



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

July 2018



Working Paper

027.2018

China's Energy Policy & Investments and their Impact on the Sub-Saharan African Region

Valentin Grimoux

Energy Scenarios and Policy

Series Editor: Manfred Hafner

China's Energy Policy & Investments and their Impact on the Sub-Saharan African Region

By Valentin Grimoux, Johns Hopkins University

Summary

This research provides a grasp of China's energy needs and their implications for SSA countries in order to give a balanced and better understanding of its role on the continent. More specifically, the aim is to understand why and how China is involved in the SSA energy sector and what are the benefits and the costs of its engagement. On the one hand, a clearer knowledge of how the Chinese investment system works will help to assess the scope of the Chinese strategy and the role of the government for the set of actors that are committed in Africa. On the other hand, by digging deeper into Chinese energy projects in Africa, one will be able to appreciate to what extent this relationship can be considered a win-win, whereby each party is equally benefitting from cooperation by ensuring the smooth development of the African and Chinese economies.

Keywords: Economic Development; Energy Security, International Cooperation, Investments

JEL Classification: O13, Q4

Address for correspondence:

Valentin Grimoux
School of Advanced International Studies
Johns Hopkins University
Via Beniamino Andreatta 3
40126 Bologna
Italy
E-mail: vgrimou1@jh.edu

CHINA'S ENERGY POLICY & INVESTMENTS AND THEIR IMPACT ON THE SUB-SAHARAN AFRICAN REGION

Valentin Grimoux¹

Johns Hopkins University

May 2018

Abstract

This research provides a grasp of China's energy needs and their implications for SSA countries in order to give a balanced and better understanding of its role on the continent. More specifically, the aim is to understand why and how China is involved in the SSA energy sector and what are the benefits and the costs of its engagement. On the one hand, a clearer knowledge of how the Chinese investment system works will help to assess the scope of the Chinese strategy and the role of the government for the set of actors that are committed in Africa. On the other hand, by digging deeper into Chinese energy projects in Africa, one will be able to appreciate to what extent this relationship can be considered a win-win, whereby each party is equally benefitting from cooperation by ensuring the smooth development of the African and Chinese economies.

Keywords: Economic Development; Energy security; International cooperation; Investments

JEL Classification: O13, Q4

¹ Valentin Grimoux, School of Advanced International Studies, Johns Hopkins University (SAIS Europe), vgrimou1@jh.edu.

INTRODUCTION

In December 2016, the government of the People's Republic of China (PRC) released its Strategy for Energy Production and Consumption Revolution for 2030 (NDRC 2016a). The report tells us that, in the last three decades, the unprecedented growth of China's economy completely altered the supply-demand equilibrium of global energy. A certain attainable threshold of energy supply is essential to adequately nurture such high economic growth. During the past ten years, its share of global energy use has nearly doubled, and its energy utilization has increased by more than 150%.

As a result, China increased its presence in world energy markets to match its interests, especially its energy demand which is expected to rise to 3.8 billion tons of oil equivalent (Btoe) by 2040 from a level of 3.0 Btoe in 2010 (NDRC 2016a). This rising demand is particularly fueled by its energy-intensive industries, such as steel, aluminum, automobiles, electronics and chemicals manufacturing. For instance, coal remains dominant in China, accounting for 58% of its energy mix in 2016 (NDRC 2016c).

Given its limited domestic supply of oil and gas, China must obtain this massive amount of new energy from imports. China's reliance on imports has led to a geopolitical dilemma in that it has become heavily dependent on external sources of supply: in 2014, the Middle East supplied 3.2 million barrels per day (44% of the country's imported supply); Africa 1.4 million (22%); Russia and the former Soviet Union states 778,000 (15%); the Americas 667,000 (15%); and the Asia-Pacific region 127,000 (4%) (NDRC 2016c). This diversification of supply sources aims to reduce China's dependence on the Middle East and on international maritime routes.

The Chinese African Policy: a win-win cooperation supply?

Recently, sub-Saharan Africa (SSA) became an important source of energy and supplier of raw materials for China's growth. Diplomatic ties between SSA and China started during the Mao era (1954-76) when China developed a relationship with newly independent countries of the Non-Aligned Movement so that the country could acquire international political leverage. Deng Xiaoping (1975-1989) renewed the relationship by shifting from an anti-colonial approach to a more pragmatic one based on economics and trade.

In 2004, Joshua C. Ramo described Chinese diplomacy in Africa (and more broadly, Chinese diplomacy in developing countries) with the concept of "Beijing Consensus". The Beijing Consensus hinges on three rules. First, development must be based on innovation. Second, economic success must be based on its sustainability and equality, not on the growth of the gross production product (GDP) per capita. Finally, China and other countries should maintain policies of self-determination against the United States' (U.S.) influence² (Ramo 2004).

2006, also known as the Sino-African year, marked the 50th anniversary of official relations between China and Africa. In this year, China released an official document on "Chinese Policies in Africa". In November 2006, Beijing hosted the Forum on China-Africa Cooperation (FOCAC) with 48 heads of state and government³. The forum outlined the relationship between China and Africa with three key points:

² The Beijing Consensus is therefore a concept built in opposition to the Washington consensus, emphasizing on a globalization which respects each country's interests. In this regard, the Chinese influence should serve as an example, and offer the capacity for an asymmetric development of capacities to withstand the US.

³ The slogan of the summit was "Friendship, Peace, Cooperation and Development". The main goals were to (1) double the amount of aid to the African continent, (2) provide facilitated credit packages, (3) create a development fund, (4) partial debt cancellation, (5) expansion of products excluded from tariff barriers, (6) soft power-related projects

- 1) The recognition of political equality of the partner with whom Beijing cooperates.
- 2) An economic “win-win” cooperation.
- 3) Principle of “non-interference in international affairs” with other countries.

The analysis of China’s policy papers on Africa (released in 2006, 2010, 2013 and 2015) tells us that cooperation in the energy sector has increased in importance. Whereas such cooperation was only encouraged in the first papers, a shift began in 2013 because of the stringent European Union (EU) regulations against Chinese renewable energy products:

“Developing the cooperation in the fight against climate change. (...) Africa needs help from the international community. China is strongly attached to cooperate with African countries against climate change. Since 2009, China undertook hundreds of clean energy projects including biogas Tunisia, Guinea, Sudan and other countries; Hydro, solar and wind energy with Morocco, Ethiopia, South Africa, Cameroon, Burundi, Nigeria, Benin. We provided to Nigeria, Benin and Madagascar other gifts such as low-energy bulbs, air-conditioners to help them adapt to climate change.” (State Council 2013).

The 2015 policy paper emphasizes the electricity production sector for the China-Africa relationship. It explains that the PRC would play a role to extend power grids in Africa and develop low carbon projects and markets focusing on renewable energy:

“We will innovate for the cooperation between China and Africa on resources and energy by extending our cooperation to the entire supply chain in the energy and mining sector. The support to African countries and the construction of regional electric grids, promoting wind, solar, hydro and other types of renewable energy (...) will push forward the industrialization of the African continent thanks to the rational development and use of renewable energy” (Xinhua 2015).

However, the Chinese energy strategy in Africa is often criticized because of a lack of control and transparency in certain SSA countries⁴ (Banoba 2018). Whereas the Western approach to international relations supports democratic values and the protection of human rights, China is thought to support authoritarian regimes indirectly⁵ which are responsible for human rights abuses. The Chinese position toward Africa is sometimes considered to be “neo-colonialist”⁶ because it exploits the continent’s natural resources and increases SSA’s dependency on exporting these goods (Su 2017).

Other critics on China’s involvement in SSA is that it may not always favor the development of these countries: Chinese National Oil Companies (NOCs) and State-Owned-Companies (SOEs) often send Chinese workers to build infrastructure, which takes away employment opportunities and skill training from local citizens⁷ (Olander et van Staden 2016), while cases of ill-treatment and substandard wages from Chinese companies to African workers have been reported⁸ (Kadirire 2017). Finally, African

⁴ While the region is experiencing the lowest scores on the Corruption Perception Index, nevertheless Banoba’s analysis notes strong improvements on the continent. Furthermore, the African Union chose 2018 to be the year for fighting corruption in every country (“Winning the Fight against Corruption: A Sustainable Path to Africa’s Transformation”).

⁵ In the line of the Beijing Consensus which states that China would not interfere in the domestic affairs of the countries with which it has partnered.

⁶ Xiaochen Su (who is working for an NGO in Tanzania) explains in her article how Chinese loans for building infrastructures in Africa can be considered as neocolonialist tools. She explains that African governments do not have the necessary liquidity to pay back the Chinese loans and therefore have to rely on their natural resources to compensate the PRC’s investment.

⁷ Olander and van Staden shows that, even if the proportion of Chinese workers employed in Chinese-built projects in Africa is relatively small, the impact on perception for locals is relatively strong due to the fact that many African citizens are still unemployed.

⁸ Kadirire reports the complaints of Zimbabwean workers working under Chinese management: “Unfair labour practices, non-payment overtime, no grading system, assault of employees, underpayment of wages and a lack of safety clothing”.

markets are also harmed by low-cost Chinese-made products, leading to the de-industrialization of the continent⁹ (Rice 2012).

Understanding China in SSA through the prism of energy cooperation.

The China-Africa relationship is therefore a broad subject which includes numerous facets and conflicts. This research will provide a grasp of China's energy needs and their implications for SSA countries in order to give a balanced and better understanding of its role on the continent. More specifically, the aim is to understand why and how China is involved in the SSA energy sector and what are the benefits and the costs of its engagement. On the one hand, a clearer knowledge of how the Chinese investment system works will help to assess the scope of the Chinese strategy and the responsibility of the government for the set of actors that are committed in Africa. On the other hand, by digging deeper into Chinese energy projects in Africa, one will be able to appreciate to what extent this relationship can be considered a win-win, whereby each party is equally benefitting from cooperation by ensuring the smooth development of the African and Chinese economies.

It is noteworthy that the notion of "economic statecraft" formulated in 1945 by the American economist Albert Hirschman in 1945 is underlying this research. Fourteen years earlier, the American historian and economist Herbert Feis founded the premises of the notion by writing *Europe, the World's Banker, 1870-1914* (1931) in which he defended the idea that great powers before the First World War were using their investments to protect themselves and ensure their own security. Hirschman went further in *National Power and the Structure of Foreign Trade* (1945) as he explained that foreign trade was a tool of power politics leading poorer countries to have lower leverage when trading with greater economic powers. It becomes difficult to dispense of such business partners and difficult to shift trade to other regions. In 2016, William J. Norris published *Chinese Economic Statecraft: Commercial Actors, Grand Strategy and State Control* based on his work at the Massachusetts Institute of Technology (MIT), wherein he applies the notion of economic statecraft to China's foreign policy and concludes: "China is entering a phase in which it has the luxury of leveraging its growing economic clout to further its foreign policy goals." By focusing on China's investment in the SSA energy sector, this thesis will therefore investigate how this theory plays out in the context of China-Africa relations.

A cross-disciplinary methodology to assess China's impact on SSA's energy sector.

This research relied on a diversity of resources coming from various fields of research including political science, energy studies and economics published in different languages (English, Chinese and French). This approach allowed access to numerous local and global institutions sources such as China's National Development and Reform Commission (NDRC), the World Bank Group (WBG), the African Development Bank (AfDB) and its multilateral counterparts, and the International Energy Agency (IEA) which all have provided sound numerical data about energy development and investment in Africa and in China.

In addition, academic resources played an important role in this research, such as the China Africa Research Initiative (CARI) from the Johns Hopkins university School of Advanced International Studies (SAIS) which was launched in 2014 to promote research on China-Africa relationship. It was particularly useful to understand the background and how Chinese loans function on the region. Moreover, Private companies such as McKinsey wrote about the Chinese influence in Africa for their clients and also published a public report on China's economic engagement in Africa in June 2017.

⁹ Taking the example of South Africa and Kenya, Rice explains that local African factories were forced to shut down because they could not compete with the low prices of Chinese imported products. That generated job losses but also led the economy to focus increasingly on resources such as oil.

Finally, field research was made possible thanks to the Frederick Hood Fund¹⁰ which allowed the author to attend the Power & Electricity Africa 2018 summit in Johannesburg, South Africa. The experience of local energy actors and conferences about African energy projects themselves increased the understanding of the involved sectors itself while numerous commercial sellers participating were Chinese¹¹. Due to confidentiality, the people interviewed on this occasion will not be named.

China and SSA through the prism of the energy sector: the story of a Dragon and a Lion.

The reflection is divided in three distinct chapters. China is the world's second largest economy and requires a vast amount of energy. Therefore, before tackling the relationship between China and SSA, it is essential to understand the two trends that drive the country outward, that is, imports and overcapacity production. On the one hand, Chinese leaders announced a progressive phasing out of coal; therefore, the country will rely increasingly on oil and gas imports while it will gradually decrease domestic production. On the other hand, the Chinese solar and wind industry's production levels are so high that the national grid cannot accommodate the entire output. As a result, China faces an overcapacity issue that constrains Chinese commercial actors to find new market overseas to sell their products (*Chapter 1*). China then became the first trading partner for SSA in 2009 and is today investing colossal amounts of money in the region. The Chinese financial system plays a crucial role in supporting its NOCs and SOEs to engage in foreign markets. In SSA specifically, Chinese companies resort to multiple types of contracts and social projects to ensure the security of their projects. This well-structured system allows them to build a critical portion of energy projects in SSA (*Chapter 2*). Nevertheless, such role raises an important question: what are the impacts and risks involved in China's pervasion of SSA's energy sector? The answer is multidimensional and includes geopolitical, environmental and economic concerns. The final picture shows to what extent each party – China as well as SSA countries – can act in response to the numerous concerns that arise from the Chinese presence in the region's energy sector (*Chapter 3*).

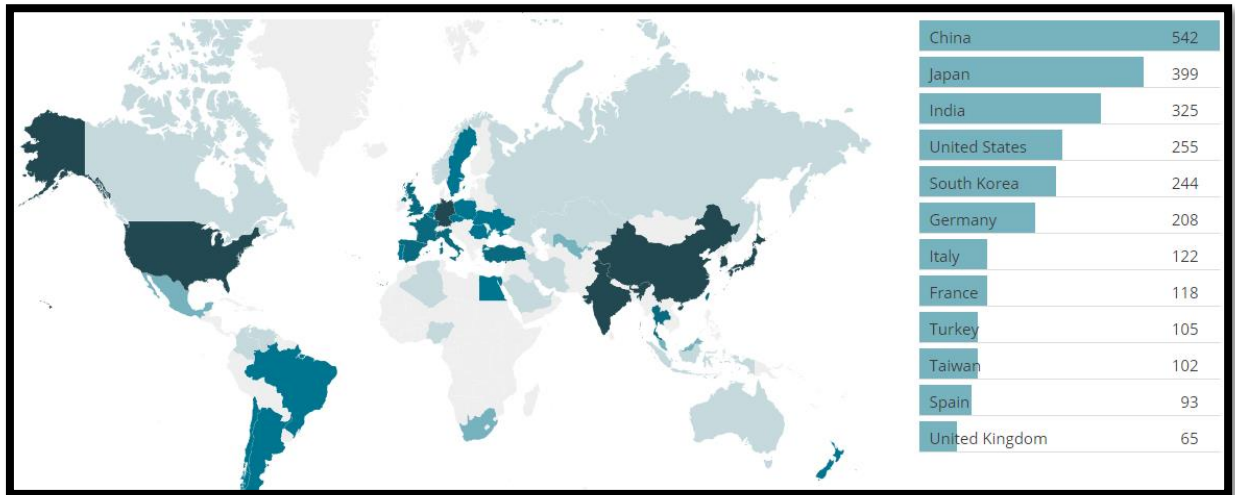
**CHAPTER 1. A THIRSTY DRAGON WITH SHACKLES
A GIANT IMPEDED BY ITS ENERGY IMPORTS AND OVERCAPACITY ISSUES.**

Before tackling the relationship between China and SSA, it is essential to understand what drives the country outward. The foundations of China's "going out" policy take root in its extraordinary development which requires a vast amount of input to satisfy its growing energy demand. Therefore, Chapter 1 deals with the Chinese government projections concerning its own energy mix, how it sees its own future and what its needs will be. The conclusions are twofold: while China will progressively phase out coal production, the demand for oil and gas will not match the domestic production. The country will rely increasingly on imports to fit its fossil fuel demand, remaining the largest net importer of energy in the world (Figure n°1). On top of that, an opposite phenomenon is affecting the Chinese renewable energy sector: the production of solar panels and wind turbines in the country outnumbers the capacity that can be accommodated by the domestic grid. Consequently, this overcapacity issue forces Chinese commercial actors to turn to overseas markets and ship out their products.

¹⁰ The "Frederick Hood Research Fund", in memory of Frederick Hood, supports research activities of Johns Hopkins SAIS students contributing towards research costs such as travel to conferences or the purchase of research publications.

¹¹ Conferences were targeting broad subjects such as "Rethinking universal access to energy in Africa" by Robert Armstrong (director of the MIT. Energy Initiative), "Shaping the future of energy in Africa" by Lawrence Jones (vice-president of the Edison Electric Institute), or "African energy projects: Sovereign guarantee or no sovereign guarantee?" with Musara Beta (Chief Market Analyst of the Southern African Power Pool).

Figure n°1. The twelve largest net importers of energy (unit: Mtoe). China is first by far.

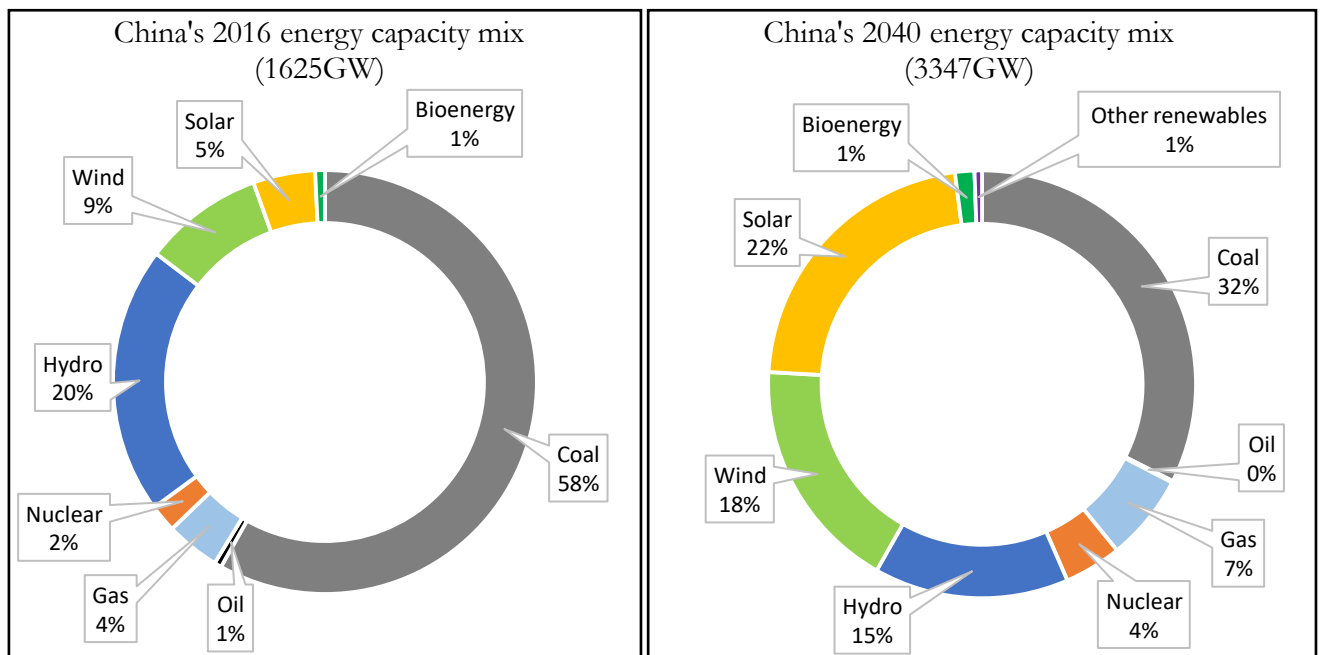


Source: Enerdata (2016)

1. China's energy dilemma: its green ambitions at the peril of galloping domestic demand

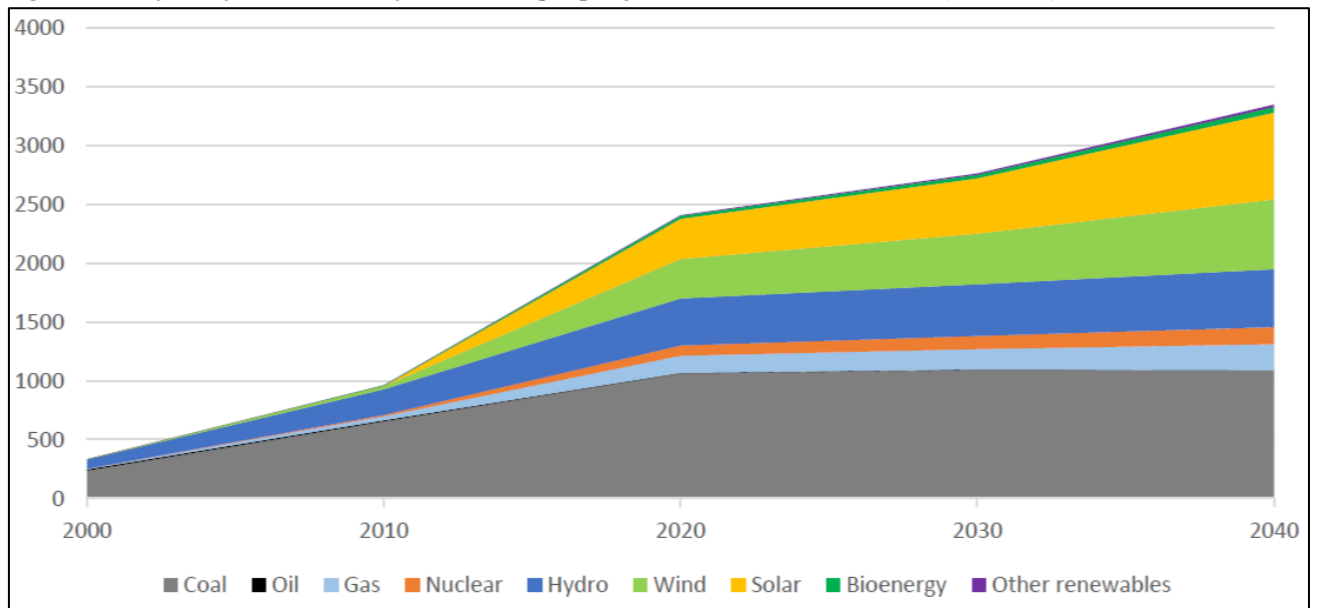
China faces colossal challenges to ensure its smooth economic and social development, particularly because it mainly generates electricity from coal power plants. Today, it is the world first emitter of greenhouse gas (9 billion tons of CO₂) – almost twice the level of emissions of the U.S. (5 billion tons of CO₂). It mainly results from a Chinese energy capacity mix which is dominated at 58% by coal (Figures n°2 and 3), with dangerous consequences on the environment and health, especially because of air pollution, but also because it has a strong negative impact on its international perception. It pressures China to switch away from coal dependency, whereas its consumption level of coal was strongly correlated to its economic growth (IEA 2017d).

Figure n°2. Projection for China's energy capacity transition between 2016 and 2040.



Source: author, based on the data from the NDRC and the IEA. (NDRC 2016c); (IEA 2017a)

Figure n°3. Projection for the evolution of China's energy capacity mix between 2000 and 2040 (unit: MW)



Source: author, based on the data from the NDRC and the IEA. (NDRC 2016c); (IEA 2017a)

Because of these gloomy repercussions, President Xi Jinping decided to announce a real shift in China's energy schemes for the future. On June 2014, he told in front of the Sixth Plenary meeting discussing the national energy security strategy that the country would follow five directions to implement a true "Energy Revolution" (Xinhua 2014):

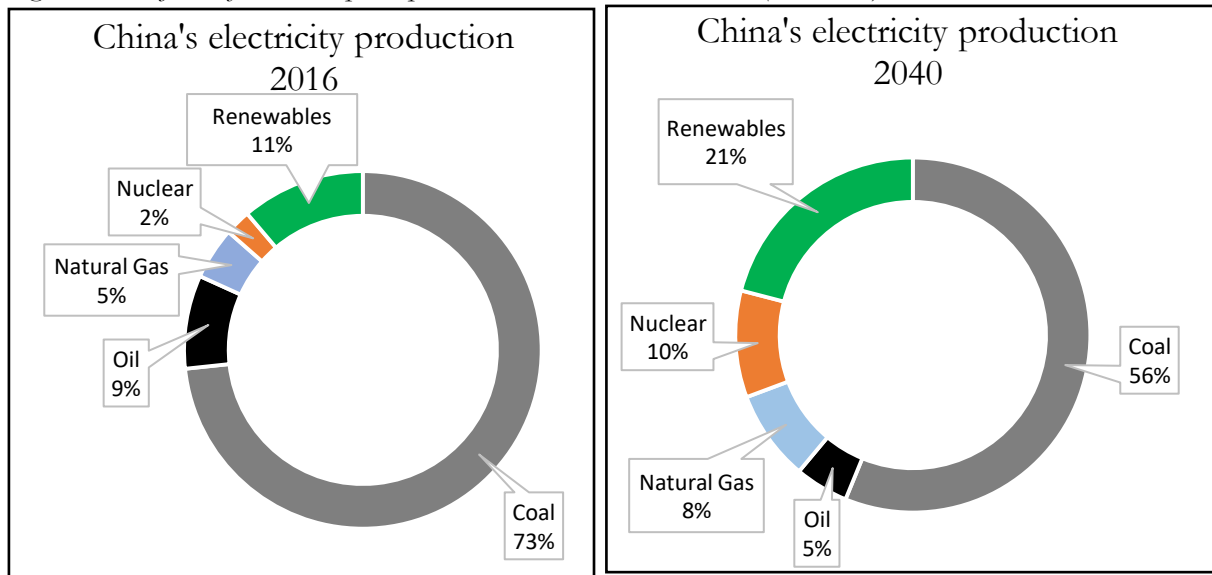
- **Promote the reasonable use of energy to limit unreasonable energy consumption.** It entails the reinforcement of the industrial and urban structure thanks to popular education and new infrastructures to ensure minimal energy losses in the transmission grid.
- **Reinvent the current energy supply to ensure the national energy security.** The government will support the domestic implementation of clean coal technologies such as Carbon Capture & Storage (CCS), the development of cogeneration systems to reuse the heat produced, and the addition of more energy capacity to the current energy mix.
- **Support Research and Development (R&D) initiatives in China.** The government will promote and value innovation in the technological, industrial, financial sectors. This is a key point in President Xi Jinping's strategy to promote modern means to achieve the clean economic growth of China.
- **Push structural reforms further to favor energy markets.** The need to introduce competition in energy markets will allow to reduce the cost of energy products, requiring the government to rethink its regulatory approach.
- **Reinforce international cooperation in every sector to achieve energy security.** The Belt & Road Initiative (BRI) project is in this regard a key element for China's global energy strategy. The BRI appears to be a monumental project that will also involve indirectly the development of African infrastructure thanks to Chinese investments in numerous African harbors, roads and railways, notably to connect the production sites to larger trade networks¹².

This announcement was the first step before the release of the Chinese Intended Nationally Determined Contributions (INDC) precisely one year later. The government committed to reduce its CO₂ emissions per unit of GDP in 2030 by 60-65% (taking its 2005 GDP as a threshold), while 20% of the national primary consumption would be covered by non-fossil fuel technologies. (Xinhua 2015a)

¹² Cf. **Appendix 1: China's BRI: Map of Chinese investments in SSA's railways, roads and harbors.**

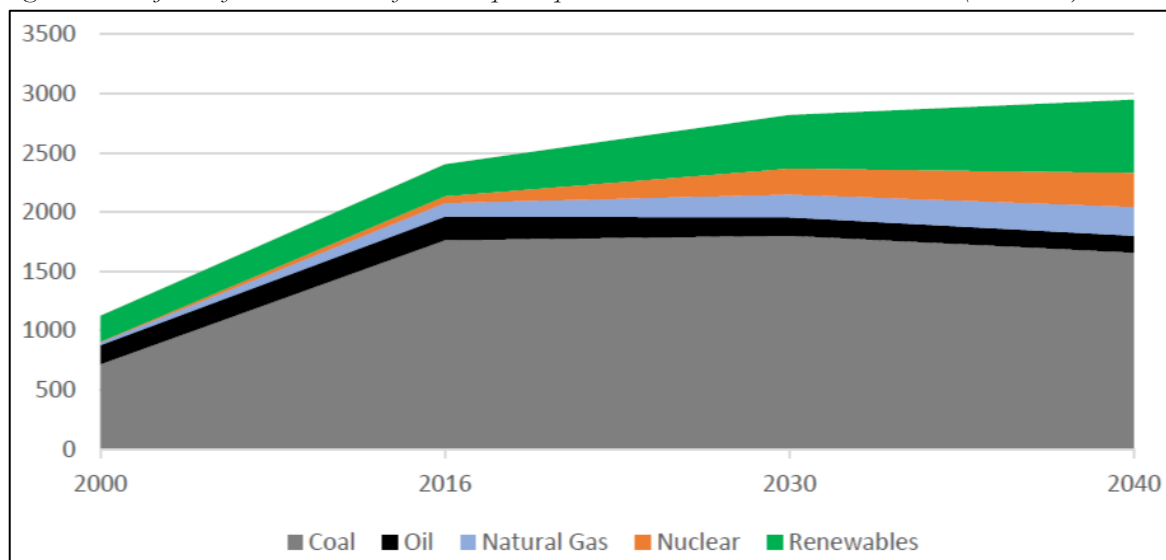
In terms of energy production, China's energy vision for 2040 does not show revolutionary changes if we compare with the current situation. The proportion of energy production obtained from fossil fuel generation (coal, oil and gas) remains relatively stable, decreasing from 87% to 79% of the total energy produced. The notable change comes from the increasing part of nuclear and renewable power production which will respectively represent 10% and 21% of China's energy production, while the percentage of electricity generated from coal- and oil-fired power plant should decrease respectively by 17% and 4% (Figures n°4 & 5).

Figure n°4. Projection for China's power production mix in 2016 and 2040 (unit: Mtoe).



Source: author, based on the data from the NDRC and the IEA. (NDRC 2016c); (IEA 2017a)

Figure n°5. Projection for the evolution of China's power production mix between 2016 and 2040 (unit: Mtoe).

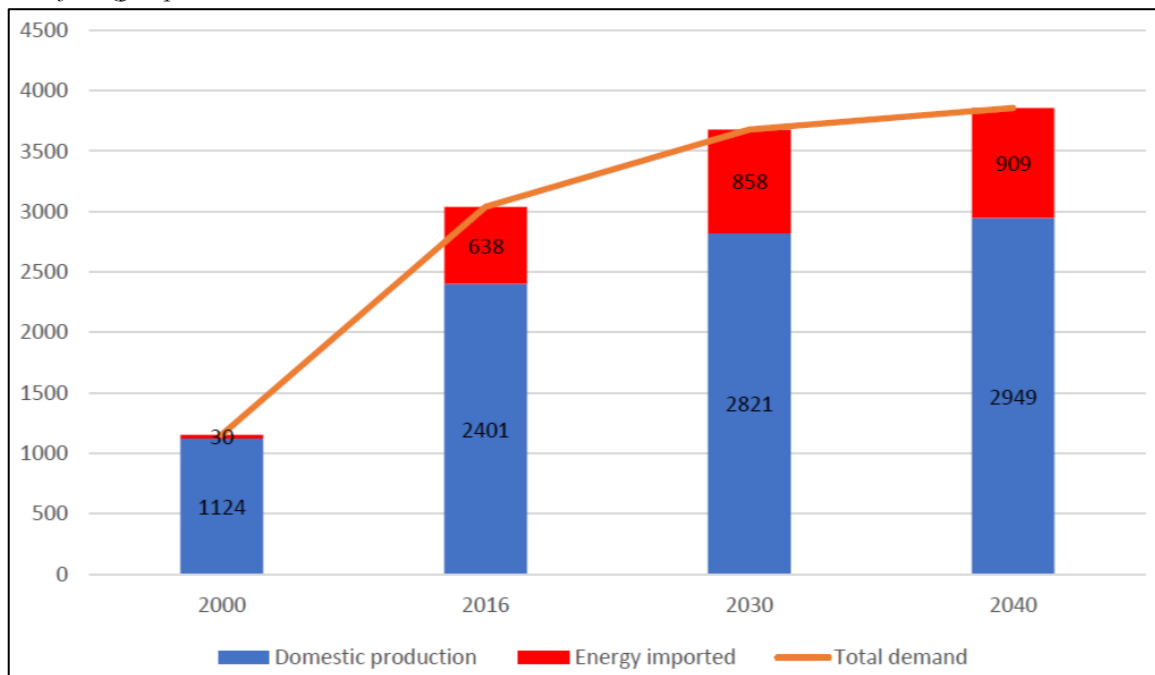


Source: author, based on the data from the NDRC and the IEA. (NDRC 2016c); (IEA 2017a)

Nonetheless, when looking at the overall evolution of the national energy capacity, one notes that apart from oil, every source of electricity production will increase by 2025: +53 Mtoe for coal (which then slowly decreases by 2040), +278 Mtoe for natural gas, +110 Mtoe for nuclear and renewables. This global increase in China's electricity capacity is necessary for the country as the national energy demand is rising sharply from 3 Btoe today to 3.9 Btoe in 2040.

Even if China will increase its domestic production tremendously thanks to investment in renewables and nuclear, that will not fit the high growth of the total electricity demand the country is facing. The part of energy that China must import should therefore increase over time from 21% (638 Mtoe) to 24% (909 Mtoe) of its total demand (Figure n°6), which explains why the country is looking for securing its long-term supply at the international scale. The decrease in coal imports will be partially compensated by the increase in oil and gas dependence: nearly one-third of the oil and a quarter of the natural gas exchanged worldwide will be intended for the Chinese economy.

Figure n°6. Evolution of China's energy demand and domestic production (unit: Mtoe).
While its domestic energy production is rising, China's energy demand is increasing even faster and will require higher levels of energy imports.



Source: author, based on the data from the NDRC and the IEA. (NDRC 2016c); (IEA 2017a)

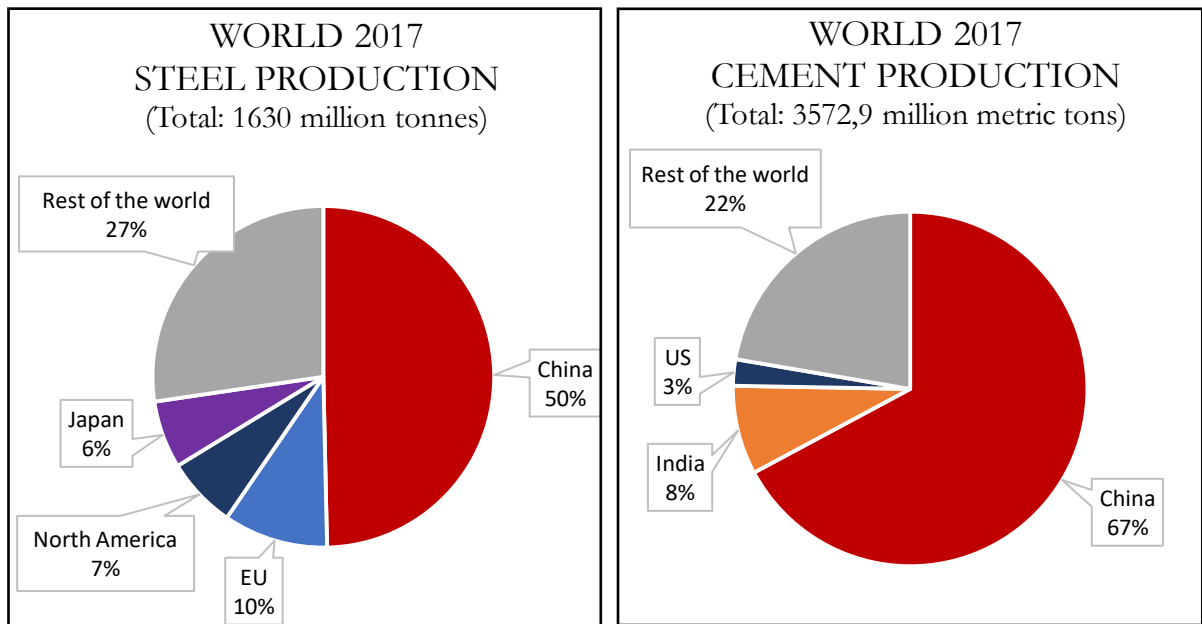
2. The historical driver of China's growth: the difficulty of phasing out coal

Coal is the premium choice for fueling heavy industries energy needs such as the cement and steel industries. China's astonishing and sustained growth has relied on the growth of its own industrial sector: in 2017, the country was responsible for 50% of the world steel production and 67% of the world cement production (Figure n°7). The national focus on the industry allowed China to increase its GDP nearly tenfold from US\$ 1.2 trillion in 2000 to US\$ 11.2 trillion in 2016.

Coal fueled the economic growth of China during decades, therefore triggering a debate about when China will reach its peak coal consumption¹³. From 1971 to 2000, China was producing less than 15% of the world output. Today, the picture has greatly changed as China represents nearly half (45%) of the world coal production. The Chinese energy mix gives a hint to understand the foundations of such increase. Numerous estimations consider that China will reach its peak coal demand between 2020 and 2040 (Wang, et al. 2013). However, other experts suggest that the country already reached it in 2014, given that the Chinese coal consumption decreased by 2.9% in 2014 and 3.6% in 2015 while the Chinese GDP kept increasing (Qi, et al. 2016).

¹³ The notion of "peak" refers to a point in time at which production and/or consumption reaches its maximum.

Figure n°7. China produced half of the world steel and two-third of the world cement in 2017.



Source: author, based on the data from the WSA and Statista. (World Steel Association 2017); (Statista 2018).

What is more, China started to evoke the need to cut down greenhouse gas emissions in 2006. The 11th Five-Year Plan targeted a 20% reduction in energy intensity, and 10% decrease in sulfur dioxide (SO₂) emissions (NDRC 2006), adding nitrogen oxide (NO_x) and ammonia (NH₃) five years later (NDRC 2011). What is more, the Chinese government imposed to several provinces to reduce their coal consumption by 83 million tons between 2012 and 2017. It concerned the manufacturing centers of China (Beijing, Hebei, Tianjin and Shandong). Consequently, the coal industry had to start thinking about a serious shift in its functioning: “Today, it takes 320 grams of coal to provide one kilowatt hour of electricity, compared with (...) 412 grams 20 years ago” (Qi, et al. 2016).

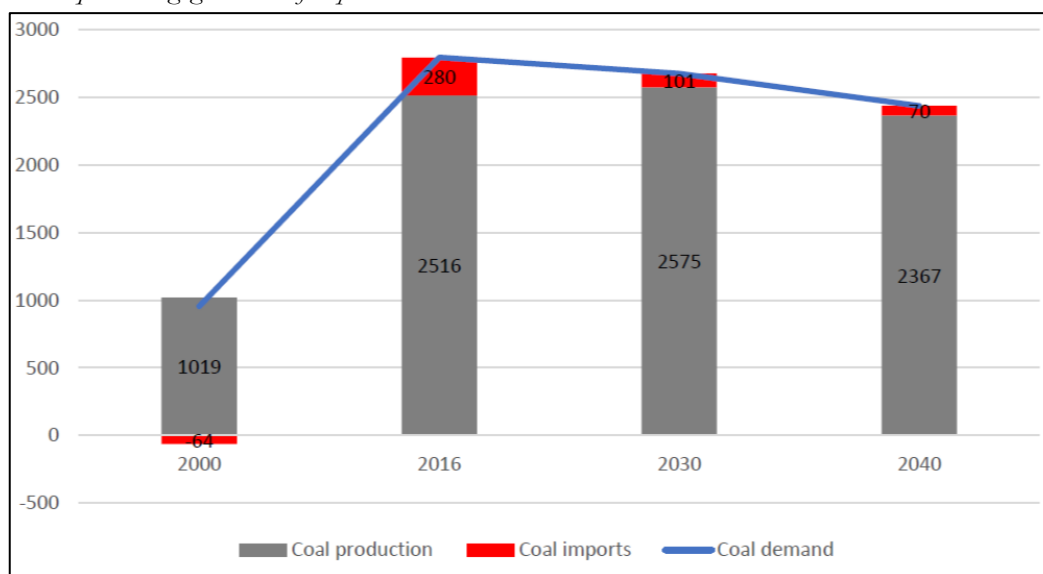
In its 13th Five-Year Plan, the Chinese government emphasized on the need to shift the economy further away from heavy industries for a service-based industry (NDRC 2016a). The government made tremendous change in its policies to reduce the energy intensity of its industry: according to the final assessment of the 12th Five-Year Plan, China’s cement sector enhanced its technology to reduce its energy intensity by 50% and that of the steel sector by 33%, due in part by energy efficiency regulations which targets more than three-quarter of the industrial energy demand (NDRC 2011). The 13th Five-Year Plan was a preliminary to the “Made in China 2025”¹⁴ (PRC State Council 2015) and the Energy Production and Consumption Revolution Strategy (NDRC 2016c) to build the path toward a fully energy efficient industrial sector. The main goal is to reduce the energy demand for each industry by 10% per unit of value added in 2020.

In some extent, China is now experiencing a post-coal growth because of two major tendencies: a lower growth in the manufacturing and construction industries, and more stringent legislation on pollution. On the one hand, between 1991 and 2010, the two sectors grew by 12.6% on average, but since the financial crisis that led to an important decrease in exports and the increase in Chinese labor cost, this growth went down by 8%. Considering that these two energy-intensive sectors represented 80% of coal consumption between 1991 and 2010, this decrease explains the significant impact on the Chinese energy demand (Du 2015).

¹⁴ The “Made in China 2025” is a strategy that aims at improving the energy efficiency in the manufacturing sector and push these companies to be competitive at the international level. These two axes should foster China’s economic growth.

Be that as it may, the Chinese energy demand is increasing faster than the growth in China's overall domestic energy production. This phenomenon requires from China to rely on every type of resources, including coal whose production will increase until 2030 (Figure n°8). This is where an issue appears for China: it will require new investment in current domestic coal mines to sustain the production. According to the IEA, it will require from China colossal level of investments (US\$ 380 billion) in new coal mines (40%) and existing ones (60%) (IEA 2017b). Indeed, while the country aims at reducing its domestic coal production, it needs more coal until 2030. However, China's coal imports should remain small, representing approximately 5-10% of the total coal demand. The part of coal imports could increase if the coal domestically produced becomes more expensive than coal from abroad, which is likely to happen.

Figure n°8. Evolution of China's coal demand and imports (unit: Mtce). China's coal demand will decrease over time, but it will still require a negligible level of imports.



Source: author, based on the data from the NDRC and the IEA. (NDRC 2016c); (IEA 2017a)

3. The oil gap: China's increasing dependence on foreign wells

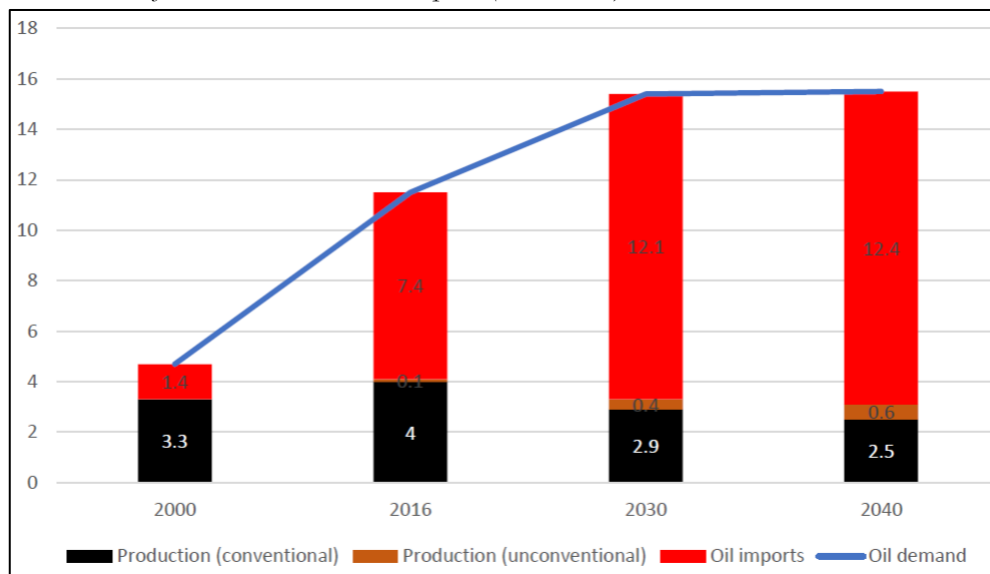
China's oil market is the story of a triad of NOCs which are responsible for the production of nine out of ten barrels for the Chinese economy: China National Petroleum Corporation (CNPC), China Petroleum and Chemicals Corporation (Sinopec) and China National Offshore Oil Cooperation (CNOOC). The country is the 7th oil producer worldwide but its oil industry is going through a severe decline due to the decrease in oil prices. As a result, China's NOCs cut their investment by 7% in 2016, while many of the oil wells currently exploited are more than thirty-year-old, leading to a slow reduction of their output (Meidan 2016).

The Chinese government evaluated the level of recoverable oil resources on its territory at roughly 115 billion barrels, among which 45.5 billion barrels from onshore wells, 32.2 billion from tight oil 11.4 billion from offshore resources and 21.9 billion from natural gas liquids (NDRC 2016c). As for now, the major part of China's oil production (around 4 billion barrels) comes from its onshore resources, due to how expensive it is today to develop the untapped resources in China. Consequently, the projections reveal a continuous decrease in domestic production from 4 today down to 3.1 million barrels in 2040.

Besides, building new projects in the Chinese oil sector became difficult in such context, and new opportunities may not arise apart from enhanced oil recovery technique¹⁵ (EOR) and a boost in coal-to-liquids¹⁶ (CTL) power plants. On the one hand, Chinese companies rely on their experience in EOR techniques (based on the injection of carbon dioxide) and are increasingly using them in current large oil fields where EOR results can be maximized such as Daqing¹⁷ (Renqing 2013). On the other hand, CTL was included in the 13th Five-Year Plan which aims at producing 300,000 barrels per day from CTL installations by 2040. It would represent 10% of the 2040 oil production of China, compensating the decrease in productivity from old onshore wells.

Nonetheless, the gap between China's domestic oil demand and its domestic oil production levels will increase: in 2016, the demand reached 11.5 Mb/d for a domestic oil production of 4 Mb/d, resulting in a 65% reliance on imports. In 2040, the demand is expected to increase to 15.5 Mb/d while the oil domestically produced will decrease at 3.1 Mb/d, meaning that China will rely at 80% on oil imports (Figure n°9). It will therefore require higher expenditures from the Chinese government to fit its oil demand, from US\$ 110 billion in 2016 to US\$ 460 in 2040.

Figure n°9. Evolution of China's oil demand and imports (unit: Mb/d).



Source: author, based on the data from the NDRC and the IEA. (NDRC 2016c); (IEA 2017a)

This is a crucial point for the Chinese government because it is relying mainly on foreign sources concentrated in the Middle East and Africa: both regions added account for 64% of China's oil imports (Figure n°10), which means that more than three quarter of China's oil imports must go through the Strait of Malacca. It raises high security concerns for the country, that is why China engaged in a fourfold strategy to decrease the risks.

First, China invested US\$ 270 billion in foreign assets to secure the production of oil, one third of which take the shape of loans that must be repaid with barrels of oil (Clover 2013). Another axis of China's strategy is to create national stocks of oil through the Mid-Long-Term Plan of National Oil Stocks (NDRC 2016b). As oil prices were low, China built its stocks to reach 245 million barrels in 2016¹⁸,

¹⁵ EOR is used to increase the oil that can be recovered from wells which are decreasing in terms of productivity. Injecting water and gas such as CO₂ increase the pressure inside the well and increase the total output generated.

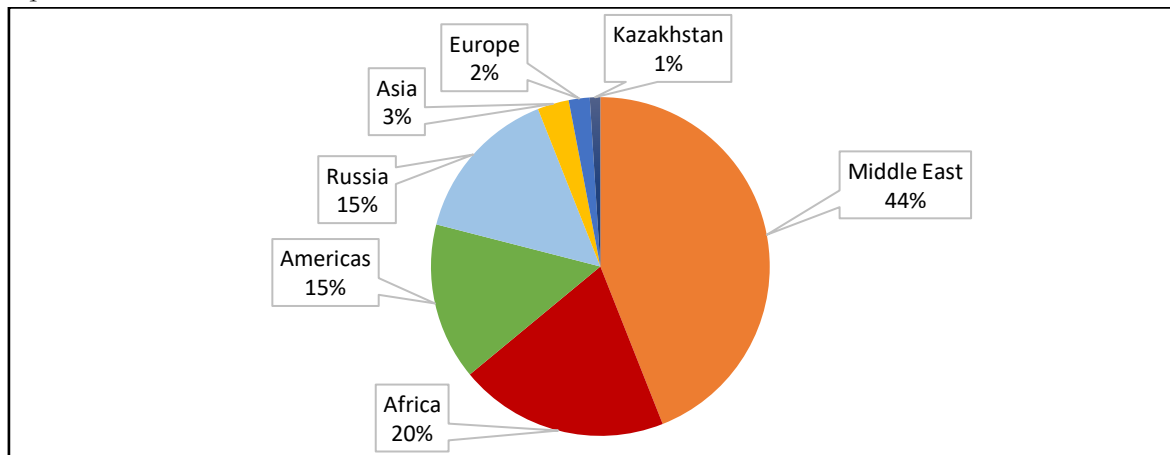
¹⁶ CTL power plants transforms coal into chemical products such as oil.

¹⁷ The Daqing oil field is located in Heilongjiang province (between the North Korean and Russian borders).

¹⁸ This number is unsure because China is not releasing data on its oil stocks. For instance, Reuters considers that China would have built a 600 million barrels oil stock to compensate 90 days of imports (Rose 2015).

which can compensate one month of imports and help the country react to potential interruption in the supply (Seth 2015).

Figure n°10. China's oil imports by origin in 2016. The Middle East and Africa account for two-third of China's oil imports.



Source: author (Excel), based on the data from the NDRC. (NDRC 2016c)

The BRI is also one of the most important projects happening worldwide and will play a prominent role in China's oil needs. The government is increasing its relationships with its neighbors, namely Kazakhstan – roughly 400,000 oil barrels per day through the pipeline – and Russia – around 800,000 oil barrels per day delivered through the East Siberian-Pacific Ocean pipeline^{19/20}. Finally, China also diverted a part of its oil trade routes going through the strait of Malacca thanks to the pipeline from Myanmar (Bengal Bay) to China (Yunnan province) which can deliver 440,000 barrels per day²¹. It partially speeded up the shipment of oil from Africa and the Middle East, while it also reduces the risk present in the Strait of Malacca.

4. The surge of gas demand: a growing challenge for China's future

China is the 6th producer of natural gas worldwide, and nearly three-quarter of its production was conventional gas in 2016 - 98 billion cubic meters (bcm) of natural gas and 38 bcm of unconventional gas. The situation will change tremendously by 2040 as unconventional gas will boom in the Chinese production and overtake the conventional production – 110 bcm of conventional produced for 226 bcm of unconventional gas (Figure n°11).

The natural gas demand in China will be nearly three times higher in 2040 (610 bcm) than in 2016 (210 bcm). The country benefits from large reserves which are assumed to reach 50 tcm, with 32 tcm²² being shale gas (e.g., Sichuan and Tarim Basins), 9 tcm of coalbed methane (e.g. Junggar, Ordos and Sichuan basins) and 3 tcm of tight gas²³ (e.g., Ordos and Sichuan province). The IEA estimates that China possesses 15% of the world shale gas resources, which means it would have the largest reserves of unconventional gas in the world (IEA 2017b).

¹⁹ Cf. **Appendix 2**: Map of the BRI and the expansion of China's pipelines with its neighbors.

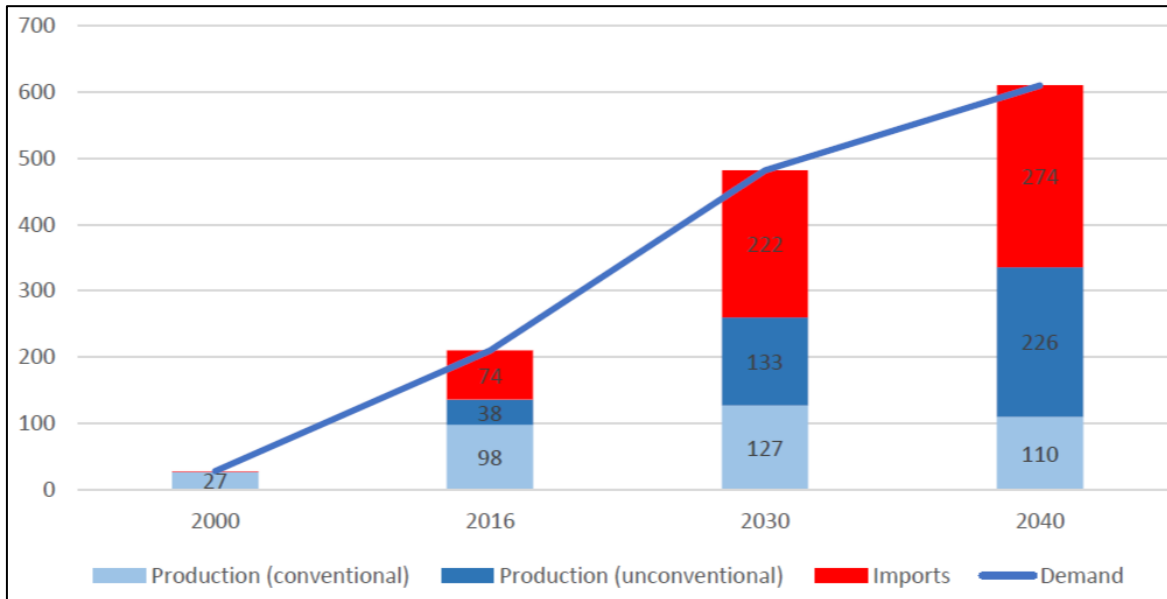
²⁰ Cf. **Appendix 3**: Map of the BRI and Chinese investments overseas.

²¹ Cf. **Appendix 2**: Map of the BRI and the expansion of China's pipelines with its neighbors.

²² Current estimates may rise in the future with new discoveries and technological advancement.

²³ China considers that tight gas is a conventional gas resource in its official documents.

Figure n°11. Evolution of China's natural gas demand and imports (unit: bcm). By 2040, China is expected to rely on 40-50% foreign supply of gas.



Source: author (Excel), based on the data from the NDRC and the IEA. (NDRC 2016c); (IEA 2017a)

However, the projections show that the Chinese production will not be able to fit entirely the domestic demand for natural gas. The gap is projected to be multiplied by four between today and 2040, from 74 to 274 bcm: almost half of the demand will have to be met through gas imports. China is therefore reinforcing its pipeline networks with its neighbors such as Russia (the “Power of Siberia” should be commissioned short after 2020 and increase the supply to the northern part of the Chinese territory), Turkmenistan (with pipelines A, B, C and line D which is at the development stage) and Myanmar supplying the southern provinces of China²⁴. The Liquefied Natural Gas (LNG) market is also a promising opportunity for China: the national capacity including the regasification terminals under construction reaches 90 bcm for 23 terminals. The LNG industry anticipates China to import more LNG than the Japanese economy by 2040 (Reuters 2018).

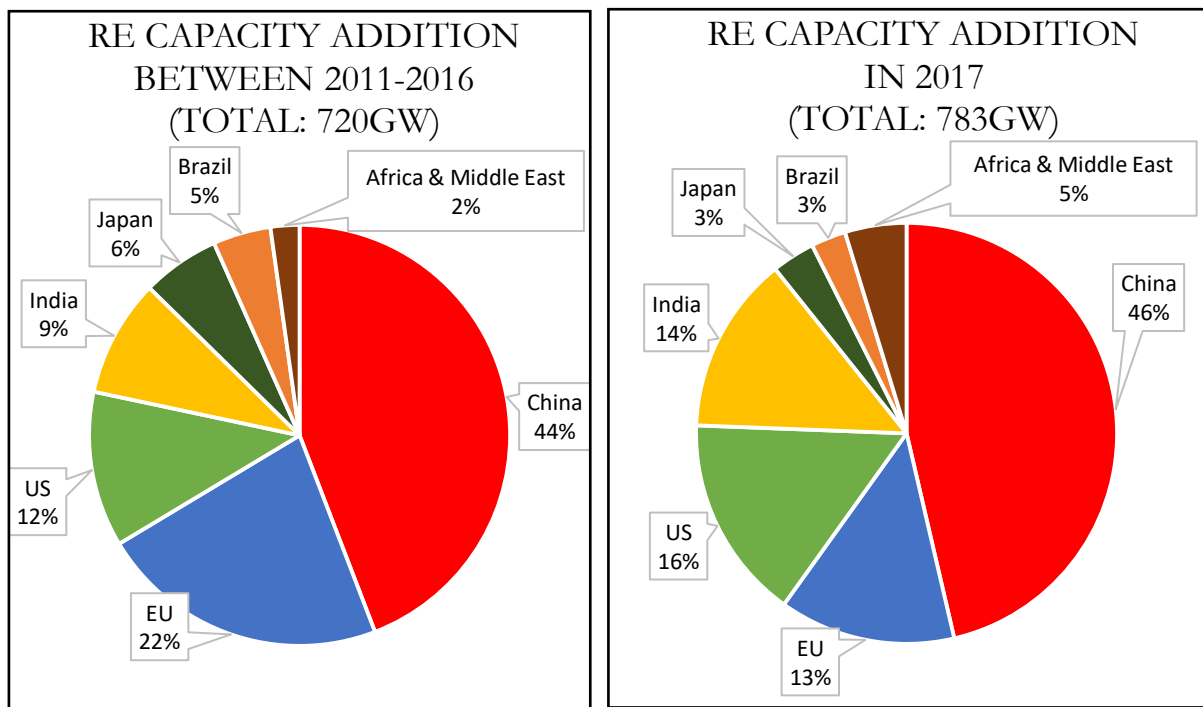
5. The problematic dynamism of the Chinese renewable energy industry: the constraints of overcapacity

The revolution in China's energy capacity mix will come from the surge of renewable energy that will lead low-carbon technologies (hydropower, wind, solar photovoltaic (PV) and other renewables) to overtake the proportion of electricity generated from fossil fuels. From 2025 onwards, they will represent nearly 57% of the capacity in China, among which one-third is solar and wind (Figure n°12).

Solar and wind technologies will grow at an average of 30 GW per year, which should allow China to increase its wind capacity fourfold (from 149 GW in 2016 to 593 GW in 2040) and its solar capacity more than tenfold (from 77 GW in 2016 to 738 GW in 2040). China's hydropower capacity will also continue to grow in a lesser extent, from 332 GW in 2016 to 493 GW in 2040. That makes China the biggest renewable energy market on the world stage, with a total added renewable energy capacity of 318 GW (44%) between 2011 and 2016 and 363 GW in 2017 (46%).

²⁴ Cf. Appendix 2: Map of the BRI and the expansion of China's pipelines with its neighbors.

Figure n°12. China accounts for nearly half of the renewable energy capacity addition worldwide.



Source: author (Excel), based on the data from the IEA. (IEA 2017c)

Even if China made climate transition one of the cornerstone of its national and international policy, it is only recently that it became the case (the impetus can be said to be the COP 21 in 2015 where China committed to reduce the level of its carbon emissions). Consequently, it cannot fully explain the earlier boom in the national production of renewable energy technologies in China.

There were two main goals: first, to ensure the security of its energy supply to meet the growing energy demand, and second, to create a solid industry which would become competitive on the international arena (Mathews 2015). Nevertheless, international markets reacted harshly to China's export capacity which led the country to face an overcapacity issue and constrain Chinese commercial actors to find new market overseas to sell their products. The Chinese wind and solar industry are particularly interesting as they exemplify the modernization of a "forced" going out strategy for the national renewable energy industry.

A. The Chinese wind industry and the State impetus.

By looking closer to the added capacity due to the Chinese wind industry on the national territory, China multiplied its wind capacity by more than sixty between 2006 and 2017, starting from merely 2.6 GW wind capacity to reach 188 GW in 2017. If one considers the global industry in 2017, China accounted for 37% of the 52 GW wind turbines newly installed, while it represented 35% of the world's wind installed capacity (GWEC 2017).

The Chinese wind industry is pushed by the State, notably for dealing with global competitors and accelerating technology transfers. The State used numerous tools to achieve this strategy such as tax redistribution to remunerate and incentivize technological upgrades or cash subsidies to deliver wind turbines with capacity surpassing 1 MW (Lewis 2013). State protectionism was also important to regulate the national market: for instance, between 2005 and 2010, the NDRC required that over 70% of the turbines installed domestically should come from a local (Chinese) producer. That explains the rise of Chinese wind leaders like Goldwind or Sinovel.

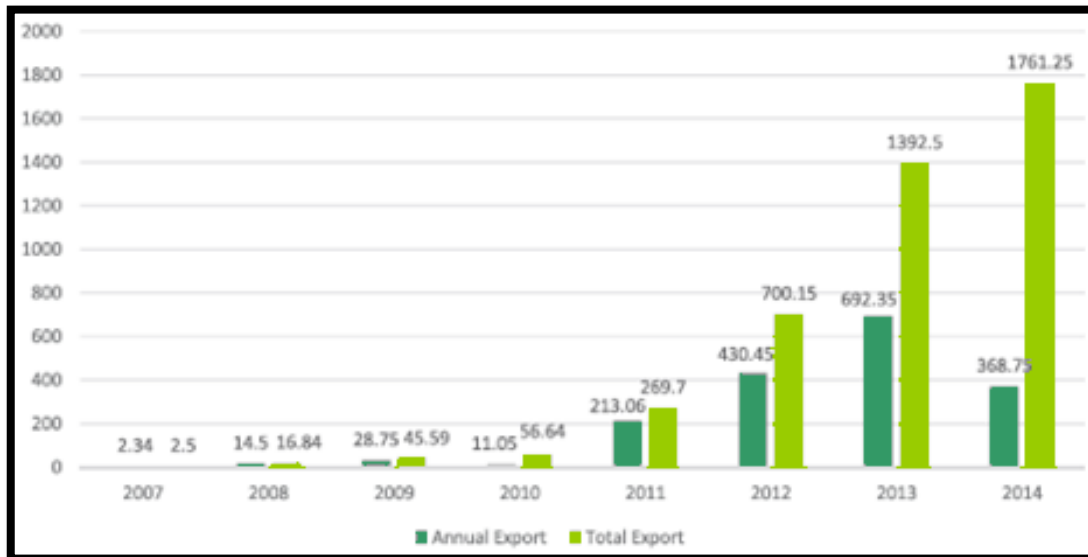
Nevertheless, this extreme growth brings also its lot of issues, implying a stronger involvement of the NDRC to control and restrict the wind industry. The Chinese companies in charge of the grid network have difficulties to follow suit as they must use and remunerate the whole energy produced from these wind farms, and because they must adapt their systems to the intermittency of such type of energy (Li 2012).

In addition, regional officials are now less interested in helping the development of wind farms as the experience showed the difficulty to secure profitable cash flows for tax revenues and ensure the smooth development of regional economic activities. It led to a transition from the production of wind turbines used for adding more power capacity to a system where local government prefer to create jobs by focusing on the manufacturing and improvement of wind technologies (Yang, et al. 2017).

The outcome of that switch toward manufacturing was that the production of wind technologies exceeded the needs of the domestic demand, leading China to face an oversupply of products. From 2012 onwards, the NDRC restricted the ability to build supplementary facilities if the national power grid would not fit the added capacity (NDRC 2012). The Chinese newly installed wind capacity has been curtailed by the inability of China’s various transmission grid companies to incorporate intermittent and variable sources into a grid that has otherwise been dependent upon coal-fired power and hydroelectricity. Consequently, curtailment levels reached 42% in 2015 in some provinces (Wei 2016).

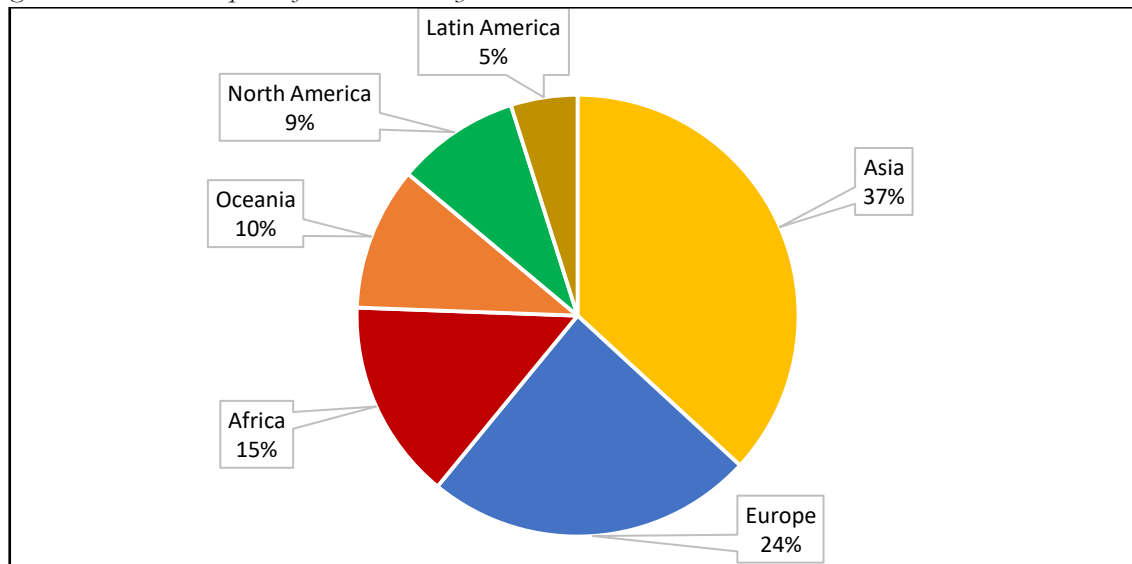
The saturation of the Chinese market and the new legal restrictions emitted by the NDRC explain why Chinese companies started to expand their horizons toward foreign markets. Data show that Chinese companies were merely exporting turbines for less than US\$ 2.5 million. Six years later, 27 partnered countries were in the loop, with a staggering growth between 2011 and 2013 which increase threefold from US\$ 270 million to US\$ 1.4 billion (Figures n°13 and 14).

Figure n°13. Chinese exports of wind turbines grew steadily since 2010 (unit: US\$ million).



Source: China Wind Energy Association – Report 2015. (Wei 2017a)

Figure n°14. China's exports of wind turbines by destination in 2015.



Source: author, based on data from the China Wind Energy Association. (CWEA 2015)

Such involvement in the global market of wind technologies implied important changes. Chinese wind companies benefit from a model that allows them to rely on solid cooperation to create a “*modular supply chain*” offering highly competitive gains in terms of cost and pace of production. Another advantage when compared to Western companies is the relative flexibility of Chinese companies to provide supplier financing (e.g., deferred payments) to their customers:

“Chinese wind turbine makers can draw on a modular supply chain, which provides considerable advantages in terms of cost and speed. Realizing this potential requires a coordination power that Chinese firms have begun to demonstrate both in the domestic and external market. (...) Chinese government support for the industry is not hampered by financial austerity, and Chinese firms can provide supplier credit to their customers to an extent that Western firms cannot match.” (Lema 2013)

B. The Chinese solar industry: the forced conquest of overseas market.

While the Chinese wind sector first focused on the domestic market, the solar sector is much more inclined toward the overseas. The current dominant Chinese solar companies (Trina Solar, JinkoSolar, JA Solar, etc.) benefitted from a Golden era of the European market at the beginning of the 2000's when countries like Spain or Germany opted for feed-in tariffs which triggered a surge in solar investments.

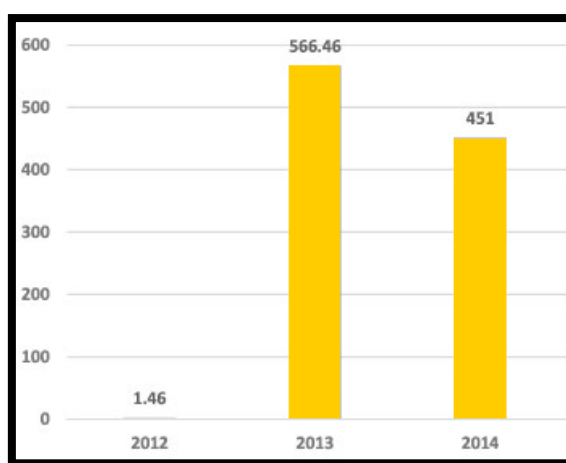
Even before 2012, 95% of solar equipment produced in China was delivered to foreign markets (CREIA 2015). As a consequence, the Chinese solar sector is dependent on global trends and therefore more sensitive to any change in the world demand. That was the case starting from 2010 when EU went through severe policy change by reducing the level of subsidies for the development of the solar sector. Such cut halved exports to Europe in 2013 (CREIA 2015).

Added to that phenomenon, the EU and the U.S. started to act against Chinese solar companies of further protectionist decisions because of anti-dumping accusations. Chinese producers suffered from these choices, resulting in many bankruptcies in 2012 and 2013. It is noteworthy that even Suntech, which was then the most influential PV manufacturer of the Chinese market, simply shut down (Hook 2013).

The Chinese government chose to counteract these events by spurring incentives to expand the outlet of the solar industry in the domestic market (Lewis 2014). Consequently, China went through a remarkable increase in solar investment at the domestic level which was efficient enough for the Chinese solar capacity to increase by 15 GW in 2015 (Xinhua 2016).

It helped the country to become today the global leader in solar deployment, however, China’s domestic market is not wide enough to tap the entire production of its industry: less than half of the products can be accommodated by the domestic demand. Therefore, because of the limited capacity of the domestic market and the protectionist measures taken by the EU and the US, Chinese solar producers are compelled to find new market overseas in emerging countries such as Africa. Consequently, in 2012 and 2013 one could see a surge in Chinese solar exports to African countries increasing from US\$ 1.5 million to reach US\$ 566 million (Figure n°15).

Figure n°15. Chinese PV industry exported massively to Africa after the 2013 trade dispute with the EU (unit: US\$ million).



Source: China Customs and China PV Industry Association – Report 2015 (Wei 2017a)

The Middle Kingdom’s domestic renewable energy market is saturated since it has faced fierce competition from Western competitors due to high anti-dumping custom duties against Chinese solar PV enforced since 2013²⁵. Before 2010, over 80% of Chinese PV exports were for the European market, but by 2016 this had dropped to around 11%. Similarly, Chinese PV exports to the U.S. also have dropped to around 11 percent in 2016 (Zhang 2014). That is why Chinese companies started to export massively their products to the African continent all along the value chain to compensate the imbalance with the EU (Figure n°15).

* *
*

China’s energy policy and projections reveal that the country is a thirsty dragon with numerous shackles: “Thirsty” because its energy demand is ceaselessly growing and will do so at least until 2040; “With shackles” because China cannot rely merely on its domestic production for its fossil fuel requirements, and because the production levels of its renewable energy industry are so high that the government must curtail their growth as the national grid cannot accommodate such output. This dual issue – required imports and problematic overcapacity – led China to turn toward overseas markets in what is usually called its “going out” strategy. In this great scheme, SSA is the region where the impact of China is prevalent. Chapter 2 will therefore shed light upon the Chinese system for investing in SSA energy projects.

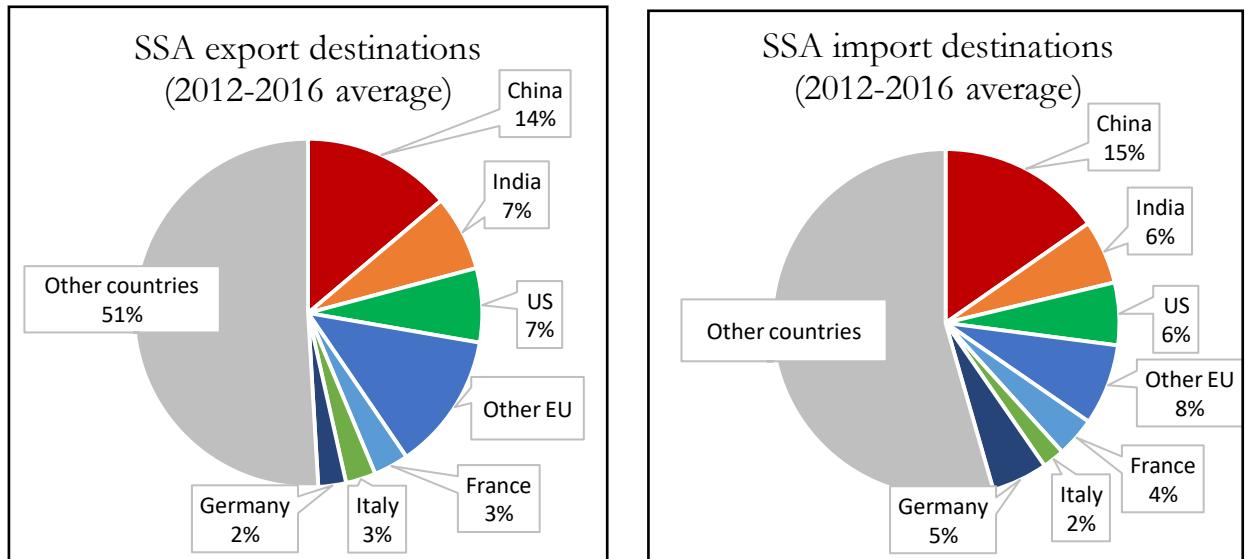
²⁵ The EU decided in September 2017 to lower gradually the anti-dumping custom duties. Duties could reach 64.9% when Chinese companies were selling their solar PV under the minimum price (Reuters 2017a).

CHAPTER 2. THE LION'S SHARE: THE TREMENDOUS INPUT OF CHINESE ENERGY INVESTMENT IN SSA.

1. The significance of China's involvement in SSA

Since 2009, China became the first commercial partner of SSA for exports as well as imports (Figure n°16) and today it is the first economic partner by far with ten thousand Chinese companies operating on the continent: Chinese investments represent nearly three times the amount dedicated by India and France (Figure n°17) which are the second and third largest economic partners of the continent (McKinsey 2017).

Figure n°16. Share of export and import partners for several SSA countries.



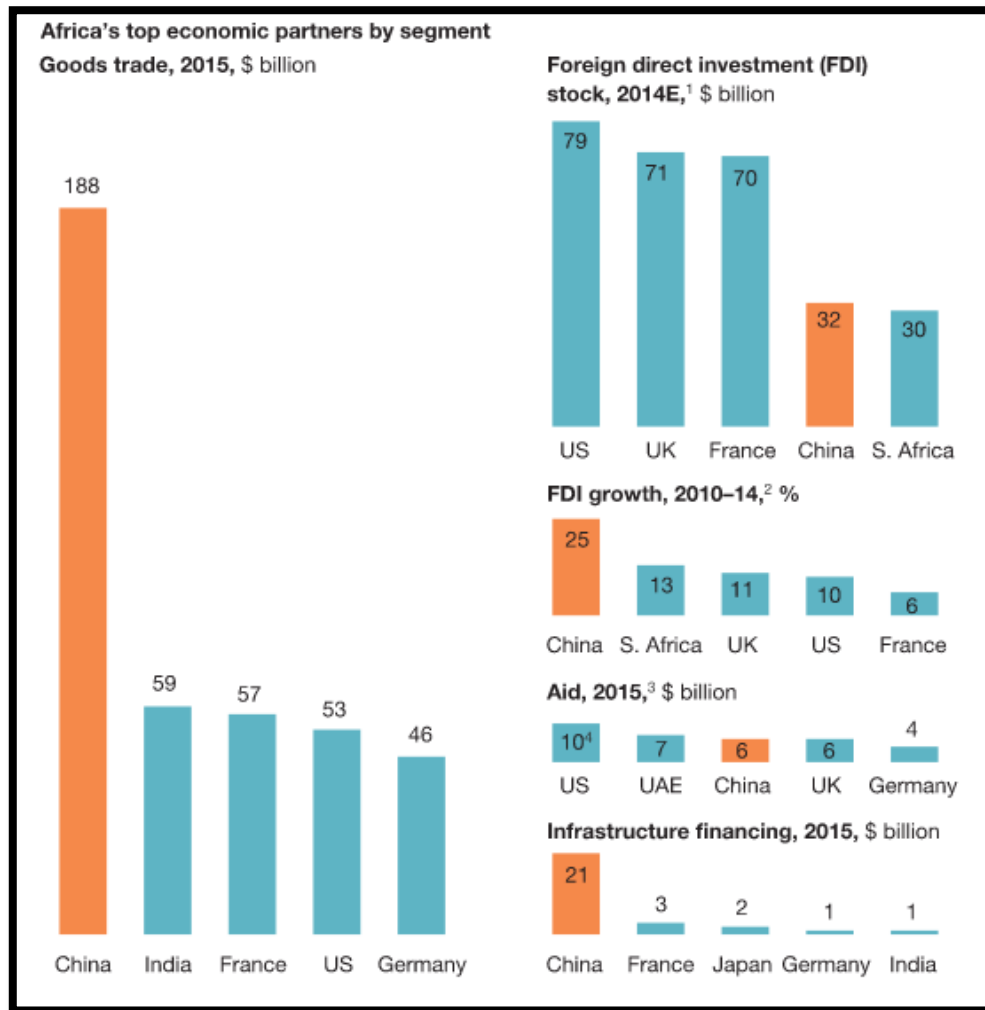
Source: author (Excel), based on data from the WBG's World Trade Integrated Solution (WTIS)²⁶.

The story of China and its relationship with the African continent is highly complex as it intertwines numerous dimensions whether they are economic, diplomatic or related to military affairs. The number of sub-Saharan Africans living without electricity is reaching 635 million people nowadays. In a region populated by 1.05 billion individuals²⁷, this is an outstanding 60.5% of citizens who do not benefit from the access to electricity or facing recurrent shortages of power supply. The region's GDP growth is among the highest in the world averaging 4-5% (IMF 2017), however, the lack of power capacity seriously impedes the further economic development of their countries and the reduction of extreme poverty. According to the IEA, it could entail dire consequences for a region where the power demand is expected to require 1,300 TWh, or an additional 385 GW in power capacity, in the next twenty years (IEA 2014).

²⁶ Methodology: We took an average of the level of exports (A) and imports (B) for a five-year period (2012-2016).

²⁷ World Population Review data: <http://worldpopulationreview.com/continents/sub-sabaran-africa-population/>

Figure n°17. Overview of Africa's top partner in trade, FDI, aid and infrastructure financing.



Source: (McKinsey 2017)

African countries require vast amount of financing to develop their infrastructures, energy systems and commercial markets. At the same time, they benefit from an interesting stock of resources: 7.5% of the world's proven reserves of oil (128 billion barrels) and gas (86.8 billion of oil equivalent) in 2017 which are expected to increase by 74% by 2050 (PwC 2017), while there is a tremendous potential for the development of renewable energy technologies. As China is diversifying its sources of energy imports and exports, and possesses a high capacity for financing projects, both parties can benefit from each other through cooperation.

2. China's economic and financial decision-making for investing in SSA: the birth of Chinese ODA from the competition between institutions

China has its own approach to cooperate with Africa, combining development assistance, trade and investment. The implication of China in SSA's energy sector is usually summarized by the "Angola Model" in which China finances infrastructures in exchange for resources and are often called by the Chinese counterpart as mutual beneficial loans ("互惠贷款", hùhuì dàikuǎn), the basis for a "win-win cooperation". It is generally offered for countries suffering from low credit ratings²⁸: as it is difficult for such countries to benefit from international funding, China offers a solid source of funding with less

²⁸ Cf. Appendix 4: List of Chinese resource-backed loans in Africa 2000-2014 (CARI).

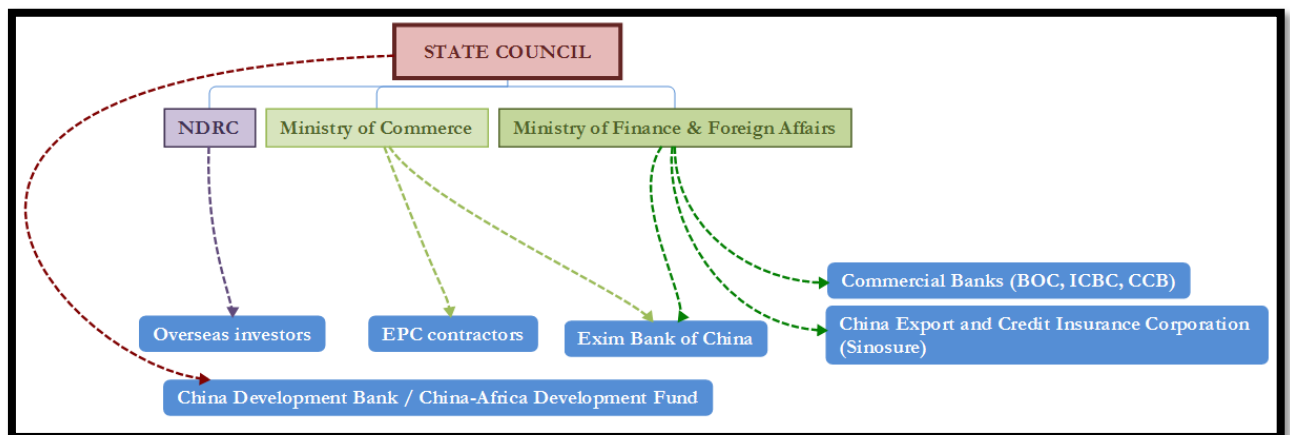
conditional clauses than international institutions²⁹. This model brings a twofold benefit for China, in that it secures the supply for its energy-hungry economy, while also allowing privileged access to Chinese SOEs.

“Almost half³⁰ of the energy projects financed by Chinese development banks are commodity-backed whereby a portion of the loan is repaid in the form of a collateral” (Gallagher, et al. 2016)

From 2000 to 2014, China contracted numerous commercial loans to countries in Africa and their affiliated national companies for a total of US\$ 86 billion, and Xi Jinping promised another US\$ 60 billion during the 2015 FOCAC (Brautigam 2016). According to Brookings’ release of the Foresight Africa 2018, China represents 14% of SSA debt which means it is the largest creditor to the continent. For instance, the proportion of Chinese loans contracted to the Kenyan government is six times larger than the amount contracted by France, the second largest creditor to the country (Brookings 2018).

Numerous institutions are involved in the governance of China’s investments in SSA (Figure n°18). On the one hand, the State Council – chief administrative authority of the PRC – is supervising the work of its different agencies, but it also controls the China-Africa Development Fund (CADF) and the China Development Bank (CDB). On the other hand, the NDRC is assigned the role of supporting and regulating overseas investment, while the Chinese Ministry of Commerce (MOFCOM) approves overseas foreign direct investment. Finally, the Ministry of Finance oversees various development agencies such as Sinosure, China’s Export-Import (Exim) Bank and the national commercial banks.

Figure n°18. Map of Chinese actors involved in energy investments in SSA. The arrows indicate a relationship of authority.



Source: author (XMind), based on the data from (Wei 2017a).

Each institution and agency possess a specific role clearly defined, and the entire system provided a total of US\$ 86.3 billion Official Development Aid (ODA) to the African continent between 2000 and 2014 (Figures n°19) (Brautigam 2016):

- **MOFCOM:** the institution is responsible of Foreign Aid allocations and manages projects which are financed through grants and zero-interest loans. It also overlooks China’s Exim Bank’s concessional loans.
- **China’s Exim Bank:** it finances large-sale substantial exports or Engineering, Procurement and Construction (EPC) contracts of Chinese corporation. It can take four shapes: letters of guarantee for Chinese companies, export seller’s credits, export buyer’s credits and concessional

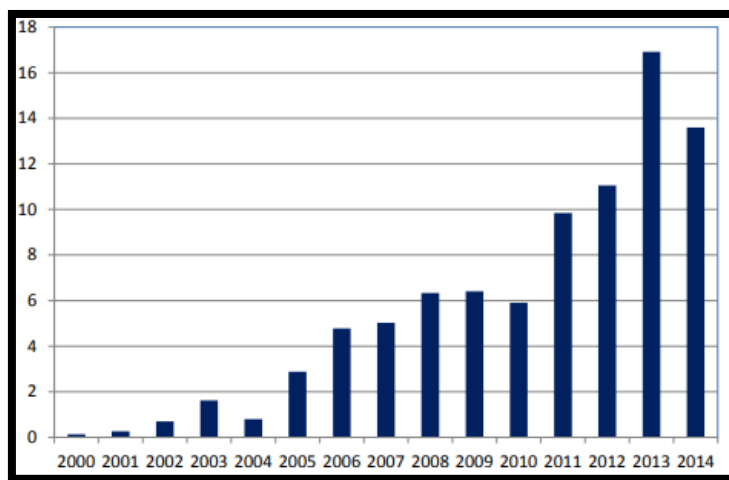
²⁹ Apart from the tacit respect of the One-China policy thereby the African government should consider PRC’s government as the only relevant authority for dealing with China.

³⁰ A Johns Hopkins’ CARI study shows that commodity-backed loans only represent one-third of the Chinese total loan finance (Brautigam 2016).

foreign aid loans. It coordinated with the China Foreign Exchange Reserves in 2016 to create the equity investment China-Africa Industrial Cooperation Capacity Fund Company for a total amount of US\$ 10 billion.

- **Sinosure** is responsible of export credit insurance and guarantee services for projects happening in markets where volatility and risk are the main characteristics.
- **China Development Bank:** it lends commercial loans to African governments and manages the **CADF** which delivers loans and equity for Chinese investments abroad with a total capital of US\$ 10 billion (CDC 2018) and the US\$ 5 billion Special Loan for the Development of African which provides loans to African banks in order to finance African firms (Robertson et Benabdallah 2016).
- The **Chinese commercial banks** (Bank of China, China Construction Bank, Industrial and Commercial Bank of China (ICBC)) complement the overall offer thanks to their assets in Africa and the possibility to fund activities that governmental institutions cannot honor.

Figure n°19. China's annual loans to African countries between 2000 and 2014 (unit: US\$ billions).



Source: (Brautigam 2016)

The Chinese system is therefore composed of a variety of private and public institutions dealing with their own strategies sometimes called “paradiplomacy”, far from being completely subjugated to the decisions of the State³¹. This intricate system generates “*conflict-ridden, incoherent policy output, often mistakenly interpreted as grand strategy*” (Hameiri et Jones 2015) resulting in an internal competition between agencies:

“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.” (Su 2012)

Therefore, the Chinese State is rather a regulator which frames the macroeconomic environment for its institutions and corporations. The MOFCOM who was usually in charge of controlling investment abroad is also less influential today: it cannot act directly on SOEs who are present on the African continent. An official from the Chinese Ministry of Commerce MOFCOM explained that:

³¹ “Disaggregated functional bodies and technical experts have increasingly formed ‘transgovernmental networks’ to coordinate regulatory policies, while subnational administrations pursue independent ‘paradiplomacy’. This networking is seen as essential to manage the risks and threats generated by deregulation and globalisation.” (Hameiri et Jones 2015)

“Nowadays, we cannot interfere too much with corporate investment decisions. If they [the corporations] insist on going somewhere, we can't stop them (...) As government agencies, we can only provide our suggestions and opinions” (Wei 2017a)

Each of these actors is incentivized to diversify and expand their portfolios so that they can gain in influence in the Chinese system. Therefore, when they decide to turn toward markets in Africa, this constellation of institutions, agencies and corporations is particularly in demand. This is particularly the case as there is very low number of local fund on the African continent, but also because the level of risk is relatively high in Africa: Control Risks evaluated and drew a risk map for each countries in Africa, and their work reveals that only 11 countries out of 54 can be considered as safe for the security of investments (“low” or “very low”), while only 7 countries have a grade of “low” or “very low” for their respective political risk situation (Control Risks 2018).

Historically, Chinese institutions concentrate their support on capital-intensive markets, infrastructure and energy projects in developing countries. As a result, they gained in understanding and maturity to deal with the variety of risks present in African countries when putting in place the services they can offer such as equity investment, export finance and EPC contracts. In addition to their experience, these Chinese institutions are also actively involved with African governments. Thanks to their participation to these events, they can better appreciate the country's policy and priorities for the future to enhance the quality of their investment. In parallel to the state level, they wove an entire network of local groups for economic intelligence purposes.

As an example, the role of the CADF is prevalent in encouraging Chinese investment to accompany certain African policies such as the Renewable Energy Independent Power Producers' Procurement Programme (RE-IPPPP) in South Africa. Through the prism of the CADF, CDB officials inform private actors about the goals of such programme to the relevant Chinese companies and led some of them to participate directly in the RE-IPPPP. For instance, Jinko Solar invested in 2014 in a factory to produce 120 MW of solar panels per year in the country, which helped to create more than 250 jobs. On the other hand, the Chinese wind company Longyuan Power engaged in the construction of wind farms (De Aar 1 and 2) in the region of Cape Town adding 244 MW capacity in total (Burgess et Esterhuysen 2015).

The Chinese State helps these renewable energy companies to venture in African markets in the framework of the “going out” strategy (Jiao 2011). Chinese renewable energy companies are supported by a solid financial system that helps them to secure their investment, but do not execute a plan set by their national government *per se*. They are incentivized to go out because of a saturated domestic market while facing an oversupply dilemma³². Chinese development agencies and banks mainly support them because first they will gain in enhancing their own reputation in a very competitive sector, and second because they can promote investment in Africa thanks to a series of cases they succeeded in achieving, thereby reducing the global perception of risk that these companies could have previously had. That explains why Chinese SOEs have the largest share of new SSA projects.

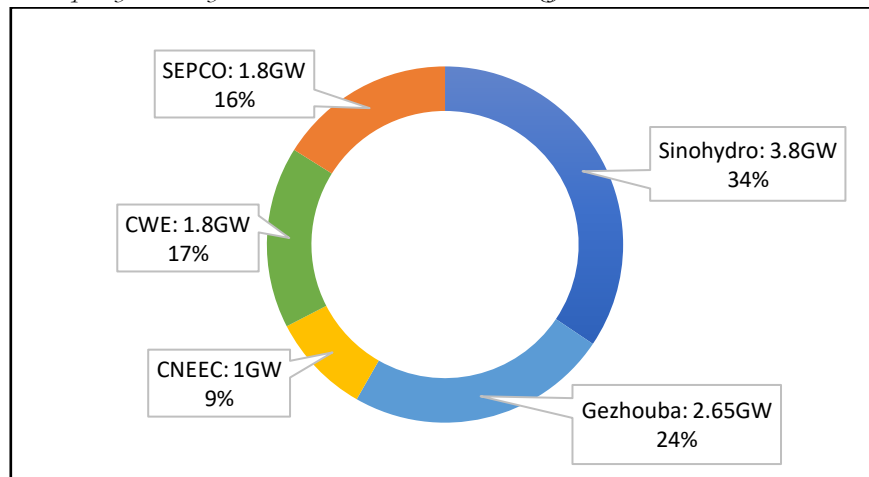
3. The prominent role of SOEs in SSA's electricity projects: tools and framework of action

The African market is the largest outlet for numerous Chinese SOEs delivering energy and construction services (IEA 2016). Within the various energy actors present in SSA, most of the contracts involving Chinese actors are led by SOEs (90%), while only 10% for Chinese private companies (IEA 2016). In fact, merely five companies manage nearly three quarters of the Chinese newly added capacity in the African power sector (Figure n°20), mainly because they have the ability to build large-scale projects:

³² *cf.* Chapter 1.5.

Sinohydro, Gezhoubu, China National Electric Engineering (CNEEC), China International Water and Electric Corporation (CWE), and Shandong Electric Power Construction Corporation (SEPCO).

Figure n°20. Total capacity added by the main Chinese renewable energy contractors in SSA.



Source: author (Excel), based on the data from (IEA 2016)

The Chinese government fostered the enlargement of national companies to incorporate other energy companies. For instance, Sinohydro and SEPCO were incorporated in PowerChina, Gezhoubu in China Energy Engineering Corporation (CEEC) and CWE in China Three Gorges Corporation (CTGC). Merging these companies in larger entities served Chinese businesses as it increased their international ranking and their ability to invest abroad: for instance, SSA is Sinohydro's first overseas market where it earns 39% of its international revenues from the SSA region with 24 projects ranging from dams to grid expansion and oil-fired power plants, for a total added capacity reaching 3.8 GW.

Chinese companies are strongly supported by the government, but how are they involved in SSA's energy sector? They offer a whole set of services for turnkey projects. This is a salient aspect of the Chinese companies' overseas investment strategy as it facilitates their overall implementation in Africa. The range of assistance they offer goes from the preparatory work and the planning of projects to the construction and operation and maintenance (O&M) services.

These companies entertain a strong dialog with Chinese and African governments that allows them to access more easily institutional actors such as banks for financing and obtain easier negotiations for debt alleviation. The tools used by Chinese companies to undertake their projects in Africa are diverse, but they generally take three main shapes: Engineering, Procurement and Construction (EPC), Build-operate Transfer (BOT) or Public-Private Partnerships (PPP) contracts.

EPC contracts are the most common type of contract used by Chinese private companies to carry on their projects in SSA. Such contracts oblige contractors to deliver the infrastructure to the developer who should be able to use it at the time of its delivery. Therefore, the EPC contractor oversees the overall engineering of the projects, from the procurement of equipment, design and construction of the facility. The price and the deadline are guaranteed, which means that any failure to respect the terms of the contract will be incurred by the company. What is more, there is a performance clause that ensure that the project will respect important characteristics of the projects such as the reliability of the infrastructure or a minimal output and efficiency for the technology implemented.

Finally, another important aspect of several Chinese SOEs engaging in the SSA market is the use of Corporate Social Responsibility (CSR) practices³³ which can even be referred to as a “*CSR with Chinese characteristics in Africa*” (Whelan 2014). A well-known example is the case of Sinopec which acquired in 2009 the Canadian oil and gas multinational Addax Petroleum operating in Nigeria. Following its new acquisition, the company founded the Sinopec-Addax Petroleum Foundation which deliver the social investment of the company to achieve the Sustainable Development Goals.

“Addax Company positively show, act and establishes the highly responsible image of Sinopec and spares no efforts to establish the brand impact of internationalized operation of Sinopec through Sinopec Addax Public Welfare Foundation. The Foundation is dedicated in the public welfare activities on health, education and environment in undeveloped areas of Africa and Middle East. In 2012, the Foundation has organized 15 public welfare activities. Such activities are spread all across Africa and Middle East such as Cameroon, Zambia, Uganda, Morocco, Togo, Iraq and Nigeria.” (Sinopec’s website)

More concretely, Sinopec’s foundation created “technical acquisition programmes” where it operates in Nigeria, in order to enhance the nationals’ abilities in the workforce to benefit the Nigerian economy, but also to develop entrepreneurship to lift the young population out of poverty, which is the first SDG decided by the UN. The foundation is also engaged in the with the International Rainwater Harvesting Alliance (IRHA) in projects to process and use rainwater for fighting water shortages in Africa and achieve the sixth SDG³⁴ (Ekhatator 2014).

Other examples include Sinohydro which is also engaged in a diversity of activities and invested US\$ 900 million in more than 30 projects in Angola that goes beyond hydropower and include hospitals, schools and transportations, training more than 8,000 local workers (ICTSD 2011). Since 2015, Chinese SOEs partnered with Kenyan investors to create a technology transfer network associated to the relevant training program in Nairobi. The finality of such project is to build a factory to manufacture locally a range of solar lighting systems for the region (Xinhua News 2015). Chinese universities are also in the loop and hosts training programs for African officials and engineers. The North China Electric Power university and the MOFCOM organized in 2015 a month to train officials from several French-speaking African countries (Comnews 2015).

Chinese SOEs have therefore a wide variety of tools and can rely on a strong national network to mitigate the risks when engaging SSA energy market, using State-backed initiatives and involving in numerous CSR activities. The Chinese State support plays an important role and explains the particular involvement of Chinese companies in the region. It protects national investments and explains the large scope of Chinese engagement in SSA energy sector. The question now is to understand the extent of China’s input to SSA’s energy growth.

4. Assessing China’s overall input into the SSA’s energy growth

The Chinese overseas investment system is essential in supporting the national engagement in SSA’s energy sector. China’s commitment in Africa is quite diverse when considering the energy sector as it involves the oil industry, the extension of transmission and distribution (T&D) networks even across borders, the construction of gas-fired power plants, hydropower dams, or the selling and the installation of technologies that helps remote villages to access electricity. Between 2010 and 2020, Chinese actors

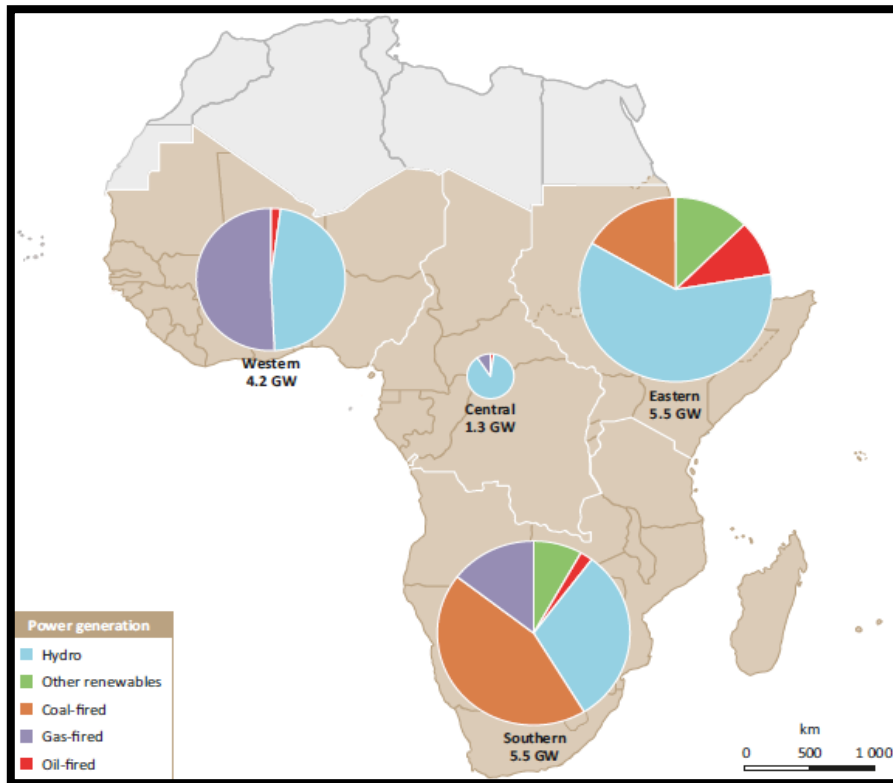
³³ CSR is the “*commitment of business to contribute to sustainable economic development, working with employees, their families, the local community and society at large to improve their quality of life*” (Amao 2014)

³⁴ The author of the article did not carry enough research to assess whether or not such “training” programme was efficient. He notes however that the impact of such programme can be rather limited, but more data are necessary to assess the true extent of the results.

will be responsible of building 96 projects to add generation capacity in the region, while 49 other projects will add capacity to African T&D systems, for a total supplementary capacity of 17 GW and 28,000 km of T&D lines.

Between 2010 and 2015, the projects contracted to Chinese companies accounted for 30% of the supplementary capacity built in SSA and will be responsible of adding 17 GW of generating capacity and 28,000 kilometers of transmission lines in the period 2010-2020 (IEA 2016). Most of these projects are located in East (33%) and Southern Africa (33%) due to higher economic growth in both regions rather than West Africa (26%) and Central Africa (8%) (Figure n°21).

Figure n°21. Map of Chinese projects according to the type of energy in each of the four SSA sub-regions.



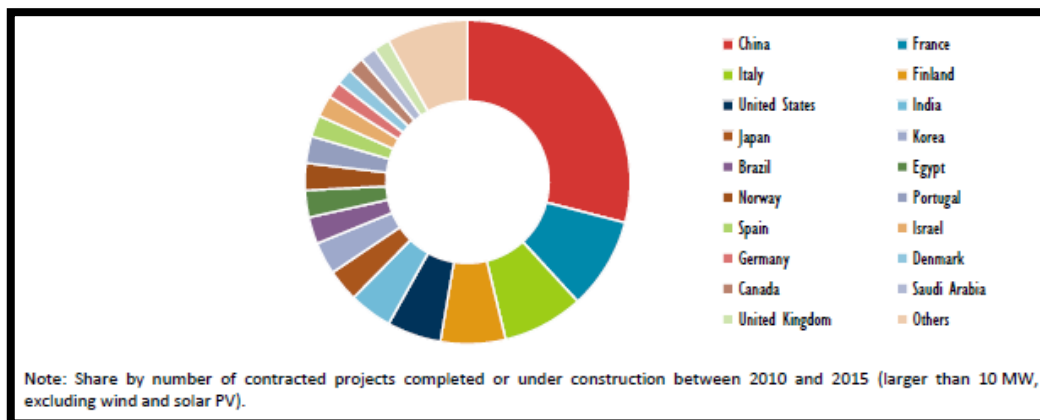
Source: (IEA 2016)

When paying closer attention to new projects contracted in SSA between 2010 and 2015³⁵, it appears that China represents the largest share of newly built projects on the continent with 25% of the contracts awarded to Chinese companies. Local contractors represent only a bit more than 15% of the new power plants built in the region, while the aggregate of all the other foreign investors represent the last 60%. By no means, China prevails for building new dams in Africa with a 58% share of all hydropower projects, while it is also responsible of 27% for the construction of new coal-fired power plants (IEA 2016).

By going more in depths in the analysis of market shares for the construction of new power plants in SSA, China leads the path, while the following candidates mainly come from developed countries such as France, Italy, Finland or the U.S. (Figure n°22).

³⁵ IEA data do not account for solar and wind project data due to tracking difficulty.

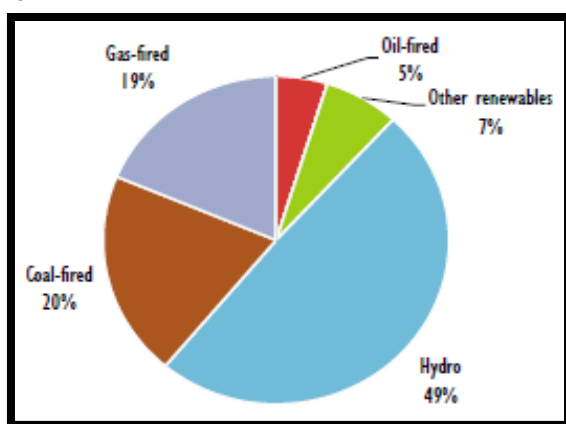
Figure n°22. Chinese companies are predominant in SSA's greenfield projects. Their total share is equivalent to the share of French, Italian, Finnish and U.S. projects combined.



Source: (IEA 2016)

China is dominant because of its high commitment in the African hydropower sector which amounts to 49% of the Chinese added capacity in Africa, followed by coal (20%) and gas projects (19%) (Figure n°23). This is partly due to the construction of new dams that strongly relies on resources that can easily be found in Africa and because they are less costly than building new coal- and gas-fired power plants. Projects focusing on capacity addition from other renewables only represent 7%, but this share may be higher as solar and wind projects are not counted in the IEA data.

Figure n°23. Half of the new capacity added by Chinese companies is hydro, while the other half is dominated by fossil-fuel capacity.



Source: (IEA 2016)

If coal still represents such an important share of new investment in the SSA energy sector, this is because the Chinese government is putting more and more restrictions on the coal sector³⁶, which constraint its future to foreign markets. Among the 2.4 GW that Chinese companies are planning to build in the near future in Africa, one of the most important Chinese-built projects is located in Zimbabwe for a 600 MW coal-fired power plant at Hwange.

³⁶ For instance, Chinese coal-fired power plants which do not meet the 310 gce standard of energy efficiency will be decommissioned by 2020. Less and less coal will therefore be consumed as Chinese coal-fired power plants are increasingly efficient. (Hart, Bassett et Johnson 2017)

Case Study: the approach of Chinese SOEs engaging in the South African RE-IPPPP programme.

In SSA, South Africa is the country requiring the highest energy needs with a peak demand reaching 34.5 GW in 2015 and 2016 (RECP 2017). The main issue of the country is its reliance on coal-fired power-plants which accounts for nearly 85% of its energy needs (Eskom 2016). The creation of the Renewable Energy Independent Power Producer Procurement Programme (RE-IPPPP) in 2011 is part of the current governmental strategy to transition its energy mix toward long-term sustainability.

This program is a framework that allows Independent Power Producers (IPPs) to install renewable energy technologies after bidding and add capacity directly to Eskom's grid³⁷. South Africa therefore created a thriving environment for the development of its renewable energy capacity³⁸: it became more competitive to build a solar or a wind farm in the country than adding a new coal-fired power plant to the mix (Matsuo 2016).

For the successful IPPs, they benefit from a Power Purchase Agreement (PPA) signed with the government which guarantees for twenty years the regulation on which they will depend on. It plays a strong role in reassuring international investors in South Africa. The program also imposes that 40% of each project's shares goes to a South African actor and 12% to black ownership, while the gearing of these RE-IPPPP projects generally follows a 70% debt (Baker, The evolving role of finance in South Africa's renewable energy sector 2015).

Following the FOCAC in 2015, the Chinese government signaled its will to play a more important role in SSA's renewable energy sector (MFA 2015). Johns Hopkins' CARI undertook an analysis of China's involvement in the South African energy sector and found that the country is more and more involved in classical business channels for energy projects – even if it is still relatively limited.

When comparing Chinese solar and wind involvement in South Africa, the main distinction comes from the difference in the diversity of their activities. Indeed, whereas Chinese wind companies operates as developer, EPC and OEM contractors, Chinese solar companies are mainly involved in the supply of the equipment (and, in a lesser extent, in financing equity)³⁹.

The study shows that China's involvement is limited either because of the risk-averse strategies of Chinese companies, but also because of the lack of compliance with the norms imposed by South Africa. For instance, Longyuan employees explained that they had to be very careful when engaging in projects abroad since their company is a SOE:

“As a state-owned company, we are very cautious of getting involved in overseas projects. We cannot afford bad investments because any loss on project is eventually the loss of state asset. Overseas project must be financially and politically viable, which significantly limits our choices as such “perfect” projects are very rare, and the competition can be insanely intense. South Africa is one of the very few acceptable countries in Africa” (Baker 2017).

³⁷ Eskom is the South African state monopoly other the national transmission grid. Today, Eskom produces more than 90% of the country's power supply and is in charge of 60% of the distribution. Since 2016, the company is in deep financial trouble which are estimated to reach US\$ 1.6 billion (Tshwane 2018)

³⁸ It is noteworthy that the programme has been recently under threat as Eskom started to reject 37 PPAs (Njobeni 2017) as such agreements imposes to Eskom to buy the electricity produced by IPPs: The utility says that there is no need for adding supplementary capacity and that they would also lose money by doing so.

³⁹ The development and EPC of solar projects under the RE-IPPPP is dominated by western companies from Europe or the US such as Enel, Solar Reserve, Siemens or Juwi (Energy Department of South Africa 2018).

On the other hand, employees at Goldwind emphasized on the difficulty for Chinese companies to comply with certifications:

“The technological acceptance is the biggest challenge for Chinese equipment suppliers, as most of our technologies are not yet world-recognized and properly certified at internal level. Financiers and investors would think such technology “unsafe”. That’s the main reason why Goldwind are rejected in the first few rounds of bidding and only secure the deal in the fourth round after DNV’s certification” (Baker 2017).

Chinese companies are not going alone in these projects and often go on joint ventures either with local or international companies. Longyuan and Goldwind both partnered with South African companies, respectively the black-owned Mulilo Wind Entreprises and BiotTherm Energy. Sinovel partnered with the Spanish company Iberdrola and the South African company Group 5.

The engagement of Chinese solar industry is very particular because of the predominance of supplier activity of cells and modules (only PowerWay was awarded an EPC contract). The development and EPC contracts under the RE-IPPPP have been awarded to western companies until now⁴⁰. Several of these Chinese solar companies invested equity in South African projects following a BOT model that helped them to expand their experience in the sector:

“At the beginning, it was not Chint’s aim to become an investor and shareholder in overseas projects, but our U.S. partner insisted on such a model in order to share the investment risks between project developers and technology suppliers. We agreed to invest in the SA project in order to secure the supply contracts but in doing so, also learned how to operate a solar park.” (Baker 2017)

* *
*

China has the lion’s share in SSA’s energy sector because of a competitive system which offer a solid support to Chinese companies willing to engage in the region. Chinese SOEs play a very important role due to their capacity and experience, but also thanks to their ability to resort to a wide diversity of tools in contracts and CSR frameworks that they try to apply at the local level. China’s overall impact on SSA’s energy sector is therefore significant with a high focus on low-carbon projects, although China’s commitment in the solar and wind sector is still limited to the supplier side. Because China’s pervasion of SSA’s energy sector is that important, the question now is to understand the aftereffects, the reactions and the potential risks that Chinese activities involve so that the entire picture can be completed.

CHAPTER 3. THE PEAKS AND TROUGHS OF THE MARRIAGE OF A DRAGON WITH A LION: THE RISKS INVOLVED IN CHINA’S PERVASION OF SSA’S ENERGY SECTOR.

The Chinese central government is certainly powerful, however, its influence on the public and private institutions and corporations do not always follow the commands from the State. Whether they are SOEs or development agencies, they obey their own plans and perspectives when they conquer African markets. Chinese companies act primarily to defend their business interests before pursuing a national framework:

⁴⁰ Developers: Enel Green Power (Italy), Scatec Solar (Norway), Solar Reserves (US).
EPC: Enertronica, Terni Energia (Italy), ABB (Switzerland), Siemens, Juwi (Germany), etc. (Energy Department of South Africa 2018)

In addition to the relative extent of their free will, Chinese companies are also intricately in a global network of value chains on which a single state – even as big as China – cannot have an entire control (Grimes 2014). The analysis of such phenomenon will help us compensate a broader approach that would have only consisted of macro-geopolitical trends, so that one can grasp the reality of the China-Africa relationship in its variety (Horner 2015).

The analysis of a particular example – the Grand Ethiopian Renaissance Dam – will first allow us to investigate the issue of China's footprint and its geopolitical implications for SSA. This case shows the mutual responsibility of Chinese and African actors in the projects they decide to undertake. Then, an analysis of the trade relationship between the two parties suggests serious challenges for SSA countries: the capacity of African governments to repay their debts raises questions about China's will to partner with the regional actors equitably. Furthermore, one needs to tackle the matter of trade dependency between SSA and China which could have serious consequences for stability in these countries. Be that as it may, the final question remains: does the Chinese government have the capacity to control these negative externalities it engenders for the SSA region?

1. The environmental and geopolitical implications of China's unconditional support: the example of the Grand Ethiopian Renaissance Dam

In 2013, the Ethiopian government announced unilaterally that it would develop the Grand Ethiopian Renaissance Dam (GERD). It is expected to be the largest hydropower dam on the African continent and is located at the border between Sudan and Ethiopia. The Italian construction company Salini Impregilo obtained the US\$ 4.8 billion contract in 2011. At the beginning, the project only aimed at adding 5.3 GW of capacity to the Ethiopian grid. In February 2017, the Ethiopian government announced that the overall capacity of the project will reach 6.5 GW thanks to technological improvements in the generators implemented. As for now, two-third of the project is achieved. (Johnson 2017)

The main goal of the GERD will be to compensate the lack of energy capacity of the country. Nevertheless, numerous protests have emerged as it would impact the flow of water of the Nile Basin, especially Egypt. In addition to this, Ethiopia did not realize an environmental assessment of the project. Such framework led to the withdrawal of foreign countries and institutions open to fund the dam (Sebban 2012).

Consequently, the Ethiopian government had to find new ways of financing its project, notably thanks to “patriotic” contributions from the Ethiopian population (Stevis-Gridneff 2018) and by the emission of national bonds (Kebede 2015). The only country which committed to the project are Chinese banks who finance approximately US\$ 1.8 billion (nearly 45% of the project cost) related to the 16 turbines and the electrical system of the dam.

The GERD is one of the six dam projects that China is supporting in Ethiopia. China is therefore supporting a project whose outcomes are uncertain and which involve numerous geopolitical issues. Indeed, a 1929 rule that dates to the British colonial empire states that Egypt has quasi full authority on the Nile's water and can oppose the constructions of dams that could affect its supply of water (Crabittès 1929). The objective here is to undertake a cost-benefit analysis to put into perspective the Chinese-backed GERD project and evaluate its potential impact in the region.

There are obvious benefits for the Ethiopian government which decided to build this project in the framework of its Growth and Transformation Plan (GTP) for 2025. The major aims of the GTP 2025 is to erase poverty from the country and build 10 GW of capacity to respond to the demographic growth of the country and its economic development. That is why a major project like the GERD which

constitutes 60% of the power capacity target was fully included in the plans of the Ethiopian government (Wuilbercq 2014).

What is more, this gigantic project is expected to develop irrigation systems for locals and create jobs during the construction of the dam and the transmission lines. It should also enable the development of continuous local economic activities due to the dam such as tourism. National plans show that the government is convinced that the economic benefit that will emerge from the dam will help the country's objective to lift the country out of poverty and therefore offset any disappointment.

Even if the project is built in a barren land (the average temperature in the area is 40°C), the dam entails several negative aspects. The dam will potentially harm the Blue Nile ecosystems on the site of its construction because riverine ecosystems may not be adapted to a lake environment, especially because it involves a modification of the chemical composition of the water and will not allow the animal species to adapt in time. Around 20,000 Ethiopian citizens living in the area will have to be relocated because of the dam, mainly hunters, farmers and fishermen (International Rivers 2017). The water of the Blue Nile is at the center of the life of these communities, economically and culturally. This region of Ethiopia is particularly touched by the malaria and increasing the level of water could potentially foster the development of the disease (Prisco 2015). Nonetheless, these communities expressed the need to remain in the region and therefore expect that the dam will generate benefits such as the construction of hospitals and schools that they currently lack of. They appear to be confident in the Ethiopian plans for generating positive outcomes in their lives (Veilleux 2013)

At the regional level, the GERD will have an impact on Egypt and Sudan. The water of the Blue Nile involves a variety of activities for Ethiopia, but also for Sudan and Egypt which are the downstream destinations for the river. In fact, the Blue Nile is central for these two countries' economies: its waters are used by their agricultural and industrial sectors, help to generate electricity and *in fine* boost their national consumption. A report from a panel of expert released in 2013 stated that it may also reduce the generation capacity of the Aswan High Dam in Egypt (2.1 GW) and will seriously impact the Nile Delta as the concentration of salt would negatively affect agricultural lands in the region. In Sudan, the reduction of the water flow in the Blue Nile may also lead to reduce the potential of flood recession agriculture carried by the local communities along the stream (WaterWorld 2016). Another report from Egyptian analysts emphasizes the fact that the GERD will seriously impact the country during the drought season and will oblige farmers to leave their crops due to an increase in water pollution. (Ibrahim 2017).

The main consequences of the GERD project are therefore geopolitical due to its environmental impact on downstream countries. By supporting this project, China is showing its support to the rise of the Ethiopian influence in Africa against Egypt, while the latter failed to obtain the support of the WBG to mediate the case (Al-Youm 2018).

The GERD example is not the only one in SSA that reveals the negative environmental of Chinese support to energy projects in the region. The issue is twofold because it implies the responsibility of Chinese companies, but also the lack enforcement of environmental regulations by SSA local governments:

“African governments contribute to the problem by failing to insist on environmental impact statements and enforce existing environmental regulations (...) Sudan’s Petroleum Wealth Act and Environmental Protection Act set down the rules for environmental preservation. These Acts, however, make clear that Sudanese government officials were more interested in advancing the oil industry than implementing environmental laws” (Shinn 2016)

2. The sustainability of national debts in SSA: CNPC in Niger's oil and gas sector

Alongside environmental concerns, the sustainability of national debts in regard of China's investments raises major questions. China is highly involved in Niger's oil and gas production with more than 200 oil wells dug since 2010 for a total discovery which amounts to one billion barrels of oil (Rosen 2015). To process all this oil, China invested in 2011 in the pipeline network of the country and the Soraz, a company owned at 60% by CNPC and 40% by the state of Niger. The overall infrastructure helped the country to reach a relative energetic independence as Soraz delivers 20,000 barrels of oil per day, which is far above Niger's domestic demand of 7,000 barrels. Therefore, Niger can export the remaining two-third of its production to neighboring countries and to China.

However, tensions arose between CNPC and Niger's state oil company Sonidep. CNPC runs the entire system, from the exploitation of oil wells to the refining process. Therefore, Sonidep pays Soraz to obtain the refining products it needs, and Soraz pays CNPC for its oil. Classically, the system is balanced between the companies which are interdependent.

Nevertheless, serious financial debts led to the unsustainability of the system. According to an investigation from Business Insider (Rosen 2015), Sonidep incurred a major debt toward Soraz which amounts to US\$ 68 million, while Soraz itself owes US\$ 100 million to CNPC. Sonidep's debt find its roots in the lack of accountability of Niger's government which went through serious turmoil in 2010⁴¹, but it is also inherent to the instability of the country which has to deal with food insecurity and the terrorist group Boko Haram.

On the other hand, a study from the International Monetary Fund (IMF) shows that Soraz's debt to CNPC is explained by the biased contract signed in 2012 which favor the Chinese company: indeed, Soraz's must buy at US\$ 70 the barrel of oil. This becomes an issue as the price of the barrel of oil in international markets decreased under the price of US\$ 50 per barrel: the effective price paid by Soraz ranged from US\$ 87 to US\$ 100 per barrel, way above the international market prices (IMF 2014).

The imbalance between China and Niger is patent through the contract, but it is also concretizing through the built infrastructure itself. For instance, the equipment and the commands or even the documents emitted by the CNPC-operated Soraz are all in Chinese (Rosen 2015). Consequently, the Nigerien Petroleum Ministry is extremely limited in its capacity to undertake a full oversight of the company's operations. This helps the Chinese NOC to weigh in the negotiations as China's oil needs increase:

"While its [SSA's] current indebtedness may not shape the course of international affairs directly, it may, in fact, benefit China. Defaulting on their debt would cause foreign investment to dry up. China's willingness to accept repayment in commodities would leave it as one of the few remaining options for countries struggling to build infrastructure. Beijing could, therefore, drive as hard a bargain as it wanted. China will continue to mine Africa for its resource needs. The only thing that will constrain its behavior in that regard is its own capital needs. It will, in other words, have to determine how much to spend as its own economic problems continue to mount." (Friedman 2018)

3. SSA's trade dependency to China and the rise of an Anti-Chinese movement

In addition to the question of debt repayments and sustainability for SSA countries toward China, there is the issue of trade dependency between the two parties as China became the first trading partner of the

⁴¹ A coup d'état by the national military overthrew the power in place. The leader Salou Djibo was designated Head of State to make Niger "a model of democracy and good governance". He held elections in 2011 and left the government (BBC 2010).

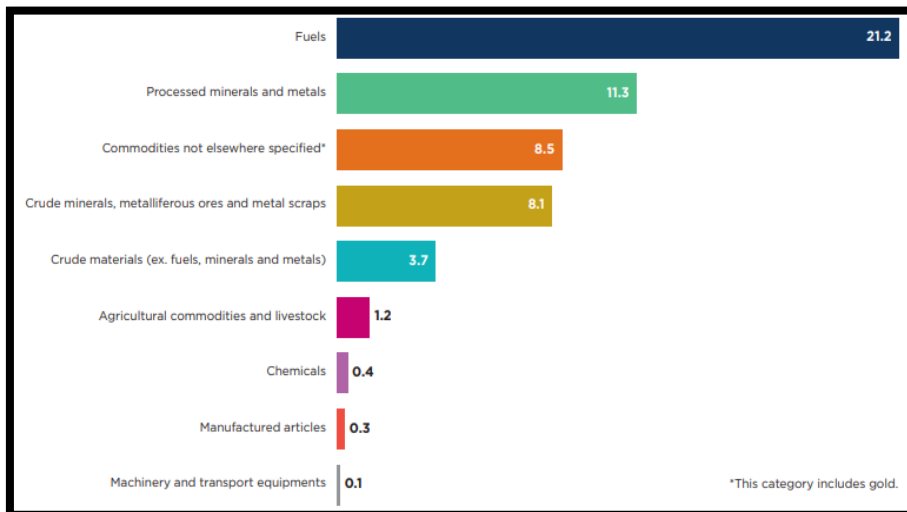
region⁴². On the one hand, SSA’s outflows toward China are dominated by fuel (39%) for a total value of US\$ 21.2 billion. Overall, 96% of their exports are composed of raw materials (Figure n°24 – A). On the other hand, three quarters of China’s outflows toward the SSA region include manufactured goods, machinery and transport equipment (Figure n°24 – B).

This reflects a relative risk for SSA countries as they are driven to focus on their natural resources (the Dutch Disease) while they also become unable to develop a solid manufacturing sector because of the high proportion of manufactured goods imports from China:

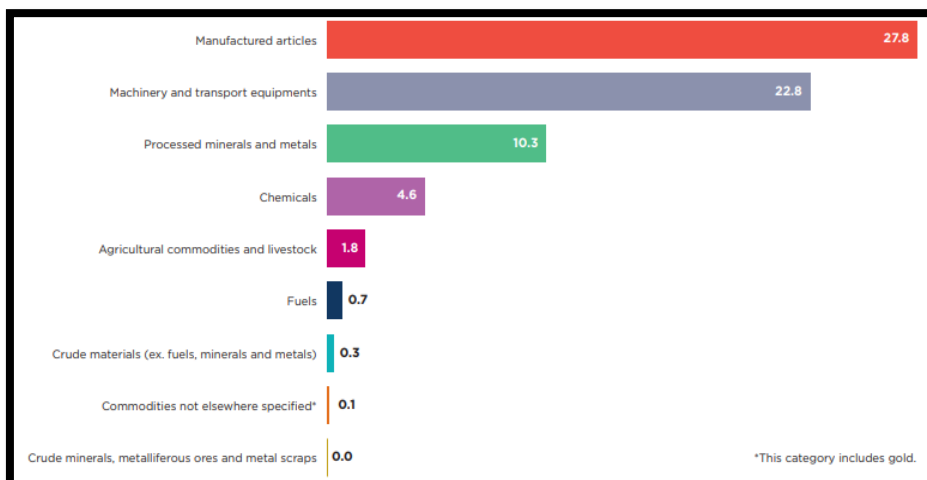
“SSA’s international competitiveness has improved but remains largely unfavourable relative to China (...). Real wages in sub-Saharan African formal manufacturing are very high relative to per capita income. High real wages in formal manufacturing reduce competitiveness in labour-intensive manufacturing. Poor infrastructure and weak institutions also adversely affect the business environment for foreign investment. (...) Given new Asian competitors and China’s continued dominant presence, the possibilities for Africa to compete in low-skill manufacturing are not encouraging, despite some progress in a few countries such as Ethiopia” (Golub, et al. 2017).

Figure n°24. Exports by category of products from SSA to China (A) and from China to SSA (B). (Unit: US\$ billion)

(A) Types of products exported from SSA to China



(B) Type of products exported from China to SSA

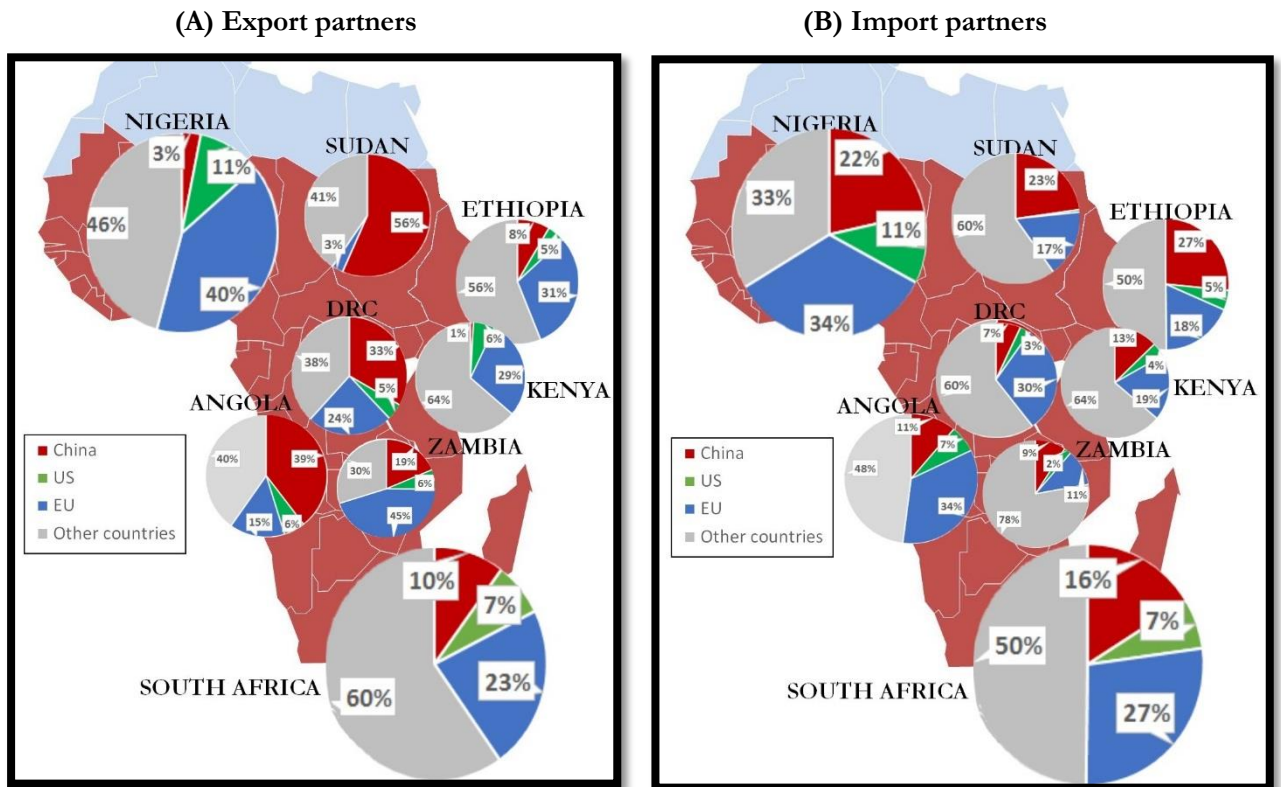


Source: (Coface 2017)

⁴² Cf. Chapter 2.1.

However, not all SSA countries bear the same risk in trade dependency toward China: the export share of the Middle Kingdom in fuel and mineral exporting countries is largely higher than in any other countries: 39% for Angola, 33% for the Democratic Republic of the Congo (DRC), and 56% for Sudan (Figure n°25 – A). SSA’s imports from China, however, are more equally distributed in the region, averaging one-fifth of their total imports: for instance, Ethiopia imported 27% of its products from China between 2012-2016. The two countries are cooperating massively in the energy sector by developing wind and solar farms, geothermal power plants and the first biomass power plant (Rojas 2016).

Figure n°25. Map of export and import partners in various SSA countries⁴³.

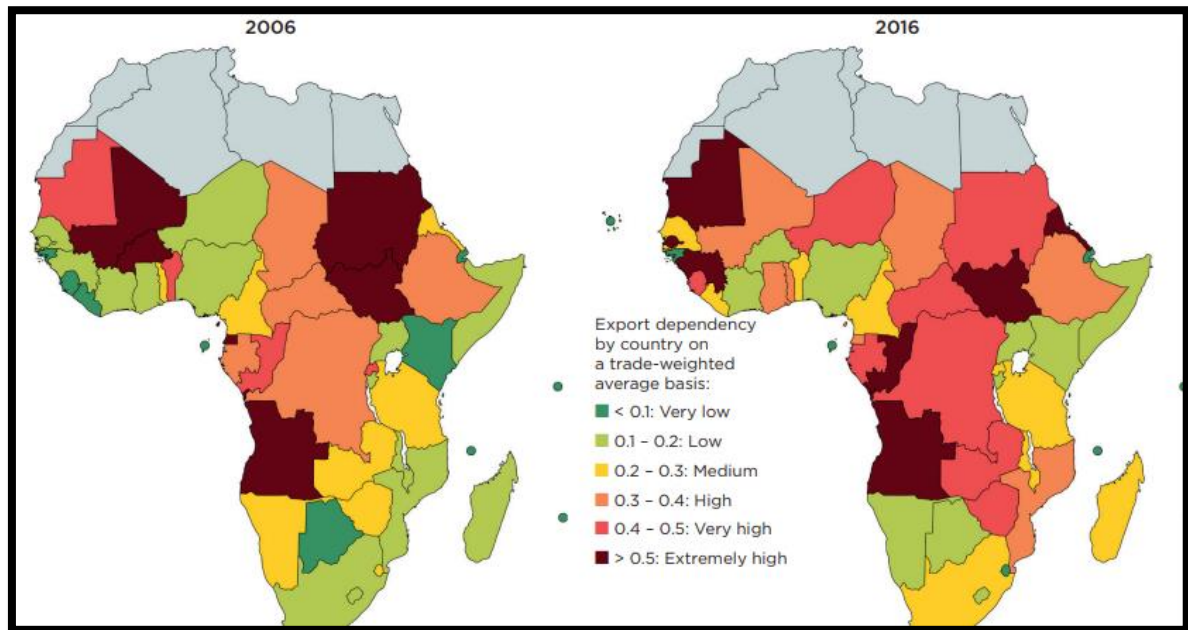


Source: author (Excel, Adobe Illustrator), based on the data from the WBG’s WTIS.

The French insurance company for international trade Coface released a report wherein they studied the degree of vulnerability to export dependency with China and compared the difference in ten years between 2006 and 2016 (Figure n°26). The first clear conclusion is that the whole continent increased its dependency to China: “Sub-Saharan Africa’s commodity export dependency on China was 0.24 in 2016; compared to 0.07 in the EU-28 and 0.12 in the United States” (Coface 2017). Above all, this is oil exporting countries which are the most dependent: Sudan with a dependency level evaluated at 0.83 in 2016, Angola at 0.66 and DRC at 0.64.

⁴³ **Methodology (cartography):** we took an average of the level of exports (A) and imports (B) for a five-year period (2012-2016) in different SSA countries. For several of them (Congo, Kenya, Sudan), some data were missing because of a lack of investigation gathered by the WTIS in certain years. Also note that the data associated with the EU is an aggregate of all European and Central Asian countries (WBG’s categorization). The category “Other countries” is largely dominated by other SSA countries: that emphasizes the prominence of SSA regional trade.

Figure n°26. Export dependency by country on a trade-weighted average basis in 2006 and 2016.



Source: (Coface 2017)

Should such level of dependency be worrying for SSA countries? SSA citizens already worry about this phenomenon: While attending the Power & Electricity Africa 2018 summit, a Chief Director within the Zimbabwe Electricity Supply Authority, said:

“Chinese energy companies take over our country, we have 90% unemployment and they bring their own labor force to build our infrastructures. And when they do hire our people, they mistreat them.” (Informal interview, March 2018)

Alongside the conference, an official from the *Agence Française de Développement* (AFD) in South Africa, explained:

“China does not comply with international aid standards, and that creates inefficiencies in the projects we can build on the continent. (...) The anti-Chinese sentiment exists here because South Africans are very entrepreneurial: They value a fair competition between actors and appreciate the compliance with bidding processes in the energy sector. But Chinese companies do not play the same rules as for now” (Informal interview, March 2018).

The Anti-Chinese movement in SSA communities is therefore a reaction to the pervasion of Chinese manufactured products in their economies, and in some extent to the mismanagement of Chinese workers in the region. The movement was already on the rise in 2006 in Zambia: During the elections, a populist candidate launched a platform to “*kick out the Chinese exploiting Zambia’s resources in a neocolonial fashion*”, and Hu Jintao’s plans to visit a free trade zone in the country were cancelled for fear of anti-Chinese demonstrations (Norris 2016). Indeed, it was reported that the Chinese owners of the Collum mines were guilty of “*labor violations, and miners said that they felt unsafe working there. They were also upset about annual wage increases that they said amounted to only a single Zambian kwacha—the equivalent of twenty cents.*” (Okeowo 2013). Nevertheless, a 2015 Afrobarometer study showed that the perception of China in the region remains largely at 63% positive across the continent (Afrobarometer 2016).

What is more, considering the trends in China's energy policy for the next twenty years, it will rely more on more on oil imports⁴⁴, which means that SSA oil exporting countries will probably secure their trade with China⁴⁵. What is more, China's manufacturing sector should also experience a progressive slowdown in the future (Reuters 2017) as the 13th Five-Year Plan wants to switch the national economy toward a service-based and low-carbon economy⁴⁶. That means the concerns about China's impediment to SSA's manufacturing sector could fade gradually and allow this part of their economy to develop smoothly. Finally, a 2017 McKinsey study showed that Chinese companies investing in Africa were largely relying on the local workforce (89%), which means that they are responsible of substantial job creation (several million according to the investigation) for a region which suffers from high levels of unemployment (McKinsey 2017).

CONCLUSION

The aim of this research was first to provide a comprehensive approach of China's energy requirements to sustain its future growth, and how it impacts the SSA region through the prism of its energy sector. In the perspective of a growing energy demand, China faces tremendous oncoming challenges as it plans to phase out coal progressively: the oil gap (12.4 Mb/d by 2040) and the switch to natural gas (from 210 bcm today to 610 bcm by 2040) imply that the Middle Kingdom will rely increasingly on foreign sources of supply. Furthermore, China faces a recurrent overcapacity issue: due to anti-dumping laws protecting Western markets, the Chinese solar and wind industries' levels of production have exceeded staggeringly the national grid's ability to accommodate this new capacity. Consequently, Chinese commercial actors looked for new market opportunities that led China – the “thirsty dragon with shackles” – to pervade SSA's energy markets.

The reasons for China's lion's share in SSA rely on Chinese institutions' ability to financially support national energy SOEs in the region. Its system is highly competitive and allows for colossal amounts of money to be attributed to ambitious companies willing to invest in risky markets such as SSA. With around 200 energy projects attributed to Chinese companies, SSA governments will benefit from new sources of revenues due to a high increase in electricity production capacity (17 GW) and its T&D systems (28,000 km). The variety of loans that Chinese institutions offer to African governments allows them to subsidize the cost of electricity and relieve the economic pressure on their population. In this regard, commodity-backed loans are also an opportunity for African government to obtain liquidity to finance their own projects and development when international institutions are not willing to lend them the necessary fund.

Chinese companies operating in the regions rely on a wide diversity of tools, ranging from EPC, BOT or PPP contracts up to more pervasive schemes such as CSR practices through which they extend their activities beyond the energy sector by funding hospitals, schools, training programmes or even engaging with environmental NGOs. These are means to improve SSA citizens' standards of living, to reduce the potential negative impacts they can have and, in the end, manage the risks involved in their activities. Overall, the Chinese involvement in SSA's energy sector brings an important input that the region requires, as today there are still more than 600 million Africans still without access to electricity.

Nonetheless, numerous concerns remain on China's impact in SSA. That will be the challenge to China's future as the country contemplates becoming a power of international stature. First, China's primary involvement in the region hinges on hydropower projects and the extractive industry which are known

⁴⁴ Cf. Chapter 1.3.

⁴⁵ It will also depend on their ability to negotiate a price which reflect international markets in order to avoid situations as it happened in Niger (Cf. Chapter 3.2.A.).

⁴⁶ Cf. Chapter 1.2.

to affect severely the ecosystems. The example of the GERD projects in Ethiopia shows how China's support to projects without solid environmental impact assessment can influence the geopolitics in the region. Even if the dam will satisfy the Ethiopian growing energy demand and even allow the government to receive new sources of fund thanks to the electricity it will export to neighboring countries, Egypt will remain opposed to the hydropower project as it could entail relative dire consequences for its economy. What we learn from such Chinese-supported projects is that the responsibility is shared between the participants. On the one hand, the project could not have started without China; even though the loan lacked environmental clauses at the time. On the other hand, this is also the SSA governments' responsibility to enforce the laws that aims at protecting their environment. The lack of enforcement of such environmental laws is a shared responsibility.

The question of the sustainability of SSA's national debts and the trade dependency toward Africa is also a serious concern. On one side, Chinese companies tends to have higher leverage when negotiating with local companies. The case of CNPC in Nigeria is a salient example: the price negotiated has been unrelated to the world oil prices and led the national companies - Sonidep and Soraz - to contract high amounts of debt toward the Chinese NOC totaling US\$ 168 million. Moreover, the fact that China became SSA's first trading partner raises the question of trade dependency between the two regions. While the major part of SSA's exports to China include fuels and raw materials, China exports almost exclusively manufactured products or machinery equipment. The consequences are twofold, as it pushes several SSA countries to focus exclusively on the development of their primary energy sector, while the competitiveness of Chinese manufactured products impede the further advancement of a regional industrial sector. Consequently, the "peaks and trough of the marriage between the Dragon and the Lion" require a rebalancing of the relationship between the two parties. The anti-Chinese sentiment arising in SSA is a symptom that spread in the regional political environment as more and more African leaders are talking about such rebalancing whether it was in Zambia and more recently in Kenya.

However, far from the dark and neocolonialist picture that is spread around the media, the future of the China-Africa relationship seems bright. Because of China's increasing reliance on oil and gas imports, SSA countries may benefit from a stable source of revenues for the years to come. But the major expected change is China's changing domestic policy for a service-based and domestic policy that could reduce the part of manufactured exports toward SSA, and therefore allow the region to develop its own industry, thereby diversifying their export destinations. Furthermore, Chinese financial institutions have started to operate a change in the way they attribute their loans to companies and projects, for instance by requiring environmental impact assessments. These are projections and their effectiveness should be checked in the near future.

BIBLIOGRAPHY

- Adogla-Bessa, Delali. 2016. "We'll mortgage Ghana's gas to China but... – Terkper." *Citifmonline*. Accessed April 25, 2018. <http://citifmonline.com/2016/10/27/well-mortgage-ghanas-gas-to-china-but-terkper/>.
- Afrobarometer. 2016. "China's growing presence in Africa wins largely positive popular reviews." *Afrobarometer.org*. October 24. Accessed May 1, 2018. http://afrobarometer.org/sites/default/files/publications/Dispatches/ab_r6_dispatchno122_perceptions_of_china_in_africa1.pdf.
- Al-Youm, Al-Masry. 2018. "Ethiopia won't accept World Bank arbitration on GERD." *Egypt Independent*. January 21. Accessed May 2, 2018. <http://www.egyptindependent.com/ethiopia-wont-accept-world-bank-arbitration-on-gerd-prime-minister/>.
- Amao, Olufemi. 2014. "Emergent State Practice on the Creation and Practice of Standards on Corporate Social Responsibility." *State Practice and International Law Journal*, 117-137. Accessed May 1, 2018. http://sro.sussex.ac.uk/56819/1/Amao_SPILJ-Vol-1-Issue-1_2014-2.pdf.
- Andrews-Speed, Phillip. 2010. "The Institutions of Energy Governance in China." *Institut Français des Relations Internationales (IFRI)*. Accessed April 17, 2018. https://www.ifri.org/sites/default/files/atoms/files/noteandrewsspeedenergychina_1.pdf.
- Armin, Rosen. n.d. Accessed May 2, 2018. <http://www.businessinsider.com/niger-oil-and-chinese-investment-in-africa-2015-9>.
- Baker, Lucy. 2015. "The evolving role of finance in South Africa's renewable energy sector." *ScienceDirect*, 146-156. Accessed April 30, 2018. <https://www.sciencedirect.com/science/article/pii/S0016718515001669>.
- Baker, Lucy. 2017a. "Commercial Scale Renewable Energy in South Africa and its Progress to Date." *IDS Bulletin*.
- Baker, Lucy, and Wei Shen. 2017b. "China's involvement in South Africa's wind and solar PV industries." *Johns Hopkins University - School of Advanced International Studies (SAIS) - China Africa Research Initiative (CARI)*. Accessed April 24, 2018. <https://static1.squarespace.com/static/5652847de4b033f56d2bdc29/t/5a3811fee4966b79a0ec06bc/1513624064682/lucy+v5.pdf>.
- Banoba, Paul. 2018. *A redefining moment for Africa*. Transparency International. Accessed April 28, 2018. https://www.transparency.org/news/feature/a_redefining_moment_for_africa.
- BBC. 2010. "Military coup ousts Niger president Mamadou Tandja." *BBC news*. <http://news.bbc.co.uk/2/hi/africa/8523196.stm>.
- Beard, Lucas. 2015. "Choosing China: Ghana's \$3 Billion Loan Decision." *Leadership Academy for Development (Stanford University)*. Accessed April 25, 2018. https://fsi.stanford.edu/sites/default/files/ghana_loan.pdf.
- BP. 2016. "Coal prices." *BP Global*. Accessed April 28, 2018. <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/coal/coal-prices.html>.

- Brautigam, Deborah. 2011. "Chinese Development Aid in Africa: What, Where, Why, and How Much?" *SSRN*. Accessed April 23, 2018.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2013609.
- Brautigam, Deborah, and Jyhjong Hwang. 2016. "Eastern promises: New data on Chinese loans in Africa, 2000 to 2014." *Johns Hopkins - China Africa Research Initiative (CARI)*. Accessed April 29, 2018.
<https://static1.squarespace.com/static/5652847de4b033f56d2bdc29/t/58ac91ede6f2e1f64a20d11a/1487704559189/eastern+promises+v4.pdf>.
- Breuer, Julia. 2017. "Two Belts, One Road? The Role of Africa in China's Belt & Road Initiative." *Stiftung Asienhaus* 1-8. Accessed April 8, 2018.
https://www.asienhaus.de/uploads/tx_news/Blickwechsel_OBOR-Afrika_01.pdf.
- Brookings. 2018. "Foresight Africa 2018." *Africa Growth Initiative*. Accessed April 26, 2018.
https://www.brookings.edu/wp-content/uploads/2018/01/foresight-2018_full_web_final2.pdf.
- Burgess, M, and H Esterhuysen. 2015. "Preparing for FOCAC VI: China-outh Africa cooperation in conservation and renewable energy." *CCS FOCAC Policy Briefing 4*. Accessed April 23, 2018.
<http://scholar.sun.ac.za/handle/10019.1/99158>.
- Casanova, Carlos, and Ruben Nizard. 2017. "China's ambitions in Sub-Saharan Africa: Efforts to Rebalance bi-lateral relations still needed." *Coface for trade*. November 7. Accessed May 1, 2018.
<http://www.coface.com/News-Publications/News/China-s-ambitions-in-sub-Saharan-Africa-efforts-to-rebalance-bi-lateral-relations-still-needed>.
- CDC. 2018. *CDC and China-Africa Development Fund sign cooperation agreement to boost investment in Africa*. CDC. Accessed April 29, 2018. <http://www.cdcgroup.com/Media/News/News-CDC-and-China-Africa-Development-Fund-sign-cooperation-agreement-to-boost-investment-in-Africa/>.
- China Investment Research. 2015. "Chinese overseas lending dominated by One Belt, One Road strategy." *China Investment Research*. Accessed April 28, 2018.
<http://www.chinainvestmentresearch.org/press/chinese-overseas-lending-dominated-by-one-belt-one-road-strategy/>.
- CIA. 2017. "China." *The World Factbook*. Accessed April 23, 2018.
<https://www.cia.gov/library/publications/the-world-factbook/geos/ch.html>.
- Clover, Charles. 2013. "Russia and China agree \$270bn oil deal." *Financial Times*. Accessed April 28, 2018. <https://www.ft.com/content/ebc10e76-da55-11e2-a237-00144feab7de>.
- Coface. 2017. "China's ambitions in Sub-Saharan Africa: Efforts to Rebalance bi-lateral relations still needed." *Coface for trade*. November 7. Accessed May 1, 2018. <http://www.coface.com/News-Publications/News/China-s-ambitions-in-sub-Saharan-Africa-efforts-to-rebalance-bi-lateral-relations-still-needed>.
- Comnews. 2015. "非洲官员来华学习电力建设经验 [“African officials to study electric power construction in China”].” *Comnews*. Accessed April 17, 2018.
<http://finance.china.com.cn/roll/20150615/3179139.shtml>.
- Conrad, Björn, Mercedes Fernandez, and Bamshad Houshyani. 2011a. *Towards an Energizing Partnership: Exploring China's Role as Catalyst of Renewable Energy Development in Africa*. Amsterdam: Climate

- Focus. Accessed April 29, 2018.
http://www.climatefocus.com/sites/default/files/towards_an_energizing_partnership.pdf.
- Conrad, Björn, and Mirjam Meissner. 2011b. *Catching a Second Wind - Changing the Logic of International Cooperation in China's Wind Energy Sector*. Berlin: Global Public Policy Institute.
- Control Risks. 2018. "RiskMap 2018." *ControlRisks*. Accessed April 23, 2018. <https://cdn-prd-com.azureedge.net/-/media/corporate/files/riskmap-2018/maps/riskmap-map-2018-uk-web.pdf?modified=20171208130003>.
- Corkin, Lucy. 2011. "Uneasy allies: China's evolving relations with Angola." *Journal of Contemporary African Studies* 169-180.
- Crabitès, Pierre. 1929. "The Nile Waters Agreement." *Foreign Affairs*. October. Accessed May 2, 2018.
<https://www.foreignaffairs.com/articles/sudan/1929-10-01/nile-waters-agreement>.
- CREIA. 2015. "2015 年全球可再生能源发展报告 [Annual World Review for China RE Industry in 2015]." Accessed April 17, 2018. <http://www.creia.net/d/file/publish/report/2016-01-14/56b463e43c9c592a1f6728ad13c716ca.pdf>.
- CREIA. 2016. *Outlook for the Chinese Solar PV industry*. Chinese Renewable Energy Industries Association.
- CWEA. 2015. *2015 年中国风电装机容量统计简报 [Rapport statistique sur l'énergie éolienne en Chine en 2015]*. China Wind Energy Association. Accessed April 29, 2018.
http://www.cnenergy.org/xny_183/fd/201604/t20160405_276532.html.
- Dinmore, Guy, and Mark Turner. 2007. "US defends Chian's role in Darfur." *Financial Times*. Accessed April 23, 2018. <http://www.focac.org/eng/ltada/dyjbzjhy/DOC12009/t606797.htm>.
- Du, Bing. 2015. "China's Coal Supply and Future Development." National Energy Administration, China. Accessed April 1, 2018.
http://aperc.ieej.or.jp/file/2015/4/24/4._China_s_Coal_Supply_and_Future_Development.pdf.
- EIA. 2014. *FACTS Global Energy*. Global Trade Information Services, Inc.
- Ekhtator, Eghosa Osa. 2014. "Corporate Social Responsibility and Chinese Oil Multinationals in the Oil and Gas Industry of Nigeria: An Appraisal." *Law School, University of Hull*. Accessed May 1, 2018. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2537436.
- Enerdata. 2016. "Energy balance of world trade." Accessed April 23, 2018.
<https://yearbook.enerdata.net/total-energy/world-import-export-statistics.html>.
- Energy Department of South Africa. 2018. "IPP Projects." Accessed April 30, 2018. <https://www.ipp-projects.co.za/>.
- Eskom. 2016. "Eskom Integrated Report." Accessed April 25, 2018.
http://www.eskom.co.za/IR2016/Documents/Eskom_integrated_report_2016.pdf.
- Esterhuysen, H. 2012. "Made in China – Energy possibilities for Africa's rural poor." *Centre for Chinese Studies at Stellenbosch University*. Accessed April 17, 2018. http://www0.sun.ac.za/ccs/wp-content/uploads/2012/11/CCS_Commentary_China_Renewable_Energy.pdf.
- Esterhuysen, H. 2014. "The potential of China's renewable energy rise in the solar energy." *International Journal of Energy Security and Environmental Research* 1-2 71-86.

- Evans, Peter C, and Erica S Downs. 2006. "Untangling China's Quest for Oil through State-Backed Financial Deals." *Brookings Policy Brief* n°154.
- Eyler, B. 2015. "China's new silk roads tie together three continents." *Chinadialogue*. Accessed April 17, 2018. <https://www.chinadialogue.net/article/show/single/en/7849-China-s-new-silk-roads-tie-together-three-continents>.
- FOCAC. 2009a. "Programme for China-Africa Cooperation in Economic and Social Development." Accessed April 23, 2018. <http://www.focac.org/eng/ltada/dyjbzjhy/DOC12009/t606797.htm>.
- FOCAC. 2009b. "Speech from Premier Wen Jiabao at the fourth Forum on China-Africa Cooperation (FOCAC)." Accessed April 17, 2018. <http://www.focac.org/eng/dsjbzjhy/zyjh/t627391.htm>.
- Friedman, Edward. 2009. "China-Driven Development." *BeijingReview.com*. February 5. Accessed April 8, 2018. http://www.bjreview.com/world/txt/2009-02/01/content_176304.htm.
- Friedman, George, et Xander Snyder. 2018. "How China Benefits from African Debts". Geopolitical Futures. 29 January. Accessed May 3, 2018. <https://geopoliticalfutures.com/china-benefits-african-debt/>
- Gallagher, Kevin P, Rohini Kamal, Yongzhong Wang, and Yanning Chen. 2016. "Fueling Growth and Financing Risk: The benefits and risks of China's development finance in the global energy sector." *Boston University: Global Economic Governance Initiative* 1-27. Accessed April 17, 2018. https://www.bu.edu/pardeeschool/files/2016/05/Fueling-Growth.FINAL_July_.pdf.
- Gazprom. 2018. "Power of Siberia." *Gazprom*. Accessed April 28, 2018. http://www.gazprom.com/f/posts/74/805991/map_sila_sib_e2017-05-18.png.
- Gill, Bates, and James Reilly. 2007. "The Tenuous Hold of China Inc. in Africa." *Washington Quarterly* 30-3 37-52.
- Golub, Stephen S, Janet Ceglowski, Ahmadou Aly Mbaye, and Varun Prasad. 2017. "Can Africa compete with China in manufacturing? The role of relative unit labour costs." *The World Economy*, December 27. Accessed May 2, 2018. <https://onlinelibrary.wiley.com/doi/pdf/10.1111/twec.12603>.
- Grimes, Seamus, and Yutao Sun. 2014. "Implications of China's ongoing Dependence on Foreign Technology." *Geoforum* 54 59-69.
- GWEC. 2017. "Global Installed Power Capacity (MW) - Regional Distribution." Accessed April 29, 2018. <http://gwec.net/wp-content/uploads/2018/04/Global-Installed-Wind-Power-Capacity-MW-%E2%80%93-Regional-Distribution-1.jpg>.
- Hameiri, Shahar, and Lee Jones. 2015. "Rising Power and State Transformation: The Case of China." *European Journal of International Relations* 22-1 72-98. Accessed April 30, 2018. <http://journals.sagepub.com/doi/pdf/10.1177/1354066115578952>.
- Hammond, Joseph. 2017. "Sudan: China's Original Foothold in Africa." Accessed May 3, 2018. <https://thediplomat.com/2017/06/sudan-chinas-original-foothold-in-africa/>.
- Hart, Melanie, Luke Bassett, and Blaine Johnson. 2017. "Everything You Think You Know About Coal in China Is Wrong." *Center for American Progress*. Accessed April 30, 2018. <https://www.americanprogress.org/issues/green/reports/2017/05/15/432141/everything-think-know-coal-china-wrong/>.

- Hensengerth, Oliver. 2013. "Chinese Hydropower Companies and Environmental Norms in Countries of the Global South: The Involvement of Sinhydro in Ghana's Bui Dam." *Environment, Development and Sustainability* 15-2 285-300.
- Hook, Leslie. 2013. "Top solar panel maker goes bankrupt." *CNN*. Accessed April 29, 2018. <https://edition.cnn.com/2013/03/20/business/china-suntech-bankrupt/index.html>.
- Horner, Rory. 2015. "A New Economic Geography of Trade and Development? Governing South-South Trade, Value Chains and Production Networks." *Territory, Politics, Governance* 1-21.
- Horta, Loro. 2009. "China in Africa: Soft Power, Hard Results." *Yale Global Online*. November 13. Accessed April 8, 2018. <https://yaleglobal.yale.edu/content/china-africa-soft-power-hard-results>.
- Ibrahim, Ahmed. 2017. "Impact of Ethiopian Renaissance Dam and Population on Future Egypt Water Needs." *American Journal of Engineering Research (AJER)* 6-5, 160-171. Accessed May 2, 2018. https://www.researchgate.net/publication/317041125_Impact_of_Ethiopian_Renaissance_Dam_and_Population_on_Future_Egypt_Water_Needs.
- ICTSD. 2011. "Social responsibility of Chinese investment in Africa: What does it mean for EU-China Cooperation on development policy towards Africa?" *International Center for Trade and Sustainable Development*. Accessed May 2, 2018. <https://www.ictsd.org/bridges-news/trade-negotiations-insights/news/social-responsibility-of-chinese-investment-in-africa>.
- IEA. 2010. "World Energy Outlook - China's Rising Energy Demand, 1990-2035 in Comparative Perspective."
- IEA. 2014. "Africa Energy Outlook - A focus on energy prospects in Sub-Saharan Africa." Accessed April 23, 2018. https://www.iea.org/publications/freepublications/publication/WEO2014_AfricaEnergyOutlook.pdf.
- IEA. 2015. "World Energy Outlook." Paris.
- IEA. 2016. "Boosting the power sector in Sub-Saharan Africa."
- IEA. 2017a. *World Energy Outlook*. Paris: OECD.
- IEA. 2017b. "World Energy Outlook 2017: China." Accessed April 1, 2018. <https://www.iea.org/weo/china/>.
- IEA. 2017c. "Market Report Series: Renewables 2017." *IEA*. October 4. Accessed April 23, 2018. <https://www.iea.org/publications/renewables2017/>.
- IEA. 2017d. "Key World Energy Statistics 2017." Accessed April 1, 2018. <https://www.iea.org/publications/freepublications/publication/KeyWorld2017.pdf>.
- IMF. 2014. "IMF Country Report 14/168 NIGER." Accessed April 26, 2018. <https://www.imf.org/external/pubs/ft/scr/2014/cr14168.pdf>.
- IMF. 2017. "Regional Economic Outlook: Sub-Saharan Africa - Fiscal Adjustment and Economic Diversification." Accessed April 23, 2018. <file:///C:/Users/Valou%20Grimoux/Desktop/T%C3%A9%20chagements/sreo1017.pdf>.

- IMF. 2018. "World Economic Outlook (April 2018) - Real GDP growth." *IMF DataMapper*. Accessed April 23, 2018.
http://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD.
- International Rivers. 2017. "Grand Ethiopian Renaissance Dam." *International Rivers*. Accessed May 2, 2018. <https://www.internationalrivers.org/campaigns/grand-ethiopian-renaissance-dam>.
- Jiao, Xiao Lei. 2011. "“走出去”战略概述 (An Overview of the "Going Out" Strategy)." *State Council of the People's Republic of China*. Accessed April 8, 2018.
<http://qwgyzy.gqb.gov.cn/yjytt/159/1743.shtml>.
- Johnson, Gwladys. 2017. "Ethiopie : une nouvelle augmentation de 450 MW de la puissance du barrage de Grand Renaissance." *Agence EcoFin*. February 27. Accessed May 2, 2018.
<https://www.agenceecofin.com/hydroelectricite/2702-45214-ethiopie-une-nouvelle-augmentation-de-450-mw-de-la-puissance-du-barrage-de-grand-renaissance>.
- Kadirire, Helen. 2017. "Chinese abusing workers: ZTCU." *Daily News Zimbabwe*. Accessed April 28, 2018. <https://www.dailynews.co.zw/articles/2017/05/08/chinese-abusing-workers-zctu>.
- Kebede, Ezana. 2015. "Ethiopia: The Financing of the Grand Ethiopian Renaissance Dam (GERD)." *Nazret.com*. March 30. Accessed May 2, 2018.
<http://nazret.com/blog/index.php/2015/03/30/ethiopia-the-financing-of-the>.
- Kerr, Pauline, Stuart Harris, and Yaqing Qin. 2008. *China's "New" Diplomacy: Tactical or Fundamental change?* New York: Palgrave Macmillan.
- Klagge, Britta, Zhigao Liu, and Pedro Campos Silva. 2012. "Constructing China's Wind Energy Innovation System." *Energy Policy* 50 370-382.
- Lema, Rasmus, Axel Berger, and Hubert Schmitz. 2013. "China's Impact on the Global Wind Power Industry." *Journal of Current Chinese Affairs* 42-1 37-69. Accessed April 29, 2018.
<http://journals.sub.uni-hamburg.de/giga/jcca/article/viewFile/591/589>.
- Lewis, Joanna. 2013. *Green Innovation in China: China's Wind Power Industry and the Global Transition to a Low-carbon Economy*. New York: Columbia University Press.
- Lewis, Joanna. 2014. "The Rise of Renewable Energy Protectionism: Emerging Trade Conflicts and Implications for Low Carbon Development." *Global Environmental Politics* 14-4 10-35.
- Li, Xin, Klaus Hubacek, and Yim Ling Siu. 2012. "Wind Power in China - Dream or Reality?" *Energy* 37-1 51-60.
- Lieberthal, Kenneth G. 2012. "Introduction: The "Fragmented Authoritarianism" Model and its Limitations"." In *Bureaucracy, Politics and Decision Making in Post-Mao China*, by Kenneth Lieberthal and David Lampton, 1-30. Berkeley: University of California Press.
- Liu, Qilin, Qi Lei, Huiming Xu, and Jiahai Yuan. 2018. "China's energy revolution strategy into 2030." *Resources, Conservation and Recycling* 128: 78-89. Accessed April 1, 2018.
<https://www.sciencedirect.com/science/article/pii/S0921344917303130#bib0215>.
- Mathews, Johns A., and Hao Tan. 2015. *China's Renewable Energy Revolution*. Basingstoke: Palgrave Macmillan.
- Matsuo, Tyeler. 2016. "Inside South Africa's battle between coal and renewables." *Climate Change News* (UNEP Centre/BNEF). Accessed April 25, 2018.

<http://www.climatechangenews.com/2016/06/16/inside-south-africas-battle-between-coal-and-renewables/>.

- McDonald, Kristen, Peter Bosshard, and Nicole Brewer. 2009. "Exporting Dams: China's Hydropower Industry goes Global." *Journal of Environmental Management* 90 294-302.
- McKinsey. 2017. "Dance of the lions and dragons: How are Africa and China engaging, and how will the partnership evolve?" *McKinsey&Company*. Accessed April 26, 2018. <https://www.mckinsey.com/~media/McKinsey/Global%20Themes/Middle%20East%20and%20Africa/The%20closest%20look%20yet%20at%20Chinese%20economic%20engagement%20in%20Africa/Dance-of-the-lions-and-dragons.ashx>.
- Meidan, Michal. 2016. "The structure of China's oil industry: Past trends and future prospects." *The Oxford Institute for Energy Studies*, May. Accessed April 28, 2018. <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2016/05/The-structure-of-Chinas-oil-industry-past-trends-and-future-prospects-WPM-66.pdf>.
- MFA. 2015. *Chinese Ambassador in South Africa, Mr. Xuejun Tian, is Interviewed by South African Independent Media Regarding the Forum on China-African Cooperation*. China's ministry of Foreign Affairs.
- Naudet, Jean-Baptiste. 2016. "France-Gabon : 56 ans de relations incestueuses." *Nouvel Obs*. Accessed April 26, 2018. <https://www.nouvelobs.com/monde/20160825.OBS6870/france-gabon-56-ans-de-relations-incestueuses.html>.
- NDRC. 2006. "11th Five-Year Plan - Energy consumption: major environment concern." Accessed April 1, 2017. http://www.gov.cn/english/2006-04/13/content_252597.htm.
- NDRC. 2011. "12th Five-Year Plan - Key Targets." Accessed April 1, 2018. http://www.gov.cn/english/2011-03/05/content_1816822.htm.
- NDRC. 2012. "国家能源局关于加强风电并网和消纳工作有关要求的通知 国能新能 [Notifications for Strengthening the Accommodation and Grid Connection of Wind Energy Production]." http://www.nea.gov.cn/2012-06/01/c_131624884.htm.
- NDRC. 2015. *推动共建丝绸之路经济带和 21 世纪海上丝绸之路的愿景与行动* ["*Vision and actions on jointly building Silk Road Economic Belt and 21st-Century Maritime Silk Road*"]. NDRC. Accessed April 17, 2018. en.ndrc.gov.cn/newsrelease/.
- NDRC. 2016a. "可再生能源发展“十三五”规划 [13th Five-Year Plan - Développement des énergies renouvelables]." NDRC. Accessed April 23, 2018. <http://www.ndrc.gov.cn/zcfb/zcfbtz/201612/W020161216659579206185.pdf>.
- NDRC. 2016b. "国家发展改革委关于印发石油天然气发展 [13th Five-Year Plan - Development Plan for Oil]." December 24. Accessed April 23, 2018. <http://zfxgk.ndrc.gov.cn/PublicItemView.aspx?ItemID={bd914c67-7b4a-4170-a43b-80bddbd07a79}>.
- NDRC. 2016c. "能源技术革命创新行动计划 (2016–2030 年) [China Energy Revolution Plan 2016-2030]." Accessed April 23, 2018. <http://www.ndrc.gov.cn/zcfb/zcfbtz/201606/W020160601304245143804.pdf>.
- Njobeni, Siseko. 2017. "Eskom in talks over 37 purchase agreements." *Business Report*. Accessed April 30, 2018. <https://www.iol.co.za/business-report/energy/eskom-in-talks-over-37-purchase-agreements-8538110>.

- Okeowo, Alexis. 2013. "China, Zambia, and a Clash in a Coal Mine." *The New Yorker*. October 09. Accessed May 3, 2018. <https://www.newyorker.com/business/currency/china-zambia-and-a-clash-in-a-coal-mine>.
- Olander, Eric, and Cobus van Staden. 2016. "Ghana Resident: Why Does China Send Workers To Africa When So Many Here Are Unemployed?" *Huffington Post*. Accessed April 28, 2018. https://www.huffingtonpost.com/entry/china-workers-africa_us_57ad51ace4b071840410bb60.
- Oronero, Jon. 2017. "China opens long-delayed Myanmar oil pipeline." *Medium*. Accessed April 28, 2018. <https://medium.com/@Oillywood/china-opens-long-delayed-myanmar-oil-pipeline-9c91dbfe0096>.
- Power, Marcus, Giles Mohan, and Tan-Mullins May. 2012. "China's Resource Diplomacy in Africa: Powering Development?" Basingstoke: Palgrave Macmillan.
- Power, Marcus, Peter Newell, Lucy Baker, Harriet Bulkeley, Joshua Kirschner, and Smith Adrian. 2016. "The Political Economy of Energy Transitions in Southern Africa: The role of Rising Power." *Energy Research and Social Sciences* 10-19.
- PRC State Council. 2015. "Made in China 2025." *PRC State Council*. Accessed April 28, 2018. <http://english.gov.cn/2016special/madeinchina2025/>.
- Prisco, Jacopo. 2015. "Can dams increase the risk of malaria?" *CNN*. September 11. Accessed May 2, 2018. <https://edition.cnn.com/2015/09/11/africa/africa-malaria-dams/index.html>.
- PwC. 2017. "Learning to leapfrog: Africa oil & gas review." Accessed April 29, 2018. <https://www.pwc.co.za/en/assets/pdf/africa-oil-and-gas-review-2017.pdf>.
- Qi, Ye, Nicholas Stern, Tong Wu, Jiaqi Lu, and Fergus Green. 2016. "China's Post-Coal Growth." *Nature Geoscience* 9: 564-566. Accessed April 1, 2018. <https://www.nature.com/articles/ngeo2777>.
- Ramo, Joshua C. 2004. *The Beijing Consensus*. The Foreign Policy center.
- RECP. 2017. "South Africa - Energy Sector." *Africa-EU Renewable Energy Cooperation Programme*. Accessed April 30, 2018. <https://www.africa-eu-renewables.org/market-information/south-africa/energy-sector/>.
- Renqing, Liu. 2013. "Development of enhanced oil recovery in Daqing." *Journal of Petroleum and Gas Engineering* 4-2, February: 46-50. Accessed April 28, 2018. <http://www.academicjournals.org/journal/JPGGE/article-full-text-pdf/E33B9484775>.
- Reuters. 2015. *Coal remains dominant in China's energy mix*. National Energy Administration - National Bureau of Statistics.
- Reuters. 2017a. "China welcomes EU decision on solar panel import prices." *Reuters*. Accessed April 28, 2018. China welcomes EU decision on solar panel import prices.
- Reuters. 2017b. "China's growth engine stutters as factories slow down." *The Guardian*. December 31. Accessed May 2, 2018. <https://www.theguardian.com/business/2017/dec/31/chinas-growth-engine-stutters-as-factories-slowdown>.
- Reuters. 2018. "China set to top Japan as world's biggest natural gas importer." *Reuters*. Accessed April 28, 2018. <https://www.cnbc.com/2018/01/03/china-set-to-top-japan-as-worlds-biggest-natural-gas-importer.html>.

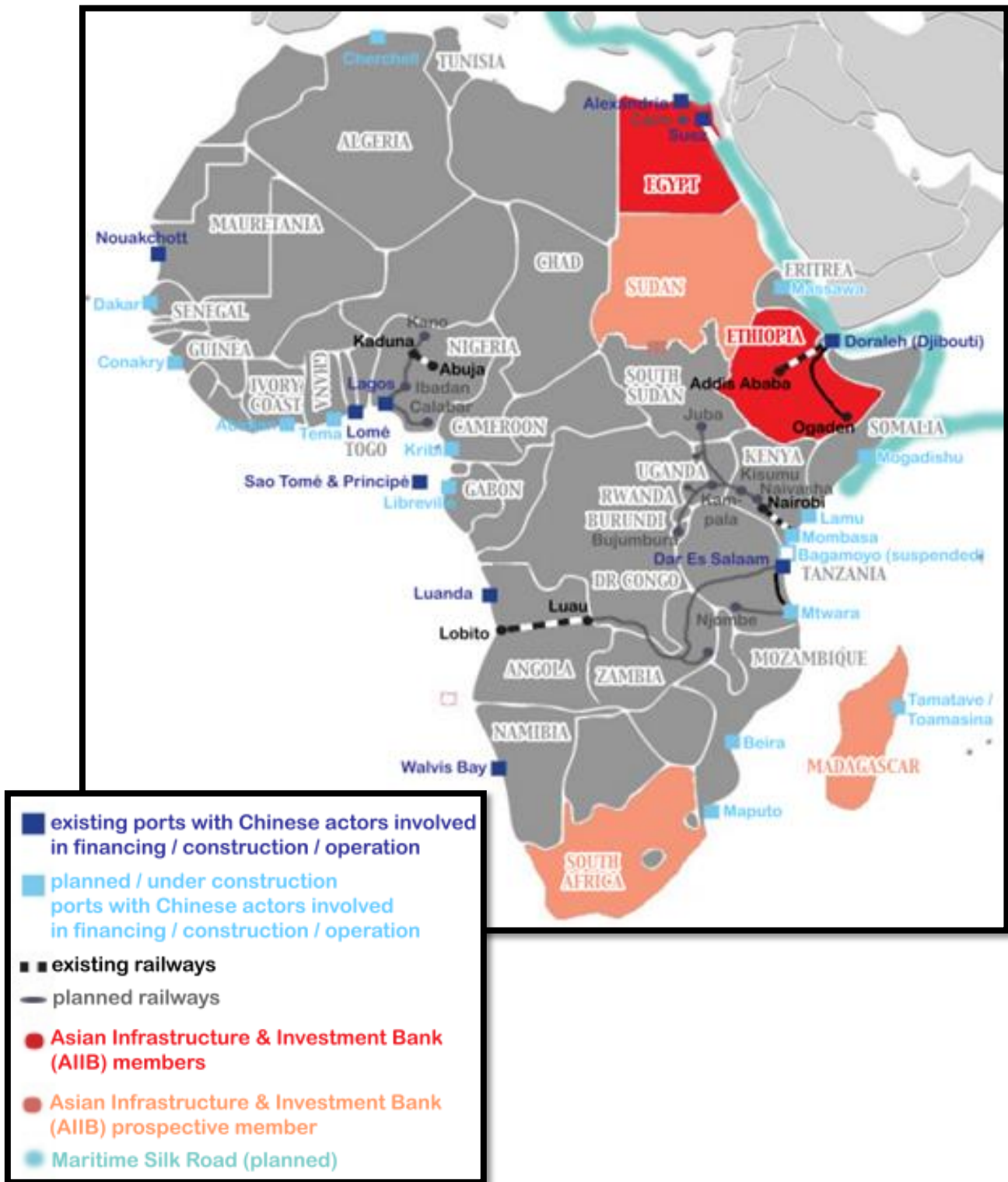
- Rice, Xan. 2012. "China's goods burden Africa's producers." *The Washington Post*. Accessed April 28, 2018. https://www.washingtonpost.com/world/africa/chinas-goods-burden-africas-producers/2012/07/20/gJQAUDVPyW_story.html?noredirect=on&utm_term=.e859d6e9e798.
- Robertson, Winslow, and Lina Benabdallah. 2016. "China pledged to invest \$60 billion in Africa. Here's what that means." *The Washington Post*. Accessed April 29, 2018. <https://www.washingtonpost.com/news/monkey-cage/wp/2016/01/07/china-pledged-to-invest-60-billion-in-africa-heres-what-that-means/>.
- Rojas, Francisco. 2016. "Ethiopia looks to China for geothermal and renewable investment." *ThinkGeoenergy*. April 20. Accessed May 2, 2018. <http://www.thinkgeoenergy.com/ethiopia-looks-to-china-for-geothermal-and-renewable-investment/>.
- Rose, Adam. 2015. "Exclusive: China crude imports seen at record as it fills strategic reserves." *Reuters*. Accessed April 28, 2018. <https://in.reuters.com/article/china-oil-reserves/exclusive-china-crude-imports-seen-at-record-as-it-fills-strategic-reserves-idINKBN0KG0WC20150107>.
- Rosen, Armin. 2015. "An oil dispute in Niger is exposing big problems with Chinese investment in Africa." *Business Insider*. Accessed April 26, 2018. <http://www.businessinsider.com/niger-oil-and-chinese-investment-in-africa-2015-9>.
- Sebban, Anne-Sophie. 2012. "Éthiopie : la construction du barrage « Renaissance » et ses enjeux." *lexpansion.com*. November 12. Accessed May 2, 2018. http://energie.lexpansion.com/energies-renouvelables/ethiopie-la-construction-du-barrage-renaissance-et-ses-enjeux_a-33-7617.html.
- Seth, Shobhit. 2015. "Why Is China Stockpiling Millions of Barrels of Oil?" *Investopedia*. Accessed April 28, 2018. <https://www.investopedia.com/articles/investing/021015/why-china-stockpiling-millions-barrels-oil.asp>.
- Shinn, David H. 2016. "The Environmental Impact of China in Africa." *Cornell International Law Journal* 49-1, 25-65. Accessed May 3, 2018. <https://scholarship.law.cornell.edu/cgi/viewcontent.cgi?article=1875&context=cilj>.
- Spillius, Alex. 2009. "Barack Obama tells Africa to stop blaming colonialism for problems." *The Telegraph*. July 09. Accessed April 8, 2018. <https://www.telegraph.co.uk/news/worldnews/africaandindianocean/5778804/Barack-Obama-tells-Africa-to-stop-blaming-colonialism-for-problems.html>.
- State Council. 2013. "中国与非洲的经贸合作 [Economic and Trade Cooperation between China and Africa]." Accessed April 23, 2018. <http://www.scio.gov.cn/zfbps/ndhf/2013/Document/1344913/1344913.htm>.
- Statista. 2018. "Major countries in worldwide cement production from 2012 to 2017 (in million metric tons)." *Statista*. Accessed April 23, 2018. <https://www.statista.com/statistics/267364/world-cement-production-by-country/>.
- Stavis-Gridneff, Matina. 2018. "Troubled Waters: Egypt and Ethiopia Wrangle Over Nile Dam." *The Wall Street Journal*. January 17. Accessed May 2, 2018. <https://www.wsj.com/articles/troubled-waters-egypt-and-ethiopia-wrangle-over-nile-dam-1516185001>.
- Su, Xiaobo. 2012. "Rescaling the Chinese State and Regionalization in the Great Mekong Subregion." *Review of International Political Economy* 19-2 502-527.
- Su, Xiaochen. 2017. "Why Chinese Infrastructure Loans in Africa Represent a Brand-New Type of Neocolonialism." *The Diplomat*, June 9. Accessed April 28, 2018.

- <https://thediplomat.com/2017/06/why-chinese-infrastructure-loans-in-africa-represent-a-brand-new-type-of-neocolonialism/>.
- Swain, Ashok. 2011. "Challenges for Water Sharing in the Nile Basin: Changing Geopolitics and Changing Climate." *Hydrological Sciences Journal* 56-4 687-702.
- kongTotal Gabon. 2018. "Rappel historique de Total au Gabon." *Total Gabon*. Accessed April 26, 2018. <https://www.total.ga/lentreprise/historique>.
- Tshwane, Tebogo. 2018. "Eskom has a problem, a R20-billion problem." *Mail & Guardian*. Accessed April 30, 2018. <https://mg.co.za/article/2018-01-12-00-eskom-has-a-problem-a-r20-billion-problem>.
- Vaillant, Frantz. 2016. "France-Gabon : pétrole, intérêts et vigilance." *TV5 Monde*. Accessed April 26, 2018. <https://information.tv5monde.com/afrique/france-gabon-petrole-interets-et-vigilance-125900>.
- van der Lugt, S. 2014. "Mapping and comparing China's imports from Africa." *European Centre for Development Policy Management (ECDPM)*. April. Accessed April 23, 2018. <http://ecdpm.org/great-insights/emerging-economies-and-africa/mapping-comparing-chinas-imports-africa/>.
- Veilleux, Jennifer C. 2013. "The Human Security Dimensions of Dam Development: The Grand Ethiopian Renaissance Dam." *Global Dialogue* 15-2. Accessed April 23, 2018. file:///C:/Users/Valou%20Grimoux/Desktop/T%C3%A9%20A9chargements/The_Human_Security_Dimensions_of_Dam_Dev.pdf.
- Wang, Jianliang, Lianyong Feng, Simon Davidsson, and Mikael Höök. 2013. "Chinese coal supply and future production outlooks." *Energy* 60: 204-214. Accessed April 1, 2018. <https://www.sciencedirect.com/science/article/pii/S0360544213006361?via%3Dihub>.
- WaterWorld. 2016. "Grand designs North Africa: Impact of Ethiopia's Renaissance Dam." *Water World*. Accessed May 2, 2018. <http://www.waterworld.com/articles/wwi/print/volume-29/issue-1/regional-spotlight/ethiopia-impact-of-renaissance-dam/grand-designs-north-africa-impact-of-ethiopia-s-renaissance-dam.html>.
- WBG. 2016a. "China's GDP in current US\$." *World Bank Data*. Accessed April 23, 2018. <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?end=2016&locations=CN&start=2000>.
- WBG. 2016b. "Sub-Saharan Africa Trade Summary 2016 Data." *World Integrated Trade Solution*. Accessed April 23, 2018. <https://wits.worldbank.org/CountryProfile/en/Country/SSF/Year/2016/Summary>.
- Wei, Shen. 2016. *A New Era for China's Renewable Energy Development? External Shocks, Internal Struggles and Policy Changes*. IDS Evidence Report 196. Accessed April 29, 2018. http://opendocs.ids.ac.uk/opendocs/bitstream/123456789/11641/1/ER196_ANewEraforChinasRenewableEnergyDevelopmentExternalShocksInternalStrugglesandPolicyChanges.pdf.
- Wei, Shen, and Marcus Power. 2017. "Africa and the export of China's clean energy revolution." *Third World Quarterly*, 678-697. Accessed May 1, 2018. <https://www.tandfonline.com/doi/full/10.1080/01436597.2016.1199262>.
- Whelan, G, and J N Muthuri. 2014. "Chinese state-owned enterprises and human rights: The importance of national and intra-organizational pressures." *Business & Society*, November 2:

- 738-781. Accessed May 1, 2018.
<http://journals.sagepub.com/doi/abs/10.1177/0007650315612399>.
- World Steel Association. 2017. "World Steel in Figures 2017." *World Steel Association*. May 29. Accessed April 23, 2018. <https://www.worldsteel.org/media-centre/press-releases/2017/world-steel-in-figures-2017.html>.
- Wuilbercq, Emeline. 2014. "Ethiopia's Nile dam project signals its intention to become an African power." *The Guardian*. Accessed April 23, 2018. <https://www.theguardian.com/global-development/2014/jul/14/ethiopia-grand-renaissance-dam-egypt>.
- Xinhua. 2014. "习近平：积极推动我国能源生产和消费革命 (Xi Jinping: Promoting Revolution in Energy Consumption and Supply)." *Xinhua News*. Accessed April 1, 2018. http://www.xinhuanet.com/politics/2014-06/13/c_1111139161.htm.
- Xinhua. 2015a. "我国提交应对气候变化国家自主贡献文件 (China Submitted Intended Nationally Determined Contributions File to UNFCCC)." *Xinhua News*. Accessed April 1, 2018. http://www.gov.cn/xinwen/2015-06/30/content_2887337.htm.
- Xinhua. 2015b. "Kenya inks nuclear power partnership deal with China." *Africa News*. Accessed April 17, 2018. http://www.xinhuanet.com/english/2015-09/11/c_134616133.htm.
- Xinhua. 2015c. "中国对非洲政策文件 [China African Policy in 2015]." *Xinhua News*. Accessed April 23, 2018. http://www.xinhuanet.com/world/2015-12/05/c_1117363276.htm.
- Xinhua. 2016. "China ranks first worldwide in PV Power Capacity." *Xinhua News*. Accessed April 17, 2018. http://www.xinhuanet.com/english/2016-01/21/c_135032035.htm.
- Yang, Jianbo, Qunyi Liu, Li Xin, and Xiandan Cui. 2017. "Overview of Wind Power in China: Status and Future." *MDPI*. Accessed April 29, 2018. www.mdpi.com/2071-1050/9/8/1454/pdf.
- Yu, Ka-ho, and Zhou Yunheng. 2016. "China's energy security and Sino-African energy cooperation." In *China's Energy Security: A Multidimensional Perspective*, by Giulia C ROMANO and Jean-François MEGLIO, edited by Taylor and Francis, 160-173. Accessed April 27, 2018. https://ebookcentral.proquest.com/lib/jhu/reader.action?docID=4556596&ppg=162&query=&_=.
- Zhang, Sufang, Philip Andrews-Speed, and Meiyun Ji. 2014. "The erratic path of the low-carbon transition in China: Evolution of solar PV policy." *ScienceDirect*. Accessed April 29, 2018. <https://www.sciencedirect.com/science/article/pii/S030142151301327X>.
- Zhao, Xiaoli, Feng Wang, and Mei Wang. 2012. "Large-scale Utilization of Wind Power in China: Obstacles of Conflict between Market and Planning." *Energy Policy* 48 222-232.

APPENDIX 1

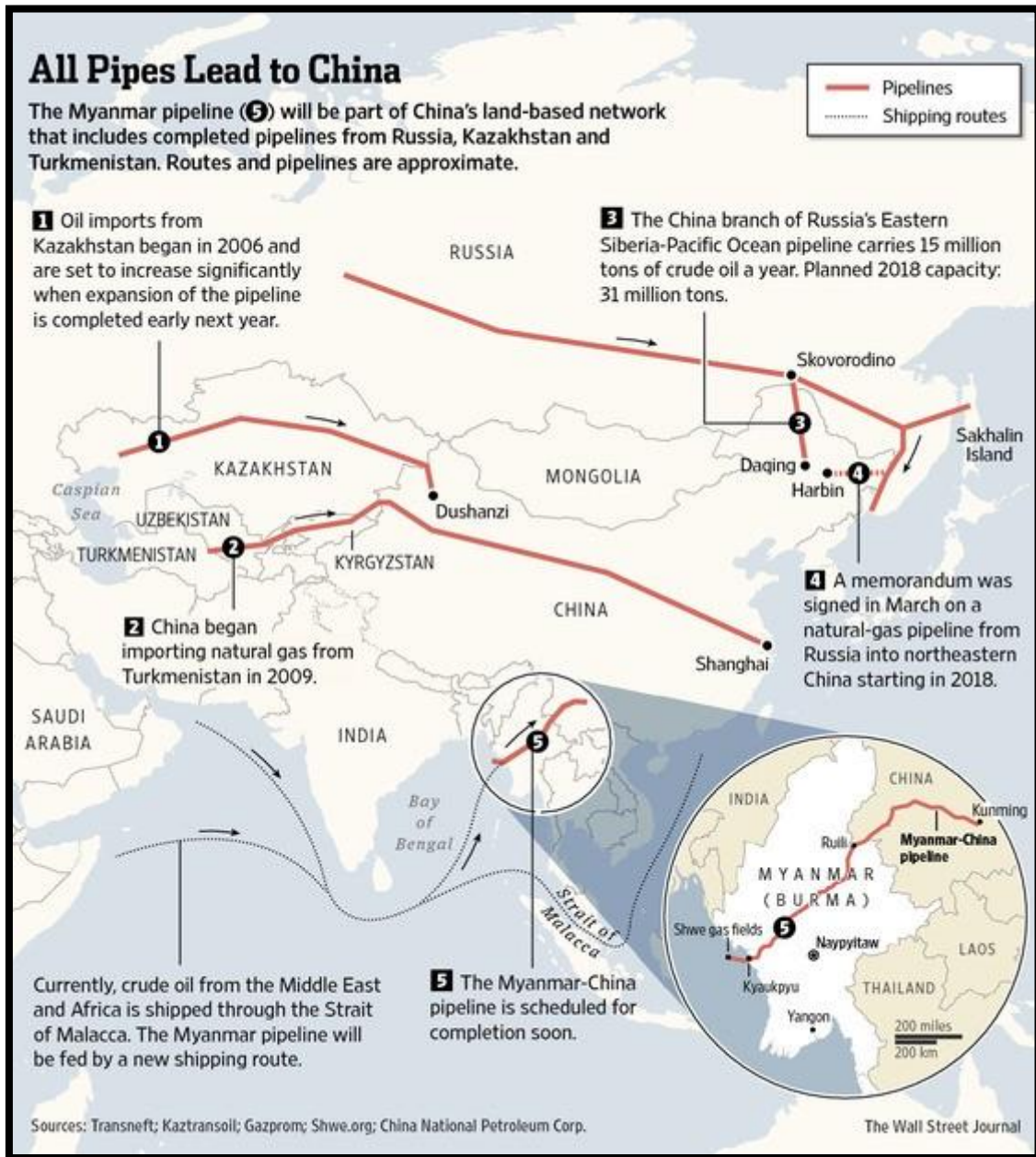
[1] China's BRI: Map of Chinese investments in SSA's railways, roads and harbors



source: (Breuer 2017)

APPENDIX 2

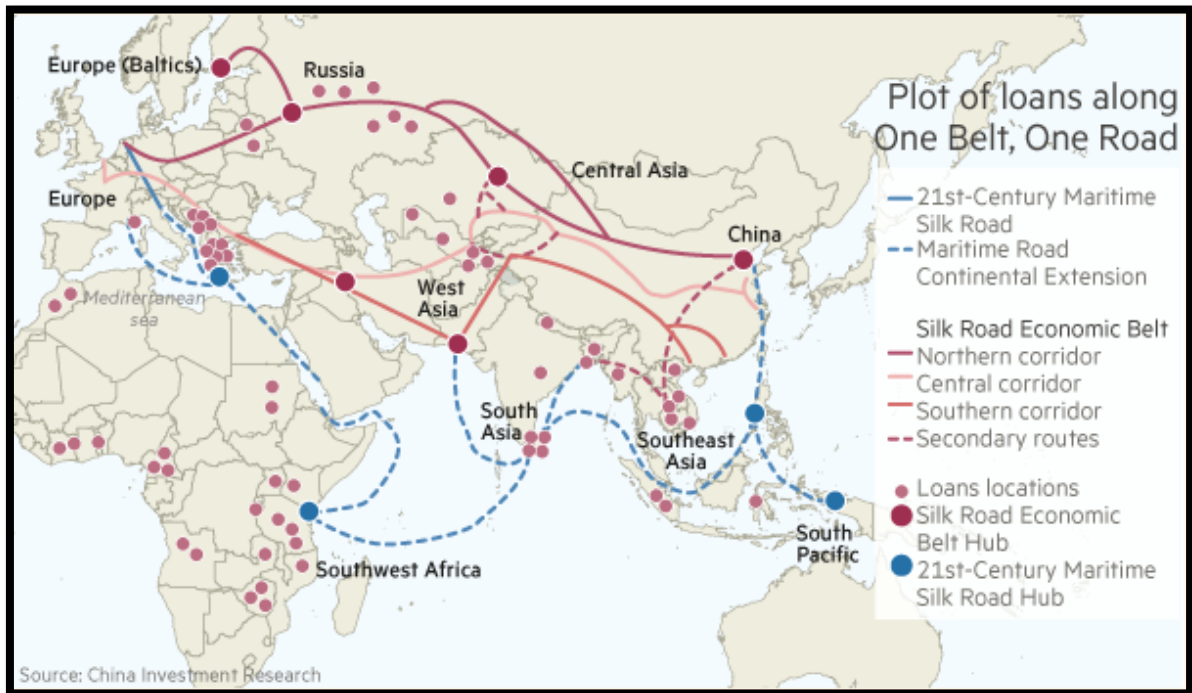
[2] Map of the BRI and the expansion of China's pipelines with its neighbors.



Source: (Oronero 2017)

APPENDIX 3

[3] Map of the BRI and Chinese investments overseas.



Source: (China Investment Research 2015)

APPENDIX 4

[4] List of Chinese resource-backed loans in Africa 2000-2014 (CARI).

(A) For projects or SOEs

Status	Year	Recipient	Financier	Actual implemented amount (US\$ mn)	Purpose	Resource-backed
Completed	2010	Angola	ICBC	2500	Resource-backed structured financing (Kilamba Kiaxi New Town)	oil backed
Implementation	2011	Angola	CDB	2000	Sonangol development	oil backed
Implementation	2012	Angola	CDB	1000	Sonangol development	oil backed
Implementation	2013	Angola	CDB	2500	Sonangol development	oil backed
Signed	2014	Angola	CDB	2000	Sonangol development	oil backed
Implementation	2008	DRC	Eximbank	1300	Mining Project disbursed amount as of END OF 2014	profits from copper
Completed	2008	Gabon	Eximbank	300	Grand Poubara Hydropower Project	iron-ore backed*
Completed	2007	Ghana	Eximbank	292	Bui Hydropower Project (CommL part)	38000 ton Cocoa/year & electricity offtake
Completed	2002	Nigeria	CMEC	115	Omosho Gas Power Plant in Ondo State	oil-backed
Completed	2006	Nigeria	Eximbank	200	NICOMSAT satellite	oil-backed

Completed	2003	ROC	CMEC	238	Imboulou Hydropower Station, new, 120MW	oil-backed
Completed	2001	Sudan	Harbin Power Equipment Company	128	El-Jaili (Garri) Gas Power Station Phase I 212MW	oil backed
Implementation	2009	Sudan	Eximbank	119	Al Rank - Malakal Road (Peace Road)	oil backed
Completed	2009	Sudan	Eximbank	86	Aum Kadada - Alfashir Road (Salvation Road/ Aum-Fa Road)	oil backed
Implementation	2009	Sudan	Eximbank	680	Al Fulah Gas-Power Plant	oil backed
Implementation	2009	Sudan	Eximbank	100	Al Dibabat - Abou Zayd - El Fula Road (Dubeibat - Abu Zabad - El Fula Road)	oil backed
Completed	2009	Sudan	Eximbank	120	El Nahood - Aum Kadada Road (En Nahud - Um Kadada Road)	oil backed
Inactive	2010	Sudan	Eximbank	118	Social housing in Khartoum and other area	oil backed
Implementation	2010	Sudan	Eximbank	233	South Kordofan Transmission Lines (Al Fulah Thermal Plant's Transmission Line?)	oil backed
Inactive	2010	Sudan	Eximbank	30	Agricultural improvement/ electricification in Blue Nile	oil backed
Signed	2010	Sudan	Eximbank	24	Dali water project	oil backed
Completed	2010	Sudan	Eximbank	66	Sennar Bridge	oil backed

Implementation	2004	Zimbabwe	Catic China	110	Purchase of Rural Electrification Agency Equipment	Tobacco
Completed	2006	Zimbabwe	Eximbank	200	Agricultural equipment, pesticides, fertilizer, etc.	Secured with platinum deposits
Completed	2011	Zimbabwe	Eximbank	105	National Defense College	diamond (Zim side of Anjin JV income in an escrow account)
TOTAL				14,564		
*proposed, but canceled						

(B) Line of credits to African governments

Status	Year	Recipient	Financier	Actual implemented amount (US\$ mn)	Purpose	Resource backed
Completed	2004	Angola	Eximbank	2,000	Multisector Infrastructure	10000 bpd oil
Completed	2007	Angola	Eximbank	2,000*	Multisector Infrastructure	oil-backed
Completed	2007	Angola	Eximbank	500	Multisector Infrastructure	oil-backed
Implementation	2009	Angola	Eximbank	2,000	Multisector Infrastructure	oil-backed
Finance Canceled	2012	Chad	Eximbank	2,000*	Multisector Infrastructure	oil-backed
Implementation	2008	DRC	Eximbank	3,000*	Multisector Infrastructure	copper profits
Implementation	2005	Eq. Guinea	Eximbank	2,000*	Multisector Infrastructure	oil-backed
Completed	2006	ROC	Eximbank	2,000*	Multisector Infrastructure	oil-backed
Implementation	2012	ROC	Eximbank	1,000*	Multisector Infrastructure	oil-backed
Completed	2007	Sudan	Eximbank	3,000*	Multisector Infrastructure	oil-backed
Completed	2011	Ghana	CDB	3,000*	Multisector Infrastructure	oil-backed
Signed	2013	Niger	Eximbank	1,000*	Unknown	oil-backed
TOTAL				23,500		

* Note that not all of these have been committed or disbursed and some are no longer active. This sum is not reflected in our database, which includes only lines of credit that were still active in 2014, and commitments and disbursements of sub-loans from previous lines of credit.

Source: (Brautigam 2016)

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI
Fondazione Eni Enrico Mattei Working Paper Series

Our Working Papers are available on the Internet at the following addresses:
<http://www.feem.it/getpage.aspx?id=73&sez=Publications&padre=20&tab=1>

NOTE DI LAVORO PUBLISHED IN 2018

- 1.2018, CSI Series, Claudio Morana, Giacomo Sbrana, [Some Financial Implications of Global Warming: an Empirical Assessment](#)
- 2.2018, ET Series, Berno Büchel, Stefan Klößner, Martin Lochmüller, Heiko Rauhut, [The Strength of Weak Leaders - An Experiment on Social Influence and Social Learning in Teams](#)
- 3.2018, ET Series, Daniele Valenti, Matteo Manera, Alessandro Sbuelz, [Interpreting the Oil Risk Premium: do Oil Price Shocks Matter?](#)
- 4.2018, CSI Series, Lionel Nesta, Elena Verdolini, Francesco Vona, [Threshold Policy Effects and Directed Technical Change in Energy Innovation](#)
- 5.2018, ET Series, Emerson Melo, [A Variational Approach to Network Games](#)
- 6.2018, ET Series, Daniele Valenti, [Modelling the Global Price of Oil: Is there any Role for the Oil Futures-spot Spread?](#)
- 7.2018, CSI Series, Giovanna d'Adda , Yu Gao , Russell Golman and Massimo Tavoni, [It's So Hot in Here : Information Avoidance, Moral Wiggle Room, and High Air Conditioning Usage](#)
- 8.2018, CSI Series, Cristina Cattaneo, [Internal and External Barriers to Energy Efficiency: Made-to-Measure Policy Interventions](#)
- 9.2018, ET Series, Hipòlit Torró, [The Response of European Energy Prices to ECB Monetary Policy](#)
- 10.2018, ESP Series, Giovanni Occhiali, Giacomo Falchetta, [The Changing Role of Natural Gas in Nigeria](#)
- 11.2018, CSI Series, Nuno Carlos Leitão, [Climate Change and Kuznets Curve: Portuguese Experience](#)
- 12.2018, ET Series, Banchongsan Charoensook, [\$B_i\$ and Branching Strict Nash Networks in Two-way Flow Models: a Generalized Sufficient Condition](#)
- 13.2018, ET Series, Maryam Ahmadi, Matteo Manera, and Mehdi Sadeghzadeh, [Investment-Uncertainty Relationship in the Oil and Gas Industry](#)
- 14.2018, ET Series, Christian K. Darko, Giovanni Occhiali and Enrico Vanino, [The Chinese are Here: Firm Level Analysis of Import Competition and Performance in Sub-Saharan Africa](#)
- 15.2018, ET Series, Giovanni Gualtieri, Marcella Nicolini, Fabio Sabatini, Luca Zamparelli, [Natural Disasters and Demand for Redistribution: Lessons from an Earthquake](#)
- 16.2018, SAS Series, Linda Arata, Gianni Guastella, Stefano Pareglio, Riccardo Scarpa, Paolo Sckokai, [Periurban Agriculture: do the Current EU Agri-environmental Policy Programmes Fit with it?](#)
- 17.2018, ET Series, HuiHui Liu, ZhongXiang Zhang, ZhanMing Chen, DeSheng Dou, [The Impact of China's Electricity Deregulation on Coal and Power Industries: Two-stage Game Modeling Approach](#)
- 18.2018, ESP Series, ZhongXiang Zhang, [Energy Price Reform in China](#)

- 19.2018, CSI Series, Soheil Shayegh, Valentina Bosetti, Simon Dietz, Johannes Emmerling, Christoph Hambel, Sverre Jensen, Holger Kraft, Massimo Tavoni, Christian Traeger, and Rick Van der Ploeg, [Recalculating the Social Cost of Carbon](#)
- 20.2018, CSI Series, Effrosyni Diamantoudi, Eftichios Sartzetakis, Stefania Strantza, [International Environmental Agreements - Stability with Transfers among Countries](#)
- 21.2018, CSI Series, Branko Bošković, Ujjayant Chakravorty, Martino Pelli, Anna Risch, [The Effect of Forest Access on the Market for Fuelwood in India](#)
- 22.2018, CSI Series, Effrosyni Diamantoudi, Eftichios Sartzetakis, Stefania Strantza, [International Environmental Agreements - The Impact of Heterogeneity among Countries on Stability](#)
- 23.2018, CSI Series, Effrosyni Diamantoudi, Eftichios Sartzetakis, Stefania Strantza, [International Environmental Agreements and Trading Blocks - Can Issue Linkage Enhance Cooperation?](#)
- 24.2018, ET Series, Ilke Aydogan, Loïc Berger, Valentina Bosetti, Ning Liu, [Three Layers of Uncertainty: an Experiment](#)
- 25.2018, SAS Series, Fabio Moliterni, [Do Global Financial Markets Capitalise Sustainability? Evidence of a Quick Reversal](#)
- 26.2018, ET Series, Rafael González-Val, Fernando Pueyo, [Natural Resources, Economic Growth and Geography](#)
- 27.2018, ESP Series, Valentin Grimoux, [China's Energy Policy & Investments and their Impact on the Sub-Saharan African Region](#)



Fondazione Eni Enrico Mattei

Corso Magenta 63, Milano - Italia

Tel. +39 02.520.36934

Fax. +39.02.520.36946

E-mail: letter@feem.it

www.feem.it

