SCALING CHINA'S GREEN ENERGY INVESTMENT IN SUB-SAHARAN AFRICA: CHALLENGES AND PROSPECTS

Frangton Chiyemura, Wei Shen and Yushi Chen







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EXECUTIVE SUMMARY

The Sub-Saharan African (SSA) region is undergoing processes of structural transformation necessary for socio-economic development. However, lack of sufficient and reliable electricity supply is known to be one of the biggest constraints. It is estimated that over 600 million people in SSA had no access to electricity in 2018, making it the region with the lowest electricity access rate in the world. Research suggests that this shortage and lack of access to reliable electricity negatively affects GDP growth by 1–2% annually, eventually increasing the cost of doing business and exacerbating poverty and inequality. Meanwhile, the number of people without access is likely to increase by 2040, when the population is estimated to be 2 billion.

New or alternative energy resources must be developed to keep pace with the demand and transformation trajectories of the region. SSA has the potential to address this challenge by tapping into non-hydro renewable energy sources, in particular wind and solar energy, especially considering the resource endowment factor, fast dropping costs of these generation technologies and the growing management expertise of deploying such technologies in different contexts.

Development and deployment of wind and solar energy holds prospects for achieving universal energy access as envisaged in Sustainable Development Goal 7. Previous research already indicates that off-grid, mini-grid and on-grid renewable energy systems have tremendous potential to provide clean and affordable electricity in both rural and urban areas in SSA. Yet, of the USD100 billion invested in the energy sector in Africa between 2010 and 2018, USD70 billion was committed to fossil fuels and only USD13 billion to renewables, plus USD13 billion to grid networks. Such levels of investment in renewables are far from sufficient, as reaching full access by 2030 would require multiplying current investment levels by five, or more than USD2 trillion, between 2019 and 2040.

In addition to the notable financial gap, there are also significant technology and expertise gaps. As with most fossil fuel equipment which is imported, many SSA countries have limited experience of manufacturing and supplying essential renewable energy equipment. Technology transfer and capacity building are hence as much needed as finance and investment.

The question is, how can these challenges be addressed? China has faced similar challenges to those of SSA and over the past few decades, due to massive investment in the sector, it has nearuniversal electricity access. Furthermore, China is now one of the leading nations in renewable energy technology manufacturing, financing and supplying, particularly in the areas of on-shore wind energy and solar PV.

Since the early 2000s, China has emerged as a leading partner for Africa's economic growth and development trajectory. China became Africa's largest trading partner in 2009, and the Asian country is also emerging as one of the leading investors and providers of development finance for infrastructure projects, resulting in some African countries achieving remarkable economic growth and development. With the launch of the Belt and Road Initiative (BRI) in 2013, infrastructure, including various power sector projects, is at the centre of China–Africa economic cooperation.

While Chinese state policy and commercial banks provided close to USD148 billion in loans between 2010 and 2018, mainly for infrastructure projects across Africa, around USD37 billion has been committed towards the energy sector. Yet, only a small segment is spent on developing wind and solar energy facilities. Still today, there are only a handful of wind and solar energy projects with significant Chinese involvement in SSA.

This report sought to investigate, from both ends, the barriers and potential solutions to scaling China's engagement with the SSA's non-hydro renewable energy market. We found that scaling of Chinese wind and solar energy projects in the SSA is constrained by a number of institutional, material and discursive factors. Firstly, the Chinese policy community and institutional arrangements for overseas energy activities are not necessarily suitable for scaling up renewable energy activities, particularly wind and solar projects in Africa. Incoherent policy goals, an inflexible project screening process and a lack of business engagement all contribute to the underrepresentation of wind and solar energy projects in the current project portfolio. Secondly, the lack of a green agenda among the key actors from both ends is deeply rooted in a scepticism about renewable energy, compared to the well-established appreciation of conventional energy sectors and their project development models. Thirdly, the political economy from both supply and demand ends plays a significant role in shaping institutions and ideologies governing the sector. Eskom, Ethiopia Electric Power and large Chinese state-owned enterprises in traditional energy sectors have tremendous influence in pushing or deterring the green agenda. Overall, Chinese involvement in African countries' renewable energy sector has much to do with the concerns about the host country's macroeconomic performance, as well as the political climate, particularly when a sovereign guarantee is absent.

From the Chinese side, in responding to these challenges, two overall strategies should be considered.

- One is to instigate changes based on the existing regulatory, financial and business model and framework. This includes urging current regulators to make more specific policy goals, pushing policy banks and export credit agencies to revise their project screening processes, working more closely with renewable energy companies and encouraging private and state companies to work jointly in exploring SSA markets.
- The other is to promote innovative solutions outside the current model that predominantly favour large-scale and conventional projects. This could be done by integrating other market-based financial instruments or multilateral funding streams rather than relying solely on traditional state-backed development finance mechanisms such as green bonds, climate and carbon finance, which have all grown fast in the past few years.

From the African side:

- The African governments should first exhibit strong ambition and determination for a clean energy transition. This would provide a signal for Chinese companies and financial institutions to consider alternative energy development pathways. The planning needs to take SSA countries' special technical and financial constraints into consideration and energy regulators should also provide more stable expectations and policy support to both the wind and solar energy generation and manufacturing capacity. In the context of the COVID-19 pandemic, the disruption of the supply chain for key equipment and components from China has urged many African governments to consider localising at least some production of crucial parts.
- Since there is a changing pattern in the procurement of renewable energy capacity, African governments should also encourage Chinese partners to be more actively involved in various

policy learning, sectoral planning and capacity-building efforts. This can be achieved by engaging directly with the newly established renewable energy alliances and interest groups. Such multi-level communication between Chinese and African non-state sectors can urge Chinese companies to shift away from the previous bilateral negotiation model that is reliant on formal, high-level diplomatic dialogue, and encourage them to participate in a more transparent and auction-based project development process.

- The African governments must also open up the generation, distribution and transmission sectors to private players using auction-based project delivery mechanisms. A lack of capital to finance these projects and the lack of a conducive environment for private players are some of the biggest challenges.
- Finally, although many African governments have done some wind and solar resources mapping studies to establish technical generation potential, very few projects are ready for development. Such inadequacies may be due to the African governments' lack of technical expertise to work on the later stages of project development, from feasibility studies to bankability analysis of projects, and coming to arrangements around distribution of risks and benefits between the private and public sectors.

1. INTRODUCTION

Lack of sufficient and reliable electricity supply is one of the biggest constraints for many Sub-Saharan African (SSA) countries' economic and social development. A report released by the World Bank in 2018 estimates that 860 million people had no access to electricity globally. Of these, 600 million are from SSA, making it the region with the lowest electricity access rate in the world. Even for those areas with grid connections, the energy service is often unreliable, with frequent power cuts, which is crippling economic and industrial activities. This shortage and lack of access to electricity affects economic productivity, increases the cost of business and exacerbates poverty and inequality. Lemma and colleagues (2016) estimate that unreliability of electricity provision in SSA negatively affects GDP growth by 1–2% annually.

While SSA has experienced positive industrial and manufacturing outputs over the last two decades, more energy is needed to sustain this improving productivity. New or alternative energy resources must be developed to keep pace with the growth and transformation trajectories of the continent. SSA has the potential to address this challenge by tapping into non-hydro renewable energy sources, in particular wind and solar energy, especially considering the endowment factor and adaptability beyond the grid-based networks.

Achieving universal energy access in SSA is crucial for meeting the international development agenda as envisaged in Sustainable Development Goal (SDG) 7. It is increasingly clear that renewable sources such as wind, solar and geothermal energy are crucial for achieving this goal due to the decreasing costs of these generation technologies and the growing management expertise of deploying such technologies in different contexts. Previous studies indicate that off-grid, mini-grid and on-grid renewable energy systems have tremendous potential to provide clean and affordable electricity in both rural and urban areas in the SSA region. However, of the \$100 billion invested in the energy sector in Africa between 2010 and 2018, USD70 billion was committed to fossil fuels and only USD13 billion in renewables, plus USD13 billion on grid networks (IEA 2019). Such levels of investment in renewables are far from sufficient. According to the International Energy Agency (IEA), reaching full access by 2030 would require multiplying current investment levels by five, or more than USD2 trillion between 2019 and 2040 (IEA 2019). Furthermore, renewable energy must take up the major share to achieve a sustainable energy transition.

Besides the notable financial gap, there are significant technology and expertise gaps in the region. As with most fossil fuel equipment, which is imported, many SSA countries do not have the required manufacturing capacities to supply essential renewable energy equipment and spare parts, and there is insufficient expertise in both the private and public sectors for managing and regulating increasingly complex renewable energy systems. Technology transfer and capacity building are hence as needed as finance and investment.

The question is, how can these challenges be addressed? China faced similar problems in the past with regards to the high number of people without access to electricity. Yet, due to massive investment in the energy sector, China now has near-universal electricity access and has installed

a considerable number of renewable energy technologies. China is also one of the leading nations for renewable energy technology manufacturing and financing, particularly in the areas of onshore wind energy and solar PV. For example, a number of Chinese enterprises have installed over 200GW generation capacity for onshore wind and solar PV, of which over 23GW wind and 31GW solar PV was installed in 2019 alone (see **Figure 1**). As a result, Chinese companies have taken significant slots among the top ten wind turbine and solar PV manufacturers in the world. We believe China's experience of developing such manufacturing and financing capabilities, resulting in the installation of such a huge capacity within a limited time frame, can potentially serve as a learning curve for African countries (Ayele et al. 2021; Chiyemura 2020).



FIGURE 1: Accumulated onshore wind and solar PV capacity in China (in MW)

Source: compiled from IRENA (2020a)

Meanwhile, since the early 2000s, China has emerged as a leading partner for Africa's economic growth and development trajectory. China became Africa's largest trading partner in 2009, with an annual trading volume of around USD207 billion in 2019 (MOFCOM 2020). Apart from trade, China has also emerged as one of the leading investors and providers of development finance for infrastructure projects, resulting in some selected African countries achieving remarkable economic growth and development (Chiyemura 2021). That said, with the launch of the Belt and Road Initiative (BRI) in 2013, infrastructure, including various power sector projects, is at the centre of China–Africa economic cooperation.

According to Johns Hopkins University's China-Africa Loan Database, Chinese state and commercial banks provided USD148 billion in loans, mainly for infrastructure projects across Africa, between 2010 and 2018, of which around USD37 billion was used for power sector projects (**Figure 2**). However, only a small segment was spent on developing wind and solar energy facilities. To date, there are only a handful of wind and solar energy projects with significant Chinese involvement in several Eastern and Southern African countries.

This is in contrast to what the Chinese government has proposed in recent years to develop a 'green' BRI. In 2017, for example, the newly reconstructed and augmented Ministry of Ecology

and Environment (MEE) announced the guiding principles of promoting green BRI, with green infrastructure projects as one of the core elements in the document (MEE 2017). This policy narrative was later endorsed on various occasions by top Chinese leadership, including the Forum on China–Africa Cooperation (FOCAC) in 2018.

Studies have illustrated that the Chinese central government usually does not make decisions at project level for most overseas activities, as to be expected for a highly centralised system, and actor groups like the policy banks and large state-owned enterprises (SOEs) play a significant role in project initiation, screening and implementation (Hale, Liu and Urpelainen 2020; Shen and Power 2017). The contrast between political rhetoric and reality raises questions as to what factors are deterring the fast-growing Chinese renewable energy sector from exploring the African renewable energy market.



FIGURE 2: Chinese loans to Africa's power sector between 2000-2018 in million USD

Source: Johns Hopkins University China-Africa Loan Database

We believe that the barriers and potential solutions to scaling China's engagement with the SSA's renewable energy markets should be investigated from both the Chinese and African ends, since both push and pull factors are important (Shen and Power 2017). Based on our field investigations with more than 20 high-level stakeholders in China, Ethiopia and South Africa who are involved in the financing and deployment of wind and solar energy, we found that Chinese wind and solar energy projects in the SSA are constrained by a number of institutional, material and discursive factors from both the supply and demand sides. While a number of African countries have demonstrated commitment to deploying wind and solar energy, we specifically focus on Ethiopia and South Africa for illustrative and comparative reasons.

Ethiopia and South Africa are selected not only because these are the markets where Chinese companies are playing a relatively more active role, but also because significant variance can be observed in the two countries' energy resource endowments, political systems and market potentials, which all impact on Chinese activities in these countries. Our analysis is based on interviews conducted between June and October 2020 and some from our previous field investigations with key stakeholders, including Chinese policy banks, export credit agencies, commercial banks, major engineering, procurement and construction (EPC) contractors,

manufacturers and suppliers of wind and solar energy technologies and renewable energy companies.

The report is arranged as follows. Section 2 addresses Africa's renewable energy sector and questions whether African countries are prioritising the deployment of renewables such as wind and solar. We found that while Africa is endowed with a significant potential for both solar and wind, an insignificant capacity has so far been installed compared to fossil fuels and hydropower. Building on this, the section further unpacks the Chinese footprint in Africa's renewable energy sector, exploring whether Chinese investments are favoured in Africa's renewable energy sector and by whom. The next section discusses the illustrative case studies of Ethiopia and South Africa, looking at the energy systems of the two countries, followed by an exploration of Chinese enterprises' involvement in their renewable energy projects. The section then offers policy implications. Section 4 addresses the drivers of Chinese renewable energy activities in Africa and the governance frameworks for the actors involved in the renewable energy sector. Section 5 concludes the report, highlighting the missing links between Chinese and African markets with regards to the scaling up of the renewable energy market, followed by recommendations for both Chinese and African stakeholders.

2. AFRICA'S RENEWABLE ENERGY LANDSCAPE

Over the past decade, the wind and solar energy industries have experienced massive public and private sector investment, thereby improving performance and reducing the cost of the technologies (see **Figure 3**). According to the Renewable Power Generation Costs Report released by IRENA in 2020, the global weighted average levelised cost of energy (LCOE) for onshore wind was USD 0.053/kWh, USD 0.047/kWh for new hydropower projects and USD 0.068/kWh for utilityscale solar PV. This shows that between 2010 and 2019 the average cost of electricity from onshore wind fell by 9% year-on-year while that of utility-scale solar PV fell by 13% year-on-year, arguably coming into range with fossil fuels, which were commissioned between USD 0.05/kWh and USD 0.177/kWh (IRENA 2020b: 12). For Africa, the report further highlighted that the weighted average decreased from USD 2 291/kW to USD 1 952/kW, which is high compared, for example, to India, which decreased from USD 1 412/kW in 2010 to USD 1 055/kW in 2019 (IRENA 2020b: 53).

It is now possible for Africa to transform its energy landscape by adopting renewables, which are increasingly becoming scalable and cost-competitive to deploy. Renewables such as wind and solar are quick to instal (Chiyemura 2019: 112–113),¹ offer better prospects for local job creation, can be deployed as microgrids in areas that do not have strong winds, and have the ability to facilitate productive investment in other industries linked to the energy sector. Africa is endowed with wind energy resources estimated to be 180 000 Terawatt hours (TWh) per annum, which is 250 times the annual electricity demand (IFC, Everoze, Vortex and GWEC 2020). Ethiopia, South Africa and another 13 countries have also been identified as having wind energy resources of about 1 000GW (IFC et al. 2020). The continent is endowed with solar energy resources estimated to be more than 660 000 TWh per year (IRENA 2014). This is more than enough to address the continent's annual electricity needs. With such wind and solar energy potential, a transition to renewables is plausible.

However, despite the renewable resources endowment, advances in technology and the financial innovations in the sector, very few renewable projects have been deployed to address the energy challenge on the continent. Between 2010 and 2018, only 4GW of new solar PV and about 5.5GW of wind was installed on the continent, a majority of which was deployed in South Africa (IEA 2016). This raises important questions about the prioritisation of wind and solar in the energy mix of the continent. In the following section, we address three main questions regarding the deployment of renewables in Africa. Firstly, looking at the installed capacity and policy environment, are renewables really prioritised? Secondly, is Chinese investment favoured and, if so, by whom? And thirdly, what institutional reforms and governance structures are needed to effectively utilise renewables in Africa?

¹ It takes between one and two years to construct a big wind farm compared to a minimum of six years for large hydropower, coal and gas power plants. For more, see https://reneweconomy.com.au/five-reasons-not-to-build-new-coal-power-plant-in-queensland-45488/.



FIGURE 3: Global levelised cost of electricity generation by selected renewable technology, 2010 and 2017

Source: Authors, based on the data retrieved from IRENA Renewable database (2018)

2.1 Are renewables really prioritised?

The deployment of renewable energy in Africa has the potential to address the energy challenge. In this section we look at two issues with regards to the prioritisation of renewable energy deployment: the actual deployment of renewable energy technologies, and the policy and regulatory aspects which promote green energy transition. Between 2010 and 2018, Africa's installed generation capacity increased from 155GW to 245GW, of which 195GW was deployed from fossil fuel-fired capacity and close to 50GW from renewable energy sources. Africa appears to be trailing behind significantly in terms of renewable energy installed capacity (see Figures 4 to 8). For example, according to the IRENA Renewable Energy Statistics 2020 report, Africa had cumulatively deployed a total of 48.4GW of renewable energy by 2019, which is significantly lower than most developing regions, such as Asia, which deployed more than 1TW (**Figure 4**). When we compared installed capacity of renewables and fossil fuels on the continent, we found that between 2010 and 2018, 100GW was deployed from gas-fired capacity (South Africa accounted for 85GW of this), 50GW was deployed from coal-fired capacity. Fossil fuel sources thus remain dominant in Africa's installed or generation capacity.



FIGURE 4: Total installed capacity from renewable energy (both grid and off-grid) for selected countries and regions

Source: Authors, based on the data obtained from IRENA (2020a)

Note: Renewables here include wind and solar, and hydro (both large and small scale). This report classifies large hydropower as renewables in line with our field investigations classification. However, we are aware that in some jurisdictions, large hydropower projects are not classified as renewables, but rather as 'clean' energy.

When disaggregating the renewable energy by technology, Africa remains the only region in the world with very low deployment of wind and solar. By the end of 2019, only 5.7GW had been deployed from wind on the continent as compared to Asia's 258GW and Europe's 195GW (Figure 5). Similarly, only 7.4GW had been deployed from solar energy on the whole continent (Figure 6). But this is not surprising given that the dominating renewable energy source is from hydropower (see Figures 7 and 8). Evidence from our fieldwork suggests that many African countries have developed a range of technological and management expertise in the hydropower sector, making it the preferred technology for energy generation. In addition, the technology maturity of hydropower, coupled with the abundant water bodies easily adaptable for hydropower, makes it an easy target for policy makers. While wind and solar are becoming increasingly cheaper, hydropower remains preferable to African governments. Our field investigations found two main explanations for this. Firstly, hydropower projects are cheap and, in most cases, are preferred because of the longer lifespan compared to the 15–20-year average for wind or solar power plants. Secondly, hydropower project deployment is generally centralised and this creates opportunities for lobbying and corruption (Interview, 5 August 2020). This is equally true for large fossil fuel-powered projects.

When assessing the total installed capacity from renewable energy sources in Africa, hydropower is significantly prioritised by African governments compared to wind, solar and other renewables, which have so far received minimal institutional, policy and regulatory attention. But this does not mean that renewables in general are less prioritised. Africa is massively endowed with renewable energy sources which, when fully tapped, will address the continent's energy demand. In addition, the global climate change agenda is pushing for the deployment of renewable energy. As such, financing for energy development is shifting towards renewables in line with the global

commitment to reduce greenhouse gas emissions. This is reflected in Agenda 2063, SDG Goal 7 and other international efforts such as the Africa Renewable Energy Access Program (AFREA I & II), Energy Sector Management Assistance Program,² Sustainable Energy for All—African Hub³ and Power Africa.⁴ Africa is seen as having the 'opportunity to leapfrog into a new era of economic growth and expansion driven by clean power generation' (Shen and Power 2017: 679).



FIGURE 5: Total installed capacity from wind energy in selected regions (both grid and off-grid)

Source: Authors, based on the data obtained from IRENA (2020a)



FIGURE 6: Total installed capacity from solar energy in selected regions (both grid and off-grid)

Source: Authors, based on the data obtained from IRENA (2020a)

4 https://www.usaid.gov/powerafrica/ethiopia.

² http://www.esmap.org/re_mapping.

³ https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/CountryRAGAs/MWH-Updated-RapidGapAnalysis.pdf.





Source: Authors, based on the data obtained from IRENA (2020a)





Source: Authors, based on the data obtained from IRENA (2020a)

Note: Renewables here include wind and solar, and hydro (both large and small scale). This report classifies large hydropower as renewables in line with our field investigations classification. However, we are aware that in some jurisdictions, large hydropower projects are not classified as renewables but rather as 'clean' energy.

Another criterion we use to ascertain how renewables are prioritised in Africa is the policy and regulatory commitment towards deployment of these new technologies. Evidence from our fieldwork as well as from the Renewable Energy Policy Network for the 21st Century's (REN21) Renewables 2020: Global Status Report suggests that 44 of the 54 African countries have renewable energy (broadly classified) targets in the energy planning and development scenarios. Thirteen of these 54 countries also have regulatory policies or frameworks for feed-in tariffs for renewables.⁵ Only four of the 54 countries have electric utility quota obligations for deployment of renewables.⁶ Our field data corroborates that of REN21 and other international energy agencies that, as at the end of 2019, 29 African countries had renewable energy tendering regulatory frameworks in place,⁷ of which 13 had their first tenders in 2019. Beyond these regulatory frameworks, our field data also shows that only four⁸ of the 54 African countries have investment/production tax credits for renewable energy and 28⁹ African countries have tax reductions for renewable energy products (REN21 2020).

When we assessed the issues around the prioritisation of renewables in Africa, we found that there are still gaps, especially concerning the regulatory environment for both public and private sector involvement in the governing of renewables. This does not, however, suggest that the policy environment currently prioritises fossil fuel or large hydropower. Unlike large hydropower and fossil fuel fired generation capacities, renewables are relatively new sources of energy generation in Africa. A majority of these countries have limited institutional, technical, operational, financial and regulatory capacity to design policies that promote the deployment of renewables. Our field evidence also suggests that there is a significant market for the deployment of renewables through the off-grid and microgrid models but that the current policy and governance environment is highly unreliable, fragmented and risky. There is a need for Africa to increase policies and improve the regulatory environment, as well as the capacity of the regulators, in order to actively support the deployment of renewables.

2.2 Are Chinese investments favoured in Africa's renewable energy sector?

Financing and technical factors were identified by the African stakeholders who participated in this research as two of the most critical issues affecting and delaying Africa's transition to green energy. The deepening of economic and technical cooperation between Africa and China has created an avenue whereby Chinese technology and capital has been helpful in financing and developing renewable energy infrastructure on the continent. Our field investigation and secondary data show that China is emerging as one of the most significant players in Africa's energy landscape. Especially with the 'going out' strategy of the Chinese government, Chinese enterprises are actively involved in a wide range of activities, including, but not limited to, greenfield investment, EPC + financing contracts, and as manufacturers and suppliers of energy technologies. A report released by the IEA in 2016 highlights that Chinese contractors built 30% of the new generation capacity on the continent between 2010 and 2015. The report further shows that these new generation capacities were dominated by renewables, including hydro at 56% (with hydropower dominating the renewables category at 49%).

⁵ Algeria, Angola, Egypt, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda and Zambia.

⁶ Ghana, Nigeria, Senegal and South Africa.

⁷ Alegria, Botswana, Mauritius, South Africa, Carbo Verde, Cote d'Ivoire, Egypt, Eswatini, Ghana, Kenya, Lesotho, Morocco, Nigeria, Zambia, Tunisia, Benin, Burkina-Faso, Ethiopia, Gambia, Guinea-Bissau, Madagascar, Mali, Malawi, Niger, Rwanda, Uganda, Tanzania, Senegal and Zimbabwe.

⁸ Carbo Verde, Lesotho, Burkina Faso and Rwanda.

⁹ Botswana, Libya, Mauritius, South Africa, Carbo Verde, Cameroon, Ghana, Lesotho, Djibouti, Kenya, Nigeria, Tunisia, Zambia, Egypt, Burkina-Faso, Gambia, Guinea, Liberia, Madagascar, Malawi, Mali, Niger, Rwanda, Senegal, Tanzania, Togo, Uganda and Zimbabwe.

Table 1: Involvement of Chinese enterprises in SSA power sector, 2010–2020							
	Generation Capacity			Transmission and Distribution Capacity			
Region	Completed projects	Under construction	Planned and financed	Completed projects	Under construction	Planed and financed	
Southern Africa	14	9	5	10	10	1	
West Africa	17	4	2	6	2	2	
Central Africa	8	5	2	5	1	2	
Eastern Africa	15	7	8	4	5	1	
Total	54	25	17	25	18	6	

Source: IEA (2016)

FIGURE 9: Chinese capacity additions in Africa from 2003-2023



Source: Authors, based on the data from China Global Energy Finance Database, Boston University, 2020

The IEA 2016 report forecast that Chinese stakeholders' involvement in Africa's energy sector between 2010 and 2020 would be significant. Chinese enterprises were involved in the construction of close to 17GW of new capacity additions on the continent.¹⁰ Of this, Eastern and Southern Africa dominated the new capacity additions at 5.5GW each, followed by 4.2GW in Western Africa and 1.3GW in Central Africa. The report also highlighted that more than 90% of Chinese-built power projects were contracted to Chinese SOEs and about 80% of these projects were financed by Chinese government-backed loans with sovereign guarantee by African governments. Hydropower dominated the new additions at 49%, followed by coal power plants (largely in South Africa) at 20%. Gas power plants were at 19%, oil-fired plants at 5%, while wind, solar, biomass and waste additions were at 7%.

¹⁰ Excluding Libya, Tunisia, Morocco, Egypt and Algeria.

Recent data released by the China Global Energy Finance Database at Boston University suggests that between 2003 and 2023, Chinese enterprises and financial institutions will have been involved in 67 energy (with installed generation capacity of 26.7GW) projects, some already commissioned and others under planning (see **Figure 9**). The capacity of these projects ranges from 14MW to 3 048MW. Figure 10 shows the added capacity (planned, under construction and in operation) distributed by generation source.

While China is playing a significant role in financing and developing energy infrastructure on the continent, we found that hydro renewable energy projects dominate the new capacity additions (see **Figure 10**). Chinese enterprises' prioritisation of hydropower development in Africa correlates with China's own development trajectories, in particular the construction of Gezhouba and Three Gorges dams. From these two projects, among many others at home, Chinese enterprises have developed the technical, management and operational skills needed for deploying hydropower, to the extent that when the 'going out' strategy started, most SOEs had the capacity to deliver such projects abroad (Brautigam and Hwang 2019).

Although non-hydro renewables were not as significant, as shown by the data, trends are changing on the ground. Table 2 outlines the non-hydro renewables projects that have been completed, are under construction or have been planned.





Source: Authors, based on the data from China Global Energy Finance Database (2020)

August 2020 (completed, under construction and planned)						
Country	Plant	Capacity MW	Status	Chinese involved		
Ethiopia	Adama 1 wind plant	51	Completed	EPC+ financing ¹¹		
	Adama II wind plant	153	Completed	EPC+ financing		
	Aysha II wind plant	120	Under construction	EPC+ financing		
	Welkait biomass plant	60	Under construction	EPC+ financing		
	Reppie waste-to- energy plant	25	Completed	Project developer ¹²		
Egypt	Benban solar plant	1 650	Under construction	Project financing and supplying of technology		
South Africa	De Aar phase 1 and 2 wind farms	244	Completed	Project developer/sponsor		
	The Golden Valley wind plant	120	Under construction	Technology supplier		
	Excelsior wind plant	109	Under construction	Technology supplier		
	Klipheuwel- Dassiesklip wind plant	27	Completed	Technology supplier		
	Van Stadens wind plant	27	Completed	Technology supplier		
	Soutpan Solar plant	31	Completed	Equity investor		
	Witkop solar plant	30	Completed	Equity investor		
	Lesedi solar plant	75	Completed	Technology supplier		
	Letsatsi solar plant	75	Completed	Technology supplier		
	Solar Capital Orange ¹³	Series of projects	Some completed and others waiting for financial closure	Technology suppliers		
Kenya	Garissa solar plant	55	Completed	Project developer + financing		
Senegal	Wind plant	12	EPC contract signed	EPC contractor		
Tanzania	Wind plant	600	Unclear	Project developer		
Ghana	Solar plant	200	Unclear	Project developer		
Uganda ¹⁴	Solar	500MW	Planned	Project developer + financing		
Zambia ¹⁵	Solar	600MW	Planned	Project developer + financing		

 Table 2: Selected non-hydro renewable energy projects in Africa involving Chinese enterprises by

 August 2020 (completed, under construction and planned)

Source: Authors' compilation from various sources

13 See: https://www.solarcapital.co.za/pipeline-projects/south-africa/.

¹¹ EPC + financing is a contract where the contractor (project developer) is tasked with mobilisation of financial resources for the project in liaison with the project owner (the employer). Some contracts are just EPCs where the contractor performs engineering, procurement and construction of the project, while the project owner is tasked with financial resources mobilisation.

¹² As part of a consortium comprising Cambridge Industries Ltd (CIL) and its partner China National Electric Engineering Co (CNEEC).

¹⁴ See: State-owned Chinese firm to build 500MW of solar in Uganda. https://www.pv-tech.org/news/state-owned-chinese-firm-to-build-500mw-of-solar-in-uganda.

¹⁵ See: Zambia's Zesco, Chinese firm sign \$548 mln solar power contracts. https://www.reuters.com/article/zambia-electricity/ zambias-zesco-chinese-firm-sign-548-mln-solar-power-contracts-idUSL8N2D31ZJ.

2.3 Are Chinese investments favoured, and by whom?

Given the economic and political cooperation between Africa and China, are Chinese renewable energy technologies, financing and contracting preferred over those by Western companies? In this section we address three questions that came out of our field investigations.

Do African governments prefer Chinese loans for the financing of renewable energy infrastructure? Our investigations show that the majority of African governments prefer Chinese loans for financing renewable energy, for a variety of reasons. As alluded to by one of the participants interviewed for this report:

The Chinese do not offer political and governance conditionalities as a determinant for access to finance for these EPC contracts. As long as you agree that the construction contract and in some instances the technology will come from China, then there is no problem. (Interview 26 July 2020)

The participants further highlighted that the Chinese do not advocate for the observance of democratic processes as preconditions for loan provision, something associated with traditional financial institutions and Western countries' agencies (Interview 26 July 2020).

However, this non-interference in the internal affairs of host African countries requires qualification, in as far as Chinese interests are concerned. We found that Chinese preconditions for loan agreements are on observance of the One China policy,¹⁶ the subcontracting of Chinese enterprises and the use of Chinese technology or inputs (Interview 24 July 2017). This could, therefore, be interpreted as clandestine conditionality.

For EPC contracts, which in most cases are government-to-government based (i.e. an African government and the Chinese government), some of our participants highlighted that Chinese loans tend to have a lower interest rate compared to what you would normally find from traditional financiers or the international market. Kaplinsky and Morris confirm that the cost of large Chinese infrastructure projects is usually '20–30 per cent lower than those of Northern (Western), South African and Brazilian competitors' (Kaplinsky and Morris 2009: 561). Although this is the case, some of our participants did not agree with this view. Specifically using examples of Chinese-backed wind farms, one of the participants involved in the project argued that:

Wind farms have the same cost, be it from a Chinese, European or American company. The wind energy unit cost is similar. What may constitute the difference is the site specifications and complications. Otherwise, you may even be surprised that the Chinese are expensive, as again there was no competitive bidding for these projects. (Interview 11 August 2017)

While China remains the preferred financier of renewable energy infrastructure by African governments, continuous borrowing is no longer considered a viable option for delivery of renewable energy infrastructure. Instead, new financing and project delivery mechanisms are being designed, including independent power producer (IPP) agreements, power purchase agreements (PPAs) and feed-in tariffs. These models appear to be on the rise. Unfortunately, most Chinese companies do not have experience in dealing with such competitive-based project procurement models. As remarked by a participant from an African country:

¹⁶ That there is only one sovereign country with 'China' in its official name and this should be the People's Republic of China (PRC) and not Taiwan/(Republic of China—ROC). All diplomatic engagement with PRC should recognise this.

Most of the Chinese enterprises that were involved in delivering renewable energy projects a couple of years ago did so under EPC + financing contracts—where in most cases tendering was non-competitive but rather government to government negotiations, or what some call direct negotiations. This model is no longer viable, we are in debt. We need a new model, and our Chinese counterparts are struggling to adapt to this new normal. The market is still there, but we have just adjusted to the basic financing principles. (Interview 4 August 2020)

This view, while representative of the participant country's position, appears to be the general view among many African governments. Auctions in renewable energy project delivery contribute to a reduction of information asymmetry and price discovery as bidders reveal costs, which overall 'contribute[s] to cost reductions by lowering the cost of capital [and] also reflect[ing] changing supply conditions' in the sector (Keay and Robinson 2019: 14).

The second question we investigated was whether Ethiopia and South Africa in particular, and Africa in general, prefer Chinese renewable energy technologies as compared to Western ones. We found that Chinese enterprises involved in the Original Equipment Manufacturing (OEM) for non-hydro renewables such as wind and solar are increasingly dominating global production and supply chains. The transition to green energy in China, motivated by government support and policies, resulted in Chinese enterprises developing five corridors of influence: production, innovation, market, coordination and financing (Lema, Berger and Schmitz 2013).

In the case of wind technology, Chinese enterprises such as Mingyang and Goldwind are leading innovators in medium speed geared drive (MSGD) and permanent magnetic direct drive (PMDD) turbine technologies respectively (Global Wind Energy Council 2019). While many Chinese wind technology manufacturers are in the top ten, our investigations show that Goldwind has more than 90% of its market share in China with the remainder outside China (REN21 2018). Envision and Mingyang had no market share outside China as of 2017 (REN21 2018). The explanation for this is that China's is the largest market for wind technology in the world (see next section). In Africa, only a handful of Chinese enterprises are involved in the wind energy sector, as shown in Table 3.

In the case of solar energy, Chinese companies are leading in the manufacturing of this technology and they dominate the production and distribution chain. An interesting finding from our field investigations is that Chinese enterprises involved in the solar energy industry, such as Jinko Solar and Trina Solar, emerged not as a response to domestic Chinese market demands but specifically for foreign markets. In Africa, Chinese enterprises involved in solar energy at the utility scale are limited. While Chinese enterprises have a limited market penetration for utility-level projects as EPCs and project financiers, they tend to dominate in the production and supply of solar equipment.

Given the breadth of Chinese enterprises' involvement in some of the African countries' wind and solar energy development, we wondered whether there is any preferential treatment for Chinese technology in comparison to Western technology. Our participants had mixed feelings in terms of the technical competency of some of the Chinese wind energy technology. For example, one of the participants highlighted:

At the moment, most of the African countries are still hesitant about some of the Chinese technology in the wind sector. I am, however, confident of Goldwind; it has one of the best technologies in the sector, although it is a bit expensive. (Interview 5 August 2020)

The participant further noted that, '*Currently, our preference is with Goldwind; it has a track record of delivering competent technology*' (Interview 5 August 2020).

Another participant brought an interesting argument to these issues:

You see we have got some Western technology that was used in the case of X wind farm. But at the moment, the wind farm is not performing to standard. It has been 12 months and no electricity is produced due to technological failures. But if you check wind farm X where the Chinese supplied technology, it is performing better, way better beyond what we expected. What I can tell you is that, at the end of the day, it doesn't matter whether it's Chinese or Western technology, it is all to do with the quality of the technology. But sometimes, we tend to stereotype that Chinese technology is of inferior quality. That's not true. Everything has to be analysed on a case-by-case basis. (Interview 8 August 2020)

Lastly, are the Chinese the preferred contractors in non-hydro renewable energy project construction? Our investigations suggest that while the Chinese are willing to work longer hours and are flexible, some gaps exist with regards to skills transfer, corporate social responsibilities and community relations. One of our participants highlighted:

The Chinese contractors are generally preferred as they are flexible in the delivery of the projects. This is not the case with Western contractors. The Western contractors tend to do everything by the book and do not compromise some regulatory requirements in comparison to the Chinese. (Interview 17 August 2020)

While Chinese enterprises have developed production, installation and operation capacities for renewables at home (in China), in Africa their footprint is not yet significant, particularly for nonhydro renewables. However, our analysis shows that it is not only the Chinese developers that have not been aggressive on Africa's wind and solar market; the trends are also observable for European and American enterprises involved in the sector. We found that despite Africa's endowment with renewable energy sources, potential investors are deterred by off-take risk, institutional and regulatory uncertainty and a 'lack of well-identified, investment-ready projects [in combination] with a weak financial sustainability of public counterparts and high-perceived risk environment' (RES4Africa Foundation 2020: page 21). For these reasons and others discussed throughout the report, EPCs appear to be the preferred model for Chinese involvement in Africa's non-hydropower renewable energy market since the risk for EPCs is short-term and, in most cases, sovereign debt is used to finance these projects.

3. ILLUSTRATIVE CASE STUDIES OF ETHIOPIA AND SOUTH AFRICA

The number of Chinese enterprises involved in the renewable energy sector has increased over the last decade in South Africa and Ethiopia. In this section, we begin by unpacking the energy systems in South Africa and Ethiopia, looking at the policies, regulations, actors and institutions, as well as risks and barriers. We then account for Chinese involvement in these two countries, paying particular attention to non-hydro renewables. We do so by assessing the challenges, achievements and lessons drawn from Chinese enterprises' involvement in these countries.

While a number of African countries have committed to deploying wind and solar energy, we specifically focus on Ethiopia and South Africa for illustrative reasons. These two countries have very different policy goals for the energy transition. South Africa is aiming to de-carbonise its coal-dominated energy sector, whereas Ethiopia's priority is to address its energy poverty and economic development issues. The political systems, industrial capacity and ambitions for renewable energy deployment in their electricity portfolios are also different. Furthermore, South Africa engages Chinese enterprises as investors, contractors or exporters, but the interaction strategy is almost on an equal footing compared to that of Ethiopia. This is because Chinese and South African engagements involve project-level cooperation in investment but the two governments also work together as part of the 'rising powers' under the banner of BRICS (Brazil, Russia, India, China and South Africa). With respect to Ethiopia, China sees the East African country as a geopolitical anchor in the region and for that reason has substantial political and economic engagement. These attributes have an impact on Chinese activities in these countries.

Data drawn from the China Africa Research Initiative shows that between 2000 and 2018, Chinese financial institutions loaned more than USD3.2 billion to Ethiopian energy infrastructure development, compared to South Africa's USD1.4 billion between 2016 and 2018.¹⁷ Ethiopia's loan was used for renewable energy, with hydropower dominating, compared to South Africa's financing of the Kusile and Medupi coal power plants.

Our focus on Chinese involvement in South Africa's and Ethiopia's renewable energy markets is influenced by the entrenchment of political and economic relations as well as Chinese enterprises' role in developing wind and solar projects in the two African countries. For example, Adama I and II in Ethiopia are the first Chinese-financed and developed wind energy projects across Africa. Similar trends are observable in South Africa.

¹⁷ The China Global Investment Tracker database managed by the American Enterprise Institute shows that between 2005 and 2019, Chinese contractors were awarded construction contracts for 12 energy projects in Ethiopia: four for hydropower projects, three for non-hydro renewables (wind energy) and five for distribution and transmission services, to the tune of USD6.9 billion. This is compared to South Africa, which had USD1.9 billion invested in two coal projects, one oil project and one wind energy project. For more, see: https://www.aei.org/china-global-investment-tracker/.

3.1 Energy systems in the two countries at a glance

Although South Africa is the second-largest economy on the continent after Nigeria, it is by far the largest producer and consumer of both renewable and non-renewable sources of electricity. Recent data shows that more than 86% of the population has access to electricity and, as of 2018, the generation capacity was 51 309MW, of which about 91% came from fossil fuels and roughly 8.8% from renewables. Coal dominates the installed generation capacity in South Africa. With this massive reliance on fossil fuels, the country plans to decommission 11GW of coal-fired power capacity and add 25.3GW from renewables by 2030 (IRP 2019). South Africa averages about 2 500 hours of sunshine with a 6.6 kWh/m2 of sunshine radiation, making it an African country richly endowed with solar energy resources (Jain and Jain 2017). Beyond solar, South Africa is also endowed with a 6 700GW potential from wind energy (Mukonza and Nhamo 2018). To achieve its renewable energy target, the South African government, among other initiatives reported in IRP 2010, created the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) in 2011. While REIPPPP appears to be meeting its objectives, especially around attracting investments in the sector, some challenges exist (discussed below).

South Africa has the most well-developed electricity sector in SSA in terms of market capabilities and regulation standards. As a result, Chinese companies involved in the renewable energy sector, such as Jinko Solar, have set up solar technology manufacturing firms. In addition, the country has received a series of foreign direct investment (FDI) packages from the Industrial and Commercial Bank of China (ICBC) Standard Bank and other Chinese financiers in the finance sector. For example, in April 2013, ICBC and Standard Bank signed a R20 billion (USD2.1bn) agreement aimed at financing development of renewable energy under South Africa's REIPPPP. Some of this funding has been used to finance more than 940MW of renewable energy in South Africa. Examples of these projects include the 27MW MetroWind Van Stadens wind farm, the 22MW Herbert photovoltaic project and the 72.5MW Kalkbult photovoltaic project. Chinese companies have also been involved in several projects as suppliers of technology, as EPCs and as project financiers (explored below). These projects include wind farms (De Aar phase 1 and 2, the Golden Valley, Excelsior project, Klipheuwel-Dassiesklip, Van Stadens wind farm) and solar farms— Soutpan solar park, Witkop solar park, the Lesedi, Letsatsi, and Solar Capital (Shen and Power 2017).

Ethiopia was the first overseas venture for Chinese EPC contracts in the financing and development of wind farms (Adama wind farms and now recently the Aysha wind farm), biomass (Welkait plant) and waste-to-energy projects (Reppie plant). Ethiopia is an interesting case study because, unlike South Africa in which 80% of the population has access to electricity, recent estimates show that only 45% of Ethiopia's 110 million people have access to electricity. The country has committed to investing in renewable energy and currently almost 100% of its 4 500MW generation capacity is from renewable energy (including large hydro). Hydropower dominates the generation sources, followed by wind. With the rising electricity demand ranging between 25% and 30%, the country estimates that by 2030, 22 000MW will be added from hydro, 1 000MW from geothermal and 2 000MW from wind. The country aims to reach a 100% electrification rate by 2025, of which 35% will be provided by off-grid and 65% by grid networks. In terms of energy market dynamics, electricity generation is 100% dominated and controlled by the government. However, recent changes in the regulations have created an avenue where the private sector is likely to play a leading role in non-hydro renewables (Chiyemura 2019).

A political economy analysis of the two countries' renewable energy landscape presents a range of similarities and differences regarding the overall governance of the sector. Energy policies in

post-apartheid South Africa are highly shaped and influenced by the historical dynamics of racial segregation, where black communities had no or limited access to energy. South Africa's energy landscape also pays particular attention to the need to reduce greenhouse gas emissions from the energy sector by committing to developing renewable energy. South Africa's energy landscape is thus shaped, on the one hand, by domestic historical factors and the need for social justice and, on the other, influenced by the international commitment to address and mitigate climate change (Cock 2019). This makes it complicated, contested and messy to reconcile various actors' and institutions' competing interests and ideas of how best to govern the sector (Baker, Newell and Phillips 2014).

South Africa's electricity production is dominated by fossil-based energy sources which are linked to the minerals-energy complex. The growth of South Africa's economy is dependent on the intensive use of low-cost coal for electricity production. Eskom, an SOE, has a monopoly over the generation, transmission and distribution of electricity. Research shows that Eskom supplies more than 90% of the electricity, owns the transmission grid and is responsible for 60% of the distribution service in the country. Eighty-five per cent of Eskom's installed generation capacity comes from coal, making South Africa the largest emitter in Africa of greenhouse gases from the energy sector (Baker and Shen 2017).

Unfortunately, reliance on coal is no longer sustainable. The country is struggling to meet its electricity demand and supply scenarios. Among many explanations, it has been observed that South African state elites have 'captured' Eskom, resulting in corruption, especially concerning 'questionable and irregular procurement decisions and practices, together with the burgeoning costs associated with the utility's capital expenditure programme and operational expenses' (Kessides 2020: v). This has led to Eskom's substantial failure to deliver the much-needed electricity to South Africa. Added to that, Eskom was in debt to the tune of over ZAR440 billion by October 2019, which is seriously incapacitating the utility's ability to efficiently deliver on its mandate (Kessides 2020: iv).

In an effort to address the electricity demand and supply crisis, the South African government introduced REIPPPP in 2011. REIPPPP is a competitive, tender-based policy initiative aimed at attracting and improving the participation of private sector investment in grid-connected renewable energy generation. So far, four and a half bidding rounds have been completed since 2011, including solar photovoltaic, onshore wind, concentrated solar power and other renewables such as small hydropower, biogas, landfill gas and biomass. The fifth Bid Window Request for Proposal for the REIPPPP submissions closed on 16 August 2021.

REIPPPP has been rated as one of the best government-led policy initiatives with regards to a transition to renewable energy in Southern Africa, if not the rest of the African continent. Reviews from the bidders suggest that the REIPPPP bidding processes are transparent and that the initiative is well designed, to the extent that South Africa has attracted substantial investment from IPPs since it was launched in 2011 (Interview, 8 November 2017). This has loosened the monopoly of coal and Eskom in the electricity sector. REIPPPP 'offers valuable lessons for other developing countries in terms of designing and running competitive tenders or auctions for grid-connected renewable energy IPPs' (Eberhard and Naude 2017: 107).

Such lessons are:

- Enabling policy and a regulatory environment;
- Mandated, authorised leadership to manage the procurement programme;
- Resources for hiring experienced transaction advisors;

- Auction design built on international best practice;
- High-quality, bankable documentation and contracts;
- Fairness, transparency and trust building to earn private sector trust;
- Capital markets that provide adequate and competitively priced funding (Eberhard and Naude 2017: 56).

Since 2011 when the programme started, more than 390 submissions (Eberhard and Naude 2017) have been made, resulting in 112 bids¹⁸ being selected for procurement of 6 422MW in seven bid rounds (bid windows 1, 2, 3, 3.5, 4 and smalls BW1 (1S2) and smalls BW2 (2S2)) as of 30 June 2020 (IPPPP 2020: 2). ZAR 209.7 billion was attracted from both equity and debt financing, of which R41.8 billion was from foreign investment (IPPPP 2020: 2). Of the 6 422MW, 4 276MW of generation capacity was added to the national grid from 68 IPP projects. More than 52 000 job years were created¹⁹ for South African citizens (IPPPP 2020: 2).

While these successes can offer valuable lessons to African countries, the programme has had its fair share of challenges. For example, in 2015 there was an impasse between the IPPs and Eskom. A participant highlighted that:

REIPPPP was lauded globally as a very good programme but unfortunately somewhere along the line in 2015, there was an impasse between the stakeholders. Although preferred bidders as part of the round were announced, they never signed the PPA [power purchase agreement] which delayed to 2018 when the new government was waiting for the release of the Integrated Resource Plan (IRP) which was later released in 2019. When the impasse happened in 2015, the major pushback from Eskom was that renewables were an intermittent power supply and could not be trusted and that the tariff was higher than what it should be. There was no political will to see it through. (Interview, 5 August 2020)

Although there were some delays, Deloitte (2019: 5) reports that the projects which were affected 'were eventually concluded in April 2018, over two years later than initially expected'.

Unlike South Africa's energy landscape, our analysis of Ethiopia shows that the energy mix is dominated by hydropower. Ethiopia's energy policy orientation is to increase electricity production, given that the majority of the population is without access to electricity. Our analysis shows that by August 2018, hydropower dominated the electricity sector at 3 814MW (88.42%), followed by wind at 324MW (7.51%), diesel at 143MW (3.31%), geothermal at 7.3MW (0.16%) and waste-to-energy at 25MW (0.57%). This highlights that the government prioritises the development of hydropower, followed by wind. Wind has a high social acceptability factor, especially with respect to permanent effects on direct land use; 'solar takes a lot of land' (Interview 25 July 2020). Evidence from the Growth and Transformation Plan II (2015/16–2020/21) shows that the government has set an ambitious target of installing 17 000MW: hydropower will contribute 13 817MW (80.2%), followed by wind at 1 224MW (7.1%), solar at 300MW (1.7%), geothermal at 577MW (3.3%), reserve fuel (gas) at 509MW (2.9%), waste at 50MW (0.2%), sugar at 474MW (2.7%) and biomass at 257MW (1.4%) (National Planning Commission 2016).

Our field investigation shows that the country is unlikely to achieve this target. The government's approach has been more of a 'centralised, top-down approach to electricity expansion', paying minimal attention to an off-grid model (Interview date August 2020). As in South Africa where Eskom has a monopoly, we found that Ethiopia Electric Power (EEP) has similar domination in the

^{18 6 422}MW from 92 large-scale renewable energy plus 99MW from 20 small-scale REIPPPs.

¹⁹ One job being equivalent to a full-time employment opportunity for one person for one year.

Ethiopian electricity market. Until late 2016, the electricity sector was dominated by the government-owned EEP and the private sector was only involved in the form of EPC contracts. Given the limitations of this model, especially as it concerns access to concessional loans, the government has sought to increase the participation of the private sector. In 2017, the government signed its first IPP agreement with Corbetti Geothermal, thereby demonstrating a commitment to increase private sector participation in the sector. However, the government is yet to finalise the feed-in tariff to create certainty for investors. Without policy and regulatory certainty, and decreasing concessional loan opportunities, increasing debt and the current political environment in Ethiopia, potential investors are taking a 'wait and see' attitude. While this is not to suggest that there is currently no market in the sector other than via EPC, the state currently appears to have limited institutional and regulatory capacity to attract, if not competitively mobilise, capital for auction-based project development.

There have been talks with the new prime minister on the need to partially privatise EEP. However, there has been pushback against this move. We found that those opposing privatisation are arguing for the need to reform EEP by unbundling it – creating a generation unit as well as a transmission unit which will be independent of EEP. While this is a possibility, our analysis shows that the government still wants to maintain tight control on this sector and the privatisation of EEP will likely not be tenable in the next five years. This will probably delay auction-based non-hydro renewable energy project delivery mechanisms.

3.2 Chinese investment: Achievements and lessons

Chinese enterprises' involvement in Ethiopia and South Africa varies and is mainly shaped by the energy market landscape, renewable energy resources endowment and the host country's political and economic relations with China. In South Africa, Chinese enterprises are generally involved in the projects through several modes of engagement, including, but not limited to, EPC contracts, technology supply and equity investment. As shown in Table 3, only a handful of Chinese enterprises have supplied wind technology in Africa. Goldwind supplied the wind technology for Adama 1 (51MW) in Ethiopia. SANY Group, a Chinese enterprise, usually not associated with wind technology, also supplied technology for Adama II (153MW). Dongfang Electric, a Chinese enterprise, was awarded the EPC + financing contract for the Aysha wind plant (120MW) in Ethiopia. China Longyuan Power was involved as a joint venture with Mulilo Enterprises in the De Aar phase 1 (100MW) and phase 2 (144MW) in South Africa. Guodian United Power supplied the technology which was used in these two projects. Goldwind was also involved in EPC and OEM contracts for the 117MW Golden Valley project and the 32MW Excelsior project which were developed by BioTherm Energy. Another Chinese company involved in the wind energy that has found inroads into the South African market is Sinovel. Sinovel was involved in two joint venture projects for the 26.2MW Klipheuwel-Dassiesklip wind farm and the 26.2MW Van Stadens wind farm.

In the case of solar, China was involved as both an equity investor and as a supplier of technology for the 28MW Soutpan solar power plant and the 30MW Witkop solar power plant in South Africa. GCL-POLY, another Chinese enterprise, was also involved as an equity investor for the 75MW Lesedi and 75MW Letsatsi solar PV power plants. In these two projects, Hanwha was the technology supplier. Emerging evidence also suggests that beyond the South African market, the Sinohydro Group is also involved in the 200MW solar farm that will be built in Bui, Ghana. In Kenya, the China Jiangxi Corporation for International Economic and Technical Co-operation was involved in the Garissa Solar Photovoltaic Power Plant as an EPC contractor, with financing from China Exim Bank. GCL, a Chinese enterprise, has also signed an agreement with Egyptian authorities for a USD2 billion solar panel manufacturing plant with capacity to produce 5GW annually. We did not find any evidence which suggests the involvement of Chinese solar energy enterprises in Ethiopia at the utility-scale level. However, there are isolated cases where Chinese-produced solar equipment is sold for household use.

Chinese enterprises involved in Ethiopia's non-hydro renewables have played an important role in new capacity additions (Adama 1 – 51MW; Adama 2 – 153MW; Aysha II – 120MW, under construction). While these projects were delivered under the EPC + financing contracts, this model is no longer likely to work in the future. The EEP has been identified by the new prime minister as being too heavily in debt, and it has reduced taking on new concessional loans to finance new energy infrastructure projects. What this suggests is that new financing models are needed, and we believe development finance institutions can play a role, particularly those with access to concessional financing and grants that can be repaid over relatively longer time horizons (Muñoz Cabré et al. 2020). Equally, there are possibilities of using IPP schemes via government-backed PPAs. South Africa's REIPPPP could also serve as a learning model for Ethiopia's future renewable energy development trajectories. The only issue is that the Ethiopian government has not yet finalised the feed-in tariff framework.

Country	Plant	Capacity MW	Status	Financial model	Chinese companies involved	
Ethiopia	Adama 1 wind plant	51	Completed	EPC+ financing	Sinohydro (HydroChina), Goldwind	
	Adama II wind plant	153	Completed	EPC+ financing	Sinohydro, SANY Group	
	Aysha II wind plant	120	Under construction	EPC+ financing	Dongfang Electric	
	Welkait biomass plant	60	Under construction	EPC+ financing	China CAMC Engineering Co Ltd	
	Reppie waste-to- energy plant	25	Completed	Project developer	Consortium comprising Cambridge Industries Ltd (CIL) and China National Electric Engineering Co (CNEEC)	
South Africa	De Aar phase 1 and 2 wind farms	244	Completed	Project developer/ sponsor	Guodian Group	
	The Golden Valley wind plant	120	Under construction	Technology supplier	Goldwind	
	Excelsior wind plant	109	Under construction	Technology supplier	Goldwind	
	Klipheuwel- Dassiesklip wind plant	27	Completed	Technology supplier	Sinovel	
	Van Stadens wind plant	27	Completed	Technology supplier	Sinovel	

Table 3: Chinese enterprises involvement in Ethiopia and South Africa's renewable energy projects

Table 3: Chinese enterprises involvement in Ethiopia and South Africa's renewable energy projects						
South	Soutpan Solar plant	31	Completed	Equity investor	Chint	
Africa	Witkop solar plant	30	Completed	Equity investor	Chint	
	Lesedi solar plant	75	Completed	Technology supplier	GCL-Poly equity investor as part of a consortium and Hanhwa	
	Letsatsi solar plant	75	Completed	Technology supplier	GCL-Poly equity investor as part of a consortium and Hanhwa	
	Solar Capital Orange ²⁰	n/a	Some completed and others waiting for financial closure	Technology supplier	Powerway	

3.3 Policy implications

In both Ethiopia and South Africa, the EPC + financing project delivery model is no longer the mainstream model. The Ethiopian government is moving away from concessional loan financing of energy infrastructure to IPPs. IPPs require competitive bidding, which most of the Chinese companies we interviewed did not have the necessary experience in to undertake such projects. EEP, the state-owned utility, opened its first solar tender in 2016; it was won by Italian energy company Enel in October 2017 (Bellini 2017). The tender was for a 100MW Metehara solar plant in the Oromia region. A second tender was issued by EEP in October 2017 for the development of two 125MW solar farms. Twelve developers were pre-selected in March 2018. The third tender was opened in 2019 for construction of 800MW of solar farms in Tigray, Oromia, Somali and Afar regional states. The International Finance Corporation (IFC) is mobilising financing resources for the projects that will be developed from the three tendering windows. The IFC will also provide guarantees for investors (Njoroge 2019), as part of the IFC and government of Ethiopia's agreed Scaling Solar program. Our interviews with Chinese enterprises in Ethiopia reveal that some are struggling to win contracts for solar projects under these competitive bidding processes. Some highlight that it is not rewarding to compete for these projects because of the risks involved in the project's finance model. There is a need for policy banks and regulators in China to financially support the Chinese enterprises that decide to adapt to this new trend (see the next section). Our field investigations show that most of the Chinese enterprises involved in the wind and solar sectors are not prepared to bid for small projects given the high risks involved. We believe there is a need for these companies to build their experience by undertaking small projects.

Ethiopia and South Africa are in the process of reforming their state-controlled energy systems, including the generation, transmission and distribution enterprises. How renewable energy development can be embedded in energy sector reform is a challenge during the transition. We found that the deployment of non-hydro renewables in Africa is currently affected by a lack of clarity regarding the number and type of policies and regulations and the methodology for delivering these technologies, in particular off-grid services, which by our analysis hold some of

²⁰ See: https://www.solarcapital.co.za/pipeline-projects/south-africa/.

the solutions to addressing the electrification challenge on the continent. We believe that there is a need for clear guidelines on the protocols, connections and exit strategies for off-grid services. This includes transparency on tariff guidelines for off-grid systems and clarification around what happens when the 'grid' arrives for those companies that would have developed off-grid systems. The risk of developing off-grid systems is high, especially in remote areas where the private sector may find it economically unviable to do business. Such remote communities are unlikely to have the income to service the connections. As such, some of the regulatory and policy reforms should incentivise and promote development of off-grid systems in remote areas through tax holidays and subsidies.

The unbundling of the electricity sector in South Africa and Ethiopia in particular, as well as Africa in general, has the capability to promote competition, increase efficiency and encourage transparency and governance echelons in the sector. This contributes to cost savings and provides avenues for risk mitigation and system resilience (Power Futures SA 2019). Our field investigations identified that the majority of African utilities have bundled transmission and distribution together and, in some instances, even generation enterprises. Some of the reforms should address this by unbundling, creating new or reforming existing transmission, distribution and generation enterprises (**Figure 11**). For example, some of our participants from Ethiopia highlighted that the government should now finalise the unbundling of EEP. The South African government is also committing to this unbundling process, during which, from 2019 to 2022, Eskom will be reformed. Three institutions will be created: a transmission entity, a distribution entity and a generation entity (Interview 27 July 2020).

FIGURE 11: The need for institutional and governance reform in SSA's renewable energy sector



Source: Authors' analysis

Furthermore, there is a need to reform or create independent regulatory bodies to ensure that decisions regarding the development of off-grid systems are reached impartially. We found this to be the case in Ethiopia where, although the Ethiopian Energy Authority (EEA), an SOE, has the constitutional mandate to regulate the sector, it is difficult for it to regulate EEP, another SOE. In the case of South Africa, the National Energy Regulator of South Africa (NERSA) has the legal, financial and operational power to carry out this work.

Our analysis of the REIPPPP framework shows that the delay or slow down which started in 2015 increased the transaction cost for those companies involved in the sector. The delay led to some Chinese companies, especially those manufacturing solar equipment, shutting their production facilities. 'Jinko Solar closed down 120 MW manufacturing facility due to delay in REIPPPP, Sun Power 160 MW/year facility is currently dormant and ART Solar 75 MW/year facility – decreased capacity due to delay in REIPPPP' (GreenCape 2020: 31). We believe there is a need to reduce the transaction costs for REIPPPP processes in South Africa. To increase REIPPPP delivery efficiency, the following factors need to be taken into consideration:

- Ensuring continuity and continued transparency in the rollout of the programme;
- Efforts to support the manufacturing base, attract new investment and build confidence;
- Prioritising the reform of the country's electricity sector to reflect South Africa's sustainable resources and market offerings;
- The availability of black equity players to participate in meeting the 12.5% Black Economic Empowerment (BEE) shareholding requirement in each project developed;
- Need to think about the utility-scale off-grid network services in the case of Ethiopia (GreenCape 2020: 37).

4. WHO DRIVES CHINA'S RENEWABLE ENERGY ACTIVITIES IN AFRICA?

On the Chinese side, the investigation focused on three groups that have been identified as key actors in promoting Chinese overseas energy activities: government ministries, policy finance institutions, and state-owned and private enterprises. Within each actor group there are both key and peripheral organisations in terms of their roles and influence in decision-making processes.

4.1 State actors: Governance vacuum and fragmentation

The policy subsystem in governing Chinese overseas activities is unique and complex as it involves several ministries in decision-making processes. The Ministry of Commerce (MOFCOM), the National Development and Reform Commission (NDRC), the Ministry of Finance (MOF) and the Ministry of Foreign Affairs (MOFA) all play a significant role in crafting and implementing China's 'going out' strategy. In addition, other line ministries such as the MEE, the National Energy Administration (NEA) and the newly established China International Development Cooperation Agency (CIDCA) play a peripheral role. Among the key guardian ministries, none plays a more dominant role than the others in decision-making processes because diplomatic relations (administered by MOFA), commercial interests (administered by MOFCOM), public financial support (administered by MOF) and the national development strategy (administered by NDRC) are all important pillars to craft Chinese overseas strategy. As a result, the overall governance of Chinese foreign trade, finance, investment and aid programmes has been highly fragmented for decades, with competing interests and preferences from different ministries.

This fragmentation has several notable implications. Big decisions, such as approving mega projects, loan facilities or rescheduling large-scale sovereign debt, cannot be made by any single ministry and therefore have to be pushed upwards to the State Council. Similarly, none of these ministries can obtain exclusive regulatory power in sectoral-based planning or strategy, which is in stark contrast to the governance of key domestic industries in China, where industrial policies and state intervention are prevalent. For example, for the domestic renewable energy market there is both a mid- to long-term strategy, stipulated clearly in the Five Year Plans (FYPs), and specific annual targets for new instalments of each energy source for each province, which is developed, monitored and adjusted by the NEA, the main regulator. But for overseas markets, currently no such planning responsibility and capability is found among any of the regulatory ministries mentioned above. MOFCOM's 13th FYP (2015–2020) on foreign trade is vague and has no specific targets for any key sectors, indicating notable gaps in sectoral-specific planning.

Another challenge with the joint but fragmented governance model is that issues like climate change and the environmental impacts of these projects are often overlooked, as they are not on the main agenda of any of the key ministries involved. It is thus not surprising that the guiding opinions on 'green BRI' were actually led by the then Ministry of Environmental Protection (MEE 2017), which was largely responsible for domestic environmental issues. Since 2018, the Ministry was restructured into an augmented MEE with the added responsibility of governing climate

change, which previously resided in the NDRC. Hence, it has a strong inclination to fill the governance vacuum of a lacking 'green' agenda in the current 'going out' strategy. Yet, whether and how the MEE or other regulators can integrate into this already highly fragmented, complex and rather enclosed policy subsystem of BRI is still too early to predict. This might explain why specific follow-up measures have not yet been published by any key ministries, including MOFCOM, MOFA and the NDRC.

Yet another effect of the fragmented governance system is that project approvals, as the most important regulatory responsibility, have largely been delegated to the policy banks and export credit agencies. Currently, most overseas construction contracts and direct investment projects, the most dominant project types, require no approval from MOFCOM and NDRC as long as basic criteria are met for the proposed projects. The ministries do, however, retain veto power to reject project applications. As a result, organisations that provide financial facilities to support these activities, particularly China Eximbank, China Development Bank and the Sinosure, have become essential gatekeepers for project screening and selection (their role and preferences are examined in the next section). This delegation of project approval also indicates that major ministries do not have preferential sectors or subsectors, such as renewable energy, to support.

Fragmentation also leads to uncoordinated official engagement with recipient African countries. Currently, most bilateral communications are confined to the diplomatic level, mainly led by MOFA, with FOCAC as a typical example of the highest level of political communication between the Chinese and African governments. Yet, at the sectoral or project level, bilateral engagement between officials is relatively rare. However, as noted, many SSA governments are busy with both sectoral reforms and clean energy transition, which requires systematic and comprehensive capacity building. It also requires advice concerning macro-level policy making and planning as well as micro-level project screening and negotiation and management skills to complement the 'hardware' technology and financial import.

Despite this, few of the Chinese ministries mentioned above are capable of providing this technical assistance. This is compared to other development agencies in developed countries, such as the Foreign, Commonwealth and Development Office (FCDO), United States Agency for International Development (USAID), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and Danish International Development Agency (DANIDA), which work closely with various think tanks, private sector and civil society groups to deliver renewable energy related capacity-building efforts. Chinese ministries are disengaged from the local sectoral development strategy and planning activities, which has led to very limited knowledge and understanding of local energy sector development, policy frameworks and market updates. Some Chinese companies and think tanks are indeed sporadically involved in local energy sectoral planning, but there is not yet a state-led or orchestrated effort or scheme. Consequently, Chinese regulators cannot provide proper guidance and support for Chinese renewable energy enterprises to explore African markets.

In general, the current governing system of Chinese overseas energy activities is highly fragmented in contrast to how energy sectors are governed within China. The key ministries involved have a notable gap in sectoral expertise, which prevents them from crafting specific development strategies from the supply end, or engaging or coordinating with recipient countries from the demand end. All the project selection and approval has been delegated either upward to the State Council (for extra-sized or politically important projects) or downward to the development finance institutions. The current system clearly lacks an implementable green agenda and therefore key ministries are supporting both traditional and renewable energy projects equally, in an unbiased manner. This creates a significant challenge to promoting Chinese renewable energy activities, particularly in difficult markets such as those in the SSA region.

4.2 Policy banks and export credit agencies: On the ground gatekeepers

A previous study illustrated that 'policy financial institutions' such as China Eximbank, CDB and Sinosure dominate the financing landscape of Chinese overseas energy activities (Brautigam 2011; Kong and Gallagher 2017), whereas Chinese commercial banks, such as the ICBC and the Bank of China, play a smaller role. These policy banks and export credit agencies were established to support China's 'going out' strategy and have not only adopted expansionary approaches in the past few decades but are also required by the MOF to provide loan facilities and export credit guarantees on a 'break even' basis with no significant losses or gains. Consequently, once these institutions are given the responsibility for project screening, they understandably apply standard risk assessment tools to hand-pick and support the most commercially viable and low-risk project proposals, with social, environmental and climate contributions as secondary determinants. In addition, since the political mission of these state-backed institutions is to promote Chinese investment and export overseas, they have no incentive or authority to exclude or discourage fossil fuel project proposals or sectors as long as they meet the eligibility criteria of guardian ministries. As a result, all energy projects, conventional or renewable, compete equally for the support of these organisations.

This project screening process, however, disadvantages renewable energy projects for several reasons. Firstly, renewable energy projects such as wind and solar farms are less likely to be supported by the sovereign guarantees issued by host countries as they are usually smaller than traditional energy projects, such as large hydro, thermal and nuclear power stations, and hence less politically appreciated by the Chinese and African governments. Projects with less political support would be considered higher risk due to the 'too big to fail' logic in the project screening process. The preference for large projects with a sovereign guarantee model is also due to the consideration that sovereign debt is less likely to be cancelled or waived completely. Most wind and solar energy projects in the SSA region are developed through public procurement or project finance arrangements without any recourse to sovereign credit.²¹ This is consequently considered more complex and a higher risk. Loan officers and underwriters are less comfortable in approving these transactions because if there is default in repayment the chance for recovery is much lower. As a result, the risk appetite of policy banks and export credit agencies for wind and solar projects is conservative.

In addition, most policy finance institutions have supported large conventional energy infrastructure projects for decades, and have established close customer relations with key Chinese exporters and contractors, mostly large SOEs. The fast expansion of policy banks and export credit agencies in the past decade depended heavily on close cooperation with these key Chinese energy companies and they are therefore unlikely to revoke their support in the foreseeable future. On the contrary, many wind and solar energy companies are relatively newly established and, until recently, seldom engaged with these policy finance institutions. It takes time to establish effective cooperation relations. Our interviews revealed a lack of understanding among some Chinese renewable energy companies about the essential financial services provided by China Eximbank and Sinosure. Ineffective communications and extended negotiations with specific loan and insurance terms are inevitable but may also lead to a delay in approval or even refusal of the project proposal. Furthermore, many renewable energy companies, particularly in the solar PV sector, are private enterprises, which often face higher barriers to accessing concessional loans or export credit finance than state-owned companies. Their limited experience in the overseas market and lack of collateral assets for supplier credit loan facilities are other setbacks in the project screening process.

²¹ With South Africa's REIPPPP as an exception.

Most of the Chinese energy infrastructure projects were implemented under the EPC + finance model, with some adaptations that are different from the model and guidelines of the Organisation for Economic Co-operation and Development (Brautigan 2011; Gallagher et al. 2018). As the EPC contractors, Chinese companies would usually seek support from Chinese banks and export credit agencies to finance the contracts under the buyers' credit arrangements (when project developers in the host countries are the borrowers) or the sellers' credit arrangements (when Chinese companies step up as the borrowers). This is mainly because most Chinese companies originated as construction companies that had a considerably low-risk appetite for equity investment, largely due to insufficient expertise. In addition to EPC, Chinese solar PV manufacturers are engaging in short-term equipment supply, supported by trade finance, which is very different from long-term project-based finance schemes. Transactions are typically done in 180 days, with lower perceived risks. In such cases, exporters are less concerned about long-term energy transition pathways and long-term social-political uncertainties.

The biggest challenge, however, is the norms and beliefs embedded in the daily practices of policy finance institutions that implicitly deter renewable energy projects, particularly in the SSA region. Interviews revealed that the risk of fossil fuel projects as 'stranded assets' has not yet been fully recognised and some risk officers believe there is at least a 15-year 'window' before applications for coal-fired power stations are completely phased out. In addition, under the EPC + finance model, the risk of the host government shutting down the fossil fuel power plants in the future will not affect Chinese contractors and financiers. Many also believe wind and solar energy are unstable and can only play a peripheral role in modern energy systems, with a landscape-level low-carbon energy transition still viewed as premature in the SSA region. The potential of decentralised renewable systems is somewhat recognised but there are concerns that the current policy framework and financial model in China are not suitable to support Chinese enterprises in exploring opportunities for off-grid and mini-grid systems in the SSA region. Key reasons deterring Chinese policy financial institutions from giving preferential treatment to renewable energy projects include the current project screening process; existing relations with the major Chinese investors and exporters in conventional energy sectors; embedded beliefs in the traditional energy development model; and unconvinced attitudes about alternative energy transition pathways.

4.3 State-owned and private companies: From competitors to partners

The majority of Chinese overseas energy infrastructure projects were essentially construction contracts undertaken by large SOEs, among which Power China, Energy China, China Three Gorges Group and SINOMACH emerged as the dominant players. These gigantic corporations have dozens of subsidiary companies operating in SSA countries (Shen 2020). Many of these subsidiaries, such as Gezhouba, China International Water and Electricity (CWE) and Sinohydro, are well known for their expertise in contracting large hydropower stations. These large SOEs are much less experienced in the wind and solar energy markets, and most have only recently established dedicated departments or subsidiaries to develop wind and solar projects.

As for the manufacturing sector, Chinese companies are leading the global wind turbine and solar panel supply. However, until recently, leading Chinese wind turbine manufacturers, such as Goldwind and Mingyang, mainly served their domestic market. For example, by 2019 Goldwind had installed a total capacity of 53.2GW but its overseas capacity, including projects in the preparation stage, was only around 1.6GW. Although Chinese wind turbine manufacturers are exhibiting increasing interest in engaging the overseas market, including a handful of projects in countries like Ethiopia and South Africa, in general they still lag behind other global leading

companies. This is partially because the Chinese domestic wind market is rather enclosed and supported by strong central and local protectionist policies, so that Chinese firms face less competition from global companies at home. The massive market potential, with strong policy support from central and local Chinese government, makes leading companies less incentivised to explore the overseas market, particularly in areas perceived as difficult. As a result, Chinese companies' competitiveness in overseas markets is often overestimated when, in fact, they face typical late-entrant barriers such as lower brand and technology recognition, weaker connections with local distributors and partners, and unfamiliarity with the political systems and policy frameworks of recipient countries.

The most active Chinese wind energy companies in African markets are not those leading Chinese companies that still focus on the fast-growing domestic market but rather suppliers such as Sany and Dongfang Electric Corp with a smaller market share for wind power. Sany has secured both distributed and large-scale wind farms in Ethiopia, Senegal and Tanzania, either as equipment suppliers or as EPC contractors. Dongfang Electric's first wind energy EPC project (Aysha II) is also in Ethiopia, with a 120MW capacity and financed by China Eximbank. Both Sany and Dongfang Electric have unique advantages in the African market. Sany is a leading supplier of construction machinery, particularly in African countries, and Dongfang's main strength is hydro and thermal power generators and boilers; wind turbines are not the core business for either.

Compared to the wind turbine sector, solar PV suppliers are serving both domestic and overseas markets. In 2019, Chinese PV exports reached 66.8GW, amounting to USD16.23 billion, a 60% jump compared to the previous year. The top ten exporters took about 74% of the total export volume, indicating that the market is increasingly captured by the leading companies. However, the increase is mainly due to the surge of European and emerging markets and the share of SSA is still relatively small. Among the top 20 destinations for Chinese solar PV exports, South Africa is the only SSA country. In addition, most Chinese solar PV suppliers are private companies, compared to the large SOE groups mentioned above, and hence most are less keen to venture into construction contracts or IPP development in overseas markets due to limited experience. Some companies, such as China and GCL, have several projects in South Africa. The leading company, Jinko, has established six offices in South Africa, Ghana and Nigeria, with around 1GW local production facility, taking around 30% of the African market. But in general, Chinese solar companies are conservative in taking up EPCs or direct investment in Africa.

One notable trend in recent years is the teaming up of private companies and SOEs to secure large, on-grid construction contracts in the SSA region. CEEC's Gezhouba group secured a 500MW solar park contract in Uganda, and Power China signed a 600MW solar contract in Zambia. Both projects are using the 'going out' strategy with Chinese private solar technology suppliers. The same strategy has also been adopted by Jinko and Jiangxi International group (CJIC), a local SOE from Jiangxi Province, to develop a 50MW solar park in Kenya. These bilateral agreements will certainly have impacts on the solar auction programmes in planning within these countries.



FIGURE 12: Barriers to scaling up wind and solar energy projects from the Chinese side

Source: authors' own work

In summary, Chinese overseas energy activities are governed by an enclosed community of government agencies, policy banks, export credit agencies, and state-owned and private companies. Notable barriers among all these actor groups deter non-hydro renewable energy activities in the SSA region (**Figure 12**).

4.4 Policy implications

The policy community of Chinese overseas energy activities is comprised of several ministries, policy financial institutions as well as state-owned and private enterprises. These actor groups face unique challenges in promoting wind and solar activities in Africa. Therefore, scaling up Chinese renewable activities requires coordinated efforts among these key organisations for institutional and ideological changes.

Firstly, although key regulators like NDRC and MOFCOM already delegate much of their project approval rights to policy finance institutions, only retaining veto power for the most politically sensitive or important projects, more efforts are needed at the macro level of planning in order to set clearer long-term and short-term policy signals for promoting Chinese overseas renewable energy activities, particularly around wind and solar energy. Such specific policy targets will elevate market expectations and create enthusiasm for achieving the current visionary strategies of a 'green BRI'. Due to the fragmentation of current governance structures, key ministries should develop proper sectoral expertise to make credible and realistic policy goals based on comprehensive communication and consultancy with key industrial and financial institutions, together with other line ministries and government departments that are responsible for energy and climate change governance. Secondly, more efforts should be made by Chinese enterprises and ministries to be actively involved in various capacity-building activities among African governments, particularly engaging energy regulators to develop plans or road maps on renewable energy capacity and to establish stable policy frameworks in supporting renewable energy development. On the one hand, the massive development of Chinese wind and solar capacity in the past decade has provided Chinese regulators with ample experiences and lessons that can be drawn on by African governments, ranging from designing feed-in tariffs or procurement programmes to preventing rampant curtailment due to the massive growth of renewables. On the other hand, active involvement in African countries' energy sector development would enable Chinese regulators to enhance their understanding of local market opportunities in specific SSA markets and encourage Chinese companies to participate in the prospecting, feasibility study or bidding preparation at an earlier stage. Yet again, such efforts require a leading government agency to coordinate with a wide range of research institutions, international organisations, non-governmental organisations and other Chinese government agencies, including the newly established CIDCA.

Chinese policy banks and export credit agencies are 'on the ground' decision makers for the approval of most overseas energy activities, and field investigations indicate that the barriers to further supporting Chinese renewable energy projects are mainly institutional and discursive. The current project screening process is designed on the basis that all Chinese exporting sectors are to be supported equally, which, in reality, can disadvantage wind and solar projects. The relatively conservative risk appetite, both for IPP and project finance transactions and for African markets in particular, should be adjusted. The Chinese government has been encouraging SOEs to shift away from the EPC + finance model and test the water in project finance-based models, including Build, Operate and Transfer (BOT) or public-private partnership (PPP) activities, as alternative routes to elevate China's 'going out' strategy (MOFCOM 2019). Yet such a transition requires tremendous determination and capacity-building efforts from both SOEs and policy finance institutions. Renewable energy can be a very good piloting sector for encouraging project finance and equity investment because government auction and procurement has become the mainstream practice for wind and solar energy activities worldwide, including in Africa. Such a transition is particularly crucial for China in the post COVID-19 context, as it will be increasingly difficult to secure sovereign guarantees from many African governments that will be facing debt servicing difficulties due to the pandemic and its consequent economic shocks (Oxford Analytica 2020). In addition, efforts should also be made to enhance engagement with leading Chinese wind and solar energy companies to understand their specific demands and unique advantages.

The lack of a green agenda among these financial institutions is mainly driven by the conventional beliefs and wisdoms that have underpinned their operations in the past few decades. The risk perceptions concerning the urgency of phasing out fossil fuel projects, as well as the impacts of climate-related natural disasters in most SSA countries, such as severe droughts and floods on large dams, are often under-recognised by loan officers and risk underwriters. On the contrary, the risks of wind and solar projects in African countries are often overestimated. For example, our interviewees indicate that there are concerns that wind and solar are still more expensive energy sources and that an underdeveloped transmission infrastructure in Africa is not suitable for the clean energy transition, at least not currently. Although these concerns are reasonable, it may lead to an overcautious attitude that ignores the fact that wind and solar energy are reaching grid parity in many SSA countries and gradually improving grid connection quality in many places in SSA. In fact, most Chinese wind and solar parks in Africa are performing well above expectations compared to large hydro and coal-fired power stations. Therefore, a proper re-evaluation is necessary of the different energy transition pathways in the context of the fast-changing technological arena and market development.

Government policies and financial instruments can only play a supportive role if Chinese renewable energy enterprises have an interest in African markets. To enhance this interest requires not only the increased attractiveness of wind and solar projects over traditional energy activities, but also the attractiveness of African wind and solar markets over other markets, including the fast-growing Asian and Chinese markets. The risk appetite of Chinese versus Western companies is notably different towards the African market. Many Western renewable energy companies have relatively limited domestic markets and consequently adopt a more global strategy, having accumulated sufficient knowledge and experience of developing overseas projects. In contrast, most leading Chinese wind and solar energy companies have been operating mainly in the Chinese domestic market over the past decades. Their involvement with overseas markets is limited and until recently mainly focused on equipment exports. Consequently, they are much less experienced and competitive, particularly in overseas markets such as the SSA region, which requires sufficient local knowledge and project management expertise. Chinese companies hence require an additional push to 'going out', which is now lacking. Meanwhile, the top four SOE groups on overseas energy construction projects are less familiar with wind and solar projects, despite their rich experience in conventional energy infrastructure projects.

The recent trend is to establish a consortium among these private and state companies. Many SOE groups such as Power China and China Three Gorges Groups have also established dedicated departments and subsidiaries for renewable energy projects. It is clear that new alliances or interest groups are taking shape within the existing policy community that are more dedicated to promoting wind and solar energy activities, which may shape the landscape in the coming years. For example, the China New Energy Overseas Development Alliance was established in 2017 and includes over 30 private and state-owned enterprises. Another newly established institution is International New Energy Solution (INES) led by Power China and Sinosure, and including Goldwind, Huawei and several private solar PV companies. Whether these new alliances or groups could destabilise incumbent actors in the traditional energy sectors or enhance the competitiveness of Chinese companies to secure a larger share of renewable energy markets is yet to be tested.

5. CONCLUSION AND RECOMMENDATIONS

This report examined the factors that deter Chinese wind and solar energy activities in the SSA region through an illustrative case analysis of Ethiopia and South Africa (from the demand end) and an institutional analysis of China (from the supply end). We found institutional and ideational barriers among both Chinese and African regulators, financiers and enterprises. Several key findings emerged during the investigation.

Firstly, the Chinese policy community and institutional arrangements for overseas energy activities are not necessarily suitable for scaling up renewable energy activities, particularly wind and solar projects in Africa. Incoherent policy goals, an inflexible project screening process and a lack of business engagement all contribute to the underrepresentation of wind and solar energy projects in the current project portfolio.

Secondly, the lack of a green agenda among the key actors from both ends is deeply rooted in a scepticism about renewable energy activities, compared to the well-established conventional energy sector and its project development models. The risk perceptions of renewable energy remain high and market potentials are often believed to be limited in Africa, which is not true.

Thirdly, the political economy from both the supply and demand ends plays a significant role in shaping these institutions and ideologies. As illustrated in this paper, the roles of Eskom, EEP and large Chinese SOEs in traditional energy sectors have tremendous influence in pushing for or deterring the green agenda.

From the Chinese side, two overall strategies should be considered in responding to these challenges. One is to instigate changes based on the existing regulatory, financial and business model and framework. This includes urging current regulators to make more specific policy goals, pushing policy banks and export credit agencies to revise their project screening processes, working more closely with renewable energy companies and encouraging private and state companies to work jointly in exploring SSA markets.

The other is to promote innovative solutions outside the current model that predominantly favours large-scale and conventional projects. This could be done by integrating other marketbased financial instruments or multilateral funding streams rather than relying solely on traditional state-backed development finance mechanisms such as green bonds, and climate and carbon finance, which have all grown substantially in the past few years. Green finance can provide a convenient and efficient financing channel for developing the renewable sector. By achieving a positive externality, green finance can transform the environmental benefit to the low-cost capital. Many financial instruments support the growth of renewable energy, such as green loans, green bonds and green insurance. There is a growing interest in corporate procurement of renewable power and new business models for small-scale renewables such as the pay-as-you-go model. Green bonds are fixed-income securities which aim to distribute to sustainable assets. The green bond market can serve as an important bridge between capital providers, such as institutional investors, and sustainable assets for renewable energy projects

(IRENA 2020b). The African Development Bank allocated USD3.7 billion to 48 projects through its green bond initiative, including solar projects, across at least 18 African countries. These emerging instruments would be particularly useful in exploring distributed systems that have tremendous potential. In 2018 and 2019, sales of both off-grid and mini-grid renewable systems boomed on the African continent. Mini-grid renewable capacities jumped from 9.6MW to 273MW between 2014 and 2018 in Africa, with huge potential to grow given proper financial support. Insurance packages to hedge weather risks that weaken wind and solar energy production have also recently been introduced. Digital technologies like block chains can help enhance the billing system, preventing energy theft and increasing the profitability (and credit rating) of many African utility companies. However, few Chinese companies and institutions have so far engaged significantly with these emerging instruments and that might provide additional benefits to enhance their appetite for engaging with difficult markets such as SSA.

From the African side, the government should first exhibit strong ambition and determination for a clean energy transition. This would provide a signal for Chinese companies and financial institutions to consider alternative energy development pathways. The planning needs to take SSA countries' special technical and financial constraints into consideration and energy regulators should also provide more stable expectations and policy support to both the wind and solar energy generation and manufacturing capacity. In the context of the COVID-19 pandemic, the disruption of the supply chain for key equipment and components from China (IEA 2020) has urged many African governments to consider localising at least some production of crucial spare parts. However, attracting investment in manufacturing capacities requires promising long-term market prospects.

Since there is a changing pattern in the procurement of renewable energy capacity, African governments should also encourage Chinese partners to be more actively involved in various policy learning, sectoral planning and capacity-building efforts. This can be achieved by engaging directly with the newly established renewable energy alliances and interest groups mentioned in previous sections. Such multi-level communication between Chinese and African non-state sectors can help urge Chinese companies to shift away from the previous bilateral negotiation model that is reliant on formal, high-level diplomatic dialogue, and encourage them to participate in a more transparent and auction-based project development process. Multi-level communications also help reduce the biased risk perceptions of African wind and solar energy markets among many Chinese companies.

Participation of the private sector (whether Chinese, European or American companies) in Africa's renewable energy sector is limited compared to other developing regions. While progress has been made on the generation capacity additions, especially under the debt financing models in selected African countries, equity financing (with the exception of South Africa) is perceived by project financiers and developers as a high-risk endeavour. IPPs, though still insignificant at the moment, may be the future, especially as it concerns equity financing to renewable energy projects. However, persistent market challenges deter potential investors. Such challenges include, but are not limited to, a lack of and/or inconsistent implementation of policies governing the sector, which could be due to institutional inadequacies and inefficiencies. Furthermore, our interviewees highlight that most African countries have weak or immature financial sectors, which has implications for offtake risks and financial sustainability. This has been identified to be the case especially on projects delivered under the PPP modality.

To address some of the challenges, African governments must open up the generation, distribution and transmission sectors to private players using auction-based project delivery mechanisms.

The lack of capital to finance these projects and the lack of a conducive environment for private players are some of the challenges.

Well-prepared projects that are ready to be constructed are rare. Despite many African governments having done some wind and solar resources mapping studies to establish technical generation potential, very few projects are ready for development. Such inadequacies may be due to African governments' lack of technical expertise to work on the later stages of project development, from feasibility studies to bankability analysis of projects, and coming to arrangements where the risk between the private sector and African governments is fairly distributed. Overall, participation of the private sector in African countries' renewable energy sectors has much to do with concerns about their macroeconomic performance, as well as the political climate, particularly when a sovereign guarantee is absent.

Finally, and crucially for both Ethiopia and South Africa, as well as the continent at large, the market for renewables such as wind, solar and geothermal is there but the pace at which institutional reforms are unfolding derails full realisation of the potential of renewables to address electricity access challenges. As such, there must be clarity on policy and regulatory frameworks, transparency on tariff guidelines, as well as a de-monopolisation of state utilities in the generation, distribution and transmission subsectors.

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About the authors

Dr Frangton Chiyemura is a Lecturer in International Development at the School of Social Sciences and Global Studies at The Open University, UK. His research focuses on the role of China in Africa's development trajectories and is particularly interested in Chinese financing and development of 'critical infrastructure' (renewable energy, space infrastructure, telecommunications, transport and, recently, the Belt and Road Initiative) in African countries and how such projects contribute to inclusive growth and structural economic transformation.

Dr Wei Shen is a Research Fellow at the Institute of Development Studies (IDS). He has over 15 years' experience in practices and research on development finance and lowcarbon development. His current research focuses on the political economy of lowcarbon energy transition and climate change policies in emergent economies, global climate finance and climate governance, and South–South cooperation on climate change issues. He is one of the lead authors of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), focusing on climate policies and institutions in the global South.

Yushi Chen is a PhD student at the Science Policy Research Unit, University of Sussex, majoring in Science and Technology Policy Studies. He completed his master's degree at Imperial College London, majoring in Climate Change, Management and Finance. His research question revolves around the interaction between the energy and financial systems and it shape the development of blockchain to achieve a transition to a sustainable economy.

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