



# The development of China New-energy vehicles and its impact

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CNPC ETRI

————— 2017. 11. 8 · Beijing —————



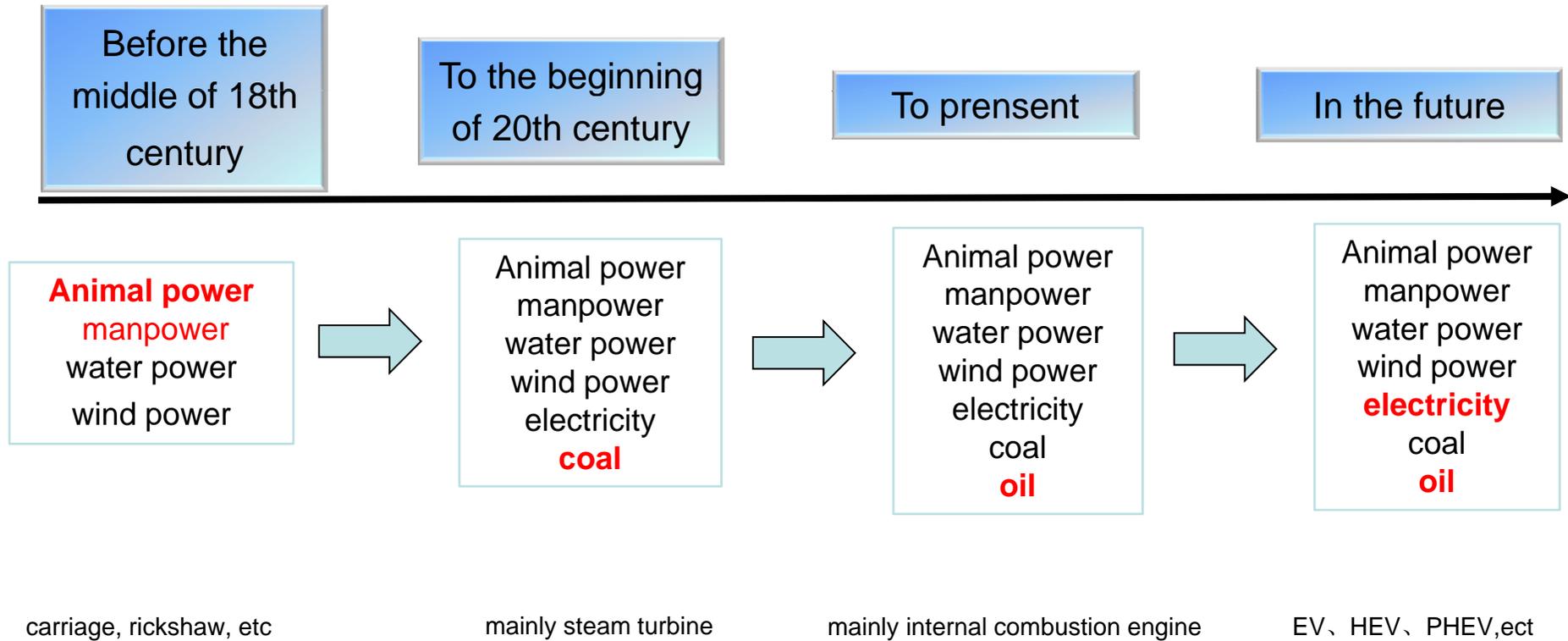
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- 2. Market situation of China's New-energy Vehicles**
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# 1. Human transportation energy development trend: more economic, more convenient and cleaner



EV is not a new thing.

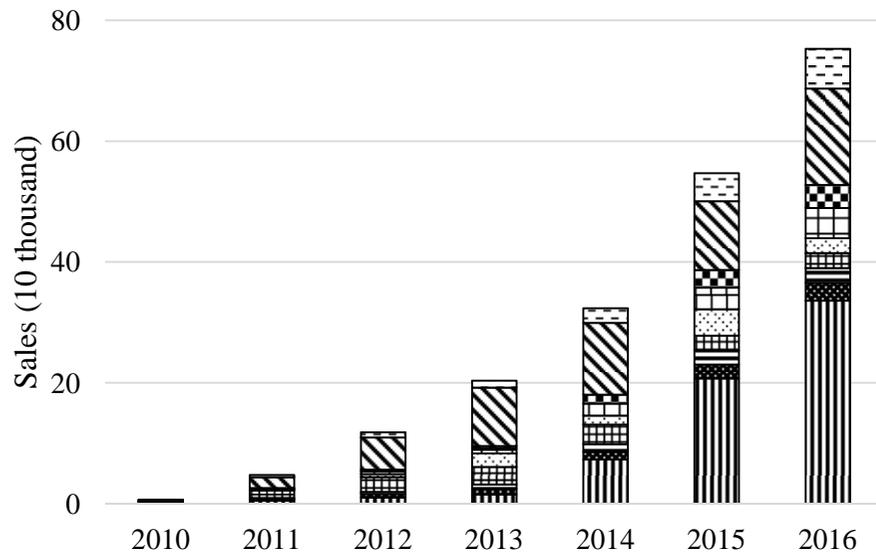
- In 1900, the United States produced 15755 electric vehicles, 1684 steam vehicles, and 936 gasoline vehicles.
- After 1910, the lower cost and more advanced ICE cars, such as Ford T, overwhelmed EVs. Since then, EVs have turned to public applications.



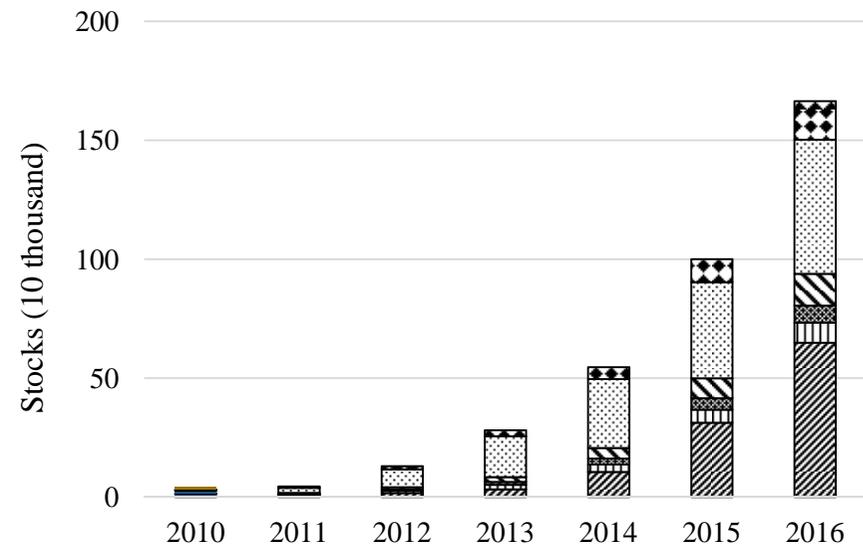
## 2. Global electric vehicles develop rapidly, China's annual sales and stock ranked first in the world

- According to *Global EV Outlook* newly released by IEA, global electric vehicle sales volume hit a record of 753 thousand in 2016, up by 37.6% compared with 2015. Global electric vehicle stock rose to 2 million vehicles, up by 59.5% compared with 2015.
- In 2016, EV's sales volume in China, the US, Japan and Europe were respectively 336 thousand vehicles, 160 thousand, 25 thousand vehicles and 167 thousand vehicles. The corresponding amount of stocks were 649 thousand, 564 thousand, 151 thousand and 488 thousand respectively in 2016.

Amount of sales volume of global EVs in 2010-2016



Global electric vehicle stocks in 2010-2016



From bottom to up is: China, France, Germany, Japan, Netherlands, Norway, UK, USA, Others



### 3. Two main driven polices for EV's development: direct subsidy and accumulated points

#### Subsidy Policies

Subsidy Patterns	Country	Major subsidy policies
Direct subsidies	German	Euro 4000 for an EV Euro 6000 for a vehicle(CO2 emissions<20g/km) Euro 1000 for a vehicle(20g/km<CO2 emissions<60g/km)
	France	Additional Euro 4000 for an EV,when replacing diesel vehicles used more than 11 years
	England	1.Subsidizing 30% of the price of a vehicle ,the upper bound is Euro 4500 for a vehicle(with condition 1) 2.Subsidizing 35% of the price of a vehicle ,the upper bound is Euro 2500 for a vehicle(with condition 2) 3.Subsidizing 35% of the price of a vehicle ,the upper bound is Euro 2500 for a vehicle(with condition 3)
Indirect subsidies		Subsidy=(Price-Benchmark Amount)*Subsidy Rate Benchmark Amount=Adjustment Amount-Basic Amount Adjustment Amount:0.5 million yen for EVs,0.4 million yen for HEVs, 0.2 million yen for other green energy vehicles Basic Amount=Price of EV - Fuel car basic model shoe rack
	Norway	Exemption from VAT(25% of total price) Exemption from use tax for 50% buses Exemption from road tax
	US	Exemption from federal tax

#### Accumulated Points System

Accumulated Points System(APS)	California	New energy vehicle AP=Vehicle AP- Government regulated AP Vehicle acquired AP=Bicycle AP+ Sales volume of car model Government regulated AP=Vehicle sales volume*Government regulated ratio
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#### China's Double-points System

Vehicle type	Accumulated points for normal vehicle type
EV	0.012*EV range
PHEV	2
FCEV	0.16*Rated power of fuel cell system



## 4. Policies drive China's new energy vehicles development

### Policies and their impacts of new energy vehicles

Release Time	Title of the Policy Document	Impact Analysis
September 2013	<i>Notice 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>Notice concerning Financial Support Policy for Promotion and Application of New Energy Vehicle from 2016 to 2020</i>	Ensure the policy foundation of new energy vehicle of China in the next 5 years, and promote 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. In 2020, the charging requirements of 5,000,000 electric vehicles are met.



## 4. Policies drive China's new energy vehicles development

### Policies and their impacts of new energy vehicles

Release Time	Title of the Policy Document	Impact Analysis
December 2016	<i>Notice on Adjusting the Financial Subsidy Policy for the Promotion and Application of New Energy Vehicles</i>	Except fuel cell vehicles, the amount of subsidies for the remaining models all are reduced , with the fast charge pure electric buses down as much as 60%, and further improve the technical qualifications of subsidies for various types of vehicles. The industry competition will be accelerated, and the pressure for product cost reduction will be conducted step by step. Finally, it will be the whole vehicle enterprises that work together with the parts and components enterprises to complete the process of adapting to the change of financial funds.
January 2017	<i>Regulations on Access Management for New Energy Automobile Manufacturing Enterprises and Its Production</i>	Further strengthen the assessment of the R & D, production, management, sales and other aspects of enterprises, accelerate the elimination of backward production capacity enterprises, and cultivate high-quality enterprises, promoting the enterprises to continuously upgrade and improve product technology levels, to eliminate and avoid the "bad money drives out good money" phenomenon.
February 2017	<i>Action Plan for Promoting the Development of Automotive Power Battery Industry</i>	Accelerate the improvement of the development capacity and level of China's automotive power battery industry ,promoting the healthy and sustainable development of new energy vehicles industry.
September 2017	<i>Integrated management of average fuel consumption and new energy vehicles in passenger car enterprises</i>	Fuel consumption accumulated points can be carried over, and new energy vehicles accumulated points can be traded; the ratio of new energy vehicles accumulated points are required to reach respectively to 10%, 12% in 2019 and 2020, respectively. New energy vehicles have become a major indicator of the development of automobile enterprises, and the transaction funds between the positive and negative accumulated points within automobile enterprises will replace the state subsidy funds, picking up the driving force to stimulate the development of automobile enterprises.



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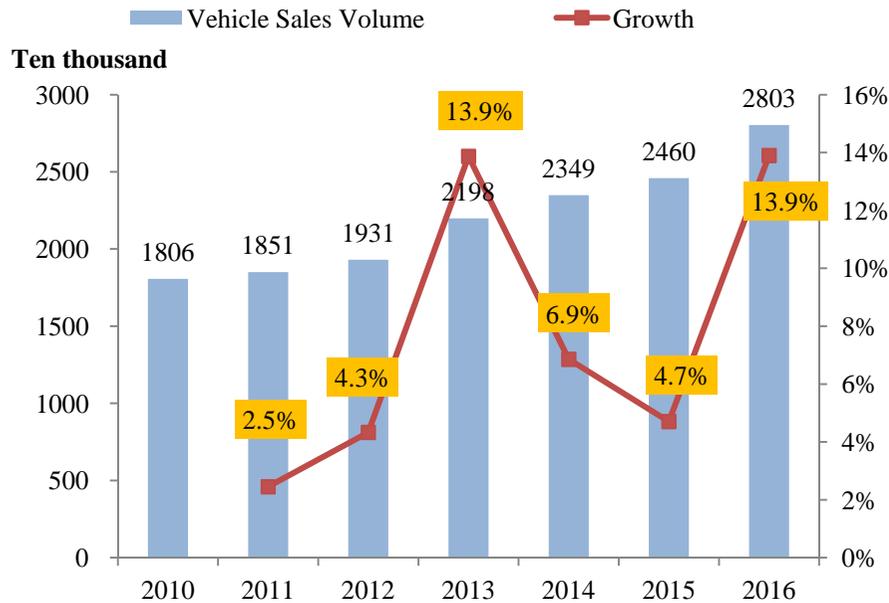
**4. China's Oil outlook**



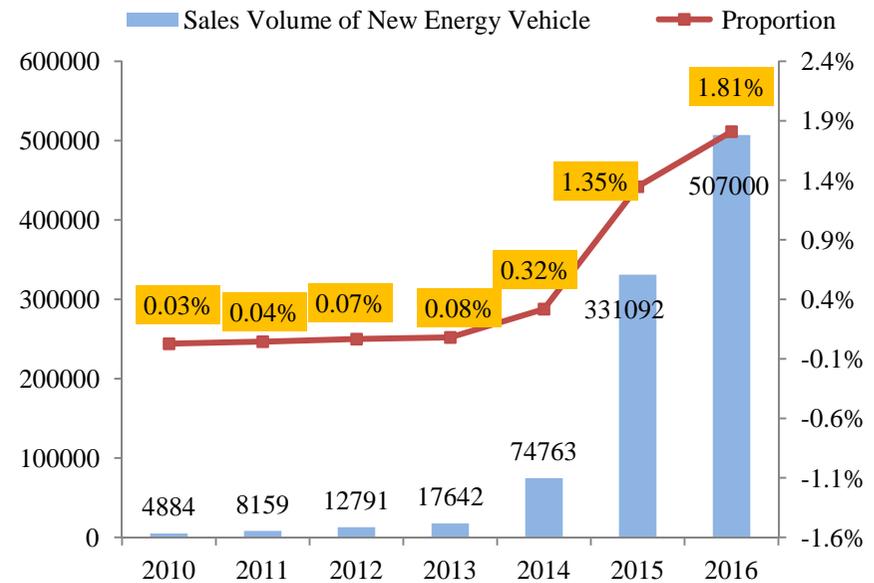
# 1. The new energy vehicles increased dramatically from a low base

- New energy vehicles include electric vehicle (EV), plug-in hybrid power vehicle (PHEV), hybrid power vehicle (HEV), fuel cell electric vehicle, hydrogen powered vehicle, and so on.
- In the past several years, China’s vehicle sales volumes increase dramatically. In 2016, the sales volume was 28,030,000, increasing by 13.9%.
- The sales volume of new energy vehicles increased much faster (by 53%), with 507,000, accounting for 1.81% of the total sales volume in 2016.

**China’s Vehicle Sales Volume and its growth rates**



**China’s New Energy Vehicle Sales Volume and its proportion of total Vehicles**

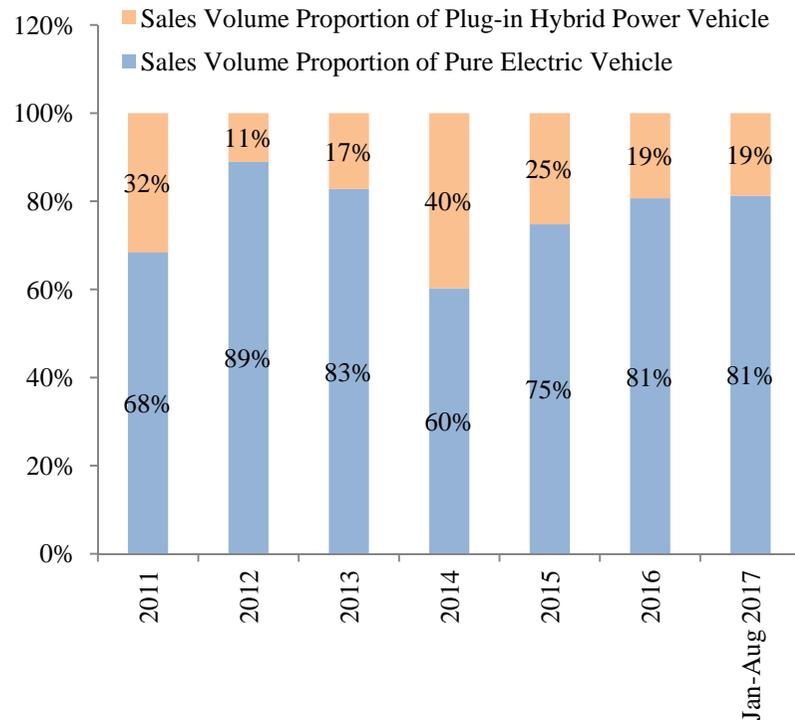




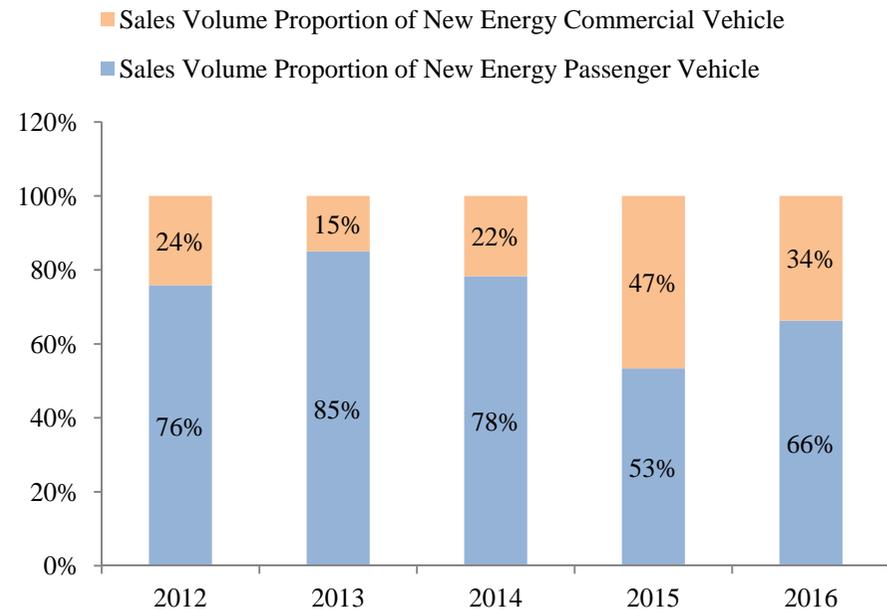
## 2. EV dominates the new energy vehicles' market

- Pure electric vehicle is still in the dominant position of all new energy vehicle sales, and its market share has been 81% since 2016.
- Compared to new energy passenger vehicles, the proportion of new energy commercial vehicles declined because of falling back of related subsidy policy in 2016.

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



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

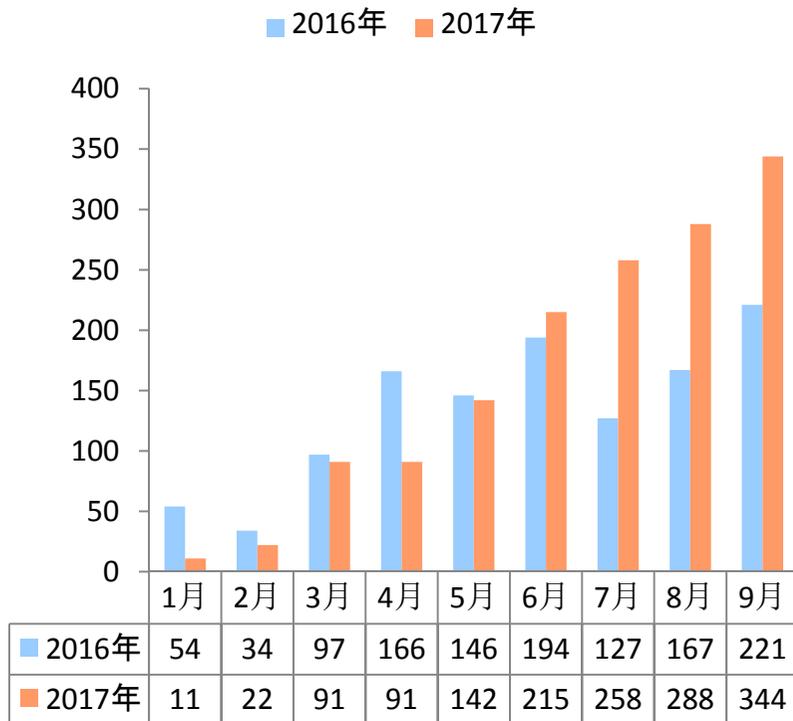




### 3. The development of new energy vehicles is highly sensitive to policy changes, and the market mechanism has not played a decisive role

- The first half of 2017, with subsidies falling off and the reevaluation of entry management standard, the new energy car battery demand has a negative growth.
- Because the subsidies decreased by more than 50%, new energy vehicle for commercial use were largely effected .

**Total installed capacity of battery for new energy vehicles**



**The battery demand of new energy vehicles**

The battery capacity	2016 (Jan-Aug)	2017 (Jan-Aug)	Growth rate
①passenger vehicles(GWh)	4.82	6.34	32%
②commercial vehicles(GWh)	5.04	4.85	-4%
proportion ①	49%	57%	
proportion ②	51%	43%	



## 4. Relatively high cost is still the most important factor restricting the development of electric vehicles

- From the technical point, according to the consumption of pure electric passenger car, 200kg battery can ride 200km, which can meet the basic travel demand. Increasing battery capacity, to reach the best mileage of 400km, can significantly alleviate the user's distance anxiety problem. Therefore, the main factor restricting the rapid popularization of electric vehicles is the economic problems.

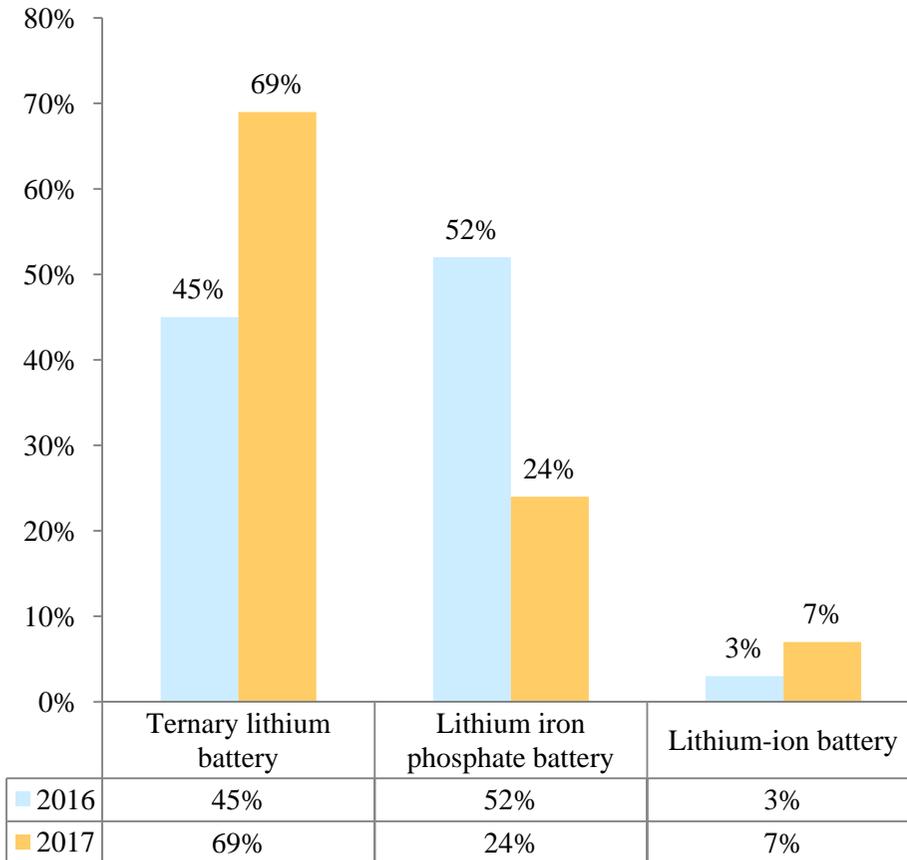
**Comparison of Tesla Model S and BAIC EV200**

	Model S	EV200
Battery capacity (kWh)	<b>85</b>	<b>30.4</b>
Mileage (km)	<b>400</b>	<b>240</b>
Standard price (Ten thousand yuan /per vehicle )	At least 0.72 million yuan	22.69/24.69
Price after subsidy (Ten thousand yuan /per vehicle )	-	13.69/15.69
Price of the fuel vehicle with the same configuration (Ten thousand yuan /per vehicle )	-	<b>around 60 thousand yuan</b>

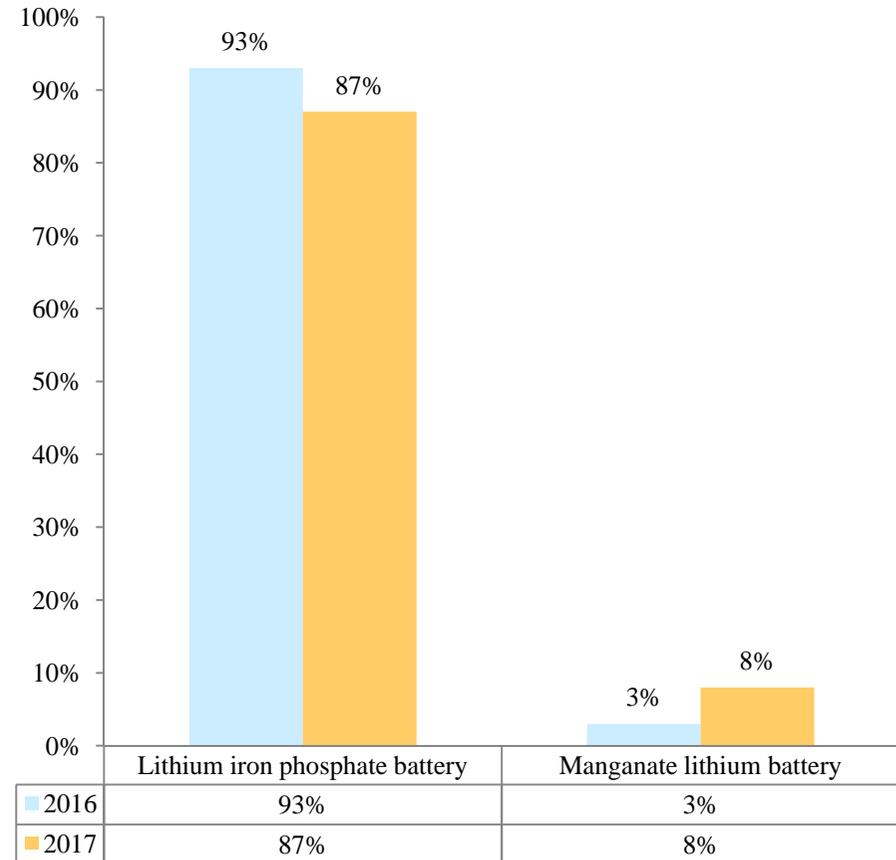


## 5. Ternary lithium battery increased dramatically

**Battery types of passenger vehicles**



**Battery types of commercial vehicles**

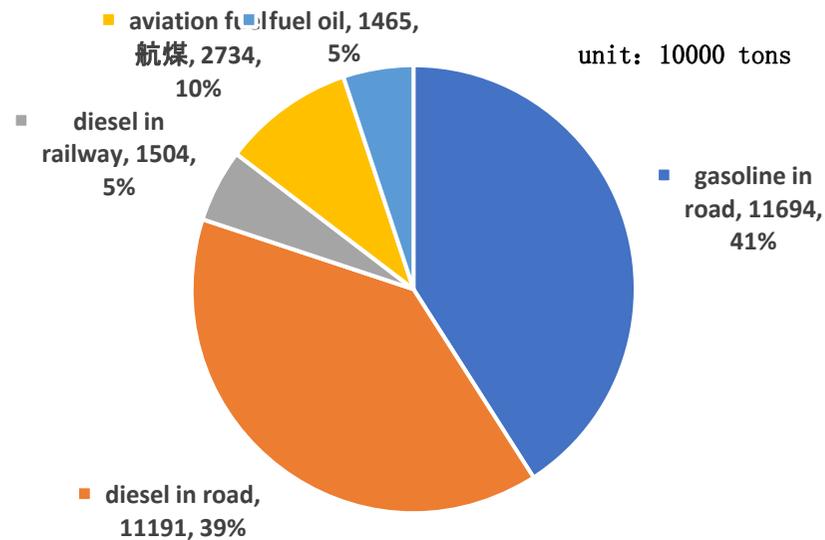


## 6. The new energy vehicles will mainly alternate the gasoline car, the total space will be 20% of oil consumption

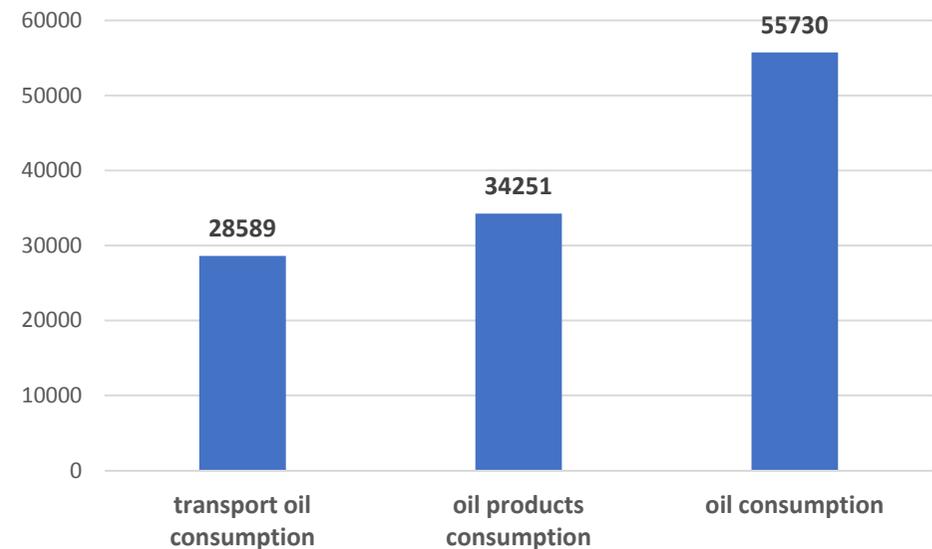


- The transportation sector remained 83% of the oil products consumption and 51% of the oil consumption in 2016 in China.
- The new energy vehicles replacing gasoline is easy in road transport, replacing diesel is difficult; electricity replacing aviation fuel is impossible in near future; diesel demand in railway will decrease slowly with the improvement of electrification, fuel oil consumption in water transport is difficult to be replaced.

Oil consumption mix of transport sector in 2016



Oil consumption percentage of transport sector in 2016





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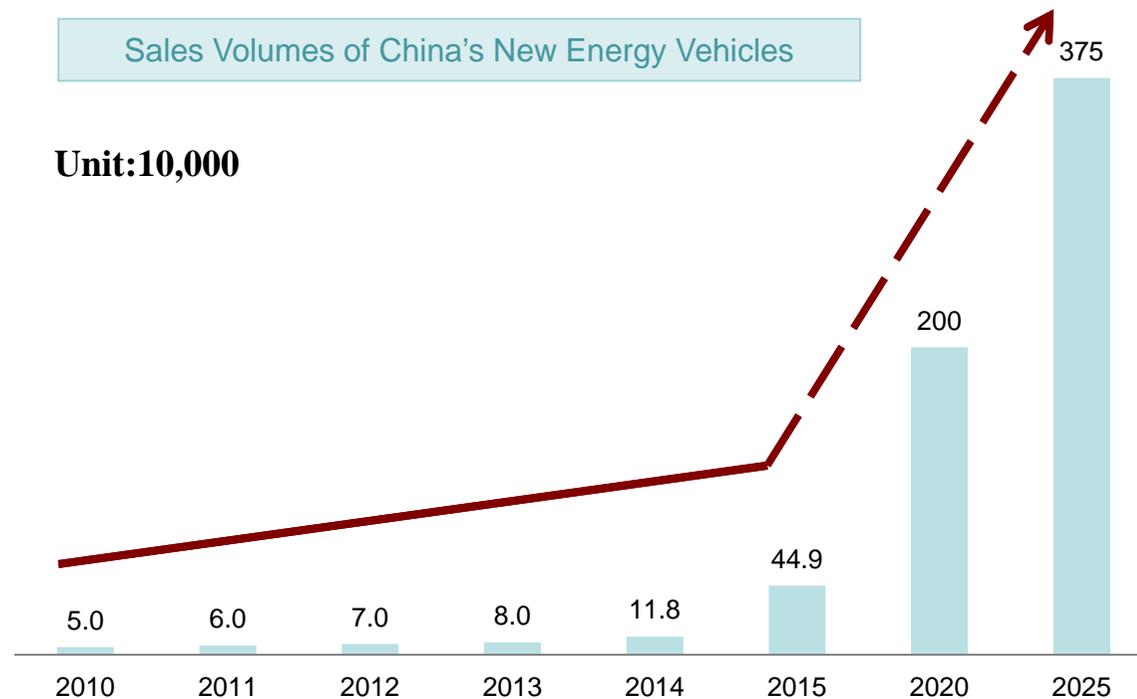
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# 1. The annual sales volumes were planned to reach 3,750,000 and stocks would be 17 million in 2025

- **Development planning for the industry of energy saving and new energy vehicles (2012-2020):** the accumulated sales volume of new energy vehicles would be 500,000 by 2015; the production capacity of new energy vehicles would be 2,000,000, and the new energy vehicles ownership will exceed 5,000,000 by 2020.
- **Made in China 2025** released by the Ministry of Industry and Information Technology: the annual sales of Chinese branded new energy vehicles will be 3 million in 2025, which accounts for more than 80% in the domestic market (which means total sales in China would be 3.75 million). According to this plan the number of new energy vehicles ownership will exceed 17 million by 2025.

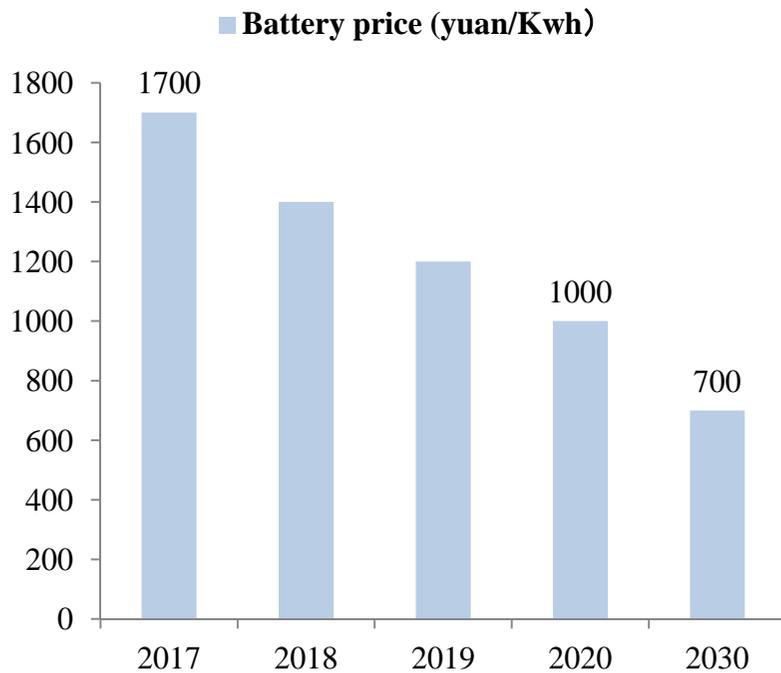




## 2. The battery cost will keep decreasing, that would make new-energy vehicles more competitive in 2030

- Material cost reduction
- Energy density enhancement
- Scale economy effect

- When the battery cost reduce to 46,000 RMB, new-energy vehicle is competitive.(if the battery capacity is 60Kwh, the unit cost should reduce to 775yuan)

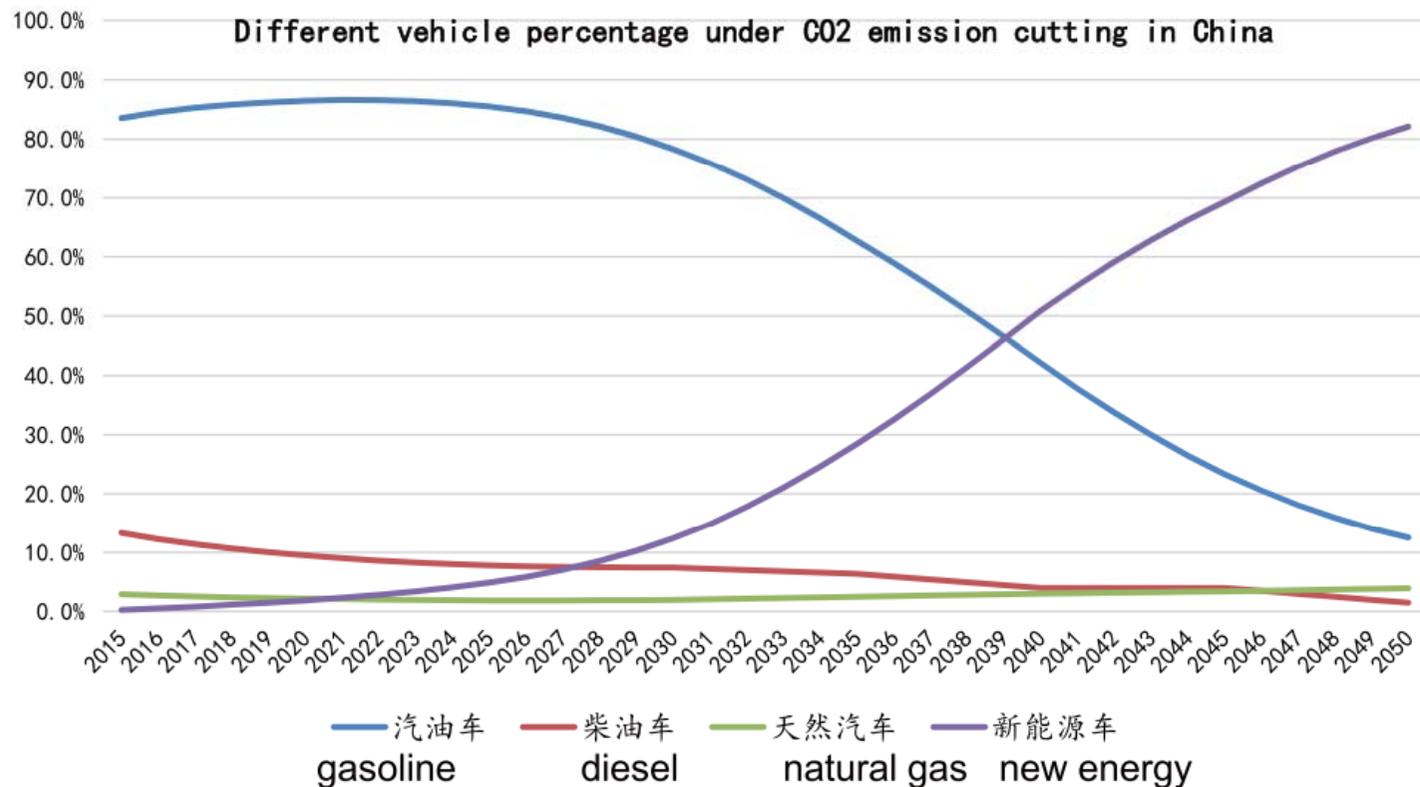


	Fuel vehicle	New-energy vehicle
Engine cost/Module cost (yuan)	35000	14000
Battery cost (yuan)	0	???
Energy efficiency	13.5 (km/L)	8 (km/kWh)
Mileage (km/y)	16000	16000
Running time (y)	5	5
Energy price	6 (yuan/L)	1(yuan/kWh)
Energy cost (yuan)	35556	10000
Cost (yuan)	70556	70556



### 3. Considering CO2 emission cutting in transportation, the oil vehicle percentage will greatly decrease in 2050

- Paris climate agreement had indicated that the CO2 emission in energy must cut to zero in 2050, but Aviation kerosene replacing by other energy is difficult, so cutting the oil vehicle will be the key choice. Considering the Vehicle lifetime, 10-15 years, China should Lock up oil vehicle in 2040, then the oil vehicle will be only 15% of car ownership in 2050, so the oil demand will decrease greatly.

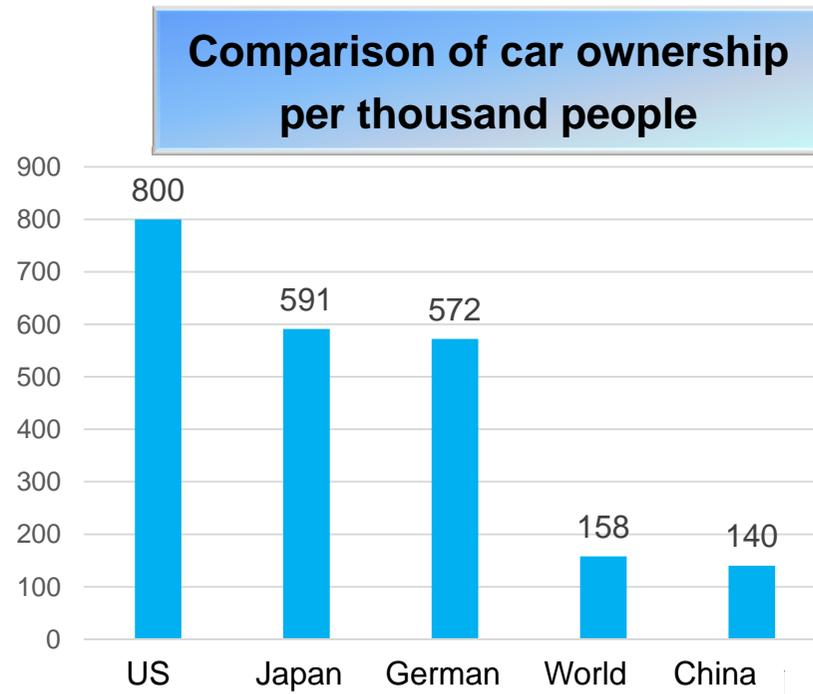




### 3. The new energy vehicles will keep increasing and its proportion in total vehicles will also increase

- In the medium and long term, the economy of new energy vehicles is still weaker than that of the fuel vehicles. We expect that the new energy vehicles will develop in accordance with the planning objectives, and the proportion will gradually increase.

Vehicle Ownership & New-energy vehicle Ownership			
	2020	2025	2030
Vehicle ownership (billion)	2.2	3.5	4
New-energy vehicle ownership (ten thousand)	500	1700	3000
The proportion of new-energy vehicle	2.3%	4.9%	7.5%





## 4. New-energy vehicles would not replace ICE vehicles in large scale before 2030

- The substituting quantities of EV for oil consumption will increase to 4 million tons (oil equivalent) by 2020, and then reach 25 million tons (oil equivalent) by 2030, accounting for 6.7% of refined oil consumption in that time.

### Estimation of Substitution Quantities of EV

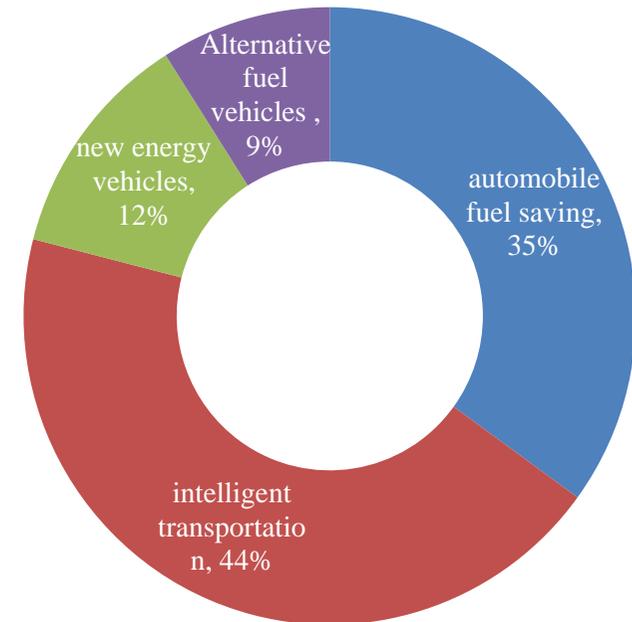
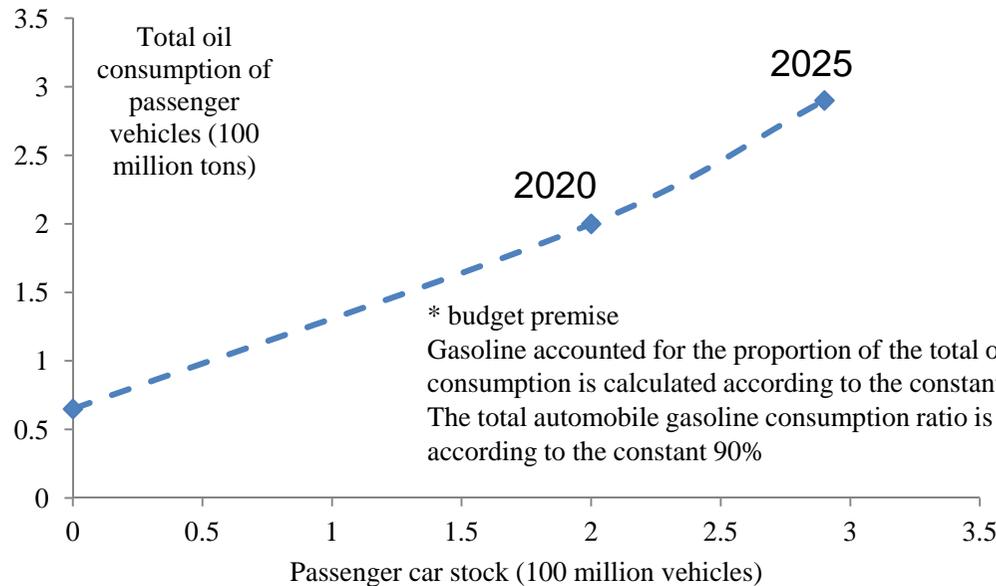
	EV
Unit of substitution quantity :	10,000 cars
2014 (Physical quantity , 10,000)	12
2014 (substitution quantity, 10000tons)	<b>9</b>
2015 (Physical quantity , 10,000)	50
2015 (substitution quantity, 10000tons)	<b>36</b>
2020 (Physical quantity , 10,000)	500
2020 (substitution quantity, 10000tons)	<b>403</b>
2030 (Physical quantity , 10,000)	3000
2030 (substitution quantity, 10000tons)	<b>2484</b>



## 5. New energy vehicles will help to reduce the degree of dependence on foreign crude oil for China

- If the degree of dependence on foreign crude oil is controlled within 67% in 2020, 130 million tons oil will be required to reduce in the passenger cars, in which the automobile fuel saving technology, intelligent transportation, new energy vehicles and alternative fuels need to contribute by 35%, 44%, 12% and 9%. From this perspective, **new energy vehicles will reduce China's dependence on foreign crude oil.**

### Automobile fuel saving target and fuel economy composition in 2025

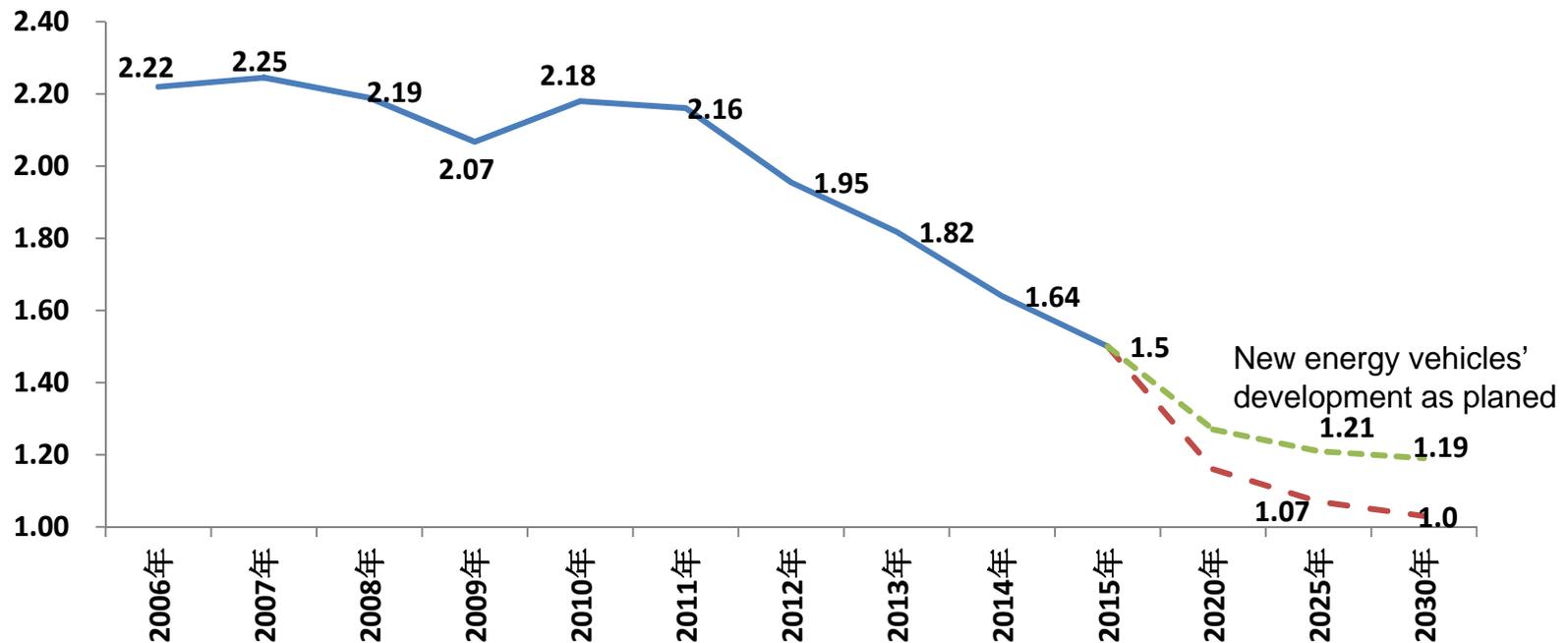




## 6. The development of new energy vehicles will help to alleviate the pressure of declining of diesel-gasoline ratio

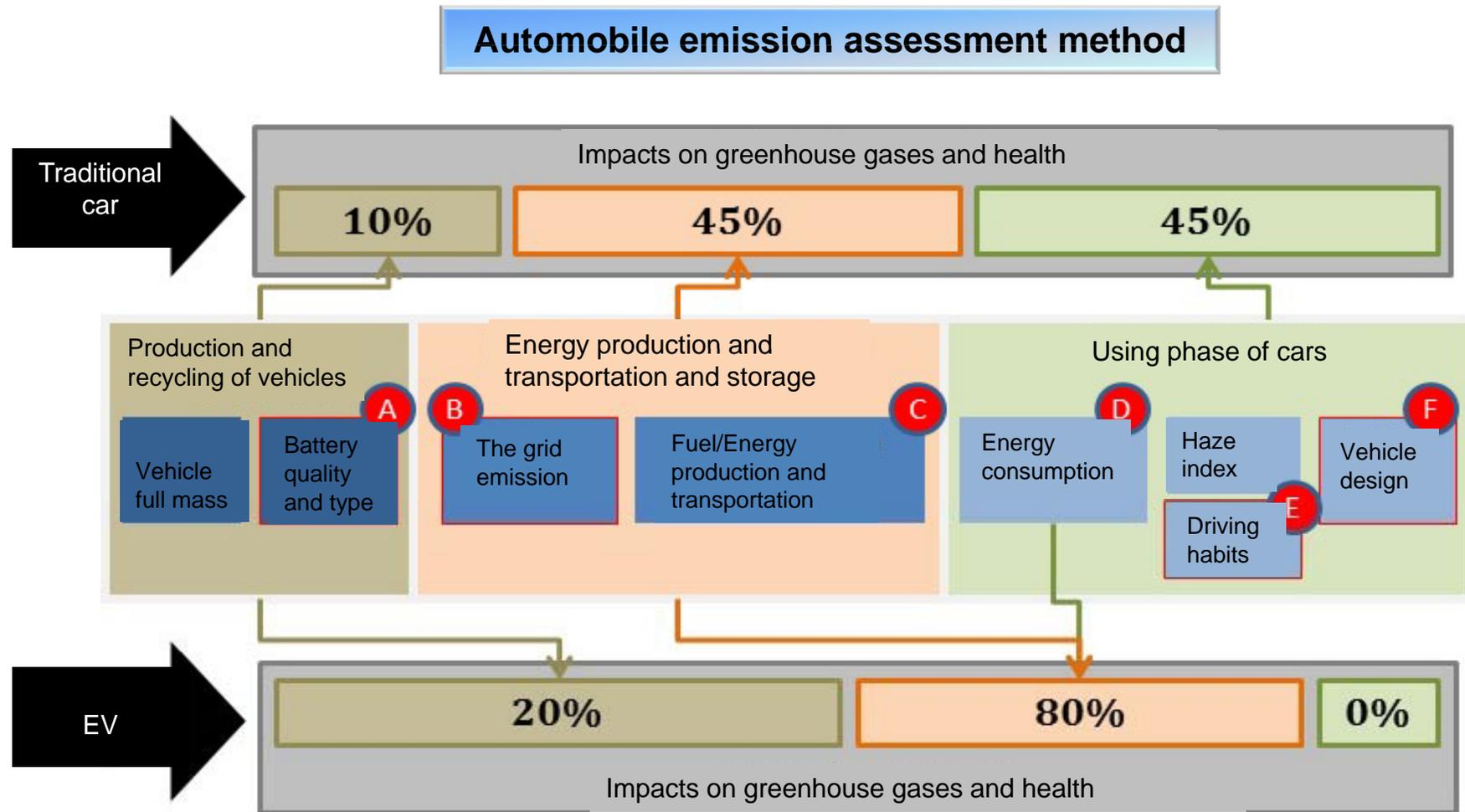
- If the new energy vehicle ownership increases to 17,000,000 in the policy planning, the diesel-gasoline ratio will reach to 1.21 compared with 1.07 in the baseline scenario;
- In order to achieve the carbon emission goal, the new energy vehicle ownership will be about 30,000,000, and the substitution quantity of passenger vehicle is about 7.5%, so the diesel-gasoline ratio will rise from 1.0 in the baseline scenario to 1.19 in 2030.

Forecast of Change of Consumption Diesel-Gasoline Ratio in Different Situations





## 7. The environmental effect of electric vehicles needs to analyze from the whole life cycle's perspective

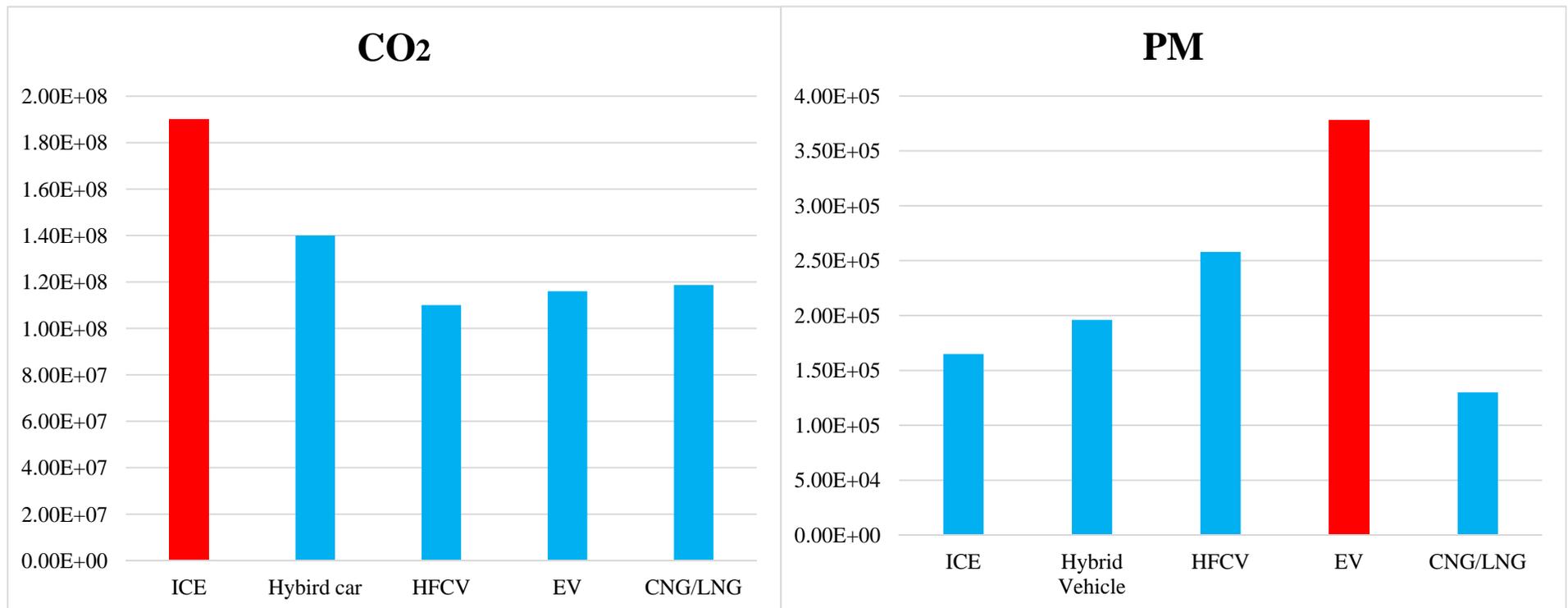




## 8. From the whole life cycle's perspective, PM emissions of electric vehicles are higher than that of fuel vehicles

- China's power structure: thermal power accounted for more than 70%, considering the efficiency of coal-fired power stations (46%) and power transmission loss rate (7.52%).
- CO<sub>2</sub> emissions: ICE > LNG/CNG ≈ EV
- PM emissions: EV > ICE > LNG/CNG

**CO<sub>2</sub> and PM emission from various types of vehicles**

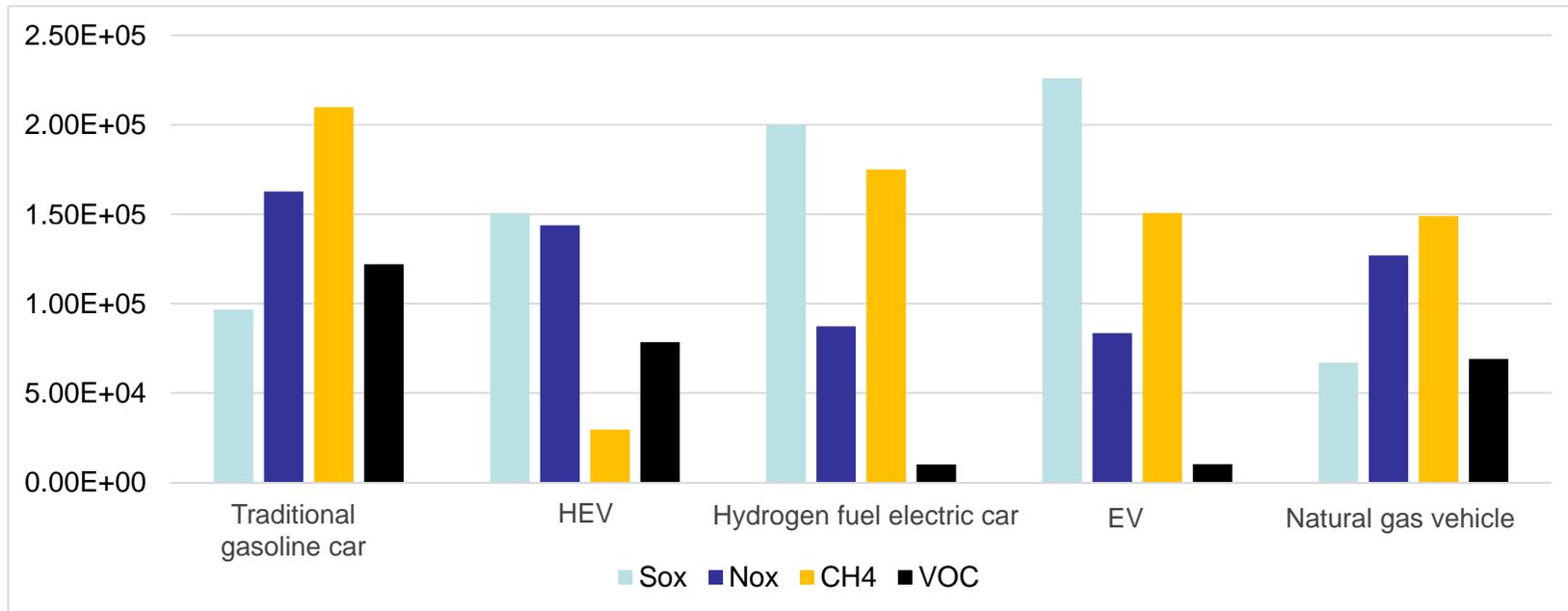




## 9. From the whole life cycle perspective, the SOx emission of electric vehicles is higher than other types vehicles

- The SOx emissions of EV are higher than the natural gas vehicle and ICEs.
- At the driving stage, new energy vehicles is relatively low, so the big cities that promote the development of electric vehicles will be beneficial to their local environment. However, from the national wide, cleaning electric power vehicles need to optimize the national energy structure.

Emissions of other harmful substances





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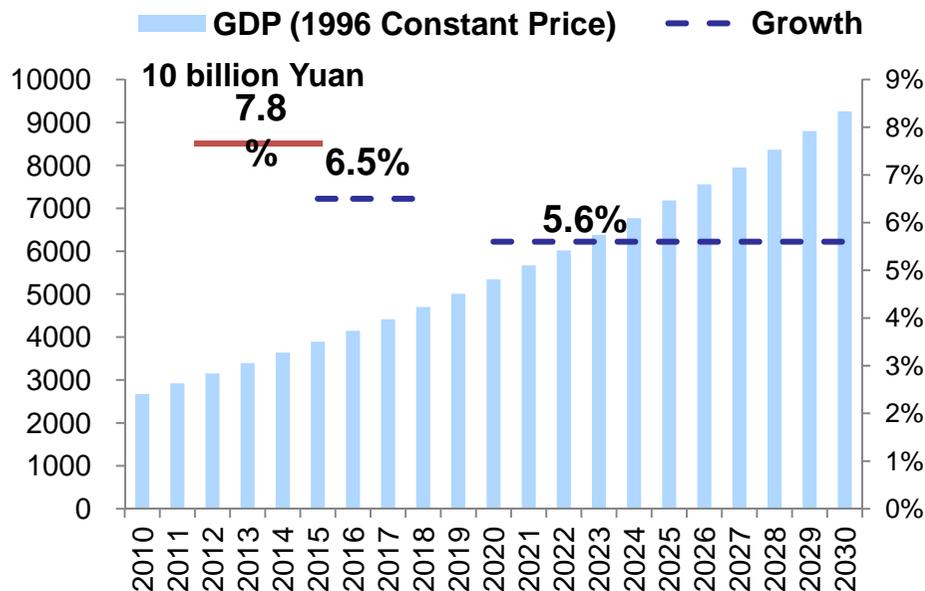
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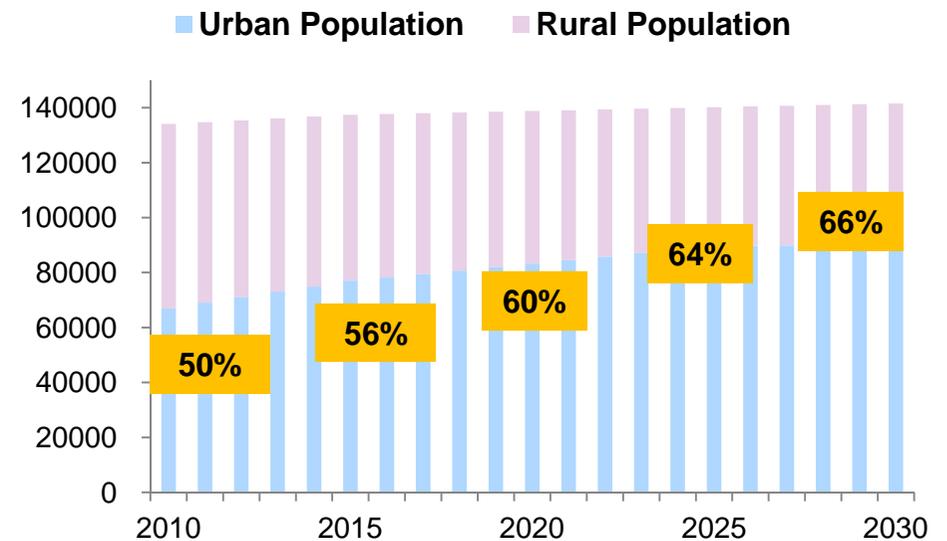
# 1. China's economic growth will step down in the future

- **BAU scenario:** China's annual GDP growth rate in 2016-2020 will be 6.5%. By 2020, GDP per capita will exceed US\$10,000. New-type industrialization will be realized, and service sector will account for over 55%, the proportion of industry sector will decline to 30%. The urbanization rate of permanent resident population will reach 60%.
- **High-growth scenario:** the reform progress accelerates, and consumption and investment demands continuously expand.
- **Low-growth scenario:** the economic transformation will be at risk, and the economic growth impetus is insufficient.

Economic Forecast



Population and its structure





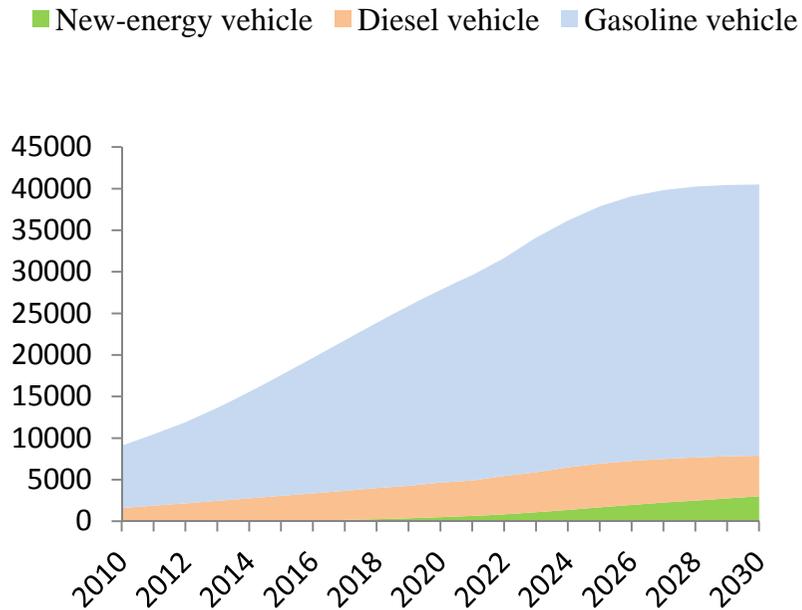
## 2. Gasoline: demand growth rate will slow down

➤ Impact Factors:

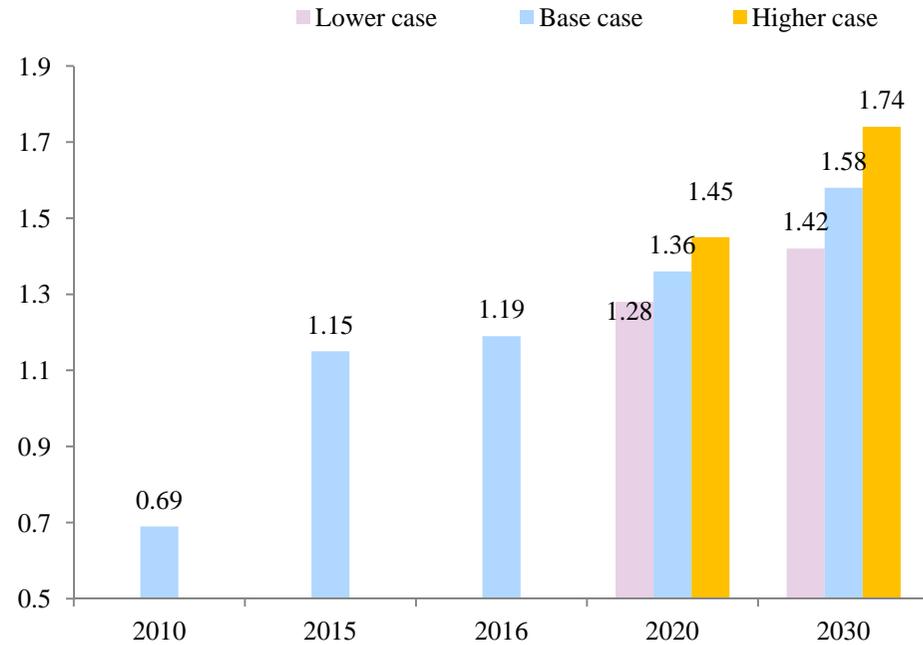
- ◆ Passenger Car population
- ◆ Fuel Saving technology

- 2016-2020 average annual growth rate : 3.4%
- 2020-2030 average annual growth rate : 1.5%

Ownership of vehicle (ten thousand)



Gasoline Demand Forecast

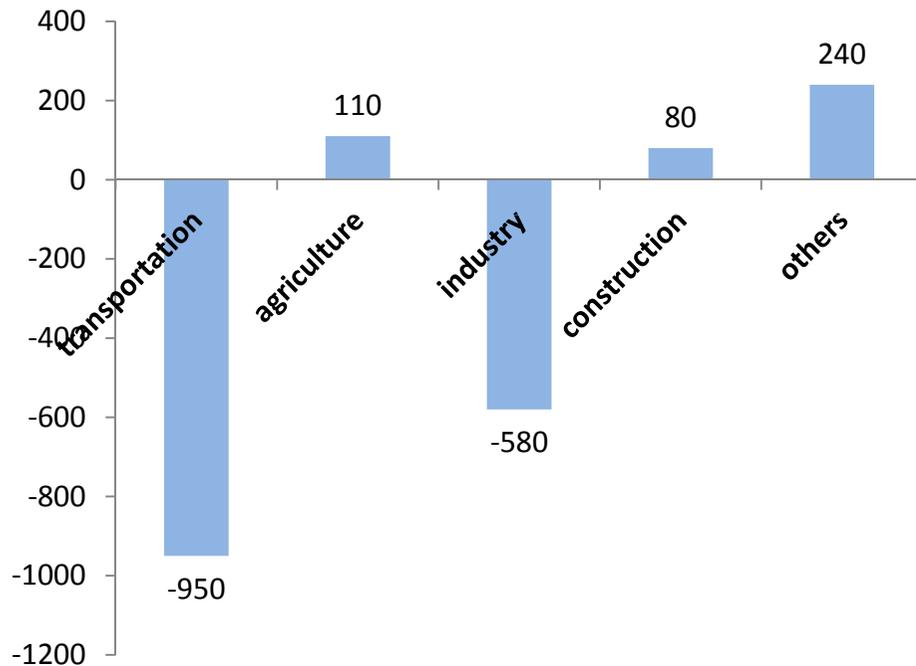




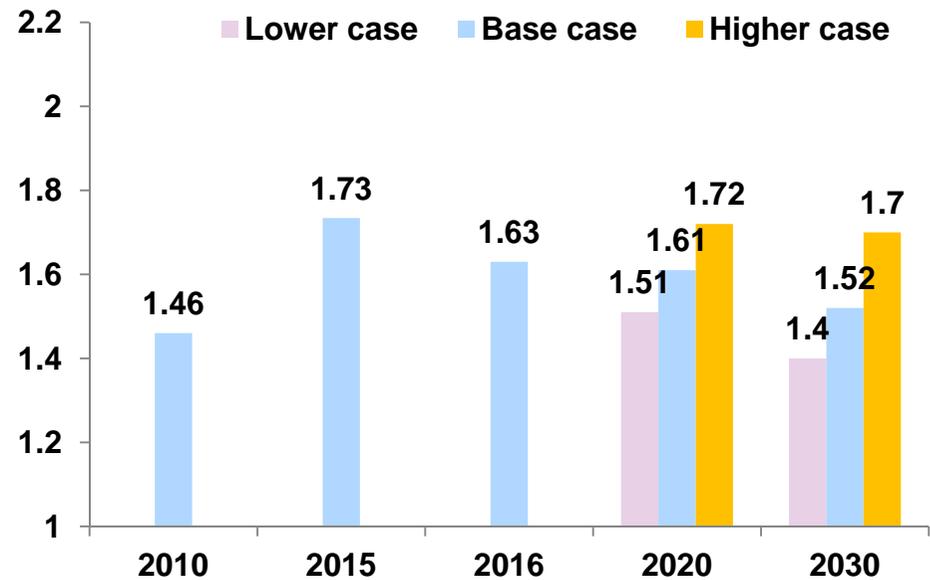
### 3. Diesel: Economic transition will lead to China's diesel demand into a platform

- Agriculture and chemical industry contribute to the increase of diesel demand, while diesel demand from transportation sector will decrease.
- 2016-2020 average annual growth rate : -0.3%
- 2020-2030 average annual growth rate : -0.6%

The changes of diesel demand in different sectors (2016-2030)



Diesel Demand Forecast

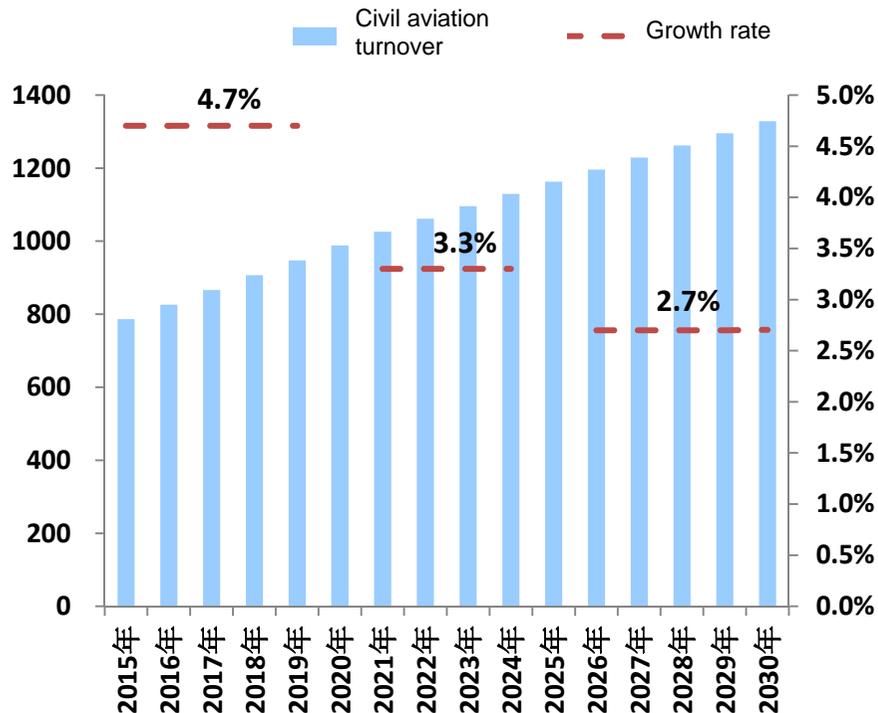




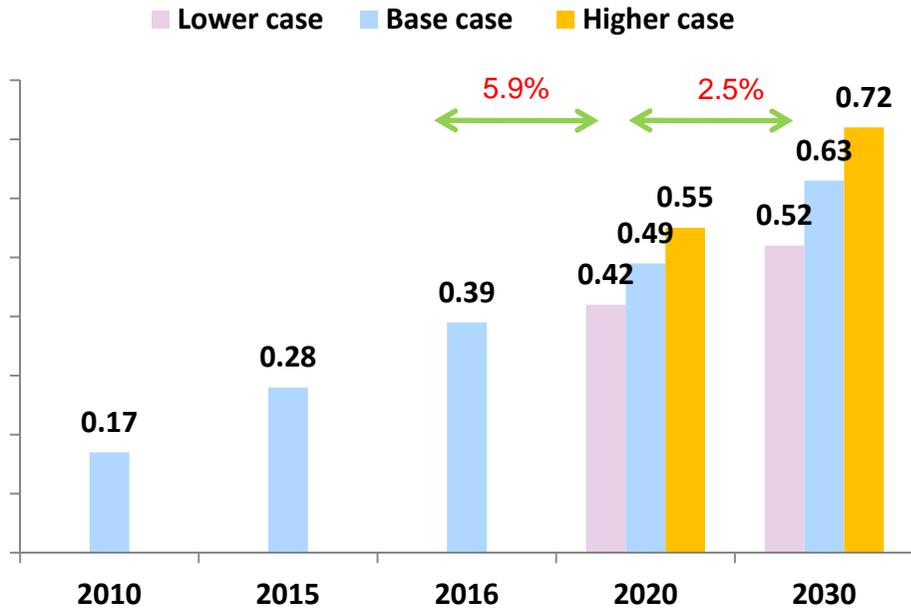
## 4. Kerosene: Rapid development of civil aviation will boost fast growth of China's kerosene demand

- China's civil aviation industry will remain in a critical period of popularization and diversification. With the economic and social development and the increasing income of residents, rapid growth is still the basic feature.
- Kerosene demand highly relates to aviation turnover, GDP, and per capita income, with the correlation coefficient up to 98%.

Forecast of civil aviation turnover



Kerosene Demand Forecast



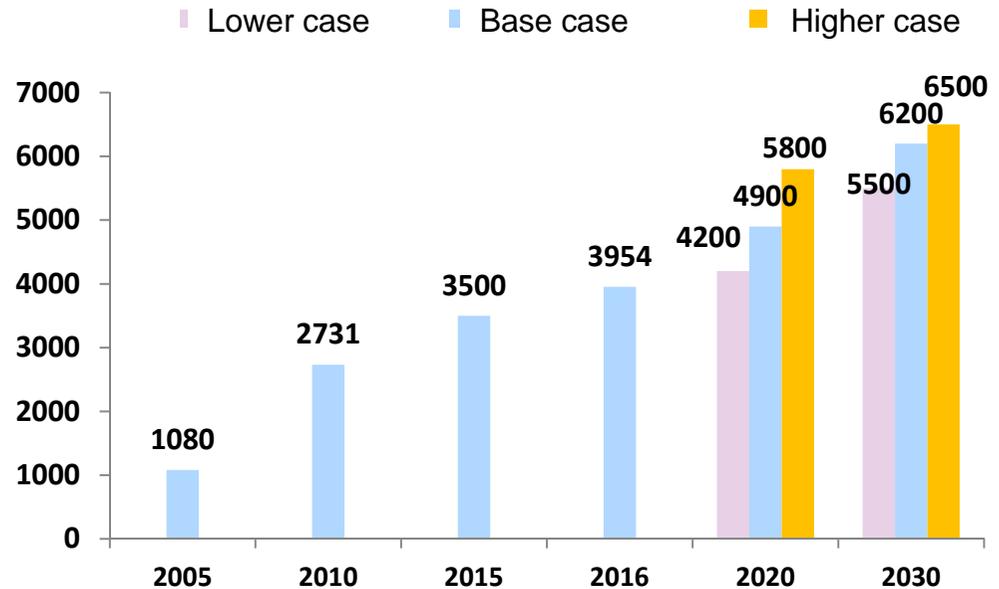


## 5. In the future, the oil demand for chemical use in China will maintain moderate growth

- China's production of ethylene was 17.81 million tons in 2016, up by 3.8%, with production of propylene 22.61 million tons, up by 13.6% .
- In 2020, the production capacity of ethylene in China is expected to exceed 30 million tons, leading to the growth of chemical oil demand.

Project/Enterprise	Group companies	Location	Ethylene capacity	Remarks
Huizhou refinery (phase two)	CNOOC	Guangdong	100	Put into operation in 2017
Sailboat Petrochemical coal based olefin	Jiangsu Sheng Hong	Jiangsu	60	Put into operation in 2017
Jilin Cornell methanol olefins	Cornell chemical	Jiangsu	10	Put into operation in 2017
<b>Total</b>			<b>170</b>	
China Ordnance Hua Petrochemical Company	Weapon	Liaoning	100	new-built, under construction stage
Yunnan petrochemical	PetroChina	Yunnan	100	new-built, under construction stage
Sinochem Quanzhou Petrochemical Corporation	SINOCHEM	Fujian	100	new-built, under construction stage
Lianyungang petrochemical	Sheng Hong	Jiangsu	100	Environmental planning phase assessment,
Zhoushan petrochemical	Rong Sheng	Zhejiang	140	Environmental planning phase assessment,
Middle East Gulf	saudi aramco	Hebei	100	Environmental planning phase assessment,
<b>Total</b>			<b>640</b>	

**Forecast results of China's oil demand for chemical use (naphtha) (2016-2030)**

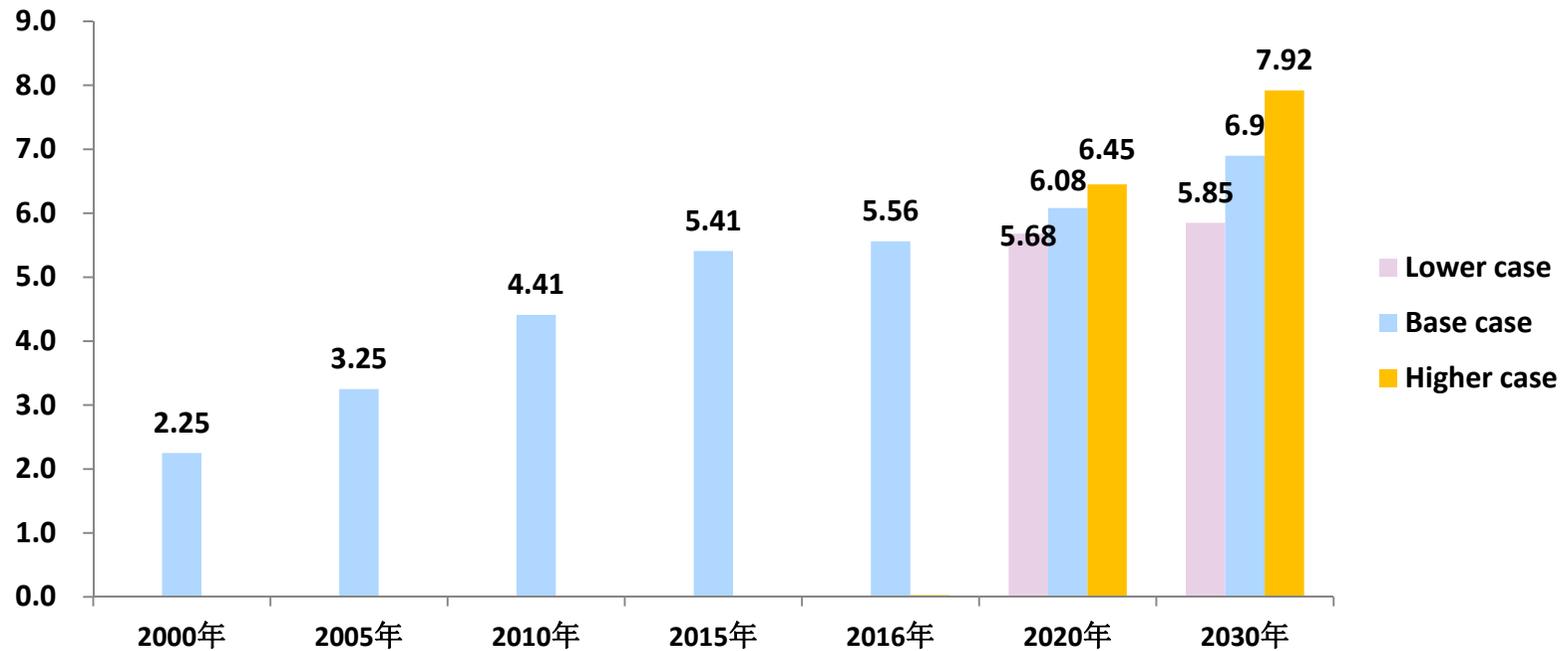




## 6. China oil's demand growth rate will slow down, but the quantity is still higher

- China oil demand will keep growing but with a slower growth rate.
- 2016-2020 average annual growth rate : 2.3%
- 2020-2030 average annual growth rate : 1.3%

**China's Oil demand Forecast**

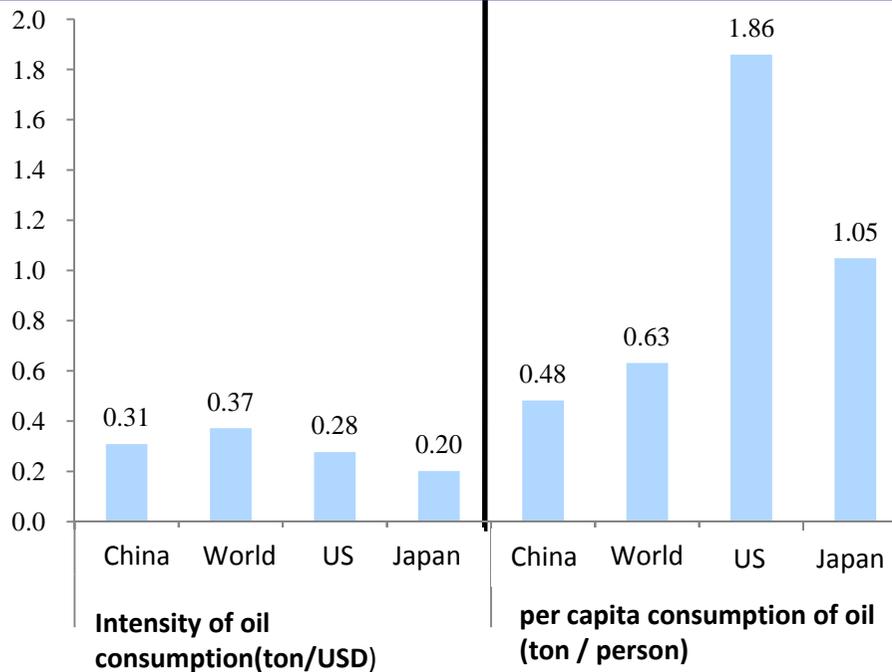




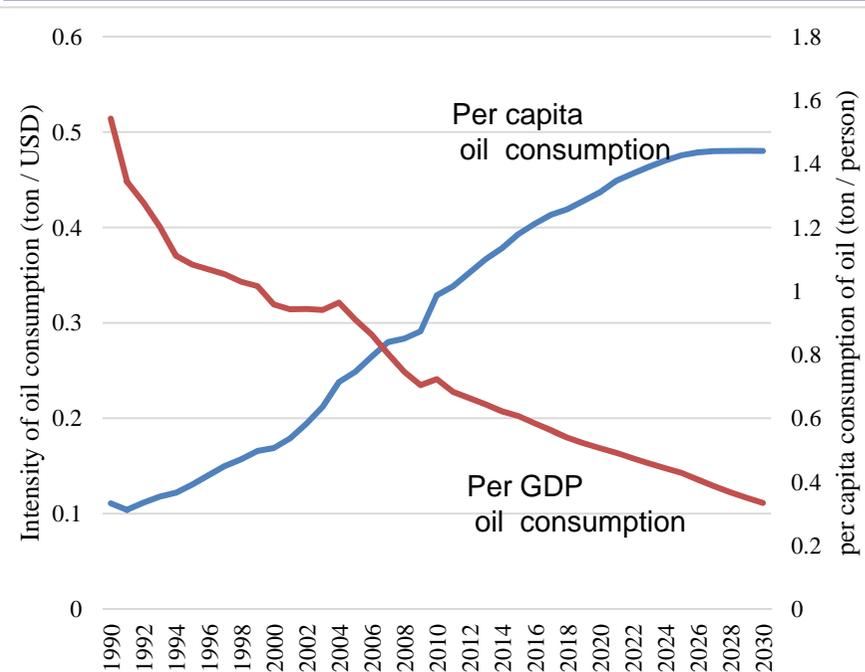
## 7. China's oil demand will reach its peak in 2030

- Two characteristics of oil consumptions in developed countries:
  - (1) Per capita oil consumption keeps stable for a long time;
  - (2) Oil consumption per unit of GDP is decreasing
- China's oil consumption trends: from the per capita oil consumption, it shows a parabolic shape, gradually close to the peak in the next 10-20 years; from the per GDP oil consumption, it has reached its peak in 1978.

**Comparison of oil consumption intensity and the level of per capita in different countries**



**China oil consumption intensity and its per capita consumption**



# Thank You



**CNPC Economics & Technology Research Institute, *ETRI***