Probing the Transition to Electric Drive: PHEVs Risks and Opportunities

Gil Tal
Michael Nicholas
Tom Turrentine

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UCDAVIS
PLUG-IN HYBRID & ELECTRIC VEHICLE RESEARCH CENTER
of the Institute of Transportation Studies

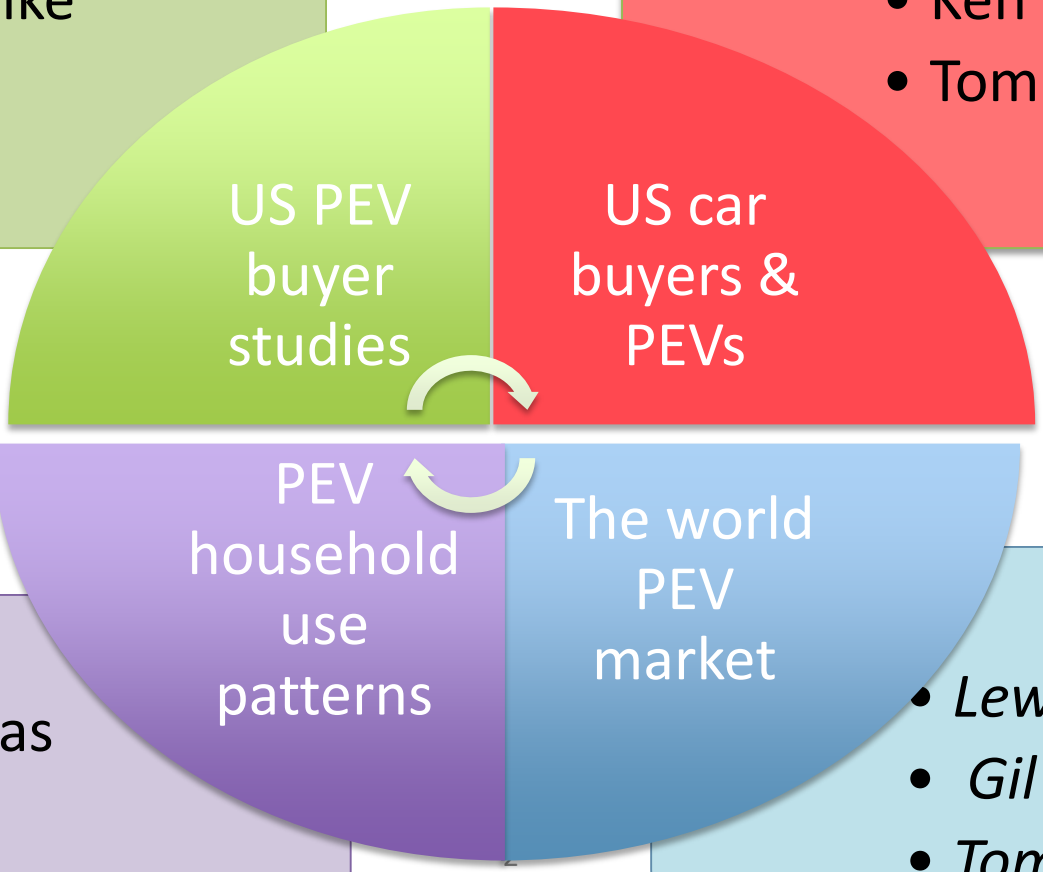
PH&EV Center "Roll-out & ramp-up research" 2013-2016

Annual & semi annual "big" & "contextual" longitudinal data

Studying the 'Evolution" of the ZEV market; the interaction of policy, technology, energy systems and consumer culture

- Gil Tal & Mike Nicholas

- Ken Kurani
- Tom Turrentine

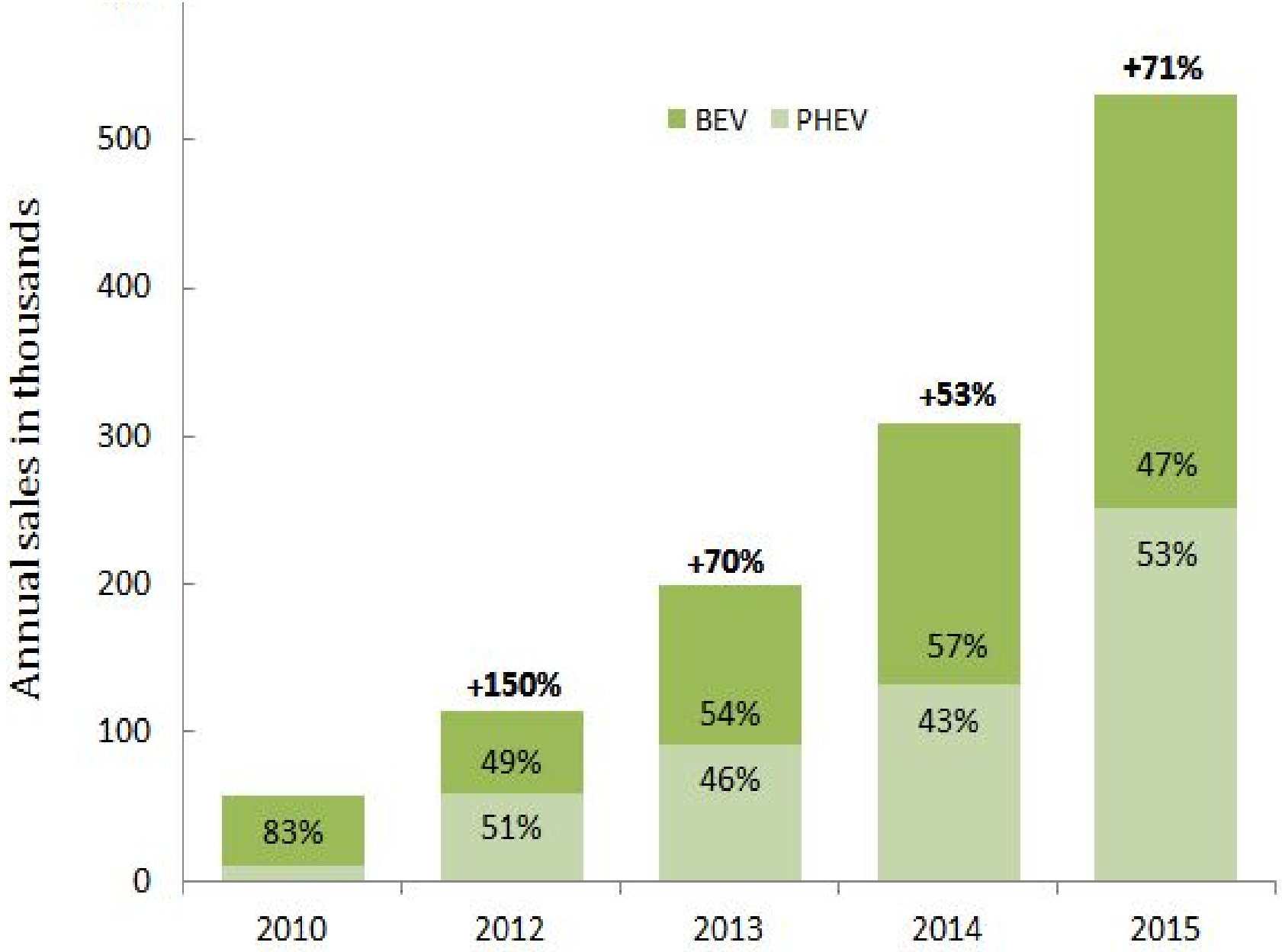


- Mike Nicholas & Gil Tal

- *Lew Fulton*
- *Gil Tal*
- *Tom Turrentine*

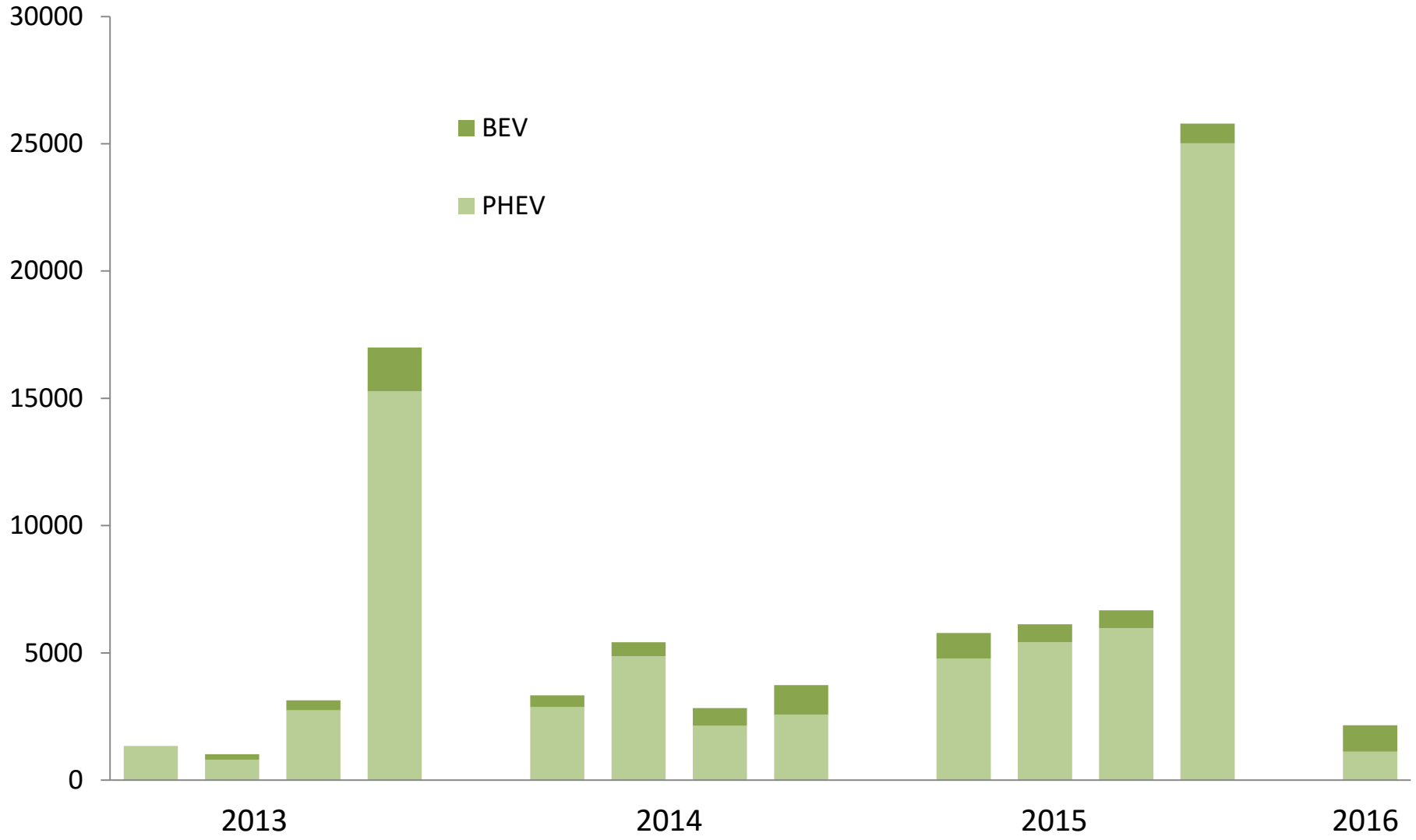
World PEV sales are doing well, growing faster than HEVs

Data from ev-sales.blogspot.com

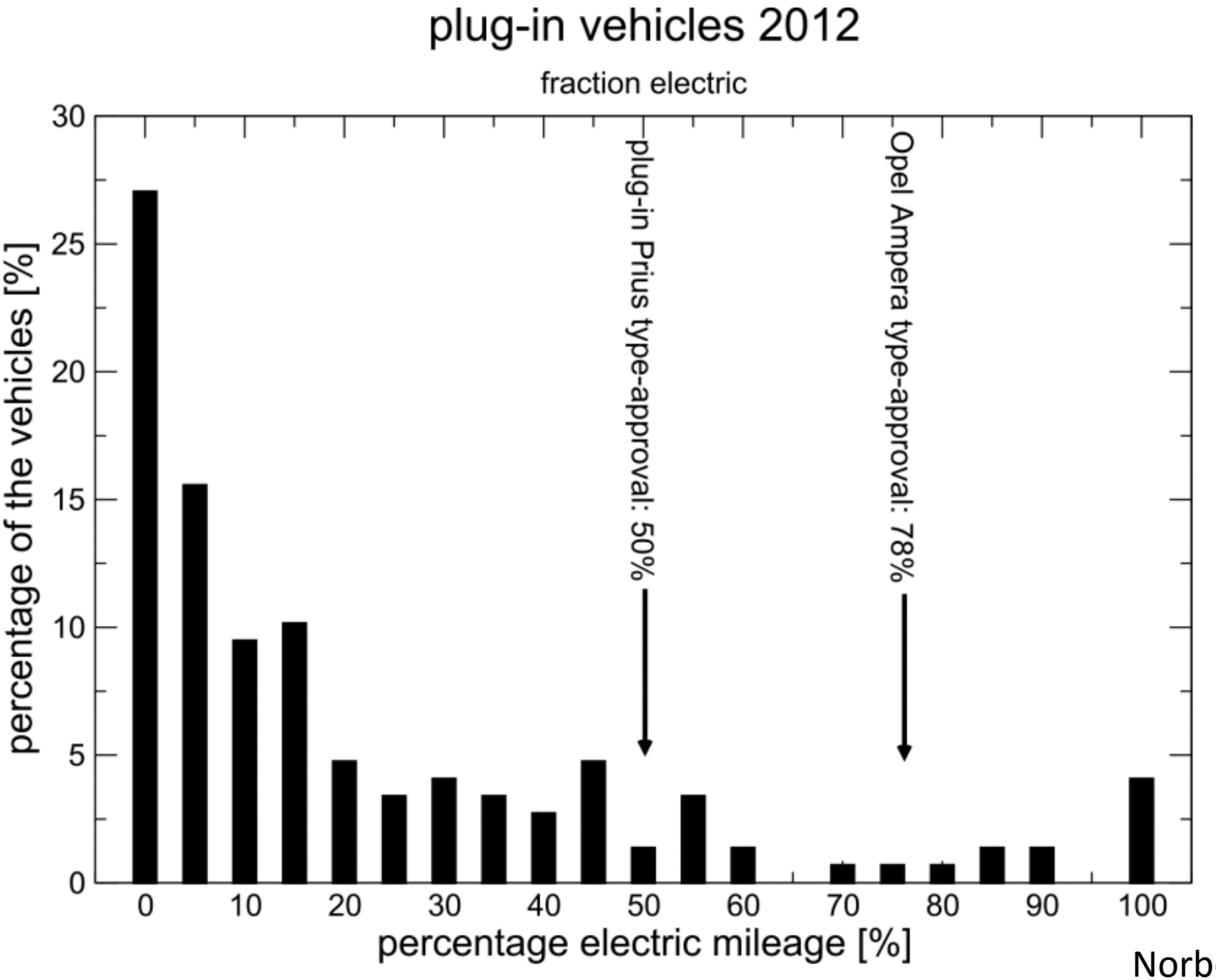


NETHERLANDS

Netherlands Quarterly Sales



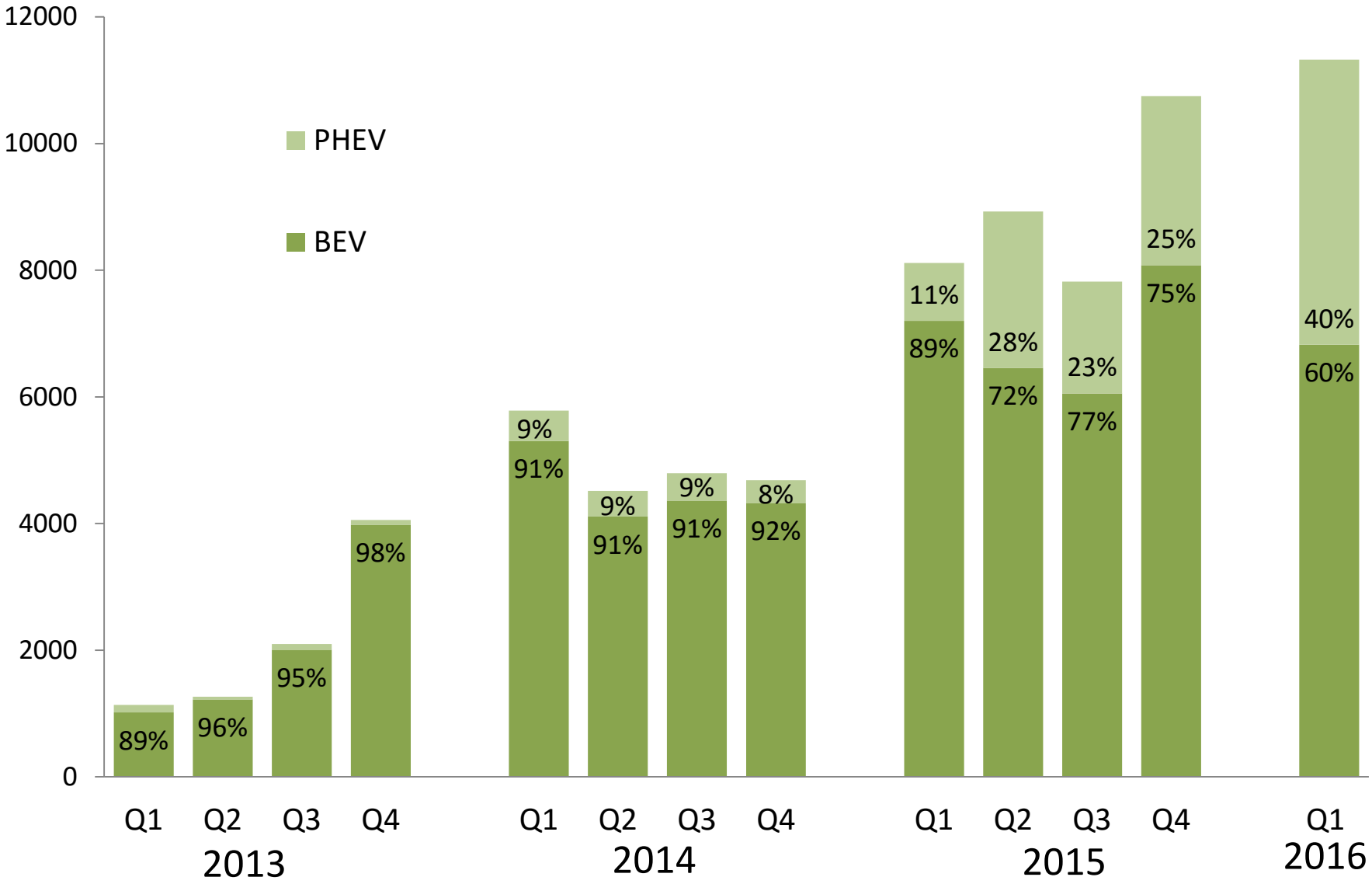
When PHEVs Backfire



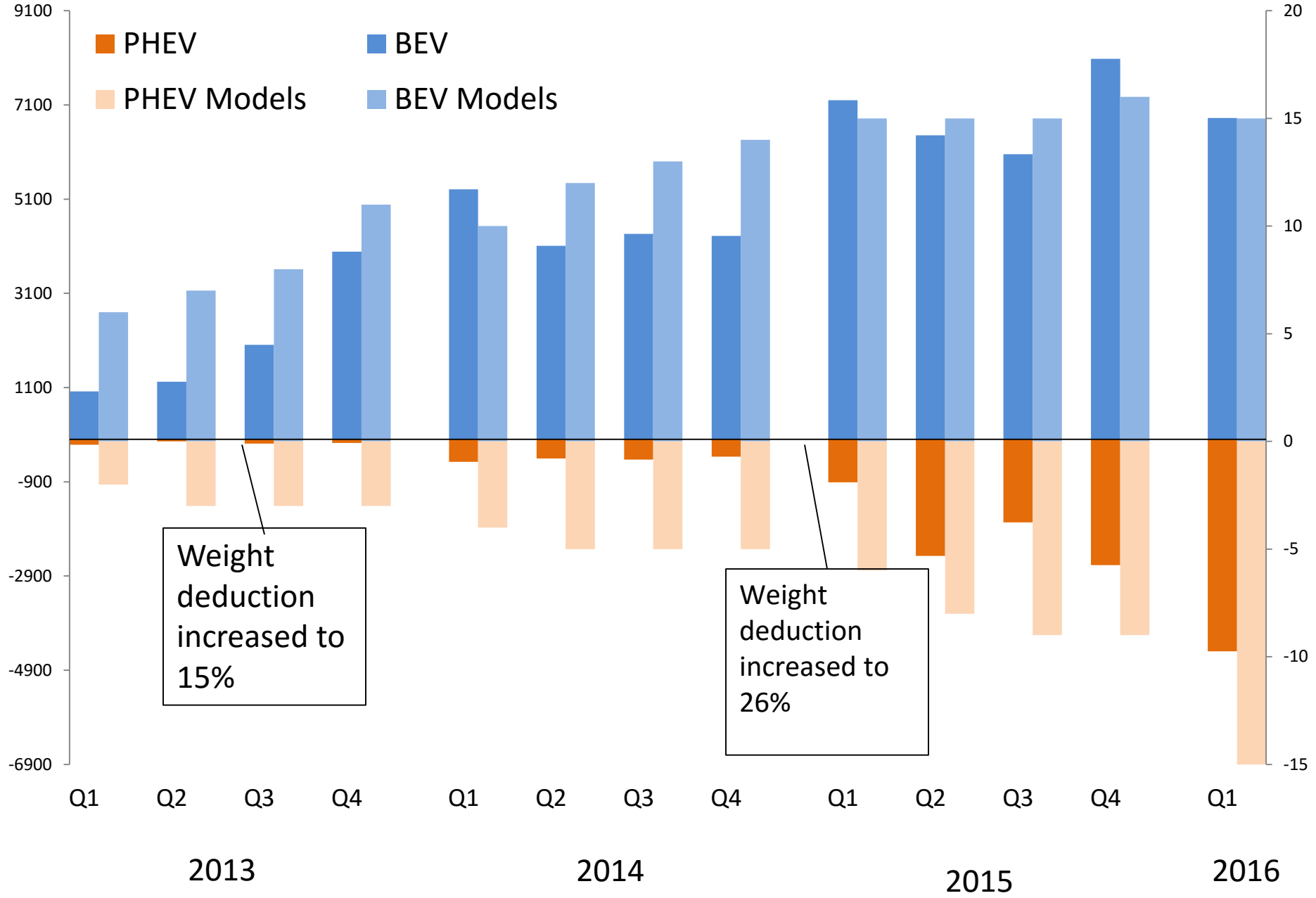
Norbert E. Ligterink EVS27

NORWAY

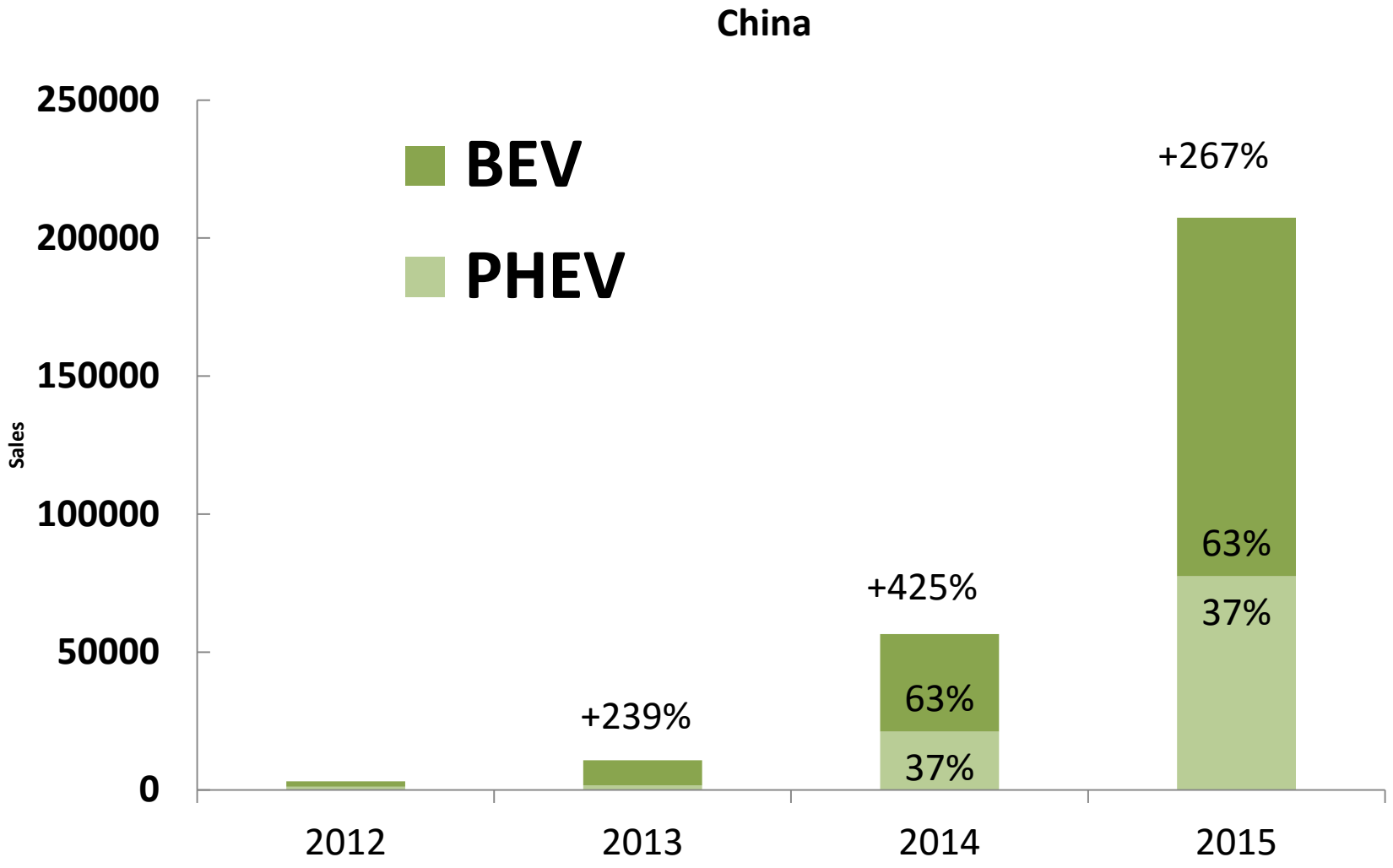
Norway Sales



Lots of new models & lower taxes in Norway for heavier PHEVs



China, the world's largest market - over 22 million vehicles per year - has in a short period double the PEV sales volumes of USA



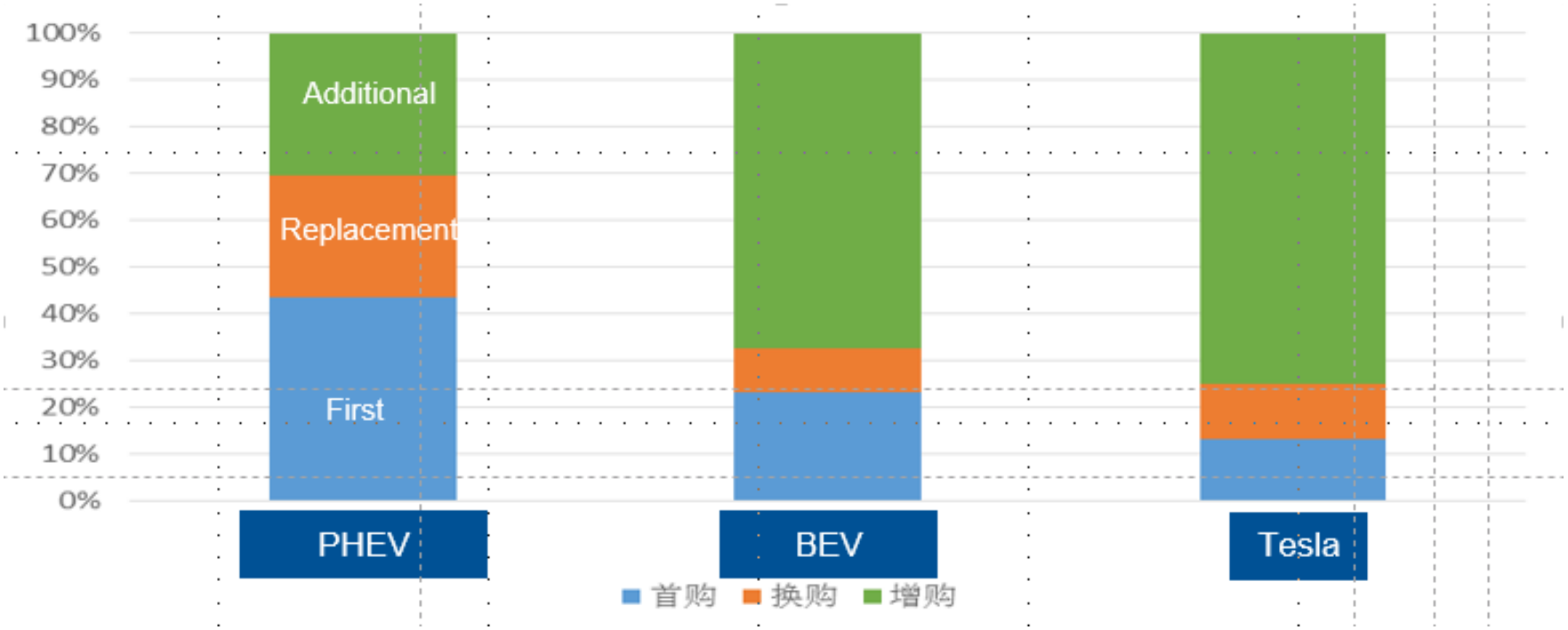
CHINA

A Tale of Two Cities: Beijing and Shanghai

- Shanghai started to restrict the volume of private vehicles through an auction system.
- 92,947 vehicles per year (2015) Winning Probability： 5.07%
- Policy support: BEVs and PHEVs
- 2015 target: 13,000
- 2015 PEVs sold: 44,247 (BEV: 10,845; PHEV: 29,752)

- Beijing restrict the volume through a lottery system.
- 120,000 per year (2015); Probability: 0.49%
- Policy support: BEV only
- 2015 target: 30,000
- 2015 PEVs sold: 23,500

Shanghai: PHEVs are the First and Most Cases Only Vehicle in the Household



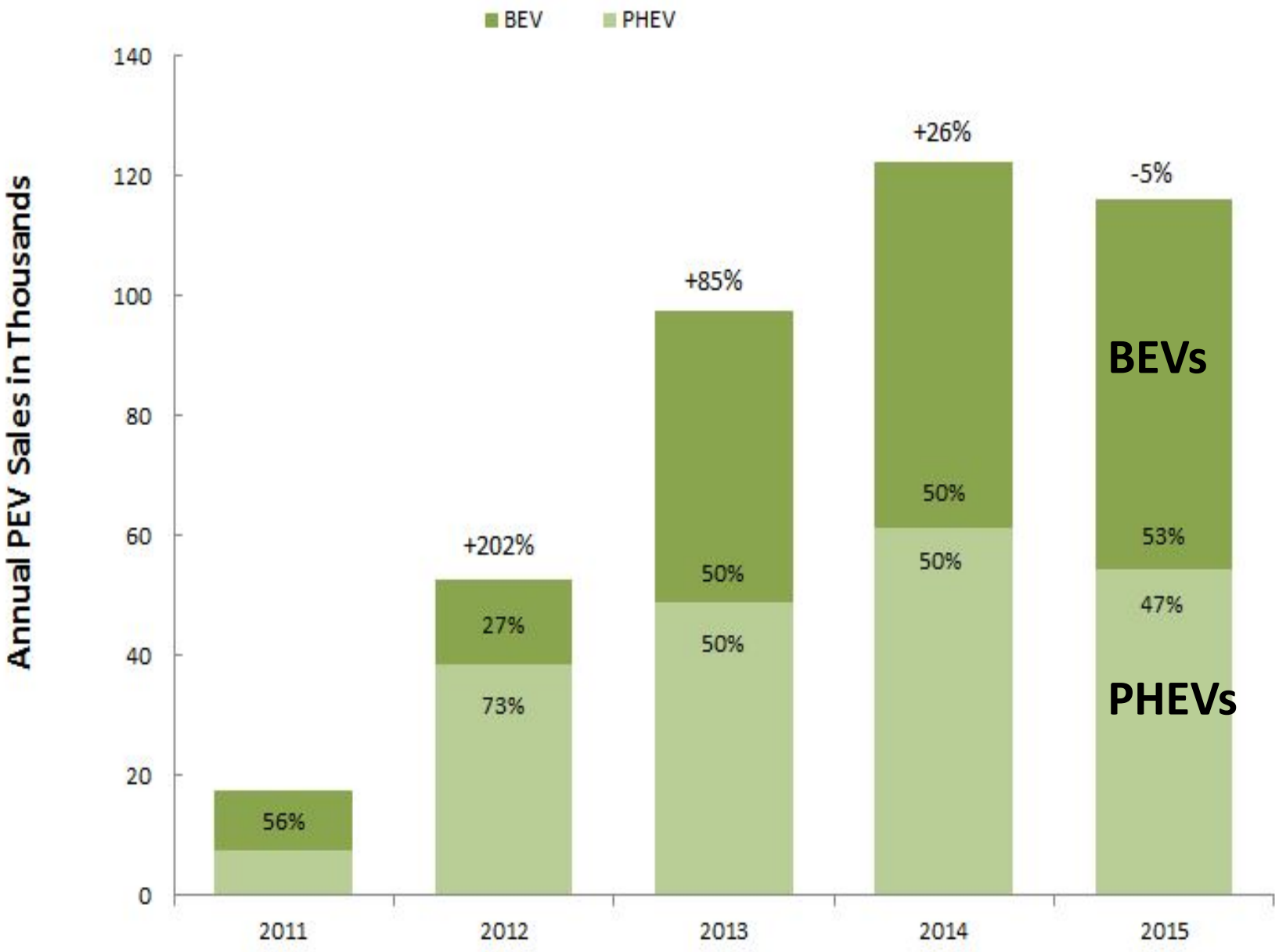
The Calculation of eVMT by PHEV Qin in Shanghai in 2015 (N=1329)

This method missed the blending of gas and electricity and over-estimated the eVMT. We are asked by Shanghai Int'l Auto City/SHEVDC to help calculate 2015 data of over 25,000 PHEVs.

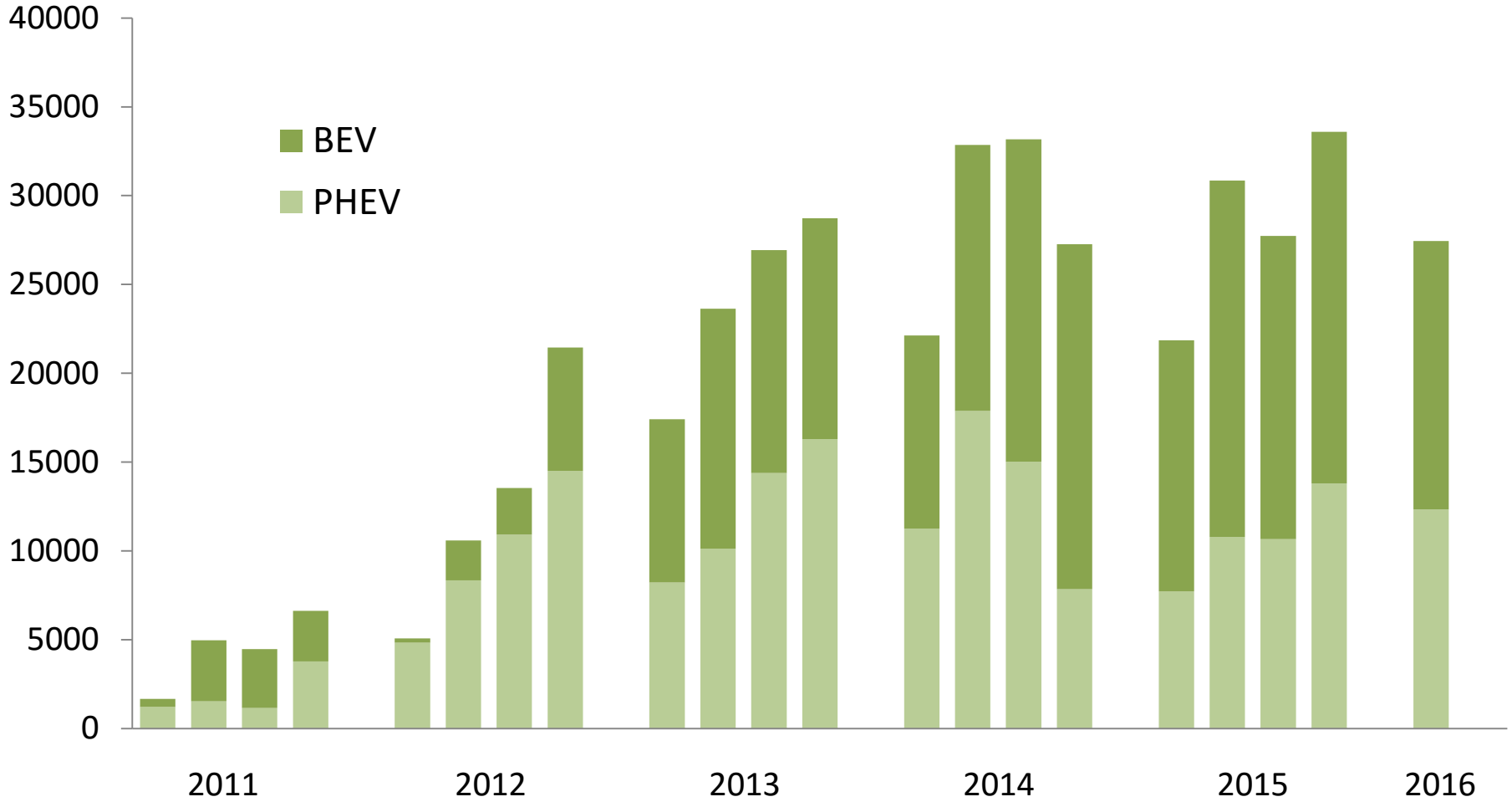
Charging frequency	Number of vehicles	Total number of days on road	Average daily driving mileage (km)	CD stage mileage (km)	Total mileage (km)	Electricity mileage percentage (%)
Twice/day	389	941	78.35	60254	73727	81.73%
Once/day	1071	7532	61.78	354979	465354	76.28%
0.5/day	547	904	87.23	55770	78854	70.73%
Total	1329	122518	32.88	2431812	4028663	60.36%

USA

US Annual PEV Sales slowed in 2015

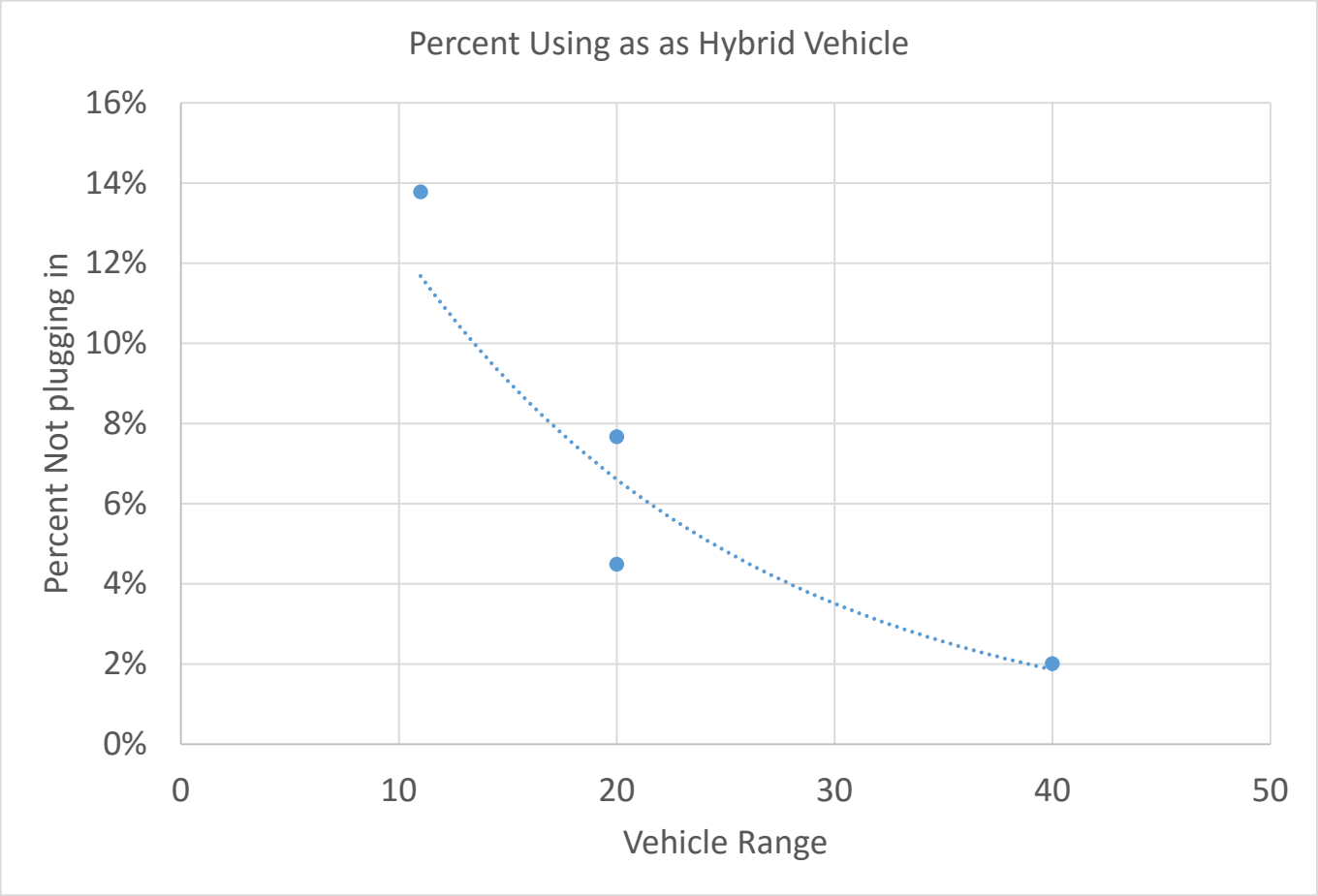


USA Quarterly Sales

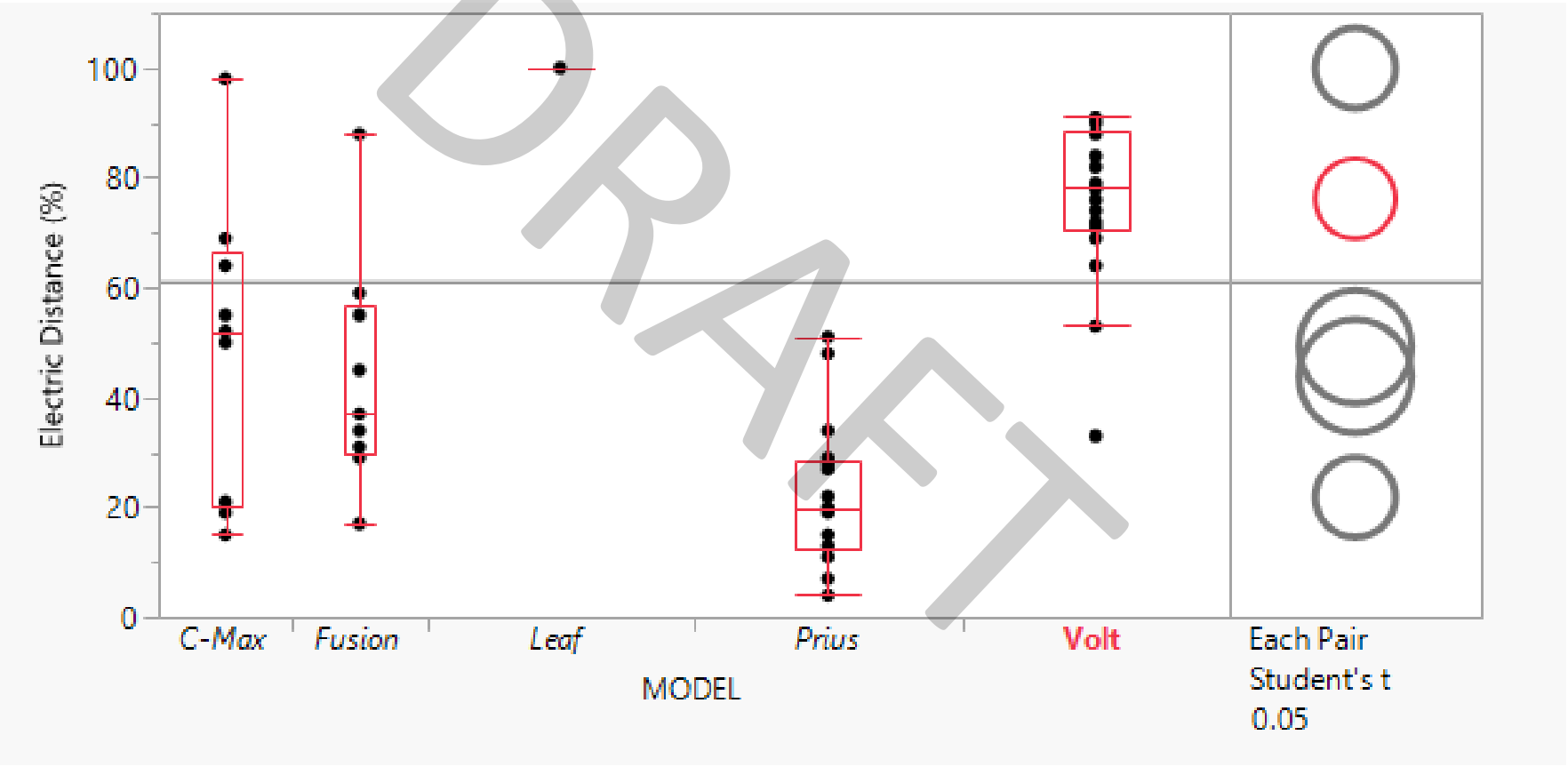


EVMT PROJECT

How many People just Don’t Plug in?

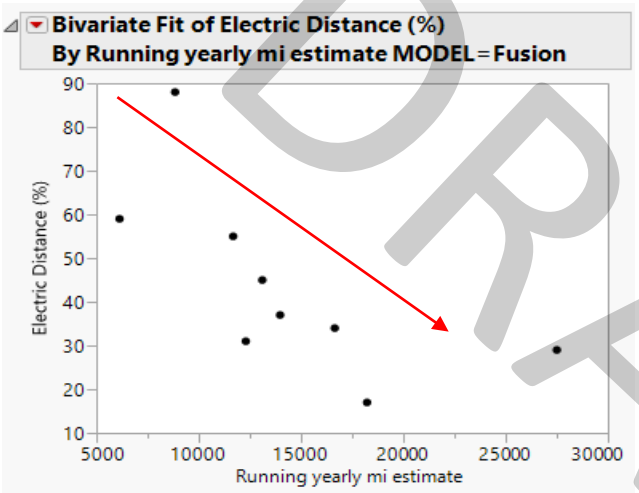


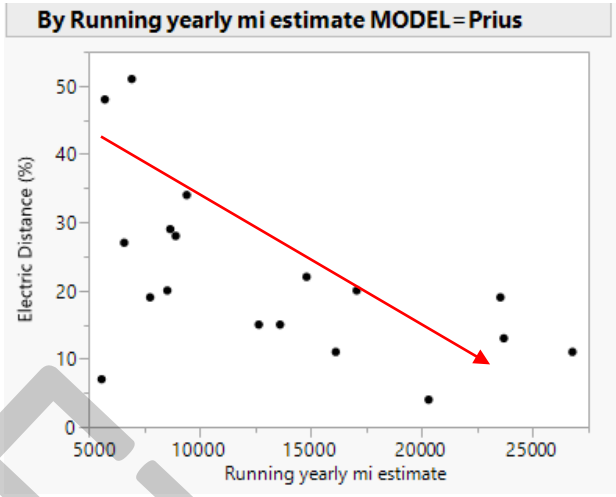
EVMT by model

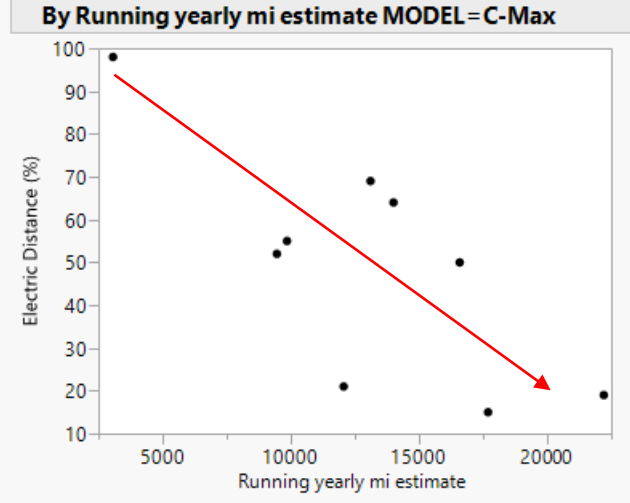


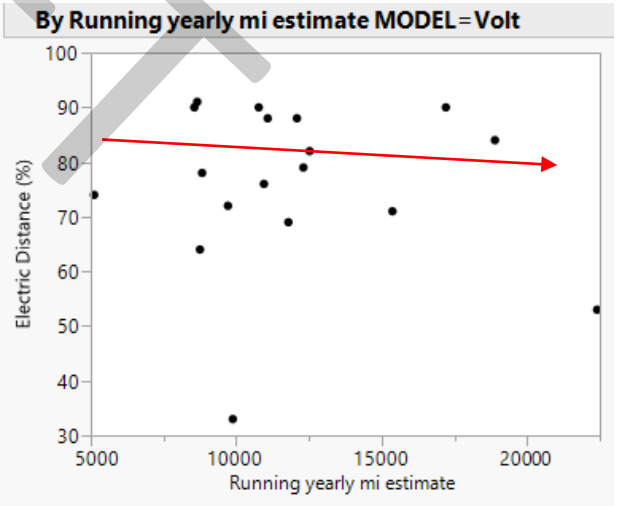
Model	Mean
Leaf	100
Volt	76.22222
C-Max	49.22222
Fusion	43.88889
Prius	21.83333

eVMT% by annual miles

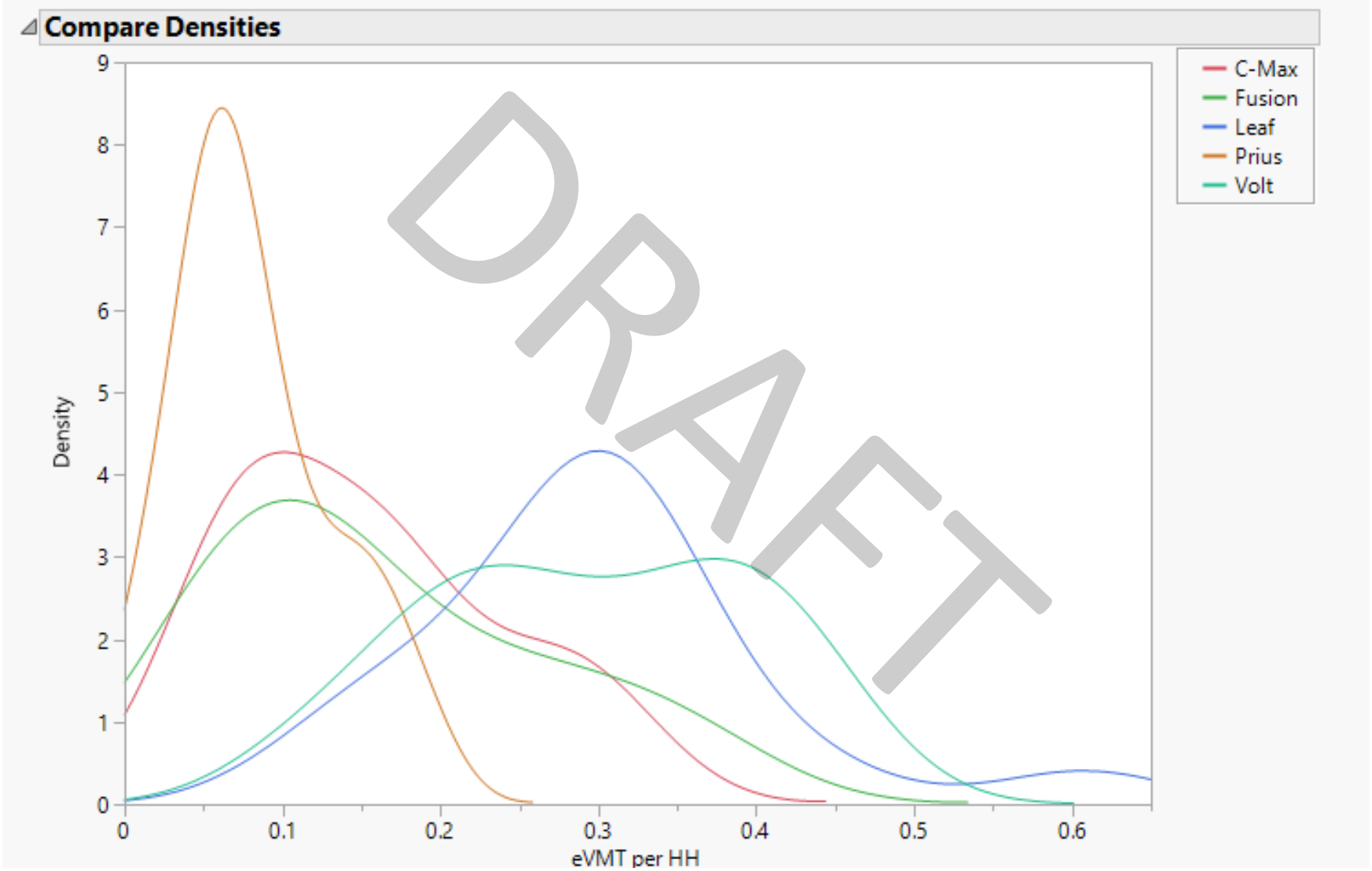






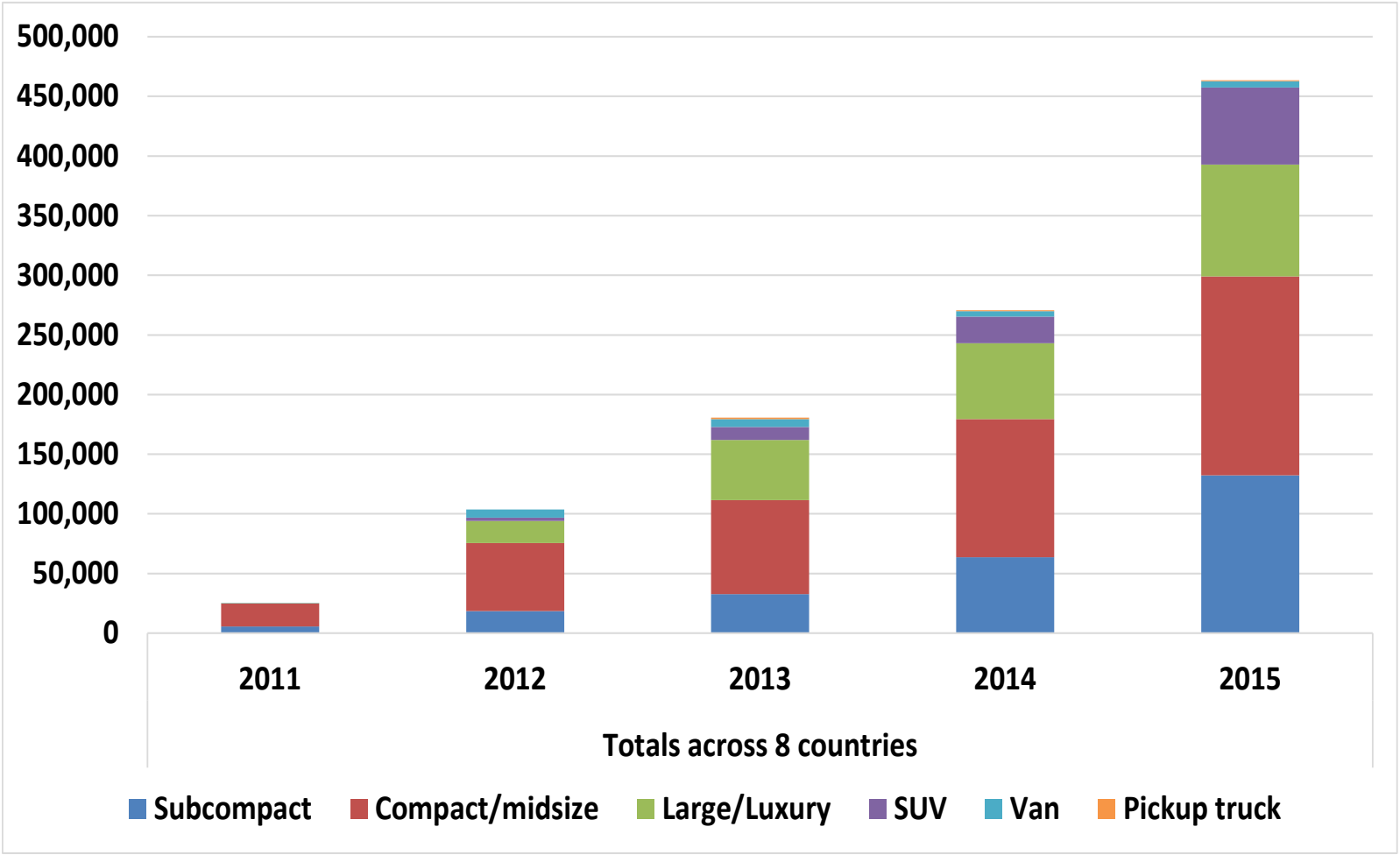


Percent eVMT on a Household Basis

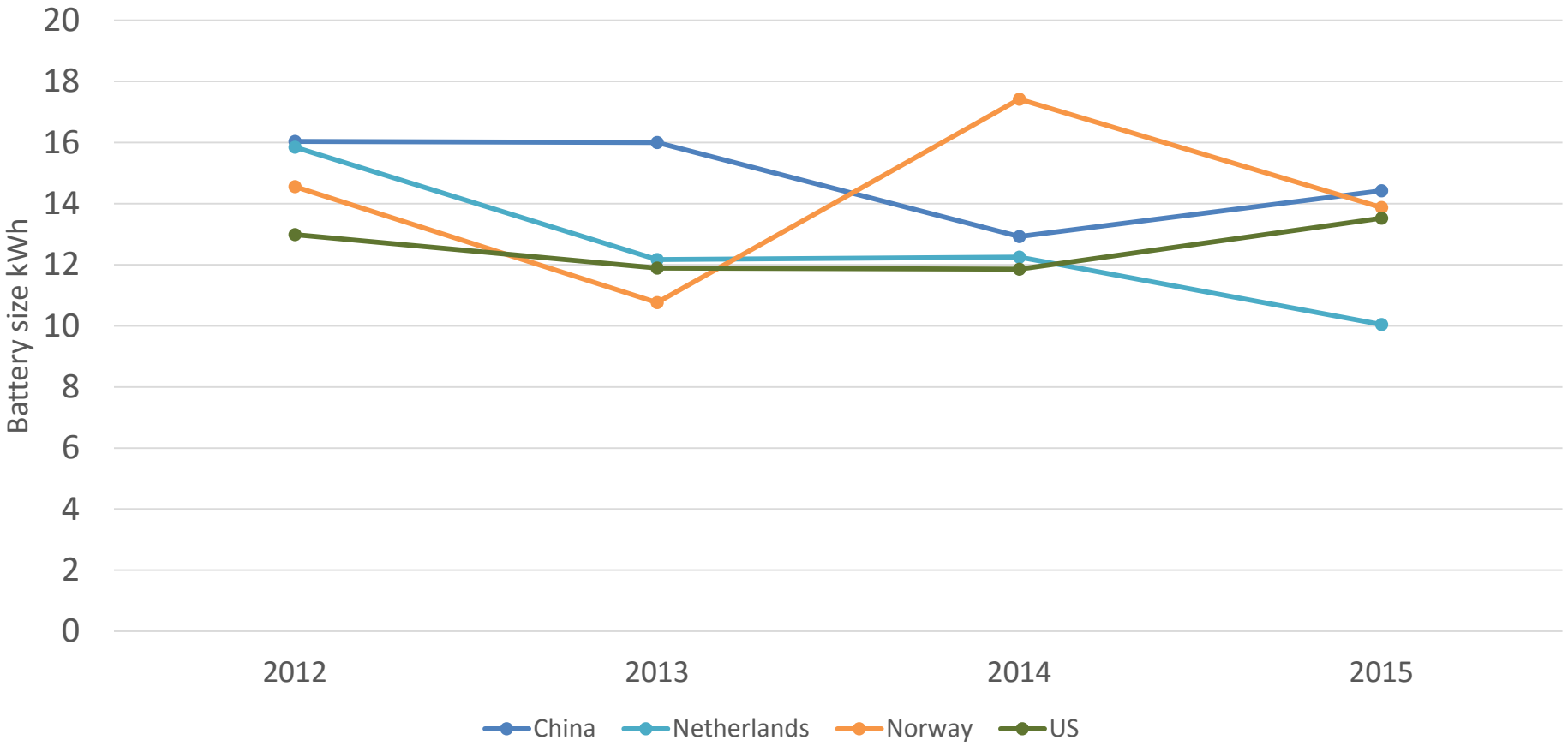


DISCUSSION

SUV PHEV sales grew dramatically in 2015

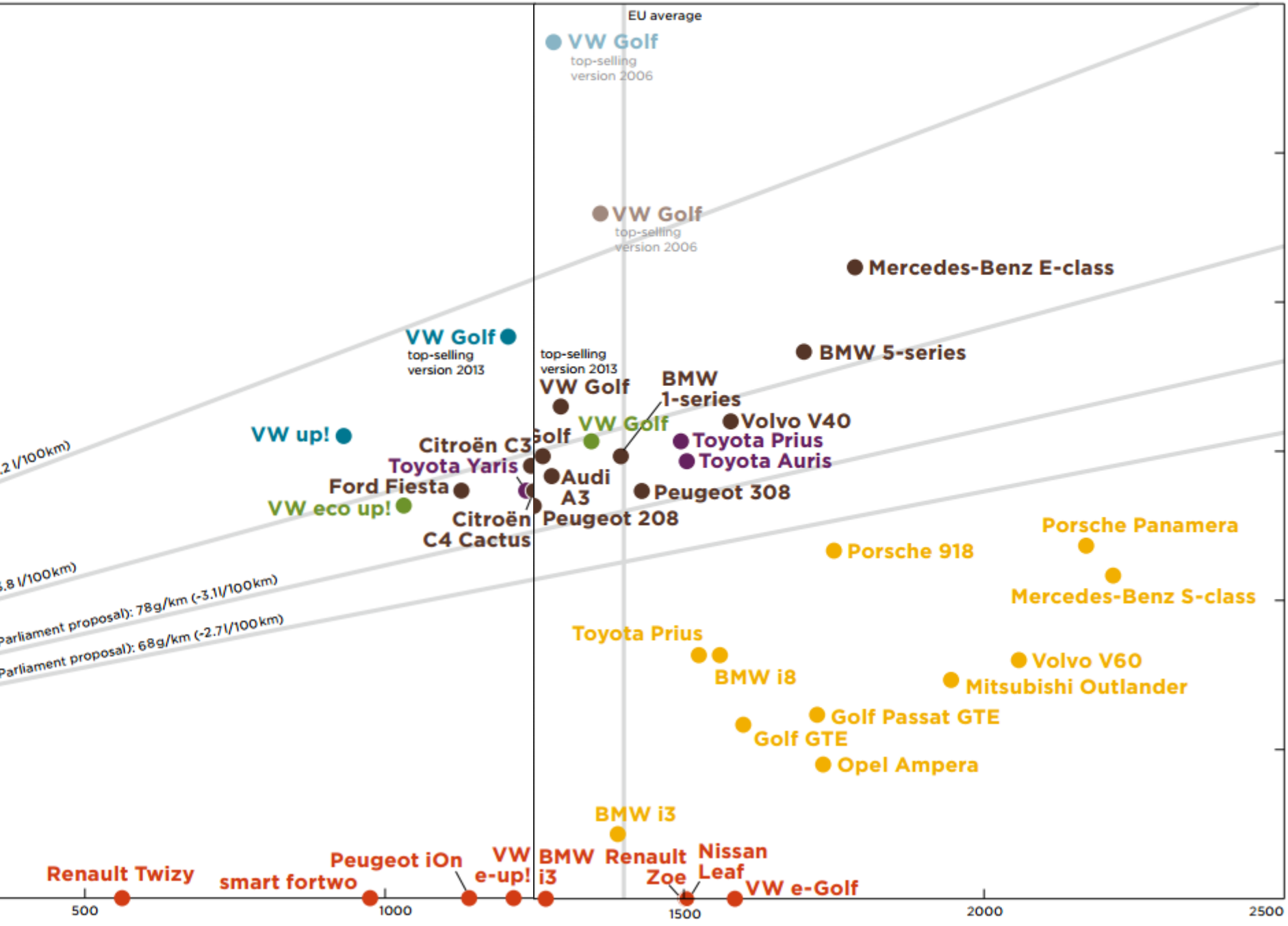


PHEVs are Getting Bigger, Batteries are Not



Data source: (DAT, 2015), manufacturers' websites.
Only a selection of available vehicles is shown.

Gasoline
Gasoline hybrid
Diesel
Plug-in hybrid
Natural gas
Full electric



Conclusions

- PHEVs can ramp up the market by:
  - Electrifying larger vehicles
  - Used by single car households
  - Used when charging infrastructure is not reliable
- PHEVs are not better than HEVs if not plugged in. when:
  - Purchased from a single reason that is not collated with charging the vehicle (HOV lanes, Registration fees, purchase cost)
  - Low benefit to plugging in (short range, no electric performance)
  - Gas price is close to electricity price
- Home or work charging are important
- Longer range and EV performance reduce the probability for not plugging in.

- <u>Without PHEV we are less likely to meet the sales and GHG goals</u>

Thank you

- Gil Tal gtal@ucdavis.edu
- Michael Nicholas mianicholas@ucdavis.edu

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