

Africa and the export of China's clean energy revolution

Abstract: The spectacular scale and speed of China's domestic renewable energy capacity development and technology catch-up has in recent years been followed by the 'go out' of Chinese clean energy technology firms seeking new markets and opportunities in sub-Saharan Africa. This paper explores the growing involvement of China in the development and transfer of renewable energy technologies in Africa and examines the key drivers and obstacles shaping Chinese renewable energy investments and exports. Far from there being some kind of grand or harmonious strategy directed by a single monolithic state we argue that fragmented and decentralised state apparatuses and quasi-market actors in China are increasingly pursuing their own independent interests and agendas around renewable energy in Africa in ways often marked by conflict, inconsistency and incoherence. Moving beyond the state-centric analysis common in much of the research on contemporary China-Africa relations we examine the motivations of a range of non-state and quasi-state actors as well their different perceptions and constructions of risk, policy environments and political stability in recipient countries. The paper explores the case study example of South Africa where Chinese firms have become increasingly significant in the diffusion of renewable energy technology.

Keywords: China, Africa, renewable energy, political economy

Introduction: China and the energy challenges facing Africa

Improving access to affordable, reliable, sustainable and modern energy services is widely regarded as an urgent and critical challenge that is key to unlocking Africa's development potential. Africa's economy and accompanying energy demand has almost doubled in size since the turn of the century and it is estimated that it will see further increases in energy demand of up to 80% by 2030 (IEA 2014). Within sub-Saharan Africa (SSA) energy demand grew by around 45% from 2000 to 2012, but accounts for only 4% of the world total, despite being home to 13% of the global population¹. Addressing the continent's growing energy needs is seen as vital not just to its economic growth and development but to the eradication of poverty. Access to modern energy services, though increasing, remains limited: despite many positive efforts, more than 620 million people in SSA remain without access to electricity and nearly 730 million rely on the traditional use of solid biomass for cooking². Bioenergy – mostly wood and charcoal - accounts for 60% of energy demand in Africa with many of those in rural areas still dependent on the use of traditional cookstoves that are often inefficient or create significant health problems as a result of indoor air pollution.

Renewable energy technologies in particular have emerged as essential to meeting Africa's energy needs, in part because of increasing international recognition of the nexus between energy access, climate change and environmental sustainability more broadly. The pursuit of sustainable energy access is now recognized as one of the sustainable development goals (SDGs) which in turn have built on previous international initiatives such as the UN-led SE4ALL (Sustainable Energy for All) global initiative which sought to universalize energy access,

increase the share of renewables in the energy mix and to improve energy efficiency, all by 2030. As the costs of low-carbon energy fall, Africa is widely seen by many donors to have an opportunity to 'leapfrog' into a new era of economic growth and expansion driven by clean power generation.

This paper seeks to analyze the increasingly significant role that China is playing in the diffusion of renewable energy technologies in Africa and focuses in particular on China's engagement with Africa's emerging wind and solar energy sectors. In recent years the growing importance of 'rising powers' like China in the African continent has attracted considerable attention and controversy. China's (re)emergence as an international development actor in Africa's energy sector has often been characterized as simply about the exploitative acquisition of natural resources such as coal, oil and gas³, or as a kind of neo-colonial resource 'grab' and plundering of Africa reminiscent of the darkest days of empire⁴. What such representations preclude, however, is recognition of the simultaneous and growing involvement of China in the development and transfer of renewable energy technologies in Africa and its potential significance in reconfiguring a range of energy systems within the continent⁵.

Facing a saturated domestic market and fierce competition in European and US markets, Chinese companies are now advancing into Africa with a full range of commercial activities along the production chain, including the export of wind turbines and solar panels, the development of new equipment manufacturing facilities, and the financing and construction of new renewable energy generation facilities such as wind or solar farms⁶. China's increasing

engagement in the promotion of renewable energy projects in Africa seems to have gone almost unnoticed but how significant is this engagement, what form does it take and how can it best be explained? While much has been written about large Chinese hydropower projects in Africa⁷, analysis of China's engagement with renewable energy technologies on the continent is scarce. More generally, work on Sino-African relations and energy cooperation has typically focused largely on extractive industries such as coal and gas understood in a narrow sense as synonymous with the activities of the (mercantilist) state but it is also necessary to look beyond the state, at the transnational activities of non-governmental actors like corporations and at the Chinese domestic dynamics that shape overseas (renewable) energy co-operation.

In the past decade the Chinese government has shown increased commitments to promote a low-energy intensive and low-carbon economy and the expansion of renewable energy is a central part of this strategy⁸. As China's renewable energy industries grow, Chinese green technology companies are starting to assert themselves in international markets and low carbon collaboration and assistance are increasingly becoming features of the country's foreign cooperation strategy⁹. At the fourth Forum on China-Africa Cooperation (FOCAC) in 2009 the Chinese Premier Wen Jiabao announced 100 clean energy projects across Africa including some small-scale projects focused on solar energy¹⁰. At the fifth FOCAC meeting in South Africa in December 2015 China pledged US\$60 billion for a variety of areas of China-Africa co-operation, including renewables and technology transfer. China's role as a promoter of renewable energy development in Africa can offer it valuable recognition as a contributor to global efforts towards the mitigation of climate change and can serve to reaffirm its position as

a lead nation among developing countries, protecting vulnerable countries from the impacts of global warming and fostering their economic growth and development in the process¹¹.

In this paper we aim to identify the major drivers leading to the advancement of Chinese companies into African wind and solar energy markets. Our intervention draws on multi-institutional and interdisciplinary research conducted over thirty months between 2012 and 2015 in which we sought to examine how, why and to what extent China is playing a role in enabling the transition to low carbon energy systems in Southern Africa¹². Our analysis is informed by a series of in-depth interviews¹³ undertaken in China and South Africa and by the creation of a database of low carbon energy projects in South Africa established to understand investment trends. The data was gathered using policy reports, press releases and web-based sources and then triangulated with findings from interviews and project site visits.

The paper is divided into four sections. In the first we set out our analytical approach for making sense of the roles of Chinese non-state actors in Africa's renewable energy expansion. In the second section we then examine the explosive growth of China's wind and solar energy industries and the development of the domestic markets around these renewable energy technologies, along with some of the growing challenges that Chinese firms now face as a result of intensifying global competition and the contraction of demand. In the third section we then explore the domestic institutional complex and policy environment within China which has encouraged and supported their growth, focusing in particular on the neglected role of quasi-state agencies such as the development or export-import banks and export credit

agencies. In the final section we discuss the key drivers and barriers shaping the 'go out' strategy of Chinese renewable energy companies in Africa and explore the specific example of South Africa where Chinese companies are now playing a growing role in renewable energy technology transfer and in the transition to a low-carbon development pathway.

China's non-state actors in Africa's renewable energy sector: an analytical approach

In contrast to previous studies regarding China's involvement in Africa that typically begin with or focus on the state, we begin our analysis by focusing on the key actors within China's domestic wind and solar industries since, as Breslin¹⁴ argues, political and economic dynamics at the local and national level are important in making sense of China's growing significance in the global South. In doing this we seek to understand the broader political economy of China's emerging engagements with African energy systems by looking at the range of actors, institutions, partnerships and policy-making processes involved. We seek to move beyond the simplistic notion that it is only state-led support from the Chinese central government that is behind the rapid expansion of Chinese investment, instead arguing that a very complex set of institutional dynamics can be observed within and beyond China that comprises quasi-state agencies (such as development banks and export credit agencies) and non-state actors (such as private companies).

Although China is an authoritarian state with a powerful central government and a complex configuration of public and private spheres¹⁵, we argue that it is problematic to treat quasi-state development agencies, SOEs and large private corporations as mere dependents of the state

or 'barnacles on the ship'¹⁶ that only respond to central government command. On the contrary, our research shows that these institutions have their own strategies and motivations for entering and engaging African markets. In addition, these actors' operations are increasingly embedded within globalized renewable energy production networks and value chains that exceed the control and authority of particular states¹⁷. A focus on global production networks and value chains is valuable here in that it helps to offset more macro-scale, geopolitical interpretations by taking an actor-centric approach to understanding the variegated, country and industry-specific development implications of south-south trade flows¹⁸.

Sinologists have long emphasised the rise of a 'fragmented authoritarianism'¹⁹, within an increasingly 'deconstructed' state²⁰ and it is important to recognise that the Chinese state has been reshaped and is now more fragmented and disaggregated as a result of decentralisation and internationalisation²¹. In this paper we seek to illustrate what this fragmentation and disaggregation means for the expansion of Chinese renewable energy enterprises in Africa by highlighting the range of different quasi-state actors involved and the roles they are playing in the 'go out' of Chinese firms.

Our argument is not that the Chinese government is no longer relevant – clearly the expansion of Chinese involvement in African's renewable energy development is, in many ways, complimentary to wider Chinese central government strategies for 'foreign cooperation' with the continent. This does not mean however that all renewable energy related activities carried out by Chinese companies are specifically led or guided by state departments. As Breslin²²

correctly points out, the overseas operations of many Chinese companies are predominantly driven by the pursuit of commercial objectives. In our analysis we seek to draw out how these non-state commercial actors view and understand the African markets they are seeking to enter along with the range of domestic 'push' factors motivating their go out and the range of 'pull' factors that are drawing Chinese actors toward opportunities in emerging renewable energy markets such as South Africa (see figure 1)..

China's wind and solar energy sectors at a crossroads

In the past decade, the Chinese central government has exhibited considerable ambition to decarbonize its economy and elevate its coal-dominant energy mix by enhancing the share of renewable energies at the energy supply side. In some quarters renewable energy has been seen as the driving force²³ for China's third industrial revolution (第三次工业革命), emphasizing its strategic value for China to shake off the negative geopolitical impact of fossil fuels imports and to achieve energy security. That said the spectacular recent build-up of renewable energy capacity in China is not primarily driven by climate change imperatives - the key concerns have been securing energy and building globally competitive industries or 'building energy security through manufacturing'²⁴. In the case of wind power, the total installed capacity in China reached over 145 GW by the end of 2015, up from just 2.6 GW in 2006²⁵, China installed nearly half of the 63 gigawatts of wind power added globally in 2015 and now accounts for about a third of the world's total installed wind power capacity²⁶. Since 2013 there has not been a single foreign manufacturer in the top ten list of wind turbine manufacturers in

China, indicating both a fast maturing domestic wind manufacturing industry and a highly protective domestic market environment.

The important role of the state in China's wind energy sector has been well documented in the existing literature²⁷. Some of this work has touched on the role the Chinese government has played in shaping international competition²⁸ or in speeding up the process of technology transfer²⁹. Supportive government policies have included tax redistribution to reward technology upgrade and the provision of cash subsidies for the delivery of large-scale (1MW+) turbines. Protectionism has also had a role to play as the key regulator, the National Development and Reform Commission (NDRC), insisted on a local content requirement (over 70%) for domestic wind farms between 2005 and 2010, which helped to cultivate some world leading turbine suppliers during this period, such as Goldwind, Sinovel and United Power. Successful firms have often grown out of existing industrial facilities such as previously large heavy-machinery manufacturers or state-owned power utility firms, which possess strong capabilities and expertise for manufacturing processes and the management of large-scale project investments.

After a decade of explosive growth, Chinese wind industries currently face a number of significant challenges however. In some ways the unprecedented 'wind rush' became an unbearable burden for the grid companies (who are required by law to take and pay for all the wind energy produced) and for the grid networks that have struggled to keep pace in terms of accommodating such large amounts of unstable wind energy resources into the grid system³⁰.

Consequently, some wind farms have been prevented from sending their power to the grid and the NDRC's Energy Bureau has had to halt the pace of further wind farm development until these connection problems are fully resolved. There is also declining local government interest in supporting wind farm investment, mainly because these projects have often failed to deliver the anticipated tax revenues and benefits to local economic and social development. Consequently, in recent years many local government officials have been keener to promote turbine manufacturing facilities in order to enhance local tax revenue and boost employment. The previous 'wind resources for power generation' model has thus been replaced by a new 'wind resources for turbine factories' model.

As new investment in wind farms has been slowing since 2010 and with more production facilities being added across the country, a significant surplus of manufacturing capability has emerged. Meanwhile, in order to deal with issues of over-capacity Chinese regulators have been restricting the space for further wind energy development. New policies from the NDRC have, since 2012, stipulated that no new project will be approved until the grid connection and accommodation problems are fully resolved in some areas³¹. It is in this context of a saturated domestic market and political constraints on domestic capacity development that Chinese firms have increasingly turned their attentions overseas. Before 2008, very few Chinese turbines had been installed in any country outside China and exports accounted for just 4.3% of Chinese turbine manufacturers' total sales volume (see figures 2 and 3). Between 2007 and 2013, the export destinations for Chinese wind turbine manufacturers increased from one to twenty-seven countries with Chinese wind turbine exports more than tripling between 2011 and

2013³². China's Goldwind exported some 361 MW worth of turbines in 2013 alone, more than all of the other Chinese manufacturers combined.

Lema et al³³ argue that the size and rapid growth of the Chinese market have a major influence on competitive parameters in the global wind power industry, changing industry dynamics and the international pecking order of lead firms. They distinguish between the following five categories of Chinese economic power: production power, coordination power, innovation power, market power, and financing power, arguing that the combination of Chinese market and manufacturing capability is beginning to change the face of this industry, not just in Asia but globally. Chinese wind turbine makers can, for example, draw on a modular supply chain, which provides considerable advantages in terms of cost and speed. Realising this potential requires a coordination power that Chinese firms have begun to demonstrate both in the domestic and external market. There is also a Chinese competitive advantage based on the ability to combine high speed and low costs complemented with financial options (e.g. Chinese firms providing supplier credits to their customers) that Western suppliers may find difficult to match. The headlines which emphasise competition or conflict between Western and Chinese companies often fail to capture the complexity of the current situation and whilst competition among lead firms is increasing, there are also prospects for a growth of inter-firm collaboration all along the value chain.

The wind energy industry consists of firms which are part of two distinct, though interconnected, value chains: (a) the manufacturing chain concerned with designing, producing

and assembling the equipment and (b) the deployment-services chain concerned with all aspects related to deployment and utilisation, including pre-project financing and post-project operation and maintenance. It is the turbine manufacturers and suppliers in the manufacturing chain who have so far driven increases in flows of trade and FDI. Dominant firms – from China and Europe in particular, but also from the US and India – compete head to head for market share. By comparison, firms in the deployment chain – such as utilities, wind park construction firms, operation and maintenance (O&M) providers and technical consultancy firms – are less globalised³⁴. Key parts (in terms of cost) are towers, blades, gearboxes and power converters, but a turbine is made up of more than 8,000 different components.

By comparison to the wind sector, the solar sector in China is a much more export-oriented industry since 95% of solar products produced in China were exported before 2012³⁵, exposing the industry to global economic downturns and shifting patterns of foreign demand. Most of the today's top solar PV manufacturers in China were established between 2003 and 2006, when a surge of purchasing orders from EU countries like Germany and Spain, who had announced ambitious feed-in tariff schemes, ignited a frenzied process of production capacity expansion. According to many of our interviewees, local business and government leaders at that time looked at the fast developing PV industry as a 'golden opportunity' for quick profits and rapid growth and as a result many local corporate leaders from other industries were persuaded by local government officers to shift to solar PV production. Consequently, the reckless expansion led to serious oversupply problems with PV panels and cells since around 2010 and the domestic deployment of solar power has lagged far behind the domestic expansion of the PV

production industry.

The situation became even worse after European countries started to cut subsidies to the solar power sector from 2010 with exports to Europe contracting by over 50% in 2013 alone³⁶. The rise of renewable energy protectionism³⁷ has also sparked off several anti-dumping and anti-subsidy investigations towards Chinese PV products from the US and EU. This sudden drop in sales in US and EU markets (see figure 4) was the 'last straw' leading to the collapse of many Chinese PV manufacturers and between 2012 and 2013, dozens of manufacturers announced bankruptcy, including Suntech, the once largest PV producer in the country. More companies simply shut down their operations and remained idle.

The dire market situation forced the Chinese government to rescue the industry by encouraging domestic deployment of solar energy³⁸, which led to a rocketing of investment in solar farms. China added 15 GW of solar PV capacity during 2015, a 40% increase on 2014, bringing the country's total solar PV capacity up to 43 GW³⁹. China has since become one of the largest solar power deployment markets in the world, yet even this massive investment in solar power generation will not fully accommodate or address the capacity surplus. The domestic market is only able to accommodate less than 50% of the current overall production capacity. It is in this context that many PV manufacturers have started to look at market opportunities outside the EU and US, turning their attentions instead toward emerging renewable energy markets including Africa. As a result, there was a massive jump in the value of Chinese solar panel exports to Africa between 2012 and 2013, from barely US\$1.46 million to over US\$566 million

(see figure 5), although this has gradually decreased since then.

Quasi-state agencies and the 'going out' of China's wind and solar companies

'we cannot treat the Chinese state as monolithic, or "China Inc.," in which everything works in harmony...the Chinese state's functionality is riddled with competing state agencies, problems of cross-department coordination, and [a] mismatch between central and local policies'⁴⁰.

The array of corporations and government bureaucracies involved in meeting China's policy objectives in Africa is far more complex than is typically assumed⁴¹. These agencies have their own strategies, motivations and practices that cannot simply be understood as a subset of national interests⁴² though they are broadly in line with state policies and political agendas. It is thus highly simplistic to view these quasi-state institutions as mere instruments or tools of the central government⁴³. It is also quite misleading to suggest that the Chinese government is singularly and centrally orchestrating overseas investment and export activities in the 'go out' to Africa.

The central government has withdrawn from directly controlling production and distribution, retreating instead to a 'regulatory state' model, setting broad macroeconomic policies for other public and private actors⁴⁴. Many agencies, regulatory bodies and subnational units have thus developed their own international policies and relationships, breaking the monopoly of foreign and defence ministries and consequently a variety of quasi-state actors are increasingly pursuing their own independent interests and agendas overseas, 'generating conflict-ridden, incoherent policy output, often mistakenly interpreted as "grand strategy"⁴⁵. Thus, state decentralisation has fostered 'paradiplomacy' by subnational agencies, turning them into

quasi-autonomous foreign policy actors⁴⁶.

What outsiders may perceive as an apparently powerful central government and unified system of governance is in fact 'a fragmented and chaotic structure over which the central government has little control'⁴⁷. Outcomes reflect not authoritative central decisions, but rather 'bargaining... horizontally between government ministries, agencies and state enterprises, as well as vertically, between different levels of government', which 'continues throughout implementation'⁴⁸. Further, the governance of renewable energy industries in China has been concentrated in the hands of a small number of bureaucrats, investors and manufacturing corporations who have formed an informal coalition that has the capabilities to negotiate, shape and even deter renewable energy policy development. Thus much of this horizontal and vertical bargaining process happens within or around this informal coalition.

Further, government officers' direct control over overseas commercial activities is actually decreasing. The Ministry of Commerce (MOFCOM), for example, does not have direct authority over any of the SOEs' operating in Africa and has conflicting internal interests, given its dual responsibilities to both support Chinese corporations going overseas and to regulate them. The combination of multiple oversight bureaucracies, competing companies, and their conflicting interests suggests that Chinese firms are likely to act in ways that are not always in complete synchrony with diplomatic objectives⁴⁹. The direct control that central government agencies had over the export sector is therefore much less tight compared to the pre-reform era as the bureaucratic hurdles for export and overseas investment have significantly diminished. As one

government officer from MOFCOM put it:

'Nowadays we cannot interfere too much with corporate investment decisions. If they [companies] insist on going somewhere we can't stop them...As government agencies we can only provide our suggestions and opinions'⁵⁰.

The relaxation of regulatory control from government ministries has created further space for autonomy for a complex of quasi-governmental development and financial agencies that have become *de facto* second-tier governance entities operating between the public and private spheres (see figure 6). These institutions, including export credit agencies, Eximbank, the China Development Bank and other financial institutions, provide crucial services that are needed to carry out overseas projects, particularly in emerging markets. The role sharing among these institutions is clear and specific. Eximbank is the key player in providing concessional loans and export finance to support Chinese companies' large scale exports of capital intensive goods or their EPC (Engineering, Procurement and Construction) contracts. The China Export and Credit Insurance Corporation (Sinosure) provides export credit insurance or guarantee services to project activities in highly risky and volatile markets. The China Development Bank and its subsidiary institution, the Sino-African Fund (SAF), provide both loans and equity investment for Chinese overseas investments. Lastly, other Chinese state banks can provide peripheral and additional finance in cases where the above mentioned institutions are not able to serve all the Chinese companies at a given time or in particular destination countries.

Without these agencies most overseas projects could not possibly be implemented on the ground. Their internal policies, decision making process and risk appetite can significantly

impact on the configuration and orientation of Chinese exports and investment, shaping what kind of projects emerge and where, even though they still have to follow broader directions and guidelines from their line ministries. Further, these organizations are actively searching for new market opportunities for Chinese enterprises because their institutional influence relies heavily on the expansion of their portfolios. The greater their perceived importance to the Chinese economy the more political influence they are likely to have:

'We can't just sit in the office waiting for enterprises to approach us. We have to be more proactive, otherwise the value of our organization will be put in question'⁵¹.

In seeking access to emerging African markets the need and demand for such support is particularly high due to the perception of risks and the shortage of funding available in host countries. Many of these institutions have been focusing on infrastructure, energy or other capital intensive markets in the global South for decades and consequently have accumulated sufficient experience and expertise regarding the wider political and market situation within host countries in Africa and the implementation of EPC contracts, equity investment or export finance. They also have access to better information channels from host countries and to local political and market elites and it is not uncommon for senior company representatives to join the diplomatic delegation in visiting different countries, giving them an invaluable insight into the investment priorities and interests of host governments and a 'heads up' on possible future projects. In recent years these institutions have also established branches, subsidiaries or informal working groups within host countries to further establish and develop their networks with local actors and to gather relevant information regarding potential deals.

Taking China's export of solar panels as an example, our fieldwork revealed that the CDB and Sinosure were the key players in identifying market opportunities in Europe after European countries had launched ambitious subsidy programs from 2006. In the next few years generous credit lines were offered by the CDB to major Chinese PV exporters which amounted to over RMB 34 billion (US\$5.25 billion) by 2011, including support for 650MW of overseas solar generation capacity⁵². Meanwhile, Sinosure also encouraged Chinese exporters to explore the European market by offering an attractive insurance premium package⁵³. Similarly, for wind energy projects the role of quasi-state institutions is also crucial with, for example, the Sino-African Fund introducing South Africa's Renewable Energy Independent Power Producers' Procurement Programme (RE IPPPP) to the companies they worked with and encouraging corporations like GCL-Poly and Powerway to venture into the South African wind market⁵⁴. South Africa's ongoing electricity crisis has created opportunities for the development of different energy technologies and the procurement models that facilitate them⁵⁵ and has led to an investment of some US\$14bn in the country's electricity infrastructure. Agencies like the SAF have thus played a key role in introducing such emerging markets in Africa (and the lucrative opportunities available there) to Chinese firms. Solar energy companies such as BYD, Jinko, Yingli, Trina, Chint, Suntech and Hanwha Solar have subsequently become active in South Africa along with wind energy firms like Longyuan, Sinoval and United Power.

It is worth remembering that there is no specific Chinese government policy focused on promoting the 'go out' of renewable energy companies and our research found little evidence to illustrate China's direct political intervention and support to the export and investment activities

of its renewable sectors in Africa. Even though their activities may be welcomed by central government agencies the support they provide to exporters and investors is not driven, directed or even motivated by a singular and coherent government strategy. Therefore, their willingness to promote renewable energy business opportunities is mainly about the advancement of their own institutional interests. Although there is no specific requirement from government to promote exports of renewable energy technologies or to invest in renewable industries, these institutions are actively exploring market opportunities and expanding their sectoral influence in this area. They can also have a significant impact on the risk perceptions held by Chinese enterprises seeking to invest in or export to Africa, boosting the confidence of exporters or investors by using their expertise and referencing previous successes in order to demonstrate that African markets are not as risky as new market entrants might imagine.

Chinese renewable investment in Africa: key drivers and barriers

Our research suggests that Chinese renewable energy companies, far from being centrally orchestrated and coordinated by an ambitious and monolithic state, were rather 'pushed' out by intense competition in domestic markets and by the need to deal with over-production, excess capacity and over-investment along with a number of severe economic and political challenges both domestically and globally. These companies first began to explore the African market so as to find new export destinations and upgrade their operations in order to survive the crisis and the serious oversupply problems at home and sharp demand contraction from overseas markets. Most of the companies we spoke to admitted that it was these internal and external pressures that forced them to shift their focus from mature markets in 'developed countries' to

emerging markets in Africa.

China's power generation market has been dominated by state-owned enterprises, particularly the so called big five utility giants, known as Guodian, Huadian, Huaneng, Datang and the China Power Investment Corporation (CPIC). These large corporations take the lion's share of both fossil fuels and renewable energy generation facilities in China⁵⁶ and had expanded their share of the solar market to over 60% by 2014 whilst the top 10 project investors in the wind energy sector are currently all SOEs. Although since 2010 the Chinese central government has been encouraging private investment in power generation, there has been little actual progress in lowering the entry barriers for non-state enterprises and private capital. Wind and solar energy development projects are highly capital intensive, needing large scale upfront investment which puts SOEs at an absolute advantage compared to private companies due to their close connection with Chinese policy makers and state banks.

In order to achieve better quality and cost control, most SOE developers are now venturing into the manufacturing realm and actively establishing their own solar panel and cell module production facilities. As these facilities are mainly focused on domestic markets or serving the power projects developed within the same parent group, they are essentially squeezing the market share of private manufacturers. Similarly, in the wind energy sector Guodian, one of the big five utility giants, has through its subsidiary wind turbine manufacturer United Power become the second largest turbine producer in China.

Manufacturers are often the most vulnerable actors along the production chain and thus many see an opportunity in overseas markets to become project developers rather than merely operating as exporters. The most active actors to explore African renewable markets are therefore those who have been hit hardest along the production chain by domestic and overseas market contraction, namely the manufacturers of solar panels and wind turbines, such as Jinko, Yingli, Goldwind and Sinovel. Typically, the majority of Chinese overseas investment in renewables involves developing or acquiring power generation facilities rather than manufacturing sites⁵⁷, indicating that these companies' have an ambition to achieve value chain upgrade in overseas markets rather than just expand exports, something that cannot be easily achieved at home.

The perception of Africa's macro-economic and political stability is another key factor that affects investment decisions. This is not unique to China - regulatory and political uncertainties are believed to be the greatest concerns of renewable energy investors in other emerging markets such as the Middle East and North Africa⁵⁸. Many African markets remain something of a mystery to the newly arrived Chinese renewable energy companies, who are often more familiar with low risk markets in Europe or North America than they are with the uncertainties associated with emerging markets (e.g. around currency depreciation or instances of political insurgency). Many interviewees noted that these risk concerns are one of the main reasons for their companies' hesitation in venturing into African countries for long-term investment. Such concerns can only partly be mitigated by the support of Chinese development agencies. In addition, most private companies are more risk averse than state owned enterprises which

partly explains why Chinese renewable energy investments are currently geographically concentrated in just a handful of countries (such as South Africa) perceived to have robust financial strength and political stability.

In addition to stimulating investment through policy, the sheer size of South Africa's renewable energy market and the continuing issuing of tenders through the Renewable Energy Independent Power Producer's Procurement Programme (RE IPPPP) have created a sense of market security⁵⁹. One Chinese wind investor told us that they are investing in South Africa mainly because they believe the political and economic risks in the country are negligible compared to other countries in Africa. Such was their confidence in the country they even rejected the export credit insurance support cover (a mechanism that aims to protect domestic exporters via payment guarantees or insurance) available from Chinese export credit agencies⁶⁰. We also found that Chinese companies look closely at the overall coherence of the policy in the long-run and seek to ensure that safety mechanisms are in place to prevent abrupt policy changes (given that projects are often so dependent on subsidies)⁶¹.

In what are perceived to be more 'mature' or established markets, Chinese solar exporters have often set up foreign subsidiaries mainly to acquire new technologies, to support the export of their products manufactured in China, or to invest in solar power plants in order to open up new markets for their products and equipment. In Africa however, very few of these investment types can be found although many companies we spoke to claim that they are now giving this serious consideration. Most Chinese renewable energy companies believe however that their

current priority in African markets is still the sale of equipment rather than direct investment, partly due to their limited experience on the continent and their caution and apprehension towards the risks associated with FDI in this unfamiliar market⁶². To date Chinese companies have been involved in South Africa's RE IPPPP largely either as suppliers or manufacturers⁶³ of technological components for PV. One exception is Jinko Solar which opened an R80 million (US\$ 7.4 million) solar PV factory in Cape Town in 2014, built to service the demand that has been created through RE-IPPPP and enabling Jinko to maintain the largest share of South Africa's solar market of approximately 30%. Jinko chose South Africa because the country has local content requirements that it could fulfill by having a factory there for manufacturing modules locally in order to meet local guidelines around black empowerment, thereby making the firm a more eligible supplier for RE-IPPPP solar projects. At present Jinko is purely a supplier in South Africa but it is considering entering future tenders as a developer and independent power producer.

Africa has excellent potential for wind and solar energy but to date both energy sources have played a limited role in the continent's power generation mix due to limited electricity infrastructures (particularly those required for transmission and distribution) and insufficient financial or technological support for implementing and maintaining large scale projects⁶⁴. As a result, many of the Chinese businesses we spoke to believe the overall market size for the development of renewable energy will remain relatively small at least in the near future. Sub-Saharan Africa is also perceived to be more challenging to Chinese investors because there is not yet a scaled 'pool' of potential projects in most countries, which can transform

theoretical renewable resources into actual capacities. The contrast in market scale is particularly dramatic compared to the huge market size at home - leading Chinese companies can often secure a gigawatts level market share in China annually but in Africa they have to compete fiercely with world class companies for megawatts level projects.

The fast reviving domestic market for solar power development has, to an extent, also diverted Chinese manufacturer's attention away from overseas markets. In 2015 the Chinese government announced ambitious plans to scale up the annual installment to 17.5 GW, demonstrating a strong determination to support the domestic solar power generation market. Consequently, many firms are hesitant in choosing between a fully-fledged overseas oriented strategy in Africa and a traditional inward looking one. Several interviewees explained their dilemma by using a Chinese proverb: 瘦死的骆驼比马大, or a starving camel (referring to the Chinese market) is still bigger than a strong horse (referring to the African market)⁶⁵.

Conclusions: disaggregating 'China' and 'Chinese investment' in Africa

Chinese wind and solar energy companies are becoming increasingly significant and influential in the transition towards renewable energy across sub-Saharan Africa and in the reconfiguration of the continent's energy systems. There are multiple drivers for this emerging trend including the need to address excess domestic capacity (particularly with solar energy) as well as the domination of domestic renewable power generation markets by SOEs which has pushed private companies to seek opportunities in overseas and emerging markets. In terms of

the key drivers behind the expansion of Chinese renewable energy enterprises our research found that the 'go out' of these firms to Africa offers them a valuable opportunity to transform from equipment producers to project owners/operators in overseas markets. The 'pull' of a favourable policy environment (e.g. RE-IPPPP in South Africa) and the strength of a recipient country's commitment to renewables is also important here as is the perception of risk and political stability in recipient countries and the opportunity to 'scale up' their activities. In addition, we have also argued that the changing conditions and dynamics within Chinese and international renewable energy markets are significant drivers here.

Far from there being some kind of sinister 'grand strategy' of phased expansion the state currently has a limited role in the promotion of China's renewable energy activities in Africa and this is possibly because the volume of deals is not yet sufficiently large enough to generate any significant impact on diplomatic relationships. Rather than this being about a state-led attempt to export China's clean energy revolution the decision to seek investment and export opportunities in emerging African markets has largely been driven by corporate strategies and competitive market logics rather than by political justifications and our research found that those companies who have been hit hardest in the domestic market are the ones that are now most actively exploring new business opportunities in Africa. Despite the lack of attention given to the role of quasi-state agencies such as the development banks or export credit agencies, our research illustrates that they are playing a decisive role in the expansion and diffusion of Chinese renewable energy technologies in Africa by identifying new market opportunities, in the analysis of 'risk' and in the provision of finance, in using their African 'expertise' to provide

information and guidance, and (perhaps most importantly) in boosting the confidence that Chinese renewable exporters and investors have in emerging African markets.

Given the scale and speed of China's own domestic renewable energy capacity development and technology catch-up, it is often suggested that the Chinese central government is steering the process through the initiation of a comprehensive set of supporting policies and mechanisms. What is usually overlooked however is firstly the fragmentation and disaggregation of the Chinese state that is the result of decentralisation and internationalisation and secondly the growing influence of key business actors. There is no singular or coherent state-led push for Chinese overseas renewable energy investment and the wide variety of state, non-state and quasi-state actors involved suggests that it is crucial to disaggregate what we mean by 'China' and 'Chinese investment' in this context and to capture emergent forms of 'paradiplomacy' amongst sub-national agencies and actors. There are a range of different firms and parts of the state engaging with different actors in Africa and pursuing a myriad of different energy developments which are not confined to renewables and which also include cooperation around nuclear energy and investments in high-carbon industries such as coal and gas. As a result, it is necessary to move beyond the simplistic but popular narrative of a monolithic and neo-colonial Chinese state plundering Africa's natural resources which fails to recognize the simultaneous and growing involvement of China in the development and transfer of renewable technologies in Africa and its potential long-term significance in opening up new pathways to low-carbon development.

In South Africa, Chinese firms have been involved in some of the country's largest wind farms, as suppliers or manufacturers of technological components for solar PV, as the Engineering Procurement & Construction (EPC) company or as subcontractors. Their presence has had some significant implications for the cost and nature of manufacturing and assembly in South Africa where, partly as a result of excess Chinese manufacturing capacity, the cost of solar PV technology has dropped significantly and consequently the price offered by solar PV developers in South Africa for which they will sell their generation has plummeted. Further, some solar PV manufacturing/assembly plants originally established in South Africa with a view to supplying projects approved under RE IPPPP, have since had to resort to the assembly of components on behalf of Chinese suppliers which are then sent on to projects in Europe. This 'toll manufacturing' enables Chinese manufacturers to evade recent EU/US anti-dumping legislation by sending the component parts (cells, frames, glass etc.) to South Africa for assembly prior to being offered by Chinese firms for sale to European markets. More might be done therefore on a bilateral basis to formalise the transfer of skills and technical knowledge between South African and Chinese actors in the renewable energy sector.

Attributing involvement or project ownership in renewable energy to China can often be problematic given the 'complex, transient and at times opaque nature of global trade and production networks and transnational and multi-national flows of investment and finance'⁶⁶. This complexity is often missed by accounts which emphasise competition or conflict between Western and Chinese companies. Chinese companies are themselves 'bound up in international networks of project developers, construction companies, technology providers and

flows of national and international investment and finance⁶⁷. As a result, we argue it is critical to follow production networks and global supply chains in renewable technologies and to carefully trace the finance and development streams around individual projects. A focus on global production networks and value chains is particularly valuable here given its actor-centric approach to understanding the variegated, country and industry-specific development implications of south-south trade flows particularly those around renewable energy⁶⁸. To overlook these complex production networks and value chains is to miss the important interdependencies that are beginning to emerge from China's growing geo-economic influence in Africa.

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- 1 IEA, "African Energy Outlook"
 - 2 Ibid.
 - 3 Power et al, "The Political economy of energy transitions".
 - 4 Power et al, *China's Resource Diplomacy*.
 - 5 Power et al, "The Political economy of energy transitions".
 - 6 Conrad et al "Towards an Energizing Partnership".
 - 7 Hensengerth, "Chinese Hydropower Companies"; McDonald et al "Exporting Dams".
 - 8 Mol, "China's Ascent".
 - 9 Gordon, *The Environmental Implications*.
 - 10 Xinhua News, 'Speech from Premier Wen Jiabao'.
 - 11 Conrad et al "Towards an Energizing Partnership".
 - 12 Further information about the project can be found on our website:
<http://community.dur.ac.uk/the.rising.powers/>
 - 13 60 Interviews were undertaken in South Africa and 15 in China with project developers, industry and industry associations, civil society organizations and trade unions, governments, the utilities and municipal level entities, bilateral donors, debt financiers, equity investors, academia and think tanks. A list of the interviews conducted is contained in Table 1.
 - 14 Breslin, *China and the Global Political Economy*.
 - 15 Dickson, *Wealth into Power*.
 - 16 Zweig, "Undemocratic Capitalism".
 - 17 Grimes and Sun, "Implications of China's ongoing dependence".
 - 18 Horner "A new economic geography".
 - 19 Lieberthal, "Introduction".
 - 20 Goodman and Segal, *China Deconstructs*.
 - 21 Hameiri and Jones, "Rising Powers and state transformation".
 - 22 Breslin, "China and the South".
 - 23 Guang Ming Daily.
 - 24 Mathews and Tan, *China's Renewable Energy Revolution*, pxiii.
 - 25 GWEC, *Global Wind Statistics 2015*.
 - 26 Ibid.
 - 27 Li et al. "Wind Power in China"; Lewis, *Green Innovation in China*; Liao et al, "Wind Power Development"; Klagge et al "Constructing China's Wind Energy".
 - 28 Zhao et al "Large-Scale Utilization"; Conrad and Meissner "Catching a Second Wind".
 - 29 Lewis, *Green Innovation*
 - 30 Li et al. "Wind Power in China".
 - 31 NDRC, "Notifications on the Works".
 - 32 CREIA (2014) *Annual Review and Outlook*.
 - 33 Lema et al "China's Impact"
 - 34 Ibid.
 - 35 CREIA (2013) *Annual Review and Outlook*.
 - 36 Ibid.
 - 37 Lewis, *The rise of renewable energy protectionism*.
 - 38 Zhang et al "The Erratic Path".

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- 39 Xinhua News 'China ranks first'.
- 40 Su, 'Rescaling the Chinese state', p4.
- 41 Power et al *China's Resource Diplomacy*.
- 42 Breslin, *China and the Global Political Economy*; Breslin, "China and the South".
- 43 Gill and Reilly, "The Tenuous Hold of China Inc."
- 44 Breslin, *China and the Global Political Economy*.
- 45 Hameiri and Jones, "Rising Powers and state transformation", p73.
- 46 Ibid.
- 47 Andrews-Speed 'The institutions of energy governance', p20
- 48 Ibid, p27.
- 49 Gill and Reilly, "The Tenuous Hold of China Inc."
- 50 Interview with a MOFCOM officer, April 12th 2014.
- 51 Interview with an Eximbank manager, August 17th 2014.
- 52 Interview with a CDB officer, August 18th 2014.
- 53 Interview with Sinosure officer in April 11th 2014.
- 54 Interview with SAF officer, August 9th 2014
- 55 Baker, "Opportunity and crisis'.
- 56 Andrews-Speed, *The governance of energy*.
- 57 WRI "China's Overseas investments".
- 58 Komendantova et al "Perception of Risks".
- 59 Interview with senior manager from Chint, October 9th 2014.
- 60 Interview with a Chinese wind farm investor in South Africa, April 11th 2014.
- 61 Interview with a manager of a Chinese wind farm operator in South Africa, April 8th 2014.
- 62 Interview with Chinese solar PV manufacturer, August 3rd 2014.
- 63 Chinese firms have also been involved in Joint Ventures (JVs) with South African companies or have operated as the Engineering Procurement and Construction (EPC) companies or one of the subcontractors (e.g. Powerway) on various renewable energy projects.
- 64 IEA *Africa Energy Outlook*.
- 65 Interview with a Chinese wind farm developer, August 5th 2014.
- 66 Baker, "The evolving role of finance", p150.
- 67 Baker and Wlokas "South Africa's renewable energy procurement", p26.
- 68 Power et al "The Political Economy of Energy Transitions".

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