<table>
<thead>
<tr>
<th><strong>Docketed</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Docket Number:</strong></td>
</tr>
<tr>
<td><strong>Project Title:</strong></td>
</tr>
<tr>
<td><strong>TN #:</strong></td>
</tr>
<tr>
<td><strong>Document Title:</strong></td>
</tr>
<tr>
<td><strong>Description:</strong></td>
</tr>
<tr>
<td><strong>Filer:</strong></td>
</tr>
<tr>
<td><strong>Organization:</strong></td>
</tr>
<tr>
<td><strong>Submitter Role:</strong></td>
</tr>
<tr>
<td><strong>Submission Date:</strong></td>
</tr>
<tr>
<td><strong>Docketed Date:</strong></td>
</tr>
</tbody>
</table>
Publicly Owned Utilities & Transportation Electrification

California Energy Commission
Lead Commissioner Workshop

Oct 5, 2016

Philip Sheehy,
Technical Director
Agenda

- Review California Transportation Electrification Assessment
- Notes from the Ground
- Questions
California Transportation Electrification Assessment

Brief Overview of Findings
Overview

- **Who:** ICF + E3 (Phase 2) + EPRI (Phase 3)
- **Client:** California Transportation Electrification Coalition
- **Engaged Stakeholders:** PG&E, SCE, SDG&E, SMUD, City of Palo Alto, LADWP, and CMUA members
- **What:** Market Sizing & Cost/Benefit (Phase 1) and Grid Impacts (Phase 2)
  - Market Sizing: What does the market look like out to 2030? (18 segments covered)
  - Cost/Benefit: What are the costs and benefits of transportation electrification?
  - Grid Impacts: Is there a case for utility investment in infrastructure?
Market Sizing

RANGE OF PEV ADOPTION SCENARIOS CONSIDERED

- **Forecated Cumulative PEVs in California**
- **Year**
- **ZEV x3**
- **ZEV, 50% FCVs**
- **ZEV Most Likely Compliance**

Publicly Owned Utilities & Transportation Electrification
RANGE OF ADOPTION FOR ZEVS

Benefits

AGGRESSIVE ADOPTION BY 2030

- **Ports**: 910 GWh
- **MD/HD PEVs & Non-Road**: 10,600 GWh
- **LD PEVs**: 16,700 GWh

GHG Emission Reductions (MMT/yr)

Criteria Air Pollutant Reductions (tons / day)
**Grid Impacts**

### Vehicle Forecast

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>VMT</th>
<th>eVMT</th>
<th>Energy Consumption (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td>Annual</td>
<td>Daily</td>
</tr>
<tr>
<td>Res</td>
<td>41.0</td>
<td>14,965</td>
<td>10.0</td>
</tr>
<tr>
<td>NonRes</td>
<td>20.0</td>
<td>7,300</td>
<td>5.6</td>
</tr>
<tr>
<td>Total</td>
<td>30.6</td>
<td>11,169</td>
<td>8.6</td>
</tr>
<tr>
<td>BEV</td>
<td>29.5</td>
<td>10,768</td>
<td>8.3</td>
</tr>
</tbody>
</table>

Developed modification for each scenario whereby the eVMT for each PEV-type is increase by one mile per day per year, not to exceed 39 daily VMT. Additional charging is assumed to happen on commercial circuits.

### Load Shapes

- L1 Home
- L2 Home
- L2 Non-Residential
- Non-TOU Home

### Energy Consumption

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>VMT</th>
<th>eVMT</th>
<th>Energy Consumption (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td>Annual</td>
<td>Daily</td>
</tr>
<tr>
<td>Res</td>
<td>10.0</td>
<td>3,650</td>
<td>2.8</td>
</tr>
<tr>
<td>NonRes</td>
<td>20.0</td>
<td>7,300</td>
<td>5.6</td>
</tr>
<tr>
<td>Total</td>
<td>30.6</td>
<td>11,169</td>
<td>8.6</td>
</tr>
<tr>
<td>BEV</td>
<td>29.5</td>
<td>10,768</td>
<td>8.3</td>
</tr>
</tbody>
</table>

Developed modification for each scenario whereby the eVMT for each PEV-type is increase by one mile per day per year, not to exceed 39 daily VMT. Additional charging is assumed to happen on commercial circuits.
Grid Impacts (ctd)

**KEY FINDINGS**

- PEV provide environmental and societal benefits
- PEVs will reduce rates for all customers
- PEVs pass CARB and CPUC cost-effectiveness tests

**LOAD BENEFITS TO RATEPAYERS**

```
Levelized $/Vehicle

$1,000 $2,000 $3,000 $4,000 $5,000 $6,000 $7,000 $8,000 $9,000

Revenue

Cost

Net Revenue
Rate Base
RPS Cost
Carbon Cost
Capacity Cost
Energy Cost
Utility Bills

$2,267
```

**DISTRIBUTION UPGRADE COSTS**

```
PV ($Billion)

$0.1 $0.2 $0.3 $0.4 $0.5

Flat
$0.38

Mixed
$0.24

TOU
$0.14
```
Where to Jump In?

Some Thoughts from the Ground
Apart from the shameless plug, this slide is more of a disclaimer: The views expressed are ICF’s alone; further, they are neither reflective of any single engagement nor should they be misconstrued to represent those of an agency listed above.
Charging / Driving Behavior

- How and where are people charging their vehicles?
  - Considerable variation across vehicle architectures
- PHEV owners are driving their vehicles just as much as other vehicle owners are driving their conventional vehicles
- BEV owners with range of 80-100 miles drive their vehicles less than other vehicle owners.

<table>
<thead>
<tr>
<th>Annual Mileage</th>
<th>electricity</th>
<th>gasoline</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEV, 80-100 mi</td>
<td>10,000 mi</td>
<td>3,500 kWh</td>
</tr>
<tr>
<td>BEV, 150+ mi</td>
<td>12,000 mi</td>
<td>4,200 kWh</td>
</tr>
<tr>
<td>PHEV20</td>
<td>12,000 mi</td>
<td>1,400 kWh</td>
</tr>
<tr>
<td>PHEV40</td>
<td>12,000 mi</td>
<td>3,150 kWh</td>
</tr>
</tbody>
</table>
Review of Core Elements of Readiness Planning

- Stakeholder Training/Education
- Building Codes
- Planning & Land Use
- Permitting & Inspection
- Incentives
- Consumer Awareness
- Consumer Behavior

Publicly Owned Utilities & Transportation Electrification
Review of Core Elements of Readiness Planning

- Stakeholder Training/Education
- Building Codes
- Planning & Land Use
- Permitting & Inspection
- Consumer Awareness
- Incentives
- Consumer Behavior

Publicly Owned Utilities & Transportation Electrification
What are the Real Challenges Facing the Market?

<table>
<thead>
<tr>
<th>Vehicle Type?</th>
<th>Level of Charging?</th>
<th>Impact on Adoption?</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHEV</td>
<td>L2</td>
<td></td>
</tr>
<tr>
<td>BEV</td>
<td>L2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DCFC</td>
<td></td>
</tr>
</tbody>
</table>

Publicly Owned Utilities & Transportation Electrification
What are the Real Challenges Facing the Market?

Vehicle Type?
- PHEV
- BEV

Level of Charging?
- L2
- DCFC

Impact on Adoption?
Thinking beyond accelerating adoption

PHEV20
- Annual Consumption: 1,400 kWh

PHEV40
- Annual Consumption: 3,150 kWh

BEV
- Annual Consumption: 3,500 kWh
- BEV, 80-100 mi
Thinking beyond accelerating adoption

Utility intervention

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Average Range</th>
<th>Annual Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHEV20</td>
<td>80-100 mi</td>
<td>1,400 kWh, 3,000 kWh</td>
</tr>
<tr>
<td>PHEV40</td>
<td>80-100 mi</td>
<td>3,150 kWh, 4,000 kWh</td>
</tr>
<tr>
<td>BEV</td>
<td>80-100 mi</td>
<td>3,500 kWh, 4,200 kWh</td>
</tr>
</tbody>
</table>

Publicly Owned Utilities & Transportation Electrification
Thank you

Philip Sheehy
Philip.Sheehy@icf.com
415-677-7139