Panels and Politics: The Role of China in Rescaling Service Delivery in Urban Africa

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"[China] is home to the world's 10 top suppliers of solar PV manufacturing equipment. China has been instrumental in bringing down costs worldwide for solar PV, with multiple benefits for clean energy transitions."

- International Energy Agency, 2022

Africa's energy transition is a key site where global politics will be played out. In the current moment, with African cities growing quickly and Africa's largest urban areas dominating national and regional economies, this energy transition is necessarily an urban question. In this piece, we explore China's role in Africa's energy transition.

Since our main interest is in the urban scale, we focus on how China's contribution to solar panel value chains (particularly manufacturing and logistics) is contributing to the "rescaling" of urban energy systems and a transition to more distributed and decentralized energy systems and value chains.

We ask: how is China's control over solar panels and product value chains shaping cities? And how might this process create new sites of geopolitical tension? We situate this conversation in the context of Africa's fragmented urban fabrics, and the rise of decentralized and distributed technologies in Africa.

Decentralizing Technologies and the Rescaling of Urban Service Delivery

Africa's urban areas have been sites of contested geopolitics for many decades. The extractive and violent projects related to colonial domination often required the development of new urban centers, supported by basic infrastructures and connected to supra-continental logistical networks.

For example, Kisumu, a small but important Kenyan city, was formed in 1902. Its location was determined by the British-owned Kenya-Uganda Railway line (often referred to as the Lunatic Line) which came to reach Lake Victoria (a key site of colonial control) where Kisumu is today.

The town was settled by British and Indian people, the latter involved heavily in the bureaucratic management of colonial settlements. Infrastructure in Kisumu, like in many African cities, was deliberately "splintered," to divide populations across racial lines, control urban population growth, and realize the extractive goals of imperialism.

Of course, the geopolitics of Africa's cities and urban infrastructure does not end with colonization. For example, Structural Adjustment (SAPs), implemented in the 1990s by the World Bank and International Monetary Fund (IMF) in order to address the global debt crisis, directly impacted African cities, contributing to overt processes of infrastructural and social disinvestment.

This process corresponded to rising urbanization and pressure being placed on already strained infrastructure networks. Through these processes, among others, African cities came to be critical sites where global power was renegotiated.

As African cities have continued to grow, so too has their role in geopolitics, both regionally and globally. And despite the importance of cities in global economies, urban management and service delivery in Africa has remained a challenge.

Among other processes, the history of colonization and structural adjustment have weakened local governments, compromised access to finance, and resulted in fragmented and partial infrastructure and service delivery networks in African cities. While the outcomes across cities differ dramatically, most cities today have hybrid service delivery patterns, with limited grid connectivity. These service systems are controlled by a mix of formal and informal operators.

For example, in Addis Ababa, less than 10 percent of people have access to networked sanitation systems—with most using onsite options, such as septic

tanks or mini-grids. Some smaller African cities have no sanitation network at all. From mini-bus taxis to water vendors, we see a wide diversity of ways that African cities, citizens, urban authorities, and service providers ensure that infrastructural services are delivered in the absence of a centralized and well-functioning network.

Against this backdrop of weak governance and limited finance, distributed and decentralized solutions and technologies are often presented as the only option for Africa's rapidly growing cities and towns. They fill infrastructure gaps wherein centralized networks have fallen into disrepair, or as is commonly the case, never existed in the first place.

This decentralization craze has shaped all manner of investment in decentralized technologies—from tech start-ups that focus on home solar systems, to aid organizations that supply water kiosks, to development finance institutions (DFIs) which fund waste picking centers

This "gap filling" is sometimes driven by informal and ad hoc processes—people and firms finding ways to access services outside of the formal system. However, decentralized options are also being driven, either directly or indirectly, by national and local states through regulatory, fiscal, and logistical decisions. This proliferation of investments has come with a proliferation of investors.

As such, the implications of decentralized technology have been as much material as they are intuitional—with the governance of African cities coming to reflect the competing objectives of a myriad of development players.

Decentralized technologies are—at their core—rescaling service delivery and the governance of urban systems. They are calling into question the ideal of centralized networked infrastructure, and creating new governance and material configurations in cities, towns, and peripheries.

China's Role in Decentralized Technologies

We now turn to China's role in these processes of technological decentralization. In the context of African cities, considerable interest has gone into the role of China in investing in strategic large-scale infrastructure, through the Belt and Road Initiative (BRI).

Of course, the focus has often been on mobility infrastructure—some of which has been strategically related to global logistics (such as the standard-gauge railway in Mombasa), while other investments lack a clear economic strategy, but undoubtedly contribute to what is commonly referred to as the extension of "soft power" on the continent (for example, Addis Ababa light rail).

Furthermore, China has become an essential trade partner for Africa. Between 2007 and 2017, China exported consumer goods, intermediate goods, and also capital goods to Africa while importing raw materials and natural resources. This multiplicity of roles is important in the development of a heterogenous view of Chinese geopolitics in Africa.

Since 2019, China has taken a deliberate decision to focus on green infrastructure investment. This investment drive has radically reduced the price of key components in the energy value chain and secured China's position in this market.

This is particularly evident in the context of solar products and components. China's control of global solar photovoltaic (PV) value chains has benefited from high levels of state investment in the manufacturing sector, which has exceeded $47 billion. The investment has covered the entire solar PV supply chain and includes expansion of the production of wafer, solar cell manufacturing, module assembly, and module components such as aluminium frames.

China has focused strategically on providing state support to Chinese manufacturers by providing cheap debt at state bond rates in exchange for ownership requirements. This investment has yielded results: approximately 40 percent of the global supply of the high-grade polysilicon required for solar panels is sourced from the Xinjiang region in China.

China also controls the Li-ion battery manufacturing sector, a key battery of choice for many mini grid projects. Although lead acid batteries are being deployed in some mini grid projects (for example, in Nigeria), Li-ion batteries are still the choice for many grid projects in Africa due to efficiency, longevity, and discharge capacities.

In the urban space, mini grids are used to provide power to communities underserved by the existing grid networks (such as urban peripheral communities) or to support industrial activities (such as mines) in far flung and under-resourced towns. Mini grids have been growing in prominence in Africa, both in rural and urban areas.

The mini grid sector in Africa doubled the number of people that are connected to a reliable electricity source over the last two years. To date over 500,000 individuals, health care facilities, schools, and small businesses in sub-Saharan Africa have access to a reliable source of electricity as a result of the deployment of mini grids. The total number of operational private sector mini grids in Africa increased by 39 percent from 2019 to 2021. This transition is notable and important.

Linking back to the role of China, the acceleration of the deployment of mini grids is attributed to the decreasing costs of key components, digital solutions, increase in the number of mini grid developers, and the growing economy of scale in the sector. In the African market, Original Equipment Manufacturers (OEMs), many of which are headquartered in China, own the intellectual property (IP) of technology and have developed businesses focused on providing subcomponents and or complete mini grid systems.

Often OEMs perceive mini grids as additional market channels to sell their equipment—by controlling utility scale and mini grid panel production. Through the pursuit of mini grids as additional revenue channels, OEMs can increase factory output and improve business operations.

Notably, there is also a rapid transition to large-scale, grid-connected, renewable energy projects whereby Chinese firms play leading roles in development, either directly as project developers or as subsidiaries. As shown in the context of Kenya, this is often a consortium of Chinese actors (often including Chinese EPCs, Chinese project developers, imported labor, and Chinese state-sponsored financial packages), working directly with national utility companies.

Despite many factors driving project selection, such as the alignment of political decisions, turnkey solutions are driven by the price of either the components or the full project. These price drivers also shape national programs aimed at energy purchases. In the South African context, for example, the price drivers for competitive tariff bidding in the REI4P (auction rounds) have meant Chinese involvement in major grid connected projects.

The efficacy of Chinese solar PV products is often higher than locally manufactured solar PV products.This has resulted in the balancing of national-local content requirements and solar component efficacies, resulting in various institutional arrangements, for example local solar manufacturer ArtSolar entering into a partnership with LONGi, a Chinese company, to set up local manufacturing capacity for bifacial panels (Tier 1).

Of course, turnkeys and mini grids are not the only place where China is making its mark in Africa's solar sectors. The vast majority of the household scale solar products entering the market are manufactured in China.

Despite considerable efforts being made to increase overall power supply and the reliability of distribution networks, in most cases the risks and costs of outages fall to households and businesses to manage. Everyday use of household scale generation and consumption technologies is common.

In addition to the well-established options (small diesel generators and paraffin and the like), solar home products are increasingly used as interim and hyper-decentralized options. These can take the form of small solar lanterns, or larger systems which can power a select range of appliances. Owing to the limited and inconsistent regulation across the continent, these products vary significantly in quality and lifespan.

Overall, whether looking at large scale turnkey projects, mini grids, or household scale products, China plays a central role in infrastructure rescaling. At the very basics, China has positioned itself to control key material and manufacturing value chains related to decentralize technology—in addition to increasingly operating as a development partner for PPP projects.

Geopolitical Implications of Urban Rescaling

Chinese manufacturing allows for the rescaling of the energy generation question, reshaping what is possible, materially and institutionally. Higher cost options—which require longer amortization periods—require capital investment or backing of national governments or event trans-African consortia. What does it mean that Africa's emergent (and very much fragmented) value chains for energy provision are dominated by Chinese companies?

There has, of course, been concern over China's dominance in the solar panel manufacturing sector. Much of this has been expressed as concern over supply chain disruptions—made more visible during COVID-19 pandemic. Additional concerns over human rights in the extractive value chains and Taiwanese diplomacy efforts have also surfaced. While important, these concerns infrequently attend to the implications of urban rescaling.

This reality of urban rescaling enables us to look at a set of geopolitical tensions which will likely become even more pertinent into the future.

First, China's role in rescaling foregrounds the tensions between price and localization. This relates to the fundamental conflict within the energy space—between the competing imperatives of reducing global carbon emission (e.g. greening), reducing energy poverty (e.g. access), and localizing value (e.g. jobs). In places like South Africa, which previously controlled significant parts of the energy value chain (e.g. coal) and stand to lose considerably in this transition as the mining sector shifts, this has resulted in ghost towns, rapid urban migration, and job loss.

From a geopolitical perspective, China has laid its claim to the solar value chains which support the green energy transition. In response, other countries

are going to have to structure their own localization policies in relation to China, responding to the established dominance in the market.

Second, a look at China's role in value chains encourages us to consider the emerging geopolitics of e-waste. Where is all this junk going and who is responsible for it? How will it be regulated? And how will cities come to be sites of disposal? According to the 2022 report of the IEA, "the solar PV reuse sector is still mostly unregulated." Research further suggests that in many countries, the import of solar products for home use are largely unregulated in terms of quality—with direct implications for the lifespan.

We are already seeing solar panel graveyards in developed countries—in cities where considerable portions of the urban fabric are unregulated, there is a huge risk that cities (particularly peri-urban areas or informal settlements) become dumping grounds for toxic and high-risk materials.

A third and important area of geopolitics is the intersections between large scale mobility and logistics projects and the importation of various solar products and components. As Africa is reframed as a consumer market, the importation of products relies on functional port structures and highly developed roads. This means that the BNR comes not only to support the export of raw materials, but also the import—particularly to urban areas and their surroundings—of products.

How are Chinese manufacturing companies building new partnerships to attend to the requirements not only of export out of Africa, but also of product consumption in Africa? This links the question of mobility and logistics infrastructure—at every scale—to the contribution to sectors like energy, as it is through mobility networks that such products are facilitated into African markets.

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