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

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Fuel Efficiency in 2016 and Beyond

Lew Fulton,
Director, STEPS Program, ITS-Davis

www.steps.ucdavis.edu
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

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

2010
2015
2020
2025
2030

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

Main market 15-25%

Early core market: 6-15%

Lithium pack prices per kWh

700 300 200 150
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 vs conventional models available by market class
USA PEV models available by market class

![Bar chart showing the distribution of BEVs and PHEVs across different vehicle classes.](chart.png)
The Impact of $1000 price Change on the Potential Market

6.47% (about 377,000 vehicles)

1.55% (about 90,000 vehicles)

0.06% (about 260 vehicles)
PEV sales by price category – C class cars

![Graph showing PEV sales by price category for C class cars in the USA in 2013. The graph displays sales in different price ranges, with the highest sales in the $11,000 to $14,999 range. The data includes sales of both conventional vehicles and electric vehicles (EVs).]
PEV sales by price category – C class cars

USA 2013 - With Incentives

USA 2013 - With Incentives - Evs
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