Accelerating Climate Action
From the Demand-Side: Transportation

by

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Presented at
andlinger center
for energy+the environment

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EV Sales to Consumers

U.S. Plug-In Car Sales

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


Princeton University

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## EV Sales to Consumers

### 2018 Monthly Sales Chart

<table>
<thead>
<tr>
<th>2018 U.S. EV SALES</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tesla Model 3*</td>
<td>1875</td>
<td>2485</td>
<td>3820</td>
<td>3750</td>
<td>6000</td>
<td>5902</td>
<td>14250</td>
<td>17800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toyota Prius Prime</td>
<td>1496</td>
<td>2050</td>
<td>2922</td>
<td>2626</td>
<td>2924</td>
<td>2237</td>
<td>1984</td>
<td>2071</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tesla Model S*</td>
<td>800</td>
<td>1125</td>
<td>3375</td>
<td>1250</td>
<td>1520</td>
<td>2750</td>
<td>1200</td>
<td>2625</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tesla Model X*</td>
<td>700</td>
<td>975</td>
<td>2825</td>
<td>1025</td>
<td>1450</td>
<td>2550</td>
<td>1325</td>
<td>2750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chevrolet Volt*</td>
<td>713</td>
<td>983</td>
<td>1782</td>
<td>1325</td>
<td>1675</td>
<td>1336</td>
<td>1475</td>
<td>1825</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chevrolet Bolt EV*</td>
<td>1177</td>
<td>1424</td>
<td>1774</td>
<td>1275</td>
<td>1125</td>
<td>1083</td>
<td>1175</td>
<td>1225</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2017 US Sales ~ 200,000 compared to 17M light duty vehicles (~1%)

2017 World Sales ~ 1,000,000 compared to 95M light duty vehicles (~1%)
Energy Flow US

Estimated U.S. Energy Consumption in 2017: 97.7 Quads
The Problem
Sacred Cows & Untouchables

- Gas Tax
- Carbon Tax
- Transit
- Ride Share
- Automation
When will aTaxis be more than a Novelty ???

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ITS America 2018
June 5, 2018
Detroit, MI
Have You Noticed???
Google/Waymo’s Buying Spree

Google/Waymo Purchase of Driverless Cars

<table>
<thead>
<tr>
<th>Year</th>
<th>Cars “Purchased”</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1</td>
</tr>
</tbody>
</table>

2009
Have You Noticed???

Google/Waymo’s Buying Spree

Google/Waymo Purchase of Driverless Cars

Cars “Purchased”

2009

2012
Have You Noticed???

Google/Waymo’s Buying Spree

Google/Waymo Purchase of Driverless Cars

Year

Cars “Purchased”

2009

2012

2014-5
Have You Noticed???

Google/Waymo’s Buying Spree

Google/Waymo Purchase of Driverless Cars

Year

2008 2012 2017 2021 2025

Cars “Purchased”

2009 2012 2015 2017
Have You Noticed???

Google/Waymo’s Buying Spree

Google/Waymo Purchase of Driverless Cars

Cars “Purchased”

Year

2009  2012  2015  2017  2018.2
Have You Noticed???

Google/Waymo’s Buying Spree

Google/Waymo Purchase of Driverless Cars

> 10X every 2 years (Waymo’s Kornhauser Law)

2009

2012

2015

2017

2018.2

2018.5
WHAT WILL WAYMO DO WITH 20,000 JAGUARS?

YOU CAN'T EAT THEM!

+ 60,000 Chrysler Minivans
What will Waymo do with 20,000 Jaguars?

Welcome to my studio apartment!

Provide housing for the homeless in San Francisco?

+ 60,000 Chrysler Minivans
Where will Waymo Deploy 20,000 + 60,000 autonomous Taxis

• Maybe they’ll “Geographically Market Test the aTaxi Mobility Experience”
  – Start by operating 1K in 20 different “cities”
    • Geo-fenced “communities of ~ 300,000” (serve 5% of personTrips)
    – Add 2K to 1st 20 (grow to 15% personTrip share) + 1K in 20 more “Communities of 300k
Where will Waymo Deploy 20,000 + 60,000 autonomous Taxis

• Maybe they’ll “Spread the Mobility Experience”
  – operate 1K in 20 different “cities”

• How about “Central New Jersey”?
  – Microcosm of USA

• Pop: ~300K

• Intra-area Trips/day: ~ 1.0M/day

• 1K aTaxis would serve ~ 5% personTrips
  – Focused initially on Mobility Disadvantaged
    • whose quality-of-life would be improved substantially!
      Provide mobility to the 90% of trips not served by walking, biking or Conventional Mass Transit.