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The Chinese solar energy industry and potential of renewables in Africa

China and Africa are developing in a time of climate change and scarcity. According to most climate scientists global economies will have to make a green shift to ensure continued future growth. However, there are very large differences in what is understood under the term “greening”. In some countries greening reflects a desire to work towards carbon-neutrality; in other countries external international pressure leads to action for the protection of internationally important carbon sinks. China faces a massive increase in energy demand—and needs to address mounting economic, political and social pressure to adopt and enforce green industrial policies and practices. Against this background, China has given rise to some of the world’s largest renewable energy companies; these companies form part of an increasingly important economic sector in China. As such these companies, their origin and drivers have become important for China’s international economic partners, including African states. This policy briefing explores the rise of and motivation behind China’s solar industry as a case study for the rise of the renewable energy industry in China. It makes suggestions to African decision makers in government and business for engaging China in the renewable energy sector.

Changing economics of energy in China

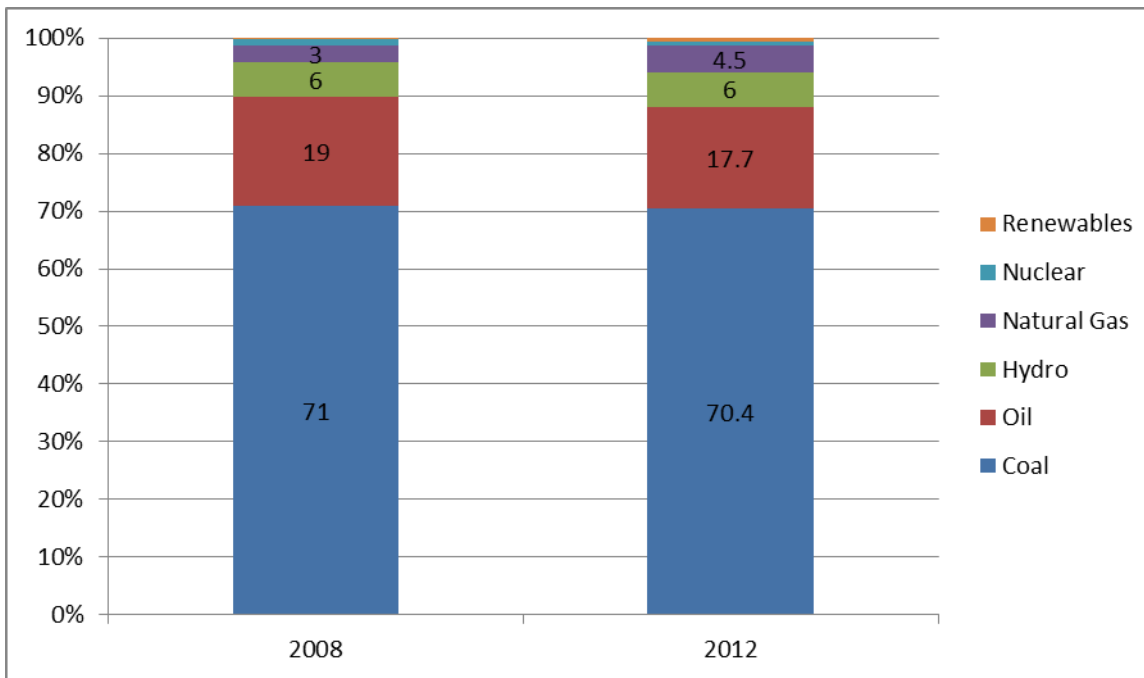
From 1979 onwards China’s government has increasingly embraced liberal market economics, establishing a “Socialist market economy” in China. By the end of the 1980s and early 1990s, the Chinese government began to open the Chinese energy production market to foreign private investment. Along with the opening up, economic competition spread to the Chinese energy generation sector. While the measures significantly reduced severe power shortage, government involvement in the sector continued. The State Power Corporation (SPC) was founded in 1998 in an attempt to separate government from enterprise. With nearly 50 per cent national generation capacity and almost complete control of the national power grid, the SPC remained in a dominant position.

In 2002, The Scheme of the Reform of Electricity Industry (Scheme of 2002) broke the SPC up into 11 new corporations, each receiving a part of the SPC’s assets. Out of the 11 corporations founded, two were grid operators. With the breakup of the SPC, competition was increased, especially with regard to power generation. Subsequent to the breakup of the SPC, generation capacity in China increased from 1434.6 TWh [Tera-Watt per hour, i.e. 1000 Giga Watt] in 2001 to 2834.4 TWh in 2006. As a comparison: in 2011, all of Africa consumed 600 TWh.

China’s rapid economic growth, powered by a steep increase in energy production based on fossil fuels, created severe pollution problems in China. China has become home to sixteen of the world’s twenty most polluted cities, with acid rain affecting 1.5 million km² of the country. China’s energy mix is dominated by coal, followed by oil (see diagram 1). Consequently, China has become the world’s largest emitter of green house gasses. In 2009 China was responsible for almost 7.7 billion tonnes of CO₂ emissions, higher than the second largest emitter, the United States, at 5.3 billion tonnes of CO₂.

A complex set of drivers for renewable energy development have thus emerged in China. Beyond debates on the human factor in climate change, Chinese development illustrates the need to move away from a dependency on fossil fuels. Unaddressed environmental problems have the potential to lead to political instability, as illustrated in Eastern Europe in the 1980s. China in recent years has already seen a spike in public unrest due to high levels of pollution, with resistance to construction of new potentially “dirty” developments. Positively speaking, the renewable energy industry provides China with opportunities to redirect its economy, which is currently at a crucial stage. Renewable energy promotion allows for combining technological developments with economic growth, including the environmental sustainability dimension.

Diagram 1: Total energy consumption in China by type - 2008 and 2012



(Compiled from: US Energy Information Administration, 2008; BP Statistical Review of World Energy, 2012)

China and renewable energy promotion (solar)

China is already the largest developer and exporter of clean technology globally. In 2011, China became the largest investor in renewable energies, overtaking the United States of America, investing US\$ 52 billion into the sector. In 2012 China attracted US\$ 65 billion in green energy investment, nearly double that of the United States at US\$35.6 billion (figures exclude government subsidies and R&D funding).

Growth of China's renewable energy industry

Renewable energy enables China to move its economy up the value chain, producing "cleaner" products and employing its growing pool of highly qualified graduates. Higher end products, both their production and development, are essential in the Chinese government's plan of creating what the government pragmatically calls "a moderately prosperous society" (in other words: a middle income country). The government has begun to promote the next step in development of the Chinese economy by creating an "ecological civilisation".

The idea of the ecological civilisation is to establish a China in which humans live in harmony with nature, "harmonious development" (read: sustainable development). In addition to the environmental and thus social benefits derived from "harmony with nature", China also stands to benefit economically. As part of greening its economy, China is enacting policies such as the introduction of newer technologies in industrial practices that allow the country to increase its energy efficiency. China's energy efficiency has improved, measured as the ratio of purchasing power parity gross domestic product per unit of energy use (PPP GDP US\$ per kg of oil equivalent). China's PPP GDP US\$ per kg of oil equivalent in 2011 was 4.1, very low compared to countries such as Germany at 10.4 in 2011 (Africa's biggest economy in 2011, South Africa, only managed 3.9) (World Bank, 2013). Lower energy usage per unit of GDP means that it is cheaper for a country to produce items of a certain value, thus sustainable practices directly convert into higher profits.

Developing from a near zero base, China developed into the largest producer of solar systems by 2010. Germany is still the largest market of solar PV systems, but China dominates the global market for solar PV component manufacturing. By 2010 China was responsible for 48 per cent of production (compared to Europe combined at 13 per cent, Japan at 8 per cent and the USA at less than 5 per cent). Diagram 3 shows the 2012 division of the solar PV module industry as based on market share.

China's solar industry has developed since 2002, taking advantage of the incentives, laws and policies, that were initiated by the Renewable Energy Law of 2002. Chinese solar companies have traditionally benefitted from cheap labour in China along with the provision of cheap government sponsored capital and land allowing for low-cost infrastructure installation. Government sponsored benefits meant that Chinese solar companies had close to only half the setup costs of their foreign competition. Chinese solar companies were able to grow even "against" weak markets due to very cheap loans backed by Chinese cities and localities. With increased capital Chinese solar companies were able to scale-up capacity and reduce manufacturing costs (economies of scale) to below that of their foreign competition.

To overcome the barriers in accessing the European market Chinese solar companies imported turnkey equipment. Chinese solar companies acquired technology through acquisitions. Through a combination of low costs for labour, capital, and customisation (due to cheap labour) and increasing low cost in innovation (due to university/company co-operation within



China), Chinese solar companies were able to sell their products at highly competitive rates. Yet, national application of solar however remained low within China itself. By 2009, only 228 MW out of 3782 MW solar PV modules produced in China were installed within the country.

China's solar industry's reliance on export driven growth has run into problems in recent years with complaints from Europe and the United States accusing Chinese companies of dumping. As a result the European Union has put a limit on the solar capacity China can export to the EU. This has exposed over-capacity in manufacturing capabilities of Chinese solar firms, which, combined with the economic down turn following the 2008 financial crisis has severely lowered profitability of Chinese solar firms. As a result, the Chinese government has begun to push for the establishment of a larger local solar PV market.

In addition to increasing the local market, new markets, such as African and South American markets, are also becoming more important for Chinese solar energy companies—not only in sales, but also potentially in manufacturing.

African relevance

Africa is exceptionally well positioned to transform its energy and electricity sectors through renewable energy. The need for

Diagram 2: Projected solar and wind energy capacity in Africa (*in 2011 Africa used 600 TWh/year)

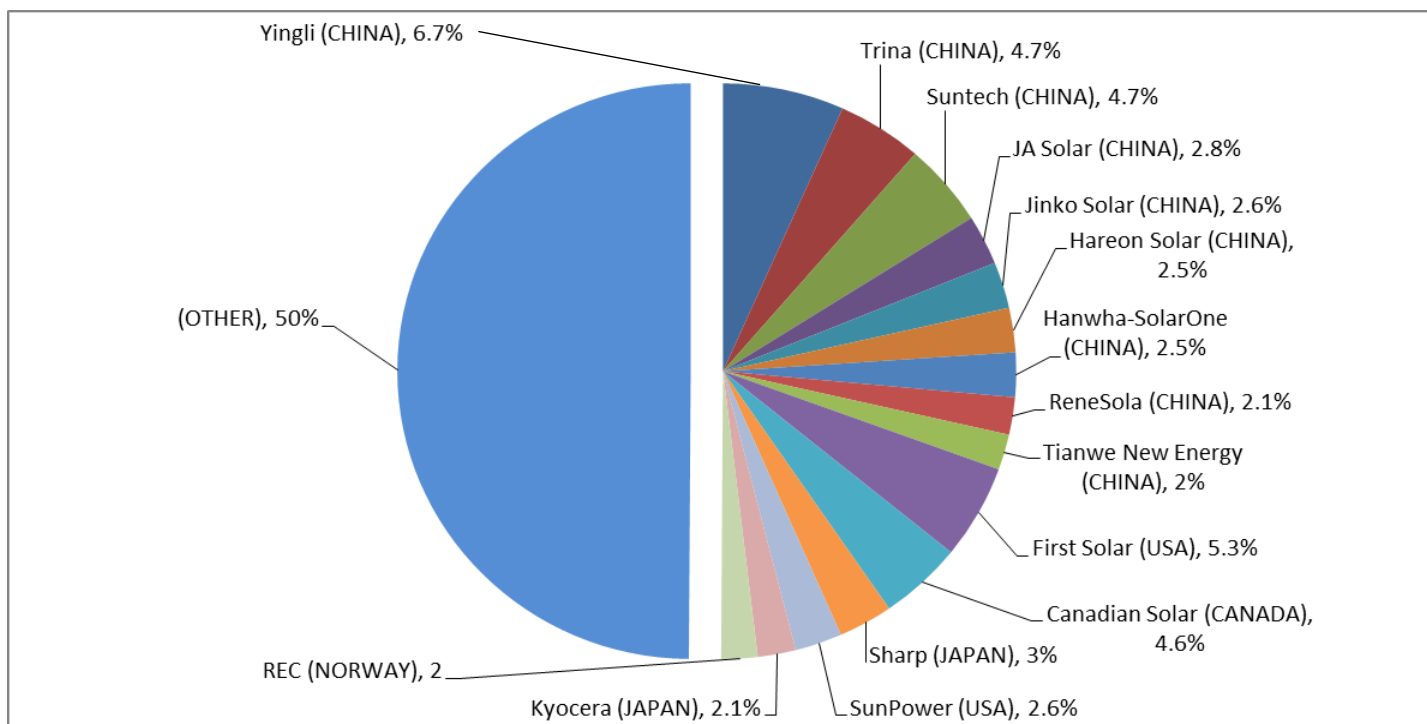
Region	Wind (TWh/yr)	Solar (TWh/yr)
East	2000-3000	30000
Central	-	-
North	3000-4000	50000-60000
South	16	25000-30000
West	0-7	50000
Total Africa	5000-7000	155000-170000

(Source: IRENA, 2011)

energy is massive and the enormous potential of renewable energy is currently untapped. Africa's energy use is equivalent to the total output of Spain for one year (600 TWh). Compared with these current figures, Africa has around 6000 TWh/year wind power potential and up to 170000 TWh/year in solar energy potential (see diagram 2).

Yet, renewable energy production is at a mere one per cent in the current energy mix. Most of Africa's energy production is

Diagram 3: Market share as percentage for top 15 solar PV module producers in 2012



(Source: Renewable Energy Policy network for the 21st Century, 2013)

based on fossil fuels, with coal and natural gas as well as oil accounting for more than 80 per cent of the energy production.

Expanding traditional energy infrastructure networks is costly and maintenance intensive in largely rural Africa. More than 60 per cent of Africa's population live in rural areas where it is less cost effective and more problematic to connect to national electricity grids, leading to increased costs and low returns. Within this context, renewable energy provides a very promising alternative with vast market potential for Chinese solar energy companies. Politically, through organisations such as the Forum on China-Africa Cooperation (FOCAC) and the well established practice of loans for resources, China is very well positioned to engage with African governments in a potentially mutually beneficial relationship, whereby Africa's energy potential can be developed, including its renewable energy sector.

Within this partnership, African states are not necessarily without agency. African states can gain access to funding for energy infrastructure, as China needs the resources and increasingly the markets that African states provide. In addition, the Chinese government's self-portrayal of Africa's "all weather friend" provides for political leverage. Furthermore, global trends might play in favour of African states as investment destinations. The recent row between China and the EU on anti-dumping measures for solar panels triggered Chinese solar companies to identify alternative manufacturing locations and/or markets. Shifting manufacturing to African locations potentially provides Chinese companies with access to beneficial trade agreements with the USA and EU. In the South African case, it also allows Chinese companies to increase the percentage of locally sourced content for renewable energy tenders.

Recommendations

Some African countries such as South Africa have made progress in establishing a renewable energy programme, while others still have much to catch up on. Even if in a very different situation, the Chinese example of renewable energy development offers much to learn from with regard to legal and economic frameworks and incentives.

Africa is well positioned to become an important player in the international renewable energy field. China, amongst other economic partners such as the EU and USA, should aspire to realize this business potential.

In order to address Africa's energy need, it is important to also engage with China's international renewable energy sector. To achieve access to renewable energy specifically, the following points are recommendations aimed at African decision-makers:

- **Adequate legislation is necessary.** African governments should draft renewable energy laws, establishing the incentives for renewable energy generation. This can be done through various methods such as feed-in tariffs or through quota based renewable portfolio standards.
- **Energy generation will be more decentralised in the future.** African governments should consider the dismantling of large state-owned power producers along with the creation of strong anti-monopoly and anti-collusion laws. Only by creating smaller units, can competition be increased by levelling the "playing field" and reducing the risk of (inefficient) monopolies.
- **Incentives are necessary to boost renewable energy supply.** African governments need to formulate and implement national regulation that facilitates the provision of renewable energy and energy investment. These regulations should include lower import tariffs on renewable energy equipment and the introduction of tax cuts to attract potential foreign renewable energy firms.
- **Africa needs to upgrade technology.** Technology transfers should be worked into investment projects to facilitate post installation upkeep and stimulate innovation. Renewable energy can only sustainably flourish as a sector in African states once innovation can be nurtured domestically. Innovation is essential in remaining internationally competitive after acquiring technology.
- **Funding opportunities needs to be explored.** For energy projects and the establishing of a renewable energy industries, funding might be obtainable through instruments such as FOCAC and infrastructure-for-resources loans.
- **Co-operation requires joint standards.** Early consideration will have to be given to avoid fragmentation into small markets. For this goal, African states should standardise renewable energy systems to increase benefits from co-operation with other African states.

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The Centre for Chinese Studies (CCS) at Stellenbosch University is the leading African research institution for innovative and policy relevant analysis of the relations between China and Africa.