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<td><strong>Project Title:</strong></td>
<td>Transportation Energy Demand Forecast</td>
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<td><strong>TN #:</strong></td>
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<td><strong>Document Title:</strong></td>
<td>Transportation Energy Demand Forecast, 2017-2030</td>
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<tr>
<td><strong>Description:</strong></td>
<td>*** THIS DOCUMENT SUPERSEDES TN 218915 *** - UPDATED CEC STAFF PRESENTATION</td>
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<tr>
<td><strong>Filer:</strong></td>
<td>Raquel Kravitz</td>
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<td><strong>Organization:</strong></td>
<td>California Energy Commission</td>
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<tr>
<td><strong>Submitter Role:</strong></td>
<td>Commission Staff</td>
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<td><strong>Submission Date:</strong></td>
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<td><strong>Docketed Date:</strong></td>
<td>6/20/2017</td>
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Transportation Energy Demand Forecast, 2017-2030

IEPR Commissioner Workshop on the Preliminary Transportation Energy Demand Forecast

June 20, 2017
Transportation Energy Forecasting Unit
Demand Analysis Office
Energy Assessments Division
Transportation Forecast Schedule

- Public comments due – July 5, 2017
- Transportation energy supply workshop – July 6, 2017
- Electricity demand forecast workshop – Aug 4, 2017
- Natural gas outlook workshop – Sept 20, 2017
- Revised transportation forecast – Nov 2017
- Staff report – Nov 2017
Key Takeaways

• Declining gasoline demand
• Increasing alternate fuel vehicles
• Increasing electrification of vehicles, especially light-duty vehicles
California Energy Commission

Transportation Models
Key Inputs & Outputs

- Economic/Demographic Forecasts & Other Data
- 2015 Vehicle Population (from California DMV)
- Crude Oil Price Forecast (from U.S. EIA)
- Regulations
  Corporate Avg. Fuel Economy
  California ZEV Program
- Vehicle Attributes (forecast)
- 2016 California Vehicle Survey

Transportation Energy Demand Models

- Transportation Energy Demand
- California Vehicle Population (forecast)
TRANSPORTATION FUEL DEMAND FORECAST
Components of Fuel Demand Section

- Transportation Demand Cases
- Fuel Costs
  - Crude Energy Price
  - Energy Costs and Costs per Mile
  - Trends in Fuel Prices
- Fuel Demand
  - Conventional Fuels (Gasoline, Diesel, Jet Fuel)
  - Alternative Fuels (Electricity, Natural Gas, Hydrogen, E85)
  - High-Speed Rail
Transportation Demand Cases

Cases represent different levels of transportation electricity demand

- Transportation Demand Cases
  - High Electricity Demand (High Case)
    - Inputs selected to represent high level of electricity demand
  - Mid Electricity Demand (Mid Case)
  - Low Electricity Demand (Low Case)
    - Inputs selected to represent low level of electricity demand

- Inputs
  - Income, population, fuel prices
Oil Prices Remain Low in the Near Term

Historical and Projected Brent Crude Oil Prices

Note: Spot prices are in nominal dollars per barrel; projections are in 2015 dollars per barrel.

Source: Energy Information Administration (Historical), California Energy Commission (Projected)
Trends in Fuel Cost per Mile

• For Light Duty Vehicles
  – Electricity is projected to have the lowest cost per mile among fuel types
  – Hydrogen fuel costs are projected to decrease over the forecast period

• For Medium Duty Trucks
  – Electricity fuel cost per mile remains relatively flat and offers the lowest cost per mile among fuel types

• For Medium Heavy Duty Trucks
  – Diesel-Electric Hybrid is the fuel type with the lowest cost per mile
  – Natural gas has marginal fuel cost advantage over diesel
Fuel Cost per Mile Trends in Light-Duty Vehicles
Midsize Cars, Mid Case

Source: California Energy Commission
California Energy Commission

Fuel Cost per Mile Trends in Medium Duty (GVWR 4 to 6) Trucks

Mid Case

Dollars per Mile ($2015)


Gasoline Diesel Natural Gas Diesel-Electric Hybrid Battery Electric

Source: California Energy Commission
California Energy Commission

Fuel Cost per Mile Trends
All New Light-Heavy (GVWR 7) and Straight Heavy-Heavy (GVWR 8) Duty, Mid Case

Source: California Energy Commission
Sustained Drop in Gasoline Demand
Projected Conventional Fuel Demand, Mid Case

Source: California Energy Commission
Projected Alternative Fuel Consumption
Mid Case, All Vehicles and Modes Excluding High-Speed Rail

‐

![Graph showing projected alternative fuel consumption from 2017 to 2030.](image)

Source: California Energy Commission
Projected High-Speed Rail Electricity Consumption

Source: California High-Speed Rail Authority
Components of Vehicle Stock Section

• Inputs
  – Economic and Demographic Data
  – Vehicle Attributes
  – Consumer Preferences

• Outputs
  – Light-Duty Stock and Fuel Economy Forecasts
  – Medium- and Heavy-Duty Stock Forecast

• Takeaways
Light-Duty Vehicle Population Grows with Population and Economy

Source: California Energy Commission
Transportation Models
Key Inputs & Outputs

- Economic/Demographic Forecasts & Other Data
- 2015 Vehicle Population (from California DMV)
- CA Transportation Energy Price Forecasts
- Crude Oil Price Forecast (from U.S. EIA)
- Regulations
  Corporate Avg. Fuel Economy
  California ZEV Program
- Vehicle Attributes (forecast)
- 2016 California Vehicle Survey

Transportation Energy Demand Models

- Transportation Energy Demand
- California Vehicle Population (forecast)
Vehicle Attributes Inform CEC Forecasts of New Vehicle Sales

- Attributes used in “vehicle choice” decisions
- Account for regulatory requirements
- Base year and projections through 2030
- Light-duty vehicle attributes
  - Range
  - Retail Price
  - Fuel Economy
  - Acceleration
  - # of Makes / Models
  - Refueling Time
  - Maintenance Costs
  - Cargo Capacity
## Consumer Attribute Preference Changes Since 2013

*Based on California Vehicle Surveys 2013 & 2016 Conducted by CEC*

<table>
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<tr>
<th>Residential</th>
<th>Commercial</th>
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<tbody>
<tr>
<td>Lower preference for vehicle price</td>
<td>Vehicle price continues as most significant attribute</td>
</tr>
<tr>
<td>Higher preference for vehicle range</td>
<td>Higher preference for vehicle range</td>
</tr>
<tr>
<td>Higher preferences for tax credit and rebate; lower for HOV lane access</td>
<td>HOV lane and Tax credits both significant</td>
</tr>
<tr>
<td>Lower preference for fuel economy</td>
<td>Lower preference for fuel economy</td>
</tr>
<tr>
<td></td>
<td>Higher preference for acceleration</td>
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Alternative Fuel Vehicle Share of Light-Duty Market Increases Throughout Forecast

Light-Duty Vehicle Population Share by Fuel Type, Mid Case

Source: California Energy Commission
Closer Look at Alternative Fuel Vehicle Share of Throughout Forecast
Light-Duty Vehicle Population Share by Fuel Type, Mid Case

Source: California Energy Commission
ZEVs Increase New Vehicle Sales Share with Price/Range Competitiveness

Light-Duty Vehicle Sales by Fuel Type, Mid Case

Source: California Energy Commission
Closer Look at ZEV New Vehicle Sales Share Throughout Forecast

Light-Duty Vehicle Sales by Fuel Type, Mid Case

Source: California Energy Commission
Fuel Economy of New Light-Duty Vehicles Increases
Sales-weighted Average Light-Duty Vehicle Fuel Economy, All Fuel Types

Source: United States Environmental Protection Agency, California Energy Commission
Alternative Fuel Truck Share Increases
New Medium Duty (GVWR 4 to 6) Truck Sales by Fuel Type, Mid Case

Source: California Energy Commission
Alternative Fuel Truck Share Increases
New Light-Heavy (GVWR 7) and Straight Heavy-Heavy (GVWR 8) Duty Truck Sales
Mid Case

Source: California Energy Commission
ZEV ANALYSIS
Battery Electric Vehicle Range is Forecasted to Grow

- Large swings in range (up or down) are due to introduction of new models.

Source: California Energy Commission
Projected Average Fleet wide BEV Range

Source: California Air Resources Board, California Energy Commission
BEV Prices Decline Over Time
BEV Sales Price, by Class

Source: California Energy Commission
**ZEV On-road Vehicle Stock Continues to Grow**

Cumulative ZEV and PHEV Population

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
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<tbody>
<tr>
<td>CEC (Mid Case)</td>
<td>171,601</td>
<td>~715,000</td>
<td>~1.4 Million</td>
<td>2.0+ Million</td>
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Source: California Air Resources Board, California Energy Commission
Growth Potential for FCEVs
Fuel Cell Vehicles 2017-2030, Mid Case

Source: California Air Resources Board, California Energy Commission
Meeting the ZEV Regulation

• CEC’s Transportation Demand Forecast assesses market demand for ZEVs, and generates a forecast of sales

• By converting forecast of ZEV sales to ZEV credits, staff can check the forecast results for compliance with ARB’s ZEV regulations

• Result: **Forecast projects compliance in all cases**
Residential Charging Primarily Occurs at Home and Overnight

Source: 2016 California Vehicle Survey, conducted by the California Energy Commission
Next Steps

• Incorporate:
  – Stakeholder feedback
  – Updated economic forecast
  – Revised light, medium and heavy-duty vehicle attributes

• Consider time of use electricity rate forecast
• Generate revised forecast
Thank You

For further questions, please contact:

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