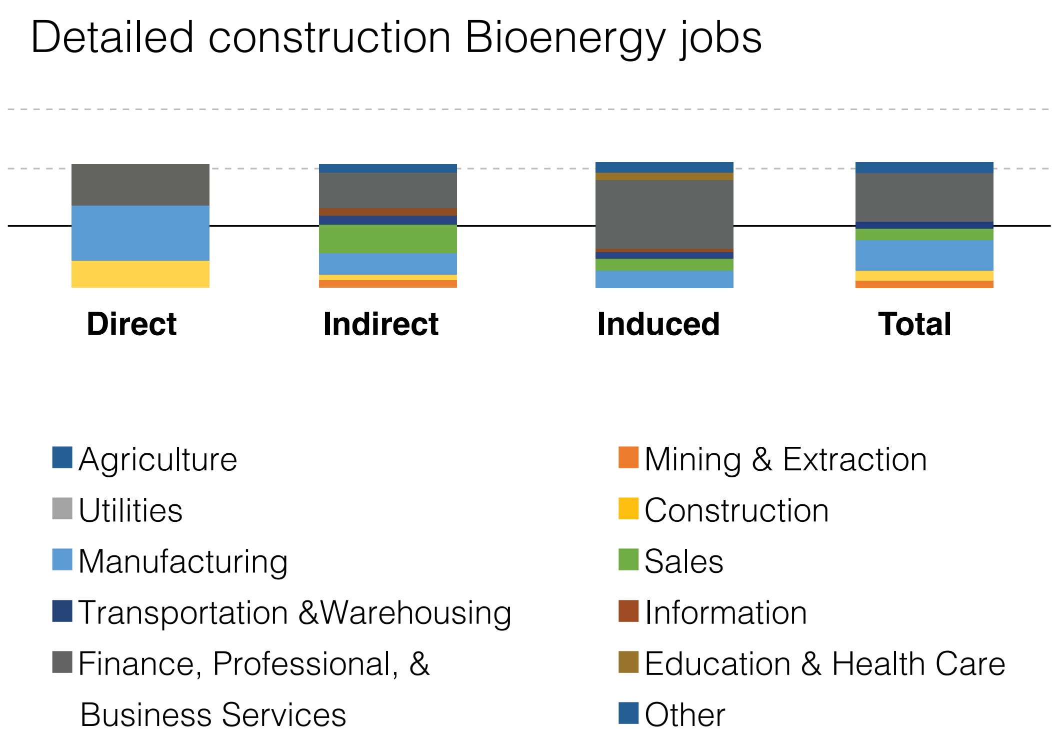
c) eSwatini base case summary results for utility scale bioenergy jobs

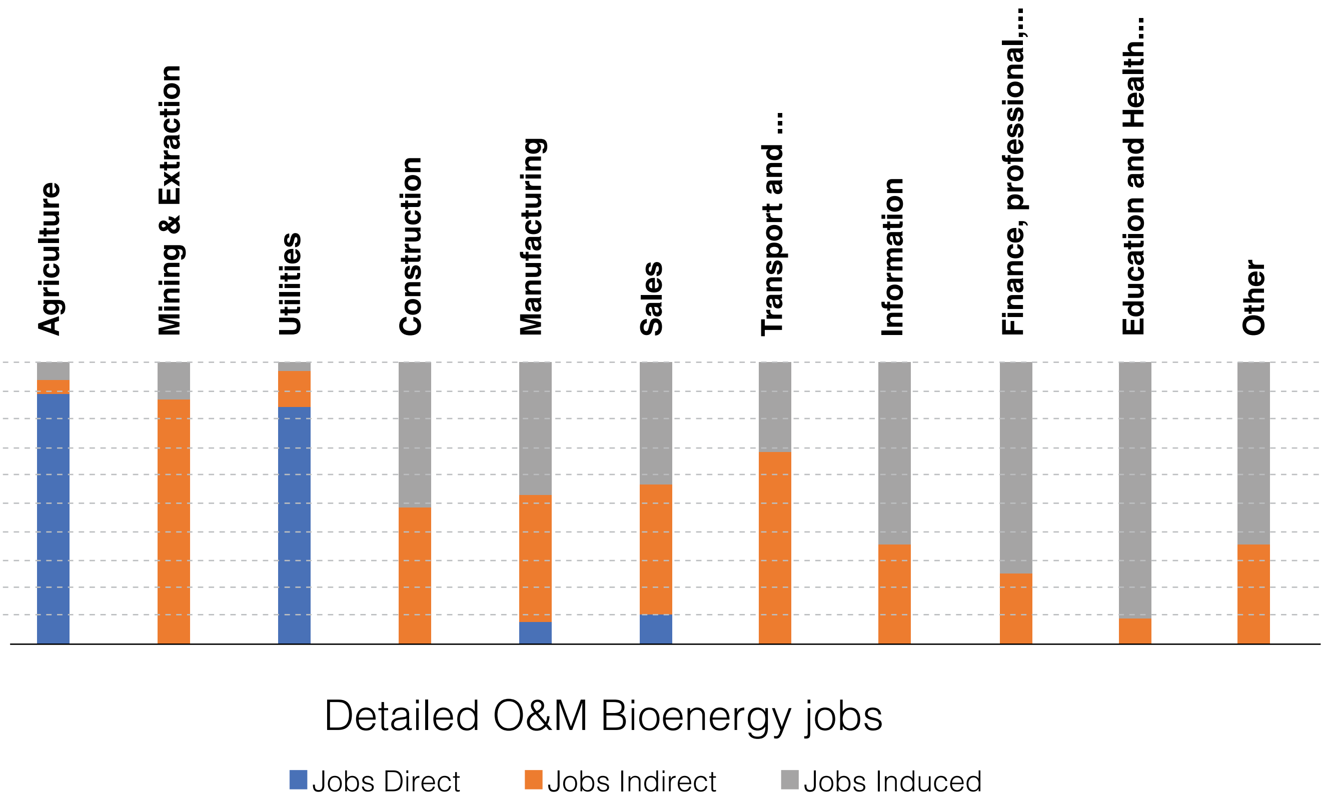
eSwatini will deploy 95 MW of bioenergy which is more than the planned MW of solar PV and hydro power. Expectedly, more bioenergy related jobs would be generated compared to other energy technologies. A total of 6 791 construction jobs would be generated with the utilities sector generating a low number of 40 jobs equivalent to less than 1% of the total jobs while the finance, professional and business services sector generates 2 759 jobs which equates to 41% of the total jobs.

Figure 5.21: Detailed utility bioenergy construction and O&M jobs eSwatini

Detailed Impacts Construction				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	-	9	42	51
Mining & Extraction	-	50	11	61
Utilities	-	20	20	40
Construction	532	111	36	680
Manufacturing	1202	301	240	1742
Sales	-	385	281	666
Transportation & Warehousing	-	156	121	277
Information	-	66	46	111
Finance, professional, & Business	831	458	1470	2759
Education and Health Care	-	24	201	225
Other	-	94	84	178
Total	**2566**	**1674**	**2552**	**6791**

Detailed Impacts O&M				
		Jobs		
	Direct	**Indirect**	**Induced**	**Total**
Agriculture	38	2	3	43
Mining & Extraction	-	15	2	17
Utilities	49	8	2	58
Construction	-	1	1	2
Manufacturing	3	19	20	43
Sales	7	31	28	66
Transportation & Warehousing	-	11	5	16
Information	-	1	2	3
Finance, professional, & Business	-	24	71	95
Education and Health Care	-	0	4	4
Other	-	7	13	20
Total	**97**	**118**	**152**	**367**





The O&M bioenergy jobs are projected to generate 38 direct jobs in the agricultural sector. Intriguingly, no direct jobs would be generated in the finance, professional and business services sector although this sector usually generates higher quantities of direct jobs across various energy technologies in studied countries. Moreover, only 3 direct O&M jobs in the manufacturing sector would be generated. eSwatini's energy adoption plans are notably less ambitious compared to countries like Ghana. This is largely due to eSwatini's smaller size, which impacts its capacity for energy development. Consequently, the expected number of bioenergy jobs in eSwatini will be lower. In contrast, Ghana, with its greater capacity, energy demands, and larger population, is projected to generate significantly more bioenergy jobs.

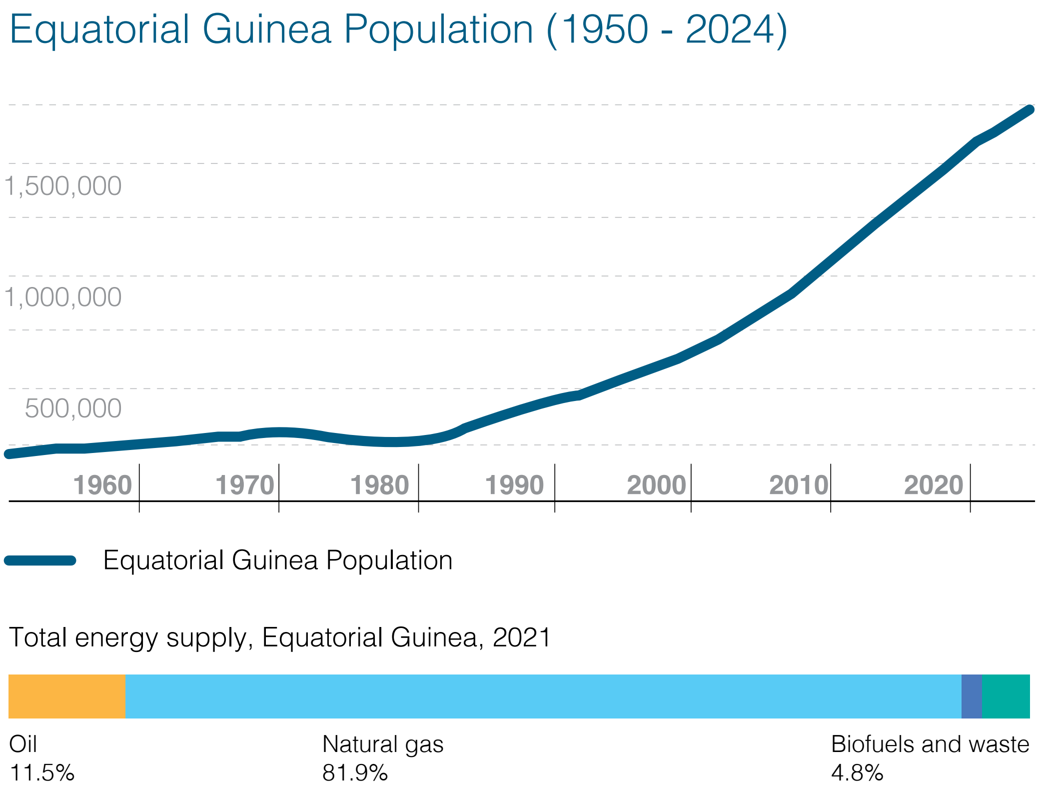
The addition of bioenergy to the national energy mix would generate a total of USD101 billion across earnings, output and value added at a 30% LCR scenario. The economic projections highlight the potential of the country's energy mix, showing a promising view to the government of eSwatini. African countries are likely to adopt diverse energy technologies if they prove beneficial to economic growth, and address challenges such as poverty, unemployment, and energy crises. This approach will also enhance electrification rates, especially in underdeveloped African nations. An additional USD24 billion is generated for 60% of LCR. Earning increased by 21% while output and value-added increases by 19% and 18% respectively.

4.5 Equatorial Guinea analysis

According to the International Energy Agency (2024), Equatorial Guinea's Total Energy Supply (TES) includes all the energy produced in or imported to a country and the exported energy or stored energy is removed from the TES. TES accounts for all the energy requirements for the country. Several of the energy sources are utilised directly certain portion is transformed into other energy carriers such as fuel and electricity that are consumed by end users.

Figure 5.22 shows the energy contribution per technology. The total installed power capacity in Equatorial Guinea is 154 MW, diesel accounts for 24 MW and natural gas generates about 129 MW (Energy Capital & Power, 2021; International Energy Agency, 2024).

Figure 5.22: Equatorial Guinea’s total energy supply and the population size



(International Energy Agency, 2024; World Meter, 2024a)

The Equatorial Guinea energy demand is forecasted to grow at approximately 10% per annum, not creating headroom for an aggressive adoption of low carbon technologies. This is mainly due to a limited population size of approximately 1.7 million citizens (World Meter, 2024b).

4.6 Lessons that could be drawn from the JEDI model

The modelling scenario covered five countries with diverse energy technologies that would be implemented from 2021 to 2030. The key lesson that should be drawn from the modelling exercise is that increasing the local content requirements for each technology that would be implemented will yield increased job creation and increased economic impact, particularly, in earning, economic output and value add.

5. Implications, key considerations and conclusion

5.1 Energy transition jobs implications for the African continent

Africa holds about one-third of the world's mineral resources, including over half of the global cobalt, manganese and platinum group reserves, as well as other critical minerals. Countries such as Gabon, Madagascar, Morocco, and South Africa are among the top sources of critical minerals. Developed countries in the northern hermisphere are heavily dependent on these countries for raw materials that are utilized to manufacture low-carbon technologies such as lithium batteries, solar PV, and wind energy components. Guinea, Mali, Mozambique, and Zambia also have significant reserves of critical minerals. Additionally, Ghana, Guinea, Mali, Namibia, South Africa, and Tanzania have essential critical minerals for an energy transition, and the minerals sector already accounts for over 25% of exports in each of these countries, without any manufacturing value-added (International Energy Agency, 2023; Pham, 2024).

In these analyses, it's important to note that the number of jobs generated for each type of renewable energy technology varies significantly. The jobs estimated in this study are specific to the countries under consideration; and they represent potential rather actual jobs as the latter depends on the necessary policy frameworks for local content requirements, capacity of the value chains, amongst others. Without the value chain capacity and policy frameworks, the jobs associated with these technologies are likely to be created elsewhere inspite of actual deployment.

When we assess the breakdown of direct jobs created per megawatt (MW) for different technologies, we find that coal and natural gas create 15 and 8 jobs per MW respectively. Whereas utility scale Solar PV and Distributed Solar PV create 17 and 13 jobs per MW respectively. Bioenergy, Geothermal, and Hydropower create 19, 95, and 49 jobs per MW respectively.[1]

Additional employment opportunities are created through indirectly and induced jobs across the value chain sectors. The value chain sectors include agriculture, utilities, construction, manufacturing, sales, transportation, warehousing, information technology, finance, professional, business services, education, health care and mining and extraction, see Table 5.2 for jobs/MW.

This means that the absence of local development and manufacturing capabilities for renewable energy technologies, particularly solar and wind energy technologies, will result in the majority of the African countries that have planned to adopt clean energy to rely on imports to meet growing energy demands. Between the years 2009 and 2013, various African countries, particularly South Africa, Ethiopia, and Egypt imported wind turbines valued at USD 342 million. Additionally, they imported PV cells and modules valued at USD 869 million from China (Gebreslassie, 2021). Moreover, the International Energy Agency (2023) shows that a strategic approach is required to reduce the problem of increasing imports of refined products in African countries. Accordingly, there may be investment policy adjustment requirements to manage the dynamics of the transition. For example, there could be a dedicated effort towards greenfield projects and more on smaller, essential upgrades given refiners' limited cash flow and working capital instead of accelerating the adoption of utility scale low carbon projects that are dependent on external funding and component manufacturing.

Several African countries have projects and policy implementations to drive industrial growth using low-carbon options across various sectors as described in Table 5.2. Notable examples include Uganda and Namibia. In Uganda, the Fundi Cement project aims to produce a type of cement for the domestic market, this type of cement emits 54% less CO_2 compared to ordinary Portland cement. In Namibia, the Groot Steel Plant project focuses on constructing a new Electric Arc Furnace (EAF) steel plant with a 3 million tonnes per year capacity, which generates significantly lower carbon emissions compared to traditional steel production methods (International Energy Agency, 2023).

Table 5.2: African policies that drive Low-carbon options in their local sectors

Policy	Country	Description
Industrial Recovery Plan 2021-2023	Morocco	The plan aims to enhance industrial competitiveness, reduce import dependency, and transform into a decarbonized industrial hub by taking advantage of domestic renewable resources.
National Environment and Climate Change Policy	Rwanda	The policy aims to advance sustainable economic growth by attracting both foreign and domestic investments in clean technologies.
Ethiopia 2030: The Pathway to Prosperity (2021 – 2030)	Ethiopia	This is a plan that aims to build an environmentally sustainable economy by focusing on energy efficiency, sectoral clusters, and private sector involve-ment in industry.
Nigerian Energy Support Programme	Nigeria	This programme aims to support renewable energy and energy efficiency in Nigeria through capacity building, development of directives, and simplifying access to financing for Nigerian companies.
Memorandum of Under-standing: Eni and Govern-ment of Rwanda	Rwanda	This Memorandum of Understanding plans collaborative opportunities in the fields of circular economy, agriculture, forestry, innovation, and digital technology.

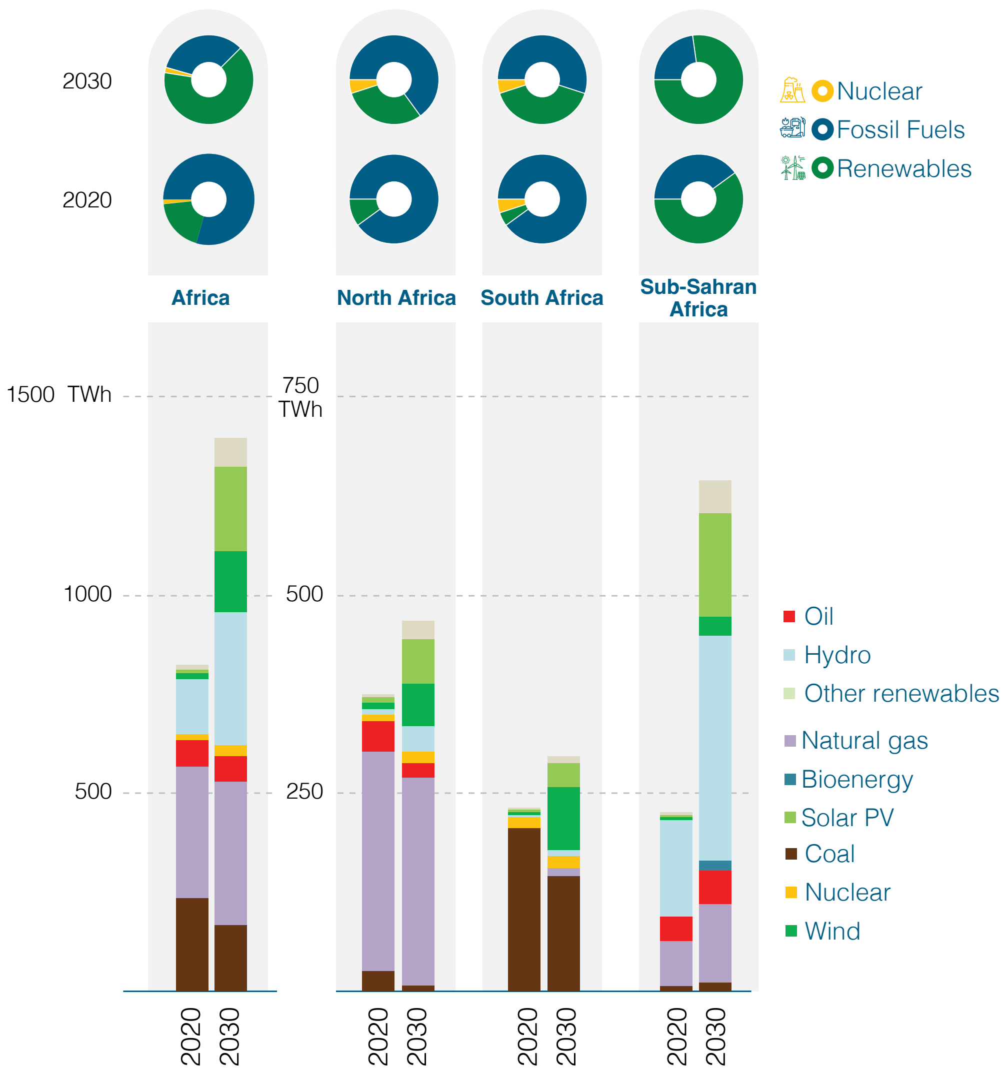
(International Energy Agency (IEA), 2023)

1 - These estimates are based on a 60% LCR, and it's worth noting that additional employment opportunties are possible through indirect and induced jobs

As Africa's population and energy demands grow, reliance on financial, skill, and resource support from the Global North is expected to increase. This dynamic will economically benefit Global North countries more than local markets. African electricity demand is expected to increase by approximately 75%, from 680 TWh to 1,180 TWh, by 2030. Over half of the surge is accounted to households due to the increased use of appliances and new household technologies. Industry accounts for the majority of the remaining increase. Per capita electricity demand is projected to increase from 500 kWh in 2020 to 700 kWh in 2030, however, within sub-Saharan Africa per capita demand will grow from 170 kWh to 390 kWh (International Energy Agency, 2023).

While numerous African nations currently depend on fossil fuels such as gas and coal for generating electricity, some still rely on fuel imports, which subjects them to unpredictable market conditions. Therefore, countries reliant on fuel imports should implement measures to reduce import dependence and transition to renewable energy. Moreover, this shift should not result in an unjust transition process where African countries would not manufacture low carbon technologies. The shift should not only remove unpredictable market conditions but also contribute to decarbonising their economy which will benefit local regions. As the African capacity has begun to rise from 260 GW in 2020 to 510 GW by 2030 as shown in Figure 5.23. This growth highlights a significant change in the types of power plants that are planned and being built across the continent. As various projects are underway, coal and hydropower are predicted to lose their prominence to solar power before 2030.

Figure 5.23: African electricity capacity and various sources from 2020 to 2030 in different regions



The energy transition investment economic multipliers will not yield economic benefits if the African continent does not adopt local content policies as an economic growth protection mechanism. While the World Trade Organization petitions for fair trading rules, the African continent needs to rethink its position on trading. The role of the Africa free trade agreement as a tool for driving robust economic development in the region.

5.2 Recommended intervention to accelerate Africa's manufacturing position and drive a positive economic impact

There is a need to drive a value-add for African minerals and limit the export of raw materials to countries that would in turn export finished products to the African continent. Low carbon investments should have clear conditions that would contribute to resolving the climate change problem, increase the African continent's electrification rate and accelerate economic development. Africa needs to safeguard against electricity provision or energy access that disregards the continent's industrialisation potential. The African continent needs to define its local content policy framework to allow the region to have a uniform position on how local content could be used as an instrument to drive economic development. The acceleration of the AfCFTA agreement needs to be utilised to create the African continent market and the required demand. Moreover, there is a need to develop policy mechanisms that would advance the implementation of AfCFTA and promote the industrialisation agenda in Africa.

5.3 Conclusion

The absence of robust policy instruments that enforce local manufacturing in the African continent is likely to perpetuate the status of African countries remaining net importers of goods and services that are produced from the African minerals. Moreover, the lack of skills in the low carbon energy multiplier sectors might have unintended consequences if the African continent does not adopt policies that would guarantee the acceleration of energy component manufacturing in the continent. The economic losses are not only in the energy sector but throughout the value and multiplier sectors. Addressing this drawback can increase the continent's industrialisation agenda and technology development capabilities. Therefore, the African continent needs a sound local content policy framework that will force low carbon technology Original Equipment Manufacturers (OEMs) to manufacture in African countries and promote economic sovereignty.

CHAPTER 6: FINANCE IMPLICATIONS OF THE ENERGY TRANSITION

By Chantal Naidoo (PhD), Patrick Lehman-Grube, Yasmin Meerholz, Ailly Sheehama, Penny Winton

Introduction

Transitions are inherently pluralistic processes, socially contested, experimental, disruptive, and generally have system-wide impacts. Such impacts are evident in the economy, environment, and the socio-economic welfare of communities. For the African continent to transition to low-carbon resilient economies in a just and equitable manner, appropriate financing and financing processes will be needed to build the adaptive capacity and social resilience to these disruptive effects. It will cost around USD 2.8 trillion between 2020 and 2030 to implement Africa's NDCs, with the additional finance[2] needed to meet this goal being USD 2.5 trillion (USD 250 billion annually).

However, there is currently a shortfall of 88%, with Africa only receiving USD 30 billion or 12% of the additional finance it needs (CPI: Guzmán et al., 2022). Furthermore, there is documented evidence that the quality of finance the continent requires is not forthcoming and there is geographic imbalance across the region of how funds are distributed.

In recent years, the UNFCCC processes and narratives aim for "greater ambitions" among countries to respond

2 - National governments have committed to providing USD 264 billion for the period 2020 – 2030 (CPI: Guzmán et al., 2022).

to climate change. In reality, independently setting ambition levels for most African countries is not possible. The current structure of the global financial architecture, particularly the sources and instruments of finance available has left much of the continent with unsustainable debt levels, high costs of finance, and dependent on their counterparts in developed countries and China, for their financing needs, especially because 90 per cent of finance for climate action comes from abroad (AFD, 2024). This hinders its ability to independently establish and achieve its development and climate response ambitions. This gives these international counterparts an implicit influence in determining the quality and quantity of finance that the continent receives, which has a direct impact on ambition. The other side of this message is that Africa's ambition is not yet coupled with its strategic assets and demographic endowments: a youthful continent with about 30% of the green minerals the rest of the world seeks to advance their own transitions. Much is wanted and expected of the continent, e.g. the imposition of carbon border adjustment mechanisms which would see African exports impacted, and the strategic green minerals global partners are extracting not for the continent's benefit.

To develop an understanding as to what is required to finance a just and equitable transition in Africa, questions have been developed to transcend the prevailing position of a reactionary African response towards one that is needs-based, and proactive countries need to ask themselves four questions (see below). These questions aim to recognise that Africa's ambition is interdependent, its response is largely informed by the continent's current position as a taker of ambition, deep developmental concerns and priorities, and the financing gaps on quality, quantity, and dignified access.

1. What is our unique transition context and what do we need to meet such needs?
2. What are the environmental and social ambitions for the country's transition?
3. How do we leverage what we have to get what we need?
4. What quality and quantity of finance is needed for Africa to realise a just and equitable transition?

The chapter explores the questions above by introducing four conceptual financing frames. These frames aim to assist policymakers in building a pragmatic and progressive view of how African countries may independently assess their ambition, generate a clear needs-based financing strategy, and begin coupling its strategic assets, and demographic endowments towards a prosperous region – that has self-defined its transition trajectory.

The first frame is a typology of African economies' based on their unique relationship with fossil fuels and relative intensities of dependence and use. This frame argues that these heterogeneous relationships should inform the needs, and transition ambition of countries. The second frame relates to the nexus of environmental and social intensity of the transition, which flows directly from what is the unique fossil fuel relationship that the country in question needs to shift or address. The third frame contributes towards ambition scenarios for finance, where high quality and high quantity are positioned as desired outcomes for African countries. The fourth frame relates to the existing conditions that inform and shape the financing options available to policy makers and how they may respond.

This chapter is organised according to i) the landscape of financing needs in Africa for climate action (Section 2); ii) factors informing Africa's access to climate and transition finance flows (Section 3); iii) characteristics of the transition relative to the economic needs of the continent (Section 4); and iv) a synthesis and key policy messages relative to the overall purpose of this study (Section 5).

2. The landscape of financing needs in Africa for climate action

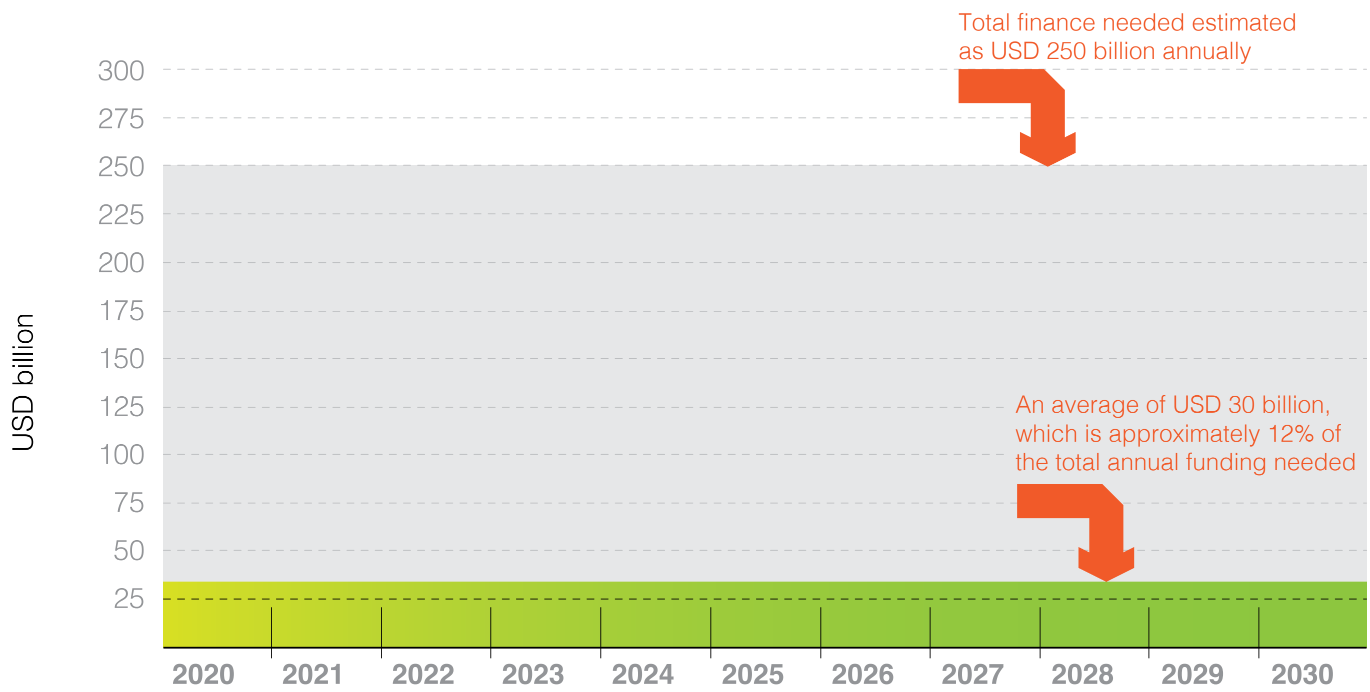
This section outlines the landscape of climate and transition finance flows on the continent, as well as the key influencing factors, that need to be considered. As a starting point existing instruments, channels and energy transition initiatives used to finance climate action on the continent are identified and unpacked. Furthermore, this section highlights the issues around the heterogeneity of African countries by outlining the typology of African economies and climate vulnerability on the continent.

2.1 Funding shortfalls and vulnerability on the continent

Based on data from Nationally Determined Contributions (NDCs), it will cost around USD 2.8 trillion between 2020 and 2030 to implement Africa's NDCs (CPI: Guzmán et al., 2022; Afdb, 2023a). According to CPI's assessment, approximately 10% (USD 264 billion) of this has been committed by national governments for the period 2020 – 2030, meaning USD 2.5 trillion (i.e. USD 250 billion annually) must come from external international public sources and domestic and international private sectors (Khamala, 2022). From a sector-specific perspective, Africa requires around USD 133 billion annually in energy investments between 2026 and 2030 (Meattle et al., 2022). The current levels of finance for climate action being made available to African countries fall far short of their needs (IPCC, 2023 and CPI, 2022).

Significant gaps in and lack of reliability of available data and the disaggregation thereof, both at a macro level and across countries for mitigation and adaptation exist (CPI: Guzmán et al., 2022). That being said, the estimated finance required is, by all accounts significantly challenging, and given the uncertainties associated with a systemic transition the estimates are likely to be grossly underestimated. Currently, the total annual climate finance flows in Africa for 2020, was only USD 30 billion, or about 12% of the estimated additional financed needed (CPI: Guzmán et al., 2022). The scale of this shortfall is illustrated in Figure 6.1.[3]

Figure 6.1: Current finance flow shortfall for Africa



Source: (CPI: Guzmán et al., 2022)

3 - The figure illustrates the annual shortfall for the period 2020-2030 using average annuals flows in 2019 and 2020 as a basis.

Using the NDCs as a guide, for the period in question, 66 per cent of the total finance needed is for mitigation, 24 per cent for adaptation, and the remaining 10 per cent for “dual benefit actions” (CPI: Guzmán et al., 2022). However, this imbalance between mitigation and adaption needs is not necessarily a true reflection of the actual finance that is required but instead indicates the inability of policymakers to adequately determine what their true adaptation needs are (CPI: Guzmán et al., 2022). This lack of data on adaptation financing needs is particularly concerning given the significant vulnerability of African countries to climate change.

The starting point in understanding mitigation and adaptation needs is understanding the vulnerability of countries. This requires a consideration of the intersection between environmental and social aspects of the transition, as these determine where finance is most needed. This narrative forms part of the second frame which relates to the nexus of the environmental and social intensity of the transition. Understanding a country’s needs stems from knowing where the needs emanate from. This is relevant for Africa, as countries will be led by vulnerabilities according to their country context, with some countries having to consider possible trade-offs in meeting the energy transition objective. This consideration has the potential to influence ambition on financing strategies and inform instruments that account for the country’s portfolio of needs. A useful and systematic method for understanding these priorities is through the application of a typology developed by Spratt (2015) and adapted by Naidoo (2019). The typology (see Table 6.1) plots the intensity of the environmental and social response of a country (relative to its needs). This narrative will be further explored in section 4.

Table 6.1: Typologies of the intensity of environmental and social responses

		Intensity of environmental response	
		Low	**High**
Intensity if social response	**Low**	**Light Green** Restructure of economic systems e.g. energy with zero/low interst in social issues — with green growth as a solution.	**Dark Green** Precutionary approach prioritising human quality of life, with low interst in social issues.
	High	**Light Green & Red** Dominant approach to sustainable development in terms of income inequality and poverty with concern for environment.	**Dark Green & Red** Precautionary approach combined with interest in distribution and wealth.

Source: (Naidoo, 2019;93)

Furthermore, key informants for measuring the climate vulnerability levels are using vulnerability and resilience levels metrics. To this end, there are a variety of different indicators that need to be considered. Given the heterogeneous nature of African subregions, adaptation and mitigation financing flows towards climate intervention needs will differ according to the “economic and demographic contexts as well as the degree of vulnerability”, (Guzmán et al., 2022; 8). The ND-GAIN (Notre Dame Global Adaptation Initiative) Index is a useful metric to assist in this purpose of examining environmental and social ambitions in the context of vulnerability. A well-defined vulnerability index offers the ability to analyse how much funding is allocated between the most and least vulnerable countries in Africa, and whether or not this is a factor that should be considered in the just transition financing space.

2.2 Sources of finance

In 2021, the largest source of international public financing for climate action globally came from Multilateral Development Banks (MDBs) (40%, or USD 11.5 billion)[4], with funding flowing towards Energy (24%), AFOLU (16%), transport (10%) and water (9%) as key sectors, however (31%) went towards cross-sectoral projects. Multilateral DFIs financing instruments are mostly debt-based (47% at the market rate and 30% at a concessional rate) compared to grants (20%), with equity financing only accounting for 3% (Meattle et al., 2022).

Furthermore, MDBs[5] made up 74% of the finance flows in Africa compared to DAC members (15%), private donors[6] (about 2%) and other multilaterals (8%) (OECD, 2021), with loans (61%) being the most used instrument compared to grants (10%) used to finance climate in low- and middle-income economies[7] (IDB et al., 2023). The common messaging in scaling finance for climate action in developing countries is no different to what it has been in the years preceding the focus on climate change, i.e. the need to leverage MDB finance to scale private sector finance to address developing countries' needs. (The billions to trillions narrative). The OECD statistics have not been verified for context however the lack of scale in quoted statistics indicates that scaling finance from private sector resources requires a deeper dive given the ineffective leveraging impact thus far.

There is also a need for a deeper dive into the attributes of the sectors and projects that require financing flows towards climate interventions and the revenue flows required to service debt across these sectors and projects. Here it is key to recognise that many of the sectors that require financing are assets of a public purpose kind where risks associated with revenue to service these assets are challenging and the risks are generally addressed through support such as guarantee structures (i.e. de-risking) that have very little transparency associated with their use and where significant risk is ultimately borne by the state. Therefore, a policy framework/strategy on what type of finance is required and the structuring of the finance is imperative. The South African REIPPPP is an example of a lack of diligence where public assets are traded with significant risk transfer and little to no oversight. Hence, the ability of the state to accept the risks through complex structuring and transferring of risks is an unknown quantity in the face of the sheer scale of finance that is required. This is explored in further detail in section 3.3.

Given that MDBs account for 74 per cent of flows in Africa, the catalysing billions to trillions narrative is all the more important, especially on the impact of the fiscal framework of African countries which are hard-pressed to service current debt. This is because MDBs have the potential to evolve and strengthen their roles, mitigate financial risks, lower investment costs, enhance access to finance, and address debt sustainability. However, the proposed changes are largely only tinkering on the edges, without addressing long-standing issues around terms and conditions, cost of finance, access to finance, debt-based options, and collateral requirements from developing countries.

4 - Multilateral DFIs invested 40% of their funding in five African countries namely Egypt, Morocco, Nigeria, Ethiopia, and Kenya.

5 - The top 5 MDBs being the World Bank (WB), AFDB (African Development Bank), EBRD (European Bank for Reconstruction and Development), EIB (European Investment Bank) and the ISDB (Islamic Development Bank).

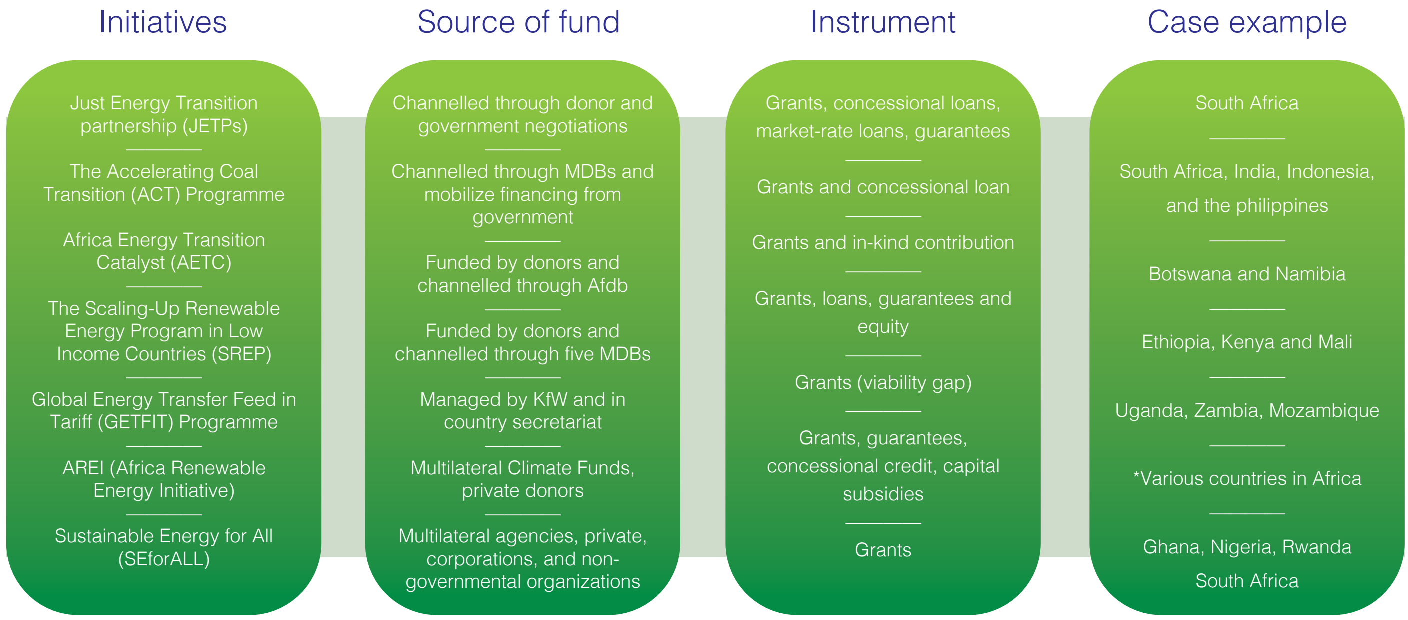
6 - This is in respect to private donors and not private finance (private finance falls under the other flows, i.e. DAC members, MDBs, and other multilaterals).

7 - This analysis included the regions of Middle East and North Africa, Sub-Saharan Africa, South Asia, Latin America and the Caribbean amongst others.

2.3 Existing initiatives and proposed economic typologies

An initial mapping of different energy transition initiatives[8] rolled out across the African region (See, Figure 6.2) shows the source, the type of finance instrument used, and the countries where these are in play. These initiatives can be linked to the first frame of the "typology of African countries" and their relationship to fossil fuels (see Table 6.1). Most recent initiatives (2021 onwards) such as JETPs, and ACT focus on African countries highly dependent on coal or other fossil fuels as primary energy sources. However, the continent has a heterogeneous set of needs, not all are dependent on fossil fuels like Nigeria, South Africa, and Botswana for energy security. For some countries, the challenge is a trade-off between fossil fuel discoveries, strategic green mineral assets, and the energy choices to be made in the future.

Figure 6.2: Examples of Energy Transition Initiatives in Africa



***AREI,** has projects in various countries such as Cameroon, Ghana, Namibia, Morocco, Tunisia, Nigeria, Tanzania, Senegal.

Source: Author's own analysis.

The analysis of the energy transition initiatives in Africa (As per Figure 6.2), illustrates the following:

- The spectrum of funding is multi-layered and is accessed from various sources such as bilateral, government, MDBs, and private sector, with some of the initiatives channelling and/or leveraging MDB involvement.
- The geographic distribution of these initiatives shows the heterogeneity of energy transition finance flows in the region, as it relates to the different pathways being explored by certain countries (AfDB, 2022a). However, some African countries are also leveraging energy transition financing initiatives at a local level (See Box 1, below).
- The analysis also highlights that most of the initiatives and instruments deployed are heavily debt-dependent. This makes a number of the aforementioned instruments not fit for the purpose, of enabling economic development and potentially mitigating indebtedness. The South African Just Energy Transition Investment Plan (JET IP) provides an overview of what kind of instruments are "offered" as part of the funding for these energy initiatives (See Box 6.1, below).

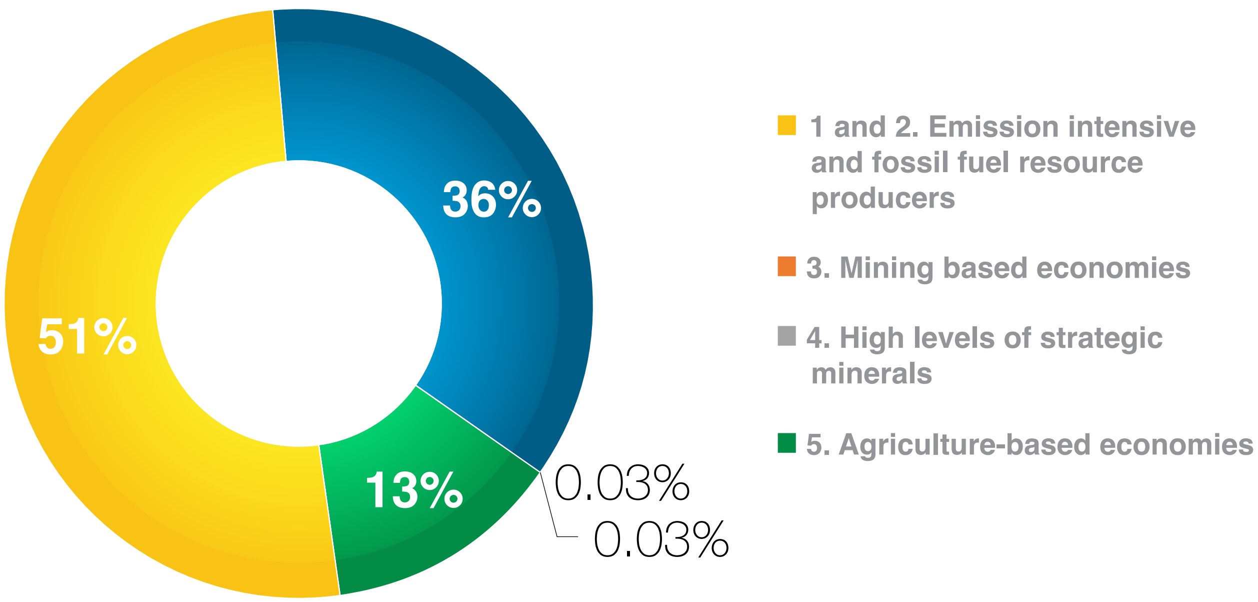
8 - The mapping of various examples of initiatives, is not an exhaustive list. This paper has not yet gone into the further aggregation of looking at instruments to identify private versus public, and nuances such as "private sector financing" where the nature of this financing is not clear.

Currently, energy transition initiatives (as per Figure 6.1) are at the core of global efforts to channel finance to Africa. Even though the initiatives are quite prolific, targeting different countries and sectors, they also show the inadequacy of funding and the clustering of financing around certain typologies. Using the Just Energy Transition Partnerships (JETP) as an example, the following can be observed:

- South Africa (Typology 1 and 2) linked to the JETP (energy transition initiative), with an initial pledged amount of USD8.5 billion (initial period of 2023-2027), to catalyse a transition away from a fossil fuel-dependent economy (PCC, 2022a).
- Senegal (Typology 5) linked to the JETP (energy transition initiative), pledged an amount of USD2.7 billion (initial period of 3 to 5 years, starting in 2023), to reach 40% renewable energy in the electricity mix by 2030 (European Commission, 2023).
- Nigeria (Typology 2), linked to the JETP (energy transition initiative). Still in progress and no signed JETP deal as of May 2024. However, it will need USD1.9 trillion in spending up to 2060, and to meet nationally determined contributions it will require USD17.7 billion in investment annually (Varin, 2023).

Looking at the funding that has already been received from the various initiatives illustrated in Figure 6.2, finance flows have been grouped in Figure 6.3 relative to the typology of the recipient country, to determine where the majority of funding is being allocated. Figure 6.3 below, shows that more than half of all funding committed through various initiatives, is currently unallocated (Bloomberg, 2023; AfDB, 2022a). Of the allocated funding, over 35% is going to countries that fall under typologies 1 and 2 (emission-intensive and fossil fuel resource-producing countries) (PCC, 2022a), and 13% is allocated to typology 5 (agriculture-based economies) (EIB, 2023; AfDB, n.d.; European Union Africa Infrastructure Trust Fund, 2019; AfDB, 2024; AfDB, 2023b; AfDB, 2023c; AfDB 2022b; AfDB, 2022c). Mining-based economies and countries with high levels of strategic minerals both only receive 0.03% of allocated funding (AfDB, 2023d; AfDB 2022d).

Figure 6.3: Allocated funding by country typology



Source: Author's own analysis

It is becoming evident that countries falling under typology one and two for example, might receive a disproportionately higher share of the funding compared to other typologies i.e. Senegal (Typology 5), which highlights potential imbalances in the distribution of finance. There is also a funding gap as seen in the amounts pledged for the JETPs as an energy transition initiative as it falls short of the required USD 250 billion per year, indicating an overall inadequacy in meeting the projected funding needs necessary to address climate challenges effectively. It is unclear to what extent energy transition initiatives are specifically responding to the different types of needs in the continent, such as JETPs (See Box 6.1). What is required is an approach that considers fit-for-purpose financing instruments, reduction of countries' debt burdens, revenue and ownership models. amongst other things.

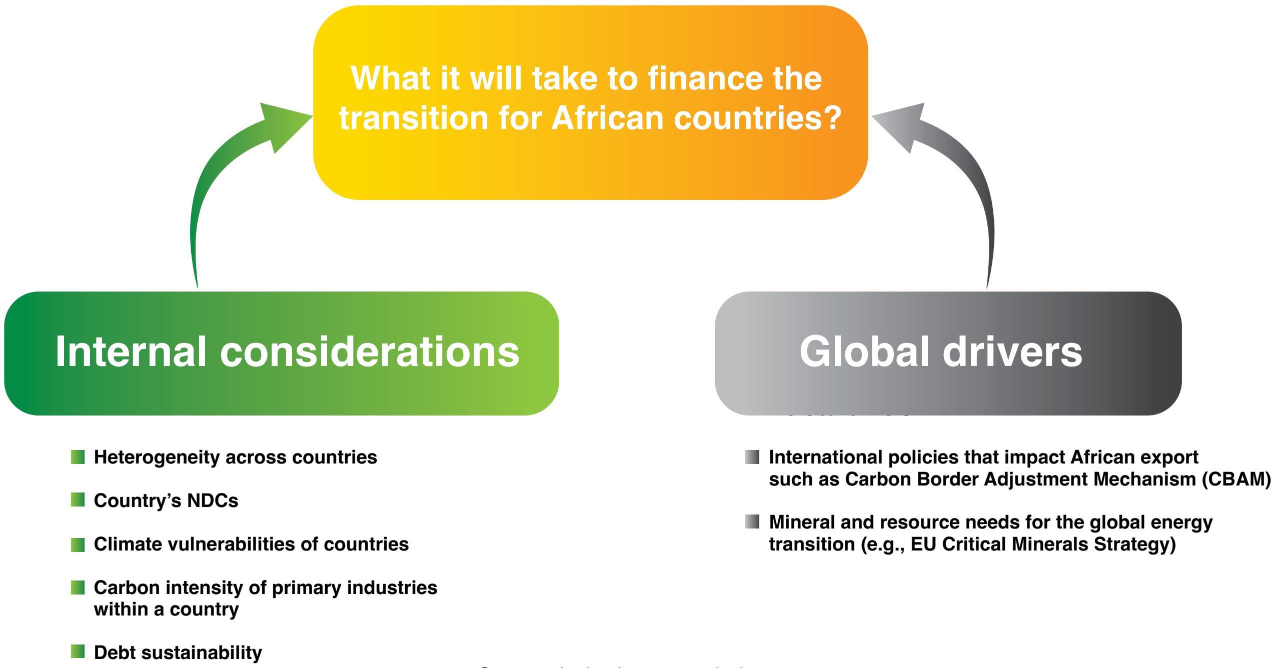
Box 6.1 | Energy transition initiative: South Africa's JETP

The South African JETP initially outlined a plan to mobilise USD 8.5 billion as part of South Africa's commitment to transition towards a low-carbon economy. However, the financing instruments proposed for the South African JET IP mostly comprised debt (PCC, 2022a). The JETPs as a resource mobilisation platform were established on the principles of justice and equity, however, that is yet to be tested through implementation and access modalities for drawing on the respective funding commitments (Naidoo et al., 2023).

Furthermore, it is also important to interrogate how the funding is used. There is evidence that money coming from global North donors has been "recycled back" to the global North. This can be seen in the South African JETP funding for grants (As per the South African JETP grant register) showing that South African implementing entities only received 24% of the capital disbursed as of November 2023 (a mix of private companies, non-governmental organisations, universities and government bodies) with international entities accounting for 76%, in most cases entities from the donor countries (Lehmann-Grube et al., 2024).

Understanding the financing needed to achieve a just energy transition across Africa is a multi-faceted question, one that requires an analysis not only of the internal heterogeneity of countries across the continent but also of how those heterogeneities interact with international policies (See, Figure 6.4).

Figure 6.4: What will it take to finance the transition in Africa



Source: Author's own analysis

In terms of heterogeneity in current finance flows, it is evident that transition funding in Africa is not evenly distributed across the continent, (Nakhooda, Caravani and Bird, 2011; Watson, Schalatek and Evéquoz, 2022), with ten countries[9] (out of 54 African countries – mostly middle-income African countries) absorbing more than half of all climate finance investment (Africa NDC Hub, 2021).

The distribution of finance flows in Africa is influenced by challenging conditions, including issues like currency instability, regulatory and governance issues, a shortage of viable projects, risks related to business partners, limited technical expertise, and gaps in transparency and accountability. These factors diminish investor interest in expanding their investments in the region (Africa NDC Hub, 2021; Meattle et al., 2022).

The heterogeneous nature of Africa calls for a detailed analysis of the needs and contexts of different African countries and regions. It has been highlighted that, across developing countries, the needs and focuses of NDCs and climate transition plans can differ greatly (UNFCCC, 2022). Thus it is crucial to adopt a targeted and contextually informed approach when analysing what will be needed for a just energy transition on the continent. Additionally, there are also tensions and differing trade circumstances and dependencies including net zero commitments by African trade partners such as the EU, that need to be considered in this analysis.

The first frame which highlights the unique heterogenous nature of Africa with regards to the transition, is based on the typology of African economies. An important component of African heterogeneity is the varied dependencies and endowments of fossil fuels either as an energy source or raw material export. McKinsey (Krishnan et al., 2022) offers a useful archetype model on the different exposures of countries to fossil fuels that recognises such heterogeneity, and the implications of net-zero policies on these archetypes. Table 6.2 below provides an adaptation of this framework, better tailored to an African context, and describes the different archetypes, their prominent sectors and the transition implication of the archetype.

Table 6.2: Typology of an African Just Energy Transition

Type	Prominent Sector	Examples	Implication
1. Emission intensive producers	Emission heavy industries	South Africa, Egypt, Morocco	High economic impact of transition policies on key industries
2. Fossil fuel resource producers and exporters	Production and exporter of fossil fuels	Nigeria, Libya, Algeria, Angola, South Africa	Greater economic impact of energy transition on the economy
3. Mining-based economies	Mining	Zambia, Namibia, DRC, Niger, South Africa	Highly vulnerable to climate change, high technology need to meet transition requirements
4. Countries with high levels of strategic minerals	Mining (specifically of strategic minerals: copper, graphite, lithium, nickel, cobalt and rare earth elements etc.)	DRC, Mozambique, Madagascar, Zambia, Zimbabwe, Tanzania, Burundi	Domestic extractive industry critical to global energy transition
5. Agriculture-based economies	Agriculture	Ghana, Kenya, Senegal, Eritrea, Mali, Ivory Coast, Uganda	Highly vulnerable to climate change, high technology need to meet transition requirements
6. Land-use-intensive countries	Forestry	Cameroon, Gabon, Côte d'Ivoire, Eq. Guinea	Similar experience to agriculture-based economies
7. Service-based economies	Service and tourism	Mauritius, Zimbabwe, Kenya, Tanzania	The sector least impacted by transition policies, but highly impacted by climate change

Source: Adapted from McKinsey (Krishnan et al., 2022)

9 - Egypt, Morocco, Nigeria, Kenya, Ethiopia, South Africa, Mozambique, Cote d'Ivoire, Tunisia and Ghana (ranked from highest to lowest).

Being able to group and disaggregate different countries based on their transition needs is fundamental to developing strategies that provide appropriate funding. As per Section 2.3, there is a disconnect between country needs versus what they are receiving in terms of finance (quantity of USD 250 billion annually), but also in that it is not enough that money is flowing, it needs to flow relative to the needs in terms of quality of finance (energy transition initiatives dominated by debt instruments). However, what we are seeing is also that, energy transition initiatives financing will most likely be funnelled towards certain countries. For example, countries in Archetypes 1 and 2 have much greater financing needs as transitioning will fundamentally alter their economic structure, compared to agriculture-based economies where new technology and farming practices would need to be developed, but the primary industry, agriculture, would not change (Naidoo et al, 2024a). Hence, in as much as there are energy transition initiatives, targeting certain typologies the international flows coming to the continent are unsuited (i.e. for example high interest on loans and only a small portion in grants, which means countries may face problems in implementing those deals) for the different types of transitions that are happening on the continent, in terms of quantity and quality of finance for climate action.

Using the **Sustainable Africa Scenario (SAS)**[10] **(IEA, 2022**) as a basis for "ambition", Table 6.3 below identifies that energy-linked development goals are needed in Africa and the implications for finance is that it can potentially shape the allocation of resources, strategies for achieving sustainable development goals and investment priorities that need to be considered for financing flows towards climate interventions.

Table 6.3: Energy-linked development goals needed for a just energy transition in Africa

	Sustainable Africa Scenario (SAS) and implications for financing strategies
Energy access	• Financing cannot only be targeted at fossil fuels and renewable energy production, but also needs to include promoting access to electricity, energy efficiency, and grid development (IEA, 2022).
Critical minerals	• Africa holds 30% of the critical minerals needed for the green transition of other countries (SAIIA, 2022) such as the EU, USA, and China. Therefore trade negotiations should be directly coupled with Africa's needs for energy transition, and the additional costs that will be imposed on African exports through Net Zero policies such as the Carbon Border Tax Adjustments (CBAM) which came into effect on the 1st July 2023. • Several critical mineral reserves currently identified across the continent[11] (The Economist; 2023) and the high quantity of minerals[12] that are fundamental for energy transition technologies respectively (AfDB; 2022b), this is evident in the EU Critical Minerals Act (2022) and the Blinken Deal. • Historically, China has been involved in the extraction of African mineral as well as being a top destination for critical minerals. The EU Critical Minerals Act seeks to put the EU in a similar position. • The biggest threat is geopolitical interest in Africa to secure raw minerals (AfDB, 2022e). This increases the threat of exploitation across the continent, and without proper resource management could result in higher transition costs for African countries, due to the inability to domestically process critical minerals, but rather having to sell raw minerals to global manufacturers and buy back final good at a significantly higher cost.
Fuel supply	• There is a global and domestic demand for natural gas, which has been identified as a "transition fuel" as it produces less GHG emissions (IEA, 2022). • Natural gas reserves, in Africa can be found in Nigeria (32%), Algeria (25%), Mozambique (16%), and Egypt (10%), with new discoveries in Namibia that further increase the share of natural gas in Africa (Climate Action Tracker; 2022)

Source: Author's own analysis

10 - IEA's Africa Energy Outlook 2022, which calls for a scenario in which all African energy-linked development goals (including universal access to energy) are reached in full and on time.

11 - Countries identified are for example: South Africa, Namibia, Zambia, Mali, Ghana, Mozambique, Congo.

12 - Minerals identified are for example: Aluminium (Solar PV, Energy Storage),Chromium (EVs), Copper (Solar PV, Energy Storage, EV), Lithium (Hydrogen, Energy Storage, EV).

Box 6.2 | The value of Carbon Sinks: the Congo River Basin Forest

One of the often overlooked contributions of the African continent towards the global ambition of achieving net zero is the carbon removed by the Congo River Basin Forest. Which is the largest carbon sink in the world, removing carbon from the atmosphere estimated to be to the value of USD55 billion annually, a figure which is reduced to USD30 billion when accounting for deforestation (Mitchell and Pleek, 2022). This sum is greater than what Africa receives in financing flows on an annual basis and a factor which is often not considered when analysing the contribution of African countries to mitigation efforts.

3. Factors informing Africa's access to climate and transition finance flows

This section outlines how equity and justice are generally understood in relation to finance for the transition and climate action. It then considers the key factors informing Africa's access to climate and transition finance flows, by detailing existing circumstances that may hinder or enhance access to finance, and as a result dictate the extent to which Africa can source and allocate finances relative to its needs.

3.1 Equity and justice in the context of finance flows

In the context of the UNFCCC equity is largely understood through the lens of Common But Differentiated Responsibility and Respective Capabilities (CBDR-RC) in light of different national circumstances (UN, 2015).
The principle of CBDR has two distinct points of emphasis: firstly, there is a common responsibility amongst the nations of the world to share the burden of environmental protection as climate change will affect all. Secondly, despite this common responsibility, the degrees to which countries are responsible are not equal, with an acknowledgement that national circumstances play a deciding role in the capacity of countries to respond to climate concerns see Article 9 of the Paris Agreement (UN, 2015). In the realm of finance flows, the UNFCCC Paris agreement (UN, 2014) saw countries reaching a consensus that developed nations are obligated to furnish financial resources aimed at aiding developing countries in both mitigation and adaptation efforts (UN, 2015). Furthermore, additional clauses were introduced to encourage other Parties to voluntarily contribute to this support as well. For developing countries, this approach to equity allows for greater levels of ambition despite different circumstances and capabilities (Al Zahrani et al., 2019).

Building on this understanding Ngwadla et al. (2023: 4) have identified four areas of consideration when determining equity in the context of finance: "The quantum of finance, the development context, reforms to global finance systems and the indispensability of international cooperation and trust building for meaningful outcomes of the process". All of these are significant in that they are underpinned by a needs-based lens, which is based on five key principles (Ngwadla et al, 2023):

- New, additional and predictable sources of finance
- Cognisant of development needs and equity
- Does not deepen indebtedness and inequality
- Informed by the temperature goal
- Common definitions and accounting

Closely linked and intertwined with the notion of equitable finance flows is justice. Drawing on the South African Just Transition Framework (JTF) there are three forms of justice which can be used as a framework. These are the principles of procedural justice, distributive justice, and restorative justice (see Table 6.4). All of which can be applied to finance flows. In addition, core priorities of a just transition have also been identified by the likes of the International Labour Organisation (ILO). In 2015 the ILO developed guidelines for just transitions delineating policy domains aimed at enabling an equitable transition, with a spotlight on macroeconomic, sectoral, and industrial policies. Furthermore, they underscore the significance of enhancing skills and instituting tailored social protection measures to effectively mitigate the socio-economic consequences of the transition.

Table 6.4: South African Just Transition Framework Principles

Climate justice principle	Description
Distributive justice	A fair distribution of the risks and opportunities associated with the transition
Procedural justice	Empowering all stakeholder groups so they can shape and guide the transition.
Restorative justice	Addressing historical damages against individuals, communities, and the environment. With a focus on rectifying and supporting disenfranchised communities and groups.

Source: PCC, 2022b

With these useful frameworks and guidelines as a basis, three distinct indicators have been identified and detailed to determine what financing the just transition in Africa in the context of equity would entail (Naidoo et al., 2024a). These are, the source and quality of funding, how funding is used, and the channels through which funding flows. The source and quality of funding refers to where the finance for the transition in Africa originates, and the instruments through which it is provided.

As significant as the source and quality of funding provided, is how the funding is used. The just and equitable elements of the transition can only be realised if funding is allocated towards efforts that are needs-based, country-led, and address the socio-economic consequences of the transition. With the most important justice elements being continued economic development and electrification (including industrialisation), reskilling of workers in fossil fuel industries, and social protection for workers and communities negatively affected by the transition (Naidoo et al., 2024a). Finally, analysing the channels of funding is useful in determining the justice element within finance for climate action, particularly as it relates to transparency and dignity.

With a clear understanding of what just and equitable finance flows entail, nine principles have been identified to guide the financing of the just transition in Africa in an equitable and just manner (see Table 6.5). These principles are based on an analysis of the foundational prerequisites for equitable and just finance flows and draw on existing initiatives and guiding documents that have already been developed, particularly the South African JET IP (PCC, 2022a). If correctly applied, these principles are a useful tool to ensure that equity and justice are placed at the centre of all transition strategies (and the associated financing); that equity and justice are reflected in the source, use, and channels of funding; and that all partners adhere to their collective and differentiated responsibilities in the global energy transition.

Table 6.5: Just Transition Financing Principles for Africa

Guiding Principle	Description
Follow UNFCCC obligations.	Adhere to the UNFCCC principle of CBDR-RC. Which outlines the financial obligations of developed countries to developing countries.
Additional to current development aid.	All finance flows to support climate action in Africa should be additional to existing development funding.
Needs-based funding	Finance flows should be needs-based, accounting for the fiscal and financial constraints of the African country in question.
Mainstream justice	Funding should only be allocated towards projects or initiatives that centralise justice considerations.
Significant concessional finance	The funding terms should be more attractive than what governments can receive in capital markets.
Predictable and consistent financing	Funding should be predictable and consistent to allow for effective timing and planning so as to avoid any delays.
Accessibility through effective institutions	The best-placed and most suitably equipped institutions should manage funds and ensure that funding is allocated to where it is needed.
Risk-sharing	Instead of focussing on public de-risking of private finance, there should be risk-sharing between the private and public sectors.
Effective governance and transparency	Effective governance and transparency mechanisms need to be established and maintained to ensure that funding is allocated for the intended purposes.

Source: Adapted from PCC, 2022a

3.2 Levels of indebtedness

Africa countries owe about US$655.6 billion to external creditors[13] as of 2022 (Harcourt, and Robertson, 2023). This includes bilateral, multilateral, and private creditors. Hence, financing needs come at a time when African countries are already facing various macroeconomic challenges. These include exchange rate depreciation and commodity price shocks, which were further exacerbated by the COVID-19 pandemic, where- Low and Middle-Income Countries (LMICs) faced heavy debt burdens due to debt incurred to fund pandemic responses.

This increase in external debt has resulted in an increasing debt-to-GDP ratio across Africa, with an estimated 65% debt-to-GDP ratio for the continent in 2022 (AfDB, 2023e). As a result of this worsening debt situation, some African countries are now listed by the International Monetary Fund (IMF) as either being at high risk of debt distress[14] (Thibault Lemaire et al., 2023) or being in debt distress[15] (IMF, 2023). This drives up the cost of accessing capital as investors price in the additional risk (IEA, 2023), and potentially weakens a country's credit ratings. Perception of increased default risk also leads to other issues such as increasing insurance premiums, which can shut out less-resourced investors (AfDB, 2022g)

The consequence of a high debt-to-GDP ratio means that debt servicing crowds out other government spending (Federspiel et. al, 2022). This brings to light the impact of debt serviceability on government expenditure. Looking at data on debt serviceability as a percentage of government debt[16], debt services make up 10% of government debt expenditure in several African countries' debt repayments. This means that often debt repayments exceed other important public spending, such as healthcare, education and investment (UNCTAD; 2023). Therefore when it comes to incurring additional debt to finance energy transitions, there needs to be a weighing of options between the ability to incur more debt versus the need for, often more important, domestic social spending. Without taking into account this consideration African countries can face increased financial vulnerability[17] and an increased risk of debt distress which would perpetuate existing inequities.

13 - This includes bilateral, multilateral, and private creditors.

14 - African countries in high risk of debt distress were listed as Burundi, Cameroon, Central African Republic, Comoros, Djibouti, Ethiopia, The Gambia, Guinea Bissau, Kenya, and Sierra Leone.

15 - African countries in debt distress are Ghana, Malawi, Zambia, Congo Republic, Somalia, and Zimbabwe.

16 - It is uncertain whether or not government debt plays a significant role in determining the ability of countries to incur more finance and take on greater amounts of debt. When contextualising Government debt as a percentage of GDP, Africa has a much lower average than the rest of the world. The average level of government debt to GDP in Africa is between 20-30% (IMF, 2023) while global public debt is currently at 96% (IMF, 2023). As an additional point of reference public debt as a percentage of GDP in the United States of America is at 128 % (CEIC, 2023). This is why debt serviceability provides a better measure of how vulnerable countries are to further indebtedness.

17 - The IPCC describes vulnerability as: "The degree to which a system is susceptible to, or unable to cope with, adverse effects of. climate change, including climate variability and extremes."

3.3 De-risking and risk-sharing

Choosing the right financing instrument is essential to ensuring economic development and potentially mitigating indebtedness (Naidoo et al., 2014), therefore finance flow commitments should not replace existing commitments to finance other Sustainable Development Goals (SDGs) (Afdb, 2022g). This means de-risking aspects also need to be considered, i.e. what de-risking would cost[18], to keep financing costs low and affordable (IEA, 2023). This is because of factors such as renewable projects failing to materialise due to a lack of accessible credit or the imposition of excessively high interest rates (AREI, 2018), and considerations when utilising public guarantees, such as the risks related to collateral and currency fluctuations, as these guarantees often depend on market conditions and external ratings, which can be influenced by economic cycles. To mitigate these, it's crucial to minimize contingent liability and long-term fiscal risks. Additionally, the presence of high sovereign debt can lead to investors demanding higher-risk premiums for credit, potentially jeopardizing the economic viability of projects seeking funding (Prasad et al., 2022).

Moreover, many of these government-supported assets are foreign-owned including ownership by foreign governments. In addition, the short-termism of privately (including foreign governments) owned assets via private equity structures may have unintended consequences associated with the security of supply as the assets change hands with little to no regulatory oversight. This is and will be a key feature throughout Africa, not because it is fit for purpose but because "it is practice in some of the global north" which is read as gospel without questioning its fit for purpose in Africa.

It should also be noted that some foreign investors accessed international instruments to further hedge their risk with costs ultimately borne by the consumer and adding to the fiscal risks associated with essentially guaranteeing the tariff and hence revenue to the investor.

Finally, regarding de-risking, the (OECD, 2021) report which highlighted the lack of private sector investment despite existing de-risking instruments is a red flag. The mushrooming of a new class of de-risking instruments by a myriad of start-ups will require a level of governance and oversight that is lacking on the continent. Governments should, as a matter of urgency commence a skills development initiative at scale to embed the in-house skills to address the implications of unmitigated use of de-risking instruments that will ultimately affect fiscal frameworks and debt sustainability adversely. Consultants, external financial advisors, and lawyers will not drive the new paradigm that is necessary to secure a financially just future for Africa.

De-risking and risk sharing are not the same concepts per se. Underpinning the difference is that private sector anticipates significant risk absorption by the public sector, however the private sector itself has enlightened self interest in the nature of investments to advance climate resilient and low emission developments such as clean energy. Therefore, there is a need to move away from a focus on de-risking to appropriate risk-sharing between both developed and developing countries and between the private and public sectors. Currently what we have is governments in developing countries (and to a lesser degree developed countries) de-risking private investment for the private sector in both the developed and developing world, without exit or scale down strategies, and excessive support that is not just or inclusive and places a burden on the public sector for longer than is necessary.

3.4 Internal capital markets

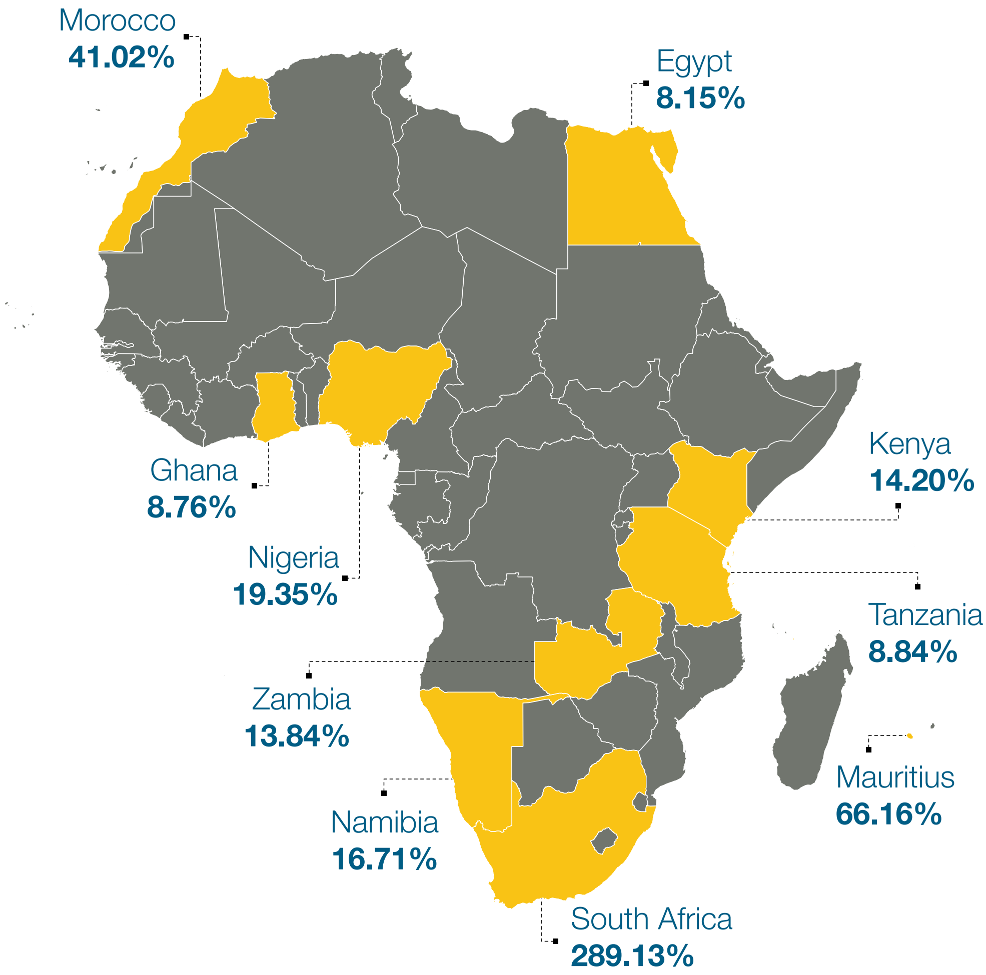
Capital markets facilitate the trade of stocks, bonds, currencies and financial assets, and provide access to capital for investment within a country (SIFMA, 2023). This mobilisation of capital provides a channel through which local investments can occur, by facilitating interactions between investors and investment opportunities. For this mechanism to operate effectively, there needs to be a level of development of capital markets, through both the capital markets themselves, as well as creating a level of investor trust.

Currently, there is an estimated USD 2.5 trillion of investable liquid wealth on the continent (Henley & Partners, 2024), this indicates the investment potential within the continent, access to which will need functional, developed capital markets.

18 - For example government guarantees as de-risking instruments adds to the cost i.e. maybe charging a premium to the guarantee.

Figure 6.5 below looks at the market capitalization of listed domestic companies as a % of GDP, this indicates total domestic market value and acts as a proxy for the size of internal capital markets. This figure shows that South Africa has a significantly more developed capital market than the rest of the continent. For context, the market capitalization of listed domestic companies as a % of GDP in the US is 208%, and the global average is 131%. This indicates that Africa has generally small internal capital markets, creating a barrier when it comes to accessing internal capital for investment in green transition activities.

Figure 6.5: Market capitalization of listed domestic companies (% of GDP) for 2022.



Source: Author's own using World Bank data

While current levels of internal capital market development are a barrier to mobilising capital for investment within African countries, it also highlights an area for improvement that would help facilitate green energy transition investment across the continent. Deepening and development of African capital markets is already the core focus of several institutions including the African Union (AU) in their Agenda 2063, and the IFC's Joint Capital Market Program (J-CAP), who have identified capital markets as a key driver for the financing and achievement of development goals through domestic resource mobilization (FSD, n.d).

For increased development of African capital markets there needs to be a focus on the development of policy and governance structures that facilitate these capital markets (IFC, 2020), as well as creating more integrated regional and continental markets, for example: the African Continental Free Trade Area (AfCFTA) (African Investment Forum, 2023). An example of regional capital market integration as a way to further develop internal capital markets is the East Africa Community (EAC) capital market regime, which creates capital market depth through the integration of capital markets across Kenya, Rwanda, Tanzania and Uganda (EAC, n.d).

3.5 Capital flight and illicit financial flows

Evidence exists that Africa is capable of significant finance contributions towards its development (Igbatayo, 2019; UNCTAD,2020; AU, 2021). However, African countries lose on average $50 billion annually through illicit financial flows (IFFs) and capital flight (Mbeki, 2016). Thus, there is potential for intrinsic rechannelling of funds to achieve development objectives including a just energy transition through addressing some of the items listed in Table 6.6. Such IFFs represent a source of revenue to build Africa's ability to independently establish and achieve its development and transition-related needs.

Table 6.6: Where is Africa susceptible to high levels of illicit financial flows?

Illicit financial flows	Reasons
1. Capital account liberalization	Facilitating a lot of LFFs through moving tax, dividends, and assets out of a country.
2. Extractives sector exploitation	50% of African IFFs are from trade mispricing, with the Sub-Saharan Africa region having the highest level of trade misinvoicing.
3. Weak institutions, weak governance, and corruption	Caused by a lack of transparency, policy gaps when addressing reporting and causes of IFFS and corrupt institutions.

Source: (UNCTAD, 2020)

The extractive industry in particular needs to be an area of focus, because of the strategic assets that many countries seek to acquire. It is estimated that at least USD40 billion in IFFs are directly linked to extractive commodities, (UNCTAD, 2020). It was also found that IFFs have been increasing across the continent, up from USD20 billion in 2001 to USD60 billion in 2010, with another estimate predicting IFF growth at 20.2% per annum (AU, 2021). In summary, it has been shown that Africa loses more through IFFs than it gains through foreign aid and Foreign Direct Investment (FDI) (Igbatayo, 2019) which has a detrimental impact on the capital stock available for funding development outcomes in Africa. Better trade deals and stemming of IFF losses can also contribute to closing the current financing gaps linked to overall financing needs between 2020 and 2030.

3.6 Limitations of the current global financial architecture

Drawing on the previous sections, it is evident that the most significant constraint and limitation on Africa's climate ambition is the current position of the continent as a "taker" of ambition. This is due to the current structure of the global financial architecture and how it limits the access of affordable and sufficient finance flows to African countries, which are needed to realise mitigation and adaptation objectives. It also relates to the climate finance architecture, which is designed in a controlled access manner, unable to guarantee the obligations of global north countries to the global south. Currently, finance for climate actions flows from a variety of channels, within and external to the UNFCCC Financial Mechanisms. This includes multi-lateral institutions such as the World Bank, bi-lateral agreements, and various funds such as the Green Climate Fund (GCF), and Climate Investment Funds (CIF) (Tamasiga et al). In addition, various financing initiatives have been established (see Section, 2.2), including the recently popularised JETPs. The primary form of finance provided by these institutions is debt provided by their shareholders such as the UK, the US, Japan, Canada, and France.

It is also important to analyse, "who" owns African debt, to understand how it can influence Africa's ambition and what is prioritised. Why is this important to know? It builds an argument that our ambition is constrained by those lending to us and our level of indebtedness, in a time when expensive credit is all that is on offer. African countries' debt is owned by a variety of stakeholders, dominated primarily by private creditors (43%), followed by multilateral organisations (34%) and bilateral partners (23%). What is also evident is that China has become Africa's biggest bilateral lender, with its government issuing almost USD 63 billion of Africa's debt in 2022, and its private lenders over USD 24 billion of Africa's external debt. The breakdown of Africa's debt ownership indicates how, in the context of ambition, Africa's ambition setting is highly dependent on its relationships with its counterparts (Harcourt, and Robertson, 2023).

As a result of their ownership of African debt, and their dominance within financing institutions, funder countries dominate the administrative and decision-making arms of these organisations and are in a position to dictate where the funding flows, when it flows, and the associated terms and conditions of the funding. This leaves African countries highly-dependent, with limited leverage to determine the scale, quality, and allocation of funding. Thereby, leaving them in a position of takers of finance, and in-turn ambition. With African leaders often finding themselves in a position where they have to "beg" for finance, and are subject to various conditions to receive finance (von Lüpke et al., 2023).

One of the primary features and consequences of the current financial architecture is the indebtedness of the continent and its reliance on credit (see Section 3.1). The credit often comes at a high-premium, as an investment in African countries, particularly for climate action is considered risky, relative to similar investments in developed countries. This perceived risk is communicated and reflected in broad assessments carried out by agencies like Fitch, Moody's, or Standard & Poor's that evaluate stability and creditworthiness. However, these ratings may not adequately consider the unique circumstances of a project and can lead to an overestimation of risks in developing economies, particularly in Africa. This can result in higher financing costs (Nkhalamba McBride et al., 2023), with the aggregate cost of financing for African countries standing at 11.6 per cent (UNCTAD, 2022).

The result of all of this is that African countries are increasingly finding it difficult to pay off current debts, and are also unable to access new loans at a scale and interest rate that they can afford. Despite calls for increased concessional finance and grants for the continent's climate mitigation and adaptation efforts, this has not been forth coming on the scale needed. The JETP is an exception to this, with 63 per cent of the total funding pledged by the IPG being concessional loans (PCC, 2022a). Furthermore, with interest rates rising in the United States of America (from 4.50% in 2022 to 5.5% in 2023), the UK (from 2.25% in 2022 to 5.25% in 2023) and the European Union (from 2.50% in 2022 to 4.50% in 2023) even the affordability of concessional loans is being called into question (UNCTAD, 2022).

Another significant feature of the current global financial architecture, which potentially limits access to and affordability of finance, is the denomination of debt issued. With the majority of debt issued being in funder currencies (i.e. dollars, euros, pounds, yuan). This leaves the total value that needs to be paid back subject to exchange rate fluctuations, which are often more extreme on the African continent relative to the global north.

The current global financial architecture is not designed in a manner that allows African countries to access the finance they need to realise their sovereign mitigation and adaptation targets. With existing finance flows and structures not reflecting the equity that is needed for a just transition on the continent.

4. Characterisation and analysis based on scenarios

To develop an understanding as to what is required to finance a just and equitable transition in Africa, four questions have been developed (see below) to move beyond the current lens through which Africa's finance ambition is understood (i.e. determined by financing partners) to one that is informed by the pre-determined needs and priorities of countries on the continent. These questions aim to recognise that Africa's ambition is interdependent, its response is largely informed by the continent's current position as a taker of ambition, deep developmental concerns and priorities, and the financing gaps on quality, quantity, and dignified access.

1. What is our unique transition context and what do we need to meet such needs?
2. What are the environmental and social ambitions for the country's transition?
3. How do we leverage what we have to get what we need?
4. What quality and quantity of finance is needed for Africa to realise a just and equitable transition?

These questions are explored by applying four conceptual financing frames. These conceptual frames are (a) frame one, a typology of African economies' based on their unique relationship with fossil fuels and relative intensities of dependence and use; (b) frame two, the nexus of the environmental and social intensity of the transition; and (c) frame three, an ambition matrix for finance, with a high quality and high quantity of being the ideal option for African countries, and (d) frame four, what existing conditions inform and shape the options available to policymakers and how they respond.

4.1 Africa's transition context and needs

Using the typology in section two as a frame (see Table 6.2: Typology of an African Just Energy Transition) one can determine the intensity of the impact a transition will have on an economy based on its reliance on fossil fuels. More specifically their level of dependence on fossil fuels and other emissions-intensive industries for energy generation and economic output. This is critical to understanding the intensity of the transition and the economic implications it will have on the economy of the country in question. For example, South Africa, which is an emissions-intensive producer, due to its large coal economy will experience widespread economic disruption to the economy as a result of a transition. The scale of the disruption and change caused by a transition in turn dictates the financing needs of the country in question. South Africa requires significant finance to fund the transition of the power sector, the development of new industries, reskilling, and social protection all of which are essential for a just transition (PCC, 2022b). Interlinked with the quantity of finance a country needs are the conditions with which it is provided.

When applying this typology, it is also important to account for the fact that given the relatively low emissions on the continent and the expected growth in population and economic output, the emissions profile of the continent is expected to grow in the coming years (Wang et al, 2024). Which will most likely change the positioning of several countries in Africa relative to the typology. This has to be considered when determining the financing needs of countries on the continent.

4.2 Defining environmental and social ambitions

Given the unique transition context (outlined in frame one, above), countries will have different vulnerabilities, given the heterogeneity in Africa. These vulnerabilities, can provide a basis for understanding the exposure, sensitivity, adaptive capacity, and readiness, of a country transitioning which provides useful information on the country's economic, social and governance readiness, to help understand where finance flows can have the greatest impact. Transitions will be influenced by how a country sets its climate and/or energy transition ambition, and what it prioritises (i.e. the environmental and social response) which essentially influences the kind of finance needed. This is led by the typology in section two (See, Table 6.7: Typologies of the intensity of environmental and social responses), as a basis for frame two, on the nexus between the environmental and social response of a country relative to its needs.

Table 6.7: Typologies of the intensity of environmental and social responses

		Intensity of environmental response	
		Low	**High**
Intensity if social response	**Low**	**Light Green** Restructure of economic systems e.g. energy with zero/low interst in social issues — with green growth as a solution.	**Dark Green** Precutionary approach prioritizing human quality of life, with low interst in social issues.
	High	**Light Green & Red** Dominant approach to sustainable development in terms of income inequality and poverty with concern for environment.	**Dark Green & Red** Precautionary approach combined with interest in distribution and wealth.

Source: (Naidoo, 2019;93)

The location of a country within a particular quadrant in Table 6.7 informs the financial needs of the transition, including the instruments, and the overall quality and quantity of finance needed (Naidoo et al, 2024b). Quality here refers to the financing instruments and the extent to which they account for a country's fiscal limitations, debt burdens, ability to take on risk and need for predictable and consistent finance. This is essential when considering and determining the ambition of African countries as the reality is that African countries are largely dependent on external finance (see Section 2). This means their ambition is directly tied to the quantity of finance they can access, and the terms and conditions under which it is provided (quality of finance).

Using, South Africa as an example in light of its commitment to a just transition and given the carbon intensity of its economy, it would fall in the "light Green & Red" quadrant. This means that significant capital is required for the country's energy transition, as well as for the justice elements of its transition which are significant and include finance for reskilling, and social protection, (PCC, 2022b; PCC, 2022a). With the JET IP outlining a need for an initial USD98 billion for the period 2023-2027 (PCC, 2022a). In addition, the country also requires a quality of finance that does not increase its substantial debt burden, accounts for existing fiscal constraints, enables appropriate risk-sharing between the private and public sectors, and is consistent and predictable. It is also essential that the finance provided is used to address the justice elements of the transition and does not only go to profit-making projects such as renewable energy transmission. To avoid this, the JET IP proposes that a portfolio-based approach be adopted.

Despite the obvious case for South Africa being in the "Light Green & Red" quadrant. When accounting for the associated financing needs, which it cannot necessarily provide internally, the country's ambition and location in the typology becomes subject to the quality and quantity of finance it can access from other actors within the global economy. This is a reality which applies to the rest of the continent and illustrates the point of Africa largely being a taker of ambition.

4.3 Leveraging Africa's critical assets as basis for just transitions

With the landscape in mind as highlighted in Section 2, it is evident that there is significant diversity in the economies of countries on the continent, as well as in their endowment of resources that are of value to the global transition. Therefore, the third question that African countries need to be asking themselves in the context of the transition is what do we have that is of value to both the global and local transition? This can be in the form of resources and capital and links to *frame four*.

Two of the most significant resources that African countries have available to them are critical minerals which are essential to the production of components needed for clean energy generation, and natural gas which is often viewed as an intermediate energy source for transitioning countries. For both of these resources, but particularly the former there is a growing demand, with global actors conscious that Africa has the resources they need for their transitions. In addition to critical minerals and natural gas, an often-overlooked resource that Africa has in the context of global efforts to mitigate climate change is carbon sinks, with the Congo River Basin Forest being the most prominent (see Box 6.2). The value of carbon sinks should not be ignored, and they are a resource that Africa can leverage for access to finance.

The reason why these resource endowments are important in understanding Africa's ambition is that the majority of African countries are dependent on international financing for their transition, with the existing evidence suggesting that they are therefore often unable to directly determine or influence the quality of finance that is provided, and how it is used (i.e. their ambition and transition pathways according to needs). Yet by having resources that many developed countries want, there is significant bargaining power that African countries can utilise to their advantage to access a quality and quantity of finance that is in line with their needs, thereby allowing them to have a greater say in setting their own ambition.

The bargaining power that select African countries have available to them relative to existing and potential financing partners can be leveraged for better financing terms. Leveraging this bargaining power will be of importance to the trajectory of the continent's emissions pathway and its overall development. However, for this to be realised, African countries with this bargaining power will have to develop mechanisms and partnerships that couple the export of both raw and beneficiated critical minerals, as well as natural gas with finance that allows them to address their environmental and social transition needs.

Furthermore, African countries with significant carbon sinks such as the Congo River Basin Forest need to develop narratives and bodies of evidence that emphasise the role of these carbon sinks in emissions reduction. As well as the importance that combatting deforestation in these areas plays in reaching net zero. With this as a basis, anti-deforestation efforts can then become a credible bargaining tool in negotiations for transition finance flows.

An often-overlooked aspect in negotiations and discussions around finance flows is the fact that IFFs deprive the continent of a significant quantity of finance that it could use for its transition efforts (see Section 3.5). African countries need to hold the global north to account for these IFFs and use available bargaining power to ensure that efforts are made to combat IFFs. If done effectively, this would make a substantial amount of capital available for African countries to invest in transition efforts.

Overall, it is evident that certain African countries are in a position to leverage their critical minerals, natural gas, and carbon sink endowments to access transition finance flows. The extent to which countries have the necessary endowments and can develop effective bargaining positions will play a critical role in determining the quality and quantity of finance they can access. Which in turn will dictate the extent of their ambitions and transition pathways.

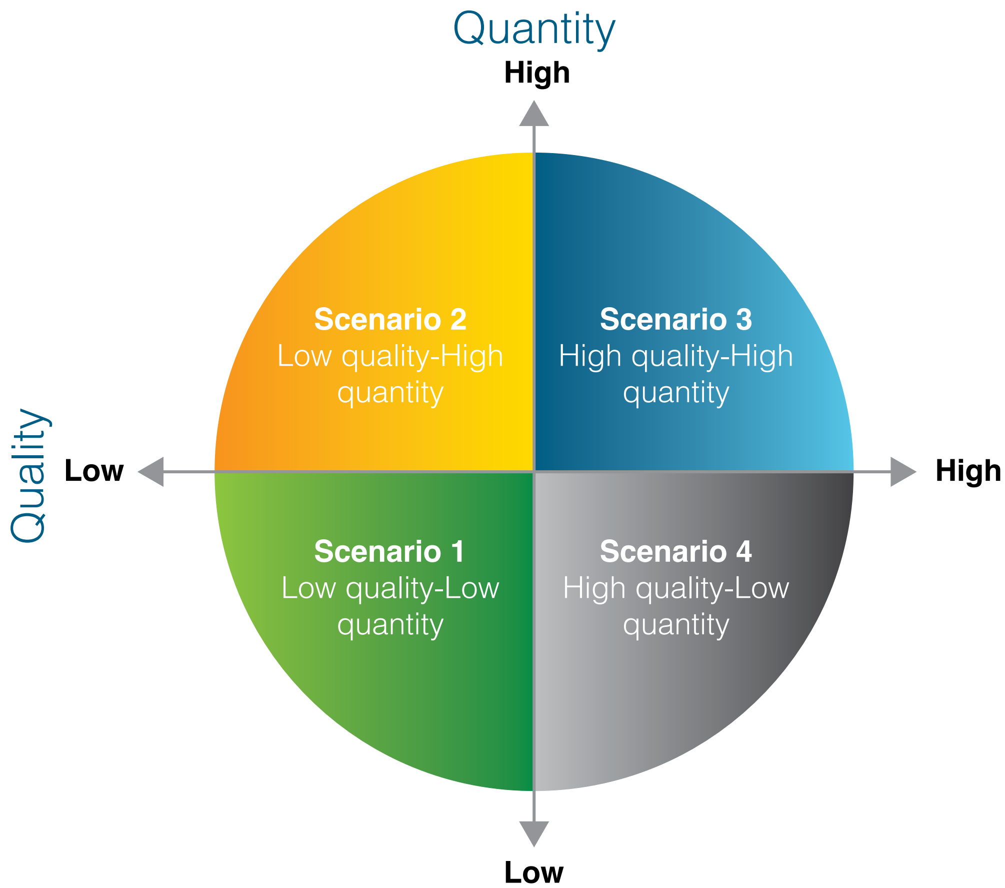
4.4 Quality and quantity of finance for Africa's just transition

Building on the previous two frames an ambition matrix[19] (see Figure 6.6) has been developed as a basis to position the desired outcomes for African countries in terms of finance flows *(frame three)*. This matrix aims to outline how Africa's financing ambition for a transition can be understood within the context of the quality and quantity of finance flows. On the X-axis countries can plot the quality of finance they need, while on the Y-axis countries can plot the quantity of finance they need. This allows countries to position themselves relative to four scenarios:

- Scenario 1: A low quality and low quantity of finance.
- Scenario 2: A low quality and high quantity of finance.
- Scenario 3: A high quantity and high quality of finance.
- Scenario 4: A high quantity and low quality of finance.

The quantity and quality of finance needed are dictated by the environmental, development and social needs and priorities of respective countries as outlined in frame two (see, Section 4.2). These in turn are informed by a multitude of factors including the economic typology (outlined in frame one) of the country in question, which details the prominent sectors in the economy and the implication that a transition would have on the economy.

Figure 6.7: Ambitions matrix in the context of finance



Source: Author's own analysis

19 - The methodology implemented in this paper does not assume that energy transition is a priority across the continent.

However, the quality and quantity of finance needed does not necessarily translate into existing finance flows, which is why a fourth frame is needed, to better understand what existing conditions inform and shape existing finance flows, and how policymakers should respond.

Based on the existing analysis and using the scenarios in Figure 6.6 as a framework, it is evident that the status quo places Africa in **scenario 1**. With both a low quantity and quality of finance available for climate and transition efforts. This is seen in Africa's 88 per cent climate financing deficit for 2020 (Guzmán et al., 2022), and the predominance of non-concessional debt as a financing instrument. Which only further adds to debt pressures across the continent (see section, 3.2).

Though the continent falls in **scenario 1** when analysed as a single entity, there are individual African countries that one could argue are currently in **scenario 2**, where there is a relatively high or growing quantity of finance that is available, but it is not a quality of finance that is sustainable and reflects the financial limitations of the country in question. An example of this is the South African JETP, which has a significant amount of initial funding promised (USD8.5 billion), but the majority of this funding is in the form of loans and places significant risks on the fiscal position of South Africa. This means the quantity of finance may be considered high, but the quality is low.

Examples of African countries being in **scenario 4** do not exist, as this would entail a high quality of finance, for example, grants as the primary financing instrument, but without the necessary scale needed to realise the country in question needs.

The most ideal scenario for African countries is **scenario 3**. However, due to several external factors the most significant of which are the current limitations and structure of both international and local financial architectures, no African countries find themselves in this scenario. With the preconditions for **scenario 3** being massive structural shifts in the global financial architecture.

From an African policymaker perspective, these shifts should be informed by existing understandings of equity and justice, and should entail the following:

- The writing-off or restructuring of existing debt Africa owes to MDBs, DFIs, and bilateral partners.
- The issuance of future loans at non-concessional rates that are affordable, relative to the existing financial position and constraints of the country in question.
- The issuance of loans in local currencies to avoid increasing debt costs that would result from currency price fluctuations.
- The establishment of an African credit rating agency that can better analyse and determine the unique factors that inform credit risks and worthiness on the continent.
- Increasing the access to Special Drawing Rights (SDRs) for African countries.
- Increasing the share of grants in existing finance flows to Africa.

Furthermore, the emphasis on de-risking of private investment by African governments needs to be replaced with greater risk-sharing arrangements between African governments and the private sectors, both local and foreign.

4.5 Summary of analysis

Africa is largely dependent on external finance flows for its transition efforts, and those providing the capital are largely able to dictate the quality and quantity, use, and channels of funding. The implication is that African countries are not necessarily able to align needs with finance, and those providing the finance dictate the continent's ambition as a result. Therefore, the continent is regarded as a "taker" of global ambition, and its needs are decoupled from the strategic assets it possesses and that are essential to the transition.

Nevertheless, there are nuances to the current context, and four frames have been outlined which if applied can help African countries to develop a better understanding as to what is required to finance a just and equitable transition and the limitations to this. These frames have been explored in this section through four questions that African countries can ask themselves.

1. What is our unique transition context and what do we need to meet such needs?
2. What are the environmental and social ambitions for the country's transition?
3. How do we leverage what we have to get what we need?
4. What quality and quantity of finance is needed for Africa to realise a just and equitable transition?

With these four questions as a lens, it is evident that there is significant heterogeneity in the economies of African countries, with this largely determined by a country's relationship with fossil fuels. This relationship is the primary determinant of the intensity of their transitions and the associated environmental and social (financing) needs. However, African countries face significant debt challenges and fiscal constraints, limiting their ability to invest in their own transitions (with a few exceptions), making African countries "takers" of environmental and social ambition.

As it stands African countries generally are only able access to a low quality and quantity of finance, which is unjust and limits the ambition of the continent. For this to change a fundamental shift is needed in the global financial architecture, the institutions that support Africa, more specifically in the way deals are modelled and financed. An emerging factor that could potentially play a role in changing this dynamic is that select African countries do have significant bargaining power that can be leveraged to improve the quantity and terms of financing that they receive, as well as allow Africa to invest in itself more.

5. Conclusion

This leaves African countries highly dependent, with limited leverage to determine the scale, quality, and allocation of funding. The result of all of this is that African countries are increasingly finding it difficult to pay off current debts, and are also unable to access new loans at a scale and interest rate that they can afford. Despite calls for increased concessional finance and grants for the continent's climate mitigation and adaptation efforts, this has not been forthcoming on the scale needed.

To navigate this difficult context and better determine what is needed to finance a just and equitable transition on the continent, four conceptual financing frames have been introduced. The first is a typology of African economies. The second frame allows for an analysis of the nexus of environmental and social intensity of the transition. The third frame relates to the understanding of ambition scenarios for finance, through the lens of the quality and quantity of finance needed, and the fourth frame is a lens through which to understand the existing factors that inform the financing options of African policymakers, and how they could potentially respond. The frames can be applied to answer four associated questions, which African policymakers should consider:

1. What is our unique transition context and what do we need to meet such needs?
2. What are the environmental and social ambitions for the country's transition?
3. How do we leverage what we have to get what we need?
4. What quality and quantity of finance is needed for Africa to realise a just and equitable transition?

Though this chapter does not provide all the answers to these questions it does offer initial insights that can be built on and developed. This includes the potential leverage Africa has in using its access to critical minerals and other resources to improve the current quality and quantity of finance flows and features of the global financial architecture that can be reformed so that it is more favourable to the needs and unique challenges facing African countries.

CONCLUSION

The developmental needs of African countries should be taken into account as the region transitions to cleaner energy sources. For example, some African countries have a high dependence on revenues from fossil fuel exports. Other African states have new fossil fuel finds and exploring options for exploitation to support the global market whilst investing in future energy sources for domestic consumption. The stability of global supplies could therefore come from African countries in the context where there is an immediate and complete phaseout of fossil fuel exploration in developed countries.

African states, being rich in critical minerals for the energy transition lack national policies to ensure maximum gains (economic, social, political) that could accrue from processing mineral wealth. This risks exploitative trade and investment regimes that perpetuate structural injustices of the past. Furthermore, other measures such as the Carbon Border Adjustment Mechanism (CBAM) and EU Forestry Regulations, and environmental standards have the potential of undermining the ability of African economies to grow and earn the required foreign exchange to drive the transitions.

The transition to a low-carbon emission economy is likely to be difficult and disruptive for Africa. On account of decline in foreign demand for fossil fuel products and deforestation products, the narrow base of exports of many countries in Africa is likely to shrink further. Unless new sources of finance and foreign exchange are found and domestic capacity to manufacture green products created, the transition to a low-carbon emission economy appears to be unviable. Furthermore, emerging trade rules prohibiting export taxes and export restrictions could impede the efforts of the African countries to create a vibrant downstream processing industry of critical minerals.

Just Transition must include the following two fundamental tenets: gains from trade-related mitigation measures should be distributed more evenly among countries, and not remain concentrated in a handful of countries; and developing countries must be allowed to preserve policy space so that the transition to renewable energy does not make Africa overwhelmingly dependent on imports.

This transition will, unavoidably, be disruptive and create a new set of economic winners and losers in the global economy. Countries such as China and Brazil are already taking advantage of the opportunities, but the question for African countries is whether they can exploit the disruption to alter their status as laggards in the global economy. Given the global disparity and the structural disadvantages with which African countries enter the global transition, the default - and difficult to avoid - economic impact is for the global energy transition to be economically damaging to African countries. This default is likely despite calls for a ‘just transition’.

Where African countries can position their development pathways as valuable to the global climate and energy transition, they will attract investment on their own terms (Williams et al., 2023). The challenge is set for African countries confronting the global energy transition as, ‘finding ways to significantly increase GDP (employment, household income and energy access) without major increases in greenhouse gas emissions.’ In the case of African countries, actively harnessing the global energy transition for the purpose of domestic development, could shift the default outcome of this transition from an additional burden on socio-economic progress to a rare opportunity to gain economic bargaining power and accelerate progress. This is not only the best, and least risk, ‘low-regrets’, development pathway available to African countries, but it may be the only durable pathway ahead of 2050.

The topic of agriculture and LULUCF is generally not prioritised in climate change discussions and negotiations as much as it should be. In fact, addressing emissions from the land sector and highlighting the importance of carbon sinks is usually an afterthought in climate policy. African leaders should continue to drive the agenda of the importance of carbon sinks in providing a service to the world and bolster the political will of governments, the support of key stakeholders, and the engagement of populations to support ambitious action to conserve and restore carbon sinks, in line with climate and development objectives. African countries should also continue to influence developed markets to invest their technical, and financial resources to support the implementation of ambitious policy frameworks aimed at maximising the contribution of carbon sinks.

To prevent future deforestation, it is crucial for policymakers to know which areas are at the highest risk and to identify the drivers creating these risks. Various tools already exist to estimate future levels of deforestation. Combining technological development and community-based requirements could create a toolkit that can drive natural climate solutions to support communities living in vulnerable ecosystems.

Africa’s climate ambition is constrained and limited by the continent’s position as a “taker” of ambition. This is due to the current structure of the global financial architecture and how it limits the access of affordable and sufficient finance flows to African countries, which are needed to realise mitigation and adaptation objectives. Linked to this is the continent’s increasing debt burden and the power imbalance this creates between African countries and their creditors. This puts them in a position to dictate where the funding flows, when it flows, and the associated terms and conditions of the funding.

To navigate this difficult context and better determine what is needed to finance a just and equitable transition on the continent, four conceptual financing frames have been introduced. The first is a typology of African economies. The second frame allows for an analysis of the nexus of environmental and social intensity of the transition. The third frame relates to the understanding of ambition scenarios for finance, through the lens of the quality and quantity of finance needed, and the fourth frame is a lens through which to understand the existing factors that inform the financing options of African policymakers, and how they could potentially respond.

APPENDICES

The framing applied in the study places the response of Africa as a whole scenarios are used, noting that scenarios are not predictions and do not have probabilities attached to them, hence most appropriate for a dynamic, unknown, and uncertain future. The African response is viewed as dynamic, informed by response scenarios, current economic conditions and capacity. The scenarios serve as a guide for each chapter in terms of policy messages that emanate from an analysis, as such are applied differently in each chapter.

APPENDIX 1:
APPROACH AND METHODS

		African Response	
		Low	High
Global Response	High	[Scenario 1] High global ambition coupled with Low ambition from African countries.	[Scenario 2] High global ambition coupled with High ambition from African countries.
	Low	[Scenario 3] Low global ambition coupled with Low ambition from African countries.	[Scenario 4] Low global ambition coupled with High ambition from African countries.

Appendix 1 outlines the scenarios that guide the appropriate African response to the global ambition, whilst calibrating the response and outcomes for African countries. Some of the chapters will therefore seek to crystallise these scenarios where relevant, with such outcomes serving as modelling parameters for the second phase.

The methodological approach applied by each of the chapters is summarised in Appendix 2 below.

APPENDIX 2:
SPECIFICS OF THE APPROACH AND METHODS USED IN EACH CHAPTER.

Chapter	Approach and methods
1. Climate Policy Framework	• Drawn from existing literature on the just transition in Africa, as well as ongoing discussions under the UNFCCC Just Transition work programme. It will further build on emerging messages from Chapter 2-6. The modality of expert interviews and review of relevant stakeholders will be employed to make inputs on the policy recommendations.
2. Trade Implications	• A multi-pronged examination undertaken, including analysis of trade-related policy measures contained in trade agreements and also advocated by some inter-governmental organisations; data analysis and trade modelling of technical trade solutions and estimate their impact on trade of African countries, and highlight the trade-offs for African countries in pursuing a low-carbon emission trajectory from the perspective of international trade. • The key areas examined include policy analysis of environment-related trade measures such as duties, taxes, standards, amongst others and dynamics of green technologies; further analysis and simulation will include examining data pertaining to environmental goods, trade in goods to markets such as the EU, fossil fuel subsidies amongst others. • Using trade data from WITS and data on foreign exchange reserves from World Bank Development Indicators, the following has been undertaken: calculate the share of fossil fuel exports in total merchandise goods and identify African countries with share of fossil fuel products in total export basket exceeding 25%; contribution of exports of fossil fuel products to total foreign exchange reserves; existing profile of exports of Deforestation Products of Africa to the European Union; contribution of exports to the EU of Deforestation products in Total foreign exchange reserve (%); profile of trade in environmental goods of the African countries etc. In addition, data on fossil fuel subsidies, as available in public will be analysed to assess the likely implications of removal of these subsidies for African countries.

3. Economic implications	• Explored the economic implications of a just climate transition at the continental scale. The focus is less on what African countries can contribute to the global 1.5°C target, and more about the tenability of respective urban development pathways in the context of the global transition. • Relying on a literature review and available data, analysis and think-through of the economic prospects of three different climate scenarios undertaken, in which African countries adopt their strategies relative to the global effort. So as not to over-generalise, distinctions are drawn between African countries based on their degree of hydro-carbon commodity dependence, urbanisation, and GDP per capita. Country case studies from Botswana, DRC, Equatorial Guinea, Ghana, and Eswatini are used to illustrate more general points. • Macro-economic modelling not adopted, but instead combined qualitative and quantitative economic data to appraise likely impacts and surfaced the most important decisions and trade-offs for leaders of African countries in pursuing socio-economic development in a world that is likely to experience temperatures that are 1.5°C warmer combined with tighter emissions constraints, sometime in the 2030s. • The respective scenarios are given further illustration by sector specific analyses of their implications in the forestry and land-use sectors, the coal, oil and gas sector, the rare earth's sectors, and the continent's cities, respectively.
4. Mitigation implications	• Current and projected baseline emissions modelled based on published emissions data (e.g. Climate Analysis Indicator Tool (CAIT) data and Our World in Data) as well as Africa's policies on achieving universal energy access, assuming a business-as-usual mix of energy technologies to meet that demand. An Excel-based emissions model is developed and used for this activity. From this exercise key GHG emission sources and mitigation sectors as well as their unique African characteristics are identified. • An analysis of mitigation options and emission scenarios for the continent is carried out, including an assessment and review of the continent's carbon sink capacity based on published literature, assessment of the impact of mitigation actions included in the NDCs of the various African countries as well implications of an Africa-wide net-zero pathway as required by the science for 1.5^{o}C temperature increase limit. • Based on the first two outputs an equitable and achievable emissions pathway for the African continent is modelled, based on ideal proportions of mitigation actions and carbon sinks, and an optimal mix of energy sources to achieve Africa's universal energy access while aligning with the requirement by science of net-zero emissions by 2050 at the latest. Equity, hereby used as a proxy for a just transition, is defined in terms of equitable access to sustainable development, which includes universal energy access for the continent.
5. Jobs implications	• The approach is premised on the theory that an equitable transition is dynamic and responds to the global level of ambition, which should inform climate action response by African governments. As such a scenario-based analysis is used, with case studies being used, where appropriate, to further elaborate specific assertions/characterisations that assist in presenting continent-wide perspectives.
6. Finance implications	• Informed by the work of Spratt (2015), Naidoo (2020) and Lowitt's (2021) work on the level of ambition for advancing a green economy or just energy transition, and in particular Naidoo's (2020) work on the quality of finance to inform sustainability transitions are be determining factors in the financial sector response that shape the analytical work. The assumption that there are underlying characteristics that determine the transition context to be funded, that the national environmental and social ambitions inform the ambition of projects, and the structure of financial systems determine the ability and capacity to finance such ambition. • The methods range from quantitative mapping with descriptive statistics, qualitative approach, textual and thematic analysis of literature, mapping of current instruments and initiatives, and finally adopting an inductive approach to the findings. Key factors underpinning the work are the cost of finance, access to finance and financial trade-offs in the course of energy transition. • The framing applied places the response of Africa as a whole at the centre. • The heuristic method has been considered and applied in framing the chapter, while recognising that Africa's ambition is interdependent, and its response is mainly informed by deep developmental concerns and priorities. • The findings consider synthesis from prior work streams but do not include primary modelling rather analysis of existing data to deduce impact and offer initial policy options across a series of possibilities.

ANNEX 3:
THE LOCAL CONTENT ASSUMPTION FOR ALL THE TECHNOLOGIES CONSIDERED IN THE STUDY AS SHOWN IN THIS APPENDIX.

3.1: Solar photovoltaic jobs estimates assumptions

Solar photovoltaic sector jobs generation	Base case Scenario1	Scenario 1
Modules	30%	60%
Inverters	30%	60%
Construction		
Design and civils	50%	50%
Installation	100%	100%
Other (public relations, legal, environmental studies)	90%	90%
Site electrical infrastructure	85%	85%
Transportation	100%	100%
Other		
Professional services (project mgmt, engineering, etc)	90%	90%
Site Improvement (i.e., Road Construction)	100%	100%
Operations and Maintenance (O&M)		
Maintenance	100%	100%
Repairs and parts	100%	100%

3.2: Coal jobs estimates assumptions

Coal sector jobs generation	Base case Scenario1	Scenario 1
Power generation (boilers, turbines, generators, control)	30%	60%
Feedstock handling equipment and ash disposal	30%	60%
General facilities (buildings, cooling system)	30%	60%
Non-electrical equipment	30%	60%
Construction		
Electrical Balance of Plant	60%	60%
Construction (Excluding Site Improvements)	100%	100%
Other		
Professional services (project mgmt, engineering, etc)	60%	60%
Site Improvement (i.e., Road Construction)	100%	100%
Operations and Maintenance (O&M)		
Coal (incl. ash disposal) and water	100%	100%
Plant Operations (staff, equipment such as trucks)	100%	100%
Civil Works (Access Road Maintenance, Etc.)	100%	100%

3.3: Natural gas jobs estimates assumptions

Natural gas sector jobs generation	Base case Scenario1	Scenario 2
Power generation (boilers, turbines, generators, control)	30%	60%
Feedstock handling equipment and ash disposal	30%	60%
General facilities (buildings, cooling system)	30%	60%
Non-electrical equipment	30%	60%
Construction		
Electrical Balance of Plant	60%	60%
Construction (Excluding Site Improvements)	100%	100%
Other		
Professional services (project mgmt, engineering, etc)	90%	90%
Site Improvement (i.e., Road Construction)	100%	100%
Operations and Maintenance (O&M)		
Coal (incl. ash disposal) and water	100%	100%
Plant Operations (staff, equipment such as trucks)	100%	100%
Civil Works (Access Road Maintenance, Etc.)	100%	100%

3.4: Wind jobs estimates assumptions

Wind sector jobs generation	Base case Scenario1	Scenario 1
Wind turbines, generators, control	30%	60%
Blades	30%	60%
Towers	30%	60%
Equipment for shipping/ Transportation	30%	60%
Construction		
Electrical Balance of Plant	60%	60%
Construction (Excluding Site Improvements)	100%	100%
Other		
Professional services (project mgmt, engineering, etc.)	90%	90%
Site Improvement (i.e., Road Construction)	100%	100%
Operations and Maintenance (O&M)		
Rotor	15%	15%
Drivetrain/nacelle	33%	33%
Tower	12%	12%
Development	3%	3%
Engineering	2%	2%
Electrical	15%	15%
Assembly/install	6%	6%
Road/civil	8%	8%
Foundation	6%	6%

3.5: Biomass jobs estimates assumptions

Wind sector jobs generation	Base case Scenario1	Scenario 1
Equipment and feedstock handling	30%	60%
Turbine, boilers, and air quality control equipment	30%	60%
Construction		
Professional Services (legal, engineering, development, public relations etc.)	90%	90%
Contractors and Balance of Plant Subtotal	100%	100%
Operations and Maintenance (O&M)		
Feedstock/ chemicals	100%	100%
Water	100%	100%
Solids and ash	100%	100%

3.6: Hydropower jobs estimates assumptions

Land and Water Rights	100%
Transmission Line Right of Way	100%
Construction Materials and Equipment	75%
Civil Works and Structures	75%
Dams and Reservoirs	75%
Water Conveyance	75%
Powerhouse Structure	75%
Navigation Locks	75%
Equipment	
Turbines	0%
Generators	0%
Balance of Plant - Electrical	25%
Balance of Plant - Mechanical	25%
Main Power Transformers	0%
Switchyard and Interconnection	0%
Transmission Line	0%
Installation/Labor	
Civil Works and Structures	50%
Turbines	50%
Generators	50%
Balance of Plant Electrical	50%
Balance of Plant Mechanical	50%
Main Power Transformers	50%
Switchyard and Interconnection	50%
Transmission Lines	50%

3.7: Geothermal jobs estimates assumptions

Construction	
Site preparation	100%
Rig operator and drilling services	100%
Cement and cement additives	90%
Petroleum	5%
Bits and stabilizers	90%
Mud and detergents	80%
Casing and wellhead	80%
Worker housing	100%
Professional services (engineers, geologists, supervisors, etc.)	90%
Other	
Engineering and design	60%
Mechanical equipment (turbines, generators, pumps, condensers, heat exchangers)	0%
Permitting and environmental assessment	100%
Additional civil works (i.e., roads)	100%
Operations and maintenance	
Plant operations, excluding equipment and field operations	100%
Civil works maintenance	100%
Equipment	0%
Field operations, including well equipment	89%

3.8: MW of electricity to be deployed in Botswana between 2021 and 2030 (Government of Botswana, 2020)

Year	Wind (MW)	Solar PV (MW)	Natural Gas (MW)	Coal (MW)
2021				
2022		100		
2023		100		
2024		100		
2025		100	10	
2026		100	10	300
2027	50	200	10	300
2028	50	200	10	300
2029	50	200	10	300
2030	50	200	10	300

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