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**Research Report**

## China's promotion of overseas green projects: Old models and new dynamics

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# CHINA'S PROMOTION OF OVERSEAS GREEN PROJECTS

Old models and new dynamics

Yang Jiang

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# LIST OF ABBREVIATIONS

<b>AIIB</b>	Asian Infrastructure Investment Bank
<b>BRI</b>	Belt and Road Initiative
<b>CADFund</b>	China-Africa Investment Fund
<b>CDB</b>	China Development Bank
<b>China ExIm</b>	Export and Import Bank of China
<b>CIC</b>	China Investment Corporation
<b>DAC</b>	Development Assistance Committee
<b>DFI</b>	development finance institution
<b>EPC</b>	engineering, procurement, and construction
<b>FDI</b>	foreign direct investment
<b>FOCAC</b>	Forum on China-Africa Cooperation
<b>GW</b>	gigawatt
<b>IEA</b>	International Energy Agency
<b>IRENA</b>	International Renewable Energy Agency
<b>MOFCOM</b>	Ministry of Commerce
<b>MEE</b>	Ministry of Ecology and Environment
<b>MFA</b>	Ministry of Foreign Affairs
<b>MOU</b>	Memorandum of Understanding
<b>MW</b>	megawatt
<b>NDB</b>	New Development Bank
<b>NDRC</b>	National Development and Reform Commission
<b>PPA</b>	power purchase agreement
<b>PPP</b>	public-private partnership
<b>PV</b>	photovoltaic
<b>Sinosure</b>	China Export & Credit Insurance Corporation
<b>SOE</b>	state-owned enterprises

# SUMMARY

Over the past 15 years, green industries have developed rapidly in China, and with an increasingly saturated domestic market, Chinese companies have intensified their search for overseas markets. The Chinese government is supporting that pursuit under the Green Belt and Road Initiative. This report provides an overview of how China is promoting its green industries overseas; specifically, which models of co-operation are typically used in non-hydro renewable energy projects and what are the new dynamics compared with the traditional projects. The analysis is illustrated with examples of projects mainly in Africa, supplemented with examples in Southeast Asia.

This report finds that the old models of traditional BRI projects – offering packages of construction, materials and financing, investment, joint venture, and bundling infrastructure with natural resources extraction – are also used in green energy projects and still give China some advantage in competing with Western countries for developing country markets. However, the old models need to adapt to the new realities of economic slowdown in China, the new focus of the BRI on ‘small and beautiful’ projects, the international scramble for critical metals and minerals, as well as the cautious attitude in many developing countries regarding debt, the pace of green transition, or over-reliance on China.

There are also new mixes of capital, technology and labour in China’s overseas green expansion, brought about by new dynamics in the green industries. The market leadership of private companies rather than SOEs in technology and manufacturing in Chinese green industries, more extensive third-party market co-operation with developed countries, and strengthened value chain co-operation with developing countries are all potential game-changing dynamics in global green transition, which can both enhance China’s competitiveness and enlarge room for co-operation between Chinese and Western companies that challenge geopolitical divides.

For developing countries, increased competition between development partners in green transition can create room for negotiation over the terms of development co-operation, especially if developing countries wish for fair terms in creating local employment, growth of local businesses and technological advancement. Some developing countries would welcome less reliance on China, or any other single country, because of economic or geopolitical concerns. At the same time, third-party market co-operation between China and the West has the potential to overcome the political or economic obstacles to green transition in some developing countries and to propel sustainable development.






Kenyan President Uhuru Kenyatta attends the launching ceremony of the 50 MW solar power farm in Garissa, Kenya, 2019. Photo: Xie Han / Zuma / Ritzau Scanpix.

## INTRODUCTION

Over the past 15 years, green industries have developed rapidly in China, since the government adopted the Decision of the State Council on Accelerating the Cultivation and Development of Strategic Emerging Industries in 2010. The Decision defined new energy, new energy vehicles, and energy conservation and environmental protection as three of the seven 'strategic emerging industries'.<sup>1</sup> In particular, developing new energy is crucial for China to reduce pollution and carbon emission, reduce reliance on imported fossil fuels and related geostrategic risks, create jobs and GDP growth, and participate in international economic and technological competition.



With central and local government support, along with ample availability of public and private capital and the zest among investors that created fierce market competition, China has been able to rapidly advance in non-hydro renewable energy. In particular, photovoltaic (PV) panel manufacturing has flourished where land and energy prices are relatively cheap, and the raw materials like graphite are abundant. China has also managed to quickly catch up and even assume a leading position in some renewable technologies, both through learning from the more advanced countries and through domestic innovation.<sup>2</sup> This has resulted in the domestic solar, wind and biomass markets becoming quite saturated. Chinese manufacturers are facing problems of oversupply, reduced profits and even bankruptcies.<sup>3</sup> They search for overseas markets through export, construction work, and increasingly, investment in overseas projects.



**This report provides an overview of how China is promoting its green industries overseas; specifically, which models of co-operation are typically used in non-hydro renewable energy projects and what are the new dynamics compared with China's traditional overseas infrastructure projects.**

Now that China is dealing with a domestic economic slowdown, financial performance issues of some BRI projects, and weak debt repayment ability of many developing countries,<sup>4</sup> the new focus of BRI is 'small and beautiful' projects—relatively small investment, quick results and benefitting the people's livelihood. The Chinese government has vowed to let green become the base colour of the Silk Road.<sup>5</sup>

This report provides an overview of how China is promoting its green industries overseas; specifically, which models of co-operation are typically used in non-hydro renewable energy projects and what are the new dynamics compared with China's traditional overseas infrastructure projects. In particular, it will discuss the new dynamics brought about by the leadership of private companies in China's renewable sectors, third-party market co-operation and value chain co-operation. The analysis will be illustrated with examples of projects mainly from Africa, supplemented with examples from Southeast Asia.

The report will not focus on the export of Chinese renewable energy equipment like solar panels or wind turbines because that topic as well as China's domestic support for the two sectors are well studied.<sup>6</sup> Nor will this report discuss the details of China's

formal policy documents or frameworks for supporting China's international green co-operation. Instead, the focus will be on the practices. The information of the practices in this study has been gathered by a survey of the details of a number of renewable energy projects in China's major co-operation partner countries in Africa from English and Chinese media and reports as well as interviews with observers and journalists on this topic.

It can be briefly mentioned that a series of policy documents has been published by the Chinese government regarding the so-called 'Green Belt and Road' – referring to the Belt and Road Initiative (BRI) with a green focus. They include the Guiding Opinions on Promoting the Construction of a Green Belt and Road Initiative in April 2017,<sup>7</sup> and the Opinions on Promoting the Joint Construction of the 'Belt and Road' Green Development in March 2022, both jointly published by National Development and Reform Commission (NDRC), Ministry of Foreign Affairs (MFA), Ministry of Ecology and Environment (MEE) and Ministry of Commerce (MOFCOM).<sup>8</sup> China also facilitated the announcement of the Beijing Initiative on Green Development along the Belt and Road among over 30 participating countries and organisations at the Third Belt and Road Forum in 2023, as well as the Belt and Road Green Energy Cooperation Action Plan (2024-2029) among the ministers of energy from 34 member countries of the Belt and Road Energy Cooperation Partnership (BREP).

China has also initiated some mini-lateral and multilateral platforms for the Green Belt and Road. In 2017, a Green Belt and Road Investor Alliance was created among the Agricultural Bank of China, China-Britain Business Council, Green Investment Group, JP Morgan and Standard Chartered, with the City of London Corporation serving as the secretariat for the alliance. In 2019, the MEE and domestic and international partners (environment ministries from other countries, companies and organisations) jointly launched the BRI International Green Development Coalition, mainly for exchanging information and coordinating policy. As for international financing platforms, China-sponsored multilateral financial institutions like the New Development Bank (NDB) of the BRICS, Asian Infrastructure Investment Bank (AIIB) and the Silk Road Fund of the BRI all have a prominent green profile. The bilateral investment co-operation funds between China and Africa, ASEAN, Latin America and Central and Eastern Europe have increasingly turned to green energy projects.





Kenyan President Uhuru Kenyatta attends the launching ceremony of the 50 MW solar power farm in Garissa, Kenya, 2019. Photo: Imago / Alamy Stock Photo.

## CHINA-AFRICA RENEWABLE ENERGY CO-OPERATION

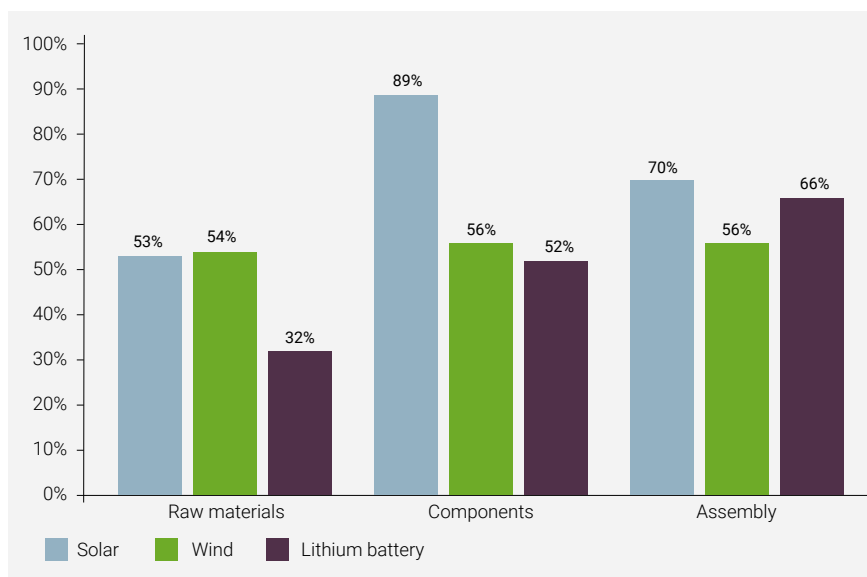
### Mutual needs and familiar paths

The main objective of China's promotion of green industry trade and investment in Africa and other continents is to find new market opportunities for Chinese renewable energy equipment producers and construction firms. It also aligns well with China's foreign policy of contributing to global sustainable development and green transition, strengthening South-South co-operation, and building the image of a responsible great power. Some energy projects also directly support other Chinese business activities like mining and manufacturing.

Africa is the focus of this report among China's target regions for promoting overseas green projects because the continent has a special place in Chinese foreign policy, and Denmark has recently made a new Africa Strategy for strengthening Danish engagement with African countries.<sup>9</sup> Africa has a large demand of energy. According to the Climate Policy Initiative, Africa needs £1.5 trillion of new power infrastructure by 2030.<sup>10</sup> It is also a continent with huge potential for developing renewable energy. The estimated renewable energy potential in Africa is over 470 gigawatts, but only a small fraction of that has been realised.<sup>11</sup>

China is poised to harness that potential because it is highly advanced in green industries and has assumed a leading position in several global supply chains of renewable energy. According to the International Renewable Energy Agency (IRENA) in 2021, China provides over half of the raw materials in solar and wind industries and 32% in lithium batteries, and its shares in components and assembly are even higher (See Figure 1).


**Figure 1. China's global share in renewable energy supply chains**



Source: IRENA (2021).<sup>12</sup>

China's dominance is especially clear in the solar panel industry. According to the International Energy Agency (IEA), China's share in all the manufacturing stages of solar panels (PV) exceeds 80%. Its supply of solar panels and components is more than double China's share of global PV demand. China is also home to the world's ten top suppliers of solar PV manufacturing equipment.<sup>13</sup>

In practice, China is a leading international player in the African market created by green transition on the continent. Dennis Munene, Executive Director of China-Africa Center at the Africa Policy Institute in Ghana, wrote in the Chinese state-affiliated newspaper Global Times: 'China, unlike other traditional partners, is on the right path to helping Africa realise the continent's potential to generate at least 300 GW of clean energy by 2030'.<sup>14</sup>



**The burgeoning green co-operation between China and Africa is built on the familiar paths of their traditional energy and infrastructure co-operation, which needs to become greener and more sustainable.**

From 2000 to 2021, China financed over USD 13 billion and developed over 10 gigawatts (GW) of clean energy capacity (including hydropower) across Africa. From 2010 to 2020, Chinese investments in renewable energy in Africa grew at an average rate of 26% every year, with solar, hydropower and wind being the top three sources of energy.<sup>15</sup> Around one-third of new grid-connected renewable capacity in sub-Saharan Africa is financed and developed by China.<sup>16</sup>

The burgeoning green co-operation between China and Africa is built on the familiar paths of their traditional energy and infrastructure co-operation, which needs to become greener and more sustainable. Over the past two decades, China has assumed a leading position in energy financing in Africa. According to China's Global Energy Finance (CGEF) Database, managed by the Boston University Global Development Policy Center, from 2000-2023, China's development finance institutions (DFI) – the China Development Bank (CDB) and the Export and Import Bank of China (China ExIm) – provided a total of USD 62.72 billion in loans to energy projects in Africa. Most of them are in fossil fuels, with 50% in oil and gas and 10% in coal; hydropower was 18% and other renewable sources was only 1% in terms of the value of loans.<sup>17</sup> If we count the number of power plant units, Chinese foreign direct investment (FDI) and the loans from those two DFIs have financed 56 power plants with an overall 173 units in Africa, providing 25 GW in power generation capacity. Most Chinese-financed power plant units in Africa are hydropower (60%), gas (17%) and coal (9%); solar and wind units account for a combined 8%.<sup>18</sup>

**Figure 2. Green BRI bonds issued by Chinese commercial banks since 2017**

Issuer	Name of bond	A m o u n t (USD equivalent)	Date issued
Bank of China	Sustainable Development Bond for Building the Belt and Road Together	USD 40 million	June 2024
ICBC	Multi-currency Belt-and-Road-Themed International Green Bond	USD 2.03 billion	October 2023
Bank of China	Green Bond for Building the Belt and Road Together	USD 770 million	September 2023
ICBC	Cooperation Bond for Green Belt-and-Road Interbank Normalisation	USD 2.2 billion	April 2019
ICBC	Green Climate Bond for the Belt and Road	USD 2.15 billion	October 2017

Source: Dialogue Earth.<sup>19</sup>

Apart from green financing from the two Chinese DFIs, Chinese commercial banks have, since 2017, issued a number of green bonds, or sustainable development bonds, to finance both green and social projects (Figure 2).

The COVID-19 pandemic disrupted China's Belt and Road Initiative (BRI), and there was no energy lending to Africa between 2021-2022. In 2023, China ExIm committed loans totalling USD 502 million to three renewable energy (solar and hydropower) projects in Madagascar, Burkina Faso and Uganda.<sup>20</sup> Although those are modest in scale, they represent a revival of Chinese financed development co-operation in Africa and a green turn. At the Forum on China-Africa Cooperation (FOCAC) in September 2024, China committed to implementing 30 clean energy and green development projects in Africa over the next three years and to setting up a Special Fund for China-Africa Green Industrial Chain.<sup>21</sup>

The next two sections will describe in more detail the models of co-operation in China's overseas green energy projects, starting with the traditional models and followed by an analysis of the new dynamics.





Solar power farm in Garissa, Kenya. Designed and built by the EPC contractor China Jiangxi Corporation for International Economic and Technical Co-operation CJIC, in conjunction with Kenya's Rural Energy Authority REA. Photo: Imago / Alamy Stock Photo.

## TRADITIONAL MODELS WITH GREEN ADAPTATIONS


The models of development co-operation that China has used for its traditional infrastructure and energy projects include a package of construction and financing, investment, joint venture, and bundling energy infrastructure with natural resources extraction. Such models can be found in Chinese overseas green projects too, with adaptations to the characteristics of the green industries and host country needs.

### **EPC + Financing**

The most common model of infrastructure co-operation that China has used in developing countries is to offer a whole package of financing, construction, and supplies, or EPC + Financing (EPC stands for engineering, procurement and



construction – a type of turnkey project). The financing is usually loans (more commercial than concessional), which would be used to pay for the construction of the project by a Chinese company and procurement of materials and equipment from Chinese suppliers. China has the advantage of gathering these whole packages from state banks and state-owned enterprises. For Western countries, it is often difficult to offer a whole package because private financial institutions and companies would often be more risk averse and have a shorter time horizon for expected returns than the Chinese and may not have many complete value chains within one country.<sup>22</sup> Moreover, for members of the Development Assistance Committee (DAC) of OECD, if the financing comes from their foreign aid budget, it should not be tied to the purchase of the products or services of the donor countries. Even for Japan, which since the government of former Prime Minister Shinzo Abe has promoted a more flexible use of development finance to promote Japanese commercial interests, Japanese companies have tended to be cautious about the risks in big infrastructure projects.<sup>23</sup>



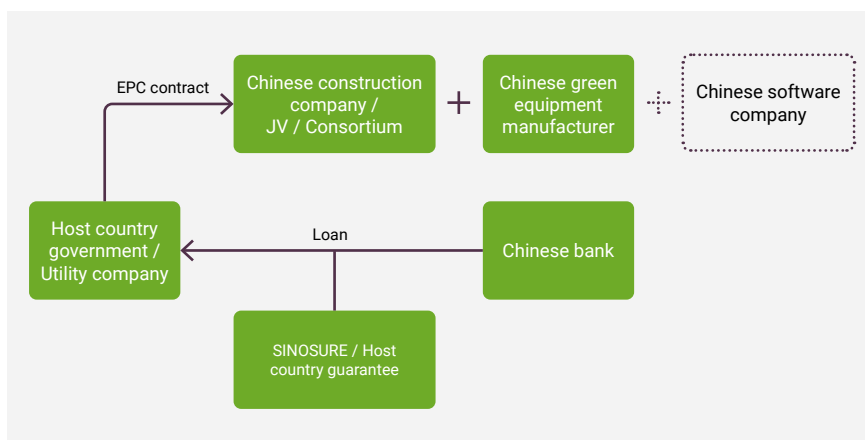
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Another advantage China can bring to its EPC + Financing model is a guarantee by the state-owned China Export & Credit Insurance Corporation (Sinosure).<sup>24</sup> It provides insurance to protect Chinese exporters against non-payment from overseas buyers, thus allowing Chinese companies to have a higher risk tolerance. Not many other countries have this instrument.<sup>25</sup> China often asks the host country to provide guarantees too, but Sinosure provides a powerful alternative.

As mentioned in the Introduction, the focus of the BRI is turning to ‘small and beautiful’ projects, and it is already reflected in the size of financing for projects. The average amount of China’s energy loans in 2023 was USD 167 million, much lower than the USD 574 million average committed from 2000-2022<sup>26</sup> Because renewable energy can be smaller-scale and off-the-grid projects, it allows Chinese projects to reach rural areas that are not connected to national grids.<sup>27</sup>

In the Chinese green industries, many green equipment manufacturers like wind turbine or solar panel producers are private enterprises, which do not have the capacity for construction of large-scale infrastructure. They can manage installations

**Figure 3. A typical model of China's green development co-operation**




Source: Author's formulation.

of smaller systems, but they often need to team up with Chinese state-owned enterprises (SOEs) with construction capacity to win contracts of bigger projects. Furthermore, software companies like Huawei have become actively involved in renewable energy projects because advanced technology is needed for energy storage and fluctuation (see Figure 3).

An example of the EPC + Financing model in practice is the 55-megawatt (MW) Garissa solar plant in Kenya, currently the biggest grid-connected solar plant in East and Central Africa. Kenya is an important target country for China's diplomacy and green co-operation in Africa because it is a key country in the Horn of Africa, hosts the headquarters of UNEP (the United Nations Environment Programme) and has a relatively good business environment.<sup>28</sup> Like many other developing countries, Kenya has heavily relied on hydropower but is increasingly faced with problems of drought. Endowed with abundant sunshine, Kenya planned to use the solar plant to supply electricity to 350,000 people and create employment opportunities in the area.<sup>29</sup> The Rural Electrification Authority (REA, a government agency) of Kenya awarded the project to the Chinese state-owned Jiangxi Corporation for International Economic and Technical Cooperation (CJIC, the EPC contractor) and Jinko Solar (a private Chinese company and one of the world's largest solar module manufacturers). The Kenyan government requested concessional loans from China ExIm, which succeeded in an RMB 867.2 million government concessional loan. The project was contracted in 2015 and completed with an official launch by the Kenyan president, Uhuru Kenyatta, in December 2019. Of the power produced by the plant, Garissa

town consumes about 5 MW, and the rest is connected to the national grid.<sup>30</sup> According to Uhuru Kenyatta, it serves the country's strategy to harvest 400 MW of electricity from solar sources and reducing development gaps between regions.<sup>31</sup>

Western countries have used and now increasingly use official aid for promoting national commercial interests, but the way Chinese companies secure business deals and financing is often distinctive from DAC members. For example, in the Olkaria IV geothermal project in Kenya, the Chinese state-owned Great Wall Drilling Company (a subsidiary of China National Petroleum Company, or CNPC) approached the Kenyan government and offered to sign a Memorandum of Understanding (MOU) with an implementing agency – the national utility company or a ministry – to supply the materials and carry out the drilling of geothermal wells in Olkaria. When it had secured such an MOU on 80 wells in 2011, it lobbied the Kenyan government to apply to China ExIm for a loan.<sup>32</sup> Given the close bilateral economic ties and the generally supportive policy at Chinese development finance institutions for Chinese SOEs to invest overseas at that time, in 2012 China ExIm offered Kenya a concessional loan of USD 367.7 million for drilling services and materials for 80 geothermal wells.<sup>33</sup>



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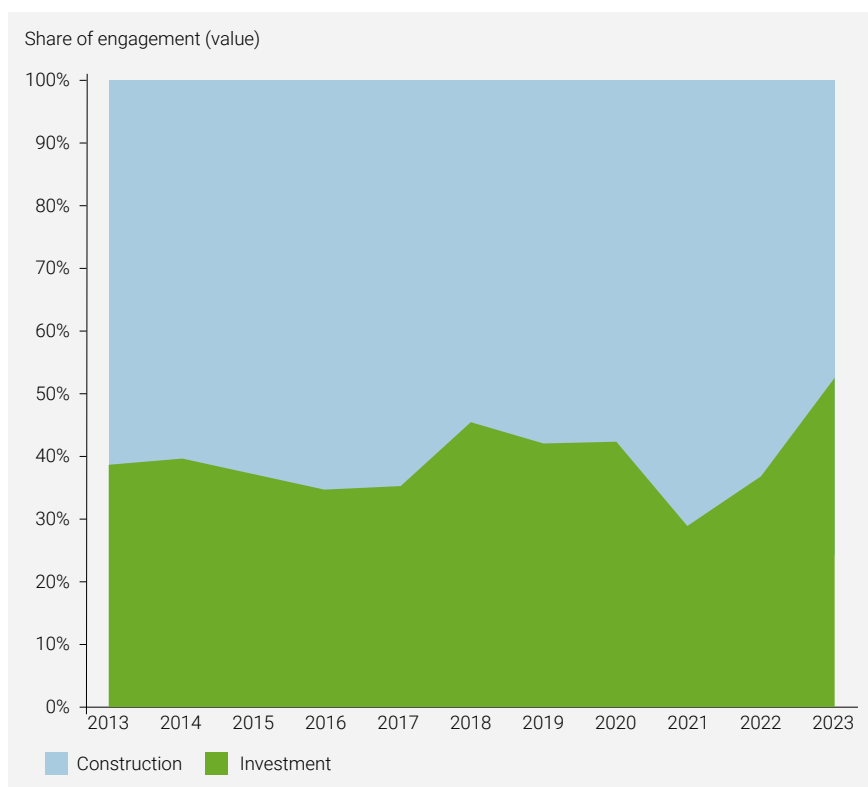
The risks with the EPC + Financing model have been financial performance, transparency and development impacts. For example, in the aforementioned Garissa solar plant in Kenya, some local farmers complained about not getting the promised benefits of jobs and electricity supply from the power plant after giving up their land. There was also reportedly an issue of grid-connected electricity being more expensive than the household fossil fuel and solar generators.<sup>34</sup> Moreover, turnkey projects can have the limitation of lack of training of local staff for operation and maintenance after the project is handed over from the Chinese contractor. As will be discussed later, capacity building has increasingly become a focus in Chinese green projects to respond to the demands from developing countries.

## Investment

The majority of China's engagement in the BRI used to be construction contracts financed by project contractors or loans from Chinese banks, with the model described above. A main reason was that Chinese companies used to prefer playing the role of a contractor or supplier backed by Chinese bank loans to the host country, compared to them directly investing in the project, to reduce financial risks on themselves. Investments exceeded construction contracts for the first time in 2023, reaching 52% (Figure 4).<sup>35</sup> According to the China Global Investment Tracker database of the American Enterprise Institute (AEI), new Chinese investment in Africa increased 114% in 2023 and reached nearly USD 11 billion, the highest level since 2005.<sup>36</sup>


The increase in investment reflects pressure from developing countries for more investment to reduce debt issues. Moreover, Chinese financial institutions, especially CDB and China ExIm, have become more cautious about the financial risks that they

**Figure 4. Share of construction contract and investment in BRI 2013-2023**



Source: Green Finance & Development Center of Fudan University and Griffith Asia Institute.

are exposed to both at home and abroad. Since the high level of capital outflow in 2016 alerted the government, Chinese sovereign lending has been on the decline and reached its lowest level in two decades in 2023.<sup>37</sup> The government has also been encouraging Chinese companies to take more equity stakes and operate their overseas infrastructure projects so that they would take more financial responsibility in their own businesses.<sup>38</sup>



**The increase in investment reflects pressure from developing countries for more investment to reduce debt issues. Moreover, Chinese financial institutions, especially CDB and China ExIm, have become more cautious about the financial risks.**

Furthermore, because most of the leading companies in the Chinese green industries are private companies, as will be discussed later, and private companies in general have more difficulty in obtaining financing from state banks than SOEs do, their overseas expansion is financed more with investment and public-private partnerships (PPPs) than direct loans from Chinese banks. Some private companies have grown big enough to invest in projects and take responsibility of financing, implementation and operation. For example, the ICT company Huawei has not only invested in Africa's data centres and cybersecurity industries; it has also become active in renewable energy. Huawei has provided microgrid solutions to shopping malls, hotels, factories, bank branches, universities and rural villages in Africa, as it declares 'a coming era of low cost solar and storage'. Huawei has also helped build big projects with its smart energy management systems, including a 540 MW solar plant in Northern Cape in South Africa as supplier of inverters and transformers for stabilising the power supply, and a solar-hydro hybrid energy storage system (ESS) project in Ghana.<sup>39</sup>

China's economic growth and technological advancement in the past four decades have benefitted tremendously from foreign investments, and a similar mechanism could be expected in Africa if foreign investments create jobs, transfer knowledge and technology, improve infrastructure and stimulate markets. However, China's 'turn from loans to investments' is only starting to slowly take place, with many cash-strapped Chinese companies searching for new markets outside the saturated domestic market. There is a risk of price wars and overcapacity like in China. Moreover, as will be discussed later, some renewable energy investments are centred around traditional industries like mining.

## Joint venture

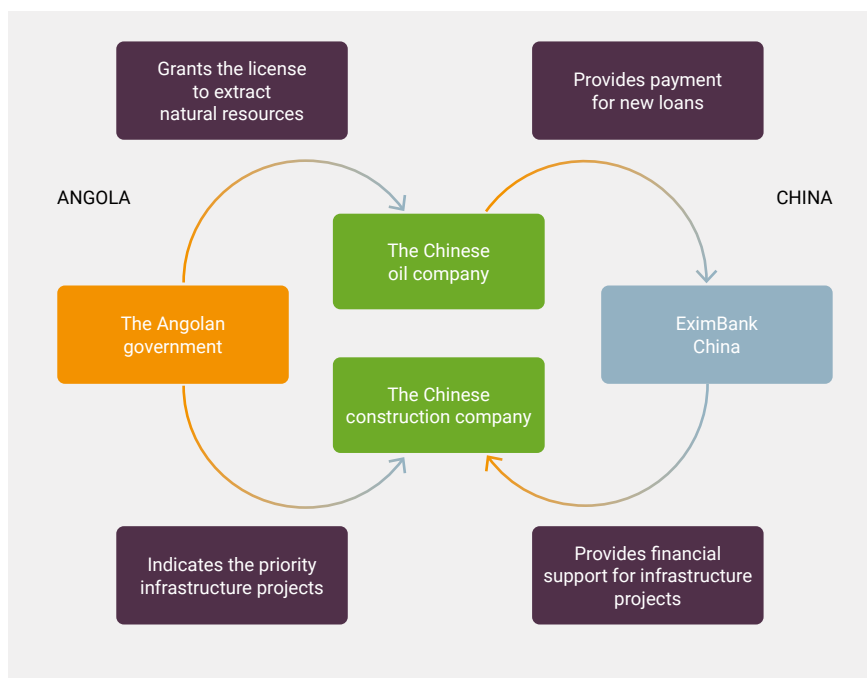
In countries where the energy market is not totally open to foreign competition or where the government demands technology transfer, establishing joint ventures with local companies help Chinese companies break into the renewable energy market and navigate the local context.

In Cambodia, when the national electricity supply was monopolised by one state utility company and not yet open to foreign renewable energy companies, Chinese Jinko created a joint venture called SchneiTec with local partners who have close ties with the Cambodian government.<sup>40</sup> Jinko and SchneiTec built some of the first few solar power plants in Cambodia, including a 100 MW solar farm in Kampong Speu and a 60 MW solar PV power station in Kampong Chhnang. As the government continues to control the pace and space of opening up to foreign participation in the country's green transition, bilateral good relations between the two governments and Chinese companies' good relations with local partners help them gain early entry into the market.

In Botswana, China Habor Engineering Company (SOE), China International Water & Electric Corporation (SOE) and New Energy Company Proprietary Limited, a Botswanan company, jointly established the company Sinotswana Green Energy, with China Habor having the controlling stake. Sinotswana obtained a power purchase agreement with Botswana Power Corporation in August 2024 to officially launch the country's first 100 MW solar PV power station project in Jwaneng, a diamond mining town.<sup>41</sup>

In South Africa, there are already 200 Chinese companies active either in joint ventures or operating independently in the renewable energy sector. Chinese official aid is also facilitating bilateral trade and investment. In June 2023, at the China-South Africa New Energy Investment and Cooperation Conference, China announced the donation of solar panels and generators to be installed at South African public institutions, which were suffering from power disruptions from occasional breakdowns of coal plants. China would provide materials, machinery and skilled workers, and China's State Grid company (SOE) would send a team of experts to South Africa to provide technical advice.<sup>42</sup> Around the same time, Pinggao, a subsidiary of State Grid, made agreements with five partners including South Africa's Neogos Energy Company to jointly develop a 50 MW solar power plant.<sup>43</sup>

**Figure 5. The Angola Model of resource-backed infrastructure**



Source: Begu et al. (2018).<sup>44</sup>

### **Packaging with natural resources**

Many traditional Chinese projects use the so-called Angola Model or resource-backed infrastructure including railways, highways, houses and hydroelectric projects (Figure 5). It enables the host country to export natural resources to a Chinese industrial company, and the income from that export is used to pay for an infrastructure project to be built by a Chinese construction company. A Chinese bank would often act as an intermediary between the transactions.

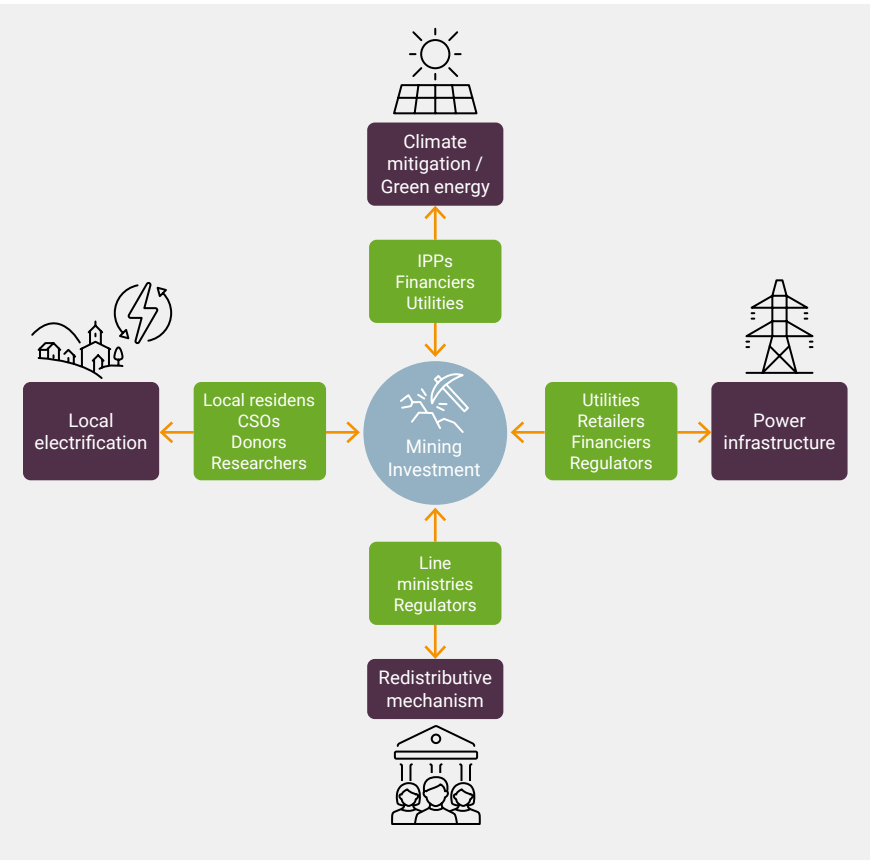
The non-hydro renewable energy sector has not seen much of this kind of direct project packaging, but it is likely to take place. China, like many other countries, is making moves to secure the supply of critical minerals and metals needed in green and high-tech industries.<sup>45</sup> The high level of investment from China to Africa in 2023 was heavily focused on metals and minerals used in green and high-tech industries, including a copper mine in Botswana and cobalt and lithium mines in countries like Namibia, Zambia and Zimbabwe. China has also pledged infrastructure investment in connection to mining, such as roads and hospitals, in exchange for a copper and cobalt joint venture agreement with Democratic Republic of Congo.<sup>46</sup>

There are now discussions in China on a Mineral-Electricity Nexus for Development (MEND) Model (矿电联合 kuang-dian lianhe), which is essentially designed to provide renewable energy to a mining facility and its surrounding communities (Figure 6).

An example is a Chinese lithium mining project in Zimbabwe, a country rich in mineral resources for green transition but suffering from shortages of power supply and infrastructure. China helped adopt power solutions for the lithium mine, with a sleeved PPA (power purchase agreement) in place and an additional solar PV plant in plan.<sup>47</sup>

Given China's pledge of more inclusive and sustainable development co-operation and its continued need of importing natural resources for fuelling domestic growth and transformation, it is likely that the usage of the MEND Model will spread in

**Figure 6. The Mineral-Electricity Nexus for Development (MEND) Model**



Source: Shen et al. (2024).<sup>48</sup>



Chinese activities in resource-rich countries, either endowed with traditional oil, gas and other minerals or critical minerals and metals used in the green and high-tech industries.

The flagship investment instrument of the China Development Bank, China-Africa Investment Fund (CADFund), in November 2024, started the first phase of a 100 MW TFC photovoltaic project in South Africa aimed at serving mining activities, jointly invested and developed with China General Nuclear Power International (SOE), China Steel Corporation (SOE) and South African investor KONA. It is the first green project invested and implemented by CADFund since the establishment of the China-Africa Green Industrial Chain Special Fund at the 2024 FOCAC meeting. The Chinese ambassador to South Africa called it a landmark project of co-operation between Chinese mining and power companies and financial institutions, and an important attempt to support the long-term development of mining projects.<sup>49</sup>

Another example is Huawei's agreement with the renewable energy firm GridAfrica signed in October 2024 to install 72 MW of solar power infrastructure to cater to the needs of mines across Zimbabwe, pledging sustainable and dependable energy to the mining sector in the country, reducing reliance on the national grid, and contributing to foreign currency savings by offsetting power imports.<sup>50</sup>

The MEND Model is a good step towards integrating mining and energy and making the energy supply greener, but it is centred around the mining activity. As a study on the aforementioned Zimbabwe lithium mine points out, the success of the MEND Model relies entirely on the cash flow generated out of the selling of preliminarily processed minerals. Moreover, its development impact depends on the support and collaboration of the host country government and civil society and the Chinese financiers. In that lithium-solar project in Zimbabwe, because the spill-over effect on local electrification is limited, the Chinese investor is carrying out additional CSR measures to address local energy poverty.<sup>51</sup>




## NEW DYNAMICS

After reviewing how China has adapted the old models of development co-operation to overseas green projects, this section will discuss some new dynamics that have emerged in China's overseas green expansion. They include the leadership of private companies in non-hydro renewable energy, more extended third-party market co-operation and value chain co-operation.

### **Market leadership of private companies**

While traditional infrastructure and energy industries in China, including oil, gas, nuclear and hydro as well as grid construction, are dominant by SOEs, non-hydro renewable energy sectors are led by private companies in technology and

manufacturing. The private companies are typically smaller in size, and many have achieved cutting-edge innovation in some parts of the value chain, but not many have the capacity for constructing or managing big projects. They are therefore often reluctant to undertake construction contracts or Independent Power Producer (IPP)<sup>52</sup> development in overseas markets. A 2021 study pointed out that the competitiveness of Chinese wind turbine producers in overseas markets was often overestimated, and that they were faced with late-comer barriers such as lower brand and technology recognition, and weaker connections with local distributors and partners. The leading Chinese wind turbine manufacturers, such as Goldwind and Mingyang, had mainly pursued the domestic market because there was still growth potential. In contrast, solar panel producers were competitive in both quality and price, and they pursued both domestic and overseas markets.<sup>53</sup> It remains to be studied whether the higher competitiveness of the Chinese solar sector in the international market than the Chinese wind turbine sector is related to a higher dominance of private companies in the former. Among the top Chinese wind turbine producers, Goldwind, Windey and Dongfang are state-owned or state-controlled, while Mingyang and SANY are private companies.<sup>54</sup> Of the top 10 top solar module suppliers in 2023 (Q1-Q3), only CanadianSolar and Astronergy are non-Chinese companies; the rest are private Chinese companies.<sup>55</sup>



**Now that the Chinese government is driving a strong initiative of promoting green co-operation, public-private partnerships (PPPs) increasingly appear in renewable energy contracts.**

Importantly, private Chinese companies do not have such a close relationship with the government or banks as SOEs do. It has not been easy for Chinese private companies to obtain financing from state banks.<sup>56</sup> That partly mirrors the domestic policy priority, where the public sectors should be the mainstay of the economy, and partly reflects the bond between Chinese banks and SOEs in traditional sectors in overseas markets. Through interviews, the above-mentioned 2021 study found that many Chinese finance institutions believed wind and solar energy were unstable and could only play a peripheral role in modern energy systems. Regarding energy transition in Africa, they thought that a widescale low-carbon energy transition was premature in sub-Saharan Africa. The limited experience of some private companies in overseas markets, as well as their lack of collateral assets for preferential supplier credit loans have also been setbacks in them getting financing from state banks.<sup>57</sup>

The relative distance between Chinese private companies and the Chinese government and state banks means that Chinese renewable energy companies have grown more organically in overseas markets via export or as suppliers to internationally funded projects because Western donors have been in general reluctant to collaborate with Chinese SOEs but are more open to work with Chinese private companies.<sup>58</sup> Chinese companies often also partner with local businesses to navigate regulatory landscapes and enhance project implementation (author's correspondence with Fikayo Akeredolu at Oxford University in November 2024).

The bigger private renewable equipment manufacturers have also started to extend their activities to investment and construction backed by international financing. For example, a 74 MW solar project in Battambang, Cambodia was invested and developed by a private Chinese company Risen Energy, which in 2020 obtained a USD 45 million loan from the German development finance institution DEG and the Interact Climate Change Facility SA (ICCF), a company owned by the French development agency AFD, together with the European Investment Bank and eleven European Development Finance Institutions.<sup>59</sup> The project was completed and commissioned in March 2021, and it was acquired by French Total Eren in November 2021. Risen Energy has also obtained financing from the European Bank for Reconstruction and Development (EBRD) for a 50 MW solar farm and another 40 MW PV project in Kazakhstan. By doing so, according to Risen Energy, the company tries to enhance its ability in building large-scale solar farms and pursue the model of 'self-invested, built and operated' independent power stations.<sup>60</sup>

Now that the Chinese government is driving a strong initiative of promoting green co-operation, Chinese SOEs have a palpable interest in the renewable energy businesses. Collaboration between Chinese private and state-owned companies, in what China calls public-private partnerships (PPPs), increasingly appear in renewable energy contracts, with or without Chinese financing. Such PPPs combines private equipment manufacturers' technology with SOEs' construction experience and networks. In 2020, Gezhouba International Company (SOE) secured an EPC contract of a 500 MW solar park in Uganda for a total of USD 500 million, and Power China (SOE) signed a contract with ZESCO (Zambian SOE) to develop three 200 MW solar plants in Zambia; both EPC contracts use private Chinese suppliers. In Cambodia, the 39 MW Banteay Meanchey Solar Project, commissioned in January 2021, was developed and owned by a Thai company, Ray Power Supply, and contracted to China Energy Engineering Shanxi (provincial SOE) for EPC with Chinese private company JA Solar as the supplier of PV modules.

In some countries, Chinese SOEs enjoy the advantage of having a track record of building traditional infrastructure and good relations with the government and elites. To Zimbabwe, which has long been sanctioned by the West, China has been an important economic partner. There, Sinohydro (SOE) won a contract to build a 25 MW solar farm, Centragrid. According to the founder of Centragrid, Victor Utedzi: 'We've known them close to maybe about 20 years and their work is evident from government projects like the Kariba Dam hydropower project, which was commissioned in 2018, and the 920 MW Hwange coal power station'.<sup>61</sup> In 2024, Sinohydro also started building a 100 MW solar power plant in the village of Tiakadougou Dialakoro in Mali.<sup>62</sup>


It remains to be seen whether private companies in green industries will receive more direct support from the Chinese government and banks as they expand further and make more technological advancement. It is a likely scenario, as the Chinese government has turned its focus in the BRI to the 'small and beautiful' projects, which are best served by private companies. China also pledged USD 50.7 billion in credit line and investments to Africa over three years for infrastructure and green energy projects at the 2024 FOCAC. Another scenario can be more competition from Chinese SOEs if SOEs start to build capacity in green equipment manufacturing, acquire or invest in private companies, although judging from domestic experiences, private companies would be wary of losing strategic assets or control over their companies to SOEs.

### **Third-party market co-operation**

While not many Western countries (and none in G7 after Italy's withdrawal) are China's formal BRI partners, China has signed third-party market co-operation agreements with 14 countries: Australia, Austria, France, the Netherlands, Belgium, Spain, Italy, Portugal, Switzerland, the UK, Japan, Singapore, South Korea and Canada. Under such agreements, China and another country would jointly facilitate co-operation between their companies in the markets of third countries. Third-party market co-operation between Chinese and other companies takes place much more often in green projects than traditional infrastructure projects. For China, third-party market co-operation not only helps Chinese companies obtain more contracting projects, learn technology and expand exports such as wind turbines and solar panels, but also helps companies diversify their financing channels and reduce financing costs. At the same time, participating in such co-operation gives Chinese financial institutions the opportunity to connect with international capital, which helps them improve risk assessment and capital management.<sup>63</sup>

The co-operation has adopted a variety of modes including joint financing, joint investment, joint construction, Chinese EPC + foreign investment, strategic co-operation agreements, etc.

France is especially active in third-party market co-operation with China. It was the first country to make such a joint statement with China in 2015. In 2016, the two sides created the Sino-French Third-Party Investment Fund, jointly managed by the Chinese sovereign fund China Investment Corporation (CIC) and the French Public Investment Bank BPI. During Xi Jinping's visit to France in 2018, several framework agreements were signed between Chinese and French companies on third-party market co-operation. They include a co-operation agreement between BPI, CIC, Shanghai SUS Environment and Quadran International to direct the funds to solar, wind and waste-to-energy projects in third-party markets; a co-operation framework between the French company Fives and Chinese SOE China National Building Materials Group for energy savings in infrastructure projects in developing countries; and an MOU for a deal valued at EURO 6 billion with Schneider Electric for the modernisation of the factories of China's Power Construction Corporation (PCC) in China and abroad. And in February 2022, after a virtual meeting between Emmanuel Macron and Xi Jinping, the two countries signed the Fourth Round China-France Third-Party Market Cooperation Pilot Project List, which includes seven projects in infrastructure, environmental protection and new energy in Africa, Southeast Asia and Central and Eastern Europe with a total value of USD 1.7 billion.<sup>64</sup>



**Third-party market co-operation between Chinese and other companies takes place much more often in green projects than traditional infrastructure projects.**

In some cases, Western companies' third-party market co-operation with China seems to facilitate their businesses within China, or vice versa. European companies are involved in a number of Chinese infrastructure projects as subcontractors, providing niche technologies. French Alstom has contracts with Sinohydro to provide turbine generators to power plants built on the Nile River in Uganda and Nigeria. Each contract is worth approximately EURO 50 million. This was followed by an expansion of Alstom Hydro's activities in China's domestic market. A similar pattern is followed by German and American companies. Siemens is involved in BRI projects in third countries, such as in Pakistan and Indonesia, with reportedly a EURO 3 billion

turnover from BRI projects from 2017 to 2019.<sup>65</sup> General Electric signed an MOU with CMEC (SOE) on strategic co-operation in 2013, which has resulted in a number of power plants including new energy plants in China, the rest of Asia and Africa.<sup>66</sup>

As mentioned earlier, Chinese companies have been equipment suppliers to many internationally funded green projects. They are also involved as construction contractors for Western or internationally financed projects in third-party markets. In Kenya, the 310 MW Lake Turkana Wind Power (LTWP) project (launched 2019) was developed by LTWP Limited (invested by the Danish Climate Investment Fund managed by IFU, Vestas, Norfund, FinnFund, KP&P BV Africa, Aldwych International), with equipment supplied by Vestas, and constructed by Spanish Isolux (2014-17), NARI Group (Chinese SOE) and Power China Guizhou Engineering (SOE) for transmission line to the national grid (2017-18).

Joint construction by Chinese and foreign companies in third-party markets is also becoming more common. For example, the 2 GW Gilgel Gibe III hydropower project in Ethiopia was jointly undertaken by Dongfang Electric Corporation (SOE) and an Italian civil engineering company Webuild. A 950 MW thermal-solar project in Dubai was jointly invested by UAE, Saudi Arabia and China, and was built by Shanghai Electric (SOE) together with Spanish and American companies.


On the financing side, Chinese financial institutions have signed strategic co-operation agreements with Western companies or banks over third-party market co-operation. The Japan Bank for International Cooperation (JBIC) has signed MOUs with both China ExIm and CDB to enhance their co-operation in supporting collaborations between Chinese and Japanese companies in third-party markets, which resulted in jointly financed power projects in Asia and Oceania. Sinosure, Bank of China and Italy's ENEL Group signed a five-year tripartite framework agreement in 2016, under which Bank of China would provide ENEL a credit line of up to USD 1 billion guaranteed by Sinosure to promote ENEL's renewable energy projects around the world involving Chinese enterprises as contractors and/or suppliers. ENEL has otherwise been active in China since 2004 through a series of greenhouse-gas emission reduction projects and signed MOUs with Chinese SOEs Huaneng, State Grid, National Nuclear, ZTE and Bank of China.<sup>67</sup>

### **Value chain co-operation**

In the FOCAC Action Plan 2025-2027, announced in September 2024, a notable initiative from the Chinese side is industrial chain co-operation. Specifically, China pledges to support Africa in developing local value chains, manufacturing, deep

processing of critical minerals, building growth circles and industrial parks, and holding training sessions on industrialisation.<sup>68</sup> Value chain co-operation can be a game changer in both Africa's development as well as consolidating China's position in the continent.

As discussed earlier, China is encouraging the integration of critical minerals extraction and renewable energy projects. It is also responding to concerns in Africa that China mainly exports equipment and construction services rather than building local manufacturing capacity in the renewable energy sector.<sup>69</sup> In fact, some private Chinese companies are setting up factories in Africa to seek market opportunities, natural resources or access to European and American markets. For example, electric motorbike and e-tricycle company Tailing has manufacturing and assembling plants in Kenya and Rwanda. Horwin has formed a joint venture with start-up Spiro to produce e-bicycles and batteries in Africa. Chinese solar PV module producer Seraphim has set up factories in South Africa, which enables it to supply local content products to solar plants in the country, including the 115 MW Avondale Solar Plant built by French EDF Renewables.<sup>70</sup> Several Chinese lithium battery companies have plans to set up factories in Morocco to take advantage of the rich phosphate, cobalt and lithium reserves, the country's preferential policies, as well as its free trade agreements (FTA) with the EU and the US, considering the EU and the US may strengthen trade restrictions against Chinese green energy products.<sup>71</sup>



**Value chain co-operation can be a game changer in both Africa's development as well as consolidating China's position in the continent.**

A rarely discussed consequence of China's value chain co-operation is norm setting, according to Eric Olander, co-founder of the China-Global South Project.<sup>72</sup> Here, norms refer to hard industrial standards and soft Chinese development experiences. When industrial standards with all Chinese solutions are adopted in African systems, it can be exclusive and can lock in Chinese interests in the green value chains. Huawei's immersive expansion of its smart power stabilisation, operation, transmission and storage solutions is one example of such standard setting.<sup>73</sup>

Standard setting both for industrial standards and human security standards (environmental, social, health etc.), however, is not uniquely a Chinese pursuit. Japan and some other OECD DAC countries actively pursue standard setting. The practices



of other countries are beyond the scope of this study, but it is seldom that a foreign country can monopolise the standards in a host country. Some African countries are consciously diversifying partners and careful not to let Chinese companies monopolise their infrastructure or energy sector.<sup>74</sup>

China is also strengthening capacity building and training of local workers in Africa as part of value chain co-operation and cultural exchange. The official Chinese rhetoric goes: 'It is better to teach a man how to fish than to give him a fish'. In the media, Chinese companies highlight how many jobs, scholarships and training opportunities they have provided during the construction of a project. Some of the training provided by companies are sponsored by the foreign aid budget from the Ministry of Commerce (MOFCOM). For example, the China Hydropower Training Institute was set up in connection to the Lower Kafue Gorge Hydropower Station built by Sinohydro in Zambia with training courses sponsored by MOFCOM. The Chinese government is also providing opportunities for Zambian participants to take training courses in China every year.<sup>75</sup>

In 2016, China began a flagship capacity building initiative named after a famous Chinese craftsman, Luban, who lived 2500 years ago. The Luban Workshops offer vocational training, and China has established 17 around Africa and ten in Asia and Europe. In Cambodia, Indonesia and Egypt, the courses cover new energy vehicles, and some are in collaboration with Chinese companies, which offer internships and employment. The China-Southeast Asia Clean Energy Luban Workshop Egret Class sends Southeast Asian students to China to learn about electricity, wind turbines, photovoltaics, project construction, construction management and so on, and some of the education is under contract with a Chinese company so that the students can work in the company as clean energy engineers upon graduation. The Luban Workshop also recruits teachers in Africa to participate in further education in China, so that they can use China's knowledge and teaching methods to train locals when they return to Africa.<sup>76</sup>

Apart from training of skilled workers, Chinese government agencies, including the Ministry of Ecology and Environment (MEE), MOFCOM, National Energy Administration, and provinces that are experienced in renewable energy development, have been arranging short-term courses for developing country officials. The contents typically consist of China's development model, Chinese culture and China's experiences in climate governance and renewable energy development.<sup>77</sup> They not only facilitate the expansion of Chinese technology but also Chinese norms in development and green transition. How effective those courses are is a topic for further studies.



Ashegoda wind farm, Ethiopia. Photo: Jenny Vaughan / AFP / Ritzau Scanpix.

## CONCLUSION

China's promotion of green industries overseas is not just old wine in new bottles – it is not simplistically operating green projects in the same way as traditional infrastructure and energy projects. Traditional models of operation in the BRI, like packaging construction, products and financing, backing infrastructure with natural resources, and setting up joint ventures, need to be adapted to the new realities of economic slowdown in China, the new focus of the BRI on 'small and beautiful' projects, and the international competition in high-tech and green industries. China also needs to respond to the cautious attitude in many developing countries regarding debt, opening renewable energy to foreign competition, or losing control over energy price or the pace of green transition.

There are also new mixes of capital, technology and labour in China's overseas green expansion, brought about by new dynamics in the green industries. The leadership of private companies rather than SOEs in technology and manufacturing in Chinese green industries, more extensive third-party market co-operation, and China's more purposeful value chain co-operation are all potential game-changing dynamics in global green transition.

To Western countries, the catch-up and even overtaking of Chinese green technology can mean more market and geopolitical competition. China can use traditional diplomatic and economic relations with developing countries, norm and standard setting, price and quality competitiveness, and the appeal of the China's domestic experiences to its advantage in such competition. The packaging of construction, products and financing, insurance of loans from China, public-private partnerships, establishing joint ventures with leading companies of the host country, setting up local factories, and training of skilled workers all add to the competitiveness of Chinese companies in the emerging green economies of developing countries. Only an active promotion of Western green industries in collaboration with the development co-operation programmes can ensure market dynamism in the global green economy. Moreover, environmental and social standards of Western companies can contribute to setting sustainable norms in developing countries.



**Only an active promotion of Western green industries in collaboration with the development co-operation programmes can ensure market dynamism in the global green economy.**

For developing countries, increased competition between development partners in green transition can create room for negotiation over the terms of development co-operation. Developing countries can use diversification of partners to demand the terms in creating local employment, servicing local communities, growth of local businesses, technological advancement and ecological protection. Some developing countries would welcome less reliance on China or another single country because of debt issues, geopolitical risks with appearing to 'pick a side' in the great power rivalry, and domestic political concerns over foreign influence.

At the same time, there already exist a lot of collaboration among companies, non-state actors and development finance institutions that combines each other's comparative advantage and creates growth, jobs and green changes. Third-party

market co-operation between China and the West has the potential to overcome the political or economic obstacles to green transition in some developing countries, many of which are hesitant to lose control over the pace of green transition because of their traditional reliance on fossil fuels and the vested interests in traditional sectors, their priority of economic growth, the uncertainty over green technology, or wariness over the expansion of foreign players in their energy sector. The more independent and flexible nature of renewable energy can more easily reach rural populations and can challenge the monopoly of the state over energy supply and other related areas of economic activities. The competition and collaboration between China and the West in green industries will be affected by geopolitics and the policy priorities in their capitals, but dynamic market competition aided and regulated by government programmes and policies can push Chinese, Western and other development partners to adopt higher standards – technological, ecological and societal.

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