Research on the Marine Energy Transportation of China

WangBin¹, YangQiuping¹*
¹Department, WTI, Beijing,100088, China
*Corresponding author’s e-mail: wangb@wti.ac.cn

Abstract. Firstly, the current situation of energy structure and consumption in China is analyzed. It can be seen that crude oil and natural gas are highly dependent on foreign countries. At the same time, the situation of the energy transportation is analyzed. Finally, the challenges of energy transport corridor of China are analyzed, and some policy recommendations are put forward.

1. Current Situation of Energy Transportation of China

1.1. Energy Structure and Consumption Status in China

(1) Petroleum
From 2000 to 2018, China's oil production grew slowly, but oil consumption increased significantly, which led to a growing gap between oil production and consumption. Slow-growing crude oil production is far from meeting oil consumption. By 2018, China's total oil consumption will reach nearly 880 million tons of standard coal, while crude oil production is only 270 million tons of standard coal. The gap between production and demand is 600 million tons of standard coal. The gap between production and demand is expanding year by year.

As China's increasing crude oil consumption, China's crude oil imports have increased year by year to meet consumption. Moreover, China's crude oil dependence on foreign countries has also increased significantly. Since 2008, crude oil imports have accounted for half of crude oil consumption. In 2018, China's crude oil imports amounted to 460 million tons, with a dependence of 71.2%. It can be seen that China's dependence on the international market of crude oil is getting higher and higher. See Figure 1 for details.

![Figure 1. The Balance of Oil Production and Consumption in China.](image)

(2) Coal
Before 2000, China's coal output exceeded its consumption. After 2000, under the background of the active adjustment of energy structure, the speed of raw coal production in China has slowed down.
Since 2014, China's raw coal production has begun to decline slightly. Under the background of environmental protection, the growth rate of total coal consumption in China is not fast. By 2018, China's raw coal production is about 2.61 billion tons of standard coal, and its consumption is nearly 2.74 billion tons. The gap between coal production and consumption balance is not big, about 120 million tons of standard coal. China's coal industry can basically achieve self-sufficiency.

China's coal consumption demand is mainly met by domestic production, and the dependence on the international market is not high, so it is not the focus of this paper.

(3) Natural gas
China's natural gas production and consumption began to show negative balance in 2007, especially in recent years, the gap between production and demand is growing. By 2018, the gap has reached 150 million tons of standard coal. Although the total production of natural gas is increasing every year, its growth rate is still lower than that of consumption. Therefore, China's external dependence on natural gas has increased year by year in recent years. By 2018, China will import 9.39 million tons of natural gas, with the external dependence reaching 47%.

1.2. Analysis of China's Energy Marine Transportation
(1) Crude oil
Crude oil is imported through waterways, highways, railways and other modes of transportation. Among them, waterway is the main way of crude oil import, accounting for about 90% of all crude oil imports. In 2018, China imported 410 million tons of crude oil by sea, accounting for 89.25% of crude oil imports. Pipeline transportation is the second largest channel for crude oil import. The proportion of crude oil imported by railways and highways is low, accounting for less than 0.5% of the total in recent years. From 2010 to 2018, the main sources of crude oil imports through waterways in China are mainly the Middle East, West Africa, South America, Russia and the United States. The proportion of imports from the Middle East reached 60.8% in 2010, and gradually dropped to below 50% in the next few years. Next are West Africa and South America. China's crude oil imports have gradually shown a trend of diversification.

| Source         | 2010 | 2015 | 2016 | 2017 | 2018 |
|----------------|------|------|------|------|------|
| South America  | 9%   | 13%  | 14%  | 15%  | 15%  |
| *Venezuela     | 3%   | 5%   | 6%   | 6%   | 4%   |
| West Africa    | 22%  | 17%  | 17%  | 19%  | 17%  |
| Middle East    | 61%  | 57%  | 53%  | 48%  | 49%  |
| *Iran          | 10%  | 9%   | 9%   | 8%   | 7%   |
| Russian        | 2%   | 6%   | 8%   | 9%   | 8%   |
| U.S.A          | 0%   | 0%   | 0%   | 2%   | 3%   |
| Other          | 6%   | 6%   | 8%   | 8%   | 7%   |

Sea lanes for energy imports of China mainly includes the Middle East Persian Gulf Region - the Strait of Hormuz - Malacca - China, Middle East Mediterranean Region - Suez Canal - Mande Strait - Malacca - China, West Africa - Cape of Good Hope - Malacca Strait (Sunda Strait) - China, South America (North America) - Cape of Good Hope - Malacca Strait (Sunda Strait) - China. Among them, political instability, terrorism, piracy and other non-traditional security incidents in the Middle East countries have a certain impact on the security of corridors. For example, the Persian Gulf and the Strait of Hormuz are obviously affected by the political conflicts in the Gulf region.

(2) LNG
In 2018, China imported 9.93 million tons of LNG, of which 57.38 million tons were imported by waterways, accounting for 59% of the total imports.
Table 2. Marine imports from major sources of LNG.

|        | 2010 | 2015 | 2016 | 2017 | 2018 |
|--------|------|------|------|------|------|
| Australia | 42%  | 28%  | 46%  | 45%  | 44%  |
| Indonesia | 18%  | 15%  | 11%  | 8%   | 9%   |
| Qatar     | 13%  | 24%  | 19%  | 20%  | 17%  |
| Malaysia  | 13%  | 17%  | 10%  | 11%  | 11%  |
| Yemen     | 6%   | 1%   | 0%   | 0%   | 0%   |
| Other     | 9%   | 15%  | 14%  | 16%  | 15%  |

China's LNG maritime imports are mainly from Australia, Indonesia, Qatar, Malaysia, Yemen and West Africa. Sea lanes for LNG imports of China mainly includes Australia - Sunda Strait (Longmu Strait, Wangjiangxi Strait) - China, Southeast Asia - China, Middle East Persian Gulf Region - Hormuz Strait - Malacca Strait - China, Middle East Mediterranean Region - Suez Canal - Mand Strait - Malacca - China, West Africa - Cape Good Hope - Malacca Strait (Sunda Strait) - China, South America (North America) - Hope Cape - Malacca Strait (Sunda Sea) Gorge - China, Gulf of Mexico - China, Arctic - China. Among them, the probability of maritime terrorism and piracy incidents in the Suluhai area in the southern South China Sea will affect the safety of ships from Eastern Australia. Piracy incidents may also occur in the Wangaxi Strait in central Indonesia, affecting the safety of ships from Indonesia and Western Australia.

2. Safety Challenges of Energy Transport Corridors in China

2.1. Port Security
At present, the safety risk of large petroleum and chemical ports in China is controllable. However, due to the huge interests, many energy exporting countries have high security risks. As Trump withdrew from the Iranian nuclear agreement, the United States resumed nuclear-related sanctions against Iran in an all-round way, and geopolitical pressure intensified. After the election, Iraq has not yet fully formed its cabinet and faces high political risks. Meanwhile, Iraq's central government has reduced overall security risks after recovering most of the territory occupied by IS organizations. However, IS organizations still exist and spread to the surrounding areas. Crimes and terrorist attacks occur from time to time. Oil and gas infrastructure has become the target of attack, and security risks are still high. Southeast Asia is mostly controlled by the United States, and has many U.S. military bases, which pose a certain threat to energy transport security. Africa, especially the resource countries of Northwest Africa, has introduced preferential policies to stimulate economic development, and the economic and policy risks are slightly lower than those of other regions. However, the northern part of Mozambique has been harassed by Islamic extremists and poses a high security risk. Venezuela in South America has a high security risk due to intense political struggle. Although Russia is subject to sanctions from the United States and Europe, its security risk is low because of its stable political situation.

2.2. Transportation Security
(1) Complex situation in key Straits
At present, China is the first country to use the Strait of Malacca, which has become the lifeline of China's economy. Moreover, the security problem of the Malacca Strait as a representative of the key global Straits not only affects the safety of China's maritime corridors, but also concerns the safety of China's economy. However, due to its important geographical location and political situation, the Strait of Malacca has faced many security difficulties in recent years.

First, the Strait of Malacca is jointly managed by Malaysia, Indonesia and Singapore. Since the independence of Malaysia, the bilateral relations between Singapore and Malaysia have been tense,
while Indonesia has its own unstable political situation. Around the issue of the Straits, the three countries have been experiencing constant friction. They all want to control and dominate the Straits. In addition, the territorial sea and territorial division of the Straits between Malaysia and Indonesia has not been completely resolved. There are also ethnic conflicts and territorial disputes between Singapore, Indonesia and Malaysia. These problems can cause distrust among countries and may lead to regional unrest, thus threatening the security of the Straits.

Secondly, the intervention of foreign countries in the Strait of Malacca has brought about confusion in the political situation. In view of the important role of the Strait of Malacca, in recent years, the world's major powers have intervened in the Strait management and stability affairs in the name of protecting the security of the Strait, making China subject to the situation of using the Strait of Malacca.

(2) Pirate

Figure 2. Yearly Statics of Incident Which Occurred Since 1984.

According to the statistics of global piracy attacks issued by the International Maritime Organization (IMO), Piracy incidents in the Gulf of Aden surged to about 150-200 cases per year in 2008-2011. Due to the rampanty of piracy in the Gulf of Aden, the major powers have sent naval forces to escort merchant ships, while more maritime carriers are forced to choose alternative routes to reduce greater economic losses and personal safety threats. Piracy incidents occurred in Malacca in 2014 and 2015, 81 and 134 respectively. In order to maintain the development of foreign economy and trade, countries need to improve ship security measures, increase the insurance quota and open up alternative routes. The most important thing is to rely on national and international cooperation forces to jointly fight piracy. All these actions have further increased the cost and difficulty of the safety and unimpeded of the relevant maritime corridors, which is very disadvantageous to the operation of the corridors.

(3) China's Controlled Ship Carries Lower Proportion of Chinese Goods

In 2018, China imported 462 million tons of crude oil, an increase of 10.1%. Among them, shipping imports reached 402 million tons, an increase of 9.0%. Cosco Shipping and China Merchants Group only carried about 100 million tons, accounting for about 22% of China's imported shipping volume. With the growth of trade volume, the proportion of national oil transport has not kept pace with the growth.

In 2018, China imported 5378 million tons of LNG. In 2018, the global LNG fleet expanded by 12% to 546 vessels, while at present, only 38 LNG vessels invested by Chinese transport enterprises, less than 7%. On the whole, China's annual import of LNG increases tremendously, but the number of
LNG vessels invested by China Shipping Company is growing slowly. There is a mismatch between capacity and demand, and "national gas and national transportation" needs to be strengthened.

2.3. Information Security
China's maritime positioning system relies heavily on foreign satellite positioning systems. The reliability of guiding and positioning system is very important for the safe navigation of modern commercial ships. The control of satellite positioning system poses a potential threat to shipping safety. At present, the navigation system of ships mainly relies on GPS, which is controlled by the United States. When necessary, the United States can suspend satellite positioning and navigation services in specific areas or provide inaccurate positioning information through technical means. In addition, the recent GPS positioning failure of merchant ships in the Strait of Hormuz also indicates that the system may fail due to planned interference in tense areas. In the future, Beidou positioning system can reduce the potential risk of relying solely on GPS satellite positioning system to a certain extent.

3. Several Policy Recommendations

3.1. Actively Integrate into the International Maritime Governance System
We will actively participate in the affairs of international organizations such as the International Maritime Organization, International Convention on Maritime Search and Rescue and International Salvage Union, conduct in-depth research on the drafting and revision of relevant international conventions and perform well the duties of member units. We will maintain 24-hour emergency duty, tracking and monitoring the information of ships passing through the Gulf of Aden, coordinating the escort operations and ensuring the service. We will improve the allocation of deep-sea search and rescue equipment, promote the global application of Beidou system, and enhance the capability of deep-sea search and rescue and navigation support.

3.2. Establishment of a National Economic Safety Fleet
First, China's flag fleet is sufficient to carry all coastal transport needs and some import and export goods in foreign trade, and can serve as the navy's military supplementary fleet in wartime or in national crisis. Second, a large-scale and specialized fleet with China's flag can carry a considerable proportion of imported petroleum, coal, liquefied gas and other important materials to maintain transport stability and economy.

3.3. Constantly Perfecting the Construction of Beidou System
As an indispensable information infrastructure for national security and social development, satellite navigation system reflects a country's international status and comprehensive national strength. Maritime navigation is an important part of transportation network, which is related to the development and security of national economy. At present, maritime navigation mainly relies on foreign satellite navigation systems, and there are huge security risks. It is suggested that the construction of Beidou system should be continuously improved so as to make Beidou system play an increasingly important role in the field of shipping.

3.4. Reducing Import Dependence and Promoting Diversification of Energy Sources
Considering the safety of oil import and the climate environment, China should vigorously develop alternative energy sources and promote the energy production and consumption revolution. Actively exploiting and utilizing new energy and promoting large-scale and extensive substitution of new energy. Actively expand oil import channels, adhere to the diversification strategy of oil import, and deepen oil cooperation with resource-rich countries along the "one belt and one road".
4. Conclusion
China's dependence on the international market of crude oil is getting higher and higher, and the dependence on natural gas is also increasing year by year in recent years. Challenges to China's energy transport security lie in the following aspects: 1. The safety risk of large petroleum and chemical ports in China is controllable. However, due to the huge interests, many energy exporting countries have high security risks. 2. The situation in Malacca and other key Straits is complex, piracy attacks are becoming more frequent, and china's Controlled Ship Carries Lower Proportion of Chinese Goods, etc. 3. China's maritime positioning system relies heavily on foreign satellite positioning systems. It is suggested that the state should actively integrate into the international maritime governance system, the state should establish a national economic safety fleet, the state should constantly perfecting the construction of Beidou System, the state should reduce import dependence and promote diversification of energy sources.

References
[1] Alfred Thayer Mahan.(1997), The Theory of Sea Power, Yanshi Press in China, Beijing
[2] Liangfang.(2011), On Maritime Strategic Access, Shishi Press, Beijing
[3] Lvjing.(2018), Research on Security of China's Sea Lines of Communications, Economic Science Press, Beijing
[4] Xu Yiyou(2006). Evolution of US Maritime Policy Volume, China Water Transport, 7:54-55.
[5] Xu Zhuyuan(2011), China's Maritime Transport Towards the World, Shipping, 6-8
[6] Hu Zi(2012), Half sea water, half flame, Water Transportation Technology, 5:5.
[7] Chen yang, Wu haile(2019), Application of Beidou System in Global Maritime Shipping, Satellite applications, 4:16-18
[8] Qin Xiao(2004), Energy Transportation in China's Energy Security Strategy, Energy of China, 7: 4–7.
[9] Sun Junyan(2005), Safety System and Evaluation of China's Oil Maritime Transportation, Shipping Management, 9:22-25.
[10] General Administration of Customs, P.R.China, http://www.customs.gov.cn/.
[11] Ministry of Commerce of the People's Republic of China, http://www.mofcom.gov.cn/.
[12] Maritime terrorism website, http://www.maritimeterrorism.com.