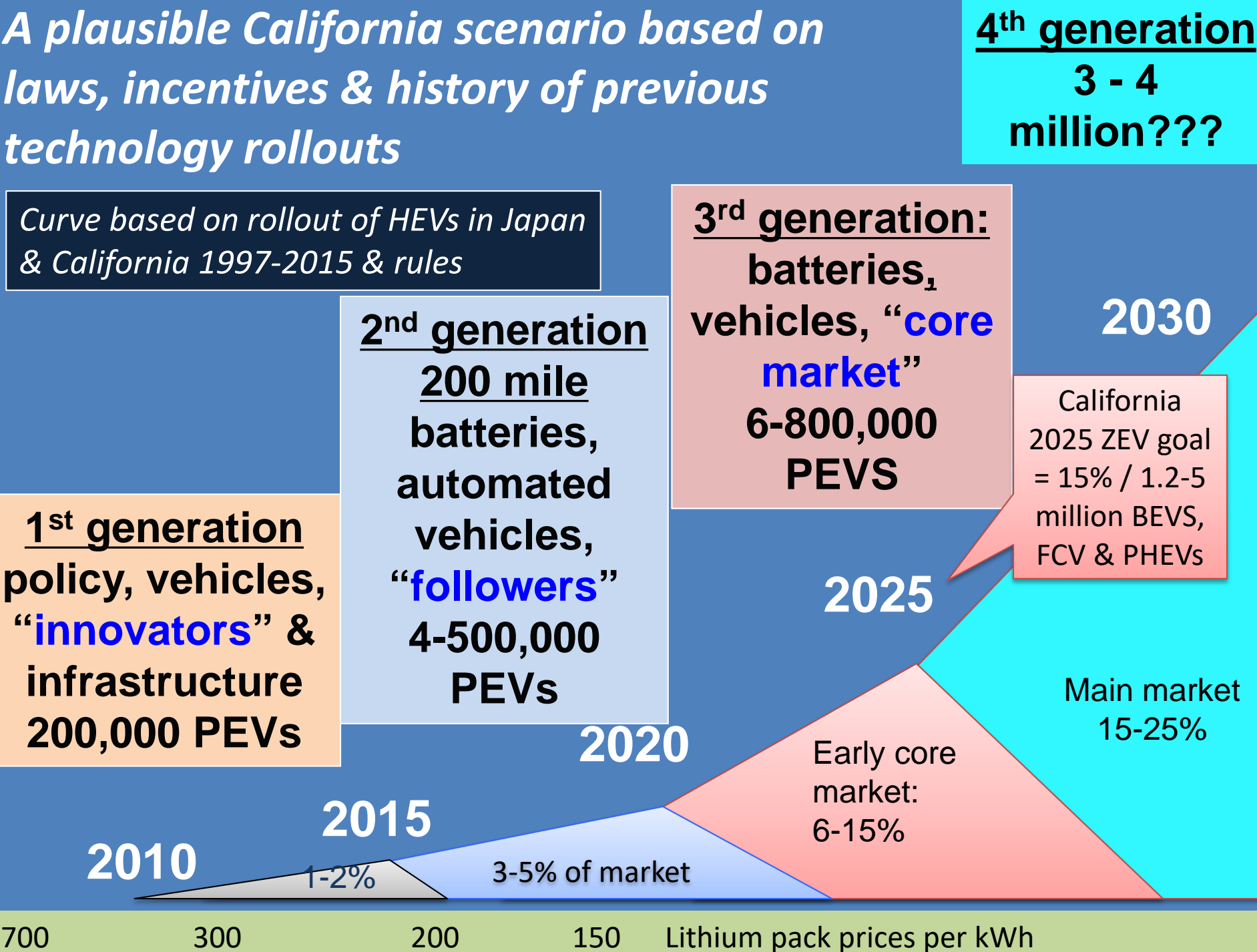
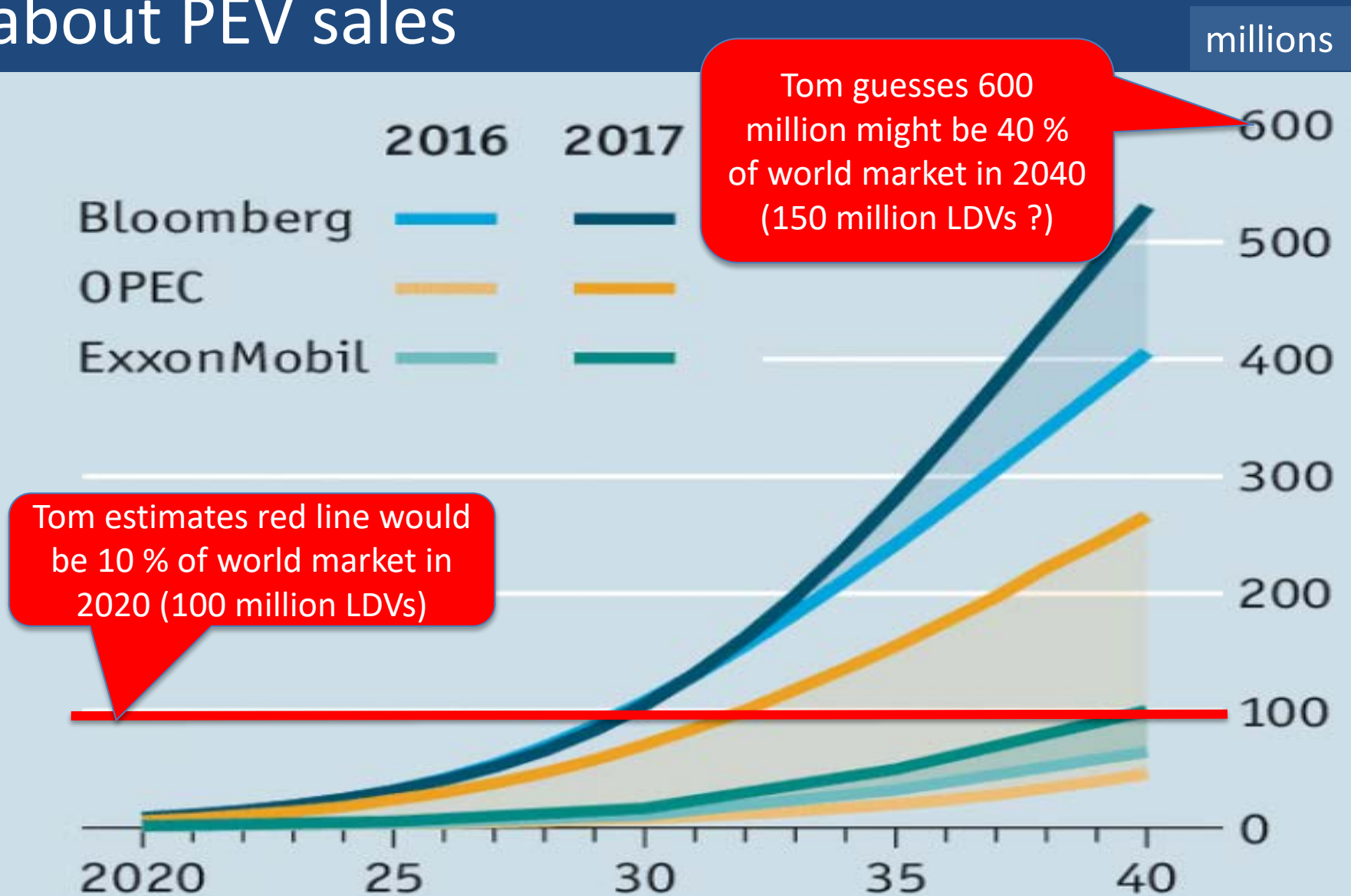


Tom Turrentine
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Asilomar August 2017

PEV WORLD MARKET



Many PEV sales forecasts getting optimistic about PEV sales



Source: Bloomberg New Energy Finance

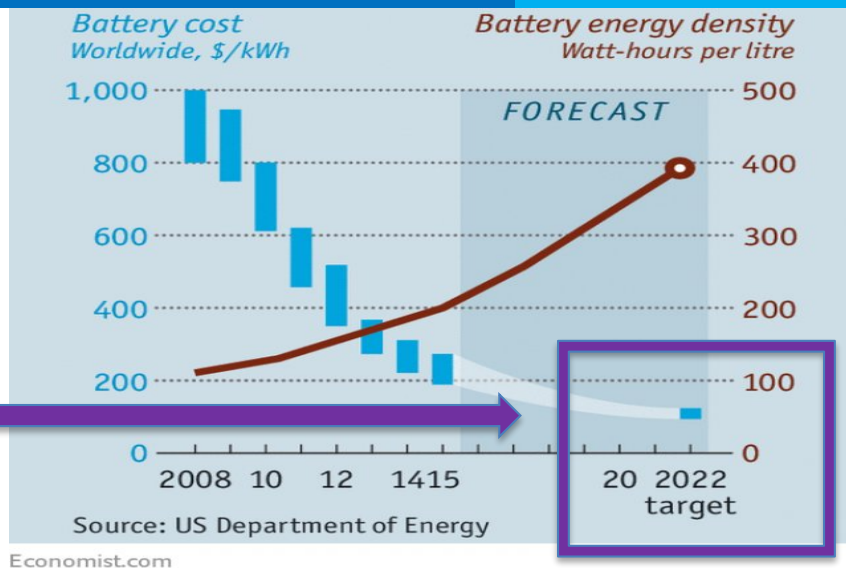
Recent stated policy goals shaping market and commercialization of PEVs

- California like ZEV programs potentially expanding to China, EU
- 2040 national goals to eliminate conventionally fueled vehicle sales:
 - UK “clean air,”
 - France “carbon” (all policy steps not yet developed)
 - India, Norway (2030)
- Cities: ban on diesel in cities:
 - many Chinese cities, Brazil, Stuttgart, Munich, London, Paris.

- Tesla says cells \$190 kWh in 2016 & \$100 in 2020
- GM said it paid \$145 per kWh “cell” for 2017 Bolt

Multiple studies point to “pack” prices under \$200 per kWh early next decade
60 kWh pack (Bolt or Tesla 3) would be around \$10,000

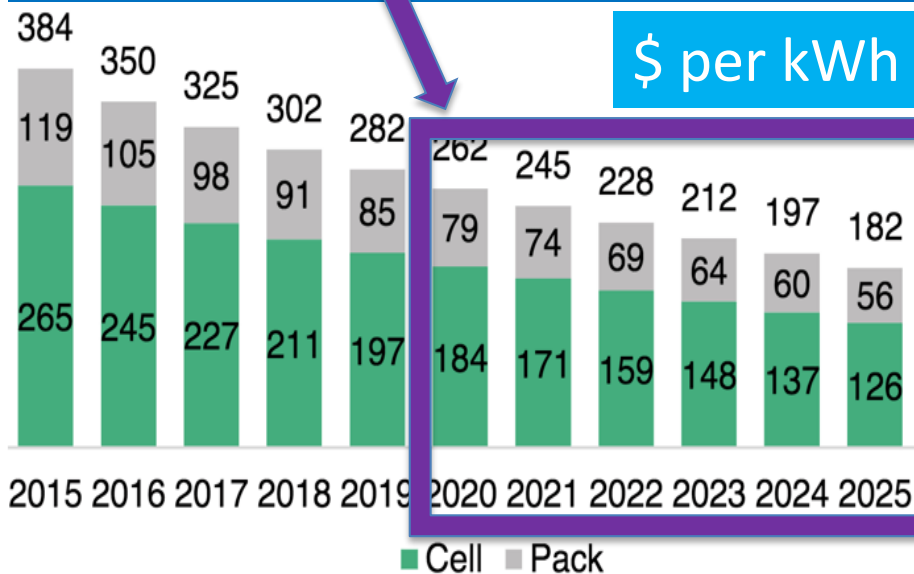
DOE – “cell price” \$ per kWh



Bloomberg

“cells” & “packs”

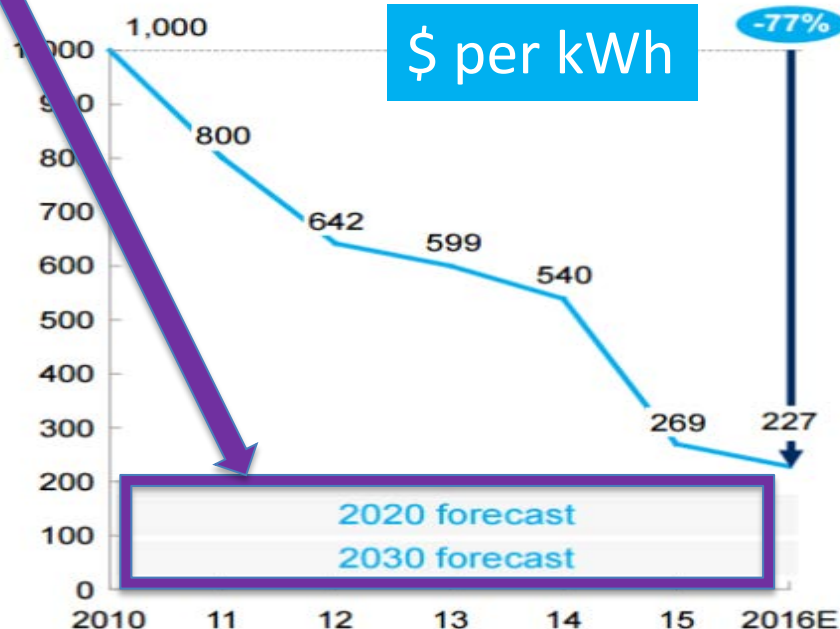
\$ per kWh



Source: Bloomberg New Energy Finance

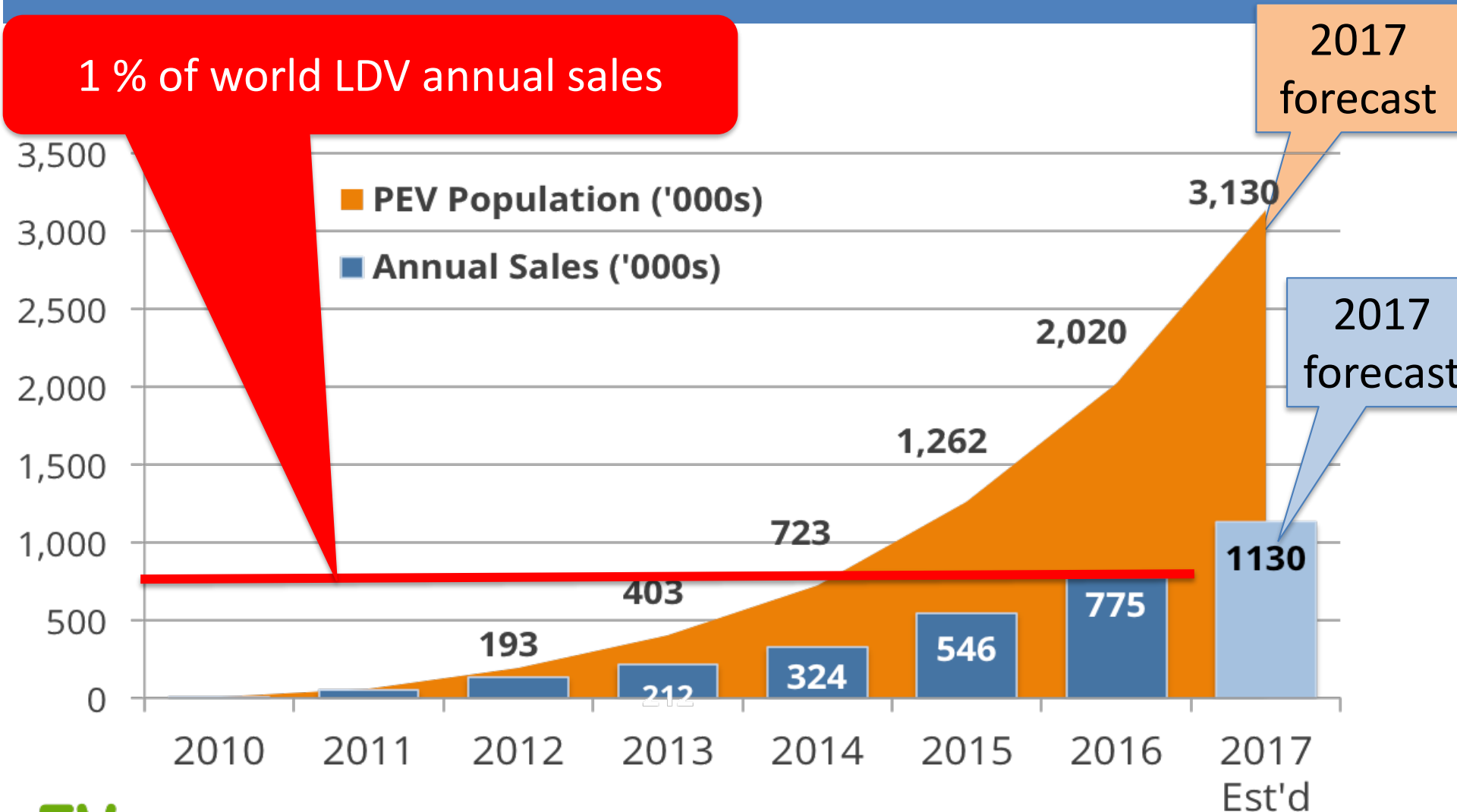
McKinsey – “pack price”

\$ per kWh



The total number of PEVs in the world at end of 2017 will likely exceed 3 million (out of 1 billion vehicles) & 1 million in sales out of 88 million (about 100,000 per month)

1 % of world LDV annual sales



Global PEV Sales by Country

700,000

600,000

500,000

400,000

300,000

200,000

100,000

0

YR 2012

YR 2013

YR 2014

YR 2015

YR 2016

France

Netherlands

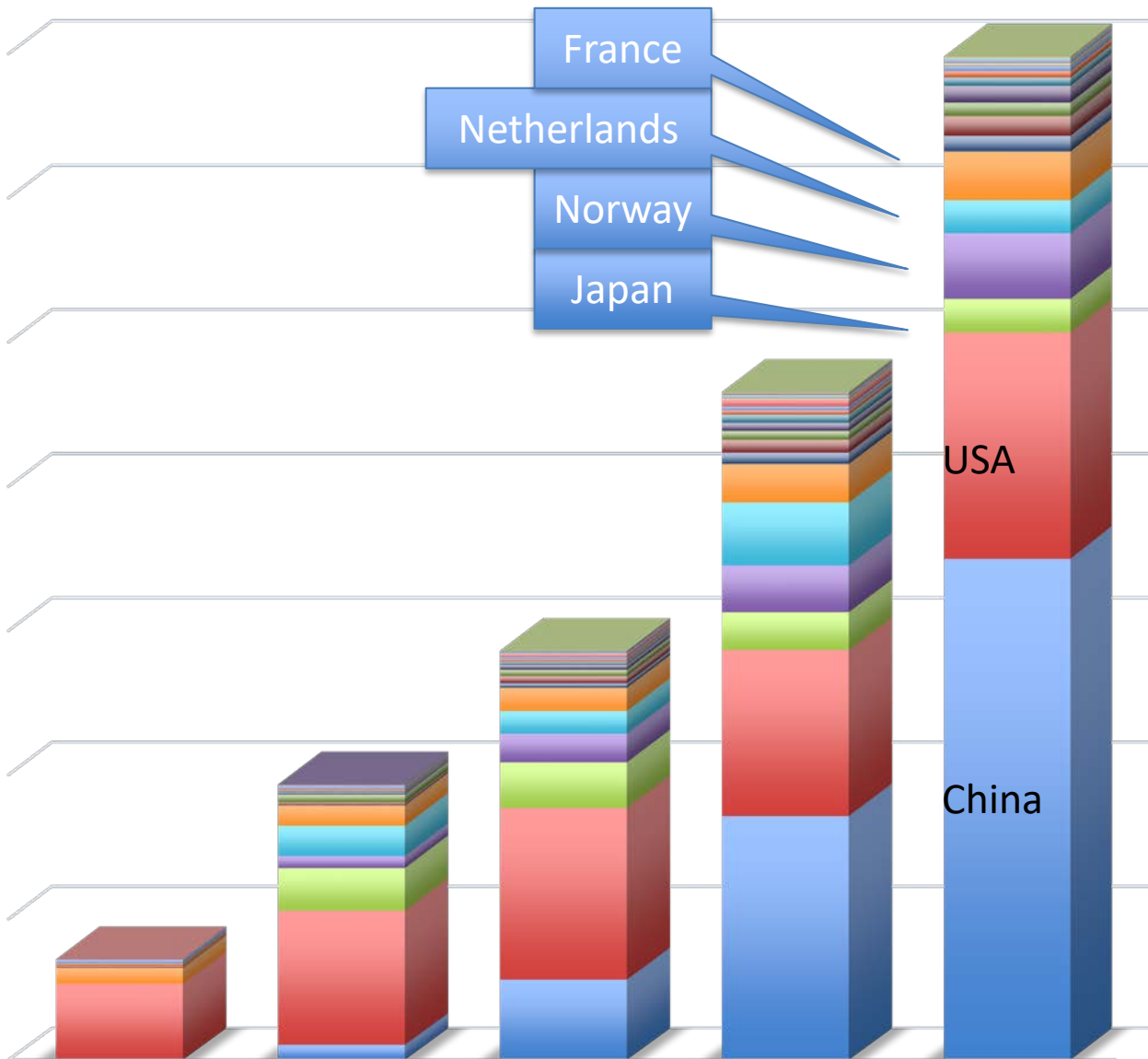
Norway

Japan

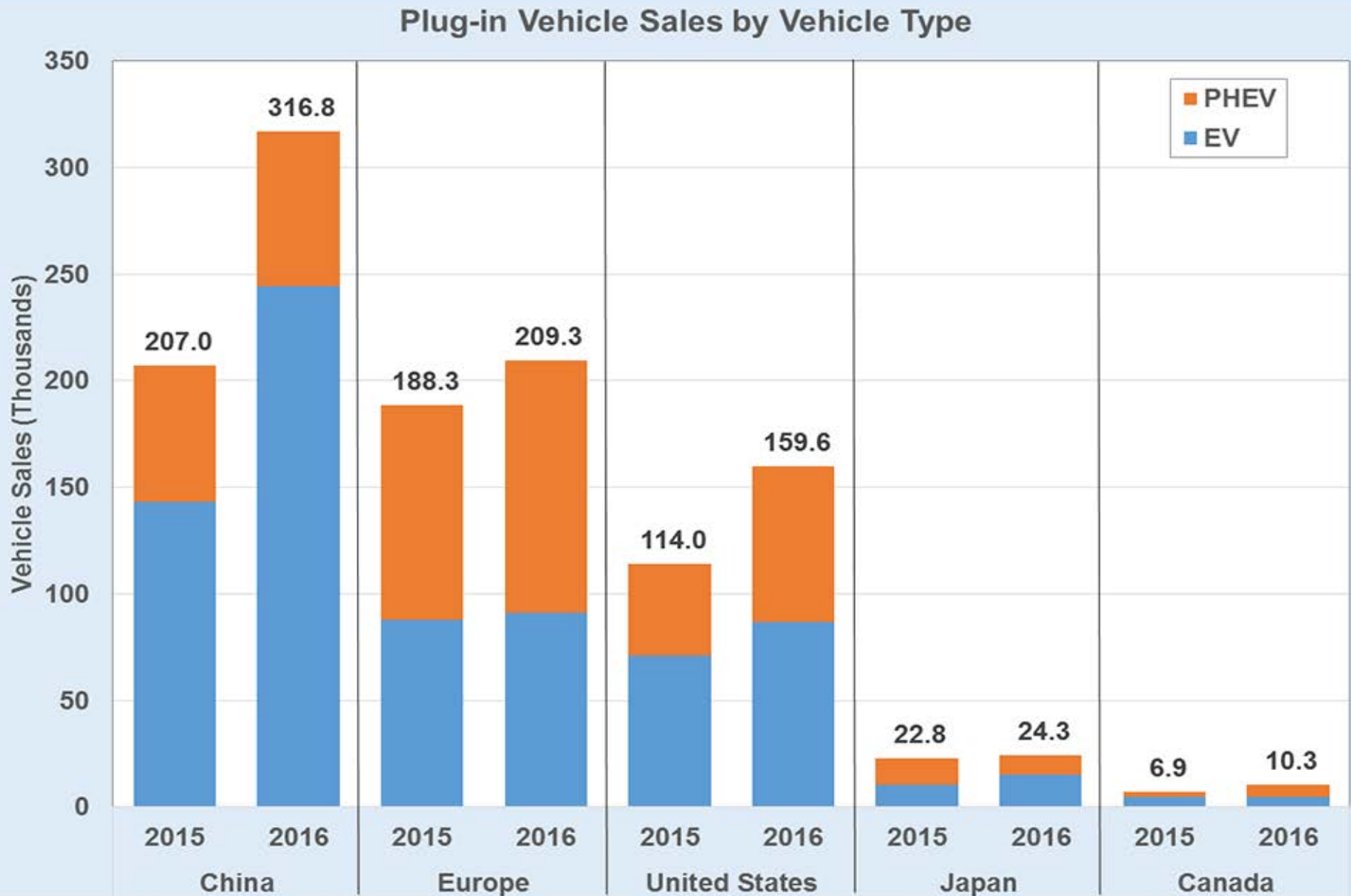
USA

China

- New Zealand
- Czech Republic
- Romania
- Slovenia
- Poland
- Estonia
- Ukraine
- Ireland
- Australia
- Iceland
- Finland
- Portugal
- Austria
- Denmark
- Italy
- Spain
- Switzerland
- Belgium
- Canada
- Sweden
- Germany
- France
- Netherlands
- Norway
- Japan
- USA
- China



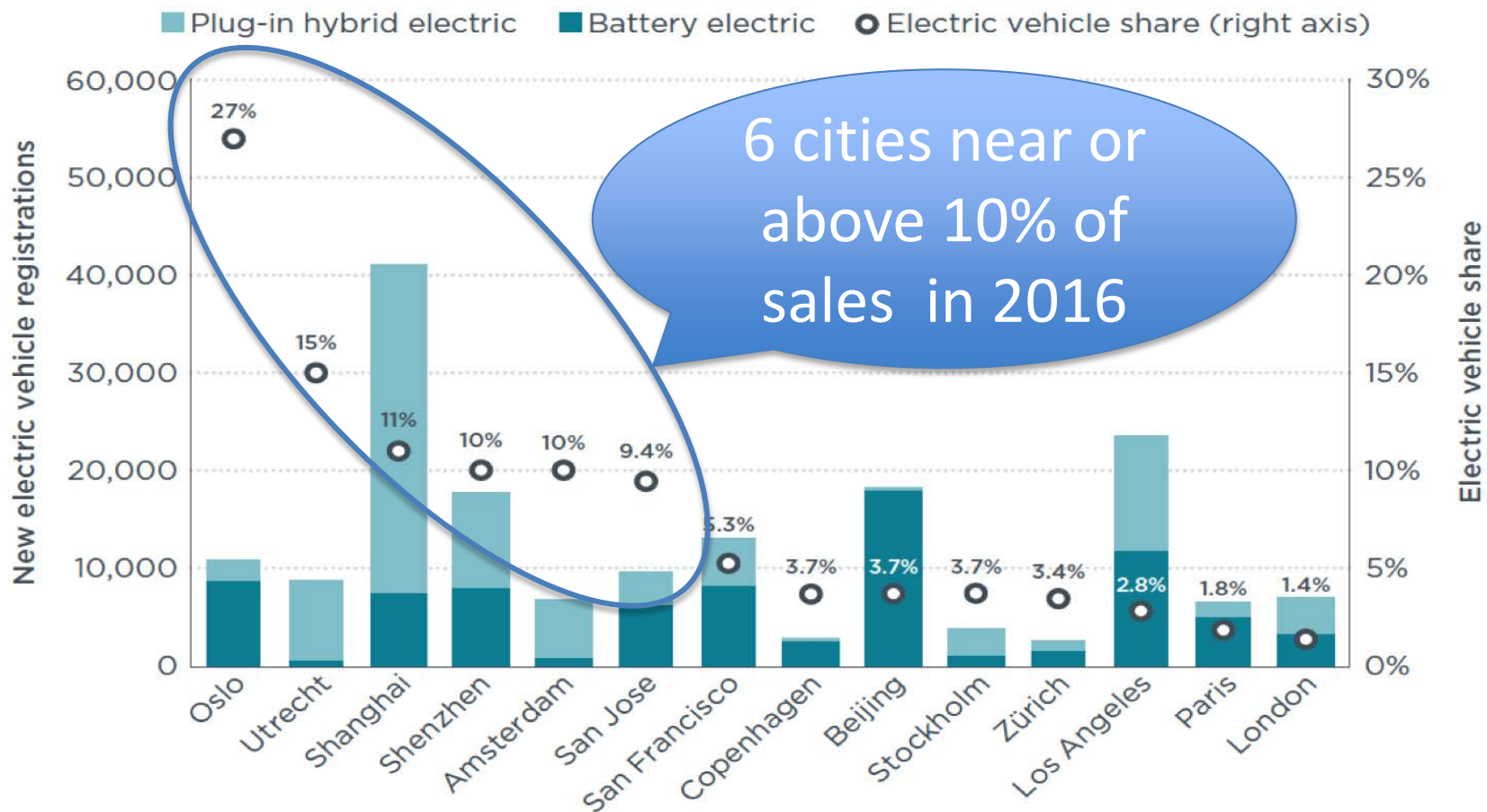
There was 37% PEV market growth worldwide in 2016.



World electric vehicle capitals

source ICCT

- Just 14 urban markets account for a third of global electric vehicle sales
 - The sales leaders have 10,000 to 40,000 new electric vehicle sales per year
 - The sales share leaders have electric vehicle shares of 10-27% of new vehicle sales



Source: Hall, D., Imdadur, M., Lutz, N. (2017). Electric vehicle capitals of the world. Demonstrating the path to electric drive. <http://www.theicct.org/EV-capitals-of-the-world>

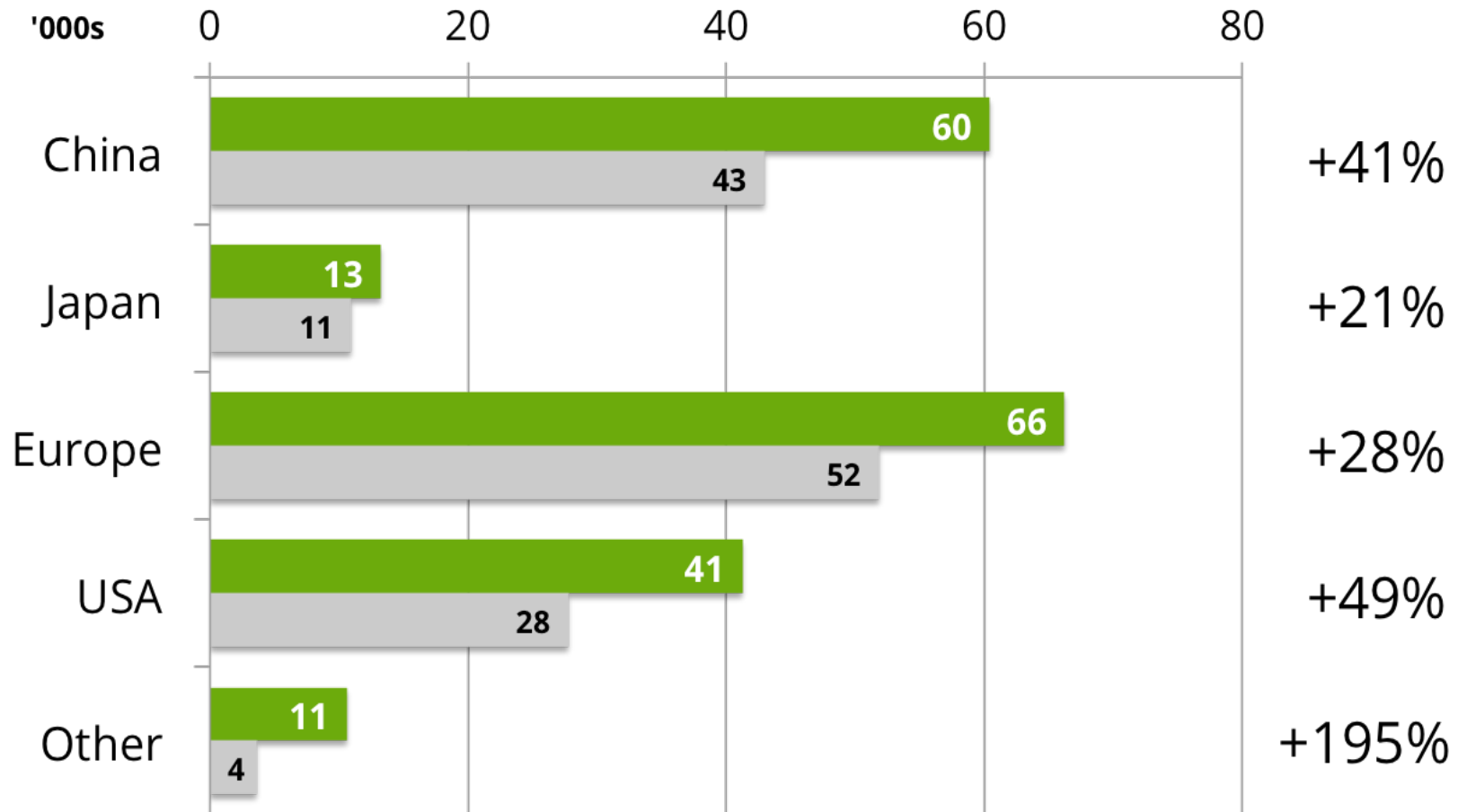
Hold up in subsidies in 1st quarter 2017 & 2016 slowed sales in China.
US saw strong growth in 1st quarter compared with last year

Plug-in Sales and % Growth

■ 2017-Q1

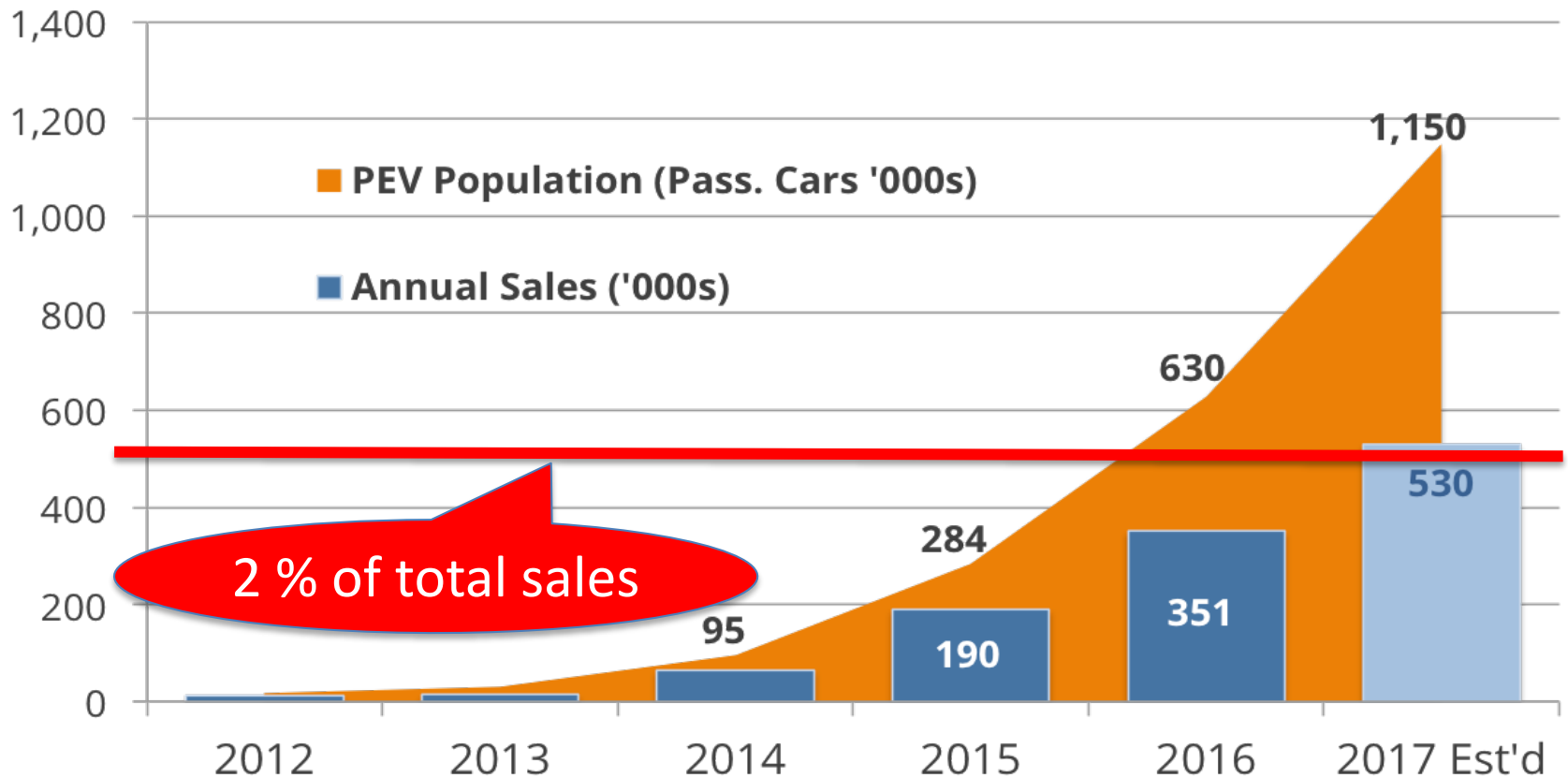
■ 2016-Q1

EV VOLUMES.COM



China now has over 1 million PEVs and accounts for almost 50% of world sales

China Plug-in Volumes - Passenger Cars

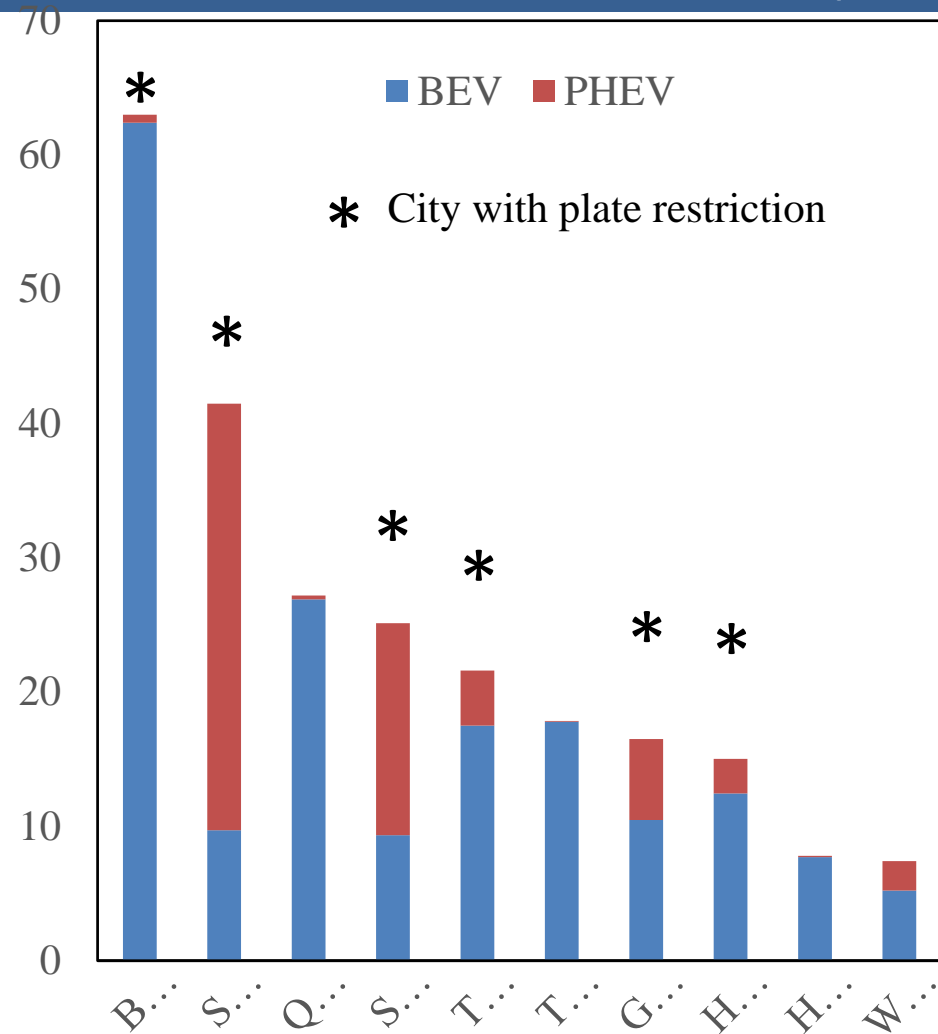


2016 PEV Sales Top 10 Cities in China: BEVs only in Beijing & registration restrictions are important

Data Source: WAYS, 2017 www.way-s.cn

	2016 PEV Sales	BEV Manufacturer	PHEV Manufacturer
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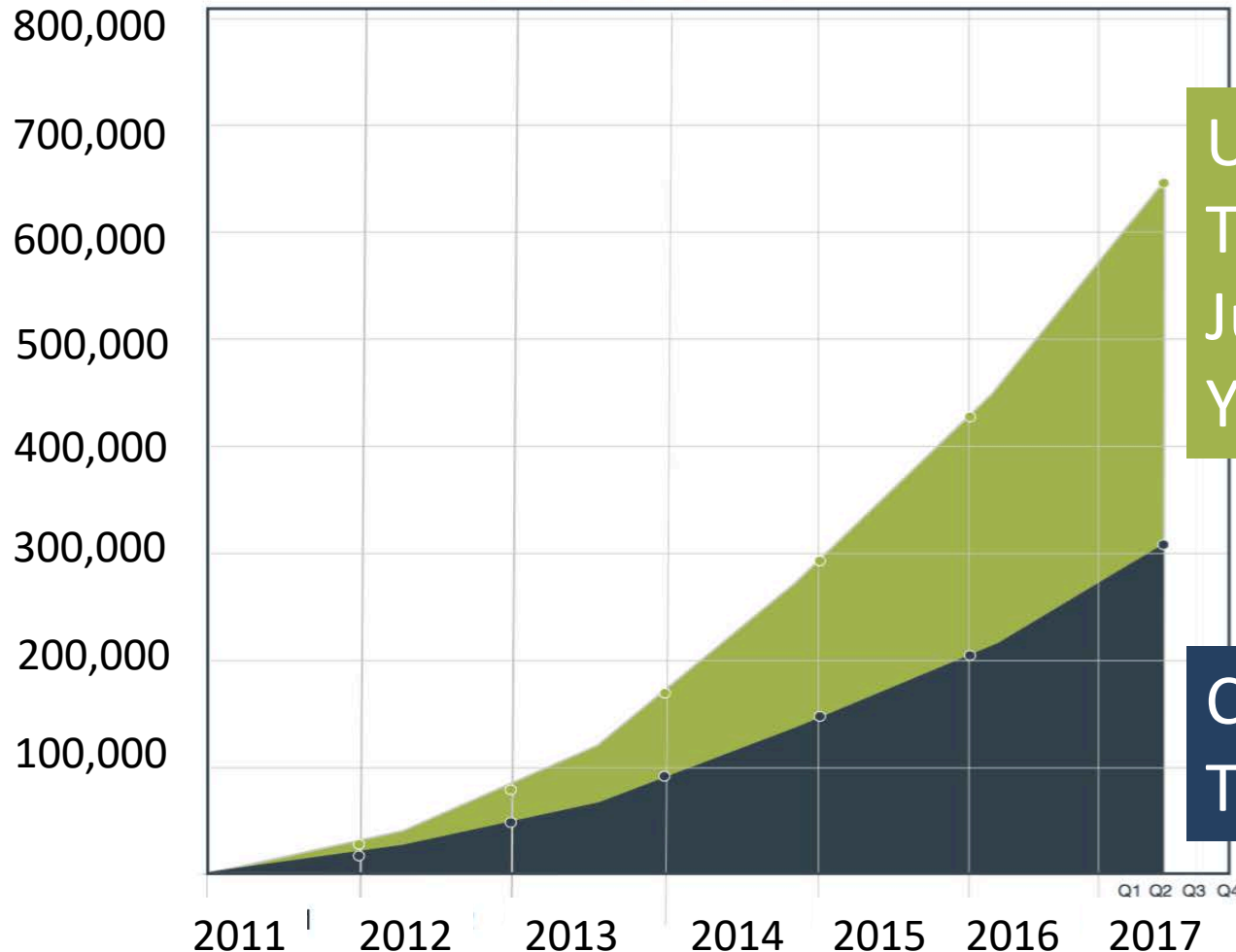
Beijing	63000	BAIC	
Shanghai	41483		SAIC
Qingdao	27198		
Shenzhen	25131	BYD	BYD
Tianjin	21611		
Taiyuan	17854		
Guangzhou	16506		GAC
Hangzhou	15033	Geely, Zotye	
Hefei	7805	JAC	
Wuhu	7413	Chery	



Cumulative USA & California PEVs June 2017



CUMULATIVE SALES



USA

Total PEV= 647, 956

June sales = 16, 591

YTD sales = 86,934

• CALIFORNIA SALES*

California

Total PEV = 308,174

* Assumes CA sales are approximately 50% of National sales (7/5/2017)

Reference: www.hybridcars.com

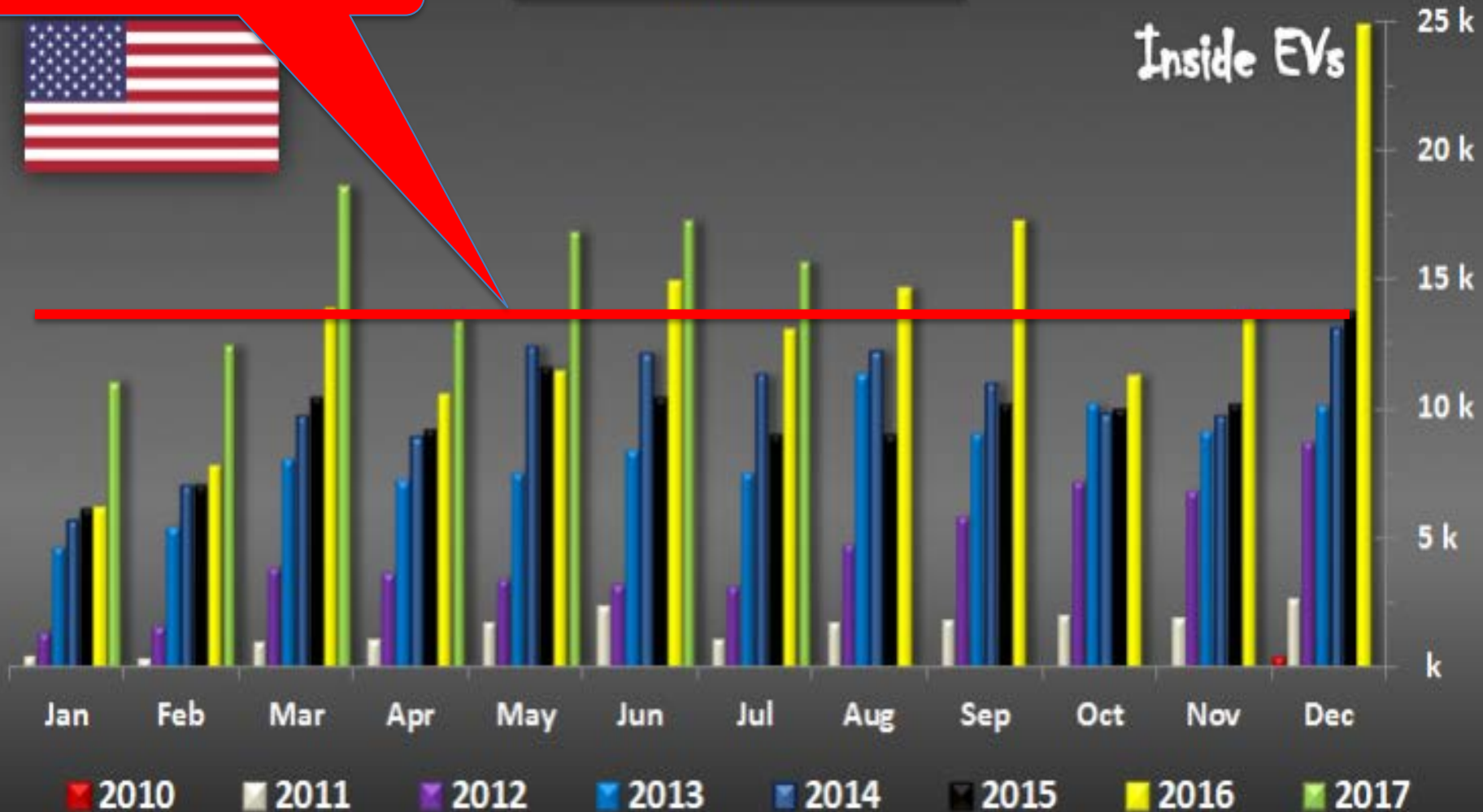
USA Sales could hit 200,000 by end of year; Tesla 3 and next Nissan Leaf should be significant additions (source Inside Evs)

1 % of US market

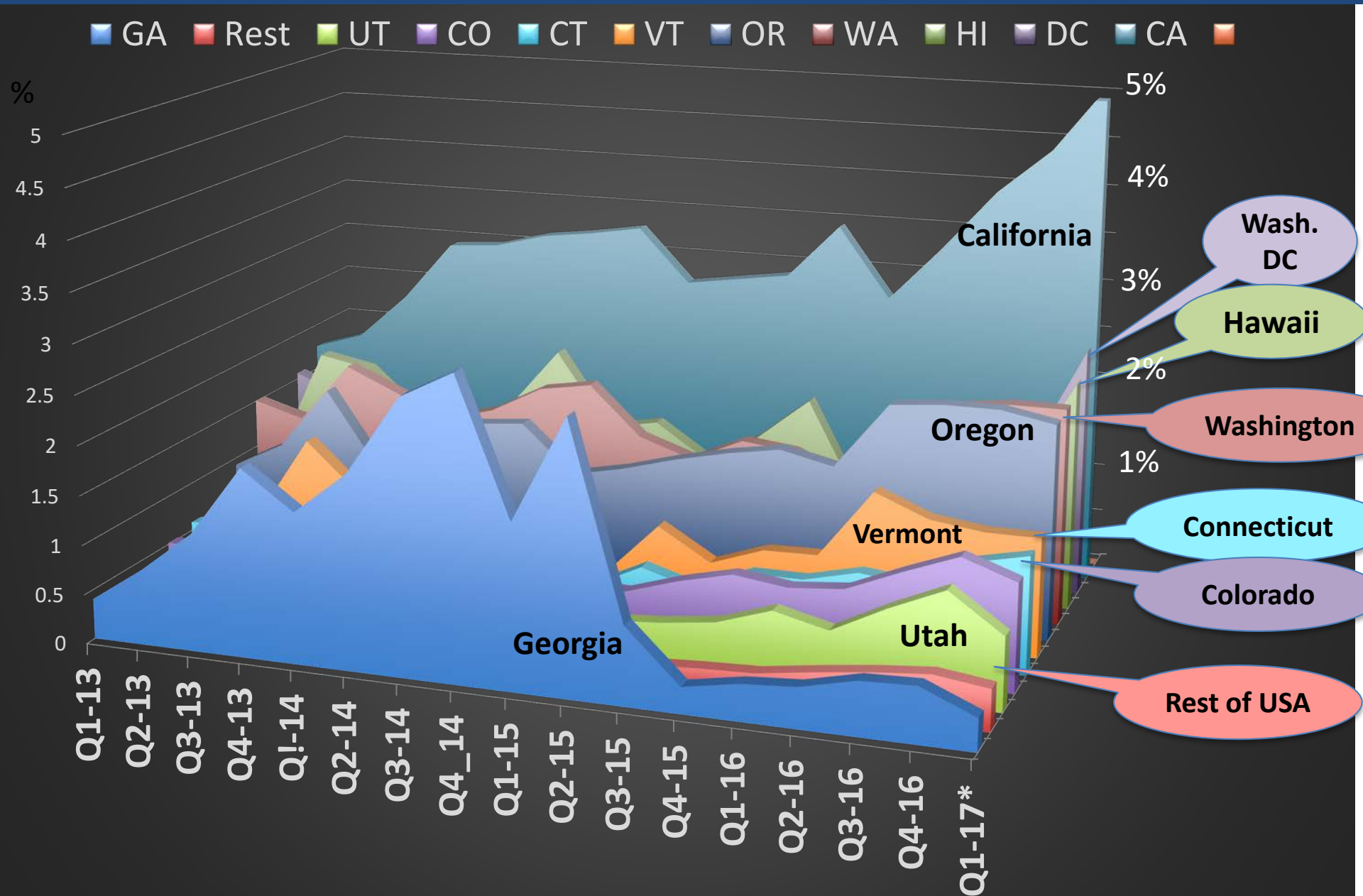


U.S. Plug-In Car Sales

Inside EVs

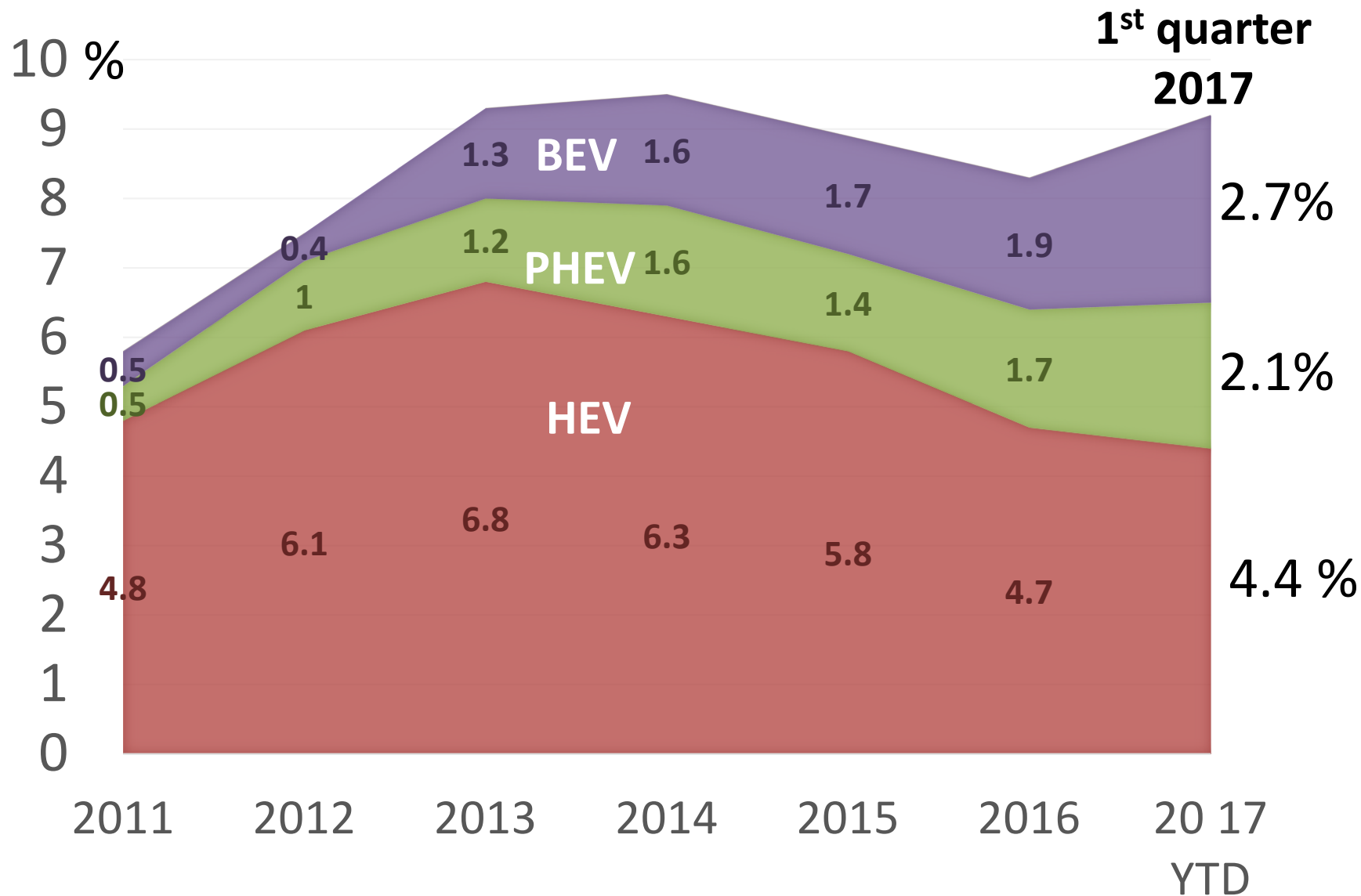


California almost 5% in this quarter, 8 states are at 1-2%, the rest of US at about .5%



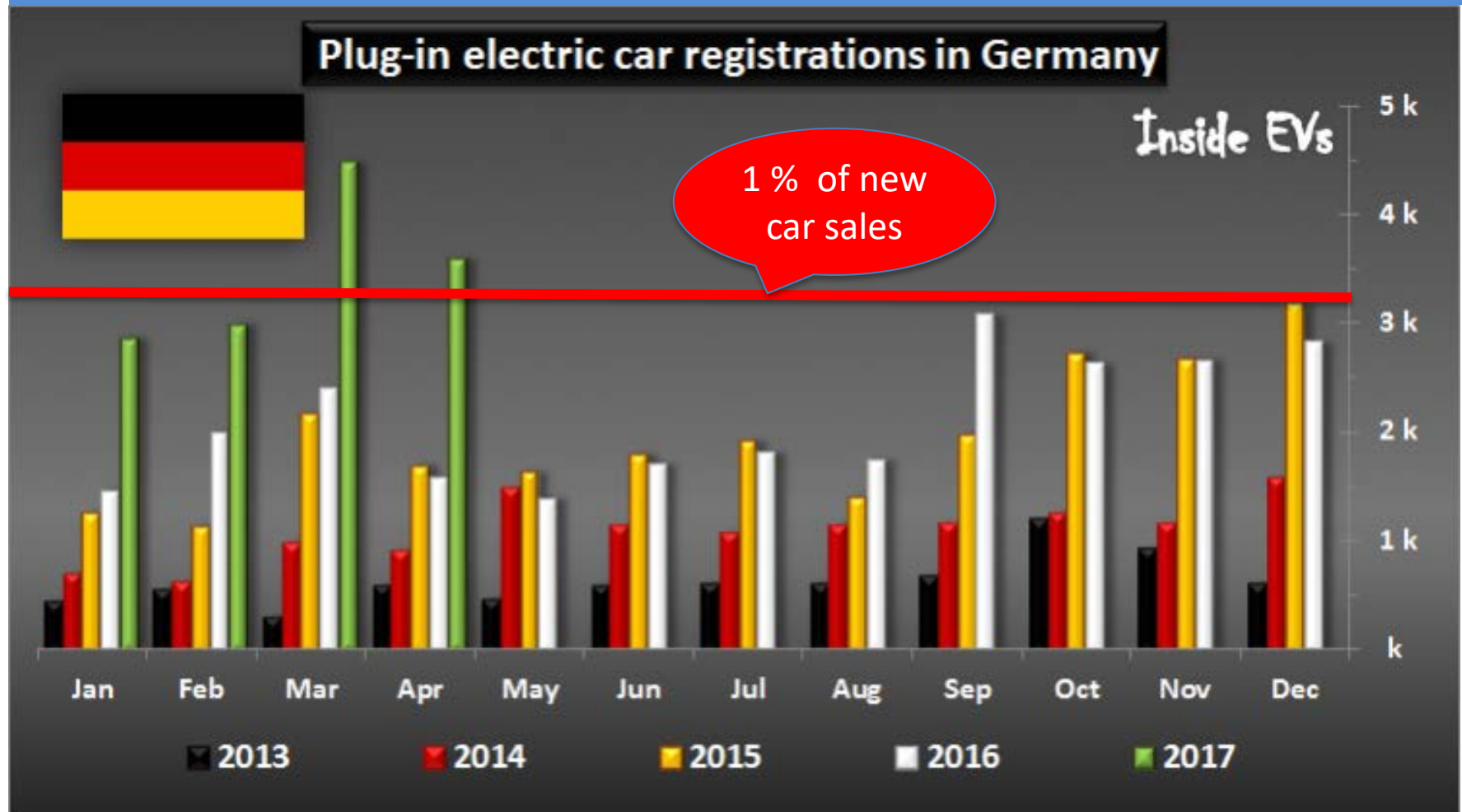
California PEV sales around 5%:

1st quarter 2017 - source CNCDA



German car market responding to incentives and new models

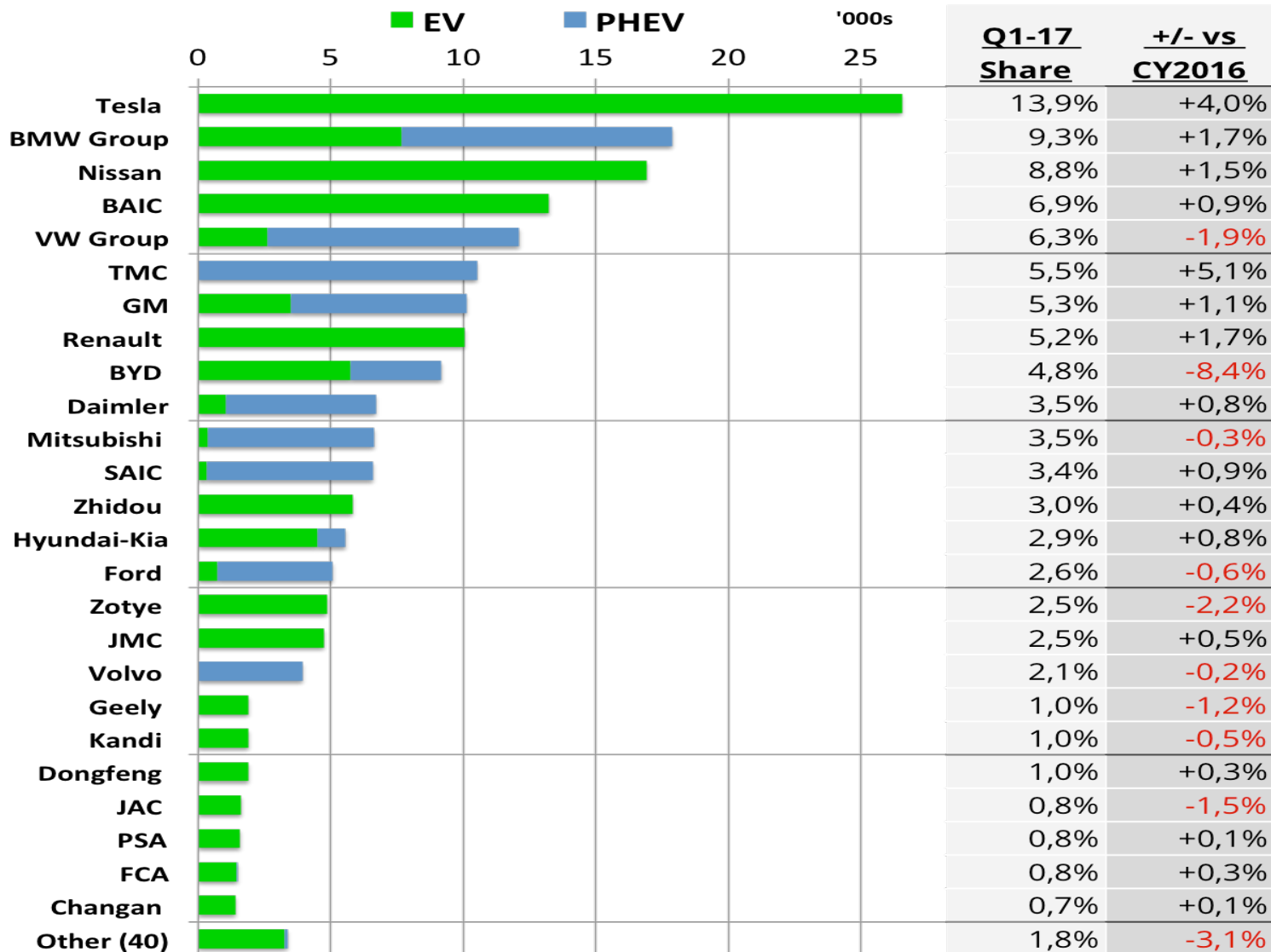
(June & July around 4000)



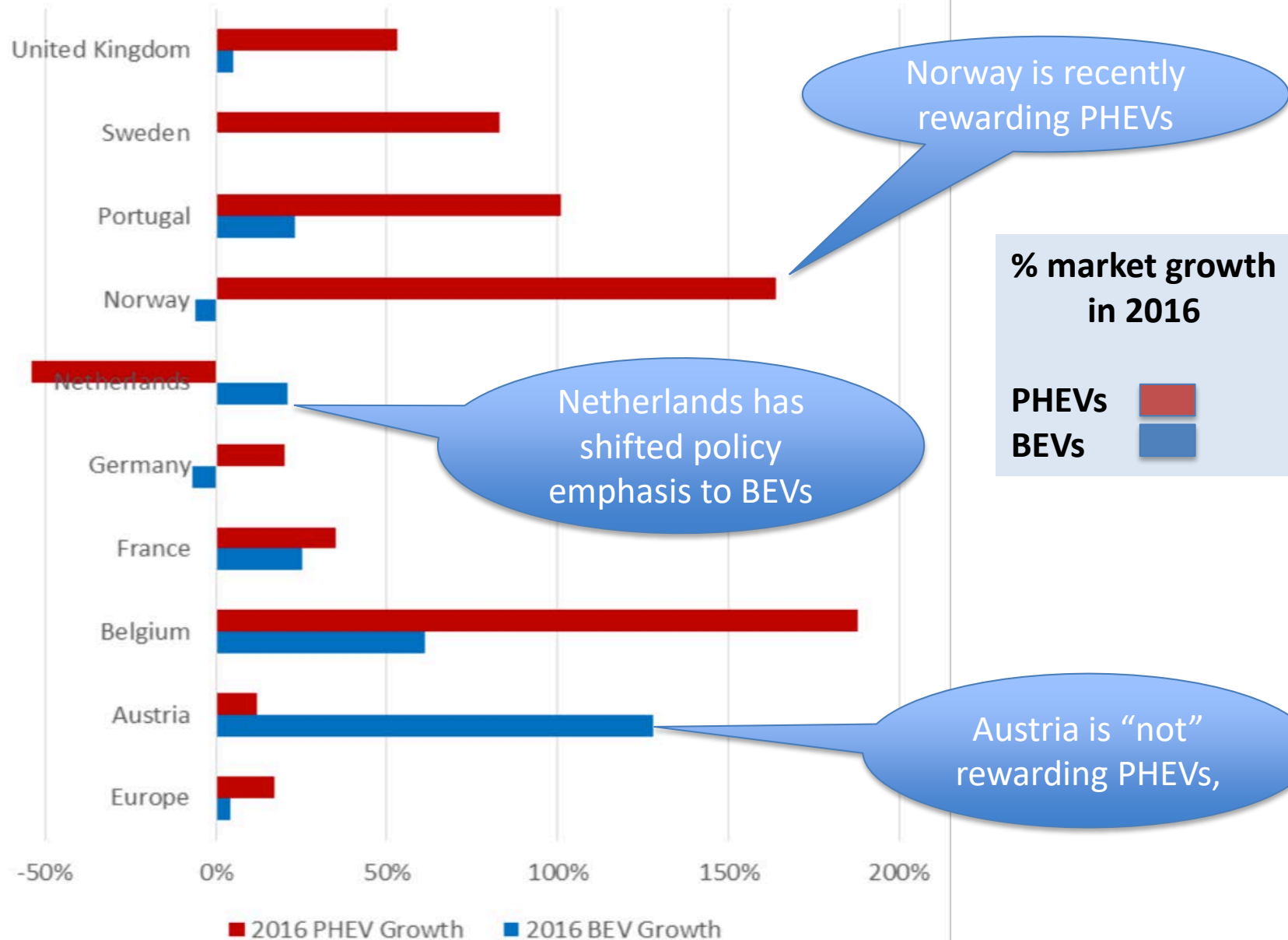
Market is increasingly diversified, with new competition each quarter

Global Plug-in Volume 2017 Q1 by Make

EV VOLUMES.COM

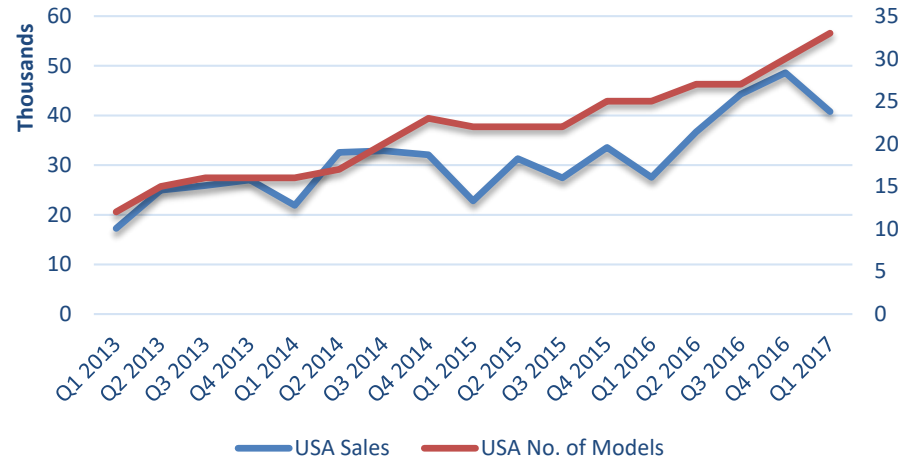


EU Policy shapes PHEV vs BEV; supply of PHEVs has gone up (source evVolumes)

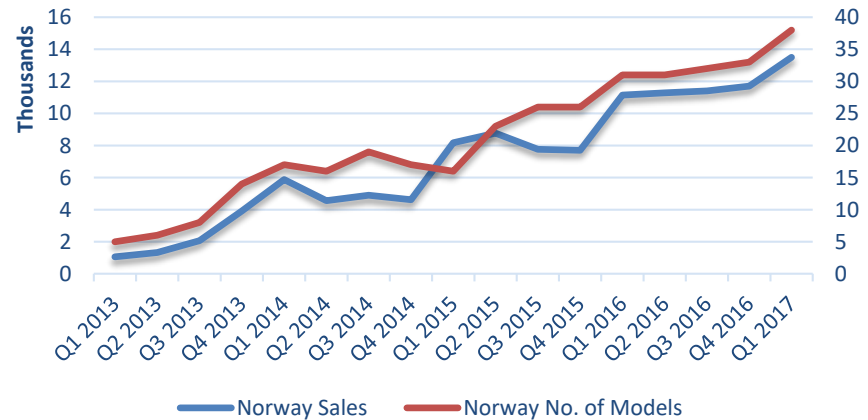


Number of models in PEV market closely linked to sales growth- thru Q-1 2017

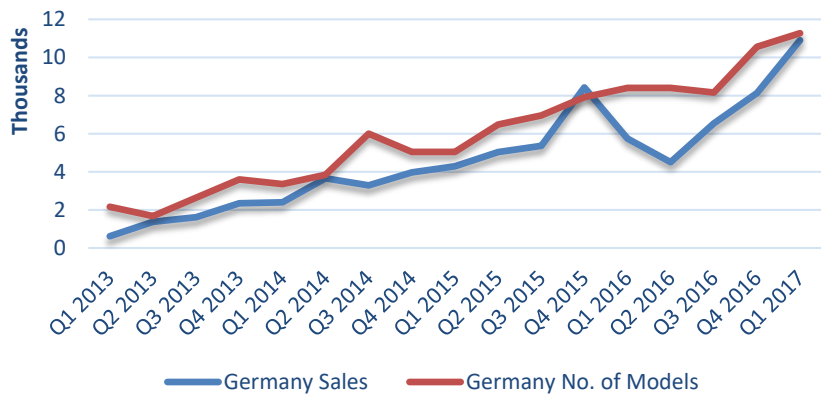
USA



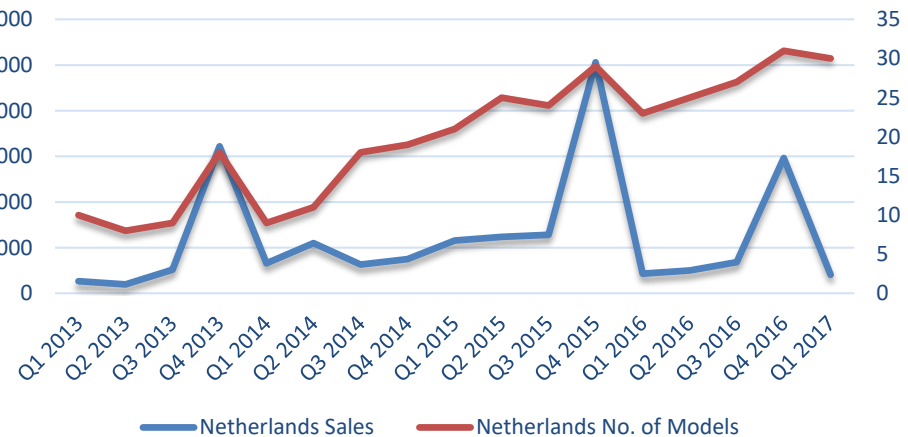
Norway



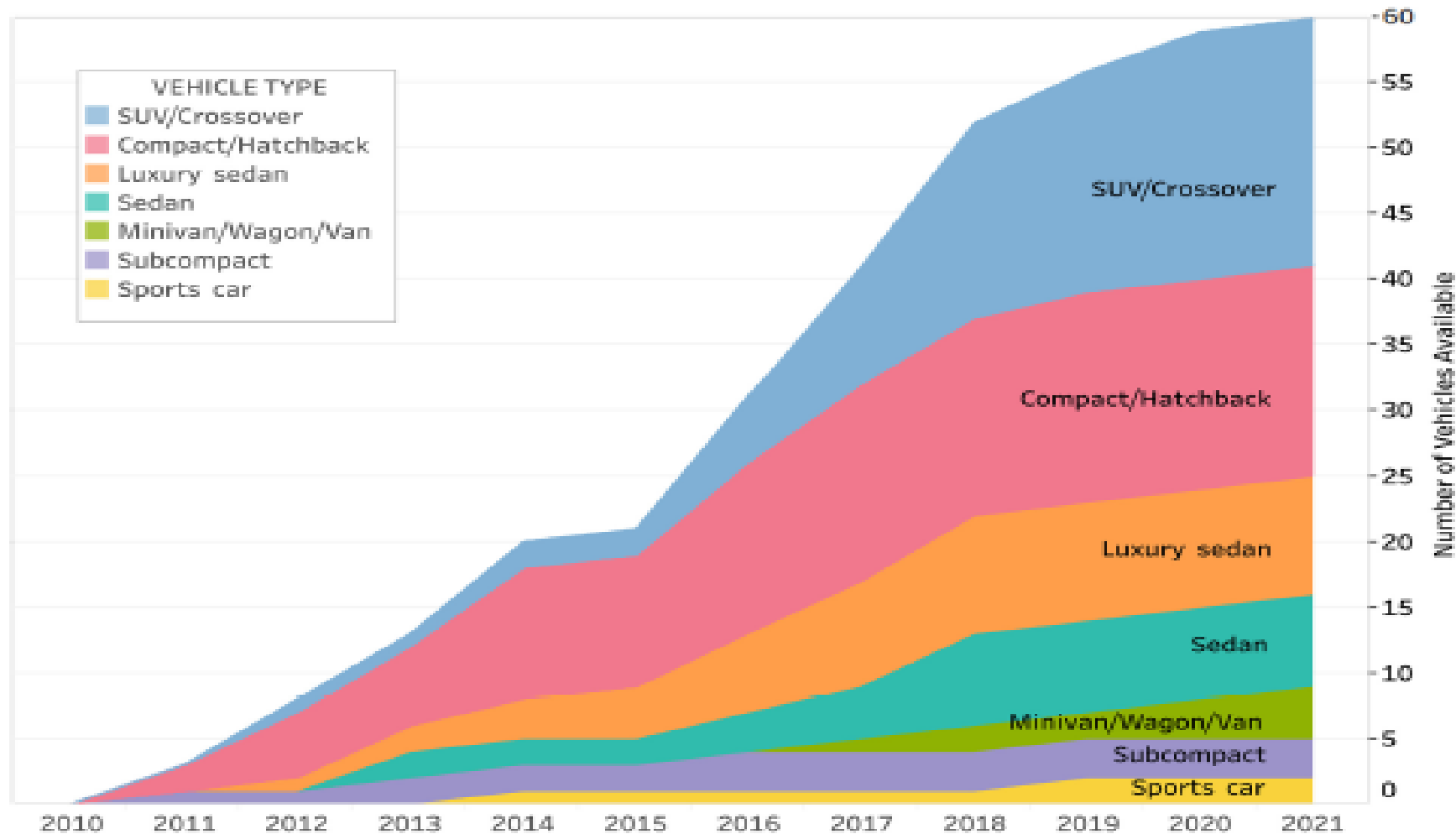
Germany



Netherlands



While the current offerings emphasizes small sedans, the shift is to SUV/Crossover & should expand sales



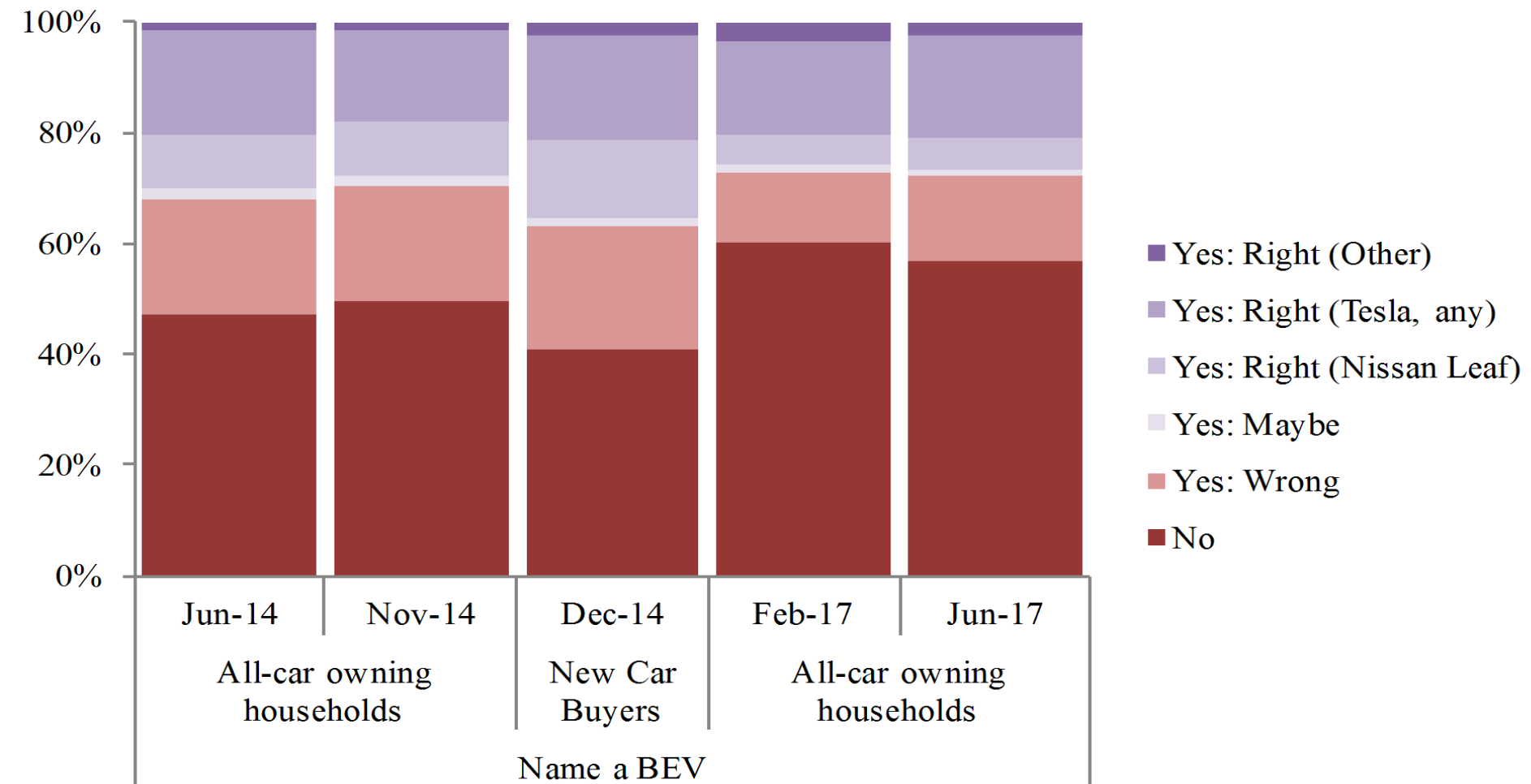
The number and variety of electric vehicle models continues to grow. By the end of 2017, about 40 different models are expected to be available. By 2021, at least 60 models are projected.

Awareness, knowledge, consideration of PEVs

Surveys of 2014-2017 California Car Buyers (n=1600)

Source:, K.Kurani UC Davis

“Can you name a BEV that is being sold in the US?”



Thank you

UC DAVIS

PLUG-IN HYBRID & ELECTRIC VEHICLE RESEARCH CENTER

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