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<tr>
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<td><strong>Document Title:</strong></td>
<td>Presentation - Transportation Electrification Common Assumptions (For Integrated Resource Planning Submittals)</td>
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<tr>
<td><strong>Description:</strong></td>
<td>Presentation by Gary Yowell for SB 350 Transportation Electrification Webinar May 31, 2017. Presentation outlines staff developed tool to help utilities with EV assumptions.</td>
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<tr>
<td><strong>Filer:</strong></td>
<td>Ryan Eggers</td>
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<td><strong>Organization:</strong></td>
<td>California Energy Commission</td>
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Transportation Electrification Common Assumptions
(For Integrated Resource Planning Submittals)
A CEC Effort in Consultation with ARB & CPUC

Webinar

May 31, 2017

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Energy Assessments Division
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Outline

• Introduction
• Overview – explain process, underlying State’s common assumptions, and results
• Demonstration – walk through spread sheet
• Questions/Answers – throughout discussion
Overview & Purpose

• Energy Commission effort in consultation with Air Resources Board and CPUC participation
• Most up-to-date assumptions from both agencies
• Help utilities quantify transportation electrification results faster and easier with more realistic results
• Help CEC/CPUC evaluate utility submittals with greater confidence in results
Inputs (Common Assumptions Utilities’ Assumptions)

- Past PEV & Future PEV Populations
- MPG Past and Future (Two Choice Future)
- Vehicle Miles Traveled (VMT) / PEV type
- Vehicle Survival Rates
- $\text{CO}_2 \text{e}$ Gasoline Carbon Intensity 2015-2030
- $\text{CO}_2$ of Generation for PEVs 2015-2030
- $\text{NO}_x$ and PM$_{2.5}$ of Generation for PEVs
- Future Composition of Electric Vehicle Fleet
State’s Common Assumptions

1. Vehicle Survival Rate (DMV)
2. Vehicle Annual Mileage and Decay (BAR – Smog Check)
3. Displaced Gasoline Vehicle Fuel Economy (EPA/DMV)
4. Gasoline GHG/gallon over time (ARB Vision)
5. Electric Vehicle Energy Efficiency (EPA/DMV)
6. PEV Location / Utility Service Territory (DMV/Utility Service ZIP-Codes)
Vehicle Survival Estimated by CARB, (CA DMV Registration Based)
Vehicle Miles Traveled Per Year (BAR Smog Check Program)

Annually Bureau of Automotive Repair (BAR) Samples 4-5 Million Vehicles
Analysis Uses On-Road Adjusted Fuel Economy Values
Range of Fuel Economy Projections

Car Fuel Economy Estimates

On-Road Fuel Economy Estimates (MPG)


ARB EMFAC

CEC Estimate

Regulatory Fuel Economy Estimates (MPG)
CEC/ARB have different DMV counts, CEC adds 15% higher energy use, AC/heater use – not captured in official testing. ARB most accurate laboratory results.
Vehicle Emissions – ARB Vision

Graph showing the trend of NOx and PM emissions over time from 2010 to 2030.
Gasoline GHG Emission - ARB Vision

Gasoline Greenhouse Gas

Gasoline (CO2e/Million Gallons)

FYI: BEV and PHEVs Market Share of New Vehicle Sales

88% of sales are conventional gasoline & FFVs

- Hybrid, 5.3%
- PHEVs & BEVs, 2.5%
- Diesel, 2.5%
- BEVs, 1.5%
FYI: PEVs Total Population Growth

California's Light Duty Vehicle Populations from Technologies First Commercial Introductions

- **Flexible Fueled Vehicles** (1992-2015)
- **Hybrids** 3-year avg growth 70K/year (2000-2015)
- **Light Duty Diesels** (1984-2015) 3-year avg, 69K/year
- **Electric Vehicles** (1996-2015) New generation EVs start on the 16th year with ≈ $10K/vehicle governmental incentives
- **5% New Vehicle Sales Growth Rate**
- **Advanced Diesels** (2000-2015)
- **Compressed Natural Gas** (1992-2015)
- **Plug Ins** (2010-2015)
- **Fuel Cell Vehicles**

Source: Energy Analysis Office, DMV Registrations 2000-2014
Heavy Duty Electric Vehicles

Work In Progress
## Heavy Duty Electric Vehicles Critical Energy Factors – Unresolved

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<th>Electric (MPG)</th>
<th>Electric (Kwh/mi)</th>
<th>EER (TTW)</th>
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NOx Emissions Are Strongly Related to Fuel Economy, Old Technology Example

2008-2009 MY Diesel Engines NOx vs Fuel Economy and Example of 2010 Projected Emissions

- 2008-09 MY Lab Measured NOx
- Exponential-Regressed Predicted NOx from Lab

61 tests, 17 drive cycles, Cummins ISL 280H, 330 H

1.25 g NOx Engines
Newer 2010 NOx Rates Were Estimated Three ways

2008-09 diesel NOx standard was 1.25 g/bhp-Hr
2010 standard is 0.2 g/bhp-Hr, 84% lower.
1) Projected NOx @ 0.2 uses 84% of the Exponential regressed line.
2) Altoona Chassis test results are plotted and in general agreement with #1.
3) Next Slide
2015+ NOx Emission Rates Used – Unresolved

Recommend Using Low to Lowes Values
The End

Gary Yowell