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Bolstering Africa's Strategic Climate Change Engagement with China

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September 2022

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CONTENTS

ACKNOWLEDGEMENTS

The authors of this report would like to thank the African Climate Foundation for their generous support of this report.

We are grateful for and acknowledge the opinions and insight provided by our practitioner and expert interviewees that who contributed to the thinking and analysis expressed in this report through their own work as well as joint and one-to-one discussions with the team, including *inter alia* Dr. Wei Shen, Mr. Li Shuo, Ms. Li Xia, Dr. Frangton Chiyemura and Mr. Nura Jibo.

However, our opinions, insights, conclusions, recommendations and errors are ours alone.

Special thanks also go to our excellent researchers David Tinashe Nyagweta, Jing Cai, Ivory Kairo, Edmond Bosilong, and Ovigwe Eguegu. Hannah Ryder and Leah Lynch are also to be thanked for help with editing and production.

CHAPTER 1

1 INTRODUCTION

The African continent is particularly vulnerable not only to the direct effects of climate change, but also to climate change ripple effects such as biodiversity loss, food and water insecurity, climate migration and economic instability. According to the Global Climate Risk Index 2021, 5 out of the 10 countries most affected by climate change are located on the continent,[1] and this high level of vulnerability has been exacerbated by the ongoing global Covid-19 pandemic. However, this vulnerability does not mean there is inaction, nor does it mean there are no future challenges associated with African economic growth. This research aims to illuminate on both questions, with a view to supporting Africans to do more, as well as build supportive strategic partnerships. By elaborating on African countries as 'contributor(s) to the solutions'[2] of climate change, this report sheds new light on how African stakeholders can build stronger strategic partnerships with development partners such as China to meet their climate change related goals, both in the run up to COP 27 and beyond.

The report begins by first examining African actions being taken to address climate-related challenges and to build more climate-resilient societies. An in-depth analysis of over 50 Nationally Determined Contributions (NDC) submitted to UNFCCC examines areas such as mitigation and adaptation goals, targets to reduce greenhouse gas (GHG) emissions and the drive to increase the use of renewable energy sources. This report also addresses the key question of the financing gap that needs to be filled if African countries are to meet their mitigation and adaptation goals.

Having detailed climate change ambition on the continent, the report moves on to explore the future using scenario-based analysis. This scenario-based analysis utilises various African growth and GHG emissions forecasts to explore whether and how the African region can meet the Sustainable Development Goals (SDGs) and Agenda 2063 and/or different levels of industrialisation and poverty alleviation, while managing climate-related goals. This analysis also provides key context for exploring questions such as what a "just transition" might mean in Africa.

Third, the research explores how and to what extent African countries are engaging with a key international partner - China - to address climate-change related issues. Given most partnerships are multi-faceted in nature, the report endeavours to highlight several key areas where engagement is already taking place, as well as where challenges are being faced, for example on questions around fossil-fuel financing, or ESG performance. Other areas explored include the nature of project contracts between African and Chinese stakeholders, in particular Public Private Partnerships (PPPs) and Engineering, Procurement and Construction contracts (EPCs). The report also reviews the policy decisions and environment that has driven (and not driven) Africa-China engagement thus far.

The report ends by using the three analyses to provide direction for Africa's future engagement with China and vice versa, including how Africa should aim to work with China in the run up to in various areas of climate-related cooperation on the continent.

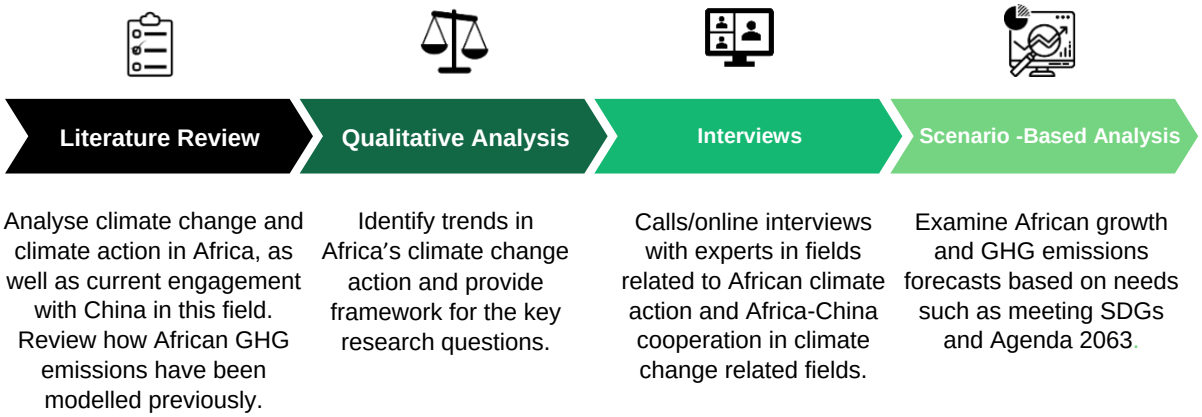
[1] Eckstein, David et al., 2021, Global Climate Risk Index 2021, Briefing Paper Germanwatch, Retrieved from https://germanwatch.org/sites/default/files/Global%20Climate%20Risk%20Index%202021_1.pdf

[2] Lopes, Carlos, 2019, Africa in Transformation Economic Development in the Age of Doubt, Palgrave Macmillan, p.118.

1.1 Methodology

This Research Analysis Paper employs a quantitative and qualitative research approach, using a variety of sources to address the main questions in the report framework. Our methodology has four key components, as set out in Figure 1 and below.

Figure 1: Methodology



1. LITERATURE REVIEW

The first major part of our methodology is a literature review, informed by both primary and secondary data that will be collated and organised through data gathering and desk research. Primary data is collected from a number of databases including the World Bank and UNFCCC and used for regression estimation, modelling scenarios in economic software as needed. Secondary data is obtained from reviews, articles, reports and other relevant internet sources. The literature review identifies key trends in Africa's climate change action and provides context to the research questions outlined in the framework**.** The literature review also analyses how African greenhouse gas emissions have been modelled in other analyses so as to inform our own modelling in this report. Finally, the literature review also explores China's contribution to Africa's climate change efforts to date through the lens of financing and adaptation mechanisms, trade and technology and capacity building.

2. QUALITATIVE ANALYSIS

The second major part of our methodology is a qualitative analysis of African climate ambition and climate action. This is carried out through an analysis of Nationally Determined Contributions (NDCs), as well as long-term development plans (LT-LEDS), policy documents, official government statements and other relevant internet sources. Finally, analysis of China's contribution to Africa's climate change efforts uses data from the Multilateral Development Banks (World Bank, AIIB, NDB), Boston University Global Development Policy Center, Trade Data, and China's Ministry of Commerce to explore key trends in FDI, investment, trade and policy.

3. INTERVIEWS

The qualitative analysis is complemented by a series of interviews with key players involved in Africa and China's climate change engagement. These interviews informed the analysis in Chapter Four and recommendations in Chapter Five.

4. SCENARIO-BASED ANALYSIS

Both our data analysis and expert interviews inform a scenario-based analysis. The analysis examines African growth and GHG emissions forecasts, based on different needs such as meeting the SDGs and Agenda 2063, and uses primary data collected from a number of databases including the World Bank and UNFCCC and used for regression estimation, modelling scenarios in economic software as needed. The analysis provides the basis for our key recommendations to development partners- in particular China.

CHAPTER TWO:

2 OVERVIEW OF CLIMATE CHANGE AMBITION ON THE AFRICAN CONTINENT

African countries are disproportionally affected by climate change. Climate change affects the continent in numerous ways, with the increased occurrence of floods, drought, heatwaves, changing rainfall patterns and rising temperatures ravaging the continent. Over a decade ago developed countries committed to providing $100 billion each year to developing countries in their fight against climate change. However, by COP26 in Glasgow this funding had not materialised, leaving more vulnerable countries struggling to address not only climate change but also challenges such as the ongoing Covid-19 pandemic. African governments have thus had to bear much of the cost linked to mitigation and adaptation efforts. According to a recent report by Power Shift Africa, countries will be making investments on adaptation to the tune of 4% of current GDPs every year.[3]

Yet despite high levels of vulnerability, African countries have enormous potential for renewable energy production in the forms of solar, wind, hydropower, geothermal, and biomass energy. This potential for cleaner energy production is matched by high levels of ambition across the continent, with all but two African countries submitting first, updated or second NDCs to UNFCCC.

2.1 Agenda 2063

Agenda 2063 is Africa's blueprint for sustainable development for a 50-year period, with the goal of achieving '*an integrated, prosperous and peaceful Africa, driven by its own citizens, representing a dynamic force in the international arena'.*[4] Agenda 2063 goal 7 is closely linked with Sustainable Development Goal 13, which calls for immediate action to fight climate change and its impacts[5], and thus shows how determined African countries are to address climate change. African leaders recently met to discuss and advance for more financial and technical in addressing climate change challenges in the continent. In pushing to address climate change challenges, African leaders believe that Africa needs to speak with one voice and the imperative to ensure momentum and focus. African leaders have called for a Climate Summit in Egypt ahead of the CoP27 to ensure that Africa stands together and speak with one voice. Climate change impacts are costing African economies between 3% - 5% of their GDP. Additionally, African leaders at the Committee of African Heads of State and Government on Climate Change (CAHOSCC) held in February 2022, agreed that as most economies in Africa

AGENDA 2063 GOAL 7

This goal aims to build environmentally sustainable and climate resilient economies and communities.

[3] Power Shift Africa, 2022, Adapt or Die: An analysis of African climate adaptation strategies. https://powershiftafrica.org/storage/publications/Adapt_or_Die_Final_1645869924.pdf
[4] African Union, 2021, Agenda 2063: The Africa We Want, Retrieved from https://au.int/en/agenda2063/overview
[5] UN, 2022. Sustainable Development Goals : Goal 13 https://www.un.org/sustainabledevelopment/climate-change/

are natural resources based, a one-size-fit-all approach to the issue of transitioning from fossil fuels disregards Africa's realities and it is not practical.

The African Union has developed a new action plan for climate change and resilience development strategy. The strategy and action plan are established to guide, coordinate and support Africa's response to climate change for the period 2022-2032[6] to contribute to the attainment of the aspirations of Agenda 2063. Figure 2 provides some of the key goals set out in the strategy.

Figure 2: Africa's Climate Change and Resilient Development Strategy and Action Plan (2022-2032)[7]

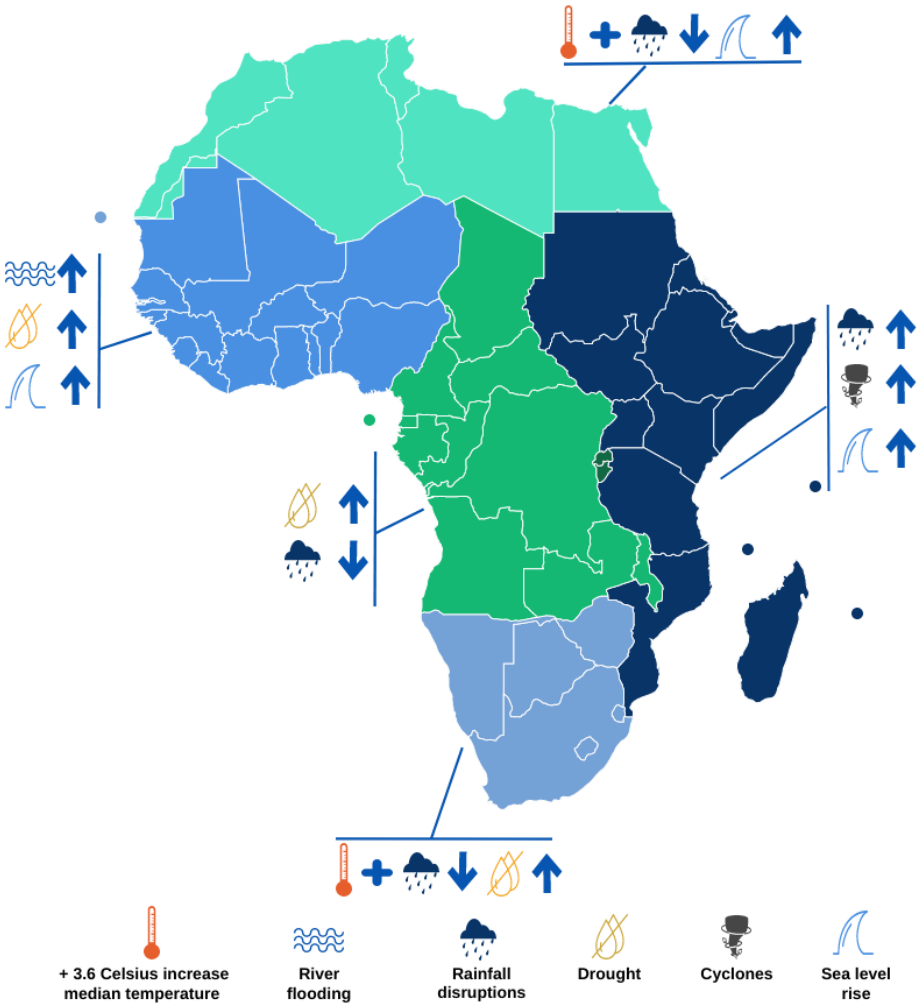
2.2 Climate Change in Africa

The Sixth Assessment Report of Working Group II of the Intergovernmental Panel on Climate Change (IPCC), released in March 2022, highlighted the climate impacts and risks on the African continent.[8] The report confirms that Africa accounts for approximately 4% of global greenhouse gas (GHG) emissions. In comparison, China emits 23%, US 19% and the European Union 13%.[9] To put Africa's emissions into perspective, the continent's current global share of CO2 emissions is at a similar level to China's carbon dioxide emissions in 1957, which was approximately 3.12%

[6] African Union, 2022a, Africa's Climate Change and Resilient Development Strategy and Action Plan (2022-2032), Retrieved from https://archive.uneca.org/sites/default/files/images/ACPC/Sweden/presentation_au_climate_change.pdf
[7] Ibid
[8] IPCC, 2022, Sixth Assessment Report Working Group II – Impacts, Adaptation and Vulnerability: Fact Sheet – Africa, Retrieved from https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Africa.pdf
[9] CDP, 2020, CDP Africa Report: Benchmarking progress towards climate safe cities, states, and regions, Retrieved from https://cdn.cdp.net/cdp-production/cms/reports/documents/000/005/023/original/CDP_Africa_Report_2020.pdf?1583855467

of global CO2 emissions for that year.[10] The IPCC has highlighted that Africa is already facing severe challenges linked to climate change, including increasing water variability, disruption to agricultural production, and losses to biodiversity. The impacts and risks of climate change are further heightened by increased levels of migration, rapid population growth and urbanization and of course the Covid-19 pandemic and the numerous socioeconomic challenges this brings. **Figure 3** provides several examples of how changing climate patterns are impacting different areas across the continent.[11]

Figure 3: Climate Change in Africa[12]



[10] Our World in Data, 2020a, China: What share of global CO_2 emissions are emitted by the country?, Retrieved from https://ourworldindata.org/co2/country/china

[11] Africa NDC Hub, 2021, Africa's NDC journey and the imperative for climate finance innovation, Retrieved from https://africandchub.org/sites/default/files/2021-11/211103_ANDC%20Hub_Africa%E2%80%99s%20NDC%20journey%20and%20climate%20finance_.pdf

[12] Ibid

2.3 Greenhouse Gas Emissions in Africa

Figure 4 demonstrates that the majority of the world's GHG emissions come from the energy sector (73%), followed by agriculture, forestry, and land use (18%), direct industrial processes (5%) and waste (3%). However, the picture is somewhat different when it comes to the African region, partly because of a lack of economic growth, as shown in Figure 5.

Figure 4: Global Emissions by Sector[13]

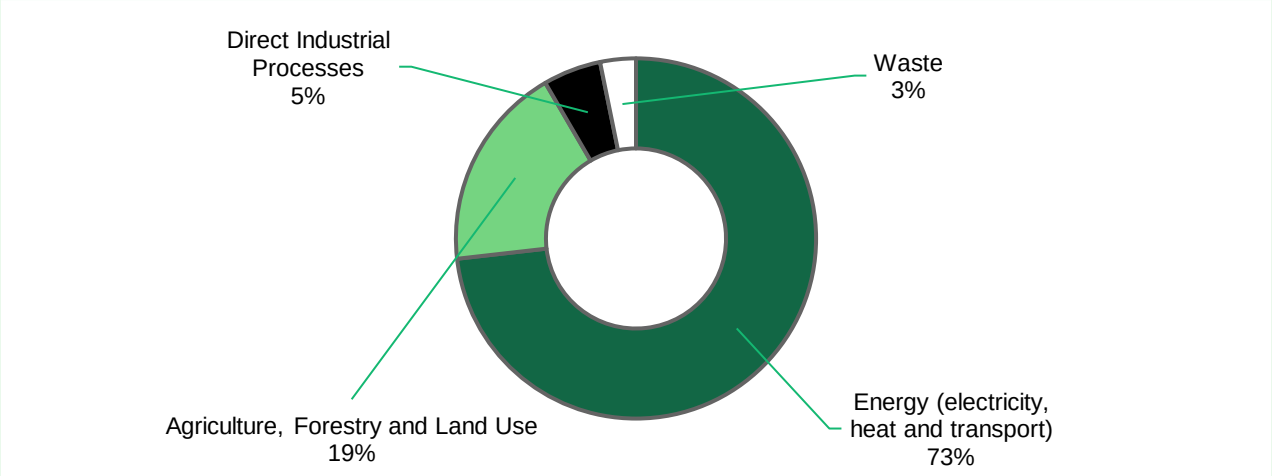
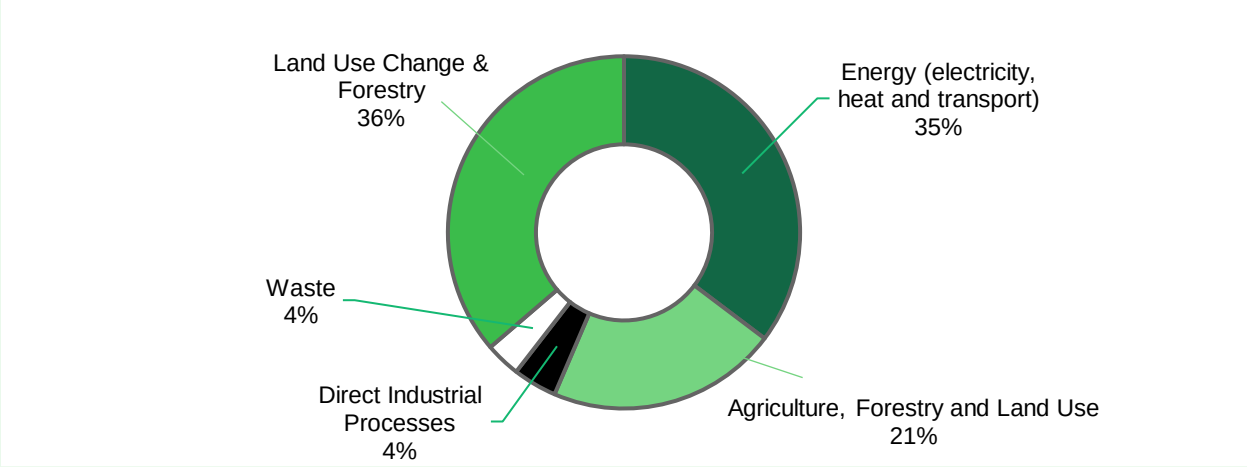


Figure 5: African Emissions by Sector[14]



[13] Our World in Data, 2020b, Emissions by Sector, Retrieved from https://ourworldindata.org/emissions-by-sector

[14] AfDB, 2020, Drivers of Greenhouse Gas emissions in Africa: Focus on agriculture, forestry and other land use, Retrieved from https://blogs.afdb.org/climate-change-africa/drivers-greenhouse-gas-emissions-africa-focus-agriculture-forestry-and-other#:~:text=Of%20this%2C%2073%25%20of%20GHG,3%25%20from%20waste%20management%20activities.

Energy

This sector includes emissions emitted from electricity, heat, and transport.

Agriculture, forestry, and land use (AFOLU)

Greenhouse gas emissions in this sector are mostly from agriculture (which include the cultivation of crops and livestock) and deforestation. Land areas can absorb carbon dioxide from the atmosphere or act as a source of greenhouse gas emissions.

Land use change and forestry

This sector reflects emissions and absorptions linked to changes in land use like deforestation, afforestation, and soil artificialisation.[15]

Direct Industrial Processes

Greenhouse gases can be produced as a by-product from chemical processes. This sector is mainly dominated by cement, chemicals, and petrochemicals.

Waste

Emissions from this sector are mainly from wastewater and landfills. Organic matter from animals, plants and humans decomposes and produces methane and nitrous oxide.[16]

However, the broad picture in the region hides a great deal of differences across Africa's 55 countries. Table 1 separates African countries[17] based on their main sources of emissions. 14 countries have the energy sector as their largest source of emissions, 22 have agriculture and 18 countries have land-use change/forestry.

[15] United States Environmental Protection Agency, 2022, Sources of greenhouse gases. Retrieved from https://www.insee.fr/en/metadonnees/definition/c2227
[16] Our World in Data, 2020b, Emissions by Sector, Retrieved from https://ourworldindata.org/emissions-by-sector
[17] There was no data available for Sahrawi Republic.

Table 1: Largest Emission source by African country in 2018[18]

Agriculture	Energy	Land-Use Change/Forestry
Chad	Algeria	Angola
Djibouti	Cape Verde	Benin
Eritrea	Comoros	Botswana
Ethiopia	Egypt, Arab Rep.	Burkina Faso
Gambia, The	Equatorial Guinea	Burundi
Guinea	Eswatini	Cameroon
Guinea-Bissau	Gabon	Central African Republic
Kenya	Ghana	Cote d'Ivoire
Lesotho	Libya	Congo, Dem. Rep.
Madagascar	Mauritius	Congo, Rep.
Mali	Morocco	Liberia
Mauritania	Seychelles	Malawi
Niger	South Africa	Mozambique
Nigeria	Tunisia	Namibia
Rwanda		Sao Tome & Principe
Senegal		Tanzania
Sierra Leone		Zambia
Somalia		Zimbabwe
South Sudan		
Sudan		
Togo		
Uganda		

So how does this difference and heterogeneity affect ambition of African countries on climate action? Exploring Africa's Nationally Determined Contributions (NDCs) can provide some key insights.

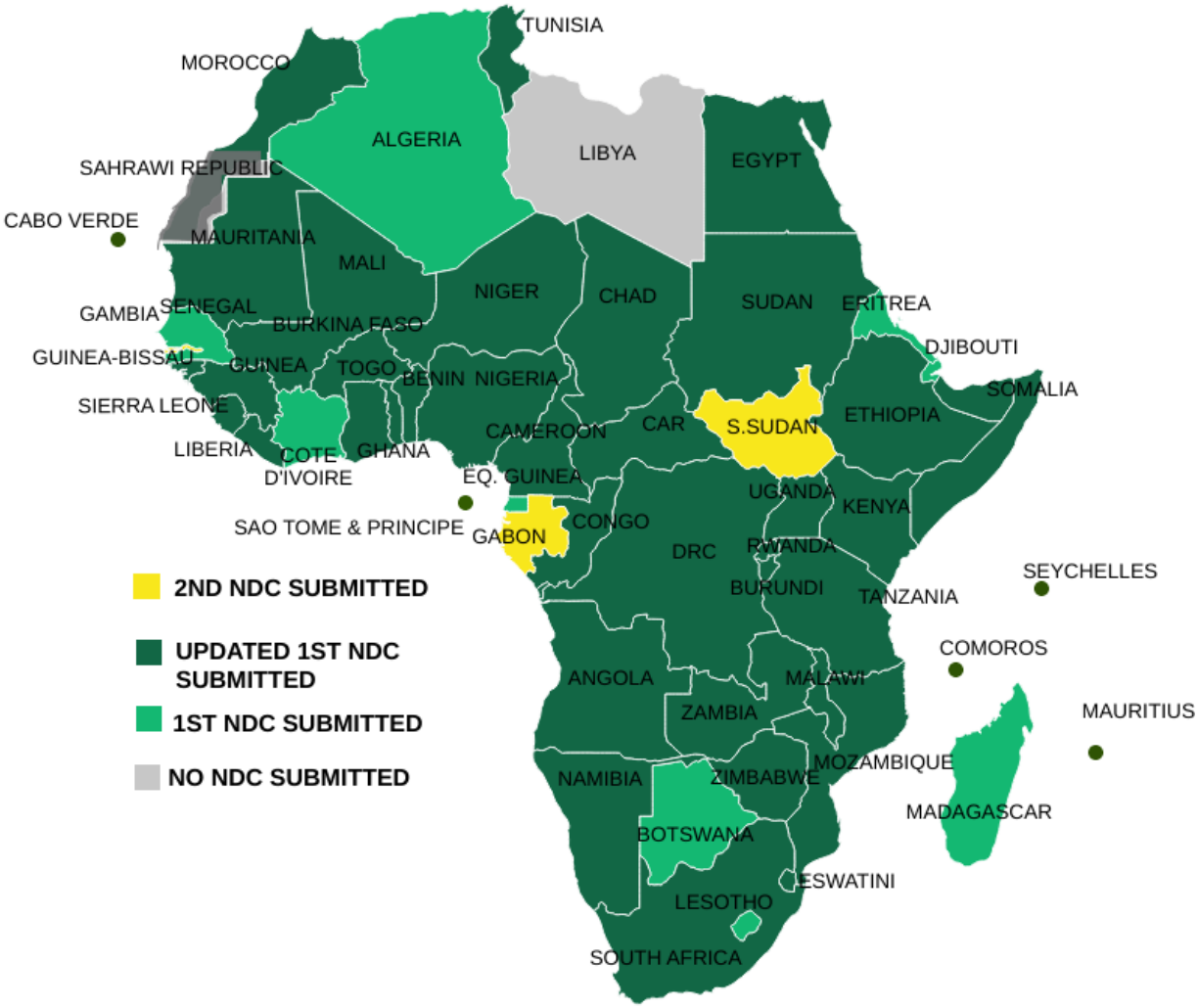
2.4 Climate Ambition in African Nationally Determined Contributions (NDCs)

2.4.1 Overview

As can be seen in Figure 6 below, 53 African countries have submitted their Nationally Determined Contributions (NDCs) to the UN Framework Climate Change Convention (UNFCCC). Of these 53 submitted NDCs, 42 are updated NDCs (also known as Enhanced NDCs (ENDCs)). The Gambia, South Sudan and Gabon have submitted their second NDCs to the UNFCCC. The overall numbers of NDCs submitted have increased significantly, with 39 NDCs being submitted in 2021 alone (2 second NDCs and 37 updated NDCs). The only African countries that have not submitted NDCs are Libya and Saharawi Arab Democratic Republic. The large amount of updated NDCs highlights the continent's strong commitment to submitting NDCs to UNFCCC.

[18] Our World in Data, 2020b

Figure 6: Nationally Determined Contributions in Africa[19]



2.4.2 NDC MITIGATION FRAMEWORKS

These NDCs allow us to analyse how African countries are addressing climate change in their countries, and how they plan to act in terms of mitigation and adaptation policies. As can be seen in Figure 7, the majority of countries across the continent use the 'Business-As-Usual' scenario (BAU) to analyse their greenhouse gas (GHG) emission reduction targets.

[19]Author's analysis based on NDC submissions retrieved from UNFCCC, 2022, NDC Registry (Interim), Retrieved from https://www4.unfccc.int/sites/ndcstaging/Pages/LatestSubmissions.aspx

Figure 7: Methods of mitigation scoring categorized[20]

2.4.3 NDC AMBITION CATEGORISATION

Figure 8 below provides information on the net-zero targets currently in place across the continent, including targets detailed in policy documents and targets detailed in political pledges.

A total of 12 African countries has ongoing net-zero pledges. A total of 5 countries have made a political pledge to reach net-zero and 7 countries have integrated their net-zero pledges into policy documents. The political pledges made by Rwanda and Malawi aim for net-zero by 2050, Mauritania by 2030, Nigeria by 2060, and Mauritius by 2070. All the pledges integrated into policy documents aim to achieve net-zero by 2050 except for Morocco, which aims to achieve net-zero by sometime this century.[21]

[20] Ibid
[21] Climate Watch Data, 2022, Net Zero Tracker, Retrieved from https://www.climatewatchdata.org/net-zero-tracker

Figure 8: Net-zero targets across the continent[22]

In Table 2 below we have categorised the levels of ambition related to GHG emission reduction targets in submitted NDCs. This categorisation is based on countries that use the BAU scenario and on conditional targets provided in their NDCs, i.e. GHG emission reduction targets that could be met providing external financing is secured.

[22] Ibid

Table 2: GHG emission reduction targets in terms of ambition[23]

Least ambitious 5-17%	Somewhat ambitious 18-30%	More ambitious 31-44%	Most ambitious 45-100%
Burundi	Algeria	Angola	Cote d'Ivoire
Eswatini	Benin	Cameroon	Djibouti
Guinea	Burkina Faso	Congo, Rep.	Ethiopia
Madagascar	Cabo Verde	Egypt	Gabon
Sierra Leone	Central African Republic	Eritrea	Gambia, The
Sudan**	Chad	Kenya	Ghana
Uganda**	Comoros	Lesotho	Liberia
	Congo, Dem. Rep.	Mauritius	Malawi
	Guinea-Bissau	Mali	Mauritania
	Sao Tomé e Principe	Niger	Morocco
	Senegal	Rwanda	Mozambique*
	Seychelles	Zambia	Namibia
	Somalia	Zimbabwe	Nigeria
	Tanzania		South Sudan
	Togo		

** Mozambique's NDC is from 2020-2025 ** These countries' NDCs did not specify their GHG emission reduction targets*

Table 2 confirms that although levels of ambition vary, there is generally relatively high levels of ambition and determination across the continent to achieve GHG emission reduction, even in some of the lowest income countries.

14 of Africa's 55 countries aim for GHG emissions reductions of over 45%. A further 13 aim for over 30% emissions reductions – meaning in total approximately half of African countries aim for 30% or more reductions on business as usual. To put this in context, the EU ambition is a 55% reduction by 2030 compared to 1990 levels, the US 50% by 2030 compared to 2005 levels, Japan by 46% by 2030 compared to 2013 levels, India by 45% by 2030 compared to 2005 levels, and China's ambition is a 65% carbon intensity reduction by 2030 versus 2005 levels.

Given this international context, African countries emissions reductions are quite ambitious considering how much lower their emissions are now and have the potential to increase to with more development, compared to the high emitters and higher income countries.

However, as we shall see in the following section where we analyse the financing needs of the countries with the most detailed finance targets, over 80% of financing targets for mitigation and adaptation measures are conditional on external financial support.

2.5 NDCs Financing Needs

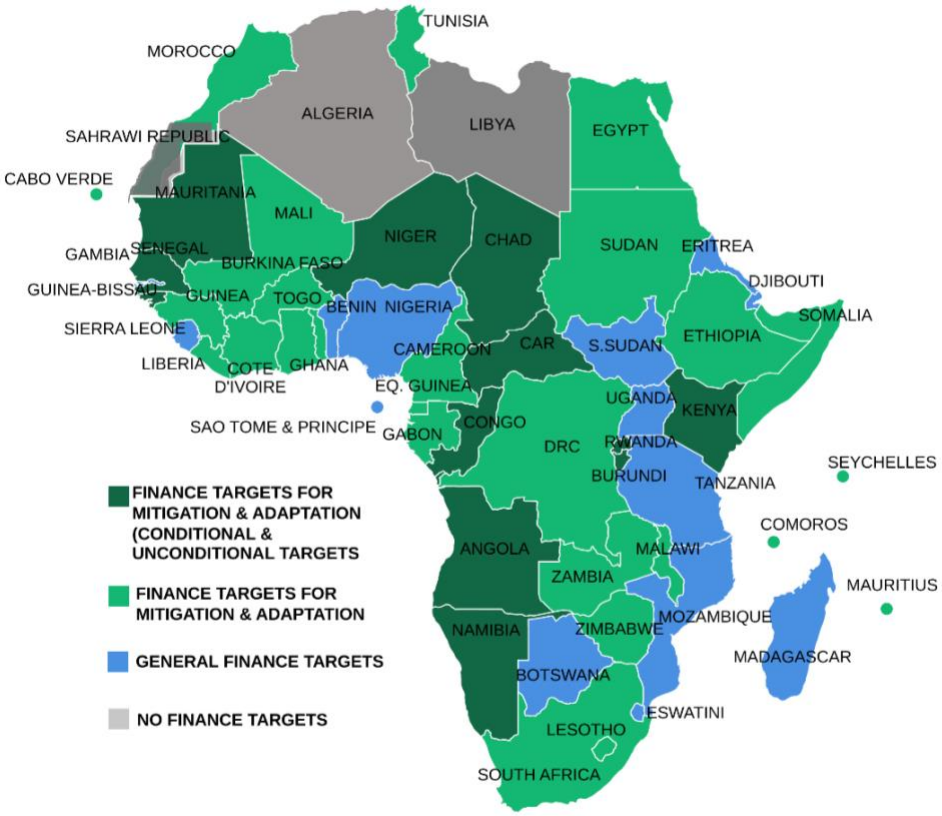
Almost all African countries show at least some ambition when it comes to reducing GHG emissions by 2030. However, in the NDCs climate ambition is often presented in an unconditional and conditional format. Figure 9 demonstrates the level of information provided in African NDCs

[23] Source: Author's analysis based on NDC submissions retrieved from UNFCCC, 2022, NDC Registry (Interim).

related to finance targets, ranging from no finance targets mentioned to finance targets including a breakdown of conditional and unconditional finance targets for both mitigation and adaptation. Overall, Figure 9 suggests climate ambition in Africa is seen to be heavily reliant on financial support from the international community, climate funds and the private sector.

Specifically, Figure 9 highlights that 10 countries (Angola, Central African Republic, Chad, Republic of Congo, Kenya, Mauritania, Namibia, Niger, Rwanda, Senegal) provide their overall finance needs, broken down into mitigation (unconditional and conditional) and adaptation (unconditional and conditional). Of these 10 countries, Figure 10 below shows the breakdown of finance into mitigation and adaptation, including conditional and unconditional finance targets. This figure demonstrates that the overwhelming majority of finance targets depend on conditional finance for both mitigation (88% of finance is conditional) and adaptation (83% is conditional) efforts. In addition, Figure 11 demonstrates that 54% of overall financing (including conditional and unconditional finance) is dedicated to mitigation efforts, with 46% dedicated to adaptation efforts.

Figure 9: African NDC finance detail levels[24]



[24] Ibid

Figure 10: Financing needs for 10 countries with most detailed financing targets (US$ Million)[25]

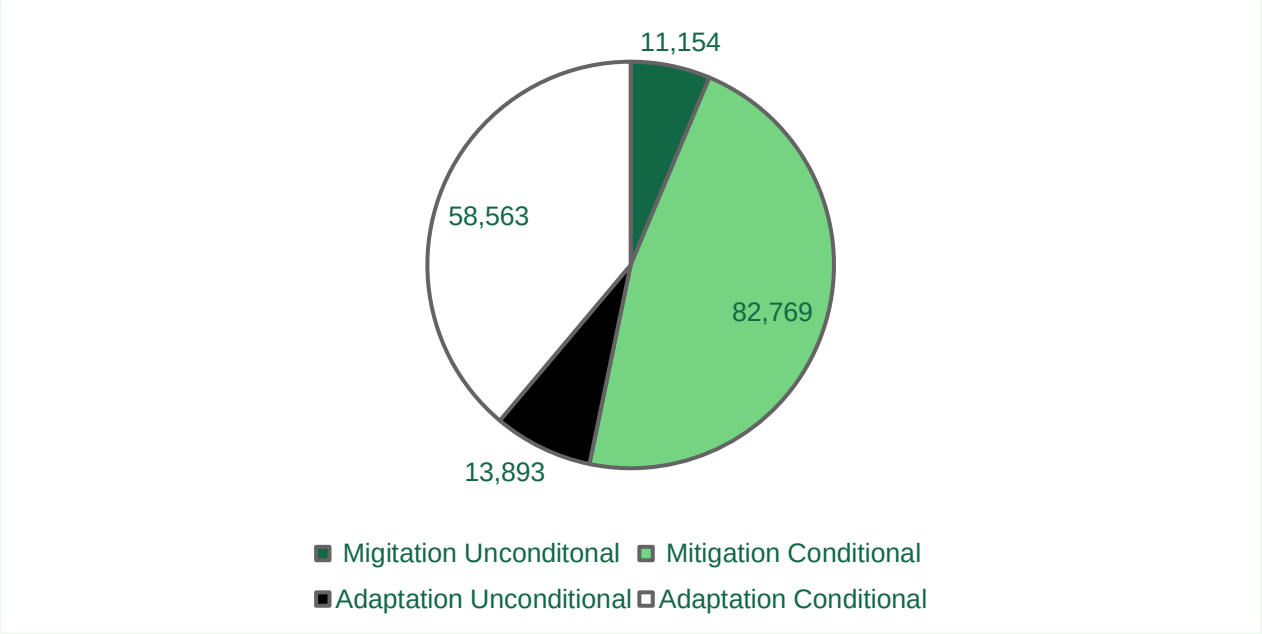
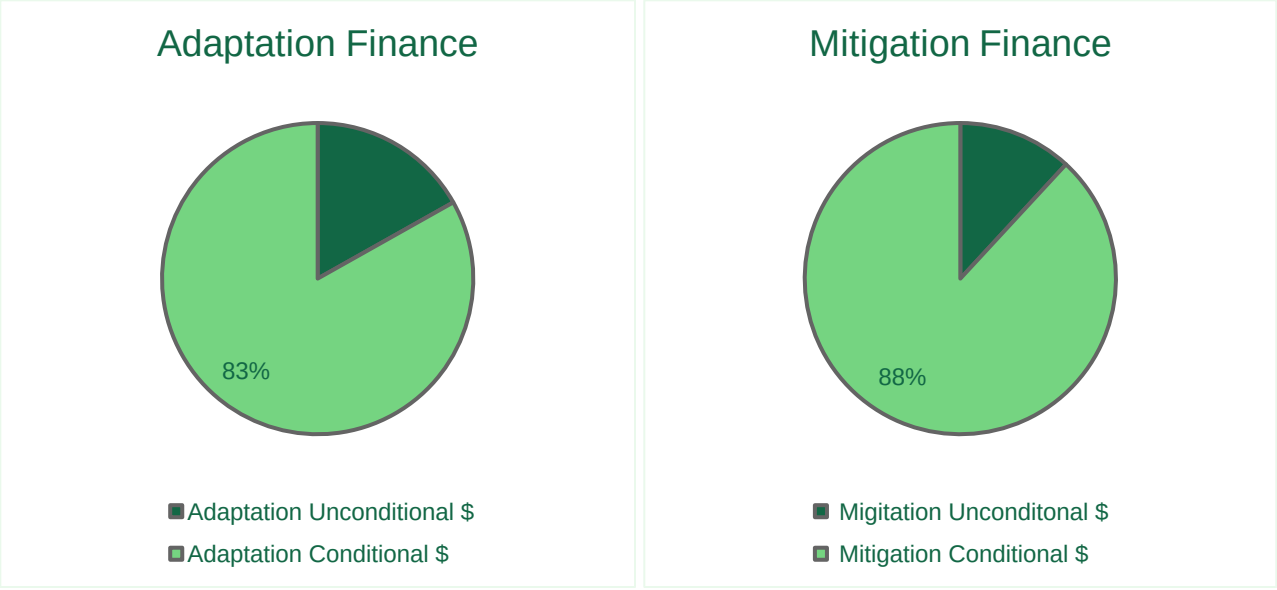


Figure 11: Mitigation and Adaptation Finace Breakdown for 10 countries with most detailed finance targets[26]



[25] Ibid
[26] Ibid

2.6 Renewable Energy Targets in NDCs

Electricity, also referred to as the power generation mix, constitutes one part of the overall energy mix. The energy mix also includes components such as transport and heating, which are heavily reliant on fossil fuels. While over one third of the world's electricity came from low carbon sources in 2019, these sources only constituted approximately 16% of the total energy mix in 2019.[27] Therefore, a renewable energy target that aims to increase the share of renewables in the overall energy mix is the more ambitious target of the two targets.

Table 3 uses this understanding to categorize African countries' renewable energy (RE) targets in their NDCs to 2030.[28] The table illustrates that literally ALL the 53 African countries with NDCs refer to the need for RE and to diversity energy sources, with the vast majority (70% in total) going as far as identifying a specific RE target in the electricity mix (52%) or energy mix (17%).

Table 3: Renewable Energy Targets across Africa

No mention of RE	Mention of RE & the need to diversify energy sources	Identifies sectors of RE increases/ concrete goals	Identifies % RE target in electricity mix	Identifies % RE target in energy mix
Libya Sahrawi Republic	Burkina Faso* Burundi Central African Republic Eritrea Ethiopia Lesotho Somalia Zambia	Democratic Republic of Congo Equatorial Guinea Malawi Mali Mozambique Sierra Leone South Sudan Sao Tome E Principe	Algeria Angola* Cabo Verde Cameroon Republic of Congo (2025) Djibouti (2035)* Egypt (2035) Eswatini Gabon The Gambia* Ghana Guinea Kenya* Liberia Mauritius* Morocco Namibia Niger* Nigeria Rwanda* Senegal Seychelles South Africa* Sudan Tanzania (2050) Tunisia* Uganda Zimbabwe*	Benin* Botswana* Comoros* Chad* Cote D'Ivoire Guinea-Bissau Madagascar Mauritania Togo

** These countries RE targets were obtained from other sources other than their NDCs (for example: Energy Policy Papers, National Energy Plans)*

Again, this illustrates that the degree of climate ambition of African countries is very high.

[27] Our World in Data, 2020c, Energy, Retrieved from https://ourworldindata.org/electricity-mix#:~:text=Electricity%20is%20one%20of%20three,electricity%20versus%20the%20energy%20mix.

[28] It is important to distinguish between targets that aim for a percentage increase in renewable energy in the electricity mix (also referred to as the 'power mix') and targets that aim for a percentage increase in the overall energy mix of the country. Sometimes these terms are used interchangeably which can make it difficult to categorize a country's targets. If countries' RE targets are beyond 2030 then the date is placed in brackets. Some of the countries mentioned their RE targets in their first NDCS (INDCS as well) but not in their updates so some info was taken from earlier NDCs. In addition, some countries mention their RE targets in other sources beyond their NDCs, and these countries are marked with an asterisk in the table above.

However, while worldwide, the use of renewable energy has been rising, according to WEF, in 2020 renewables contributed about nine percent to the total energy mix of Africa.[29] As of 2020, the total renewable energy capacity in Africa reached nearly 54 gigawatts, which represented an increase of five percent from the previous year. However, this is tiny. Currently, Africa's renewable energy capacity accounted for two percent of the global total capacity.[30]

2.7 Carbon Trading

Carbon trading, also referred to emissions trading, is a market-based system of "buying and selling permits and credits that allow the permit holder to emit carbon dioxide." The dominated model widely used is the Cap-and-Trade scheme, where the government or inter-governmental body sets an overall legal limit on emissions (a cap) over a specific period of time and grants a fixed number of permits or allowances of emission that can be trade between companies.[31] Carbon trading is one of the mechanisms of Kyoto protocol framework like, Joint Implementation (JI) and Clean Development Mechanisms (CDM).

Carbon trading is important for several reasons:

- Carbon trading allows countries to meet climate targets, laid out in policy documents such as NDCs.
- Facilitates emission reductions at the lowest cost. Permitting carbon trading within a specified cap is one effective way of minimising the cost – which in some way is good for both businesses and households.
- Carbon trading is better able to respond to economic fluctuations – allowing the open market to set the price of carbon translates to flexibility and avoids price shocks or undue burdens.
- Provides a global response to a global challenge – permitting the use of offset can assist in involving other jurisdictions in the fight against climate change and can even motivate them to start their own carbon trading systems just like the CDM offset programme inspired China to set up its own system.[32]

2.7.1 CARBON TRADING IN AFRICA

Africa accounts for just 2% of the global carbon market[33] but it is the continent widely seen as most vulnerable to a changing climate. As more countries have introduced its ETS, the introduction of carbon trading schemes has not transferred money or technology to Africa. The Clean Development Mechanism (CDM) is the main carbon market resulting from the Kyoto

[29] World Economic Forum, 2022, This is the state of renewable energy in Africa right now, Retrieved from https://www.weforum.org/agenda/2022/04/renewable-energy-africa-capabilities/
[30] Statista, 2022a, Renewable energy in Africa – statistics & facts, Retrieved from https://www.statista.com/topics/9143/renewable-energy-in-africa/#dossierKeyfigures
[31] Fern, 2014, What is carbon trading?, Retrieved from https://www.fern.org/publications-insight/what-is-carbon-trading-584/
[32] IETA, 2019, Benefits of carbon trading, Retrieved from https://www.ieta.org/resources/Resources/101s/Benefits%20of%20Emissions%20Trading.pdf
[33] Mboya, Tom, 2020, Africa: Can Carbon Trading Work in Africa?, AllAfrica, Retrieved from https://allafrica.com/stories/202009120368.html

Protocol, allowing emission-reduction projects in developing countries to earn certified emission reduction credit.[34] African's participation in CDM is lagging, with only 3% of projects in Africa.[35]

Having said this, African organizations and countries have developed some carbon trading initiatives. For example, the African Carbon Asset Development (ACAD) Facility was established in 2009 to provide a public-private partnership to enhance their awareness and investment willingness in the African carbon market.[36] The African Development Bank (AfDB) launched the African Carbon Support Programme in 2010 as a two-year technical assistance to countries interest carbon financing.[37] More recently, Kenya began plans in 2021 to establish its emission trading system, which will allow companies to buy allowances to enable Kenya to meet its commitments in limiting greenhouse emissions.[38] The African Union (AU) aims to promote development orientated carbon trading mechanisms that can help support climate adaptation in Africa in its Green Recovery Action Plan (2021-2027).[39]

However, the carbon financing market in Africa is highly unequal. First, CDM does not play a critical role across Africa. CDM projects are mainly located in middle-income countries, such as those in Asia-Pacific (especially China) possessing 80% of the total CDM projects,[40] that have experienced dramatic increases in energy-intensive and carbon intensive industries over the past 20 years. Second, the lack of carbon reduction investment opportunities in the power sector and the limited number of carbon-intensive industries outside of North and South Africa mean that the rest of the continent is not well positioned to influence the direction of the carbon trading debate.[41] Third, investors in carbon reduction projects are profit-driven with the aim of offsetting emissions in the cheapest way possible. However, the types of projects that could provide livelihood benefits to Africans, such as renewable energy, are not perceived as "cheap", low-risk carbon reduction options and therefore do not attract large investors.[42]

Nonetheless, Africa's carbon markets have significant potential to channel new investment and finance its renewable energy sector and other industrial activities in the continent, especially if African countries can deliver the kind of growth dynamics of Asia-Pacific markets going forwards. As more African countries show interest in carbon trading, they should take advantage of the CDM funding under the Kyoto Protocol but most importantly, countries will need to strengthen and enhance the regulations and policies that apply to their own carbon markets. The upcoming Sustainable Development Mechanism (SDM), established under Article 6.4 of the Paris Agreement and following on from the CDM, provides African countries with an opportunity to shape the SDM frameworks in African interests and therefore gain greater access to international carbon markets.

[34] UNFCCC, About CDM, Retrieved from https://cdm.unfccc.int/about/index.html
[35] United Nations Environment Programme, 2022, CDM projects by host region, Retrieved from https://cdmpipeline.org/cdm-projects-region.htm
[36] United Nations Environment Programme, African Carbon Asset Development, Retrieved from https://unepdtu.org/project/african-carbon-asset-development-acad-facility-i-ii/
[37] AfDB, African Carbon Support Program, Retrieved from https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/african-carbon-support-program
[38] Obulutsa, George, 2021, Kenya plans to set up emissions trading system, Reuters, Retrieved from https://www.reuters.com/world/africa/kenya-plans-set-up-emissions-trading-system-2021-05-11/
[39] African Union, 2021, African Union Green Recovery Action Plan (2021-2027), Retrieved from https://au.int/sites/default/files/documents/40790-doc-AU_Green_Recovery_Action_Plan_ENGLISH1.pdf
[40] United Nations Environment Programme, CDM projects by host region, Retrieved from https://www.cdmpipeline.org/cdm-projects-region.htm
[41] Institute for Security Studies, 2011, Carbon Trading in Africa. A critical review, ISS Monograph Number 184, Retrieved from https://media.africaportal.org/documents/Mono184.pdf
[42] Ibid

2.8 Africa's Green Infrastructure Vision

The Programme for Infrastructure Development in Africa (PIDA) is a joint initiative of the African Union Commission, the New Partnership for Africa's Development Planning and Coordination Agency (NPCA), and the African Development Bank (AfDB). PIDA's main objective aims at providing a common framework for African stakeholders to build the infrastructure necessary for more integrated transport, energy, ICT, and trans-boundary water networks to boost trade, growth and create jobs.[43]

Part of the PIDA mandate is the 'energy vision' to harness the African energy resources to make sure that African households, businesses and industries have access to modern energy in developing efficient, reliable, cost effective and environmentally friendly energy infrastructure contributing to poverty eradication. According to PIDA, only 39% of the African population has access to electricity, compared to 70 – 90% in other parts of the developing word. In implementing its energy sector plan, PIDA will enable Africa to save on electricity production costs close to US$ 30 billion a year. PIDA research shows a realistic integration scenario would save US$ 860 billion over 2014 – 2040 period.[44]

PIDA's Priority Action Plan (PIDA- PAP) in the energy sector covers projects in power generation, power interconnections, power access and gas and petroleum products pipelines. To meet forecast demand to 2040, PIDA estimates to spend US$42.2 billion on power.[45] Currently the Programme has a great number of completed and implementing projects. Below is a selection of current projects:

1. Grand Inga Dam - this project is expected to generate 43, 200 megawatts of power to support current regional power pools and their combined service to transform Africa from traditional to modern sources of energy.46 This is one of renewable energy flagship projects of the agenda 2063.
2. LAPSSET - the Lamu, South Sudan, Ethiopia Transport Corridor Program (LAPSSET) project covers 3 countries (Ethiopia, South Sudan and Kenya) to link them to each other and their neighbouring states in Eastern Africa. It is one of the largest and most ambitious infrastructure projects in Eastern Africa. It consists of seven key infrastructure projects like Lamu port; four interregional highways; two crude oil pipeline and two product line; four interregional standard gauge railways lines; three international airports; three

[43] African Union, 2022b, Program Infrastructure Development for Africa, Retrieved from https://au.int/en/ie/pida
44 PIDA, The PIDA Energy Vision, Retrieved from The PIDA Energy Vision (afdb.org)
[45] PIDA, The PIDA Energy Vision, Retrieved from The PIDA Energy Vision (afdb.org)
[46] Hydro Review, Grand Inga Hydropower Project, Retrieved from https://www.hydroreview.com/hydro-projects/grand-inga-hydropower-project/#gref

resort cities; and the multipurpose high grand falls dam along the Tana River.[47]

3. ZiZaBoNa - this is a renewable energy power projects covering 4 countries namely; Zimbabwe, Zambia, Botswana and Namibia. The project entails construction of 400 Kv transmission line network from Zimbabwe to Zambia, Zimbabwe to Botswana and Zambia to Namibia. This is a PPP project and adopted the develop, finance, construct and operate model of contract. African Development Bank and the four governments have already committed a portion of the total project funding.[48]

2.8.1 AFRICAN VIEWS ON 'JUST TRANSITION'

The AfDB describes its just transition initiative as '*a framework for facilitating equitable access to the benefits and sharing of the costs of sustainable development such that livelihoods of all people, including the most vulnerable, are supported and enhanced as societies make the transition to low carbon and resilient economies'.*[49] This just transition initiative aims to create a network of stakeholders from across the continent who can create a just transition framework that is based on the specific needs of African countries, including both climate resilience and economic growth. A 'just transition' is also one of the core principles of the AU's Climate Change and Resilient Development Strategy and Action Plan (2022-2032).[50]

At COP26 in 2021 South Africa entered into the Just Energy Transition Partnership (JETP) with the United States, United Kingdom, Germany, France and the European Union. The main goal of this partnership is to support the decarbonisation of South Africa's industries and encourage a just transition to a greener and low carbon economy, and $8.5 billion has been pledged to support the goals of the JETP.[51]

2.9 The greening of African countries' trade patterns

2.9.1 TRADE IN CRITICAL RAW MATERIALS

The Critical Raw Materials Alliance defines critical raw materials (CRMs) as raw materials important for the economy and strategy for a region, and their supply is associated with high risk.[52] CRMs are now more than ever considered important for technological, industrial, and environmental development of modern economies. As such, reliable and unhindered access to CRMs is a big policy priority, and rising political concern, for most major economic powers on the globe.[53] The EU, in its 2020 Communication on Critical Raw Materials,[54] highlights 30 materials as CRMs crucial for its economic activities. African countries are major suppliers of 8 of the 30 CRMs imported by the EU. For example, 64% of bauxite imports come from Guinea, 68% of

[47] Lapsset, 2022, What is the Lapsset Corridor Program?, Retrieved from https://www.lapsset.go.ke
[48] AfDB, 2022a,Multinational – Regional Rusumo Falls Hydropower Project, Retrieved from https://projectsportal.afdb.org/dataportal/VProject/show/P-Z1-FAD-008
[49] AfDB, 2022b, Just Transition Initiative to Address Climate Change in the African context, Retrieved from https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/climate-investment-funds-cif/just-transition-initiative#:~:text=The%20African%20Development%20Bank%20Group%20defines%20the%20Just%20Transition%20concept,societies%20make%20the%20transition%20to
[50] African Union, 2022a
[51] AfDB, 2022c, Joint Statement of the Government of the Republic of South Africa and the African Development Bank in relation to South Africa's Just Energy Transition process, Retrieved from https://www.afdb.org/en/news-and-events/press-releases/joint-statement-government-republic-south-africa-and-african-development-bank-relation-south-africas-just-energy-transition-process-51926
[52] Critical Raw Materials Alliance, What Are Critical Raw Materials? Retrieved from https://www.crmalliance.eu/critical-raw-materials
[53] European Commission, Critical raw materials, Retrieved from https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en
[54] European Commission. 2020, Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability, Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0474

cobalt and 36% of tantalum from the Democratic Republic of Congo, and 71% of platinum from South Africa. Chapter four further analyses the current role of CRM imports and exports for African countries with trade partners such as China and the EU.

2.9.2 TRADE IN ENVIRONMENTAL GOODS

The trade of CRMs is closely linked to the manufacture and trade of Environmental goods (EGs). EGs are defined by the OECD as 'activities that produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems'.[55] The Asia-Pacific Economic Cooperation (APEC) has a slightly narrower definition of environmental goods that includes a list of 54 Harmonized System (HS) codes, that focuses more on industrial products.[56] These products can be divided into four main categories: Environmental Protection (EP), Renewable Energy (RE), Environmental Monitoring & Assessment (EMA) and Environmentally Preferable Products (EPP). Environmental services are not specifically included in this APEC list, but they are closely linked. In chapter four we analyse global trade of EGs, and in particular trade between China and African countries.

[55] OECD, 2005, Environmental Goods: A Comparison of the APEC and OECD Lists, OECD Trade and Environment, Working Paper No. 2005-04
[56] Ibid

CHAPTER THREE:

3 SCENARIO ANALYSIS

This chapter uses and builds on the analysis in Chapter Two to explore future needs using scenario-based analysis. The analysis uses the data provided plus African growth and GHG emissions forecasts to explore whether and how as the African region can meet SDGs and Agenda 2063 and/or different levels of industrialisation and poverty alleviation, while managing climate-related goals. This analysis also provides key context for exploring questions such as what a "just transition" might mean in Africa.

3.1 Theory and evidence of future African emissions changes

GHGs are the product of complex dynamic systems, mainly determined by driving forces such as socio-economic development, technological change and demographic development. It is therefore difficult but not impossible to forecast GHGs – and for some time now the IPCC and other organisations have developed long-term emissions scenarios, which naturally incorporate scenarios of African GHG patterns.

The IPCC define scenarios as alternatives images of how the future might unfold and an appropriate tool with which to analyze the influence of driving forces on future emissions outcomes and assess the associated uncertainties.[57] Scenarios assist in climate change analysis like climate modelling and assessment of impacts, adaptation and mitigation. Generally, estimating carbon dioxide has often been done in the context of a popularly known hypothesis named, environmental Kuznet curve (EKC). The hypothesis states that environmental degradation like water, air pollution and solid waste generation follow an inverted-U relationship with economic growth. In other words, at the initial stage of a country's economic growth, environmental pollution is likely to increase due to rapid expansion in economic activities, however after a threshold level of income per capita in the country is reached, the environmental quality improves due to a higher share of (public) funds being devoted to improving environmental quality.

This is a pertinent question for the African region. In theory, the continued need for energy to facilitate economic development could significantly increase Africa's contribution to global GHG emissions in the future. Indeed, the Africa Agenda 2063 vision is for Africa to be the 3rd largest economy in the world by 2063,[58] moving up from the 8th position currently. This shift is expected to occur through effective use and implementation of the AfCFTA and a number of other flagship projects and frameworks, which envision a significant scaling up of African manufacturing in a wide range of sectors, plus a scaling up of infrastructure as well as related services such as air and rail transport, and energy use. The question therefore is to what degree this so-called "Business as Usual" (BAU) growth will drive emissions in Africa up and what impact this would have globally and within the continent.

[57] IPCC, 2000, Emissions Scenarios, Retrieved from Emissions Scenarios — IPCC
[58] African Union, 2014, Agenda 2063: The Africa we want, Retrieved from https://au.int/sites/default/files/documents/33126-doc-06_the_vision.pdf

Certain types of models can enable some understanding of this question. Auffhammer and Steinhauser believe that there are two distinctly different approaches to modelling emissions of carbon dioxide; structural general or partial equilibrium and a reduced-from econometric models.[59]

Structural general or partial equilibrium modelling is an approach whereby a sizeable set of parameters is fixed by judgement and calibration. It is the predominant approach in the natural science and engineering literature. The organizing framework is based on *the Impact = Population, Affluence and Technology* index (IPAT model). According to Auffhammer and Steinhauser,[60] IPAT models imply that emissions increase monotonically in population and affluence and decrease with beneficial technological progress.

The econometrics (reduced-form) models focus more on the in-simple relationship between air pollutants and income. Some authors have criticized this model stating that it does not separate the income effect from other factors driving emissions. The driving forces of the GHG emissions are demographic change, social and economic development and the rate and direction of technology. Nevertheless, the main advantage of the reduced form on a practical perspective is that assumptions are clearer (less of a "black box" compared to GE or PE approaches) and they have lower data requirements, which allows the use of longer time series and facilitates the analysis for countries where the structural approach is impractical.

The results of these methods reveal various relevant insights.

A study by Chen *et al.* used Chinese data for a period 1980 – 2014 and explored the relationships amongst GDP, renewable energy and non-renewable energy production, per capita carbon dioxide emissions and foreign trade.[61] The analysts found a long-run relationship amongst the variables and in addition noticed that China does not follow the EKC for emissions under the influence of economic growth, non-renewable energy production and foreign trade. Instead, the addition of renewable energy production variables supported the U-shaped EKC hypothesis in the long run.

Noting that there might be a nonlinear relationship between indicators, economic growth and carbon dioxide emissions, Researchers (Jena, Managi and Majhi) developed a multilayer artificial neural network model (MLANN), which they suggest more efficient in capturing the nonlinearity present in the time series data and gives higher accuracy in predicting the emissions based on the past values of emissions and economic indicators.[62] This model is mostly relevant for the short-run and forecasts the carbon dioxide emissions based on the inputs given.

Lastly, one model established by Xie Zeqiong *et al.* to forecast the direct carbon emission of residents of Guangdong was the system dynamics model.[63] The growth of artificial intelligence technology and increasing requirement of prediction accuracy, generic algorithm, Support Vector Machine (SVM), BP neural network, Extreme Learning machine (ELM) and other machine

[59] Auffhammer, Maximilian, & Steinhauser, Ralf, 2012, Forecasting the path of US. co_2 emissions using state-level information. *The Review of Economics and Statistics*, *94*(1), 172–185, Retrieved from http://www.jstor.org/stable/41349167
[60] Ibid
[61] Chen, Yulong et al., CO2 emissions, economic growth, renewable and non-renewable energy production and foreign trade in China, Retrieved from https://doi.org/10.1016/j.renene.2018.07.047
[62] Jena, Pradyot Ranjan et al., 2021, Forecasting the CO2 Emissions at the Global Level: A Multilayer Artificial Neural Network Modelling, Retrieved from Energies | Free Full-Text | Forecasting the CO2 Emissions at the Global Level: A Multilayer Artificial Neural Network Modelling (mdpi.com)
[63] Zeqiong, Xie et al., 2020, Decomposition and prediction of direct residential carbon emission indicators in Guangdong Province of China, Retrieved from Decomposition and prediction of direct residential carbon emission indicators in Guangdong Province of China - ScienceDirect

learning methods have been extensively used in carbon emissions forecasting due to their strong ability in dealing with nonlinear and complex problems.

3.2 Current forecasts of African Emissions

3.2.1 IPCC FORECASTS OF AFRICAN EMISSIONS

When it comes to predictions under various scenarios by the IPCC, Africa typically receives more focus in terms of impacts of climate change and a focus on "risks". In turn, IPCC scenarios for African emissions are very broad, and often Africa is merged with other regions.

For instance, as shown in Table 4, according to the IPCC, in a less stringent scenario (i.e., 530 – 650 per parts million equivalent – less likely to keep temperature increases below 2 degrees Celsius), GHG emissions in the Middle East and Africa will peak by 2040 but overall increase by 22 percent by 2030. Under a more stringent global emissions reductions scenario (to 430 – 530 carbon dioxide parts per million equivalent), emissions will peak in the Middle East and Africa by 2030 and there would be an 8 percent reduction in emissions.

This focus and lack of detail is perhaps not surprising given that it was recently found that only 11% of authors of the latest IPCC Sixth Assessment Report were from Africa.[64] Thus it is important to review other sources for more insights.

Table 4: IPCC Mid-Term Scenarios for GHG emissions in various regions[65]

Scenario: 430–530 CO_2 ppm equivalent				
	OECD countries as of 1990	Asia	Latin America	Middle East & Africa
Peak year	2020	2030	2025	2030
Emission changes by 2030 compared to 2010	-32%	1%	-35%	-8%
Scenario: 530–650 CO_2 ppm equivalent				
	OECD countries as of 1990	Asia	Latin America	Middle East & Africa
Peak year	2025	2040	2030	2040
Emission changes by 2030 compared to 2010	-14%	34%	-9%	22%

3.2.2 IRENA AND IEA FORECASTS OF AFRICAN EMISSIONS

In a 2022 joint report with the African Development Bank, IRENA model two GHG scenarios for Africa, using Cambridge Econometrics E3ME model:[66] 1) an ambitious energy transition scenario (1.5-S) that aims to reach the global 1.5°C goal; and 2) a scenario based on current plans – the Planned Energy Scenario (PES).[67] The 1.5-S scenario makes several assumptions. First, it

[64] Climate & Development Knowledge Network, 2022, IPCC climate science needs African authors to succeed, Retrieved from https://cdkn.org/story/ipcc-climate-science-needs-african-authors-succeed
[65] IPCC, 2014, Fifth Assessment Report, Retrieved from https://www.ipcc.ch/assessment-report/ar5/
[66] E3ME Cambridge Econometrics, 2022, Retrieved from https://www.e3me.com
[67] IRENA, 2022, Renewable Energy Market Analysis: Africa and its Regions, Retrieved from https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Jan/IRENA_Market_Africa_2022.pdf?la=en&hash=BC8DEB8130CF9CC1C28FFE87ECBA519B32076013

assumes systematic support of emerging technologies likeliest to be competitive in the short term and best at lowering emissions over the long term. Other assumptions: limited investment in oil and gas; phase-outs of coal and fossil fuel subsidies; adapted market structures and policies promoting resilience, inclusion, and equity; and measures protecting transition-affected workers and communities. Among other things, this implies that under the global 1.5°C trajectory by 2050, electricity will be the main energy carrier, with hydrogen and derivatives accounting for 12% of final energy, and bioenergy for 18%. IRENA measures the impacts of transition scenarios and their accompanying policy baskets through the evaluation of their socio-economic footprint, which includes GDP, employment, and welfare.

IRENA focus in particular on sharing the endogenous growth, welfare and job creation effects of these scenarios, but their underlying results for GHG emissions are unclear. This may be because E3ME until late 2021 only covered 2 African countries and the "rest of Africa". Now it has been upgraded to cover five key African economies individually: Egypt, DRC, Kenya, Nigeria and South Africa, plus five African sub-regions (North, Central, East, West and South respectively).[68]

Similarly, the latest IEA report mentions global trends[69] under three scenarios:

- **Net Zero Emissions** by 2050 Scenario (NZE) – which shows a narrow but achieve pathway for the global energy sector to achieve net zero carbon dioxide emissions by 2050. The same scenario shows that advanced economies will reach net zero in advance of developing economies;
- the **Announced Pledges Scenario (APS)** which takes account of all climate commitments made by governments around the world, inclusive of NDCs and net zero target, and assumes they will be met in full and on the specified time; and
- **Stated Policies Scenario (STEPS) -** which provides a more conservative benchmark of the future as it does not take it for granted that governments will reach all announced goals, and instead reviews sector by sector what has been put in place to reach all energy related objectives taking consideration of all existing and upcoming policies and measures.

The IEA uses these scenarios as a basis for its 2022 analysis for Africa, whereby it explores **a Sustainable Africa Scenario (SAS)** in which Africa achieves universal access to modern energy services by 2030 and the full implementation of all African climate pledges to date.[70] The IEA find that this scenario requires more than doubling current energy investment to over USD 190 billion per year from 2026 to 2030, with two-thirds going to clean energy. This might seem like a great deal but the IEA clarify that it accounts for around 5% of the global total investment in the Net Zero Emissions by 2050 Scenario. The IEA also find that cumulative CO2 emissions from the use of Africa's current gas resources over the next 30 years would bring Africa's share of global emissions to 3.5%. This lends weight to the proposition from Akinwumi Adesina, President of the African Development Bank (AfDB), that African countries should include natural gas in their energy mixes and stressed the potential of gas to promote economic growth.[71] Speaking at

[68] E3ME Cambridge Econometrics, 2021, E3ME adds detailed regional coverage of Africa and OPEC countries, Retrieved from https://www.e3me.com/developments/e3me-adds-detailed-regional-coverage-of-africa-and-opec-countries/
[69] IEA, 2021, World Energy Outlook 2021, Retrieved from https://iea.blob.core.windows.net/assets/4ed140c1-c3f3-4fd9-acae-789a4e14a23c/WorldEnergyOutlook2021.pdf
[70] IEA, 2022, Africa Energy Outlook 2022: Key Findings, Retrieved from https://www.iea.org/reports/africa-energy-outlook-2022/key-findings
[71] Boston University Global Development Policy Center, 2022a, Who Funds Overseas Gas Projects?, Retrieved from https://www.bu.edu/gdp/files/2022/06/GEGI_PB_020_EN.pdf

COP26 in Glasgow, a chief officer at AfDB Dr. Arron Tchouka Singhe also stressed that *'natural gas stands as an ecologically plausible solution for industrialisation and clean cooking in Africa'.*[72]

3.2.3 OTHER FORECASTS OF AFRICAN EMISSIONS

There are a number of other organizations that have relevant modelling results.

C–Roads suggests that while GHG emissions from developed countries do not show any major increase, the developing regions like Africa (but excluding China and India) are set to double their GHG emissions by 2100 moving from around 20 GT of carbon dioxide in 2020 to approximately 44GT in 2100.[73]

The EU Science Hub's 2019 report – which combines The Electricity Model Base for Africa (TEMBA) with The Open Source Modelling System (OSeMOSYS) - predicts the growth of Africa's total primary energy supply by 35 per cent from 2015 – 2050 and 27 per cent from 2050 – 2065. According to the report, the models suggests that Africa's use of fossil fuels could double by 2065 if no effort is made to transition to greener energy.[74]

Mckinsey focus on African manufacturing – and state that the sector currently emits about 440 $MtCO_2e$ — about 30 to 40 percent of total African emissions, and mainly from four countries (South Africa - 37%; Egypt – 20%; Algeria – 10%; and Nigeria – 7%). They suggest that if the sector "follows the growth trajectory of developed markets", it will likely double in size, and emissions could nearly double as well to about 830 $MtCO_2e$ by 2050. However, their scenario taking into account current NDC commitments (based on NDCs submitted by mid-2021) suggests emissions from African manufacturing could grow by 70% by 2050 to 755 MtCO2e. They suggest a more aggressive plan to "keep pace with the commitments being made in the rest of the world to keep global temperature rises below the 1.5°C target", could lead to emissions amounting to just 47 MtCO2e by 2050, but would require $2 trillion of additional investments in manufacturing and power over the next three decades.[75]

Finally, in a study by the IMF,[76] as income increases, emissions increase *pari passu* until a threshold level at which emissions start to decline. The IMF study suggests that for selected countries in Africa, emissions may be limited to specific sectors or firms, which may facilitate enforcement of any emissions growth.

3.3 Development Reimagined forecasts of African Emissions

A comparison of the above scenarios by all organizations with the real-world experience of other countries and regions reveals their different limitations. China's CO^2 emissions have doubled since approximately 2005.[77] India's emissions have doubled between 2006-2019.[78] Hence, a

[72] Ibid
[73] Climate Interactive, 2022, The C-Roads Climate Change Policy Simulator, Retrieved from https://www.climateinteractive.org/tools/c-roads/
[74] European Commission, 2019, JRC Publications Repository, Energy projections for African countries, Retrieved from https://publications.jrc.ec.europa.eu/repository/handle/JRC118432
[75] McKinsey Sustainability, 2021, Africa's green manufacturing crossroads: Choices for a low-carbon industrial future, Retrieved from https://www.mckinsey.com/business-functions/sustainability/our-insights/africas-green-manufacturing-crossroads-choices-for-a-low-carbon-industrial-future
[76] IMF, 2022, Climate Change in Sub-Saharan Africa Fragile States: Evidence from Panel Estimations Prepared by Rodolfo Maino and Drilona Emrullahu, Retrieved from https://www.elibrary.imf.org/view/journals/001/2022/054/article-A000-en.xml
[77] Our World in Data, 2020a
[78] Our World in Data, 2020d, India CO2 Profile, Retrieved from https://ourworldindata.org/co2/country/india

doubling of African emissions by 2050 or even 2065 is moderate compared to other global economies. This calls into question the expected role of Africa in the global economy by 2065 in these models. The assumptions about African growth appear to be considerably more modest than the growth aspirations of African countries under the African Union's Agenda 2063, yet they need to be combined with the high-climate ambition expressed in the African NDCs, as explained in **Chapter 2.**

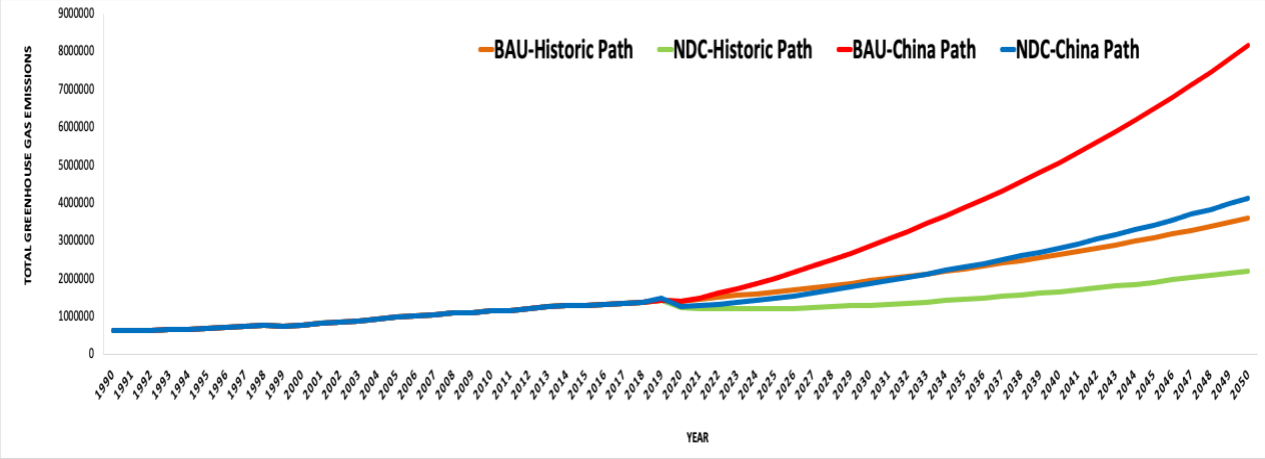
This rationale provides a basis for our estimation. Our scenario analysis uses an econometric methodology for simplicity and clarity of assumptions. We use African emissions, growth and other historic data directly, plus a range of assumptions to model four scenarios:

1. A **business-as-usual + average growth scenario** whereby African growth rates continue as per historical rates, maintaining existing industrial structures, fossil-fuel/renewable energy mixes and energy intensity. This can also be thought of as a **"*do nothing*" scenario**, as it could also be interpreted as NDC ambitions by African countries NOT being realised (e.g. due to lack of finance, commitment, etc);
2. A **NDC + average growth scenario** whereby African growth rates continue as per historical rates, but aspirations regarding net zero, renewable energy mixes and energy intensity are incorporated. This can be thought of as a ***"basic access to energy"* scenario** – given that industrial structures do not necessarily change and therefore demand additional energy consumption;
3. A **business-as-usual + China path scenario** whereby African growth rates accelerate to "China levels" (see further below), but existing industrial structures, fossil-fuel/renewable energy mixes and energy intensity are maintained. This can be thought of as a **"*high brown growth*" scenario** – whereby access to electricity has the potential to improve for both residential populations and scaled up industrial production, etc;
4. A **NDC + China path scenario** whereby African growth rates accelerate to "China levels" (see further below), AND aspirations regarding net zero, renewable energy mixes and energy intensity are incorporated. This can be thought of as a **"high green growth ambition" scenario –** as the greening component of growth is higher than all other scenarios. This scenario would deliver access to electricity for populations but also require the deepest recalibration of industrial structures and global supply chains (including in environmental goods) to deliver.

The econometric modelling, the assumptions behind these scenarios, as well as underlying data broken down by country can be found in Annex 1. Here, we show the continent-wide results of these four scenarios up to 2050 - in Figure 12 below.[79]

[79] Note – results for 2050 will also be generated

Figure 12: Four scenarios for African GHG emissions to 2050



The results suggest the following key implications:

- First, if African countries continue their usual growth path, without changing industrial structures, meaning they might be able to provide more electricity access but do not reach the Agenda 2063 goals, and do not implement the plans in NDCs – for example due to a lack of climate finance alongside continued (yet relatively slow) investment into fossil-fuels – emissions will increase by 41% on 2018 levels by 2030 and 162% by 2050. In other words, Africa's emissions will be 2.6 times larger by 2050, assuming a "do nothing" *status quo*. Second, if African countries can accelerate industrialisation and growth, towards China levels, in order to meet Agenda 2063 goals as well as electricity access, but do not implement the plans in NDCs, emissions will increase by around 108% from 2018 levels, thereby more than doubling by 2030, and by 2050 they will be almost six times 2018 levels (an increase of almost 500%). While this is a high growth scenario, from a climate point of view, this is the worst outcome of the four scenarios.
- Third, the best outcome of the four scenarios from a climate point of view is where African countries continue their usual growth path, without changing industrial structures, meaning they manage to deliver on electricity access but do not reach the agenda 2063 goals, yet manage to implement the plans in NDCs – for example through accelerated climate finance. Under this scenario emissions fall by 5% on 2018 levels by 2030, rising again by 2035 to eventually increase by 61% by 2050. This scenario is akin to the IEA's Sustainable Africa Scenario (SAS). However, even this scenario does not imply a "peaking" of emissions in Africa, unless further NDC targets are committed to by African countries.

The best outcome from an African welfare **and** ambition point of view – where growth accelerates while NDC ambitions are still realised ("high ambition") – leads to a modest increase of emissions by 35% by 2030 and by 201% by 2050 compared to 2018 levels, meaning that emissions increase by three times over the next three decades.

Overall, our modelling suggests that the "high green growth ambition" scenario is - at least up to 2030 - an environmentally superior scenario to the "*do nothing*" path – i.e. low growth, low change, and little climate action or climate finance path. However, from around 2040 onwards, the "do

nothing" path is environmentally superior to the "high green growth" scenarios. On the other hand, the implications in terms of adaptation costs as well as poverty increases embedded within the do-nothing scenario may well create externalities that lead it also to be highly costly for humanity in other ways.

This suggests the "high green growth ambition" scenario is a better focus globally than "do nothing". Providing climate finance to meet African ambitions already included in their NDCs is best for the world.

However, the choice between the "high green growth ambition" path and the "basic access to energy" scenario is more challenging, especially for development partners. The recalibration that the high green growth scenario presents – of industrial structures, global supply chains, logistical investment across the continent – to meet Agenda 2063 could be highly disruptive and challenging to finance.

In particular, it almost certainly would require a significant increase in global climate finance availability, as well as revision of current views on "debt sustainability thresholds", as the finance required is unlikely to be generated internally within African countries but could be repaid over long periods of time.[80]

Furthermore, in emissions terms, the "high green growth ambition" path is worse than the "basic access to electricity" scenario – by 2050 emissions increase by 3 times under the high growth path, versus just 1.6 times on 2018 levels for the basic access path. Thus, the modelling clearly illustrates the theory of a "just transition", and the key trade off – based on existing technologies – between growth and climate action, holding everything else equal.

However, IF other countries and regions reduce their emissions significantly, this could create the "climate space" for the African growth transformation to be realized. As noted in other models such as IEA, a modest increase of African emissions by 2030 or 2050 from a very low starting point in 2018 can be absorbed by others.

[80] For more on this point please see: https://www.africaunconstrained.com/options-for-reimagining-africas-debt-system/

Finally, it should be noted that none of these scenarios account for any major technological shifts – for example shifts that make low-carbon development significantly cheaper (e.g., a further major cut in renewable energy costs). The scenarios only account for low emissions improvements in terms of output. They also do not account for externalities in terms of other environmental challenges (e.g., air, water, soil quality), adaptation costs or broader poverty-related implications.

Nevertheless, these findings have important implications for the development partnerships that African countries seek, including with China. The next chapter turns to the history, achievements and challenges of the Africa-China relationship in the climate arena, with a view to understanding how it can possibly contribute.

CHAPTER FOUR:

4 CLIMATE CHANGE ENGAGEMENTS BETWEEN AFRICAN COUNTRIES AND CHINA

It is well established that African countries have had deepening links with China in key sectors such as trade, finance, and investment. However, in 2006, the first China's African Policy[81] only mentioned climate change under environmental cooperation, and some of China's engagement was not particularly climate-friendly – for example projects in Africa's power sectors has involved both fossil-fuels and renewable energy. But by 2021, the 8th FOCAC included an entire Declaration on China-Africa Cooperation on Combating Climate Change,[82] and reiterated a commitment made at COP26 that China would no longer fund any coal-fired power plants overseas.[83] Does this mean times have changed? If so, why and how? And is this sufficient change in the right direction for the future, especially if African countries are aspiring to "high green growth" scenarios?

This chapter explores Africa's existing strategic partnerships with China and their rationales, in terms of climate financing, trade and technology, and capacity building. The chapter has a strong but not entire focus on the energy sector, partly because of data availability but also as the sector exemplifies the kind of transformation that is required and challenges that arise. This analysis is provided with a view to exploring the potential for future collaboration – for instance to achieve the high ambition, "green but high growth" scenario set out in Chapter 3.

4.1 CHINA'S FINANCING OF MITIGATION AND ADAPTATION MECHANISMS

Chinese financing around climate change has its unique characteristics – and when it comes to Africa has been determined less by climate funds, and more through bilateral engagement – both "Chinese bank to government", and "Chinese enterprises to government".

4.1.1 CHINA'S OFFICIAL CLIMATE FINANCE COMMITMENTS AND UNFCCC FUNDS

Classified as a developing country under the United Nations Framework Convention on Climate Change (UNFCCC), China is not legally obligated to provide climate finance to developing countries. China currently does not contribute to funds established under UNFCCC such as the Green Climate Fund or the Adaptation Fund. However, this may change. CDB has recently signed

[81] Gazette of the State Council, 2006, China's Policy Paper on Africa, Retrieved from http://www.gov.cn/gongbao/content/2006/content_212161.htm
82 Ministry of Foreign Affairs of the People's Republic of China, 2021, Declaration on China-African Cooperation on Combating Climate Change, Retrieved from http://focac.org.cn/focacdakar/eng/hygk_1/202112/t20211203_10461928.htm
[83] Mukeredzi, Tonderayi, 2021, High expectations on climate, energy for upcoming FOCAC, https://global.chinadaily.com.cn/a/202111/26/WS61a0d643a310cdd39bc77d52.html

a Memorandum of Understanding with the Green Climate Fund and emphasised clean energy cooperation.[84]

However, China already has a fund for south-south cooperation on climate change.[85] In 2015, Chinese President Xi Jingping announced this fund would provide 20 billion RMB (equivalent to 3.15 billion USD) to help developing countries tackle climate change.[86] Through the Forum on China Africa Cooperation (FOCAC) and the Belt and Road Initiative (BRI), some is expected to go to African countries, although the deadline for spending this remains unclear. Further, due to limited official data, there is no clear source on how these commitments have been distributed or which developing countries have received financing from the Fund. However, the South-South Climate Cooperation Fund is widely used to support China's flagship "10-100-1000" Programme[87], a programme announced by President Xi at the Paris Climate Change Conference in 2015 to carry out 10 low-carbon demonstration zones, 100 climate change mitigation and adaptation projects and 1,000 training places to address climate change in the developing countries since 2016.[88] Unfortunately, more detailed information, such as the list of countries having such projects and the progress of these projects, is not clear. This does not help in establishing China's credibility as a source of climate finance. In addition, it is unclear what proportion is devoted to mitigation or adaptation. One of the interviewees for this report highlighted the need for financing to go to adaptation in particular, stressing that *'most African countries need adaptation funding as it is more urgent compared to mitigation funding.'*

4.1.2 PUBLIC FINANCE FROM AIIB AND NDB

Multilateral development organizations which China is deeply involved and which are considered to be China-led‐ the Asian Infrastructure Investment Bank (AIIB) and the New Development Bank (NDB) are one of the sources to finance climate projects in Africa – for example in energy or transport sectors. Both have issued finance for projects targeting African countries, as shown in Figure 13.

[84] Ma, Xinyue et al. 2022, Outliner or New Normal? Trends in China's Global Energy finance, Boston University Global Development Policy Center, Retrieved from https://www.bu.edu/gdp/files/2022/03/GCI_PB_011_FIN.pdf

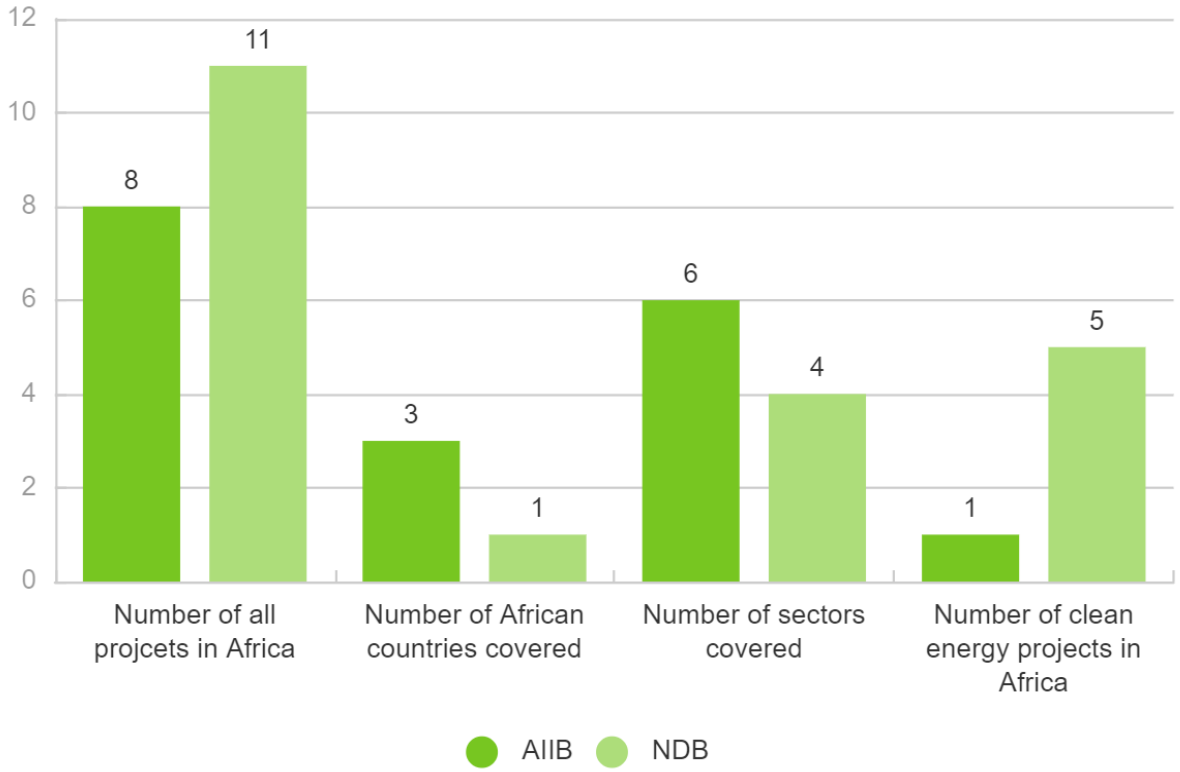
[85] China International Development Cooperation Agency (CIDCA), 2014, China pledges US$20 million a year to its new South-South Cooperation Fund, Retrieved from http://en.cidca.gov.cn/2014-12/12/c_262149.htm

[86] National Center for Climate Change Strategy and International Cooperation, 2015, China builds 'China Climate Change South-South Cooperation Fund' with 20 billion RMB, Retrieved from http://www.ncsc.org.cn/xwdt/gnxw/201509/t20150928_611107.shtml

[87] United Nations Office for South-South Cooperation, 2017, China and the United Nations Have Committed to Supporting South-South Climate Cooperation, Retrieved from https://www.unsouthsouth.org/2017/11/15/china-and-the-united-nations-have-committed-to-supporting-south-south-climate-cooperation/

[88] Li, Yan, 2020, The course and achievements of China's South-South cooperation on climate change, *World Development*, Retrieved from http://www.chinaeol.net/zyzx/sjhjzz/zzlm/lssj/202108/P020210825372496902224.pdf

Figure 13: Projects from AIIB and NDB in Africa[89]

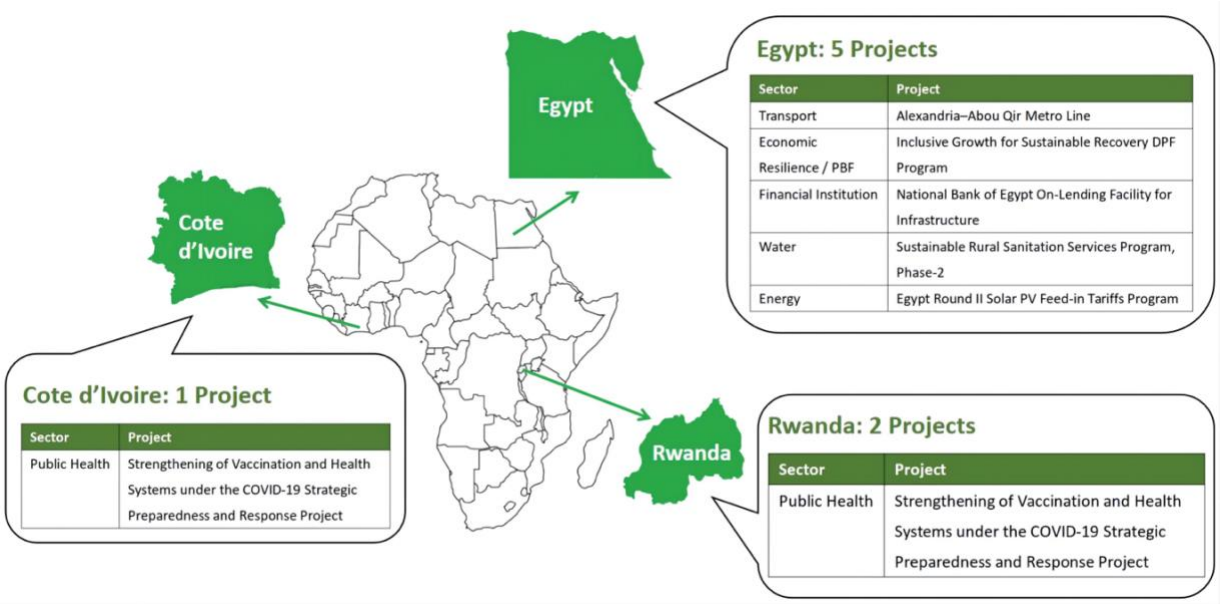


AIIB, which began operations in 2016, is a multilateral development bank focused on developing Asia, but currently has 105 members from all over the world. Ten African countries are already non-regional members of the AIIB, while nine countries from Africa are prospective members.[90] Among 194 country-based projects, only eight of them are in African countries, including two in Rwanda, one in Cote d'Ivoire, and five in Egypt.[91] The total value of these projects is $1.57 billion.

AIIB does not finance any fossil fuels projects. The 41 projects related to energy sector are focused on hydroelectric, wind power generation, solar power generation, and relevant infrastructure construction. There is one clean energy project in Africa, that is, the Egypt Round II Solar PV Feed-in Tariffs Program. This solar project received $210 million in approved funding, accounting for 14% of all African projects.[92] Other projects in Africa cover sectors such as public health, transport, and economic resilience.

[89] Source: AIIB and NDB Project List
[90] Asian Infrastructure Investment Bank, Members and Prospective Members of the Bank, Retrieved from https://www.aiib.org/en/about-aiib/governance/members-of-bank/index.html
[91] Asian Infrastructure Investment Bank, Our Projects, Retrieved from https://www.aiib.org/en/projects/list/year/All/member/All/sector/All/financing_type/All/status/All
[92] Asian Infrastructure Investment Bank, Egypt: Egypt Round II Solar PV Feed-in Tariffs Program, Retrieved from https://www.aiib.org/en/projects/details/2017/approved/Egypt-Egypt-Round-II-Solar-PV-Feed-in-Tariffs-Program.html

Figure 14: AIIB's Projects in African Countries



The New Development Bank (NDB) is established in 2015 by the BRICS countries and has other 2 members (Bangladesh and UAE) and 2 prospective members (Egypt and Uruguay). NDB has a total of 104 projects to date, 11 of which are in South Africa, the only African country receiving finances from NDB for now.[93] South Africa has gotten approval for five clean energy projects, which is the most among BRICS members. The total value of these five projects is around $1.44 billion. Like AIIB, the NDB does not have any fossil fuel projects or investments.

4.1.3 CHINA'S BILATERAL FINANCE TO AFRICAN COUNTRIES

Chinese loans and foreign direct investment are the two dominance sources that finance China's activities in Africa. Chinese stated-owned enterprises (SOEs) are active participants, as most projects in Africa that are supported by Chinese banks (for example in the energy and transport sectors) typically adopt an engineering, procurement, and construction (EPC) contract model, which is often awarded to SOEs. Additionally, African governments often tender for projects and can contract Chinese SOEs based on various criteria such as value for money or previous expertise. Hence, in 2020, Chinese construction companies were responsible for 31% of all infrastructure projects in Africa valued at or over $50 million.[94] However, financing methods differ, and the detail can matter. For instance, one of the interviewees asserted that *'a number of contracts that [they] have had access to particularly wind and solar […], most of these actually are part of these preferential export credits, where Chinese companies are actually buying Chinese developed technology and then use that to develop projects in Africa. And as part of the contractual agreement, you have to take the inputs from China, except for aspects like cement or steel in some cases, but I think even in the early phases steel was coming from China'.*

[93] New Development Bank, List of All Projects, Retrieved from https://www.ndb.int/projects/list-of-all-projects/?country_name=5&sector_name=1
[94] Kenny, Charles, 2022, Why is China Building so Much in Africa?, Center for Global Development, Retrieved from https://www.cgdev.org/blog/why-china-building-so-much-africa

For Chinese projects, EPC or a turnkey is still the dominant model.[95] There are some foreign companies involved in Chinese hydropower projects, but only to provide equipment manufactured by these companies in China. For example, the Bui dam hydro-power project in Ghana, constructed by Sinohydro in 2013, used Francis turbined produced by Alstom in China.[96]

Furthermore, China's domestic policies have a strong climate-positive influence on Chinese activities in Africa, for instance in the energy sector. Since 2015 when the Paris Agreement was adopted, China's new coal-fired power capacity declined from 65.8 GW in 2015 to 41.4 GW in 2020.[97] China has increased its share of global wind and solar power generation from 4% to 10%.[98] Reflecting this, China has issued several guidelines and frameworks on promoting green development overseas through its projects, such as *Guiding Opinions on Promoting the Construction of Green Belt and Road*[99] and *White Paper on China's Policies and Actions to Address Climate Change.*[100] The 2021 *Action Plan for Carbon Dioxide Peaking Before 2030,*[101] and 2021 *White Paper on China's Policies and Actions to Address Climate Change.*[102] These all provide opportunities for understanding China's climate change journey.

So how has all of this translated into actual growth and climate impacts in African countries? And what do the trends suggest for the future? The following sub-sections use the example of energy sector investment from China to explore this question, given data availability.

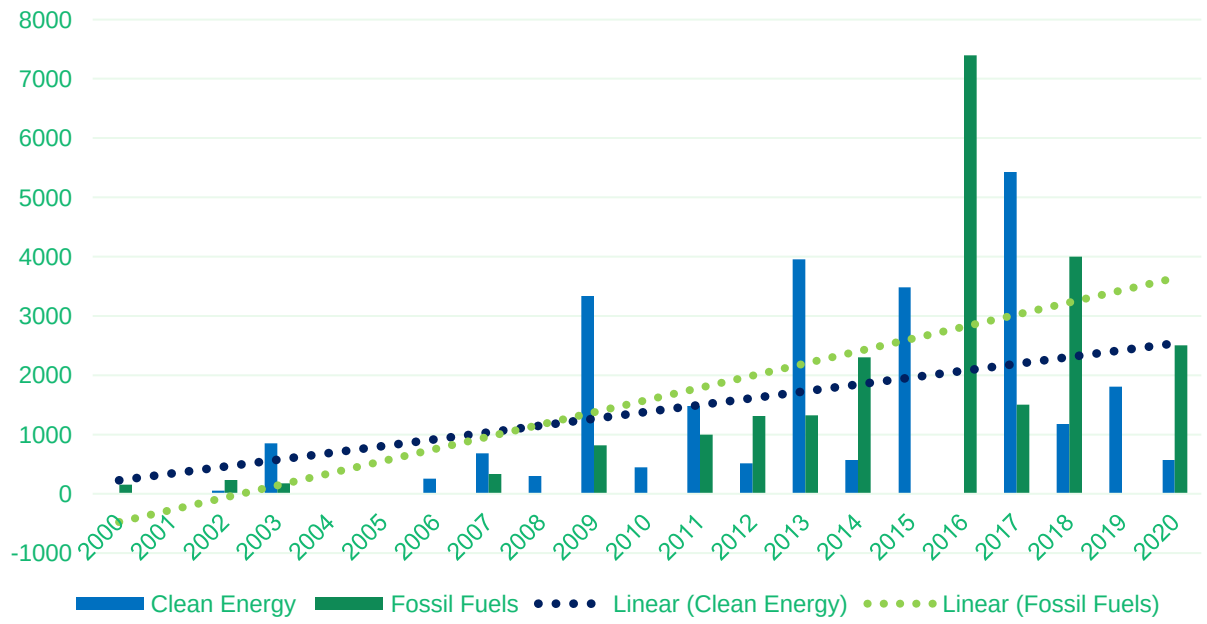
4.1.3.1 Chinese loans in energy

It is difficult to give a precise picture of Chinese energy projects in Africa, mainly because there is no official database from Chinese government to record its overseas development projects. Institutions such as Boston University's Global Development Policy Center and Johns Hopkins University's China Africa Research Initiative have collected and validated information on Chinese loans projects. The China's Global Energy Finance (CGEF) database captures a relatively comprehensive financing for global energy projects by China's two policy banks – the China Development Bank (CDB) and the Export-Import Bank of China (EXIM), while CGIT captures Chinese i*nvestment* activities (not loans) since 2005 and provides supplementary data sources for China's overseas investment in various sectors, including energy. However, one of the limitations of the CGIT database is that it does not list any descriptions of investments. Therefore, under the subsector "alternative energy", there is no information indicating whether this investment is in wind energy or solar power. Also, other financial institutions, including China Export Credit Insurance Co. (Sinosure), the policy insurance company, plus several commercial banks such as Bank of China and the Industrial and Commercial Bank of China, also provide funding support for China's oversea energy projects.

[95] Baxter, Tom. 2022. "Stepping up" Chinese solar and wind investment in Africa: an interview with Dr. Shen Wei. Panda Paw Dragon Claw, Retrieved from https://pandapawdragonclaw.blog/2022/01/17/stepping-up-chinese-solar-and-wind-investment-in-africa-an-interview-with-dr-shen-wei/
[96] Lema, Rasmus et al. 2021, China's investments in renewable energy in Africa: creating co-benefits or just cashing-in?, World Development. Volume 141, Retrieved from https://doi.org/10.1016/j.worlddev.2020.105365
[97] Global Coal Plant Tracker, Global Energy Monitor, Retrieved from https://globalenergymonitor.org/projects/global-coal-plant-tracker/
[98] Jones, Dave, 2020, Global electricity analysis: H1-2020, Ember Climate, Retrieved from https://ember-climate.org/insights/research/global-electricity-h12020/
[99] Ministry of Ecology and Environment, People's Republic of China, 2017, Guidance on Promoting Green Belt and Road, Retrieved from https://english.mee.gov.cn/Resources/Policies/policies/Frameworkp1/201706/t20170628_416864.shtml
[100] The State Council of the People's Public of China, 2021a, Responding to Climate Change: China's Policies and Actions, Retrieved from http://english.www.gov.cn/archive/whitepaper/202110/27/content_WS617916abc6d0df57f98e3f3b.html
[101] The State Council of the People's Public of China, 2021b, Action Plan for Carbon Dioxide Peaking Before 2030, Retrieved from http://www.gov.cn/zhengce/content/2021-10/26/content_5644984.htm
[102] The State Council of the People's Public of China, 2021c, White Paper on China's Policies and Actions to Address Climate Change, Retrieved from http://www.gov.cn/zhengce/2021-10/27/content_5646697.htm

According to the CGEF database, China's total (loan) financing in energy sector in Africa since 2000 is worth around $53 billion, with $25 billion in clean energy and $23 billion in fossil fuels. Trends are shown in Figure 15.

Figure 15: Chinese projects in clean energy vs. fossil fuels between 2000-2020 (in US millions)[103]



The trendlines suggest that China is growing its financing in both clean energy and fossil fuels but the growth rate in fossil fuels is faster. One reason for this is that the data are affected by an extreme value – a $6.9 billion oil project in Angola in 2016.[104]

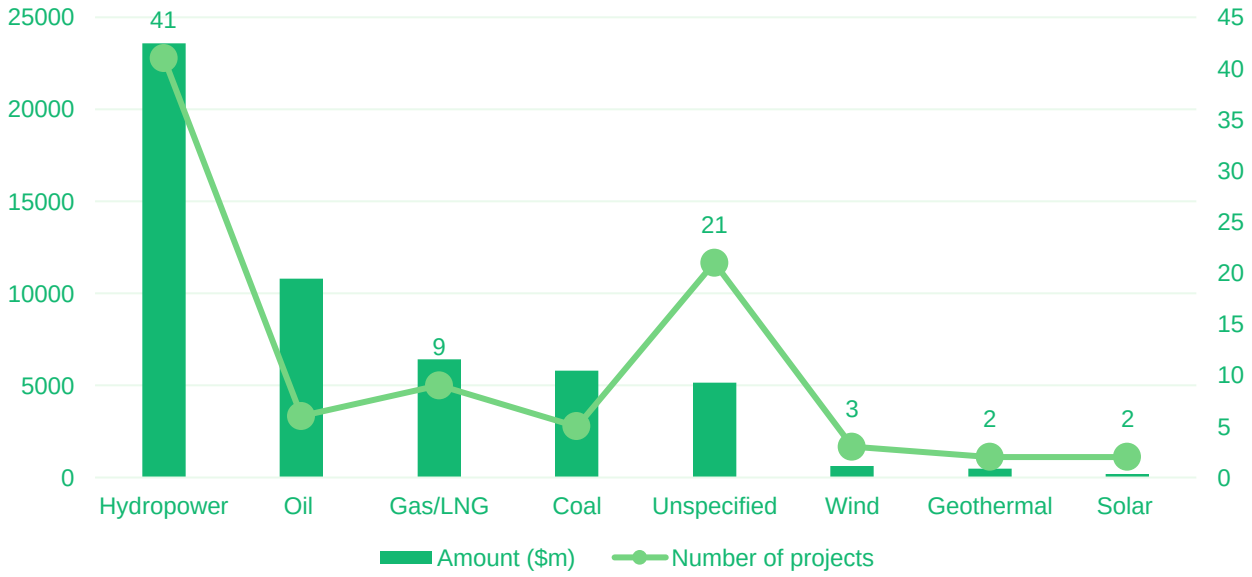
In fact, the two key Chinese policy banks have funded more clean energy projects in Africa than fossil fuel projects. Specifically, the CGEF database has recorded 89 Chinese energy projects in Africa since 2000. As shown in Figure 16, 48 projects are on clean energy (hydropower, wind, geothermal and solar), while 20 are on fossil fuels (oil, gas and coal). The rest 21 projects were related to transmission and distribution of power, such as power plant upgrade or rehabilitation and electricity supply.[105]

Our interviews corroborate this. One interviewee asserted that '*over the past maybe 10 to 15 years, we have seen Chinese commitments in the energy sector are increasing but surprisingly,*

[103] Source: China's Global Energy Finance (CGEF) Database, 2021. Boston University Global Development Policy Center
[104] Boston University Global Development Policy Center, 2021a, China's Global Energy Finance Database, Retrieved from https://www.bu.edu/gdp/2021/02/12/chinas-global-energy-finance-2020/
[105] Based on the author's own calculation by using the data from Boston University Global Development Policy Center, 2021a, China's Global Energy Finance Database, Retrieved from https://www.bu.edu/gdp/2021/02/12/chinas-global-energy-finance-2020/

the non-hydro has not really been taking up much of the share, […] non-hydro financing is still very limited.'

Figure 16: Chinese Energy Projects in Africa between 2000-2020 by Sectors (in US million)[106]



On a country-by-country level, while 30 out of 55 African countries have received energy financing from China, flows are not evenly distributed, as shown in **Figure 17.** Resource-rich countries, like Angola and South Africa, are dominated by fossil fuels projects. Angola alone received 44% of China's total fossil fuel financing to Africa. Moreover, as shown in **Figure 18,** countries with large populations, such as Nigeria and Ethiopia,[107] have sought more Chinese financed hydropower projects than other countries.[108]

[106] Source: China's Global Energy Finance (CGEF) Database, 2021. Boston University Global Development Policy Center
[107] Statista, 2022b, African countries with the largest population as of 2020, Retrieved from https://www.statista.com/statistics/1121246/population-in-africa-by-country/
[108] Gerretsen, Isabelle, 2018. Oil-rich Nigeria turns to renewable energy as population booms, Retrieved from https://www.reuters.com/article/us-nigeria-britain-renewables-analysis/oil-rich-nigeria-turns-to-renewable-energy-as-population-booms-idUSKBN1I419F

Figure 17: Distribution of Chinese Energy Projects in African Countries (in US millions)[109]

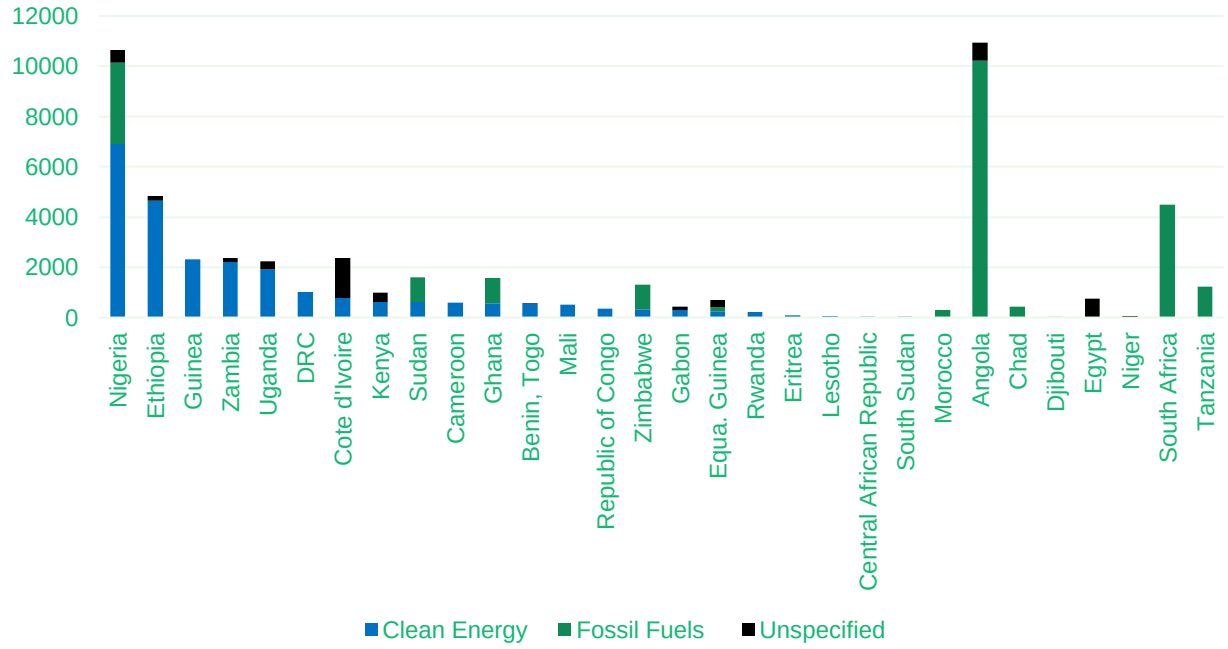
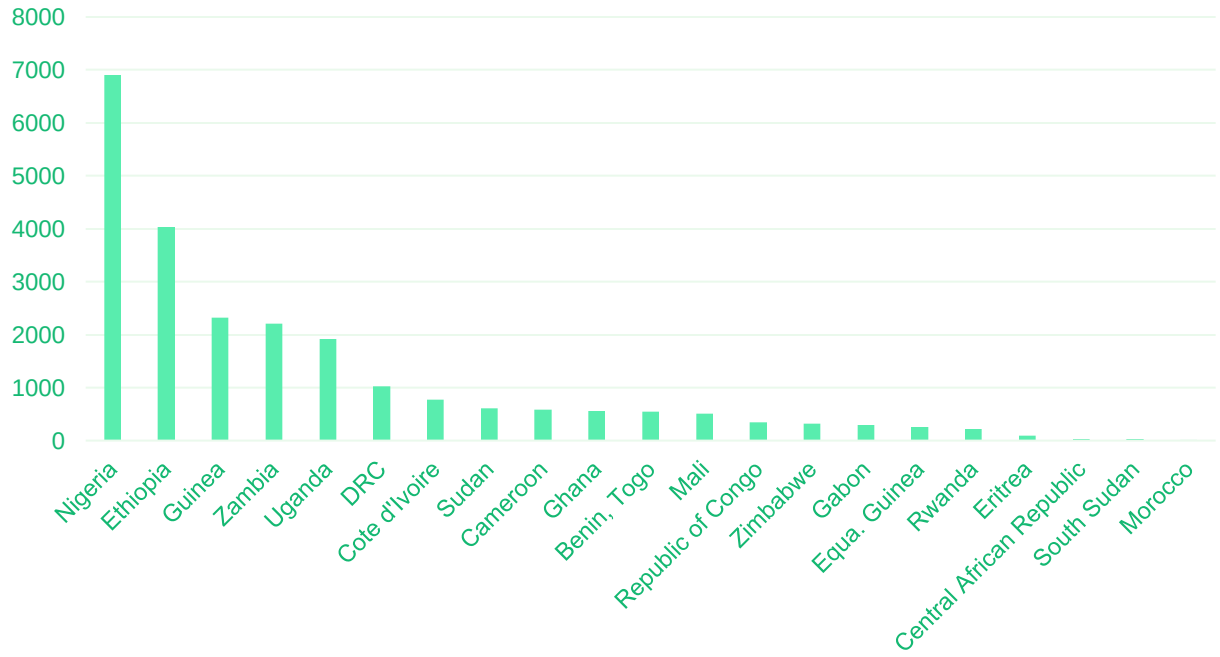


Figure 18: Chinese financed hydropower projects in African Countries (in US millions)[110]



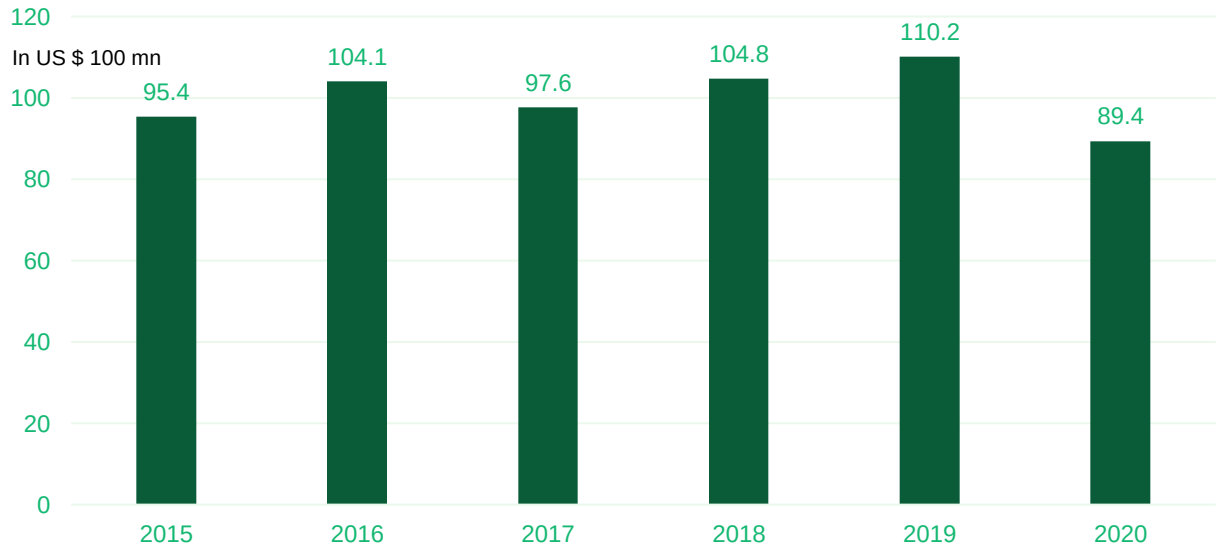
[109] Source: China's Global Energy Finance (CGEF) Database, 2022. Boston University Global Development Policy Center
[110] Source: China's Global Energy Finance (CGEF) Database, 2021. Boston University Global Development Policy Center

Looking at the gas sector, a recent report compared the role of Chinese and MDBs overseas gas financing. China has said under FOCAC in 2021 that it is ready to support '*qualified gas-to-power and green hydrogen development projects in accessing green investment and financing support'*. The report concludes that while neither the Chinese policy banks or MDBs analysed have a concrete policy framework for their financing of gas overseas, this lack of policy clarity also gives Chinese development finance the opportunity to engage in gas development abroad, and to include the private sector in their financing policies.[111]

4.1.3.2 Chinese foreign direct investment in energy

Chinese foreign direct investments (FDI) play important roles in financing Africa's energy sector. However, Chinese official FDI data[112] does not clearly break down its stocks in the energy sector. In 2020, Chinese FDI stock in Africa amounted at $43.4 billion. Mining is the second largest recipient of Chinese FDI (20.6%), after construction (34.9%). **Figure 19** reveals that in 2020, Chinese FDI stocks in Africa's mining were at their lowest point since 2015.

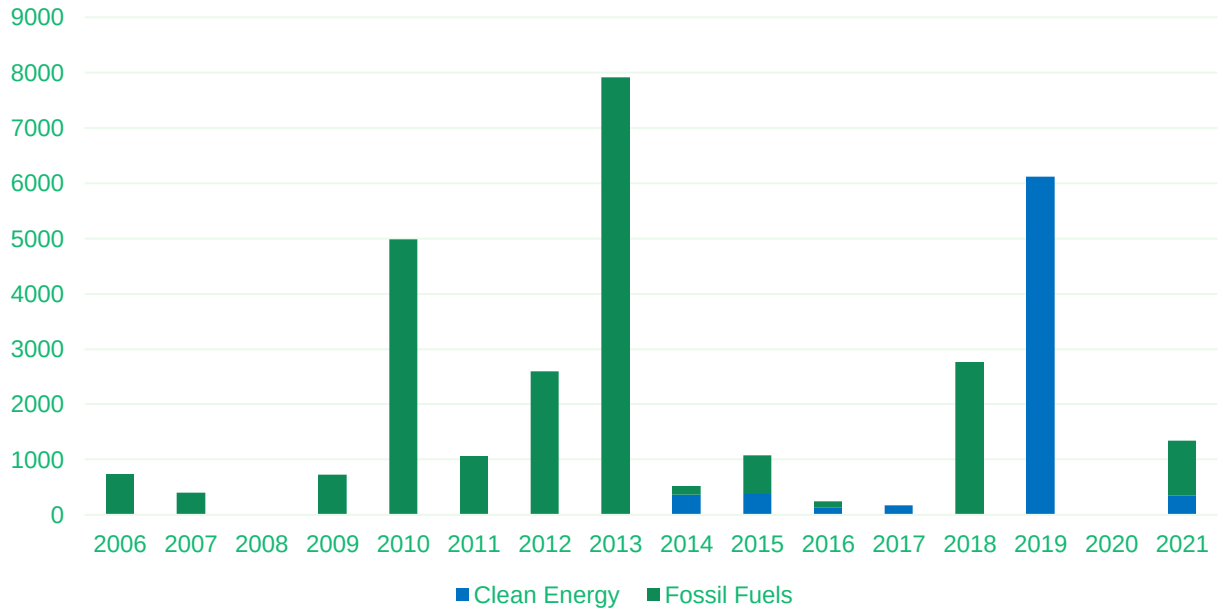
Figure 19: Chinese FDI Stocks in Mining Sector in African Countries (in US $100 millions)[113]



According to the China Global Investment Tracker (CGIT)[114] database, published by the American Enterprise institute (AEI), the total value of Chinese investment in Africa since 2005 is $99.3 billion, of which energy received a total of $36.2 billion, accounting for 36% of the total. Trends are shown in **Figure 20.**

[111] Ibid
[112] China's Ministry of Commerce, 2021, Statistical Bulletin of China's Outward Foreign Direct Investment, Retrieved from http://english.mofcom.gov.cn/statistic/charts.shtml
[113] Ibid
[114] American Enterprise Institute, China Global Investment Tracker, Retrieved from https://www.aei.org/china-global-investment-tracker/

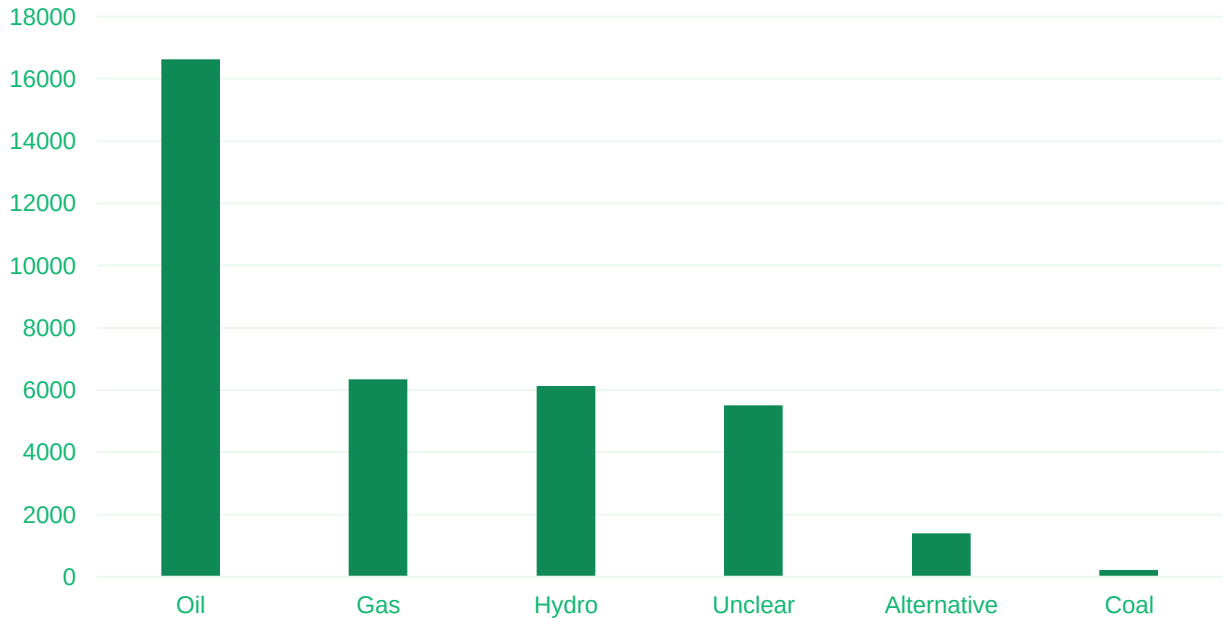
Figure 20: Chinese Investment in Africa's Energy between 2005-2021(in US millions)[115]



Furthermore, as shown in **Figure 21,** Chinese investors in Africa's energy sector are primarily engaged in oil, accounting for 46% of the total energy investments, followed by gas and hydropower. Meanwhile, Chinese state-owned enterprises (SOEs) are the main investors in the Africa's energy sector. Of 37 investments under CGIT, only three are financed by private companies (two in renewable energy and one in coal).

[115] Clean energy includes CGIT's subsector of hydropower and alternative energy. Fossil fuels include oil, gas, and oil. Source: China Global Investment Tracker. American Enterprise Institute. 2022

Figure 21: Chinese Investment in Africa's Energy Subsectors between 2005-2021(in US millions)[116]



However, Chinese clean energy investment has increased since 2014. In 2017, there was no investment in fossil fuels. In 2019, the database recorded a hydropower project in Mambila, Nigeria with the total cost of $5.8 billion, the largest hydropower investment in the CGIT. The Mambila Hydro-Electric Power Project was firstly awarded to Chinese SOEs in 2017, after President Muhammadu Buhari visited Beijing and met with President of China in 2016.[117]

Analysts have stated that Chinese investors have not yet been heavily involved in solar photovoltaic (PV) investment in the region, which surpassed hydropower investments for the first time in 2019. Chinese investment in wind energy is also expected to grow rapidly in Africa, especially in countries at high altitude or at some distance from the equator.[118] While Chinese investments in wind and solar are expected to rise, one interviewee stressed that countries now need to *'build up baseline capacities'* and that wind and solar are not currently enough to form *'a base energy system […] to sustain the overall energy, industry infrastructure or energy systems for most of [African] countries*.'

A policy brief from Boston University Global Development Policy Center suggests that FDI will play more important roles in Chinese overseas energy projects, particularly in the electricity sector, due to the slower loan-making caused by the regulation and risk management for Chinese banks' overseas loan businesses.[119] In addition, given China's continued emphasis on greening

[116] Source: China Global Investment Tracker. American Enterprise Institute. 2022
[117] Government of Nigeria, 2017, Mambila Power: Buhari's Big Bang Project in Ten Points by Garba Shehu, Retrieved from https://theasovilla.medium.com/mambila-power-buharis-big-bang-project-in-ten-points-by-garba-shehu-736264596f91
[118] Lema, Rasmus et al., 2021, China's investments in renewable energy in Africa: creating co-benefits or just cashing-in?, World Development. Volume 141. Retrieved from https://doi.org/10.1016/j.worlddev.2020.105365
[119] Ma, Xinyue et al. 2022, Outliner or New Normal? Trends in China's Global Energy finance, Boston University Global Development Policy Center, Retrieved from https://www.bu.edu/gdp/files/2022/03/GCI_PB_011_FIN.pdf

BRI and 49 African countries that are BRI signatories, contracting or technical assistance[120] will be alternative forms of clean energy cooperation in Africa.

4.1.3.3 Chinese model in supporting Africa's energy sector ambitions

Chinese stakeholders are involved in the energy and other infrastructure sectors in Africa through an integrated solution of Chinese development assistance (loans), government-driven investment and investment.[121] Therefore, Chinese projects in Africa, including energy projects, have tended to adopt a contractor-driven model. Specifically, an engineering, procurement and construction (EPC) contract is awarded to a specialized infrastructure services company, usually a state-owned enterprise (SOE), that drives and coordinates the project and then subcontracts tasks to other product and service providers.[122] For example, in Nigeria's Mambila Hydro-Electric Power Project, China's EXIM bank finances 85%[123] of the development (the rest 15% from Nigeran government) but three Chinese SOEs – China Gezhouba Group Company, SinoHydro, and CGCOC were signed as EPC contractors.[124] During interviews conducted, several interviewees discussed the different types of contract models available for energy projects. One interviewee stated that '*most African countries, partly because of pricing debt issues, are no longer delivering projects using the state backed finance, in other words, EPC contracts. Now most African countries are moving towards auction-based project delivery mechanism. For example, South Africa has a renewable energy independent procurement program. […] And what I have discovered is that most of the Chinese companies that are already doing business in Africa, they do not have the experience of participating in this auction-based, competition-based project delivery mechanism.'* Another interviewee echoed this sentiment and asserted that, when it comes to public-private partnerships models, '*Chinese SOEs […] don't have any comparative advantages*. It can be concluded from these expert comments that Chinese stakeholders therefore need to be aware of changing dynamics across the continent and, depending on the context, work to adapt to different project frameworks.

Looking at the energy projects themselves, the preferences of Chinese SOEs have a strong influence on the selection and development of projects.[125] Chinese SOEs have strong expertise in the hydropower sector. This explains why hydropower contracts dominate the current project portfolios in Africa.[126] During the interviews conducted, experts pointed to the key role played by Chinese SOEs in the selection and development of energy projects. One interviewee highlighted the different levels of stakeholders that are involved in energy projects across the continent, illustrated in Figure 22 below, and asserted that '*the relationship between these three levels of stakeholders determines what happens on the ground. In other words, it determines what happens in donor countries. And what we have seen in the past 15 to 20 years, we have seen this bottom layer, these enterprises driving the engagements with African countries in the renewable energy sector.'*

[120] Ibid
[121] International Energy Agency, 2016, Boosting the Power Sector in Sub-Saharan Africa Boosting the Power Sector in Sub-Saharan Africa: China's Involvement, https://www.iea.org/reports/partner-country-series-boosting-the-power-sector-in-sub-saharan-africa
[122] Lema, Rasmus et al., 2021, China's investments in renewable energy in Africa: creating co0benefits or just cashing-in?, World Development. Volume 141. Retrieved from https://doi.org/10.1016/j.worlddev.2020.105365
[123] Monks, Kieron, 2017, Nigeria announces $5.8 billion deal for record-breaking power project, *CNN*, Retrieved from https://www.cnn.com/2017/09/14/africa/nigeria-china-hydropower/index.html
[124] Government of Nigeria, 2017, Mambila Power: Buhari's Big Bang Project in Ten Points by Barba Shehu, *Medium*, Retrieved from https://theasovilla.medium.com/mambila-power-buharis-big-bang-project-in-ten-points-by-garba-shehu-736264596f91
[125] Shen, Wei, 2020, China role for Africa energy transition: a critical review, Oxford Policy Management. Retrieved from https://www.researchgate.net/publication/338913949_China_role_for_Africa_energy_transition_a_critical_review
[126] Ibid

Figure 22: The types of Chinese stakeholders in renewable energy projects in Africa[127]

Overall, this analysis therefore suggests - and using energy sector as an example – that China's potential to continue to support African growth and climate goals is highly dependent on African decisions regarding the scale of acceleration of energy required, the energy mix planned for as well as the type of finance African governments are seeking. China's potential to continue this support is also dependent on the ability of both Chinese and African stakeholders to adapt and respond effectively to the evolution of these decisions across the continent.

If African governments aim for a high green growth scenario, most likely there will be a need to continue building and financing hydropower, which China already has experience and expertise in, though it may develop expertise in other areas in time. However, if African governments are constrained to use PPP models to finance projects, this will likely act as a barrier to engaging with Chinese stakeholders.

There is also significant potential for wind and solar energy in Africa, and Chinese exports of renewable energy equipment such as turbines and solar panels to Africa have increased over the past decade as China has focused on developing its domestic wind and solar markets.[128] Chinese wind and solar investments in Africa are largely driven by private companies, such as clean energy development, construction and operations company CHINT Solar, which won a contract to build three solar PV plants in Egypt in 2018.[129]However, private companies are smaller in size and financing compared to state-owned companies in hydropower projects. Moreover, private companies' investments in Africa are more driven by commercial purposes, so any perceived investment risks in African markets could hinder their interest.[130] Thus, it will likely take time for Chinese companies to achieve a similar share of wind or solar sectors as they have achieved in hydropower projects.

So, what about trade? Has and can the Africa-China trade relationship contribute to Africa's growth and climate ambitions?

[127] Source: Authors' interviews
[128] Lema, Rasmus et al., 2021
[129] ACWA Power, 2018, ACWA Power signs EPC contract with CHINT group to build three PV projects at Egypt totaling 165.5MV capacity, Retrieved from https://www.acwapower.com/news/acwa-power-signs-epc-contract-with-chint-group-to-build-three-pv-projects-at-egypt-totaling-1655mw-capacity/
[130] Baxter, Tom, 2022, 'Stepping up' Chinese solar and wind investment in Africa: an interview with Dr Shen Wei, Panda Paw Dragon Claw, Retrieved from https://pandapawdragonclaw.blog/2022/01/17/stepping-up-chinese-solar-and-wind-investment-in-africa-an-interview-with-dr-shen-wei/

4.2 Trade and Technological Transfer

This section will address different aspects of trade and technological transfer between Africa and China, both in terms of current trends and in terms of potential areas for deepened cooperation. These aspects include the value of export trade in CRMs from Africa to China and the opportunities for developing added-value chains to grow Africa's manufacturing capacity of green goods. This section will also analyse the importance of advancing green technology on the continent by addressing technological transfer and the role of IP mechanisms in trade. Through special vehicles like the African Mining Vision (AMV) which is mandated to create a transparent, equitable and optimal exploitation of mineral resources to underpin broad-based sustainable growth and socio-economic development, China and Africa can deepen their relations in this area - especially on using green technology in the mining sector. Moreover, the AMV creates a platform for negotiations between China's mining multinational companies and African nations on how mining can benefit local communities and protect their environments.[131]

4.2.1 TRADE IN CRITICAL RAW MATERIALS

China has the highest domestic supply of CRMs in the world and is also the largest importer of CRMs mined elsewhere in the world.[132] China is the main producer of most CRMs, including magnesium, tungsten, gallium, and the rare earth elements. It imports CRMs such as copper, iron ore, chromium, manganese, cobalt, tantalum, niobium, PGMs, and lithium.[133] Lithium and cobalt are some of the commodities used in green technology and are useful in storing energy in solar and wind which are sources of green energy,[134] while CRMs such as lithium, cobalt and nickel are used in the manufacturing of electric vehicles. Other countries are global leaders in a smaller selection of CRMs. For example, the United States (helium and beryllium), Russia (palladium), Brazil (niobium), Chile and Australia (lithium), and South Africa (rhodium, platinum, iridium, and ruthenium).[135]

Nevertheless, although China does not possess reserves of all CRMs, it still accounts for 45% of global production of CRMs, with the next ten biggest suppliers accounting for just 35% combined.[136] This is demonstrating China's dominance in raw material value chains, and its major role in the processing and refining of CRMs.

Taking lithium as an example, China processes and refines raw lithium that is imported from markets such as Chile, Argentina, and Australia. Chinese stakeholders such as Chengdu Tianqi Industry Group Co. Ltd and Zijin Mining Group Co. Ltd have successfully secured access to supplies of raw lithium through projects across lithium-rich regions, which is especially important considering increasing shortages and subsequent global price increases.[137] It has been estimated

[131] African Union, 2022c, African Mining Vision, Retrieved from https://au.int/en/ti/amv/about
[132] Penke, Michel, 2021 How China's mines rule the market of critical raw materials. *DW Akademie*, Retrieved from https://www.dw.com/en/how-chinas-mines-rule-the-market-of-critical-raw-materials/a-57148375#:~:text=That%20makes%20China%20both%20the,importer%20of%20those%20mined%20elsewhere.
[133] Congressional Research Service, 2015, China's Mineral Industry and U.S. Access to Strategic and Critical Minerals: Issues for Congress, *Research Congressional Service*, Retrieved from https://crsreports.congress.gov/product/pdf/R/R43864
[134] USAID, 2021, Mining and the Green Energy Transition: Review of International Development Challenges and Opportunities, Retrieved from https://www.land-links.org/wp-content/uploads/2021/11/Green-Energy-Minerals-Report_FINAL.pdf
[135] Geological Survey of Sweden, 2021, Critical Raw Materials, Retrieved from https://www.sgu.se/en/mineral-resources/critical-raw-materials/
[136] DW, 2021, How China's mines rule the market of critical raw materials, Retrieved from https://www.dw.com/en/how-chinas-mines-rule-the-market-of-critical-raw-materials/a-57148375
[137] S&P Global, 2021, China mining, battery companies sweep up lithium supplies in acquisition blitz, Retrieved from https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/china-mining-battery-companies-sweep-up-lithium-supplies-in-acquisition-blitz-67205411

that China now controls 80% of the raw material refining, almost 80% of global cell capacity and 60% of global component manufacturing.[138]

China places high value on CRMs as it looks to develop clean energy and a sustainable future for its citizens. The Center for Strategic and International Studies (CSIS) says that China is routing for clean and renewable energy as it will eventually solve their water and air pollution issues.[139] China's supply of CRMs also facilitates its leading role in the production of renewable energy worldwide. Lastly, China will no longer depend on unstable regions to supply them with fossil energy. In the event China can cater for its own energy and that of its population, reliance will have been alleviated.

At the same time, especially under a high green growth scenario, these same CRMs are likely to be useful for African development, as much as they are to China or other development partners.

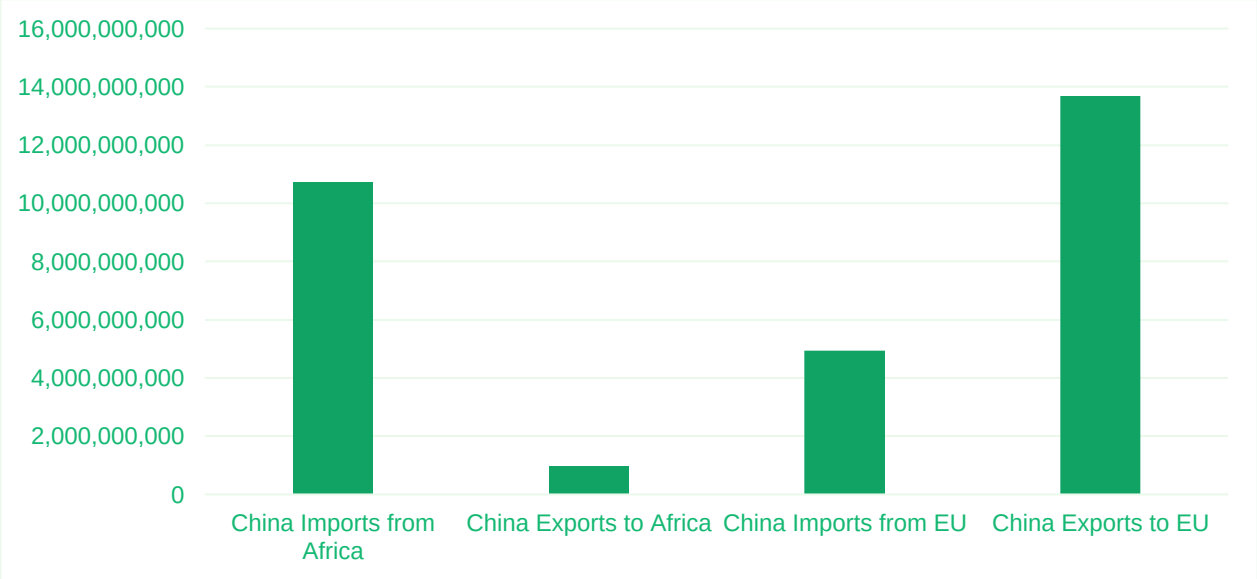
4.2.2 TRADE IN CRMS BETWEEN CHINA AND AFRICAN COUNTRIES

Looking specifically at Africa-China relations in the trade of CRMs, China imports approximately 11 times more CRMs from Africa than it exports to African countries. This might seem large but as Figure 23 shows, China itself exports more CRMs to Europe. China is the EU's largest supplier of CRMs such as magnesium (93%), tungsten (69%), light rare earth elements (LREEs) (99%), and heavy rare earth elements (HREEs) (98%).[140]

From Africa, China imports CRMs such as Bauxite, Cobalt, and Phosphate Rock from Guinea, Democratic Republic of Congo and Morocco respectively.[141] However, Africa is not China's only source for CRMs. China also imports CRMs from elsewhere, including the EU. Not all of these will be for domestic use.

[138] BloombergNEF, 2020, China Dominates the Lithium-ion Battery Supply Chain, but Europe is on the Rise, Retrieved from https://about.bnef.com/blog/china-dominates-the-lithium-ion-battery-supply-chain-but-europe-is-on-the-rise/
[139] Chiu, Dominic, 2020, The East Is Green: China's Global Leadership in Renewable Energy, *Center for Strategic and International Studies*, Retrieved from https://www.csis.org/east-green-chinas-global-leadership-renewable-energy#:~:text=China%20is%20already%20leading%20in,by%20Chinese%20companies%20in%202016.
[140] Ibid
[141] European Commission, 2020, Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability, Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0474&from=EN

Figure 23: Trade of CRMs and 'rare-earth' materials between African countries and China in 2021, with China's trade of CRMs with the EU as context[142]



The low level of CRM exports to Africa is likely because, given the low degree of industrialization and technological sophistication of almost all African economies, there is no current demand for CRMs in Africa, and as such imports of such materials have so far been close to non-existent. For example, while China exports 58.3% of the world's magnesium, the entirety of Africa imports less than 2% of the world's imports, with South Africa taking up more than half of that. Similarly, China exports 26.9% of the world's tungsten, but Africa imports less than 1% of the world's total imports, with South Africa again accounting for around half of Africa's total.

Although African exports to China are currently low, these exports are creating a symbiotic relationship between the two regions. Africa benefits from the subsidized loans - case in point Angola and Congo. African states also receive oil supplies in exchange for exploration and mining rights by China. This trend begun in the early 2000s with Gabon and Congo benefiting from oil supplies worth $3 billion and $9 billion respectively.[143] The role of CRMs in African countries' relationships with China is crucial, especially given that CRMs are expected to play an even bigger role in the environmental-led development paradigms of the 2020s-2030s.[144] One expert interviewee also suggested that emerging manufacturing industries in Africa could draw lessons from industries in China that are already more developed, such as textiles, and apply these lessons to green manufacturing across the continent.

[142] This data was obtained by searching 'critical raw materials' and 'rare-earth' in the Chinese customs statistics database. Customs Statistics, 2022, Export & Import Data, Retrieved from http://43.248.49.97/indexEn

[143] South African Institute of International Affairs, 2009, China and Africa's Natural Resources: The Challenges and Implications for Development and Governance, 9, Retrieved from https://www.voltairenet.org/IMG/pdf/China_and_Africa_s_Natural_Resources.pdf

[144] Usman, Zainab et al., 2021, What Does the European Green Deal Mean for Africa?, Carnegie Endowment for International Peace, Retrieved from https://carnegieendowment.org/2021/10/18/what-does-european-green-deal-mean-for-africa-pub-85570

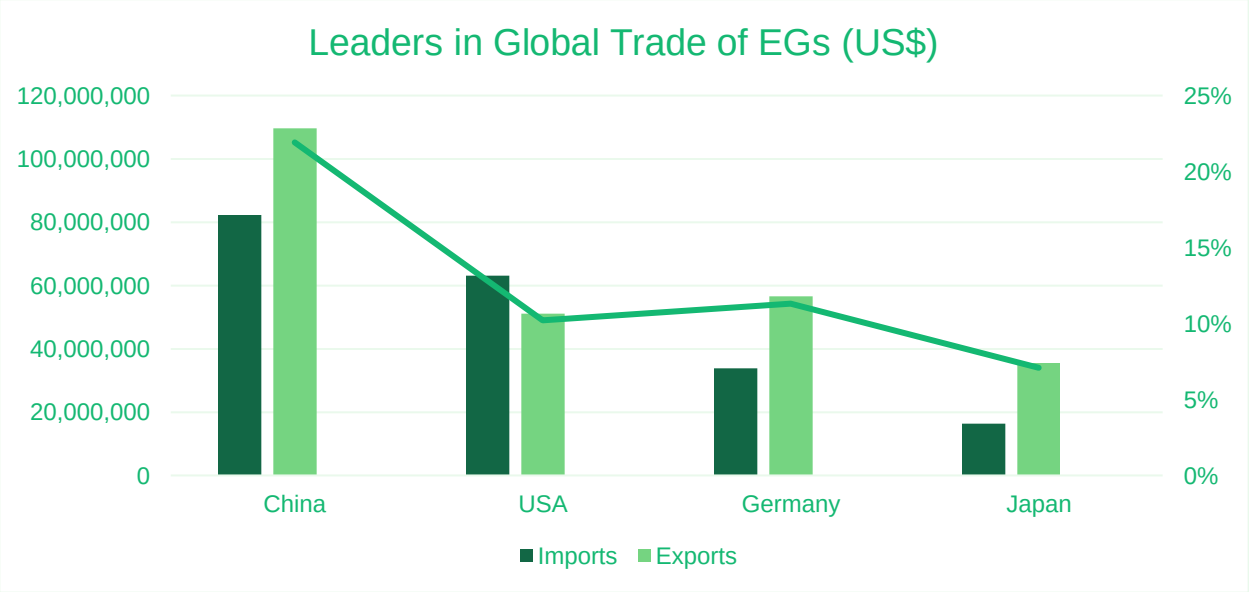
4.2.3 EXPORT OF ENVIRONMENTAL GOODS

As discussed in the previous section, CRMs are essential for the development of manufacturing activities across the globe. Africa compared to the world produces very little manufactured value-added goods. As of 2018, a report showed that value-added manufactured goods from Sub-Saharan Africa accounted for 1% of the total.[145] Most African countries face the same challenges in terms of manufacturing value-added goods such as low or no technological capabilities, water and electricity scarcity, high input costs and low productivity.

This section will address the opportunities available to both African countries and China to utilise the continent's CRMs and potential for manufacturing to develop the production and trade of environmental goods and services across Africa. Global trade in EGs reflects the growing global demand for more renewable energy to achieve the goals of the Paris Agreement and decrease emissions, shore up national energy security and build more climate-resilient societies.

Using APEC's list of Environmental goods, the overall global trade in EGs reached approximately $1,000 billion in 2020. **Figure 24** below shows the global leaders in the trade of EGs in 2020, with their percentage share in overall global trade shown on the right-hand side axis.

Figure 24: The top Importers and Exports of EGs in 2020[146]



If Africa is to realise Agenda 2063 goals, no doubt the continent would need to become a leader in trade of EGs and appear on such figures.

[145] United Nations Environment Programme, 2020, Green Manufacturing in Africa: Focus on Micro, Small and Medium Enterprises (MSMEs), Retrieved from file:///C:/Users/Mukami/Downloads/GMA.pdf
[146] ITC Trade Map, 2020, Retrieved from https://www.trademap.org/Index.aspx

4.2.4 AFRICA-CHINA COOPERATION IN ENVIRONMENTAL GOODS

As Figure 23 above demonstrates, China is both the largest global importer and exporter of EGs. It also dominates renewable energy sectors such solar and wind energy. For example, eight of the top ten solar production companies are Chinese, and at least four of the top ten wind turbine production companies are Chinese.[147] In 2021, China accounted for approximately half of the world's increase in wind and solar capacity.[148] In stark contrast, Africa accounts for approximately 1% of global trade in EGs, with just 1% of EGs global exports and less than 1% of global imports in 2020. The top supplying markets of EGs to Africa during this time period were China, USA, Germany and Italy. The top exporter of EGs in Africa in 2020 was South Africa: 79% of overall exports in EGs in 2020.[149]

In terms of Africa-China cooperation in the EGs sector, several of these major Chinese companies are involved in various energy projects across the continent, especially in wind and solar photovoltaic (PV) sectors. A case study is provided in Box 1. However, most of this cooperation is based on individual interactions rather than on a standardized framework of cooperation. Chinese renewable energy projects around areas such as wind and solar on the continent account for less than 5% of overall energy projects on the continent.[150] Having said this, China's decreasing engagement in the continent's fossil fuel sectors could pave the way for a shift in focus to more cooperation in green energy, and in EGs manufacturing and trade more specifically.[151]

Box 1: Case Study: Shenzhen Power Solution

Shenzhen Power Solution is a Chinese company established in 2004 and describes itself as a 'social enterprise' that works to improve peoples' quality of life across the globe. It was established to provide electricity access through renewable energy to low-income 'bottom of pyramid populations' in partner countries. Their supply of solar lightings and solar panels is closely linked to SDG7 – affordable and clean energy and access to electricity as a human right.

Cooperation with African countries:

- Shenzhen Power Solution has approximately 30 partners in Africa, including big markets such as Nigeria, Ethiopia, and Kenya.
- The company's solar lighting can be used for 36 months that is both more affordable and more cost-effective than traditional lighting
- The company promotes its products as an energy product and not a consumer product.
- As a small manufacturing enterprise, they are flexible and can quickly address new market demands.
- They provide technical support to customers across the continent.

[147] Shen, Wei, 2021, China-Africa Cooperation in the Energy Sector: Towards a More Sustainable Pathway?, Italian Institute for International Political Studies, Retrieved from https://www.ispionline.it/en/pubblicazione/china-africa-cooperation-energy-sector-towards-more-sustainable-pathway-31257
[148] BP. 2021. Statistical Review of World Energy 70th edition, Retrieved from https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-full-report.pdf
[149] ITC Trade Map, 2020, Retrieved from https://www.trademap.org/Index.aspx
[150] Ayele, Seife et al.. 2021, Enhancing China-Africa Cooperation in the Renewable Energy Sector, *Institute of Development Studies.* Policy Brief Issue 176.
[151] Shen, Wei, 2021

4.2.5 IP MECHANISMS

Having addressed the role of CRMs in trade and their role in developing Africa's green manufacturing capabilities, we now turn to the opportunities around technology transfer between China and African countries. Technology transfer refers to the flow of the know-how, elements, procedures, and methods of technology.[152] Technology transfer between China and Africa has for a long time been discussed amongst Africans and African policy makers. In fact, Africans have time and time again made it known that they are interested in technology transfer, with the former African Union Commission Chairperson – Nkosazana Dlamini – Zuma at the forefront.[153]

Sources indicate that during the 2018 Forum on China-Africa Cooperation (FOCAC), technology transfer was mentioned over 40 times.[154] A Chinese report also indicates that China intends to increase its technology transfer to Africa and will do this by creating 10 Luban Workshops ("鲁班工坊") to provide training to Africans.[155] Its first such workshop is in Djibouti and will focus on railway and commerce in the country. So far, 12 Luban workshops have been set up in Africa by the Tianjin University of Technology and Education with one such workshop in Ethiopia. The workshop set up at the Ethiopian Technical University aims at imparting Artificial Intelligence (AI) knowledge to the young Ethiopians.[156] Artificial Intelligence is important in Africa as the continent works towards providing electricity to its citizens in a decarbonized way.

AI coupled with Machine Learning (ML) can be used to map out potential areas to set up solar panels. AI can also be used to address the potential challenges that come with solar energy such as the intermittent supply of sunlight. Kenya in fact has turned to AI for this purpose while also using AI driven data to from a solar plant to spot potential failures in solar supply due to dust or shade.[157] It is no doubt that AI has a role to play in green technology in Africa with data being used to make informed decisions such as seeking alternative sources of energy knowing the downfalls of solar energy. It is for this reason that the Luban workshop in Ethiopia will be of great help not only for the country but also for the continent working towards electrification while being mindful of the environment.

Other than the Luban workshops, many African countries have benefited from China's willingness to transfer its technology knowhow. Zambia and Ghana have benefited as China has assisted in the renewable energies sector. These projects have made the use of renewable energies easier for Ghana and Zambia.

Kenya has also reaped the benefits of technology transfer from China. There is a training center called the China – Kenya Solid State Lighting Technology Transfer Center, that assembles solar lighting systems in Nairobi.[158] The need arose from a huge demand for renewable energy in the region as it is much more cost effective compared to the electricity provided by the government.

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[152] Gottwald J et al., 2013, Technology Transfer, Encyclopaedia of Corporate Social Responsibility. Springer, Berlin, Heidelberg, Retrieved from https://doi.org/10.1007/978-3-642-28036-8_673

[153] Yu-Shan Wu, How technical knowledge flows between China and Africa: It's complicated, (Africa Portal, 2 September 2019) https://www.africaportal.org/features/how-technical-knowledge-flows-between-china-and-africa-its-complicated/

[154] Ibid

[155] China Daily, 2019, Luban Workshops Witness International Cooperation, Retrieved from http://www.chinadaily.com.cn/a/201901/04/WS5c3416d1a31068606745f79b.html

[156] Xinhua, 2022, Chinese Luban Workshop Launched in Ethiopia to Boost Vocational Training, *Xinhua*, Retrieved from http://www.xinhuanet.com/english/2021-04/28/c_139913065.htm

[157] Power, Richard, 2021, Artificial Intelligence and energy justice in Africa, *Clyde & Co.*, Retrieved from https://www.clydeco.com/en/insights/2021/03/artificial-intelligence-energy-justice-in-africa

[158] Meza, Edgar, 2015, Kenya establishes solar technology transfer center, *PV Magazine*, Retrieved from https://www.pv-magazine.com/2015/04/27/china-kenya-establish-solar-technology-transfer-center_100019259/

Phyllis Wakiaga, CEO of Kenya Association of Manufactures says that technology transfer to Kenya has been beneficial as it has reduced Kenya's reliance on importing goods.[159]

4.2.6 SHARING INTELLECTUAL PROPERTY WITH AFRICA

China has been a member of the World Intellectual Property Organization (WIPO) for more than 30 years now, having joined in 1980.China then joined the World Trade Organization (WTO) in 2001 and as the 143rd country even after most African countries had joined the WTO. The years in between 1980 and 2001 were characterized with little IP enforcement and few litigation cases despite the availability of laws. In addition to this, China set up its first specialized IP court in 2014 and previously from 1996, all IP matters were heard in the IP division under the Supreme People's Court, 16 years after accession to WIPO. In general, the IP mechanisms in China protect innovation with the slow growth of IP in China despite WIPO dedicating the 2020 World Intellectual Property Day to a green future with innovation while supporting intellectual property rights.

The Chinese system was more inclined to innovation rather than protecting investor rights especially between 1985-1999 and such an environment promotes counterfeiting.[160] A study conducted by China's Research and Development Centre in 2001 showed that counterfeit goods amounted to approximately USD 19 billion to USD 24 billion in China. The country is notorious for producing counterfeit goods while also consuming them. In the spirit of routing for innovation, China has an open innovation policy with emphasis on who is the fastest to get their product to the market therefore not prioritizing IP. As the market enjoys the product the innovator's IP is not yet registered and enforced, it is too late for it to have an impact even when the IP is ready. Open innovation allows innovators to ride on another invention to make theirs better, therefore more often than not, by the time the IP of one innovation is out, the latest technology that used another to make theirs better is out and more popular than the old one.

China has been able to grow economically through innovation as innovation is seen to push a country to grow economically. China has also been used as a testing ground for new technology products due to easy access to the 1.4 billion consumers. While there are IP mechanisms in place, room for litigation and enforcement procedures, they are not an innovators first priority due to the open innovation policy coupled by a fast-paced technology demand in China. The IP mechanisms in China are not what promote innovation but the need to do better, to improve existing technologies and to push the known boundaries that technology has.

With this China context in mind, the main concern right now is if China's internal IP system facilitates technology transfer or if its mechanisms are a hinderance to trade between China and other countries specifically those in Africa?

China has protected its intellectual property, specifically with regard to technology transfer from as early as the 1980s. The protectionist move was in a bid to protect companies without experience in technology transfer from being taken advantage of. Now, technology transfer has been regulated by the Administration of Technology Import and Export Regulations (TIER) and

[159] CGTN, 2021, Chinese firms boosting Kenya's manufacturing sector via technology, Retrieved from https://newsaf.cgtn.com/news/2021-09-14/Chinese-firms-boosting-Kenya-s-manufacturing-sector-via-technology--13x2mTtdSUq/index.html
[160] Grinsted, Peter & Eugene, Ovigwe, 2021, China's Model of Innovation: Are there Lessons for African Countries?, *Centre for Global Development*, Retrieved from https://www.cgdev.org/sites/default/files/China-model-innovation-lessons-for-Africa.pdf

for a long time prompted forced technology transfer (FFT) while dividing exports into three categories:

a) Freely tradable
b) Restricted; and
c) Prohibited.[161]

In 2020, the TIER was amended while at the same time adjusting the lists in each category.[162] In the event one wants to export a restricted item, they must apply to the provincial government for an export license. Under the new amendments, technology transfer will be restricted due to public reasons and or national security that will be determined by the government officials.

African governments that have retained Chinese companies to develop certain aspects of their countries such as in the railway and renewable energy sectors have a lot to think about. In the event technology transfer is denied, this will lead to dependency on foreigners for the development of their countries. Under the previous TIER, China had included FFT which has since been removed under the newly amended TIER. FFT was experienced first-hand when China was in a growth period and required technology transfer in their quest to develop and grow in almost all sectors. China required foreign investors to partner with local companies and transfer its technology to its people. For example, Germany's Siemens in the early 2000s transferred its railway technology from Germany to China aiding China in becoming the high-speed railway powerhouse it now is.

It is important for African countries and other developing countries to benefit from technology transfer especially from countries facilitating development such as China. This involves encouraging the development of tech capacity in the country where the project is being carried out. One interviewee asserted that stakeholders often overlook '*the key aspect of first understanding the contractual terms and conditions of any project. […] The contractual aspects [can be] limiting in terms of genuine tech capacity building in the renewable energy projects.'* They may also want to adapt lessons from China's FFT policy to ensure technology transfer. The effects of the new TIER regulations may stifle this rendering Africans helpless in terms of technology transfer should the government deny a company an export license. However, it might also be a blessing in disguise for African government intending to trade with China as there is room for negotiations.

Currently, there are those that are inclined to the proposed auction-based system where foreign companies will be required to bid for a tender before development. This will allow African governments to choose a bidder that is also open to technology transfer especially in the early stages of work as there might be little technical know-how in the country. It also means that Chinese stakeholders may also need to adapt to the auction-based system in relevant situations.

In conclusion, China might limit technology transfer especially with the amendments to the TIER regulations. However, African countries must be willing to negotiate on matters technology transfer as in the long run an informed and well-abled citizenry will build technology that best suits their countries.

[161]Ho, Victoria et al., 2020, China: Technology export control and beyond, Retrieved from https://www.allenovery.com/en-gb/global/news-and-insights/publications/china-technology-export-control-and-beyond
[162]Sheng, Jenny et al., 2020, China Tightens Technology Export Control Rules, Retrieved from https://www.pillsburylaw.com/en/news-and-insights/china-tightens-technology-export-control-rules.html

Now, how do these issues apply to people-to-people cooperation mechanisms? Has and can the Africa-China people relationship contribute to Africa's growth and climate ambitions?

4.3 People to People Cooperation

An important but often forgotten area between China-Africa cooperation in climate change is people-to-people strategic interaction – for example in the form of capacity building, or people flows. China already partners with Africa in capacity building, for example in technologies for agricultural production, sustainable transport systems, water management and resource management, some of which touch on policies that China has used domestically. It is worth noting that China's policy exchange work is mainly focused on approaches that have already been used domestically in China. This approach often differs from other donors' approaches, which may seek to provide policy 'advice' that may or may not have been used as a domestic policy in the donor countries.

As carbon trading has been increasingly mentioned internationally, the section will first present a brief overview about carbon trading in China and Africa and address the implications of Chinese experience with carbon trading schemes, which can be helpful for African own development on this topic, as an example of how capacity could be built in a climate-relevant area. This section will also explore China's attitude towards climate migrants.

4.3.1 CHINA'S CARBON TRADING SCHEMES AS AN EXAMPLE OF SHARING DOMESTIC POLICY EXPERIENCE

The Chinese government policy towards Carbon Trading Schemes is embodied by its recently created "Emissions Trading Scheme" (ETS), China's main market-based tool to abate carbon emissions in its power sector and achieve its climate goals. First thought of and initiated as a regional pilot program in 2013 (there are now eight regional pilot ETSs), China's national ETS was officially launched in 2017, and entered its first compliance period in 2021.[163] Its initial phase covers coal- and gas-powered plants, including those for co-generation, but it is set to be extended to other energy-intensive sectors in the near future, as industry and the aviation sector are to be included by 2025. Nevertheless, China's ETS will be the world's largest by ETS, covering coal- and gas-fired power entities whose emissions amount to roughly more than 40% of the country's total CO_2 emissions.[164]

Unlike other mainstream mass-based ETSs that having a predetermined absolute cap on emissions levels, China's uses an output- and rate-based approach for allowance allocations, which entails that "allowances are determined according to actual electricity and heat output over the compliance period and predetermined CO_2 emissions intensity benchmarks".[165] In other words, China's ETS is based on the plants' energy intensity, rather than on the nation's energy

[163] International Energy Agency, 2021, The Role of China's ETS in Power Sector Decarbonisation, Retrieved from https://www.iea.org/reports/the-role-of-chinas-ets-in-power-sector-decarbonisation
[164] Ibid
[165] Ibid

absolute, so that emissions may be abated relatively without impacting - at least in the short term - the growth of the economy.

4.3.1.1 Implications of Chinese experience in carbon trading for African countries

China has dominated the CDM market since its inception, accounting for about 66% of all registered CDM between 2002 and 2008. The latest data reveals that around 48% CDM registered projects are in China.[166] Analysts believe that the great success of the CDM in China is largely due to the strong coordinated capacity building that China has. Various ministries and departments from both central- and provincial level, such as the National Development and Reform Commission, the Ministry of Ecology and Environment, and the Ministry of Science and Technology, has involved to initiative and implement CDM projects.[167] This cross-departmental approach allows the government to monitor projects closely and ensure that the expected local benefits are realized. In this way, increasing Africa's access to CDM projects is important and will contribute to the continent's renewable energy development.

China could play an important role in such CDM reform. Many African countries, such as Kenya, Ghana, Mozambique, Uganda, and the DRC, have seen a surge in demand for offset projects in the voluntary carbon markets. China could share its experience and knowledge with African countries on, for example, how to design CDM projects that are more attractive to investors. During interviews it was commented that China could use its expertise in supplying carbon credits and designing methodologies to provide consultancy capacities to other countries that want to engage in carbon offsetting projects. China could also be an investor in those carbon offset projects. It was mentioned during interviews that while China is facing challenges related to its own domestic carbon market, there are options for China to use international carbon offset schemes to invest in African renewables such as EVs and urban transportation systems.

It took nearly a decade from the time China had the idea to establish a carbon trading scheme to formally adopt its ETC. Chinese experience is unique, as in the past, as a major manufacturing hub and exporter of consumer goods, China's large proportion of growing emissions was due to the rest of the world's dependence on Chinese exports. And it is even more important for Africa, as an emerging and future manufacturing base, to embed a carbon trading framework into policies that apply to its own industrial development and the African Union's Agenda 2063.

4.3.2 CHINA'S POLICY TOWARDS CLIMATE MIGRANTS

The attitudes of the Chinese government towards climate migrants are mostly contained to the country's own internal experience with climate-led migration, as there seems to be few (if any) official policies and perspectives related to climate migration in other settings, including Africa. The only exception to this has been the recent 'Declaration on China-Africa Cooperation on Combating Climate Change', where it is stated: "We believe that climate change, and the migratory movements that result from it, are a common challenge facing humanity and must be

[166] Fenhann, Joergen, 2022, CDM pipeline spreadsheet, UNEP Copenhagen Climate Center, Retrieved from https://www.cdmpipeline.org/
[167] Kinkead, Belinda, 2012, China Successfully Uses Market Mechanism for Sustainable Development, Ecosystem Market Place, Retrieved from https://www.ecosystemmarketplace.com/articles/china-successfully-uses-market-br-mechanism-for-sustainable-development/

addressed through united actions under multilateral frameworks".[168] However, which multilateral frameworks are intended here, or which united actions are implied, is not further detailed out.

Regarding Chinese climate migrants, the government's attitudes and policies are shaped by the long history of Chinese mass migration, alongside the country's current high risk of climate vulnerability.[169] The main government approach to the issue has been to sponsor and promote "Environmental Displacement and Resettlement" of communities that reside in environmentally vulnerable contexts, so that (a) the communities might be protected from the adverse effects of climate degradation, (b) the environment might be protected from further human activity, and (c) the development of the country might be accelerated through urbanisation and industrialisation.[170] These aims are reinforced by the facts that communities residing in environmentally vulnerable areas are both amongst the poorest of the country, and are also ethnically diverse, so that their relocation should aid in the fulfilling of China's poverty reduction and affirmative action agendas.

Beyond "Environmental Displacement and Resettlement", the government has also recently commenced prioritising Adaptation in environmentally vulnerable communities, especially within agricultural areas (which are increasingly scarce around the country). In lands at risk of drought, for example, official policy has been to share early warning and prevention information with farmers, and provide farmers with technical, financial, and physical support.[171] Whilst these initiatives are only at their onset, they signal a partial shift in thinking on the part of the Chinese government, as now adaptation seems to have become an acceptable alternative to the mantra of displacement and resettlement.

[168] The 8th Ministerial Conference of the forum on China-Africa Cooperation, 2021, Declaration on China-Africa Cooperation on Combating Climate Change, Retrieved from http://focac.org.cn/focacdakar/eng/hyqk_1/202112/t20211203_10461928.htm

[169] Gray, Clark et al., 2020, The changing climate migration relationship in China, 1989-2011, *Climate Change* 160, 102-122, Retrieved from https://link.springer.com/article/10.1007/s10584-020-02657-x

[170] Yan Tan, 2011, Chinese Perspective on Climate Change and Resettlement, *Population Environment Research Network*. Retrieved from https://www.populationenvironmentresearch.org/pern_files/statements/Tan

[171] Chen, Huang et al., 2014, Policy Support, social capital, and farmers' adaptation to drought in China, *Global Environmental Change* Volume 24, 193-202, Retrieved from https://www.sciencedirect.com/science/article/pii/S0959378013002173?

CHAPTER FIVE:

5 THE IMPLICATIONS OF CHINA'S EVOLVING AFRICA POLICY

5.1 Overall Trends of FOCAC Commitments

The commitments announced during each Forum on China-Africa Cooperation (FOCAC) closely guide and influence China's activities in Africa (*see Annex for specific commitments*). There has been a huge progress of China on its climate-change related commitments. Specifically, from FOCAC 1 (2000) to FOCAC 3 (2006), commitments were broadly focused on cooperation in energy and natural resources and environmental protection, rather than special target of climate change. "Climate change" was not mentioned until FOCAC 4 in 2009, when United Nations Framework Convention on Climate Change and Kyoto Protocol were referred to under the category of Cooperation in International Affairs. China started to make concrete commitments to strengthen cooperation with Africa in tackling climate change.

FOCAC 6 in 2015 is a big step up for climate change, as China expanded the cooperation in terms of focusing area, funding, and mechanism, including to set up the China-Africa Environment Cooperation Centre, launch the "China-Africa Green Innovation Project" under the framework of "China South-South Environmental Cooperation-Green Envoys Programme". Notably, China also committed to make available 20 billion RMB ($3.2 billion) for setting up the China South-South Cooperation Fund, although there is no further detailed information disclosure about the status of this fund to date.

Since then, more climate change related commitments have been witnessed under the FOCAC document. For example, the term of "Green Energy" was first used in FOCAC 7 in 2018 to encourage green energy financing and explore green and sustainable ways of energy cooperation between the two side. China also reclaimed to support the development of renewable energy, mainly solar energy in Africa and will consider establishing a China-Africa Geoscience Cooperation Center for joint research on national resources sustainability and environment. More recently, at FOCAC 8 in 2021, "Green Development" is the brand-new section with a series of action points targeting green energy and climate change. For example, China committed to undertake 10 green development, environmental protection and climate action assistance projects for Africa and support the development of the Great Green Wall. In addition, Declaration on China-Africa Cooperation on Combating Climate Change was issued as a key outcome document of FOCAC 8.

5.1.1 FOCAC'S LINKAGE WITH CHINA'S DOMESTIC POLICY

China has been improving its domestic climate change policy over the past decade. The 11th Five-Year Plan (2006–2010)[172] was the first to include a binding target for energy efficiency.

[172] China's National Economic and Social Development "11th Five-Year Plan" Outline. 2006. https://www.chinanews.com.cn/news/2006/2006-03-16/8/704064.shtml

Climate change adaptation was clearly addressed in China's 12th Five Year Plan (2011-2015)[173] for the first time. The 12th Five Year Plan included the rate of reduction of carbon dioxide emissions per unit of GDP (carbon intensity) as a binding indicator in the outline of national economic and social development planning, and identified key tasks, important areas and major projects to address climate change. Three pillars are outlined 1). Control of GHG Emissions 2). Enhancing Capacity to Climate Change Adaptation 3). International Cooperation on Climate Change. In 2013, the Chinese government released its first National Climate Change Adaptation Plan and China issued National Plan For Tackling Climate Change 2014-2020 in the coming year, with the target to cut carbon emissions per unit of GDP by 40-45% from 2005 levels and to increase the percentage of non-fossil fuels in primary energy consumption to 15% by 2020. Though little changes were made in the 13th Five Year Plan comparing to the 12th FYP on climate change, China's 14th FYP and Vision 2035[174] outline the binding target of reducing CO2 emissions per unit of GDP by 18% by 2025 compared to 2020.

Overall, China's enhancement on its domestic policy on climate change seems to have positive affects in particular after 2011. With China's growing attention towards climate change, it is seeking to expand international climate cooperation. As mentioned in the section above, China started to provide more holistic assistance to Africa including policy dialogue, capacity building and technological transfer from FOCAC 6 in 2015, right after series of climate change policies were issued domestically. As key documents published at most recent FOCAC 8, Declaration on China-Africa Cooperation on Combating Climate Change and China-Africa Cooperation Vision 2035 are closely in line with China's domestic Vision 2035 strategy.

5.1.2 REVIEW OF FOCAC DOCUMENTS AND OUTLINE OF PREVIOUS TECHNOLOGY TRANSFER

Most of China's technological transfer on climate change and green energy are provided through sets of projects. In 2009, China committed to assist African countries with 100 small-sized well digging projects for water supply and clean energy projects of biogas, solar energy and small hydro-power plants[175] and another hundred projects in 2015. The number of this type projects declined to 50 at FOCAC 7 in 2018 and then to 10 at latest FOCAC in 2021. Example of such project includes clean energy demonstration projects in Gabon have helped increase their electricity supply while reducing the adverse impact on the environment.

In addition, China provided technical support for African countries on environment surveillance through data sharing from the China-Brazil Earth Resources Satellite and Fengyun meteorological satellite, as well as to promote the application of the data in land use, weather monitoring and environmental protection in Africa since FOCAC 4.[176] According to China's Foreign Aid White Paper,[177] China started to build automatic meteorological observation stations, high-altitude observation radar stations and other facilities, provide forest protection equipment from 2012 to support Africa in strengthening ecological protection and addressing the challenges of climate

[173] China's National Economic and Social Development "12th Five-Year Plan" Outline. 2011. http://www.gov.cn/zhuanti/2011-03/16/content_2623428.htm
[174] China's National Economic and Social Development "12th Five-Year Plan" and Vision 2035. 2021. http://www.xinhuanet.com/2021-03/13/c_1127205564.htm
[175] Forum on China-Africa cooperation Sharm El Sheikh Action plan (2010-2012), Retrieved from http://www.focac.org/eng/zywx_1/zywj/200911/t20091112_7933571.htm
[176] Ibid
[177] The State Council of the People's Republic of China, 2014, The People's Republic of China, China's Foreign Aid White Paper, Retrieved from http://english.www.gov.cn/archive/white_paper/2014/08/23/content_281474982986592.htm

change. China also committed to build low-carbon demonstration zones and climate adaptation demonstration zones in Africa and to propose satellite remote-sensing Cloud services to more African countries at FOCAC 8.

Detailed commitments made are as following:

	Commitments
FOCAC 1 & FOCAC 2	• Invest in natural resource and energy sector (with environmental considerations).
FOCAC 4	• 100 small-sized well digging projects for water supply and clean energy projects in the next three years. • Advance cooperation in environment surveillance. Share data from the China-Brazil Earth Resources Satellite and promote the application of the data in land use, weather monitoring and environmental protection.
FOCAC 6	• implement 100 clean energy and wildlife protection projects, environment friendly agricultural projects and smart city construction projects. • Provide rapid mapping service for disaster emergencies based on space technology for emergency disaster responses.
FOCAC 7	• 50 projects for green development and ecological and environmental protection in Africa to expand exchanges and cooperation with Africa on climate change, ocean, desertification prevention and control, and wildlife protection. • Expand exchanges and cooperation on climate change, ocean, desertification prevention and control, and wildlife protection.
FOCAC 8	• 10 green development, environmental protection and climate action assistance projects. • Support the development of the Great Green Wall. • Build low-carbon demonstration zones and climate adaptation demonstration zones. • Supports the African Agriculture Adaptation (AAA) and Sustainability Stability and Security (SSS) initiatives. • Propose satellite remote-sensing Cloud services to more African countries.

5.1.3 REVIEW OF FOCAC DOCUMENTS AND OUTLINE OF PREVIOUS CAPACITY BUILDING INITIATIVES

In terms of capacity building, training sessions in topics such as climate change, environmental protection and resources management are dominated forms of capacity building between the two side. China started to provide training on environmental protection for African countries since FOCAC 3 in 2006. The area of training has been expanding over the years, including climate change, forest resources cultivation, the use of new energy, environmental management and pollution prevention and control. From 2013 to 2018, China held more than 200 training programs on climate change and ecological and environmental protection themes, and set up specialties

such as environmental management and sustainable development in academic degree programs, training more than 5,000 personnel for relevant countries.[178] To increase Africa's research capacity, China committed to support the establishment of a number of research institutes such as UNEP China-Africa Environment Center and China-Africa Geoscience Cooperation Center.

Additionally, China supports Africa in improving the structure of its energy and resources industrial chain, improving its capacity to process energy and resources products, increasing the added value of products, and upgrading its energy and resources industrial chain toward greener development. For example, the China-supported Garissa photovoltaic power station in Kenya has an average annual power generation capacity of over 76 million kWh, helping to reduce 64,000 tons of carbon dioxide emissions annually.[179]

Details of commitments made are as follows:

Commitments	
FOCAC 3	• Increase the number of environmental protection administrators and experts from Africa to receive training in China in the next three years.
FOCAC 4	• Enhance capacity building in meteorological infrastructure and forest protection and management. • Scale up assistance and training in disaster prevention, treatment of desertification, ecological protection, and environment management.
FOCAC 5	• Share the experience of applying space technologies to disaster reduction. • Exchanges in remote sensing drought surveillance technologies and upgrade drought surveillance capacity
FOCAC 6	• Promote the development of the "China-Africa Joint Research Centre" project. • Cooperate in biodiversity protection, prevention of desertification, sustainable forest management and modern agriculture demonstration.
FOCAC 7	• Consider the joint establishment of a China-Africa Geoscience Cooperation Centre. • Provide Fengyun meteorological satellite data, products and necessary technical support. • Provide meteorological and remote-sensing application equipment, education and training support. • Host regular workshops and training sessions on disaster risk management, application of disaster relief and mitigation technologies, and public awareness campaigns. • Send experts to local communities to guide and organize training and capacity-building activities.
FOCAC 8	• Support Africa in improving the structure of energy and resources industrial chain.

[178] The State Council of the People's Republic of China, 2021d, White Paper: China's International Development and Cooperation in the New Era, Retrieved from http://www.scio.gov.cn/zfbps/32832/Document/1696686/1696686.htm

[179] Ibid

Commitments	
	• Support to improve Africa's capacity to process energy and resources products, increasing the added value of products.

Again, there is currently no database or platform inside or outside China to track how these climate-related commitments under FOCAC are being met or have been delivered.

5.2 China's approach to specific new Climate policies as applied to African countries

As one of the world's leading economies and development partners, China's domestic efforts to tackle climate change issues are important to Africa as well, especially as the FOCAC commitments are largely tied to China's domestic policies. But more concrete actions are urgently needed. First, from the previous FOCAC analysis, it can be seen that most of China's commitment on climate change in Africa under FOCAC are focused on capacity building and the construction initiatives such as green development, environmental protection or demonstration park projects. Although the number of specific planned construction projects is consistently mentioned, it remains difficult to track the real impact of these projects. Second, FOCAC 8's Declaration on Climate Change has mentioned to increase China's green investment to Africa. But specific commitments on exact numbers of green investment or climate-related financing are still missing. Third, though the FOCAC 8 documents includes an action plan to accelerate the cooperation between China and Africa under the South-South Cooperation, the information of project implementations is lacking.

However, the very fact that FOCAC does drive China's climate policy towards Africa means that suggestions for new policies need to either be piloted and then incorporated into the framework or agreed through that framework and then piloted. In all cases, language linked to existing Chinese policy is key to use. For example, clearer linkage to the BRI for green development on low-carbon infrastructure (such as wind and solar PV) could be one of the priorities in next FOCAC commitments.

Three key examples are provided below.

5.2.1 CHINA'S ROLE AND APPROACH TO 'JUST TRANSITION' PARTNERSHIPS

China tends not to use "just transition" phrase and wording. Speaking at the UN General Assembly, last September, China's president, Xi Jinping, announced China would provide strong support for "green transitions" in developing nations. Around China there are several domestic examples of green industries moving into sectors formerly dominated by heavy industries and creating jobs from the transition. For example, the city of Taiyuan in Shanxi province successfully switched its complete taxi fleet from fossil fuels to EV taxis through effective planning and subsidies[180] Examples such as these have made China as a leader in green jobs. China

[180] China Dialogue, 2018, Chinese coal town embraces electric vehicles, Retrieved from https://chinadialogue.net/en/transport/10335-chinese-coal-town-embraces-electric-vehicles/

accounted for almost 40% of global jobs in the renewable energy sector in 2019, with over 4 million people employed in the sector.[181]

With regards to Africa, the announcement that China will cease to finance coal powerplants has marked a new beginning for China-Africa cooperation in energy transition. As noted above, research suggests that Chinese firms currently in Africa don't often engage in project development. Shen Wei, an energy expert with the UK's Institute of Development Studies, says that *"in South Africa and elsewhere on the continent, Chinese firms involved in renewable energy projects usually act as engineering, procurement, and construction contractors – few are the project developer. That limits what Chinese firms can do to help with a just transition".*[182] One explanation for this is the lack of a Chinese "green transition" model.

Shen argued that *"Chinese firms should build long-term community partnerships and produce long-term plans for their operations. In particular, they should have specific teams and budgets dedicated to understanding local needs to help the firms win more renewables projects".*[183]

The Just Energy Transition Partnership (JETP) announced at COP 26 is mitigation-based and as such it is most suitable for countries with high carbon emissions. This makes South Africa a perfect candidate for the JETP, since it generates about 80% of its power from coal, making it the world's 12th largest carbon emitter. At the same time, South Africa received a significant amount of the 5% of global FDI flows that entered the continent in 2021 and has been designated as one of the most favorable countries for investment in renewable energy in Africa, alongside Egypt.[184] Scaling up private investment in renewable energy to replace coal is therefore arguably more feasible in South Africa than anywhere else on the continent.[185] This makes the JETP and its 'transition' framework hard to replicate in the African context, and as a result brings up several key questions around the appropriateness of JETPs for other countries on the continent. Firstly, do other countries on the continent require the same type of 'transition' framework support as that which South Africa will receive under the JETP framework? And secondly, is the model of one recipient and several donors suitable, and indeed beneficial, for African countries?

Could a JETP between China and African countries be feasible? For the JETP model to be an effective approach to China-Africa energy transition cooperation, it must be with countries with similar characteristics like South Africa, in particular its attractiveness for private sector investment. That said, a Chinese version of JETP could be phrased as GETP (Green Energy Transition Partnership), and China could develop a model that speaks to its economic relations with Africa. Criteria for its model could be rapidly industrialising, energy poor countries that already have a strong Chinese presence in their manufacturing sector.

In this regard, a country such as Ethiopia that currently host SEZs is a strong candidate. Other countries like Nigeria that are positioned to host Chinese owned factories will also make good candidates. This approach has a dual benefit, firstly it would see China play a bigger role in helping African countries with financing to build greener energy generation capacity to power their

[181] Climate Scorecard, 2020, China leads green jobs in renewable energy sector, Retrieved from https://www.climatescorecard.org/2020/09/china-leads-green-jobs-in-renewable-energy-sector/
[182] China Dialogue, 2021, How can China help South Africa achieve a just transition?, Retrieved from https://chinadialogue.net/en/climate/how-can-china-help-south-africa-achieve-a-just-transition/
[183] Ibid
[184] University of Oxford, 2022, Invest strategically in wind and solar farms in Africa – Oxford study, Retrieved from https://www.ox.ac.uk/news/2022-01-26-invest-strategically-wind-and-solar-farms-africa-oxford-study
[185] UNCTAD, 2022, Investment flows to Africa hit a record of $ 83 billion in 2021, Retrieved from //unctad.org/news/investment-flows-africa-reached-record-83-billion-2021

industrialisation. While also greening Chinese oversees manufacturing and help them play a bigger role in project development.

5.2.2 CHINA'S ROLE AND APPROACH TO NATURE-BASED SOLUTIONS & DEBT-FOR-CLIMATE SWAPS

There is evidence from FOCAC 8 documents that China supports Nature Based Solutions (NBS). The problem is that NBS are actually very hard to do in a way that is responsible and sensitive to local environments. e.g., Just planting trees that are going to capture carbon isn't necessarily sensitive to or beneficial for local ecosystems and biodiversity and it's very hard to get across those subtleties in the Chinese target-driven system.

Conceptually, NBS cannot be seen as an alternative to rapid decarbonisation. Especially for countries already eyeing growth is non-renewable power generation and steel production. NBS take time and their capacity to absorb carbon tends to be limited. There is a real issue that governments may see NBS as an easy option with political and reputational wins, a way to skirt doing the really hard work of reforming the political economy of the heavy industry sectors.

5.2.3 DEBT-FOR-CLIMATE SWAPS

Debt-for-climate swaps have been defined as '*an incentive-based solution for achieving conservation targets in highly indebted countries, where organisations and/or government creditors negotiate with government debtors to cancel or reduce debts in return for binding commitments to protect threatened species, reduce deforestation, or achieve other environmental goals'*.[186] Debt-for climate swaps have been used in over 30 countries, with the first occurring between the Bolivian government and US-based NGO Conservation International in 1987.[187]

China has no prior experience in engaging in debt-for-nature or debt-for climate swaps. However, the IIGF Green Belt and Road Initiative Center, based in Beijing, have concluded that debt-for-climate swaps in the BRI could be a key tool in debt restructuring and in green development.[188] They have provided several recommendations for Chinese stakeholders, including establishing a dedicated policy-making agency and creating debt-for-climate agreements tailored to each country's own environmental goals.[189] The Global Development Policy Center at Boston University has also encouraged China to engage in debt-for-climate swaps in a recent report, stating that such a move would help simultaneously tackle climate change and provide more financial stability for debt-stressed countries, as well as showing Beijing's commitment to global finance and climate action.[190]

[186] Boston University Global Development Policy Center, 2021b, Debt Swaps: How China can Create Opportunities for Financial and Environmental Stability, Retrieved from https://www.bu.edu/gdp/2021/01/29/debt-swaps-how-china-can-create-opportunities-for-financial-and-environmental-stability/#:~:text=Traditional%20'debt%2Dfor%2Dnature,to%20protect%20threatened%20species%2C%20reduce
[187] ibid
[188] IIGF Green Belt and Road Initiative Center, 2021, Debt-For-Nature: A Triple-Win Solution for Debt Sustainability and Biodiversity Finance in the Belt and Road Initiative (BRI)?, Retrieved from https://green-bri.org/debt-for-nature-swaps-in-the-belt-and-road-initiative-bri/
[189] ibid
[190] Boston University Global Development Policy Center, 2021b

CHAPTER SIX:

6 CONCLUSIONS AND RECOMMENDATIONS

The in-depth analysis conducted for this report, as well as insight gathered from expert interviews, have highlighted several key conclusions on the nature of current engagement between African and Chinese stakeholders on climate change and possible directions for the future. These overall conclusions are detailed below and are followed by both general and more specific recommendations for both African and Chinese stakeholders.

1. There is no shortage of African ambition to tackle climate change

This report demonstrates that there is no shortage of ambition to take climate action and its effects across the continent, even in some of the lowest income countries. This ambition is expressed in both mitigation and adaptation targets detailed in NDC commitments, as well as in partnerships with countries such as China. For instance, the limited finance that has been available to date has been directed by African governments towards a mix of fossil-fuel and renewable energy, and data suggests that Chinese stakeholders have engaged in both types.

2. To deliver on Agenda 2063, fast, green growth is needed, but challenging

Our modelling of four scenarios of climate and growth ambition on the continent suggests that the scenario where growth accelerates while NDC ambitions are still realised ("high ambition") – leads to a modest increase of emissions by 35% by 2030 and by 201% by 2050 compared to 2018 levels, meaning that emissions increase by three times over the next three decade. This scenario best meets African development needs and aspirations, and – as the analysis of China-Africa cooperation to date suggests - China has the scale and finance to support it. However, it is unclear whether many other development partners will really support the delivery of this scenario, especially because of the level of change it requires to global supply chains, the volume of climate finance it might require (especially given lack of achievement to date), and the fact that it is less climate-friendly than a scenario where development partners simply focus on universal energy access and African NDCs.

3. There is insufficient finance and technology transfer

While there are high levels of ambition to tackle climate change and build greener futures, there is a lack of finance and technology transfer to facilitate African countries' transitions to greener economies. Over 80% of both mitigation and adaptation financing targets for selected case study countries are conditional on international financial support.

4. China is a key partner for African stakeholders on climate change

The analysis of existing climate change engagement between African and Chinese stakeholders has highlighted China's role as a key partner for African stakeholders in various different areas such as finance, trade and investment. Climate finance has also been provided through frameworks such as FOCAC and the BRI. China has been a key partner is both non-renewable and renewable energy projects. This provides the basis for several opportunities for continuing and bolstering engagement, also as China moves towards a low-carbon transition itself.

5. Chinese state-owned enterprises have built their capacity in EPC contracts, especially in green solutions

Several of the experts interviewed for this report spoke of an expected increase in public-private partnerships across the continent for green projects in various sectors including energy, especially given (often undue) international pressures that many African countries are under to reduce debt levels. However, this could prove a mismatch for China. For example, in the energy sector, Chinese state-owned enterprises have extensive experience in EPC contracts, especially related to hydro projects. The move to more auction-based contracts may prove a challenge for Chinese stakeholders, who comparatively do not have as much experience with these types of contracts. Thus, both African and Chinese stakeholders must be cautious when accepting calls for reduced debt spending.

6. China has been responsive bilaterally, but needs are not always well articulated continentally

This report's analysis into existing cooperation has shown that China has been responsive bilaterally to African needs – for example in the energy sector, but that cooperation has not always been well articulated on a continental level. This reflects China's current model for coordinating with stakeholders to deliver aid, loans and investment on a bilateral rather than on a multilateral basis, although there are indications this could change especially via AIIB and NDB. Engagement with pan-African institutions such as the AfDB and AfCFTA also provide important opportunities for regional delivery.

7. China's domestic and international policy sets the stage for delivery on the ground

The report shows that China's grand policy direction – set centrally and often by the President – is key to unlocking interest and actual (financial) incentives for cooperation by Chinese actors towards African actors and countries. Thus, any grand future cooperation needs from the African point of view must be understood and a policy vision and/or targets set at the national level if Chinese financial, public and private stakeholders are to deliver.

KEY RECOMMENDATIONS

These conclusions lead us to a number of recommendations for the way forward, relevant to both African and Chinese stakeholders:

1. First, we strongly recommend that **African and Chinese stakeholders jointly and explicitly work towards the "high green growth" scenario** outlined in **Chapter 3**. This will not only lead to a higher likelihood that Africa meets Agenda 2063 but will also provide a benchmark for Africa's other development partners to meet.

2. Given the significant effort and determination this scenario will entail, there is an urgent need for **more concrete targets** to be set by both African and Chinese stakeholders for climate-friendly projects and climate change action across the continent – at the very least for the energy sector (such as overseas renewable energy installation targets and/or investment targets) but also for instance in the transport sector as well as trade (e.g. in relation to value-addition investment into and infrastructure for CRMs). The use of more detailed and concrete targets will ensure incentives on all sides to try new ways of working such as PPPs, and provide a common goal for all parties involved to work towards.

3. There is a **continued need for loans from China and others** to enable Africa's green transition at the required scale. This report has highlighted the lack of financing available to African stakeholders. China and African countries should not be afraid to continue to finance – especially through highly concessional, long-term loans - particular areas of existing Chinese expertise and African experience such as hydro (or high-speed rail for transport) to enable African countries to transition towards greener economies. Supporting green regional infrastructure projects is a key first step to deliver this, as part of the FOCAC8 commitment, linking to Africa's PIDA framework. Opportunities around developing more regional cooperation in renewable energy projects and regional power pools and regional transport networks exist.

4. While African countries and China should avoid relying on PPPs to deliver major public goods, in some areas this has worked in African countries and China, and can continue to work, especially with clear and strong government regulation. In this sense, there is a need for the **financial and logistical barriers for smaller-scale green and renewable PPPs** to be considered and addressed, and gradually scaled-up where it makes sense.

5. **FDI from China into green manufacturing and the production of value-added goods on the African continent should be a major priority** for both African and Chinese stakeholders, including to shift the structure of African economies to stimulate higher yet green growth as well as technology transfer. This includes using CRMs already available on the continent to manufacture green goods such as solar panels and wind turbines, including by locating in existing special economic zones. African stakeholders can learn from China's own experiences in developing these green industries and create more coordinated frameworks for capacity building and skills transfer.

6. **One or two pilots** for “Green Energy Partnerships” could be initiated by China – for example in one of the continent’s sub-regions or a country such as Ethiopia or Nigeria which will likely be centres of gravity for Chinese investment in manufacturing in future, and also have large populations and therefore markets for China’s green products. A national pilot partnership would allow countries to further develop their green manufacturing and renewable energy production, thereby reaching their goals related to the SDGs and Agenda 2063 by ‘scaling up’ levels of industrialisation and energy access. Alternatively, or in addition, regional pilot frameworks could help build regional power pools or much needed power storage facilities, that would in turn better facilitate the import and export of renewable energy across borders. Such frameworks could also be framed around transport or other sectors (e.g. “Green Transport Partnerships’’).

7. African governments must **be more strategic regarding China engagement** – sharing experience to date, being transparent with citizens/businesses and each other on and negotiating contracts that allow for capacity building and skills transfer on the ground, and not just using technology imported from China, as well as more stringent environmental regulation and monitoring. Chinese stakeholders (and their African partners ideally) will then be able to abide by these standards. These considerations can also be part of the early phase of projects and included in contracts.

8. Chinese stakeholders need to continue to **understand in more depth** the special and unique opportunities and challenges of investing in African countries. This is not just a case of using analysis provided by traditional IFIs or European/American-based firms. Analysis must be tailored for Chinese audiences with a Chinese development outlook and provided with a view to better delivering on African aspirations, integrating with the local environment and the local populations and adding value across African countries. As one interviewee put it: “*There is a need for a transition from “what we know on the ground” to “what must be done”.*


ANNEX 1: OTHER DETAILED RECOMMENDATIONS ARISING

RECOMMENDATIONS ON FINANCING MITIGATION AND ADAPTATION MECHANISMS

African stakeholders

- There is a need for more specific renewable energy targets and an understanding of how Chinese stakeholder involvement can help achieve these targets.
- Improve frameworks around EPCs. More organisation around negotiations of EPC contracts.

Chinese stakeholders

- Chinese stakeholders need to increase access to concessional loans for green financing. Increase financing in non-hydro projects.
- For Chinese stakeholders, PPPs have not been a major part of involvement in African infrastructure landscape. If they continue with EPCs, then they need to show that they are not risk averse and that they're ready to invest in these projects.
- If Chinese stakeholders do decide to enter into PPPs, then then there needs to be more understanding regarding African markets and the different types of PPP contracts.

RECOMMENDATIONS ON TRADE & TECHNOLOGICAL TRANSFER

African stakeholders

- African countries should use available CRMs and other locally sourced materials to develop green goods manufacturing. This would help grow local manufacturing and decrease dependency on the import of green goods such as solar panels and wind turbines.
- The AfCFTA allows countries to develop shared goals and to encourage the flow of intra-African trade in EGs and environmental services. However, African countries need (green) infrastructure in place for this to be successful.
- The development of local manufacturing and trade can help harness the massive renewable energy potential on the continent, which has thus far not been developed but will be essential for building more sustainable societies.
- By entering into global EGs chains African countries can set an example of how countries with low levels of energy infrastructure can harness natural resources and develop low-carbon sustainable power systems.[191]

[191] Powanga, Luka & Giner-Reichl, Irene, 2019, China's Contribution to the African Power Sector: Policy Implications for African Countries, *Hindawi Journal of Energy*. Volume 2019, Retrieved from https://doi.org/10.1155/2019/7013594

African countries can benefit from China's own experience of developing their EGs sector, through areas such as environmental standards and regulations, capacity building programmes, skills transfer and various energy advisory opportunities.

The increased manufacture and trade of EGs would also aid the creation of environmental services, as these are closely linked to the manufacture of EGs.

African governments intending to use Chinese skills must enforce technology transfer and capacity building from an early contractual stage. There is a very little that can be done to alter the terms of a contract and more specifically, there is very little than can be done to facilitate technology transfer in that is not part of a contract.

Chinese stakeholders

- **(Interviewee)** Certain global geopolitical situations might encourage Chinese manufacturers (in solar panels for example) to look for other international markets to sell their goods.
- There is a need for a more standardized framework of cooperation in renewable energy:
    - cooperation in green goods manufacturing will allow Chinese actors to switch more comfortably from fossil fuel projects and into more sustainable projects that are more in line with the country's Green Belt and Road Initiative (BRI). This is especially important considering China's own domestic goal to reach carbon neutrality by 2060.
    - Africa's EGs sector is still in its infancy, and thus gives China companies the opportunity to trial the development new environmental goods and technologies that allow it to maintain its status as the global leader in renewable energy technology.[192]
    - By developing a more diverse and cooperative model of engagement, actors on both sides would potentially see more lasting impacts and results in the field of EGs and in renewable energy cooperation more broadly.

RECOMMENDATIONS ON PEOPLE EXCHANGES

African stakeholders

- African stakeholders can learn from China's experience in carbon trading schemes.
- African stakeholders can encourage the involvement of third parties such as NGOs in working with Chinese stakeholders to increase capacity building in climate change issues.

Chinese stakeholders

- PPP/EPC – helping Chinese firms understand the different types of PPP contracts.
- The need for more investment at the local level, more FDI.
- **(Interviewee)** The actors involved in South-South climate cooperation should be diversified because of the unique constraints that the Chinese government has.

[192] Shen, Wei, 2021

ANNEX 2: FOCAC CLIMATE COMMITMENTS IN DETAIL

New Commitment	
FOCAC 1 (2000)	Exploration and Utilization of Natural Resources and Energy: • Promote investment in the exploration and utilization of metal resources • on a reciprocal basis with consideration to environmental practices. Environmental Management and Biodiversity • Committed to forging closer co-operation and joint participation in capacity building for integrating environmental management in national development. • Cooperate in all areas related to environmental management, including pollution control, biodiversity conservation, forest ecosystem protection, fisheries and wildlife management, to ensure economic development and sustainable human development.
FOCAC 2 (2003)	Natural Resources and Energy Development: • Expand the scope of cooperation on energy development and increase its investment.
FOCAC 3 (2006)	Cooperation in Energy and Resources • China gives high priority to helping African countries turn their advantages in energy and resources into development strengths, protecting the local environment and promoting sustainable social and economic development in the local areas. Environmental Protection • The Conference on China-Africa Cooperation in Environmental Protection. • The African side expressed appreciation of the fund provided by the Chinese Government for the establishment of the UNEP China-Africa Environment Center. • Increase the number of environmental protection administrators and experts from Africa to receive training in China in the next 3 years. • Work with the UNEP for multilateral cooperation in environmental protection. • Step up cooperation in capacity building, prevention and control of water pollution and desertification, maintenance of biodiversity and the development of environmental protection industry.

New Commitment	
FOCAC 4 (2009)	Cooperation in International Affairs • The United Nations Framework Convention on Climate Change and its Kyoto Protocol should be taken as the main channel, and the mandate of the "Bali Roadmap" should be observed. • Supports Africa's legitimate demands, including more financial support and technological transfer. Climate Change and Environmental Protection • Step up human resources training on climate change, forest resources cultivation, the use of new energy, environmental management and pollution prevention and control. • Proposed the establishment of a China-Africa partnership and the holding of senior officials' consultations on a non-regular basis. • 100 small-sized well digging projects for water supply and clean energy projects of biogas, solar energy and small hydro-power plants in the next three years. • Share with African countries data from the China-Brazil Earth Resources Satellite and promote the application of the data in land use, weather monitoring and environmental protection in Africa. • Protect the ecosystem and biodiversity and improve the comprehensive treatment of desertified areas and the relevant surveillance capacity.
FOCAC 5 (2012)	Cooperation in International Affairs: • Jointly call upon the international community to follow the relevant spirit of the United Nations Climate Change Conference held in Durban, South Africa at the end of 2011 and keep to the United Nations Framework Convention on Climate Change and its Kyoto Protocol, the mandate of the "Bali Roadmap" and the principles of equity and "common but differentiated responsibilities." Climate Change and Environmental Protection: • Initiative of establishing a China-Africa partnership in addressing climate change and closer policy dialogue and exchange. • Enhance capacity building in meteorological infrastructure and forest protection and management and scale up assistance. • Provide training in disaster prevention and reduction, treatment of desertification, ecological protection, and environment management. (Same as FOCAC 4) • Continue to share with African countries the data from the China-Brazil Earth Resources Satellite and promote the application of the data in land use, weather monitoring and environmental protection in Africa. (Same as FOCAC 4) • Share experience of applying space technologies to disaster reduction, conduct exchanges and cooperation in remote sensing drought surveillance technologies and upgrade drought surveillance capacity.
FOCAC 6 (2015)	Environmental Protection and Tackling Climate Change: • Introduce the "China-Africa Green Envoys Programme". • Set up the China-Africa Environment Cooperation Centre • Launch the China-Africa Green Innovation Project under the framework of "China South-South Environmental Cooperation-Green Envoys Programme".

New Commitment	
	• Provide training for Africa in the fields of eco-environment protection, environment management and pollution prevention and treatment. • Push forward dialogue and cooperation on China-Africa green finance, and explore a model of environmental cooperation between Chinese and African governments and non-governmental capital. • Promote the "China-Africa Joint Research Centre" project. • Implement 100 clean energy and wild life protection projects, environment friendly agricultural projects and smart city construction projects. • Strengthen the policy dialogue and improve the China-Africa consultation and collaboration mechanism on climate change. (Similar to FOCAC 4&5) • Committed to 20 billion Renminbi Yuan for setting up the China South-South Cooperation Fund. • Enhance China-Africa South-South cooperation on climate change. • Set up a multi-level disaster reduction and relief cooperation and dialogue mechanism, expand exchanges in post-disaster response and recovery, risk assessment, disaster preparedness and recovery education programmes. • Provide rapid mapping service for disaster emergencies.
FOCAC 7 (2018)	Energy and Natural Resources • Carry out demonstration projects in green energy financing and explore green and sustainable ways of energy cooperation. • Support the development of renewable energy, mainly solar energy in Africa as well as the use of battery storage and strengthening of the electricity grid. • Consider the joint establishment of a China-Africa Geoscience Cooperation Center for joint research on national resources sustainability and environment. Environmental Protection and Tackling Climate Change • The African side appreciates China's efforts in actively implementing the China-Africa Green Development Plan. • 50 projects for green development and ecological and environmental protection. • Raise public awareness of environmental protection. • Set up a China-Africa environmental cooperation center and deepen environment cooperation through more policy dialogue and joint research on environmental issues. • Continue to implement the China-Africa Green Envoys Program to strengthen Africa's human capacity for environmental management, pollution prevention and control, and green development, and continue to enhance capacity-building and promote the green development of Africa. • Continue to provide Fengyun meteorological satellite data, products and technical support. • Provide meteorological and remote-sensing application equipment, education and training support to contribute to the implementation of the integrated African Strategy on Meteorology (Weather and Climate Services)

New Commitment	
	• Deepen pragmatic cooperation under the framework of Climate Change South-South Cooperation, and help African countries strengthen climate change adaption capabilities through capacity-building training. • Hold regular workshops and training sessions on disaster risk management, application of disaster relief and mitigation technologies, and public awareness campaigns for disaster management teams, technical professionals and communities from Africa. • Send experts to local communities to guide and organize such training and capacity-building activities.
FOCAC 8 (2021)	Ecological Protection and Climate Response • Committed to establishing and improving an economic system for green, low-carbon and circular development, actively participating in global environmental governance, and jointly tackling climate change. The two sides will continue to strengthen exchanges and cooperation on ecological protection, maritime cooperation, desertification prevention and treatment, and the protection of wildlife. • Support tapping into the role of the China-Africa Environmental Cooperation Center, and advance environmental cooperation through more policy exchanges and dialogue, closer exchanges and cooperation on environmental industry and technological information, and joint research on environmental issues. • Establish a China-Africa marine science and blue economy cooperation center. • 10 green development, environmental protection and climate action assistance projects. • Support the development of the Great Green Wall. • Continue to implement the China-Africa Green Envoys Program, the China-Africa Green Innovation Program. • Build low-carbon demonstration zones and climate adaptation demonstration zones in Africa • Deepen practical cooperation with African countries under the framework of South-South cooperation on climate change and the Belt and Road Initiative. • Support the African Agriculture Adaptation (AAA) and Sustainability Stability and Security (SSS) initiatives. • Cooperation on the application of satellite remote-sensing technology in the field of natural resources. • Propose satellite remote-sensing Cloud services to more African countries.

New Commitment	
	Cooperation on Energy and Natural Resources • Enhance practical cooperation in the energy sector under the framework of the China-African Union Energy Partnership. • Improve the level of electrification in Africa, increase the share of clean energy, address step by step the issue of energy accessibility, and promote sustainable energy development of both sides. • Stop building new coal-fired power projects abroad, support in developing green and low-carbon energy. • Strengthen cooperation on trade, investment, technology and standards in the energy and resources sector. • Encourage and support establishment of strategic partnerships by Chinese and African businesses. • Support Africa in improving the structure of its energy and resources industrial chain.

Foreign Aid and International Cooperation White Papers

Achievements	
China's Foreign Aid White Paper (2014)	• Signed the Memorandum of Understanding to address climate change with nine countries, including Grenada, Ethiopia, Madagascar, Nigeria, Benin, Maldives, Cameroon, Burundi and Samoa. • Donated more than 500,000 energy-saving lamps and more than 10,000 energy-saving air conditioners. • Carried out technical cooperation with Ethiopia, Burundi, Sudan and other countries, promoting the improvements. • Held 150 training courses on environmental protection and climate change for more than 120 developing countries, training more than 4,000 officials and technicians. • Build automatic meteorological observation stations, high-altitude observation radar stations and other facilities,. • Provide forest protection equipment and conduct personnel training and exchange seminars. • 105 clean energy and water supply projects.
China's International Cooperation White Paper (2021)	• At the 2nd Belt and Road Summit on International Cooperation in 2019, President Xi Jinping announced the implementation of the Belt and Road South-South Cooperation Program to address climate change. • Increase support for renewable energy projects and help build a number of clean energy projects. • China announced the establishment of the Climate Change South-South Cooperation Fund to carry out 10 low-carbon demonstration zones, 100 climate change mitigation and adaptation projects and 1,000 training places for climate change in developing countries.

Achievements	
	• Held more than 200 training programs on climate change, training more than 5,000 personnel.
China-Africa Cooperation White Paper (2021)	• Jointly organized a seminar on "China-Africa Green Cooperation to Lead the Economy of the Future" and the "China-Africa Ministerial Dialogue on Environmental Cooperation". • The China-Africa Environment Cooperation Center will be launched in 2020. • Seven African countries, including Angola and Kenya, have joined the "Belt and Road" International Alliance for Green Development, making positive contributions to the construction of the Green Silk Road. • China has signed 15 cooperation documents with 14 African countries to provide support to Africa in addressing climate change. Cooperated with Ethiopia to launch the Earth observation remote sensing satellite.

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