

Implementation
EXECUTIVE REPORT
report

"Study on High-Quality Development of the Petrochemical Industry in the 14th Five-Year Plan"

high quality development of petrochemical industry during the period of china's 14th FIVE-YEAR-PLAN

Petroleum and Chemical Industry Planning Institute
(PCIPi)

China National Petroleum & Chemical Planning Institute (NPCPI)

Research Project on Total Oil Consumption Control and Policy in China (Oil Control Research Project)

China is the world's second largest oil consumer and the largest oil importer. Oil is an important driving force for China's socio-economic development, but its production and consumption have caused serious damage to the ecological environment; at the same time, rising oil dependence on foreign countries threatens the security of China's energy supply. In order to address climate change and reduce environmental pollution, the Natural Resources Defense Council (NRDC) and Energy Foundation China (EF China), as the coordinators and in cooperation with more than 20 influential organizations, including domestic and foreign government research think tanks, scientific research institutes and industry associations, jointly launched the "China's Oil Consumption Control and Policy Research" project (referred to as the Oil Control Project) in January 2018, with the aim of improving China's energy supply and reducing environmental pollution. "The project aims to promote the sustainable development and utilization of oil resources in a safe, efficient, green and low-carbon manner, help China transcend the "oil era" and enter the new energy era at an early date, and contribute to the multiple goals of ensuring energy security, conserving resources, protecting the environment and public health, and responding to climate change. It also contributes to the goals of ensuring energy security, conserving resources, protecting the environment and public health, and responding to climate change.

This report is one of the sub-topics of the Oil Control Research Program, coordinated by the Petroleum and Chemical Industry Planning Institute.



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In July, 2008, it is a Grade A credentialed engineering consulting unit engaged in national petroleum and chemical industry planning research and engineering technology consulting; an investment consulting and assessment organization recognized by the National Development and Reform Commission, and a technical support unit of the National Development and Reform Commission, the Ministry of Industry and Information Technology, and the National Energy Administration. For more than 40 years, PICIP has prepared special studies on industry development planning and industrial policy research for the country, participated in the preparation of the National Petrochemical Industry Adjustment and Revitalization Plan, the Guidance Catalogue for Industrial Structure Adjustment, the Planning and Layout Program of Petrochemical Industry, and the Layout Program for Innovative Development of Modern Coal Chemical Industry, and completed thousands of consulting projects for government departments at all levels and domestic and foreign enterprises. It has been honored by relevant ministries and commissions, and has won the National Excellent Engineering Consulting Award, the Science and Technology Progress Award of China Petrochemical Federation and many other awards.

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14th Five-Year Plan

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"Study on High-Quality Development of the Petrochemical Industry in the 14th Five-Year Plan

HIGH-QUALITY DEVELOPMENT OF PETROCHEMICAL INDUSTRY
DURING THE PERIOD OF CHINA'S 14th FIVE-YEAR-PLAN

Implementation report

EXECUTIVE REPORT

Han Hongmei Wang Min Tian Guili Li Ye Xing Lei Yang Zheng Wang Yubo

Petroleum and Chemical Industry Planning Institute (PCIPi)
China National Petroleum & Chemical Planning Institute (NPCPI)

December 2020

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summaries

The research scope of this report includes the part of chemical raw materials and chemical products in the petrochemical production process, excluding the part of refined oil products; by focusing on the overall development of the petrochemical industry, the largest downstream plastics industry of petrochemicals, the direction of high-quality development of the petrochemical industry, and the paths and measures of the high-quality development of the petrochemical industry on the oil control work, it will provide the basis and rationale for the oil control target. The main research results include:

1. China's petrochemical industry continues to expand. In 2019, China's crude oil processing volume of 652 million tons, an increase of
The national ethylene output was 20.523 million tons (excluding coal/methanol ethylene), up 9.4% year-on-year. Demand for petrochemical products is becoming the biggest driver of incremental oil consumption, and is one of the key factors determining the trend of total oil consumption. According to conventional forecasts, under the baseline scenario, China's petrochemical industry will consume
Oil volumes will increase by about 158 million tons from 104 million tons in 2018 to 162 million tons by
This further increases to about 243 million tons in 2035.
2. China's petrochemical industry still faces a number of problems and challenges, including overcapacity, small and scattered refineries, unbalanced industrial structure, insufficient supply of ethylene and aromatic hydrocarbon feedstocks, and serious shortage of resource supply. China's petrochemical industry is large in scale and is one of the industries with a large total amount of pollutant emissions, and there is still room for further emission reductions.
3. The basic strategy for the high-quality development of China's petrochemical industry is to push forward the supply-side structural reform, vigorously implement the innovation-driven and green sustainable development strategy, and promote

the continuous optimization of the industrial structure, product structure, organizational structure, and layout structure through "large-scale, integration, cleanliness, high-end, and clustering" to improve the international competitiveness and sustainable development capability of the industry. It will promote the continuous optimization of industrial structure, product structure, organizational structure and layout structure through "large scale, integration, cleanliness, high-endization and clustering", enhance the international competitiveness of the industry and its ability of sustainable development, and push our country forward to become a strong petrochemical country.

4. Through high-quality development, China's petrochemical industry oil control general idea is to start from the "two sides of the five sides". "Both sides" refers to the demand side and the supply side. The "five sides" refer to the five aspects of "reduction, efficiency, substitution, structural optimization, and cleanliness". Through the oil control work, the high-quality development of the petrochemical industry will achieve significant oil reduction, and it is expected that the oil reduction will be 0.39 billion tons by 2025, and the oil reduction will reach 0.83 billion tons by 2035. Making The petrochemical industry reduces its crude oil consumption from 162 million tons in the baseline scenario to 123 million tons in 2025 and 2035, respectively. Crude oil consumption decreases from 243 million tons in the baseline scenario to 159 million tons.



Petrochemical industry high-quality development to reduce the effect of oil				
serial number	trails	step	Oil reduction in 2025 (tons)	Oil reduction in 2035 (tons)
-	demand side		1962	5143
	fuel reduction			
1	Reduction to increase utilization of waste rubber; increase utilization of waste synthetic fibers	Ban some plastics; increase plastic recycling rates; Rate.	1194	3374
2	Efficient substitute for	Increase the proportion of high-end products and reduce oil consumption per unit of output.	615	615
3		Development of non-petroleum-based (with emphasis on bio-based) material substitution	153	654
		Petrochemical synthetic materials		
4	structural superiority			
	chemicalization (e.g., in the form of a chemical fertilizer) exports	Moderate restructuring of imports and exports	500	
stupid (Beijing dialect)	Supply Side Oil Reduction		1895	3166
1	reduction	The refining industry adjusts its product mix to increase the proportion of downstream chemical products, so that fewer oils are consumed to obtain the same chemical products, thus reducing oil consumption	587	1003
2	efficiently	Through industrial restructuring, increase the degree of basing, integration and intensification of the oil refining and petrochemical industries, promote energy-saving technologies and the construction of intelligent factories, and reduce the energy consumption of oil refining, ethylene, aromatics and other production processes	302	604



3	substitute for	Petrochemical feedstock to promote diversification, reduce the proportion of petroleum-dependent chemical light oil; moderate imports of ethane, propane and other intermediate products as petrochemical feedstock for the production of olefins; moderate development of methanol to olefins, the use of imported methanol to produce olefin	906	1359
4	Cleaner fossilized processes 100	200	industries adopt advanced cleaning	
suriname San	Subtotal		3857	8309

5. In order to achieve oil control, this report makes the following policy recommendations:

(1) Demand-side measures

Strictly enforcing measures to ban and restrict plastic. Encourage the development of non-petroleum-based (bio-based) material products. Promote the application of alternative products, such as environmentally friendly cloth bags, paper bags and other non-plastic products and biodegradable shopping bags; encourage the development of high-end products; and restrict the packaging of plastic products.

(2) Supply-side measures

Strictly control oil refining capacity and eliminate outdated capacity. By 2025, oil refining capacity will be limited to 930 million tons/year. The focus will be on the elimination of refineries with a capacity of 5 million tons/year or less in the eastern region and the Bohai Rim, or the replacement of capacity by the same amount of reduction. In the implementation of capacity transfer, the principle of market-led and government-guided will be followed, and various measures will be taken to mobilize the enthusiasm of all stakeholders.

Control and standardize the layout of chemical parks, introduce norms and standards for the construction of chemical parks, promote the transfer and upgrading of production capacity in the petrochemical industry to chemical parks, and backward production capacity that cannot be transferred and upgraded should be eliminated locally.

Promoting energy conservation and emission reduction in the oil refining and petrochemical industries, strictly enforcing the relevant energy consumption, energy efficiency and emission standards, encouraging the application of energy-saving and green technology within the industry, and continuing to implement the "frontrunner" system and energy efficiency benchmarking actions in the petrochemical industry.

Promote the diversification of olefin feedstock, and develop ethane, propane to olefin and methanol to olefin moderately in the eastern region.

abstract

This report mainly studies the raw materials and products of the petrochemical industry, excluding refined oil. We focus on the analysis of the current situation of China's petrochemical industry, China's plastic industry, high-quality development strategy of the petrochemical industry and We focus on the analysis of the current situation of China's petrochemical industry, China's plastic industry, high-quality development strategy of the petrochemical industry and pathways to control the oil consumption for this industry. We focus on the analysis of the current situation of China's petrochemical industry, China's plastic industry, high-quality development strategy of the petrochemical industry and pathways to control the oil consumption for this industry.

1. China's petrochemical industry is expanding continually. In 2019, the amount of raw oil refined in China reached 652 million tons, which increased by 7.6% comparing with 2018. 7.6% comparing with 2018. The production of ethylene in China reached 20.5 million tons (excluding coal/methanol to ethylene), which increased by 9.4% comparing with 2018. The increase of petrochemical products demand has become the biggest driver for China's growing oil consumption and will impact the trend of oil consumption greatly. The increase of petrochemical products demand has become the biggest driver for China's growing oil consumption and will impact the trend of oil consumption greatly. Under the baseline scenario, it is predicted that the annual raw oil consumption in the petrochemical industry will increase from 104 million tons in 2018 to 162 million tons in 2025, and further increase to 243 million tons in 2035.
2. China's petrochemical industry is now facing some challenges such as overcapacity, small and scaled plant capacity, unbalanced industry structure, insufficient supply of raw materials of ethylene and aromatic hydrocarbon, insufficient supply of raw oil. China's petrochemical industry is now facing some challenges such as overcapacity, small and scattered plant capacity, unbalanced industry structure, insufficient supply of raw materials of ethylene and aromatic hydrocarbon, insufficient supply of raw oil. China's petrochemical industry emits large number of pollutants which should be further reduced.
3. The basic strategy of high-quality development of China's petrochemical industry is the supply-side structure reform and realizing innovative and green development.



The basic strategy of high-quality development of China's petrochemical industry is the supply-side structure reform and realizing innovative and green development. Industry structure, product structure, organization structure and layout structure needs to be optimized by "large-scale, integrated, clean, high-end and clustered" development, which will enhance the international competitiveness and sustainable development capabilities of the industry and help it become capabilities of the industry and help it become stronger.

4. By means of high-quality development, the overall way of achieving the goal of China's oil cap is based on "two sides" and "five aspects". The "two sides" refer to both the demand and supply sides. The "two sides" refer to both the demand and supply sides. The "five aspects" refer to The "five aspects" refer to "reduction, high-level

High-quality development of China's petrochemical industry will lead obvious oil reduction, which results in a reduction of 39 million tons of oil. High-quality development of China's petrochemical industry will lead obvious oil reduction, which results in a reduction of 39 million tons oil consumption in 2025 and a reduction of 83 million tons oil consumption in 2035. High-quality development of China's petrochemical industry will lead obvious oil reduction, which results in a reduction of 39 million tons oil consumption in 2025 and a reduction of 83 million tons oil consumption in 2035. The total oil consumption by China's petrochemical industry is expected to decrease to 123 million tons in 2025, compared with 162 million tons in the BAU scenario, and decrease to 159 million tons in 2035, compared with 243 million tons in the BAU scenario. China's petrochemical industry is expected to decrease to 123 million tons in 2025, compared with 162 million tons in the BAU scenario, and decrease to 159 million tons in 2035, compared with 243 million tons in the BAU scenario.

Effect of oil reduction by high-quality development of China's petrochemical industry

Sequence	Pathway	Measures	Oil reduction in 2025 (kt)	Oil reduction in 2035 (kt)
1 Demand side			19,620	51,430
1)	Reduction	Usage prohibition of some kinds of plastics; Increasing the recycling rate of waste plastics; Increasing the recycling rate of waste rubbers; Increasing the recycling rate of synthetic fibres.	11,940	33,740
2)	High-efficiency	Increasing the share of high-value products to reduce oil consumption per output value.	6,150	6,150
3)	Substitution	Replacing petro-chemical materials by biological materials	1,530	6,540
4)	optimization	Structural Adjustment of import and export structure	0	5,000
2	Supply side		18,950	31,660
1)	Reduction	The oil refining industry adjusts the product structure, increases the proportion of downstream chemical products, and consumes less oil to obtain the same chemical products, thereby reducing oil consumption. The	5,870	10,030

		oil refining industry adjusts the product structure, increases the proportion of downstream chemical products, and consumes less oil to obtain the		
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2)	High-efficiency	Through industrial restructuring, increase the base, integration and intensification of the refining and petrochemical industries, promote energy-saving technologies and the construction of smart chemical plants, and reduce energy consumption in the production process of oil refining, ethylene, ethylene, and petrochemical industries. saving technologies and the construction of smart chemical plants, and reduce energy consumption in the production process of oil refining, ethylene, and aromatics. and aromatics	3,020	6,040
3)	Substitution	Raw material diversification of petro-chemical products, reducing the share of naphtha; Importing ethane, propane in producing olefins; Properly develop methanol-to-olefins and use imported methanol to produce olefins	9,060	13,590
4)	Cleanliness	Applying advanced and clean process	1,000	2,000
4	Total		38,570	83,090

5. Policy recommendations.

1) Demand side

Strictly implement the rule of plastics prohibition or restriction. Encouraging the development of biological materials products. Spreading substitute products including cotton bags, paper bags and degradable bags. Encouraging the development of high-value products. Encouraging the development of high-value products.

2) Supply side



Strictly control the refining capacity and eliminate some backward capacity. Restricting the refining capacity to 930 million tons per year by 2025. Focusing on the elimination or replacement of refining plants with a capacity no more than 5 million tons per year in the eastern region and surrounding Bohai sea area. When implementing capacity transfer, follow the principles of market leadership and government guidance, and mobilize the enthusiasm of various stakeholders through various measures. When implementing capacity transfer, follow the principles of market leadership and government guidance, and mobilize the enthusiasm of various stakeholders through various measures.

Better manage the layout of chemical parks and encourage petrochemical plants to move to chemical parks. Outdated production capacity that cannot be transferred and upgraded should be eliminated locally. Outdated production capacity that cannot be transferred and upgraded should be eliminated locally.

Promoting energy-saving and pollutants reduction of refining and petro-chemical plants. Strictly implement the energy consumption, energy efficiency and pollutants emission standards. Strictly implement the energy consumption, energy efficiency and pollutants emission standards. Encouraging applying energy-saving and green technologies. Encouraging applying energy-saving and green technologies.

Promoting raw material diversification of olefins. Properly producing olefins from ethane, propane and methanol in the eastern region.

1

It is important to study
oil control in the



The study of oil control in the petrochemical industry has the following implications:

1) Reducing the environmental impact of the petrochemical industry. The petrochemical industry has an impact on the environment in its production operations, and its emissions of pollutants such as chemical oxygen demand, ammonia nitrogen, total nitrogen, total phosphorus, and volatile organic compounds (VOCs) rank among the top three of all industrial source emissions. The petrochemical industry is also a source of carbon emissions. In September 2020, General Secretary Xi proposed that China will strive to

Peak carbon dioxide emissions by 2030 and strive to achieve carbon neutrality by 2060. Studying oil control measures in the petrochemical industry and promoting early peaking of oil consumption will be of great significance in reducing the environmental impact of the petrochemical industry and helping China to achieve the goals of carbon peaking and carbon neutrality.

2) It is conducive to ecological protection and public health. With the improvement of living standards, China's consumption of plastics has been increasing, and the consequent "white pollution" of waste plastics has become increasingly serious. The study of ways to reduce plastic consumption through oil control measures in the petrochemical industry is of great significance to ecological protection and public health.

3) Guaranteeing China's energy security. China has become the world's largest oil importer and the second largest oil consumer. Due to resource endowment limitations, most of China's oil consumption comes from imports, and China's oil import dependence has reached 72.6% in 2019. Studying oil control measures in the petrochemical industry and urging the petrochemical industry to economize on oil consumption will also have a positive significance in safeguarding China's energy security.

This study focuses on analyzing: 1) the overall development of the petrochemical industry; 2) the direction of the largest downstream petrochemical plastics industry; 3) the direction of the high-quality development of the petrochemical industry; and 4) the path and measures of the high-quality development of the petrochemical industry for oil control work.

The basis of this study includes current national industrial policies and public data, and this study will provide a foundation and basis for oil control objectives.

According to.

2

Overall development of
China's petrochemical
industry and supply and



2.1 Overall development

In 2019, the value added of China's petroleum and chemical industry increased by 4.8% year-on-year; operating income was 12.27 trillion yuan, up 1.3% year-on-year; total profit was 668.37 billion yuan, down 14.9% year-on-year; total import and export amounted to 722.21 billion U.S. dollars, down 2.8% year-on-year; the total crude oil and natural gas output was 347 million tons (oil equivalent), up 4.7% year-on-year; and total output of major chemicals increased by about 4.6% year-on-year. Total output of crude oil and natural gas 347 million tons (oil equivalent), up 4.7% year-on-year; total output of major chemicals, up 4.6% year-on-year; national crude oil production of 191 million tons in 2019, up 0.8% year-on-year; national crude oil processing capacity of 652 million tons, up 7.6% year-on-year; output of refined oil products (gasoline, kerosene and diesel fuel, combined, the same hereinafter) 360 million tons, up 0.2% year-on-year. In 2019, the national ethylene output was 20.523 million tons (excluding coal/methanol ethylene), up 9.4% year-on-year; pure benzene output was 8.618 million tons, down 2.1% year-on-year; synthetic resins were 95.744 million tons, up 9.3% year-on-year; and synthetic fibre monomers (polymerized) were 74.059 million tons, up 9.9% year-on-year.

2.2 Key petrochemicals

Demand for petrochemical products is becoming the biggest driver of incremental oil consumption and is one of the key influencing factors in determining the trend of total oil consumption. Synthetic resins (plastics), synthetic rubber and synthetic fibers and other three synthetic materials are the most dominant and important downstream petrochemical products. Organic raw materials represented by "triene and triphenyl" (ethylene, propylene, butadiene, benzene, toluene and xylene) are the main intermediate products in the petrochemical industry, and are used as raw materials for the production of synthetic resins (plastics), synthetic rubber and synthetic fibers.

China's synthetic resins and synthetic rubbers generally show insufficient supply and

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demand, synthetic fibers supply exceeds demand and exports significantly. In 2019, the Petrochemical Industry in the
China's synthetic resin consumption will be about 123 million tons, synthetic fiber 14th Five-Year Plan
consumption will be about 83 million tons, and the main synthetic
Rubber consumption was 4.98 million tons.

At present, China's basic organic chemical raw materials such as triene and triphenyl are still characterized by oversupply, especially paraxylene, with a self-sufficiency rate of only 49.5%. According to the statistics of Petroleum and Chemical Industry Planning Institute, the equivalent consumption of ethylene and propylene in China in 2019 will be about 55 million tons and 42 million tons respectively, and the actual self-sufficiency rate of ethylene and propylene will be 49.3% and 78.9% respectively. Ethylene is in serious short supply. Compared with ethylene and paraxylene, the contradiction between supply and demand of other organic raw materials is relatively moderate, with the self-sufficiency rate above 80%, and the domestic production and a small amount of import can basically meet the demand.



2.3 Problems and challenges

1) the contradiction of overcapacity cannot be ignored; 2) the status quo of small and scattered refineries is still relatively prominent; 3) the industrial structure is unbalanced, and the ratio of oil and chemical is out of proportion; 4) the irrational layout has led to the dislocation of production capacity, raw materials and consumption areas; 5) the supply of ethylene and aromatics raw materials is insufficient, and the rate of integration is relatively low; and 6) the supply of domestic petroleum resources is seriously insufficient.

2.4 environmental impact

China's petrochemical industry is huge and is one of the pillar industries of the national economy, and at the same time, it is also one of the industries with a large total amount of pollutant emissions. In terms of the overall pollutant emissions of the industry, according to the Second National Pollution Source Census Bulletin jointly issued by the Ministry of Ecology and Environment, the National Bureau of Statistics and the Ministry of Agriculture and Rural Development in 2020, the chemical oxygen demand emissions of the petrochemical and chemical industry

11.92 million tons, ranked second in industrial source emissions, accounting for 13.1% of all industrial source emissions; ammonia nitrogen emissions of 10,900 tons, ranked first in industrial source emissions, accounting for 24.5% of all industrial source emissions; total nitrogen emissions of 38,400 tons, ranked first in industrial source emissions, accounting for 24.7% of all industrial source emissions; total phosphorus emissions of 948.79 tons, ranked second in industrial source emissions, accounting for 12.0% of all industrial source emissions; volatile organic matter emissions of 1,075,700 tons, ranked first in industrial source emissions, accounting for 22.3% of all industrial source emissions. Total phosphorus emissions 948.79 tons, ranked second in industrial emissions, accounting for 12.0% of all industrial emissions; volatile organic compounds emissions 1,075,700 tons, ranked first in industrial emissions, accounting for 22.3% of all industrial emissions. There is room for further emission

2.5 demand forecast

With the development of China's petrochemical industry, large-scale bases continue to be built, the growth of demand for key petrochemical products will diverge. Demand for the three major synthetic materials will also grow, with new material products growing faster than general-purpose products. Due to the rapid increase in refining and petrochemical production capacity, organic feedstock production and apparent demand growth is faster than the downstream three major synthetic materials, basic organic feedstock production and apparent demand growth is faster than other organic feedstocks. The following is a forecast of the supply and demand of China's petrochemical industry and key petrochemical products based on the current actual demand and forecasted demand growth rates, and a forecast of the supply and demand of basic organic chemical feedstocks ("trienes and triphenyls") based on the product supply and demand forecasts, which serves as the basis for the forecast of the amount of petroleum consumed by China's petrochemical industry. This forecast was made without taking special measures to control oil consumption, i.e., based on the basic organic chemical feedstock ("triene trisbenzene").



Quasi-scenario projections.

(1) Plastics and synthetic resins

In Annex II, China's consumption of plastics is projected with the median scenario setting the growth rate of apparent consumption of plastics in line with the actual GDP growth rate, the low scenario setting the growth rate of apparent consumption of plastics 1 percentage point lower than the actual GDP growth rate, and the high scenario setting the growth rate of apparent consumption of plastics 1 percentage point higher than the actual GDP growth rate. Under the three scenarios, China's per capita consumption of plastics by 2035 is 187 kg/person in the median, 187 kg/person in the low scenario, and 187 kg/person in the high scenario.

159 kg/capita and a high of 219 kg/capita. According to the current per capita consumption of plastics in developed countries ranges from 100 to 140 kg.

/ Given the current situation, this study believes that it is more likely that China's per capita consumption of plastics will reach a low level of 159 kg/capita by 2035, and the baseline demand forecast for plastics in this study is based on the low scenario, thus obtaining a forecast of the balance between supply and demand for plastics in China. On this basis, the forecast of China's synthetic resin demand can be obtained based on the plastics demand scenario. Based on this data, and assuming that the import and export volume of synthetic resins remains unchanged until 2035, the supply/demand balance forecast for synthetic resins in China can be obtained, as shown in the table below:

Table 2-1 Forecast of supply/demand balance of synthetic resin in China

serial number	offerings	unit (of meas ure)	2018	2025	2030	2035	note
1	Consumption Side - Synthetic Resins			million tons	10929	14608	17428
	total consumption						19950
1.1	Plastics Consumption Synthetic Resin Tons				10424	14024	Share of total consumpt ion of synthetic resins is
	16731	19152					

about 96%.

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1.2	Other areas of consumption synthesis Resin	million tons	505	584	697	798	
2	Supply side - total supply of synthetic resins	tons	10929	14608	17428	19950	
2.1	Synthetic resin production	tons	8587	12266	15086	17608	
2.1.1	Production of five major general-purpose resins	tons	6192	8831	10862	12678	
2.1.2	Production of other resins	tons	2395	3434	4224	4930	
2.2	Imports of synthetic resins	tons	3600	3600	3600	3600	
2.3	Exports of synthetic resins	tons	1258	1258	1258	1258	

1. Source of data in 2018: National Bureau of Statistics, Zhuochuang data; 2. Setting the import and export volume of synthetic resin to remain unchanged until 2035



According to the forecast, China's synthetic resin demand will reach 146 million tons by 2025 and 2035, respectively.

This represents an increase of 33.9 per cent and 83.5 per cent, respectively, from the current level of 109 million tons.

(2) Synthetic rubber

China has become the largest producer of synthetic rubber, according to the National Bureau of Statistics, China's synthetic rubber production in 2018 was 5,590,000 tons, a decrease of 3.4% compared with the previous year. In 2018, China's synthetic rubber imports totaled 4,411,800 tons, with the number of imports increasing by 1.10% year-on-year, and the total synthetic rubber exports totaled 303,400 tons, with the number of exports increasing by 16.04% year-on-year. Overall, the structural contradiction between the excess supply and large imports of China's synthetic rubber industry is more prominent.

About 60% of China's synthetic rubber is used in the production of tires, while the rest is used in a variety of fields such as shoe-making, adhesive tapes, hoses and so on.

Looking ahead, although China's auto sales in 2018 were about 27.8 million units, compared with 28.8 million units in 2017, the number of vehicles sold in China is expected to increase by about 10 percent. However, as there is still a big gap between China's per capita car ownership and that of developed countries, the number of cars has decreased by 1 million.

Sales are expected to remain high and slow until 2035, leading to increased demand for tires. Projected 2025 China's demand for synthetic rubber for tires will grow at an average annual rate of about 1.5% until 2030, and then at an average annual rate of about 1% until 2035. The application of synthetic rubber in other fields will grow slightly faster than that of tires due to the development and consumption of specialty rubbers, and the average annual growth rate of synthetic rubber consumption in other fields is estimated to be about 2% until 2030, and then decrease to 1.5% until 2035. The supply/demand balance of synthetic rubber in China is forecast as shown in the table below:

Table 2-2 Forecast of supply/demand balance of synthetic rubber in China

serial number	offerings	unit (of measure)	2018	2025	2030	2035	note
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Consumption side - Synthetic rubber million tons

1 rubber consumption

970 1092 1171 1244

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1.1	Tons of tires	582	646	679	714	
1.2	Other tons	388	446	492	530	Various rubber products including shoes, hoses, tapes, etc.
2	Supply Side - Synthetic Rubber Supply	tons	970	1092	1171	1244
2.1	Synthetic rubber production	tons	559	681	760	833
2.2	Synthetic rubber imports	tons	441	441	441	441
2.3	Exports of synthetic rubber	tons	30	30	30	30

1. 2018 data source: National Bureau of Statistics, Zhuochuang Data, China Rubber Industry Association; 2. Setting the import and export volume of synthetic rubber to remain unchanged until 2035

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							production.
2.2	Synthetic fiber imports	tons	83	83	83	83	
2.3	Synthetic fiber exports	tons	422	422	422	422	

1. Data source: National Bureau of Statistics, Zhuochuang data; 2. Setting the import and export volume of synthetic fibers to remain unchanged until 2035.

(4) Basic organic raw materials

The three major synthetic materials are the most important downstream consumer users of basic organic raw materials. Supply and demand balance of basic organic raw materials in China



The forecast is shown in the table below. The projections are based on the following scenarios:

- 1) The proportion of each basic organic feedstock consumed in each downstream sector remains essentially unchanged;
- 2) Based on the projected growth in different downstream consumption areas, the amount of basic organic raw materials consumed in that downstream area is calculated, and the projected consumption of each basic organic raw material is obtained in total;
- 3) Based on the projected consumption of basic organic raw materials, the domestic production of the basic organic raw materials is obtained by setting the import and export volume of the basic organic raw materials unchanged.

A significant increase in China's production of basic organic raw materials can be seen due to the rising demand for the three main synthetic materials, especially synthetic resins. For example, ethylene production in 2025 and 2035 is expected to reach 1.43 times the 2018 level, and 2.03 times.

Table 2-4 Forecast of Supply and Demand Balance of Basic Organic Raw Materials in China

serial number	offerings	unit (of measure)	2018	2025	2030	2035	note
1	Consumer side - base Organic raw materials consumption						
1.1	vinyl	tons	2619	3630	4384	5062	
1.1.1	synthetic resin	tons	1938	2768	3405	3974	
1.1.2	synthetic rubber	tons	30	37	42	46	
1.1.3	synthetic fiber	tons	340	387	406	425	

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1.1.4	Other areas	tons	310	437	532	618
1.2	propylene	tons	3426	4843	5917	6879
1.2.1	synthetic resin	tons	2398	3426	4213	4918
1.2.2	synthetic rubber	tons	12	15	17	18
1.2.3	synthetic fiber	tons	100	114	119	125
1.2.4	Other areas	tons	916	1289	1568	1818
1.3	butadiene C4H6	tons	374	477	552	618
1.3.1	synthetic resin	tons	67	95	117	137
1.3.2	synthetic rubber	tons	288	355	402	443
1.3.3	synthetic fiber	tons				
1.3.4	Other areas	tons	19	27	33	39



1.4	benzene	tons	1435	1984	2391	2757	
1.4.1	synthetic resin	tons	748	1069	1314	1534	
1.4.2	Synthetic rubber	tons	20	25	28	31	
1.4.3	Synthetic Fiber	tons	178	203	212	223	
1.4.4	Other areas	tons	489	687	836	970	
1.5	Toluene	tons	316	446	543	631	Deducting the amount spent on raw Benzene- and paraxylene-producing fraction
1.5.1	synthetic resin	tons	44	63	78	91	
1.5.2	Synthetic rubber	tons					
1.5.3	Synthetic Fiber	tons					
1.5.4	Other areas	tons	272	383	466	540	
1.6	paraxylene	tons	2614	3252	3656	4031	
1.6.1	synthetic resin	tons	836	1195	1470	1715	
1.6.2	Synthetic rubber	tons					
1.6.3	Synthetic Fiber	tons	1647	1873	1963	2057	
1.6.4	Other areas	tons	131	184	224	259	
2	Supply side - availability of basic organic						



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	raw materials						
2.1	vinyl	tons	2619	3630	4384	5062	
2.1.1	yield	tons	2372	3383	4137	4815	
2.1.2	import volume	tons	247	247	247	247	
2.1.3	export volume	tons	0	0	0	0	
2.2	propylene	tons	3426	4843	5917	6879	
2.2.1	yield	tons	3140	4557	5631	6593	
2.2.2	import volume	tons	286	286	286	286	
2.2.3	export volume	tons	0	0	0	0	
2.3	butadiene C ₄ H ₆	tons	374	477	552	618	
2.3.1	yield	tons	346	449	524	590	
2.3.2	import volume	tons	30	30	30	30	
2.3.3	export volume	tons	2	2	2	2	



2.4	benzene	tons	1435	1984	2391	2757	
2.4.1	yield	tons	1182	1731	2138	2504	
2.4.2	import volume	tons	257	257	257	257	
2.4.3	export volume	tons	4	4	4	4	
2.5	toluene C ₆ H ₅ CH ₃	tons	316	446	543	631	
2.5.1	yield	tons	285	415	512	600	
2.5.2	import volume	tons	33	33	33	33	
2.5.3	export volume	tons	2	2	2	2	
2.6	paraxylene	tons	2613	3252	3656	4031	
2.6.1	yield	tons	1023	1662	2066	2441	
2.6.2	import volume	tons	1590	1590	1590	1590	
2.6.3	export volume	tons	0	0	0	0	

(5) Forecast of oil consumption in the petrochemical industry and key petrochemical products

According to the industry chain analysis of the petrochemical industry, the focus of petrochemical oil use is on the use of organic feedstock, because the production of downstream synthetic materials and other chemicals requires the consumption of organic feedstock, of which the basic organic feedstock is the raw material for other organic feedstock. Therefore, the forecast of petrochemical oil consumption is essentially based on the forecast of domestic production of basic organic raw materials ("triene" and "triphenyl") to petrochemical oil consumption forecast. The current situation of oil consumption in the petrochemical industry is shown in the table below:

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Table 2-5 Analysis of oil consumption in China's petrochemical
industry

serial number	sports event	unit (of measure)	numerical value	note
1	Total basic organic raw materials yield	tons	8302	
1.1	Production of petroleum-based products	tons	6863	
1.1.1	vinyl	tons	1841	
1.1.2	propylene	tons	2540	
1.1.3	butadiene C4H6	tons	346	
1.1.4	benzene	tons	828	



1.1.5	toluene C6H5CH3	tons	285	
1.1.6	paraxylene	tons	1023	
1.2	Non-petroleum-based products measure word	tons	1439	
1.2.1	vinyl	tons	531	
1.2.2	propylene	tons	554	
1.2.3	benzene	tons	354	From coked benzene processing
2	Consumption of raw materials			
2.1	Petroleum-based raw materials	tons	9849	
2.1.1	Chemical light oil	tons	7200	The total consumption of chemical light oils is 72 million tons, all of which are used in the chemical industry.
2.1.2	Light hydrocarbons (mainly (LPG)	tons	2235	The total consumption of light hydrocarbons was 55.87 million tonnes, of which Of these, 40% are used in the chemical industry.
2.1.3	heavy oil	tons	414	Total consumption of heavy oil (i.e., fuel oil) is 24.34 million tons, of which 17% is used in the chemical industry.
2.2	Non-petroleum- based raw materials			
2.2.1	wood spirit	tons	3492	Consumption of methanol for all methanol-to-olefins (including methanol consumption for coal- to-olefin intermediate products)
2.2.2	Coked crude benzene	tons	438	Coking by-products
3	Petroleum-based raw materials Oil	million tons	10367	Consideration 5% Processing consumption
4	Combined oil discount factor		1.51	Volume of petroleum-based raw materials / Volume of petroleum-based products from



				basic organic raw materials
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As shown in the above table, this study considers the basic organic chemical raw materials of "triene and triphenyl" as a whole, and examines the petroleum raw materials required for the production of a unit of product in accordance with the actual situation of the industry in 2018.China's "triene and triphenyl" raw materials in 2018

The total production of basic organic chemical raw materials of "alkylenetriphenylene" was 83.02 million tons, of which the production of petroleum-based products using petroleum raw materials amounted to 1.5 million tons. The output of non-petroleum-based products was 14.39 million tons, accounting for 82.7% of the total production.

17.3%. Petroleum-based products consume a total of 98.49 million tons of petroleum-based raw materials, taking into account about 5 per cent of consumption in petroleum processing.

Petroleum-based feedstock oil discount is 103.67 million tons, that is, in 2018 China's petrochemical industry consumed 103.67 million tons of oil. In this case, the basic organic chemical raw materials comprehensive oil discount coefficient (petroleum-based raw materials / basic organic raw materials in the output of petroleum-based products) can be calculated as 1.51.

The baseline scenario oil use forecast for China's petrochemical industry is set based on the following scenarios:



(1) before 2035, the basic organic chemical raw materials comprehensive oil refraction coefficient (petroleum-based raw materials / basic organic raw materials in the production of petroleum-based products) is constant at 1.51;

(2) The incremental demand for basic organic chemical raw materials before 2035 will all be met by petroleum, i.e., the current production of basic organic chemical raw materials of non-petroleum-based routes will remain unchanged.

Based on the results of the basic organic chemical feedstock production forecast and the above scenario setting, the oil consumption forecast for the petrochemical industry in the baseline scenario is obtained as shown in the table below.

Table 2-6 Petrochemical Sector Oil Consumption Forecasts in the Baseline Scenario

serial number	offerings	2018	2025	2030	2035	note
1	Basic organic feedstock production					
1.1	Ethylene production	2372	3383	4137	4815	
1.2	Propylene production	3140	4557	5631	6593	
1.3	Butadiene production	346	449	524	590	
1.4	benzene production	1182	1731	2138	2504	
1.5	Toluene production	316	446	543	631	
1.6	Paraxylene production	1023	1662	2066	2441	
2	Incremental production of basic organic raw materials (based on 2018)	0	3848	6661	9194	
2.1	Incremental ethylene production	0	1011	1765	2443	
2.2	Incremental propylene production	0	1417	2491	3453	
2.3	Incremental butadiene production	0	103	178	244	
2.4	Incremental benzene	0	549	956	1322	

	production					
2.5	Incremental toluene production	0	130	227	315	
2.6	Incremental paraxylene production	0	639	1043	1418	
3	Combined oil discount factor		1.51	1.51	1.51	1.51
4	Incremental oil consumption	0	5813	10062	13889	



According to the baseline scenario, China's petrochemical industry will consume 58 million tons more oil by 2025 than in 2018

The number of tons of water is expected to increase to around 162 million tons by 2035, and further to around 243 million tons by 2035.

2.6 Analysis of the Impact of the New Crown Pneumonia Epidemic and Lower Oil Prices on China's Petrochemical Industry

(1) Impact on the refining industry

(1) Epidemic impact of refined oil consumption fell sharply, refining start-up fell sharply, but after the resumption of work and production of refined oil market will show an uptrend

Affected by the epidemic, domestic consumption of refined oil products dropped sharply, logistics and transportation were seriously hindered, and refineries were under great pressure to sell oil products. The weak consumption of oil products led to the rise of refined oil product inventory in refining enterprises, and the domestic refined oil product inventory is now at a historically high level, and the inventory digestion is very slow. The operating rate of main refineries dropped by more than 10%, while local refineries, due to the lack of sales terminals, were under great pressure to sell oil products.

The gold chain is relatively tense, the inventory is small, and the work rate has dropped to about 40%. However, after the related industries resume work one after another, the market will go through a digestion period, and the domestic sales of refined oil products will face downward pressure in the first quarter, but with the gradual recovery of private cars, logistics and public transportation in the late stage of the epidemic, the market of refined oil products will generally show an upward trend.

(2) Lower oil prices can mitigate the negative impact of the epidemic on the oil refining industry to a certain extent

On the one hand, the rapid decline in oil prices led to a rapid decline in the price of refined oil products, due to the majority of refinery inventories at historically high levels, will force refineries to suffer great direct economic losses; on the other hand, the cost of crude oil accounted for more than 90% of the total cost of refineries, refineries in the digestion of the previous high-priced inventories, the cost of raw material purchases will be significantly reduced, a greater good for the refining industry, but this is also largely affected by the However, this is largely influenced by whether the low level of crude oil price can be sustained and whether the consumption of refined oil products market can recover quickly.

Overall, with the epidemic under control, transportation, engineering construction and other industries gradually resumed production, the demand for refined oil products will gradually improve, if the international oil price can be maintained at below 40 U.S. dollars / barrel or slightly stabilized and rebounded, profit from the sale of refined oil products is expected to grow. However, in the long run, due to the large oil inventory pressure in the early stage, coupled with the obvious domestic refining overcapacity, even if the normal demand for refined oil consumption will be restored, it will still be facing increasingly fierce competition, which will further reduce the overall profit level of oil refining enterprises.

(2) Impact on the petrochemical industry



1) Impact on ethylene and downstream synthetic materials

The cost of petrochemical midstream and downstream industries is closely related to crude oil prices. Generally speaking, the cost of raw materials in the production of organic raw materials and synthetic materials account for a large proportion of the cost of basic organic raw materials such as olefins, aromatics and other raw material costs accounted for more than 80% of the cost of production. As organic raw materials and general synthetic materials production enterprises are mostly integrated production enterprises, the decline in crude oil prices will make olefins, aromatics, represented by the cost of basic organic raw materials fell significantly, and further drive the olefin downstream industry production costs down, so that the entire market cost center of gravity downward. According to estimates, crude oil prices fell 10 U.S. dollars / barrel, olefin costs fell about 800 yuan / ton. Since the outbreak of the epidemic, the price of crude oil has fallen more than 20 U.S. dollars / barrel, which is estimated that the cost of olefins in the oil route fell by 1,500-2,000 yuan / ton.

In the medium to long term, demand for olefins is mainly influenced by ☒ the performance of the economy. Olefins and their downstream derivatives are widely used in various industries of the national economy, and their demand is directly related to ☒ the development of the economy. At present, the impact of the epidemic on the global economy is gradually appearing, if the epidemic triggered a worldwide recession or even economic crisis, it will largely affect the market demand for olefins and their downstream products. As the world is currently in the olefin production capacity expansion cycle, the epidemic led to olefin demand growth is less than expected will result in the olefin industry as a whole oversupply, profit levels decline, industry competition is more intense.

2) Impact on the organic raw materials industry

Styrene, ethylene glycol, acrylonitrile, propylene oxide, methanol, acetic acid and other organic raw materials by downstream demand, especially styrene downstream of EPS and other applications in packaging, building materials, ethylene glycol used in chemical fiber textile and apparel and other fields, as well as vinyl acetate, acetic acid esters, and other products are used in adhesives, coatings and other fields, most of the downstream industry labor-intensive by the impact of the epidemic resumption of work late, the demand declined. Enterprise inventory rose, product prices fell sharply.

3) Impact on the aromatics industry

Affected by the epidemic, the domestic demand for oil and other products during the Spring Festival dropped significantly, some refineries have higher oil stocks, some enterprises reduce production and load, PX unit start-up load has been affected to

some extent. Affected by the sharp decline in crude oil prices, PX and naphtha price differential has expanded, the short-term PX processing profit has improved, but by the pressure of refined oil sales and PX downstream demand recovery is slow, the short-term PX supply overall will remain stable. If domestic refined oil demand recovers slowly in the future, some domestic PX producers without refined oil sales network will face greater pressure to reduce production and load. As the downstream polyester and chemical fiber industry demand for PX continues to improve slowly, the profit margin of PX is expected to be further compressed.

(3) Low oil prices are generally favorable for China's petrochemical industry

(1) Contribute to the reduction of China's crude oil procurement costs

As one of the world's largest importers of crude oil, lower crude oil prices can reduce foreign exchange expenses for China. Each barrel of oil can save 3.7 billion U.S. dollars for every 1 U.S. dollar reduction. the average price of imported crude oil in 2019 is 65 U.S. dollars / barrel, if the oil import volume in 2020 is the same as in 2019, according to the current oil price of 35 U.S. dollars / barrel, the foreign exchange can be saved for the whole year 111 billion U.S. dollars. As a net oil importer, low oil prices are generally favorable to China's petrochemical industry and even national economic development.



(2) Drive down the cost of petrochemical midstream and downstream products and promote the transformation and upgrading of the industry

Generally speaking, the cost of raw materials in organic raw materials and synthetic materials production costs account for a large proportion of the decline in crude oil prices will make olefins, aromatics, represented by the cost of basic organic raw materials fell significantly, and further drive its downstream organic raw materials and synthetic materials production costs, so that the entire market cost center of gravity downward.

Combining upstream and downstream factors, the impact of the epidemic will intensify competition in the petrochemical midstream and downstream industries. Large integrated enterprises can make full use of the profit margin brought by the decline in oil prices and utilize costs to cope with market competition. Differentiated enterprises have high customer stickiness, their products have low price demand elasticity, are not much affected by the decline in market demand, and are able to obtain excess profits over the market average. Enterprises with core technology can also flexibly adjust their product programs according to changes in market demand (e.g., the demand for high-melting polypropylene specialties for meltblown fabrics increased dramatically during the current epidemic), and seize market opportunities in a timely manner. In the epidemic suppressed demand, the decline in oil prices affect the center of gravity of the cost of the market environment, integration, scale, differentiation, mastery of the core technology of the petrochemical midstream and downstream enterprises will gain a more obvious competitive advantage, small scale, low degree of integration, can only produce general-purpose products in the petrochemical midstream and downstream enterprises will be eliminated by the market risk. Multiple factors are superimposed, the impact of the epidemic will accelerate the integration of petrochemical midstream and downstream industries and the transformation and upgrading of development.

3

China's petrochemical
industry's high-quality





3.1 High-quality development strategies and pathways

The basic strategies for the high-quality development of China's petrochemical industry are: to take "removing production capacity and making up for short boards" as the core, and "adjusting structure and promoting upgrading" as the main line, to promote the supply-side structural reform to enter a new stage; to vigorously implement the strategy of innovation-driven and green sustainable development. Promote the continuous optimization of industrial structure, product structure, organizational structure and layout structure through "large-scale, integration, cleanliness, high-end and clustering"; in accordance with the principle of "focusing on quality and lightening quantity", strive to enhance the international competitiveness and sustainable development of the industry. In accordance with the principle of "quality over quantity", we will strive to enhance the international competitiveness and sustainable development capability of the industry, and promote China's progress towards a strong petrochemical industry.

The key points for the high-quality development of China's petrochemical industry are: strict control of incremental growth, optimization of stock, integration and aggregation, and reduction of oil and increase of chemistry. The development path is: relying on large refineries, optimizing resource allocation, and enhancing the level of integration; integrating small and medium-sized refineries, expanding resource utilization, and integrating and characterizing development; implementing imported/domestic ethane/light hydrocarbon resources, light hydrocarbon cracking and refining aggregation, and basing layout to achieve product diversification and high-end development; optimizing the cost of aromatics feedstock, and upstream and downstream integration to enhance the competitiveness of the whole industry chain; Enhance the quality of downstream industry and realize high-end transformation.

3.2 Forecast of Oil Consumption in China's Petrochemical Industry

(1) Overview

Petrochemical industry chain is long, product variety, petrochemical industry, oil control of the general idea from the "two sides of the five sides" to start, seize the key to implement:

"Both sides" refers to both the demand side and the supply side. Synthetic resins (plastics), synthetic fibers and synthetic rubber and other three synthetic materials are the most important direction and support for the petrochemical industry products. Therefore, the focus of the petrochemical industry chain on the demand side is the demand for the three major synthetic materials. Reducing the demand for the three major synthetic materials can significantly reduce the demand for oil. The supply side refers to the production process from oil refining to organic feedstock and synthetic materials. Measures to improve supply efficiency from the supply side, reduce process energy consumption, improve process energy efficiency, and develop non-oil feedstock routes and processes all contribute to oil control.

The "five facets" refer to the five aspects of "reduction, efficiency, substitution, structural optimization and cleanliness". Reduction refers to the effect of reducing upstream production through adjusting the industrial structure, lowering downstream consumption, improving recycling and other measures, thereby promoting a reduction in oil consumption. High efficiency refers to promoting the reduction of oil consumption by improving product production efficiency and reducing resource consumption per unit of product.



Into the reduction of oil consumption. Structural optimization refers to promoting the reduction of oil consumption through the optimization of the import and export structure and other aspects. Substitution refers to promoting the reduction of oil consumption through the substitution of petroleum-based products by non-petroleum-based products and the substitution of petroleum-based raw materials by non-petroleum-based raw materials. Cleaner means saving oil through cleaner production, cleaner products, and environmental standards that reduce the disposal of pollutants.

The petrochemical industry's "five sides" oil control measures are highlighted in the table below:

Table 3-1 Highlights of oil control measures in the petrochemical industry		
goal	demand side	supply side
reduction	Plastics are used less; Increase the recycling rate of plastics;	The refining industry adjusts its product mix to increase the proportion of downstream chemical products, so that fewer oils are consumed to obtain the same chemical products, thus reducing oil consumption
efficiently	Increase the proportion of high-end products and reduce oil consumption per unit of output value;	Through industrial restructuring, increase the degree of basing, integration and intensification of the oil refining and petrochemical industries, promote energy-saving technologies and the construction of intelligent factories, and reduce the energy consumption of oil refining, ethylene, aromatics and other production processes
Substitution	Development of non-petroleum-based (with a focus on (Bio-based) materials instead of petrochemical synthetics	Petrochemical feedstock to promote diversification, reduce the proportion of petroleum-dependent chemical light oil; moderate imports of ethane, propane and other intermediate products as petrochemical feedstock for the production of olefins; moderate development of methanol to olefins, the use of imported methanol production of olefins.
Structural optimization	Moderate reduction in exports of low-end products	
Cleaner fossilized		industries use advanced cleaning processes

(2) Demand-side analysis

1) Reduction

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Reduction is the focus of demand-side oil control in the petrochemical industry. The three major synthetic materials are the focus of petrochemical product consumption, so the volume reduction measures are mainly reflected in the reduction of consumption of the three major synthetic materials. In a comprehensive analysis, the oil reduction achieved by the three major synthetic materials through volume reduction measures is shown in the table below:

Table 3-2 Effect of Oil Reduction by Demand-Side Reduction Measures

serial number	trails	step	Oil reduction in 2025 (tons)	Oil reduction in 2035 (tons)
1	plastics	Prohibit the use of non-biodegradable plastic bags with a thickness of less than 50 microns, disposable toiletries, straws, disposable stickers, etc.; increase the recycling rate of plastics;	643	2394



2	synthetic oak Rubber	Improvement of scrap rubber recycling rate	203	284
3	synthetic fiber	Improving the utilization of waste synthetic fibers	348	696
4	add up the total		1194	3374

- plastics

Plastics (synthetic resins) consumption accounts for about two-thirds of synthetic materials consumption, and the focus of demand-side reduction in the petrochemical industry is on plastic control. According to the analysis of the current situation of supply and demand of plastic products in China in Chapter 3, plastics are widely used in packaging, films, pipes, sheets, foams and other fields, among which plastic packaging has the largest output, the largest amount of waste generated, the largest proportion of waste generated, and the shortest average life cycle, which is the focus of plastic control. There are two major measures for plastic packaging reduction and oil control: banning plastic and improving the plastic recycling rate.

The plastic ban includes a ban on the use of non-biodegradable supermarket plastic bags with a thickness of less than 50 microns, disposable toiletries, straws, cotton swabs, and other plastic products that are heavily used, polluting, non-recyclable, non-essential, or replaceable, with an estimated total of about 3 million tons per year.

The focus of increasing the plastic recycling rate is the control of packaging plastics. This study predicts that the oil control efforts will result in a 20% recycling rate of packaging waste plastics by 2025 and a 30% recycling rate of packaging waste plastics by 2035, and that the amount of recycled plastics and the amount of oil reduction will be predicted in the context of oil control, as shown in the table below:

Table 3-3 Projected Recycling Volume of Plastic Supplies under Oil Control Scenario

serial number	offerings	unit (of measure)	2018	2025	2030	2035	note
1	Base scenario packaging	tons	4751	6659	8102	9392	Packaging plastics based on 42% of plastics consumption

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	plastics consumption						
2	Baseline scenario packaging Plastic Recycling Volume	746	907	1052	million tons	532	Calculated on the basis of 80% of the current waste generation
3	Volume of packaging plastics recycled under oil control scenarios	tons	532	1065	1944	3006	Based on 80% waste generation in the current year and a 20% recycling rate in 2025. 30% recycling rate by 2030. 40% recycling rate by 2035
4	Pack Incremental plastic recycling						

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5	Packaging plastics oil refraction coefficient		1.07	1.07	1.07	1.07	
	Packaging Plastic Recycling	million tons	0	343	1112	2094	
6	Increase corresponds to decrease in oil volume						

- synthetic rubber

China is a rubber consuming country, according to the estimation, the annual production of national waste tires reaches 350 million, weighing 12.7 million tons, and a large number of end-of-life force car tires, hose tapes, rubber shoes and rubber gaskets and other millions of tons of waste rubber products, the total number of more than 15 million tons of waste rubber products, waste rubber products, 27.7 million tons of resources, the largest bulk of rubber products for the wheel

The content of rubber raw materials in tires is about 45%, and according to this estimation, the amount of waste rubber resources is about 12.5 million tons per year. This study The study set the level of resource utilization of waste rubber in China to increase by 10 and 15 percent by 2025 and 2035, respectively, compared with the current level.

This is a percentage point increase to 85% by 2025 and 90% by 2035, and then a percentage increase by 2025 and 2035, respectively.

The total amount of recycled rubber is estimated to be 1.25 million tons and 1.88 million tons more than the current level. According to this calculation, by 2025 and 2035

In 2010, the oil reduction through increased utilization of scrap rubber was 2.03 million tons and 2.84 million tons, respectively, compared with the current level.

- synthetic fiber

China is a large producer and consumer of synthetic fibers, and it has been reported that China's social reserves of used chemical fiber textiles are nearly 400 million tons.

About 20 million tons of waste textiles are produced annually, and the current recycling rate is less than 10%. In this study, the recycling rate of waste textiles is set to be less than 10% by 2025.

Doubling the utilization rate of used synthetic fibre textiles from the current 10 per cent to 20 per cent, i.e., recycling 4 million tons of waste annually

The percentage of used chemical fibers as recycled fibers will be further increased to 30% by 2035, i.e., 6 million tons of used chemical fibers will be recovered as recycled fibers annually. Since polyester accounts for the vast majority of synthetic

fibers, polyester is used as the baseline for measuring oil reduction from recycled fibers. Accordingly, it can be concluded that by increasing the recycling rate of synthetic fibers in 2025 and 2035, more oil will be recycled than the current situation.

2 million tons and 4 million tons of synthetic fibers, or 3.48 million tons and 6.96 million tons of oil, respectively.

2) Efficient

Demand-side efficient development of the petrochemical industry focuses on increasing the proportion of high-end products and reducing oil consumption per unit of output value. The petrochemical industry is an important support industry for China's national economy, with a large industry economy, a wide driving surface, and a large number of people employed, and its stable development has a pivotal position in the national economy. According to the data of the National Bureau of Statistics, as of the end of 2018, the petrochemical industry has a large economic volume and a large number of employees.

There are 27,813 enterprises above designated size in the oil and chemical industry, with main business income of RMB 12.4 trillion yuan and total profit of RMB 839.38 billion yuan, accounting for 12.1% and 12.7% of the main business income and total profit of the nation's large-scale industry respectively. The assets of the petroleum and chemical industry totaled 12.81 trillion yuan, accounting for 11.3% of the total assets of the national large-scale industry. The realization of the oil control target must be carried out by adjusting the internal structure without sacrificing the development of the petrochemical industry or lowering the industry's economic total. Through the efficient development of the petrochemical industry, increasing the proportion of high-end products and decreasing the proportion of low-end products while stabilizing the total output value of the industry, oil consumption can be moderately reduced.

China's current high-end products in synthetic resins are generally in short supply, need to be imported, and have higher prices, while bulk general-purpose synthetic materials have been able to meet domestic demand. Through efficient development, the proportion of high-end product production will be increased, and the proportion of general-purpose product production will be reduced.

The proportion of the product can reduce the oil consumption per unit of output value, that is to say, reduce the oil consumption while achieving the same scale of output value.

The focus of efficient demand-side development in the petrochemical industry is to increase the production of high-end products that are imported in larger quantities but consume less crude oil per unit of product, such as polycarbonate, polyamide 66, polyformaldehyde and other key engineering plastics products, as shown in the table below:

Table 3-4 Demand-side efficient development of oil reduction in the petrochemical industry

serial number	offerings	polycarbonate	Polyamide 66	polyformaldehyde (CH ₂ O) _n	add up the total
-	Fraction of oil				
	Imports in 2018, million				
1	production value Tons*	142	27	34	203
2	oil discount	1.25	0.5	0	
3	factor Average market price, oil/equivalent ton (loanword)	22000 177.5	30000 13.5	13,000 0	191
2	Corresponding value of output, in billions of dollars	312	81	44	438
	Tri-fold general-purpose plastic folding oil volume				
1	Polyethylene products of the same value Volume, tons **	347	90	49	486
2	Polyethylene refractive index	1.66	1.66	1.66	
3	Oil volume, tons	576	149	81	806

					"Study on High-Quality Development the Petrochemical Industry in the th Five-Year Plan
4	Oil reduction, tons			615	

1. imports of these products are assumed to be replaced by home production in 2025 and 2030; 2. the price of polyethylene is based on \$9,000 per ton.

As seen in the above table, by taking the three general engineering plastics such as polycarbonate, polyamide 66 and polyformaldehyde into 2018

By replacing all of the import volume (a total of 2.03 million tons) with domestic production, the amount of polyethylene production could be reduced with the same value of production.

It produced 4.86 million tons of oil and achieved a reduction of 6.15 million tons.



3) Substitution

The core of demand-side alternative development in the petrochemical industry is the replacement of petroleum-based materials with non-petroleum-based materials, with a focus on the development of bio-based materials. Bio-based materials are new materials manufactured by biological, chemical and physical means using renewable biomass, including crops, trees and other plants and their residues and inclusions, as raw materials.

Bio-based materials can not only reduce the consumption of petroleum, and its degradability is much better than the general petroleum-based products, which is conducive to reducing plastic waste pollution, and is of great significance to environmental protection. China's bio-industry "13th Five-Year Plan" development plan points out to "establish organic acids, chemical alcohols, olefins, alkanes, aromatic hydrocarbons, organic amines and other basic chemical products of the bio-manufacturing route, to obtain the competitive advantage over the petroleum route, and to achieve large-scale production and application of bio-processing; to promote the chemical polymerization of materials, monomers, polyols, hydroxycarboxylic acids, olefins, and other basic chemical products. Polyol, hydroxycarboxylic acid, enoic acid and other bio-manufacturing and polymerization and modification technology development and application, promote bio-based polyester, bio-based polyurethane, bio-nylon, bio-rubber, microbial polysaccharides, marine biomaterials and other large-scale production and demonstration of application, to achieve the chain of bio-based materials industry, agglomeration, large-scale development; greatly enhance the independent innovation ability and international competitive level of the bulk of amino acids, vitamins and other fermentation products industry. innovation ability and international competition level of amino acids, vitamins and other bulk fermentation products, realizing benign and high-end development of the industry."

Currently, bio-based materials include polybinary acid diol esters, polylactic acid (PLA), polyhydroxy fatty acid esters (PHA, PHBV), and natural polymer starch and its blends (starch/PVA, starch/PBS, starch/PLA). Among them, polybutyric acid diol esters include polybutylene succinate (PBS), polybutylene succinate-adipate (PBSA), polybutylene terephthalate-adipate (PBAT) and so on.

Polylactic acid (PLA) is a typical bio-based material, whose raw material lactic acid is prepared through starch fermentation, and the market process and technology are already very mature. PLA can be completely degraded in the natural environment or composting conditions, non-toxic and harmless to the environment, with the reduction of production costs and improved performance, it can gradually replace the traditional

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polyethylene (PE) polystyrene (PS) and other materials in the field of packaging, of the Petrochemical Industry in the
reducing oil consumption and environmental pollution. 14th Five-Year Plan

In the "Chemical Fiber Industry 13th Five-Year Plan" development guidance emphasizes the development of bio-based synthetic fibers, breakthroughs in bio-based synthetic fiber raw material industrialization and preparation technology, focusing on the development of non-food resources of bio-based fiber raw material production, enhancement of polylactic acid, polypropylene terephthalate (PTT) and bio-based polyamide (bio-based nylon) polymerization, spinning and dyeing and finishing industrialization technology level.) polymerization, spinning, dyeing and finishing industrialization technology.

China's current development of bio-based materials is relatively fast, with a high growth rate of 211.9% in the value added of bio-based materials manufacturing in 2018. According to the development of China's bio-based materials, China's bio and materials are expected to realize faster growth by 2025 and 2035, and the consumption of oil replaced will also increase faster, as shown in the table below:

Table 3-5 Predicted Oil Reduction from Biobased Materials

serial number	name (of a thing)	2018	2025	2035	note
-	Bio-based plastics				
1	consumption	50	100	300	
	Poly(dibasic acid) diol esters	6	15	70	
	Poly(lactic acid (PLA)	4	15	80	
	Thermoplastic Biomass Plastics (Main) (to be thermoplastic starch and vegetable fiber molding)	20	30	70	
	(sth. or sb) else	20	40	80	
2	oil discount factor	1.46	1.46	1.46	Taking the top five universal trees Average oil refractive index of fat
3	oil equivalent	73	146	438	
stupid (Beijing dialect)	Bio-based fibers (can replace petroleum-based products)				
1	consumption	34	80	200	
	Bio-based synthetic fibers, including PLA fibers (polylactic acid fibers), PHBV and PLA blended fibers, PTT fibers, PBT fibers and so on.	10	30	100	
	New bio-based cellulosic fibers, including Lyocell fiber (Tencel), bamboo pulp fiber, hemp pulp fiber	10	20	50	

					"Study on High-Quality Development the Petrochemical Industry in the th Five-Year Plan
	(sth. or sb) else	20	30	50	
2	oil discount factor	1.74	1.74	1.74	Take the polyester refractive index
3	oil equivalent	59	139	348	
Triple	total discounted oil volume		132	285	786
4	New additions and subtractions	0	153	654	



4) Structural optimization

With the development of China's economy, China's exports of plastic products increased from 7.95 million tons in 2011 to 18 million tons in 2018, with a compound annual growth rate of 12.4%. Although the export of plastic products has brought great economic benefits, it has also increased the production of plastic products, thus increasing oil consumption. By appropriately restricting the export of low-end plastic products, without affecting the domestic supply can play a role in reducing the effect of oil. The export of plastic products is closely related to employment and tax revenue, and in 2018 the export of plastic products amounted to about 43 billion U.S. dollars. Therefore, restrictions on exports of plastic products should not be rushed. From Export trends show that the volume of plastic exports will increase in the coming years. About 25% of the exports of plastic products are packaging plastics, which are of low value and can be targeted for restriction.

By restricting exports of packaging plastics, exports of plastics are expected to show a convex trend through 2025, increasing and then decreasing, with plastics exports remaining at 2018 levels through 2025, and then declining by 20 percent through 2035, or

Decrease of 3.6 million tons. From the products of the five major general-purpose resin proportion of weighted average, and then consider the additives factor can be obtained plastics production

The oil discount factor for plastic products is 1.39. The amount of oil reduced by restricting the export of plastic products in 2035 is 5 million tons.

5) Summary

Through the above analysis, the petrochemical industry's demand-side oil control focuses on plastics recycling, with its 2025 and 2035

The annual oil reduction reached 11.94 million tons and 33.74 million tons respectively, with the most significant effect.

Next is the demand-side efficiency of the petrochemical industry development, with oil reductions of 6.15 million tons in both 2025 and 2035. The use of biobased materials could result in oil reductions of 6.15 million tons in both 2025 and 2035.

Oil reductions of 1.53 million tons and 6.54 million tons by 2035, respectively, have also been effective. By restricting the export of plastic products, it is possible to

to achieve an oil reduction of 5 million tons in 2035. Combining the four major pathways of demand-side oil control, the 2025 and 2035 oil reduction scenarios are

The demand-side oil reductions in the petrochemical industry in 2007 were 19.62 million tons and 51.43 million tons respectively, as shown in the table below:

Table 3-6 Summary of demand-side oil reductions in the
petrochemical industry

serial number	trails	step	Oil reduction in 2025, tons	Oil reduction in 2035, tons
1	Reductions		increase plastic recycling rates	1194
2	efficiently	Increase the proportion of high-end products and reduce oil consumption per unit of output value	615	615
3	Alternative	Development of non-petroleum-based (with emphasis on bio-based) materials Replacement of petrochemical synthetics with synthetic materials		153
4	Structural optimization	Restrictions on exports of low-end plastic products	0	500
	add up the total		1962	5143
				3374

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The focus of the increase in the proportion of chemical light oil production is on small local refineries other than Sinopec and PetroChina. In 2018, the crude oil processing volume of refineries other than the two major companies amounted to 208 million tons, and the production of chemical light oil was about 12.84 million tons, and the chemical light oil yield was only 6.17%, which was significantly lower than the national average water consumption rate of 11.2% (see Table 1).

It is even lower than Sinopec's level of 15.8%, and there is still a lot of potential for improvement.

Due to industrial policies and other factors, it is expected that at least about 70 million tons/year of refining capacity will be withdrawn from China by 2025, mainly including small refineries in Shandong, Jiangsu, Hebei and other regions. According to the current situation of large-scale refining and chemical projects under construction, proposed construction and planning, it is expected that about 140 million tons of new refining capacity will be built by 2025, all of which will be new 10 million tons.

above or expanding on the basis of the existing 10-million-ton refining units. China's net addition of refining capacity by 2025

The total refining capacity will be about 0.35 billion tons, reaching about 930 million tons/year. Among them, the capacity of 10-million-ton refineries will exceed 570 million tons, accounting for 61% of the total refining capacity.

With the integration and agglomeration of local state-owned enterprises and private enterprises' refineries, as well as the accelerated pace of elimination of backward production capacity, the degree of refining and chemical integration has been improved, and its product structure will be adjusted accordingly, with a certain increase in the yield of chemical light oils and an increase in the proportion of corresponding chemical products. If the crude oil processing capacity of refineries other than the two major companies is maintained in 2025 and 2035, the product mix will also be adjusted.

The production level will remain unchanged in 2018, and with the development of refining and chemical integration, the downstream supporting ethylene glycol production capacity of refining capacity other than the two major companies will be increased to a level of 1.5 million tons.

Olefin and aromatics production capacity will grow rapidly, and its feedstock chemical light oil yield will be increased to at least 9% in 2025, and to the national average of 11% in 2018 by 2035, then as the proportion of chemical light oil is increased, the output of the obtained chemical light oil will be significantly increased, and the increased output of chemical light oil corresponds to the corresponding amount of the reduction of the excess of refined products, which also means the reduction of the consumption of crude oil, as shown in the table below. The table below shows:

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Table 3-7 Local Refinery Reduction Effect Predictions

serial number	norm	2018	2025	2035	note
-	Crude oil processing volume, million tons	20800	20800	20800	
Secondary		chemical light oil yield, %			6.17 9.0 11.0
surname San	Chemical light oil production, million tons	1285	1872	2288	
Quadruple Oil 1003		Reduction 587			Increased availability of light chemical oils corresponds to a corresponding reduction in excess refined oil products, which in turn corresponds to a reduction in crude oil consumption.

It can be seen that through the supply-side reform, eliminating backward production capacity and adjusting product structure make a greater contribution to oil reduction. By 2025

The annual oil reduction amounts to 5.87 million tons, and by 2035 it will reach 10.03 million tons.

2) Efficient

The main measures of the supply-side efficient development path are to improve the degree of basing, integration and intensification of the refining and petrochemical industries through industrial restructuring, and to reduce the energy consumption of the production processes of refining, ethylene, aromatics, etc., of which the main focus is on the reduction of crude oil consumption through the reduction of energy consumption of refining units.

At present, the national average comprehensive energy consumption of oil refining is about 65kgoe/t, and the comprehensive energy consumption of oil refining of main enterprises is relatively low, about 60kgoe/t on average; some high-quality enterprises have reached the world's advanced level of energy consumption, such as Zhenhai Refining and Chemical Company, whose comprehensive energy consumption of refining (per unit) reaches 48kgoe/t, and Maoming Petrochemical Company, whose

comprehensive energy consumption of refining (per unit) reaches 51kgoe/t, etc.), but a considerable number of local refineries still consume more than 70 or even 90kgoe/t, and the energy saving and emission reduction potential exists. However, some local oil refining enterprises still have energy consumption above 70 or even 90kgoe/t, so there is a large potential for energy saving and emission reduction. The "13th Five-Year" Energy Conservation and Emission Reduction Comprehensive Working Program proposes that the comprehensive energy consumption of oil refining should be reduced to 63kgoe/t by 2020. According to the national standard

Limit of Energy Consumption per Unit Product of Oil Refining (GB 30251-2013), in which the requirement for the access value of comprehensive energy consumption for oil refining (per unit) of newly built oil refining enterprises is 63kgoe/t.

It is expected that by 2025 and 2035, with the development of refining and chemical integration, backward production capacity will be eliminated, and the capacity of local and private refineries will gradually be concentrated into large-scale units, which will strongly contribute to the decline of comprehensive energy consumption in refining. The path will be realized mainly by promoting the promotion of energy-saving technologies and intelligent development in the petrochemical industry.

In promoting energy-saving technologies in the petrochemical industry, it focused on promoting a series of energy-saving technologies, including energy balance and optimal scheduling technologies for petrochemical enterprises, low-temperature heat recovery and power generation technologies for aromatics plants, and steam system operation optimization and energy-saving technologies. In terms of intelligent petrochemical plant construction, China Petroleum & Chemical Corporation Zhenhai Refining & Chemical Branch (Zhenhai Refining & Chemical) has made a demonstration. Focusing on the petrochemical industry's goal of improving quality, increasing efficiency and transforming development, Zhenhai Refining and Chemical Company has used big data and other modern information technologies to build an intelligent manufacturing demonstration project for integrated refining and chemical production driven by supply chain-industrial chain-value chain synergistic optimization, and to push forward changes in the mode of production and operation management. Through the above intelligent measures and the adoption of key energy-saving technologies, Zhenhai Refining's comprehensive energy consumption in oil refining (unit) is as low as 48kgoe/t, which is about 24% lower than the national average energy consumption.



Through the full application of the above measures, it is expected that the national average comprehensive energy consumption of oil refining will be reduced by 5% and 9% to 60kgoe/t and 55kgoe/t by 2025 and 2035, respectively, on the basis of 2018, and then oil will be reduced by 3.02 million tons by 2025 and 4.83 million tons by 2035, respectively, in the process, as shown in the table below:

Table 3-8 Oil refining energy saving, consumption reduction and fuel reduction

serial number	sports event	2018	2025	2035	note
-Crude oil processing volume, million tons		60400	60400	60400	Based on 2018 crude oil processing volume
stupid (Beijing dialect)	Average energy consumption ,kgoe/t	65	60	55	
three	Crude oil consumption, million tons	3926	3624	3322	
4	Oil reduction, tons		302	604	Based on energy savings of 1 kilogram of standard oil (kgoe) Calculated as equivalent to 1 kg of crude oil saved

3) Substitution

The focus of supply-side alternative development is to promote the diversification of petrochemical feedstocks and to reduce the proportion of chemical light oils in feedstocks that must rely on oil. Enhancing the proportion of non-oil chemical process routes is one of the most important ways to control the use of chemical oil. Currently, ethane cracking to ethylene, methanol to olefins, propane / mixed alkane dehydrogenation to olefins and other processes are relatively mature and developing rapidly, and in the future can further form a substitution effect on the traditional naphtha, hydrotailing oil olefin process, thus reducing the demand for chemical oil.

The focus of the route of diversification of petrochemical feedstock includes two major aspects: 1) moderate import of intermediate products such as ethane and propane

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as petrochemical feedstock for the production of olefins; and 2) moderate development of the Petrochemical Industry in the
methanol to olefins, and the use of imported methanol for the production of olefins. 14th Five-Year Plan

- Import of ethane and propane for olefin production

With the revolutionary development of U.S. shale gas, the U.S. ethane production surge, but ethylene plant expansion and export capacity is limited and unable to consume the huge incremental amount of ethane, resulting in the U.S. ethane oversupply is becoming increasingly prominent, the price is significantly lower. Measured at the current price level, imported U.S. ethane has a certain cost competitiveness in the construction of cracking units in China, therefore, a number of domestic enterprises are building or planning to build imported ethane cracking projects, and all of them are considering imported U.S. ethane as a feedstock. In August 2019 China's first unit using imported ethane as a feedstock for the preparation of ethylene - the Xinpu Chemical Olefin Project went into operation, with a capacity of 650,000 tons / year of ethylene. The capacity is 650,000 tons/year of ethylene, 120,000 tons/year of propylene, 14,500 tons/year of hydrogen, 45,000 tons/year of C4, 30,000 tons/year of methane, and 45,000 tons/year of cracked gasoline.

At present, China's ethane to ethylene also exists in the lack of raw material sources, price changes in the risk of larger, logistics bottlenecks highlighted and other constraints, ethane cracking to ethylene project construction is a complex systematic project, for Chinese enterprises, ethane to ethylene project must be set up to establish a stable and reliable supply chain of raw materials. It is necessary to establish a stable and reliable raw material supply chain for Chinese enterprises to launch ethane-to-ethylene projects.



China has certain control over the construction of ethane ocean transportation vessels, domestic port terminal storage construction, ethane cracker construction and many other aspects. From a comprehensive point of view, China's utilization of U.S. ethane ethylene in the raw material supply chain, price fluctuations, product flexibility, comprehensive fault tolerance, there are certain risks. In the current tense trade relations between China and the United States, the source of ethane raw materials will be affected to a certain extent. According to the progress of the proposed projects, it is expected that by 2022, PetroChina's Xinjiang Bazhou project and Shaanxi Yulin project with a total capacity of 1.4 million tons/year will be able to come into operation, and together with the already commissioned Xinpu Chemical project, the scale of China's ethane cracking to ethylene will reach 2 million tons/year, and the capacity of the cracked ethane to ethylene will be increased by 1 million tons/year in the period of 2023-2025, and the capacity will be increased by 1 million tons/year in the period of 2025. By 2025, China's ethane cracked ethylene capacity could reach 3 million tons/year and production could reach 2 million tons. 2026-2030, China's ethane cracked ethylene capacity is expected to grow, and production by 2030 could reach 2 million tons/year.

It could grow further to 3 million tons.

In 2013, Tianjin Bohua put into operation 600,000 tons/propane-to-propylene plant, which is the first propane-to-propylene plant in China. After that, China

The propane to propylene industry in China has been developing rapidly, and industrialization has been formed so far, and the completed capacity has reached about 6.18 million tons.

According to incomplete statistics, the capacity of propylene-to-propylene projects under construction and planning is about 1.65 million tons/year in 2011, and the production capacity of propylene-to-propylene projects under construction and planning is about 1.65 million tons/year. Considering the capacity of under-construction and planned projects, feedstock supply and the factors of slowing down of propylene market growth, it is expected that the start rate of propane-to-propylene will be reduced, and the new imported propane-to-propylene production will reach 2 million tons in 2025, and increase by another 1 million tons in 2035.

- Imported methanol for olefin production

Coal to olefin / methanol to olefin has become one of the important process routes for olefin products in China. In 2018, the capacity of coal to olefin / methanol to olefin was 14.11 million tons/year, of which the ethylene capacity was about 6.4 million tons/year, with the capacity accounting for about 25% of the total ethylene capacity. Most of China's coal-to-olefin production capacity is located in the western region, while a considerable part of methanol-to-olefin production capacity is constructed in the eastern region due to the easy availability of imported methanol as a result of higher

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coal prices. 2018 China's methanol-to-olefin production capacity was about 6.97 million tons/year (including ethylene and propylene), with the production capacity in the eastern region amounting to 3.79 million tons/year, which is more than half of the total production capacity. 2018 China's methanol imports amounted to 7.43 million tons. In 2018, China's methanol imports amounted to 7.43 million tons, part of which was used as feedstock for methanol-to-olefin plants in the eastern region. It is expected that the eastern region will add 2 million tons/year of methanol-to-olefin capacity by 2025 and another 1 million tons/year by 2035.

To summarize, oil reduction on the supply side of the petrochemical industry through feedstock substitution is shown in the table below:

Table 3-9 Petrochemical industry supply-side feedstock alternatives for oil reduction

serial number	sports event	2025	2035	note
1	New ethane to ethylene production than in 2018 Olefin, million tons	200	300	Utilization of imported ethane
2	New propane to propane ratio than 2018 Olefin, million tons	200	300	Utilization of imported propane

serial number	sports event	2025	2035	note
3	Methanol-to-Olefin added over 2018 Hydrocarbons, tons	200	300	Utilization of imported methanol
stupid (Beijing dialect)	oil discount factor	1.51	1.51	
Triple	reduction in oil volume, million tons	906	1359	

4) Cleanliness

Production in the petrochemical industry has certain impacts and hazards on air, water, solid waste and soil, and petrochemical enterprises have certain environmental risks. Replacing traditional processes through cleaner processes is conducive to reducing environmental pollution and energy saving. At present, many areas of the petrochemical industry have the potential for cleaner substitution. For example, direct oxidation method, co-oxidation method of propylene oxide to replace the traditional chlorohydrin method of propylene oxide; glycerol method of epichlorohydrin to replace the traditional process; isobutene / tert-butanol method of methallyl alcohol / methyl methacrylate to replace the acetone cyanohydrin route process and so on. As cleaner production processes are promoted, pollutant emissions are reduced, recycling is increased, and the cleaner pathway can also have the effect of reducing oil consumption. It is expected that in 2025 and 2035 by

The roll-out of cleaner processes in the petrochemical industry saved 1 million tons and 2 million tons of oil, respectively.

5) Summary

Through the above analysis, integrating the three major paths of supply-side oil control in the petrochemical industry, the supply-side oil reduction in the petrochemical industry in 2025 and 2030 will be 18.98 million tons and 31.66 million tons respectively, as shown in the table below:

Table 3-10 Summary of supply-side oil reduction in the petrochemical industry

serial number	trails	step	Oil reduction in 2025, tons	Oil reduction in 2035, tons
1	minimize	Increase the proportion of chemical light oil in the product mix and reduce the proportion of corresponding Oil consumption.	590	1003
2	efficiency	Through industrial restructuring, increase the degree of basing, integration and intensification of the oil refining and petrochemical industries, and reduce the energy consumption of oil refining, ethylene, aromatics and other production processes.	302	604
Alternative		moderate imports of ethane, propane and other intermediate products as petrochemical feedstock for the production of olefins; moderate development of methanol to olefins, the use of imported methanol production of olefins.		
4	cleanliness		100	200
add up the total			1898	3166



(4) Overall oil reduction effect

Through demand-side and supply-side analysis, the high-quality development of the petrochemical industry will achieve significant oil reduction, as shown in the following two tables

Show.

Table 3-11 Oil reduction effects of high-quality development in the petrochemical industry					
serial number	trails	step	2025 fuel reduction (tons)	2035 fuel reduction (tons)	note
demand-side reduction					
-	Oil volume		1962	5143	
1	reduction	Banning some plastics; increasing the rate of plastics recycling; increasing the rate of waste rubber utilization; increasing the rate of waste synthetic fiber utilization.	1194	3374	
2	efficiently	Increase the proportion of high-end products, reduce the single Bit production value oil consumption;	615	615	
3	substitute for	Development of non-petroleum based (with emphasis on bio) (base) materials to replace petrochemical synthetics	153	654	
4	Structural Optimization Structure	0	Moderate Adjustment of 500	Import and Export	
stupi d (Beiji ng dialec t)	Supply Side Oil Reductio n		1895	3166	
1	reduction	The refining industry adjusts its product mix to increase the proportion of downstream chemical	587	1003	

		products, so that fewer oils are consumed to obtain the same chemical products, thus reducing oil consumption			
2	efficiently	Through industrial restructuring, increase the degree of basing, integration and intensification of the oil refining and petrochemical industries, promote energy-saving technologies and the construction of intelligent factories, and reduce the energy consumption of oil refining, ethylene, aromatics and other production processes	302	604	



3	substitute for	Petrochemical feedstock to promote diversification, reduce the proportion of petroleum-dependent chemical light oil; moderate imports of ethane, propane and other intermediate products as petrochemical feedstock for the production of olefins; moderate development of methanol to olefins, the use of imported methanol production of olefins.	906	1359	
4	cleanliness	Adoption of advanced cleaning processes in the petrochemical industry	100	200	
Subtotal III			3857	8309	
4	Carbon reduction effect in the context of oil control, tons		7251	15621	According to the data of the study report on China's Total Oil Consumption Peak Achievement and Control Program, the GHG emissions of 1 ton of oil production, processing and consumption are 1.88 tons of CO ₂ .

Table 3-12 Comparison of the Effectiveness of Oil Reduction Measures in China's Petrochemical Industry

serial number	trails	unit (of measure)	2025	2035
	-Demand-side oil reduction in tons		1962	5143
stupid	Supply Side Oil	tons	1895	3166

Study on High-Quality Development of the Petrochemical Industry in the 14th Five-Year Plan				
(Beijing dialect)	Reduction			
Three subtotal tons		3857	8309	
4	Baseline fuel consumption	tons	16180	24256
Five	oil control fuel consumption	tons	12323	15947

As shown in the table above, through the high-quality development of the petrochemical industry, it is expected that 385.7 million tons of oil will be reduced by 2025, and by 2035, oil reduction reaches 83.09 million tons. This reduces the petrochemical industry's crude oil consumption in 2025 from 161.8 million tons in the baseline scenario to 123.23 million tons and from 242.56 million tons to 159.47 million tons in 2035. Lower crude oil consumption in the petrochemical industry relative to the baseline scenario will also lead to a relative reduction in carbon emissions. It is estimated that by 2025 carbon emissions are reduced by 72.51 million tons in 2010 and 156.21 million tons in 2035 compared to the baseline scenario.

4

Policy recommendations



4.1 Demand-side measures

Encourage the development of non-petroleum-based material products, focusing on supporting the development of bio-based materials such as polydiacid diol esters, polylactic acid and bio-based nylon.

Promote the application of alternative products, such as environmentally friendly cloth bags, paper bags and other non-plastic products and biodegradable shopping bags, and promote the use of bio-based, biodegradable packaging products. Promote biodegradable mulch.

Encourage the development of high-end products. Update the guidelines for the development of the new materials industry issued by four ministries and commissions in 2016, and formulate the 14th Five-Year Plan for the development of the new materials industry to promote the development of the new materials industry.

Restrict the export of packaging plastic products, encourage the upgrading of plastic products enterprises to switch to renewable, biodegradable plastic products.

Pins.

4.2 Supply-side measures

Strictly control oil refining production capacity, eliminate backward production capacity, and promote the structural adjustment of the oil refining industry. Promote the large-scale and integrated development of the oil refining and petrochemical industry in accordance with the Petrochemical Industry Planning and Layout Program. By 2025, the oil refining capacity will be controlled to within 930 million tons/year. It will focus on eliminating or replacing refineries of 5 million tons/year or less in the eastern region and the Bohai Rim with equivalent capacity reduction. For densely populated urban areas and local refineries with refining capacity of less than 5 million tons/year that have not realized refining and chemical integration, all of them will carry out capacity integration and transfer by 2025 if they have the will to do so, and those that do not participate in capacity integration and transfer will withdraw from production capacity on the spot. In principle, the capacity to be integrated and transferred should enter

the nationally planned petrochemical bases or provincial petrochemical parks, and the starting refining scale should not be less than 10 million tons/year. In the implementation of capacity transfer, follow the principle of market-led and government-guided, and mobilize the enthusiasm of enterprises, transferring places, access places and other stakeholders through the trading of production capacity indexes and the sharing of fiscal and tax revenues between the transferring places and the transferring places.

Control and standardize the layout of chemical parks, introduce norms and standards for the construction of chemical parks, promote the transfer and upgrading of production capacity in the petrochemical industry to chemical parks, and phase out backward production capacity that cannot be transferred and upgraded locally.

Promote energy conservation and emission reduction in the oil refining and petrochemical industries, and strictly enforce relevant energy consumption energy efficiency and emission standards. Encourage the application of energy-saving and green process technologies in the National Key Energy-saving and Low-carbon Technology Promotion Catalog and the Petrochemical Green Process Directory, etc., and fully support the industries in the Green Industry Guidance Catalog. Continuing to implement the "frontrunner" system and energy efficiency standardization and benchmarking actions in the petrochemical industry.

Promote the diversification of olefin feedstock, and moderately develop ethane, propane-to-olefin and methanol-to-olefin in the eastern region. Maintain the industrial policy of allowing ethane, propane to olefin and methanol to olefin to remain unchanged.



Contact Us

Address: 1706 Taikang Financial Building, No. 38
North Dongsanhuan Road, Chaoyang District, Beijing,
100026, P.R. China
Tel: +86 (10) 5927-0688
Fax: +86 (10) 5927-0699

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