Dr. Tom Turrentine,  Director
Dr. Gil Tal, PEV Use Patterns & Infrastructure Needs, China
Dr. Ken Kurani,  Consumer Studies
Dahlia Garas, Program Director
Dr. Alan Jenn, PEV Regulations & Incentive Structures in USA
Dr. Scott Hardman, Europe PEV Markets
Dr. Angela Sanguinetti, Energy Feedback
The best news is that battery “cell” and “pack” prices have been dropping & forecast prices for 2020 & 2025 dropping as well

- US Department of Energy predicts $125 kWh (pack) by 2022
- Tesla says $190 kWh in 2016 and $100 in 2020 (cells)
- GM said it paid $145 per kWh “cell” price for 2017 Bolt
- GM says Bolt will reach price parity in 2022.
- Renault says they will reach price parity 2020.
The number of PEVs in the world in 2017 will likely go over 3 million (out of 1 billion vehicles) & over 1 million in sales (out of 90 million vehicles).
First quarter 2017 global PEV sales by model

Thousands

Nissan Leaf: 6, 2, 4
Tesla Model S: 8, 4
Tesla Model X: 8, 4
T. Prius Prime: 4, 2
Renault Zoe: 8, 4
BMW i3: 4, 2
BAIC EC180: 4, 2
M. Outlander PHEV: 4, 2
Chevrolet Volt: 2, 1
Zhidou D2 EV: 2, 1

March
YTD
1st quarter (& March) 2017 global PEV sales by manufacturer

Thousands

- Tesla
- BMW
- Nissan
- BAIC
- Toyota
- Renault
- Chevrolet
- BYD
- Mitsubishi
- Mercedes
And as a result, car makers are now in competition to make “second generation” BEVs, 130-250 miles of range, Level 1-2 automation, AWD, high power charging

2018 Tesla Model

2017 Volkswagen eGolf

2017 Chevrolet Bolt

2017 BMW i3

238 miles range, $29,995 after tax credit
And second generation PHEVs
20-40 miles range, larger, SUV/Crossover type vehicles, more power, AWD, & more automation

2017 Toyota Prius Prime

2017 Chevrolet Volt

2017 Audi A3 eTron

2017 Volkswagen Passat

2017 Chrysler Pacifica
While the current PEV offerings emphasizes small sedans, the shift is to more SUV/Crossover

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.
Growth in most markets has followed increase in number of models for sale.
There was 37% growth worldwide in 2016.
Ratio of BEVs to PHEVs varies, is shaped by policies, trending to PHEVs in several markets, with eVMT problems.
This slide is one year old, but still relevant. Small shifts in PEV policy in Norway made more room for growth around PHEVs in one car & older households.

PEV Models in Norway: sales of PEVs that are a bit larger & designed for winter. 挪威PEV车型：销售的PEVs大一些，设计适应冬季低温.

Weight tax deduction increased to 15%

Weight tax deduction increased to 26%

Source: Dr. Gil Tal, UC Davis
German car market responding to incentives & new PEV models

First quarter 2017
Sales growth in China continues, and always follows a pattern for strong end-of-year sales (Chinese New Year or tax deadlines?)

Data Source: China Passenger Cars Association (CPCA)
China is moving further towards BEVs - 80% China PEV Quarterly Sales

**China PEV Quarterly Sales**

- **BEV**
- **PHEV**

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</tr>
</thead>
<tbody>
<tr>
<td>Sales (Thousands)</td>
<td>40.5%</td>
<td>57.6%</td>
<td>59.5%</td>
<td>54.1%</td>
<td>72.2%</td>
<td>72.8%</td>
<td>27.8%</td>
<td>31.0%</td>
<td>69.0%</td>
<td>62.6%</td>
<td>72.1%</td>
<td>86.6%</td>
<td>19.8%</td>
</tr>
</tbody>
</table>

**Note:** BEV and PHEV sales as a percentage of total sales.

**Source:** China PEV Quarterly Sales report.
### 2016 PEV Sales Top 10 Cities in China: BEVs only in Beijing & registration restrictions are important

Data Source: WAYS, 2017 [ww.way-s.cn](http://ww.way-s.cn)

<table>
<thead>
<tr>
<th>City</th>
<th>2016 PEV Sales</th>
<th>BEV Manufacturer</th>
<th>PHEV Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>63000</td>
<td>BAIC</td>
<td></td>
</tr>
<tr>
<td>Shanghai</td>
<td>41483</td>
<td></td>
<td>SAIC</td>
</tr>
<tr>
<td>Qingdao</td>
<td>27198</td>
<td>BYD</td>
<td>BYD</td>
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<td>Tianjin</td>
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<td>Taiyuan</td>
<td>17854</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guangzhou</td>
<td>16506</td>
<td>Geely, Zotye</td>
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</tr>
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<td>Hangzhou</td>
<td>15033</td>
<td></td>
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</tr>
<tr>
<td>Hefei</td>
<td>7805</td>
<td>JAC</td>
<td></td>
</tr>
<tr>
<td>Wuhu</td>
<td>7413</td>
<td>Chery</td>
<td></td>
</tr>
</tbody>
</table>

* City with plate restriction

Bar chart showing sales for BEVs and PHEVs in the top 10 cities.
PEV MARKET DEVELOPMENT IN USA & CALIFORNIA
US PEV sales were flat in 2015, but pick up in 2016, and jumped in Dec. 2016, with steady growth 1\textsuperscript{st} Quarter 2017
US PEV Sales first four months 2017: solid sales all around, could hit 200,000 this year if Dec strong.
PEVs are almost 1% of registrations; what % of VMT?

Source: EVvolumes.com

California is about 10-12% of total vehicle sales in USA, is almost 50% of total US PEV sales & fleet.
California almost 5% in this quarter, 8 states are at 1-2%, the rest of US at about .5%
PHEV & BEV combined passed HEV 91% increase in 1st quarter 2017 over 1st Quarter 2016 - source CNCDA /
World electric vehicle capitals

Analyzed at metro area level, 2015.

Source: Hall, D., Moultak, M., Lutsey, N. (2017). Electric vehicle capitals of the world: Demonstrating the path to electric drive.

http://www.theicct.org/EV-capitals-of-the-world