



China's March towards e-Mobility

19 September 2018

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Prepared for:

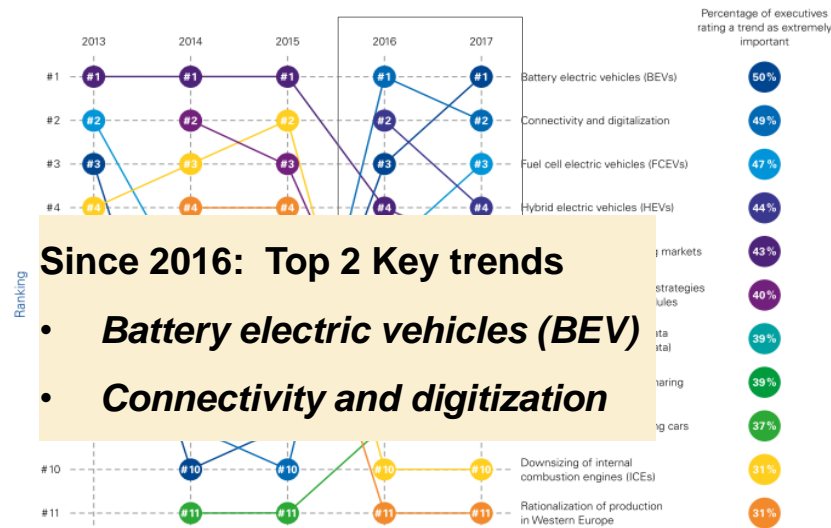
POWER-GEN ASIA

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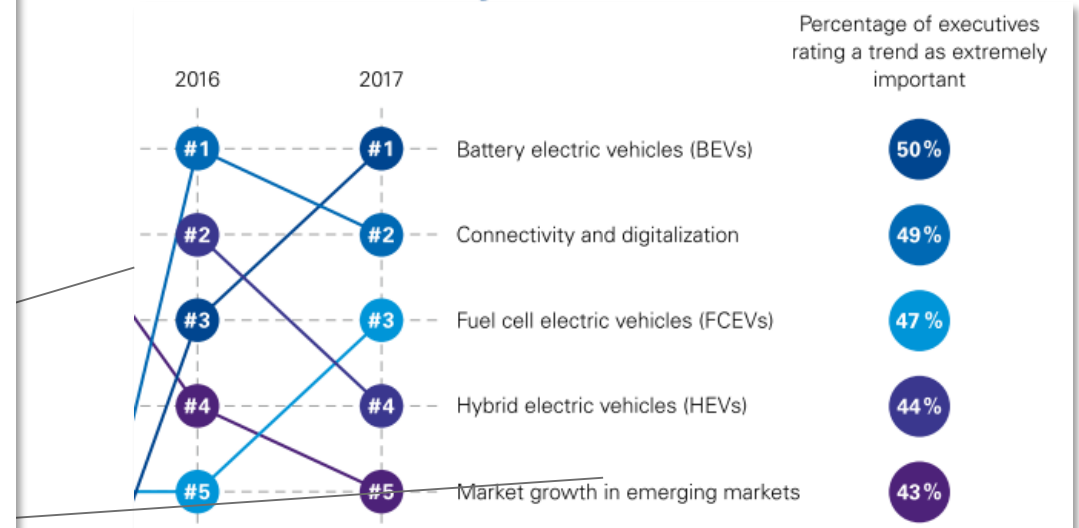
Agenda

- China in the global EV picture
- Key Drivers & Enablers
- Recent Policies/Market Developments and Implications Ahead

Regulatory pressure pushes awareness for electrification:
Battery electric vehicles are this year's #1 key trend.



What are the key trends until 2025?

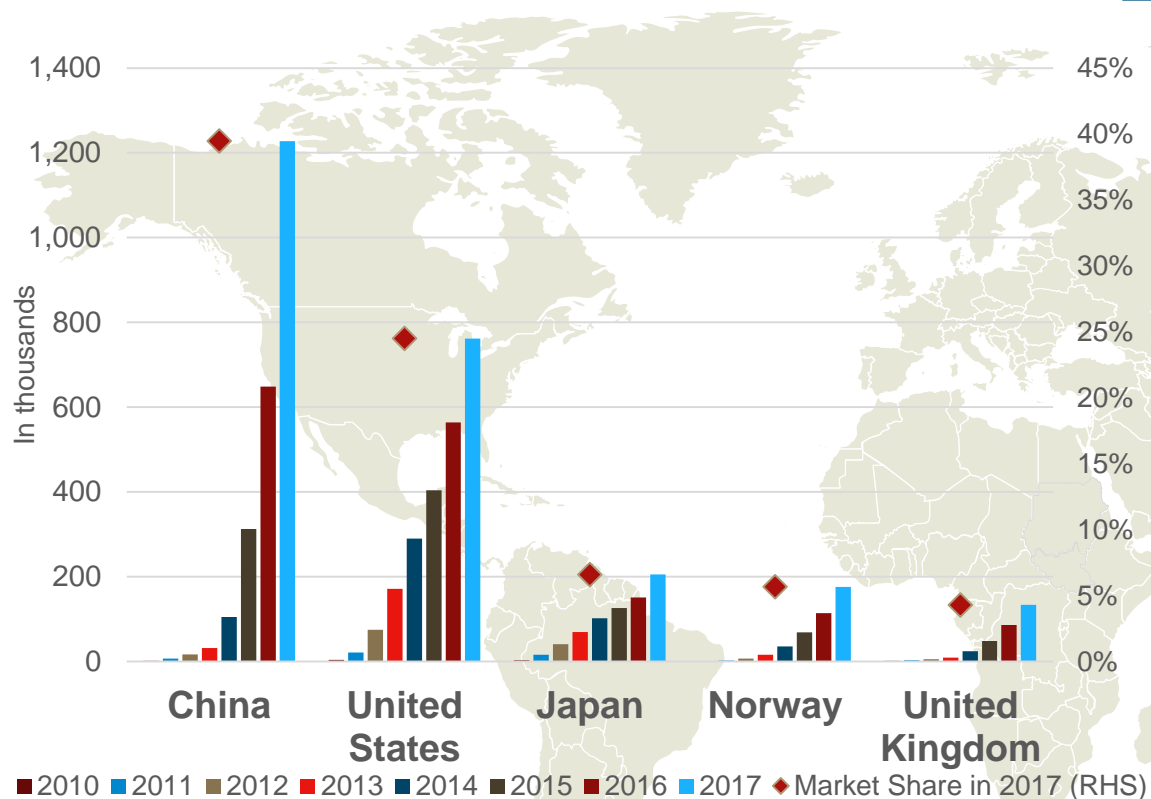


Source: KPMG: Global Automotive Executive Survey 2017

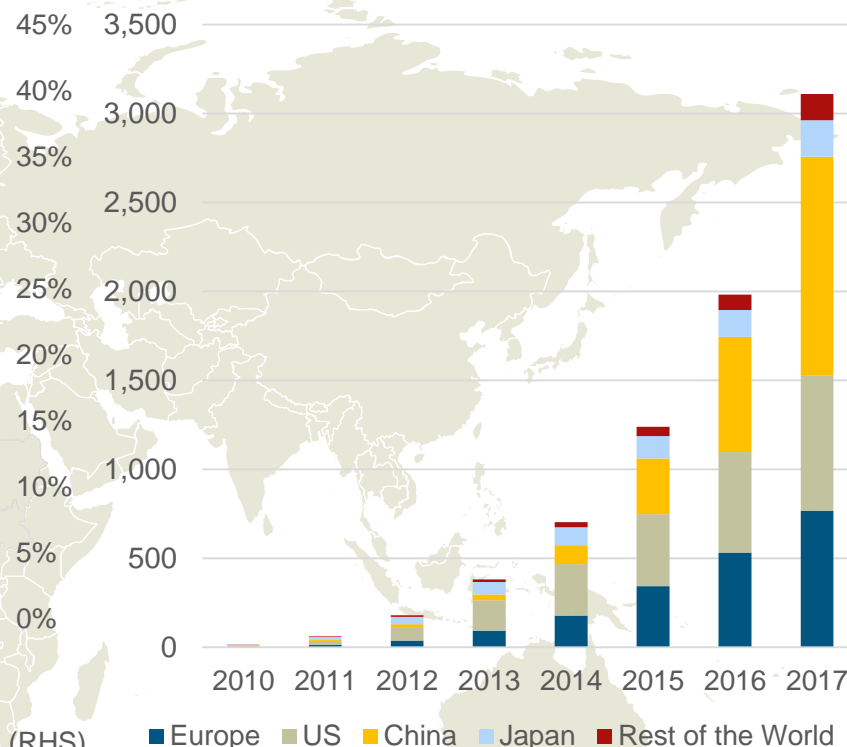
China in the global EV picture

China's on-road electric cars surpassed the 1 million mark in 2017

Electric car stock (Top 5 countries)



Electric car stock by geography

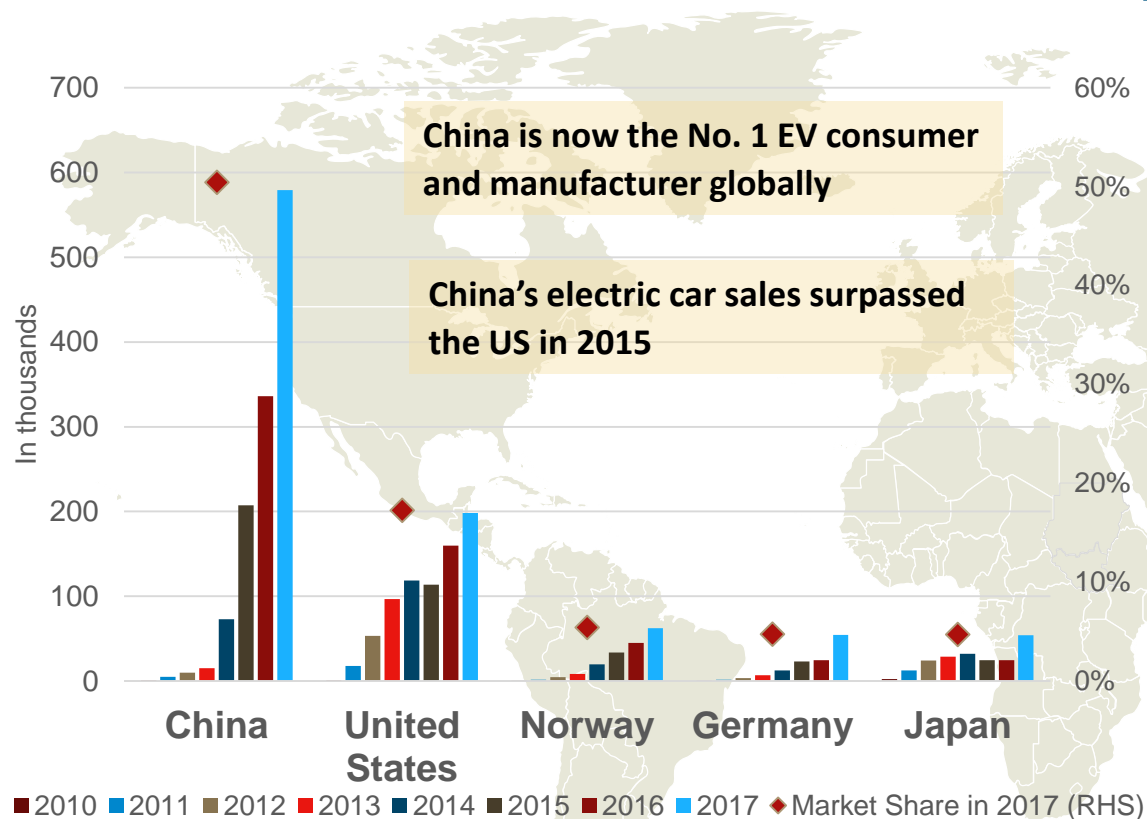


Number of electric cars on the road in China has surpassed 1 million in 2017 – accounting for approx. 40% of the global electric car fleet

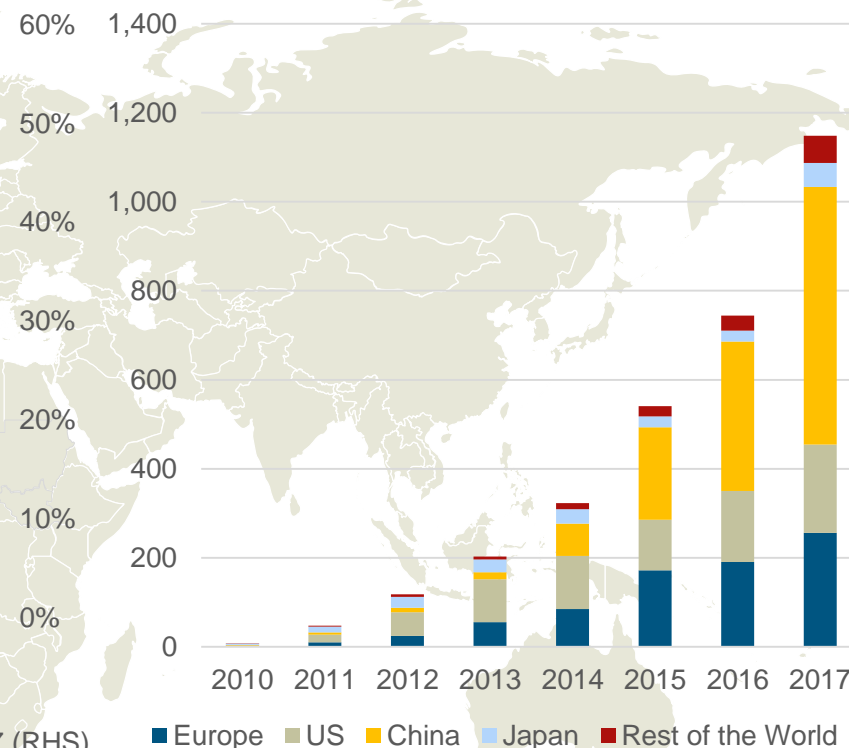
China in the global EV picture

China's electric car sales account for half of the global electric car market in 2017

New electric car sales (Top 5 countries)



New electric car sales by geography

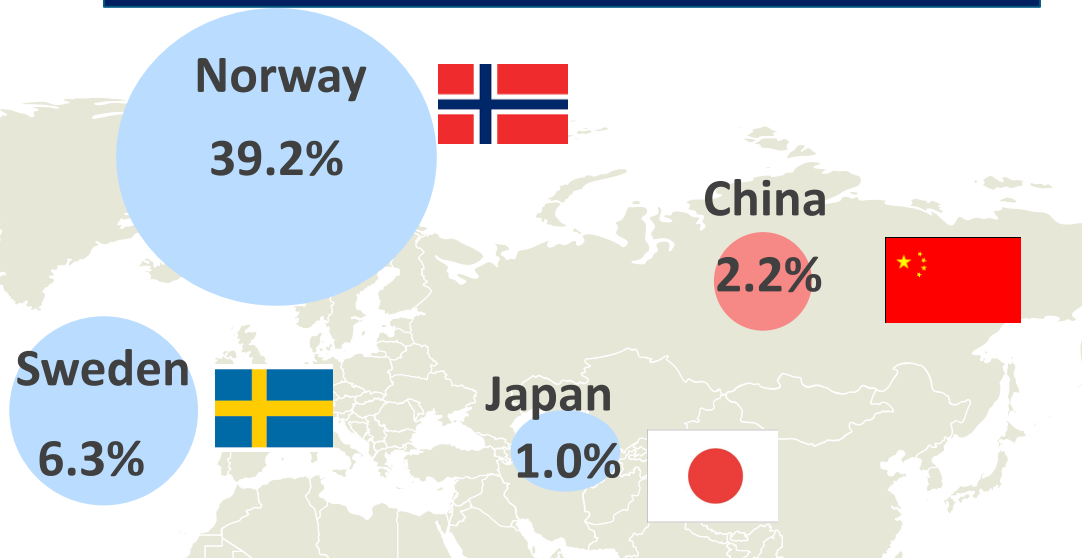


China's electric car sales spiked 72% y-o-y to some 593,000 in 2017, accounting for half of the global electric car market.

China in the global EV picture

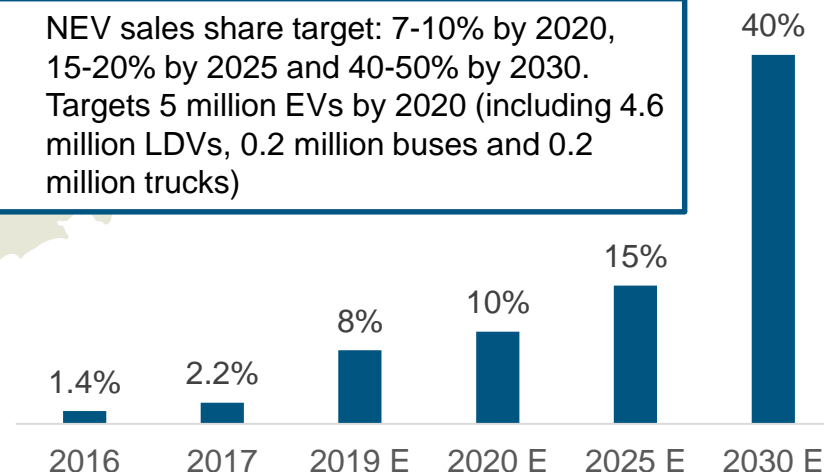
Significant growth potential remains...

Market share of electric cars in auto sales (2017)

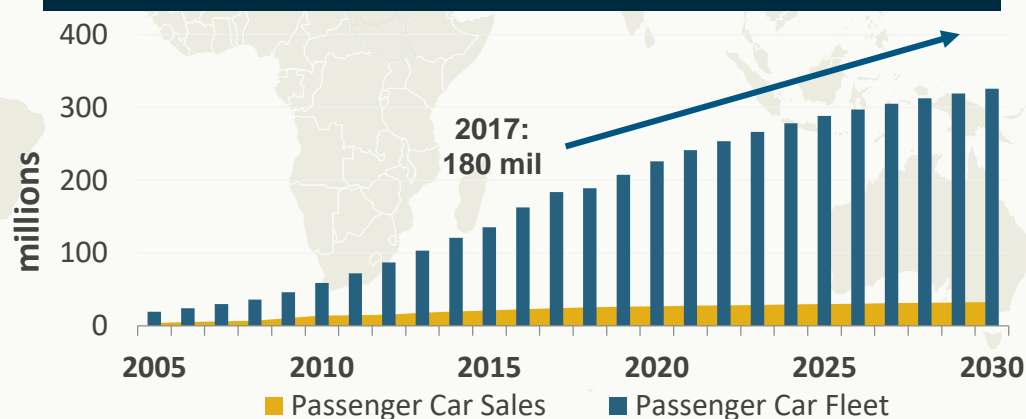


China's EV sales share target by 2030

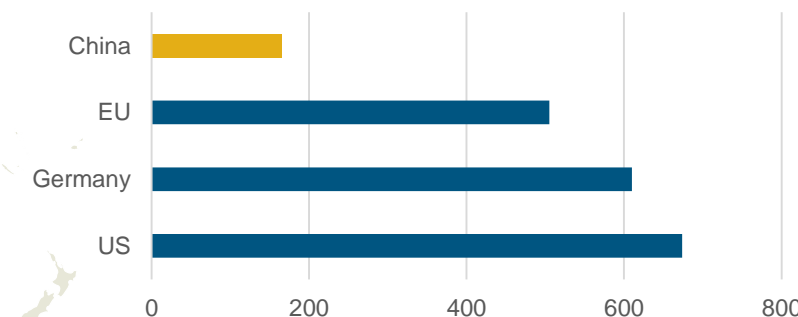
- NEV sales share target: 7-10% by 2020, 15-20% by 2025 and 40-50% by 2030.
- Targets 5 million EVs by 2020 (including 4.6 million LDVs, 0.2 million buses and 0.2 million trucks)



China's Passenger car fleet and sales



Passenger cars per 1,000 people*

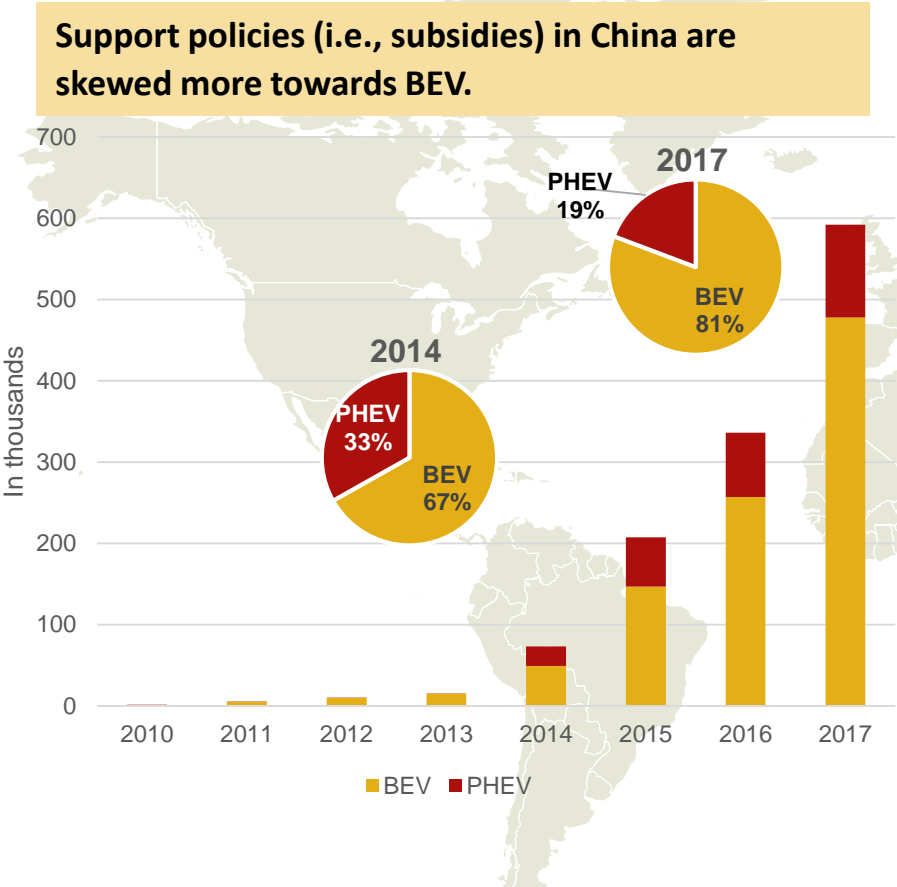


Based on 2016/2017 figures

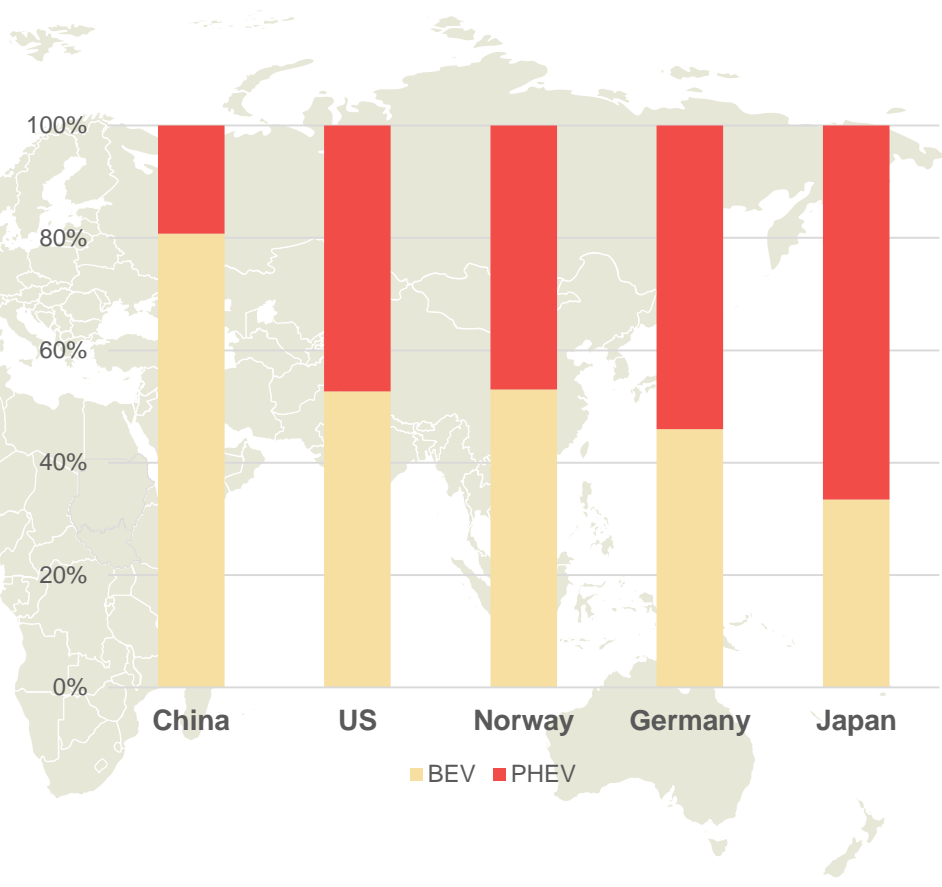
Source: TLG Analysis, ACEA, State Council, EVI (2016b) MIIT (2017), IEA

BEV will remain of major relevance in China

China's EV Sales (BEV vs PHEV)



EV Sales by EV technology in 2017

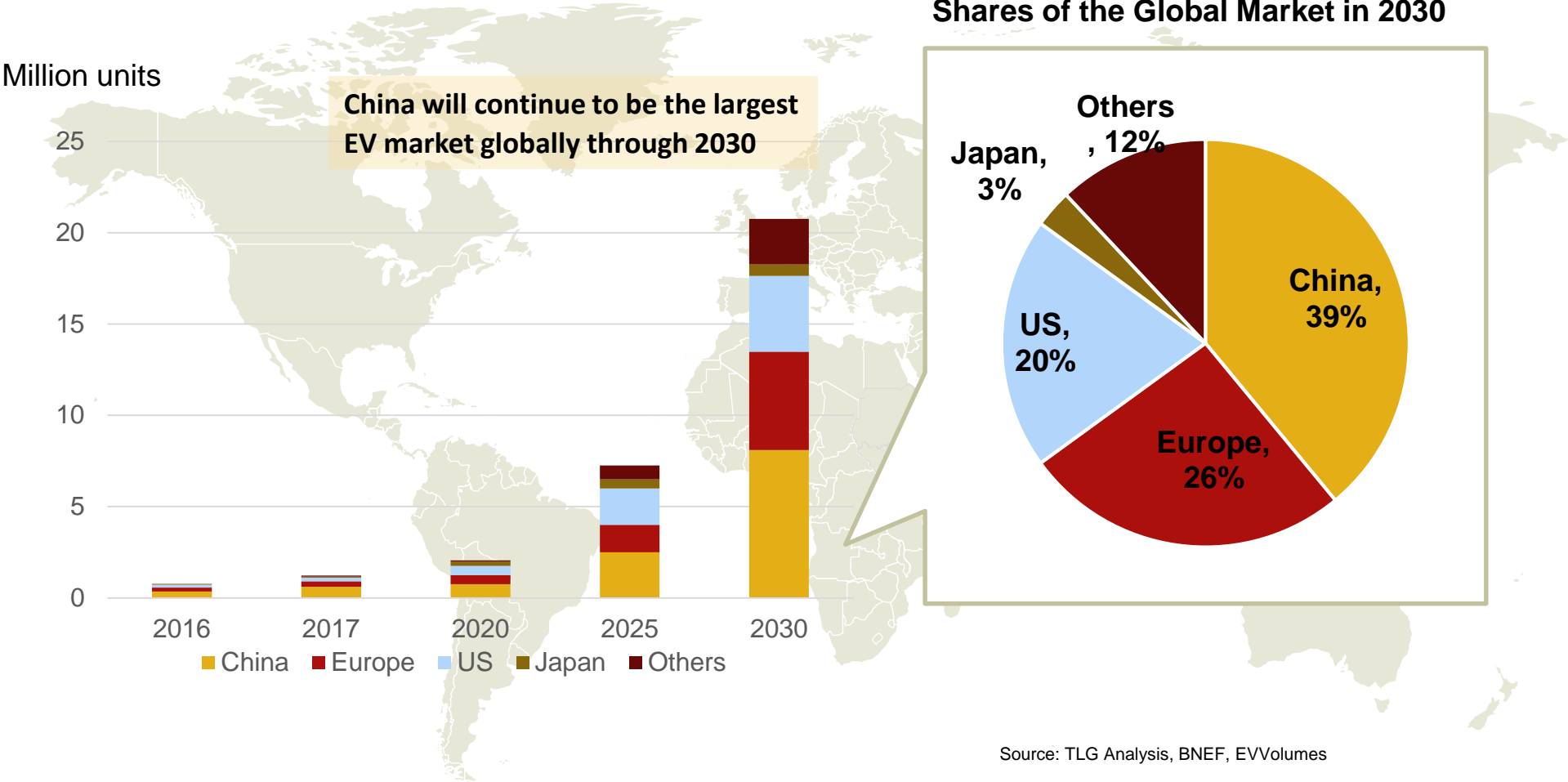


NEV market in China can be segmented into pure battery-powered electric vehicle (BEV) and plug-in hybrid vehicle (PHEV).

Source: TLG Analysis, BNEF, EVVolumes

More than 20 million sales by 2030 with China leading the game

Global EV Sales Outlook through 2030



What's driving the adoption of EV in China?

Government's strong push for NEVs



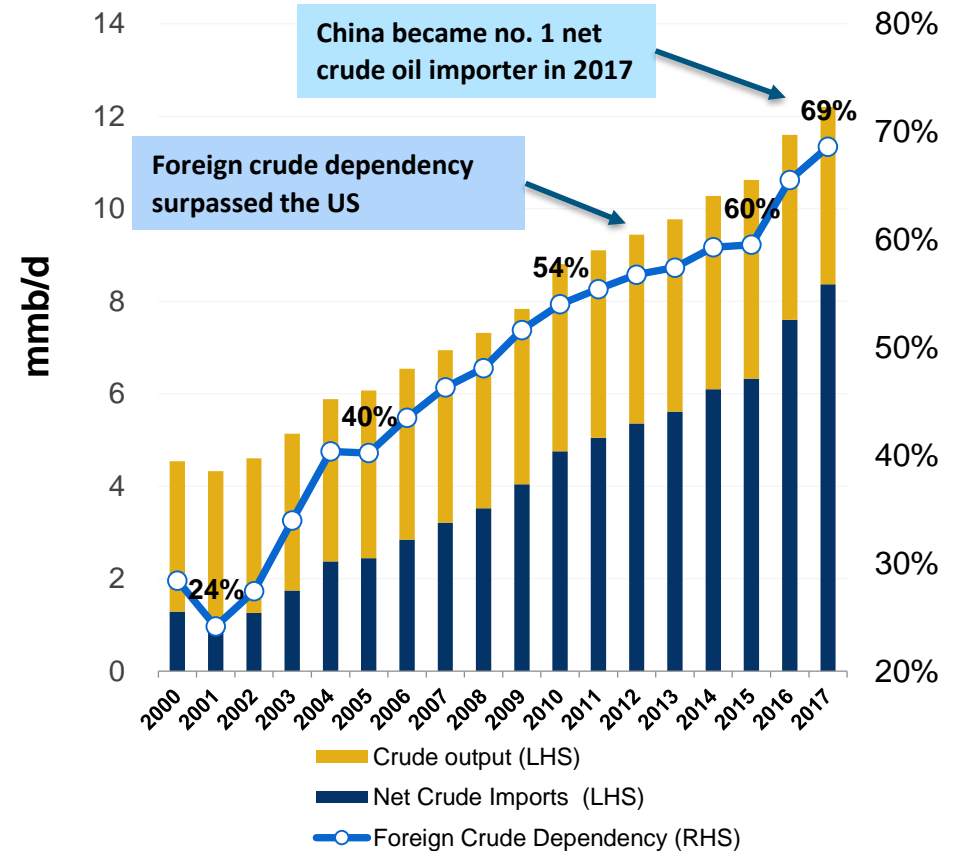
HEAVY SMOG IN CHINA
Government issues orange alerts

CCTV
AMERICA



Air Pollution / Smog – SO_x, NO_x and particulate matter

China's Crude oil Demand and Foreign Crude Dependency

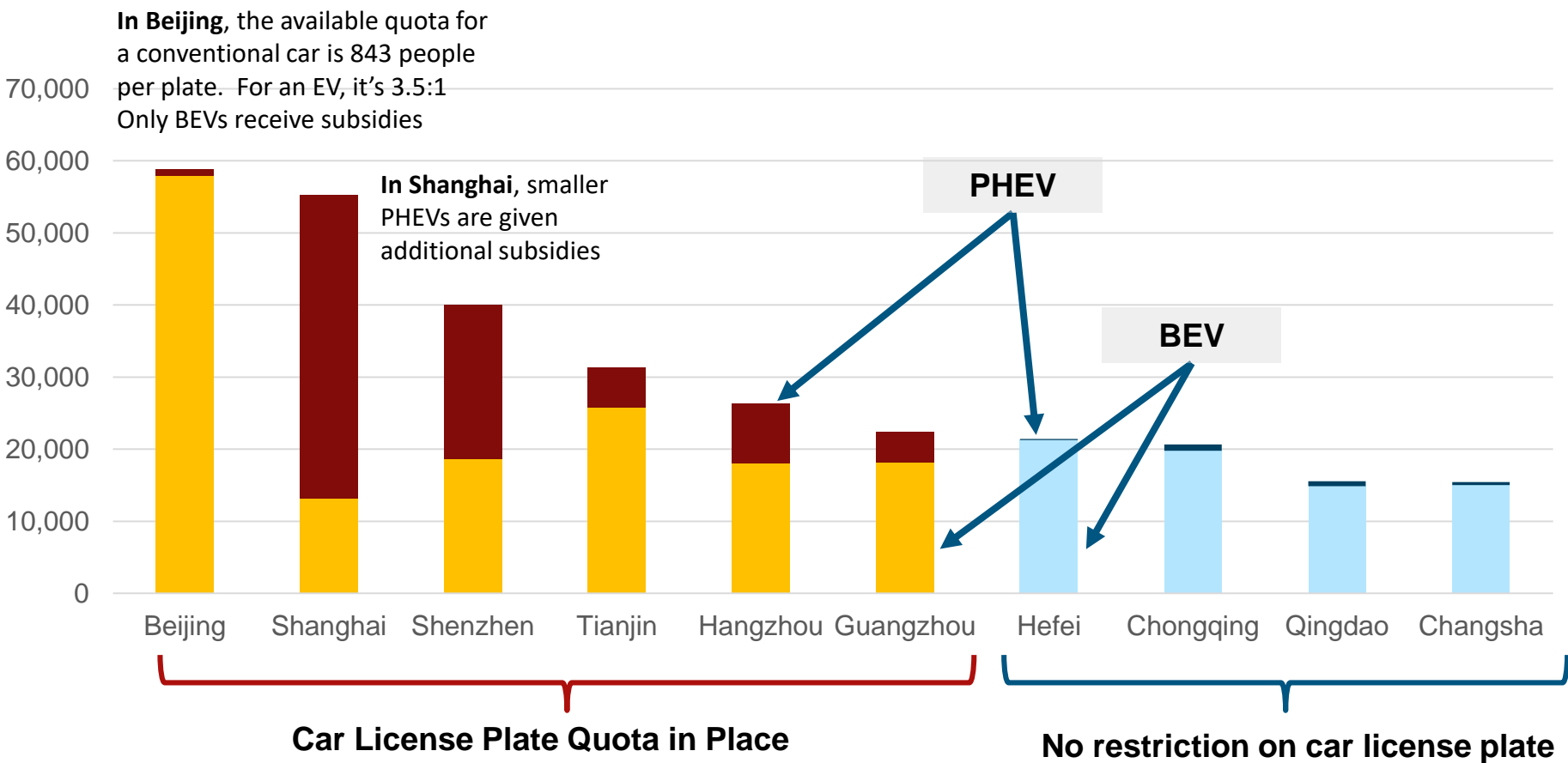


National Energy Security

Car license plate restriction on gasoline-fueled cars led to a surge in demand for electric cars in major Chinese cities

Battery Electric Vehicle (BEV) Vs. Plug-in Hybrid Electric Vehicle (PHEV) Market Shares by Sales in Top Ten Cities (2017)

Majority of the top ten cities (by NEV sales) have vehicle license plate quotas

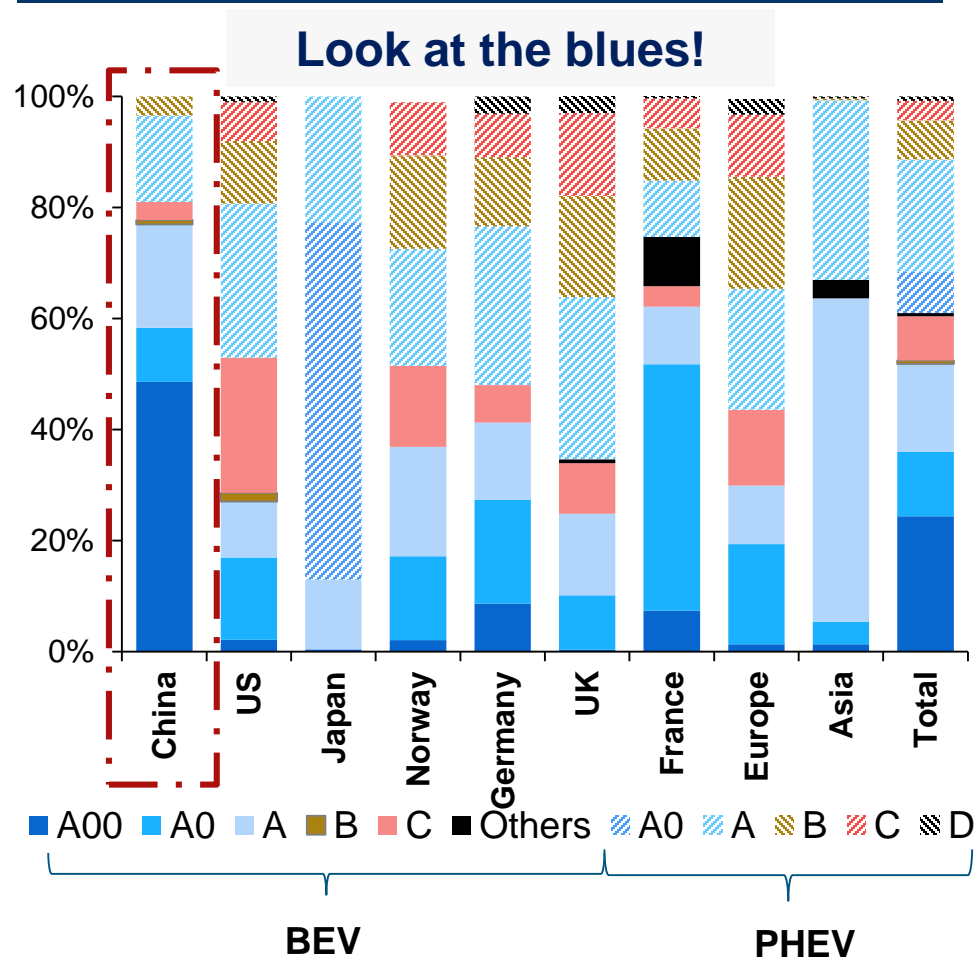


In Beijing, the EV quota has tripled from 20,000 in 2014 to 60,000 in 2017, while the quota for conventional vehicles has been slashed from 120,000 to 80,000

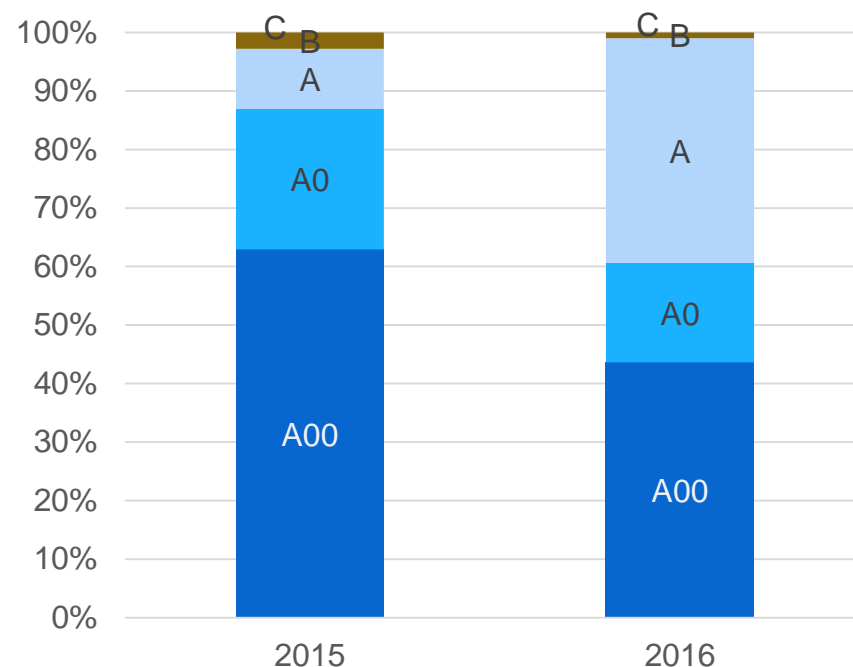
Source: OFweek

Government's subsidy regimes are incentivizing adoption of smaller electric cars

Electric Car Sales by Segment in 2017



Electric Vehicle Market Shares in China



Legend:

- A: A-segment mini cars
- B: B-segment small cars
- C: C-segment medium cars
- D: D-segment large cars

Government's subsidy regimes are incentivizing adoption of smaller electric cars

A00



A0



- A00: Wheelbase 2-2.2m
 - Engine Capacity <1.0 L
- A0: Wheelbase 2.3-2.45m
 - Engine Capacity 1-1.6L
- A: Wheelbase 2.45-2.65m
 - Engine Capacity 1.6-2.0L
- B: Wheelbase 2.6-2.75m
 - Engine Capacity 1.8-2.4L
- C: Wheelbase 2.7-2.8m
 - Engine Capacity 2-3.0L
- D: Wheelbase 2.8m+
 - Engine Capacity >3.0L

C

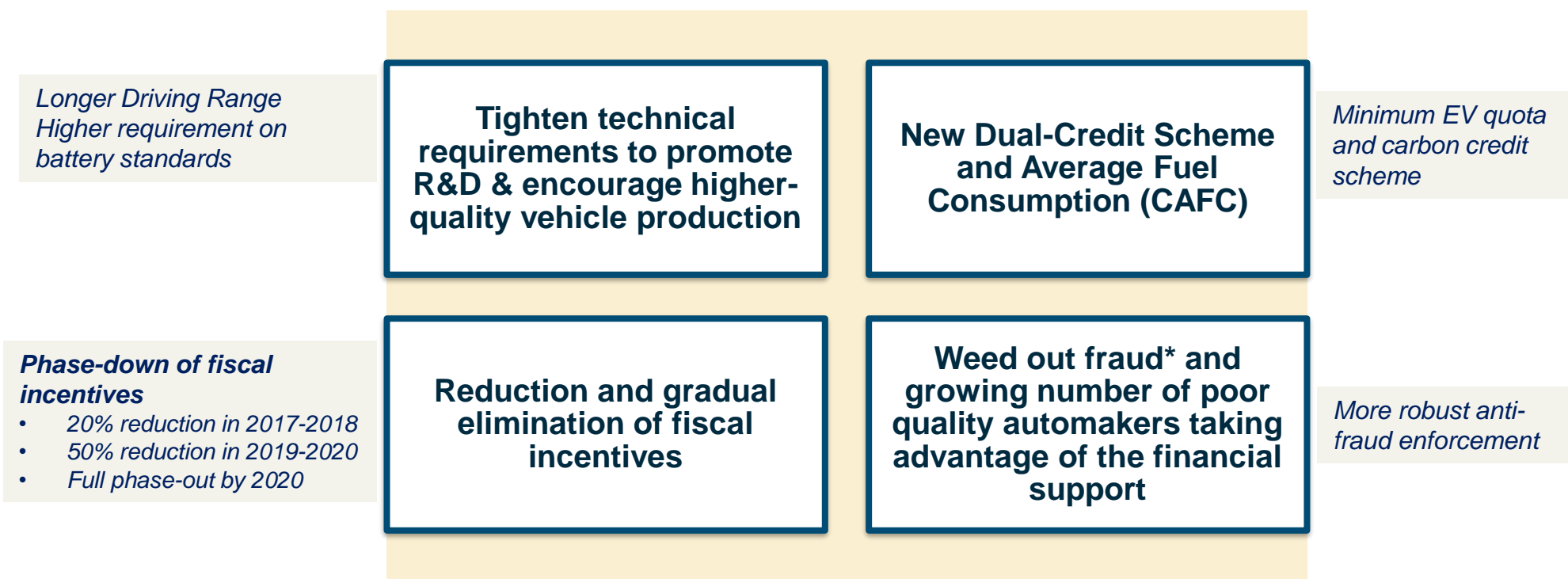


D



The Government continues to support the EV industry, but is moving away from direct fiscal incentives to encouraging automakers to innovate

- In February 2018, the government promulgated national changes to the subsidy regime in a 'Notice on adjusting and improving the financial subsidy policy for the promotion and application of New Energy Vehicles'. The new subsidy standards took effect on June 12, 2018 (following a four-month transitional period)



***Main manufacturers' fraud:** i) **Short on quality** (i.e. Using smaller batteries in production for subsidies that are driving range based)
ii) **Inflated sales** (i.e., Selling vehicles back to manufactures' rental companies to boost sales for subsidies that are quantity based)

Government policies force manufacturers to match conventional car production with EV production

- A New Dual-Credit Scheme and Average Fuel Consumption (CAFC) Regulation has been introduced in September 2017, requiring automakers to generate EV credit points starting from 2019. Automakers are required to earn credit points from NEVs equivalent to 10% of total vehicles produced in 2019 which will rise to 12% in 2020. Furthermore, automakers are expected to adhere to more stringent fuel consumption standard.
- This is a requirement for car manufacturers which governs how many EVs they must produce per production of conventional vehicles.
- The calculation is based on i) Electric range, ii) Energy efficiency, iii) Rated power of fuel cell systems
- Put simply, if you produce vehicles with better range and higher efficiency, you could produce fewer of them to match the conventional production
- Also allows companies to trade or transfer credits among each other:
 - More concentrated with top manufactures which have the ability to produce high performance NEVs and trade credits

Source: Xinhua, OFweek

New subsidy scheme is directed to encourage R&D and technology upgrades;
and moving away from hybrids towards pure EVs

Electric Bus Subsidies (2017 vs 2018)

Vehicle Type	Year	State Subsidy (RMB/kWh)	State Subsidy Adjusting Factors			Max Subsidy (000 RMB)		
						6<L≤8m	8<L≤10m	L>10m
			System Energy Density (Wh/kg)					
Non fast charging EV	2018	1200	115-135		135+	Higher battery density requirement		80
			1		1.1			
	2017	1800	85-95	95-115	115+	90	200	300
			0.8	1	1.2			
			Fast Charge Multiples					
			3C-5C	5C-15C	15C+			
Fast charging EV	Bigger reduction on PHEV subsidies		0.8	1	1.1	40	80	130
			0.8	1	1.4	60	120	200
			Gas Saving Level					
PHEV	2018	1500	60-65%	65-70%	70%+	Encourage lower energy consumption		75
			0.8	1	1.1			
	2017	3000	40-45%	45-60%	60%+	45	90	150
			0.8	1	1.2			

To combat range anxiety, China is pushing its automakers to develop longer-range BEVs

- Improvement of subsidy distribution to promote technology improvement
- More categories to encourage longer driving range

Electric Passenger Car Subsidies (2017 vs 2018)

Vehicle Type	Driving Range (km)	2017 Subsidy (000 RMB)	2018 Subsidy (000 RMB)	Change	
BEV	100-150	20	0	↓ 100%	Higher Threshold
	150-200	36	15	↓ 58.3%	
	200-250		24	↓ 33.3%	
	250-300	44	34	↓ 22.7%	Favour longer driving range
	300-400		45	↑ 2.3%	
	>400		50	↑ 13.7%	

Incentive scheme has greater impact on purchasers of smaller (cheaper) vehicles as these incentives are less relevant for rich buyers

1

Extension of 10% EV purchase tax waiver until 2020

2

Special NEV plate

(i.e., Toll exemptions; Elimination of drivable date restrictions; Parking discounts; Special entrance permits – logistic vehicles)

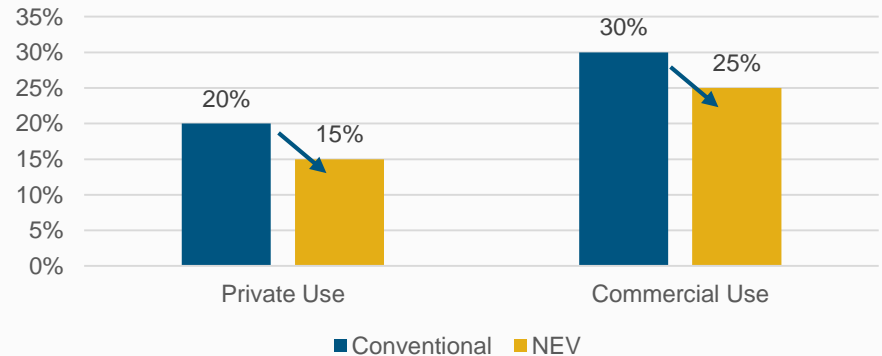
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Lower down-payment requirements from 2018



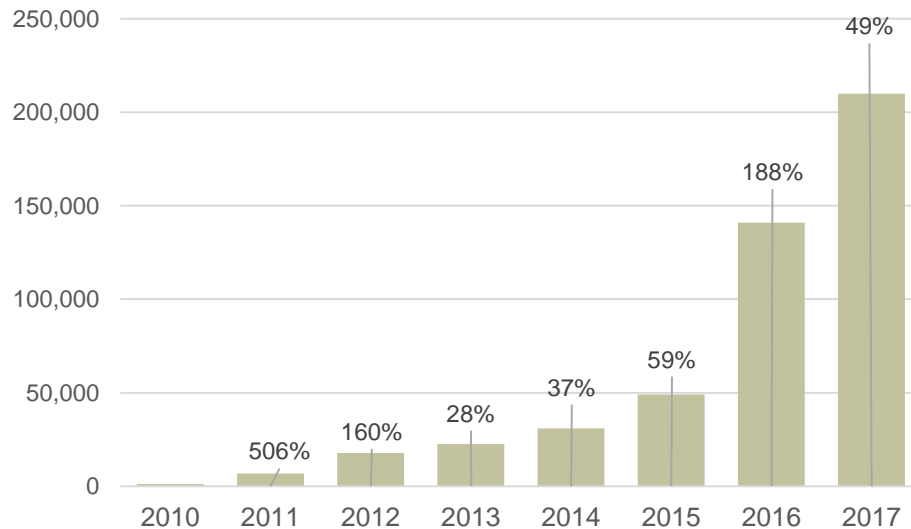
Image source: sorax/123rf.com

**Down-payment requirements
(Conventional vs NEVs)**



Charging facilities are below par – but growing and improving

Public Charging Poles in China

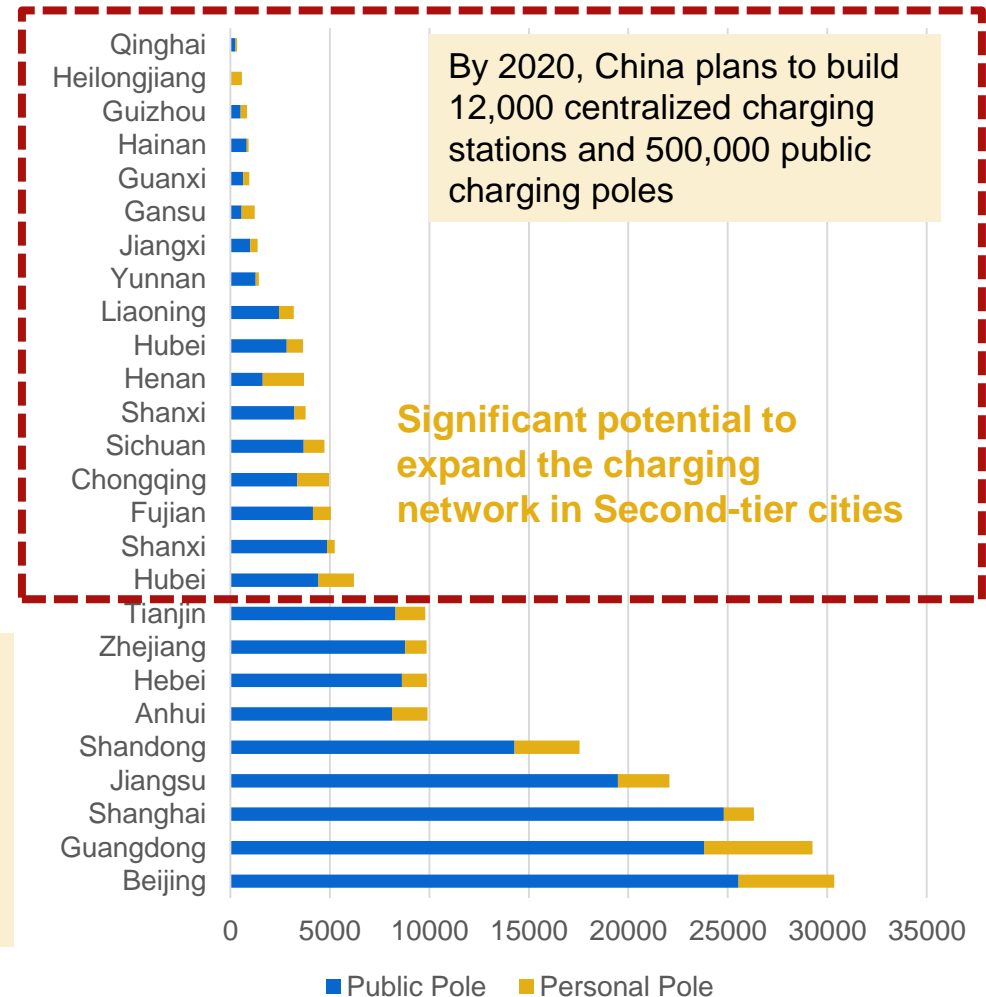


Proportion of ownership of EVs to public charging stations is only 8.6:1.

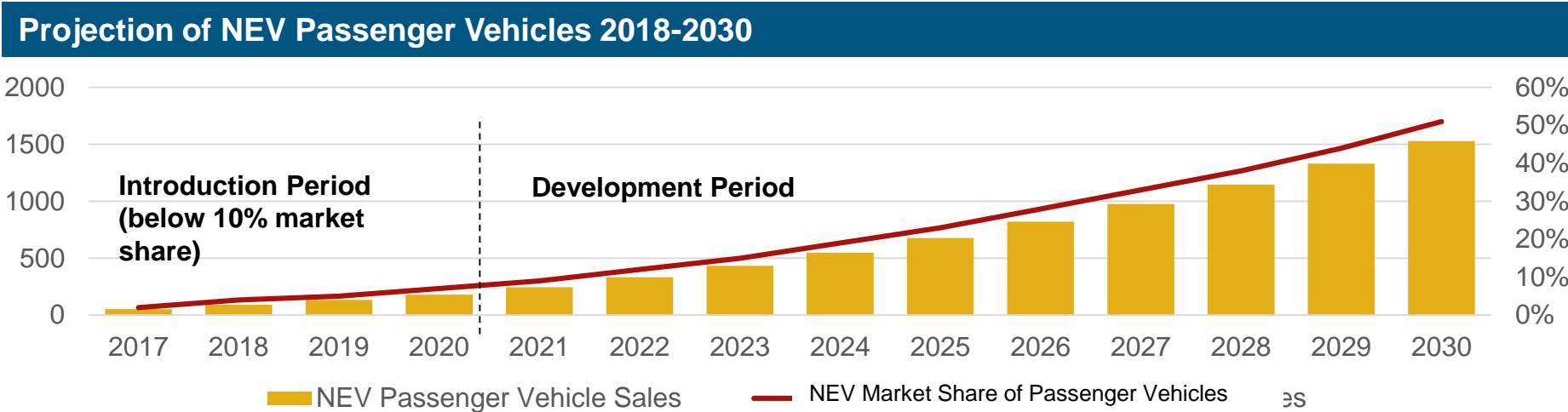
Proper planning and maintenance are needed

- The current utilization of public charging poles has not even reached 15% since users prefer private poles
- Most of the charging poles only last up to 3 yrs

Charging Facility by Province in 2017



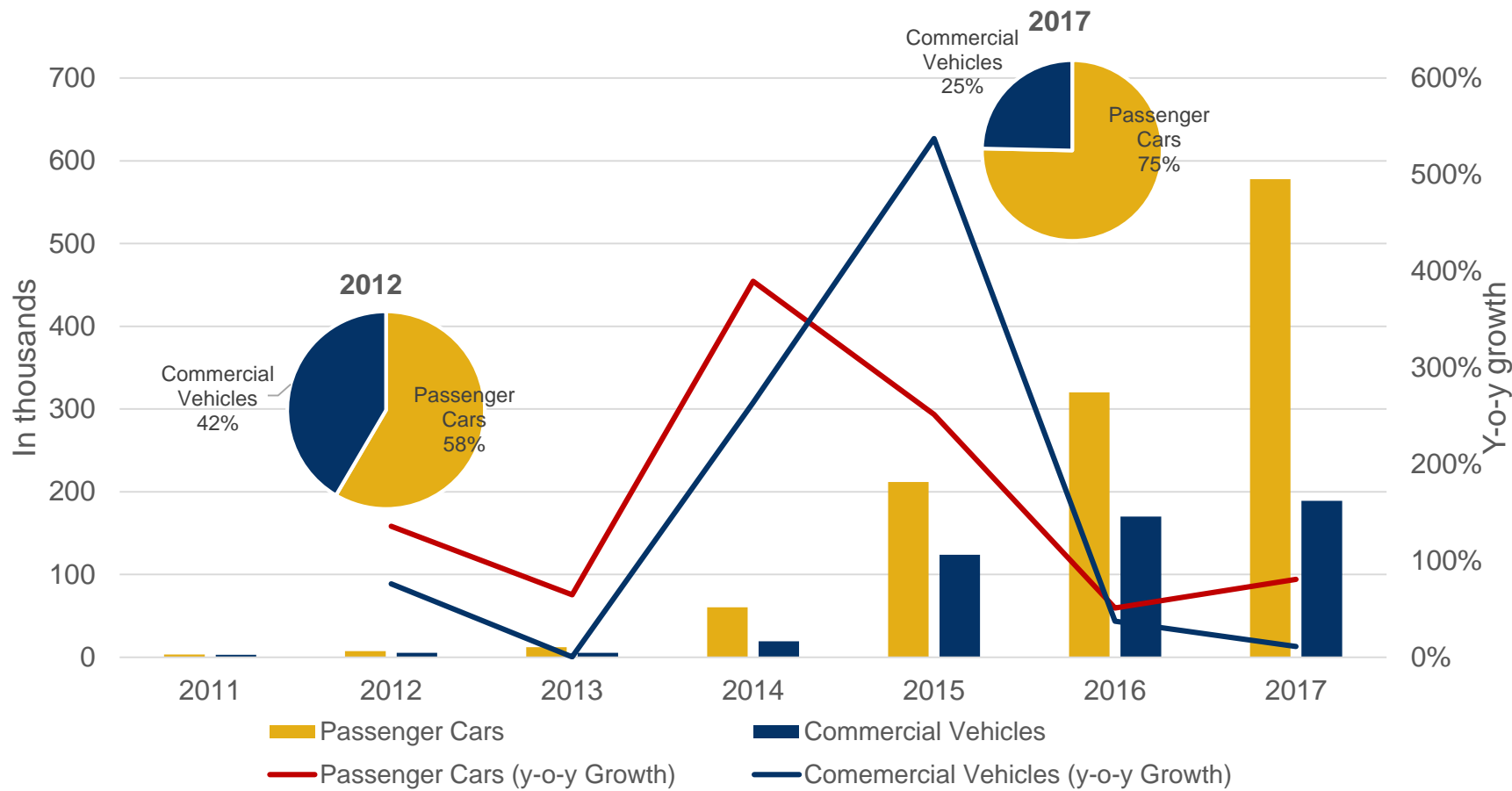
A consensus market projection sees the growth continuing beyond subsidies, but with more innovative and increasingly cost competitive product ranges



2017-2020	2021-2030	2030
<ul style="list-style-type: none">• Policy-driven• 2020 passenger vehicle annual sales target :1.8 million	<ul style="list-style-type: none">• More innovative products• Decreasing cost--competitiveness with conventional vehicles by 2021-2022, echoing the full phase out of fiscal subsidies by 2021, i.e., battery cost:<ul style="list-style-type: none">– Twelfth five-year annual plan target: 2 RMB/kWh– Thirteenth five-year annual plan target: < 1 RMB/kWh (by 2020) with higher energy density	<ul style="list-style-type: none">• Planned NEV market share: 40%• Battery cost: 30% of current cost• Driving range: 500 km+• Reduced charging time• Other accessories: 5G, self-driving etc.

Passenger car ownership to drive EV sales as China transitions from commercial vehicle purchases induced by state-controlled entities

Electric Passenger Cars vs Commercial Vehicles Sales in China

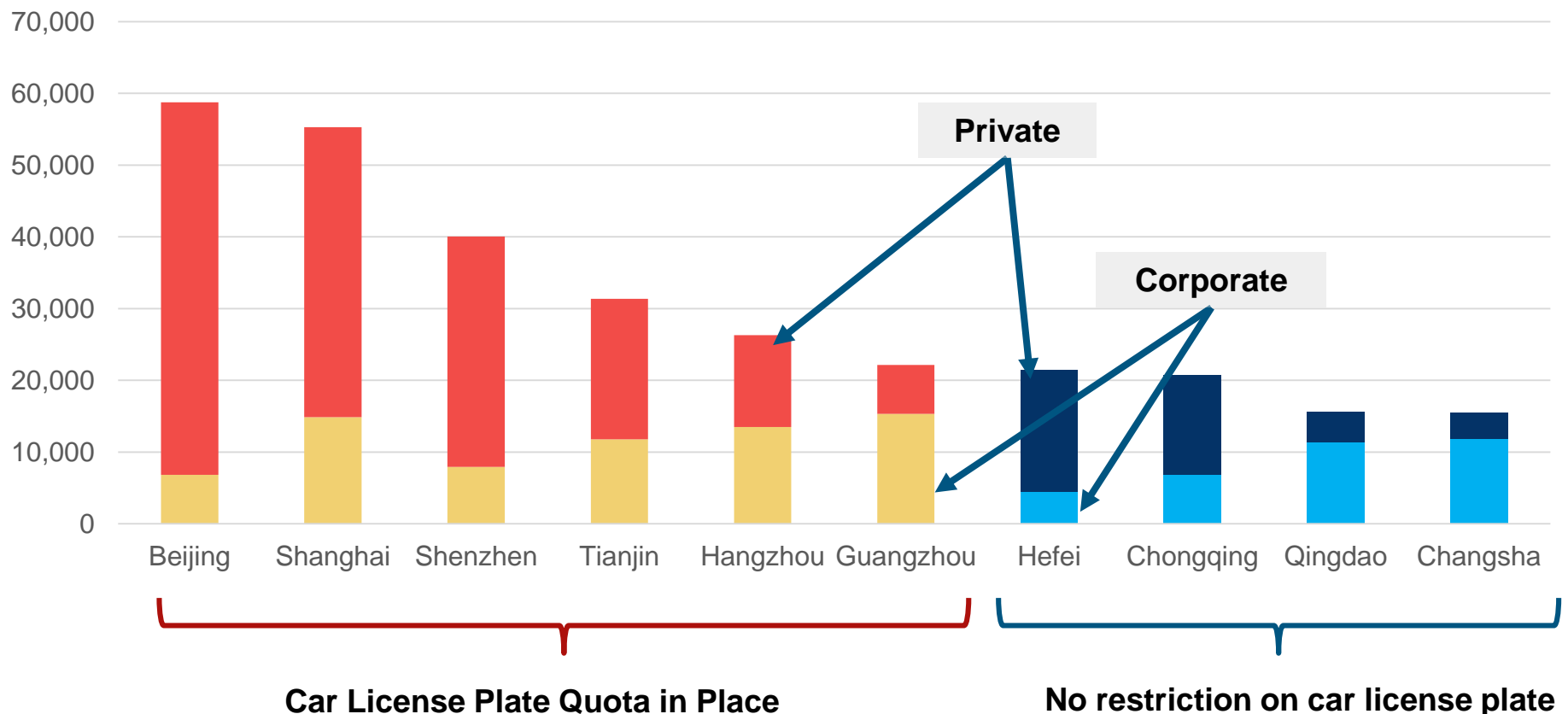


EVs in China are segmented into two categories: Passenger cars and Commercial vehicles (buses, special vehicles including trucks, logistics vehicles, postal vehicles, and construction vehicles)

The phasing out of subsidies will likely see a progressive transformation of the NEV industry from a policy-driven to a more market-centric one

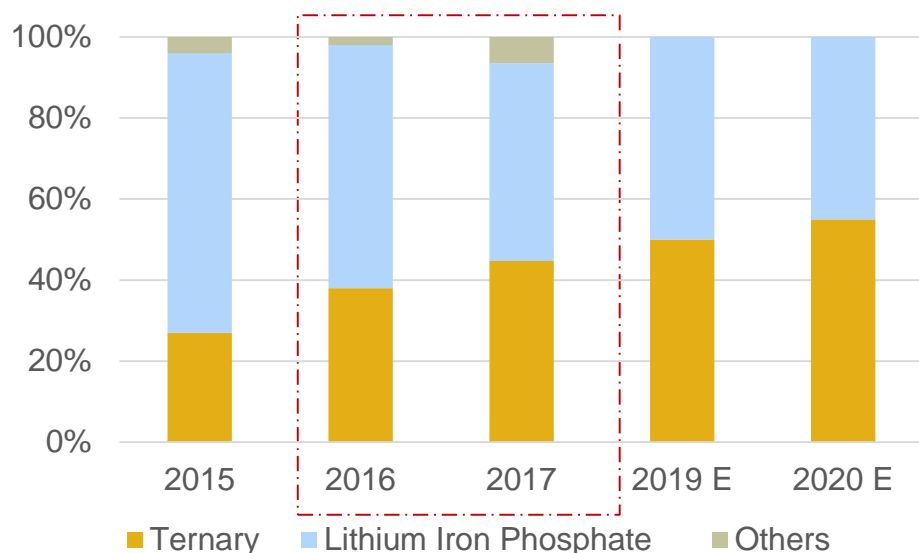
Corporate Vs. Private Purchases in Top Ten Cities (2017)

Majority of the top ten cities (by NEV sales) have vehicle license plate quotas



The battle of the batteries – Ternary battery is expected to dominate the market

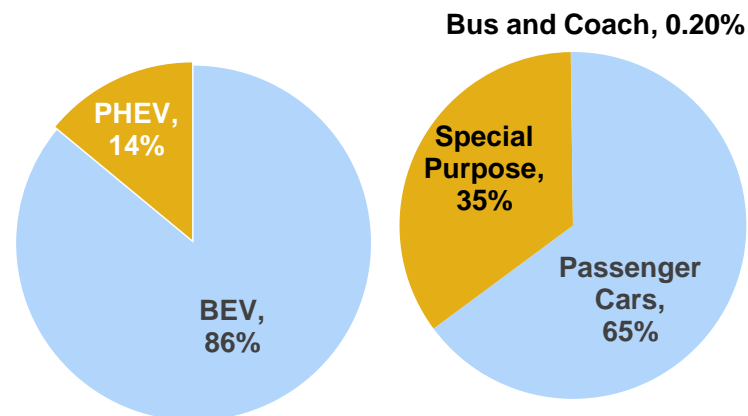
Battery Market Shares in China



- Before 2017, ternary not allowed on bus and coach: low stability + poor performance at higher temperature
- Ternary was suspended from the State NEV Recommended List from Jan. to Dec. 2016 by the Ministry of Industry and Information Technology
- Now the technologies have advanced!

With growing smaller electric vehicle sales, requirements on energy density and driving distance, ternary battery is expected to dominate the market

Ternary Battery Market Segments



Ternary Battery:

Higher energy density → higher performance

Lithium Iron Phosphate:

Safer and long cycle time

EVs are becoming more consumer driven – automakers will increasingly need to innovate and deliver on what the customers value to stay competitive

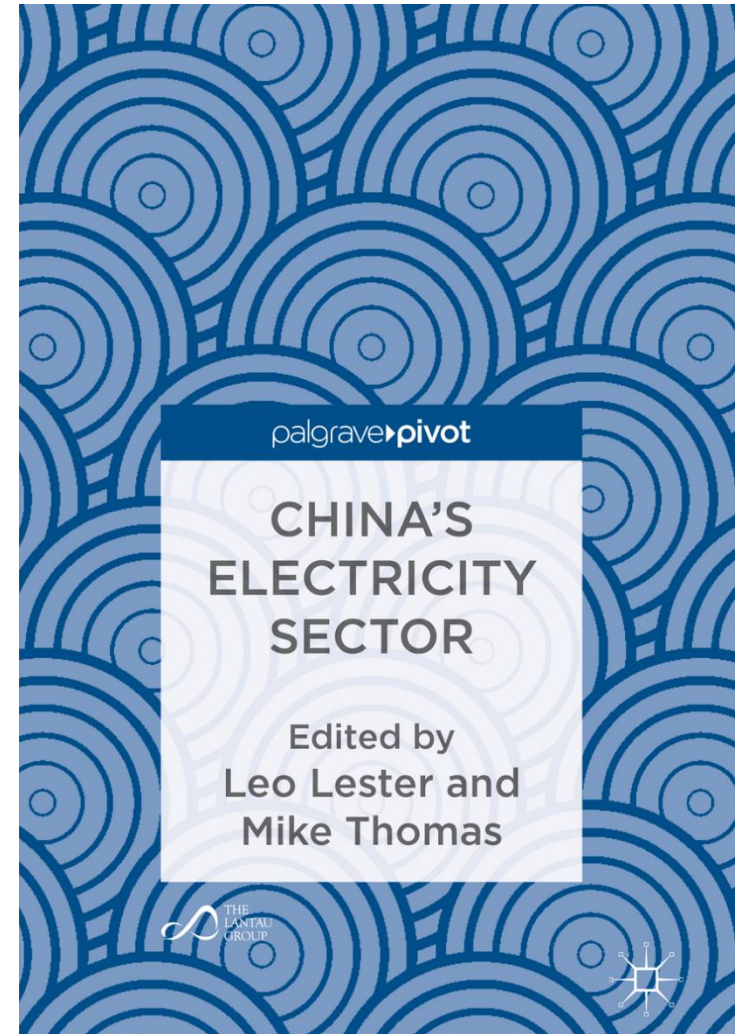
70% consumers need to travel ~40km on weekdays, ~26km on weekends	Shorter Charging Time	Advanced Driver Assistance System (ADAS)
70% consumers expect the range to be 350km	53%+ owners and 73% potential buyers: Up to 4hrs regular charging	Parking Assistance
Quietness with high energy density	84% owners and 61% potential buyers: Maximum fast charging time < 1hr	Market Change
Economical	High-Tech Features	More high-end options other than Tesla
Lower maintenance costs	49% owners: Autonomous driving level 3 (eyes off)	Very little market competition for vehicles priced between 33,000 and 47,000 EUR
Environmental Friendly	32% owners: Autonomous driving level 2 (hands off)	Sharing Economy
45% current NEV owners would purchase another NEV	68% potential buyers: Both autonomous driving level 2 and 3	65% of population would use self-driving car-sharing services

In summary

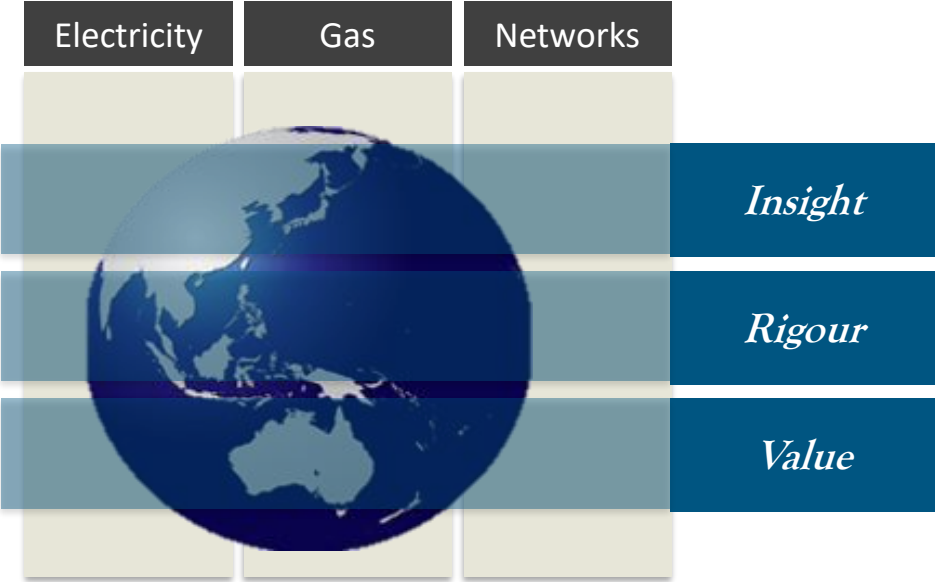
- EV policy is driven by a need for lower air pollution and a diversification away from oil for security of supply reasons
- EV ownership started with state-owned companies (more easily done in a command and control economy) but now individuals are seeing the benefits and the ownership is spreading out to the private sector
- The Government is using policy mechanisms to:
 - Reduce the direct financial burden of the policies (phasing out direct subsidies but using other incentives instead)
 - Improve EV quality and standards
 - To promote pure EV rather than PHEV
 - Force manufacturers to ramp up production
- This is resulting in a move towards more private buyers of EV's:
 - Which is driving small cars (because incentives are more valuable to lower income purchasers)
 - Who want greater performance (impacts on ternary battery)
 - And making the rampant fraud easier to stamp out

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