中国石油消费总量控制和政策研究项目 综合报告(2019)

中国石油消费总量达峰与控制方案研究

RESEARCH ON CHINA OIL CONSUMPTION PEAK AND CAP PLAN

油控研究项目课题组

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EXECUTIVE SUMMARY

Reasonably capping oil consumption and achieving peak oil as early as possible is of the utmost importance for China to safeguard its energy supply and economic security, tackle climate change, win "the Battle for Blue Skies", and build a green, low-carbon, and high-quality modern economy. China is the world's 2nd largest oil consumer and Ist largest oil importer, with its oil use and imports continuously expanding over the years. China consumed 628 million tons of oil in 2018. The uncertainties and challenges associated with its high oil import dependence—which was more than 70% in 2018—and the volatile international oil market have caused China to put oil supply security high on its political agenda. Today, China and the international community are working together to combat climate change with a long-term goal of achieving carbon neutrality by the second half of this century.

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"Leaping over the age of oil" is the clear path forward for China. After a long period of high oil consumption, major developed countries have accelerated their energy transformation, providing the impetus for China to establish and implement a strategy for "leaping over the age of oil." Currently, major developed countries still rely on oil as a dominant energy source, but their total and per capita oil use has already peaked and since declined significantly, while major international oil companies are also shifting towards clean and renewable energy. Chinese per capita oil use is relatively lower than that of the developed countries; under the constraints imposed by limited resources, the environment, and climate, China needs to explore an innovative path towards oil consumption that is significantly less than that of developed countries, and even lower than the world's per capita oil consumption of 0.6 tons, thus supporting its goal of building a modern society, and achieving a leapfrog approach to development.

The total external cost of China's oil development and utilization was 507 RMB per metric ton of oil in 2015. Every aspect of oil development and utilization in China—from extraction to transportation, storage, conversion, utilization and product manufacturing—can produce negative or harmful effects on the environment. The external costs of oil development and use in China were 347 RMB per metric ton in 2015 considering impacts such as environmental pollution, water resource damage, soil pollution, health risks and greenhouse gas emissions. This figure rises to 507 RMB per metric ton if climate impacts are also considered. The goal of the study on the environmental costs of oil is to help help facilitate the gradual internalization of such external costs and will provide a basis for the assessment of relevant environmental taxes and fees, standards, regulations and measures. It will also help boost energy efficiency, foster technology innovation, reduce the emission of pollutants and protect people's health.

Under the oil cap scenario pathway, China's oil consumption can peak by 2025 and basically meet the 'carbon neutral' requirements of the 1.5°C temperature control target by 2050. The oil cap pathway is proposed based on international comparative studies and scenario analysis, taking into account an energy revolution and China's green, low-carbon and quality-oriented economic transition. Under this pathway, China's

oil consumption is expected to peak before 2025. Under the vision of a "Beautiful China", oil consumption would decrease to about 600 million metric tons by 2035. Oil consumption would be limited to within 420 million tons by 2050. With the commercialization of Carbon Capture, Utilization and Storage (CCUS) technology and the expansion of forest carbon-sinks, carbon emissions will be dramatically reduced.

The five major approaches for capping oil use include reducing demand; improving efficiency; replacing oil with alternative energy sources; optimizing industry structures and product portfolios; and encouraging clean use. By 2050, the oil cap scenario pathway would reduce oil consumption by 350 million metric tons compared to the baseline scenario. Of these reductions, the transportation sector would account for 66.3%, the chemical sector would account for 14.3%, and other sectors would account for 19.4%. Oil reduction potential can be broken down according to the five major approaches, of which oil replacement accounts for 48%, efficiency improvements account for 20%, structural optimization for 16%, reducing demand accounts for 15%, and clean utilization accounts for 1%. Replacement and efficiency improvements are by far the most significant contributor, accounting for 68% of oil reduction potential.

Under this scenario, the oil consumption structure would experience significant changes. When breaking down China's oil consumption in 2017 we find that the transportation sector accounted for 57.7%, the chemical sector accounted for 15.3%, and other sectors 27.0%. However, by 2050, the transportation sector will account for 33.3% of oil consumption, the chemical sector will account for 42.4%, and other sectors will account for 24.3%.

The transportation sector is expected to reach peak oil consumption between 2020 and 2023. By 2050, oil consumption in the transportation sector will have decreased by about 232 million tons compared to the baseline scenario. The transportation sector should move in the direction of substitution, increasing efficiency, and clean utilization, making progress from both the supply and demand sides. Fuel substitution approaches, such as automobile electrification, will contribute 64.7% of the decrease, and efficiency measures such as fuel economy improvements will account for 17.1%. The structural optimization of passenger and cargo transportation and of urban travel, unreasonable transportation reduction through optimized urban planning, and clean utilization will account for 18.2% of these reducations.

Oil consumption in the petrochemical sector is expected to peak around 2035, followed by a long plateau. In 2050, petrochemical sector oil consumption will be reduced by about 50 million tons compared with the baseline scenario. Oil reduction measures such as implementing prohibitions and limitations on plastics and increasing recycling rates for plastics will contribute around 38% of this reduction. Structural optimization approaches such as controlling the scale of production capacity in the petrochemical sector and reducing indirect oil consumption through optimizing petrochemical exports will contribute about 30% of this reduction. Increasing overall energy efficiency in the petrochemical sector, implementing supply-side structural reforms, extending the added value of the industrial chain and optimizing the energy consumption structure will contribute about 20%. By increasing imports of petrochemical raw materials or basic products, developing non-oil consuming chemical industries and promoting cleaner production, the petrochemical sector will reduce oil consumption and contribute to another 12% of reductions.

Oil consumption in other sectors is expected to peak between 2025 and 2035. Oil consumption in other sectors will have decreased by 68 million tons in 2050. Oil is mainly used in various kinds of machinery, including in gasoline and diesel engines, domestic heating, and industrial lubricants. Of this reduction, improving efficiency standards for gasoline and diesel engines accounts for 29.4%, elimination of backward and highly polluting machinery accounts for 23.5%, replacement with electric and non-oil options, optimization of the engineering operation and production processes, and clean utilization accounts for 47.1%. There are various kinds of oil-consuming machinery in operation, causing serious pollution. It is therefore important to improve fuel efficiency and pollution emission standards for gasoline and diesel engines and to implement electric heating substitution.

A detailed and enforceable timetable for a fuel phase-out is one

of the most influential policy tools available. Many provincial and municipal governments, for example Hainan Provincial Government, have designed and are carrying out a plan for replacing and phasing-out different types of traditional internal combustion engine (ICE) vehicles, laying a solid fundation for the launch of a national scale ICE phase-out policy. Automobile manufacturing companies can formulate timetables for the suspension and ban of traditional fuel vehicles, as well as develop new energy vehicle production and sales programs according to market strategy, technology R&D and the current policy environment. The report points out that traditional ICE vehicles should be phased out according to a timetable that specifies deadlines for different vehicle types, regions and phases. The ban will first be introduced to megacities, large core cities, cities in key air pollution regions and pilot NEV cities, where electrification and other types of new energy will be adopted around 2020-2025 for all vehicles used for urban public transportation, sanitation, logistics, commuter service vehicles, taxis and ride hailing vehicles. The timetable also envisions replacing traditional ICE vehicles with NEVs for all government vehicles by 2030, for all private cars by 2040, for general and special-purpose passenger vehicles by 2045, and for heavy-duty trucks by 2050. In addition to road traffic, it is also necessary to formulate near, medium, and long-term fuel phase-out plans for water shipping and air operations.

China's solid, effective and forceful efforts in promoting a cap on oil consumption are supported by three pillars—the ban of traditional petrol and diesel vehicles in the transportation sector, the restriction of plastic products in the petrochemical sector, and the imposition of stricter energy efficiency standards in other sectors. The oil reduction potential of these three pillars is 205 million tons, accounting for 58.6% of the total. We recommend that the government formulate, publish and enforce timetables for the ban of traditional petrol and diesel vehicles, for the restriction of plastic products, and for the imposition of stricter energy efficiency standards in other sectors during the 14th Five-Year Plan period (2021-2025). The three pillars have multiple benefits, including reducing carbon emissions, protecting the environment and protecting public health.

We recommend establishing three indicators for capping oil consumption. The first is a guiding target of the share of oil in total energy consumption. The second is to elevate the mandatory dual-credit system for passenger cars' fuel efficiency and New Energy Vehicles from a sectoral level target to a national one. The third is to establish external oil dependence as an early warning indicator. During the 14th Five-Year Energy Plan, the share of oil consumption should be less than 20%, with gradual reductions every five years. Energy efficiency and New Electric Vehicle targets for passenger cars should also be tightened every five years. The target for China's external dependence on oil at peak oil consumption in 2025 should be set at 73% or less, and gradually decline in the future. If the rate of external dependence passes this target, the country should take effective actions to control external dependence to within the target range.

The development strategy for "Leaping Over the Age of Oil" with an oil consumption cap at its core will boost economic growth. Market-oriented reforms and institutional innovation will catalyze and nurture new commercial activities. This report recommends that the government speed up the adjustment and removal of unreasonable subsidies to build an oil market and tax system that reflects the true external cost of oil use; improve fiscal and tax policies that encourage oil saving and substitution; and formulate a roadmap for the phase-out of ICE vehicles to promote the automotive technology revolution; and to deepen the reform of the oil and gas sector and mechanisms for managing investments to create a market and policy environment that promotes the shale oil and gas revolution.