

The 10th CNPC/IEEJ Research Meeting



Outlook on China's Petroleum Demand: Under the Rapid Development of Alternative Energy

**CNPC Economics & Technology
Research Institute**


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Main Contents

-  I. Development of Electric Vehicles and Other Kinds of Alternative Energy
- II. Features of China's Petroleum Market
- III. Outlook on China's Mid- and Long-term Petroleum Demand

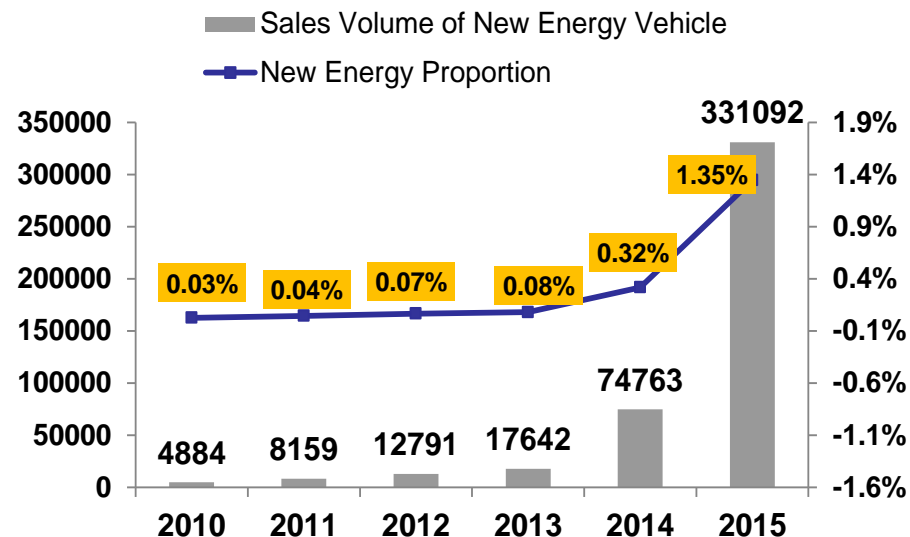
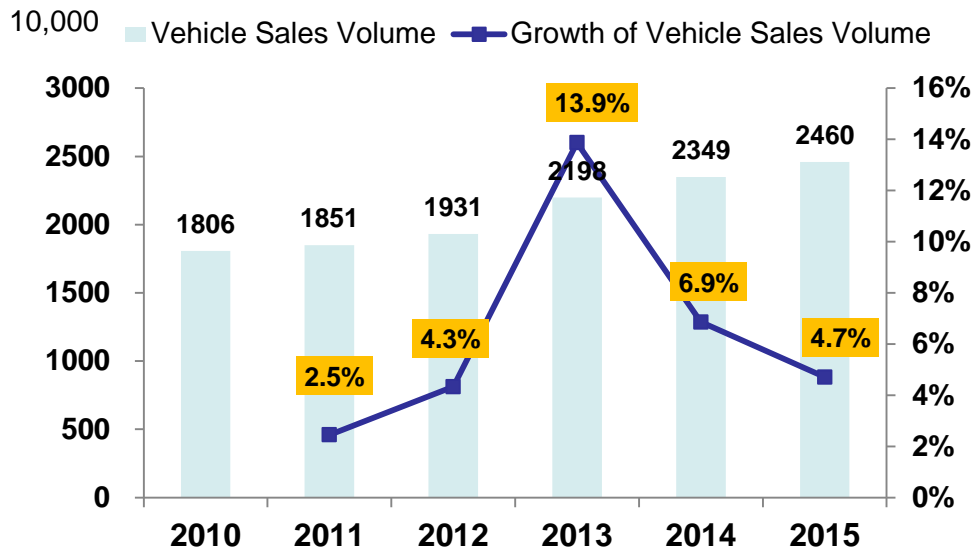


1. Current situation of new energy vehicle in China: rapid growth from a low level

- New energy vehicles include pure electric vehicle (EV), plug-in hybrid power vehicle (PHEV), hybrid power vehicle (HEV), fuel cell electric vehicle, hydrogen engine vehicle, and other kinds of new energy vehicles.
- The growth of China's vehicle sales volumes maintains mid-to-high growth rates. In 2015, the sales volume of vehicle was 24,600,000, with annual growth rate of 4.7%; in the same year, sales volume of new energy vehicles was 331,000 (increased by 3.4 times on a year-on-year basis), accounting for 1.35% of the total vehicle sales volume.

China's Vehicle Sales Volumes and Corresponding Growth Rates

China's Vehicle Sales Volumes and Proportion of New Energy Vehicles



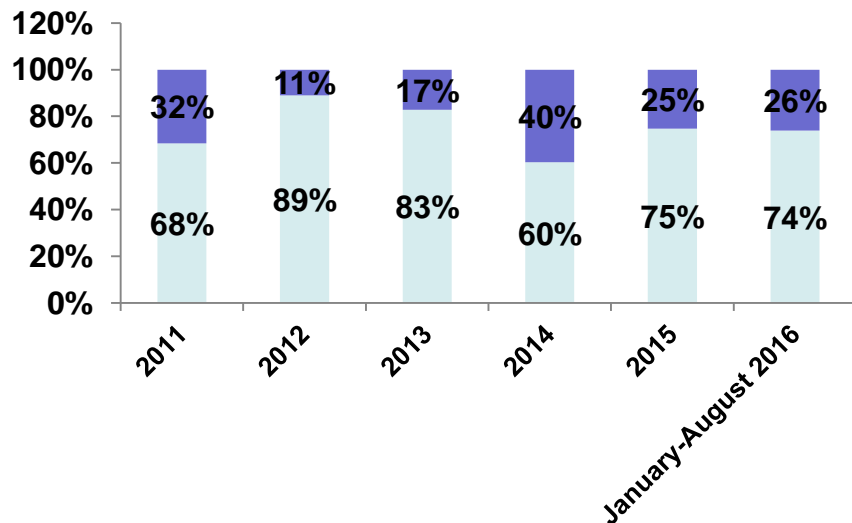


2. Market structure of China's new energy vehicles: pure electric vehicle dominates the market, and the proportion of commercial vehicle rises

- **In China**, the term “new energy vehicle” mainly refers to **pure electric vehicle and plug-in hybrid power vehicle**. Conventional hybrid power vehicle is defined as energy saving vehicle.
- In the proportion of new energy vehicles sales, pure electric vehicle is still in the dominant position, and its market share has been 74% in the first 8 months of 2016.
- Commercial vehicles, as a subcategory of new energy vehicles (classified by different purposes), continuously expands its proportion to nearly 50% presently.

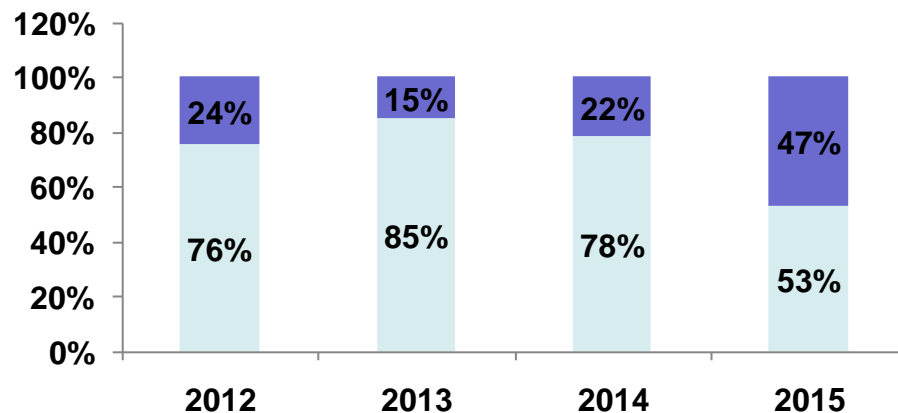
Proportion of China's New Energy Vehicles Sales
(by different powers)

■ Sales Volume Proportion of Plug-in Hybrid Power Vehicle
■ Sales Volume Proportion of Pure Electric Vehicle



Proportion of China's New Energy Vehicles Sales
(by different purposes)

■ Sales Volume Proportion of New Energy Passenger Vehicle
■ Sales Volume Proportion of New Energy Commercial Vehicle





3. Policies on China's new energy vehicles development: strong industrial support

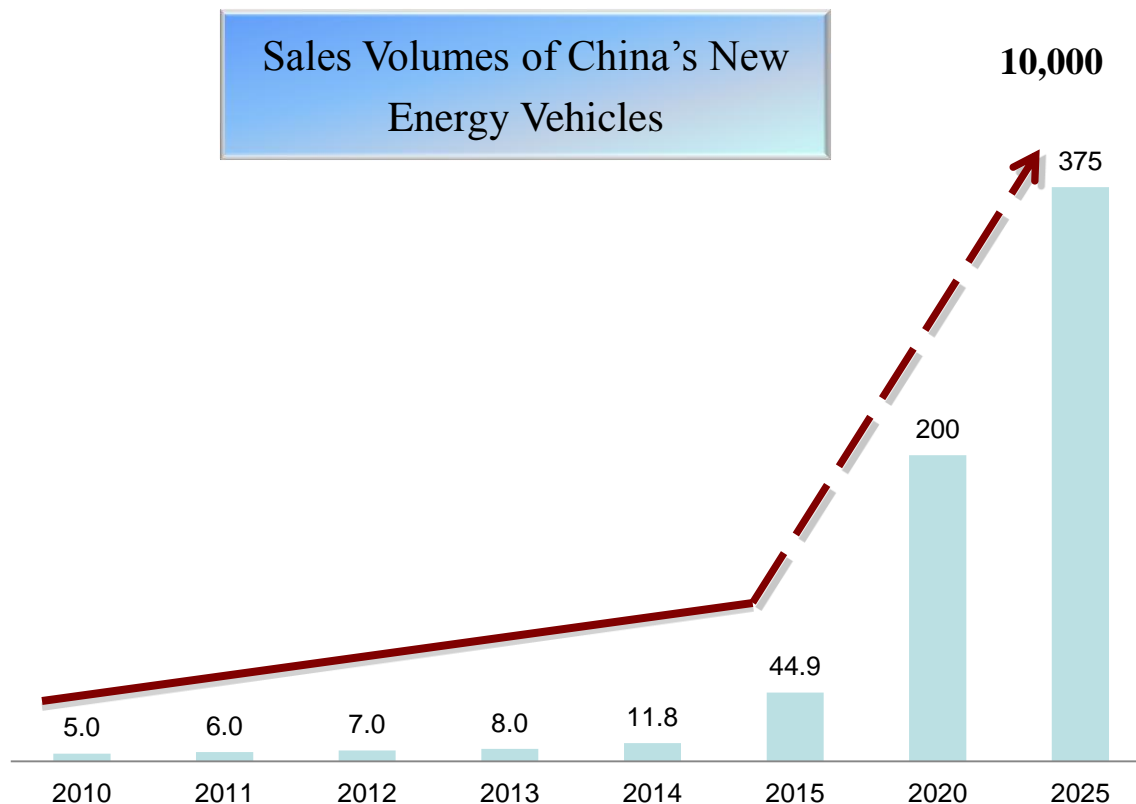
Policies and impacts of new energy vehicles: An analysis

Release Time	Title of the Policy Document	Impact Analysis
September 2013	<i>The Notice of concerning Promotion and Application of New Energy Vehicle Continuously</i>	The subsidy of pure electric passenger vehicle goes beyond the expectation; the subsidy of plug-in hybrid power vehicle decreases greatly, and the subsidy is provided to the new energy passenger vehicle based on the continuous driving mileage standard. The local protectionism barrier is destroyed relatively.
July 2014	<i>Guiding Opinions on Acceleration of Promotion and Application of New Energy Vehicle</i>	25 measures are raised for accelerating the promotion and application of new energy vehicle and they are the programme for the new energy vehicle development in a period of time in future.
March 2015	<i>Interim Regulations on Investment Project and Production Access Management of Newly-constructed Pure Electric Passenger Vehicle Production Enterprise</i>	Essentially, the access management aims to introduce some fresh blood to the new energy vehicle field and enhance the overall vitality of new energy vehicle market. However, the current interim regulations have raised tough requirements for the enterprise. In the short term, it is difficult for the internet vehicle and pure investor to enter. In the long term, the qualification let-go is the future development trend.
April 2015	<i>The Notice of concerning Financial Support Policy for Promotion and Application of New Energy Vehicle from 2016 to 2020</i>	This notice ensures the policy foundation of new energy vehicle of China in the next 5 years, and promotes the large-scale popularization of new energy vehicle and cultivate the new business model.
October 2015	<i>Guide to the Development of Charging Facilities of Electric Vehicle (2015-2020)</i>	The construction lagging of charging station is an important bottleneck to the development of new energy vehicle. This planning covers the construction goal of charging facilities in the next few years, subsidy policy for charging station construction, encouraging the introduction of social capital to participate in the charging station construction and other aspects. It will meet the charging requirements of 5,000,000 electric vehicles in 2020.



4. Development planning of new energy vehicles: 2025 annual sales volume will reach 3,750,000

- Development planning for the industry of energy saving and new energy vehicles (2012-2020): by 2015, the accumulated output and sales volume of both pure electric vehicle and plug-in hybrid power vehicle would be 500,000; by 2020, the production capacity of pure electric vehicle and plug-in hybrid power vehicle would be 2,000,000, and the accumulated output and sales volume will exceed 5,000,000.
- *Made in China 2025* by the Ministry of Industry and Information Technology: in 2025, the annual sales volume of Chinese branded new energy vehicles will be 3,000,000, which accounts for more than 80% in the domestic market. According to this goal, in 2025, the accumulated sales volume of new energy vehicles will be 17,000,000.

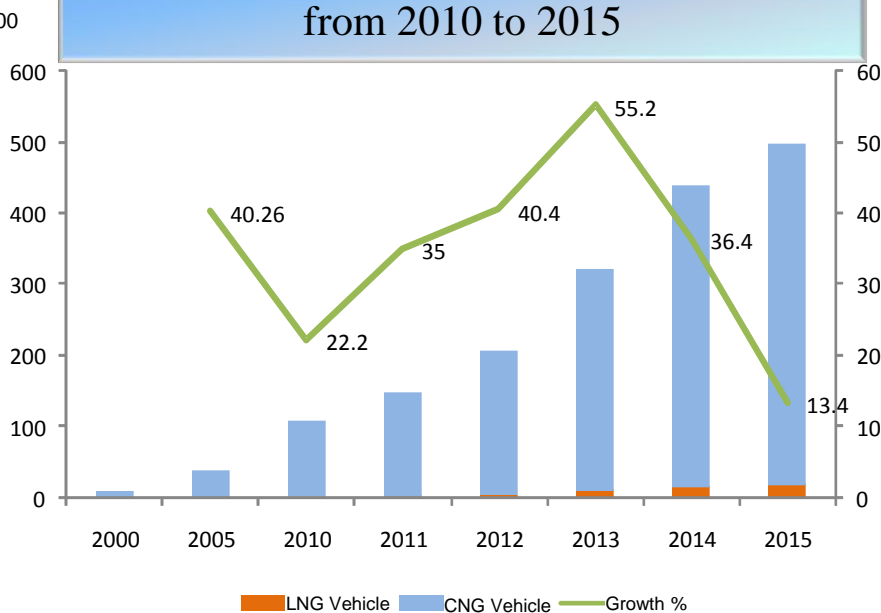




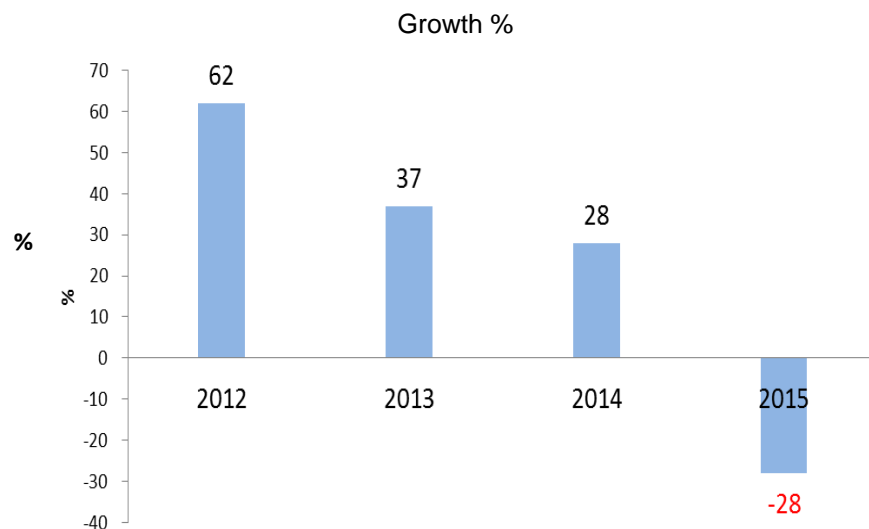
5. Growth rate of natural gas vehicles slows down recently

- From 2000 to 2013, natural gas vehicles of China presented an explosive growth; they increased from 100,000 to 3,235,000, with an annual average growth rate of 30%.
- From 2013 to 2015, due to the changing of domestic economic growth rate, non-prominent economic advantage of natural gas compared with petroleum products, and other factors, the growth rate slowed down to some extent, but was still at high level. The refitted vehicle grew relatively rapidly, and the new vehicle output decreased obviously. In 2015, the output of China's natural gas vehicles was 201,000, decreasing by 27.6% on a year-on-year basis, while the negative growth occurred for the first time.
- In 2015, the gas consumption of LNG vehicles was about 10,000,000,000m³, which substituted 8,200,000t diesel, accounting for 4.7% of total diesel consumption; in 2015, the gas consumption of CNG vehicles was 14,800,000,000m³, which substituted about 12,000,000t gasoline, accounting for 10.4% of total gasoline consumption.

Ownership of China's Natural Gas Vehicles from 2010 to 2015



Growth Rates of China's Natural Gas Vehicles Output from 2012 to 2015



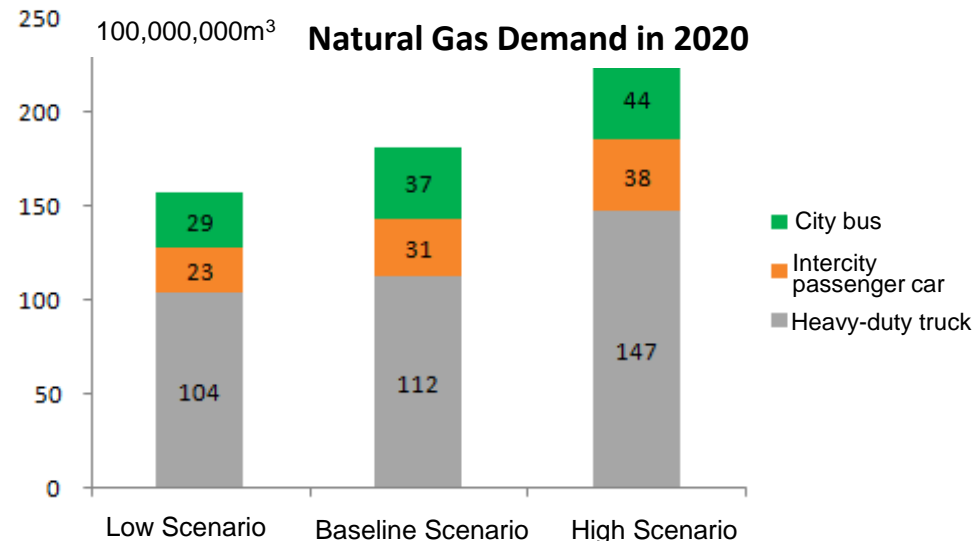
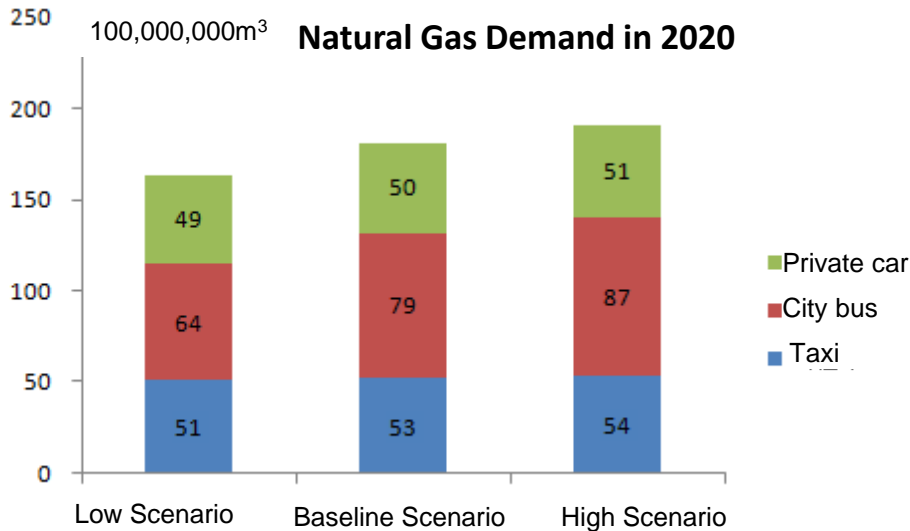


6. Gas consumption forecast of natural gas vehicles

- In the baseline scenario, China's CNG vehicle ownership will maintain a steady growth rate. In 2020, the incremental will be 520,000, and total ownership will exceed 5,040,000. Gas consumption will be 18,200,000,000m³, increasing by 3,400,000,000m³ compared with that of 2015, and the annual average growth rate will be 4.2%.
- In the baseline scenario, China's LNG vehicle ownership will grow rapidly. In 2020, the total ownership will exceed 500,000. The gas consumption will be 18,100,000,000m³, increasing by 8,100,000,000m³ compared with that of 2015, and the annual average growth rate will be 12.6%.

Gas Consumption Forecast of CNG Vehicle in 2020 per Scenario

Gas Consumption Forecast of LNG Vehicle in 2020 per Scenario





7. China's development trends of alternative energy to petroleum

- The alternative transportation energy, especially natural gas and electric energy, will develop rapidly.
- It is estimated that the substitution quantity will increase to 75,020,000t oil equivalent in 2020 and will exceed 120,000,000t oil equivalent in 2030; natural gas and electric energy will be in the dominant position.

Estimation of Substitution Quantities of Alternative Energy

	Natural Gas	Fuel Methanol	Fuel Ethanol	Coal-to-liquids	Bio-diesel	Electric Locomotive	Electric Vehicle	Total
Unit of Substitution Quantity: 10,000t	100,000,000 m ³	10,000t	10,000t	10,000t	10,000t	100,000,000K WH	10,000	10,000t
2012 (physical quantity)	156	400	200	100	100	910	3	—
2012 (substitution quantity)	1285	180	120	100	100	2400	2	4187
2015 (physical quantity)	248	400	200	150	300	1060	50	—
2015 (substitution quantity)	2020	180	120	150	300	2800	25	5595
2020 (physical quantity)	363	500	200	500	200	1230	500	—
2020 (substitution quantity)	2957	225	120	500	200	3250	250	7502
2030 (physical quantity)	638	600	200	1000	200	1500	3000	—
2030 substitution quantity)	5257	270	120	1000	200	4000	1500	12347



Main Contents

I. Development of Electric Vehicles and Other Kinds of Alternative Energy



II. Features of China's Petroleum Market

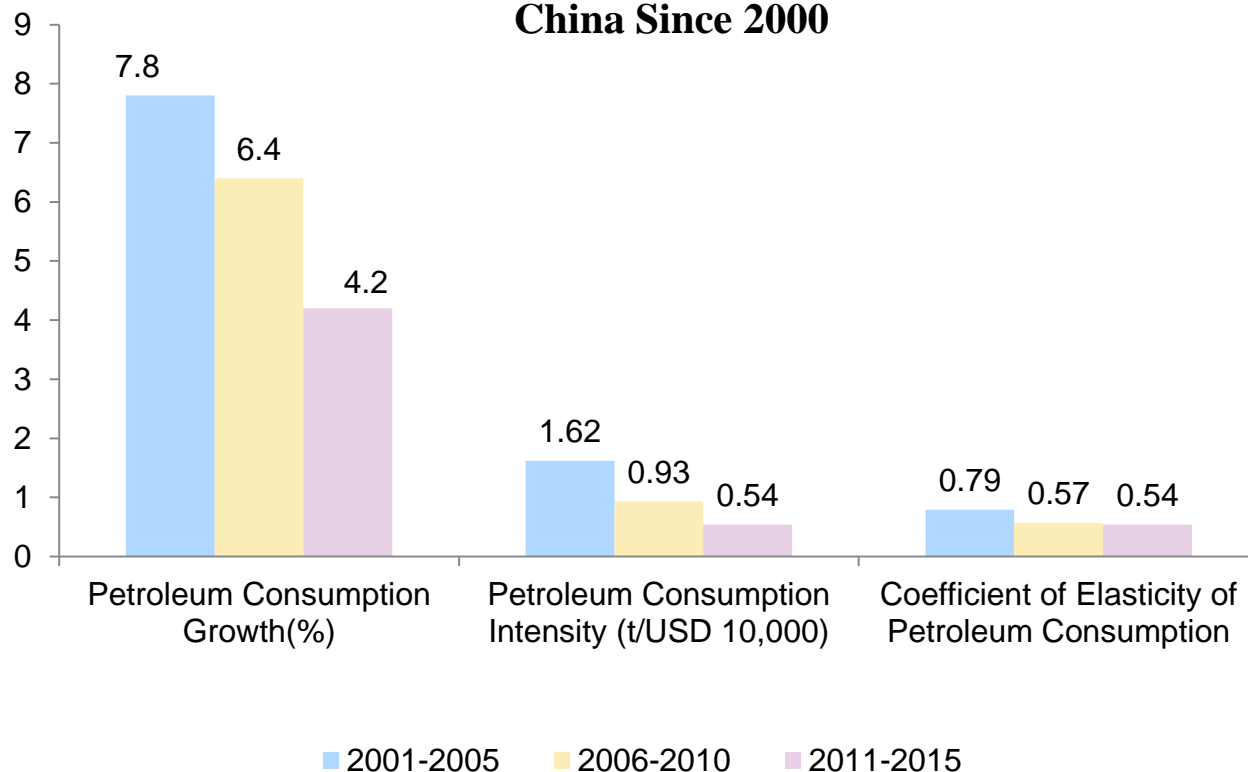
III. Outlook on China's Mid- and Long-term Petroleum Demand



1. Three characteristics of China's oil demand: Lower Growth Rate, lower Intensity, and lower Elasticity

- **Lower Growth Rate:** during the “12th Five-year Plan”, the annual average growth of petroleum consumption of China was 4.2%, which dropped by 1/3 compared with that during the “11th Five-year Plan”.
- **Lower Intensity:** in 2015, the petroleum consumption of unit GDP of China dropped to 0.5t/USD 10,000, which was close to the world average level.
- **Lower Elasticity:** due to the economic structural adjustment, the coefficient of elasticity of petroleum consumption of China decreased obviously. During the “10th Five-year Plan”, the “11th Five-year Plan” and the “12th Five-year Plan”, the coefficient of elasticity of consumption was 0.79, 0.57 and 0.54 respectively.

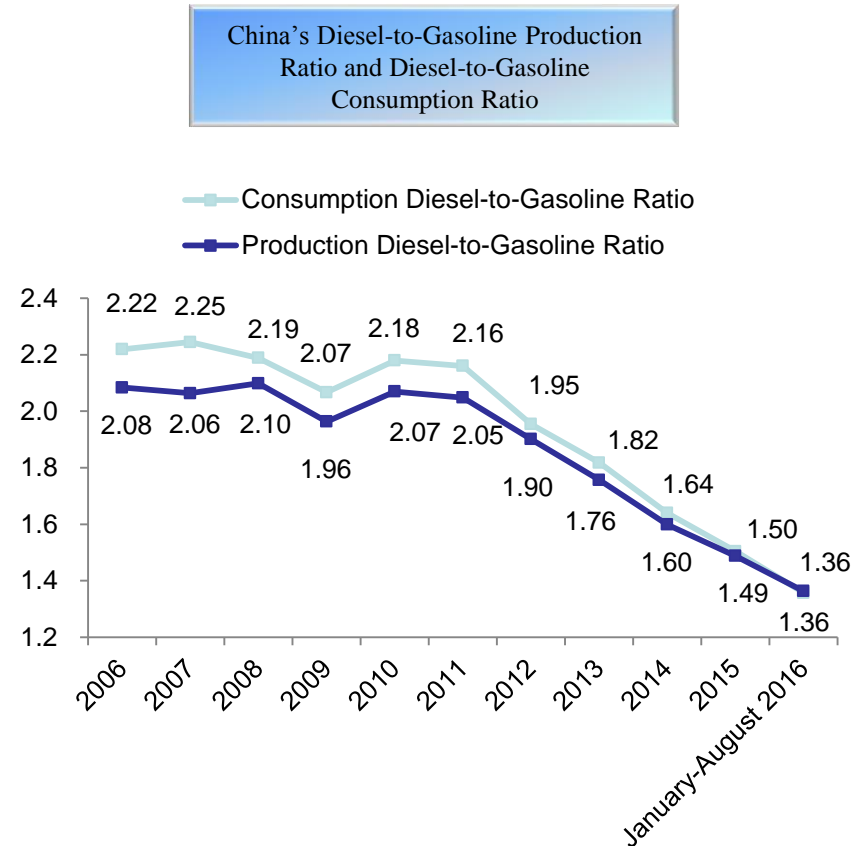
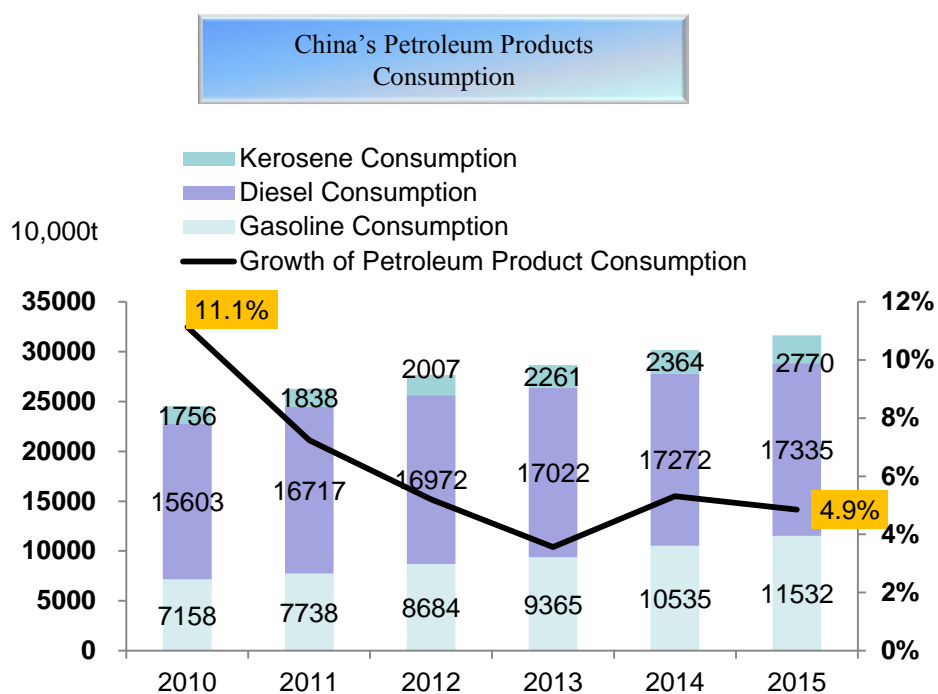
Features of Petroleum Consumption of China Since 2000





2. The petroleum product demand is continuously divided, and the ratio of diesel to gasoline continuously decreases

- Due to the downturn of both macro economy and traditional industry, the rigid demand of diesel is continuously weakened, while the gasoline demand grows relatively rapidly. The growth of China's petroleum products consumption has changed from diesel-driven to gasoline-driven. In 2015, the contribution rates of gasoline, diesel and kerosene to the increment consumption of petroleum products was 63.3%, 13.6% and 23.1% respectively.
- China's diesel-to-gasoline consumption ratio has decreased for six years consecutively, and it is continuously in the down channel. The gap between diesel-to-gasoline production ratio and diesel-to-gasoline consumption ratio is further narrowed.



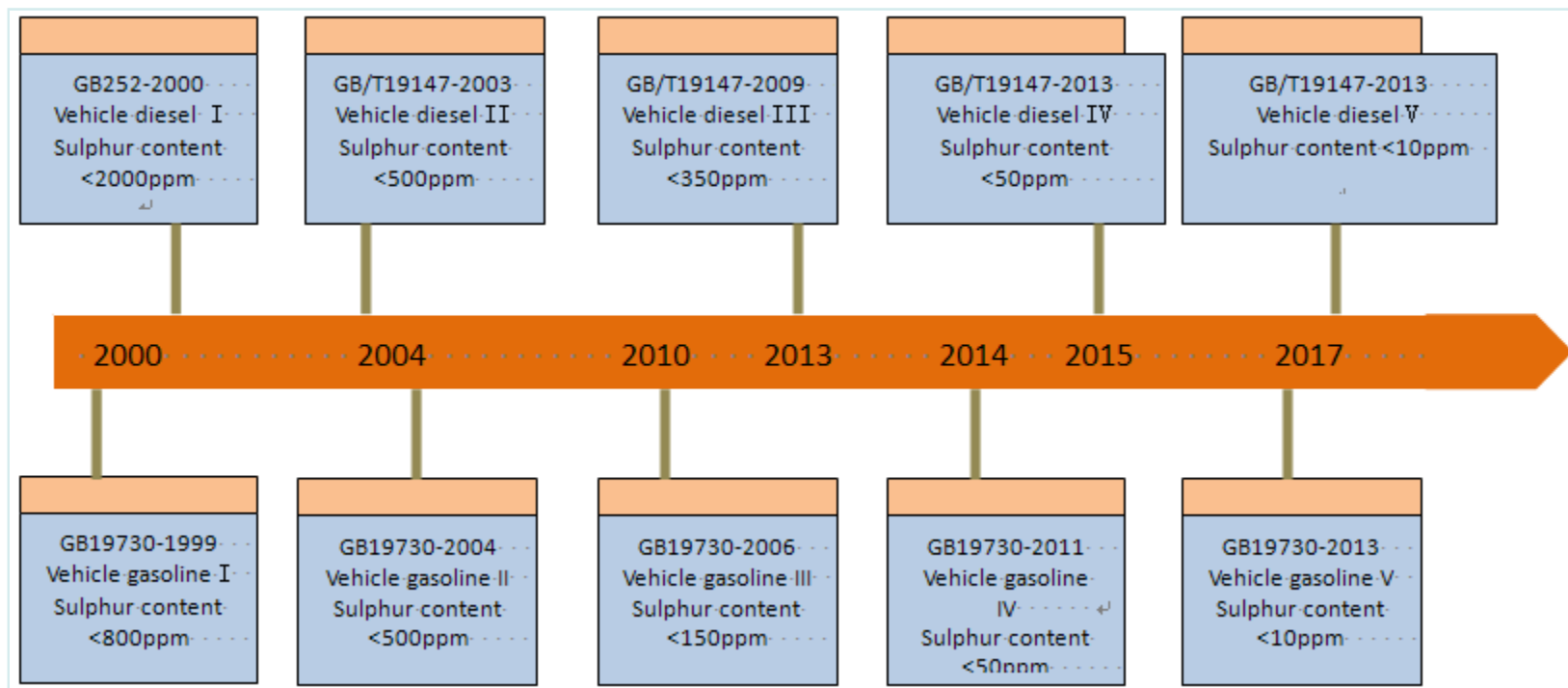


3. The quality of China's oil products has upgraded rapidly since the 21st century

Since the beginning of the 21st century, the quality upgrading of China's oil products acts on the international convention. China spends about 10 years yet Europe and America have spent 20-30 years in the upgrading:

- In 2000, the lead-free gasoline was implemented nationwide.
- 2014 was the year of quality upgrading of oil products. Since January 1st 2014, National IV gasoline standard was comprehensively executed. By the end of the year, National IV diesel standard was executed, with the sulphur content decreasing to 50 μ g/g. Beijing, Shanghai, Guangzhou, Jiangsu and some other regions entered National V standard era.
- As for the upgrading from National I to National V, the limitation of sulphur content in the standard has been decreased from no more than 1000ppm in 2000 to no more than 10ppm in National V, down by 99%.

Quality Upgrading Timeline of China's Oil Products





4. Rapid expansion of market share of gasoline and diesel of local refinery

- After the government loosens the imported crude oil control and the local refinery obtains the crude oil import right, use right of imported crude oil and export right of petroleum products since 2015, the local refinery breaks the raw material bottleneck, and the gasoline and diesel output rises greatly.
- From January to August 2016, the gasoline output of local refinery was 17,460,000t, increasing by 25.5% on a year-on-year basis; the diesel output was 28,390,000t, increasing by 23.7% on a year-on-year basis.

Crude Oil Import of Local Refinery

Crude Oil Import	Quota Refinery	Quota Quantity (10,000t)	Import Nationwide (10,000t)	Proportion of Local Refinery
2015	13	5519	33262	17%
2016	21	7982	36000	21%

Change of Gasoline and Diesel Output of Local Refinery

Output of Local Refinery from January to August		Gasoline (10,000t)	Diesel (10,000t)
Output	2015	1391	2295
	2016	1746	2839
	Growth	25.5%	23.7%
Proportion in National Output	2015	17.4%	19.2%
	2016	20.4%	24.3%
	Growth	3.0%	5.2%

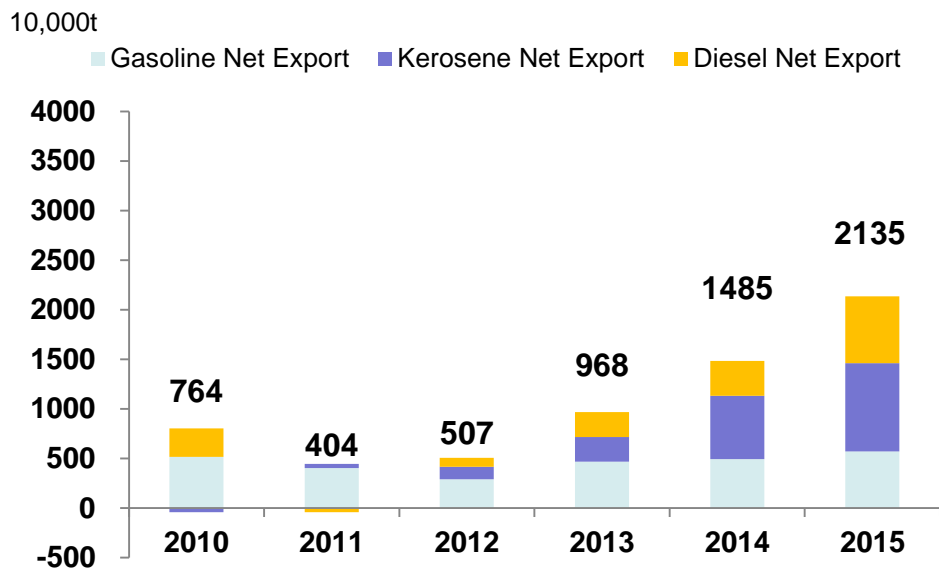
Note: local (more than 5,000,000t) data are provided by the Development and Reform Commission and local (other) is output of China Petroleum and Chemical Industry Federation-output of Development and Reform Commission



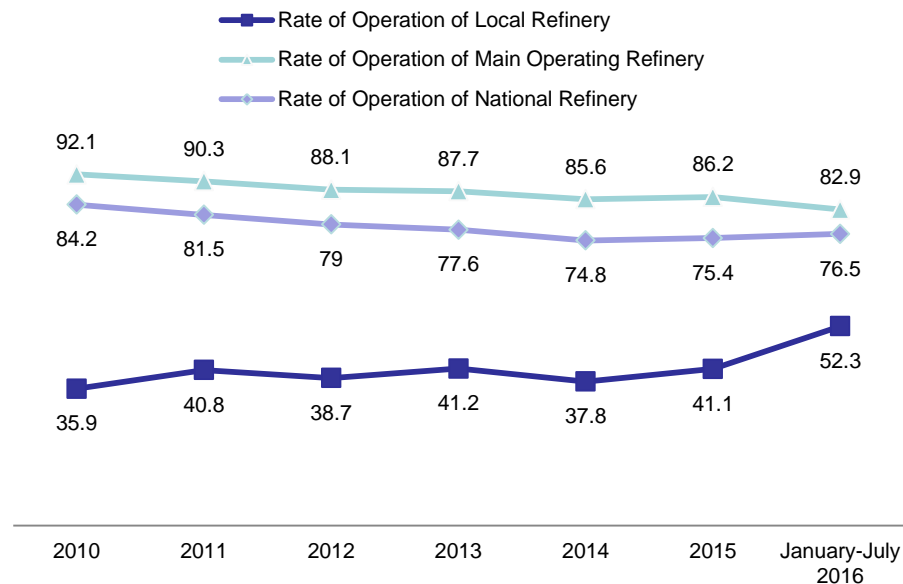
5. The export of petroleum products rises greatly, and the rate of operation nationwide rises slightly

- As of the end of July 2016, the domestic oil refining capacity was 697,920,000t/year, the average rate of operation of refinery was 76.5%, increasing by 2.5 percentage points on a year-on-year basis, and the rate of operation of main operator was 82.9%, decreasing by 1 percentage point on a year-on-year basis. The rate of operation of local refinery was 52.3%, increasing by 11.6 percentage points on a year-on-year basis. The great increase of gasoline and diesel output of local refinery intensifies the excess situation of domestic petroleum product market, and the competition is increasingly fierce.
- The excess situation of petroleum products of China is increasingly austere, and the export volume increases constantly. From January to August 2016, the net export volume was 20,000,000t, increasing by 82.1% on a year-on-year basis, and the diesel growth was the greatest.

Export Situation of Petroleum Products of China



Rate of Operation of Refinery





Main Contents

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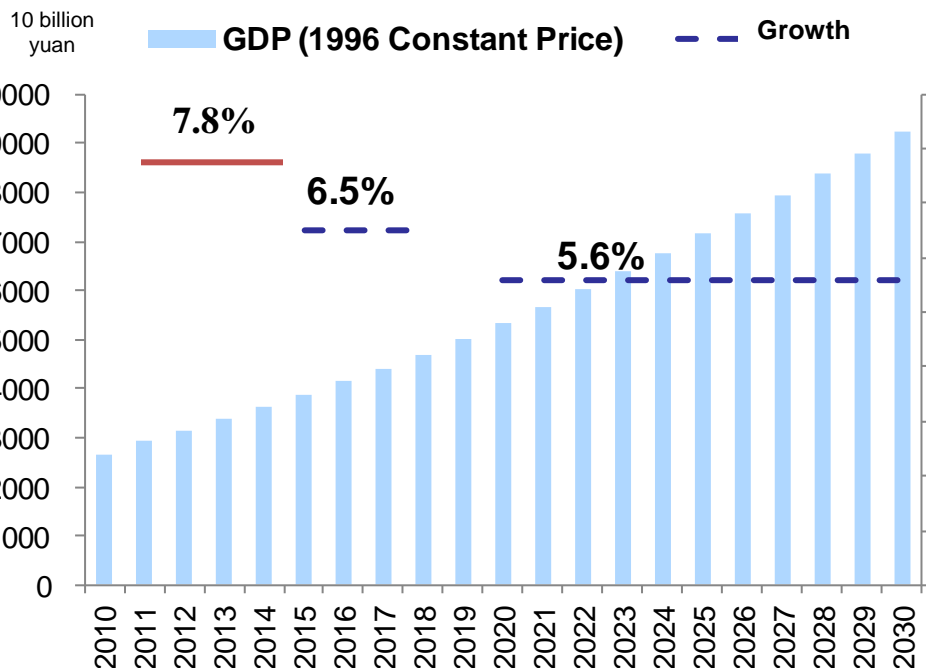
III. Outlook on China's Mid- and Long-term Petroleum Demand



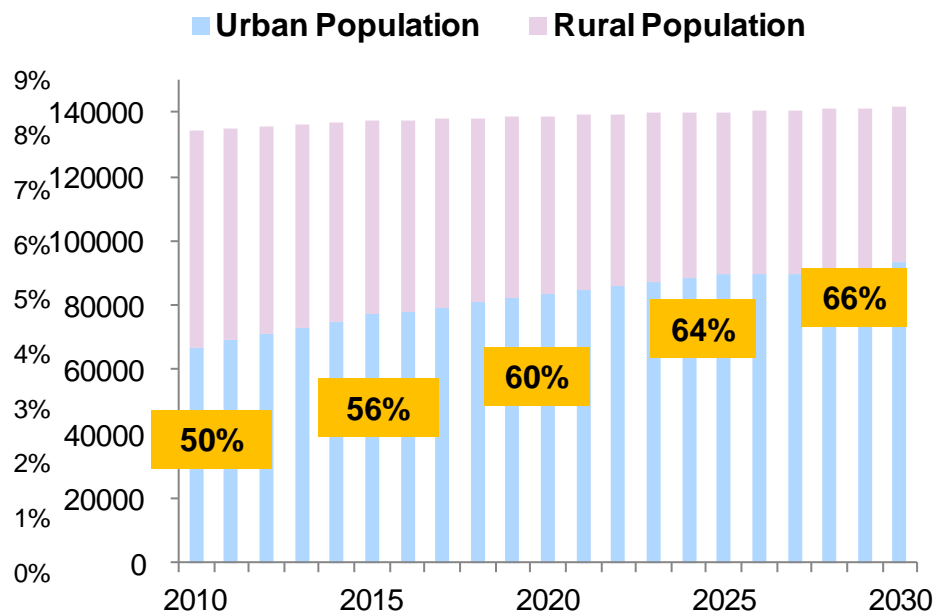
1. Scenario setting of China's economic growth

- **BAU scenario:** in 2020, a moderately prosperous society will be comprehensively constructed; both GDP and income of urban-rural residents will double compared with those of 2010;
 - In 2030, China will become the high-income country at the medium level, and the economic structure will realize the optimized transformation.
- **High-growth scenario:** the reform progress will accelerate, and consumption and investment demands will continuously expand.
- **Low-growth scenario:** the economic transformation will be at risk, and the economic growth impetus will be insufficient.

Economic Development Forecast of Baseline Scenario



Population and Structural Development





2. Forecast of China's economic structure

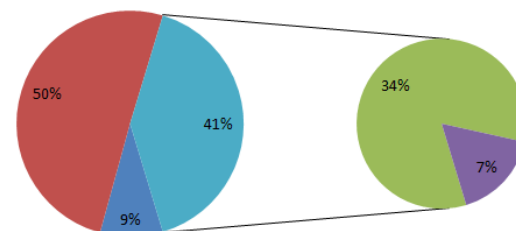
- The proportion of industry in GDP reached the peak value of 42% in 2006, then it decreased to 34% in 2015; the proportion of service industry rises continuously, thus the economic structure is undergoing the material change.
- The industrial growth point is shifted from the traditional industry to the high-grade, precision and advanced technological industry, and the traditional industry reaches the peak value. Due to the promotion of urbanization, the proportion of construction industry grows slightly.

The peak value of industrialization proportion of major economies is basically 40%

	Peak Value of Industrial Proportion	GDP Growth of Peak Value Year	Current Industrial Proportion
Japan	39%	1964/16.7%	21%
South Korea	30%	1987/4.8%	27%
Taiwan Province	46%	1986/4.8%	23%
China	42%	2006/12.7%	34%

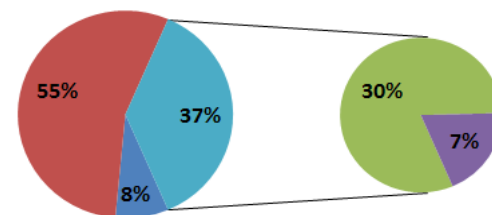
Economic Structure in 2015

■ Primary Industry ■ Tertiary Industry ■ Industry ■ Construction Industry



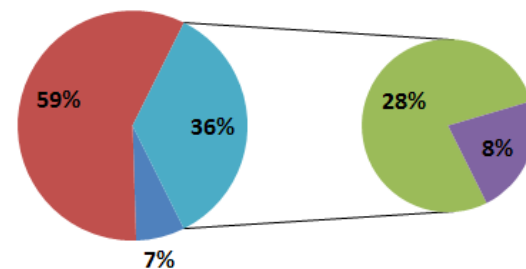
Economic Structure in 2020

■ Primary Industry ■ Tertiary Industry
■ Industry ■ Construction Industry



Economic Structure in 2030

■ Primary Industry ■ Tertiary Industry
■ Industry ■ Construction Industry

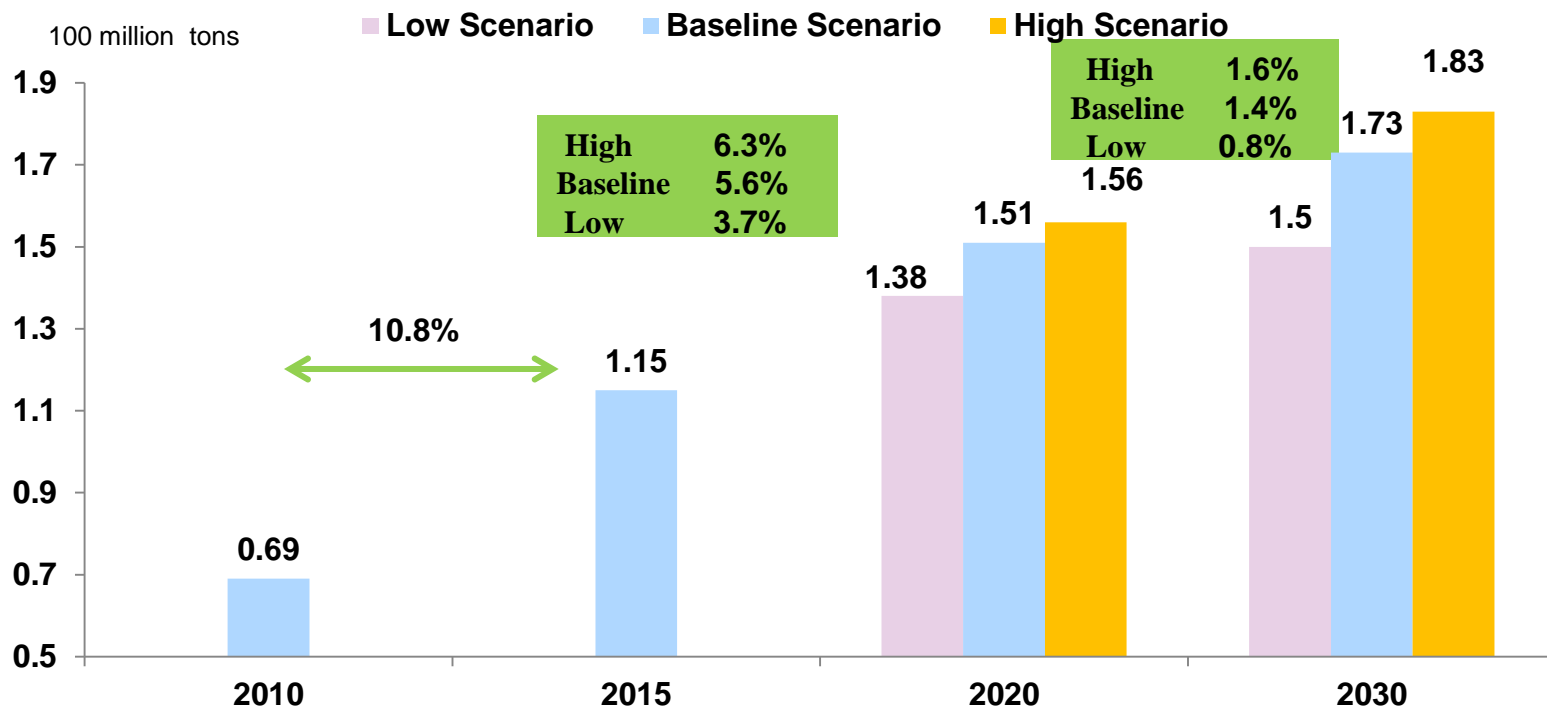




3. China's mid- and long-term gasoline demand will still grow continuously

- With the improvement of per capita income and living standard of China, the passenger vehicle consumption of China will maintain relatively rapid growth. It is estimated that the annual average growth of private vehicle ownership of China during the “13th Five-year Plan” will be 8%-12%. However, the oil saving technological progress will affect the gasoline consumption. The overall goal of vehicle energy saving standard of China has been specified in the plan. Oil consumption per hundred kilometers of passenger vehicles should be 5.0L and 3.2L respectively in 2020 and 2030, down by about 30% and 50% respectively compared with that in 2015.

Forecast Results of Medium- and Long-term Gasoline Demand of China per Scenario (2015-2030)

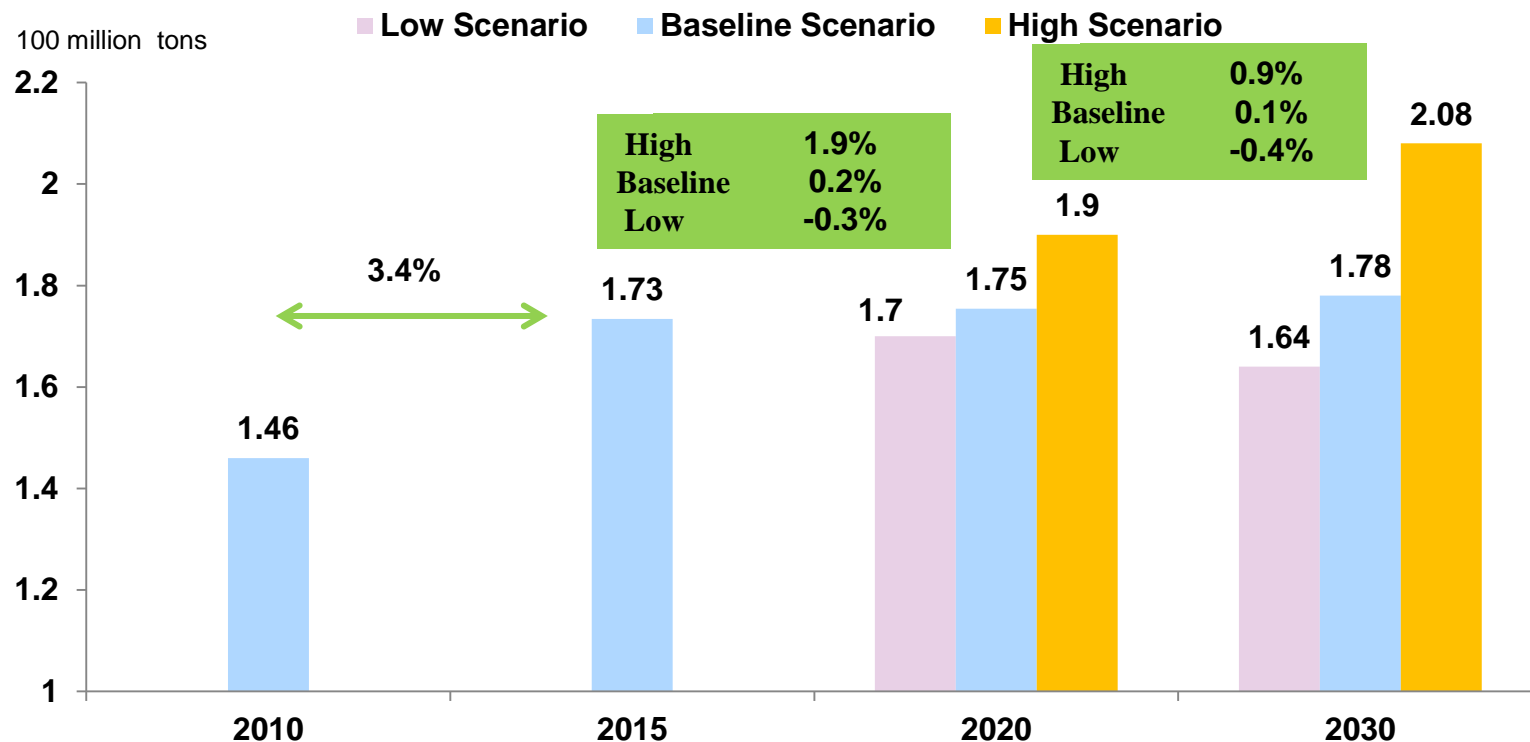




4. China's mid- and long-term diesel demand growth tends to stagnate

- Macro economy: the correlation coefficient of diesel consumption and GDP is more than 90%, but the correlation is weakening.
- Transportation: with the industrial transformation, the bulk commodity demand growth decreases, and the road freight transportation demand shrinks. As a result, the diesel consumption enters the stagnation period directly.

Forecast Results of Medium- and Long-term Diesel Demand of China per Scenario (2015-2030)

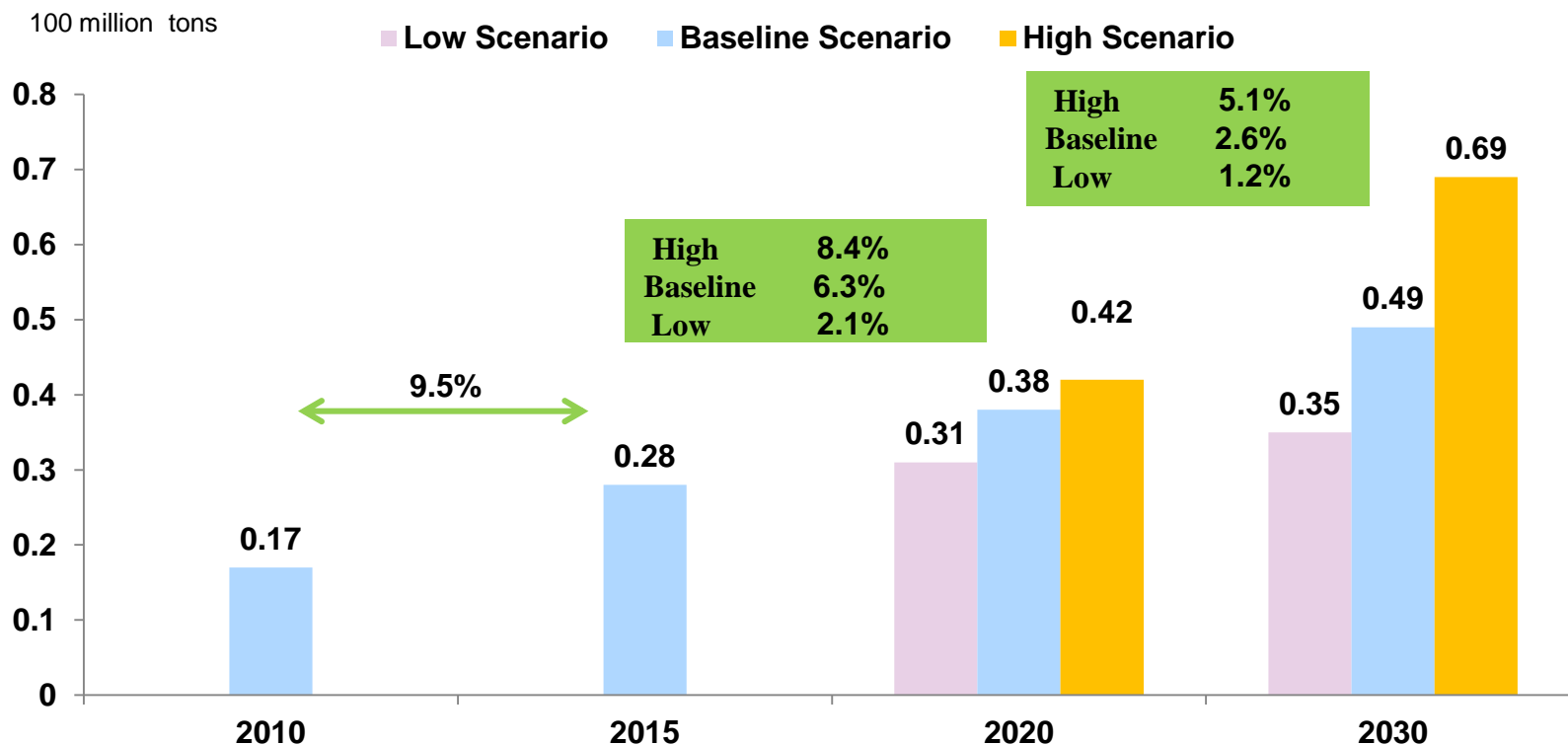




5. China's mid- and long-term kerosene demand maintains a relatively rapid growth rate

- The kerosene demand is closely related to the civil aviation turnover, GDP and per capita income, and the correlation coefficient is 98%. In the medium and long term, the economic development and resident income will maintain more than 6% medium- and high-speed growth, the Chinese civil aviation will still be in the important period of popular and diversified development, and the rapid growth is still the essential characteristic.
- Alternative energy: electric locomotive, substitution of short-distance aviation demand.

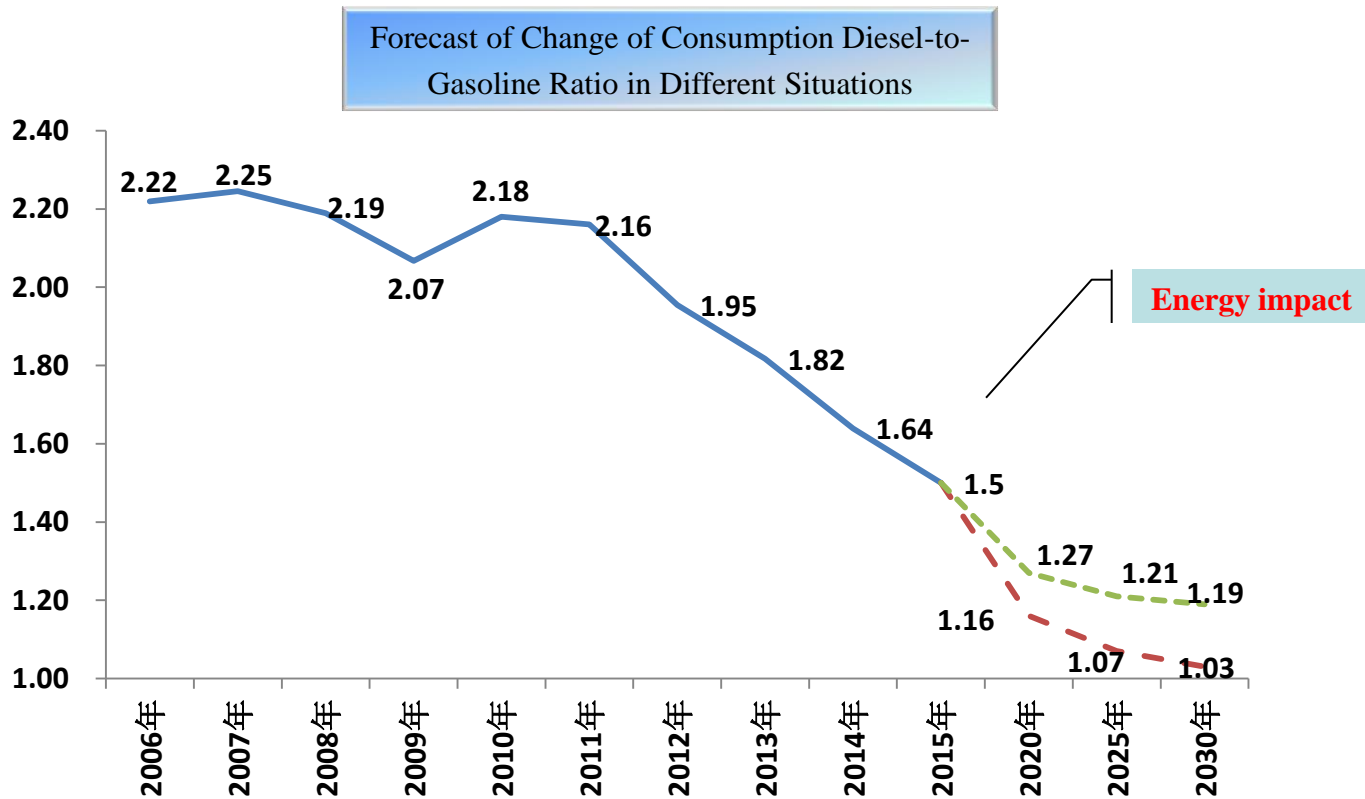
Forecast Results of Medium- and Long-term Kerosene Demand of China per Scenario (2015-2030)





6. High-speed development scenario of new energy vehicles: constrain the downtrend of the mid- and long-term diesel-to-gasoline ratio

- High-speed development scenario of new energy vehicles: in 2025, if the new energy vehicle ownership increases to 17,000,000 in the policy planning, the diesel-to-gasoline ratio will rise from 1.07 of baseline scenario to 1.21; in order to achieve the carbon emission goal, in 2030, the new energy vehicle ownership will be about 30,000,000, and the substitution quantity of passenger vehicle is about 10%, so the diesel-to-gasoline ratio will rise from 1.03 of baseline scenario to 1.19.

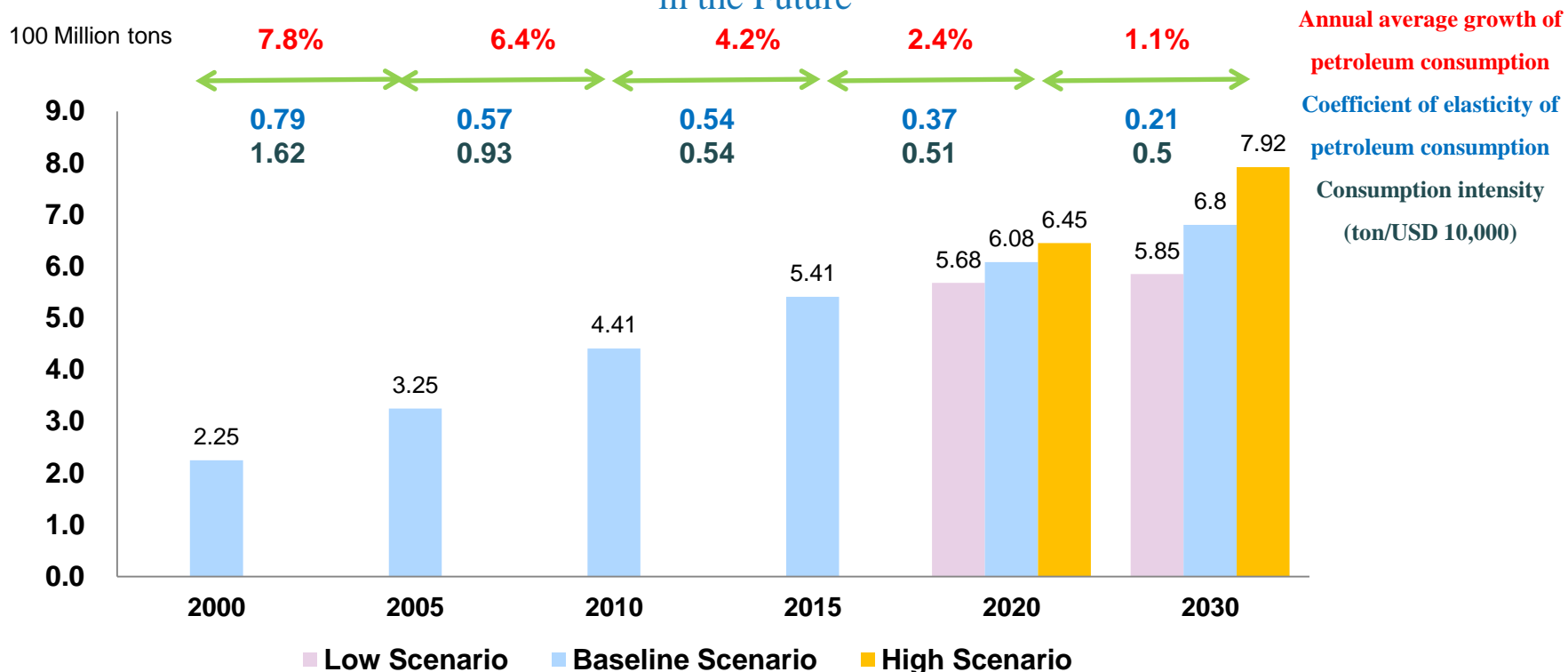




7. In the future, China's petroleum demand growth rate will decrease, but the absolute quantity will be relatively high

- In the future, the low- and medium-speed growth rate of petroleum product demand of China and continuous increase of oil refining capacity will drive the petroleum demand of China to maintain the growth situation.
- According to the model prediction, taking alternative energy effect into account, in the baseline scenario, the petroleum consumption of China will be 608,000,000t and 680,000,000t respectively in 2020 and 2030. The average annual growth rate from 2015 to 2020 and that from 2020 to 2030 is 2.4% and 1.1% respectively.

Forecast of Development Trend of China's Petroleum Demand
in the Future

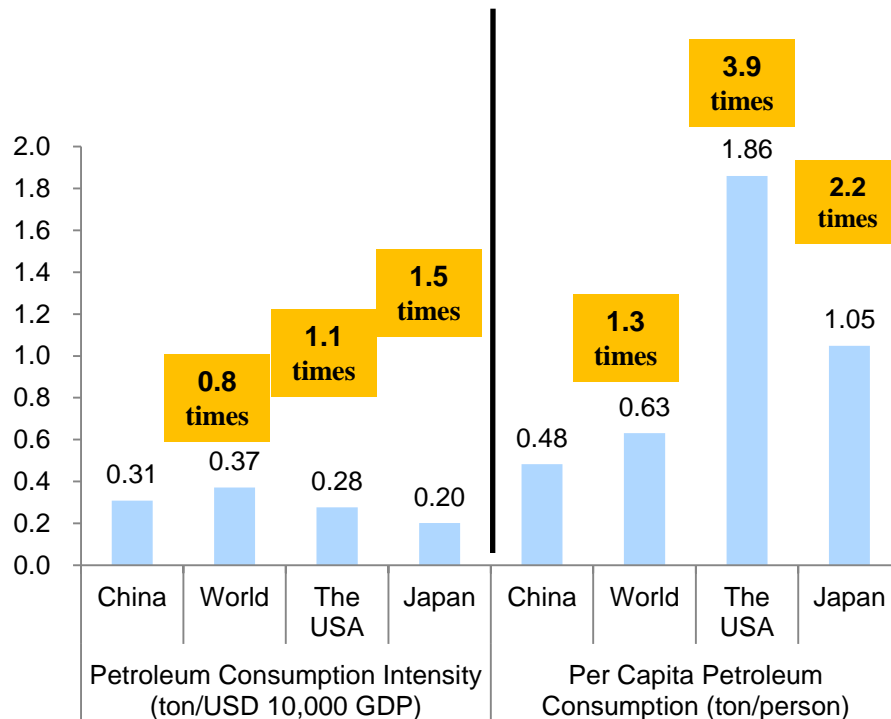




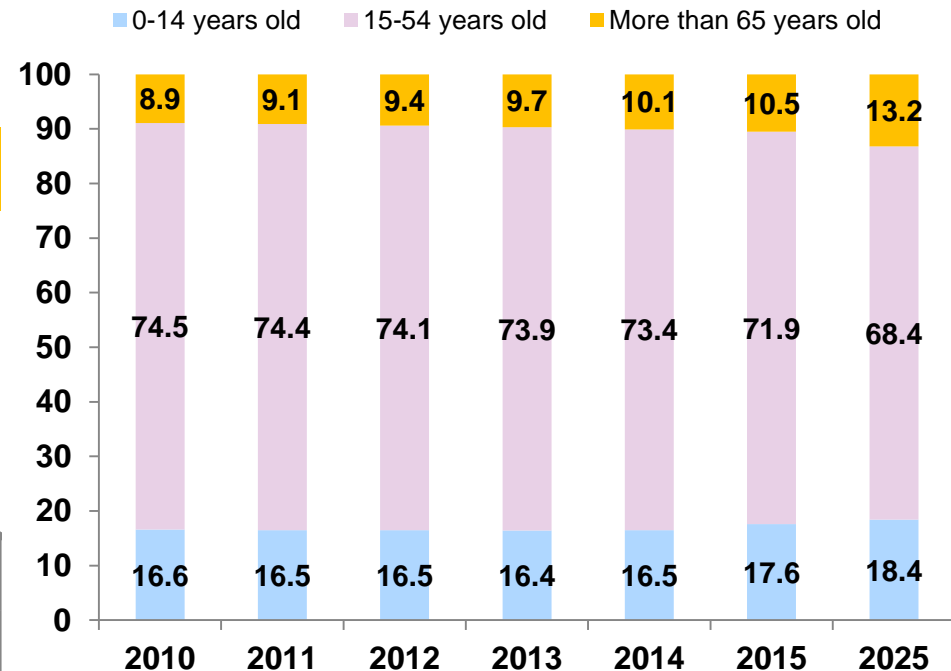
8. China's petroleum demand will reach the peak value around 2030

- Two features of petroleum consumption in developed countries
 - (1) The per capita petroleum consumption maintains stable for a long term;
 - (2) The petroleum consumption of unit GDP presents a decline trend.
- China's petroleum consumption trend: in terms of per capita consumption, the consumption curve is the parabolic growth and gradually close to the peak value in the future; in terms of unit GDP consumption, the curve reached the peak value in 1978, then it declines year by year thereafter.

Comparison between Different Countries with regard to Petroleum Consumption Intensity and Per Capita Level in 2030



Aging of Chinese Population in the Mid- and Long Term





Conclusions

1. The driving function of economy for petroleum consumption weakens. In the future, China's petroleum demand will maintain a 2%-3% low-speed growth rate.
2. In the future, the consumption of China's petroleum products will present a low-growth, low-consumption and low-pollution development trend.
3. The growth of China's petroleum products consumption is continuously divided, and "high gasoline, low diesel and much kerosene" feature is increasingly significant.
4. In the future, both supply and demand of China's petroleum product are loose, and the export (especially diesel export) will be normal and massive.
5. The development of alternative energy, especially natural gas and electric energy, will accelerate.
6. Due to policy and technology factors, the development of electric vehicles still faces uncertainty.



Thanks !

