China New Energy Vehicle Market and Policies

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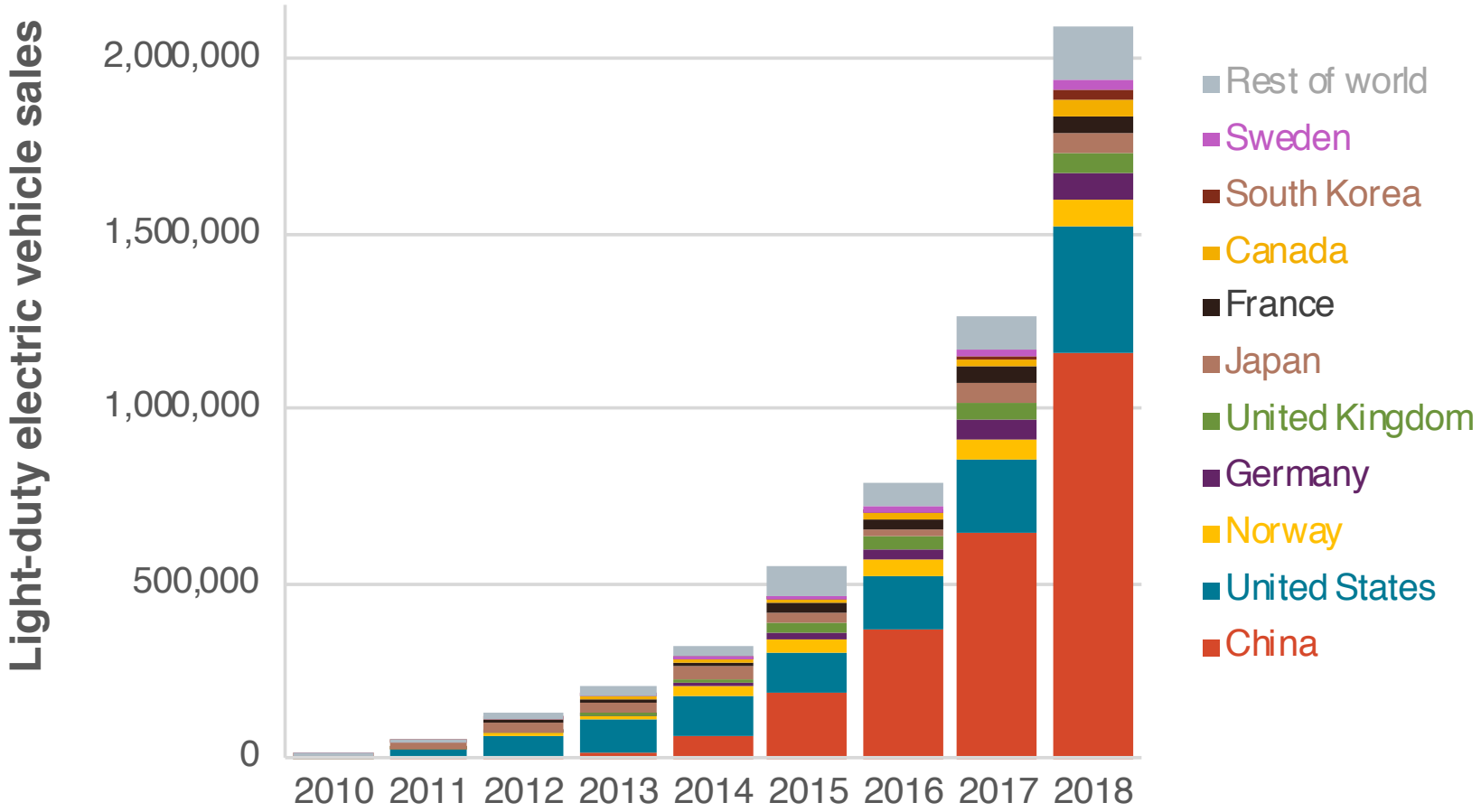
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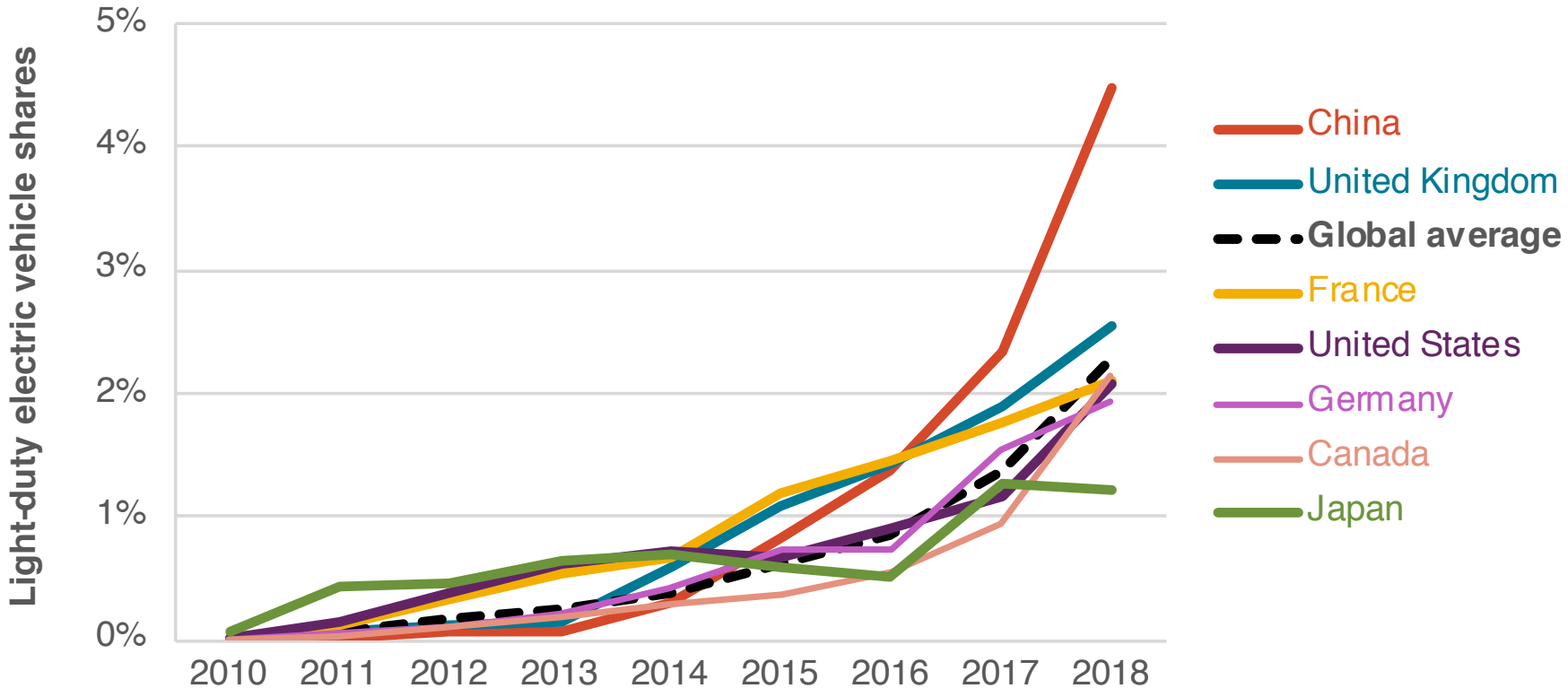
China sold most of world's electric cars

- In 2018, China sold 1.16 million light-duty EVs, or 56% of the world total



China's EV share has doubled the global average and other major markets

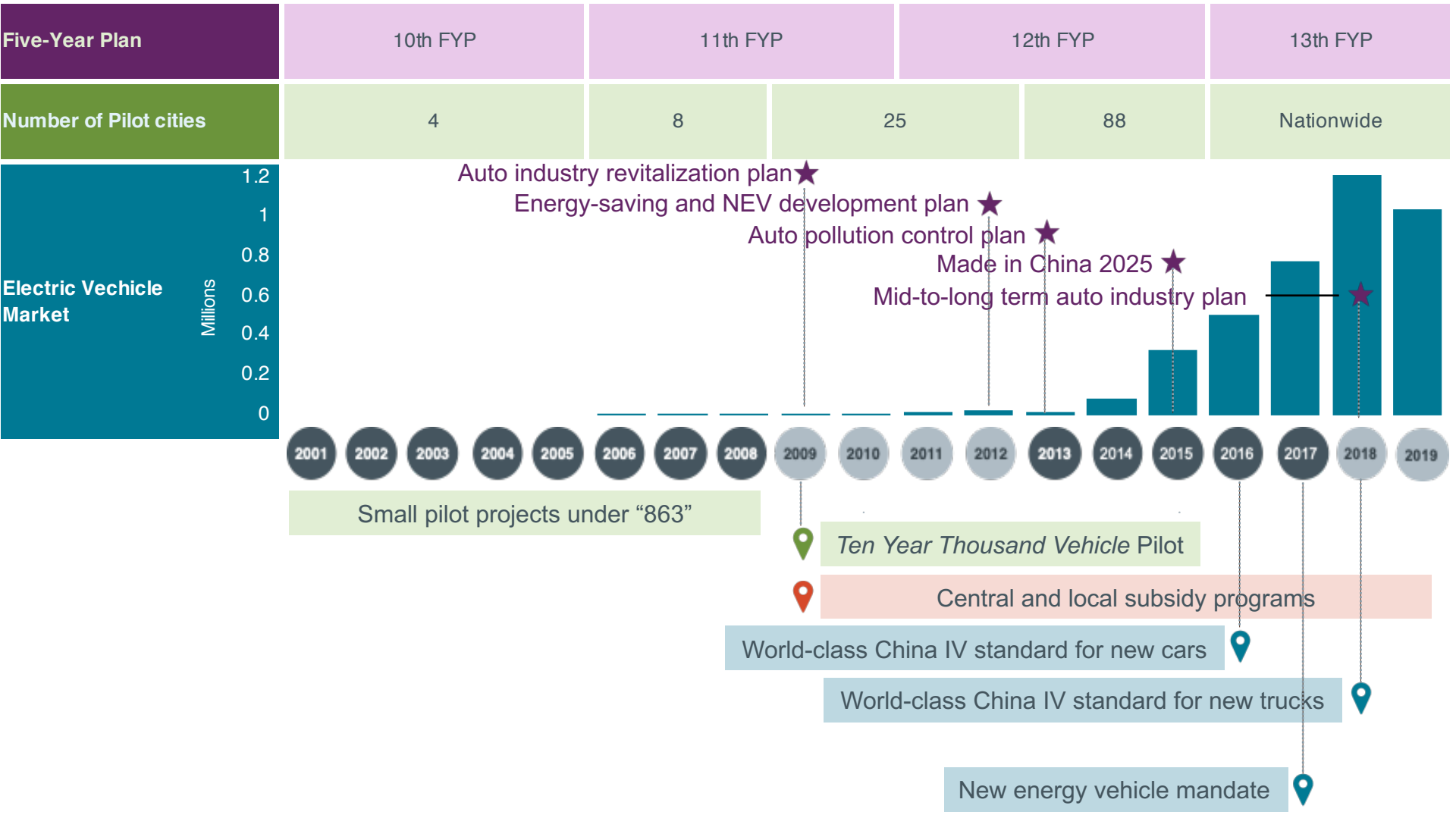
- The global average EV share of new light-duty vehicle sales is around 2% (including all-electric and plug-in hybrids)



Policies in a snapshot

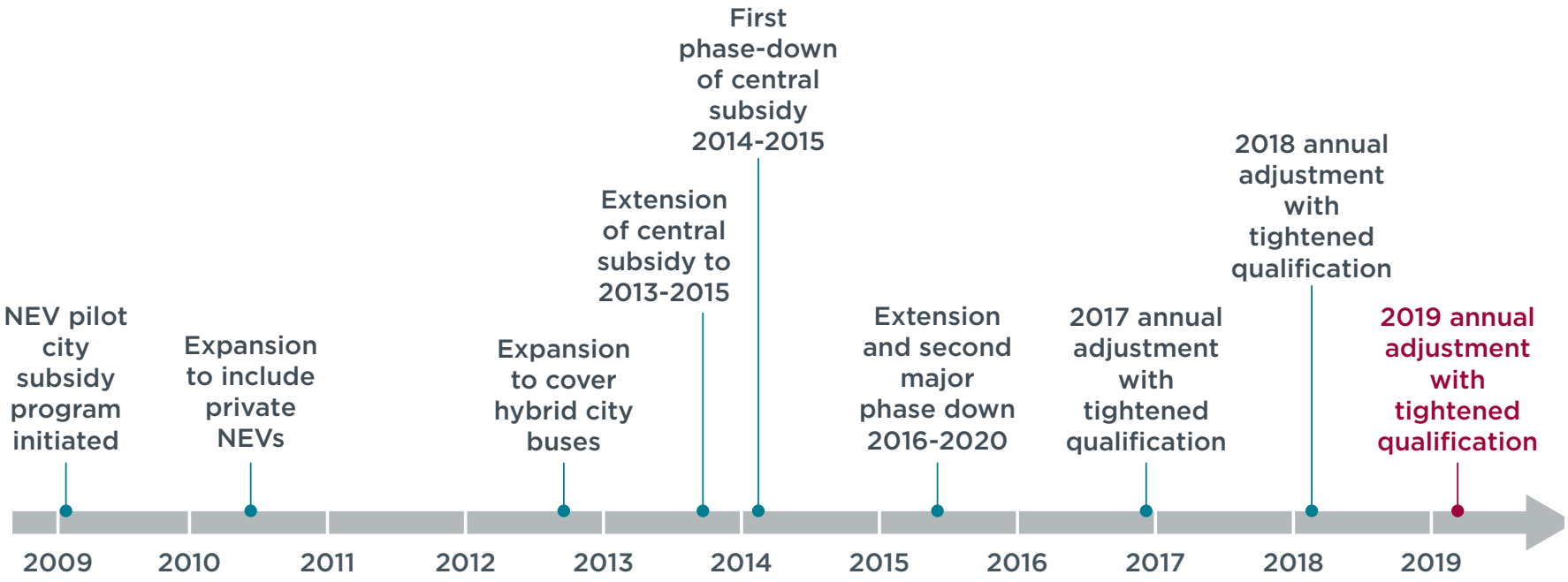
- Macro planning and goals
  - Five-year plans and industry strategic plans: 25% of new sales by 2025
  - Sectoral goals (e.g. for buses)
  - Provincial/local goals driven by air quality needs
- National policies
  - Central subsidy – 2009~2020
  - NEV mandate (dual credit) – For LDVs 2019-2020
- Subnational policies
  - Pilot EV cities
  - Innovative local measures
- Charging infrastructure

Historical timeline of major policies and market

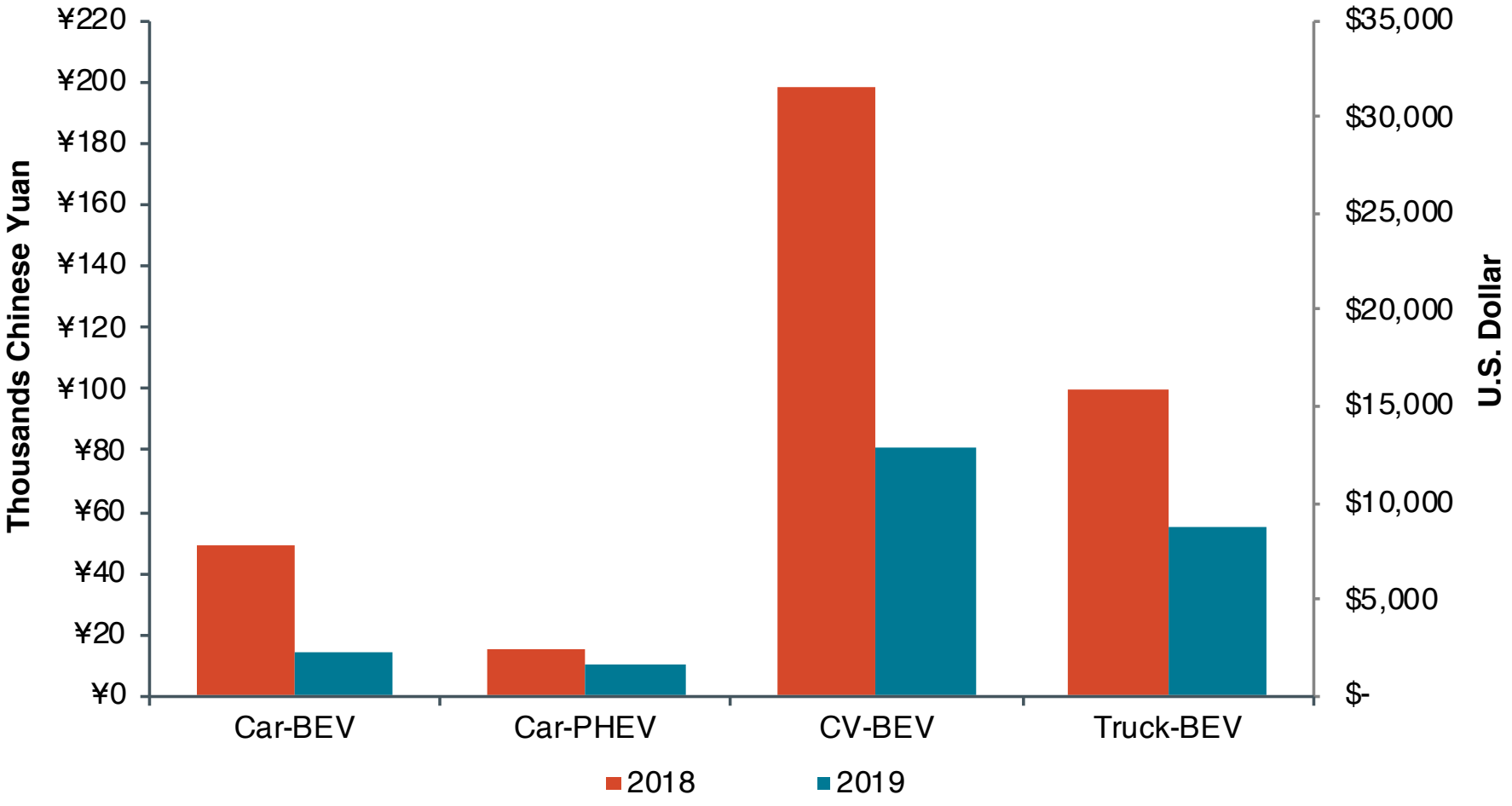


Central Subsidy Policy

Timeline of central subsidy



Examples of changing subsidy overtime



Design of central subsidy overtime (car)

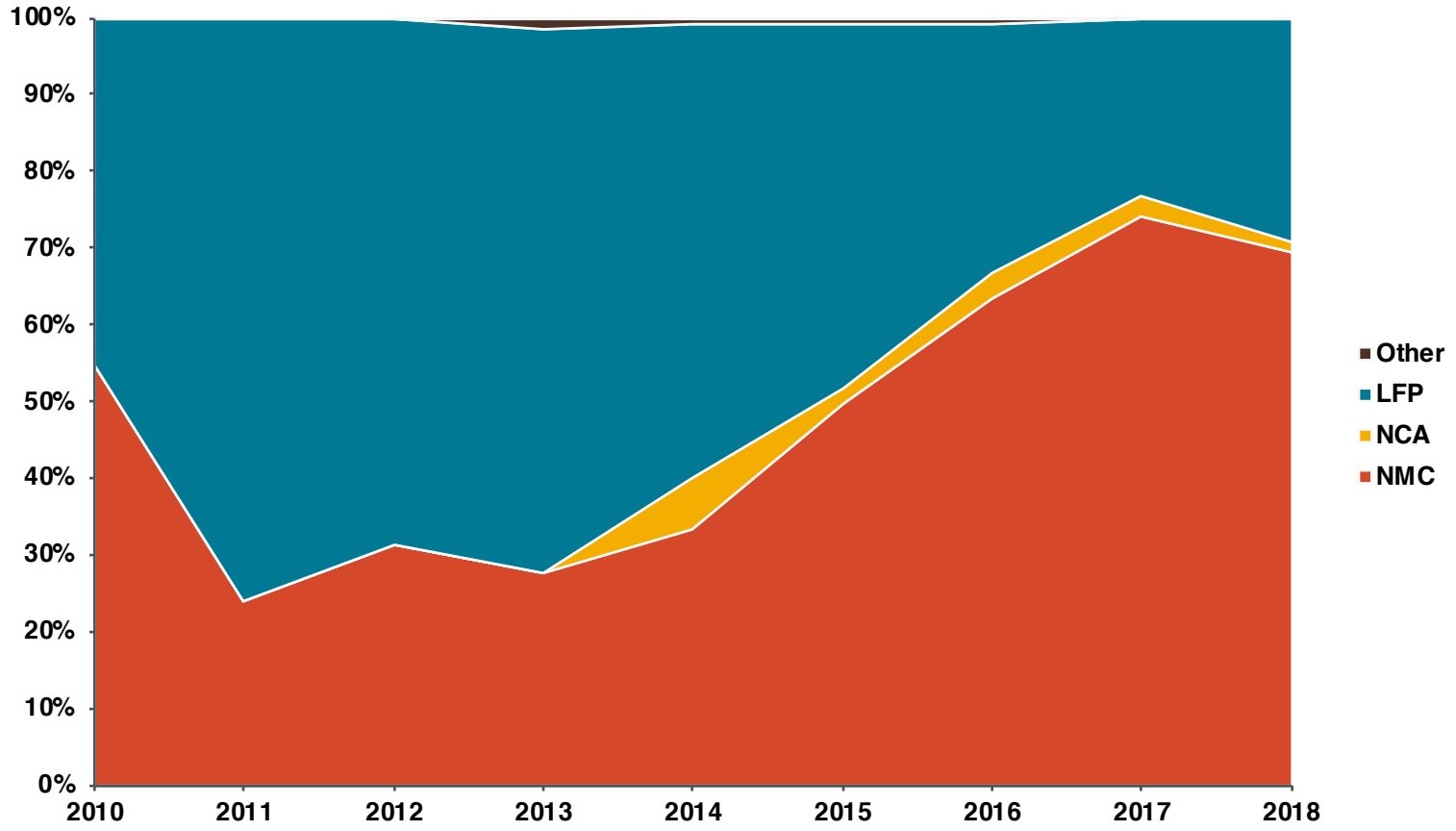
VEHICLE TYPE	TECHNOLOGY	YEAR	DESIGN PARAMETERS									
			EF	ER	LH	BS	BD	BM	CS	SP	FS	RP	VM
Passenger Cars	BEV	2016		☒								X	
	BEV	2017	X	☒			☒			X			
	BEV	2018	☒	☒		☒	☒			X			
	BEV	2019	☒	☒		☒	☒			X			
	PHEV	2016		X							X		
	PHEV	2017	X	X							X		
	PHEV	2018		X		☒					☒		
	PHEV	2019		X		☒					☒		
	FCV	2016		X									
	FCV	2017		X								☒	
	FCV	2018										☒	

EF= Energy Efficiency, measured in Wh/100-km for passenger cars, or Wh/km kg for buses, coaches, trucks and vocational vehicles
ER=electric range, meausred in km
LH=Length of vehicle
BS=Battery size, measured in kWh
BD=Battery enery density, measured in Wh/kg
BM=Battery mass as a percentage of vehicle curb mass, measured in %
CS=Charging speed of batteries
SP=Maximum vehicle speed
FS=Fuel saving compared with conventional vehicles
RP=Rated power

X Threshold ■ Scaling factor ☒ Threshold and scaling factor

Impact of policy design: battery chemistry

- Driven by the requirement on battery energy density and electric range, the market share of high-density battery technologies NMC increased substantially



EV Mandate Policy

NEV mandate

Government	Target year	Percentage of EV credits	ICCT estimate of percent EV sales
China NEV	2019-2020 2021-2023	10-12% 14-18%	~5% ~8%
California ZEV	2025	22%	8%
Quebec ZEV	2025	22%	10%
British Columbia ZEV (legislation passed May 2019)	2025 2030 2040		10% 30% 100%

- China's New Energy Vehicle mandate is integrated into its existing fuel economy standards, an excellent first step but in need to substantial improvement in the next iteration of the standards.
- California forecasts only 8% EV penetration in 2025 due to credit multipliers which needs substantial enhancements to achieve a ~ 30% target by 2030.
- Quebec's policy is nearly identical to California's but with fewer credits

Current compliance status

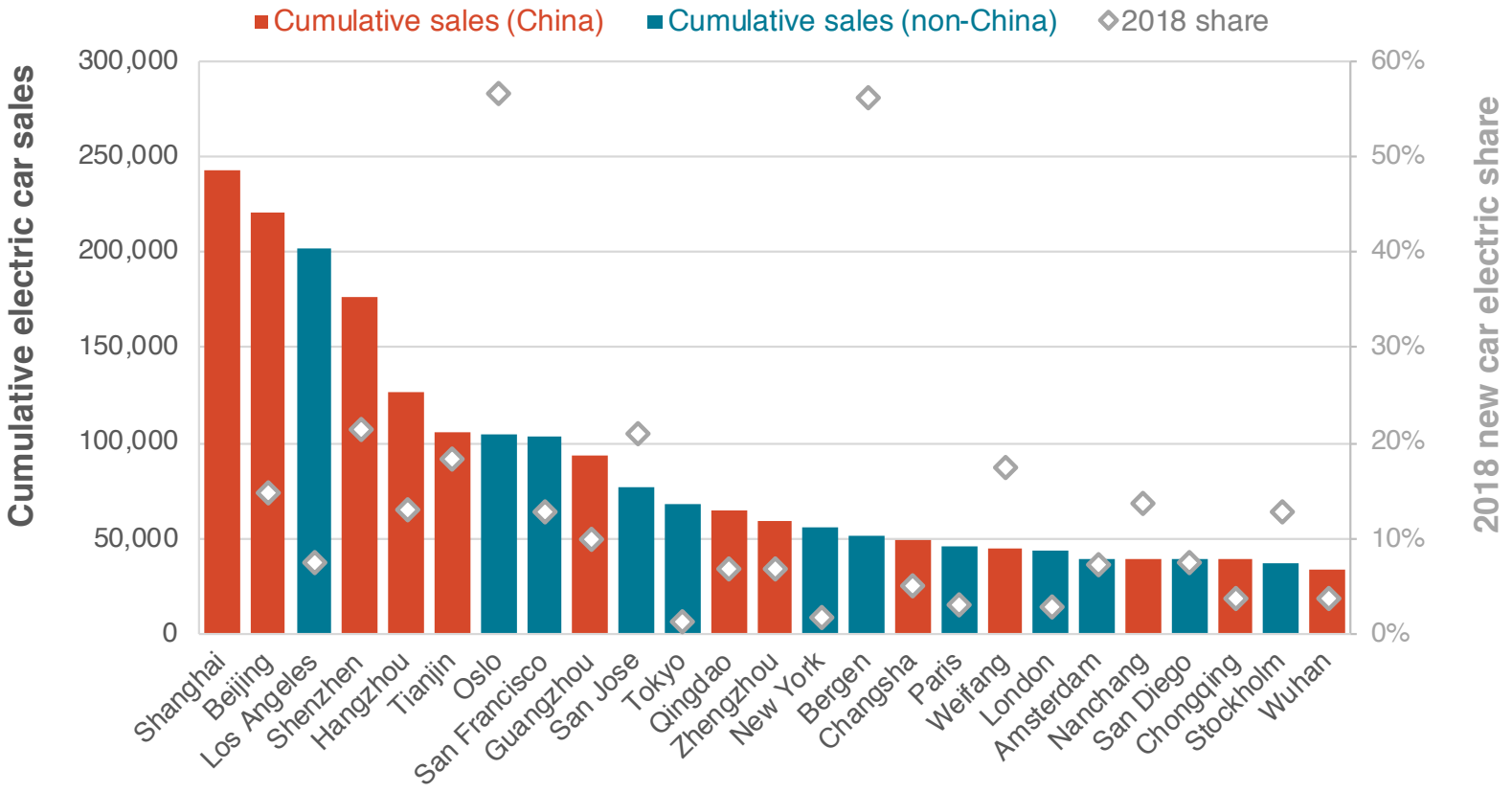
	PV Prod. 2018	PV Mkt% 2018	CAFC Credit 2018	NEV Credit 2018	Required NEV Credit 2020
Ford	384,336	1.7%	(199,855)	4,238	46,120
GM	3,343,502	15.1%	(852,709)	115,911	401,220
Hyundai	800,625	3.6%	(208,163)	9,618	96,075
Kia	359,470	1.6%	(32,353)	16,215	43,136
Mazda	162,965	0.7%	(6,519)	-	19,556
Mercedes-Benz	511,299	2.3%	15,624	2	61,356
Mitsubishi	146,229	0.7%	(102,361)	7,452	17,547
Nissan	31,006	0.1%	(10,543)	7,158	3,721
PSA	249,874	1.1%	(62,499)	-	29,985
Toyota	713,995	3.2%	173,358	-	85,679
Volkswagen	4,113,943	18.5%	265,498	33,820	493,673
Honda	1,490,471	6.7%	(97,241)	723	178,857
Renault	104,420	0.5%	(84,493)	-	12,530
BMW	490,151	2.2%	426,431	43,144	58,818

Original data source: MIIT

Local Policies

Thirteen of top 25 global EV city markets are in China

- 42% of world's passenger EV sales are in 25 cities
  - 13 of the top-25 global markets by EV market size are in China
  - The path to a mainstream market: Regulation, incentives, infrastructure, local actions



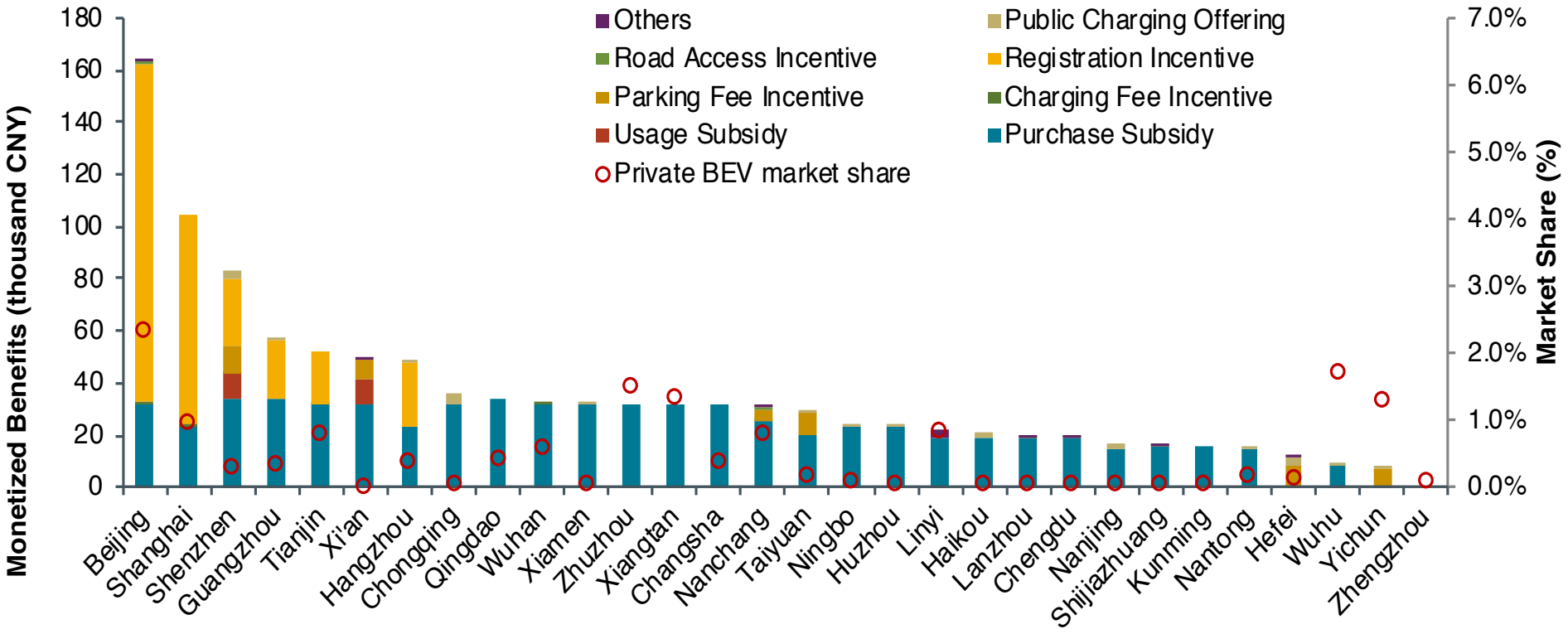
Based on Hall, Cui, & Lutsey, 2019. https://theicct.org/publications/ev-capitals-of-the-world-2019

Local policy catalog

Country	Metropolitan area	Planned zero-emission area	Exemption from vehicle licensing restriction	Purchase incentive	Charging station incentives	EV-ready building and parking codes	Priority road access	Parking benefits	Electric taxi promotion	Electric car-sharing	City fleet electrification goal	100% zero emission bus target	Consumer awareness program
China	Shanghai		×	⊗	⊗	×		×	⊗	×	×	○	×
	Beijing			⊗	⊗	×	×		⊗	×	×	○	×
	Shenzhen		×	⊗	⊗	×	×	×	⊗	×	×	⊗	×
	Hangzhou		×	⊗	○	×	×		⊗	×		○	×
	Tianjin		×	⊗	○	×	×	×	⊗	×	×	○	×
	Guangzhou		×	⊗	⊗	×			⊗	×		⊗	×
	Qingdao			○	○	×		×	⊗	×		○	×
	Zhengzhou			⊗	○	×	×	×	⊗	×	×	○	×
	Changsha			⊗	○	×		×	⊗	×		○	×
	Weifang			○	○	×		×	⊗	×			×
	Nanchang			○	⊗	×	×	×	⊗	×		○	×
	Chongqing			⊗	⊗	×	×	×	⊗	×		○	×
	Wuhan			⊗	⊗		×	×	⊗	×		○	×

× = action by local government; (○) = action by state or national government; (⊗) = action at multiple levels

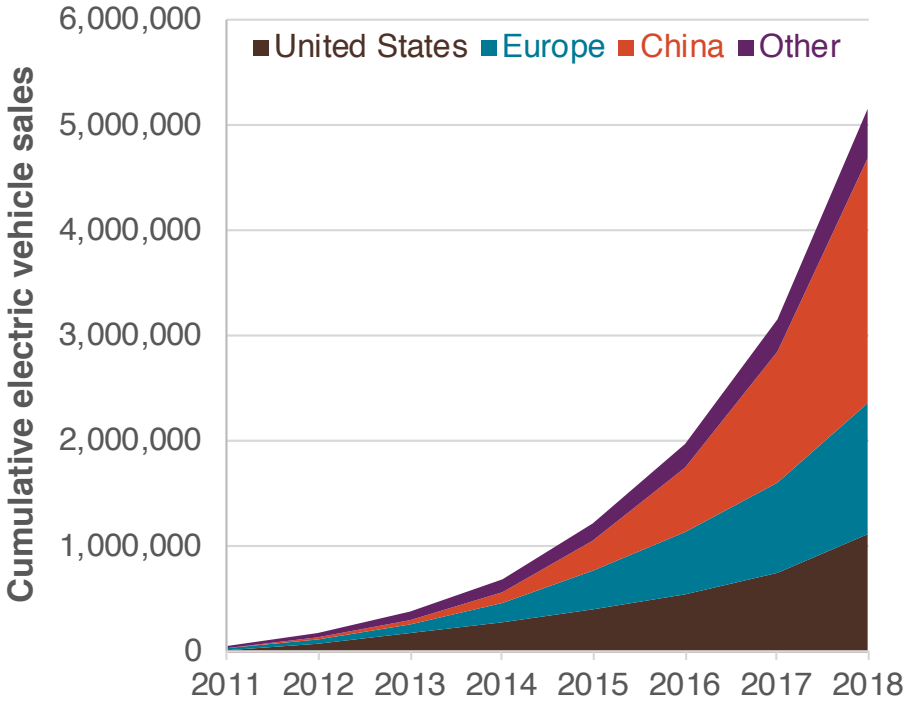
Impact of local policies

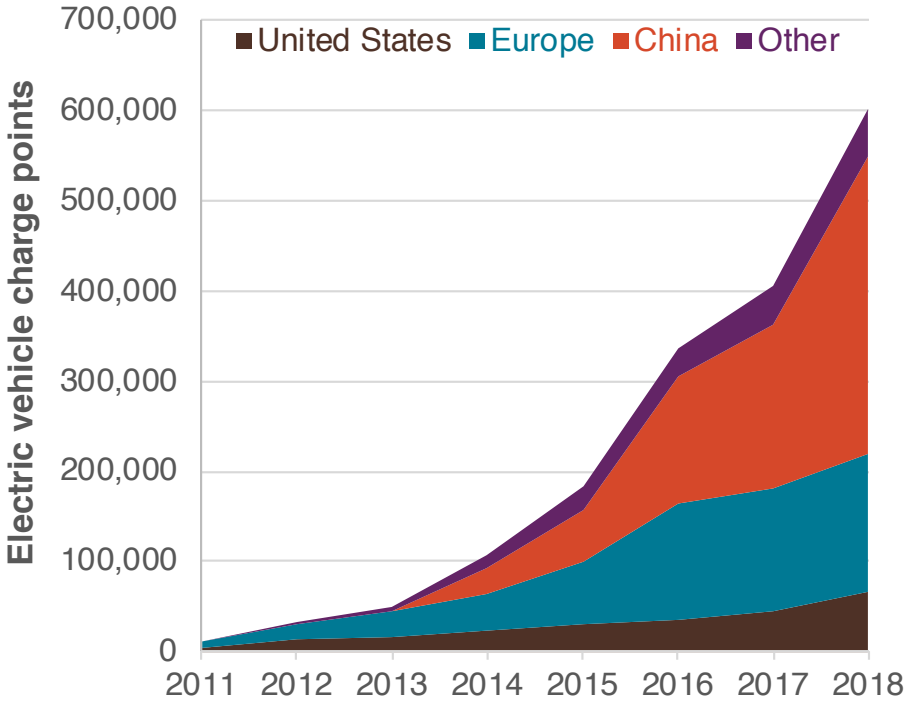


Charging Infrastructure

Top markets invest in charging infrastructure

- EV sales and their charging infrastructure ecosystem grow together
- Countries are developing—and adapting—their charging strategies by shifting from simply putting more chargers on the ground to better catering local consumer needs





Summary

- In China, the macro plans set the EV target and lead the development of policies.
- The decade-long subsidy program has largely driven the EV market.
- The design of the subsidy program has profound impact on vehicle technologies and market, such as long-range, high battery density cars.
- At the national level, China is transitioning from fiscal incentives to EV sales mandates. Enforcement is the key for a true credit market.
- Cities adopted a wide range of innovative polices, such as vehicle registration, parking, road access incentives and government-private partnership in fleet programs.
- Registration (license plate) incentive was found to have major impact on consumer market.
- China invested heavily in charging infrastructure.

Thank you!

Questions?

More info

ICCT electric vehicle page:

http://theicct.org/electric-vehicles

ZEV Alliance:

http://www.zevalliance.org

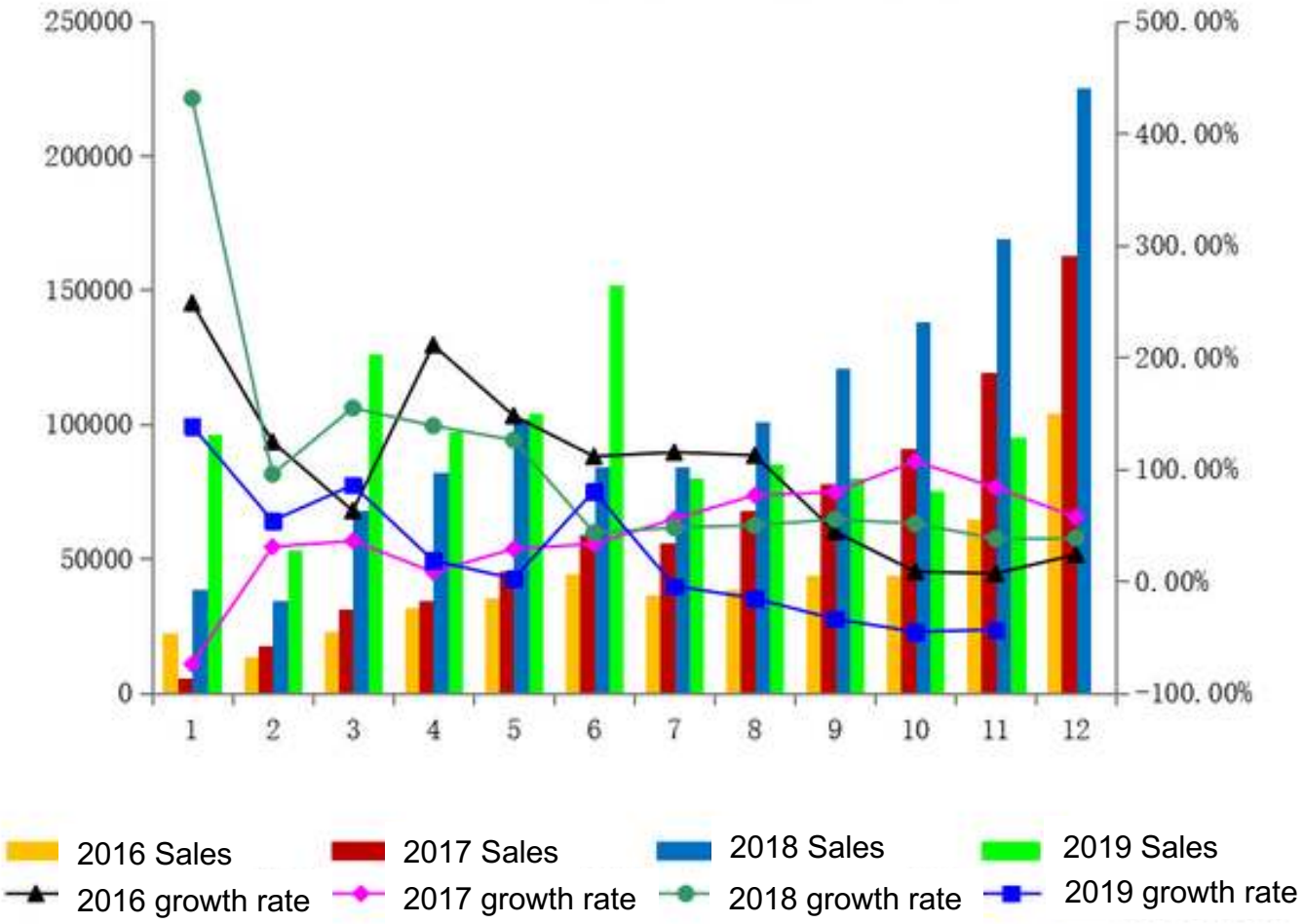
Email: hui@theicct.org

Back up slides

Challenges

Market reliance on subsidy?

Monthly NEV sales 2016-2019



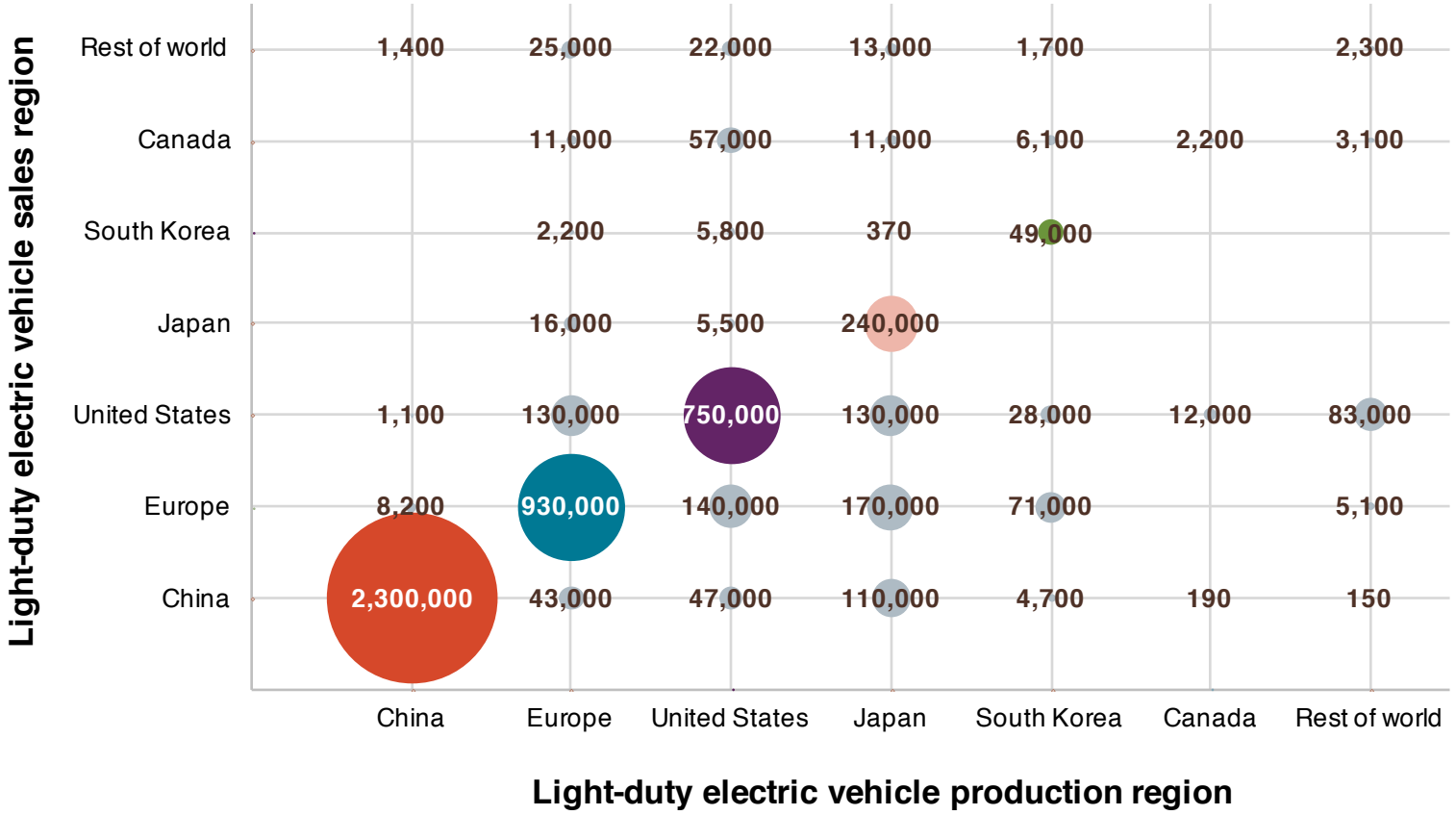
Original data source: MIIT

Local protectionism?

	BAIC	BYD	Roewe	Zotye	Zhidou	JMC	Changan	Chery	JAC	Geely	Kandi	Baojun	DFW	HAWAI	Haima
Zhejiang	7%	11%	3%	12%	9%	5%	6%	2%	2%	20%	16%	0%	7%	0%	0%
Shanghai	15%	23%	50%	0%	0%	0%	2%	5%	5%	0%	0%	0%	0%	0%	0%
Shandong	41%	2%	1%	8%	6%	11%	5%	9%	15%	0%	0%	0%	0%	1%	1%
Guangdong	11%	52%	9%	7%	10%	1%	2%	5%	2%	1%	0%	0%	0%	0%	0%
Beijing	30%	32%	5%	3%	1%	0%	11%	3%	3%	12%	0%	0%	0%	0%	0%
Tianjin	14%	13%	3%	12%	17%	1%	3%	10%	9%	5%	1%	0%	0%	12%	1%
Henan	23%	3%	1%	13%	17%	10%	7%	4%	0%	0%	0%	0%	0%	2%	19%
Jiangsu	37%	7%	5%	8%	12%	8%	3%	6%	5%	2%	4%	0%	1%	1%	1%
Hunan	16%	5%	0%	28%	20%	8%	1%	1%	12%	2%	0%	0%	5%	1%	0%
Jiangxi	7%	1%	0%	1%	1%	89%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Fujian	42%	16%	1%	5%	8%	2%	7%	12%	4%	3%	1%	0%	0%	0%	0%
Guangxi	1%	3%	0%	1%	0%	1%	0%	3%	1%	0%	0%	89%	0%	0%	0%
Anhui	4%	2%	1%	2%	0%	1%	3%	32%	53%	0%	0%	0%	0%	0%	0%
Yunnan	44%	8%	1%	3%	3%	3%	34%	4%	0%	0%	0%	0%	0%	0%	0%
Chongqing	8%	3%	0%	10%	19%	1%	54%	1%	0%	3%	0%	0%	0%	0%	0%

Isolated market?

- China's EV developments: Leading market and producer, but still relatively isolated
  - Other EV-producing countries are exporting EVs much more to other markets
- China has an immense opportunity to expand EV shipments abroad



Design of central subsidy overtime (bus)

VEHICLE TYPE	TECHNOLOGY	YEAR	DESIGN PARAMETERS									
			EF	ER	LH	BS	BD	BM	CS	SP	FS	RP	VM
Bus/Coach	BEV	2016	☒	☒	■								
	BEV	2017	X	X	■	■	☒	X	☒				
	BEV	2018	☒	X	■	■	☒	X	☒				
	BEV	2019	☒	X	■	■	☒		☒				
	PHEV	2016		☒	X						X		
	PHEV	2017	X		■	■		X			☒		
	PHEV	2018	X	X	■	■		X			☒		
	PHEV	2019		X	■	■					☒		
	FCV	2016		X									
	FCV	2017		X								X	
	FCV	2018											

EF= Energy Efficiency, measured in Wh/100-km for passenger cars, or Wh/km kg for buses, coaches, trucks and vocational vehicles
ER=electric range, meausred in km
LH=Length of vehicle
BS=Battery size, measured in kWh
BD=Battery enery density, measured in Wh/kg
BM=Battery mass as a percentage of vehicle curb mass, measured in %
CS=Charging speed of batteries
SP=Maximum vehicle speed
FS=Fuel saving compared with conventional vehicles
RP=Rated power

X Threshold ■ Scaling factor ☒ Threshold and scaling factor

Design of central subsidy overtime (truck)

VEHICLE TYPE	TECHNOLOGY	YEAR	DESIGN PARAMETERS									
			EF	ER	LH	BS	BD	BM	CS	SP	FS	RP	VM
Truck/Vocational	BEV	2016		X		■							
	BEV	2017	X			■	X						
	BEV	2018	☒			■	X						
	BEV	2019	X	X		■	X						■
	PHEV	2016		X		■					X		
	PHEV	2017				■	X						
	PHEV	2018		X		■					X		
	PHEV	2019		X		■					X		■
	FCV	2016		X									
	FCV	2017		X								X	
	FCV	2018											

EF= Energy Efficiency, measured in Wh/100-km for passenger cars, or Wh/km kg for buses, coaches, trucks and vocational vehicles
ER=electric range, meausred in km
LH=Length of vehicle
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