

## DOCKETED

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California Energy Commission

# **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

(Dates to be added before workshop)

- Public comments
- Transportation energy supply workshop
- Electricity demand forecast workshop
- Natural gas outlook workshop
- Revised transportation forecast
- Staff report



# Key Takeaways

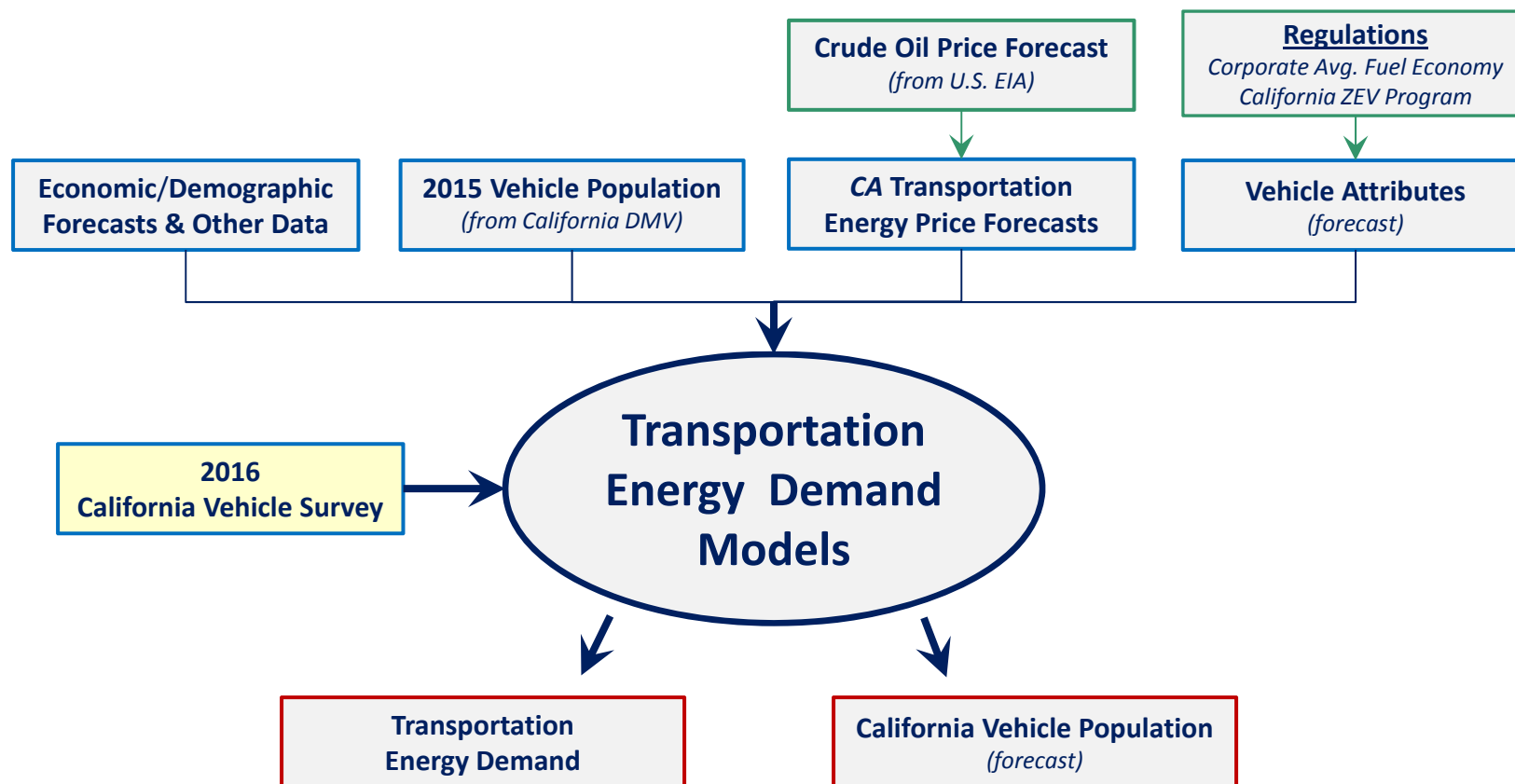
- Declining gasoline demand
- Increasing alternate fuel vehicles
- Increasing electrification of vehicles, especially light-duty vehicles



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# Transportation Models

## Key Inputs & Outputs





# 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

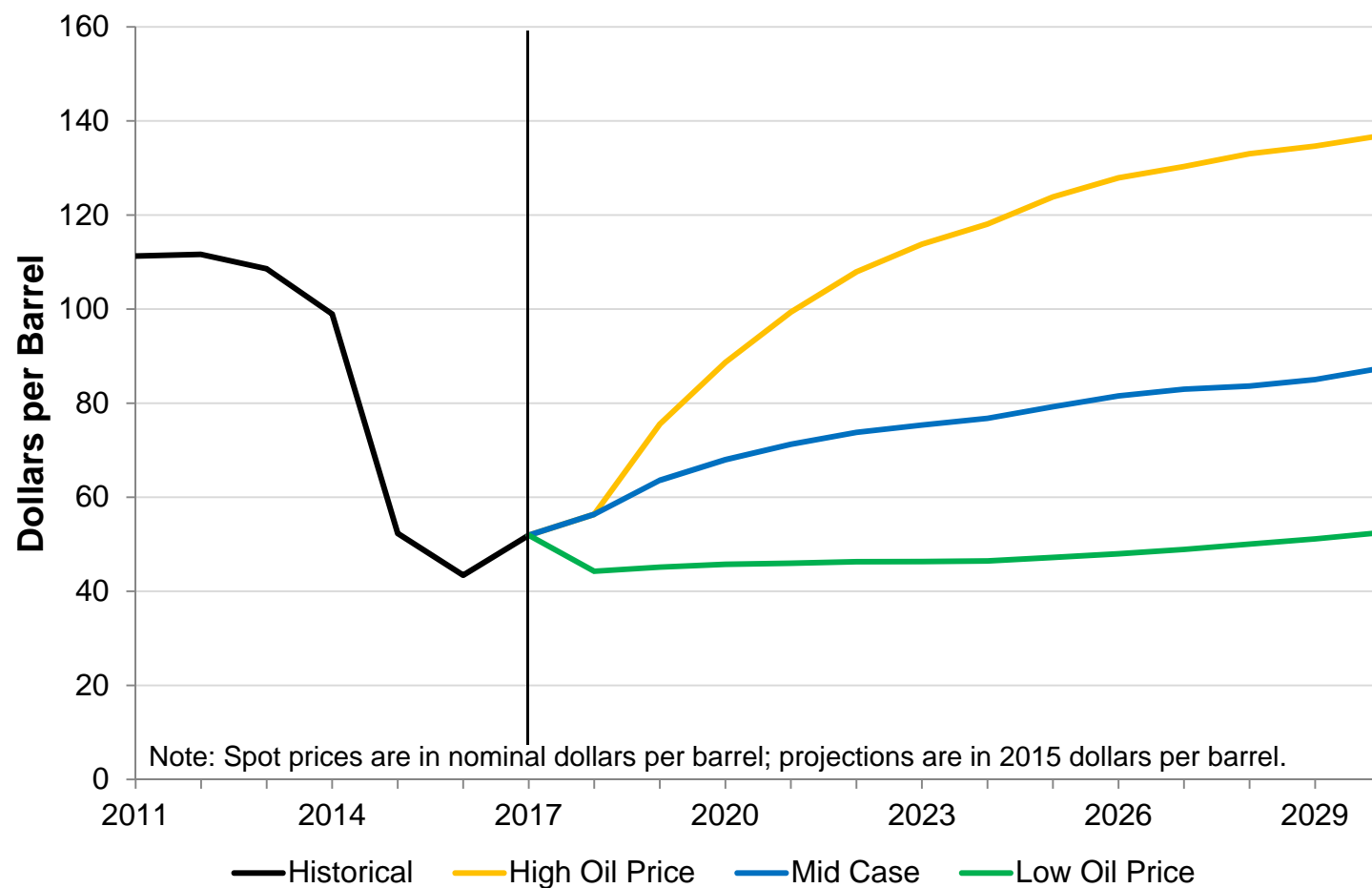




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# Oil Prices Remain Low in the Near Term

### Historical and Projected Brent Crude Oil Prices



Source: Energy Information Administration (Historical), California Energy Commission (Projected)



# Trends in Fuel Prices

- 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

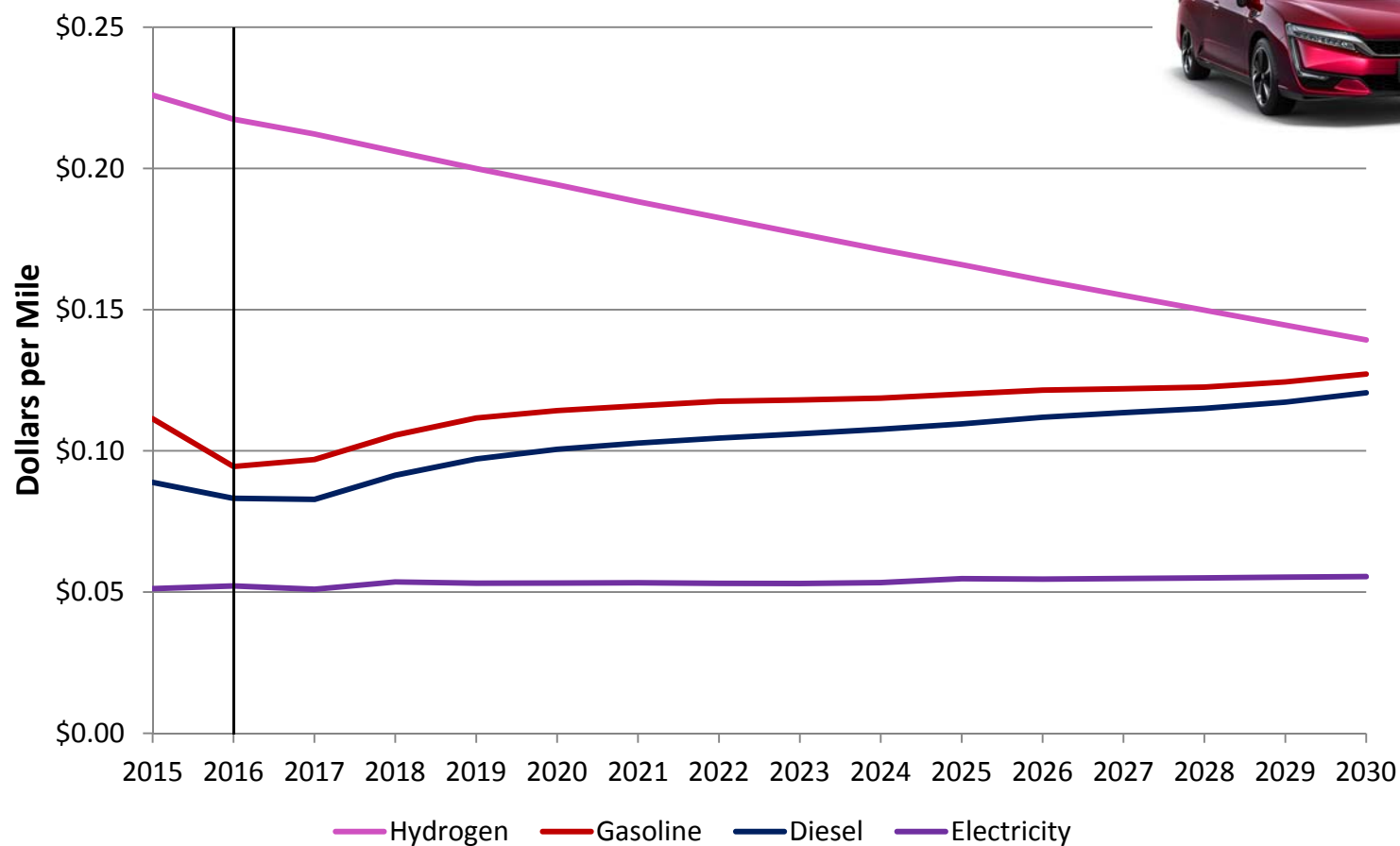




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### Fuel Cost per Mile Trends in Light-Duty Vehicles

Midsize Cars, Mid Case



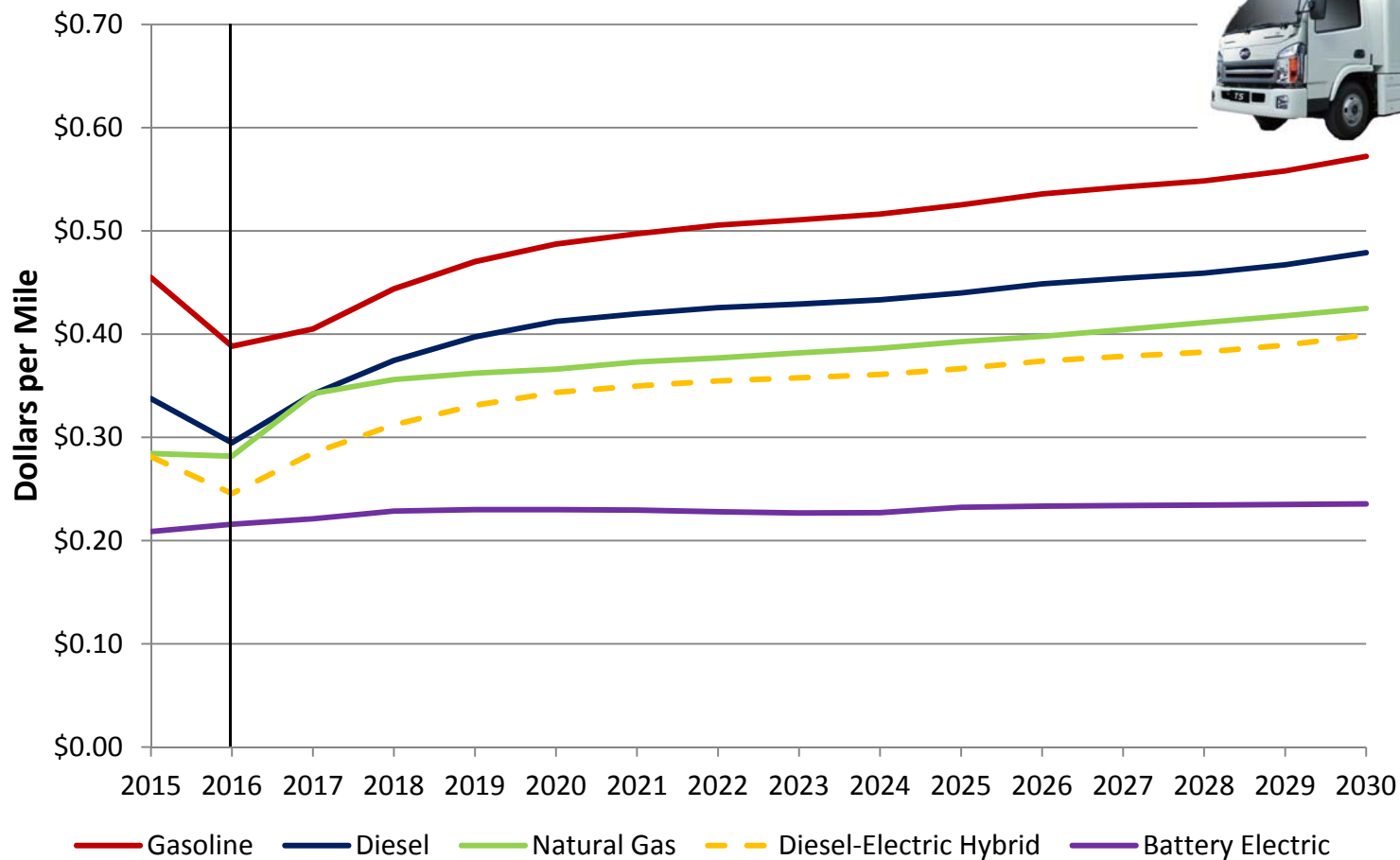
Source: California Energy Commission



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

Mid Case



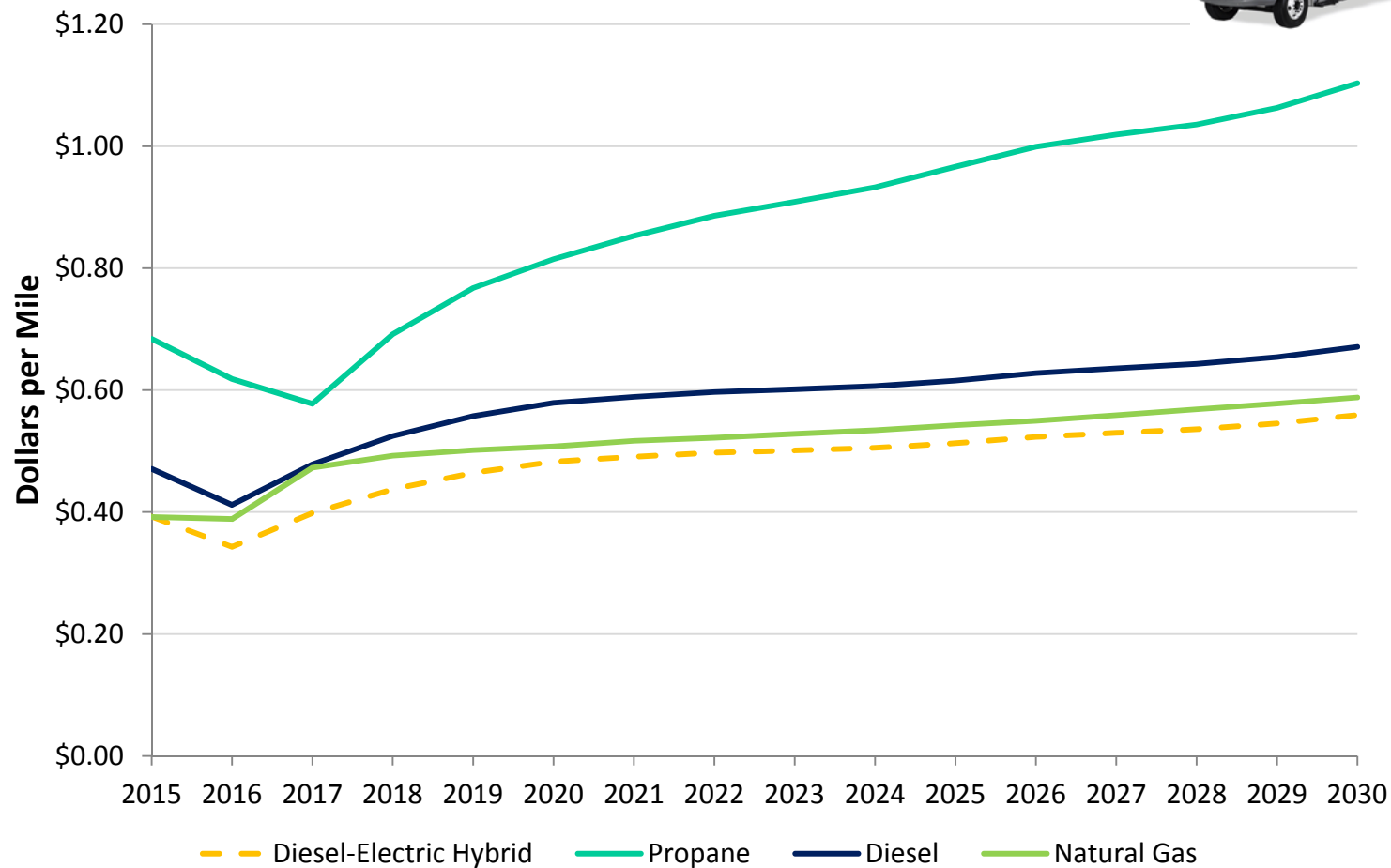
Source: California Energy Commission



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### Fuel Cost per Mile Trends

All New Light-Heavy (GVWR 7) and  
Straight Heavy-Heavy (GVWR 8) Duty, Mid Case



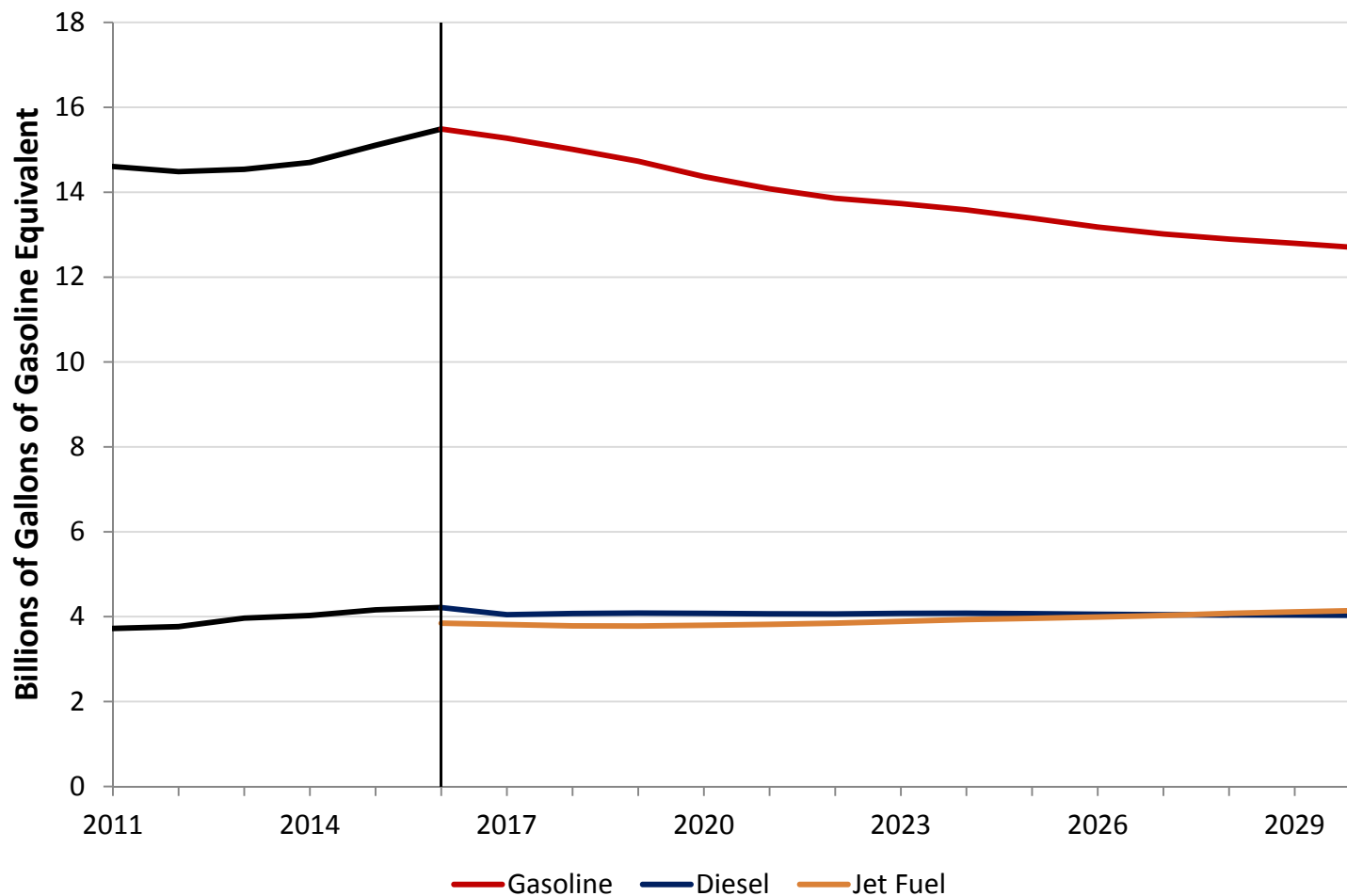
Source: California Energy Commission



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# Sustained Drop in Gasoline Demand

Projected Conventional Fuel Demand, Mid Case



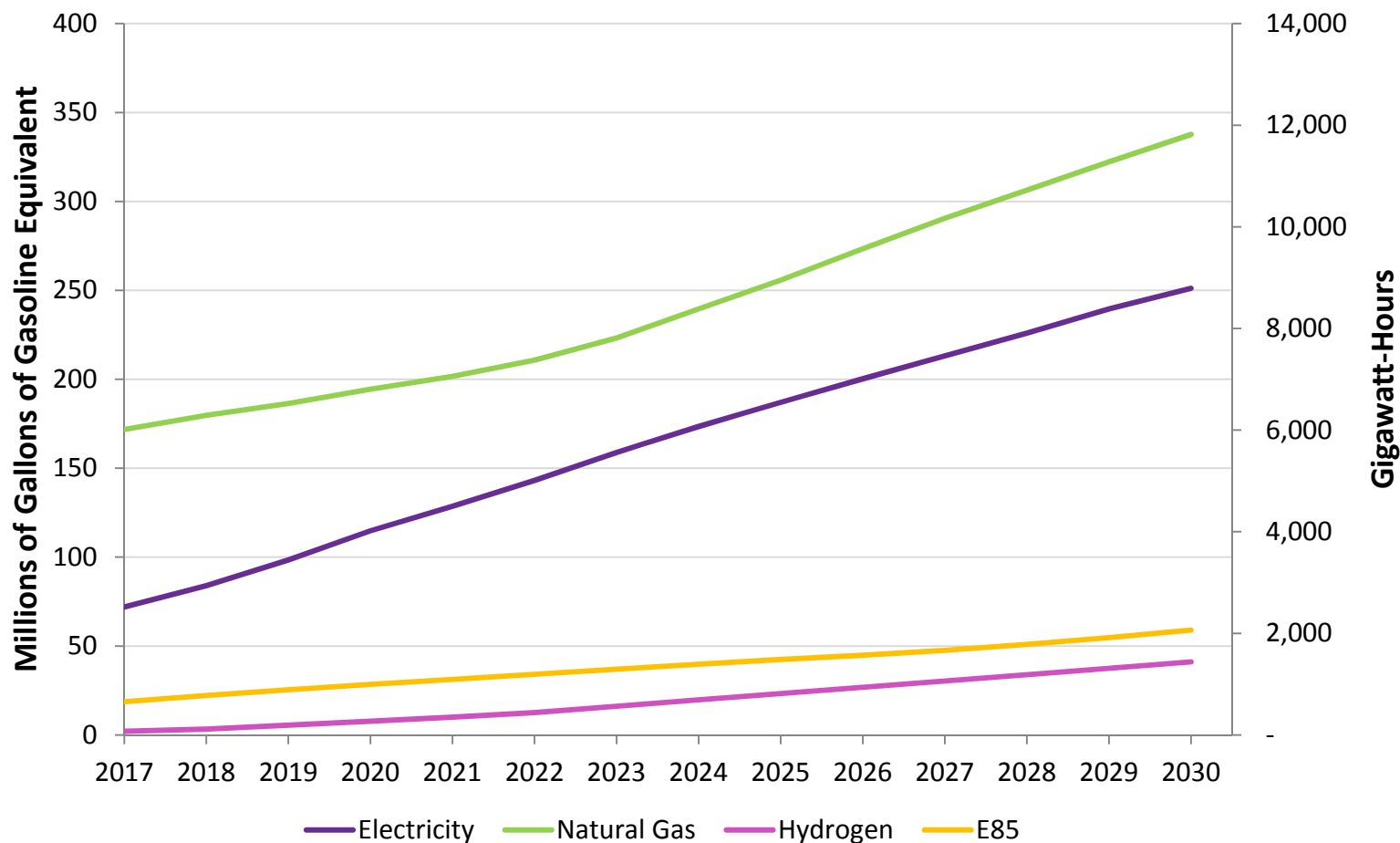
Source: California Energy Commission



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# Projected Alternative Fuel Consumption

Mid Case, All Vehicles and Modes

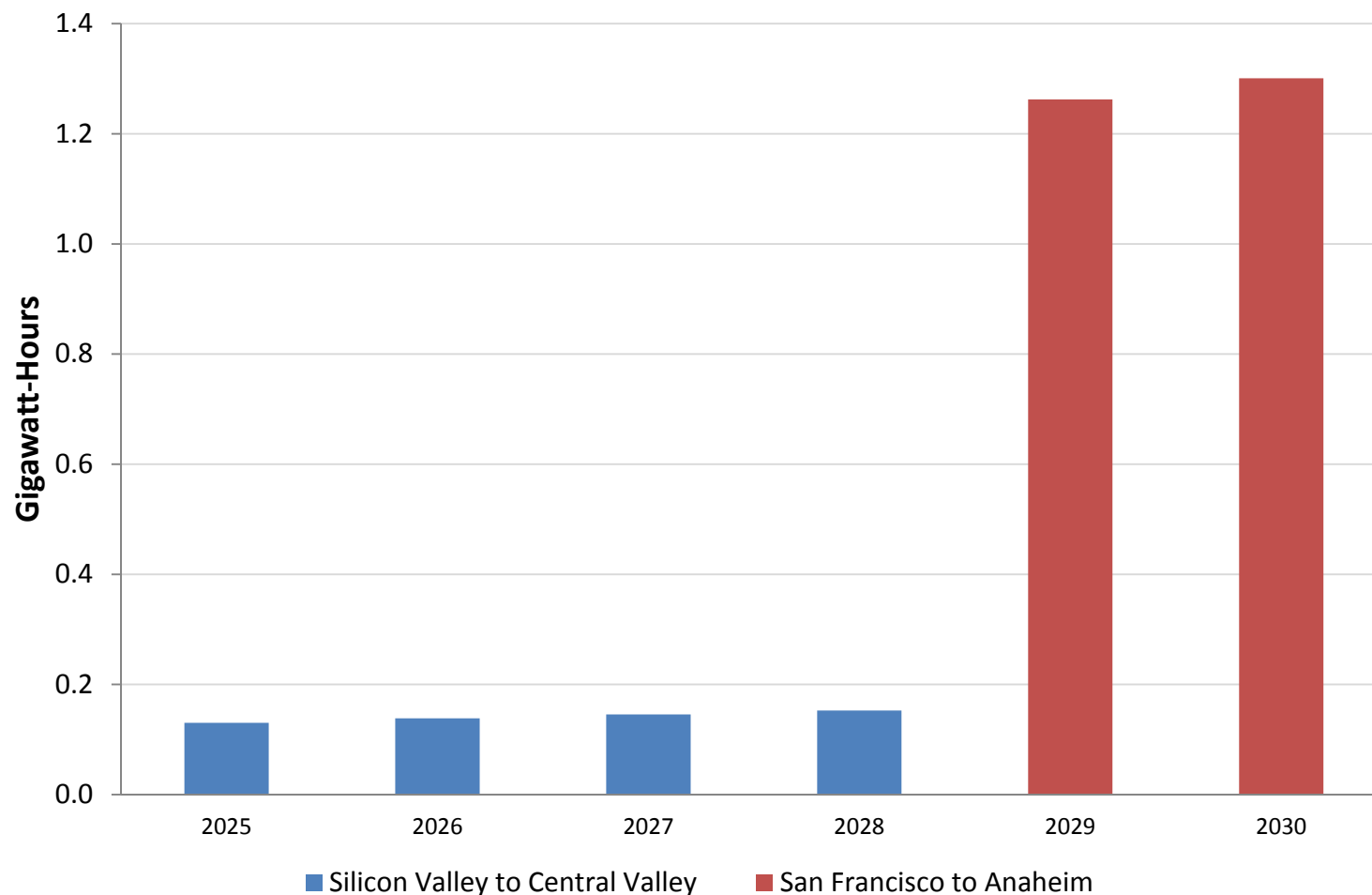


Source: California Energy Commission



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### Projected High-Speed Rail Electricity Consumption



Source: California High-Speed Rail Authority





# VEHICLE SALES FORECAST



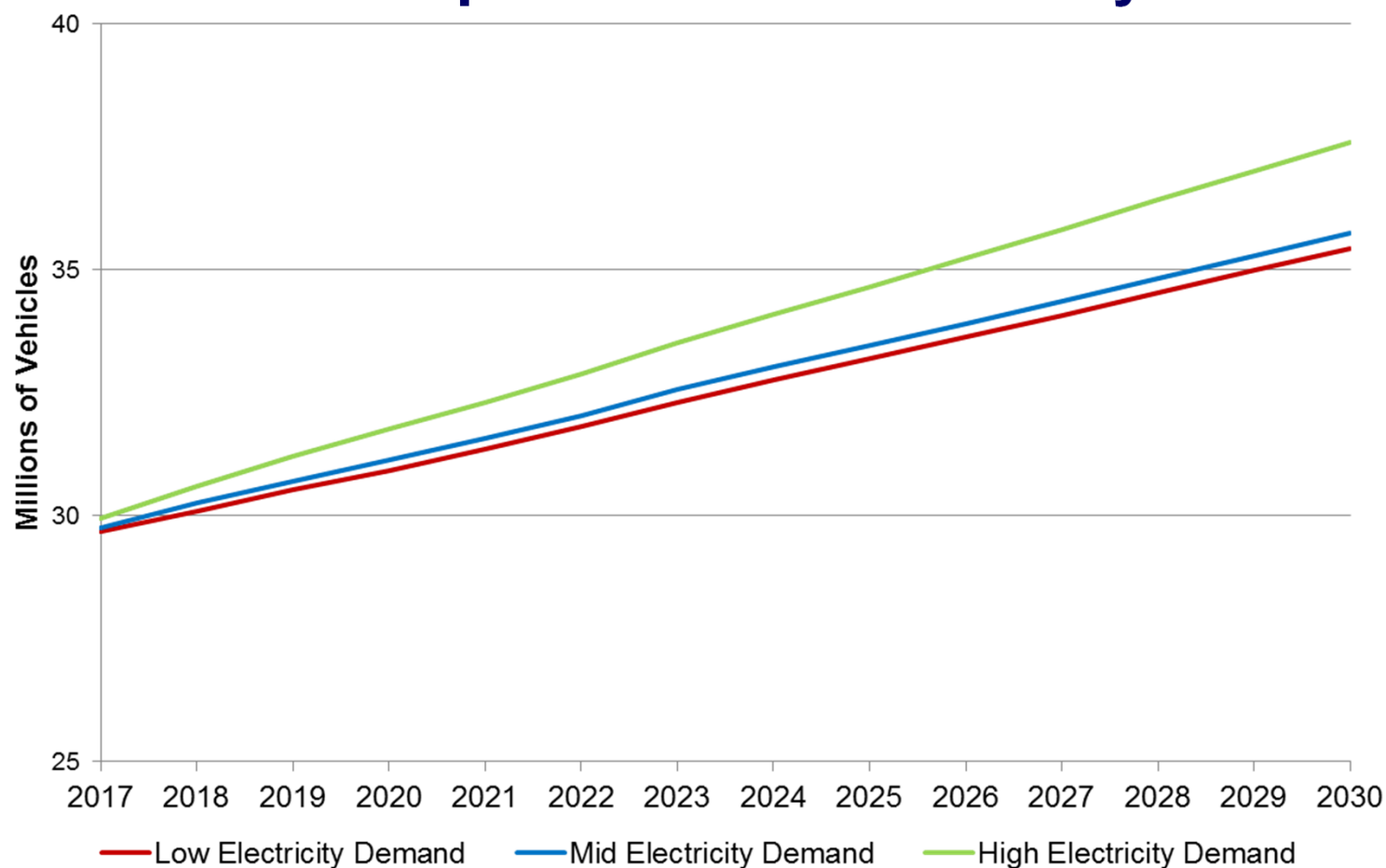
# Components of Vehicle Stock Section

- Inputs
  - Economic and Demographic Data
  - Vehicle Attributes
  - Consumer Preferences
- Outputs
  - Light-Duty Stock and Fuel Economy Forecasts
  - Medium- and Heavy-Duty Stock Forecast
- Takeaways



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### Light-Duty Vehicle Population Grows with Population and Economy



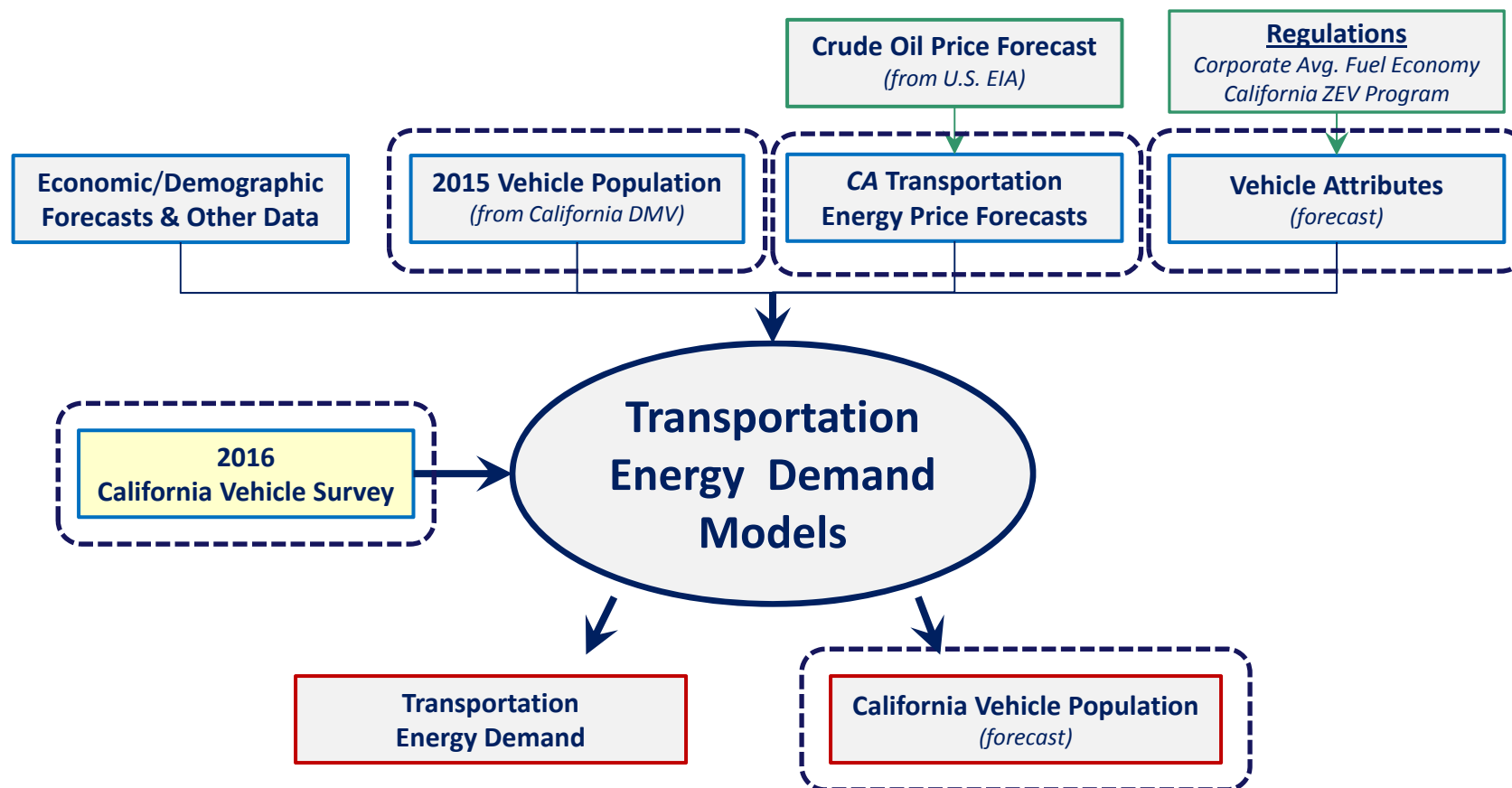
Source: California Energy Commission



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# Transportation Models

## Key Inputs & Outputs





# 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



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### Consumer Attribute Preference Changes Since 2013

(Based on California Vehicle Surveys 2013 & 2016 Conducted by CEC)

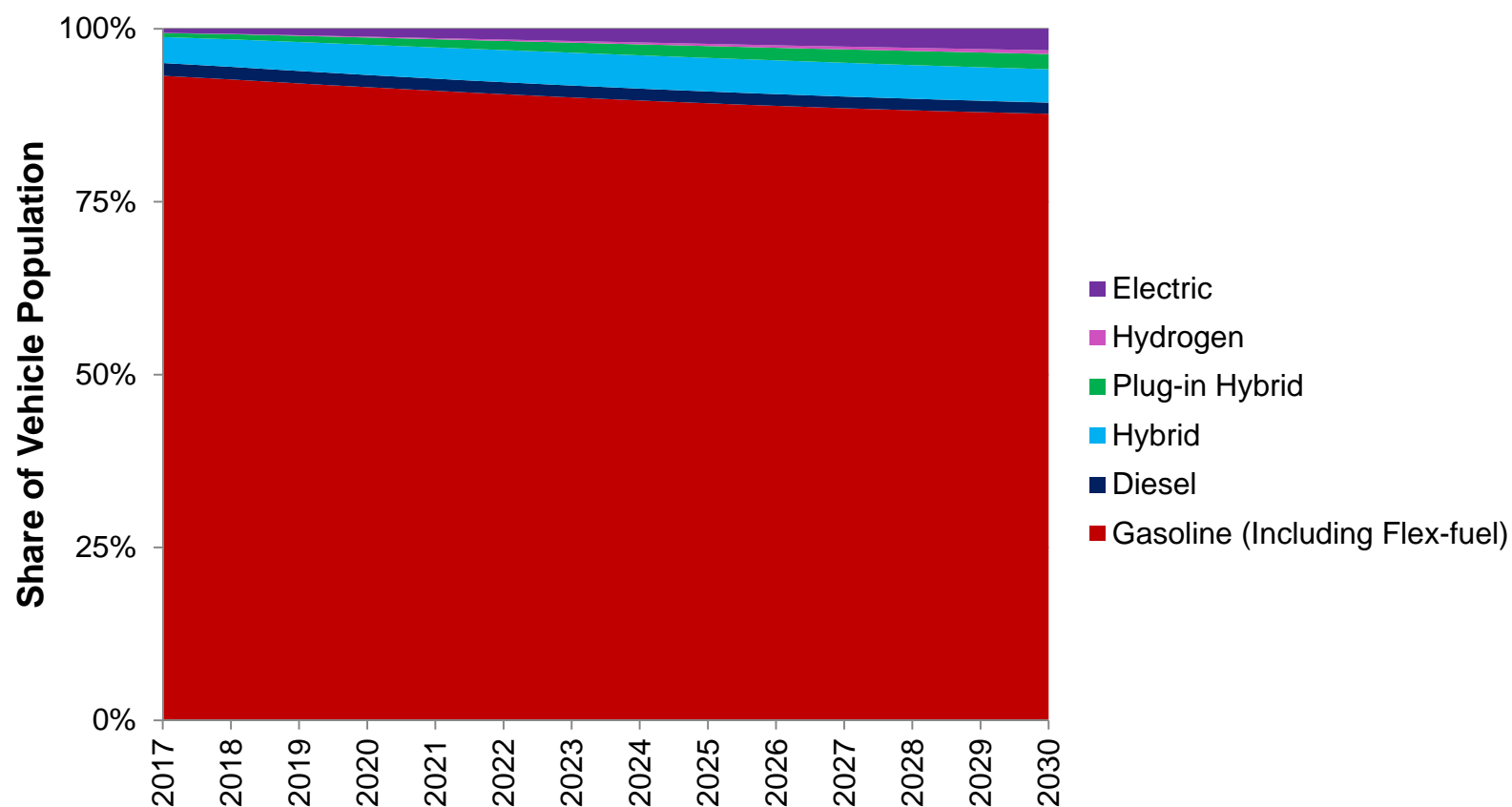
Residential	Commercial
Lower preference for vehicle price	Vehicle price continues as most significant attribute
Higher preference for vehicle range	Higher preference for vehicle range
Higher preferences for tax credit and rebate; lower for HOV lane access	HOV lane and Tax credits both significant
Lower preference for fuel economy	Lower preference for fuel economy
	Higher preference for acceleration



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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



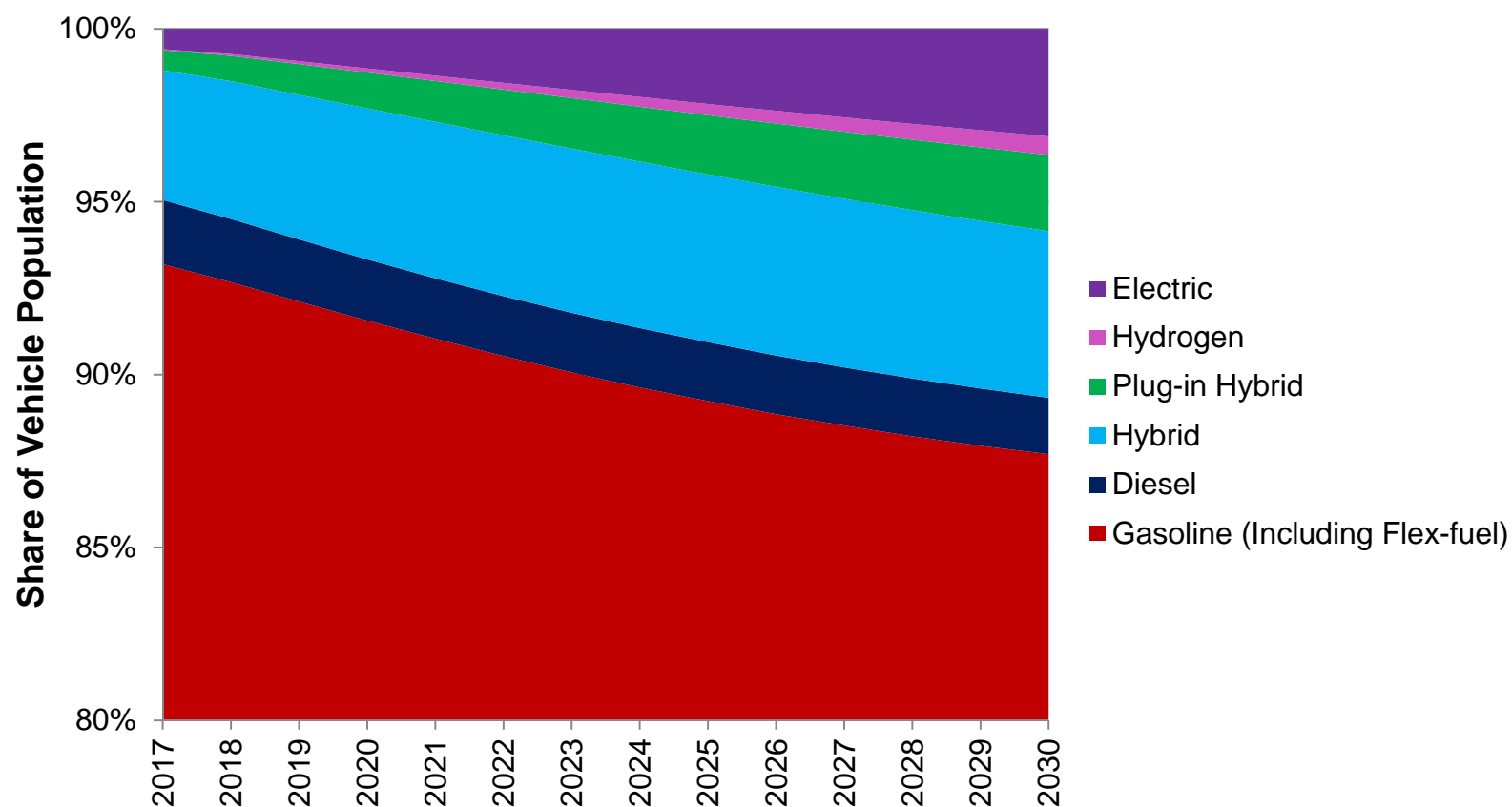
Source: California Energy Commission



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### Closer Look at Alternative Fuel Vehicle Share of Throughout Forecast

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



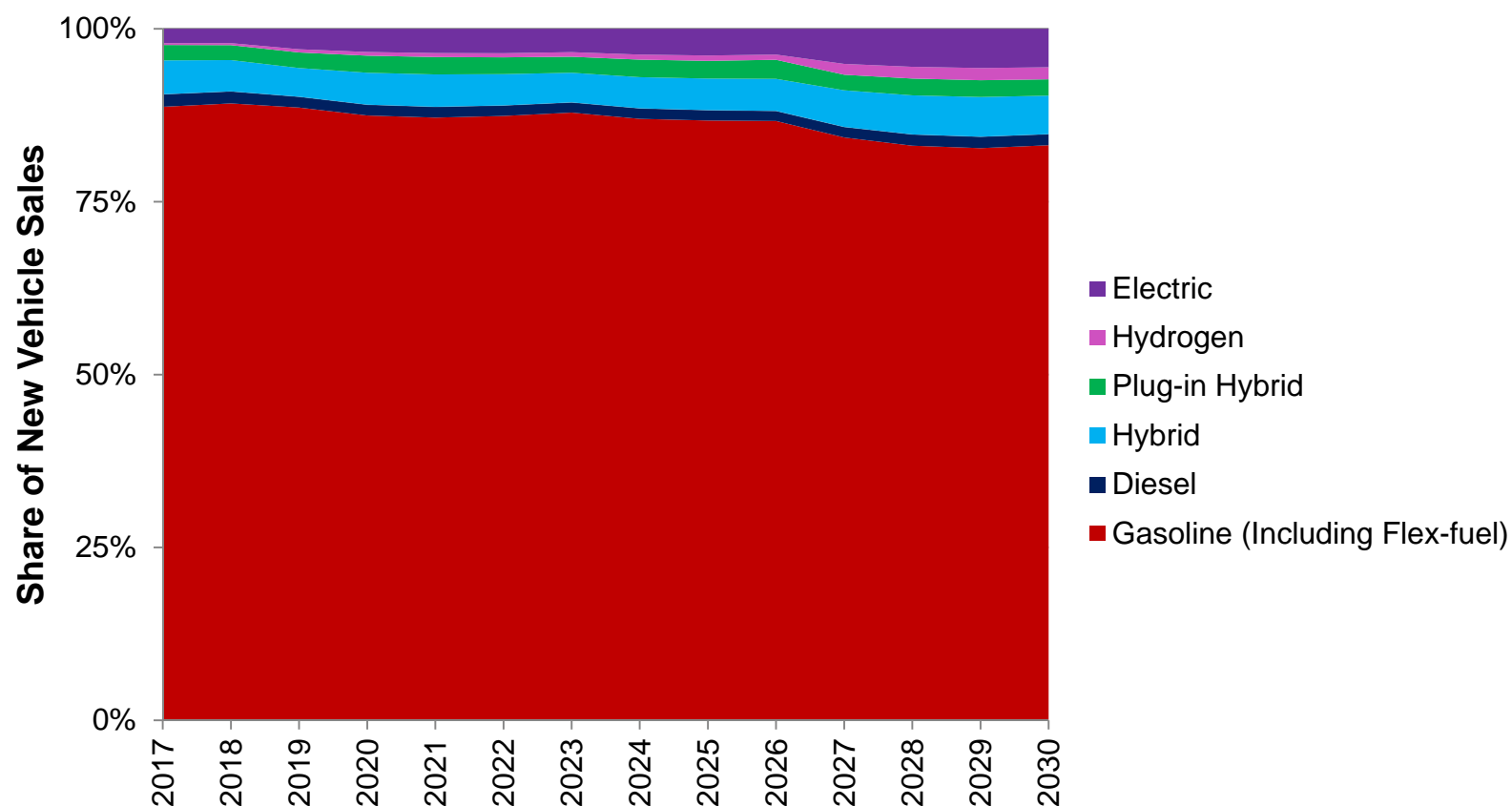




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# ZEVs Increase New Vehicle Sales Share with Price/Range Competitiveness

Light-Duty Vehicle Sales by Fuel Type, Mid Case



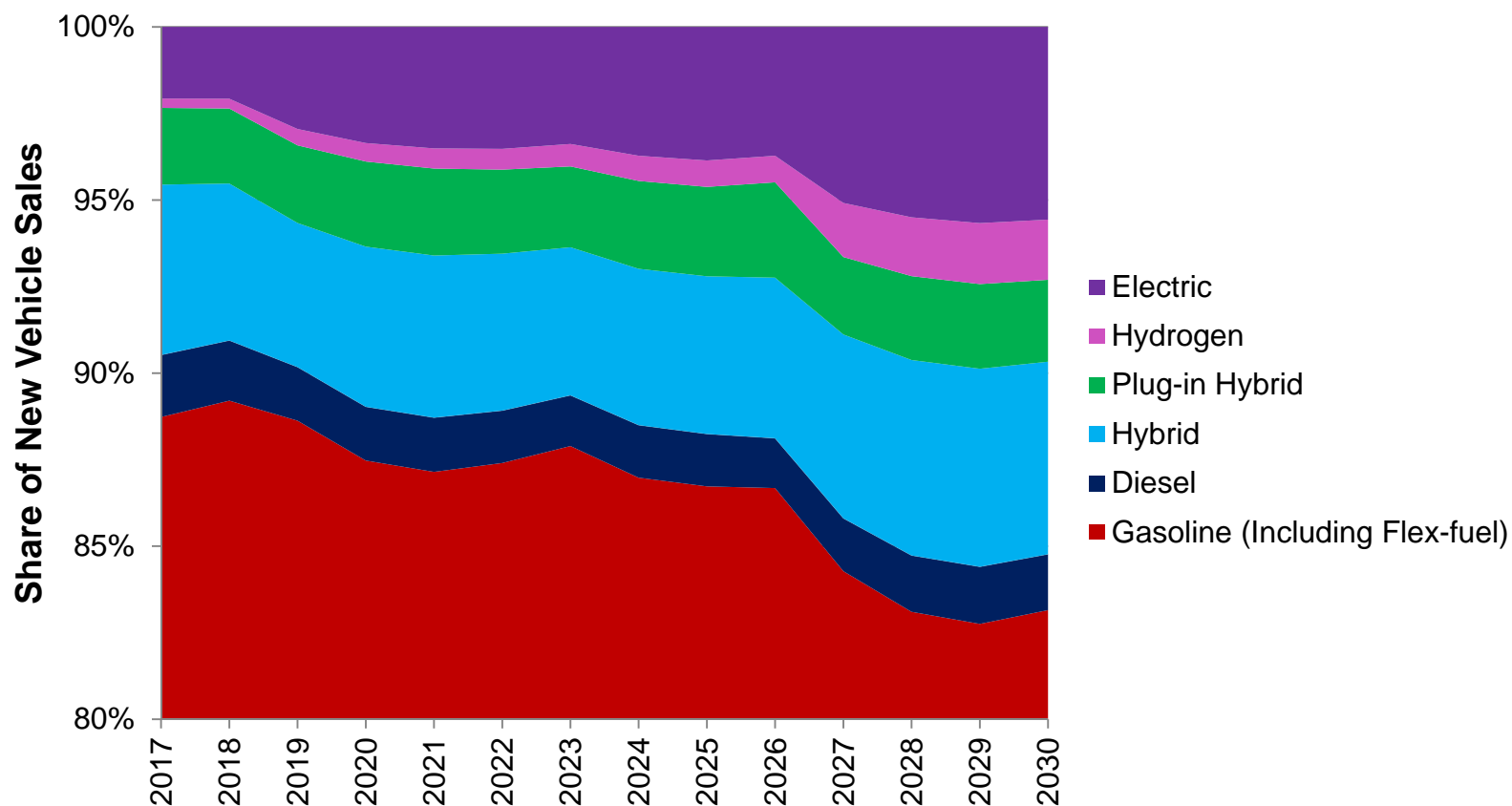
Source: California Energy Commission



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# Closer Look at ZEV New Vehicle Sales Share Throughout Forecast

Light-Duty Vehicle Sales by Fuel Type, Mid Case



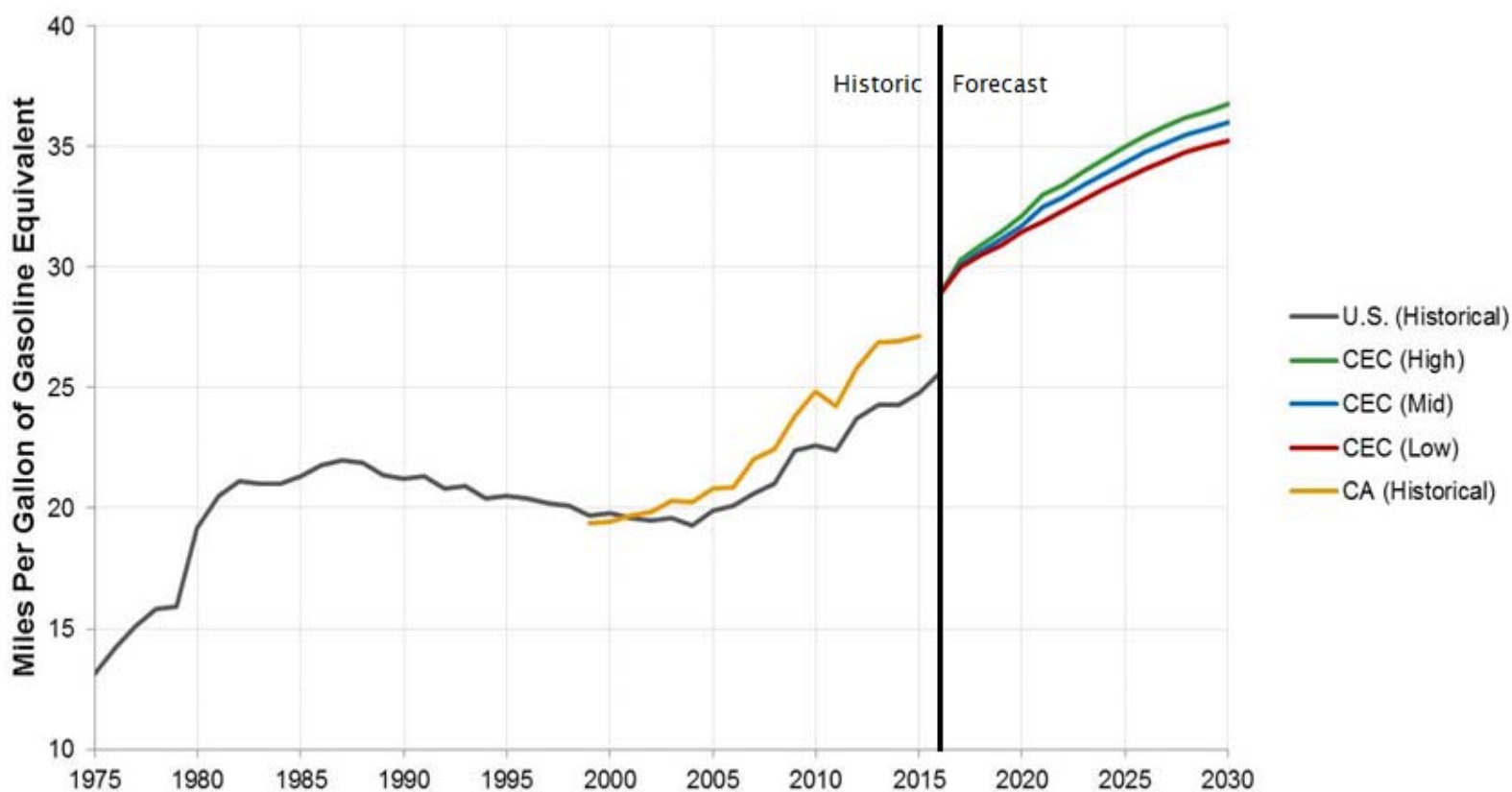
Source: California Energy Commission



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# Fuel Economy of New Light-Duty Vehicles Increases

Sales-weighted Average Light-Duty Vehicle Fuel Economy, All Fuel Types



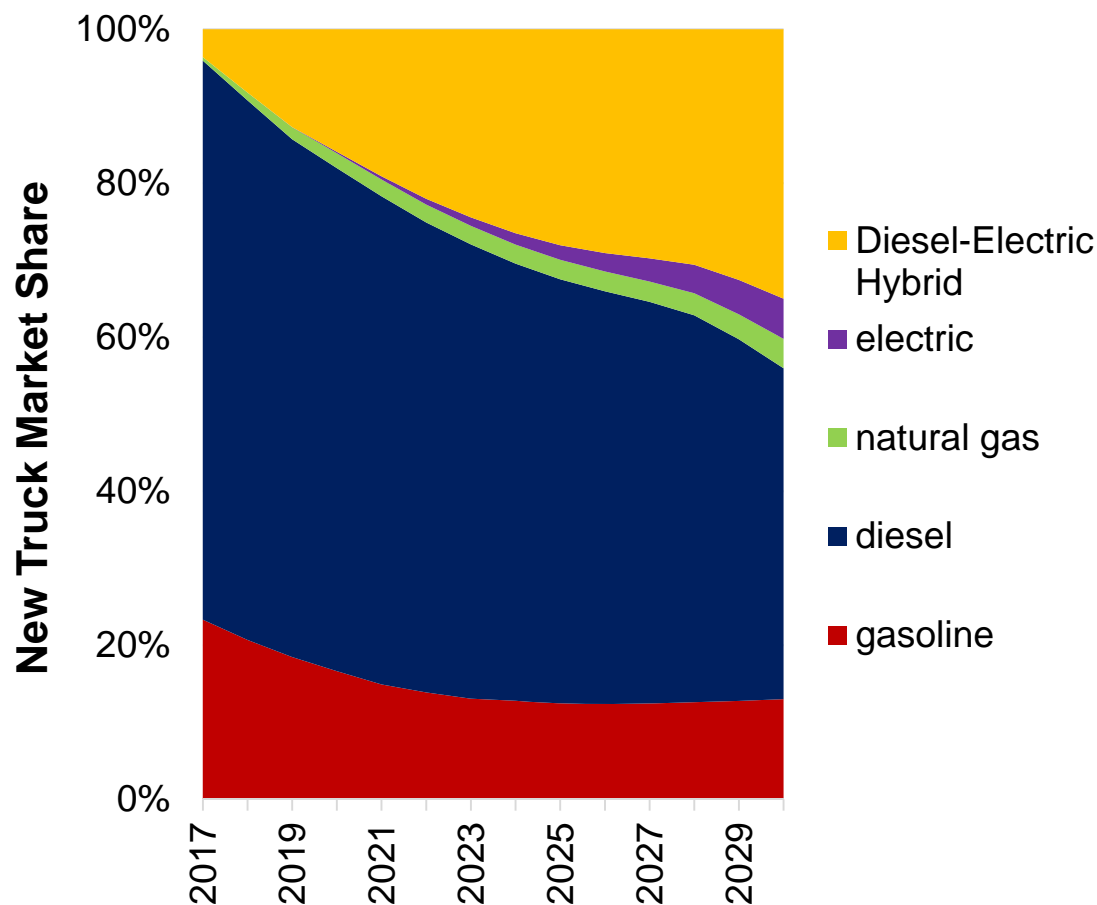
Source: United States Environmental Protection Agency, California Energy Commission



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# Alternative Fuel Truck Share Increases

New Medium Duty (GVWR 4 to 6) Truck Sales by Fuel Type, Mid Case

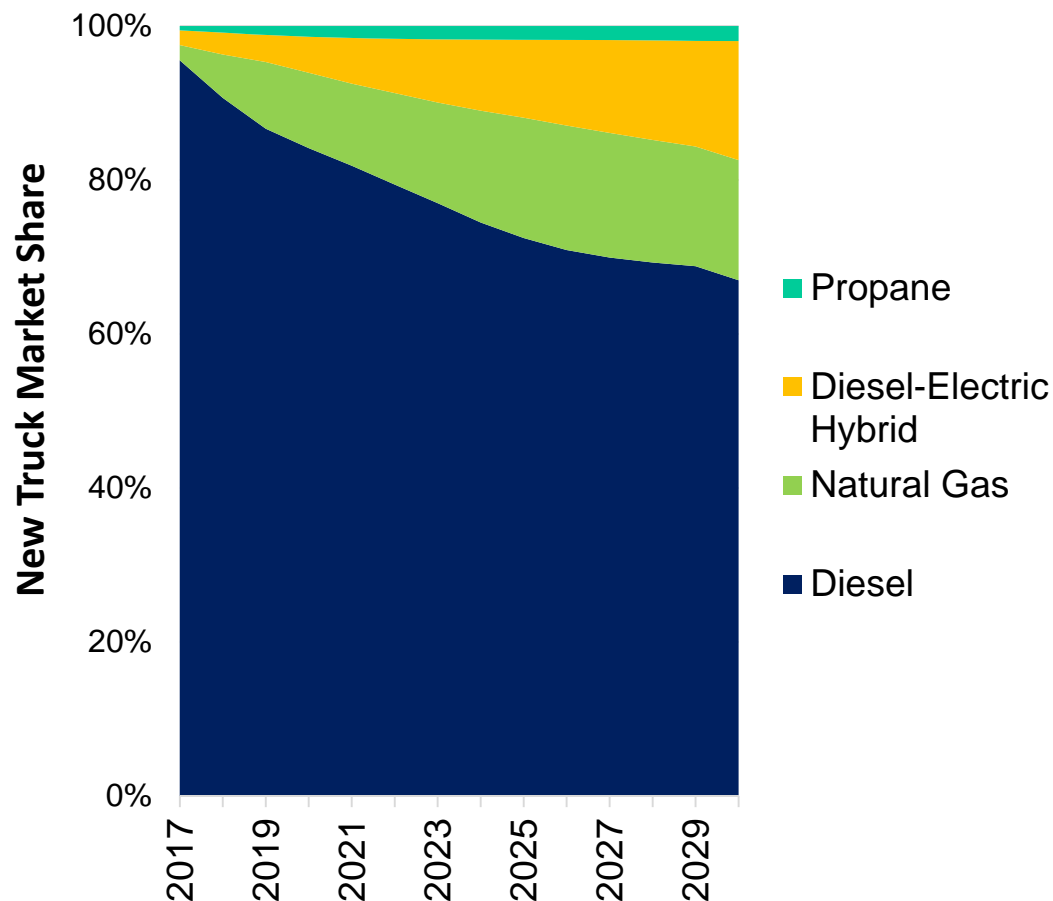




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# Alternative Fuel Truck Share Increases

New Light-Heavy (GVWR 7) and Straight Heavy-Heavy (GVWR 8) Duty Truck Sales  
Mid Case



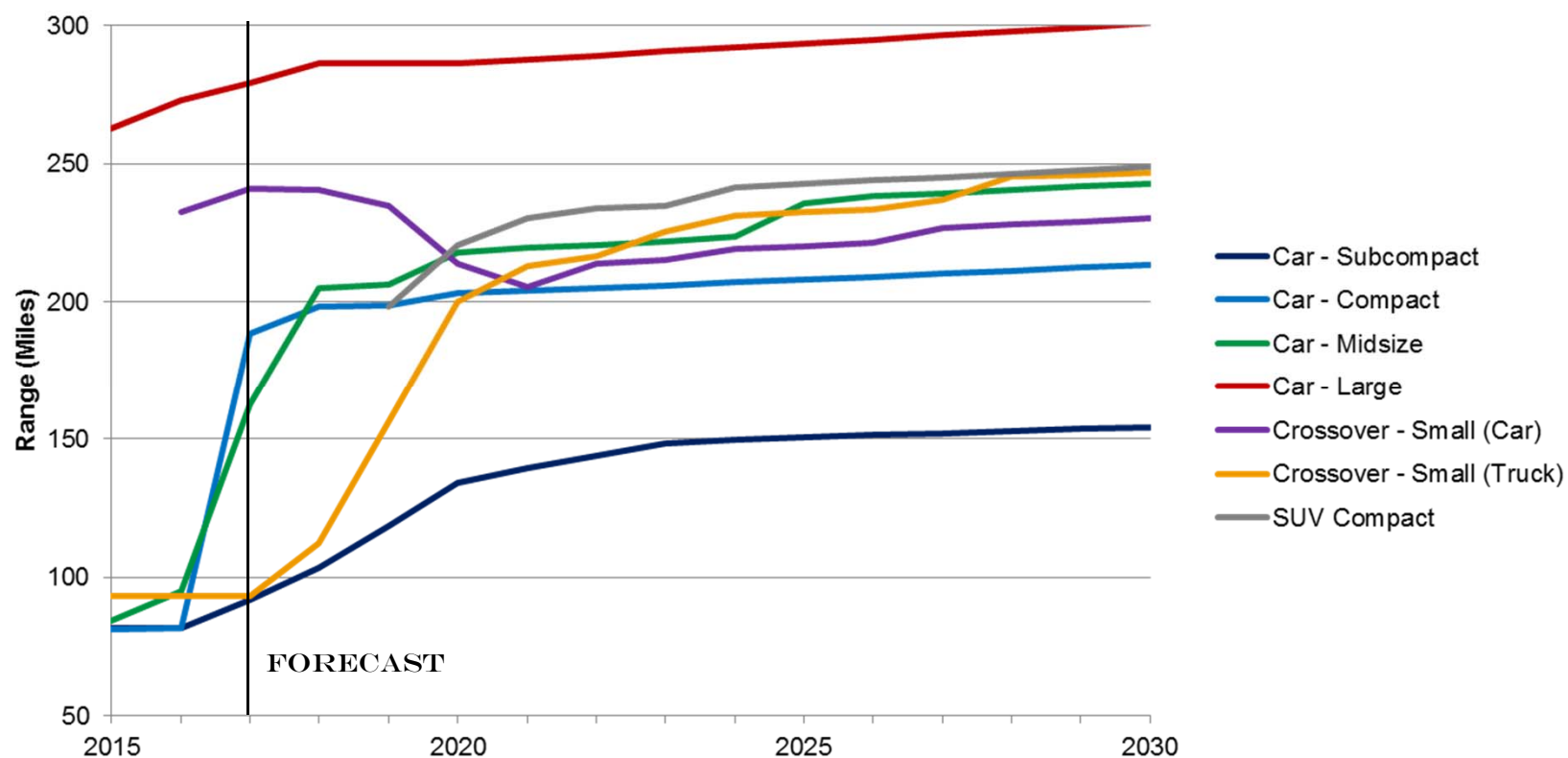


# ZEV ANALYSIS



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# Battery Electric Vehicle Range is Forecasted to Grow

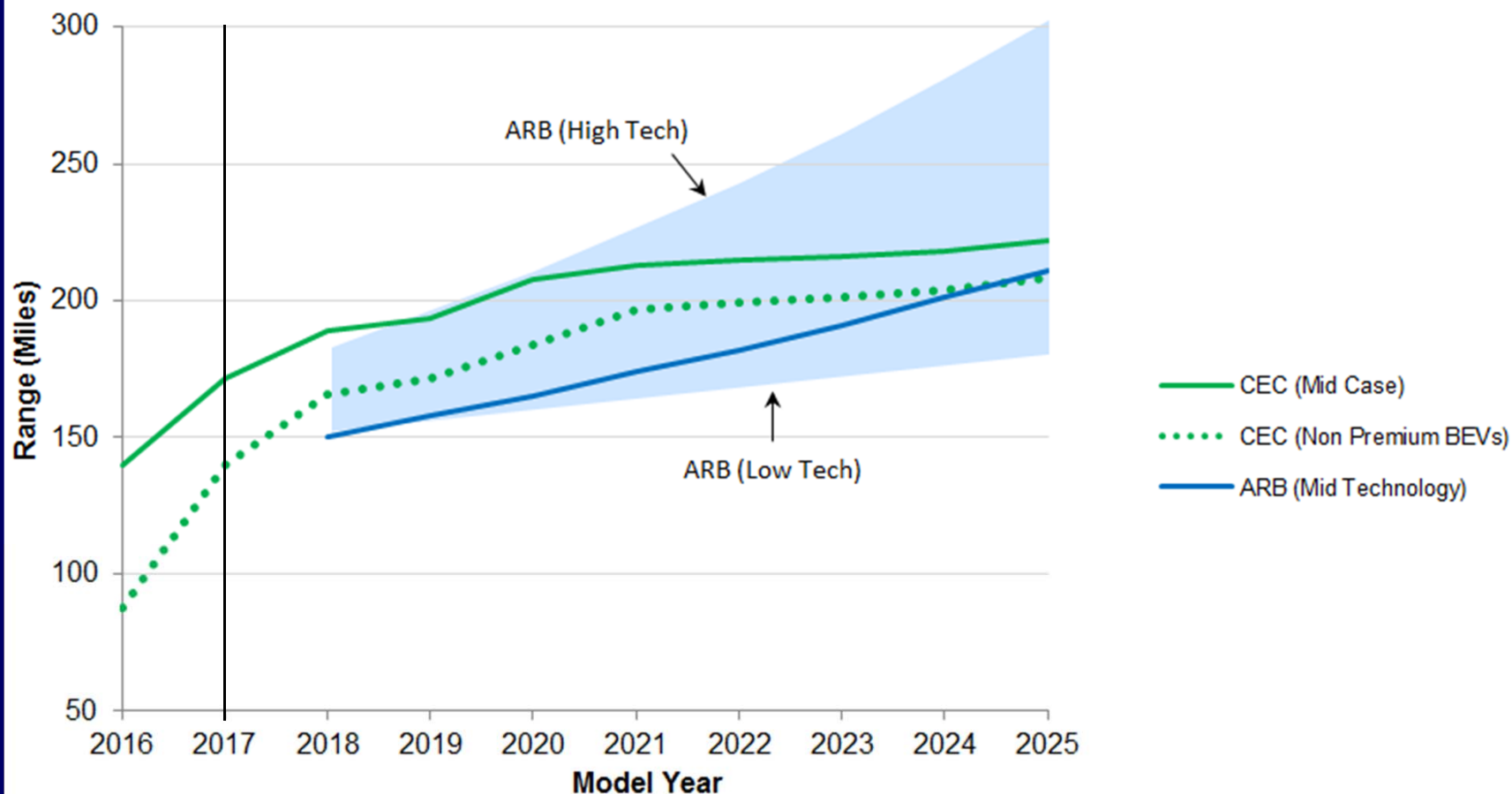


- Large swings in range (up or down) are due to introduction of new models.



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### Projected Average Fleet wide BEV Range



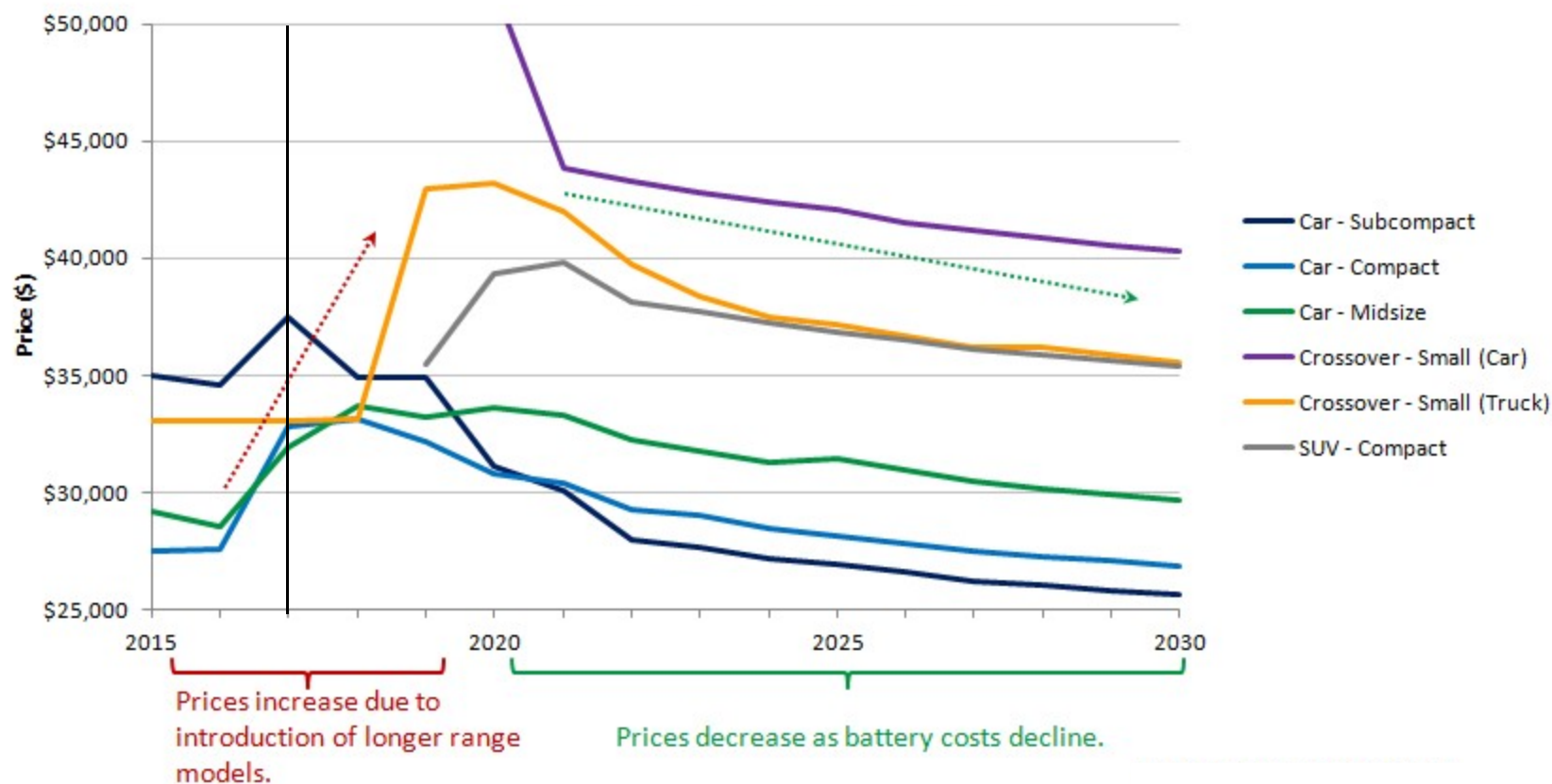




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# BEV Prices Decline Over Time

## BEV Sales Price, by Class

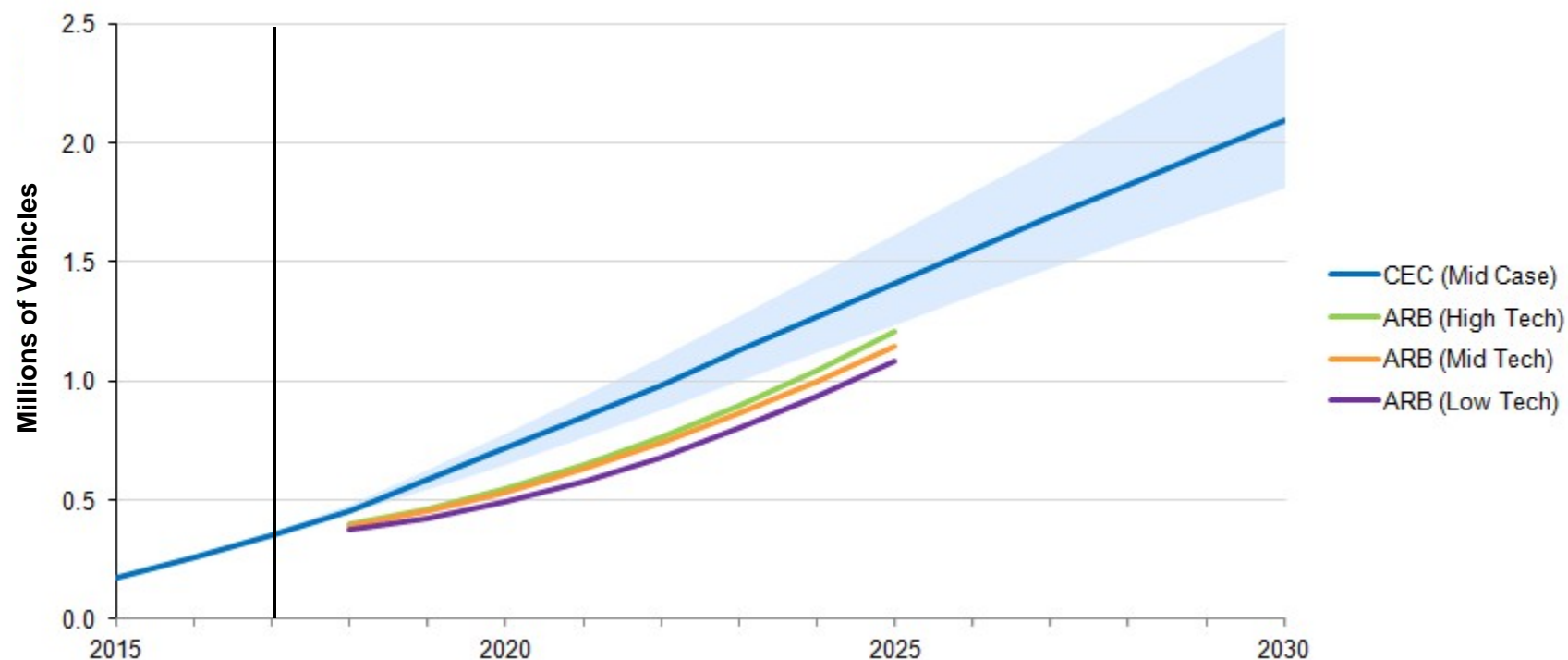


Source: California Energy Commission



# ZEV On-road Vehicle Stock Continues to Grow

## Cumulative ZEV and PHEV Population



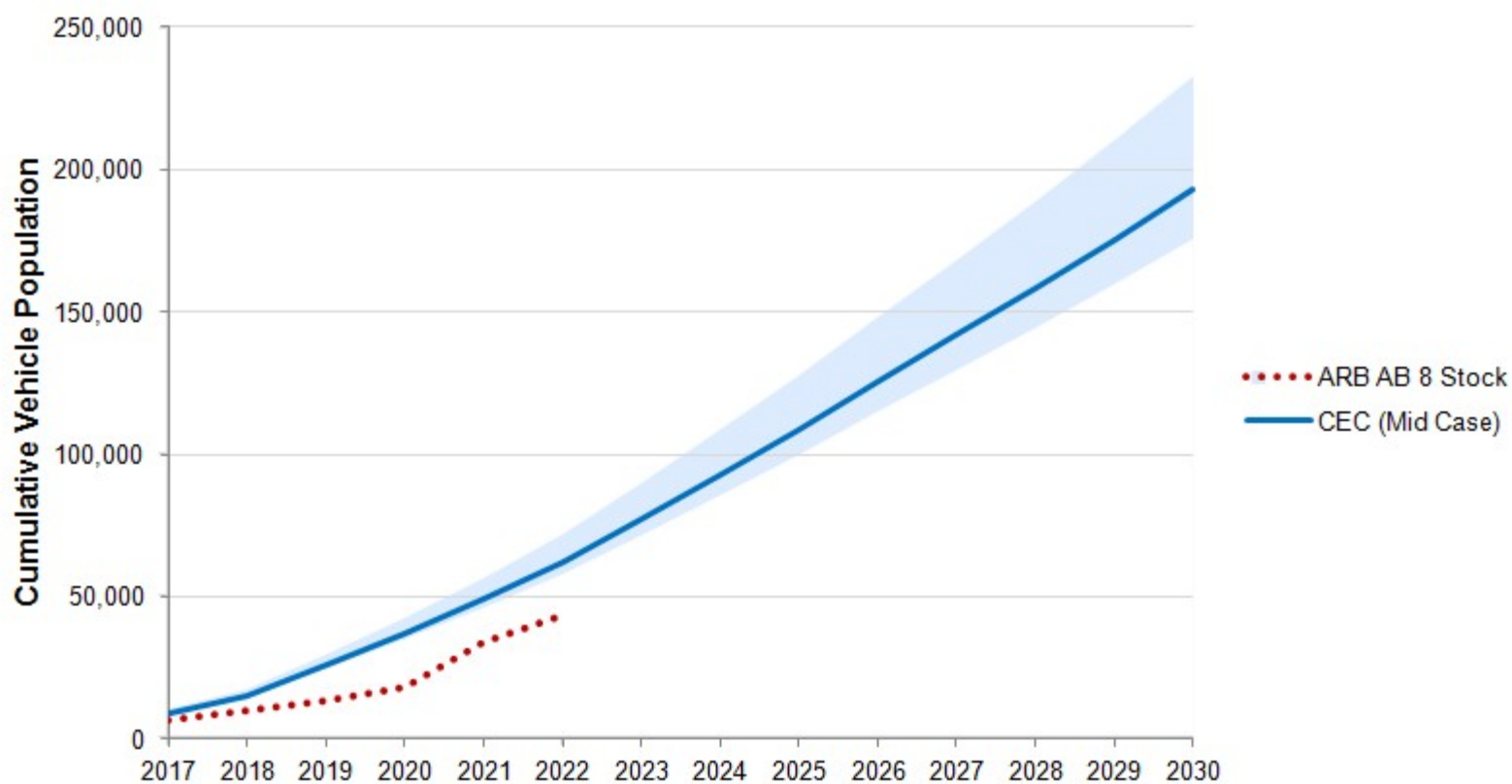
	<u>2015</u>	<u>2020</u>	<u>2025</u>	<u>2030</u>
CEC (Mid Case)	171,601	~715,000	~1.4 Million	2.0+ Million



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# Growth Potential for FCEVs

### Fuel Cell Vehicles 2017-2030, Mid Case



Source: California Air Resources Board, California Energy Commission



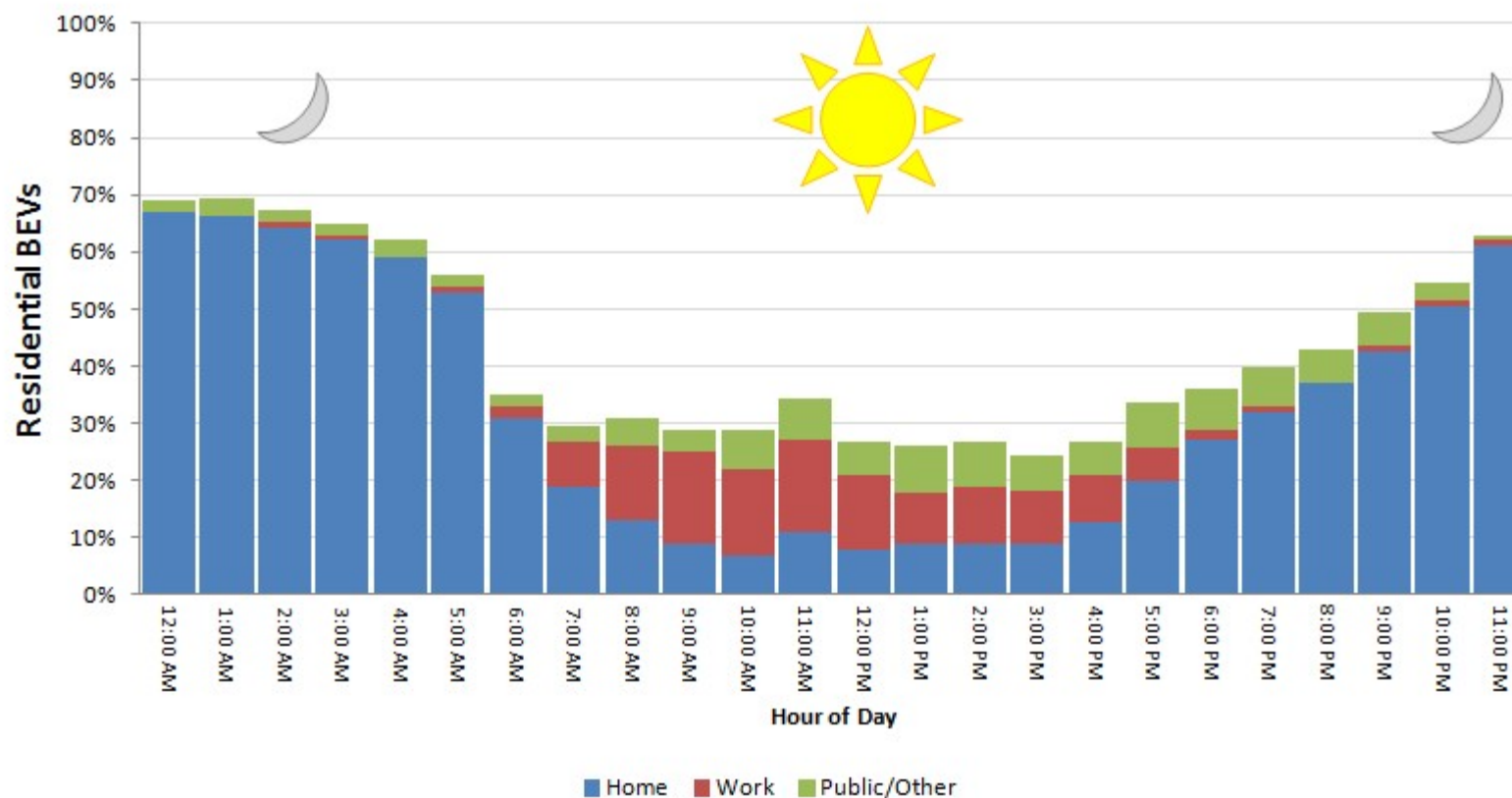
### Meeting the ZEV Regulation

- 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**



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# 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

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