



Sustainable Transportation Energy Pathways (STEPS)

**Can the world reach 100 million
plug-in electric vehicles by 2030?**

19 May 2016

GFEI at ITF Leipzig Forum

Fuel Efficiency in 2016 and Beyond

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The potential for low-carbon vehicles around the world



- This project is developing a new approach to projecting PEV vehicle market penetration around the world
- We are exploring what it would take to achieve various PEV targets, policy/technology-wise
- We are also estimating the energy/GHG impacts of these PEV scenarios
- First GFEI working paper almost complete

Our idea...



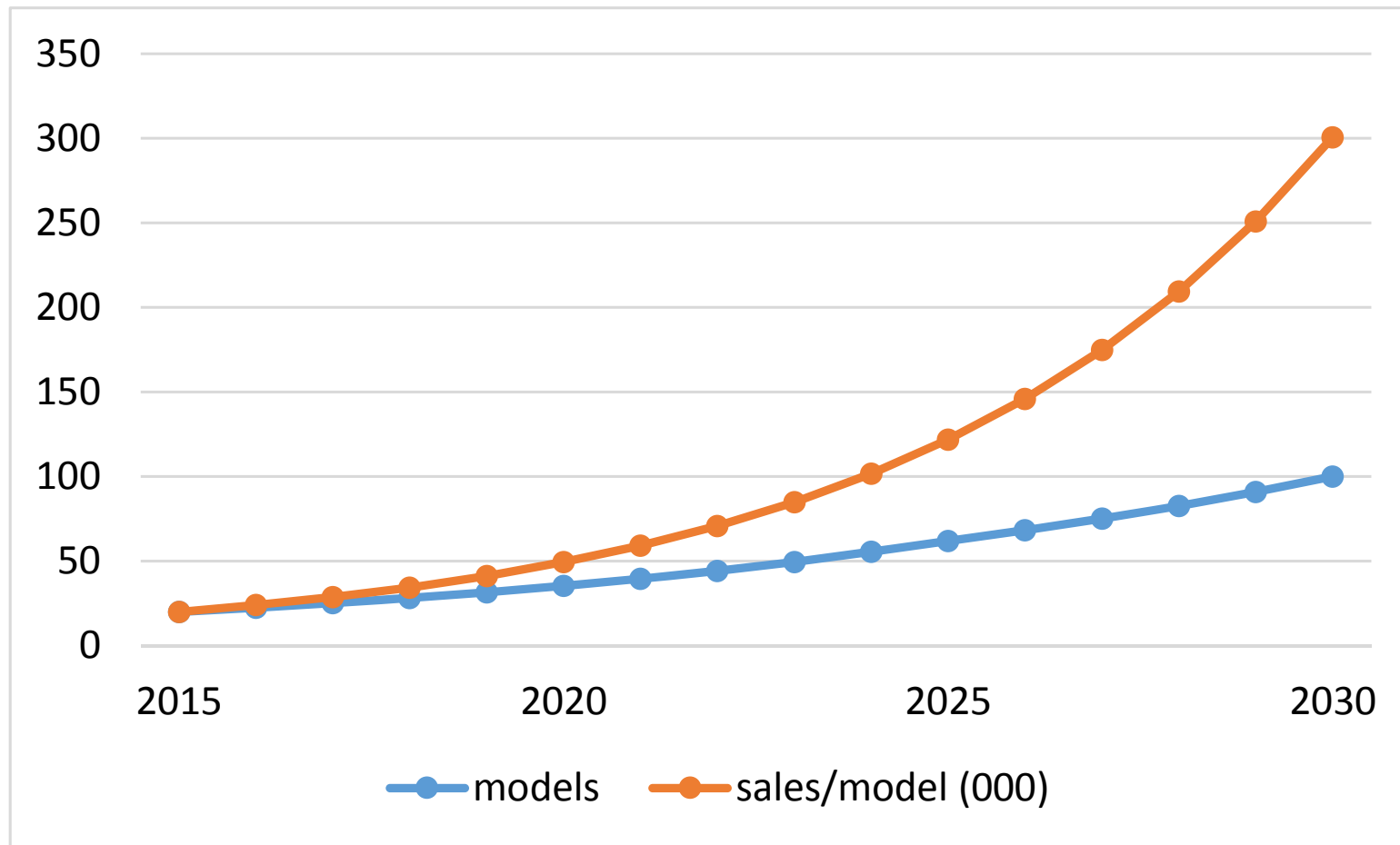
- Is not to “predict” or “forecast” the sales of PEVs, but explore what factors may matter in determining the trajectory, such as:
 - Consumer awareness, interest in different countries
 - Rate of new model appearance; manufacturer investments in new models/facilities and production ramp-up rates
 - The size and nature of different market segments in different countries, where PEVs are likely to appear, and how this may evolve
 - Diffusion rates of models across countries
 - Policy overlays – the PEV-relevant policies in major markets and their impacts on market development
- We are developing a model to combine these concepts into a quantitative framework that allows us to project PEV sales to 2030, using a scenario approach

COP Announcement – Paris Declaration on E-mobility

- Released at COP 21, December 5 2015
- Signed by UN Agencies, IEA and many governments
- Commits to “**more than 100 million electric-driven cars**” on the worlds roads by 2030 as part of achieving a 2-degree target.
- IEA roughly estimates that electric **vehicle sales will need to be 25% (~30 million)** world wide in 2030 to achieve this target.
- Is this possible? Plausible? What would be needed to achieve such a target?

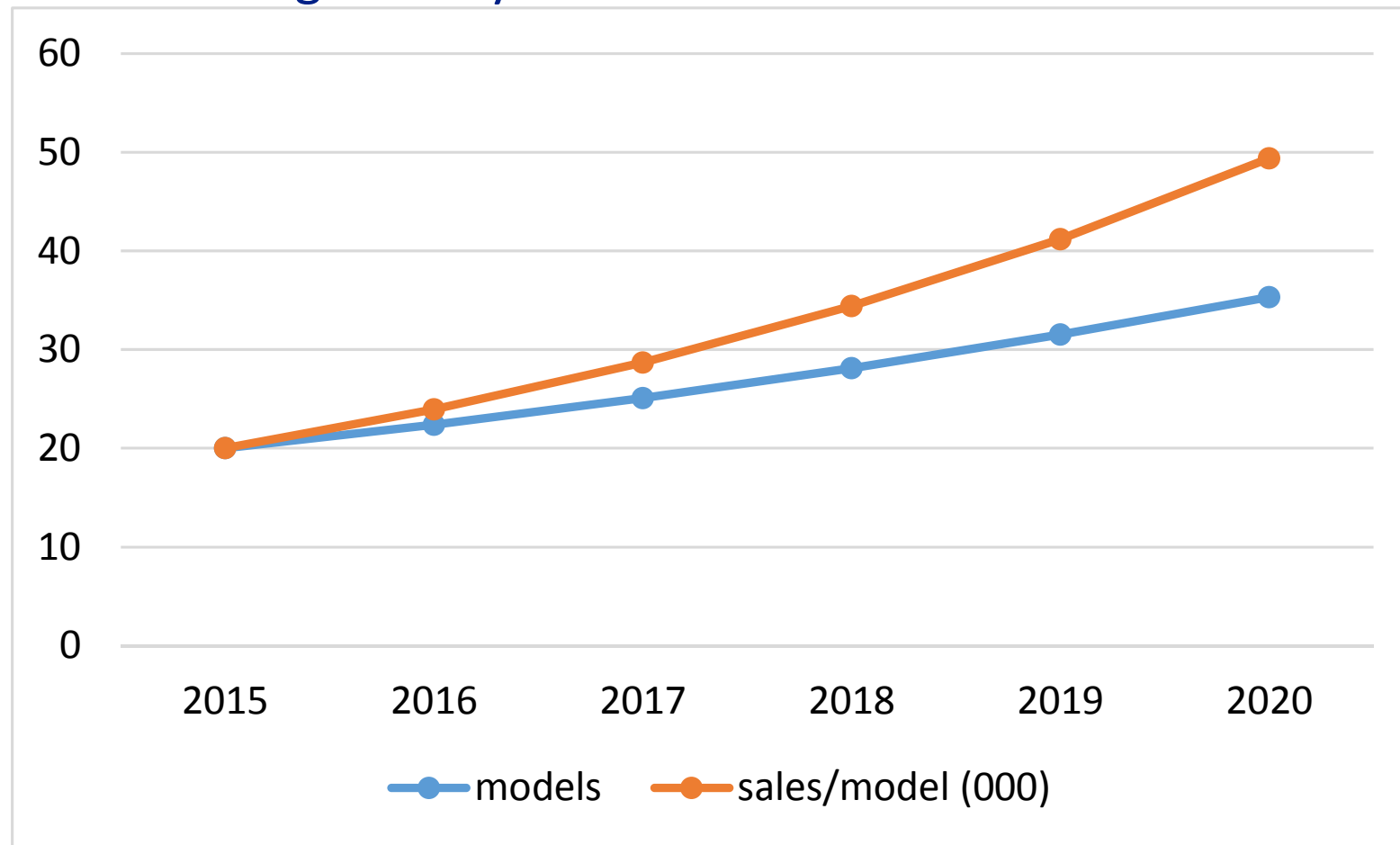
What does achieving the Paris Declaration targets look like?

- One possible way: 100 models selling 300k/yr each in 2030



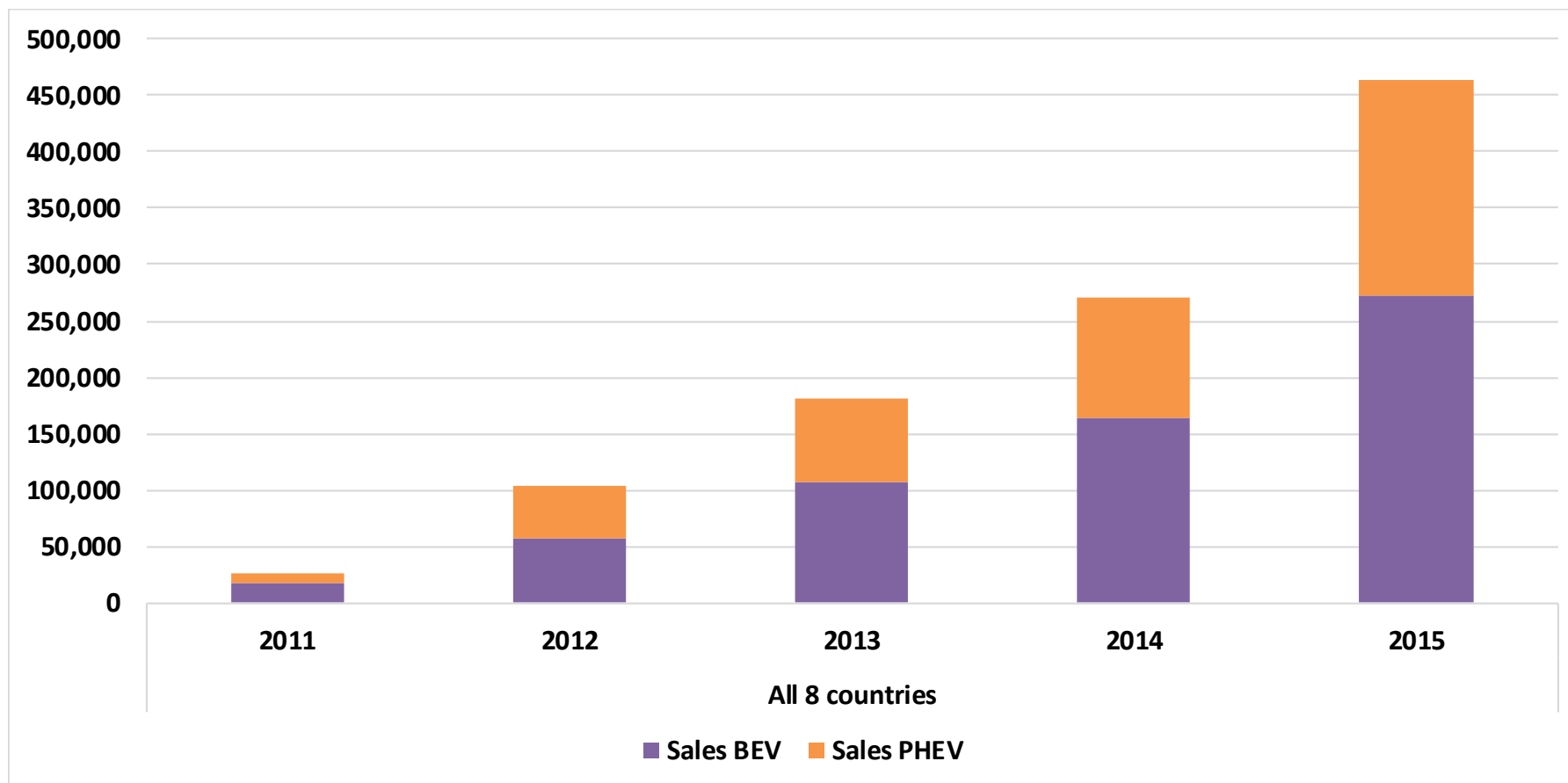
Zooming in to the next 5 years...

- About 3 new models per year, and 6000 units increase in world average each year



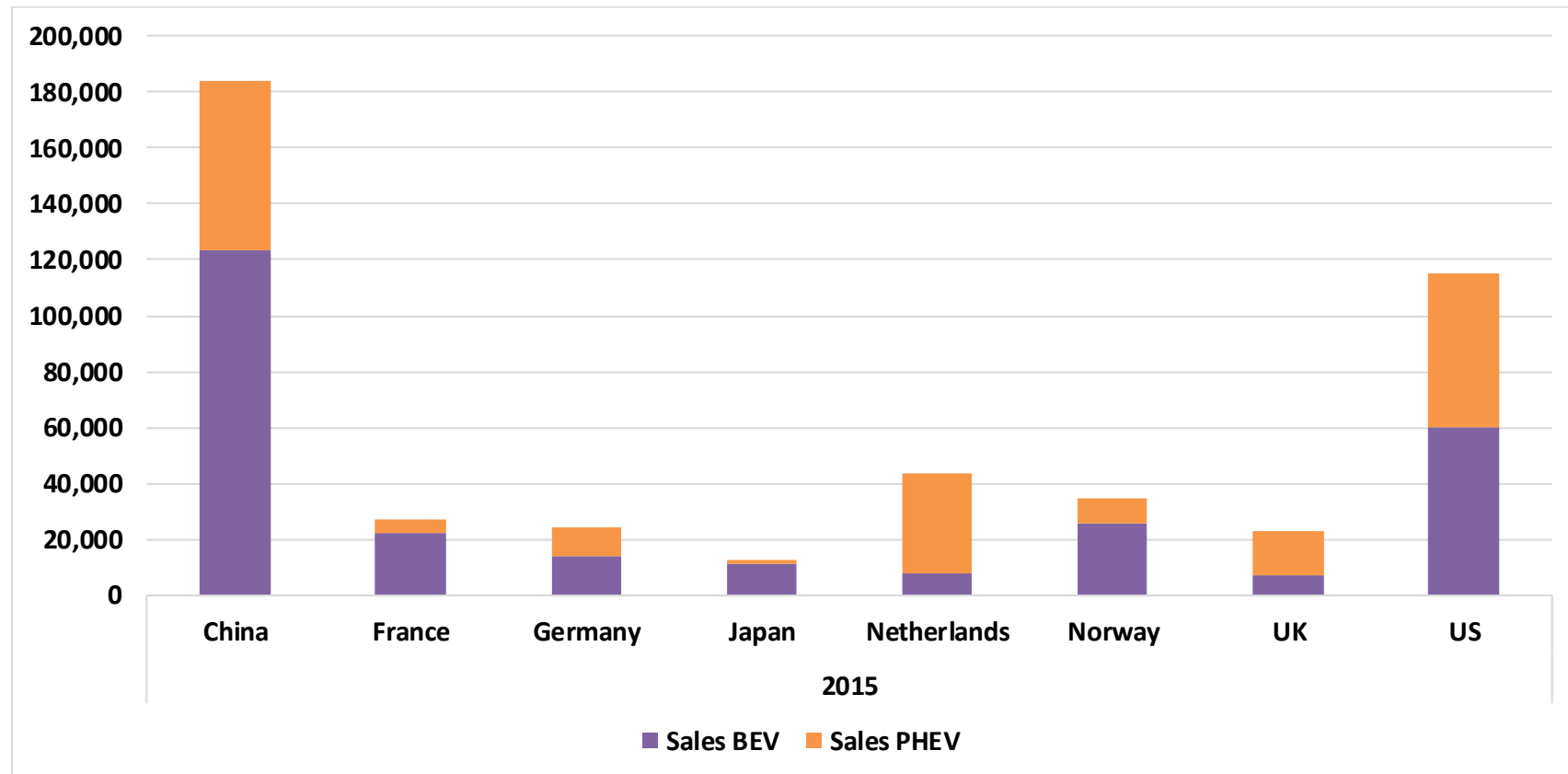
All PEV sales rising; PHEVs catching up to BEVs

- Sales of BEVs and PHEVs by year across 8 major markets



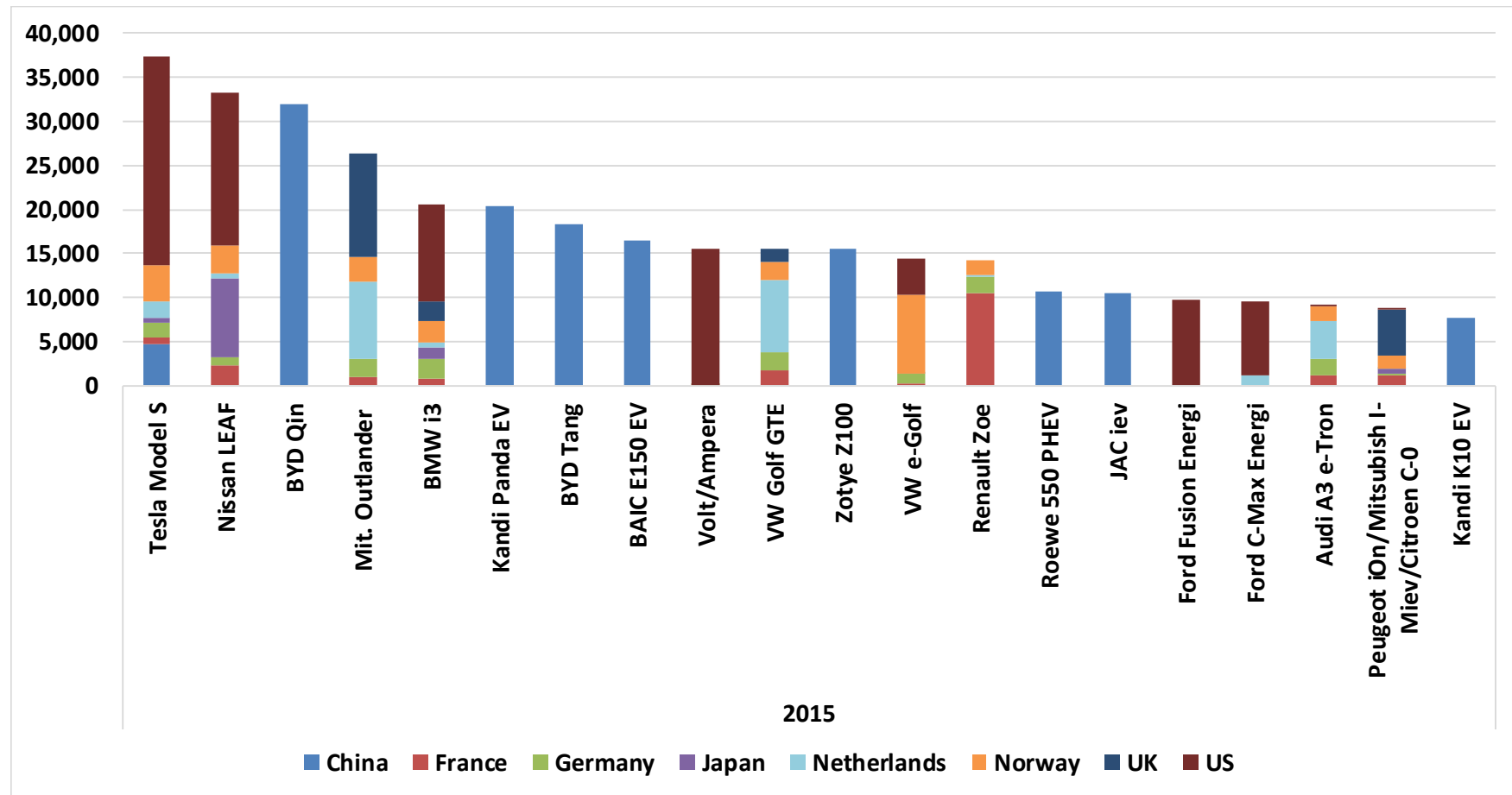
2015: Two biggest markets have most balanced BEV and PHEV sales

- Netherlands with the highest PHEV share; Japan the lowest



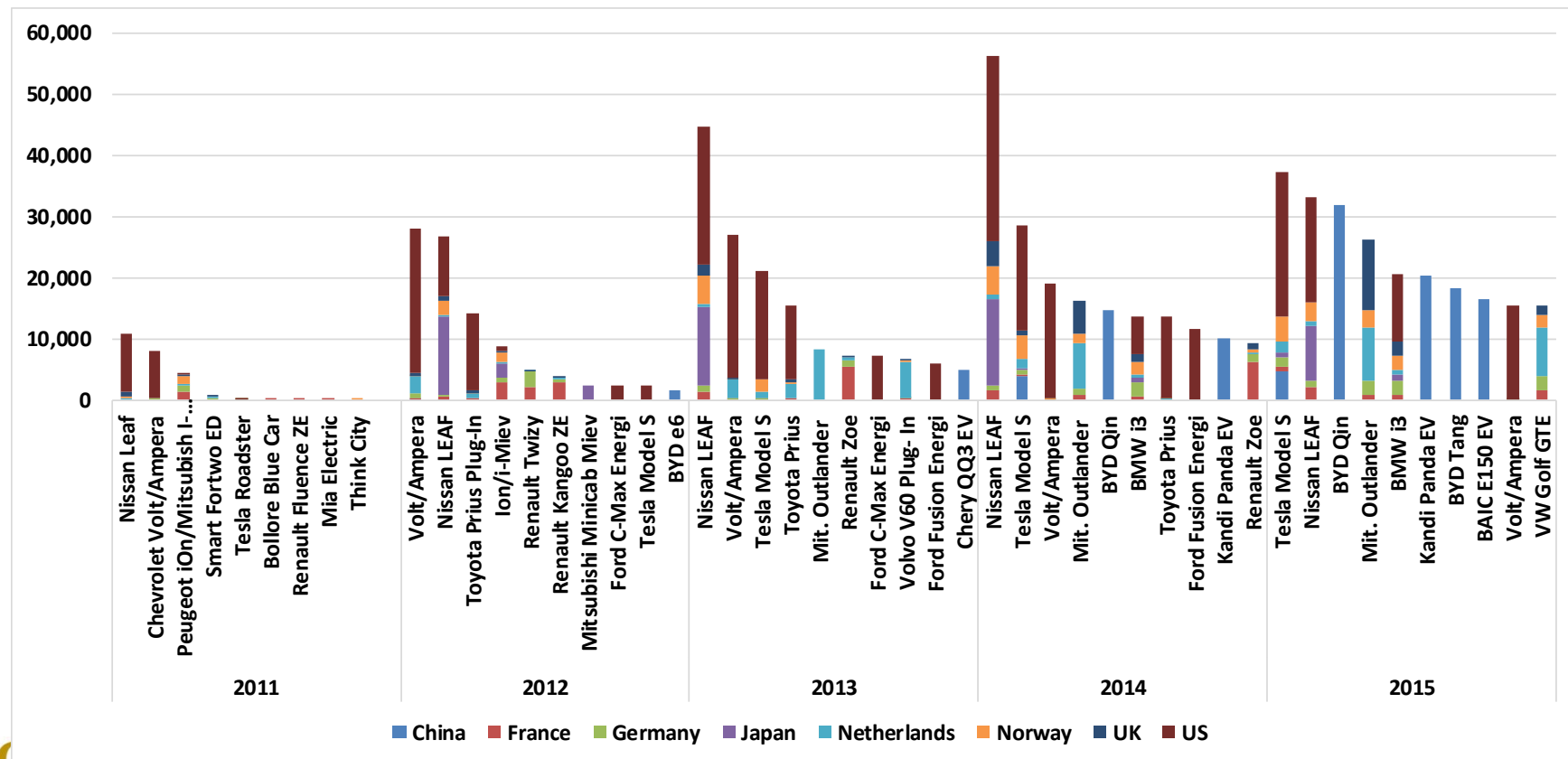
2015: Top 20 models averaged about 18,000 sales

- 8 of top 20 models sold only in China
- 4 of 5 top selling models have significant sales in multiple countries



Sales of top selling models across 8 countries have increased and equalized over time

- Top 10 average sales grew from below 2,000 units in 2011 to about 20,000 units in 2015
- Top selling Leaf in 2014 gave way to a much lower peak sales number of the top selling Tesla S in 2015



3 regions are doing very well, China, Northern Europe, West Coast cities in the United States-Feb. 2016 /all year 2015 sources evblogspot, insideevs, CNCDA, IEA

	Country	Est Total PEVs. Feb 2016	Est. PEV Sales 2015	PEVs as % of 2015 market	Total LDV market 2015
1	USA	>415,000	>115,000	0.6%	17,500,000
	California	>189,000	>62,000	3.1%	2,100,000
2	China	300,000	207,000	0.8%	22,000,000
3	Japan (est)	150,000	25,000	> 1.0%	4,200,000
4	Netherlands	91,000	43,000	9.6 %	420,000
5	Norway	90,000	34,000	> 20%	170,000
6	France	> 70,000	27,000	1.5%	2,000,000
7	Germany	> 50,000	24,000	0.75%	3,500,000
8	UK (est)	>38,000	>28,000	> 1.0%	2,700,000
	Europe		>193,000		
	World	>1,100,000	>450,000	0.5%	88,000,000

A plausible PEV rollout scenario based on technology change, incentives & history of previous technology rollouts

This sales curve would be similar to the rollout of HEVs in Japan & California, 1997-2015

1st generation
early policy,
converted vehicles,
“**innovators**” &
early infrastructure

2nd generation
improved batteries,
more driving range,
“**followers**”
Adequate infrastructure

3rd generation:
batteries,
vehicles,
“**core market**”
PEVs competitive

4th generation:
PEVs begin to dominate

2030

California
2025 ZEV goal
= 15% / 1.5
million BEVs,
FCV & PHEVs

2025

Early core market:
6-15%

Main market
15-25%

2020

2015

3-5% of market

1-2%

2010

700

300

200

150

Lithium pack prices per kWh

2nd Generation PEVs (2015-20) include higher range and more efficient, popular designs

1st Generation

PHEV 20-30 kms



PHEV 60



BEV 120



BEV 250-300



2nd Generation

PHEV 30-50 kms



PHEV 80, BEV 10



BEV 150

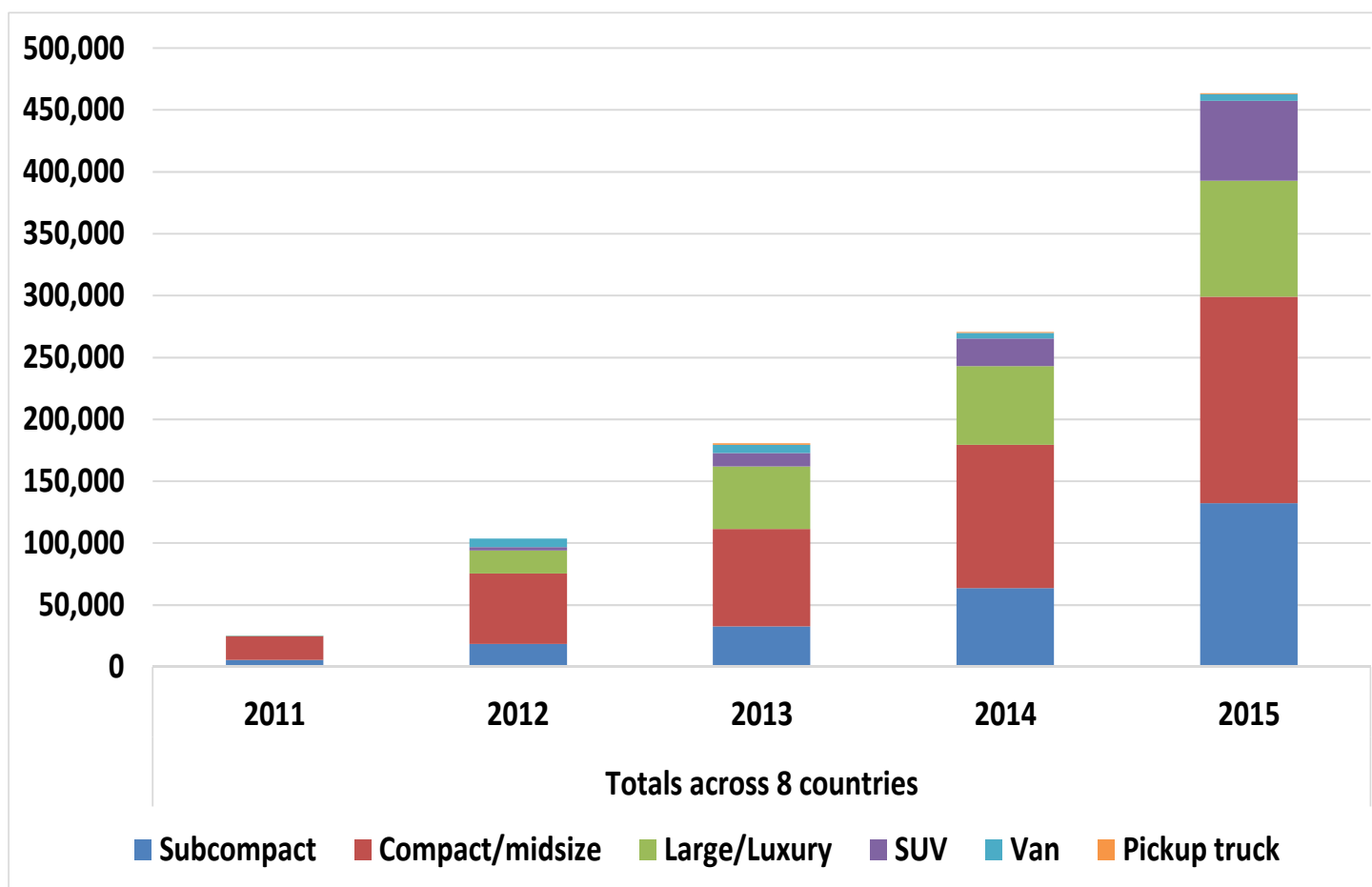


BEV 300 - 450



Back to PEVs – fairly diverse mix in 2015

- SUV PEV sales grew dramatically in 2015



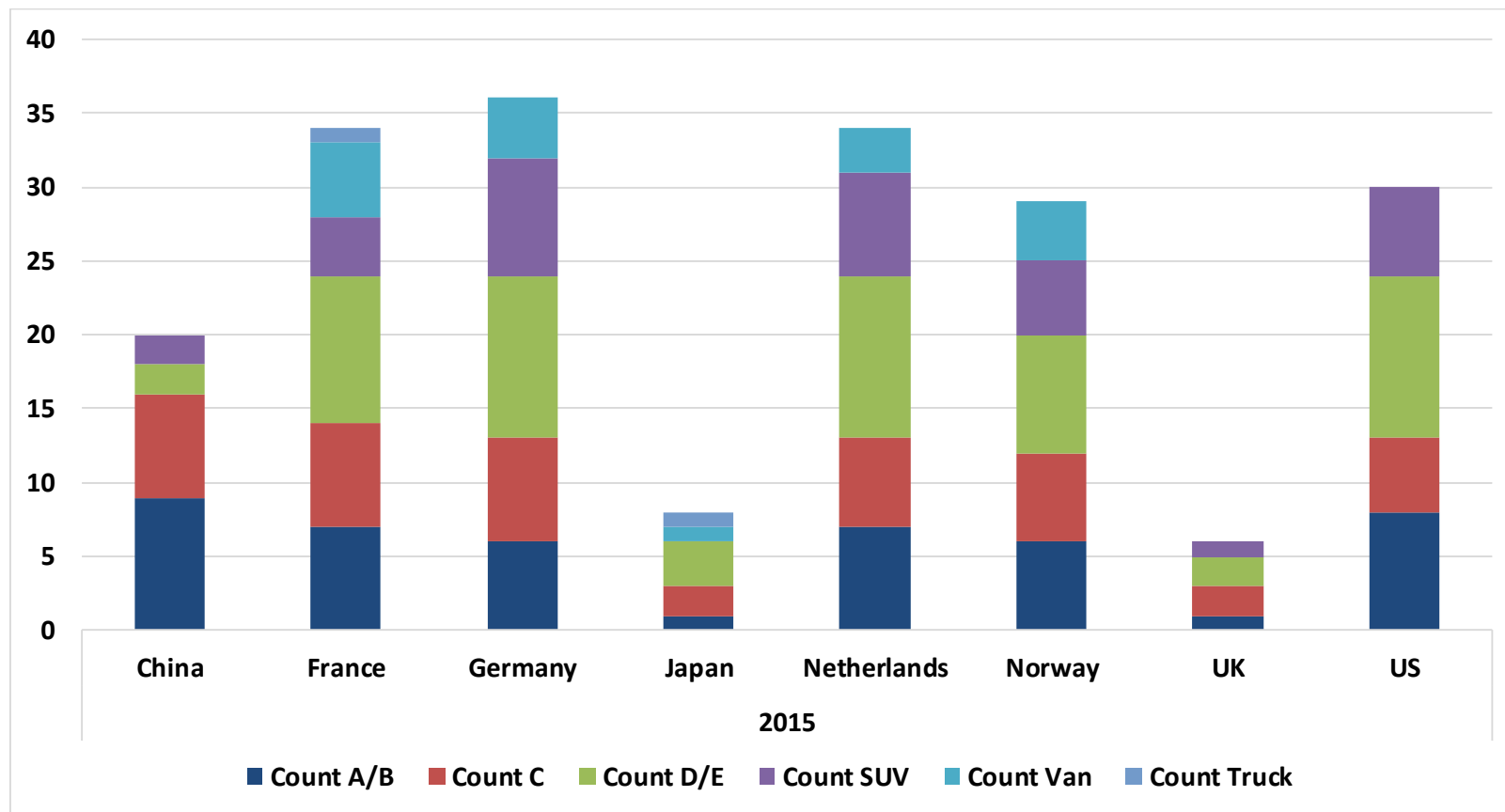
2015 PEV sales: very different market segment mixes in different countries

- Sales of A/B/C class cars more than 50% of PEV sales except in the Netherlands and UK. Extremes are Japan with 88% A/B/C; UK 51% SUV
- US PEVs are 95% cars despite over 50% of all LDV sales SUV/Van/Lt-Truck



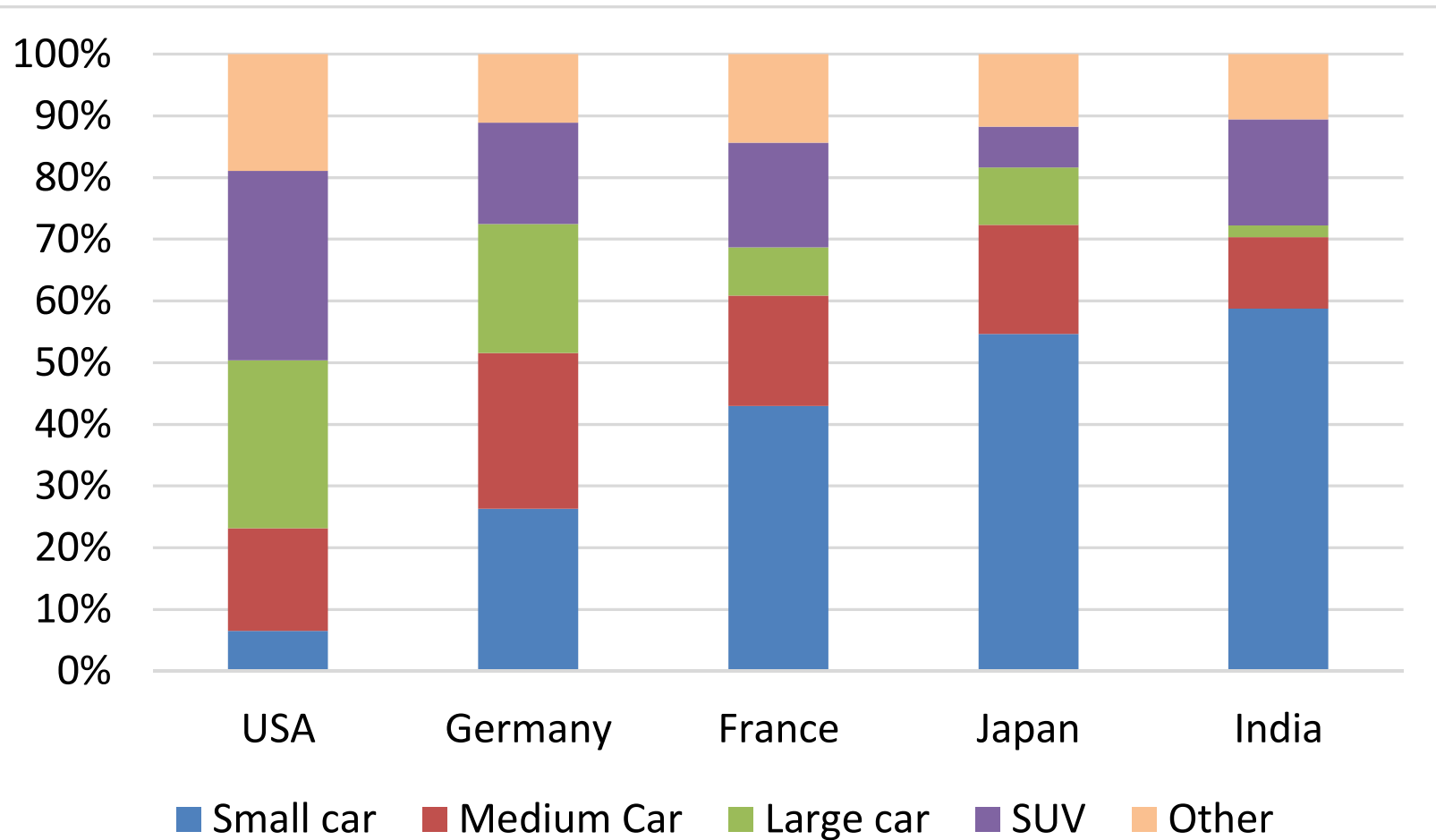
2015: reasonably good availability of models in most market classes in most countries except Japan and UK

- The US and China have far higher sales without far higher numbers of models than in Europe
- Japan and UK have inexplicably low numbers of models on offer

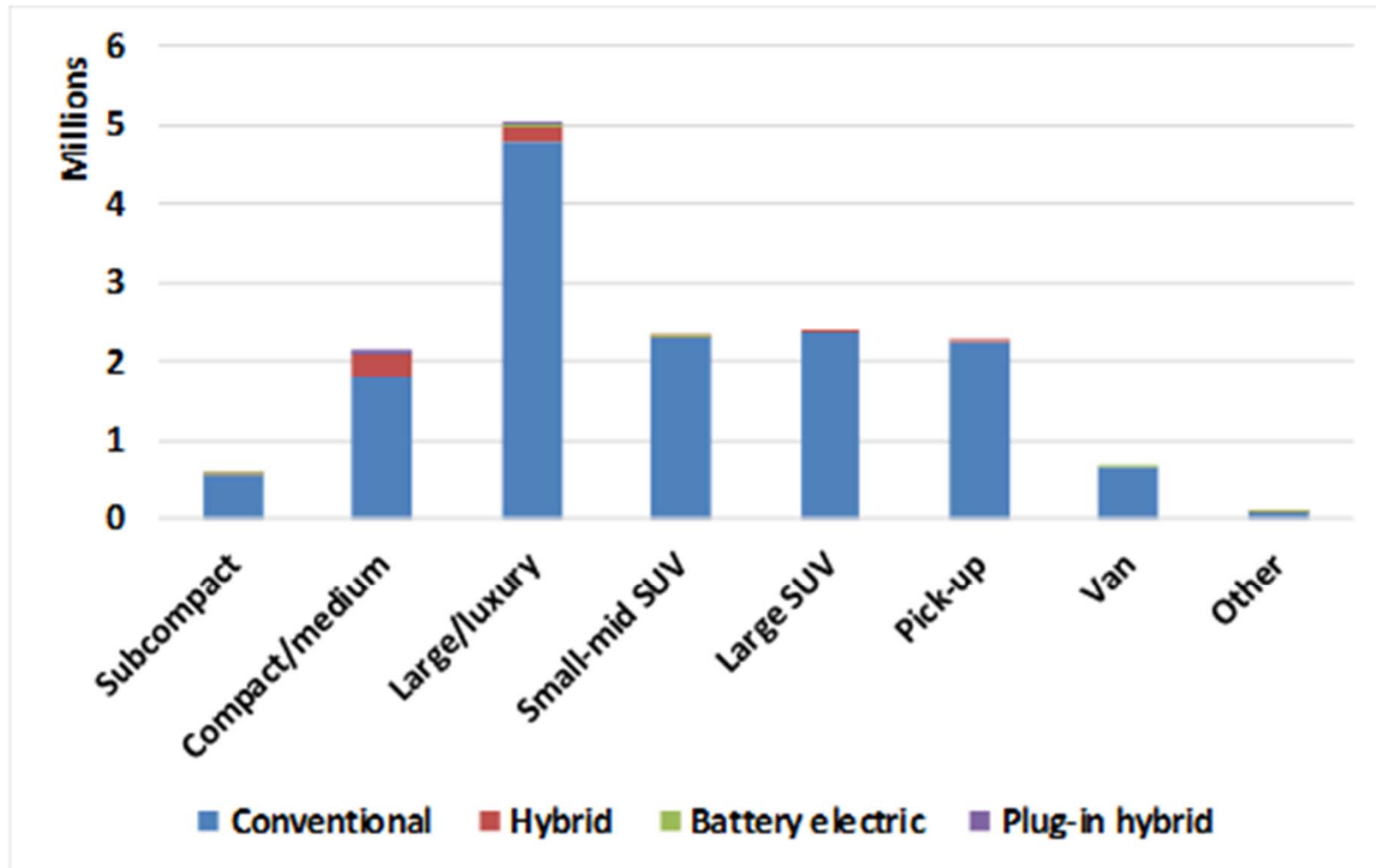


In looking at all PLDV sales, countries are different...

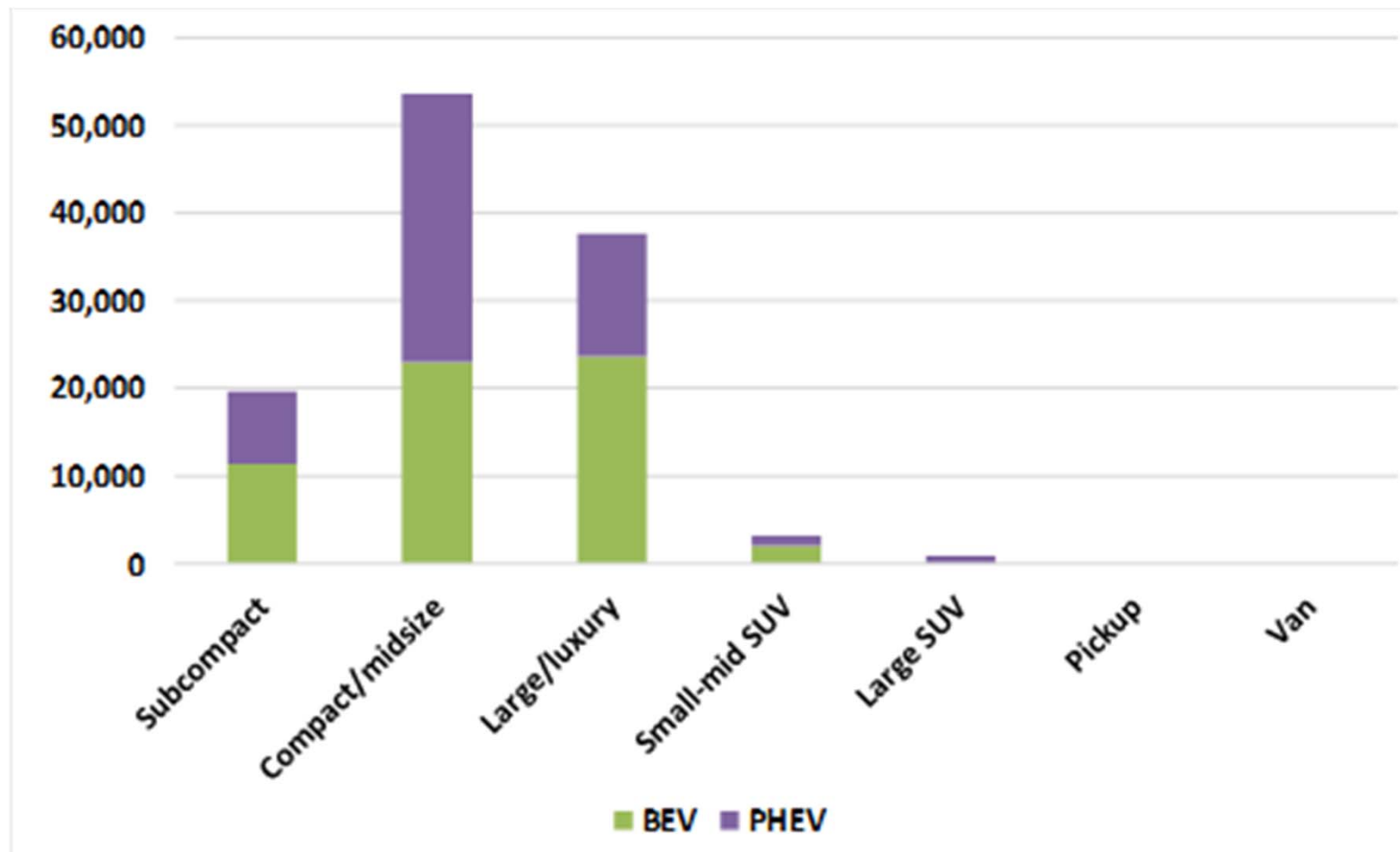
- 2013 sales of all light-duty vehicles by market class vary considerably by major market



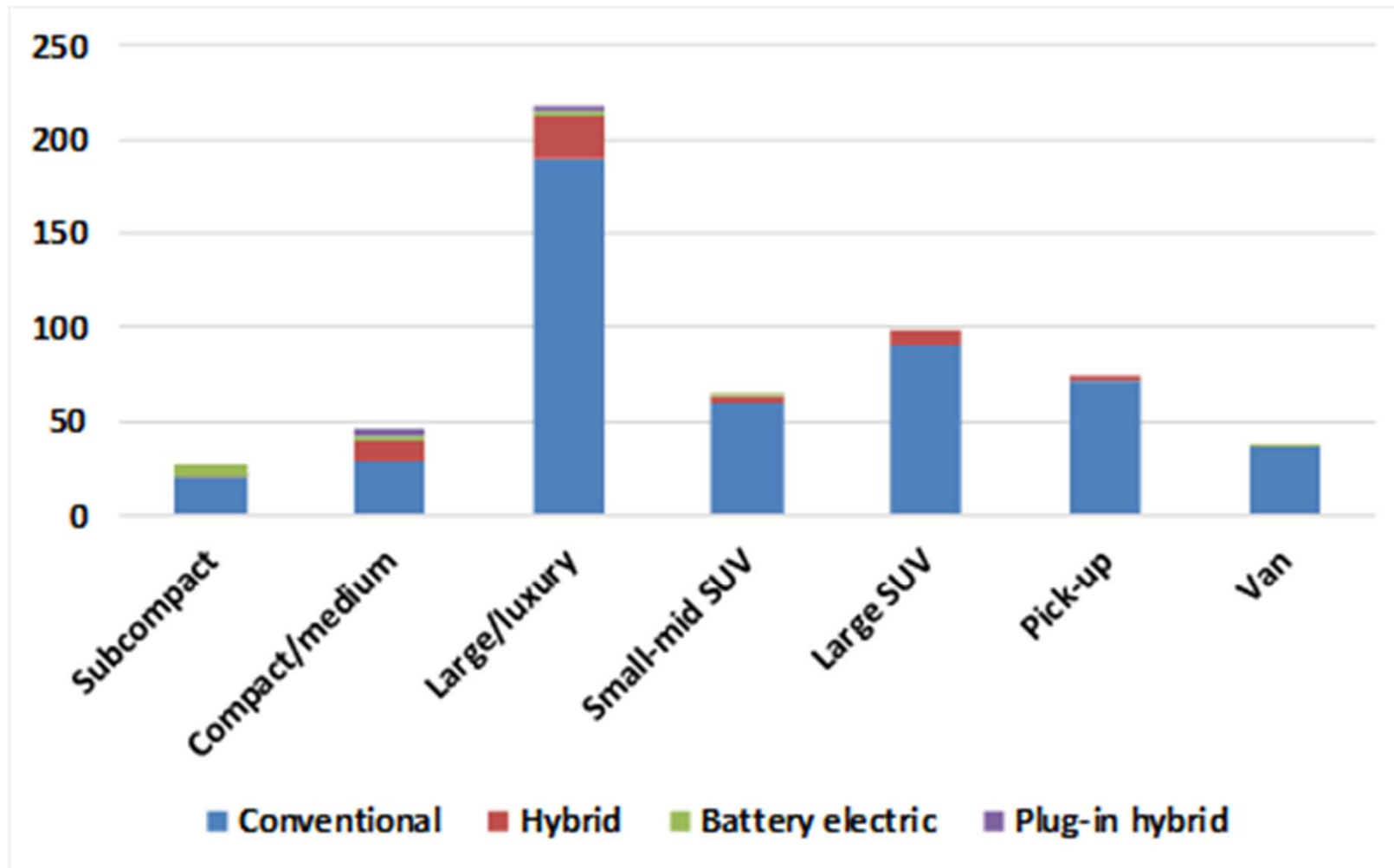
USA: BEVs and PHEVs hard to spot as market share by market class



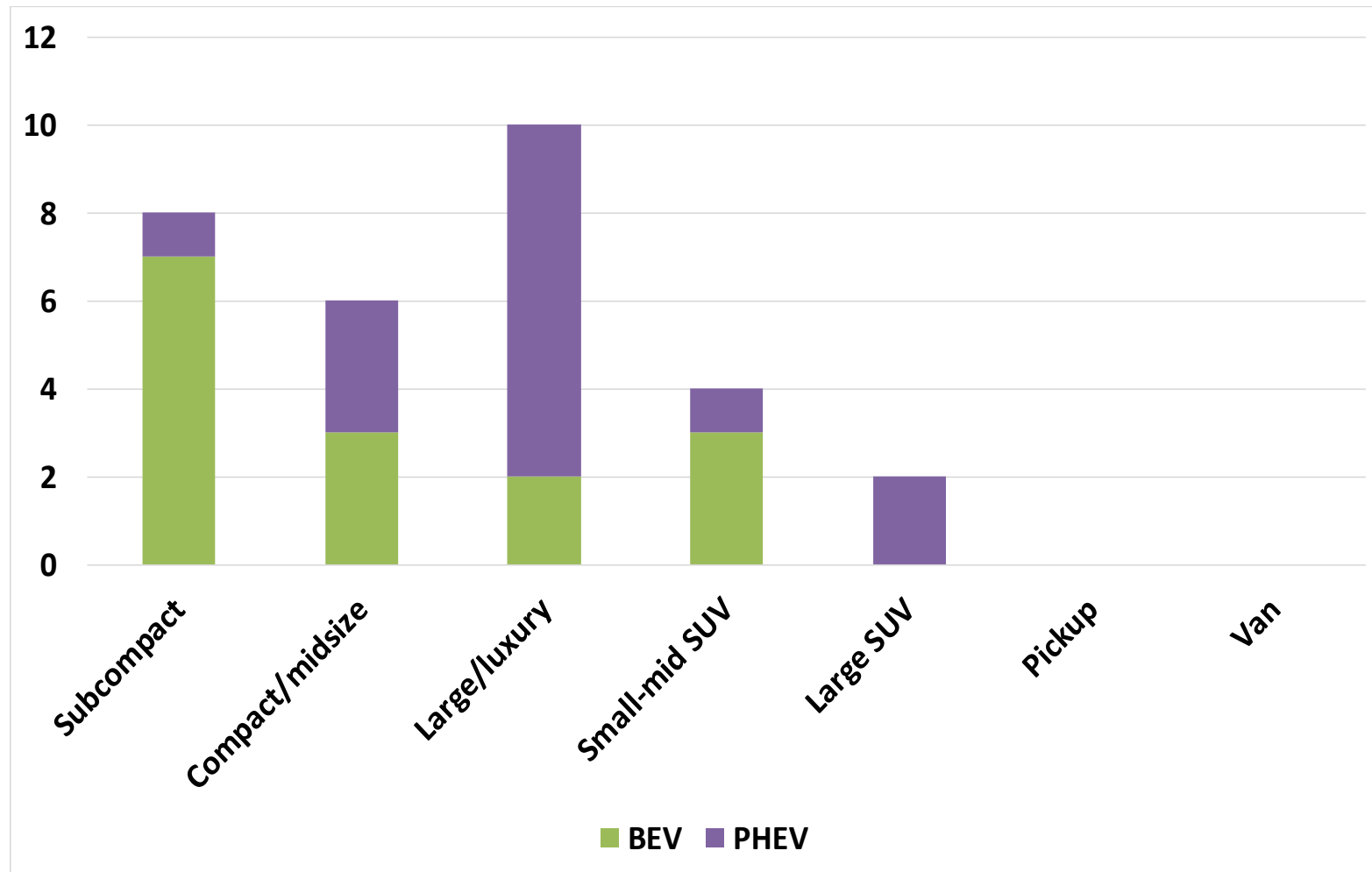
USA: BEVs and PHEV 2015 sales broken out



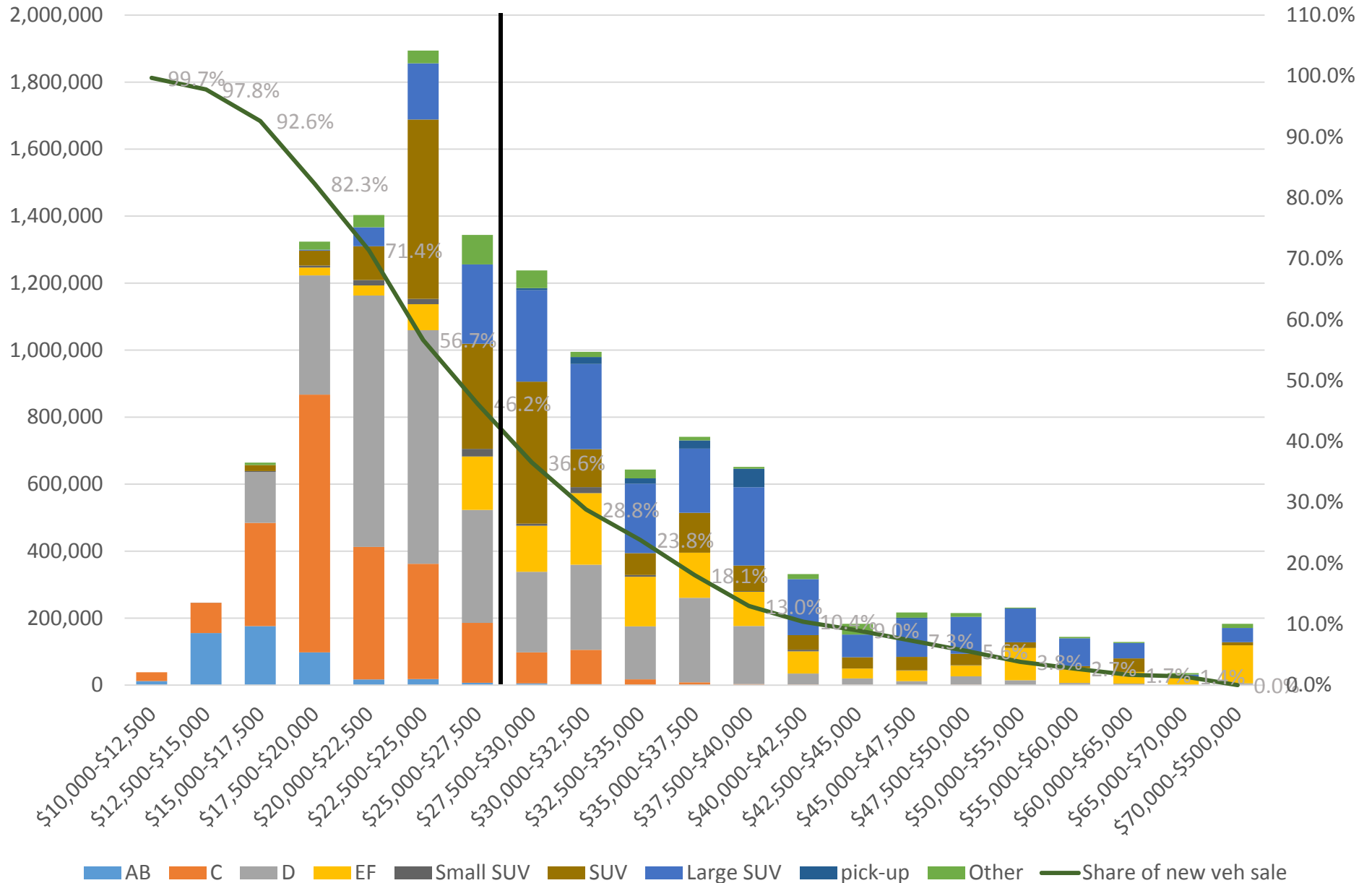
USA PEVs v conventional models available by market class



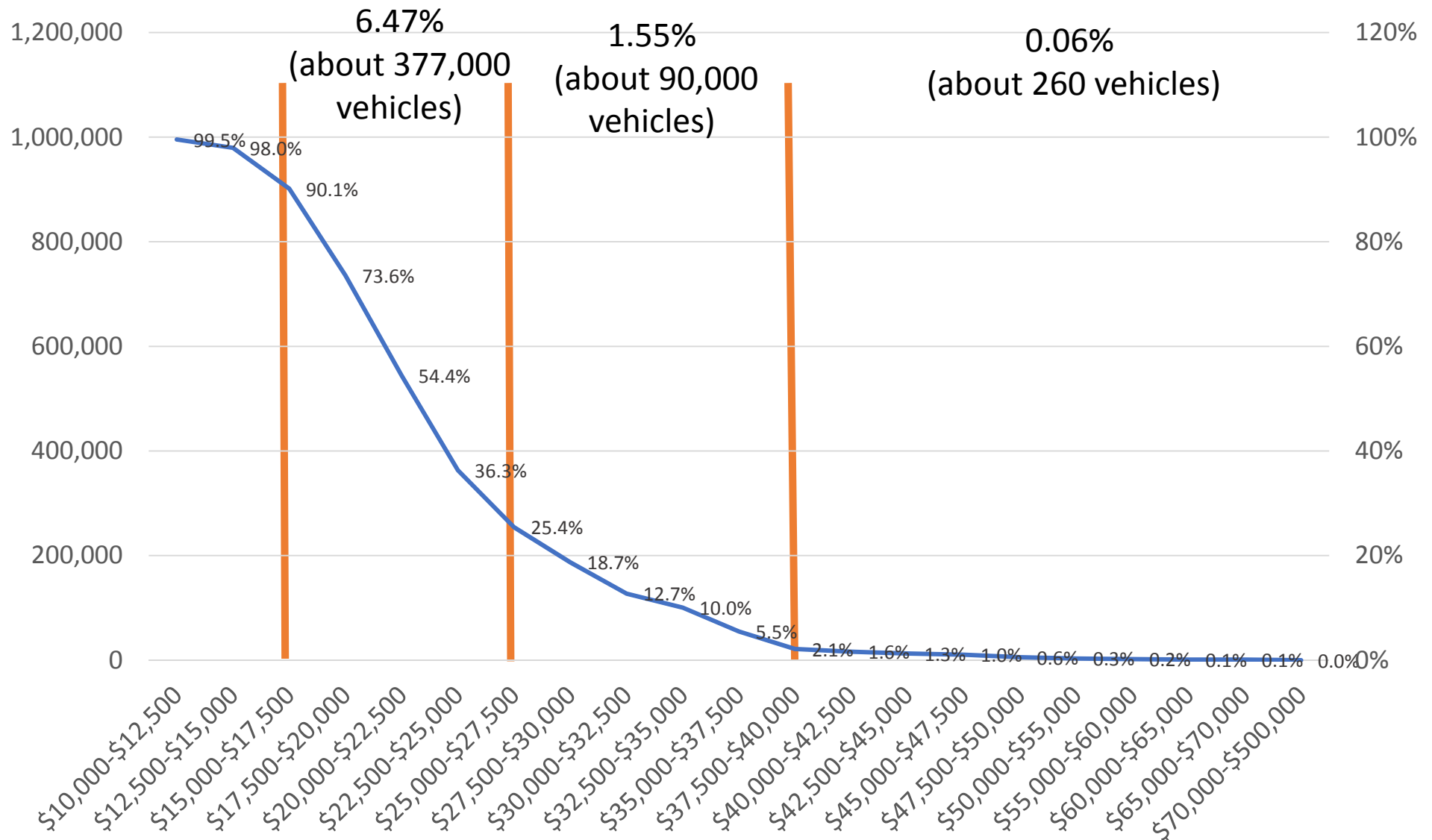
USA PEV models available by market class



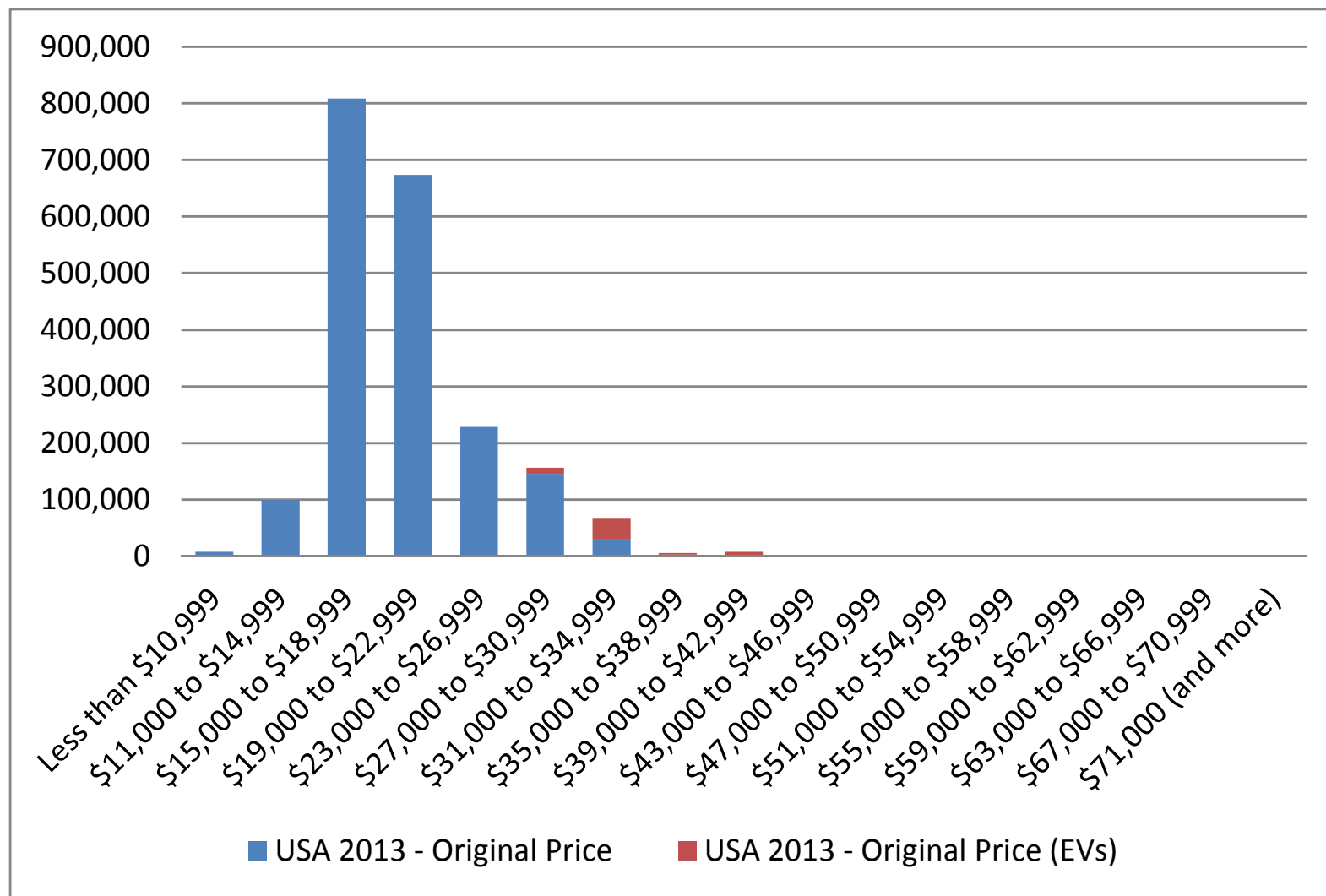
2013 US Market by Segment and Price



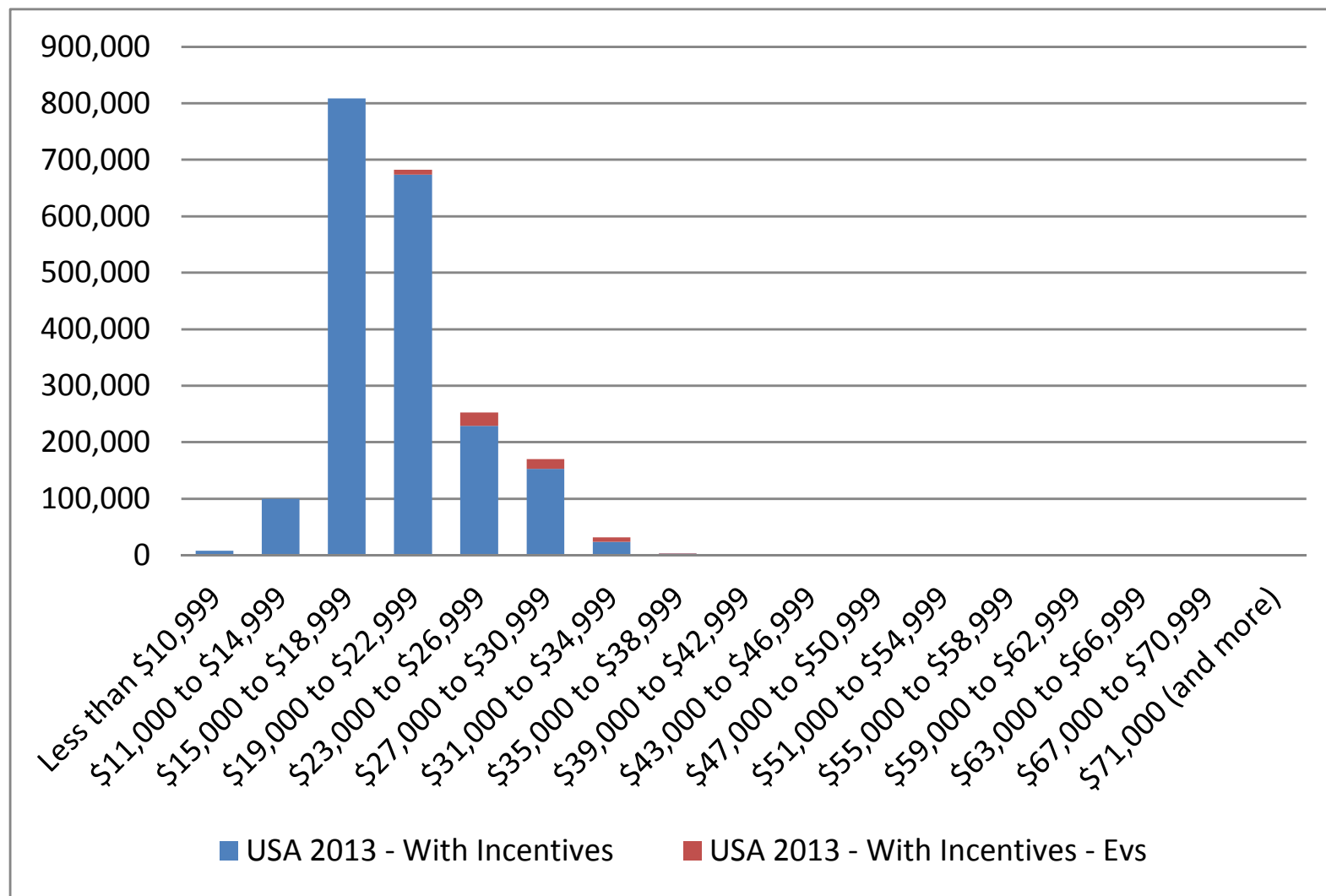
The Impact of \$1000 price Change on the Potential Market



PEV sales by price category – C class cars



PEV sales by price category – C class cars



Next steps



- Develop policy-driven scenarios for PEV global/regional sales by country, PEV type, through 2030
- Feed this into IEA Mobility Model to generate impacts in terms of electricity use, other energy use, CO2 emissions across transport. Might use this model also to apply diffusion to other countries beyond the major markets we characterize in our main study
- Show the contribution of PEVs through 2030/2050, describe what factors will be most important, how changes in policy could change trajectory
- First working paper soon; full report by end 2016