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The BRI and its Implications for China's Energy Security: The Four As Model Perspective

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ABSTRACT

The 'Belt and Road Initiative' (BRI) proposal provides an opportunity to address the challenges of energy security. This paper aims to explore the relationship between China's energy policies and the BRI, especially in energy security, by highlighting the energy status in China and its top energy priorities. In this study, the analytical framework presented is based on the model of "four As." The results indicated that BRI can improve China's energy security in all four areas of availability, accessibility, affordability, and acceptability. By deepening energy cooperation with BRI countries, the import transportation channels of energy in China can be further diversified, its room for maneuver in the international energy market will increase, along with its voice in international energy negotiations and global energy governance. The initiative will enable member states to collaborate on energy supply and security issues broadly and strategically. In addition, it can improve energy development efficiency and speed up the circulation of investment funds. Further, BRI can increase energy technology exchanges and cooperation with major energy-consuming countries such as Japan and Singapore. Contrary to merely geopolitical analysis, China's BRI Energy Sustainable Project should be observed in a broader context in terms of sustainable development and economic objectives. Under the framework of the BRI strategy, the future development path of China's energy security strategy may open the way for pluralistic economic cooperation in the field of energy.

Keywords: Energy Security, Energy Strategy, Belt and Road Initiative, BRI, China
JEL Classifications: F50; F63; H10

1. INTRODUCTION

The uneven distribution of energy resources worldwide has caused major energy supply vulnerabilities among the countries. At the macro level, there are distinct concepts of energy security and various interpretations of the concept. Since the 1980s, the traditional concept of energy security, which takes supply security as the main starting point, has gradually developed in the direction of the so-called comprehensive energy security (Sovacool, 2012; Augutis et al., 2017). Energy security is increasingly endowed with more and more modern connotations which has less been emphasized by policymakers in the past. Indeed, the traditional concept of energy security, which only emphasizes the protection of energy supply at affordable prices (Deese, 1979; Krugman, 1988), has become too narrow to meet security requirements comprehensively. Some issues such as environmental sustainability, energy efficiency, laws, and social norms, and type of governance are considered as influential factors which can only be considered in a more comprehensive definition of the concept of energy security (Cherp, 2012).

Further, the BRI has been a hot topic explored by scholars since its proposal. Although a few scholars have analyzed the energy relationship between China and the countries along the BRI (Zhao et al., 2019; Len, 2015; Umbach, 2019; Sarker et al., 2018; Zhang et al., 2019), all have examined China's BRI energy security policies from either traditional concept of energy security or geopolitical perspectives. In the conventional definition of energy security, the security of oil exports to China is related to the analytical center (Dong et al., 2017; Shi and Cai, 2020). In a geopolitical context, some theories such as "Hegemonic Stability Theory" (HST) and "power and interdependence" are used to describe energy ties between China and other players in the future (Eder, 2013, 57-65; Gueldry and Liang, 2016). The rest of the papers deals with the commercial, economic and legal aspects of China's BRI energy security policies (Simon-Pearson, 2018; Shi and Yao, 2019; Jing et al., 2020).

However, the present study aims to highlight the comprehensive concept of energy security and apply a sustainable definition based on environmental protection. In an era of globalization in the pursuit of sustainable development, breaking through the traditional concept of energy security and establishing a comprehensive concept of energy security have become an inevitable trend in formulating national energy strategy. In this study, energy supply, energy efficiency, and environmental quality as the essential elements were considered for analyzing China's BRI energy security policies. This approach to broadening the definition of the energy security concept is in line with some previous studies (von Hippel et al., 2011; Holley and Lecavalier, 2017; Knox-Hayes et al., 2013). This holistic concept of energy security, in addition to offering a more consistent theoretical context, will provide a more detailed and in-depth evaluation of the risks and challenges to China's energy security by analyzing a more thorough range of factors. The methodological structure for the search is addressed in Section 2. China's energy challenges are examined through the analytical approach of this study in Section 4. Finally, the opportunities created in the BRI project in ensuring China's energy security are explored in Section 5.

2. COMPREHENSIVE ENERGY SECURITY: THE FOUR AS MODEL

Energy security is a multifaceted term which is usually defined concerning the purpose of the study (von Hippel et al., 2011). The Four As model has been the starting point for analyzing many areas related to energy security. In addition, it is a powerful analytical framework for examining three main questions including "Security for who?" "Security for what values?," and "Security from what threats?." According to this model, energy security can be considered as a stable and reliable supply of energy at reasonable prices and social costs. This definition includes availability based on geological characteristics (Kruyt et al., 2009; Sovacool and Mukherjee, 2011), accessibility based on geopolitical factors (Youngs, 2014), affordability related to the economic sphere (Yao and Chang, 2014; Le and Nguyen 2019), and acceptability based on social and environmental concerns (Holley and Lecavalier, 2017).

Availability and affordability refer to the traditional definition of energy security as the uninterrupted supply of a given primary energy source at a reasonable price (Deese, 1979; Kruyt et al., 2009). Contrary to the traditional approach, which focused more on the economic and physical aspects including energy supply, accessibility and acceptability, were relatively newer concepts which arose from the complexities of energy supply (Cherp and Jewell, 2014). The concept of accessibility is largely close to availability, but energy supply is analyzed with emphasis on geopolitical issues in the former. The issue of energy was initially more economical, but its geopolitical aspects have been emphasized in recent years, especially after the gas crisis between Russia and Ukraine in 2006 (Umbach, 2010). The resurgence of the crisis in 2009 and post-conflict tensions between Russia and the West in the Ukraine crisis in 2014 compounded by repeated conflicts in the Middle East caused international relation thinkers to pay more attention to the concept of energy security.

The concept of energy security has evolved after highlighting environmental and social aspects of energy consumption in the world. On one hand, global warming and environmental issues have led to the concept of "sustainability" being considered in the development of energy security policies. On the other hand, the need to pay attention to the social and cultural norms in energy-exporting societies became one of the axes in policymaking agendas (Corner et al., 2011). By emphasizing the need for focusing environmental issues, Chester (2010) recognized the fourth dimension of the concept of energy security as "sustainability" (Chester, 2010). Although the inclusion of a sustainability factor to the energy security concept was made to respect the environment, there was still a lack of new approaches to the social responsibility of energy security policies in this area. In this study, the fourth factor is expressed in a broader sense with the term "acceptability," which includes both sustainability and social responsibility concepts (von Hippel et al., 2011).

3. CHINA'S CHALLENGES IN ENERGY SECURITY

Energy competition caused by energy shortage is the critical factor inflaming international political and economic instability (Bradshaw, 2009). As the second largest economy in the world, China's economy continues to expand at a reasonably fast pace. Although China's rise in energy consumption has declined, the absolute volume has been increasing year by year. Dong et al. (2017) estimated that coal, oil, and gas consumption will reach 2362, 785, 487 Mtoe by 2040, respectively (Dong et al., 2017). While increasing the demand, it is becoming increasingly difficult to access reliable energy resources.

During the recent years, the imported oil and gas channels have been suffering from changes in geopolitical patterns, rampant terrorist attacks and piracy, and interference by great powers (Kulkarni and Nathan, 2016; Bompard et al., 2017). The political instability of many energy-consuming states, manipulation of energy supplies, competition for energy sources, attacks on supply facilities and incidents, natural disasters, and dependency on foreign countries for oil are considered as the challenges related to energy security (Kisel et al., 2016; Azzuni and Breyer 2018; Madani et al., 2020). Although significant achievements have been made in China's energy development, it should be noted that the contradictions and problems accumulated over the years have become more prominent with the rapid economic and social development. Energy security challenges in China are mainly reflected in environmental issues, diversification of sources, and security of supply and transportation routes in these sources.

3.1. Energy Structure is Not Conducive to Environmental Protection

China is a significant energy producer and consumer, which ranks first in the world in the production of energy (Table 1). Coal is the main energy supply in China and about half of the global demand for coal will come from the Chinese market over the next 4 years.[1] According to a report published by the World Energy Council (WEC) in 2016, China's annual coal production is 2.48 billion tonnes of oil equivalent per year, nearly 5 times more than annual oil production in Saudi Arabia.[2] The role of coal in the Chinese economy is quite prominent. In addition, around 70% of the energy consumption comes from coal (Yuan, 2018), which accounts for roughly 50% of the energy consumption in power plants.

Despite the crucial role coal plays in China's energy supply, its use on a large-scale has unparalleled environmental consequences. Apart from water resource depletion and severe air pollution in major cities, it is considered as the largest emitter of greenhouse gases in the world. To counter environmental pollution, China in 2015 submitted an action plan called "Intended Nationally Determined Contribution" (INDC) to the UN Framework Convention on Climate Change (UNFCCC) in order to reduce greenhouse gas emissions. By joining the Paris climate treaty in 2016, China practically obliged to reduce its greenhouse gas emissions efficiently.

However, it is challenging to change the energy structure in China, which is rich in coal, and short in oil and gas. Fossil fuels heavily dominate on China's energy consumption. In 2018, non-renewable energies accounted for 85.7% of the total energy produced in the country (Table 2). Compared with the world's energy consumption structure, China's primary energy consumption presents very different structural characteristics. In fact, the proportion of coal consumption is the same as that of oil and natural gas consumption in the world, accounting for 60-70%, while the proportion of oil and gas consumption is the same as that of coal consumption in the world, accounting for only 20-30% (Dong et al., 2017). Although China plans to decrease the proportion of coal, its dominant position in the structure of energy consumption will make any major change difficult in a certain period. On one hand, the need for environmental sustainability and the heavy use of coal in the country's economy has been threatened by China's tough challenges, some of which are as follow.

In the process of rapid industrialization, urbanization, and modernization, meeting people's requirements is necessary for improving environmental quality and providing cheap, clean, feasible, and convenient supplies. As China's basic energy consumption accounts for 1/10th of the world's overall consumption, second only to the United States, this challenge can be converted into a dilemma. B.P. China consumed 24% of all energy produced globally in 2018 and accounted for 34% of global energy consumption growth.[3] However, resource constraints are severe, and supply and demand contradictions are prominent. The per capita ownership is far lower than the world average although China's total energy resources are relatively large and the proven reserves of fossil energy are about 750 billion tons of standard coal. The surplus recoverable reserves of coal, oil, and natural gas per capita are only 58.6, 7.69, and 7.05% of the world average, respectively (Wei et al., 2019).

China is under international pressure to curb greenhouse gas emissions as a part of its international commitments although supplying cheap energy to continue the phase of economic growth remains the country's top priority for the coming years. Coal dominates China's energy structure due to its availability and low price. More than half of China's power plants consume coal. Among the remaining half, the industrial sector accounts for 41% of total consumption (Liedtke, 2017). Under the Paris Agreement, China is committed to the reduction of greenhouse gas emissions by 60-65% by 2035 (Liu et al., 2017). To achieve the objectives of reducing carbon dioxide (CO2) emissions, China needs deep reforms to change the industrial structure and economic growth planning model of the country (Guan et al., 2018).

3.2. China's Energy Efficiency is Low

During the years, China has made a lot of improvements in energy efficiency, especially since 2015. However, energy efficiency in this country is 0.701, which indicates the greater need to increase efficiency (Zhang et al., 2020). Although China has made significant progress in energy technology, there is still a long way, compared with development requirements

1 Coal 2019: Analysis and Forecasts to 2024. Fuel Report. December 2019. International Energy Agency (IEA). Available at https://www.iea.org/reports/coal-2019

2 Frangoul, Anmar. October 2016. The world's largest energy producer. CNBC. Available at https://www.cnbc.com/2016/10/07/the-worlds-largest-energy-producers.html

3 BP, Fast Facts. 2018. Statistical review of world energy- country and regional insights- China. Available at https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/country-and-regional-insights/china.html

Table 1: Top 10 energy producers in the world-2017

Ranking	Country	quadrillion Btu
1	China	112.018
2	United States	88.092
3	Russia	61.276
4	Saudi Arabia	28.809
5	Canada	22.519
6	Iran	18.217
7	India	17.676
8	Australia	15.9
9	Indonesia	13.941
10	Brazil	11.221
11	Qatar	10.134

Source: U.S. Energy Information Administration (EIA), 2017

Table 2: Primary energy consumption, 2018-19, Share (%)

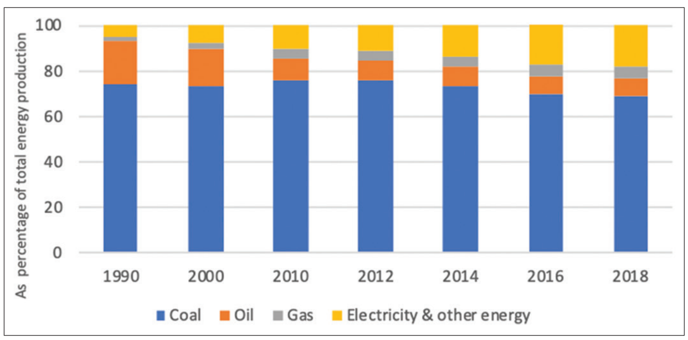
Primary energy	China	World	OECD	European Union
Oil	12.6	33	38.4	38.4
Natural gas	7.8	24.2	27.8	24.4
Coal	57.6	27.2	13.7	11.2
Nuclear	2.2	4.2	7.6	10.6
Hydro	8	6.4	5.28	4.3
Renewables	4.6	4.9	7.2	10.9

Source: BP Statistical Review of World Energy 2019 and advanced international standards. Comprehensive mining machinery and core coal liquefaction technology equipment in major coal mines should be improved, gas extraction and utilization technology are backward, there is also plenty of room for development in production management, and the equipment level of the production system is relatively low (Lina, 2018). Furthermore, major oil exploration and processing equipment, ultra-high voltage power transmission equipment, and advanced nuclear power equipment cannot be designed and manufactured independently. The backward technology restricts the improvement of efficiency. In terms of energy consumption per unit of GDP, China's per capita energy consumption decreased sharply to 0.32 toe/USD in 2016, falling 33% from 2005. Despite this significant decline in 2016, China's total primary energy supply (TPES) to GDP was almost 3 times that of the countries of the European Union and 4.5 times higher than that of Japan (Table 3).

3.3. Energy Availability is a Significant Concern for China

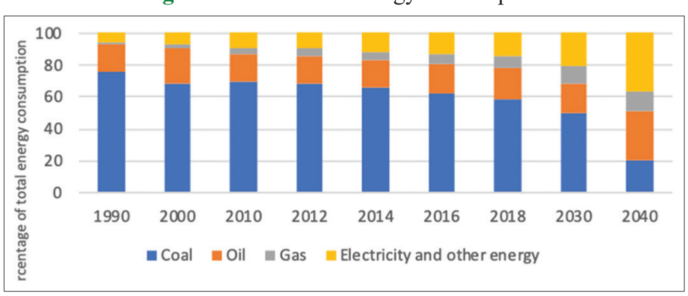
The ratio of gas to oil in China's energy basket is increasing, while the share of oil and gas in the domestic energy production portfolio is decreasing (Figures 1 and 2). China imported 440 million tons of crude oil in 2018, a year-on-year increase of 11%, according to China National Petroleum Corp.'s Economics and Technology Research Institute.[4] In contrast, domestic oil production has been declining in recent years. In 2018, about 189 million tonnes of oil were extracted from mainland oil reserves in Chinese oil companies, which was 3 million tonnes less than the amount in the previous year. The decline in domestic production, coupled with the country's surging demand for energy consumption, has created a situation which makes reliance on oil imports unavoidable.

Figure 1: China total energy production



Source: National bureau of statistics of China

Figure 2: China total energy consumption



Source: National bureau of statistics of China; Economic Research Institute for ASEAN and East Asia, 2019

Table 3: Energy intensity - GDP (kg oil energy intensity equivalent/dollar)

Countries	2012	2013	2014	2015	2016
China	0.39	0.37	0.36	0.34	0.32
EU	0.10	0.10	0.09	0.09	0.10
Japan	0.08	0.08	0.08	0.07	0.07

Source: BP World Energy Statistics, 2017.

With the more expansion of economic scale, energy demand will continue to increase rapidly, forming tremendous energy supply pressure. The contradiction between supply and demand will exist for a long time, and the dependence of oil and gas on foreign countries will be more. Further, resource exploration lags affect the improvement of energy production capacity (Wang and Liu, 2017). At the same time, China's energy supply delivery is very unbalanced, large-scale, and depends on long-distance coal transport, leading to tight transport capability and higher prices, and disruption of the organized growth of the energy industry (Wang et al., 2018).

To overcome the energy shortage, China imported more than 10.12 million barrels of oil per day in 2019, the amount of which is well beyond the several thousand barrels of oil imported in the early 1980s, indicating a steep rise in oil imports in recent decades. BP estimated that China's demand for crude oil would increase by 19% by 2040.[5] China's dependence on foreign oils is increasing while most of the imports come from politically-unstable regions and countries. In 2019, the Middle East supplied about 45% of the flow of oil imported to China. Further, it is expected that the share of Middle East in oil imported to China has been doubled by 2035.[6]

The political risks of oil imports are not confined to the Middle East. Among the 15 countries with the highest oil exports to China, nine faced with political, security, or social turmoil of any kind (Table 4). Political and social unrest, war, rebellion, and internal conflicts can adversely affect oil production capacity in oil-producing countries. In a recent example, Libya's civil wars dramatically reduced the capacity of its oil export. In January 2020, on the eve of a European summit related to the Libyan crisis, Libyan National Army (LNA) forces shut down oil shipments from all ports under their control, which is related to a decrease in national crude supply by more than half. In 2018, Libya exported over $4.7 billion of oil to China and became one of China's biggest oil suppliers. Another case which reflects the high political risks of oil imports is related to U.S. sanctions against Iran, which has been one of China's most important oil suppliers in recent decades. Nevertheless, sanctions against Iran have been re-imposed with the advent of Trump in the U.S. According to some estimates, Iran's oil exports in recent months have fallen to half compared to the same period a year earlier.

4 Xin, Zheng. June 2019. Nation's reliance on crude oil imports set to continue. China Daily Global, 2019. Available at https://www.chinadaily.com.cn/global/2019-06/05/content_37477320.htm

5 Outlook, B. E. (2019). 2019 edition. *London, United Kingdom2019*.

6 CAIRO. June 18, 2015 edition. China and the Arab world: The great wall of China. The Economist. Available at https://www.economist.com/middle-east-and-africa/2015/06/18/the-great-well-of-china

3.4. Securing Energy Routes

The geographic location of China is regarded as an island. Although 14 other countries are adjacent, more than any other state globally and very few of its boundaries have become very permeable to trade and cultural exchange, due to its mountains, deserts, swamps, and high altitudes. The geopolitical location of China is a significant strategic advantage which has shielded the country from foreign invasion. However, being island-based has also made China heavily rely on sea routes for its foreign trade including importing oils.

Malacca Strait is considered as one of the China's commercial bottlenecks. Much of China's foreign trade with Europe, the Middle East, and North Africa passes through the Malacca Strait. Because of its geographical location, the Malacca Strait is the gateway for energy flows from the Middle East and Africa to Southeast Asian countries. For energy imports, China relies on the Malacca Strait, leaving it vulnerable to insecurity or other disruption (Gholizadeh et al., 2020). The Strait of Makassar is the only option. In that case, it is necessary for ships to enter China, bypass Indonesia, and cross the Makassar Strait to transport oil. However, it adds to the shipping cost, which can increase shipping time 7 days more, affecting energy prices.

Further, a significant portion of oil is imported from the Middle East. To carry Middle Eastern oil, tankers generally have to cross the Strait of Hormuz. Located in the Persian Gulf and the gateway to the Oman Sea and the Indian Ocean, this strait is the world's most significant oil transit chokepoint. As reported by the U.S. Energy Information Administration (EIA), about 21 million barrels of oil a day went through the Strait of Hormuz.[7], which is about 21% of total oil production in the world. By 2018, the amount of oil transit from the strait reached about one-third of the world's total oil production. This strategic strait also accounts for more than a quarter of the world's liquefied gas. This region of the world faces many conflicts and uncertainties despite the importance of the Middle East and the Strait of Hormuz for supplying oil to international markets. Recent Arab revolutions, U.S. conflicts in Afghanistan and Iraq, Middle Eastern proxy wars, civil wars in Syria and Libya, and rising tensions between Iran and the U.S. are highlights of the region's political turmoil (Madani and Nobakht, 2014). Increasing uncertainty in the Middle East could directly impact the global energy market, particularly for the significant energy buyers in the region. The security situation in the Persian Gulf and the Strait of Hormuz has become more complex, especially after Trump's unilateral sanctions against Iran. Attacks on oil tankers and attacks on Saudi oil facilities were among the most significant developments in the region in 2019. While the origin of these attacks is unknown, their effect on the world market for oil has been very obvious. In the event of an attack on a Saudi oil refinery, oil prices increased by $20 per barrel in just 1 day.

7 EIA. June 2019. The Strait of Hormuz is the world's most important oil transit chokepoint. Available at https://www.eia.gov/todayinenergy/detail.php?id=39932

Table 4: Political instability index of 15 countries with the highest oil exports to China

Country	% of China's total imported crude oil	MARSH political index (Long Term Political index, 2020)*	Regional Political Risk Index, PRS group (2019)**	Political stability, global economy index (2019)***
Saudi Arabia	16.8	56.7	74	–0.43
Russia	15.3	61.7	57	–0.54
Iraq	9.9	36.7	48	–2.56
Angola	9.5	55.9	63	–0.31
Brazil	7.8	68.9	66	–0.55
Oman	6.9	72.8	74	N/A
Kuwait	4.5	66.4	77	0.2
United Arab Emirates	3.1	76.1	89	0.7
Iran	3	54	49	–1.7
United Kingdom	2.7	82.7	87	0.52
Congo	2.3	30.1	62	–0.89
Malaysia	2.3	65.2	78	0.11
Colombia	2.3	61.7	71	–0.92
Libya	2	20.2	46	–2.57
Venezuela	1.9	44.8	39	–1.45

*Higher score means lower levels of instability. **Higher score means better levels of stability. ***–2.5 weak; +2.5 strong

Given the inability to circumvent the strait, the sensitivity of global energy market to the security situation in the Strait of Hormuz is very high. In general, energy bottlenecks and being heavily reliant on sea routes for energy transit are critical to China's energy security. Any instability in oil-producing countries or the inability to transit oil from bottlenecks, even temporarily, can cause substantial supply delays and higher shipping costs, leading to higher world energy prices. Although it is feasible to bypass chokepoints in some cases, it can increase shipping costs and increase transit time significantly, making it practically unprofitable.

4. RELATIONSHIP BETWEEN BRI AND CHINA ENERGY SECURITY

4.1. BRI, Availability, and Affordability

BRI can be a practical step in terms of energy supply and energy security for China. To maintain its rapid economic growth, China needs sufficient and affordable energy imports. Beijing has always sought to seize every opportunity of international cooperation in energy supply. BRI is an important stage for China to participate in global energy governance. International energy governance power is embodied in many aspects including higher energy security levels, safe energy transport channels, influence on energy pricing, and leading power in international energy organizations. Although China is the world's largest consumer of oil, its power of government, leverage, and debate on the international energy arena is not strong, mainly reflected in some aspects such as insufficient sources of energy imports and transport channels, lack of energy pricing power, and inadequate leadership in international energy organizations (Gao, 2017).

The implementation of BRI projects could establish a long-term framework for current energy cooperation and enable China to expand energy relations with member states in a strategic form. BRI can form a framework for strategic partnership in the field of energy which ultimately leads to institutionalization. In 2017, China's National Development and Reform Commission (NDRC) and the country's National Energy Administration (NEA) released the first executive document in the field of energy partnership, named "the Vision and Actions on Energy Cooperation in Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road." This document proposed a platform to increase energy partnership among BRI members. In 2018, at the level of energy ministers of member countries, Beijing held its first Energy Meeting. The 'Belt and Road Energy Partnership' (BREP) was officially established in Beijing less than a year later.[8] According to a document released at the inauguration ceremony, member states agreed to work together in the field of energy to enhance energy investment, facilitate unimpeded trade of energy commodities, increase energy efficiency, strengthen infrastructure connectivity, and promote energy cooperation. Such initiatives within the BRI could allow China and other member states to enhance integrations and interconnectivity, as well as promoting regional cooperation. Further, it can increase China's global energy governance power, contribute to the convergence of governance, and eventually increase energy ties between BRI countries (Han et al., 2018; Yu, 2019).

Furthermore, the completion of BRI projects leads to the upgrading of regional and international transport infrastructure and network. Completing the development of ports, energy transmission lines can reduce logistics and transportation costs, while improving energy supply infrastructure and increasing regional integration. Pelagidis and Haralambides (2019) estimated that China's foreign trade costs decreases by at least 3 percent with just 10% of BRI completed projects (Pelagidis and Haralambides, 2019), leading to an increase in China's imports and exports by 6 and 9%, respectively.

The China-Pakistan Economic Corridor (CPEC) can significantly reduce logistics and transportation costs. During the implementation of CPEC, the traditional routes of energy and goods transfer from the Middle East and Africa to China can significantly reduce in terms of distance and cost (Table 5). Just in one scenario, the Middle East-China Corridor, one of the major trade routes between China and the Middle East and North Africa, would benefit from a reduction in distance and transportation costs of 72% and 45%, respectively. If the Pakistan-China proposed pipeline is materialized, oil transportation from the Persian Gulf to the port of Gwadar in Pakistan is possible in just 2 days at 0.23 USD dollar (Shaikh et al., 2016). Transit oil from Gwadar to China will cost less than 1.23 USD dollars and take 4 days.

In addition, energy cooperation can break Asia's energy premium. In terms of energy pricing, Asia has little influence on international oil and gas prices. There has been an "Asian premium" for oil and gas prices for a long time, and Asian countries have had to pay more for energy imports than other countries. In 2015, for example, the natural gas price in Asia represented by the LNG import price in Japan was $ 10.31 million BTU, which was 1.6 times the natural gas import price in Germany and the U.K., and 4 times the natural gas price in the U.S.

4.2. BRI and Accessibility

4.2.1. Diversification of energy recourses

Regarding the BRI, abundant resources play an irreplaceable role. The BRI line is the world's most oil-rich zone, which plays a significant influence on the international energy stage. By 2015, the cumulative proven energy supplies of the BRI member countries were estimated at 758.73 billion tonnes of standard coal including 52.27% of world reserves (Zhao et al., 2019). BRI member countries can meet China's energy needs well. Many of these countries are abundant in energy and natural resources. Oil, natural gas, and coal imports from BRI countries account for 65.8, 85.2, and 43.6% of China's total imports, respectively, in 2018.

Energy plays an important role in China's BRI investments. The ratio of the investment in BRI member countries to total investment has increased while outward foreign direct investment (OFDI) in China has declined during the recent years (Figure 3). In 2019, China's investment in BRI projects allocated 69.6% of the total foreign investment since the BRI was proposed. In comparison, the bulk of these investments occurred in the energy sector. In the BRI energy sector, China's foreign investment was $43.1 billion, accounting for 84.4% of China's total energy investment. In recent years, China's energy spending declined from $71.4 billion in 2016 to $51.4 billion in 2019, and global oil prices decreased (Figure 4). However, the ratio of energy investments in BRI to total foreign energy investments increased significantly during the same period. In 2019, the ratio of energy investments in BRI hit 84.37% of total foreign energy investments while it was only 69.6% in 2016.

The geographical distribution of China's energy investments indicates an increase in energy investment in BRI core regions, namely Africa and Asia (Figures 5 and 6). Asia has attracted the most Chinese investment in the energy sector. The countries in West and Southwest Asia received $ 99.7 billion from Chinese capitals during 2013 and 2019. The amount of investment shows a 68.4% increase compared to the period during 2006-2012. In addition, Africa has become one of the main destinations for Chinese foreign investment in the energy sector, allocating a total of $ 68.4 billion in Chinese investment in the 6 years to 2019, almost doubled the previous 6-year period. A surge in energy investment projects in Asia and Africa reflect China's strategic and commercial goals in pursuing supply chain security policies.

8 Xin, Zheng. June 2019. Nation's reliance on crude oil imports set to continue. China Daily Global, 2019. Available at https://www.chinadaily.com.cn/global/2019-06/05/content_37477320.htm

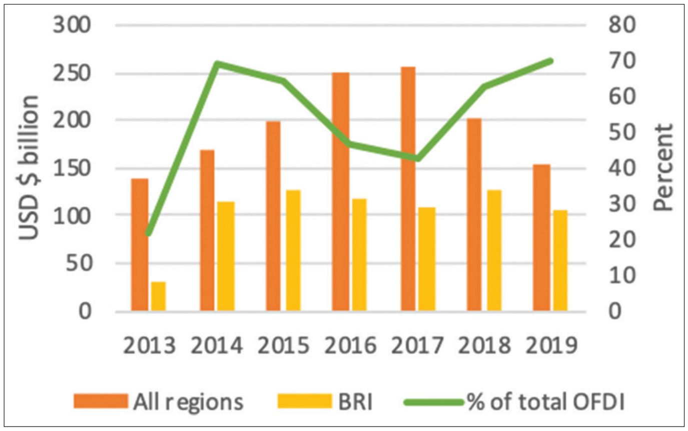
Table 5: CPEC trade route analysis

Corridor name	Distance (Miles)			Cost savings (US$/Mile)		
	Traditional route	CPEC	Miles saved (%)	Traditional route	CPEC	Cost saving (%)
Europe-China	19132	9597	9535 (50)	8026	4719	3307 (41)
Middle East- China	9146	2546	6600 (72)	6029	3309	2720 (45)
Africa-China	9785	4464	5321 (54)	6157	3692	2456 (40)

Source: Shanghai institute for international studies

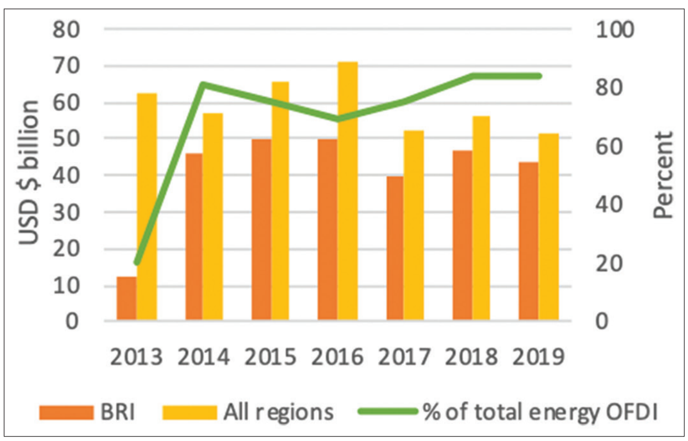
A review of the proposed BRI schemes also revealed that China's outbound investment focuses on numerous energy supply chain segments including extraction, power generation, and transmission lines. Only in one recent case, China announced that it is investing $280 billion in the oil and gas industry in Iran. The funding is a part of a $ 400 billion deal reached in 2016 between the two countries.

Figure 3: Chinese OFDI in the BRI countries, all countries, and their share of total Chinese OFDI



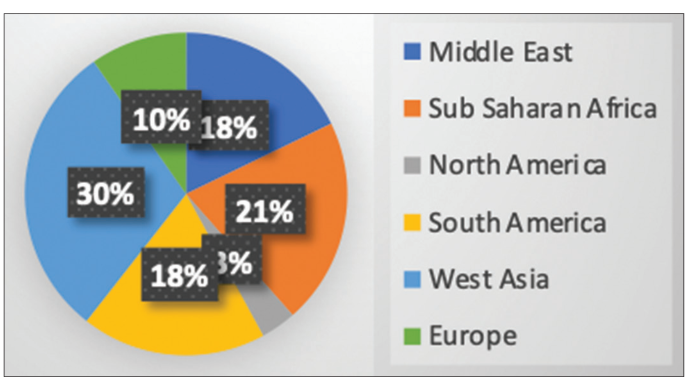
Source: Green BRI Center / International Institute of Green Finance (IIGF)

Figure 4: Chinese energy ODI in the BRI countries, all countries, and therir share of total Chinese OFDI



Source: Green BRI Center / International Institute of Green Finance (IIGF)

Figure 5: Distribution of China's OFDI in energy by region, 2013-2019



Source: China global investment tracker (CGIT)

China's investment in energy in the form of BRI-related projects can enhance the security of the energy supply chain.

4.2.2. Diversification of energy routes and BRI

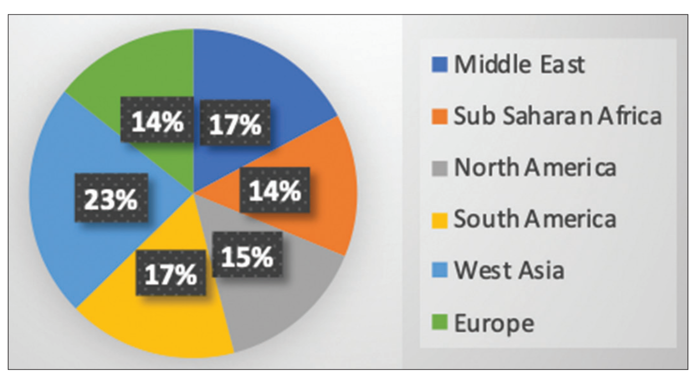
China has proposed several energy corridors within the BRI to reduce the risks of energy supply disruption. The Eastern Siberia-Pacific Ocean oil pipeline (ESPOOP) was built by Russia in 2019 as a part of the Chin-Russian economic corridor. By its full operation in 2024, ESPOOP will deliver 38 billion cubic meters of Russian gas to China annually.[9] Along with the China-Russia pipeline, Pakistan's Gwadar Port, a crucial part of the China-Pakistan Economic Corridor (CPEC), will serve as the hub for energy and trade in the region. In addition to connecting the western province of Xinjiang to the free waters in the Indian Ocean, the development of Gwadar will allow China to circumvent the Malacca Strait and transit of goods and energy through CPEC (Gholizadeh et al., 2020). Further, China built a deep-water port in Kyaukpyu in Myanmar, pumping USD 1.5 billion oil and natural gas pipeline to Yunnan in China. Another project is related to the construction of a fourth pipeline (line D) of the Central Asia-China Gas Pipeline. Furthermore, Line D will deliver 15 billion m3 of Kazakstan gas to China's Xinjiang annually (Table 6).

China's energy import channels have steadily diversified with the completion of the China-Russia oil pipeline, the Central Asian oil and gas pipeline, and the China-Myanmar oil and gas pipeline along the "BRI" route. In the future, with the completion of the eastern and western lines of the China-Russia natural gas pipeline, as well as the China-Pakistan energy corridor starting from Gwadar port, China's energy import channels are expanded.

Furthermore, concerns over energy security have led to the rapid expansion of China's navy presence. The development of the Maritime Silk Road Initiative (MSRI) will allow China to exert more control over the ports, thereby providing logistical support for securing sea routes (Blanchard and Flint, 2017). China officially established the first overseas military base in Djibouti in 2015, which is a small country on the horn of

9 Xi, Putin witness the launch of the China-Russia east-route natural gas pipeline. Xinhua news agency, December 2019. Available at http://www.china.org.cn/world/2019-12/03/content_75471266.htm

Figure 6: Distribution of China's OFDI in energy by region, 2005-2012



Source: China global investment tracker (CGIT)

Africa. However, it holds a strategic position in the region, and a crucial maritime chokepoint, along the Bab el-Mandeb strait. In addition, to provide logistical support to merchant ships, the facilities at the Chinese naval base in Djibouti enable the Chinese Navy to respond to any threat to the security of trade routes quickly.

4.3. Environmental Issues and BRI

Although the share of coal in China's primary energy mix has steadily declined in recent years reaching below 60% for the 1st time in 2018, the overall consumption increased by 1% in the absolute term compared to 2017.[10] As a result, CO2 emission increased by 2.2% despite the efforts made by Chinese government to reduce greenhouse gas emissions. In line with its commitment to the Paris climate agreement, China must reduce its dependence on coal. Thus, China needs a massive surge in natural gas use over the coming decades. However, the lack of domestic supply has made gas imports one of top priorities in energy policy in this country. Further, China's depressing demand for gas can be fulfilled well by BRI countries. According to the initiative, the estimated proven natural gas reserves in different countries reach 143.3 trillion cubic meters including 76.6% of the total world reserves (Zhao et al., 2019). Geographically, most of the world's gas resources are located along the BRI in Russia, the Middle East, and Central Asia (Table 7). Beijing aims to build five domestic gas lines from west to east in order to supply imported gas by linking gas pipes from Central Asia and the Middle East to China's western province (Table 6).

Table 6: BRI's energy corridors

Corridor route	Name of the corridor	Annual capacity	Description
Asia-Pacific energy corridor	The Eastern Siberia – Pacific Ocean oil pipeline (ESPOOP)	The transmission capacity of this line was equivalent to 1 million barrels per day in 2016. By 2025, this amount will increase to 1.6 million barrels per day	The 4857-kilometer pipeline that supplies Russian Siberian gas to the Asia-Pacific market
Northwest energy corridor	Central Asia-China gas pipeline (Line C)	Running parallel with Line A and Line B, it can deliver 25 million m3 per year	The 3,666km gas pipeline extends from the Turkmenistan/ Uzbekistan border to west of China
	Central Asia-China gas pipeline (Line D)	It will supply 15 billion m3 per year	Connecting Turkmenistan to the eastern border of China
Southwest energy corridor	The Myanmar-China Crude Oil Pipeline (MCOP)	Upon the completion of phase 1 and phase 2, MCOP is able to deliver 12Mt, and 22Mt, respectively	The 771 km long pipeline connects the west coast of Myanmar to the southwestern Chinese province of Yunnan
	The Myanmar-China Gas Pipeline (MCGP)	Upon the completion of phase 1 and phase 2, it can deliver 17.2 billion m3 per year	The 793 km long pipeline, running in parallel with the MCOP

Source: Shanghai institutes for international studies; Guo, Huang, and Wu 2019

Further, BRI can indirectly enhance the capacity of China's green production and improve technology in various ways. By strengthening regional cooperation, Chinese companies can export their products using their competitive advantages in clean energy production. Increased investment and efficiency and technological upgrades resulting from such partnerships will help develop renewable energy productions in China (Ji et al., 2018). The BRI can significantly boost external demand for Chinese products, promote market capacity, achieve economies of scale, and ultimately increase production efficiency (Liu and Xin, 2019).

In 2017, the "Guidance on Promoting Green Belt and Road" was released by the Ministry of Environmental Protection of China.[11] Guided by ecological civilization and green development concepts, the Green Belt and Road Initiative follows the principle of being resource-efficient and environmentally friendly, incorporating the green concept into policy coordination efforts, connectivity facilities, unimpeded trade, financial integration, and people-people bonds. Additionally, it incorporates eco-environment preservation into all dimensions of the BRI construction process as a whole. China aims to establish partnerships with multiple financial

10 Daly and Xu, 2019. China's 2018 coal usage rises 1 percent, but the share of the energy mix falls. Reuters, 2019. Available at https://www.reuters.com/article/us-china-energy/chinas-2018-coal-usage-rises-1-percent-but-share-of-energy-mix-falls-idUSKCN1QH0C4

11 The full text is available at http://english.mee.gov.cn/Resources/Policies/policies/Frameworkp1/201706/t20170628_416864.shtml

Table 7: Top five countries with the biggest natural gas reserves

Country	Proven gas resources (tcm)*	The world's share of natural gas resources %	Geographical area	BRI membership status
Russia	38	19	Asia	Yes
Iran	32	16	Middle East	Yes
Qatar	24.7	12	Middle East	Yes
Turkmenistan	19.5	9.8	Central Asia	Yes
United states	12.9	6.5	America	No

Source: BP Statistical Review of World Energy 2020. *Trillion cubic meters institutions such as the Asian Infrastructure Investment Bank (AIIB) in order to fund renewable energy investment initiatives to meet green development goals.

5. CONCLUSION

During economic growth in China, energy supply and security are considered as two important issues in its foreign policy for decades. Given the fact that countries with abundant energy resources are the members of the BRI, energy cooperation will undoubtedly be at the center of important issues in this initiative. The relationship between the BRI and China's energy policies has been the subject of much debate in scientific circles. The importance of BRI in the energy security of China has been discussed in several studies published in recent years. However, researchers have discussed one of the geopolitical, political, or economic aspects of such a relationship. Furthermore, only environmental factors have been considered in the studies related to sustainability. We believe that examining the influential factors separately cannot reveal the role of this initiative in China's energy security completely. Thus, this study attempted to use a detailed description of the term *energy security* to examine the role of the BRI in China's energy security policy. APERC presented one of the most popular descriptions of the idea of energy security in 2007. By categorizing energy security concerns, APERC introduced four main analytical pillars including availability, accessibility, affordability, and acceptability. By applying the four As approach, this research focused on energy supply, energy efficiency, and environmental quality as the essential components to analyze China's BRI energy security policies.

China achieved the following objectives after implementing BRI:

1. Establishing direct energy trade with energy cooperation countries: The proportion of energy production in the Middle East is decreasing year by year through changing the world energy system pattern. OPEC oil production decreased to 41.0% of total world supply in 2014, while oil production in non-OPCE countries increased to 43.0%. In other words, China's energy exchange needs to open up more channels and develop a partnership with more emerging energy producers in terms of trade. BRI can be served as a platform in the field of energy trade to guarantee energy cooperation among the countries along with the Chinese initiative and ensure energy supply to China.
2. Dominating the Asia region to form an integrated energy consumption market: The "Belt and Road" initiative outlines a complete economic and trade system, which covers all upstream, midstream, and downstream of the energy industries. BRI allows China to establish an Asian energy integration market actively, improve energy infrastructure interrelationships and cooperation, and safeguard the transportation of oil and gas pipelines jointly. In addition, the BRI aimed at developing Africa and Europe's economic energy infrastructure. Furthermore, through economic cooperation, BRI could help China to achieve policy communication, facility connectivity, trade smooth, financing, and people-to-people communication to improve the degree of economic energy integration and reduce the impact of geopolitical factors on international energy security and energy order.
3. Improving energy development efficiency, speeding up the circulation of investment funds, and promoting energy sustainability: BRI will increase energy technology exchanges and cooperation with major energy-consuming countries such as Japan and Singapore, introduce high and new technologies such as energy refining and chemical and new energy development, develop clean energy vigorously, and promote sustainable development. The lack of domestic energy resources and growing energy consumption has led to the use of coal as an available domestic resource in China's energy structure. However, increasing air pollution and environmental degradation would push the Chinese government to look at less polluting alternatives. Such a necessity will transform China's energy structure from being coal-based to consuming more natural gas as comparatively safe and available energy. BRI countries can meet China's need for gas well. The total proven natural gas reserves in the countries along the initiative exceed 143.3 trillion cubic meters, allocating 76.6% of total global reserves. In addition, China defined gas transmission lines as a part of BRI projects, which plays an important role in supplying energy to China. By the end of the 13th 5-year plan, nine overland oil and gas import pipelines are built in the BRI region, with a total length of 13,119 km (overseas part) and an annual capacity of 72 million tons and 135 billion cubic meters, respectively. The completion of these networks can play an important role in producing and constructing China's sustainable energy security.
4. China's energy trade has been under the control of the United States in the past decades including political intervention in energy exporters with trade relations with China and the world energy transport channel. China should use all opportunities to establish a direct and equal trade cooperation with energy cooperation countries, eliminate hegemonic interference, and minimize the impact of geopolitical factors on the economy. Strengthening energy cooperation with the BRI countries can diversify energy import transport routes in China, expand its space for maneuver in the international energy market, and strengthen its voice in international energy negotiations and global energy governance.
5. Implementing the BRI strategy provides an important stage for China to participate in international energy governance and expand its influence and voice in the international energy system. Energy cooperation should be multi-field, omni-directional, and multi-regional, with versatile and diverse forms of cooperation. Further, a stable level of energy security is a prerequisite for China to engage in international energy governance. The future development direction of China's energy security strategy under the background of the "Belt and Road Initiative" strategy can open up pluralistic economic cooperation in the energy field.

Energy cooperation heavily relies on the behavior of producer and consumer countries in a world with growing interdependence among nations. The BRI strategy is devoted to linking Asia, Europe, and Africa and their surrounding oceans together in order to establish and reinforce partnerships between countries along the route, create a strong network of connectivity, and achieve diversified, independent, balanced, and sustainable development of countries along the Belt and along the road.

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