Report

China's evolving role in Africa's energy transition

Overseas trade and investment in Kenya, Mozambique and South Africa

Elena Kiryakova, Olena Borodyna and Rebecca Nadin
with Lorraine Howe and Yue Cao

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Acronyms

AfDB	African Development Bank
BRI	Belt and Road Initiative
CDB	China Development Bank
DFC	United States International Development Finance Corporation
EDM	*Electricidade de Moçambique*
EMDE	emerging market and developing economy
EPC	engineering, procurement and construction
EV	electric vehicle
FDI	Foreign Direct Investment
FOCAC	Forum on China-Africa Cooperation
FUNAE	*Fundo de Energia*
FYP	five-year plan
GDP	gross domestic product
GHG	greenhouse gas
HCB	Cahora Bassa Hydroelectric Plant
IEA	International Energy Agency
ICBC	Industrial and Commercial Bank of China
ICE	internal combustion engine
IMF	International Monetary Fund
IPG	International Partners Group
IPPs	independent power producers
JETP	Just Energy Transition Partnership
KPLC	Kenya Power and Lighting Company
LNG	liquefied natural gas
M&As	mergers and acquisitions
MDB	multilateral development bank
NDC	Nationally Determined Contribution
NEVs	new energy vehicles
OEM	original equipment manufacturer
PPP	public-private partnership

PRC	People's Republic of China
PV	photovoltaic
RE	renewable energy
SADC	Southern African Development Community
SAPP	Southern Africa Power Pool
SOEs	state-owned enterprises
SPV	Special Purpose Vehicle
VAT	Value Added Tax
WITS	World Integrated Trade Solution

Executive summary

China has emerged as a leading global bilateral creditor and developer of energy infrastructure projects, as well as exporter of clean energy technology. Between 2010 and 2021, on average, Chinese financial institutions lent over $18 billion annually in energy finance worldwide. Since 2010, on average each year Chinese state-owned enterprises (SOEs) and private companies have made over $33 billion worth of direct equity investments and Chinese engineering firms have been awarded over $57 billion worth of construction and installation contracts for energy projects abroad. China dominates supply chains for major clean-energy technologies, exporting $114 billion worth of solar panels, wind turbines, lithium-ion batteries and electric vehicles in 2024.

This surge in outward investment and trade, driven by clear domestic policy signals in China and the prospect of commercial opportunities abroad, is increasingly directed towards emerging market and developing economies (EMDEs). These countries urgently need expanded access to finance, capacity-building and clean-energy technology to bridge energy deficits and meet national decarbonisation targets. However, limited fiscal capacity and high capital costs in many EMDEs obstruct the development of new clean energy projects despite interest from Chinese and other foreign investors. This challenge is especially acute in Africa, where the cost of capital for utility-scale clean energy generation remains up to three times higher than in advanced economies and China.

This report examines the distinct modalities of China's overseas energy sector lending, equity investments and construction activities, as well as its exports of clean energy technology components. Understanding the evolution of these practices serves two main purposes. First, it highlights the challenges of mobilising finance for energy transitions in EMDEs, which are not unique to Chinese investors. Second, it provides context for crafting effective policy-making and international partnerships that engage constructively, manage risks, and identify opportunities to fill gaps in China's involvement.

Specifically, the report explores if, and how, Chinese stakeholders are contributing to energy transitions in three African countries – Kenya, Mozambique and South Africa. In each case study, we analyse China's trade, lending and investment activities through the lens of the national energy and industrial strategies and broader socio-economic development objectives. This allows us to assess China's contributions to meeting partner countries' financing and technology needs for their energy transitions as well as the constraints they face in doing so.

Key messages

China's official annual overseas energy sector lending peaked in 2016 and has steadily decreased since then. Between 2010 and 2021, African economies received $65 billion in energy-related financing, or nearly a third of China's total overseas energy lending portfolio. Global trends in China's lending reveal that the financing approach is shifting away from concessional loans provided by state-owned policy banks towards increased participation from commercial banks, with funds increasingly directed to joint ventures or special purpose vehicles. However, a closer look at engagement modalities in Africa shows that China's energy financing on the continent remains predominantly directed to government agencies or state-owned enterprises.

Globally, Chinese SOEs and private enterprises prefer to bid for construction and equipment installation contracts, rather than making direct equity investments in energy sectors abroad. This is especially true in higher-risk markets, like African countries, where construction contracts account for 85% of Chinese project-level activity, compared to 15% for projects with Chinese equity stakes or acquisitions. With few exceptions, in Kenya, Mozambique and South Africa, Chinese enterprises have typically avoided developing independent power producer (IPP) projects where they rely on power purchase agreements with local utilities or other off-takers. For both clean energy and fossil fuel developments, their involvement follows the engineering, procurement and construction (EPC) model of building power plants without taking long-term ownership.

A growing share of this overseas engagement is concentrated in the renewable energy sector, particularly solar power. By 2024, nearly half of China's overseas investments and construction projects were in the renewable energy sector. Since 2010, a fifth of Chinese overseas renewable energy Foreign Direct Investment (FDI) and construction activity – valued at $66 billion – has taken place in Africa.

Chinese clean energy technology manufacturers are also actively expanding into EMDE markets, with significant growth in exports to Africa. While African economies represent a relatively minor destination for Chinese wind and solar power technology, exports of these products to Africa grew by 153% year-on-year between 2020 and 2024. This growth trend is likely to persist given rising demand for electricity generation and untapped renewable energy resources on the continent.

Lessons from the case studies

Kenya

Since 2020, there have been no new fossil fuel energy investments or construction contracts involving Chinese entities in Kenya, indicating a shift towards renewable energy projects. Historically, China has been a significant lender for Kenya's energy infrastructure development,

predominantly through loans for large transmission infrastructure construction and upgrades. However, since 2010 Chinese entities have also financed, designed and constructed several key renewable energy projects, such as the Olkaria IV Geothermal Field and the Garissa Solar Park. Despite Chinese participation in public-private partnerships (PPPs) to finance transportation infrastructure projects, Chinese equity investors have had limited participation in energy-related PPPs.

China is also a significant trading partner to Kenya and the largest single source of imports of clean energy technology in the country. There is growing interest in Kenya for partnerships between Chinese manufacturers and domestic Kenyan firms for local assembly of clean energy technologies like solar panels, to replace fully assembled imports and promote local content. Kenya's ambition to localise low-carbon value chains will necessitate a rethinking of China's engagement modalities, moving beyond lending, technology exports and EPC contracts towards more collaborative financing ventures for clean energy projects.

Mozambique

China's involvement in Mozambique's energy sector has focused on liquefied natural gas (LNG) financing, in line with the country's strategic vision to use natural gas as both a transition and export fuel. This financial engagement combines concessional lending with commercial bank participation in syndicated loans for major developments such as the Coral Sul FLNG and Rovuma LNG sites, with all investments backed by Sinosure credit insurance to manage project risks. Chinese developers have not yet made investments in Mozambique's solar photovoltaic (PV) or wind energy infrastructure, but there are expectations for increased Chinese involvement in green industrialisation through projects like the Tsingshan Green Industrial Park.

China's main contribution to Mozambique's clean energy transition has been through clean energy technology supply. Despite high import costs for renewable energy equipment in the country, China is the leading source of solar technology for both utility-scale plants and off-grid solutions. Looking ahead, Mozambique sees an opportunity to capitalise on its mineral endowments for the energy transition and move up the critical minerals value chains. However, the timeline for its aspirations – and how China will contribute – remains unclear.

South Africa

Despite South Africa being the primary destination for Chinese FDI in Africa, Chinese financial institutions, SOEs and private companies have played a limited role as equity investors with ownership stakes in clean energy projects, or power projects generally. South Africa's domestic banks and other international partners such as the International Partners Group (IPG) have dominated debt and equity financing for power projects in the country. Moreover, China has demonstrated limited involvement in early-stage financing,

capacity-building or project preparation for clean energy projects in South Africa – areas that remain challenging for the country's energy and local manufacturing development.

China's primary contribution to South Africa's energy transition has instead taken two forms: first, as the dominant supplier of imported clean energy technology, and second, through Chinese EPC firms capturing a significant market share of the energy sector, particularly in solar power projects since 2022. These engineering contractors have been able to meet the strict quality standards of local financial institutions while offering more competitive pricing compared to previously favoured Western companies. While there have been Chinese-South African partnerships for local solar panel assembly, the cost-competitiveness of Chinese imports hinder South Africa's local content and value addition ambitions.

Looking ahead

In Kenya, Mozambique and South Africa, the strategies and risk tolerance of different Chinese actors have been shaped by the local investment climate and policy ambition on the energy transition. Chinese finance and engineering activity have generally been thematically aligned with the host governments' national priorities.

Given high debt burdens, these economies are shifting from borrowing to PPPs to finance energy projects – a model with which China has had limited experience in these contexts. While the size of future Chinese lending and investment deals is likely to continue to fall, Chinese technology manufacturers will likely remain the key suppliers of clean energy technology on the continent. China's evolving offer to African economies will be important to watch amid ongoing geopolitical shifts, policy uncertainty from major international clean energy funders, and EMDEs' increasing drive to localise and build green value chains.

What to watch

- How will the equity investment appetite of Chinese financial institutions, SOEs and private companies for African energy projects evolve as China's policy bank lending declines and most African governments face limited fiscal capacity? Will this environment drive greater Chinese participation in PPPs for clean energy development?

- Will Chinese creditors and investors be willing or able to step in to fill energy transition financing gaps, given China's own de-risking of overseas economic engagement and the geopolitical uncertainty in advanced economies that are major funders of African energy projects?

- How will China's ambitions to expand its clean energy technology exports to EMDEs interact with the policy momentum towards localisation and regionalisation of green value chains in Africa? What will be the impact of tariff uncertainty from the US on global clean energy technology trade flows?

1 Introduction

Access to reliable, affordable and clean energy is crucial for economic development. Annual clean energy investment in EMDEs needs to more than triple by 2030 to meet national climate and energy pledges, yet EMDEs outside China account for only 15% of global clean energy spending (IEA, 2024f, 2024e). Many mature technologies like solar power outperform fossil fuel options on levelised cost of electricity, but the high cost of capital in these countries makes it much more difficult to develop clean energy projects (IRENA, 2024c). This is most evident in Africa, where the cost of capital for large utility-scale clean energy generation remains two to three times higher than in advanced economies and China (IEA, 2023b). To achieve bold climate goals and bridge energy access gaps, the African continent needs increased access to finance, capacity building and high-quality clean energy technology.[1]

China has positioned itself as a major foreign investor and creditor to EMDEs, and a central player in global energy infrastructure investment. Energy finance is a cornerstone of China's Belt and Road Initiative (BRI) and broader strategy to deepen economic and political ties with emerging and developing economies (Nadin et al., 2023). In light of this, China has a potential role to play in supporting its partner countries to overcome the financial and technical barriers to low-carbon energy transitions (Keane et al., 2021).

Recent policy shifts reflect China's evolving approach to international energy engagement in favour of clean energy activity. President Xi Jinping's September 2021 announcement that China would cease to finance new overseas coal projects marked a departure from the fossil fuel-heavy investments and non-interference approach of the early BRI years (Wang et al., 2024). This commitment was reinforced during the most recent Forum on China-Africa Cooperation, which published a 2025–2027 action plan stating that China would implement 30 clean energy and green development projects and set up a Special Fund for Green Industrial Chain in Africa (MFA of the PRC, 2024a).

China's involvement extends beyond financing for major energy infrastructure projects – Chinese companies are also winning contracts to construct them. The International Energy Agency (IEA) estimated that between 2010 and 2015, Chinese contractors were responsible for 30% of new capacity additions in sub-Saharan Africa. Chinese firms were also contracted to build 17 GW of generation capacity from 2010 to 2020, equivalent to 10% of the subcontinent's existing installed capacity (IEA, 2016a).

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1 Achieving the energy- and climate-related goals of African economies will require over $200 billion in annual investments until 2030 (IEA, 2024e).

These engineering firms have been active in winning tenders for construction and installation projects ranging from conventional fossil fuel developments to, increasingly, solar power plants and electricity transmission lines.

Moreover, EMDEs are increasingly important markets for China's clean energy technology products. Nearly a third of China's exports of solar panels, wind turbines, electric vehicles (EVs) and lithium-ion batteries in 2024 went to EMDEs, with almost half of all solar panel and wind turbine exports going to these countries.[2]

Against this backdrop and given China's own leadership ambitions in clean energy technology, this report explores whether and how Chinese actors are contributing to energy transitions in Africa. We analyse the diverse ways that Chinese creditors, investors, engineering firms and technology suppliers engage in overseas energy sectors, with a focus on three countries: Kenya, Mozambique and South Africa. The scale and nature of involvement from these different Chinese actors reflects their distinct risk preferences within China's evolving strategy of de-risking its broader BRI engagement in EMDEs.

The case study countries were selected based on their economic and political relationships with China, their strategic importance within the BRI, and their progress in national energy transitions alongside existing infrastructure needs.[3] China's political ties with Mozambique and Kenya date back to the 1960s and 1970s, while its cooperation with South Africa was established in the late 1990s. All three countries are strategically important for China, both economically and politically. Mozambique and Kenya have signed comprehensive strategic cooperative partnerships with China, while South Africa has established a comprehensive strategic partnership. Their cooperation with China spans a range of bilateral activities, including joint military exercises, cultural and political exchanges, and engagement through multilateral forums such as the Forum on China-Africa Cooperation (FOCAC) and BRICS (in South Africa's case).

Each country has distinct energy needs and varying degrees of economic dependence on China (Table 1). All three have developed plans to expand renewable energy and transmission infrastructure to address current energy gaps, as well as to decarbonise sectors like transport. Kenya and South Africa also aim to scale-up low-carbon value chains, an area where Mozambique trails behind. Within the operational environment constraints in each country, China's finance and engineering activity has

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2 Authors' calculations based on General Administration of Customs of the People's Republic of China data obtained from Ember and the Observatory of Economic Complexity. See Section 1.2.3.

3 Kenya, Mozambique and South Africa have been BRI signatories since 2017, 2018 and 2015.

generally targeted the sub-sectors aligned with the national energy priorities of each country.

The report is structured as follows. In Section 1.1 we outline the domestic drivers of China's overseas energy-related activity. This sets the scene for Section 1.2 which presents the distinct characteristics of China's energy-related lending practices, equity investments and construction activities, as well as its export flows for clean energy technology components.

Sections 2, 3 and 4, which are the focus of this paper, present the country case studies for Kenya, Mozambique and South Africa, respectively. In each case study, we analyse how bilateral trade, investment and lending from China contributes to the national energy transition goals, the implications of these on the energy and other sectors of the economy, and the gaps. In Section 5 we discuss how China's offer to EMDEs is likely to evolve, and the implications of unfolding geopolitical realignments for the energy transition needs in Africa.

Box 1 Scope and approach

The study draws on descriptive quantitative analysis, policy review and stakeholder consultations with national and international experts in each country.[4]

What do we mean by overseas economic engagement?

We use 'overseas economic engagement' as an umbrella term that captures China's foreign investments, bilateral lending and exports.[5] When looking at energy equity investment and lending, we focus on financial flows into power generation plants, transmission and distribution projects and local manufacturing for clean energy technology components. Investment includes greenfield investments and mergers and acquisitions (M&A). The trade analysis focuses on China's exports of four clean energy technology products: assembled solar panels, wind turbines, lithium-ion batteries and fully electric motor vehicles.

4 Given the sensitive nature of issues probed in this study, interviewees requested anonymity in sharing their views. The analysis therefore does not identify individual interviewees but includes references to ideas shared through stakeholder consultations where relevant.

5 Official sector lending covers bilateral lending only and excludes China's multilateral lending, such as through the New Development Bank or African Development Bank.

For the lending analysis, we use AidData's Global Chinese Development Finance dataset (V3.0) which documents bilateral loan commitments from China's official sector institutions through 2021. Note that we cannot address more recent lending trends due to this limitation. Foreign investment and construction contracts data primarily comes from the Janes IntelTrak database of Chinese overseas investments, while our trade information is compiled from multiple sources (which are specified in each instance). For investments, construction activities and trade, our analysis covers trends through 2024.[6]

What do we mean by energy transitions?

Energy transition is the structural shift from an energy mix based on fossil fuels such as coal, oil and natural gas, to one based on renewable energy sources: modern bioenergy, geothermal, solar, wind, hydropower, marine energy (IRENA, 2024b). We follow the IEA and use 'clean energy' as a broader umbrella term that groups energy sources, infrastructure, applications and assets compatible with a net zero emissions energy system (IEA, n.d.). This includes battery storage and electricity grids, and end-use applications such as hydrogen fuels and EVs.

In each case study, we use the frame of the national energy and industrial strategy and broader socio-economic development goals to assess China's contribution to meeting the financing and technology needs of the domestic energy transition. In the case of Mozambique, natural gas exploration is part of the economic development agenda. Natural gas, which emits less carbon than most other fossil fuels, is commonly considered a 'transition fuel' away from coal, or a back-up for variable wind and solar power (Gürsan and De Gooyert, 2021). While increasing natural gas production is not compatible with the IEA's net zero pathway, we acknowledge China's activity within these expectations on the role of gas in Mozambique's development.

Given the limited timeframe and scope of this analysis, the report provides an initial exploration of Chinese actors' evolving role in supporting clean energy transitions abroad. Further studies with more extensive fieldwork and broader geographic reach could build on these insights. We discuss some suggestions for future analysis in Section 5.

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6 See Appendix 1 for details on the data sources and methodology.

Table 1 Summary indicators for case study countries

Country	GDP per capita (current US$), 2023	Chinese FDI stock (current US$ billion), 2022	External debt to China as % of GDP, 2023	Import share from China (% of all imports), 2023	Export share to China (% of all exports), 2023	Regulatory Indicators for Sustainable Energy (RISE)
Kenya	1,952	1.78	5.56	17.61	2.89	61
Mozambique	623	1.18	7.95	15.38	14.30	39
South Africa	6,022	5.74	0.93	20.46	11.29	47

Note: RISE is a combined index of electricity access, access to clean cooking, energy efficiency and renewable energy that is designed to compare national policy and regulatory frameworks for sustainable energy. RISE classifies strong performers as having a score of 67-100, mid-performers with 34-66 and weak performers with 0-33.

Source: authors' elaborations based on World Bank Development Indicators, World Bank International Debt Statistics, WITS, Regulatory Indices for Sustainable Energy, China's Ministry of Commerce

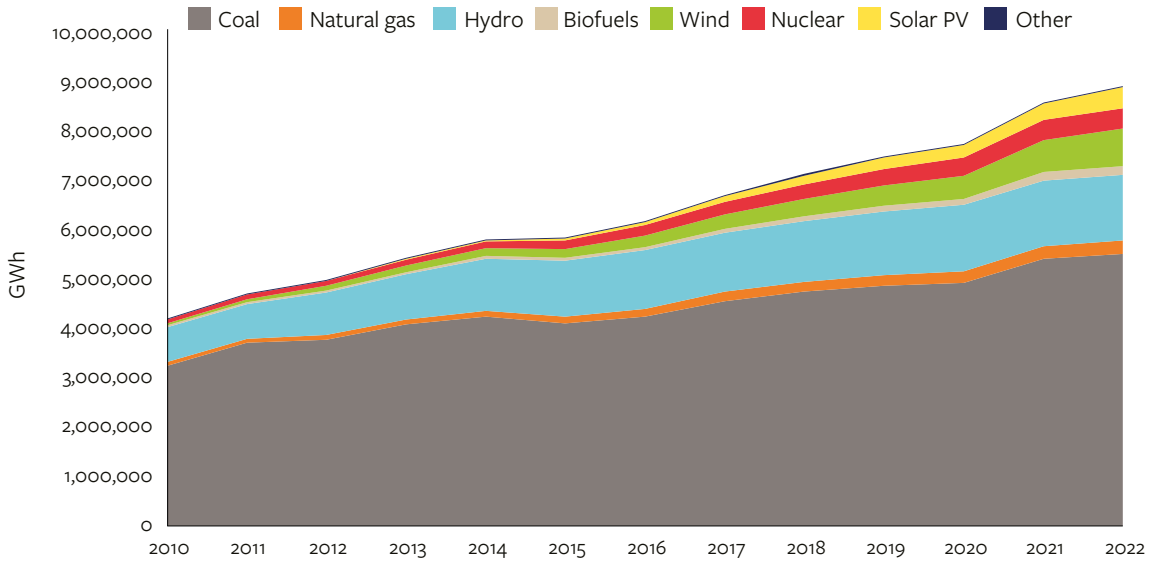
1.1 Domestic drivers of China's overseas investment in energy and green value chains

Overseas energy sources gained in prominence in China's foreign policy in the 1990s (Nadin, 2007). In 1993 the then Premier of the PRC, Li Peng, announced that a primary policy goal was 'to secure a long-term and stable supply of oil to China' (Nadin, 2007). In a bid to increase production and reserve volumes, establish overseas bases and diversify suppliers, China's energy policy focused heavily on overseas expansion and investment in oil-producing countries such as Russia, Kazakhstan, Iran, Iraq and Sudan (Nadin, 2007). Its 10th FYP (2001–2005), emphasised the importance of 'energy security' as a foreign policy objective. The objective for exploration was to 'ensure a long-term reliable and sustainable oil supply at a reasonable price in order to achieve the national goal of sustainable and sound economic growth'. With the expansion of its overseas energy portfolio, China had to focus on ensuring political and physical security along supply routes in exporting and transit states (Nadin, 2007).

How China now defines the sources of its energy security has evolved, but its primacy as a national security goal has not diminished. This is partly due to the fact that China's economic expansion over the past two decades has fuelled energy consumption, with power consumption going up by 560% (IEA, 2024a). As of 2022, fossil fuels, primarily coal, comprised the majority of the energy mix, including in power production (IEA, 2024a). The share of modern renewables, such as solar PV and wind, reached 5% and 9% of the total electricity respectively in the same year (ibid). From 2010 to 2022,

China saw solar PV electricity production grow from 699 GWh to 427,000 GWh, while wind power generation increased from 45,000 GWh 763,000 GWh respectively (ibid). The share of electricity generated from natural gas and nuclear power has also increased (ibid).

Figure 1 Electricity production in China by source, 2010–2022



Source: authors' elaborations based on (IEA, 2024a)

Despite growing diversification of the power mix, energy security remains a national security priority for the Chinese government.[7] The shift to actively promoting wind and solar sectors can be traced to the mid-2000s with the adoption of the Renewable Energy Law in 2005 and the Mid-to-Long-Term Renewable Energy Development Plan in 2007 (Hove, 2024). The 2020 White Paper on China's Energy Development in the New Era outlines priorities for the energy sector, including a diversified supply system, promotion of the energy technology revolution and strengthening international cooperation to achieve energy security (The Information Office of the State Council, 2020).[8] According to the White Paper, the aim is to sustain investment in coal and gas exploration, as well as promote green and efficient coal mining practices (ibid). Since 2019, China's crude petroleum imports from Africa have increasingly been replaced by imports

7 Article 21 of the National Security Law, 2015.

8 (1) Promote the energy consumption revolution and suppress unreasonable energy consumption. (2) Promote the energy supply revolution and establish a diversified supply system. (3) Promote the energy technology revolution and drive industrial upgrading. (4) Promote the energy system revolution and open up the fast lane of energy development. (5) Strengthen international cooperation in an all-round way to achieve energy security under open conditions.

from Russia, the Gulf Cooperation Council countries and other Asian economies (Usman and Xiaoyang, 2024).[9]

It was the 14th Five-Year Plan (FYP) for Renewable Energy (2021–2025) that accelerated China's aims to further drive the adoption of renewable energy (RE). Targets include increasing RE capacity by 50%, raising its share to 33% of overall power mix, and the share of non-hydro renewables to 18% (National Development and Reform Commission et al., 2021). Thus, initially geared towards export markets, solar production received strong government support at various levels, including targeted assistance through low-cost loans (Hove, 2024). Hove (2024) identifies four broad factors that have enabled China to promote clean energy production: policy support, technology transfer as a policy and corporate strategy, manufacturing scale-up through integrated industrial clusters, and the development of human capital. In 2023, nine of the top ten global solar PV manufacturers were Chinese companies (Wood Mackenzie, 2024b). The country also accounted for four of the five leading wind turbine original equipment manufacturers (OEMs), with GoldWind alone installing 16.3 GW that year. However, rising competition and intense price cutting are weighing on profitability in the sector (Wood Mackenzie, 2024a).

The earlier state-led 'Made in China 2025' policy already highlighted new energy vehicles (NEVs), fuel cell vehicles and electric power equipment, including for RE technologies and advanced energy storage, as key strategic industries for internal and external promotion (State Council of the People's Republic of China, 2015). However, during the 14th FYP period, the role of strategic emerging industries, including new energy, new materials, high-end equipment, and NEVs, is expected to grow, with their contribution to value addition targeted to exceed 17% of GDP (National Development and Reform Commission, 2022b).

1.1.1 Evolution of renewable energy and low-carbon value chains in China's foreign and outward investment policy

As the country's economy and industry developed, the role of the energy sector in its foreign and outward investment policy expanded from an initial focus on securing oil reserves to fuel growth, to incorporating renewable energy projects and exports of products along the low-carbon value chain. A number of policy frameworks were established during the 13th Five Year Plan (2016-2020) to encourage Chinese enterprises to trade and participate in RE and low-carbon value chains projects and products. This included the *Guiding Opinions of the CPC Central Committee and the State Council on Promoting High-Quality Development of Trade*, which emphasised expanding markets and trade in high-quality, high-tech and high-value-added products, including through the BRI and

9 According to WITS data, in 2023, 87% of China's $103 billion worth of imports from Africa were concentrated in four commodity categories – mineral fuels, ores, precious metals and copper.

in emerging industries, as well as green design and manufacturing (MOFCOM, 2019). Similarly, the *Guiding Opinions on Strengthening International Cooperation to Improve the Status of China's Industrial Global Value Chain* encouraged Chinese enterprises to participate in construction contracts and to export Chinese equipment, technology, standards and services, including in the power equipment sector (MOFCOM, 2016).

China's 14th FYP for RE prominently featured the country's role in promoting a low-carbon energy transition and strengthening international trade in renewable energy solutions. This includes cooperation in planning guidance, policy design, technical exchanges, financing and high-level political engagement through mechanisms like the BRI Energy Ministerial Meeting (National Development and Reform Commission et al., 2021). The 14th FYP for RE placed particular emphasis on encouraging high-quality RE industries to 'go out' and integrate into global value chains in equipment, technology, standards and branding (ibid.).

The country's medium-term plans for NEVs and hydrogen industries also include a strong outward investment and trade angle. Chinese NEV producers, for instance, are encouraged to enhance their global competitiveness, develop international markets and promote industrial cooperation along the entire value chain (General Office of the State Council, 2020). Consistent with China's broader approach to shaping standards along BRI in other sectors, such as digital infrastructure, similar initiatives have emerged in green infrastructure and transportation.[10]

1.1.2 BRI and the Forum on China-Africa Cooperation

The energy sector is one of the priority cooperation areas under China's flagship BRI announced in 2013, which aims to promote connectivity across the Asian, European, and African continents (Nadin et al., 2023). Flagship economic corridors like the China-Pakistan Economic Corridor (CPEC) are intended to secure the passage of China's oil and petroleum imports from the Middle East by avoiding existing routes and choke points through the Straits of Malacca between Malaysia and Indonesia (Nadin et al., 2023). CPEC projects also provided an opportunity to address power shortages and infrastructure deficits in countries like Pakistan. Energy generation and transmission projects have played a prominent role in this regard, with coal accounting for most of the additional generation capacity that exceeds 8,000 MW across 14 completed projects. However, renewable energy sources such as wind, solar, and hydro also featured in the project mix (Nadin et al., 2023). Some of China's financing and construction

10 For example, the BRI Vehicles Low-Carbon Standards Research and Demonstration Project, under the BRI International Green Development Coalition, promotes China's active participation in shaping standards for emerging industries.

activities in the energy sector in Asian and African countries pre-date the BRI (Borodyna et al., 2022).[11]

China affirmed its commitment to RE in Africa and the development of low-carbon value chains, pledging to implement 30 clean energy and green development projects and establishing a Special Fund for Green Industrial Chains under the FOCAC action plan. Across the continent, renewable energy presents an opportunity to bridge power access gaps. There is also an increasing focus on value addition in mineral supply chains. For instance, the African Union's African Commodities Strategy aims to expand local processing (African Union, 2021). Green industrialisation is also gaining momentum, reflected in Kenyan President William Ruto's launch of the pan-African Green Industrialisation Initiative at COP28.

At the most recent FOCAC Summit in 2024, China committed to strengthening industrial cooperation by supporting local value chains, expanding manufacturing and processing of critical minerals, and driving growth across five regions with 10 projects to support industrial parks. President Xi Jinping reaffirmed that 'China is ready to help Africa build 'green growth engines', narrow the gap in energy accessibility ... and jointly push for the global transition to green and low-carbon development'; pledging to launch 30 clean energy projects over the next three years and encourage two-way investment for new business operations by Chinese and African companies and create 1 million jobs on the continent (MFA of the PRC, 2024a).

1.1.3 Commercial drivers of outward investment

China's overseas financing and construction of clean energy projects is driven by several interconnected domestic economic factors. One major driver is the need to invest its large reserves of savings and address industrial overcapacity. The Chinese government's response to the 2008 financial crisis led to the over-expansion of the construction and heavy manufacturing sectors. This created industrial overcapacity in the production of materials such as steel, as well as surplus investment capital and skilled labour that were not yielding high enough returns domestically (Nadin et al., 2023). China's overseas economic engagement, such as through the BRI, serves to redeploy excess resources abroad, mitigate these domestic inefficiencies and generate new demand for its exports.

Second, China's economic strategy targets leadership in high-end manufacturing, including supply chains for clean energy. Through targeted

11 For instance, in Kyrgyzstan, China provided financing for the modernisation of electricity transmission lines through the Export-Import Bank of China (EXIM Bank), with construction carried out by TBEA, dating back to 2011 (Borodyna et al., 2022). A year later, China also financed the construction of the 500 kV Datka-Kemin electricity transmission line and the 500 kV Datka substation, which were also constructed by TBEA. These projects aimed to improve energy connectivity and enhance the region's power infrastructure.

government support and demand-side policies – such as subsidies, tax credits and feed-in tariffs, China has become a leader in several clean energy technology supply chains, controlling over 80% of solar panel manufacturing and 60% of wind turbine component production (IEA, 2022, 2023a). By 2028, China is projected to account for nearly 60% of global new renewable energy capacity (IEA, 2023c). By financing, constructing and supplying equipment for overseas renewable energy projects, China creates (i) export markets for its domestically prioritised industries – such as NEVs and batteries, and (ii) opportunities for its contractors to move up global value chains, competing in higher-value markets for design and consulting – sectors historically dominated by European firms (Tanjangco et al., 2021).

State industrial policy and domestic competition have also allowed Chinese companies to reduce domestic costs for key technologies, such as solar PV, and out-compete other markets (Zhu et al., 2019). The scale of China's clean energy technology sector growth has also reduced prices for key equipment worldwide and narrowed the cost barrier to green energy transitions in the Global South (IEA, 2023a). This creates a feedback loop for Chinese exports as developing and emerging economies interested in developing renewables will almost certainly source components from China.

1.2 Global overview of China's overseas energy sector engagement

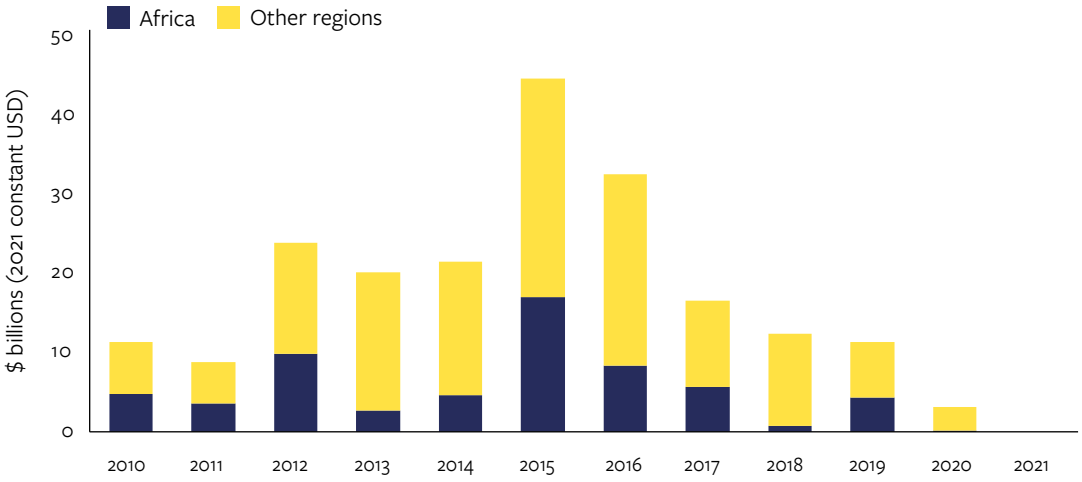
Having explored China's motivations for overseas energy sector engagement, we now turn to how this engagement manifests in practice. This section presents the distinct characteristics of China's lending practices, equity investments and construction activities in energy sectors, as well as its trade flows for clean energy technology components.

For policymakers, understanding these patterns serves two main purposes. First, it highlights the complexities of mobilising finance for energy transitions in EMDEs. While Chinese capital and expertise have been significant contributors in these markets, the constraints China faces are not unique, and similar challenges are encountered by other foreign investors in these regions. Second, it provides context for crafting effective international partnerships and risk mitigation strategies that account for the evolving capabilities and risk preferences of Chinese actors. As China controls manufacturing and trade for most clean energy technologies, the resulting geographic concentration leaves the entire supply chain vulnerable to disruptions from policy shifts, corporate decisions, technical failures or natural disasters (IEA, 2023a).

1.2.1 Lending

China's official annual overseas energy sector lending peaked in 2016 and has steadily decreased since (Figure 2). The scale of this financing was substantial, with total energy lending reaching $225 billion between 2010 and 2021.[12] The China Export and Credit Insurance Corporation (Sinosure) underwrote just over a third of all energy loans, and over half of commercial bank loans. This funding was also highly concentrated, with 60% directed to just ten recipient countries: Pakistan, Angola, Brazil, Viet Nam, Indonesia, Laos, Bangladesh, South Africa, Argentina and Venezuela (see Figure 3). African economies received nearly a third ($65 billion) of energy-related financing during this period.

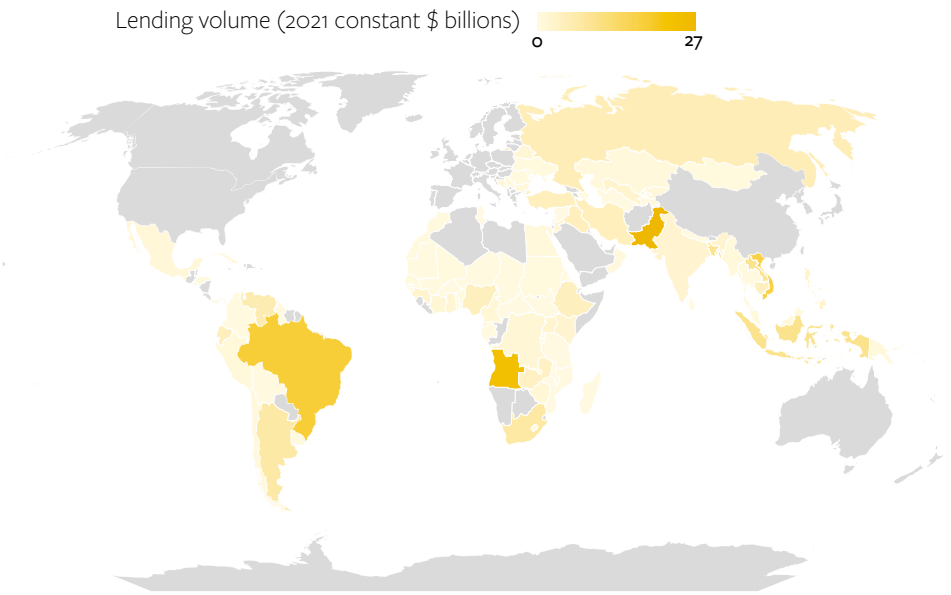
Figure 2 Annual Chinese overseas energy lending to Africa and the rest of the world, 2010–2021



Source: Authors' elaborations based on AidData (2023)

12 Unlike other sectors where the relative share of renminbi-denominated loans has increased, Chinese energy lending remained predominantly dollar-denominated: 94% of Chinese energy sector loans were dollar-denominated (2010–2021).

Figure 3 Cumulative Chinese overseas energy lending, 2010–2021

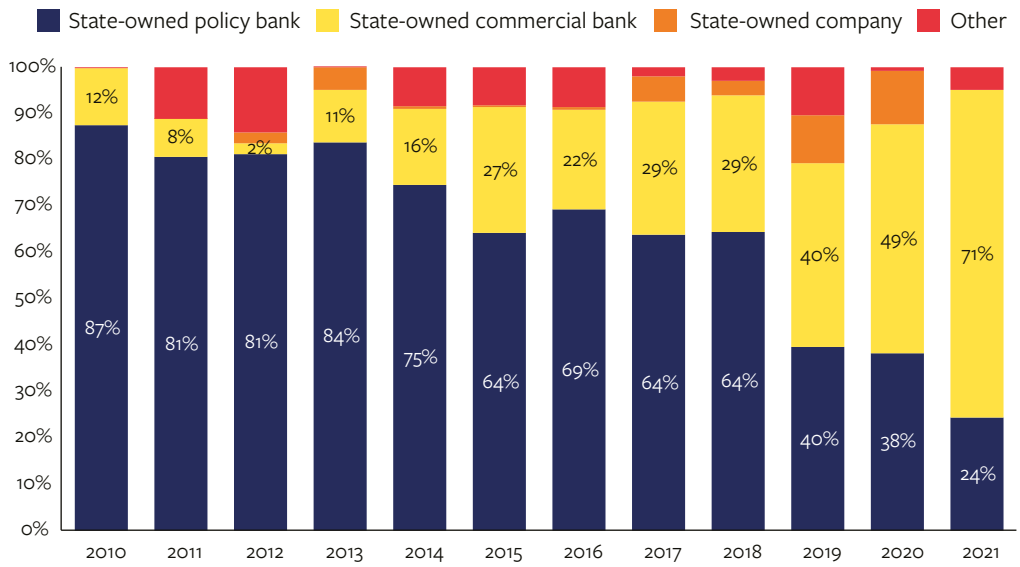


Source: Authors' elaborations based on AidData (2023)

Debt financing from state-owned policy banks has been the dominant model for Chinese energy sector lending, but this is changing. The Export-Import Bank of China (China Eximbank) and the China Development Bank (CDB) provided over two-thirds of cumulative external energy lending over this period. However, lending from the policy banks has been on the decline in both absolute values and as a share of China's total energy lending since 2017 (Figure 4). In 2021, loans from commercial lenders, such as the Industrial and Commercial Bank of China (ICBC) and Bank of China, stood at $2 billion and represented 71% of all energy lending, compared to $760 million from policy banks. This suggests that while Chinese companies continue to develop energy projects overseas (see 1.2.2), the funding no longer comes primarily from traditional policy bank lenders as financing approaches are shifting towards commercial lending and project finance. Additionally, the use of preferential (export) buyer's credits – which offer more favourable terms than market rates – has declined since peaking in 2015, indicating a reduced role of concessional finance for overseas energy projects.[13]

13 A preferential (export) buyer's credit (PBC) is a USD- or EUR-denominated loan that China Eximbank issues to government institutions to facilitate their acquisition of goods and services from a Chinese supplier. The borrowing terms of these loans vary, but they tend to be offered at fixed interest rates that are typically more generous than prevailing market (floating) rates. China Eximbank's policy is to allow borrowers to use PBC proceeds to finance up to 85% of the cost of a commercial contract with a Chinese supplier, while counterpart funding is required to cover the remainder.

Figure 4 Composition of China's global energy lending by creditor type, 2010–2021



Note: 'Other' includes lending by government agencies, state-owned funds and syndicated loans or co-financing by state-owned policy banks and state-owned commercial banks.

Source: authors' elaborations based on AidData (2023)

Chinese financial institutions have increasingly been lending to special purpose vehicles (SPVs) rather than to foreign governments or SOEs, likely due to growing concerns over borrower risk and repayment capacity. In 2010, 70% of China's global energy lending was directly channelled to a government agency or state-owned company in a recipient country – in 2021, this share stood at 4%. Joint ventures and SPVs have become an increasingly popular vehicle for receiving and managing these financial transfers. In 2010, only 18% of Chinese energy flows were received by a joint venture of SPV, but this share increased to 43% in 2021. These joint ventures or SPVs are typically set up between a Chinese SOE or private company and a recipient country organisation. Meanwhile, foreign private sector institutions in recipient countries received less than 4% of all Chinese flows throughout this period.

In Africa, energy loans remain predominantly directed to recipient government agencies or state-owned companies. On average, between 2010 and 2021, 92% of China's energy loans were delivered to a host country government agency or SOE, with SOEs increasingly receiving a greater share of this financing in recent years. There has been virtually no lending to the local private sector in African countries. Lending to SPVs and joint ventures increased in 2021, but it is too early to establish a clear trend. Chinese creditors likely continue to mostly lend to public sector institutions on the continent due to a combination of China's diplomatic objectives and market access strategy, and limited local implementation capacity to structure complex SPV arrangements. Moreover, the data up to 2021 indicates that policy bank lending has not experienced the same decline as in China's global

lending portfolio, likely due to commercial creditors' hesitance to lend without some form of guarantee – nearly three-quarters of commercial energy loans to Africa over the period analysed were underwritten by Sinosure.

1.2.2 Equity investment and construction activity

The scale of China's overseas energy sector activity, through foreign investments and engineering contracts, exceeds official lending commitments. Between 2010 and 2024, Chinese SOEs and private companies engaged in FDI and construction contracts for energy-related projects worth $1,374 billion.[14] Annual project activity peaked in 2019 with 294 projects valued at $177 billion.

Chinese SOEs and private enterprises prefer to bid for construction contracts, especially in higher-risk markets, rather than making direct equity investments in energy sectors abroad. Over the same period, Chinese companies were awarded $866 billion worth of engineering contracts while they made $507 billion worth of direct equity investments globally.[15] While energy-related equity investment picked up slightly in the last two years, the relative share of projects where Chinese companies have equity stakes compared to those where they are awarded construction contracts, has been stable over time. In African countries, the relative share of contracts (85%) compared to investments (15%) was even higher. In emerging and developing markets, Chinese enterprises typically avoid developing IPP projects where they rely on power purchase agreements with local utilities or other off-takers.[16] Instead, their involvement typically follows the EPC model of building power plants without taking on ownership.[17] This approach is largely driven by significant off-taker risks in emerging economies, where there are few reliable customers at scale, such as national utilities or large industrial enterprises, to purchase the power generated. Limited pipelines of bankable projects with predictable returns further discourage Chinese firms from making

14 Based on the cumulative value of transactions recorded in the Janes IntelTrak database. This value likely represents a lower bound estimate as monetary values are not disclosed for all projects in the database.

15 Due to limited information on some transactions, it is not possible to categorise them as either contracts or direct investments. This applies to 1% of projects.

16 An 'energy off-taker' is an entity that agrees to purchase a pre-agreed amount of generated electricity from a power plant or project developer at a negotiated rate for a certain period of time. Off-take agreements are common in the energy sector as they provide demand certainty and predictable revenues for project developers. Large industrial and commercial entities, such as data centres and telecommunications companies, are ideal off-takers due to their significant and steady energy demand and creditworthiness.

17 The business model used by Chinese companies to build and finance large-scale infrastructure projects overseas is frequently termed EPC+F (engineering, procurement, construction and finance) and represents an integrated package of financing, construction services and technical assistance. Financing typically comes from Chinese lenders, either through borrowing by the local government or direct project finance to Chinese SOEs or private enterprises.

equity investments that would require them to assume long-term operational and market risks.[18]

Chinese enterprises have been successful in winning EPC contracts through competitive bidding processes. Chinese engineering firms – particularly large SOEs such as PowerChina, China Gezhouba Group and Sinohydro, frequently outperform other foreign competitors in securing these contracts from multilateral development banks (MDBs). Issues with sanctionable fraud and misconduct leading to debarment occur, and Chinese firms represent a large share of such debarments, but this is largely driven by (i) the sheer volume of Chinese contractors that bid for overseas projects, and (ii) instances of less well-known or established Chinese companies being awarded these contracts. The majority operate under a transparent system with clear standards (Morris et al., 2021).[19]

A growing share of this activity has been concentrated in the renewable energy sector, particularly solar power. Since 2010, there has been a steady increase in the proportion of engineering contracts and investments in renewable energy projects. By 2024, 49% of all Chinese overseas energy-related projects were in the renewables sector (Figure 5). Solar power, hydropower and wind power projects dominated this space, though hydropower activity declined notably over time (from 64% of projects in 2010 to 5% in 2024).[20] This decline in hydropower activity is also associated with a falling average size of renewable energy projects, from $405 million in 2010 to $118 million in 2024.[21]

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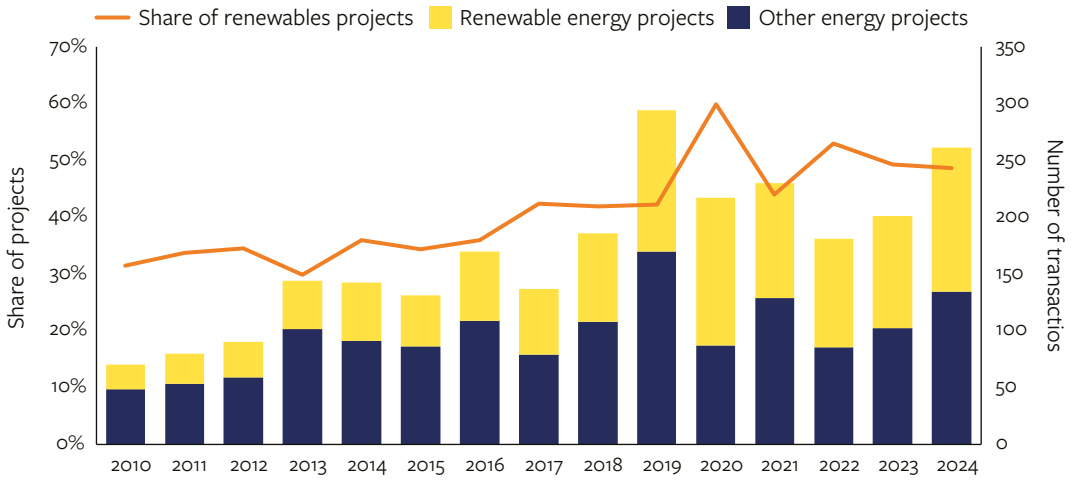
18 In addition to these constraints, there is a wide range of investment risks associated with renewable energy projects in EMDEs, including currency risk, regulatory risk, market risk, supply chain risk, construction risk. See (IRENA, 2024a) for a detailed discussion.

19 This view was also shared during stakeholder consultations with MDB representatives. There has also been a notable improvement in transparency and performance over time.

20 Meanwhile, the share of solar power projects rose from 5% in 2010 to 47% in 2024.

21 Projects include both direct investments and provision of engineering services.

Figure 5 Number of Chinese global energy sector investments and engineering contracts, 2010–2024



Note: Renewable energy projects are defined as solar, geothermal, biomass, hydropower and wind power generation projects, as well as transmission infrastructure projects that connect to one of these energy sources. Projects to build dual purpose transmission infrastructure are excluded. Only transactions tagged as foreign investment or M&A are included.

Source: authors' elaborations based on Janes (2024)

A fifth of China's overall energy sector and also a fifth of renewable energy investment and construction activity has taken place in Africa. Between 2010 and 2024, Chinese renewable energy investment and construction activity on the African continent reached $66 billion. Three-fifths of these projects were under $100 million and just 15% were over $500 million. In 2024, renewables represented 59% of the announced total 49 energy-related projects. Africa has also been a major overseas market for several of the leading SOEs.[22]

1.2.3 Trade in clean energy technology

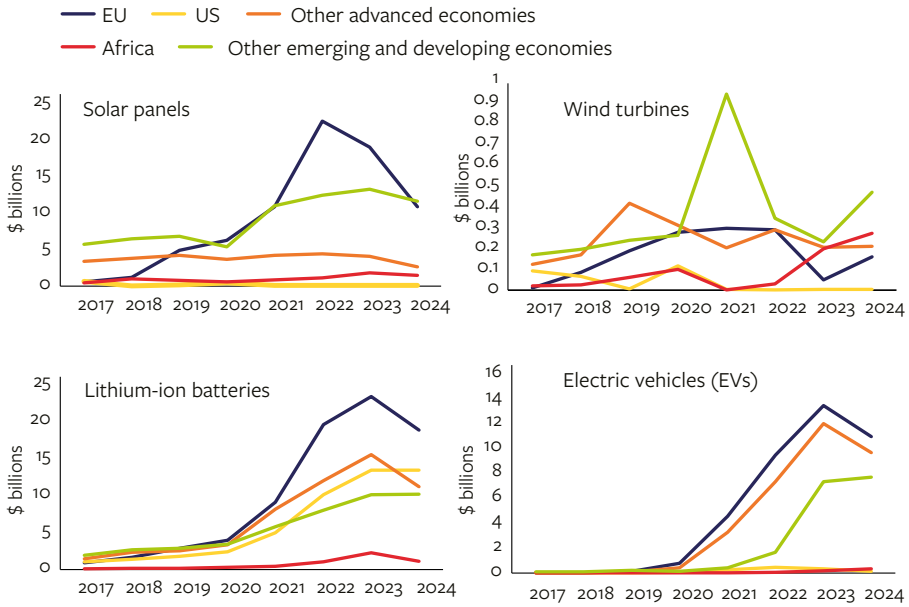
Chinese clean energy technology manufacturers are actively expanding into global markets. Infrastructure projects led by Chinese engineering and construction companies, such as those discussed above, typically source equipment from Chinese producers like Huawei and Trina Solar. China's combined exports of solar panels, lithium-ion batteries, wind turbines and EVs exceeded $114 billion in 2024, an 18% year-on-year decrease from 2023. This decline largely reflects the impact of significant trade barriers imposed by the EU and the US, including increased tariffs on solar cells, electric vehicles and battery components.

22 Between 2010 and 2024, over 40% of China International Water and Electric Corporation, Gezhouba Group and Sinohydro's renewable energy project portfolio was in African countries.

As traditional markets become more restricted, EMDEs are becoming increasingly important markets for Chinese clean energy technology exports. Nearly half of China's exports of solar and wind power equipment in 2024, valued at $13.8 billion, went to developing and emerging markets such as South Africa, Egypt, Brazil and Pakistan (Figure 6). In contrast, China's solar and wind power exports to the European Union and the United States stood at $11 billion and $117 million, respectively. The shift towards emerging markets is particularly evident in wind power technology, where four of China's top five export destinations between 2020 and 2024 were developing economies: Viet Nam ($922 million), South Africa ($314 million), Chile ($282 million) and Brazil ($262 million).

African economies represent a smaller, but growing destination for Chinese wind and solar power technology. Exports of these products to Africa grew by 153% year-on-year between 2020 and 2024. This growth trend is likely to continue given rising demand for electricity generation and untapped renewable energy resources on the continent.

Figure 6 China's annual exports of clean energy products by trade value and destination, 2017–2024



Source: authors' elaborations using Observatory of Economic Complexity and Ember based on General Administration of Customs of the People's Republic of China[23]

23 The product mapping follows the Harmonised System (HS) by the World Customs Organisation. The HS product codes used are 850231 (wind turbines); 85414020 and 85414300 (solar panels); 850760 (lithium-ion batteries); 870380 (fully electric motor vehicles). Country groups are based on the IMF's World Economic Outlook (WEO) groups.

2 China's energy projects and clean energy technology trade in Kenya

As demonstrated in Section 1, China's clean energy footprint is expanding globally, including in Africa, with strong outward investment policy signal to participate in the energy transition. This section presents Kenya's energy transition needs and examines how, if at all, China is meeting these through trade, lending and investment flows. It includes analysis of the implications of these changes for Kenya's low-carbon transition plans and domestic energy sector, as well as other sectors of the economy.

A lower-middle-income economy, Kenya aims to achieve upper-middle-income status by 2030. Its demographics are shifting, with a rapidly growing youth population (39% of the population is now under the age of 15) driving demand for jobs (World Bank, 2023a). The country's exports and trade are largely driven by natural resources, with agriculture being the largest employer and contributing 20% to GDP, while sectors like manufacturing have seen limited growth (World Bank, 2023a). ICT and finance sectors are expanding, adding to power demand (World Bank, 2023a).

Kenya has a longstanding bilateral relationship with China, marked by strong economic and political ties. As Kenya seeks to expand its renewable energy portfolio, enhance grid and transmission infrastructure and scale up low-carbon value chains, there are significant opportunities for China and other stakeholders to support the country's national development and energy transition goals.

2.1 Overview of Kenya's energy sector and green industrialisation ambition

2.1.1 Overview of the energy sector

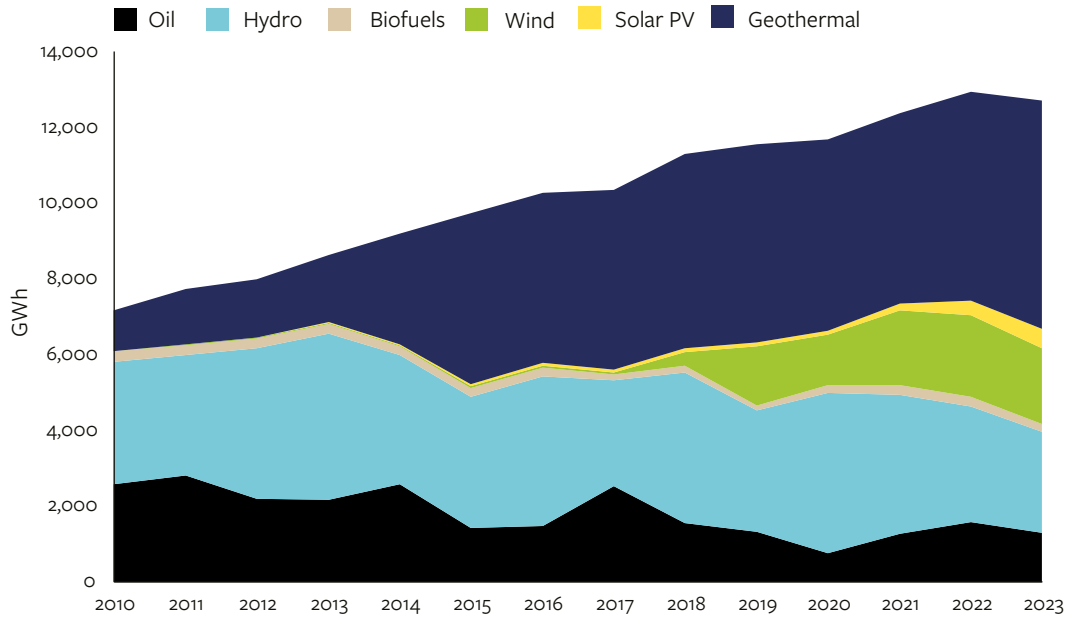
Despite significant progress in closing energy access gaps over the past decade (from 38% in 2012 to 76% of the population in 2022), disparities between rural and urban areas persist, with rural residents lacking connectivity (Ministry of Energy and Petroleum, 2025).[24] Targeted rural electrification programmes, such as the Last Mile Connectivity Project, are implemented by the Kenya Power and Lighting Company (KPLC) and the

24 Data on access to electricity comes from the World Bank Development Indicators.

Rural Electrification and Renewable Energy Corporation (REREC) (Ministry of Energy and Petroleum, 2025). REREC was established to provide subsidised electricity in rural areas with an expanded mandate to promote green energy adoption (REREC, n.d.). Among grid-connected electricity customers, the uptake of electric cooking appliances remains low, at just 3% in 2023 (Ministry of Energy and Petroleum, 2025).

With a baseload powered by geothermal energy, supplemented by wind and solar, Kenya's power mix is already dominated by renewable energy. In 2023, approximately 90% of electricity generation came from RE sources: geothermal (47%), hydropower (21%), wind (16%), solar (4%) and biofuels (2%) (Figure 7). There has been a significant improvement in phasing out thermal generation in the electricity mix since 2010. However, the country's overall energy mix remains dominated by biofuels (61%), followed by renewable energy (18%), as well as oil (17%) and coal (3%) (IEA, 2024b). Limited access to clean cooking drives the reliance on biofuels, while fossil fuels are widely used in industrial processes and transport.

Figure 7 Electricity production in Kenya by source, 2010–2023



Source: authors' elaborations based on IEA (2024b)

The power sector accounts for only 9% Kenya's overall energy demand and requires scaling up to meet growing demand (Ministry of Energy and Petroleum, 2025). Its overall effective installed electricity capacity increased from 2,736 MW in 2019 to 3,112 MW (Kenya National Bureau of Statistics, 2024).

With the number of KPLC customers growing by over 3 million between mid-2018 and early 2025 to reach 10 million, the country's peak demand has also increased to reach 2,304

MW (Ministry of Energy and Petroleum, 2025). Electrification of cooking and shift to EVs are among the factors that will generate additional grid demand (Ministry of Energy and Petroleum, 2025). Kenya's power demand varies throughout the day and week, with peaks in the evenings and on weekends.[25] After the evening peaks, the country often implements curtailment, with excess baseload, generated primarily from geothermal power, venting steam (Ministry of Energy and Petroleum, 2025).

Kenya's transmission grid includes a range of high-voltage transmission lines and is connected to Ethiopia, Uganda and Tanzania. Under the Transmission Master Plan 2024–2043, its grid will expand by approximately 2,500 km by 2027 and around 9,000 km by 2041 (Ministry of Energy and Petroleum, 2025). In 2024, Kenya's electricity imports from Ethiopia and Uganda rose to meet peak demand (Nzomo, 2024). Recent upgrades to transmission lines between Kenya and Tanzania have enhanced connectivity between the two countries (KETRACO, 2024). This is particularly significant as both nations are members of the Eastern Africa Power Pool, where cross-border transmission and trade are set to commence in March 2025 (ibid.).

As of 2021, Kenya accounted for just 0.1% of global greenhouse gas (GHG) emissions, but the country is highly vulnerable to climate risks (IEA, 2024b; World Bank, 2023a). Emissions from the energy sector have risen by 116% over the past two decades, with transport contributing the largest share of emissions (62%), followed by industry (18%), electricity and heat (7%), and residential sectors (6%) (IEA, 2024b). Kenya's Nationally Determined Contribution (NDC) commits the country to a 32% reduction in emissions compared to the business-as-usual scenario by 2030, conditional on financing, with adaptation as a key priority (Ministry of Environment and Forestry, 2020). The country ranks 145th on the ND-GAIN Index, underscoring its vulnerability to climate risks (University of Notre Dame, 2025). Climate-related hazards like droughts and floods affect both the economy and households through multiple channels (World Bank, 2023a).

2.1.2 Overview of energy and green industrialisation policy

Energy access is a crucial pillar of Kenya's Vision 2030, the country's blueprint for long-term economic development. The plan aims to transform Kenya into 'a newly industrialising, middle-income country providing a high quality life to all citizens' in a 'clean and secure environment' (Government of the Republic of Kenya, 2007). The government is targeting universal energy access and 100% renewable electricity by 2030 through a series of strategies (Ministry of Energy and Petroleum, 2024).

Kenya aims to develop a diverse energy mix to support its growing economy and expand electrification across key sectors such as clean cooking, industry and transport. The country's draft Energy

25 Source: stakeholder consultation with energy sector experts.

Plan for 2025–2034 outlines six strategic objectives, including reaffirming Kenya's commitment to achieving universal electricity access by 2030, prioritising renewable energy in diversifying the energy mix for cooking, and supporting innovation through emerging technologies and financing mechanisms (Ministry of Energy and Petroleum, 2025).

When it comes to modern renewables, Kenya plans to scale-up geothermal, solar and wind power. With installed geothermal capacity already reaching 940 MW, the government plans to invest in its further development, including the creation of the National Geothermal Development Strategy. With an installed capacity of 435 MW of wind and 212.5 MW of solar, Kenya plans to scale up these technologies while investing in grid stability to manage their intermittency. Among other clean energy sources, hydropower is a priority. The country currently has an installed hydro capacity of around 840 MW, much of which is aging. With approximately 6,000 MW of hydro potential, including small hydro, it aims to harness these resources while managing their environmental and social impacts (Ministry of Energy and Petroleum, 2025).

Kenya has a long-term goal of developing nuclear power, viewing it as a potential source of baseload electricity. Construction of its first nuclear power plant is expected by 2027, with electricity generation set to begin by 2034 (Payton, 2024). In 2019, Kenya's Nuclear Power and Energy Agency signed a contract with China National Nuclear Corporation to determine the most suitable location for this (Janes, 2024). Other sources such as thermal power generation will continue to be part of the power mix to help meet peak power demand.

The country is looking to localise low-carbon value chains and reduce reliance on imported renewable energy technologies. The draft energy policy emphasises the need to not only establish effective support mechanisms for solar, wind, and geothermal expansion but increase the role of local content (Ministry of Energy and Petroleum, 2025). To this end, Kenya aims to promote local manufacturing hubs. Other opportunities for localising value chains include clean cooking equipment, R&D capacity, as well as strengthening the critical minerals value chain. In the first five years of the strategy, quotas for locally manufactured energy components will be developed (Ministry of Energy and Petroleum, 2025).

Kenya aims to capitalise on its abundant renewable energy resources to scale up green hydrogen production and published its first Hydrogen Strategy in 2023 (Ministry of Energy and Petroleum, 2023). With potential applications across various sectors, including industry, transport, power and agriculture, the government plans to adopt a phased approach to developing the industry over ten years. The use of hydrogen for nitrogen fertiliser and methanol production in agriculture is of particular interest, given the sector's significant role in employment and contribution to GDP, and the country's

reliance on imported fertilisers, which impacts its balance of payments (Ministry of Energy and Petroleum, 2023). Overall, the strategy has four objectives: (1) improve balance of payments, (2) enhance food security and resilience, (3) promote green industrialisation and decarbonisation and (4) attract investment (Ministry of Energy and Petroleum, 2023). Several projects have already been announced. For instance, Fortescue plans to develop a 300 MW capacity green ammonia and fertiliser facility utilising geothermal resources in Naivasha (Green Hydrogen Organisation, n.d.).

2.2 Trade in clean energy technology

China is Kenya's largest import trading partner, with Kenya a net importer from China. The relationship is characterised by a substantial trade deficit for Kenya – this reached $3.07 billion in 2023. Kenya primarily imports manufactured goods, machinery (including machinery predominantly used in the construction sector) and electrical equipment from China, while it exports mineral ores (chiefly titanium, zirconium and manganese) and agricultural products.[26] This pattern reinforces China's role as a supplier of value-added goods while positioning Kenya primarily as a provider of raw materials.

Kenya relies on imports to scale its renewable energy capacity and the existing general regulatory framework incentivises the uptake of clean energy. For example, certain items such as windmills are not subject to import duties, and with the Finance Act 2021 the government reintroduced VAT exemptions for specialised solar and wind energy generation equipment, including PV modules, current inverters and deep cycle batteries that use or store solar power (IEA, 2016b; PwC Kenya, 2021). These measures demonstrate a commitment to reduce barriers for renewable energy technology adoption despite the reliance on imports.

China dominates Kenya's clean energy technology import market. In 2024, Chinese exports to Kenya included $45.9 million worth of assembled solar panels, $39.3 million worth of lithium-ion batteries and $2.3 million worth of electric motor vehicles (Figure 8). According to World Integrated Trade Solution (WITS) data, China is the largest single source of imports for all three clean energy technology products – in 2023, 96% of Kenya's PV panels, 81% of lithium-ion batteries and 21% of electric vehicles came from China. China surpassed Japan as the leading importer of EVs in 2023. Other significant EV exporters to Kenya in the same year were South Korea (18%), Japan (16%) and the United Kingdom (15%), illustrating a more diversified supplier base in this sector.

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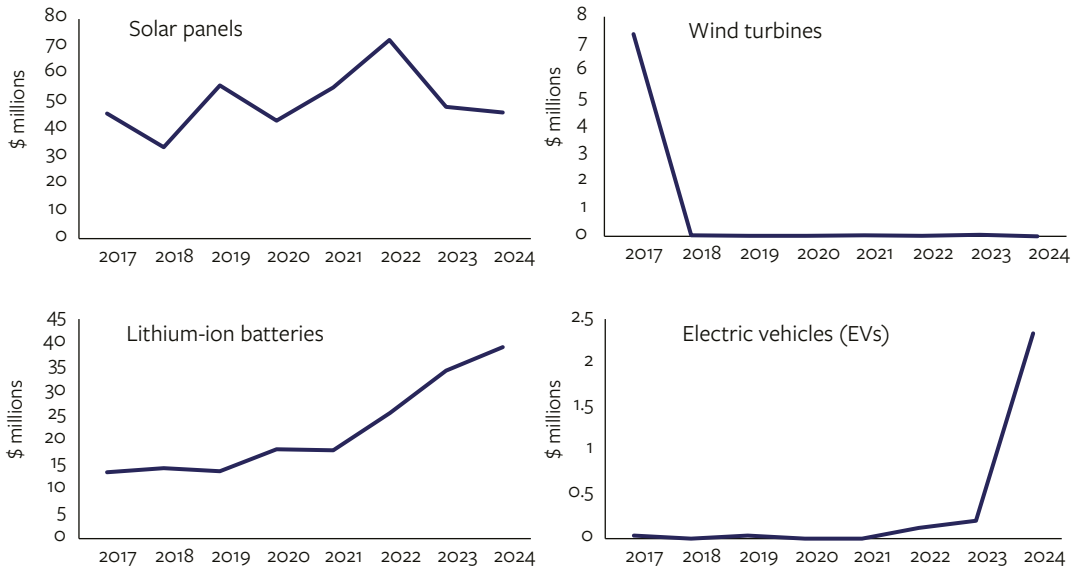
26 Data as of 2023 from Observatory of Economic Complexity, based on UN Comtrade.

Figure 8 China's annual exports of clean energy products to Kenya by trade value, 2017–2024



Source: authors' elaborations using Observatory of Economic Complexity and Ember based on General Administration of Customs of the People's Republic of China[27]

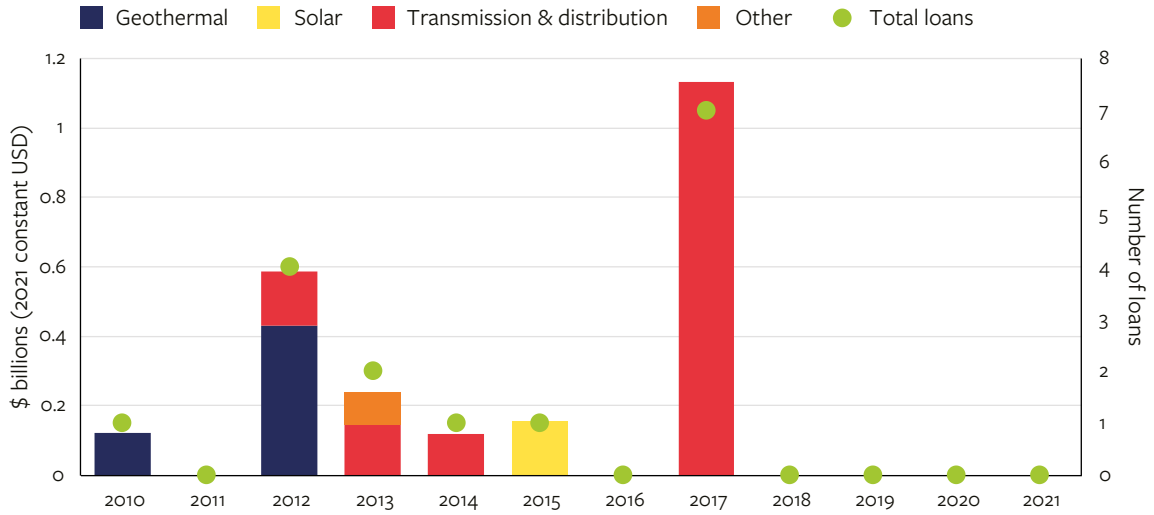
2.3 Energy-related investment and lending

2.3.1 Lending

China's energy-related lending to Kenya has been dominated by bilateral policy-bank debt financing for large transmission infrastructure projects. According to AidData, between 2010 and 2021, Kenya received $2.35 billion through 16 project-based loans (Figure 9). Eximbank provided over 80% of these loans, and Chinese SOEs and private companies were involved in the implementation of all of the loans, either as the standalone implementing agency or in a joint venture with Kenyan government agencies or SOEs. Lending from Eximbank has been concessional, with 2–3% interest rates where the borrowing terms are disclosed. China's energy-related loans peaked in 2017 with no new lending since.

27 The product mapping follows the Harmonised System (HS) by the World Customs Organisation. The HS product codes used are 850231 (wind turbines); 85414020 and 85414300 (solar panels); 850760 (lithium-ion batteries); 870380 (fully electric motor vehicles).

Figure 9 Chinese energy-related loans to Kenya by sub-sector, 2010–2021



Source: authors' elaborations based on AidData (2023)

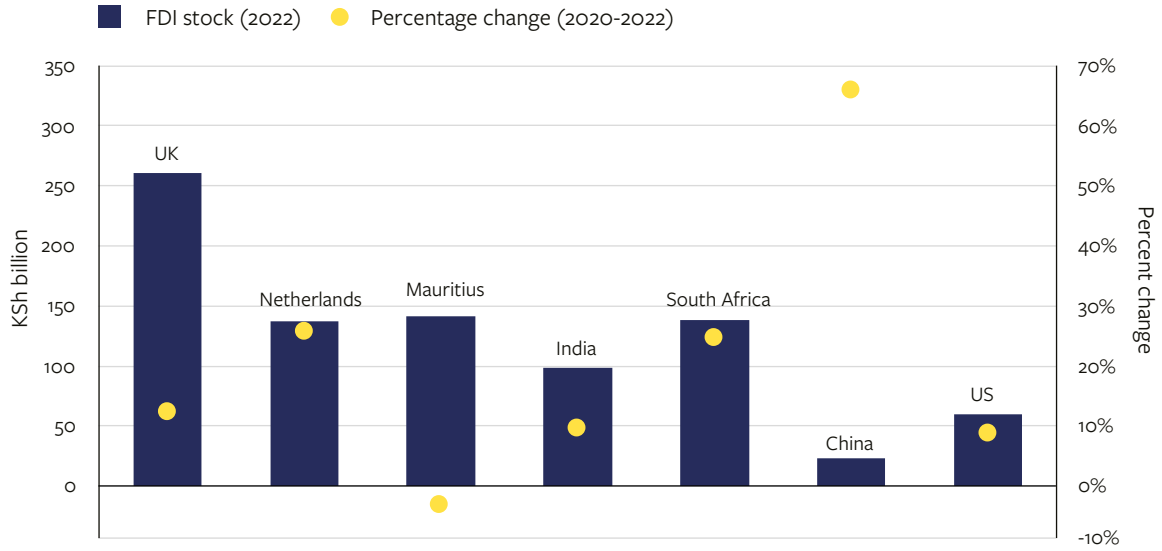
The Government of Kenya was the direct recipient of the majority of these loans – 13 were made directly to the government, and one specifically targeted the National Treasury. The National Treasury loan was underwritten by the China Export & Credit Insurance Corporation (Sinosure). The two loans not directed towards the government – received by Triumph Power Generating Company (a Kenyan SPV) and China International Water and Electrical Corporation (a Chinese SOE), received third-party insurance from the Multilateral Investment Guarantee Agency and a sovereign guarantee, respectively. This pattern of direct lending to government is observed across China's lending in other sectors.

2.3.2 Equity investment and construction activity

China's total FDI in Kenya is growing. In 2022, the leading foreign investors by FDI stock were the United Kingdom (21.9% of total FDI), Mauritius (11.8%), the Netherlands (11.5%), South Africa (11.5%) and India (8.3%). China's FDI stock in that year stood at 23.3 billion Kenyan shillings ($189 million) – less than 2% of Kenya's total FDI stock (Kenya National Bureau of Statistics, 2023).[28] However, this represented an increase of 66% from 2020 levels, which was significantly faster than the FDI stock growth of other major investors.

28 Exchange rate used for conversion: 1 KES = 0.0088104 USD (31 December 2022). Source: Wise Currency Converter.

Figure 10 Kenya's FDI stock by country of origin, 2022



Source: authors' elaborations based on Kenya National Bureau of Statistics' 2023 Foreign Investment Survey Report

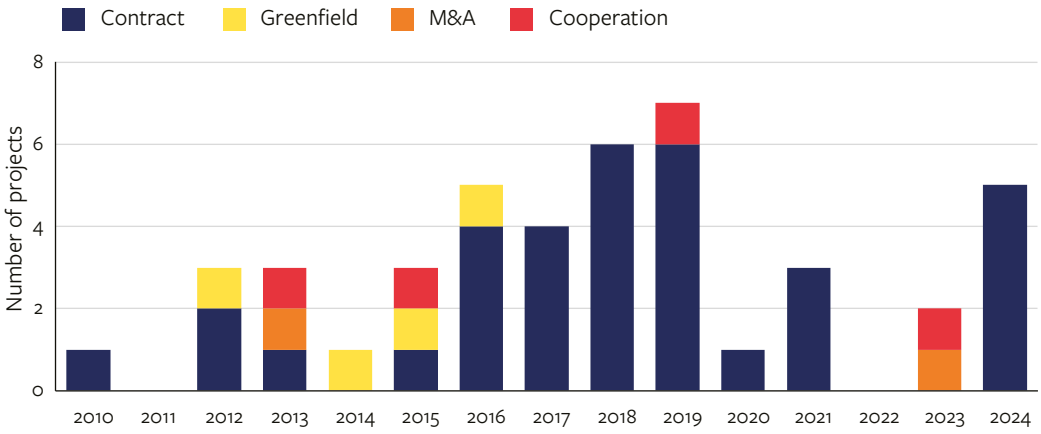
China is now an important investment partner in Kenya's energy infrastructure. In recent years, it has financed and constructed several key renewable energy projects, such as:

- **Funding and technical support for the Olkaria IV Geothermal Field Project.** In 2010 China Eximbank and the Government of Kenya signed a $93 million concessional loan agreement for the development of a 140 MW geothermal power plant in Naivasha, Nakuru County. China's Great Wall Drilling Company implemented the project in collaboration with KenGen, Kenya's Ministry of Energy and Petroleum, and Kenya's special purpose vehicle for geothermal development, the Geothermal Development Company.
- **Funding, design and construction of the Garissa Solar Park.** The 50 MW solar power farm located in Garissa, one of the largest solar PV stations in Africa, was designed and built by China Jiangxi Corporation for International Economic and Technical Co-operation, in collaboration with Kenya's Rural Energy Authority and Chinese solar company JinkoSolar Holding, which supplied the PV modules. The project was funded by a $135 million concessional loan from China Eximbank and has been operational since 2019. The Rural Electrification Authority and China Jiangxi reported that 600 local people were employed in the construction phase, while 50 Kenyan technicians received training during installation (China Daily, 2019).

- **Funding and construction of the Orpower 22 Geothermal Power Plant.** In November 2024, Kaishan Group announced a $93 million investment in the 35 MW geothermal power plant near Nakuru, which is being constructed by PowerChina. The plant is part of the Menengai Geothermal Power Project, which consists of three geothermal power plants built and operated by IPPs. Kaishan Group, which in 2023 acquired a 100% stake in Orpower 22, a Kenyan independent power producer, supplied the equipment. President Ruto stated that the completion of the project will elevate Kenya to the fifth largest geothermal power producer in the world (Xinhua, 2024).

Between 2010 and 2024, Chinese companies were involved in the investment and construction of 44 energy projects worth $7.3 billion.[29] The bulk of Chinese activity in Kenya's energy sector comprises EPC contracts won by large Chinese SOEs such as PowerChina and China CAMC Engineering Co Ltd to build transmission lines and substations and geothermal, wind, biomass and hydropower and solar power plants. The monetary value of these contracts, where reported, ranged from $14.5 million to $407 million.

Figure 11 Number of Chinese energy-related projects in Kenya, 2010–2024

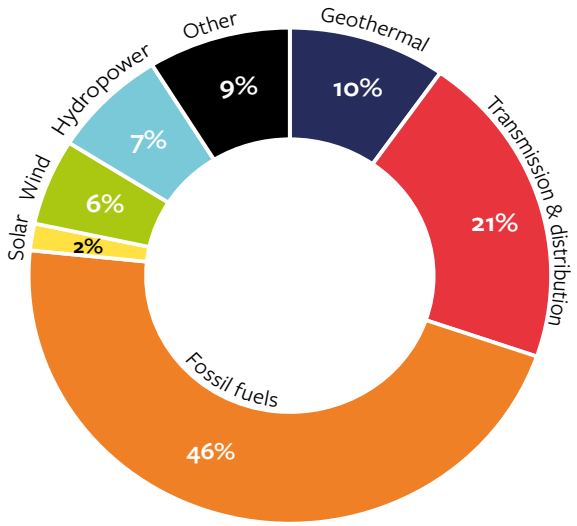


Note: excludes loan agreements. Projects are categorised as 'cooperation' where the nature of the transaction is unclear but is described as a collaborative project. Source: authors' elaborations based on Janes (2024)

29 This estimate likely represents a lower bound as monetary values are not reported for all transactions in the database.

Transmission and distribution projects, mostly composed of engineering contracts won by Chinese firms, represented two-fifths of projects over this period and collectively reached $1.5 billion, or 21% of the value of all energy projects (Figure 12). Renewable power generation projects collectively accounted for over $1.7 billion worth of projects, with most of these focused on geothermal development (10 projects).[30] The highest valued transaction was Shanxi Fenxi Mining Group's $3 billion acquisition of two coal blocks in the former Eastern Province in 2011. Since 2020, there have been no new fossil fuel energy investments or construction contracts.

Figure 12 Composition of Chinese energy investments in Kenya by project value, 2010–2024



Note: 'Fossil fuels' includes a coal development and an oil terminal construction project. 'Other' includes one nuclear power plant project, one waste heat recovery project and one waste-to-energy power generation project. Percentages based on projects for which monetary values were reported. No project values were recorded for 40% of transactions.
Source: authors' elaborations based on Janes (2024)

30 Between 2010 and 2023, Chinese construction or financing of other renewable sources such as solar (2 projects), wind (2 projects) and hydropower (3 projects) was less common.

2.4 Impact assessment: how is China contributing to Kenya's energy transition?

China is an active contributor to Kenya's energy transition through trade, clean energy technology supply and project development. Chinese presence in the energy sector has been most visible in terms of technology and equipment supply. Imports of Chinese clean energy technology components such as fully assembled solar panels, batteries and EVs have been cost-competitive options to meet local demand. Chinese SOEs have been winning bids to build renewable power generation plants (with no fossil fuel activity since 2020) as well as crucial electricity infrastructure such as high-voltage transmission lines and substations.

Chinese financing has provided essential capital for Kenya's energy infrastructure development, though with mixed economic impacts. High initial capital requirements for any energy sector project are the main challenge with scaling renewable energy in Kenya. Projects financed by China Eximbank, such as the Olkaria IV Geothermal Project and Garissa Solar Park, have frequently subcontracted Chinese engineering companies, limiting the economic spillover effects for the local economy.

At the same time, Chinese contractors have demonstrated competitive advantages that Kenyan stakeholders value. In construction projects, Chinese EPC firms have also tended to outperform other foreign contractors in terms of respecting project timelines and addressing right-of-way challenges that come up during project implementation.[31] Chinese engineering companies have established market dominance in Kenya's energy infrastructure sector through aggressive bidding strategies – there have been examples of large tenders only attracting Chinese bidders. This competitive approach has reshaped the contractor landscape, with Chinese and Indian firms now dominating bids in a space where European and Japanese companies once competed more effectively.[32] In many cases, such as the Menengai Geothermal Project where each IPP is responsible for their own procurement and contractor selection, stakeholders say it is too early to tell if there is a quality difference between foreign contractors.

Kenya's approach to energy sector financing is evolving, and Chinese investors have not yet stepped up. Historically, the Government of Kenya would directly fund the Kenya Electricity Generating Company (KenGen) with development partners providing supplementary loans to cover funding deficits. However, with Kenya's increasingly limited fiscal space, the government has pivoted toward PPPs. For example, the Nairobi Expressway, recently developed under a design-build-finance-operate-transfer PPP model, was fully financed by the China Road and Bridge Corporation,

31 Source: stakeholder consultation with MDB energy experts.
32 Source: stakeholder consultation with MDB and local electricity sector experts.

which will recover its investment through toll fees before handing it over to the Government of Kenya after 27 years. Chinese participation in energy-sector PPPs or equity investments are limited to date. Moreover, there is an unfilled investment need in creating demand for electricity consumption where currently there is none – through investments in green industry and electricity off-takers. These are missed opportunities as government advisors perceive Chinese investors as generally more risk-tolerant and action-oriented than their Western counterparts, who have been more hesitant to invest in recent years.

These gaps in how China operates in the country are partly due to constraints in the broader operational environment. For example, utility-scale projects in Kenya face extremely unpredictable development timelines, creating high development risk due to regulatory and off-taker uncertainty. Implementation is lengthy, with upstream activities requiring 1–2 years of feasibility studies to prepare a bankable project. These extended timelines often create misaligned expectations between investors and project developers.

Underperformance on the contractor side, whether Chinese or another foreign entity, tends to be driven by limited due diligence capacity from local implementing agencies. On-site contractors consistently encounter challenges with right-of-way issues, compensation disputes, and tax exemption complications. When foreign contractors fail to meet their contractual obligations, it typically stems from local implementing agencies lacking the capacity and networks necessary for proper contractor vetting. These challenges are common throughout the region, and not unique to Kenya.[33] Stakeholder interviews indicate these issues primarily result from weak administrative and due diligence processes. On the procurement side, there are uniform standards established across projects funded by MDBs so there is no difference in performance between Chinese and other foreign suppliers.

The employment impact of Chinese energy investments and construction activity shows a nuanced picture. Unemployment stands as a central challenge to Kenya's economic development and underpins the government's focus on green industrialisation as both a potential growth avenue and green employment solution.[34] Bidding documents for energy projects, particularly those financed by MDBs, will also typically have conditions around temporary and permanent job creation

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33 Source: stakeholder consultation with MDB experts. MDBs in the region have cross-debarment agreements such that a contractor sanctioned by one MDB would be debarred by other MDBs on the same terms and conditions. Less well-known and 'new entrant' Chinese construction companies are frequently on these debarment lists due to the due diligence challenges outlined above.

34 Through initiatives like the Africa Green Industrialisation Initiative and the Accelerated Partnerships for Renewables in Africa, the Government of Kenya aims to streamline foreign investment pipelines in clean energy and adjacent sectors which will create green jobs.

as part of their results measurement frameworks. While Chinese EPC firms have improved in creating temporary job opportunities, local staff have historically been hired for short-term, low-skilled support positions. There has been little evidence of technical skill transfer from the expert engineers that come from China. However, energy sector stakeholders emphasised that fostering long-term skills transfer remains the responsibility of the Kenyan government and implementing agencies.

What is the potential for technology transfer? Historically, the prevalence of donor-funded projects and inconsistent local demand created investor uncertainty around setting up local clean energy technology manufacturing. However, there is a growing business case for local assembly as the government works towards establishing industrial and export-processing zones focused on attracting high-energy-consuming industries and clean energy technology plants. For example, energy sector stakeholders expressed interest in partnerships between Chinese manufacturers and domestic Kenyan firms for solar panel assembly to replace fully assembled PV imports. Moreover, there is an ongoing feasibility study, financed by the World Bank, for a battery energy storage systems pilot, which is seeking foreign partners. Foreign investors who embed knowledge transfer through joint ventures with local firms stand to gain from priority access to these opportunities.

Lastly, Kenya's debt situation presents both constraints and opportunities for energy sector financing. The IMF currently assesses Kenya's debt as sustainable, but with high risk of debt distress (IMF, 2021). As of September 2024, China is Kenya's leading bilateral creditor with a total debt of $5.4 billion (or 66% of Kenya's bilateral external debt), which is mainly composed of borrowing to finance the construction of the Standard Gauge Railway (SGR) connecting Nairobi to Mombasa (National Treasury, 2024).[35] However, the majority of Kenya's external debt is multilateral (with the World Bank the main creditor) and China's share of the total debt was only 13.4%. Given that fiscal consolidation is a priority for the current administration, it is unlikely that the Government of Kenya will take on more loans to fund energy-related projects, which opens up opportunities for innovative financing solutions from Kenya's traditional and new partners in this sector.[36]

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35 Kenya's National Treasury reports public and publicly guaranteed external debt in local currency. The authors used the Central Bank of Kenya's period end market exchange rate to convert this into US dollars (1 USD = 129.1957 KES).

36 As shared in stakeholder interviews with development partners, the main financiers in Kenya's energy sector have historically been the African Development Bank, the World Bank, the French Development Agency (AFD), Japan International Cooperation Agency (JICA), China Eximbank, the Export-Import Bank of Korea (KEXIM) and the European Union.

3 China's energy projects and clean energy technology trade in Mozambique

This section explores Mozambique's energy transition needs and examines how, if at all, China is meeting these through trade, lending and investment flows. It includes analysis of the implications of these changes for Mozambique's low-carbon transition plans and domestic energy sector, as well as other sectors of the economy.

Mozambique is a low-income country with a growing economy and population, driving demand for energy and employment (World Bank, 2023b). The economy is largely dependent on agriculture, fishing and mining, which provide employment for around 75% of the workforce, while the tertiary sector, including services and trade, accounts for 20% (Ministry of Economy and Finance, 2024). Energy, manufacturing and construction make up the remaining 4% (Ministry of Economy and Finance, 2024). Although Mozambique experienced strong economic growth before 2016, multiple shocks, including cyclones and a hidden debt crisis, have since weakened its growth trajectory (World Bank, 2024b). Underemployment remains high, and a large share of the workforce is engaged in the informal sector, leaving many vulnerable to economic shocks (World Bank, 2024b).

Like Kenya, Mozambique has a longstanding bilateral relationship with China, with bilateral economic and political ties. Expanding energy access is crucial for addressing the country's socioeconomic challenges. As Mozambique seeks to grow its renewable energy portfolio while continuing to scale up investment in gas as a transition fuel and enhance grid and transmission infrastructure, there are significant opportunities for China and other stakeholders to support its national development and energy transition goal.

3.1 Overview of energy sector and green industrialisation ambition

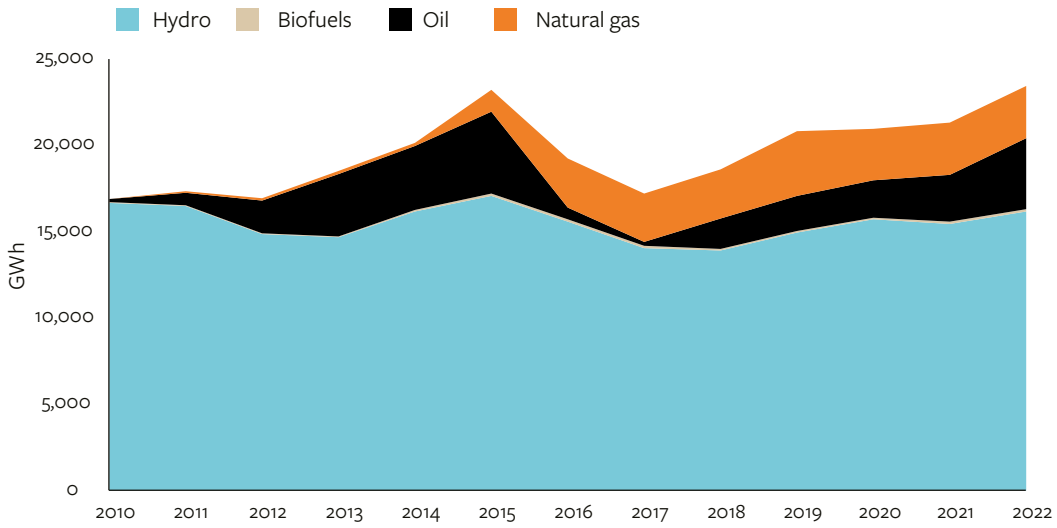
3.1.1 Overview of the energy sector

Mozambique has expanded electricity access over the past decade, but it remains limited to 51% of the population, with continued disparities between provinces and between rural and urban areas (Government of Mozambique, 2023; World Bank, 2023b). While access is nearly universal in southern Maputo province and exceeds 60% in Gaza province, it remains limited in northern provinces, with only 19% connected in Cabo Delgado (Government of Mozambique, 2023). Limited interconnections between the southern, central and northern parts of the country prevent many provinces from benefiting from Mozambique's low-carbon electricity generation and limits industrial development

and access to services (Government of Mozambique, 2023; World Bank, 2023b). In recent years, off-grid solutions have gained popularity as an alternative for expanding access, particularly in remote areas (World Bank, 2023b).

The country's energy mix is varied, with coal a dominant source, at 37%, followed by biofuels and waste (32%) and natural gas (24%) (IEA, 2024c). Electricity accounts for only 10–20% of the country's final energy consumption, with a total installed capacity of 2,889 MW (Government of Mozambique, 2023). Hydropower is a dominant source of electricity, though most of electricity produced by the Cahora Bassa Hydroelectric Plant is exported to South Africa's ESKOM with a smaller portion (300 MW of firm power and 380 MW of variable power) supplied to the state-owned energy company, *Electricidade de Moçambique* (EDM).[37] Unlike most electricity produced across the Southern African Power Pool (SAPP) countries, which is primarily coal-based, Mozambique relies on hydropower exports. Since 2015, natural gas has played a growing role in the power mix, but it has also contributed to rising GHG emissions. New renewables like solar and wind are playing a minor role in power generation mix.

Figure 13 Electricity production in Mozambique by source, 2010–2022



Source: authors' elaborations based on IEA (2024c)

Energy demand is expected to rise significantly in the coming decades, reflecting the country's growing development needs, and is forecast to increase annually by 2–4% (Government of Mozambique, 2023).

37 Cahora Bassa Hydroelectric Plant has a total installed capacity of 2,075 MW and is majority owned by the Government of Mozambique

This growth would see total energy demand rise from 110–130 TWh in 2020 to 310–330 TWh by 2050. In a business-as-usual scenario, the share of electricity in household energy consumption is expected to increase from 10–20% in 2020 to 20–40% by 2050. However, biomass and fossil fuels will continue to meet much of this demand.

Mozambique remains a low GHG emitter but is highly vulnerable to climate change, ranking 153rd on the ND-GAIN index (University of Notre Dame, 2025). The country's per capita emissions have risen threefold since 1990 to around 2 tCO_2eq today. Transport is the leading source of energy-related emissions (56%), followed by electricity and heat (22%) and industry (13%) (IEA, 2024c). The country's updated NDC commitments could reduce emissions by 40 $MtCO_2e$ between 2020–2025, though its implementation is conditional on international support (Ministry of Land and Environment of Mozambique, n.d.).

3.1.2 Overview of energy and related industrial policies

Energy and green industry are key priority sectors in Mozambique's National Development Strategy 2025–2044, with a goal of increasing electricity production from 19,286 GWh to 73,000 GWh (Ministry of Economy and Finance, 2024). The government has also adopted several policies to expand energy access and strengthen the sector, including the EDM Strategy, the Rural Electrification Strategy, and *Fundo de Energia's* (FUNAE) Off-grid Electrification Roadmap which targets electrification rate of 100% by 2030. The EDM Strategy (2018–2028) focuses on reforming the company to electrification as a driver of economic transformation, supporting Mozambique's transition from an agriculture-based economy to a service-oriented one, better integrated with regional and global markets (Electricidade de Moçambique, 2018). These policies collectively aim to enhance energy security, support industrialisation, and position Mozambique as a key energy player in Southern Africa.

Most recently, Mozambique's Energy Transition Strategy (*Estratégia de Transição Energética* – ETE), launched at COP28 in 2023, outlined long-term vision for the energy sector. The strategy has four pillars: (1) a modern energy system based on renewable sources, (2) green industrialisation, (3) universal access to modern energy, and (4) the adoption of clean energy for transport (Government of Mozambique, 2023). The ETE emphasises a just and equitable transition, with 70% of the population connected to the national grid and 30% relying on off-grid solar solutions by 2030 (ibid.).[38] However, achieving these objectives requires a renewed financing push as they are unlikely to be met on the current trajectory.

38 To meet this ambition, 2 million off-grid connections will be required via mini-grid or solar-home systems by 2030.

Mozambique's future power mix will draw on a diverse range of sources to meet growing domestic demand and establish the country as a regional energy exporter (Government of Mozambique, 2023). Natural gas plays a key role in the country's energy strategy, with plans for both domestic use and export, including LNG production using clean power and increased natural gas exports to diversify coal and aluminium exports (ibid.).

Hydropower will continue playing a critical role with plans to repatriate electricity from the Cahora Bassa Hydroelectric Plant (HCB) for domestic use once the current export agreement with South Africa expires in 2030 (Government of Mozambique, 2023). In the long term, the country plans to develop 14 GW of hydro capacity, with some of the additional capacity potentially being exported to the SAPP once internal demand is met (ibid.).

Mozambique plans to expand solar and wind production and attract large-scale industrial investments. The country aims to develop 32–43 GW of solar PV capacity and 4–7 GW of wind power capacity by 2050. In the near term, this means installing at least 1 GW of new solar PV capacity and 200–500 MW of onshore wind capacity by 2030, followed by 2.5 GW of new solar PV and 1 GW of wind capacity per decade through 2050 (Government of Mozambique, 2023).

In addition to these efforts, the country plans to establish itself as a leading early producer of hydrogen in Southern Africa. The strategy is set to include collaboration with the Southern African Development Community (SADC) to build a regional hydrogen economy, complete with production, storage, and transportation facilities (Government of Mozambique, 2023).

While Mozambique has significant energy generation potential, building out transmission is critical to support clean energy exports and solidify its role as a strategic energy hub in the region.[39] A key focus of recent energy strategies, including ETE, is on strengthening energy infrastructure to connect supply and demand, particularly given Mozambique's vulnerability to climate-related hazards such as cyclones, which have disrupted transmission and distribution networks. To reach its electrification targets by 2030, the country needs to add approximately 2.5 million on-grid and 2 million off-grid connections while expanding the national grid to support 28–32 TWh of additional energy, including 15–25% intermittent renewables (Government of Mozambique, 2023). However, the current rate of capacity additions is insufficient to achieve its electrification ambitions.[40]

Beyond expanding electricity access and the grid, the country looks to promote green industrialisation through the development of green

39 Source: stakeholder consultation with MDB representative.
40 Source: stakeholder consultation with MDB representative.

energy corridors and industrial parks. By 2030, Mozambique plans to establish at least one industrial park as a model for future expansion, with new parks and corridors forming the core of its industrial development strategy (Government of Mozambique, 2023). Already a producer of minerals such as natural gas, gold, titanium ores from heavy sands, and graphite, Mozambique is now seeking to capitalise on its resource wealth by moving beyond extraction. The aim is to retain greater value through domestic processing, not only of its own reserves but also of resources sourced from landlocked neighbours such as Zambia and Zimbabwe (ibid.). However, as with other areas of its energy and industrial strategy, it remains unclear whether strategic planning and quantitative targets for attracting FDI into the sector have been set.

Mozambique's ETE estimates that implementation will require approximately $80 billion. Investments before 2030 will focus on grid expansion and hydropower, with post-2030 efforts shifting toward large-scale solar and wind projects (Government of Mozambique, 2023). To finance transition, Mozambique will develop a financing strategy that leverages different sources of funds. PPPs are set to play a key role in funding large-scale strategic projects, while targeted public support will focus on enabling infrastructure, feasibility studies, and risk mitigation instruments. Given fiscal constraints, spending on enabling projects rather than directly investing in large-scale developments will be prioritised (ibid.).

Institutional and financial constraints may impede progress toward its energy transition and green industrialisation aspirations. From an institutional perspective, stakeholders have noted a lack of coordination in developing a comprehensive strategic vision. The ETE published in 2023 is the key energy sector strategy but new strategies may be in development, leading to uncertainty about long-term planning. Strengthening institutional capacity is essential to bring new renewable energy capacity to the grid, manage the country's LNG revenues, and allocate resources toward enhanced climate adaptation given the country's high vulnerability to climate risk. A fragmented institutional landscape also creates difficulties in implementing tax and import duty exemptions for renewable energy equipment under the economic stimulus package, which could help reduce the cost of imported technology.

When it comes to financial sustainability, Mozambique's state-owned energy company, EDM, which oversees the country's electrification policy, struggles with cost recovery and improving its financial and operational performance. Electricity added to the grid since 2015 sourced by EDM from its own sources as well as HCB and IPPs has been both more expensive and more carbon intensive. With HCB's lower-cost electricity exported to South Africa via SAPP, the government will need to decide whether to continue exporting its capacity into 2030s or redirect the electricity to power domestic industrial development.[41]

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41 Source: stakeholder consultation with energy sector advisor (2).

3.2 Trade in clean energy technology

China is Mozambique's second largest export destination (after India), accounting for over 14% of all exports, valued at $1.2 billion, in 2023. The main products purchased by China include natural gas, coal, heavy sands, oilseeds and fruits and graphite.[42] In the same year, China was also the second largest source of imports (after South Africa), with $1.4 billion, focused on the supply of agricultural materials, tires, tractors and cars for transporting goods, among others (Bank of Mozambique, 2023). The trade balance favours China.

Mozambique relies on imports of renewable energy equipment and components. The costs of importing these products are high and imported components related to renewable energy projects mostly come from China. For example, China is the main source of solar technology, including the equipment needed for off-grid projects and larger grid-connected plants such as the 19 MW Cuamba solar plant, the country's first combined utility-scale solar and energy storage plant.[43] In 2023, 62% of Mozambique's assembled solar PV panels came from China.[44] This is despite higher import duties for Chinese imports. According to one analysis, the total tax burden applied to the imports of these goods can be as high as 36% (including VAT and customs duties); import duties between SADC countries, and between these and the EU, are 0% (ALER and AMER, 2023). That the majority of renewable products are still sourced from China signals their relative affordability, a trend that is not expected to change soon.

Given the relative nascency of utility-scale wind projects in Mozambique, trade volumes of wind turbines are unsurprisingly low, with no clear regional pattern across the years. Just over half (51%) of lithium-ion batteries between 2017 and 2023 came from China, while 31% were imported from South Africa. Japan is the biggest exporter of electric vehicles to Mozambique, accounting for 53% of imports over the same period.[45]

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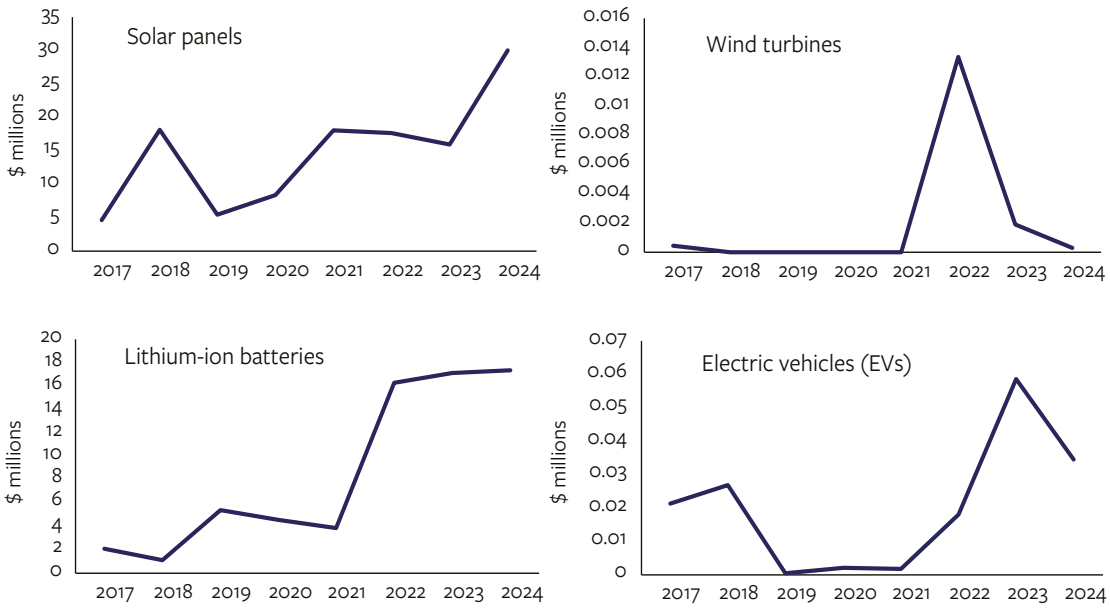
42 In 2023, Mozambique was the second-largest exporter of graphite in the world, after China. Graphite is the main material used for the anodes of lithium-ion batteries (Zhao et al., 2024).

43 Shared during stakeholder consultation with development partners.

44 Source: WITS. China and Mozambique report markedly different trade volume data on renewable energy equipment products. In theory, the volume of China's exports of solar panels should be identical to the volume of Mozambique's imports of solar panels, but the values reported by Mozambique are lower. This signals imperfect data collection by one or both countries. However, the trade patterns reported by Mozambique are broadly in line with those depicted in Figure 14. For consistency with the rest of the paper, and for its more up-to-date information, we use the volumes reported in China's customs data. We use data reported by Mozambique (to WITS) to assess the relative share of imports from China compared to other trade partners.

45 Data source: WITS.

Figure 14 China's annual exports of clean energy products to Mozambique by trade value, 2017–2024



Source: authors' elaborations using Observatory of Economic Complexity and Ember based on General Administration of Customs of the People's Republic of China.[46]

3.3 Energy-related investment and lending

3.3.1 Lending

China's official energy-related lending to Mozambique has been a mix of commercial and concessional lending, primarily for LNG projects, which are in line with Mozambique's plans to transform the economy and energy exports. Between 2014 and 2020, Chinese policy and commercial banks committed five loans, collectively worth over $1.7 billion.

The Rovuma Basin off the coast of Cabo Delgado Province contains one of the continent's largest reserves of natural gas and its development as a global LNG hub is key to Mozambique's economic transformation ambitions (AfDB, 2019). In 2017, three Chinese banks – the Bank of China ($500 million), ICBC ($550 million) and China Eximbank ($500 million) – contributed to a $4.66 billion international syndicated loan agreement for the Coral South Floating Liquefied Natural Gas Project, the first floating natural gas facility built on the African continent.[47] Later,

46 The product mapping follows the Harmonised System (HS) by the World Customs Organisation. The HS product codes used are 850231 (wind turbines); 85414020 and 85414300 (solar panels); 850760 (lithium-ion batteries); 870380 (fully electric motor vehicles).

47 The other lenders in this syndicate were Credit Agricole, Sumitomo Mitsui Banking Corporation, Export-Import Bank of Korea, ABN Amro, BNP Paribas, HSBC, Korea Development Bank, Natixis, Societe Generale, Standard Bank, UBI Banca and UniCredit.

in 2020, ICBC contributed to another $1.26 billion syndicated loan for the Rovuma Liquefied Natural Gas Project.[48]

Due to its market uncertainty and political environment, Mozambique ranks among the riskiest countries in the world to do business (World Bank, 2021). In all Chinese lending to LNG projects, credit insurance from Sinosure was used to mitigate investment risks.

3.3.2 Equity investment and construction activity

Although China is one of Mozambique's top 10 foreign investors, it lags behind the leading foreign players. In 2023, China contributed just 0.6% of net FDI flows in Mozambique, with investment activity focused on the extractive and manufacturing industries (Bank of Mozambique, 2023). The main investors were Mauritius, South Africa and the Netherlands, jointly accounting for nearly 85% of FDI in the country.

At the project level, between 2010 and 2024, Chinese companies were involved in the investment and construction of 13 energy projects worth $13.76 billion.[49] China's presence in Mozambique's energy sector is focused on EPC contracts rather than IPPs that own or operate power generation plants. Out of the 13 projects recorded over this period, eight were engineering service contracts awarded to Chinese companies for the design and construction of transmission lines and substations, gas pipelines and transportation (Figure 15). Chinese SOEs such as China Energy Engineering Group and PowerChina have won EPC contracts from EDM. In general, Chinese companies tend to bid for larger capital project tenders, such as World Bank or African Development Bank construction projects.[50]

The remaining projects comprised two greenfield projects, two M&As and one cooperation agreement for oil and gas exploration and production between the China National Petroleum Corporation and the *Empresa Nacional Hidrocarbonetos de Mozambique* in 2016. China's National Petroleum Corporation has a 20% ownership stake in the Rovuma Basin's Area 4 natural gas development site.[51]

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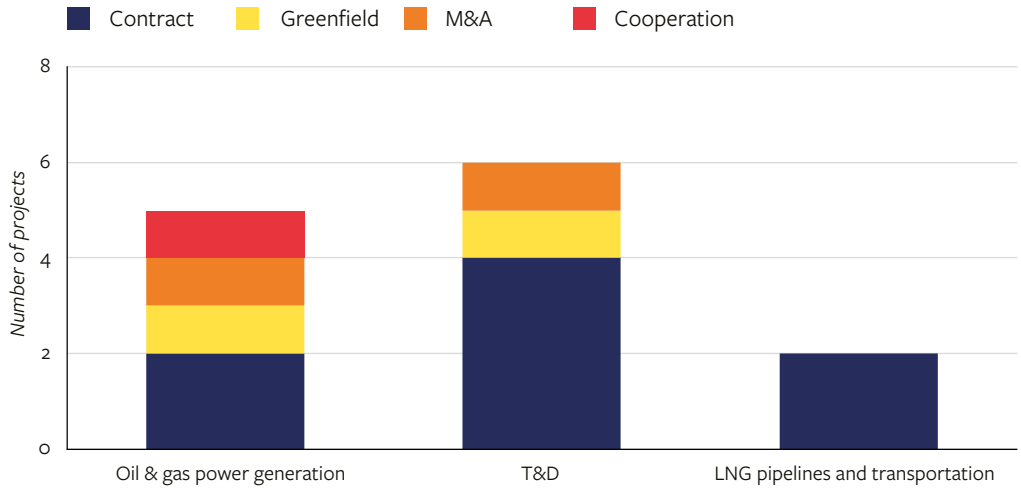
48 This project is current affected by the armed insurgency in Cabo Delgado. The other (commercial) lenders in this syndicate were MUFG, Standard Chartered, Mizuho, Societe Generale, SMBC, ABSA and IDC.

49 This estimate likely represents a lower bound as monetary values are not reported for all named transactions in the database.

50 Source: stakeholder interviews with energy sector experts.

51 The Rovuma Basin's Area 4 is owned by a consortium of Mozambique's state-owned petroleum company and foreign developers, with the following shares: Eni (25%), ExxonMobil (25%), China National Petroleum Corporation (20%), Korea Gas Corporation (10%), Galp Energia (10%), Empresa Nacional de Hidrocarbonetos (10%) (Eni, 2017).

Figure 15 Number of Chinese energy-related projects in Mozambique, 2010–2024



Note: excludes loan agreements. Source: authors' elaborations based on Janes (2024)

Between 2010 and 2014, Chinese companies were contracted for the construction of several high-voltage transmission lines and substations, which are a priority investment area for the government. There is currently no connection between the three main transmission grids in the country, and interconnecting the southern, central and northern electricity systems into a single integrated system is a priority for ensuring universal energy access (Government of Mozambique, 2023). Transmission network improvements are also key to Mozambique's ambitions to position itself as the energy hub in the SAPP market. Some Chinese transmission and distribution projects have also aimed to connect to industrial sites – for example, in 2022, PowerChina signed a contract develop a 104 km transmission line linking to the Nipepe graphite mine developed by China's DH Mining.

Large utility-scale renewable energy projects in Mozambique are still relatively nascent, and Chinese developers have not yet made investments into the country's solar PV or wind energy infrastructure. European companies – such as Norwegian Scatec Solar (Mocuba Solar Power Station) or French Neoen (Metoro Solar Power Station) – have been more active in this area.[52] In 2023, China's Tsingshan Group signed a memorandum of cooperation with the government of Mozambique to develop the Mozambique Green Industrial Park in the country's central Sofala province. The $40 billion project will be the country's largest special economic zone and it plans to develop clean energy power sources such as solar and wind energy and to establish a local new energy batteries and solar photovoltaic industry (Seetao, 2023).

52 World Bank (2023) Private Participation in Infrastructure database.

3.4 Impact assessment: how is China contributing to Mozambique's energy transition?

China has a longstanding relationship with Mozambique and has engaged in various sectors, but its participation in the energy sector has focused on gas projects and mostly happens through trade, providing clean energy technologies and EPC projects. Like Kenya, China's presence in Mozambique's energy sector has been most visible in technology and equipment supply.[53] Imports of Chinese solar panels align with Mozambique's goal of expanding off-grid electricity access. However, high costs remain a barrier, as tax exemption measures have not been implemented, making it difficult to develop sustainable business models for solar home systems. Huawei is among the Chinese companies that seek active participation in Mozambique's clean energy rollout, having participated in annual conference of the *Associação Moçambicana de Energias Renováveis*.[54] Huawei provides residential, utility-scale, and micro-grid solar PV solutions and has signed strategic cooperation agreements with other African countries, including Ghana (Colthorpe, 2022).[55]

China's official energy-related lending to Mozambique consists of a mix of commercial and concessional loans, primarily targeting LNG developments, in line with the ETE priority to develop gas as a transition fuel. However, as Mozambique seeks to expand gas production, some stakeholders have emphasised the need for greater analysis of the country's exposure to transition risks under different energy transition scenarios.[56] China is not the only country financing the sector; for instance, TotalEnergies' project most recently secured funding from the US International Development Finance Corporation (DFC). A range of multinational companies, including Eni and ExxonMobil, are involved in gas field developments, notably projects such as Rovuma LNG and Coral Sul FLNG.

The National Development Strategy assumes that, until 2030, LNG will support economic growth, but in the longer term, growth and income are expected to come from other sectors. The economic benefits of LNG investments to the government depend on the international LNG market, raising concerns about the risk of stranded assets, as these projects primarily target exports rather than domestic energy supply. The Government of Mozambique has arguably prioritised the urgency of restarting stalled projects. This was underscored by President Daniel Chapo's early meeting with the TotalEnergies CEO in January 2025, shortly after taking

53 Source: stakeholder consultation with government representative in energy sector.
54 Source: stakeholder consultation with energy sector association (1).
55 The company has supplied solar PV and energy storage system solutions for what is reportedly Africa's largest solar PV generation project with 1 GW of solar PV capacity and 500 MWh of battery storage.
56 Source: stakeholder consultation with energy sector advisor (1).

office, to discuss the resumption of LNG and gas-to-power projects, which had been delayed due to ongoing insecurity (Hernandez and Roelf, 2025). Project financing was later approved by the U.S. Export-Import Bank, which reportedly re-authorised a $4.7 billion loan to TotalEnergies for project development (Johnston and Smyth, 2025). The issue remains closely tied to government legitimacy and power structures.

In terms of financing the sector and providing technical assistance, other international players are taking a more active role as Mozambique seeks to scale up its renewable energy, transmission, and gas infrastructure. European donors from Belgium, Norway and Sweden have provided financing, including grants, while MDBs such as the World Bank and the African Development Bank (AfDB) are supporting the strengthening of large-scale grid infrastructure and backbone transmission lines.[57]

Most of the renewable capacity in the pipeline through 2030 is expected to come from solar power, with financing and implementation led by European financiers and companies.[58] Solar and wind components of the ETE will reportedly be financed by GET.transform, with a strategy involving government representatives, private sector and donors. Their goal is to address key barriers to investment, including establishing the right regulatory framework for PPPs, addressing tariffs, improving procurement processes, and refining concession agreements to make the sector more attractive to private investors.[59] However, financing delays, linked to the country's risk profile, have been a challenge, and securing the release of funds remains a key priority.[60] With a new president in office, it remains to be seen which projects will be prioritised under the ETE.[61]

China has yet to make significant investments in large-scale renewable energy projects in Mozambique, with its primary presence so far in EPC contracts for fossil fuel and transmission infrastructure. As Mozambique works to expand its energy generation and transmission infrastructure to address infrastructure gaps, several stakeholders noted that Chinese companies have approached the country to explore 'turnkey' projects in the renewables sectors, where they would provide labour, materials and oversee the process. However, they are yet to participate as IPPs or engage in tender processes.[62] As in other countries across Africa and globally, Chinese companies have been successful in securing

57 Source: stakeholder consultation with energy sector association; stakeholder consultation with government representative in energy sector.
58 Source: stakeholder consultation with energy sector association.
59 Source: stakeholder consultation with energy sector advisor (2).
60 Source: stakeholder consultation with development partner (3).
61 Source stakeholder consultation with energy sector association.
62 Source: stakeholder consultation with government representative in energy sector; stakeholder consultation with energy sector association.

construction contracts for projects financed by MDBs. A Chinese contractor, for instance, was awarded the contract to implement the substation and high-voltage components of the Temane Transmission Line, a major project co-financed by the AfDB, World Bank, Islamic Development Bank, the OPEC Fund and Norway.[63]

While green industrialisation is included in the ETE, Mozambique appears to be in the early stages of planning its implementation.[64] The extent of China's contribution Tsingshan Park, once completed, also remains to be seen. Mozambique's energy fund, FUNAE, operates a solar panel assembly plant in Maputo Province, built in 2013 with loan financing from the Indian EXIM Bank. However, it requires operational updates, and its capacity to supply at scale remains unclear.[65] China's Tsingshan Park plans to use clean energy sources such as solar and wind and aims to establish a local new energy battery and solar PV industry. This presents China with an opportunity to contribute to the country's green industrialisation. There is evidence that China has constructed infrastructure to connect its industrial sites (including mines) to power grids, given its significant mining exports from Mozambique. However, the extent, systematic nature, and spillover benefits of this investment for Mozambique's electrification remain unclear. For example, while China developed transmission and distribution infrastructure in Niassa Province, where only 25% of the population has access to electricity, it is uncertain what benefits this has provided to the local population and how systematically this approach has been applied.

Mozambique sees an opportunity to capitalise on its mineral endowments in the energy transition and move up the critical mining value chain, but the timeline for its aspirations – and how China will contribute – remains unclear. A lack of existing industrial capacity and elevated country risk pose significant challenges to attracting FDI. Political unrest has disrupted production at the existing GK Ancuabe graphite mine since 2023, while development at the Balama mine, which secured DFC financing in September 2024, also faced local unrest (Club of Mozambique, 2024). Whether China, already a major minerals exporter from the country with presence in its minerals sector, will invest in processing capacity in the sector remains uncertain. At the recent FOCAC summit, China signalled its interest in expanding cooperation in infrastructure, energy and minerals 'to boost Mozambique's industrialisation and economic diversification' (MFA of the PRC, 2024b).

The employment impact of Chinese energy investments and construction activity in Mozambique remains uncertain. Similar to Kenya,

63 Source: stakeholder consultation with MDB representative.
64 Source: stakeholder consultation with development partner (2).
65 Source: stakeholder consultation with government representative in energy sector; stakeholder consultation with energy sector association; stakeholder consultation with development partner (3).

unemployment is a significant challenge and a key priority for the country's economic development. Limited evidence is available on the extent of skills transfer from expert engineers working on Chinese EPC projects, as well as their impact on local value addition. Stakeholders suggested that Chinese projects are perceived in-country as employing local workers primarily in low-paid, unskilled positions. However, there is limited evidence on how this applies specifically to the energy sector, as China has had greater visibility in other industries.[66]

The energy sector is a relatively recent area of engagement for China in Mozambique, and perceptions of China's involvement are often considered within the broader context of its overall engagement in the country. China's approach in the sector appears to mirror its engagement in other countries, where it does not participate in donor coordination mechanisms with government agencies, such as the energy sector working group.[67] Indeed, as pointed out by one of the stakeholders, China is perceived as a business partner rather than a development one.[68] Regarding risks and opportunities, concerns have been raised about the transparency of China's involvement in infrastructure projects, particularly in the context of weaker institutions.[69] However, evidence of China's impact with regard to rule of law and government effectiveness in Mozambique's energy sector remains limited.

66 Source: stakeholder consultation with development partner (1).
67 Source: stakeholder consultation with development partner (2); stakeholder consultation with MDB representative.
68 Source: stakeholder consultation with development partner (2).
69 Source: stakeholder consultation with development partner (1).

4 China's energy projects and clean energy technology trade in South Africa

Having explored China's expanding clean energy footprint worldwide, including in Kenya and Mozambique, this section now looks at South Africa's energy transition needs and examines how – if at all – China is meeting these through trade, lending and investment flows. It includes analysis of the implications of these changes for South Africa's low-carbon transition plans and domestic energy sector, as well as other sectors of the economy. In contrast to Kenya and Mozambique, South Africa benefits from mature capital markets and a highly developed banking sector, which facilitates mobilisation of clean energy capital through a range of instruments.

South Africa is an upper-middle-income economy with a population of just over 60 million, a third of whom are aged 18 to 34 years old. Post-pandemic economic recovery has been constrained by supply-side factors including infrastructure bottlenecks, low productivity and a weak business environment. The country has high levels of poverty, with around 63% living below upper middle-income threshold. Unemployment remains a pressing socioeconomic issue, with just over a third of South Africans out of work (World Bank, 2024a). The young are particularly affected, with over 60% unable to find employment, largely due to a lack of skills. The government's low-carbon transition plan aims to tackle both unemployment and poverty (The Presidency of the Republic of South Africa, 2022).

South Africa's political and economic relationship with China has evolved significantly since the two countries first established ties in the late 1990s. Energy security is critical to addressing South Africa's socioeconomic challenges and fuelling economic growth and competitiveness in manufacturing and other sectors. As South Africa seeks to grow its renewable energy portfolio and phase out coal, enhance grid and transmission infrastructure, and build out low-carbon supply chains, there are significant opportunities for China and other stakeholders to support its national development and energy transition.

4.1 Overview of energy sector and green industrialisation ambition

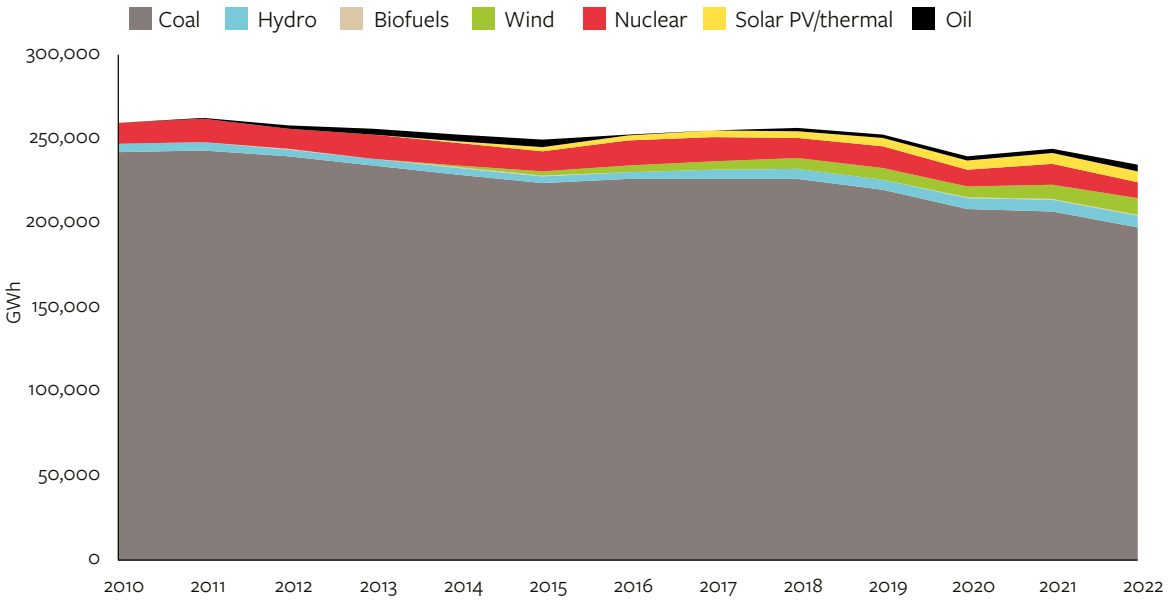
4.1.1 Overview of the energy sector

South Africa has made major gains in improving electricity access,

with nearly 90% of the population connected, but energy poverty remains widespread, affecting 47% of households (World Bank, 2022). Energy subsidies for both the industrial sector and households remain a key feature of the sector, with electricity tariff under-pricing used as a tool for industrial policy and to support low-income households (World Bank, 2022).

South Africa's energy mix remains heavily reliant on fossil fuels, making it the most coal-dependent country in the G20 (World Bank, 2022). Coal accounts for over 80% of electricity generation, with the bulk still produced in the Mpumalanga coalfields. Nuclear and wind contribute 4% each, followed by hydro and solar (Figure 16). Renewable energy uptake gained momentum in 2011 with the launch of the government-led Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) (DMRE, DSI and DTIC, 2023). However, battery procurement was delayed and only started in 2022.

Figure 16 Electricity production in South Africa by source, 2010–2022



Source: authors' elaborations based on IEA (2024g)

South Africa has experienced frequent load-shedding over the past decade. In the first nine months of 2022, load-shedding occurred over 1,950 hours or one-third of the time (World Bank, 2022). The South African Reserve Bank estimated that the productivity loss impact of load shedding was between -0.7 and -3.2 percentage points of 2022 GDP growth (Janse van Rensburg and Morema, 2023). On 9 February 2023, the President of South Africa declared a 'state of

disaster' due to electricity shortages though the order was rescinded after two months (Terblanche et al., 2024). The sector's poor performance has undermined the political legitimacy of the governing African National Congress, led by President Cyril Ramaphosa (Kelsall et al., 2024).

The country's updated NDC, submitted in 2021, sets more ambitious targets for reducing GHG emissions, targeting a 32% decrease by 2030. South Africa aims to limit emissions to 398–510 $MtCO_2e$ by 2025, and 350–420 $MtCO_2e$ by 2030 (Republic of South Africa, 2021). The power sector, dominated by coal, accounts for almost 50% of the country's emissions and is a priority sector for transition in the 2020s (The Presidency of the Republic of South Africa, 2022).

4.1.2 Overview of energy sector policy and industrial ambitions

The National Development Plan, South Africa's strategic development framework, outlines the ambition to transition to less carbon-intensive electricity production and to procure at least 20,000 MW of renewable electricity by 2030 (National Planning Commission, 2012). At COP26, South Africa's Just Energy Transition Partnership was announced. The IPG of France, the United Kingdom, Germany, the EU and the US committed to providing $8.5 billion in financing to promote the country's energy transition.

South Africa's Just Energy Transition Framework outlines its vision to leverage the energy transition as an opportunity to address structural economic and social challenges through 'affordable, decentralized, and diversely owned renewable energy systems' (Presidential Climate Commission, 2022). The Framework identifies four sectors most at risk during transition, including the coal and automotive industries. With 80% of coal production concentrated in the Mpumalanga district, phasing out coal will impact both livelihoods of workers directly employed in the sector and other businesses indirectly supporting it (ibid.). Likewise, in the automotive sector, transition will both impact workers directly employed in the sector, and over 250,000 workers indirectly servicing it as mechanics, and 130,000 employed in petrol stations (ibid.).

The Just Energy Transition Investment Plan proposed at COP28 prioritises investment in three sectors – electricity, NEVs and green hydrogen – and two cross-cutting areas – skills development and municipalities – for the initial period of 2023–2027 (The Presidency of the Republic of South Africa, 2022). In the electricity sector, new solar PV, wind and transmission infrastructure accounts for majority of identified investment needs (ibid.). The initial funding of ZAR 1.5 trillion ($100 billion) was to be sourced from a range of funding sources including developed countries, development finance institutions, MDBs, the South African government, the private sector and philanthropists (ibid.). In this initial period, the investment plan presented a portfolio of programmes and projects to enable SA in achieving its lower end of the NDC target range in 2030 (350–375 $MtCO_2e$).

South Africa has a range of planning documents for the energy sector, including its latest Integrated Resource Plan, published

for consultation in 2023 but not yet adopted (DMRE, DSI and DTIC, 2023). The Plan envisions a diversified energy mix that includes renewables, nuclear, hydropower, and fossil fuels – coal with carbon capture and storage, and gas (ibid.). In terms of modern renewable energy, solar PV, wind, and concentrated solar power present opportunities to diversify the energy sector and spur growth in new industries (ibid.). Nuclear and gas are both viewed as dispatchable power sources that complement renewables. For gas, South Africa is considering both domestic resources and imports from Mozambique and Namibia. However, timelines remain unclear, as delays in Mozambique could potentially impact South Africa's energy security. For hydropower, South Africa is exploring both domestic sources and imports from Mozambique, as well as from the Democratic Republic of Congo via neighbouring countries.

South Africa's Hydrogen Roadmap (2021) aims to scale up green hydrogen value chains using its abundant mineral and renewable energy resources to boost industrial growth, decarbonise transport and energy-intensive sectors, and promote exports (DTIC, 2021). Four catalytic projects are expected to create 20,000 jobs and produce 500 kt of hydrogen annually by 2030 (DTIC, 2021).[70] Beyond exporting hydrogen to the EU, Japan, and South Korea, South Africa plans to export hydrogen components such as electrolysers and catalysts for fuel cells using platinum group metals.[71] This strategy aims to mitigate the risks associated with declining demand for these metals, of which South Africa is a major producer, as they are primarily used in catalytic converters for internal combustion engine (ICE) vehicles (DTIC, 2021).[72]

South Africa also plans to scale up EV production. The automotive sector, which accounts for 10% of manufacturing capacity and up to 3% of GDP, faces transition risks as key export markets like the EU and UK phase out ICE vehicle sales over the next 12 years (DTIC, 2023). The Electric Vehicle White Paper (2023) outlines South Africa's approach to expand EV production, aiming for 1% of global production and increasing local content from the current 40% to 60%, as set out in the South African Automotive Masterplan (DTIC, 2023). South Africa aims to develop critical mineral-to-battery value chains within this decade. The JETP Investment Plan outlines the need for $8.5 billion in investment for the NEV sector between

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70 The four projects are the Platinum Valley Initiative (South African Hydrogen Valley), the CoalCO2-X Project, Boegoebaai Special Economic Zone (SEZ) and the Sustainable Aviation Fuels (SAF) project.

71 These include platinum, palladium, ruthenium, rhodium, iridium and osmium.

72 The Green Hydrogen Commercialisation Strategy (2022), developed by a coalition of public and private sector leaders coordinated by the IDC, outlines a roadmap with both short-term (2022–2025) and long-term (2022–2050) actions to achieve the goals set in the Hydrogen Roadmap (Department of Trade, Industry and Competition, 2022).

2023 and 2027, covering areas such as industrial innovation and deployment support (The Presidency of the Republic of South Africa, 2022).

EV adoption in South Africa remains low, as is the availability of charging infrastructure. Enhancing energy security is crucial for South Africa's ambitions in the sector, as power interruptions hinder production efficiency and weaken international competitiveness of the sector. Scaling up the grid is essential to support the country's broader green industrial ambitions, a process being coordinated through the Energy Action Plan (DTIC, 2023).

4.2 Trade in clean energy technology

China is South Africa's largest trading partner, accounting for 11.8% of South Africa's exports and 21.7% of its imports in 2024 (South African Revenue Service, 2024). The trade imbalance between the two economies has persistently favoured China. South Africa mainly imports machinery, and iron and steel products, while it exports minerals. In 2024, South Africa exported over ZAR 147 billion ($7.8 billion) of minerals to China – 66.6% of its total exports to the country – which makes South Africa's exports to China vulnerable to commodity price volatility.[73]

Despite the emergence of local solar panel assembly and the presence of EV OEMs, South Africa's energy transition has been heavily fuelled by imports of clean energy technology components.[74] The country has consistently been the largest export market for Chinese solar panels in Africa since 2019. In 2023, Chinese solar panel exports to South Africa peaked at 4.3 GW (valued at $855 million), which was driven by the domestic energy crisis and the growth in the private market for solar installations (Figure 17).[75] This coincided with the government's introduction of a temporary tax rebate scheme for new home and commercial solar PV panel installations to address the load-shedding issues (Chong and Vanmali, 2023). Chinese solar panel equipment manufacturers like JA Solar, Trina Solar and BYD supply most of the equipment for industrial and residential solar projects.

China is also the dominant source of imports for assembled wind turbines, lithium-ion batteries and electric vehicles. According to WITS data, in 2024 South Africa imported 93% of its lithium-ion batteries, 52% of its fully electric motor vehicles and 77% of its wind-powered

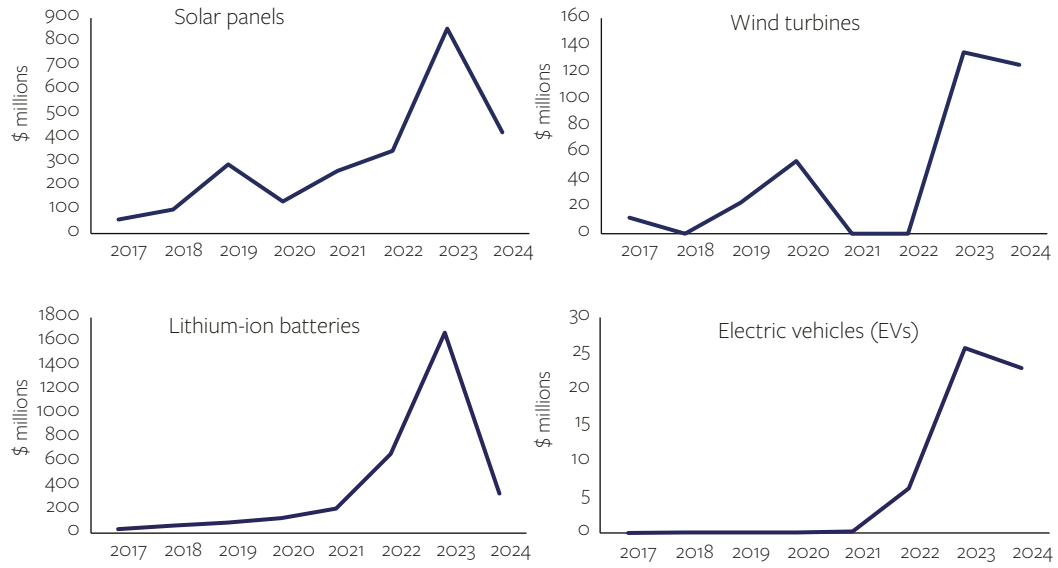
73 Exchange rate used for conversion: ZAR 1 = USD 0.05322 (31 December 2024). Source: Wise Currency Converter.

74 Stakeholder interviews indicated that at the time of writing, South Africa has six EV OEMs, all of which use imported batteries.

75 Before the energy crisis, the bulk of solar panel demand was driven by large utility-scale solar plant construction.

electric generating sets from China.[76] South Africa's volume of Chinese imports for all four clean energy products has been on the rise since 2017.

Figure 17 China's annual exports of clean energy products to South Africa by trade value, 2017–2024



Source: authors' elaborations using Observatory of Economic Complexity and Ember based on General Administration of Customs of the People's Republic of China[77]

4.3 Energy-related investment and lending

4.3.1 Lending

China's official energy-related lending to South Africa has primarily focused on general capital provision to power companies and on large-scale coal power project financing. Between 2010 and 2021, South Africa received over $5.4 billion through seven loans. Three of these were bilateral loan agreements, worth $5 billion, made between 2016 and 2018 for the construction of the Medupi and Kusile coal-fired power plants. All three loans were funded by CDB, which has been the most active Chinese policy bank in the country.

Commercial lenders have also been active in the energy sector. In 2016, Bank of China contributed $150 million

76 WITS is the World Integrated Trade Solution database.

77 The product mapping follows the Harmonised System (HS) by the World Customs Organisation. The HS product codes used are 850231 (wind turbines); 85414020 and 85414300 (solar panels); 850760 (lithium-ion batteries); 870380 (fully electric motor vehicles).

to a syndicated loan with the AfDB and other international commercial banks to support the capital expenditure programme of Eskom, South Africa's state-owned power utility. In the following year, the ICBC issued a $70 million working capital loan to ACWA Power, a private developer and investor headquartered in Saudi Arabia, for their activities in South Africa.[78] Renewable energy lending, notably for the Upington Solar Complex in 2018, has been significantly smaller in scale ($103 million). There has been no new bilateral Chinese official sector lending since 2018.

Eskom was the primary recipient of Chinese loans over this period, and all loans to Eskom were supported by sovereign guarantees from the South African government. The government-backed loans financed coal-fired power generation projects and transmission network improvements. In 2023, South Africa's National Treasury announced it would take on ZAR 254 billion ($14 billion) of Eskom's ZAR 423 billion debt which was at risk of default, to enable the company to settle its principal and interest obligations (National Treasury, 2023). As part of the debt relief package, Eskom is currently subject to a borrowing moratorium until 2026.

China has also engaged in limited official training and technology transfer for low-carbon energy development, beyond official financial assistance. For example, in 2015 China's State Nuclear Power Technology Corporation provided a two-year training programme to South African nuclear professionals. Moreover, in 2019, the China-South Africa Clean Energy Joint Research Center was established through an academic collaboration between Beijing University of Chemical Technology and the University of Witwatersrand. However, these initiatives remain small in scale and do not translate into major commitments for renewables.

4.3.2 Equity investment and construction activity

South Africa is the main destination for overall Chinese FDI in Africa, but China's share of South Africa's inward investment flows is low compared to that of other foreign partners.[79] In 2023, China accounted for 5.1% (worth $5.66 billion) of South Africa's inward FDI stock. The top investors were the United Kingdom (23.9%), the Netherlands (17.7%), Belgium (11.9%), the United States (8%) and Germany (7.4%) (IMF, 2025).

Chinese direct investment through project finance, both equity and debt, has been limited in the power sector. Data on energy investments in South Africa from the Power Futures Lab indicates that Chinese companies have been major shareholders in

78 ICBC has held a 20% stake in South Africa's Standard Bank since 2007.

79 SAIS China-Africa Research Initiative based on China's Ministry of Commerce (data available as of 2022).

neither Eskom-contracted nor privately contracted power projects in the country.[80] Moreover, the majority of debt financing comes from local, South African banks.

Recently, however, Chinese EPC firms have gained an increasingly large market share in the construction of (clean) energy sector projects, particularly solar. Between 2010 and 2024, Chinese companies were awarded contracts to build 13 projects worth $1.07 billion.[81] Eleven of these have been awarded since 2022, and 69% of all contracts are for solar power plant construction or solar panel installation. Beyond EPC contracts, Chinese firms dominate the supply chain for solar panels and inverters. Major recent projects include:

- **Construction of the Mooi Plaats ground photovoltaic power plant.** The 283 MW project in the Northern Cape Province, announced in 2024, is a partnership between Trina Solar (a Chinese solar PV manufacturer) and two construction and engineering companies – China Gezhouba Group and China International Energy Group.

- **Construction of the Redstone Concentrated Solar Thermal Project.** In 2021, SEPCOIII Electric Power Construction Corporation, a PowerChina subsidiary, signed a $704 million deal with ACWA Power to develop a 100 MW concentrated solar power plant in the Northern Cape Province. The project was connected to the grid in 2024, and created 2,500 jobs, of which 650 were filled by local community members (FOCAC, 2024).

- **Construction of the De Aar Central Solar Power Plant.** In 2024, PowerChina signed an agreement with SolarAfrica Energy, a South African PV developer, for a 342 MW plant which will supply power to data centres and industrial customers. The plant will be the country's largest single solar power plant by installed capacity.

Over this period, Chinese companies have also been involved in the construction of battery energy storage systems and partnerships to localise solar module production. For example, in 2022, Pinggao Group, a subsidiary of State Grid Corporation of China, won a contract to develop an 80 MW storage facility in the Western Cape. In the same year, Chinese Talesun Solar partnered with ARTsolar, South Africa's only locally owned solar panel manufacturer, to develop a domestic production facility for large-format PV modules. ARTsolar had previously also signed a manufacturing agreement with BYD, another Chinese manufacturer of renewable energy and battery technology, in 2014. However, at

80 South Africa's Private Power Projects Dashboard maintained by the Power Futures Lab at the University of Cape Town (https://powerfutureslab.co.za/sa-ipp-data).

81 This estimate likely represents a lower bound as monetary values are not reported for all transactions in the database.

the time of writing, solar panel production in South Africa is solely focused on assembly using solar cells typically imported from China.[82]

4.4 Impact assessment: how is China contributing to South Africa's energy transition?

China's contribution to South Africa's energy transition is centred on its role as a major trade partner and primary source of clean energy technology imports. South Africa is the largest export market for Chinese solar panels, and Chinese suppliers dominate domestic solar PV, lithium-ion battery, wind turbine and EV imports. Chinese clean energy technology manufacturers have been involved in partnerships for local solar panel assembly, which they have not done in other countries in the region.

While South Africa is the main destination for Chinese FDI in Africa, Chinese financiers, SOEs and private companies have played a limited role as equity investors with ownership stakes in clean energy projects or power sector projects generally. Chinese financial institutions have also played a limited role in debt-based project finance, which is mostly provided by local South African banks. There has been no new official Chinese bilateral energy sector lending since 2018, so Chinese financial institutions have not contributed to bridging the country's ZAR 647 billion electricity sector infrastructure investment need between 2023 and 2027, through bilateral channels (The Presidency of the Republic of South Africa, 2022). Earlier lending from CDB was directed towards financing large-scale coal power projects in Mpumalanga and Limpopo provinces.

Chinese EPC firms have gradually established credibility in South Africa's energy market as projects have benefited from reduced costs. Despite initial scepticism from local banks, which are typically the financiers of such projects and have strict quality requirements, there has been growing involvement of Chinese contractors in the development of clean energy projects since 2022. This trend reflects their ability to underprice most of their other foreign counterparts, for both engineering, procurement and construction, but also operations and maintenance of installations.[83] As the South African energy market has become increasingly price-competitive, these firms have successfully demonstrated they can meet standards while offering more competitive pricing than previously favoured and more established Western companies.[84]

Some of the constraints to Chinese involvement towards South Africa's energy transition are inherent to the country's operational environment. For example, there is limited evidence

82 Source: stakeholder interview with South African industry development expert.
83 The EPC landscape for energy projects was historically dominated by a mix of European firms. Source: stakeholder interview with South African energy sector expert.
84 Source: stakeholder interview with South African energy sector expert.

of Chinese engagement in early-stage capacity building and project preparation, but this lack of project readiness support and early-stage funding is common in South Africa, which exacerbates the limited pipeline of bankable clean energy projects (de Aragão Fernandes et al., 2023).[85] South Africa's historic reliance on coal poses challenges for the social and economic impacts of phasing out coal. The government's just transition commitments will directly and indirectly impact jobs in the energy and automotive sectors and will require a skilled workforce for the deployment and maintenance of clean energy projects. At the moment, there are several obstacles to this, including limited domestic re-skilling efforts and the spatial mismatch between 'green' jobs and the coal field regions where coal workers live.

While Chinese imports have facilitated rapid renewable energy deployment, the heavy reliance on imported components poses a potential constraint on the development of a local clean energy manufacturing industry. South Africa's ambition to increase local content and value addition in sectors such as solar panel manufacturing and EVs faces challenges from the cost-competitiveness of Chinese imports and is at risk of remaining limited to assembly using imported components. Local stakeholders argued that part of the reason why Chinese equity investors are not particularly active is in South Africa is because they view selling their products directly as more profitable than shifting operations or ownership stakes abroad. In turn, South African manufacturers find it challenging to access the Chinese market. Trade flows with the UK and EU are much more balanced.

South Africa has a diverse set of partnerships for its energy transition goals and, to date, IPG members have dominated equity investments and lending. For example, between 2022 and 2024 just three European companies – Engie, Scatec Solar and EDF, held 57% of equity shares for large Eskom-contracted power projects.[86] The IPG members have pledged the majority of energy transition financing, though the US's recent exit from the JETP leaves a financing gap which will have to be compensated by alternative sources (Chime, 2025).[87]

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85 This view was also shared during a stakeholder consultation with a South African industry development expert.

86 Authors' calculations based on the South Africa Private Power Projects Dashboard of the Power Futures Lab. Includes power projects that reached financial close, are in construction or operation and above 5 MW of generation capacity. These are a combination of solar, wind and battery energy storage projects.

87 The US commitment to South Africa's JETP has included $56 million in grants and $1 billion in commercial investments from the DFC, which combined represent less than 10% of the total JETP pledge.

5 Looking forward

The expansion of Chinese financial institutions, SOEs and private companies into overseas energy sectors and green value chains has been driven by clear policy signals from Beijing and commercial drivers both domestically and abroad.

First, with domestic renewable energy markets approaching saturation, China's clean energy industries are seeking international markets to export their technologies and services.

Second, Chinese companies are capitalising on business opportunities for construction, equipment and engineering expertise in underdeveloped power sectors abroad, often supported by Chinese financial institutions. Chinese engineering firms have also demonstrated their competitiveness by participating as contractors in new markets, as evidenced by their participation in competitive project tenders.

Third, this analysis has found examples of Chinese companies building transmission infrastructure to support adjacent sectors where they have stakes, such as graphite mining in Mozambique, but more evidence is needed to understand these linkages and what they imply for host countries.

Different Chinese actors vary in their strategies and risk tolerance, which are shaped by the investment climate and governance structures of the countries in which they operate. For example, Kenya has attracted a wider diversity of Chinese energy-related investment and construction activity than Mozambique, due to a combination of the investment climate and policy ambition. Moreover, unlike in sectors such as telecommunications which have experienced a surge in Chinese M&A and greenfield activity, there has been relatively little involvement from equity investors in energy-related activity in the countries analysed. To date, Chinese companies have primarily focused on securing construction contracts and exporting clean energy technologies. More research is needed to understand China's evolving strategy of de-risking its overseas engagement in clean energy projects.

How is China's offer to EMDEs evolving? Current debt burdens in most EMDEs mean that borrowing is no longer a viable option for the delivery of energy and clean energy technology manufacturing projects, and governments are exploring alternative financing mechanisms based on PPPs. Chinese companies have had limited engagement with these models for energy projects, and it is unclear whether China would be willing to increase equity stakes or shift clean energy manufacturing overseas.[88] Lending data through 2021 indicates that Chinese

88 This study had limited scope to deep dive into the ESG or risk governance of individual Chinese projects. China is aiming to raise standards in energy infrastructure projects, and it will be important to watch whether this ambition materialises on the ground.

creditors are pivoting from large-scale infrastructure loans toward targeted commercial investments and the size of future individual deals will likely continue to decline. Domestically, strong policy signals to prioritise renewable energy and low-carbon value chain expansion to overseas markets and medium-term development plans for NEVs suggest that China will remain an important supplier of clean energy imports in EMDEs. China's engagement in clean energy in Africa will probably remain strong given the momentum of initiatives like the Africa Green Industrialisation Initiative on the continent and its own diplomatic ambitions within FOCAC. It may also prioritise engagement with countries like Kenya and South Africa that play significant roles in the African Union and shape trade policy on the continent.

What are the implications for the alternative strategies pursued by the G7? To compete effectively through the EU's Global Gateway or the Partnership for Global Infrastructure and Investment, Western policymakers need to understand the BRI's evolving scale, nature, and terms – particularly following China's de-risking efforts. This also requires a greater understanding of how various Chinese companies and financiers work together across sectors to create ecosystems (e.g. power-mining-logistics partnerships). For most countries, it is not realistic to compete effectively across all parts of the clean energy technology supply chain, and careful consideration of where to specialise domestically and where it might be better to establish partnerships or make direct investments abroad, should inform considerations of countries' industrial strategies (IEA, 2023a).[89] Outside of China, stakeholders from other countries can also significantly contribute to clean power sector development and electrification, but overall success remains dependent on African countries.

Looking ahead, China's evolving response to global dynamics will be important to watch on several fronts. First, geopolitical uncertainty in advanced economies that are key financiers of energy transitions will inform the responses of China and EMDEs. For example, given recent announcements that the US is pulling back on clean energy financing in Africa, whether China steps in to fill the energy transition gap will depend on the strength of its political ties rather than its existing (limited) equity stakes in clean energy on the continent (Auth, 2025; Chime, 2025). However, policy inconsistency from the US and the new push on fossil fuel development threatens to lock-in emissions and reverse progress on policy efforts to phase out coal. Additionally, the localisation and regionalisation agenda for green value chains in EMDEs represents a challenge for China's ambitions to continue expanding its reach in terms of clean energy technology exports. While African policies are unlikely to be as protectionist

89 For example, in December 2024 the DFC pledged $553 million to upgrade the Lobito Atlantic Railway in Angola as part of a commitment to both secure US strategic interests in minerals supply chains and build out the low-carbon value chain in the region (DFC, 2024).

as those observed in the US and Europe (e.g. imposition of tariffs on Chinese goods), the growing use of local content requirements to increase domestic value addition will require Beijing to rethink its engagement modalities. In the midst of geopolitical uncertainty, policymakers in EMDEs will also need to think about how to approach China strategically, which begins with an understanding of China's domestic rationale for outward engagement and priority sectors. Lastly, Europe's response to President Donald Trump's African agenda will be important to watch given it is more closely aligned with China on low-carbon growth.

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Appendix1 Methodology

Data sources and limitations

As China does not publish official disaggregated data for its overseas economic activities, this paper uses several databases. For lending information, we rely on projects reported in AidData's Global Chinese Development Finance dataset (Version 3.0) which captures bilateral loan commitments from official sector institutions in China. These include state-owned policy and commercial banks, and state-owned enterprises (SOEs).

Data on Foreign Direct Investment, including mergers and acquisitions and greenfield investments, as well as engineering and construction contracts comes from the Janes IntelTrak database of Chinese investments. Like other databases of its kind, IntelTrak collects this information mainly from media reports, company press release and other online sources, making a light-touch effort to verify its accuracy and consistency over time. As the large body of literature on Chinese overseas economic activity suggests, many of these announcements never materialise into actual disbursements, amounts may change or the database may miss some projects. Thus, while useful as an indicator of investment appetite and 'real-time' trends in Chinese overseas corporate activity, the monetary of value of the investments and contracts should be viewed with caution. Moreover, not all activities reported in the database feature contract values. It is important to note that both the AidData and IntelTrak database track financial *commitments* rather than actual *disbursements*, which can vary in practice.

Trade data is obtained from a combination of sources: (i) the World Integrated Trade Solution, (ii) Ember's database on China's Solar PV exports, (iii) the Observatory of Economic Complexity. The last two databases compile data from China's General Administration of Customs. Due to variations in data providers' methodologies, the trends in this paper are presented without making direct comparisons between the various data sources.

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