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Department of Sociology, Economic
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38.04.01 Economics
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GRADUATION THESIS

on

International energy trade of China: current state and development prospects

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ASSIGNMENT
FOR THE GRADUATION THESIS OF

Master's degree student Wang Jiayang, group 22ЭЭБма1, full-time mode of study

1 The topic of the graduation thesis: «International energy trade of China: current state and development prospects»

was approved by the university order

dated «__» _____ 20__ no. _____

2 The deadline for the Master's degree student to complete the graduation thesis is 11.06.2024.

3 The input data for the graduation thesis is the regulatory and legal framework, scientific literature and reference books, and Internet data.

4 The list of issues to be studied includes current state of domestic economy and energy structure in China, analysis of the current state of China's energy trade, further development of China's energy trade.

5 The list of visuals contains tables and figures.

6 The date of setting the assignment is 28.11.2023.

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Schedule for completing the graduation thesis

№ п/п	Content of the thesis	Deadline for completion	Due date, signature of the academic adviser
First year of study			
1	Substantiating of the research topic and methodology, subject and object of research	1.09.2022 – 31.10.2022	
2	Framing the scientific concept of research	1.11.2022 – 18.12.2022	
3	Collection of scientific literature for the thesis	19.12.2022 – 15.01.2023	
4	Substantiating the relevance, concept, and novelty of the research	16.01.2023 – 19.02.2023	
5	Framing of a detailed plan and layout of the research	20.02.2023 – 12.03.2023	
6	Studying new literature sources within the topic of the thesis	13.03.2023 – 26.03.2023	
7	Conducting theoretical research within the first chapter of the thesis	27.03.2023 – 30.04.2023	
8	Preparing the first chapter of the thesis	1.05.2023 – 30.06.2023	
Second year of study			
9	Conducting analytical research within the second chapter of the thesis	1.09.2023 – 22.10.2023	
10	Preparing the second chapter of the thesis	23.10.2023 – 24.12.2023	
11	Conducting analytical research within the third chapter of the thesis	25.12.2023 – 25.02.2024	
12	Preparing the third chapter of the thesis	26.02.2024 – 21.04.2024	
13	Preparing the introduction and conclusion	22.04.2024 – 12.05.2024	
14	Completing the graduation thesis	13.05.2024 – 26.05.2024	
15	Handing in the thesis for compliance control and antiplagiat	27.05.2024 – 9.06.2024	
16	Getting acquainted with the feedback and review	10.06.2024	
17	Presenting the written thesis	11.06.2024	

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Summary

The graduation thesis comprises 76 pages, 3 chapters, 27 figures, 1 table, 61 sources.

INTERNATIONAL TRADE, ENERGY TRADE, EXPORT, IMPORT, CHINA, OIL, GAS, COAL

The object of research is international energy markets. The subject of the thesis is current state and prospects of international energy trade of China.

The research purpose is to analyze the current state and development prospects of China's international energy trade.

The methodological framework of the paper is formed by system approach, analysis and synthesis, statistical and comparative methods. To display identified economic dependencies graphical method was applied.

The results of work include: the importance of energy trade to China's economy was studied; primary energy production in China and the energy demand structure of China was identified; current state of China's energy trade was analyzed; obstacles of Chinese energy trade development were examined; prospects and countermeasures for the transformation of domestic energy consumption structure in the future were studied; strategies to strengthen China's relationship with energy trading partners were identified.

The novelty of the work is trends and prospects for the development of energy trade cooperation of China and strategies to strengthen China's relationship with energy trading partners are revealed.

The theoretical and practical significance of the research is that the conclusions made in the thesis form the basis for further research of energy cooperation of China. The results of the research can be used in the teaching of educational disciplines World Economy, International Economic Relations, International Trade.

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Introduction

Energy is an important foundation of the national economy and a basic condition for human survival. The development of China's economy has attracted worldwide attention, and energy is the driving force for economic development. There are some imbalances in China's energy supply and demand structure, such as excessive dependence on coal energy supply, low energy utilization, and more energy demand for domestic economic development. China is a big energy consumer. Although China's domestic energy resources are abundant, domestic energy supply alone cannot meet the speed of China's economic development. Therefore, more energy needs to rely on foreign imports. There have also been many dramatic changes in the field of international energy trade. Since the beginning of the 21st century, oil storage in Latin America and Africa has increased substantially, oil supply has developed towards multipolarization, and the focus of oil consumption is turning to oil producing countries and developing countries. China's energy import channels are beginning to become more diversified. China is seeking more energy trading partners, on the one hand to meet its growing energy needs, and on the other hand, diversified energy import channels guarantee China's energy sources safety. China has taken many powerful measures to this end, the most concerned of which is China's proposed Belt and Road Initiative. Based on the One Belt and One Road initiative, China has built a broad platform for economic cooperation, rapidly developed trade cooperation with many energy exporting countries, and also established the Asian Investment Bank to provide financial support for the implementation of the plan. China's major energy trading partners include Russia, Saudi Arabia and Australia, and will continue to maintain good trade relations with these countries in the future and seek more energy trade channels.

The relevance of this research is the following some aspects: firstly, with the rapid development of China's economy, China's energy supply is insufficient, and a large amount of energy comes from foreign imports. International energy trade is vital to the Chinese economy. In addition, China is very dependent on imported energy, but the current energy import channels are still relatively simple, which poses a huge threat to

China's energy security. China needs to seek more partners. And the focus of international energy trade is gradually shifting from the Atlantic coast to the Asia-Pacific region. China should seize the opportunity to ensure its solid position in the new energy trade market. However, the discovery and exploitation of new energy has begun to attract the attention of countries all over the world. The future energy trade will focus on new energy. China should pay attention to the investment and trade of new energy and prepare for future energy trade, and the proposal of the Belt and Road initiative provides the best platform for China's energy trade. China can better cooperate with energy exporting countries and build a more stable cooperation platform.

The object of this research is international energy markets. The subject of this thesis is current state and prospects of international energy trade of China.

The research purpose is to analyze the current state and development prospects of China's international energy trade. In order to achieve it we need to complete the following tasks:

- introduce the importance of energy trade to China's economy;
- examine primary energy production in China and describe the energy demand structure of China;
- examine current energy strategy;
- overview the current state of China's energy trade;
- discuss the prospects and countermeasures for the transformation of domestic energy consumption structure in the future and analyze the strategies to strengthen China's relationship with energy trading partners.

The main research methods used are literature research, qualitative analysis and comparative analysis. And the following methods also widely used in this thesis: quantitative analysis; quantity research method; experience summary method and descriptive research. This study focuses on the current status and trends of China's energy trade and aims to promote the future development of China's energy trade.

This study is based on data and information collected from a variety of sources. In order to compare and analyze the dependence of energy trade between China and the world's energy exporting countries, the value of China's annual energy imports is

measured in units of dollars. These analyses are aimed at determining the most important sources of China's imports of coal, oil and natural gas, as well as a comparative analysis of China's energy trade trends.

The novelty of the work is trends and prospects for the development of energy trade cooperation of China and strategies to strengthen China's relationship with energy trading partners are revealed.

The theoretical and practical significance of the research is that the conclusions made in the thesis form the basis for further research of energy cooperation of China. The results of the research can be used in the teaching of educational disciplines World Economy, International Economic Relations, International Trade.

The work structure is determined by the purpose and tasks decided in the work. The first chapter of this thesis focuses on China's domestic energy structure. Firstly, it demonstrates the close relationship between China's economic development and energy supply. Then it compares the supply and demand structure of various types of energy in China in two sections. Through the research in the first chapter, the current problems of China's energy structure could be clearly to see. The second chapter mainly deals with the analysis of China's energy trade. The trade dependence of each trading partner will be compared based on major energy commodities such as oil, coal and natural gas. The goal of this section is to clarify the various types of energy trade in China. The main content of the third chapter is to predict the future development of China's energy trade and provide some suggestions.

Chapter 1 Current state of domestic economy and energy structure in China

1.1 China economic status

China is the second largest economy in the world. From the point of view of economic quantity, goods and services are the foundation. In 2022, total imports and exports of goods amounted to 4,20428 trillion yuan, an increase of 7,7 % over the previous year. Among them, exports amounted to 21,734 billion yuan, up by 10,5 %. Imports amounted to 18,026 billion yuan, up by 4,7 %. In 2022, China and the countries along the «Belt and Road» countries imports and exported the country's trade and exports of 13,83 trillion yuan, an increase of 19,4 % over the previous year. The proportion of China's total foreign trade value reached 32,9 %, an increase of 3,2 percentage points from the previous year, which was increased by 7,9 percentage points from the 2013 Belt and Road Initiative (figure 1.1).

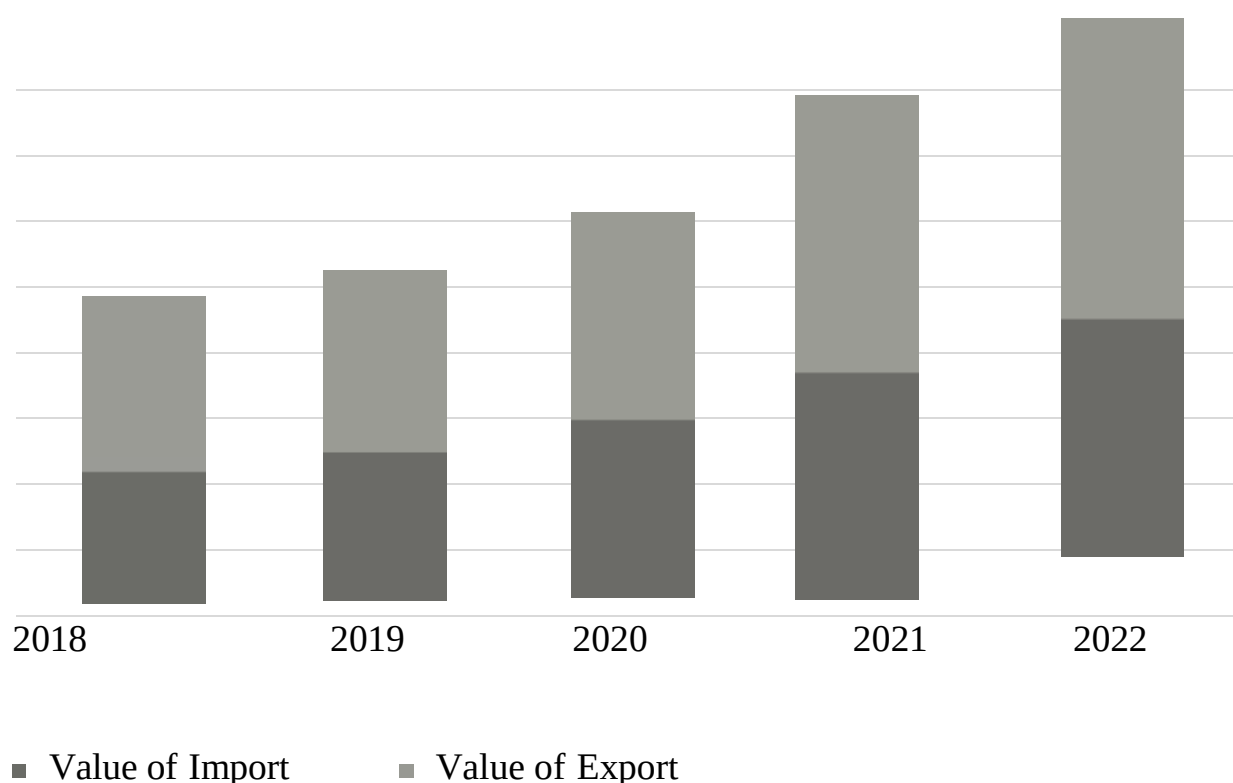


Figure 1.1 – Import and export of goods [10]

In 2020, the economy was affected by the COVID-19 epidemic and stagnated, but it still achieved growth in the end. Among the major imported primary products, energy demand is relatively large. In 2020, the import volume of coal was 303,99 million tons, an increase of 1,5 % over the previous year, and the import value was 141,1 billion yuan, a negative 12,1 % over the previous year. The import volume of crude oil was 542,39 million tons, an increase of 7,3 % over the previous year, and the import value was 1,2218 billion won, an increase of 26,8 % over the previous year. The import volume of refined oil was 28,35 million tons, an increase of 7,2 % over the previous year, and the import value was 81,8 billion yuan, an increase of 30,4 % over the previous year. The import volume of natural gas was 101,66 million tons, an increase of 5,3 % over the previous year, and the import value was 231,5 billion yuan, an increase of 19,4 % over the previous year. The demand for primary energy in 2020 was large. Although the import growth rate slowed down, it can be seen that the country still relies on imports [8, p. 17].

From the perspective of economic structure, China's economic growth has slowed down in recent years, but it still maintains a high growth rate, and the overall economic operation is stable. After preliminary calculations, China's annual GDP was 121020,7 billion yuan, an increase of 3,0 % over the previous year. Among them, the added value of the primary industry was 8834,5 billion yuan, up 4,1 % over the previous year; the added value of the secondary industry was 48316,4 billion yuan, up 3,8 %; and the added value of the tertiary industry was 63869,8 billion yuan, up 2,3 %. The added value of the primary industry accounted for 7,3 % of the GDP, the added value of the secondary industry accounted for 39,9 %, and the added value of the tertiary industry accounted for 52,8 %. Final consumption expenditure drove GDP growth by 1,0 percentage point, total capital formation drove GDP growth by 1,5 percentage points, and net exports of goods and services drove GDP growth by 0,5 percentage points. The annual per capita GDP was 85,698 yuan, up 3,0 % over the previous year. The national gross income was 119,721.5 billion yuan, up 2,8 % over the previous year. The total labor productivity was 152,977 yuan per person, up 4,2 % over the previous year (figure 1.2).

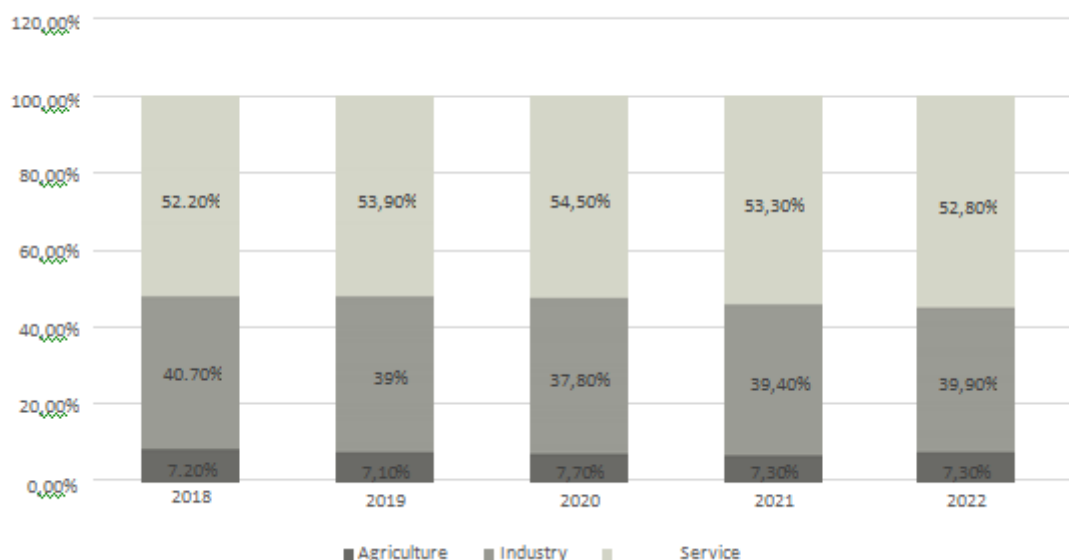


Figure 1.2 – The transformation of China's economic structure [5, p. 232]

Compared with the previous year, the proportion of industrial added value in 2022 has declined, but it is not difficult to see that the implementation of a series of policies has made China's economic structure more coordinated and developed in the direction of optimization and modernization. The proportion relationship between and within industries in my country has improved significantly, with the proportion of the primary industry decreasing and the proportion of the secondary and tertiary industries increasing. The growth of the total national economy mainly relies on the transfer of the primary and secondary industries to the secondary and tertiary industries. The growth of the secondary industry is the main driving force for the rapid development of my country's economy. While the overall industrial structure has changed, the internal structure of each industry has also changed significantly. China has undergone three economic structural adjustments. Industry still plays a very important role in economic development and still occupies a considerable proportion (table 1.1) [5, p. 232].

Table 1.1 – The pull of industry on GDP growth (%) [5, p. 233]

Growth	2018	2019	2020	2021	2022
GDP	6,7 %	6,1 %	2,3 %	8,1 %	3 %
Second Industry	2,8 %	2,5 %	2,5%	8,2 %	3,8 %
Industry	1,9 %	2,1 %	2,8 %	9,6 %	3,4 %

According to historical data, industry accounts for a large proportion of the secondary industry, and its role in driving GDP is between 1,9 % and 2,1 %. This shows that, whether in the past or now, the role of industry in driving the economy is positive and sustainable. This promotion effect is also due to the adjustment of the industrial structure, which makes industry the driving force of economic development. Although the adjustment of the industrial structure has promoted economic development, it has also brought about the problem of overcapacity in this process. Among them, the unreasonable economic growth mode is an important reason for overcapacity. Professor Wen Qian believes that one of the deep-seated reasons for overcapacity is the slow transformation of economic growth mode. He pointed out that the level of economic growth rate is largely restricted by the extensive or intensive economic growth mode, and the increase in my country's economic growth rate generally relies on extensive growth methods such as increasing investment, and the transformation of economic growth mode has not really started. Wang Xiaoguang also believes that the main reason for overcapacity is the unreasonable economic growth mode, which is manifested in the excessive intervention of local governments in investment and economic growth, forming vicious investment competition, and it is difficult to curb capacity expansion. For enterprises, due to low technical level and weak independent innovation ability, the competition between them is mainly concentrated on resource input, output quantity and price competition. It can be seen that the economic development model has caused overcapacity, which in turn has affected the development of the industry.

At present, country's energy structure is in a transition stage. China is the world's largest coal consumer, accounting for more than 50 % of global coal consumption, and is also a major installer of renewable energy power generation. In the next 30 years, renewable energy will replace coal in China's power structure, helping China become a regional leader in non-fossil energy.

After decades of averaging around 10 % real GDP growth per year, China's economic growth is widely expected to slow. DNV forecasts that GDP growth will average 2,5 % per year by 2050. Population decline and slower urban migration are the main reasons for this, but there are also wider structural issues. China will face difficult

times before the economy rebalances to consumption-led growth, with capital allocated more to less labour-intensive production, while continued protectionism makes it more difficult to change the export structure. Growth will depend heavily on China's ability to increase domestic consumption and productivity. However, as we have seen in this report, China has strong innovation capabilities, especially in green technologies. Despite the lower growth rate, GDP per capita is expected to increase by more than 120 % by the middle of the 21st century [11].

China's programmatic focus on energy intensity – defined as the amount of primary energy used per GDP unit – has led to significant reductions, and these are expected to continue. Current use is projected at 4.8MJ/USD. This is set to fall to 3.4MJ/USD by 2035 and to 2.2MJ/USD by 2050. The drivers of energy efficiency improvements are complex and intertwined – for example, urbanization promotes more compact living and efficiency in electricity supply; economic activity also increases. In addition, technological factors have a strong impact on the transportation sector, where technological change will lead to a rapid transition to electric vehicles and subsequently to automation and sharing.

China places national security and stability at the top of its energy development strategy, and the emphasis should be on resilience and social needs rather than rapid economic growth. Provinces share the same view of security and stability within their jurisdictions, sometimes even challenging national priorities. Coal is mainly supplied domestically, while 58 % of natural gas and 76 % of oil are currently imported. China is far ahead of the world in developing and manufacturing non-fossil energy technologies (nuclear, bioenergy and renewable energy), and in this sense, clean technology has indeed promoted China's energy independence. However, China still relies on imports of key materials, including silver powder for photovoltaic panels, nickel, lithium and cobalt for batteries, and uranium, and these supply chains must be established and improved.

In recent years, some scholars have concluded through econometric models that the rapid development of the industrial economy during the period of rapid economic development can be attributed to the role of energy consumption. Zhao Lixia, Wei Weixian and others introduced energy as a new variable into the Cobb-Douglas production function, established a vector autoregression model, and conducted an empirical study on

the relationship between China's economic growth and energy. The study of modern economic growth theory found that in the long run, the economic growth of most countries has steady-state characteristics, thus constructing the Lucas R.E. economic growth model under energy constraints. The conclusion is that to achieve economic growth, human capital and consumption are both positive growth in long-term development, and economic growth needs to be supported by the growth of energy input.

The theoretical achievements of many scholars have laid the foundation for my thesis research. In the process of economic development, energy has created new growth opportunities for the economy, dominated the progress and development of the economy, and provided dynamic support. Social and economic growth requires the support of energy consumption, so energy can drive economic growth. Energy supply can only increase when the social economy meets certain conditions, so economic growth can also promote energy development. On the one hand, economic growth increases the demand for energy, and on the other hand, the role of energy in economic growth is to increase energy input, promote production development and economic scale expansion, promote the birth and development of emerging industries, and promote technological progress [39, p. 125]. At the same time, energy is the core and power source of social productivity and the material basis for my country's sustainable development. Energy development and economic growth are mutually influential. Energy development can promote economic growth, and in turn, economic growth provides an economic basis for energy development.

1.2 Demand and supply structure for China's energy trade environment

China's energy demand grew rapidly between 2002 and 2014, but is now slowing down for a number of structural reasons. Energy demand is expected to stabilize at around 122 EJ in 2029, then gradually decline to 104 EJ by mid-century five years later.

China's total energy demand has grown by an average of 3 % per year over the past five years. Energy demand growth will slow to around 1 % in 2022. This reflects slower economic growth and weaker consumer confidence and spending. However, preliminary official data suggest that energy demand will surge by around 5,7 % as economic activity

recovers in 2023, although not to pre-COVID-19 levels. Growth driven primarily by fossil fuels has already set a new world record for China's fossil CO₂ emissions in 2023. Over the rest of the century, China's energy demand is expected to slow for a number of reasons, including ongoing demographic changes, reduced reliance on heavy industry as a catalyst for growth, improved energy efficiency, and slower overall economic growth. Indeed, these trends will cause energy demand to stabilize at around 122 EJ from 2029 and steadily decline to 104 EJ in 2050 [21].

As shown in figure 1.3, fossil fuels directly meet 65 % of final energy demand in 2022, but in fact the share of fossil fuels is much higher than this level, as 60 % of grid-connected electricity in 2022 comes from coal and 6 % from natural gas. By 2050, removing the remaining 7 % fossil fuel share in the power mix, the share of fossil fuels in final energy demand will reach 38 %. The share of electricity is expected to increase from 25 % in 2022 to 46.5 % by 2050, while hydrogen is expected to rise from almost 0 % in 2022 to 3.6 % of final energy demand in 2050.

By 2050, manufacturing will remain the largest energy demander, accounting for 42 % of total energy demand, down from 51 % today, while the share of buildings will increase from 19 % to 28 %. Transport's share will initially grow from 16 % today to 18 % in 2027, before falling to 14 % by 2050 as electrification of road transport (and thus greater efficiency) expands from the late 2020s.

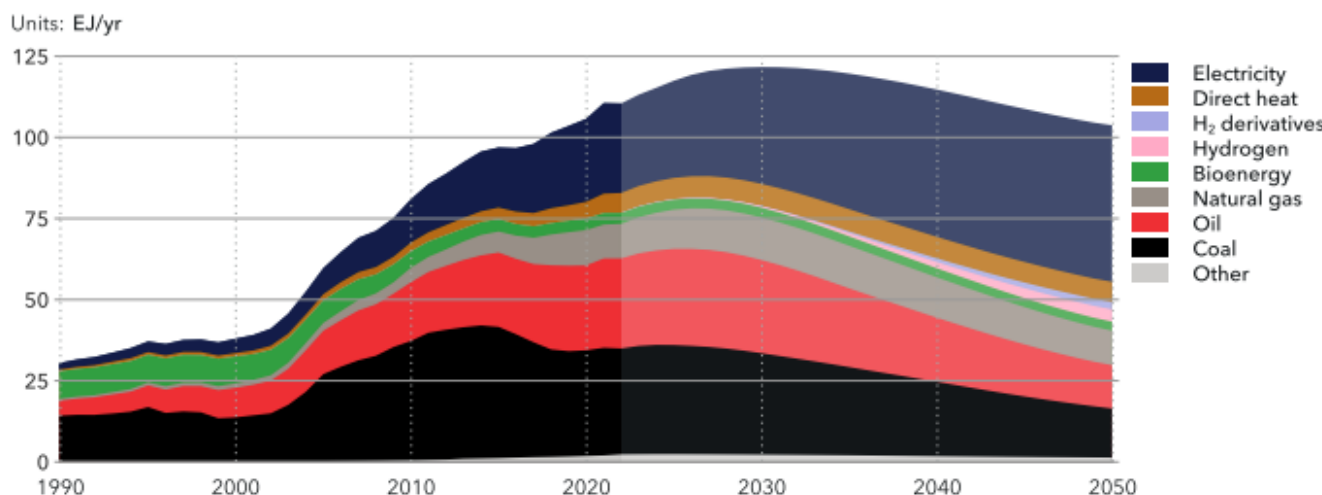


Figure 1.3 – Final energy demand [12]

In China, demographic changes, mainly population decline, aging, and rural-to-urban migration, are affecting all energy demand sectors, further reducing the available labor force (the working-age population peaked around 2010), which raises labor costs and productivity challenges. In addition, changes in consumer preferences and demand, influenced by demographic changes, change the types of products produced and affect energy use in the manufacturing sector.

Despite a declining population and rising living standards, passenger vehicle density is expected to increase significantly, peaking around 2038, up more than 70 % from about 252 million vehicles in 2022. However, high levels of urbanization and widespread public transportation mean that vehicle density remains lower than in OECD countries. By the 2040s, the number of cars in use is likely to decline due to population decline, automation, and increased car sharing.

Today, nearly two-thirds of China's population lives in cities, most of whom live in newly built high-rise buildings. By 2050, China will increase residential construction by 28 % and commercial construction by 157 %, driven by smaller household sizes and rising living standards. However, a strong focus on energy efficiency will limit the growth of building energy consumption, which will remain relatively stable from 2030 onwards. Energy demand for heating, hot water and cooking will remain relatively stable, but cooling energy will increase more than sixfold over the next 20 years. By 2050, cooling energy will account for 29 % of China's building energy consumption, second only to heating energy demand [28, p. 13].

The carbon intensity of China's energy demand will drop from the current 104 gCO₂/MJ to 34 gCO₂/MJ in the next 30 years, primarily accompanied by a reduction in China's coal consumption.

Demand for energy services in China is poised for significant growth, but the resulting energy demand will move in the opposite direction: decreasing slightly from 19 EJ in 2022 to 15 EJ by the year 2050, after peaking at around 21 EJ at the end of this decade. More transportation with lower energy demand will be delivered by the efficiencies inherent in electrification as well as the growing use of low-carbon fuels.

The global transportation department is expected to achieve significant growth and profound transformation, as is the Chinese transport department. The expected development from 2022 to 2050 includes a larger vehicle sales three times among passenger lights, and railway passengers and railway operating numbers are nearly twice. In 2022, these diverse transportation activities jointly consumed 19 EJ energy. Although the transportation of goods and personnel has increased, it is expected to grow in 2050, the energy consumption of the industry is expected to be 15 EJ in the middle of this century. This reduction is mainly derived from the power that spread road transportation through extensive efficiency.

In the end, the carbon emission transportation department depends on the cope of fuel challenges. The emissions generated by transportation are located in road vehicles, aircraft and ships, and have proposed major challenges in effective capture. In addition to carbon dioxide, these emissions often include effective greenhouse gases and harmful particulate matter, which may adversely affect and human health on the two environmental conditions. Highway transportation and by 2050, the use of biofuels and hydrogen (and their derivatives) in sea and aviation will almost minimize the discharge of Chinese transportation departments.

China has been a key catalyst for global growth in refined petroleum products such as gasoline and diesel over the past two decades. However, in mid-2023, Chinese oil giant Sinopec made a surprise announcement that went almost unnoticed: the company now expects Chinese gasoline demand to peak in 2023, two years earlier than previously forecast. The main factor behind this change is the rapid increase in the number of electric vehicles on the road. We forecast that China's road sector oil demand will fall by 94 % by 2050, with major implications for domestic oil production and oil imports as well.

Chinese consumers are rapidly embracing electric vehicles, with electric vehicles accounting for around 20 % of new passenger car sales in full-year 2022 and around a quarter in recent months, meaning that China has already exceeded its target of 20 % new energy vehicle (NEV) sales by 2025. The Chinese government has been committed to the development and widespread adoption of electric vehicles, motivated by concerns about

the adverse health effects of local air pollution and the country's dependence on imported oil, as well as related energy security challenges (figure 1.4).

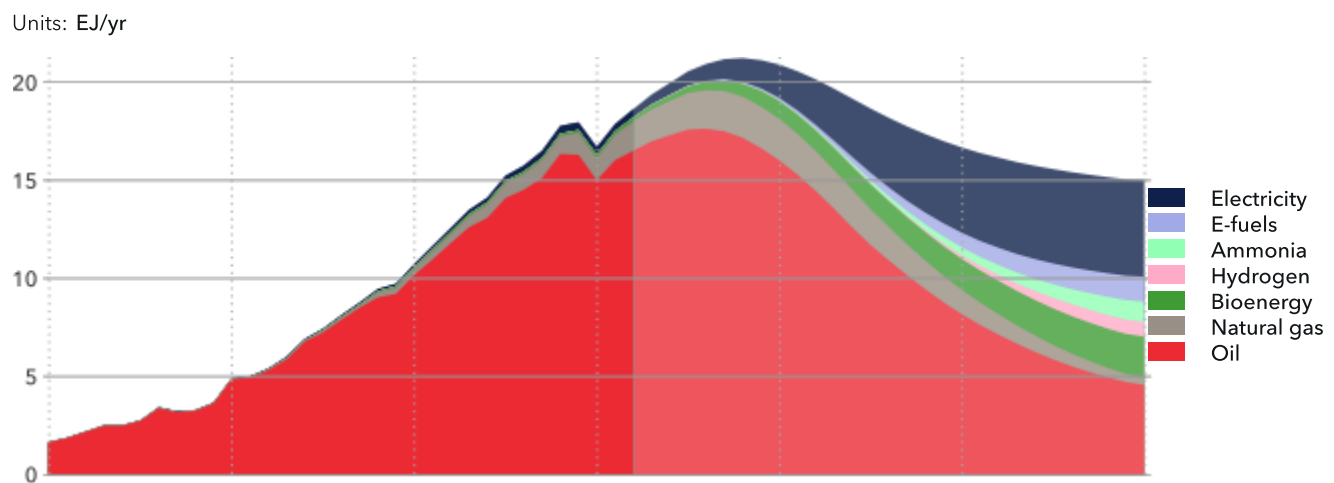


Figure 1.4 – Transport energy demand by carrier [12]

In December 2022, China ended its national NEV subsidy program. However, in June 2023, China introduced a major four-year, RMB 520 billion tax package. NEVs purchased in 2024 and 2025 will be completely exempt from purchase tax, up to RMB 30,000 per vehicle, but this maximum discount will be halved for purchases in 2026 and 2027. The government's move is aimed at boosting the electric vehicle market and fits into China's broader goals, including achieving a 50 % share of NEV sales in key air pollution control areas by 2030 and a 40 % share nationwide by the same year. The tax cuts mark a major effort to revive the auto industry amid sluggish sales and the phasing out of previous subsidies (figure 1.5).

Currently, nearly 5 % of passenger cars are either pure electric or plug-in hybrids. In addition, internal combustion engine cars are becoming more efficient due to increasing fuel economy targets.

We forecast that China will have the fastest adoption of electric vehicles of any region, with electric vehicles accounting for half of new passenger car sales in China by 2027 and half of total passenger car sales by 2035. Another aspect of electric vehicle adoption is that these vehicles are more prevalent in China's online ride-hailing vehicles, accounting for nearly 40 % of total sales, while private cars account for nearly 40 %.

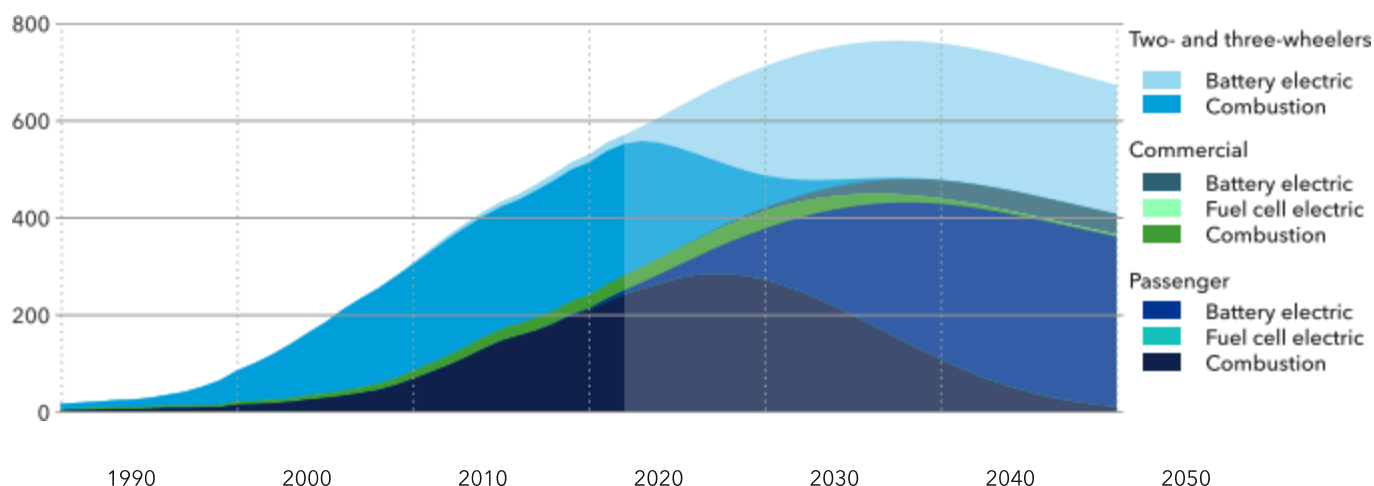


Figure 1.5 – Number of road vehicles by type and demand [12]

Two- and three-wheelers are a sub-sector of roads that are further along than passenger cars in the transition to zero-emission propulsion. Fuel demand for two- and three-wheelers has been falling sharply for more than a decade, and about 40 % of sales in this category are currently electric vehicles. Electric two- and three-wheelers are expected to account for 97 % of total transportation by the end of the decade.

It can be predicted that by 2050, China's oil demand in the road sector will be reduced by 94 %, which will also have a significant impact on domestic oil production and oil imports.

In the buildings sector, electricity will expand from 34 % of the energy mix today to 63 % by 2050. The floor space of China's building stock will grow by 49 % to more than 100,000 square kilometers by 2050, and total energy demand will increase by more than 40 %. Retrofitting buildings and improving insulation will be key to increasing energy efficiency and lowering emissions (figure 1.6).

China has prioritized building energy efficiency and green building development in its 14th Five-Year Plan. While energy efficiency, insulation, and heating/cooling equipment will improve, building energy demand and floor space will still increase. Although the region's population has peaked, GDP continues to grow. Driven by this growth, residential building floor space will increase by 28 % and commercial building floor space will increase by 157 % by 2050.

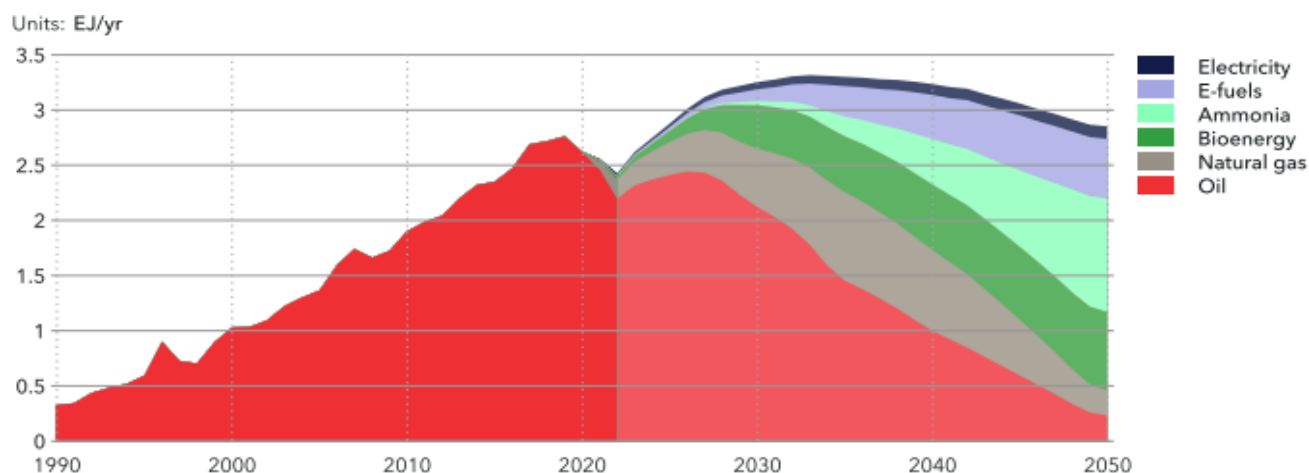


Figure 1.6 – Buildings energy demand by carrier [12]

Between now and 2050, China's building energy demand will grow by more than 40 %, peaking in 2045 and then declining slightly to stabilize at 29 EJ by 2050 – almost one-fifth of global building energy consumption. Building energy demand will also increase from 19 % to 28 % of final energy by 2050, due both to growth in floor space and to a reduction in energy demand in manufacturing and improved electricity efficiency in this sector.

The building sector is divided into residential and commercial properties. Currently, about 80 % of energy is consumed by residential buildings. As GDP grows faster than population, this share will fall slightly to 70 % by 2050, with the 29 EJ of sector demand in 2050 split between 20 EJ residential and 9 EJ commercial. Electricity gradually becomes the main energy carrier, expanding from 34 % today to 63 % in 2050. The share of oil, biomass and coal falls to negligible levels, but we still see a fair amount of natural gas – 22 % in 2050 – as this energy carrier is prevalent in gas boilers for space heating and cooking appliances. Emissions from this sector are relatively low at 0.42 Gt CO₂ (figure 1.7).

In terms of building stock, growth in floor space is one of the main drivers of building energy demand. By 2050, China's building stock will have a floor space of more than 100,000 square kilometers, an area comparable to Iceland and accounting for about a quarter of the world's floor space, with growth driven primarily by GDP.

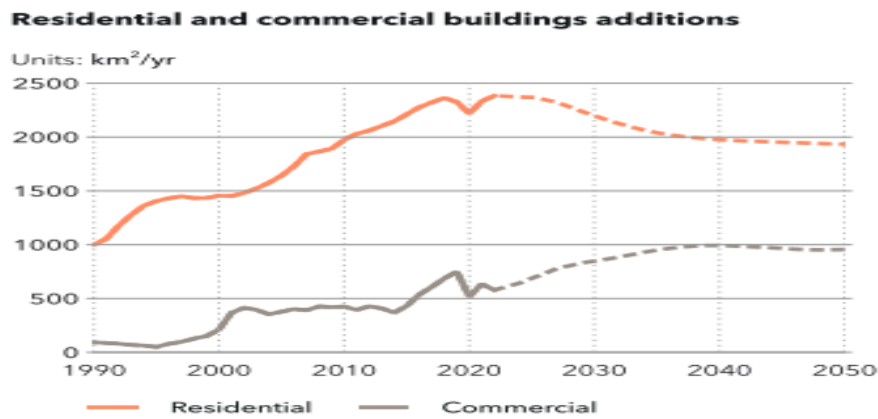


Figure 1.7 – Residential and commercial buildings additions [11]

China currently faces industry-wide challenges in the construction sector, especially residential construction, with weak demand exacerbating oversupply and capital issues. A series of government policies aimed at easing restrictions on residential purchases and stimulating residential completions, as well as lowering interest rates as the dollar-yuan exchange rate allows, may ease the current crisis in the medium term. However, the current difficulties in the construction industry do portend a slowdown in demand for construction in China in the long term. Evergrande Group, the country's largest construction company, defaulted in late 2021, has filed for bankruptcy protection in the United States, and is now facing liquidation. It is not alone; many construction companies are struggling with high debts and unfinished buildings. We see this in residential building addition, which will decline and essentially level off by the late 2030s, while commercial building addition will steadily increase until then and then level off.

Retrofitting buildings and improving insulation will be key to improving energy efficiency and lowering emissions. As mentioned earlier, China has called for urban renewal in its 14th Five-Year Plan, ending the cycle of demolition and reconstruction and focusing instead on energy-efficient retrofits. As of 2021, China has prioritized retrofitting older buildings in the north, with plans to complete more than 350 million square meters of energy-efficient retrofits by 2025. There is also legislation on the efficiency of new residential buildings, which on average must consume 75 % less energy than new buildings built in 1980 in northern China. We believe this legislation has roughly achieved its goal, with u-values (a measure of thermal transfer rate, or the rate at which heat is

transferred through a substance) falling by about 15 % for both residential and commercial buildings by 2050 (figure 1.8).

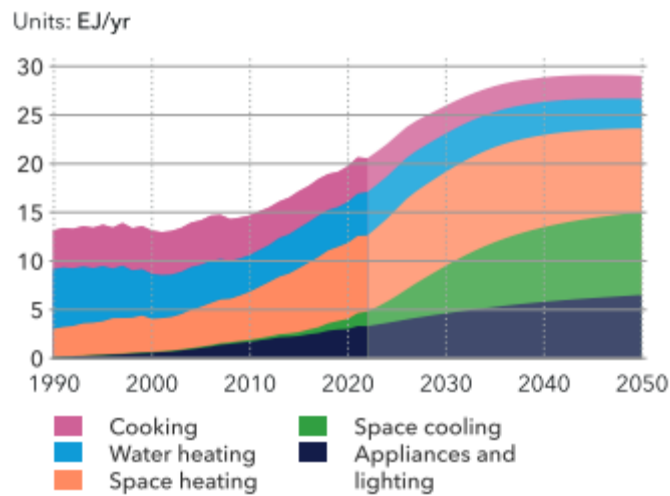


Figure 1.8 – Buildings energy demand by end-use [12]

In the field of space cooling, in the use of all energy end, the demand for space cooling is the most, from a 7 % mixed volume to 29 % in 2050. This will be split around 80:20 between residential and commercial space. There are two drivers of this increase: Firstly, the demand for cooling rises with GDP as more people can afford the technology. Secondly, the effects of climate change; a study from Tsinghua University predicts that heatwave days in 74 key cities will increase from 2.7 to 8.8 per year [16, p. 4].

We measure the effect of increasing world temperatures through the rise in cooling-degree days. In 2022 these stood at 519° C-days/year in China, by 2050 they will have increased over 40 % to 742° C-days/year. Insulation plays a significant role in lowering space cooling energy demand; without improvements over time, the space cooling demand in 2050 would be around 20% higher. In 2050, China will use a little over 30 % of the world's total cooling energy, around 8.5 EJ [16, p. 6].

In the field of cooking, we see the results of two efficiency improvements and obtaining modern cooking. By 2050, house holders who do not use modern cooking will drop from 21 % today to nearly zero in 2050. The biomass constitutes the largest part of today's cooking energy, accounting for 56 % of the mixed amount. By 2050, natural gas will exceed 57 %, and modern biological volume will account for 21 %, and the power of

the younger generation will account for 19 % of the combination. Compared with biomass, electricity and natural gas have a greater effect on cooking. We see the impact of this efficiency improvement in the final use mixing. In 2050, the cooking share fell from 17 % to 8 %. China's cooking energy use in 2050 will be 2400 PJ/year [10].

Regarding the field of electrical and lighting, the relevant situation is as follows.

Demand for energy for appliances and lighting is driven by the share of the tertiary sector in GDP, while also accounting for energy efficiency improvements over time. With China's tertiary sector set to grow from 53 % of GDP to 72 % by 2050, we will see energy use for appliances and lighting double in terms of energy used (6,550 PJ/yr in 2050), rising from 16 % of the mix to 23 % by 2050. Electricity is naturally the only energy carrier in this sector. Demand for appliances, especially smart appliances, is already on the rise and is only projected to grow. China is already the largest consumer market of smart home devices.

Insulation materials play an important role in reducing space cooling energy; over time, space cooling demand in 2050 will be about 20 % high.

Manufacturing is the largest energy consumer in China in 2022, accounting for more than 50 % of the ultimate energy demand (56 EJ). Historically, China has always been a strong country for manufacturing. In the global key industries such as steel, cement, manufacturing and basic materials, it has accounted for a large share. By 2050, half of the coal in the Chinese manufacturing energy combination is not only half, but China's manufacturing industry will still use more coal than coal in other parts of the world.

In the past two decades, industrial development has been the main driving force for China's rise and supports domestic and international development. This ability has led to the nickname World Factory, which is inseparable from China's global obligations. More than 40 % of global manufacturing energy demand has been concentrated in China. In the past 20 years, this demand has doubled. After this period of fast and energy -intensive growth, China's manufacturing industry has gradually shifted to improving energy efficiency.

Heavy Industry has always been the backbone of China's development, but China's manufacturing industry is a continuous development department. This is the

transformation of products such as industrial economic activities from energy -dense, low -value added (such as steel, construction materials, and textiles) to higher-tech senior manufacturing and other products.

The industrial strategy is guided by the five -year plan of the central government. These plans have been supported by the National Development and Reform Commission (NDRC) policies and implementation plans in China's 1+N policy framework. The framework was supported by provincial and urban -level action plans. The broader policy goal stipulated in the 14th five -year plan is to establish industries in central and western provinces in central China, because the current output is concentrated in eastern and coastal provinces, which are more developed and populated in these provinces.

The central policy has very strong obligations. One of the most eye-catching examples is the reform policy of supply implemented in the late 2010s. In 2015, the problem of production capacity became more obvious in some departments. The transformation of policy -driven coal has declined significantly in the 2010s, after the global peak coal consumption in 2014. The compound annual growth rate of coal between 2000 and 2009 was about 10 %, and the level of decline in ten years was approximately 1,3 % [34, p. 47].

In the construction and mining sectors, national decarbonization plans are driving growing demand for battery- and hydrogen-powered heavy equipment. Chinese manufacturers such as the state-owned Xuzhou Construction Machinery Group aim to increase the use of battery-powered and all-electric heavy trucks and equipment, reflecting the general trend towards electrification of transportation and manufacturing.

While energy demand will fall in most subsectors, production of chemicals and petrochemicals will continue to grow, driving energy demand to grow by an average of 2 % per year through 2030 before plateauing in the 2030s. Subsector development is critical to achieving China's self-sufficiency goals. China accounts for a large share of today's chemical market and built its industry first around coal and is now importing increasing amounts of crude oil.

The manufactured goods subsector is where most of the value added and exports are created, especially given China's shift to higher value-added products, particularly those

related to the energy transition. The lower value-added sector is also migrating to other countries. In this subsector, temperature requirements are generally lower and more efficient electrification processes can often be used. This is why, despite an increase in manufacturing value added (MVA), we forecast a decline in energy use.

China has developed, and is still developing, its chemical industry at a remarkable pace, as have its other industrial sectors. This is the main factor explaining the historical and future growth in non-energy demand. To support this growth, China has chosen a rather unique path compared to other large chemical producers.

One major difference is the early and extensive use of coal as the primary feedstock, as coal is abundant, cheap, and domestically available. Coal and petroleum coke (a byproduct of oil refining) are used primarily to produce the base chemicals ammonia and methanol, of which China has become the world's largest producer. Coal's primacy is evident in methanol production, where more than 75 % of methanol produced in China comes from coal, compared to a global average of 8 %.

Ammonia demand as a feedstock (for fertilizers or chemicals) is projected to remain relatively stable between now and 2050, at around 55 MtNH₃/yr. Agricultural ammonia demand declines due to increased fertilizer utilization, but this decline is likely to be offset by increased ammonia use in the chemical industry.

Coal-based chemical production will remain strong despite China's increasing use of natural gas as a substitute, despite the fact that coal-based processes are much more emission-intensive than natural gas processes. Authorities generally consider coal-based chemicals to be a more efficient and less emissions-intensive alternative to generating electricity from coal. Coal-to-chemical production plants are also concentrated in coal-rich provinces, such as Shanxi and Shaanxi in the northwest, which have a strong interest in protecting local industry.

That is why we forecast that coal use will continue over the coming decades, only falling after 2030 to 60 % of today's levels by 2050. Many existing production assets are new, so retrofitting facilities with CCS is a cost-effective pathway to low-carbon production.

Much of the growth in non-energy demand will continue to come from the production of plastics and other chemicals. Demand for these products is rising, first and foremost to support domestic demand. Feedstocks depend on local supply and prices, but petroleum-based naphtha now dominates and will support future growth (figure 1.9).

Non-energy demand for energy carriers by end use

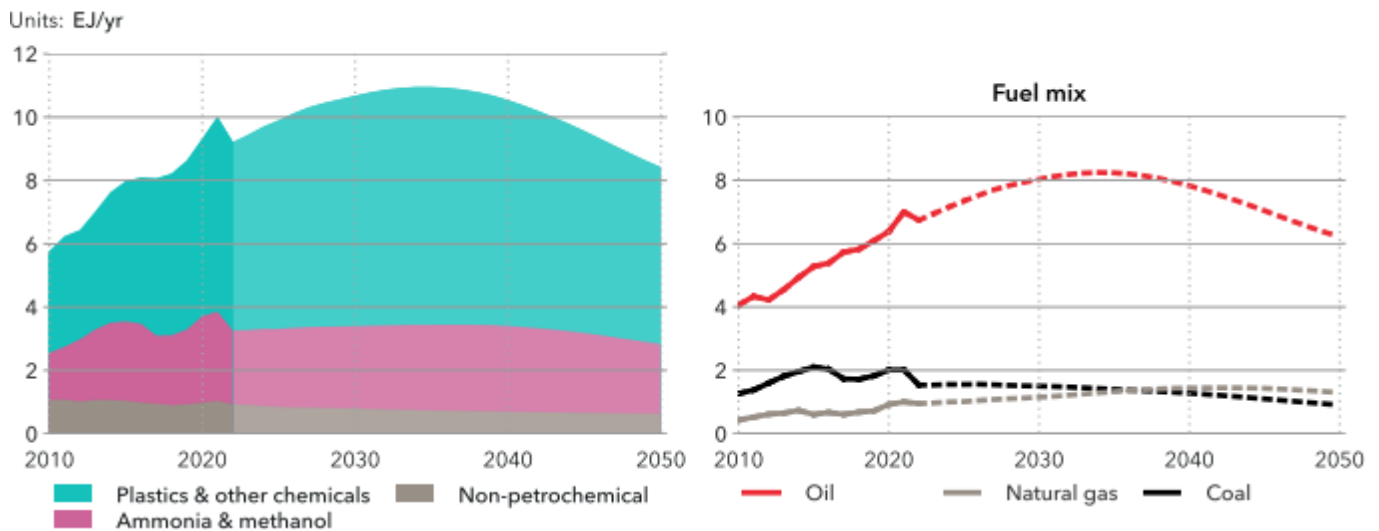


Figure 1.9 – Non-energy demand for energy carriers by end use [12]

Petroleum-to-petrochemical production is concentrated in two coastal provinces with distinct characteristics. Shandong is the largest refinery center, close to oil resources, with convenient trade routes and more active state-owned enterprises than private companies. Zhejiang is developing its petrochemical industry by building its own refinery and transforming one of its ports, with the goal of becoming a major hub for petrochemical imports and exports.

While there is no goal of self-sufficiency, the aim is to develop the industry and strengthen a domestic supply chain that still relies on imports. For example, China became the number one importer of ethylene and its derivatives in 2022, which are the basic building blocks of most plastics and chemicals. China's chemical industry is also currently struggling with overcapacity in low-end products and insufficient supply of high-end products. Efforts are currently underway to address these issues. For example, Chinese refining and petrochemical companies, led by state-owned oil giant Sinopec, are investing heavily in producing high-end chemicals for solar panels and batteries. This will also help

achieve their industrial value-added growth target of 5 % per year, a figure slightly lower than the battery and renewable energy industries (8–10 %).

Therefore, while oil demand for energy uses will peak before 2030, demand for non-energy uses will continue to increase over the next decade (figure 1.10).

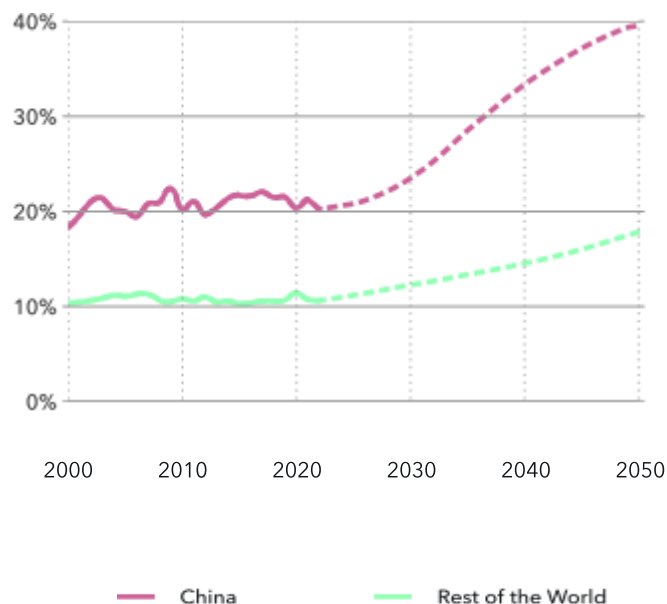


Figure 1.10 – Share of non-energy use in China and global oil demand [21]

The share of non-energy uses will double to account for about 40 % of oil demand by 2050. In contrast, the share of oil for non-energy uses in the rest of the world will slowly increase to 18 % in 2050, less than half of that in China. Total oil demand for non-energy uses is expected to fall from a peak of 8 EJ/year in the 2030s to around 6 EJ/year in 2050. This decline will not be due to a drop in demand for plastics, but rather to a steady increase in recycling rates from the current 20 %. Mechanical and chemical recycling together will cover around 70 % of waste streams by 2050.

1.3 China energy strategy

Following President Xi Jinping's announcement of the zero emission strategy, the Institute of Climate Change and Sustainable Development at Tsinghua University released a research report on China's zero emission strategy by 2050. The report proposes that

China's achievement of carbon neutrality will be carried out in two stages: 2030–2035, with a focus on social modernization and environmental improvement. During this period, climate change efforts will implement and strengthen the national voluntary contribution targets while guiding the economy to transform to low-carbon development. By 2050, carbon neutrality will become a central focus, and related efforts will be aligned with global strategies to address the climate crisis [55, p. 87].

The ambitious 2060 carbon neutrality goal will require profound changes in all socio-economic sectors in China. While it is too early to specify what actions are needed to achieve the carbon neutrality goal, most experts agree that technical efforts should focus on five key areas: sustainable energy consumption and related lifestyle changes, power sector decarbonization, electrification, and carbon capture and storage. The challenge lies not in expertise but in the speed of climate action and the effective management of multiple social goals. Achieving carbon neutrality will also require China to make significant capital investments.

It is estimated that cumulative investment in energy infrastructure will reach US 15,2 trillion (RMB 99,1 trillion in 2015 constant prices) in the 2° C scenario and US 21,1 trillion (RMB 137,7 trillion in 2015 constant prices) in the 1.5° C scenario between 2020 and 2050. These investments are approximately 1,9 and 2,6 times the investment required in the business-as-usual scenario, respectively. Note that most of the investment will be allocated to the energy supply sector in these scenarios [51, p. 14].

Overall, China sees its 2060 carbon neutrality target as an important part of a comprehensive strategy to guide the country's long-term economic transformation. Given the national target, specific sectoral and regional allocations need to be developed. The urgent task ahead is to strengthen China's NDC and take concrete actions to reduce peak CO₂ emissions before 2030, which is essential to achieving the long-term carbon neutrality goal.

On March 11, 2021, China's 14th Five-Year Plan (2021–2025) was approved by the National People's Congress. The plan is determined that the goal of decreased by 18 % of carbon dioxide strength (carbon dioxide/GDP) from 2021 to 2025, a target of 13,5 % of energy strength (energy/GDP), and setting the goal of 20 % of the total energy

consumption of non-fossil energy consumption. The concept of upper limit of carbon dioxide emissions and carbon neutrality was first mentioned, but no relevant target was set. The GDP growth target has not been included in the five-year plan for the first time, emphasizing the importance of changing from quantitative growth to quality growth and self-sufficiency [53, p. 6].

The new round of economic and social development planning in the 14th Five-Year Plan identified five major areas of economic and social development and 20 indicators, including four binding targets related to energy and climate for 2025: reducing energy consumption per unit of GDP (down 13,5 % from 2015), reducing carbon dioxide emissions per unit of GDP (down 18 % from 2015), increasing forest coverage (to 24,1 % by 2025), and increasing the share of non-fossil energy consumption in total primary energy consumption (20 %). Compared with the 13th Five-Year Plan, the carbon dioxide intensity target remains unchanged, but energy consumption per unit of GDP actually decreases. The 14th Five-Year Plan requires an increase in the share of non-fossil energy consumption from 15,6 % to 20 % between 2020 and 2025 [15, p. 459].

Given that oil and gas consumption are expected to continue to increase, reducing peaks and reducing carbon dioxide emissions by 2030 will require that coal consumption not only stop growing, but also begin to decline in absolute terms. This change will require a major commitment to increasing non-fossil fuel supply in the energy mix over the next five years.

After the 14th Five-Year Plan was released, some experts worried that the plan's goals were not aggressive enough to achieve the 2060 carbon neutrality goal, but the 2030 CO₂ peak target could be easily achieved. Others pointed out that the central and local governments need to ensure that these binding targets are achievable and that they need to set targets in a more ambitious way.

The specific targets announced in the 14th Five-Year Plan provide a direction for the next five years. The national 14th Five-Year Plan encourages some economically developed regions, key industries, and enterprises to reduce emissions as early as possible. China is still working out the details of the provincial and industry 14th Five-Year Plans. These plans are critical to achieving or even exceeding the national goals.

China's 14th Five-Year Plan also emphasizes self-sufficiency, as reflected in the inclusion of energy production capacity in security indicators. The plan mentions the clean and efficient use of coal, 70 GW of nuclear power capacity by 2025 (up from the current 52 GW), and increased production and storage of oil and gas. The emphasis on energy self-sufficiency is consistent with China's goal of self-reliance in other areas, including goods, services, and scientific research. However, this focus could make it more difficult to reduce emissions from the fossil fuel sector as oil and gas continue to be promoted.

On October 24, 2021, the CPC Central Committee and the State Council issued the Guidelines for Comprehensively Implementing the New Development Concept, Peaking Carbon Dioxide, and Achieving Carbon Neutrality – the so-called 1+N policy framework¹⁹. The guidelines are an overarching document that reiterates China's climate goals for 2025, 2030, and 2060, including the following key targets: by 2025, the economic energy intensity (energy consumption per unit of GDP) will decrease by 13,5 % compared with 2020, the carbon intensity (carbon dioxide emissions per unit of GDP) will decrease by 18 % compared with 2020, and the proportion of non-fossil energy in primary energy consumption will increase to about 20 %. By 2030, the carbon intensity (carbon dioxide emissions per unit of GDP) will decrease by more than 65 % compared with 2005, the proportion of non-fossil energy in primary energy consumption will increase to about 25 %, the installed capacity of wind and solar power generation will reach 1,200 GW, and carbon dioxide emissions will peak and gradually decline. In addition, oil consumption is expected to stabilize during the 15th Five-Year Plan period. By 2060, the proportion of non-fossil energy in total primary energy consumption will increase to more than 80 %, and carbon neutrality will be achieved [15, p. 460].

The above targets are all included in China's latest NDC submitted to the United Nations Framework Convention on Climate Change (UNFCCC) on October 28, 2021. Compared with China's NDC submitted in 2016, some targets have changed. By 2030, carbon dioxide intensity will be reduced by 60–65 % compared with 2005, and will be reduced to more than 65 % in the current NDC. By 2030, the proportion of non-fossil energy in primary energy consumption will increase from about 20 % to about 25 %, and a target of increasing solar and wind power generation capacity will be added. However,

except for the 80 % non-fossil fuel target by 2060, President Xi Jinping first committed to all updated NDC targets at the United Nations General Assembly in September 2020, and then at the Climate Ambition Summit in December 2020 [55, p. 86].

The N+1 Guidance further outlines measures to achieve the three goals, focusing on five key areas: developing a green, low-carbon and circular economy; improving energy efficiency; increasing the use of non-fossil energy; reducing CO₂ emissions; expanding carbon absorption capacity.

Following the release of the Guidance, the State Council of China issued the Action Plan for Peaking CO₂ Before 2030 on October 26, 2021. The Action Plan reiterates the short-term goals (2020–2030) set out in the Guidance. It also reiterates the working principles in the Guidance, emphasizing national coordination, identifying key industries to peak ahead of schedule, establishing the principle of steady, orderly and safe carbon reduction, and ensuring national energy security and economic development as the bottom line and ensuring national energy security, supply chain security, food security and people's normal life.

In addition to this action plan, the N part of the 1+N framework also includes policy measures and actions for key economic sectors and industries. On July 27, 2021, China's Special Envoy for Climate Change Xie Zhenhua introduced N in more detail, including ten areas:

Optimizing the energy structure (e.g. controlling and reducing coal and other fossil fuel energy). Optimizing and upgrading industries and sectors. Improving energy-saving and low-carbon buildings and low-carbon infrastructure. Developing a green and low-carbon transportation system. Developing a circular economy that can improve resource utilization. Promoting green and low-carbon innovation. Developing green finance. Formulating and issuing supportive economic policies and reform measures. Improving the carbon market and carbon pricing mechanism. Implementing nature-based solutions.

China's Belt and Road Initiative (BRI) is a major outward-looking international program with impacts on energy and energy-related CO₂ emissions beyond China's borders. The BRI vision is to build a vast network of energy-related and physical infrastructure – railways, fuel pipelines, ports, airports, and highways. The goal is to

increase trade and investment between China and 68 countries that together account for 30 % of global GDP, 62 % of the world's population, and 75 % of known energy reserves.

As of June 2021, an estimated 1,800 large-scale projects (such as roads, bridges, airports, and dams) have begun construction out of a total of 3,120 planned projects. The BRI's initial focus has expanded from Asia and Europe to Africa, Latin America, and the South Pacific.

Since 2013, China's investment in Belt and Road projects (estimated at 136 billion) has generated a cumulative trade of 9.2 trillion. One of the largest investments to date is the 68 billion China-Pakistan Economic Corridor, which connects China to the Pakistani port of Gwadar on the Arabian Sea. Other major corridors connecting Asia to other economic entities in the world include the New Eurasian Land Bridge, the China-Mongolia-Russia Economic Corridor, the China-Central Asia-West Asia Economic Corridor, the China-Indochina Peninsula Economic Corridor, and the Bangladesh-China-India-Myanmar Economic Corridor.

Researchers tracked two major financial institutions involved in development projects between 2008 and 2019, the China Development Bank and the Export-Import Bank of China, and estimated that three sectors, transportation, extraction, and energy production, accounted for 72 % of China's total energy consumption in the Belt and Road, at 336 billion. This finding shows the importance of energy investment to the Belt and Road.

Through the Belt and Road Initiative, China has built numerous thermal, nuclear, and hydroelectric power plants; power transmission systems; oil and gas pipelines; mining operations; roads and railways; heavy industrial facilities; and renewable energy facilities. Belt and Road Initiative activities in energy transportation include the China-Russia crude oil pipeline, the China-Central Asia natural gas pipeline, the China-Russia natural gas pipeline, and the recently completed China-Myanmar oil and gas pipeline.

Of the 160 billion in Chinese-backed coal-fired power plants announced between 2014 and 2020, more than 65 billion in projects were shelved, mothballed, or canceled. In 2020, no new coal plants were announced, while solar and wind power plants grew

steadily, accounting for nearly 23 % of total energy investment in 2020. In 2020, BRI investments in solar, wind, and hydropower exceeded spending on fossil fuel power plants

In 2017, the Chinese government issued official guidance, an ecological and environmental cooperation plan, and a vision and action statement on energy development to promote greening the BRI. In April 2019, at the Second Belt and Road Forum for International Cooperation in Beijing, China's National Development and Reform Commission (NDRC), the Energy Foundation, UN partners at the United Nations Economic and Social Commission for Asia and the Pacific, and the United Nations Industrial Development Organization jointly launched the BRI Green Refrigeration Initiative. In 2020, the Chinese Green Bond Support Project Catalog removed the reference to clean energy.

Although China has clearly promised and issued a guide, further deployment through BRI's renewable energy projects will depend on the policy of receiving the country. In part, the reason is that China's green BRI investment is voluntary and the project is voluntary.

The actual development of the project is usually based on the method of the host country. Green BRI will also depend on the type of renewable energy projects deployed.

Chapter 2 China's international energy trade market

2.1 China's trade status in the coal market

According to new data released by the General Administration of Customs of China on January 12, 2024, China's imports of various types of coal and charcoal in 2023 were 474.42 million tons, a significant increase of 61.8 % over 2022, setting a historical high.

According to statistics from the General Administration of Customs of China, the reason for the incomplete record for the whole year of 2023 is that China's imports in December were 47.3 million tons, an increase of 8.7 % from November, and the import volume increased, up 53 % year-on-year. China is the world's largest coal producer. With the arrival of severe cold weather, the supply of imported coal, especially ordinary coal, is strengthening. According to previous reports from the General Administration of Customs, ordinary coal imports usually account for more than 70% of China's total coal imports.

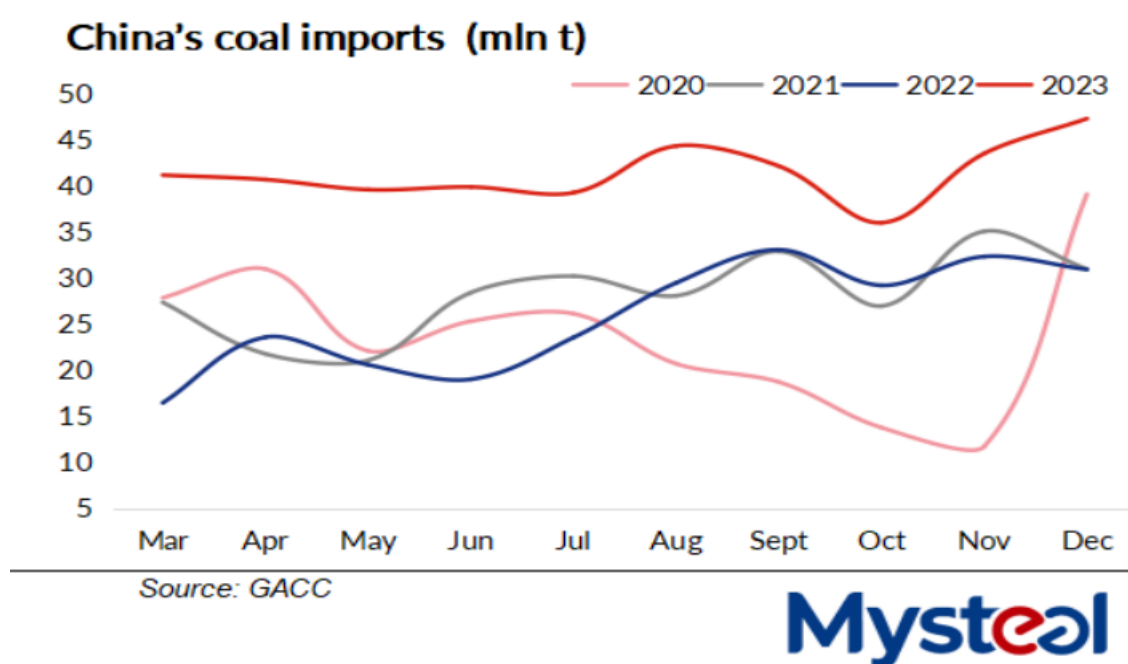


Figure 2.1 – China's coal imports (mln t) [21]

According to Mysteel Global, on December 16, 2023, the China Meteorological Administration issued the first cooling warning of the year, warning that a large-scale cold

wave will cause a sharp drop in temperatures in most parts of the country in the next week. In response to the increased electricity demand caused by home heating, Chinese power plants actively imported thermal coal from major suppliers to support peak power generation. In fact, Mysteel's tracking data showed that from December 16 to 22, 2023, the daily coal consumption of 256 power plants in the country that Mysteel regularly tracks rose sharply by 11.6 % month-on-month to 2.61 million tons.

Large-scale coal consumption also led to a sharp drop in coal inventories at these 256 power plants. According to the same data, as of December 29, their inventories fell by about 5.8 % month-on-month to 46.92 million tons, enough for only 18 days of use. Another driver of China's growing demand for imported thermal coal last month was the higher cost-effectiveness of foreign coal compared with domestic coal, said an analyst based in Shanxi, North China. For example, Mysteel data showed that last month, the average FOB price of Indonesian 3,800 kcal/kg NAR thermal coal was 93.4 yuan/t (\$13/t) cheaper than similar Chinese coal, up from 82.3 yuan/t the previous month. However, with the re-imposition of import tariffs on various coals from January 1, 2024, Chinese buyers will reportedly find foreign coal supplies, especially coking coal, less attractive. This could keep imports this year below last year's record [12].

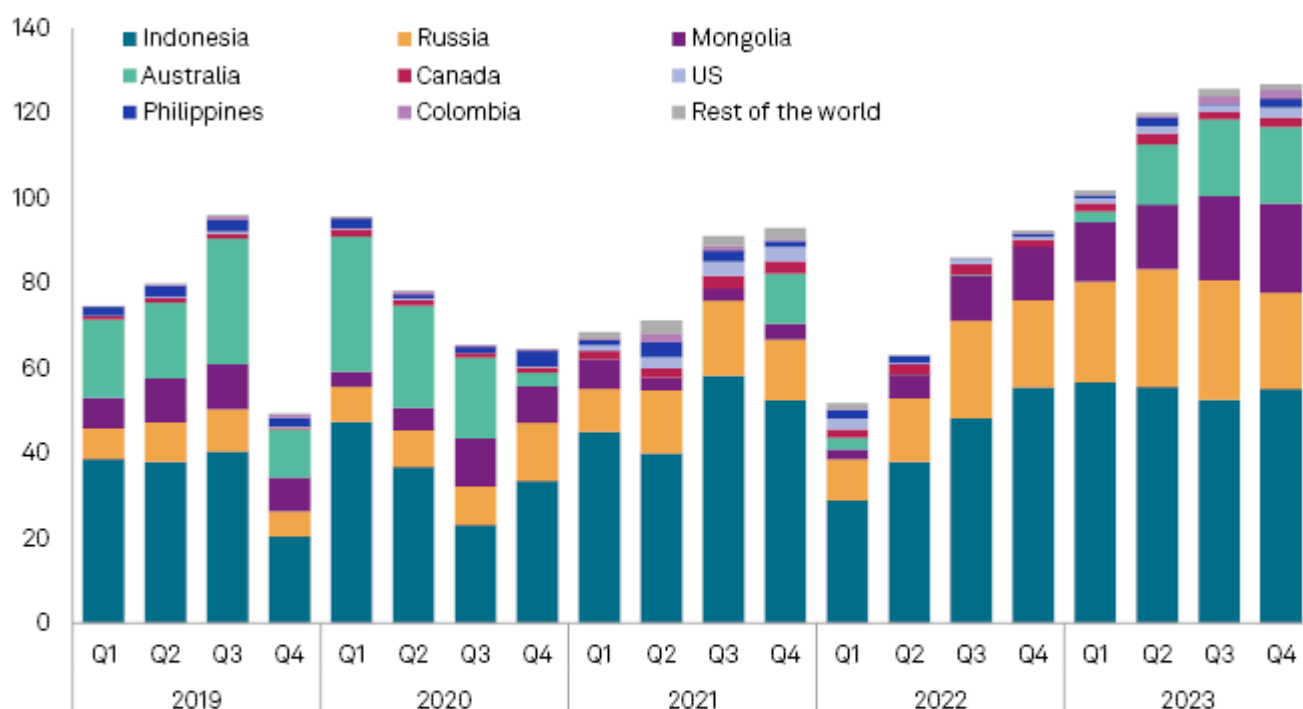
China's coal imports hit a record high in the fourth quarter of 2023, and there is a high probability that imports will peak in 2024 due to aging domestic production and overseas coal price advantages. According to the S&P Index (GTAS), China, the world's largest coal producer and buyer, imported 126.79 million tons of coal in the fourth half of 2023, a year-on-year increase of 37.2 % [12].

China's coal imports hit a new high of 474.7 million tons in 2023, an increase of 61.8% over 2022, the highest level since 2013. Analysts in related fields said that the rapid growth in imports was mainly due to the price advantage of China's coal supply. With the growth of the world economy and the urgency of electricity demand, international coal prices have fallen, and European countries have made progress in coal destocking due to the expansion of renewable energy supply and the decline in natural gas prices. As international excess supply continues to pour into China, the Chinese central government

puts the safety of the coal industry first and encourages imports by temporarily exempting coal tariffs and lifting the unofficial ban on Austrian coal.

According to analysts at the China Coal Transportation and Marketing Association and coal consortium Yimei, there is a high possibility that China's coal imports will reach a high of 450 million to 490 million tons by 2024 due to price advantages (figure 2.2).

China coal imports by markets of origin (million metric tons)



Data compiled Jan. 24, 2024.

Includes imports of HS codes 2701 and 2702.

Total imports may have slight differences to aggregated country imports due to rounding.

Listed countries are those that accounted for the largest China coal imports over the last 12 months.

Sources: S&P Global Market Intelligence Global Trade Analytics Suite; General Administration of Customs China.

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Figure 2.2 – China coal imports by markets of origin (million metric tons) [10]

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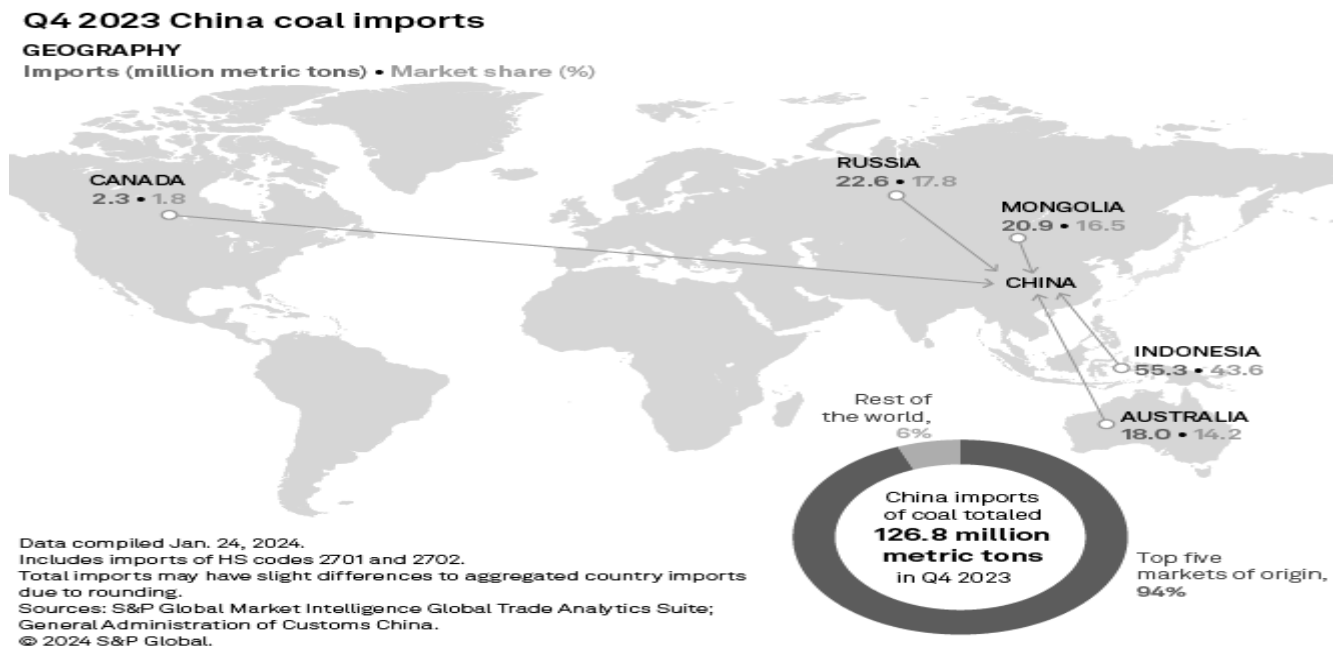
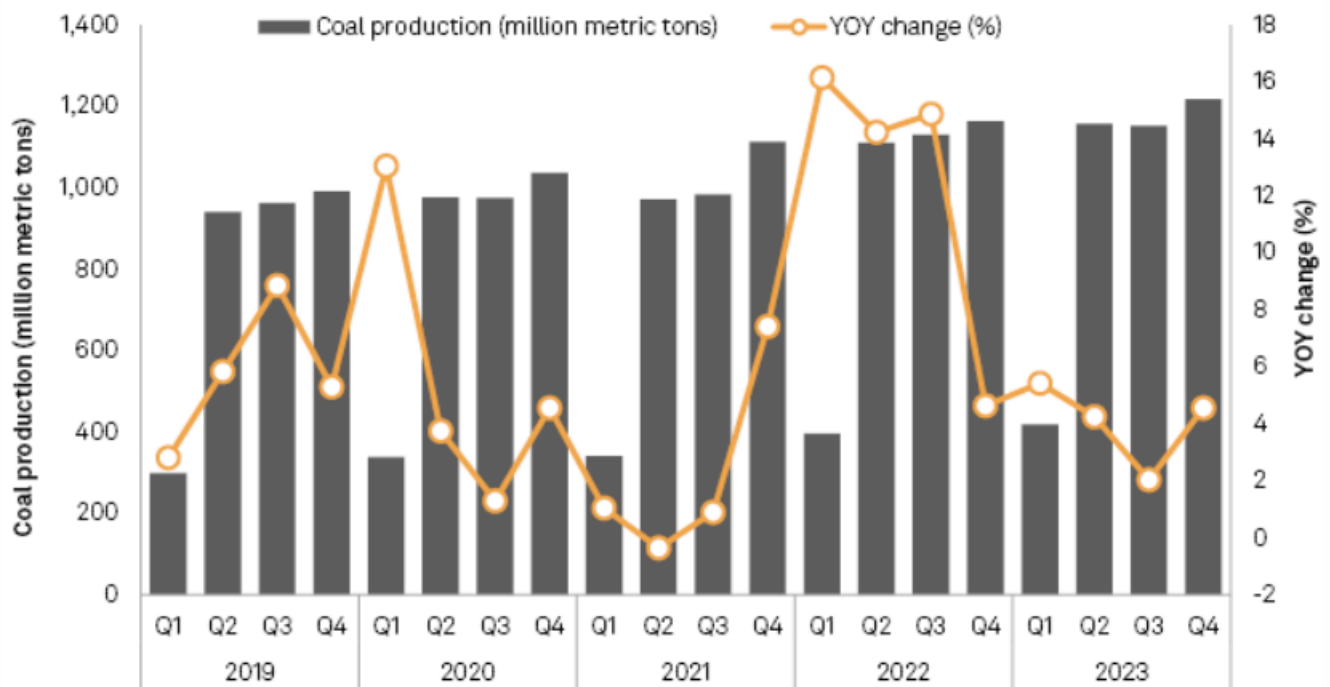


Figure 2.3 – China coal imports in Q4 2023 [12]

China's coal production is expected to grow 4.5 % to 1.22 billion tons in the second half of 2023, according to China's National Bureau of Statistics. In addition, the Chinese government is trying to avoid power shortages by increasing output from local miners, with the growth rate flat with 2022 levels and comparisons. In China, mining safety regulations will be strengthened by August 2023 due to concentrated mining activities leading to fatal accidents in mines. Zhang Yupeng, an analyst at CCTD, said on January

24 that China's State Mine Safety Administration will launch a six-month safety campaign in Shanxi, the largest coal-producing province, from November 2023. The possibility of a decline in coal production in 2024 has been mentioned. Shanxi province will account for 29.1 % of coal production in 2023. Zhang said that the growth rate of China's coal production is expected to be as low as 1.1 % in 2024 (figure 2.4).

China coal production since 2019



Data compiled Jan. 24, 2024.
Source: National Bureau of Statistics of China.
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Figure 2.4 – China coal production since 2019 [21]

In the fourth quarter of 2023, China's general carbon-emitting electricity generation increased by 7.3 % year-on-year to 1,584TWh, accounting for nearly 70 % of the country's electricity generation. The International Energy Agency said in December 2023 that coal will be used as a substitute in the context of China's low hydropower capacity, and hydropower supply will undergo significant changes in the short term. At the same time, China's coal consumption is expected to increase in 2024 and decrease in 2026. 2026 will be a stable year. International energy companies are experiencing the emergence of energy alternatives to coal, with hydropower generation improving as expected and coal-fired

power generation decreasing as China's introduction of solar and wind power accelerates (figure 2.5).

China's HRC supply remains strong

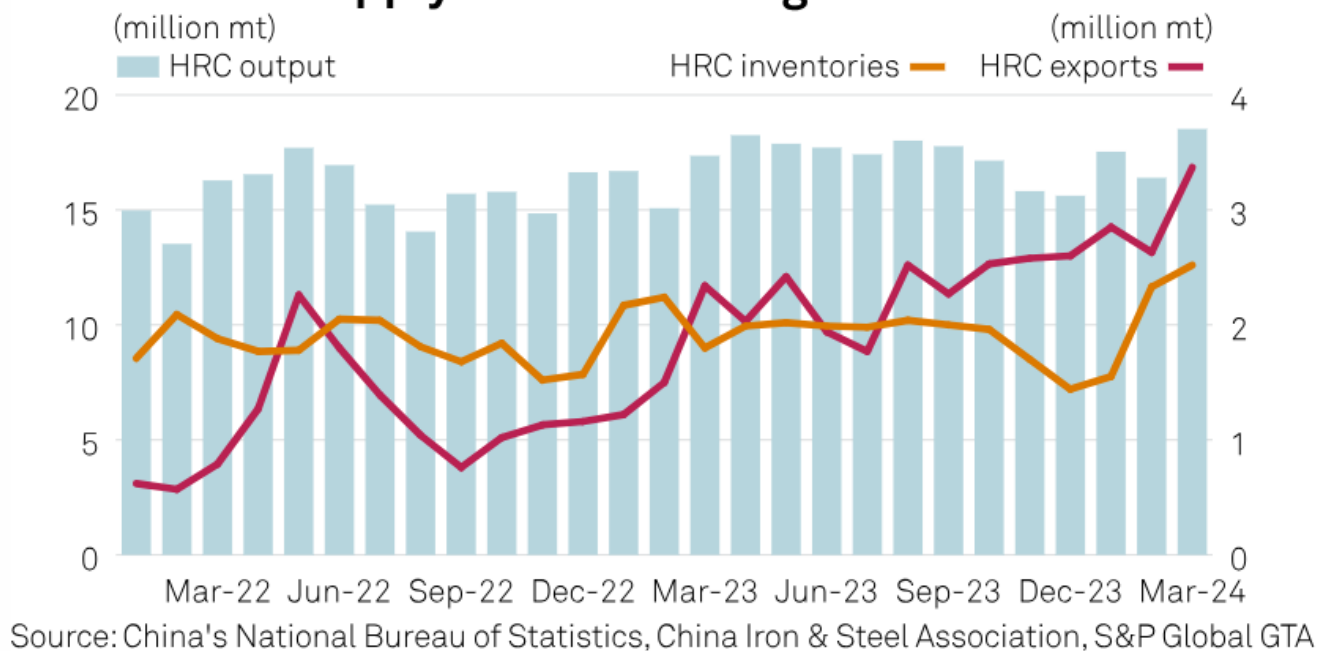


Figure 2.5 – China's HRC supply remains strong [21]

China's demand for metallurgical coal will continue to grow in 2022 and 2023 despite weaker demand from the real estate and infrastructure sectors. Although steel demand from both sectors declined, overall productivity did not see a big drop as strong manufacturing demand and growing exports continued to encourage steelmakers to increase output, the sources said.

As the metallurgical coal industry copes with these different market conditions, China's metallurgical coal demand is expected to grow slightly year-on-year in 2024. Analysts at Wuhan-based consultancy Tianfeng Securities said China's metallurgical coal consumption is expected to reach 595.64 million tons in 2024, up 0.9 % from 2023. The steel industry is still one of the pillars of China's economy, and even if the economy goes down, it is not expected to deteriorate too much, but the market is by no means optimistic about metallurgical coal demand for the rest of 2024, said a trader at Xiamen Newspaper Group. However, it is clear that China's metallurgical coal demand and consumption

growth has slowed in the past two years. China's metallurgical coal consumption is expected to grow by 2.8 % year-on-year in 2022 and 4.6 % year-on-year in 2023.

China's coal exports fell from 185,427 in January 2024 to 47,528 in February. From 1996 to 2024, China's coal exports averaged 155,465.87, reaching an all-time high of 810,089.00 in June 2008 and a record low of 11,446.00 in August 2017.

Between 1980 and 2022, China's exports during this period averaged 28799.16 thousand short tons, with the lowest value being 3486.61 thousand short tons in 2020 and the highest value being 103650.21 thousand short tons in 2003. The latest value in 2022 is 4380.67 thousand short tons. In comparison, the world average based on 192 countries in 2022 is 8130.09 thousand tons.

2.2 China's trade status in the gas market

China is the world's third-largest natural gas market, consuming 364.6 billion cubic meters (bcm) of natural gas in 2022, down 1.2 % from 2021 (4.4 bcm), second only to the United States (881 billion cubic meters) and Russia (408 billion cubic meters). The Chinese government aims to continue to meet more than half of the country's natural gas demand with domestic production. The China Natural Gas Development Report 2023, released in July 2023, provides insight into how China's key government agencies view the Chinese and global natural gas markets.

China's LNG imports increased by 11.4 % in 2023 as the zero-COVID policy was reversed, boosting shipments. Global seaborne LNG trade continued to grow last year, as developments in Ukraine forced Europe to diversify towards Russian pipeline gas, shipbroker Banchero Costa said in its latest weekly report. However, full-year LNG shipments rose by 1.7 % in 2023. LNG production has now slowed slightly after strong year-on-year growth of 4.7 % in 2021 and 7.3 % in 2023, according to Refinitiv ship tracking data. The largest exporter was the United States, accounting for 21.7 % of shipments in the 12 months of 2023, followed by Australia at 19.7% and Qatar at 19.2 %, according to Refinitiv ship tracking data (figure 2.6).

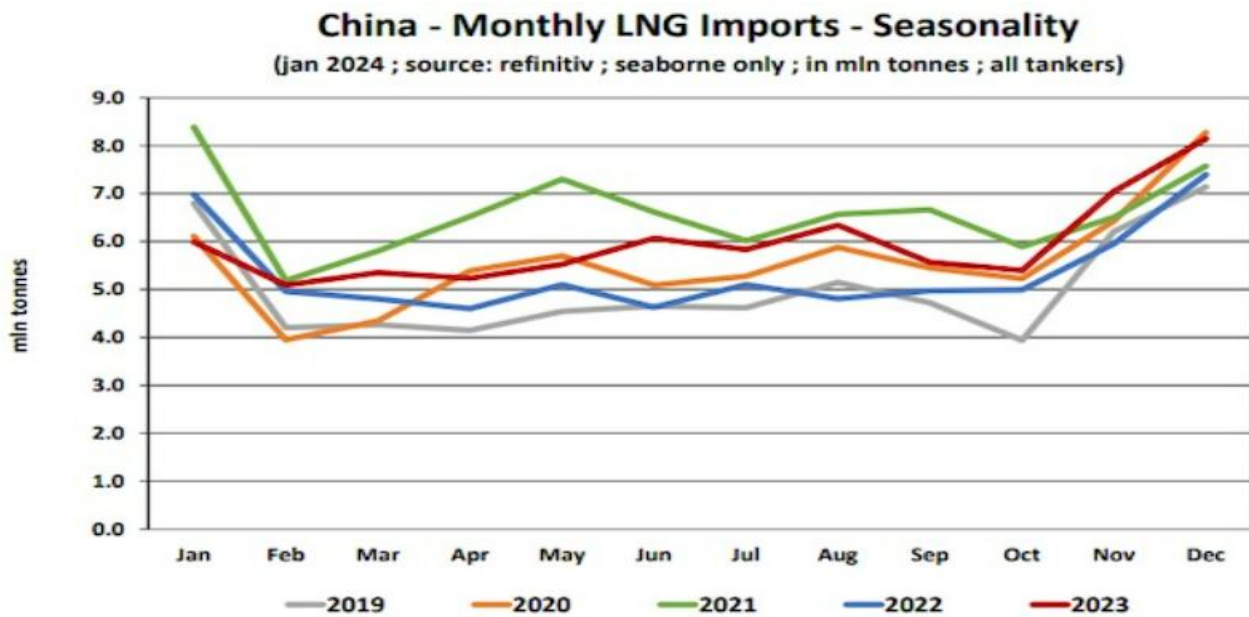


Figure 2.6 – Monthly LNG Imports [21]

US LNG exports in 2023 will be 88.9 million tonnes, up 12.0 % from 79.4 million tonnes in 2022. This is a significant increase compared to US exports of 72.5 million tonnes in 2021 and 48.2 million tonnes in 2020. Australia exports in January-December 2023 will be 80.8 million tonnes, down 0.6 % from the previous year. Qatar exports in January-December 2023 will be 78.6 million tonnes, down 1.6 % from the previous year. Russia's 2023 LNG shipments will be 30.9 million tonnes, down 6.1 % from the record 32.9 million tonnes in 2022, but still higher than 30.3 million tonnes in 2021. The EU remains the world's largest LNG importer. In 2023, the EU imports 102 million tonnes of LNG, up +1.9 % year-on-year, accounting for 25.0 % of global LNG imports. In 2023, mainland China will import 71.6 million tons of liquefied natural gas, an increase of +11.4 % year-on-year from 64.3 million tons in 2022, but a decrease from 79 million tons in 2021. Japan's imports in 2023 will be 66.9 million tons, a decrease of 9.2 % from the previous year. South Korea's imports in 2023 will be 45.5 million tons, a decrease of 3.5 % from the previous year. India's imports in 2023 will be 21.1 million tons, an increase of 10.3 % from the previous year. The UK's imports in 2023 will be 14.9 million tons, a decrease of 22.9 % from the previous year [21].

In 2021, mainland China temporarily became the world's largest importer of LNG, accounting for 20.7 %. China's imports in 2021 will increase by 17.8 % year-on-year to 79.1 million tons. In 2021, the relevant growth data fell by 2.8 % from the previous year to 76.5 million tons. In 2022, due to the soaring natural gas prices and the manufacturing blockade caused by the new coronavirus infection, the fuel demand has dropped. In 2022, China's LNG imports fell by 18.7 % from 79 million tons in 2021 to 64.3 million tons.

In 2023, China's imports recovered strongly to 71.6 million tons, up 11.4 % from the previous year, but will not exceed the EU's imports. China's LNG transportation sources also increased significantly. From January to December 2023, China imported 25.1 million tons of LNG from Australia, up 12.5 % year-on-year from 22.4 million tons in 2022. This is still significantly lower than the 31 million tons imported from Australia. In 2021, it fell sharply by 27.8 % from the previous year. Australia remains China's largest supplier, accounting for 35.1 % of China's total supply in 2023. Qatar's exports to China in 2023 increased by 5.9 % from the previous year to 16.6 million tons. The year-on-year growth rate in 2022 was 76.4 %. In 2023, Qatar accounted for 23.2% of China's total LNG imports. In 2023, China's imports from ASEAN (Malaysia, Indonesia) fell by 0.9 % from the previous year to 11.8 million tons. Russia's exports to China increased by 5.5% year-on-year last year, from 5.8 million tons in 2022 to 6.1 million tons. Finally, US exports to China rebounded by 46.8 % year-on-year in 2023 to 3 million tons (figure 2.7).

According to Global LNG hub, China's LNG imports will recover in 2023, driven by a 5 % increase in gas demand, but Northeast Asia's LNG imports are expected to grow by only 0.3 %, with falling gas demand in Japan and South Korea expected to cause LNG imports to fall to 206.4 million tons in 2023. South Korea and Taiwan are offsetting China's growth.

LNG imports are expected to rise to 218.7 million tonnes in 2024 and 225.8 million tonnes in 2025. Nuclear reactor restarts and increased renewable energy output have led to lower gas consumption in the power and industrial sectors this year. Gas demand is expected to increase in 2024 and 2025 due to economic growth in the region, which will increase the need for LNG imports.

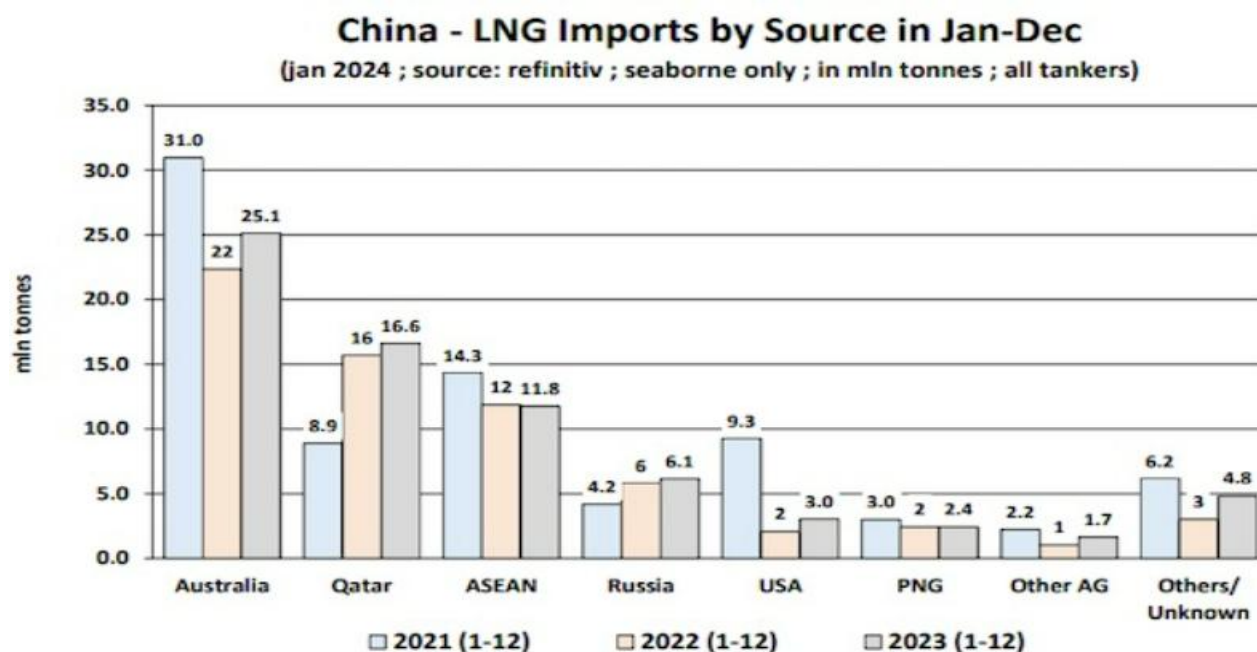


Figure 2.7 – China-LNG imports by source in Jan-Dec [12]

The main reason for the increase in LNG imports due to the arrival of winter is mainly China. The country's LNG imports are expected to increase from 34.8 million tons in the winter of last year to 43.7 million tons this winter. Imports from Japan are expected to reach 36.8 million tons this winter, an increase of 1.1 million tons from 35.7 million tons last winter. Imports from other countries have decreased, and imports from South Korea have also decreased in winter. China's LNG imports will increase significantly from an average of 7.3 million tons/m³ in the period from October 2023 to March 2024, from 5.7 million tons/m³ in 2023. On the other hand, another energy source is the downward shock brought by China's winter LNG import forecast. China's coal supply will be very high by 2023, and coal imports will increase as domestic production increases. With the increase in domestic natural gas production, Russia plans to increase its annual oil exports to China by 8 billion cubic meters to 30 billion cubic meters per year by 2024 (figure 2.8).

Most of China's gas imports by pipeline come from Northeast Eurasia, with the exception of a relatively small and stable 4 billion cubic meters of gas imported from Southeast Asia. Pipeline imports from Northeast Eurasia will increase by 7.8 % year-on-year to 62.7 billion cubic meters in 2022. Gas imports from Russia will increase by 54 %, from 10.4 billion cubic meters to 16 billion cubic meters (figure 2.9).

Northeast Asia Winter LNG Import Forecast

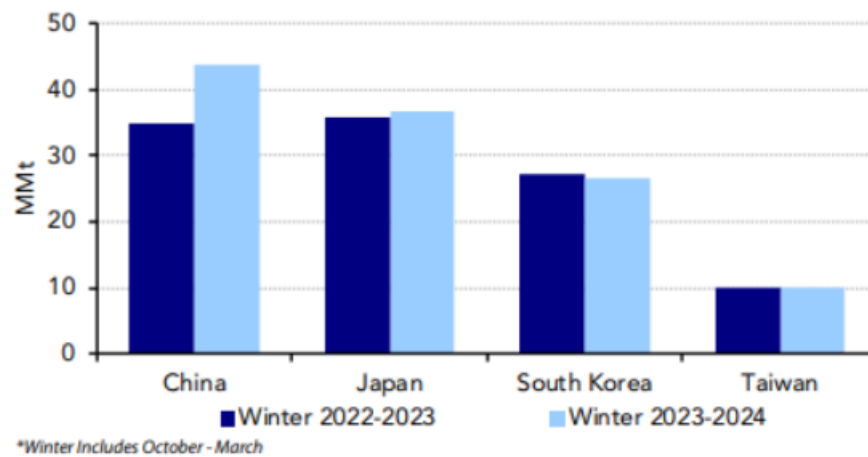


Figure 2.8 – Northeast Asia Winter LNG import forecast [11]

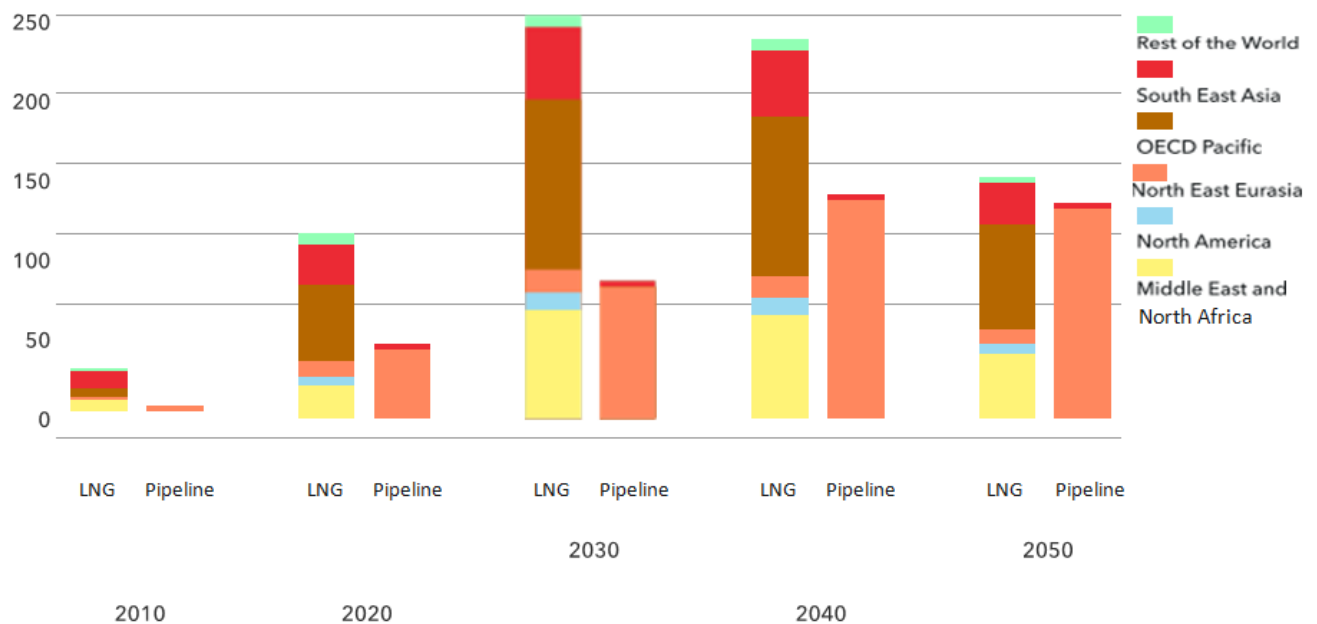


Figure 2.9 – Gas import as LNG and via pipeline by region [10]

When demand is low (summer), natural gas is injected into underground storage facilities (salt caverns, aquifers or depleted oil fields) and extracted when heating demand increases (winter). China is investing in underground gas storage facilities to provide a buffer to supply interruptions and seasonal fluctuations in gas demand, thereby enhancing energy security. By December 2022, China will have 84 underground gas storage facilities in operation. These underground storage facilities can supply 19.8 billion cubic meters of

peak natural gas. To alleviate seasonal gas shortages, more than 43 new underground gas storage facilities are planned, with an effective peak capacity of more than 61.5 billion cubic meters. By 2050, about 50 % of hydrogen production capacity will be recovered from methane storage facilities. China has invested more in energy supply and infrastructure than any other country. About 13 % of global energy supply investment went to China in the past decade, and we expect this share to remain stable in the coming decades. However, the distribution of these investments will change significantly as fossil fuel investments are gradually replaced by non-fossil fuel investments. This year, annual investment will reach a ten-year high of about 470 billion and will decline slightly over the next two decades. Self-sufficiency and energy security are key elements of Chinese policy. However, the gradual reduction in the use of fossil fuels and the increase in the use of renewable energy will continue to increase domestic energy content. This is one reason why investment will remain high even as energy demand begins to decline in the 2030s. Although China is far from energy self-sufficient in oil and gas, it is also a significant producer of these fossil fuels. This means more than 1 trillion in investment, especially in this decade. Starting in the 2030s, natural gas will become mainstream investment. China's natural gas consumption is growing faster than its production. Between 2000 and 2010, natural gas consumption grew by an average of 16.1 % per year, but between 2010 and 2020, it fell slightly, with an average annual growth rate of 11.2 %. By 2020, my country's natural gas consumption will be 418 million tons of standard coal, but production will be only 217 million tons of standard coal. In 2020, net natural gas imports accounted for 48 % of total natural gas consumption. In 2020, China imported about 67 million tons of liquefied natural gas (LNG) (125 million tons of standard coal), of which 43 % came from Australia, 12 % from Qatar, 9 % from Malaysia, 8 % from Indonesia, 8 % from Qatar, and 5 % from Russia and the United States. In addition, China imported about 35 million tons of natural gas (65 million tons of standard coal) by pipeline in 2020, of which about 60 % came from Turkmenistan. Through the Belt and Road Initiative, China has built numerous thermal power plants, nuclear power plants, hydropower plants, oil drilling facilities, railway facilities, and renewable energy facilities. The Belt and Road Initiative's activities in the field of energy transportation include the China-Russia crude oil pipeline, the China-

Central Asia natural gas pipeline, the China-Russia natural gas pipeline, and the recently built China-Myanmar oil and gas pipeline. At the same time, China's 14th Five-Year Plan also emphasizes that China should use energy production capacity as a security indicator in the coming years. To achieve this goal, the plan mentions clean and efficient use of coal, a goal of increasing nuclear power capacity from the current 52 GW to 70 GW by 2025, and increased production and storage of oil and gas. The emphasis on energy self-sufficiency is consistent with China's plans to achieve self-sufficiency in other areas, including goods, services, and scientific research. However, this focus could make it more difficult to reduce emissions from the fossil fuel sector as oil and gas continue to be promoted.

For China's natural gas, there may be the following problems at present:

1 Insufficient total resources and high external dependence. On the one hand, it is reflected in the fact that self-produced resources are still relatively limited, and existing resources are far from meeting development needs; on the other hand, it is also reflected in the fact that incremental resources mainly rely on purchasing spot LNG, and the ability to resist risks is weak.

2 It is difficult to implement a large number of high-quality resources in the short term. There is still a gap between the existing long-term LNG contracts of large domestic oil and gas companies and the overall demand, and it is urgent to implement low-cost resources as soon as possible to ensure energy supply. At the same time, the long-term LNG contracts of large oil and gas companies are linked to low oil prices and the prices are relatively high. When the spot price level is low, companies with high-priced long-term contracts will suffer serious losses due to price inversion.

3 Storage and transportation facilities still need to be strengthened. Mainly considering the dual carbon goals and the development direction of the energy structure, the current LNG receiving station receiving capacity is still insufficient to meet the growing demand for LNG imports.

2.3 China's trade status in the oil market

Oil has been the second largest contributor to China's energy supply for nearly 30 years, rising from 18 % of primary energy supply in 1996 to 21 % in 2022. We expect this share to remain the same until 2027, before gradually declining to 11 % in 2050.

According to provisional data calculated by China's General Administration of Customs, China's average imports in January and February 2024 were 10.79 million barrels per day, up from 10.44 million barrels per day in the same period of 2023. Compared with the same period last year, it increased by 3.3 %. Due to the Lunar New Year, the data for January and February will be released in time for March. The year-on-year increase in China's crude oil imports is eye-catching because it is a trend that shows that China's demand as the world's largest crude oil importer is gradually increasing. The steady growth of China's crude oil imports has been a positive factor for the overall crude oil market in recent months [35, p. 16].

In addition, economic indicators released in the past month and market participants' views on the Chinese economy are relatively optimistic. For example, the Financial News Manufacturing Purchasing Managers' Index (PMI) was 50.9 in February, higher than 50.8 in January. The United States and the European Union, including China, are the only major economies that have recorded economic expansion indexes (above 50.0) in the past few months. Today, China's economy has recovered to an annual rate of 0.7 % after months of decline. In the crude oil market, the key factor is the early signs of price reduction, based on the current economic results and import conditions, such as China's economic recovery, stronger oil demand, and the possibility of lower prices. China's crude oil import prices hit a record high, US production hit a record high, OPEC continued production cuts and supply suspensions caused by potential tensions in the Middle East, and the steady increase in crude oil imports in the market, with limited gains. For reference, the average monthly price of Brent crude oil (DH-0) in February 2024 was US 81.72 per barrel, up 3.4 % month-on-month and 2.2 % year-on-year [30, p. 2605].

As the world's largest crude oil importer, China imported 11.3 million b/d of crude oil in 2023, 10 % more than in 2022, according to Chinese customs data. In 2023, Chinese

refineries imported record amounts of crude oil to meet the country's growing refining capacity, thereby supporting the country's transportation fuel needs and producing feedstock for its growing petrochemical industry (figure 2.10).

China annual crude oil imports (2011–2023)

million barrels per day

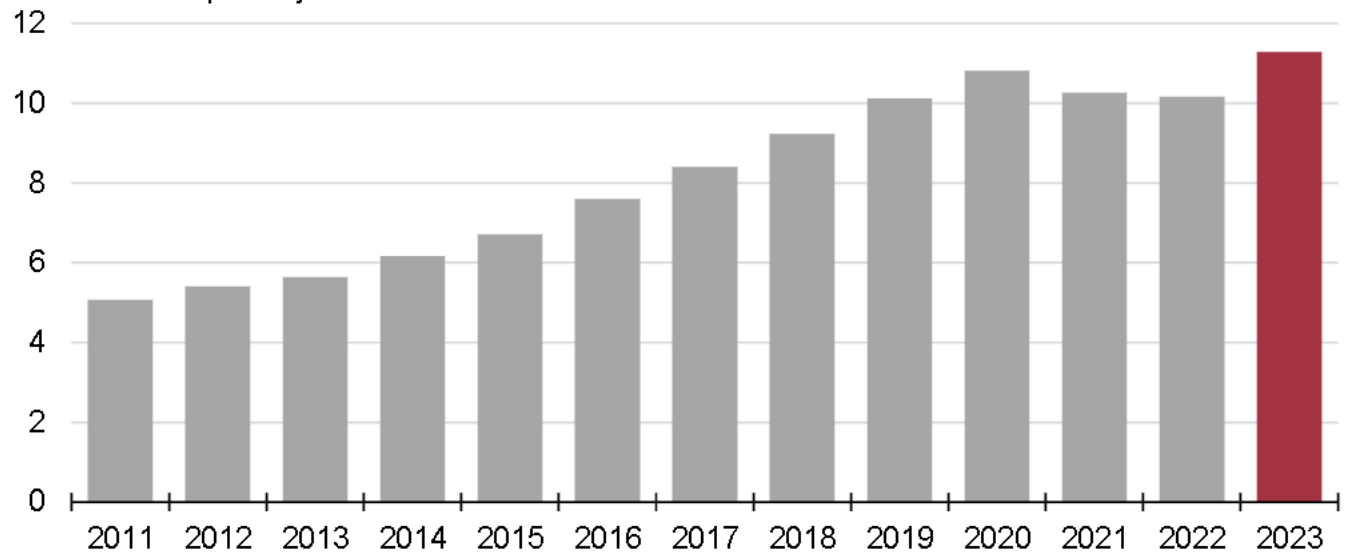


Figure 2.10 – China annual crude oil imports (2011–2023) [21]

Russia, Saudi Arabia, and Iraq were the main sources of China's crude oil imports in 2023. The largest increases in China's crude oil imports in 2023 compared to 2022 were from Russia, Iran, Brazil, and the United States. The largest increase in China's crude oil imports in 2023 was from Russia. From 2019 to 2021, China received 15 % of its crude oil imports from Russia, second only to Saudi Arabia. In 2023, Russia became China's largest source of crude oil imports, accounting for 19 % of China's crude oil imports (2.1 million b/d). This increase was the result of discounts caused by sanctions and price ceilings on crude oil imposed by Russia.

Many of the imports attributed to Malaysia, the United Arab Emirates (UAE) and Oman originated in Iran and were relabeled to avoid detection. The main trading partners are all countries from which China imports more than 150,000 barrels of crude oil per day between 2020 and 2023 (figure 2.11).

Crude oil imports to China from top trading partners (2022 vs. 2023)
million barrels per day

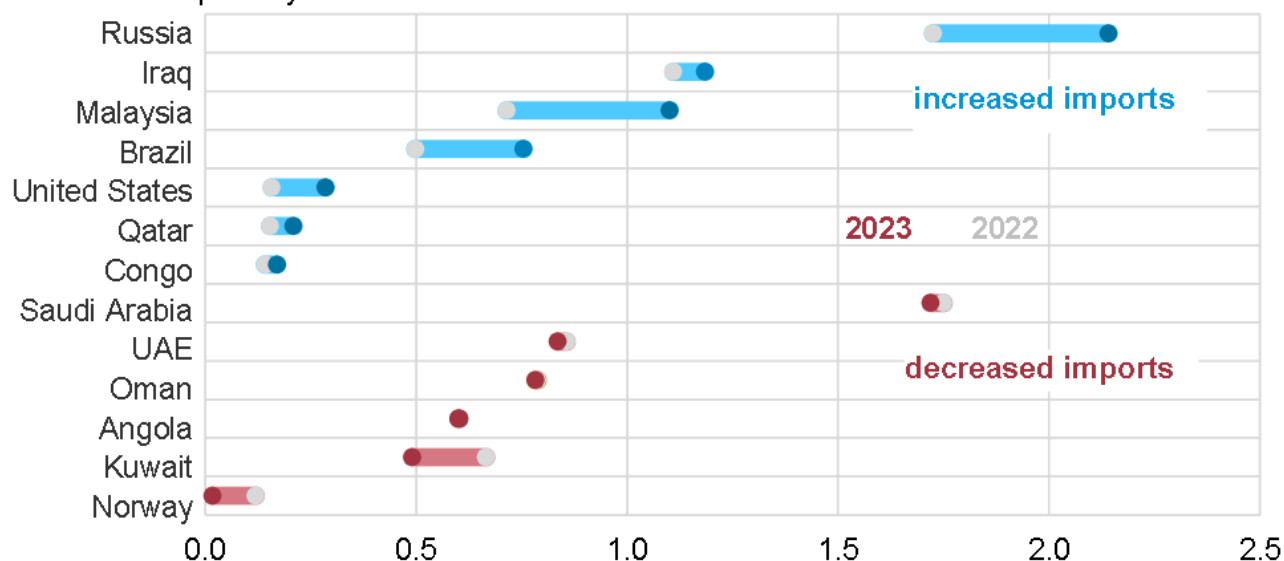


Figure 2.11 – Crude oil imports to China from top trading partners [21]

According to customs data, China's crude oil imports from Malaysia in 2023 increased by 54 % (1.1 million barrels) from 2022. Imports from Malaysia exceed Malaysia's total crude oil production, and industry analysts say much of the crude oil shipped to China from Iran is to circumvent US sanctions on its oil trading partners, and the product is believed to have been relabeled as domestic in 2017. Countries such as Malaysia, the United Arab Emirates and Oman. China's crude oil imports from Brazil will increase by 52 % in 2023, from 498,000 barrels per day to 755,000 barrels per day, and crude oil imports from the United States will increase by 81 %, from 158,000 barrels per day to 286,000 barrels per day.

Driven by the expansion of China's refinery operations and the government's efforts to restart the economy after easing travel restrictions due to the COVID-19 virus, China's crude oil imports hit a record high in the first half of 2023. In the first half of 2023, China imported an average of 11.4 million barrels of crude oil per day, up 12 % from an average of 10.2 million barrels per day in 2022. According to statistics from the General

Administration of Customs, my country's crude oil imports in the first half of 2023 exceeded eight of the top ten crude oil importers in 2022 (figure 2.12).

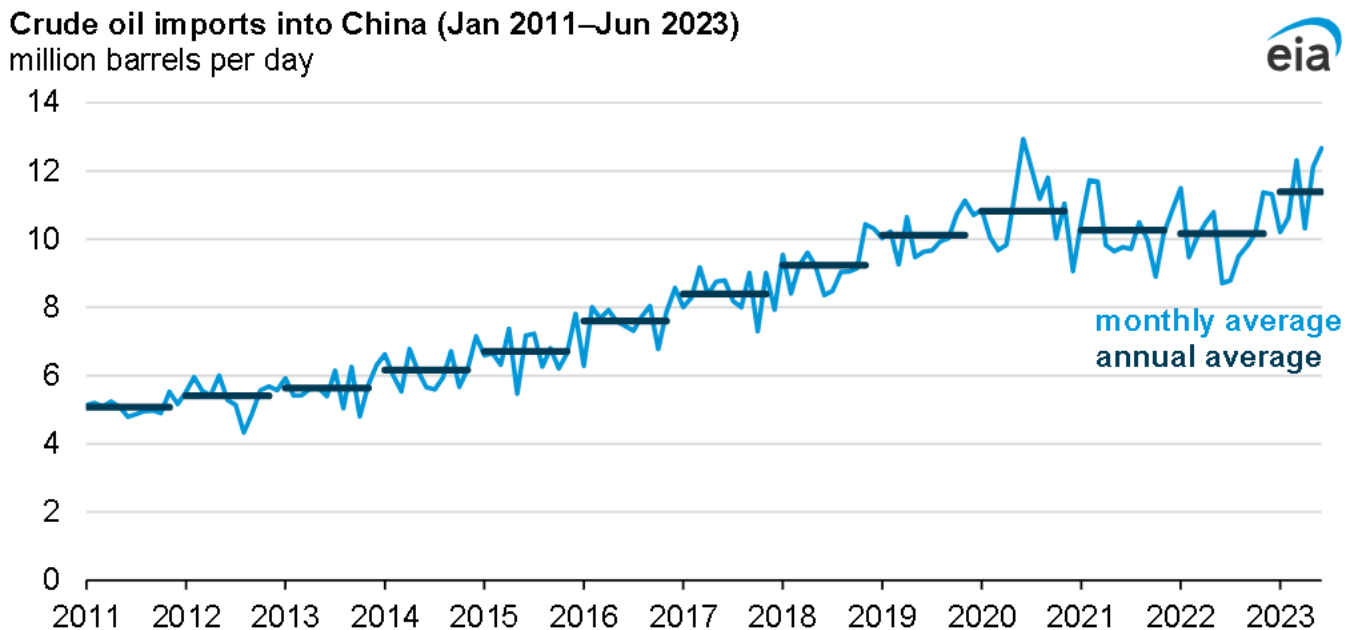


Figure 2.12 – Crude oil imports to China (Jan 2011–Jun 2023) [21]

Although China's overall crude oil imports have increased, crude oil imports from several major sources have decreased. In particular, China has reduced its oil imports from its home country Western Europe after the implementation of sanctions and imported oil from Russia at a discount. China's crude oil imports from Norway will decrease by 100,000 barrels per day from 2022 to 2023, and China's crude oil imports from the United Kingdom will continue to be far below the pre-discount level of Russian crude oil.

Russia surpassed Saudi Arabia to become China's largest oil supplier in 2023, according to the latest data from China Customs. China imported Russian oil at record prices in 2022 as the world's largest crude oil buyer, taking advantage of Russia's rush to find new buyers in 2022 amid sanctions.

This helped Russia surpass Saudi Arabia to become China's largest crude oil supplier this year. The Middle Eastern country shipped 85.96 million metric tons of crude oil to China in 2023, down 2 % from 2022.

According to a report by TASS on May 20, data released by the General Administration of Customs of China showed that Russia's oil supply to China in January-April this year increased by 16.6 % year-on-year to 37.8 million tons. The oil transaction volume between China and Russia in the first four months of this year was US 22.16 billion, an increase of 25.4 % over the same period last year. In terms of transaction volume, oil accounts for half of Russia's total exports to China. According to reports, Russia will remain China's largest oil supplier in January-April 2024. Saudi Arabia ranks second (26.1 million tons, US 16.16 billion) and Iraq ranks third (21.4 million tons, US 12.4 billion). In 2023, Russia's oil exports to China will reach 107 million tons, an increase of 24 % over 2022 [58, p. 1170].

Russian oil discounts helped China reduce its energy bills. Despite an 11 % increase in total crude oil imports, including from Saudi Arabia and Iraq, its total spending on oil purchases in 2023 actually fell 7.7 % to 337.5 billion from 2022, customs data showed.

In 2023, the total trade volume between China and Russia hit a new high of 240 billion, up 26 % from the previous year. This means that the two countries achieved the target set in 2019 one year ahead of schedule.

Against the backdrop of Western brands leaving the Russian market due to the Russia-Ukraine conflict, Chinese companies, as substitutes, also have great development potential in the Russian market in this situation.

China's refined oil imports in May fell 21.5 % to 4.45 million tonnes from a record high in April as independent refineries cut purchases of raw fuel oil, data from the General Administration of Customs showed on June 7.

According to estimates by the General Administration of Customs of China, Russia surpassed Saudi Arabia to become China's largest crude oil supplier in 2023, with a record high crude oil exports to China of 107 million tons, 2.14 million barrels per day (2.4 million barrels per day). Compared with 2022, it increased. Saudi Arabia, once China's largest supplier, saw its imports fall by 1.8 % to about 86 million tons, while Iraq ranked third with exports of more than 59 million tons (up 6.8 %). Increasing demand for discounted crude oil from Chinese and Indian refineries will push Russian oil prices higher by 2023, causing it to break the 60 per barrel price ceiling set by the Group of Seven in

December 2022. The United States will become China's 10th largest crude oil supplier in 2023, exporting more than 14 million tons to China, an increase of more than 81 % from 2022. In addition, the General Administration of Customs of China revealed that Russia will export 8 million tons of liquefied natural gas to China in 2023, an increase of 23 % from 2022. Russia is one of China's top three liquefied natural gas suppliers, after Australia (24.2 million tons) and Qatar (16.7 million tons).

In May 2024, China's crude oil imports will fall 8.7 % year-on-year to 11.11 million barrels (46.97 million tons) per day, due to the suspension of production plans at many national and privately operated oil plants. Based on data from Commodity Insights, the average utilization rate of 51 state-owned oil factories fell to 78.70 % in May, the lowest level since December, down from 80.9 % in April and a six-month high in March. Zhejiang Petrochemical plans to repair and restore production to 800,000 barrels per day in May, with capacity utilization rate improving from 87.5 % in April to around 103 %, but the possibility of obtaining compensation is low [22].

Guangzhou Auto Group data shows that imports from Asia's largest oil consuming country will fall 1.1 % year-on-year in the five months to 2024, averaging 11.04 million barrels per day.

According to data released by GAC Group Commodity Insights based on public data, sales in the first five months of this year were 229.03 million tons, a decrease of 0.4 % from the same period in 2023 (figure 2.13).

In addition to the decline, imports by Asia's largest crude oil consumer and its peers fell 1.1 % year-on-year, with imports averaging 11.04 million bpd in the first five months of 2024, GAC data showed. GAC publishes the median of the date, and Commodity Insights changes the number of bars used by a conversion factor of 7.33. Imports in the first five months of this year were 229.03 million metal tons, down 0.4 % from the same period in 2023. Some market analysts are concerned about weaker crude oil prices and a short-term recovery in the refining market, while some independent refiners are concerned about resuming the use of crude oil as a fuel oil supply feedstock. , China's demand for imported crude oil improved as expected. Analysts at Commodities and Oilfield Services predict that refinery productivity will weaken. This year, China's annual crude oil imports

are expected to increase sharply from 1.1 million bpd in 2023 to 72,000 bpd in 2024, and the number of people buying cars has also exceeded expectations.

China's crude oil imports

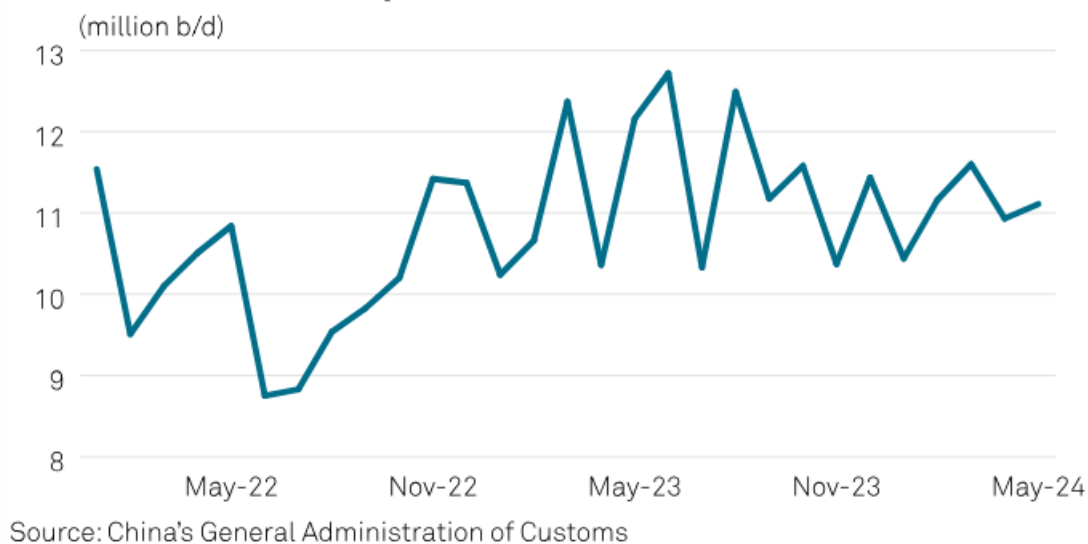


Figure 2.13 – China's crude oil imports in 2024 [22]

Looking ahead to 2024, the uncertainty of geopolitical conflicts will intensify, coupled with the pressure of high inflation and high interest rates, the global economy will still face huge downside risks, energy commodity prices will continue to fluctuate, and the energy industry will become an important area of competition among major powers. The affordability and security concerns caused by the global energy crisis will make governments and companies pay more attention to the development of clean energy technologies. China's continued economic recovery will support the growth of oil demand. China's oil demand will rise steadily in 2024, and the peak time of refined oil demand may be brought forward to before 2025. Against the backdrop of the construction of a new energy system, natural gas is becoming an important energy source to support the comprehensive green transformation of the economy and society, continuously replacing high-polluting fuels and supporting the large-scale development of new energy.

Chapter 3 Further development of China's energy trade

3.1 Prospects and countermeasures for the transformation of domestic energy consumption structure in future

First, the consumption demand of coal will drop sharply. Most of the net decline – about 290 million tons of standard coal – comes from a decline in steel production, which is China's second largest source of coal consumption today (the first is power generation), and its output will experience structure during the forecast period of this report. About 70 million tons of standard coal is used for cement production. Cement production is now the fourth largest source of coal consumption, and it has a structural decline during the forecast period. In the medium term, the residential sector will shift from coal-fired heating to natural gas and electric heating. China will achieve the goal of energy development in the 14th Five-Year Plan, the population using natural gas will increase to 470 million. At the beginning of the forecasting phase, there was no structural decline in coal demand in the power sector until around 20 billion dollars tons of standard coal in 2030, but with the large-scale decommissioning of power plants built in the late 20th and early 21st centuries, Coal-fired power generation will begin to enter a slow structural decline [17, p. 33].

China's terminal energy consumption has shown a significant shift (figure 3.1, figure 3.2 and figure 3.3). By 2040, electricity accounts for more than half of energy demand growth, and by 2040 more than coal and oil have become the main source of end-use energy consumption. Although electrification of road transport is becoming an increasingly important source of electricity demand, by 2040, industry and construction remain the main drivers of electricity demand growth, accounting for around 45 % of all growth. Natural gas is the second largest contributor to the growth of end-use energy consumption, accounting for three of total demand growth.

Especially in industry and construction, energy demand has grown significantly, with about half of the growth coming from industry, especially in non-high-energy industries, natural gas demand in buildings accounts for 45 % of total energy demand

growth. Demand for oil in the transportation and petrochemical feedstock industries continues to grow: its total growth is 4.7 million barrels per day, enough to offset the decline in all other industries; by 2040, the transportation and petrochemical feedstock industries account for almost all of the increase in oil demand. The use of renewable energy is also expanding, with special progress in providing hot water and heating using solar and geothermal energy. In addition, by 2040, renewable energy (excluding traditional biomass) can directly meet nearly 20 % of terminal energy consumption growth.

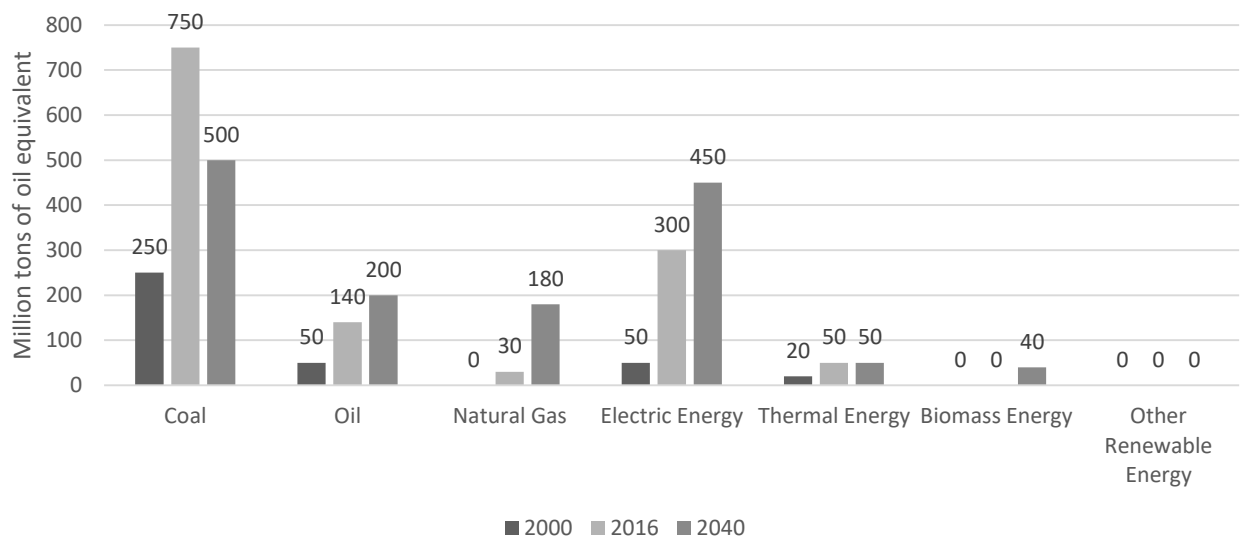


Figure 3.1 – Fuel demand of Chinese industry under the new policy [21]

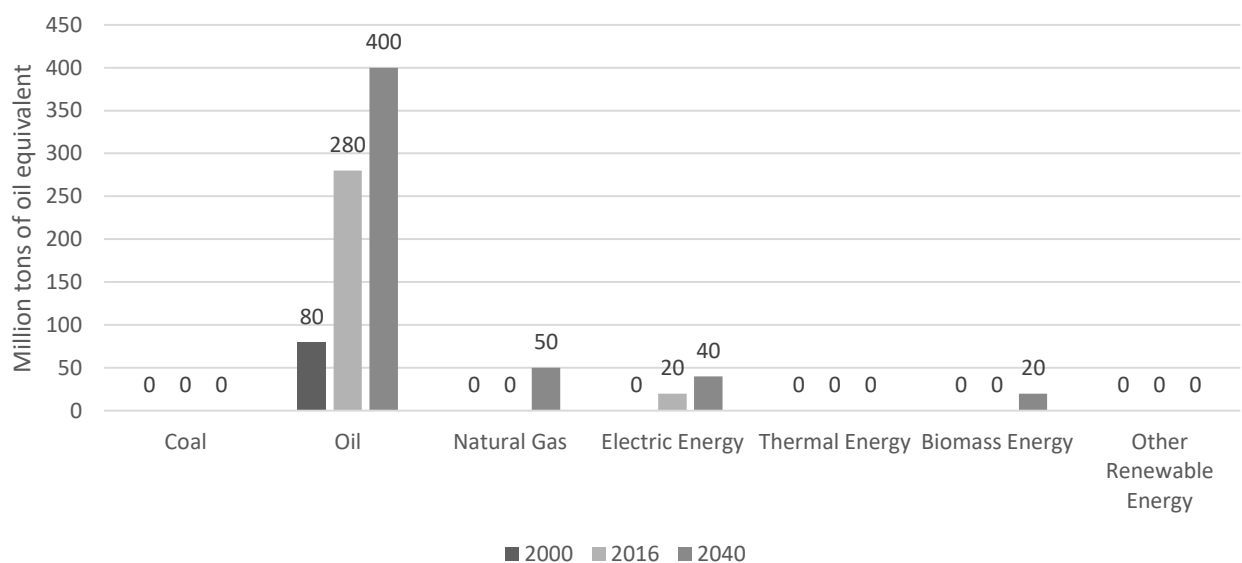


Figure 3.2 – Fuel demand of China's transportation industry under the new policy [21]

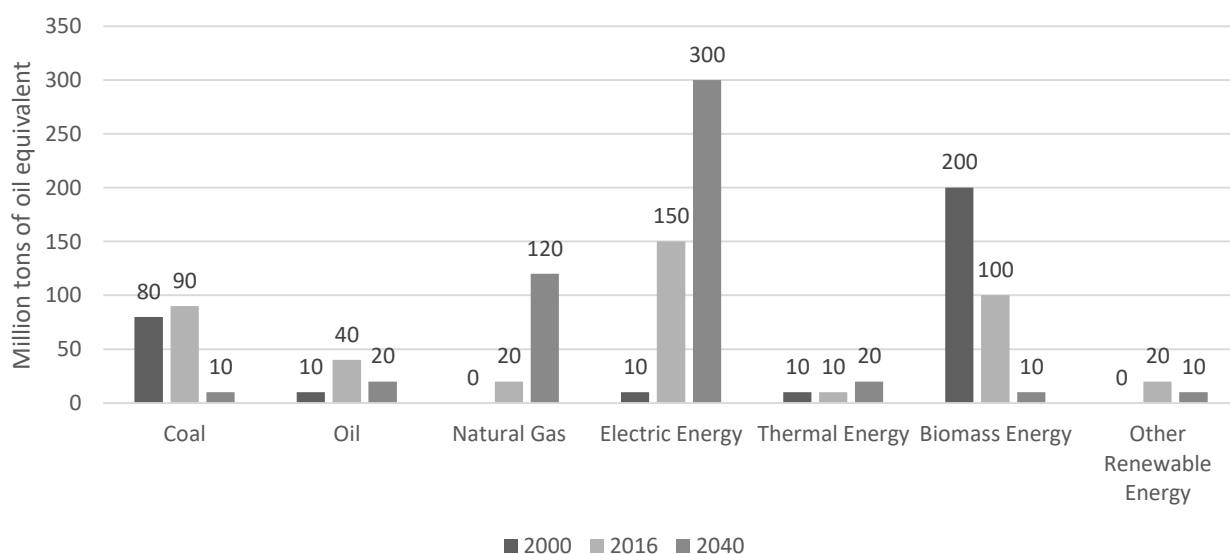


Figure 3.3 – Fuel demand of China's construction industry under the new policy [21]

Under the new policy scenario, industrial energy demand growth will slow down sharply. Compared with the average annual growth rate of 7.7 % since 2000, the average annual growth rate in 2040 will be as low as 0.5 %, continuing the downward trend since 2011. By 2040, the growth rate of industrial activities will continue the trend since the implementation of the first energy intensity target during the 11th Five-Year Plan period, from 10 % in 2000 to 3.6 %.

Driven by the relative competitiveness of fuels and the policy of improving industrial energy efficiency, the slowdown in industrial energy demand growth has been accompanied by a huge shift in energy demand. Industry is the main factor leading to peak coal demand and declining demand in China under the new policy scenario. Industrial coal demand will fall by 30 % in 2040 compared to 2016. At the same time, energy demand growth will be mainly due to increased demand for electricity and natural gas. Electricity demand will increase by 1800 TWh, which alone accounts for the majority of the total net increase in industrial energy demand, which is a significant change from the ratio of electricity to only 25 % of total industrial demand growth since 2000. The largest increase in electricity demand occurs in both chemical and non-energy-intensive industries, both

due to increased production and due to the application of electrothermal technology including heat pumps. Natural gas use will increase by 152 billion dollars cubic meters, equivalent to three-quarters of the net increase in industrial energy demand, which has been below 5 % since 2000. The growth in oil demand is consistent with the past. In 2040, compared with 2016, oil demand increased by 1.7 million barrels per day, almost the same as the growth rate in 2000–2016. By 2040, raw material use has become the single largest source of growth in industrial oil demand.

Under the new policy scenario, industrial restructuring will dramatically change future energy needs. Today, the four heavy industry sectors (steel, petrochemical, cement and aluminum) account for almost three-quarters of industrial energy use, 80 % of industrial coal, 70 % of industrial oil demand, and industrial gas demand, respectively. And 55 % of industrial electricity demand. In the future, by 2040, the proportion of these industries in industrial energy demand will fall to about two-thirds, about 10 percentage points lower than the current level. Driven by both efficiency and reduced production, the energy demand in the steel and cement industries has fallen sharply, with a total reduction of 250 million tons of oil equivalent. This in particular reduces the amount of coal used in these industries. The total amount of industrial coal fell back to the level of about a decade ago. The decline in production is related to the efforts of the factory with the lowest efficiency in the short-term and medium-term shutdowns (China plans to cut 150 million tons of steel capacity and 10 % of clinker capacity by 2020) and the economic transformation plan. Raw steel production will fall from more than 800 million tons in 2016 to below 600 million tons in 2040; cement production will fall from more than 240 million tons in 2016 to about 160 million tons in 2040. Energy demand in other energy-intensive industries, such as paper and aluminum, may remain steady or slightly up. But not all energy-intensive industries have reduced energy demand. In all industrial sectors, the absolute largest increase in energy demand comes from the chemical and petrochemical industries, where production has increased significantly, with olefin production doubled, while production in other industries (especially cement and steel) has declined. Offset the impact of its production growth. The growth in the chemical and petrochemical industries is driven by a variety of energy sources, including coal

(especially coal to olefins, methanol and ammonia production), petroleum (key petrochemical feedstock), natural gas, electricity, heat and renewable energy. By 2040, about a quarter of China's raw materials are coal, which is used frequently in the production of high value-added chemicals from methanol to olefins and coal to olefins. The development of the chemical and petrochemical industries contributes to productivity gains in the agricultural sector, to the development of other manufacturing industries (such as the manufacture of finished plastic products), and to the use of methanol to reduce air pollution caused by transportation fuels.

Under the new policy scenario, by 2040, the share of non-energy-intensive industries will increase by 10 percentage points to 47 %, about one-third of the growth between 1990 and 2016. Demand for natural gas in non-energy-intensive industries has grown faster than in the past few decades. Increasing the use of natural gas is an important policy goal for China: under the new policy scenario, the demand for natural gas in non-energy-intensive industries is growing, mainly from emerging industries and energy conversion in existing industries in the gas-producing region, in part to reach the environment. In areas where there is no natural gas supply, the alternative is to shut down old, polluting, inefficient industrial facilities in the same way that heavy industry is handled. In many cases, because the facility cannot be retrofitted, they can only continue to run until they are shut down [5, p. 242].

China's transformation plan, from traditional energy-intensive industries to high-tech, high-value, low-energy industrial activities, is the main driver of energy demand outlook under the new policy scenario. Achieving this goal will help China successfully transform into a more balanced macroeconomic growth model similar to today's advanced economies and achieve its energy and environmental goals. However, this is an ambitious undertaking with many short- and medium-term goals. This wide-ranging economic reform is bound to face unexpected obstacles, for example, because the domestic demand for certain materials may increase, resulting in a delay in production reduction compared to the original plan. This potential delay will dramatically change the outlook for industrial energy demand, increase energy demand (especially coal) and related carbon dioxide emissions. They may delay the production of steel and cement industries with

overcapacity, so it is likely that demand in the coal industry will begin to decline after 2020. Relative to the new policy scenario, if the restructuring of these industries is postponed to 2035, it will lead to more than 800 million tons of new cement production by 2040, and crude steel production will exceed 150 million tons, which is equivalent to the global cement and steel production capacity increase respectively. Under this circumstance, China will use more than 100 million tons of oil equivalent energy in 2040, of which about three-quarters will be coal. In 2035, the largest year of growth, coal use will increase by more than 120 million tons of standard coal, almost equal to the current year of coal demand in South Africa [21].

Analyzing the differences between China's energy structure and the international community, China's energy structure adjustment can have a general direction, but adjustments must be based on China's specific national conditions and reality. After an objective understanding of China's current energy sources and clean energy sources, The proportion of raw coal consumption can be reduced and oil, natural gas and other energy sources can improve the overall energy consumption structure within the development space. China's geographical conditions and the status of mineral resources determine that China is dominated by raw coal production and consumption. The maturity of coal mining technology and the convenience of resources make the coal's consumption cost quite competitive with other energy sources, which also makes it difficult for China's overall energy structure to achieve breakthrough changes in the short term. Although the overall trend of coal dominated in China's energy structure will exist for a long time, with the development of China's oil exploitation, the deepening of natural gas development and utilization, and the start of various clean energy sources, the energy structure will be adjusted, and the proportion of coal consumption will be reduced within an appropriate range. It is still feasible to increase the proportion of other energy sources in the energy production and consumption structure. The development of the national economy is greatly influenced by the optimization of the energy structure and the improvement of the industrial structure. Combining the current status of China's energy distribution and the strategic objectives of economic development, China can ease energy conflicts and optimize energy structure from the following aspects.

1 Optimize coal energy is the most important. Strengthen the position of the coal foundation and optimize the pricing mechanism of coal. The proportion of coal in China's energy structure is declining year by year. However, the fundamental position of coal in the energy structure cannot be changed. This is determined by China's national conditions. Because China's coal reserves rank third in the world and its resource base is abundant, it is currently underdeveloped. It can be predicted that coal will still account for the energy production and consumption structure in the future. From the point of view of sustainable development, the coal industry must strengthen reasonable pricing, link coal prices with the international market, and promote the development of the coal industry.

2 Rational development of petroleum resources and active development of international cooperation. The contradiction between oil supply and demand is very prominent in China's energy consumption structure. At present, the highest level of domestic oil production in China is close to domestic supply capacity, and domestic oil exploitation should be carried out appropriately and in turn. To meet the needs of domestic oil consumption growth, it is necessary to import petroleum from abroad in a modest amount, and it is possible to obtain more money with little money. Energy can also avoid the energy crisis and economic crisis caused by the fluctuation of international oil prices. At the same time, it should minimize China's dependence on the oil international market and foreign exchange payments, and advocate oil conservation. To further widen the oil exploration and development sector, China's oil resources are relatively scarce, but widening the oil development field can well make up for this gap. The development and utilization of overseas markets and deepening the exploitation of offshore oil resources are two aspects of expanding the field. China's exploration and development of overseas oil has entered a stage of rapid development and gratifying results have been achieved. The exploration of the entire overseas oil and gas industry, and the level of commercial negotiations and political negotiations with resource countries are continuing to mature. Under the premise of maintaining established overseas markets and maintaining the relationship between governments, China should further expand its overseas oil development. In addition, it is also very important to strengthen the development of offshore oil and gas resources. Again, upgrade offshore oil exploration technology. In the

South China Sea area, there are a lot of reserves of oil and gas resources. Due to the constraints of technical conditions, there has been no good exploration and development. China should strengthen the research and development of marine exploration technologies, upgrade its own deep-sea operating capabilities, and fully develop this part of resources.

3 Strengthen the development and utilization of natural gas. Natural gas, as a kind of high-quality, high-efficiency clean energy, accounts for 23.76 % of the world's major energy consumption. From the perspective of the current rapid development of natural gas in China, strengthening natural gas development and utilization can effectively improve the status quo of China's energy structure and reduce the use of raw coal in energy. The proportion of consumption. In foreign countries, we must strengthen international cooperation. With the changes in the world situation, LNG has changed from a buyer's market to a seller's market. It is increasingly important to further utilize foreign resources and strengthen international cooperation. At home, China's natural gas reserves have entered a phase of rapid growth since the beginning of the 20th century, forming a gas-bed methane resource area dominated by six major basins: Sichuan, Ordos, Tarim, Qaidam, Qiongzhusi, and Donghai. The proved reserves of natural gas have also increased substantially. Five discovered gas fields with a proven geological reserve of more than 1 billion cubic meters have been discovered in Sulige, Daniudi, Puguang, Zizhou-Qinglan and Qingshen. In the third national assessment of oil and gas resources, it is estimated that the country's conventional natural gas resources will reach 56 trillion cubic meters, and the recoverable resources will be 22 trillion cubic meters. With the continuous improvement of China's exploration technology and deepening of exploration efforts, China's natural gas reserves will also increase. Natural gas is the most promising clean energy in the 21st century. The state must increase the investment in natural gas so that the West-East Gas Transmission Project and supporting projects can be carried out smoothly, and the utilization rate of natural gas in small and medium-sized cities and towns can be enhanced, and citizens of the city can be encouraged to use natural gas clean energy stoves. In short, to strengthen the development and utilization of natural gas, we must make full use of foreign resources, but also actively develop the domestic market.

4 Develop hydropower. Strengthening the construction of hydropower stations is of

great significance for replacing the consumption of raw coal. Most thermal power plants in China use raw coal as a fuel. Raw coal releases a large amount of greenhouse gases after combustion. Hydropower is a safe and cost-effective green energy. Substituting part of coal-fired power can effectively reduce greenhouse gas emissions and reduce the proportion of raw coal used. Promote the adjustment of China's energy structure and develop a low-carbon economy. According to the existing hydropower development in China, the current level of hydropower development in China is still less than 50 %. The level of development in the western region is even lower, especially in the southwest region, where the development level is only 17 %.

5 Pay attention to the development of nuclear power. In terms of nuclear power, first of all technically, the world has gradually transformed from second-generation nuclear technology to third-generation nuclear technology. In addition to the well-known nuclear accident in Japan in 2011, nuclear power has attracted the attention of various countries in the world. Scientists have begun to work on nuclear power worldwide. Conducting in-depth research will undoubtedly promote the further development of nuclear technology. One million kilowatts of nuclear power plants can save 3.5 million tons of coal a year if they replace thermal power plants of the same size. Second, improve the investment operation mechanism and increase the number of owners of nuclear power construction holdings. The insufficiency of investment and the unsmooth management and operation have greatly hampered the development of China's nuclear power business. Allowing investment groups with investment ability from state-level investment groups to participate in the investment will help accelerate the pace of nuclear power development. China should continue to learn from foreign experience, strengthen self-study, and raise China's nuclear power technology to a new level. Second, the location of nuclear power plants should follow the guidelines of environmental compatibility and economic rationality. China has a vast territory, which provides more options and greater feasibility for the site selection of nuclear power plants. Thirdly, based on the installed capacity of nuclear power in Jiangsu, Zhejiang, and Guangdong, considering the alternative site, China's existing resources can support more than 160 million kilowatts of installed nuclear power capacity. Therefore, it is realistic and feasible for China to strengthen the

development and utilization of nuclear power.

3.2 Strategies to strengthen China's relationship with energy trading partners

Strengthen China's cooperation between energy companies and the international market is the most important. All four major oil companies in China are strengthening the exploration and development of oil and gas, and the market has expanded from home to abroad. China National Petroleum Corporation has established an overseas exploration and development company, which is responsible for the exploration and development of overseas oil and gas, which is a great complement to the gap in China's oil resources. So far, PetroChina has operated dozens of oil and gas exploration projects in the world's major oil resource regions such as the Middle East, Central Asia, North and South America, North Africa, and Asia Pacific. In addition, the centralized management of PetroChina has made China's overseas oil and gas exploration and development more efficient. China's oil strategic reserve and its strategic cooperation and development model with foreign oil resources countries resulted in a large increase in China's oil production and oil production reached the highest level in history. In addition, we should also strengthen exchanges and cooperation with international oil companies such as BP Petroleum, Royal Dutch Shell Petroleum, and Total Petroleum. China's exchanges and cooperation with these major international oil companies not only learn advanced technologies from these large companies, but they can also jointly do some oil and gas projects and obtain a certain share of development and utilization. Second, we must do a good job in political diplomacy. Because energy is related to the safety of a country, exploration and development of foreign oil and gas are not only the development and utilization of energy, but also political negotiations. Under the complicated and changing world situation, diplomatic work has become a necessary condition for the cooperation of overseas oil and gas projects [10].

Specifically, Russia, Central Asian countries, and Middle Eastn countries are all countries with significant influence along the One Belt and One Road region. They have extensive interests in the region, while Central Asia and Middle East are regions where

energy exporters are concentrated. In the era of globalization, China can only actively promote cooperation in the Belt and Road energy cooperation with the above-mentioned countries and regions, actively control and control these competitions and conflicts, and benefit from benign competition in order to further deepen trade relations with energy exporting countries. The following sections will analyze the specific situations of different countries.

Russia has taken a positive attitude toward China's promotion of the One Belt, One Road initiative and related energy cooperation. China-Russia energy cooperation is of strategic significance to both parties. At present, the level of energy cooperation between China and Russia is continuously rising. The tremendous potential and complementarity of Sino-Russian energy cooperation is gradually being released, and both sides benefit from it. We can continue to deepen cooperation in the following areas in the future [19, p. 192].

First, fully implement existing agreements and continue to expand the scale of trade. China and Russia finally reached a 30-year long-term natural gas pipeline long-term gas supply agreement after more than 10 years of negotiations. The volume reached 38 billion dollars cubic meters, and the scale of energy trade between the two countries has achieved a qualitative leap. The two parties agreed to implement the solution to the pipeline construction and related financing and technical issues as soon as possible to ensure that the goal of starting gas supply and gradually increasing the volume of gas supply. At the same time, the energy trade between China and Russia still has huge room for development. Through the energy talks under the regular consultation mechanism between the two countries' premiers, the companies of the two countries will increase the scale of oil and gas trade, increase the supply of oil and gas pipelines in the eastern section, and deepen the level of mutual dependence.

Second, we must strengthen energy interconnection and construction. At present, the pipeline oil and gas transportation capacity between China and Russia is relatively limited, and it is difficult to meet the demand for energy cooperation between the two countries; the maritime transportation capacity has not been fully developed. Promote energy infrastructure construction. The designation is the meaning of the Belt and Road energy cooperation issue. We must expedite the implementation of pipeline construction in the

western part of China and Russia and push for a new pipeline construction agreement between the two countries to achieve a significant increase in energy transportation capacity; conduct research on the construction of offshore oil and gas transportation corridors between the two countries, achieve diversification of energy transportation modes, and reduce pressure on pipeline transportation safety.

1 The first step on promoting the development of China-Russia energy trade is to strengthen cooperation and mutual trust between the two governments. Political advantage is an important driving force for the development of energy trade between the two countries. However, Russian domestic people are also dissatisfied with the reality of Sino-Russian energy trade. They believe that Russia has become China's raw material supply base, and the difficulties in laying oil pipelines and natural gas pipelines between the two countries have been It proves that the political mutual trust between the two countries has not reached the corresponding level. Therefore, although the energy trade between the two countries can bring trade benefits to both sides, if we want to continue to develop, we must further strengthen political mutual trust between the two countries and strive to raise consensus. At the same time, it is necessary to strengthen and deepen exchanges and cooperation in the fields of culture, education, sports, media and tourism between the two countries, continuously consolidate the social foundation of bilateral relations, and enable the Russian people to regard China's traditional culture, basic national policies, and open strategies. Have a more objective understanding, constantly enhance the sentiments between the two peoples, and consolidate the social foundation for multi-field cooperation between the two countries [1, p. 846].

2 Accelerate the infrastructure construction in the border areas of the two countries, improve transportation capacity, accelerate the infrastructure construction in the border areas, improve the economic development level of the border areas and further develop Russia's abundant energy resources, and provide new capital for the development of border areas. In addition, it is also conducive to solving the problem of insufficient transportation capacity in Sino-Russian energy trade and promoting the development of Sino-Russian energy trade. China should actively participate in infrastructure construction in eastern Russia, including not only oil and gas resources transportation pipelines,

refineries and other energy-related construction projects, but also transportation infrastructure and water supply and power supply facilities in the Sino-Russian border area. In this way, while improving the living conditions of local residents in Russia, it can also solve the employment problems of local residents, thereby reducing the barriers for Russian residents to develop energy in China and Russia, combating the Chinese forces in Russia, and solving the healthy development of energy trade between the two countries. Political interference.

3 Actively build a national-level new district in China and Russia, and promote the construction of a free trade zone. The construction of Sino-Russian national new districts can focus on four aspects to actively explore: (1) explore effective mechanisms to play the role of market and government; (2) explore effective ways to promote deep integration of science and technology; (3) explore effective measures to stimulate the motivation and vitality of innovators; (4) Explore an effective model for deepening open innovation. On this basis, all levels of government in China should pay full attention to the preferential policies in the Opinions of the State Council on Supporting the Development and Opening of Several Policy Measures in Key Areas Along Border Areas, focusing on the construction of Manzhouli, Suifenhe and Heihe three open cities along the border with Russia. Based on this, we will actively explore and promote the construction of a Sino-Russian free trade zone, gradually increase the level and level of China's trade with Russia, and promote energy trade between the two countries [53, p. 6].

4 Increase direct investment in Russia and actively participate in the development of energy resources in the Russian Far East. The Russian Far East covers an area of 6.2 million square kilometers and has a population of only 6 million. The region is rich in resources, and timber, coal, oil and natural gas reserves account for a large proportion of Russia's energy reserves, but due to geographical and natural conditions, the degree of development is seriously inadequate. In April 2013, the National Plan for Social and Economic Development in the Far East and Baikal entered into force, which means that the development strategy of the Far East has entered the implementation stage. The Heilongjiang provincial government should encourage and support local enterprises to seize this favorable opportunity to increase direct investment in the Russian Far East and

actively participate in the development of energy resources in the Russian Far East. This will not only effectively reduce the transportation and logistics costs of enterprises, but also make full use of the tax incentives of the local government of Russia to understand the consumer demand in the local market and then make rapid changes. By hiring local residents of Russia, it is also possible to solve the employment problems of some local residents, and to a certain extent, to alleviate the discriminatory mentality and Chinese exclusivity of Russian residents on Chinese goods and businessmen [57, p. 1098].

In addition, China should improve the single issue of energy products in Central Asian countries. As the energy trade development process in China and Central Asia, the issue of energy product simplification emerged. In order to promote the sustainable development of energy trade between the two sides, both parties need to make breakthroughs in the development of energy products. On the one hand, China needs to diversify its energy trading needs and avoid over-reliance on the energy risks associated with certain types of products. At the same time, in the cooperation of energy products, we should actively cooperate with the five countries in Central Asia to develop new energy sources. China can make full use of its One Belt and One Road policy and vigorously build infrastructure for new energy trade in the five countries of Central Asia to provide more convenient conditions for China's energy imports. At the same time, the five Central Asian countries can rely on their rich energy advantages, continuously research and develop new energy products, strengthen the level of science and technology in energy products, achieve diversification of energy products, and ensure the sustainable development of energy product exports.

Accelerate the construction of land and sea transportation facilities in Middle East. First, shipping is the main transportation channel between China and Middle East. China can build a convenient, safe, and efficient transportation system through large customs clearance, and build a maritime interconnection network system with key coastal ports and important Middle Eastn ports as nodes. Second, the land is interconnected. China should strengthen the infrastructure construction of roads, railways, and land bridges, and build a faster land bridge trade clearance system with Middle East, such as the promotion of land-to-rail projects such as China-Israel Railway International Cooperation Construction

Project. Third, air interconnection and intercommunication. China can deepen cooperation in airport positioning, airspace planning, customs supervision, security work, and flight rights policies by promoting the exchange and interoperability between the airports in the two airports, and accelerate the docking and co-construction of domestic airports and Middle East International Airport and expand trade with Asia Middle East Airways. The throughput capacity.

Opportunities faced in Africa's energy cooperation. First, the African oil industry has developed rapidly. With the exception of Nigeria, Algeria, and Libya, all other oil-producing countries in Africa are non-OPEC members. Their production is not limited by their peers, and their development potential and exploitation potential are huge. Oil exploration and development in Africa is entering a golden period of rapid development. A group of emerging oil-producing countries has rapidly emerged, providing a broad space for China-Africa energy cooperation.

Second, the oil producing countries in Africa seek to diversify their development partners. Western oil companies have monopolized the African oil market for a long time. They have firmly controlled the exploration and development rights and oil pricing power of African oil resources, which has seriously damaged the interests of oil-producing countries in Africa. In order to safeguard national sovereignty and legitimate oil rights and interests, some oil-producing countries are vigorously implementing the diversification strategy for the exploration and development of oil, and hope to develop oil cooperation with developing countries such as China on the basis of equality and mutual benefit, in order to break the Western oil companies' own oil industry. Monopoly situation. This provides a good external environment for Chinese oil companies to enter the African oil field and strengthen China-Africa energy cooperation.

On this basis, it is also possible to expand markets abroad. For example, some countries in North Africa rely on the Mediterranean Sea. The coastline is very long and contains a lot of petroleum resources. Establishing oil cooperation with these countries requires multiple forms of cooperation to explore and develop the oceans of resource countries. Oil and gas resources are also a great complement to China's overseas markets. In terms of oil, it can be seen that the development and utilization of China's oil show a

good development trend. It will be possible for China to increase its consumption of oil in the future and then increase the proportion of oil consumed in China's energy structure.

In addition, China's oil imports from Venezuela, Kazakhstan, Canada, and Mongolia also increased significantly. In recent years, the share of imports from Central and South America and Africa has increased due to the diversification strategy of energy imports. At present, the main problem of China's oil imports is that the concentration of oil imports is relatively high and it relies heavily on the Middle East. This is not conducive to the dispersion of risks. Once an unexpected event is encountered, the impact on China's energy security will be greater. In recent years, China has actively implemented a diversification strategy for energy imports. Through strengthening energy cooperation with Africa, Russia, Central Asia and other places, it has continuously explored new oil import channels to reduce its dependence on Middle East oil and achieved certain achievements. The proportion of imports from African countries has risen to 24.7 %. Breakthrough progress in energy cooperation with several countries.

The two governments should increase policy support for energy cooperation enterprises between the two sides and create a favorable policy environment for Sino-Russian energy and trade cooperation. At present, both China and Russia, the concentration of domestic energy companies are relatively high, and active policies should be introduced to encourage these companies to introduce modern enterprise management models, go abroad and actively participate in global energy trade. In addition, Russia's energy exploration, production, processing, transportation and other aspects are strictly controlled by the government. This is basically consistent with the situation of China's three major state-owned oil companies controlling the domestic market. The two governments should strengthen coordination and communication at the government level according to this feature. To provide financial and policy support for energy companies that cooperate, and continuously expand the scale and scope of energy trade cooperation between the two sides. On the other hand, the two governments must strengthen the construction of infrastructure and technical equipment. Weak infrastructure and backward technology are important factors that restrict Sino-Russian energy and trade cooperation. For example, the differences in railway standards between the two countries have severely

limited bilateral cargo turnover.

We will improve the energy transportation channels between the two countries, and work hard to strengthen the construction of port stations and wharf infrastructure around energy transfer, and form a comprehensive transportation channel for roads, railways and pipelines. With energy mining technology innovation and cooperation as the focus of energy trade cooperation, through the joint research and sharing of technology, the Sino-Russian energy trade cooperation will continue to promote sustainable and healthy development.

The global economic and trade pattern is in a turbulent situation, and Sino-Russian energy and trade cooperation has therefore become more uncertain. The developed countries have not given up the interference in Sino-Russian energy and trade cooperation, which has caused great obstacles to Sino-Russian energy and trade cooperation. In the face of these difficulties, Chinese energy companies must improve their market competitiveness as soon as possible, work hard to eliminate interference, actively meet challenges, and identify their position in a complex international energy trading environment. It is necessary to seize the opportunity of Russia to develop oil and natural gas in the eastern region and the Silia region, and to improve the independent research and development technology level of China's energy enterprises through cooperation and mergers and acquisitions, and continuously expand the scope of Sino-Russian energy trade cooperation [3, p. 124].

Build a more efficient and smooth energy trade cooperation coordination mechanism. Sino-Russian energy trade cooperation relies too much on spot trading, and is mostly driven by the government. The lack of market-oriented energy trade cooperation coordination mechanism has led to slow progress in Sino-Russian energy trade cooperation. It is necessary to strengthen communication at the level of the two governments and build a more efficient and smooth energy trade cooperation coordination system. First, we must strengthen government-level design and establish an energy trade cooperation mechanism recognized by both sides. The key point is to establish a trade system that is in line with the interests of both parties and achieves mutual benefit and win-win results. The second is to further optimize the investment environment of the two

countries. From the perspective of facilitating bilateral energy trade cooperation, we will continuously optimize the investment environment of the two countries and promote the in-depth development of energy trade cooperation between the two countries. Strengthen political mutual trust, further improve bilateral investment agreements, open up larger markets to each other, and strive to reduce investment barriers. The third is to establish a daily communication and coordination organization. China and Russia have different cultural practices and business models, which will cause misunderstandings in the trade process and affect mutual trust. Establishing a daily communication and coordination organization can effectively solve this problem. The institution must absorb talents who have a good understanding of the cultures and customs of the two countries and have the ability to trade internationally. The personnel of daily communication and coordination agencies must respect each other's customs and practices to ensure the sustainable and healthy development of Sino-Russian energy and trade cooperation.

Conclusion

This thesis starts with China's domestic energy demand situation and then analyzes China's status in the international energy trade market. The domestic energy demand structure in China still has major problems. The proportion of coal supply is too large, and the level of utilization of clean energy and new energy is low. The import of important strategic energy sources such as oil and natural gas is heavily dependent on imports. The domestic energy supply structure is in urgent need of improvement. China needs to proceed from the upgrading of its energy structure. On the one hand, it has greatly increased the penetration rate of clean energy energy, such as natural gas. On the one hand, it has increased investment in research and development of new energy, so as to achieve the problem of improving the energy structure of the country's energy.

In the international energy trade market, China has even greater problems. First of all, major energy sources such as oil and natural gas are heavily dependent on imports. China's overseas energy import channels are very simple. Most of the oil imports come from the Middle East. While oil from the Middle East is almost entirely dependent on shipping, it must pass through the Straits of Malacca. In the event of turbulence in the international situation, once this sea route is cut off, China will face a very large threat to energy security. Therefore, China should open up new energy import channels, such as increasing energy trade cooperation with Russia and Central Asian countries, signing new oilfield development agreements and establishing transnational oil pipelines. These measures will greatly increase China's energy security, while making China's energy sources more diversified.

Of the major energy trading partners in China, Russia is the country that needs the most attention. First of all, Russia is one of the largest countries in the “One Belt and One Road” strategic region. China has expanded its world energy trade channels with the “One Belt and One Road” strategic fulcrum. The first thing to face is Russia’s energy trade cooperation. In recent years, China and Russia have signed long-term oil and natural gas trade contracts, laying a solid foundation for cooperation in energy trade between the two countries. China and Russia have always been friendly and inseparable strategic partners,

China and Russia. The energy cooperation will be the starting point for China's world energy trade.

Central Asian countries are the light of hope for China's energy trade. Due to political and economic reasons, the energy industry in Central Asian countries has not been properly developed. The proposal of the Belt and Road strategy and the establishment of the Asian Investment Bank have brought the gospel to these countries with energy endowments. With the Belt and Road as the cooperation platform, China has begun to gradually develop in-depth energy cooperation with these countries, help Central Asian countries to establish energy extraction infrastructure, and sign energy sales contracts with these countries, which will help China to open up a brand-new and stable Source of energy trade.

The friendly relations between African countries and China have existed for a long time. As early as the last century, China had invested a lot of money to help many African countries build infrastructure. Therefore, China's energy cooperation prospects in Africa can be said to be the most reliable. Due to historical reasons, a large number of high-quality oil fields in Africa have been controlled by oil companies in Western developed countries. Even Chinese energy companies have been rejected, which is very unfavorable to China's African energy strategy. The African countries also do not want their energy industry to be controlled by Western countries, so they hope to deepen energy cooperation with China. This shows that the energy cooperation between China and African countries is in line with the interests of both parties.

To sum up, there are still a lot of issues that cannot be ignored in China's energy trade. China must rely on the One Belt and One Road strategy and the mutually-beneficial and win-win diplomatic objectives to build an energy trading platform for peaceful, friendly, and common development throughout the world. China has abundant capital and energy needs. Once this huge energy trading platform is successfully established and continues to develop steadily, China's energy trade situation will be greatly improved. Not only China but also the world's energy exporting countries will also promote the infrastructure and economic development of these countries.

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