

CHALLENGES AND PROMISES OF THE CHINESE ENERGY MATRIX AND ITS IMPACT ON THE BRAZILIAN ECONOMY

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Overview

Estimates show that, by 2035, the global demand for energy will be 37% higher than the current one and that China and India will account for almost half of such increase. Nowadays, the Chinese energy matrix is mostly based on coal, which is a highly polluting fossil fuel. It raises enormous pressure by the international community with regard to carbon dioxide emission reductions. On the other hand, China ranks first in installed wind energy capacity in the world. The aim of the current study is to identify in the literature the Brazilian opportunities resulting from the increased energy demand in China. The results show that due to its high energy consumption, by 2025, China will surpass the European Union as the world's biggest energy importer. Thus, China and Brazil have great potential to increasingly intensify their relationship and, consequently, increase the Asian giant's investments in Brazil. However, it is worth highlighting that such deep relationship may negatively affect Brazil whenever China experiences economic problems. Therefore, Brazil should also strengthen trade relations with other countries in order to keep its commercial sustainability over time, regardless of its relationship with China.

Keywords: China; Renewable energy; Coal; Carbon emissions; Geopolitics; Pre-salt layer

1. Introduction

Since 1978, when Deng Xiaoping¹ promoted the political reform and the opening of China to the international trade, the country has experienced a rapid economic development, especially between 2000 and 2011, when an economic "boom" could be noticed through the GDP growth rate of 10% per year in the country (Creedy, 2006).

Such acceleration led China to surpass Japan and to become the second biggest economy in the world, which meant a significant expansion of the domestic energy consumption. Thus, China became the world's biggest energy consumer in 2009 (International Energy Agency, 2013) and left the United States behind.

At the same time, China, which holds alone 13% of the world's coal reserves, began to experience an additional problem due to the high carbon dioxide emissions resulting from coal burning. These emissions endangered the planet well-being, as it contributes to increase global warming

¹ Deng Xiaoping was a Chinese politician and communist leader. As President of the Central Military Commission of the Chinese Communist Party, Deng Xiaoping initiated the economic reform that would make China the country with the highest economic growth in the world. During the same period, he also led the country to its great diplomatic opening.

It is worth highlighting that nothing is little or expressionless when it comes to the People's Republic of China. The country has 9.6 million square kilometers and it is one of the world's largest countries in total area and the second largest in land area. The Chinese population comprises 1,357 billion people (the Chinese Embassy in Brazil 2013) and it makes the country the most populated one in the planet. China alone represents almost 1/5 of the total population on Earth.

The Chinese energy security became priority to the government due to the always-high numbers. It is possible saying that such concern goes beyond the Chinese territorial boundaries and that it inevitably affects the geopolitics of the entire planet, since energy dependence is a risk to any nation that seeks development. Therefore, the diversification of energy sources becomes a hotspot.

Thus, despite all the challenges in recent years, Brazil stands out in the international renewable energy scenario. However, for China, Brazil is an alternative to the pollution generated by coal due to its oil wells yet to be explored. Brazil may be a frequent partner in the Chinese plans.

The aim of the current study is to understand the areas of opportunity to Brazil, as well as to understand what has been done so far. Thus, the following topics were analyzed: the energy demand in the world for the next twenty years; the way the Chinese energy matrix is currently structured and the environmental challenges resulting from such matrix; the measures taken by the Chinese government in recent years in response to the aforementioned growing energy demand; the real opportunities to Brazil due to the Chinese growing energy demand context and; finally, the Chinese economy deceleration impacts on Brazil.

2. The global energy demand and the estimates for the next twenty years

Estimates (indicated by the Energy Outlook 2035 - British Petroleum) show that, despite the recent weakening of some energy markets throughout the world, the expansion of some developing powers will be responsible for maintaining the high global demand for energy in the next 20 (twenty) years.

The indication is that, by 2035, such demand will be up to 37% higher than the current one, with mean growth of 1.4% per year. China and India will account for almost half of such increase. The report also predicts 0.8% annual increase in the oil demand, and such growing demand will come from non-OECD member countries (British Petroleum, 2014).

Thus, according to the report, China stands out once again, because by 2035 the country will confirm its position as the biggest oil importer in the world. It also refers to the prediction that the United States will be declared energy self-sufficient by 2021 (British Petroleum, 2014).

Russia would remain as the biggest energy exporter in the world, meeting alone 4% of the energy demand by 2035. On the other hand, China would be the biggest energy importer in the world by 2025 (British Petroleum, 2014). Therefore, the permanent increase of the Chinese importance in the energy scenario in the coming years is clear.

The same study allows observing that coal, which stood out in the last decade as the most used fossil fuel due to the Chinese demand, will rank last in the fossil fuel increase prediction in the years to come; and that the natural gas consumption increase will stand out.

The demand for natural gas will be met mainly by Russia and by the Middle East. The demand for unconventional gas, which is largely originated in North America, will also increase. The coal use decline is directly linked to the Chinese decisions, as it is discussed below.

3. The Chinese energy matrix and the environmental challenges

According to data obtained from the National Bureau of Statistics of China (2013), the Chinese energy matrix is mainly based on coal (it is responsible for meeting 66% of the energy demand in the country), petroleum (it covers 18.4% of the demand) and natural gas (which accounts for 5.8% of the demand). Thus, as it can be seen, China is nowadays a voracious fossil fuel consumer, and coal is acknowledged as the most polluting of all.

The predominant use of coal associated with the increased energy consumption in the planet generates alarming data: sixteen out of the twenty most polluted cities in the world are located in China. According to Greenpeace (2013), the coal burning process used to produce electricity discharges more carbon dioxide into the atmosphere than any other energy source. China is now the biggest greenhouse gas emitter in the world, accounting alone for 24.65% of the global emissions.

Such magnitude leads to a concern of international scale and China, along with other countries such as the United States, has faced strong external pressures to reduce its carbon dioxide emissions, which would be closely linked to coal use.

The Chinese government has initiated some changes in response to both the international and the internal pressures, since the Chinese citizens are increasingly concerned with the pollution cloud they are exposed to.

In its latest five-year plan, the Chinese government set the goal of supplying its energy needs with 15% renewable sources by 2020. In addition, in November 2014, China and the United States - the two biggest polluters in the planet - signed a historic agreement² on climate change; they pledged to have 20% of their energy coming from clean and renewable sources by 2030 (Cartillier, 2014).

It is worth highlighting that the Chinese government also includes the nuclear power as one of the big energy alternatives to fossil fuels. According to data from the Nuclear Energy Association of China (2015), the nuclear power now represents 2.4% of the total electricity production in the country. Nowadays, the country holds 23 operating plants generating 20 gigawatts, and there are plans to build other 26 in order to reach the potential of generating 58 gigawatts;

Regarding the Chinese potential to develop renewable energy, a recent study conducted by the International Renewable Energy Agency (IRENA, 2014), named REMAP 2030³, reported that China will increase its participation in renewable energy sources from 12% to 26% by 2030; it would be above the targets set in the aforementioned agreement on climate changes. The investments in this field are already booming, as it will be discussed in the next item.

² Signed by the presidents of the People's Republic of China and the United States in November 2014. The Agreement also states that the United States want to reduce its gas emissions by 26-28% by 2015 (Cartillier, 2014).

³ IRENA's Global Renewable Energy Roadmap (REMAP)

4. The measures taken by the Chinese government in recent years

Given the environmental and geopolitical issues from maintaining a coal-based energy matrix, China began a wave of green investments. According to the Global Trends on Renewable Energy Investment report issued by the United Nations Environment Programme (UNEP) (UN, 2015), China invested US\$ 83.3 billion dollars in this purpose, only in 2014.

In addition, the Chinese government offers several benefits to renewable energy projects, as well as tax reduction for the companies involved in it.

In return, besides the reduction of greenhouse gas emissions, China commercially stands out in some areas, such as in the manufacturing of photovoltaic panels.

Subsequently to the major investment in this type of renewable energy, which included the development of the Solar Valley⁴ settlement in Dezhou (Northern part of the country), China broke the world record in photovoltaic project facilities in 2013. In addition, it hosts the world's biggest producer of solar water heaters.

China also stands out in the wind energy field. The country expansion in this field, in recent years, was the largest one ever seen in the world. The size of wind farms has trebled from 2009 to 2012 and it may increase even more by 2020.

According to the World Wind Energy Association (WWEA, 2015), Germany ranked first among the wind source-based energy-producing countries until 2005. However, it was overtaken by the United States in 2008 and China became the biggest producer since 2010.

Data from 2012 show that the wind power was already responsible for generating 2% of China's electricity, which represents an electricity production higher than that produced from the same source throughout the European Union (Shukman, 2014).

In 2016, the expansion in China totaled 23.3 GW , accounting for 42.7% of the world total (Godoi, 2017).

However, although the wind power is booming, it still faces some obstacles that hinder the further growth of its importance in the Chinese energy scenario, namely: the wind farms located in the long Chinese coastline are usually distant from the large urban centers, where there is greater demand for electricity; thus, its transmission generates additional costs. It is worth highlighting that problems are common in the distribution lines due to the volatility of this type of energy. Finally, there is also storage impossibility, which is also a problem faced by solar energy.

In addition to the progress made in the renewable energy field, China still recorded increased natural gas use during the last decade - mean annual increase of 17.3% (Xu, 2015). The demand is still predominantly industrial, but the use of natural gas is expected to increase in other areas in the coming years, especially when it comes to electricity generation.

Such increase gains strength due to the agreement signed between the Russian gas consortium - Gazprom - and the China National Offshore Oil Corporation (CNOOC), in May 2014. According to

⁴ The Solar Valley is a city that uses only solar energy as energy source in order to operate.

such agreement, Gazprom is responsible for providing 38 billion m³/year of gas to China from 2018 on, and during the subsequent three decades (Paton, 2014). The gas is expected to represent 10% of China's energy matrix by 2020. Nowadays, it accounts for only 5.8% of the energy demand in China (National Bureau of Statistics of China, 2015).

5. Opportunities for the Brazilian economy based on the Chinese energy demand

Brazil and China started their diplomatic relations in August 1974. Since then, the Sino-Brazilian relationship is increasingly gaining importance and prominence in several fields such as agriculture, science and technology, trade and energy (Consulado Geral da República Popular da China no Rio de Janeiro, 2015).

With respect to energy, there are many examples of the partnership between the two countries. It is clear that the Chinese presence in the Brazilian energy market is strong and growing. By considering the period between 2005 and 2012, the Brazilian energy sector received US\$ 18.2 billion in Chinese investments (IEA, 2013). Such amount did not include the Pre-salt bidding and the State Grid⁵ participation in the transmission lines of Belo Monte Hydroelectric Dam, Pará State, since they both occurred after the calculation period in question, which will be addressed below.

China is one of the biggest oil producers in the world; however, its production cannot meet the entire demand of the country, fact that turned the country into the major oil importer since 1993.

According to the British Petroleum (2015), the 2012 global oil trade increased by 1.3%, i.e., 0.7 million barrels per day, whereas the net oil imports in China increased 0.61 million barrels per day, i.e., 86% of the global increase.

Although China has been seeking to develop new energy sources - preferably cleaner sources - the country still has great need of oil. It is necessary to ensure the energy supply in the coming years. Given the internal instability of the oil producing countries in the Middle East, China cannot remain dependent on them.

Thus, China invests in several countries worldwide. Kazakhstan, Egypt, Canada, Uganda, Ecuador and Venezuela are among the countries where there is Chinese participation in oil exploration, whether through Chinese state-owned companies, joint ventures or investments in local companies.

Similarly, it is also possible seeing the Chinese presence in Brazil. In 2013, the consortium formed by companies such as Petrobrás, Shell Brazil, Total (French), China National Petroleum Corporation (CNPC) and China National Offshore Oil Corporation (CNOOC) won the Pre-salt bidding to explore the Libra Field, which is located in Santos Basin. The field reserve is estimated between 8 and 12 billion recoverable oil barrels.

⁵ State Grid Corporation of China (SGCC) is the Chinese energy company responsible for most of the national power grid operation. It is the largest electric power transmission and distribution company in China and worldwide.

It is worth emphasizing that Petrobrás signed a financing agreement with the China Development Bank (CDB) for US\$ 3.5 billion, months after the bidding. It would be just the first contract of a cooperation agreement that would be implemented throughout 2015 and 2016 (Ordonez and Rosa, 2015). Petrobrás did not report the rates or the conditions of the financing agreement; however, there are those among the professionals in this field who understand that the signing of the contract by Petrobrás Global Trading (PGT), which is a state-owned subsidiary abroad, may be a strong evidence of an oil supply negotiation (Trevizan, 2015).

Moreover, the Chinese strategy of making loans to oil-producing countries is common. In turn, China has the guarantee that it will receive the payment at market-price oil barrels (Schüffner, 2013).

It is possible stating that the strategy of the Chinese companies would be based on the following stages - which can also be taken into consideration in a similar way to other fields, besides the oil one: establishing long-term partnership with the Brazilian government and with Brazilian oil companies; participating in the oil infrastructure construction in the country; buying shares of the foreign oil companies established in Brazil; and providing loans to the Brazilian oil industry (V Seminário Nacional de Sociologia e Política, UFPR, 2014).

Such actions are already in practice and they enable China to increasingly reassure its oil supply in the coming years.

Such participation brings some reassurances to China, it aims to create jobs for the Chinese people and to open opportunities to other companies to provide complementary services to the production, not to mention the absorption of the offshore production technology.

In addition to oil, it is possible seeing the notorious Chinese presence in other energy market fields, such as the participation of the Chinese company State Grid in the consortium that won the bidding to build the transmission lines responsible for flowing the energy production of Belo Monte Hydroelectric Dam, in Pará State.

The information available at the State Grid website (2015) have demonstrated the Chinese interest in the Brazilian market. There is a clear indication that Brazil was the first non-Asian country chosen to receive major investments in 2010. At that time, the State Grid Brazil Holding acquired seven national power transmission companies at total cost of US\$ 989 million. Nowadays, the company ranks fifth in the list of biggest power transmission companies in Brazil (the company's website, 2015).

According to IEA (2015), Brazil is China's natural partner in the transmission segment; Ribas (2013) points out the geographical similarities between these two countries in both the generated electricity transmission meshes and the distance from major consumer centers.

The State Grid said that it would implement the 800kV voltage in Brazil, which currently just exists in China (Magnabosco, 2014), in order to reduce the common energy waste.

The State Grid has already made investments of R\$ 7 billion since it started its activities in Brazil. The company also enabled Chinese machinery, tool and automation companies, which are also dedicated to the industry, to come to Brazil (Bahnemann, 2015).

China's influence on the Brazilian energy industry is expected to increase even more in the coming years.

The Chinese Prime Minister Li Keqiang visited Brazil in May 2016 and signed 35 contracts with the Brazilian government. Such contracts focused on the agriculture, foreign trade, science and technology, foreign affairs and, mainly, on the infrastructure (including transports) and energy issues. The total value for all the agreements exceeds US\$ 50 billion. Out of the aforementioned amount, US\$ 7 billion are concentrated in two agreements concerning the Chinese financing of Petrobrás projects. A third cooperation agreement has also been signed in order to create a long-term relationship between these countries (Trevizan, 2015).

According to Trevizan (2015), among the agreements that were recently signed by the two governments concerning the energy sector, it is worth highlighting the contract to finalize the transfer of Energias de Portugal Renováveis (EDPR) shares to the Três Gargantas Group. The contract regards the wind power project, the memorandum on the cooperation in the nuclear technology field, as well as the cooperation agreement on the promotion of trade and investments in the construction of photovoltaic solar panels.

6. Risks to the Brazilian economy due to China's economic deceleration

Despite the advantages of a strong link between the two countries, it is likely that the deceleration of one of these economies may harm the economy of the other.

The herein analyzed case is not different. Nowadays, China has the power to boost the economy of many countries worldwide, since it is a major buyer of industrial commodities such as oil, copper and iron ore.

Therefore, a crisis in China would undoubtedly generate repercussions in the countries that export the aforementioned items to the Asian country.

As it was previously mentioned, China is Brazil's biggest trading partner nowadays. Since 2014, when China had its lowest economic growth rate in the last 5 years, Brazil has already begun to feel the impacts on its trade balance, which contributed to its current economic crisis.

The Chinese economy deceleration and its consequent oil demand decrease have resulted in one-third reduction in the value of the Brent crude oil since June 2015, when the Chinese problems started being reported (Walker, 2015).

The low oil prices and the high Pre-salt cost made Brazil little competitive in comparison to other exporters. It will require the Brazilian government to work harder in order to take advantage of the economic opportunities in the Chinese energy sector.

7. Conclusion

The Sino-Brazilian relations dramatically accelerated since 2000 due to a remarkable synergy in the soybean and iron ore fields. In addition, it is possible seeing the increasing Chinese influence on the Brazilian infrastructure and energy fields, over the past few years.

Despite the reduction in the Chinese economy/industry numbers in 2014, the country is still constantly growing and its need of energy sources, especially the cleaner ones, is huge.

The vast area and the abundance of natural resources that favor the development of technologies such as wind power, solar energy, sugarcane ethanol production, as well as the oil reserves, notably after the discovery of the Pre-salt layer, enable Brazil to be a long-term Chinese partner.

In addition to the high values negotiated in recent agreements signed between Brazil and China, it is worth highlighting - as an example of the increasing relationship between these countries - that China invited Brazil to participate as a founding member of the Asian Infrastructure Investment Bank (AIIB). Such invitation was accepted.

The aim of such institution is to finance infrastructure projects in Asia, which is an area of great interest to the Brazilian growth.

The link between China and Brazil becomes increasingly stronger and the impacts of the Chinese economy on the Brazilian economy are quite noticeable.

As it has been emphasized by representatives from both countries, Brazil is an important ally to the growth plans of the Asian giant. However, the increasing dependence of the Brazilian economy on the Chinese economy puts the commercial balance sustainability at risk against China's moments of crisis.

The opportunities exist; however, nowadays, the Brazilian government needs to know how to work its partnership with China with excellence in order to achieve the expected success. In addition, the country also needs to strengthen partnerships with other countries.

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