Transportation Energy Analysis and Scenarios - General Approach

FTD Transportation Public Workshop

Hearing Room A

February 24, 2011

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Transportation Energy Summary

- Purposes and uses of analyses, including statewide goals
- Overall framework and approach
- Demand model discussion – methods, input, scenarios, changes, and assumptions
- Proposed demand scenarios
- Transportation fuel price cases
- Policy and Infrastructure Analyses
- Next Steps

Uses of Transportation Fuel Demand Assessments

Transportation energy demand and fuel price analyses support:

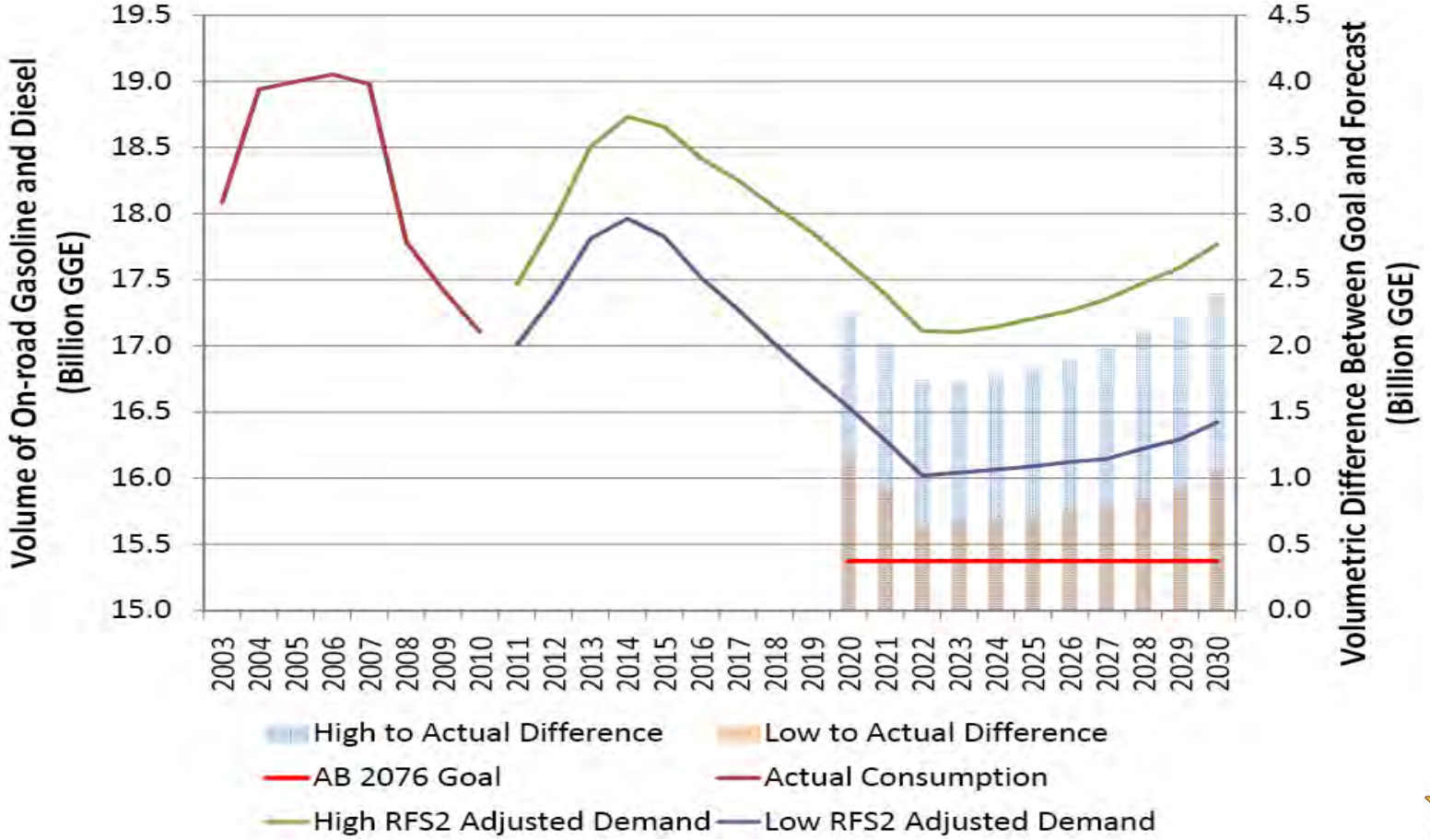
- Energy policy making and program implementation activities, including:
  - Alternative and Renewable Fuel and Vehicle Technology Program (Assembly Bill 118, Nuñez, Chapter 750, Statutes of 2007) investment allocation analyses
  - Petroleum use reduction assessments
  - Transportation fuel infrastructure requirements assessments
  - California transportation electricity demand forecasts
- Electricity and natural gas demand assessments and forecasts including:
  - Natural gas vehicles
  - Electric vehicles and plug-in hybrids
  - Rail

Proposed California Goals for Comparison

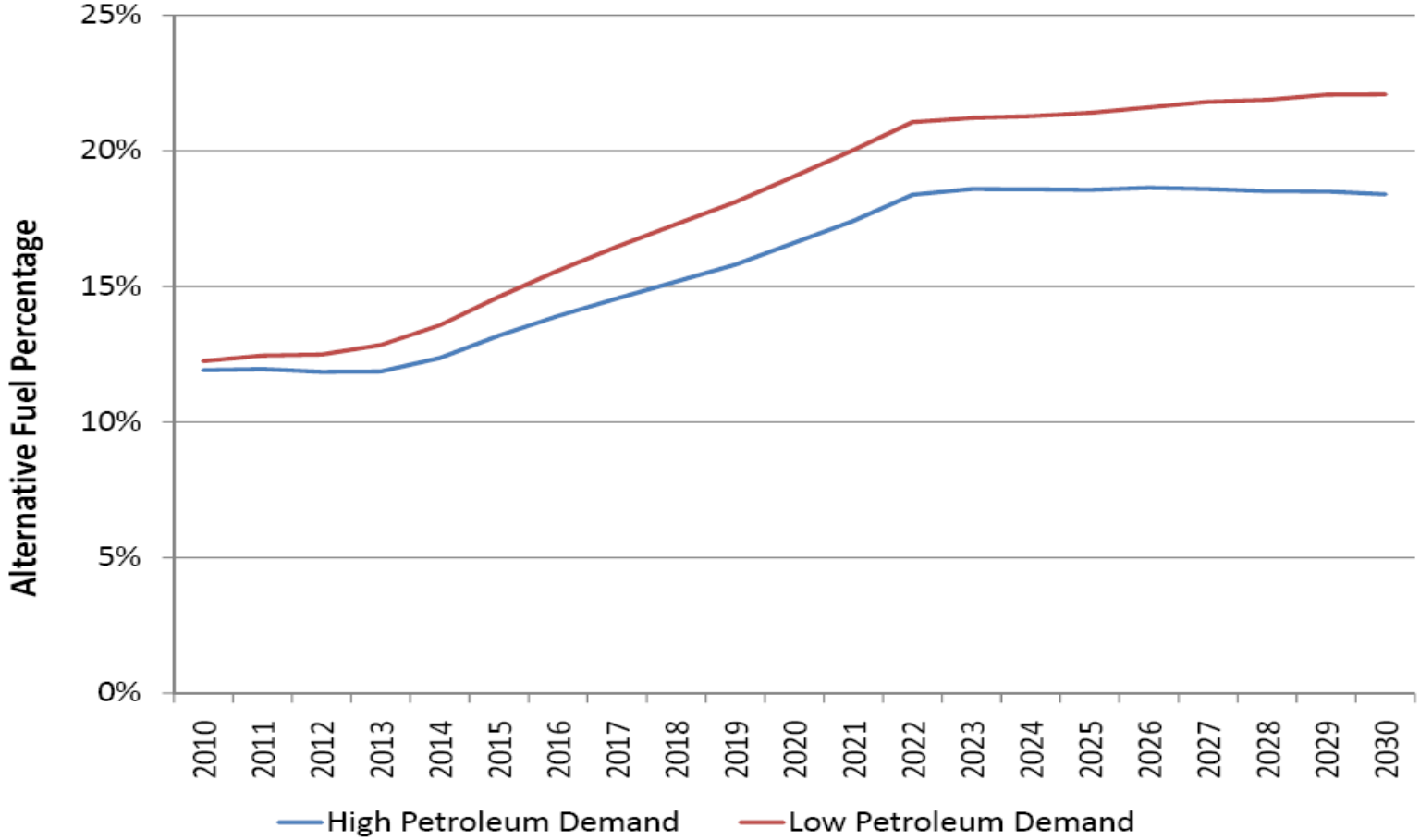
Two primary goals we plan to evaluate:

- Petroleum Demand Reduction: 15 percent reduction of on-road gasoline (without oxygenate) and diesel below 2003 by 2020
- Alternative Fuel Use: 26 percent alternative fuels by 2022

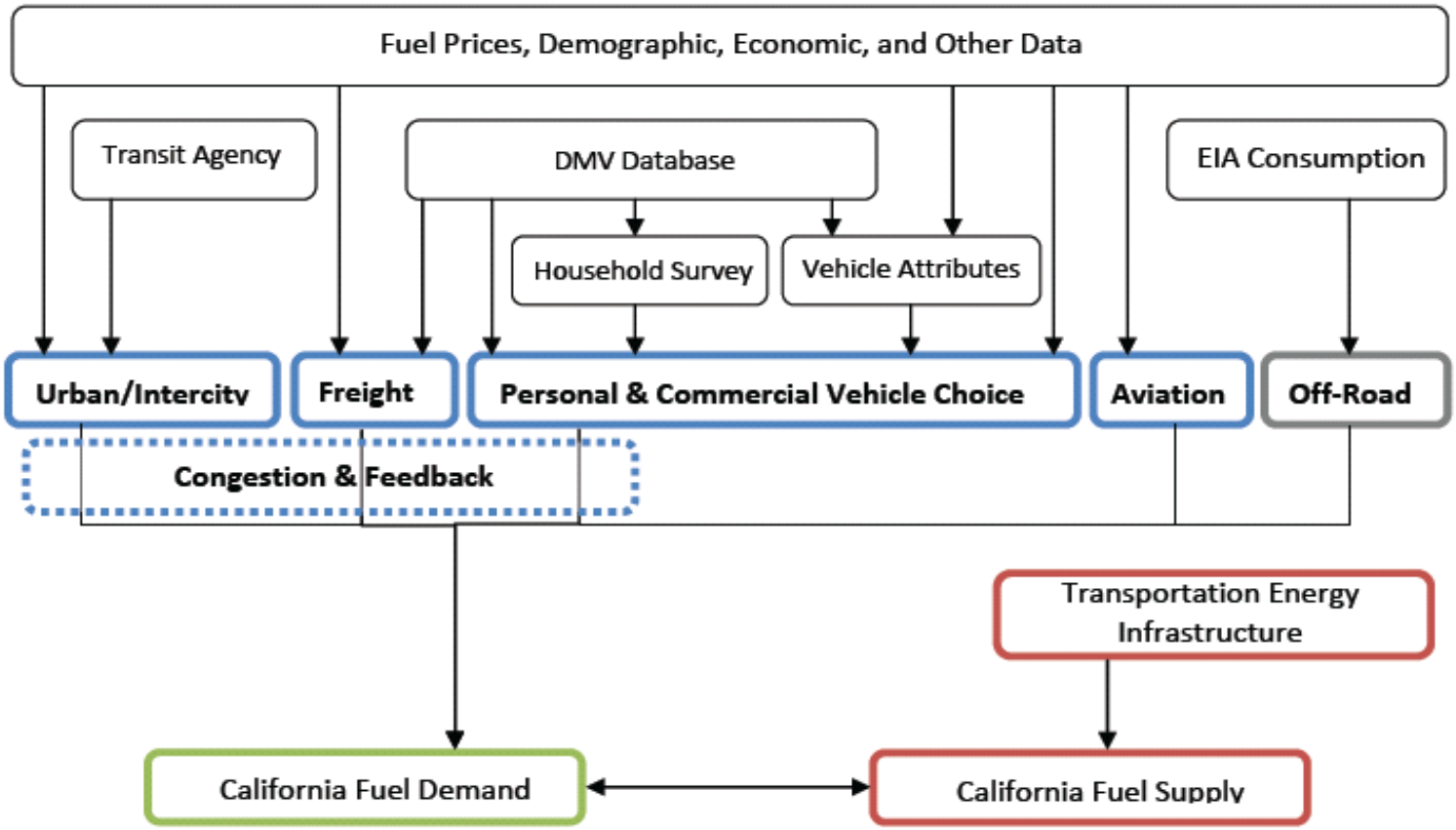
AB 2076 Reduction Goal Comparison to 2009 IEPR



AB 1007 Alternative Fuel Goal Comparison to IEPR 2009



Data Flow to Transportation Energy Demand Models



Proposed Forecasted Transportation Fuels

Staff intends to include the following fuels in the transportation energy demand forecasts:

1) Gasoline
2) Diesel
3) Electricity
4) E85 (85 percent Ethanol blended with gasoline)
5) Jet Fuel
6) Natural gas
7) Biomass-based Diesel

Selected Inputs into Models

- Transportation fuel prices, from EIA, Energy Commission staff, and Utilities
- Estimates of base year transportation fuel demand, from BOE, staff calculations, and EIA
- Economic and demographic data and projections, from DOF, Economy.com, and Census
- Air travel and flight data, from FAA and BTS TranStats
- Vehicle registration data, from DMV Registration Database
- Transit agency transit fuel cost and service share from Energy Commission survey of transit agencies
- Projections of vehicle attributes by class, from ICF
- Travel data from CalTrans' 2000-2001 California Household Travel Survey
- Freight commodity distribution, from FHWA FAF3
- Vehicle choice preferences, Energy Commission 2009 Household Vehicle Survey

Proposed Transportation Fuel Demand Scenarios

Petroleum Demand Scenarios	Transportation Fuel price		Economic Growth
	Petroleum Fuels (Gasoline, Diesel, E85, B5, Propane)	Natural Gas & Electricity	
High Demand	Low	High	High
Low Demand	High	Low	Low

Qualifying Notes:

- These scenarios will frame FFO analysis designed to discover vulnerabilities in the transportation fuels infrastructure.
- The outcome of these scenario runs will be processed to account for the impact of some of the more important transportation energy related policies and regulations.

Transportation Fuel Demand Scenario Methodology

Two step approach:

1) Develop initial modeling demand based on our defined scenarios
2) Post-processing to adjust demand for fuel selection, sectors not included in demand models, and policies

Changes to FFO Modeling Methodology

- New Aviation model
- VMT will be calculated using a simplified travel model with a mode choice function
- Transit has been updated with new survey information
- Freight has been updated with FAF3 data

Policies Staff not Planning to Evaluate

Most of AB 32 transportation measures and metrics including:

- Ship Electrification
- Goods movement efficiency improvement
- VMT reduction strategies (such as SB 375)

Air Quality Regulations

- National Ambient Air Quality Standards
- Regional Air Quality Criteria and Regulations

Model Post-Processing Activities and Policies

Fuel Selection and Sectors

- PHEV base electricity consumption
- E85 base consumption
- Off-road

Policies

- RFS2
- LCFS

Crude Oil and Transportation Fuel Price Cases

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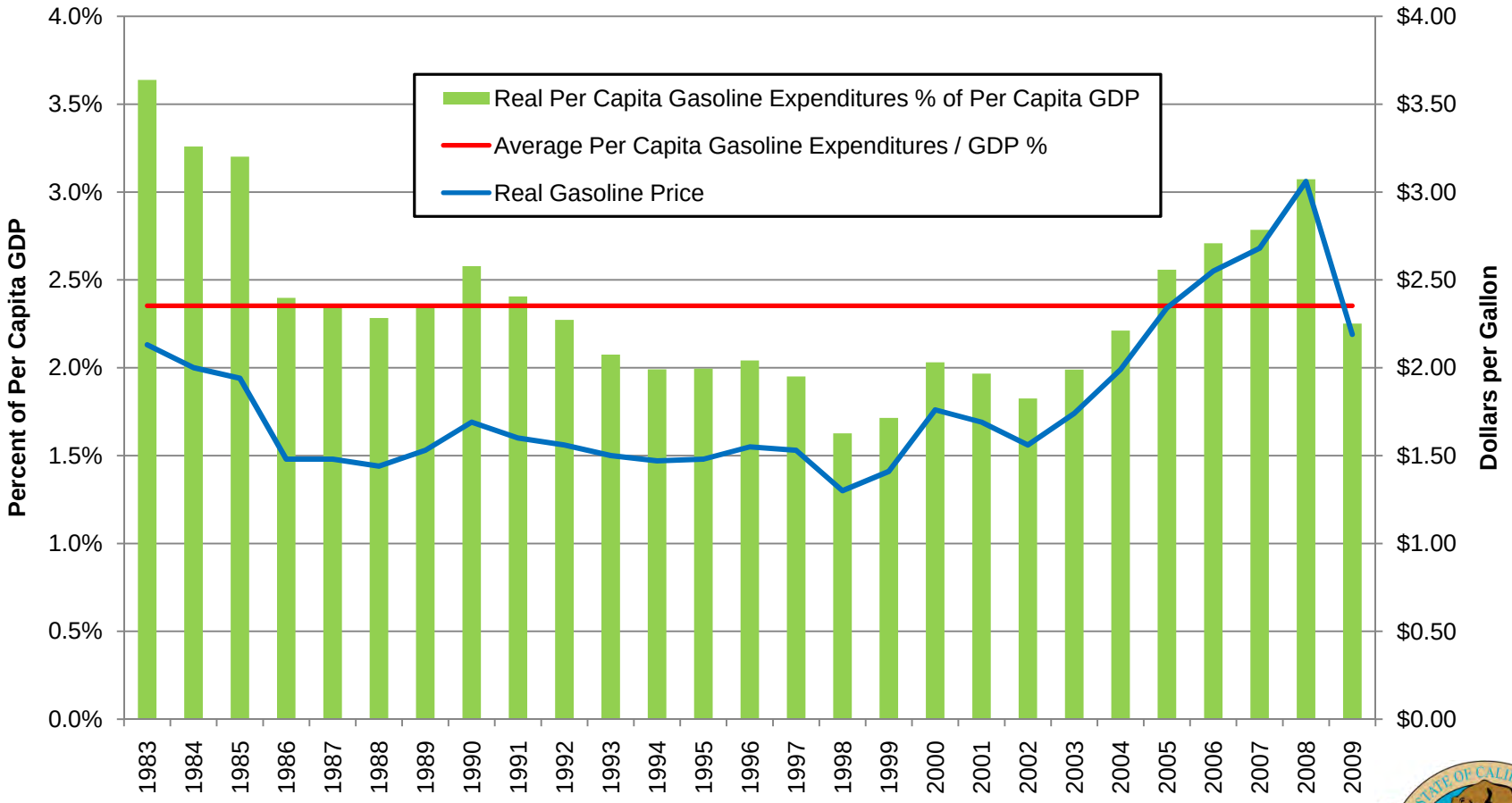
Introduction

Three Topics to Cover:

1) Current and Historic Trends in Crude Oil Prices
2) Fossil Fuel Office Crude Oil Price Cases
3) Transportation Fuel Price Relationships and Price Cases

U.S. Per Capita Gasoline Expenditures and Gasoline Prices, 1983 to 2009

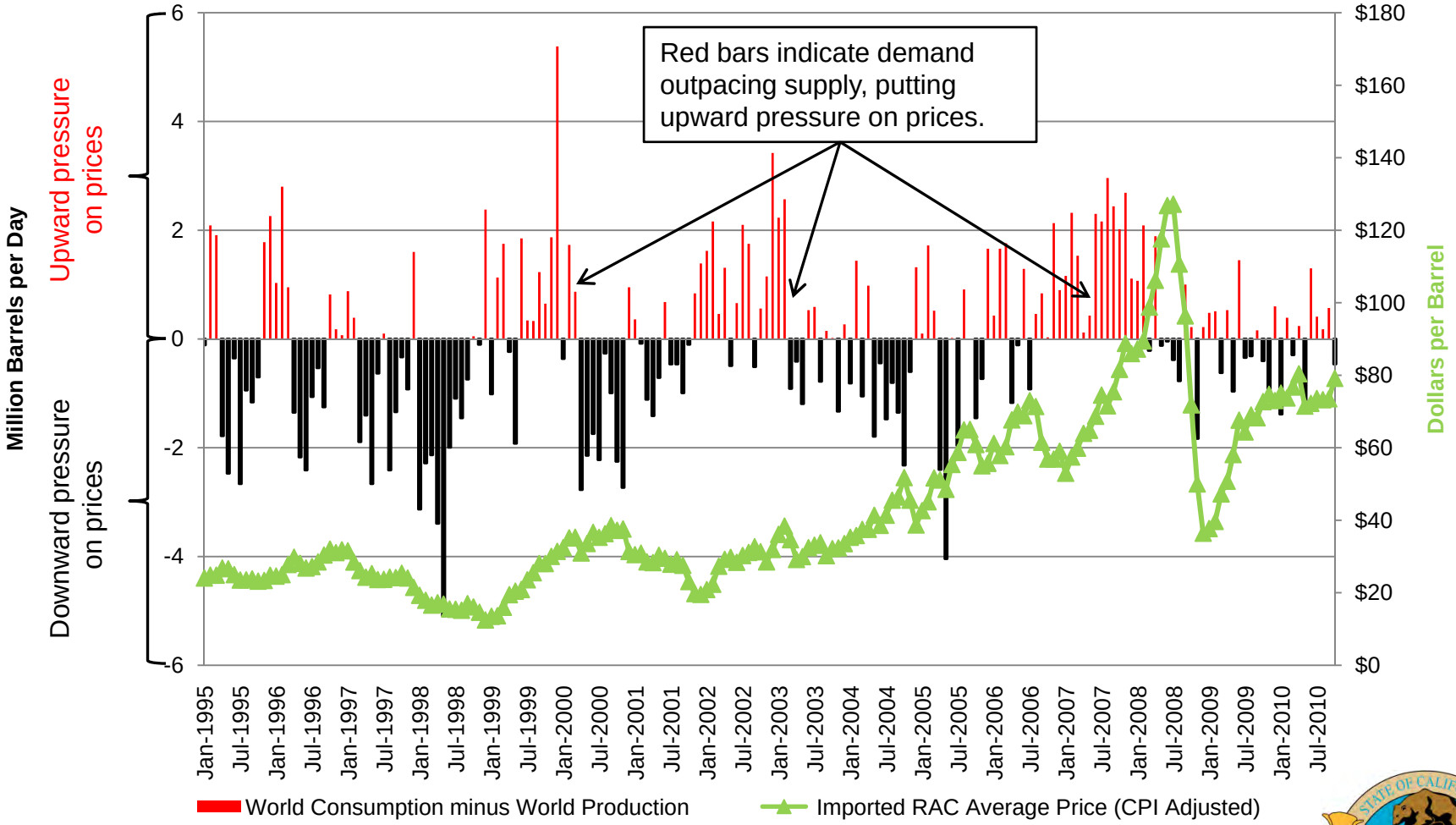


Source: U.S. Energy Information Administration and U.S. Bureau of Economic Analysis

Factors in Crude Oil Prices

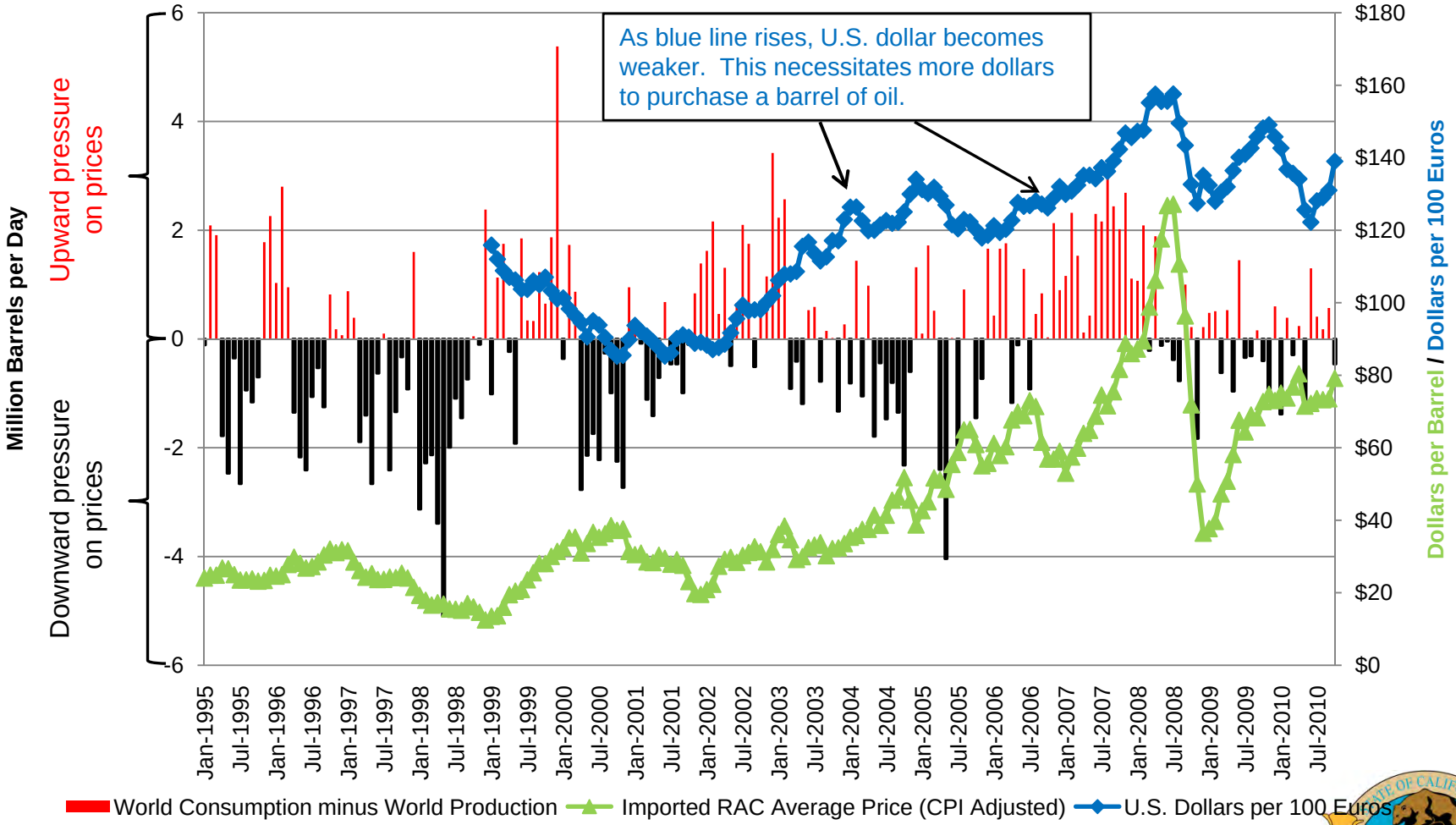
- World petroleum supply and demand
- Resource nationalism
- Rising oil production project costs
- Economic growth
- Dollar valuation fluctuations
- Increase speculation
- Political Unrest (Middle East)

World Oil Demand Balance & the Price of Oil



Source: U.S. Energy Information Administration

World Oil Demand Balance & Value of the Dollar



Source: U.S. Energy Information Administration and the Federal Reserve Board

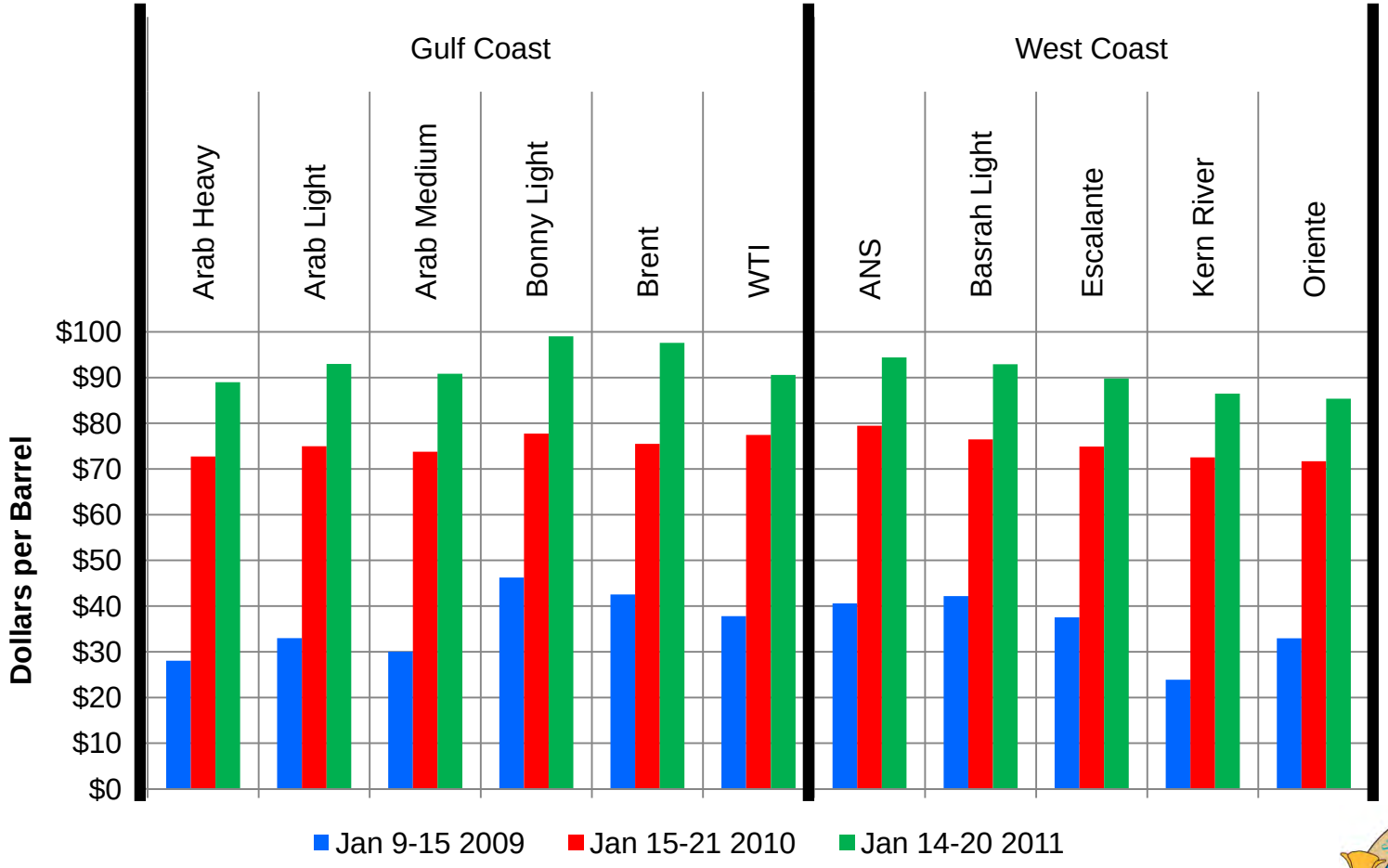
Challenges in California Transportation Fuel Price Case Development

- Recent price volatility in crude oil and fuel markets
- No in-house integrated world energy model
- Limited data on alternative and renewable fuels
- Long term projection horizon

Solutions

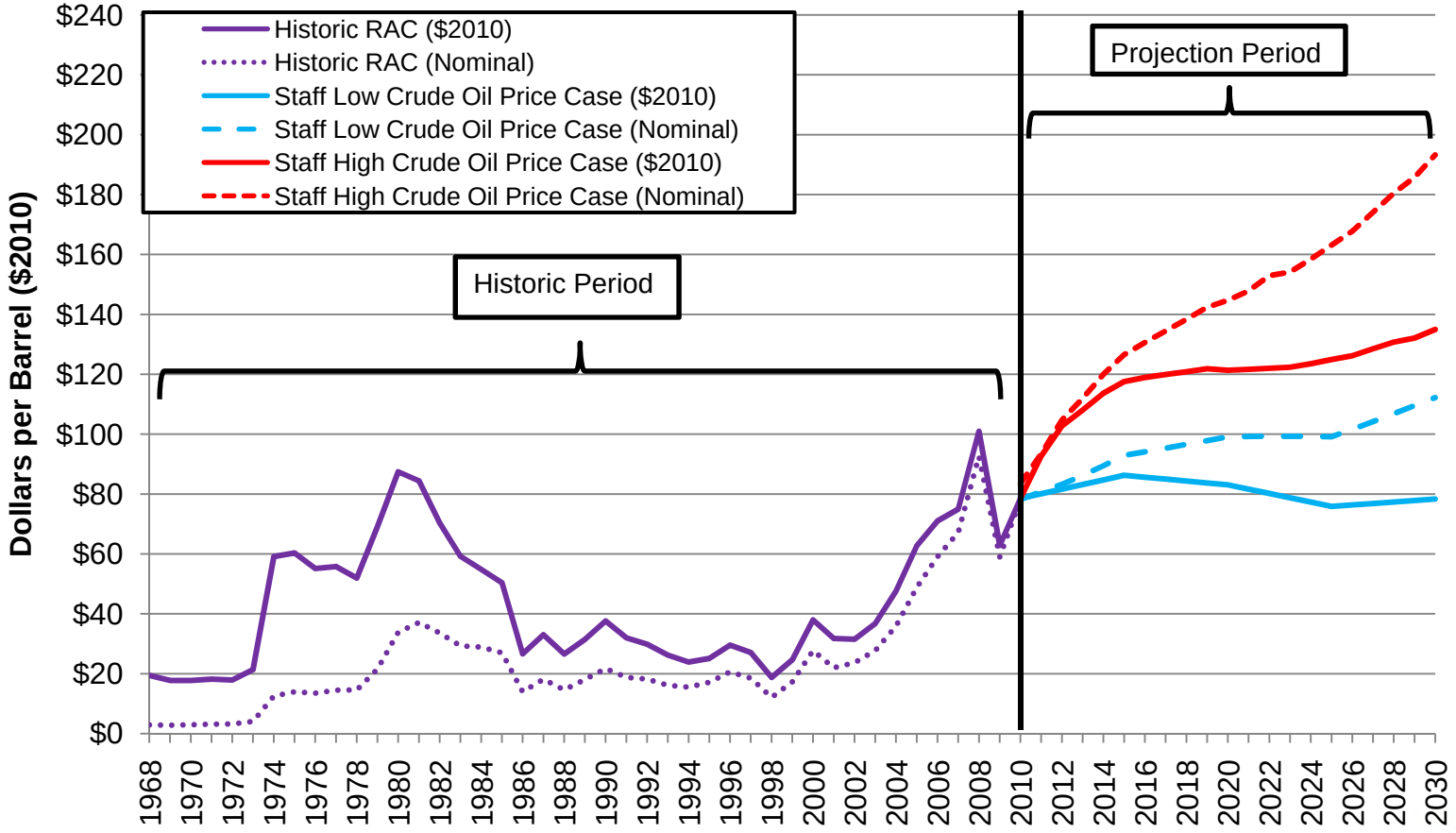
- Assess other crude oil price forecasts from EIA, IEA, or other organizations
- Use historical data on U.S. Imported Refiner Acquisition Cost (RAC) of crude oil and state petroleum fuel price relationships
- Consult with other offices on prices for E85, natural gas, and hydrogen, as well as electric rates for EVs and plug-in-hybrids
- Solicit expert advice from workshop participants

Crude Oil Spot Price Indexes



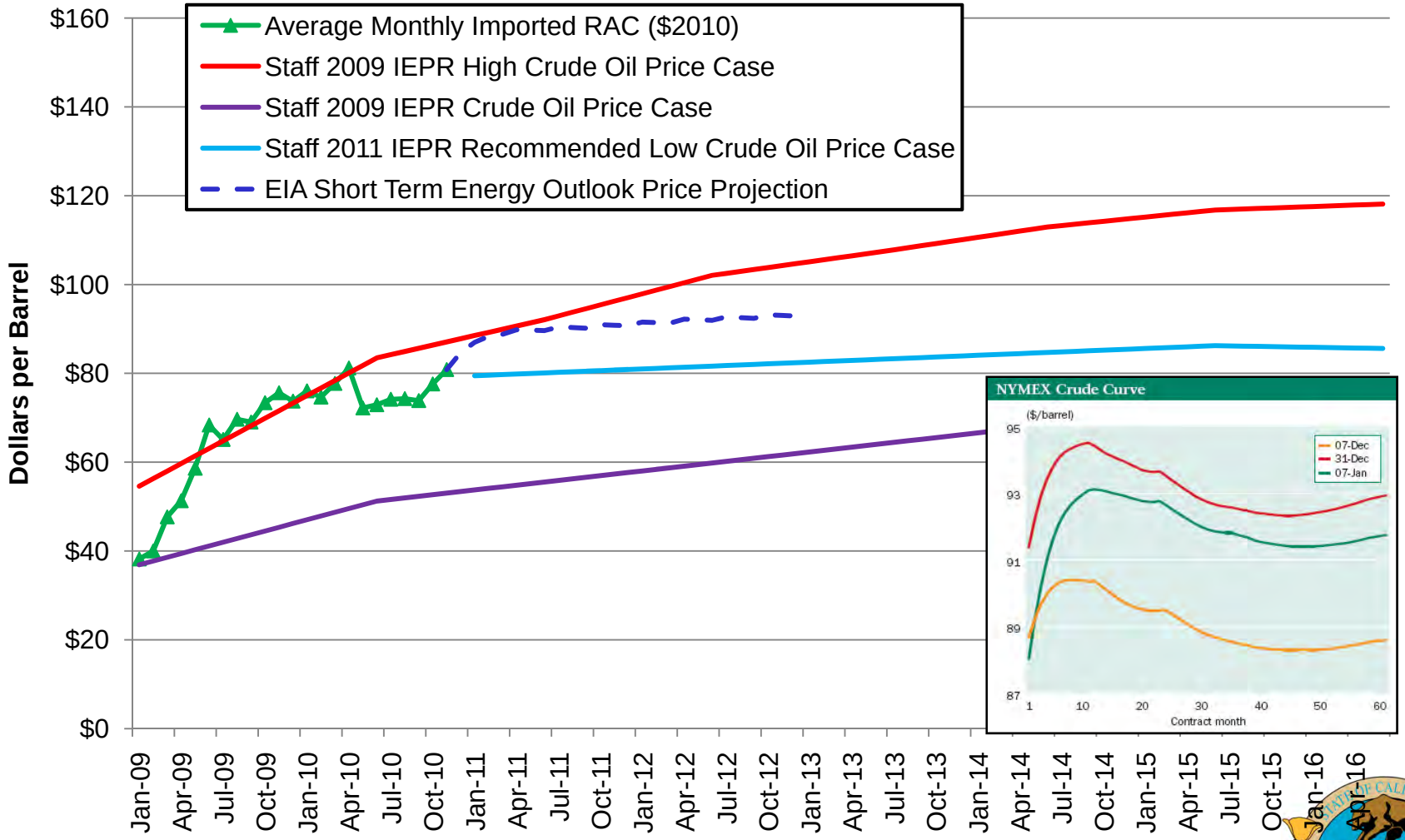
Source: Platt's Oilgram & Price Report

U.S. RAC Historic & Energy Commission RAC Price Cases



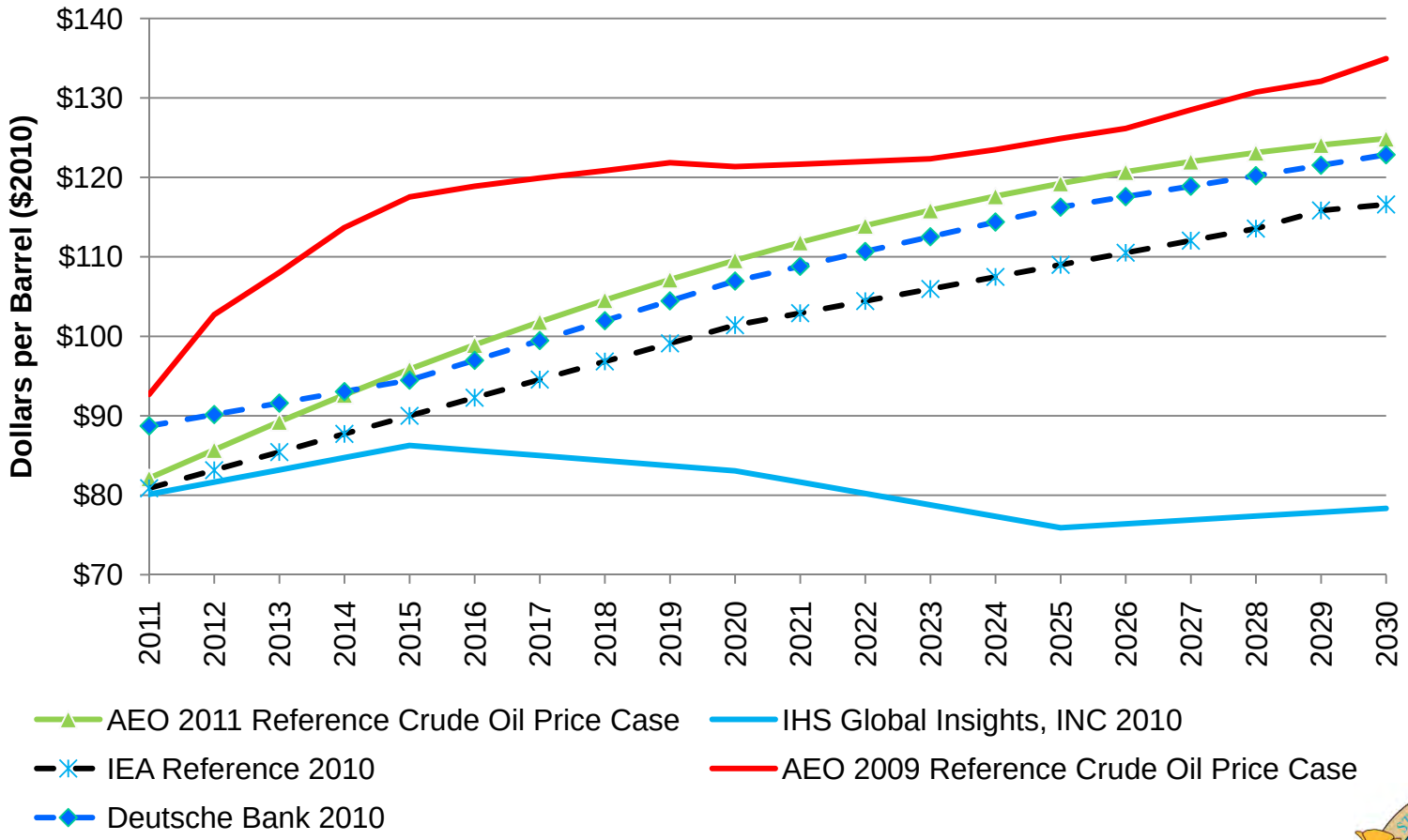
Source: Energy Commission and U.S. Energy Information Administration

2009 IEPR Price Cases in Review



Source: Energy Commission, U.S. Energy Information Administration, and Platt's Oilgram & Price Report

Crude Oil Price Projections, 2011 to 2030 (2010 Dollars)



Source: Energy Commission and U.S. Energy Information Administration

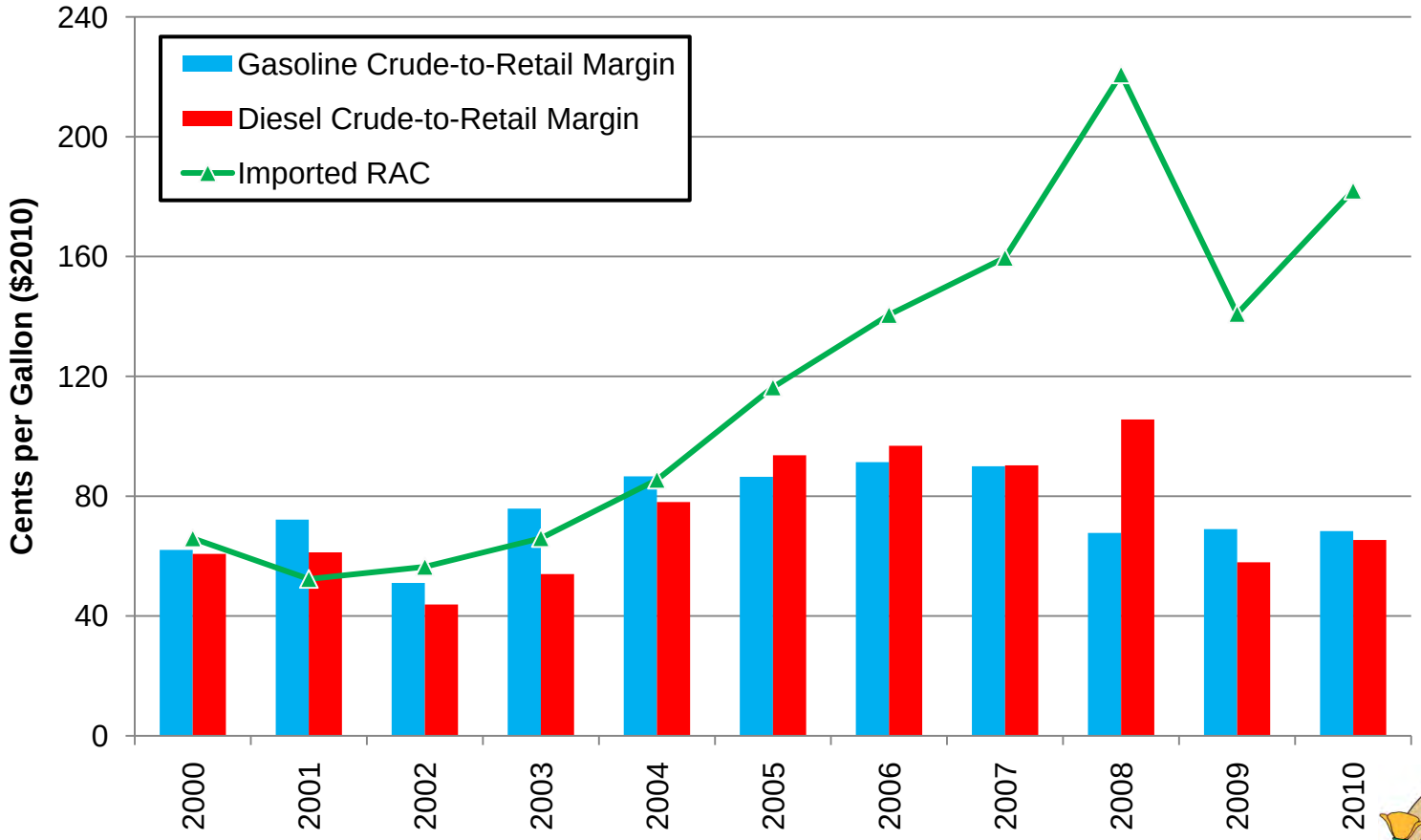
Petroleum Transportation Fuel Price Projection Methodology

- Uses forecasted RAC oil price in cents per gallon
- Establishes and adds a margin for regular grade gasoline and diesel prices
  - RAC to ex-tax retail price margin (High and Low)
- Adds California and federal taxes and fees (excise and sales)
  - Uses the fuel tax structure outlined in the Board of Equalization's "Gas Tax Swap" and "Diesel Tax Swap", which take effect July 1, 2010 and July 1, 2011, respectively.

Assumptions

- In real terms, fuel margins are held constant
- California and federal excise taxes and fees are held constant in real terms
- Current fuel formulations to remain constant
- No greenhouse gas reduction regulations beyond Pavley rules incorporated in cases

California Gasoline and Diesel RAC-to-Retail Price Margins (2010 Cents)



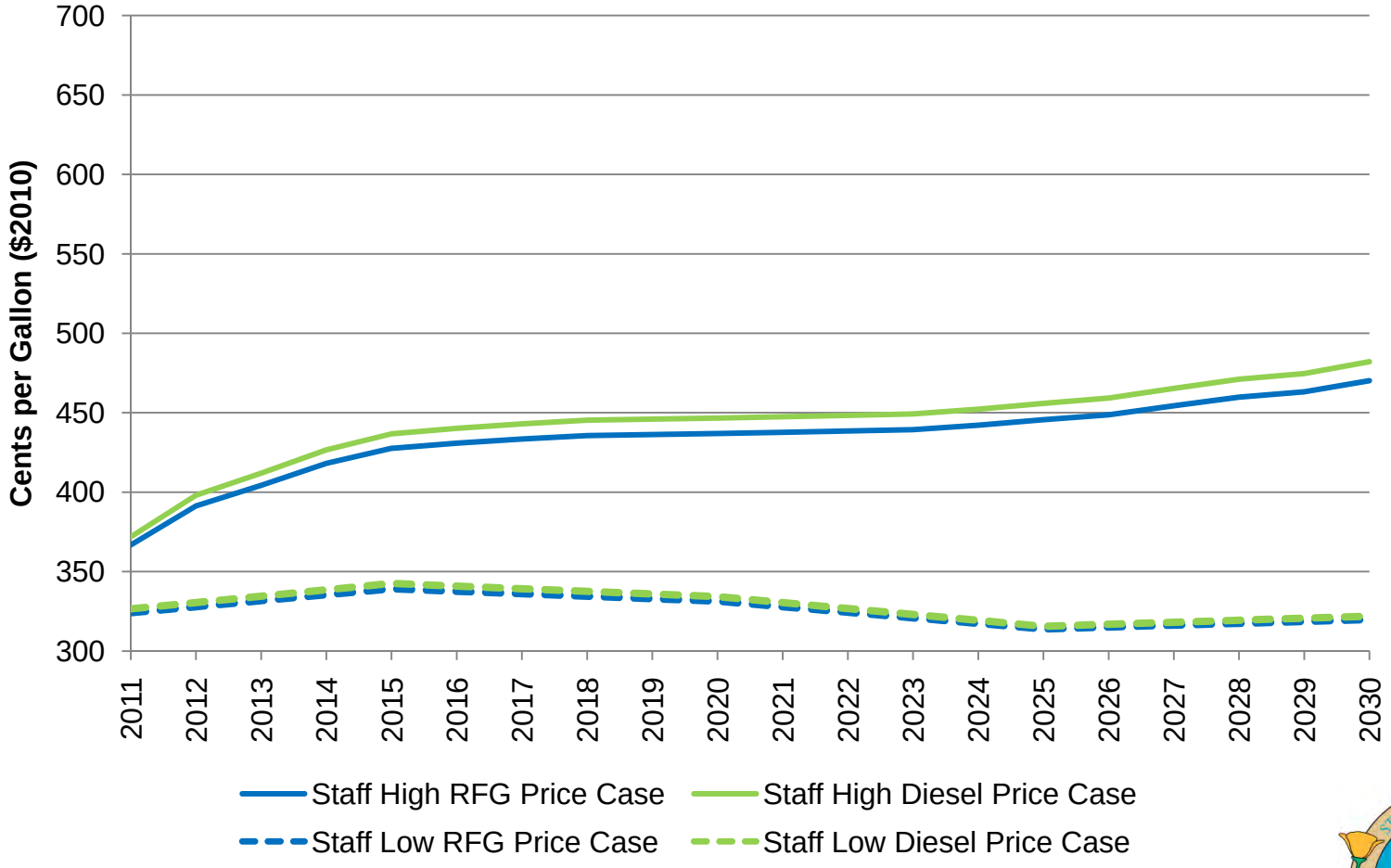
Sources: Derived by Energy Commission staff from U.S. Energy Information Administration

California Transportation Fuel Price Margins & Taxes (2010 Cents)

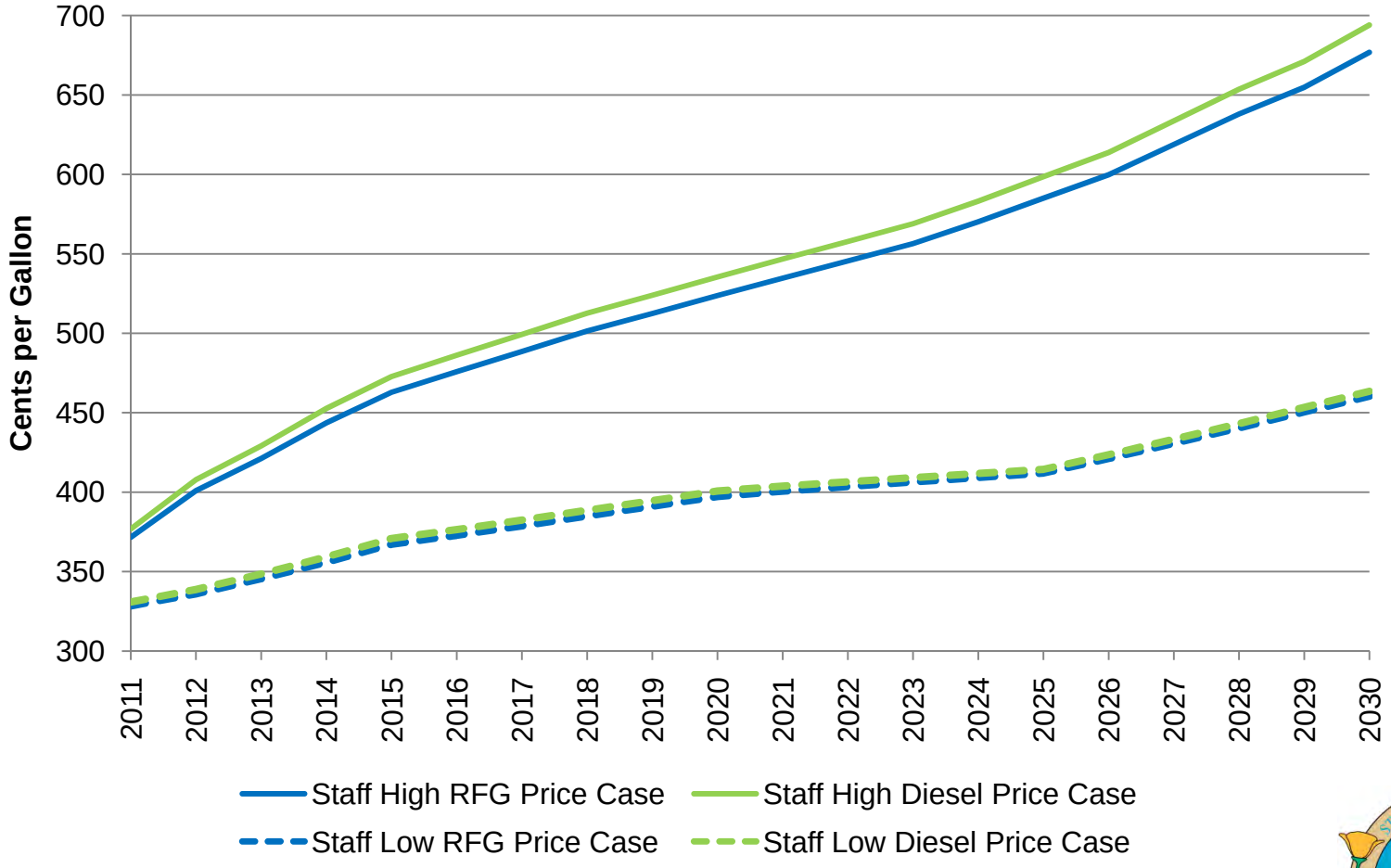
Fuel Price Case	Crude-to-Retail Margin	Federal Excise Tax	State Excise Tax	Under-ground Storage Tank Tax	State and Local Sales Tax
Energy Commission High Gasoline Price Margin	79.9	18.4	35.3	2	3.25%
Energy Commission High Diesel Price Margin	83.9	24.4	13.6	2	10%
Energy Commission Low Gasoline Price Margin	68.4	18.4	35.3	2	3.25%
Energy Commission Low Diesel Price Margin	76.3	24.4	13.6	2	10%

Sources: Derived by Energy Commission staff from U.S. Energy Information Administration and the Board of Equalization

California Regular-Grade Gasoline & Diesel Price Cases (2010 Cents)



California Regular-Grade Gasoline & Diesel Price Cases (Nominal)



Railroad Diesel and Jet Fuel Price Cases

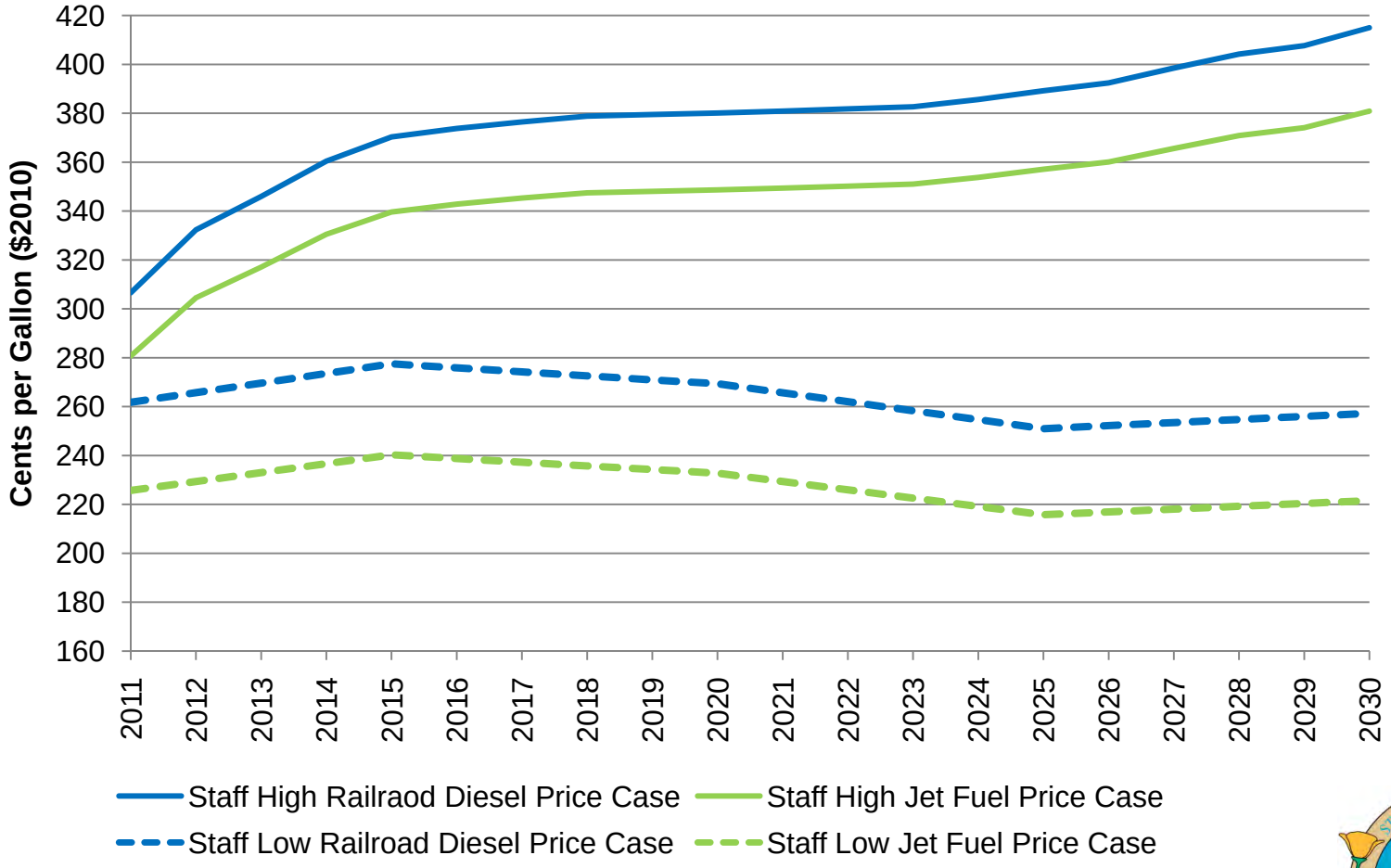
Railroad Diesel

- Margins estimated at 61.2 cents per gallon for the high case and 51.6 cents per gallon for the low case
- 8.25% California sales tax

Jet Fuel

- RAC to Jet Fuel Margin of 61 cents per gallon for the high case and 36 cents per gallon for the low case
- No taxes are added

California Railroad Diesel & Jet Fuel Price Cases (2010 Cents)



E85, B5, and Propane Price Projection Methodology

E85

- Based on high and low gasoline price cases
- Gasoline price cases are divided by 1.37 to price E85 on a similar Btu content basis

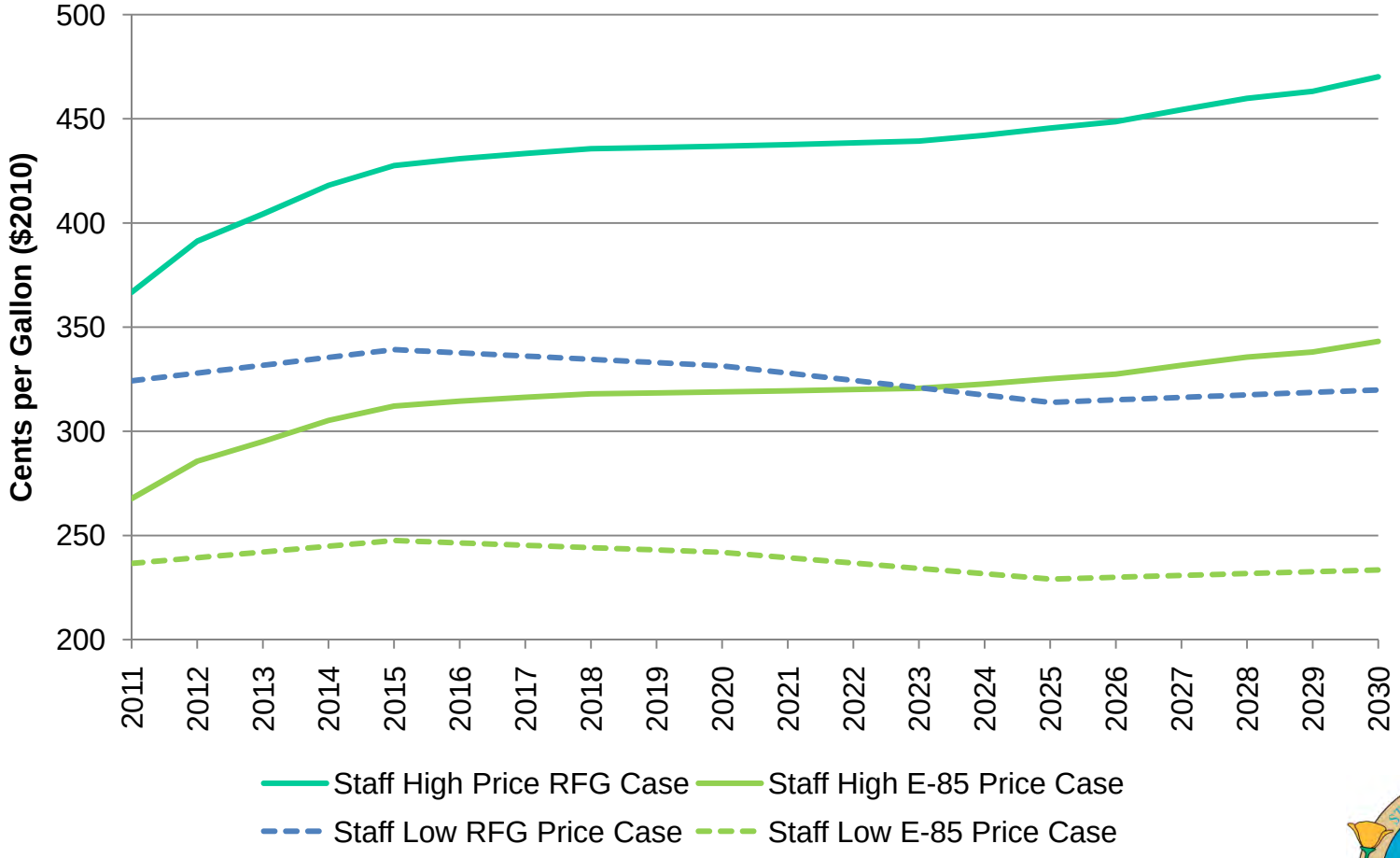
B5

- Substitute for diesel
- Priced at the same price as diesel

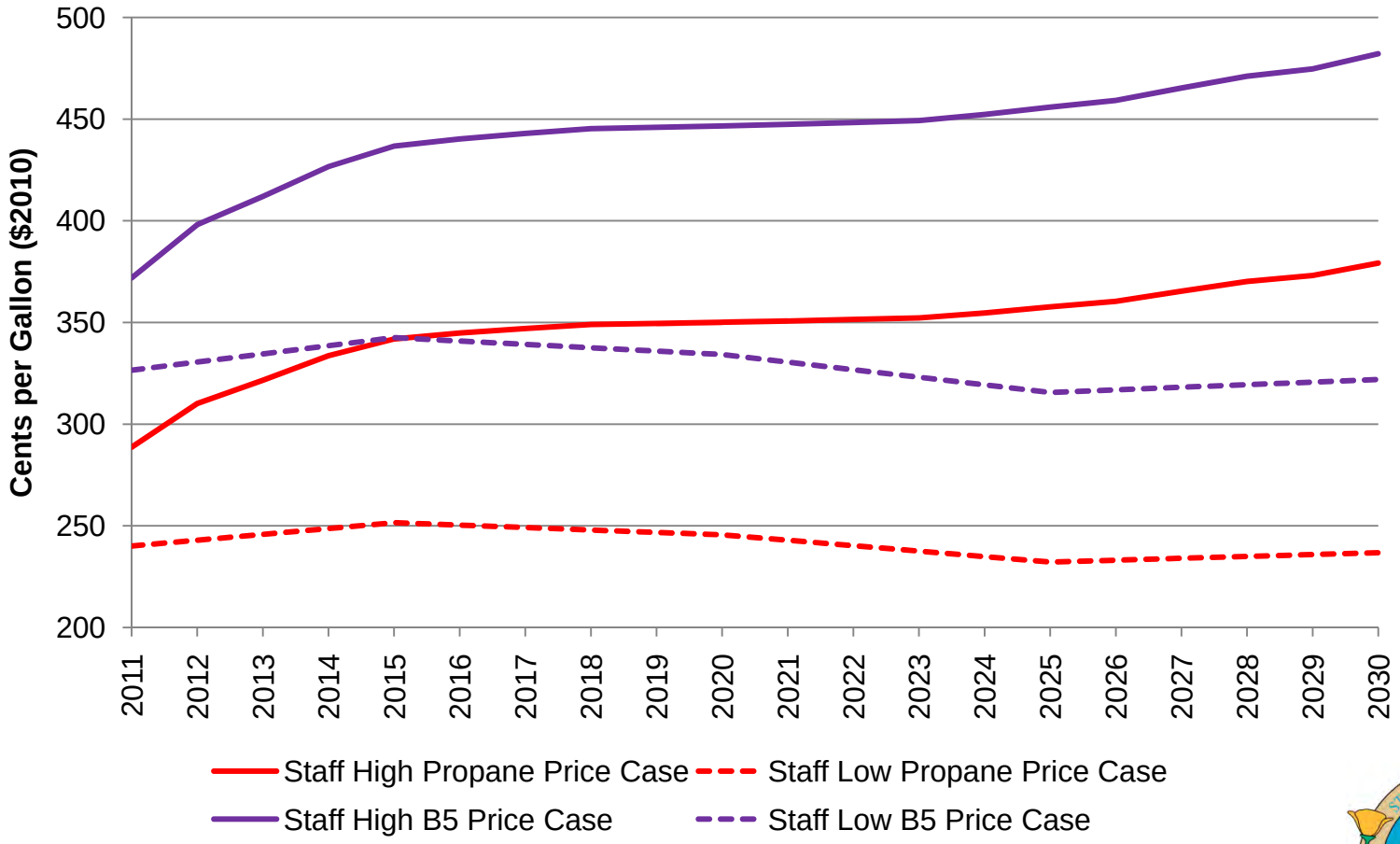
Propane

- Uses high and low RAC price forecasts
- Crude to whole sale margins of 84% (high) and 73% (low) price of crude oil with 58 cent retail margin
- Excise tax of 24.4 cents and sales tax of 8.25%

California E85 and RFG Price Cases (2010 Cents)



California B5 Price and Propane Price Cases (2010 Cents)



Price Forecast for Transportation Natural Gas and Hydrogen

- Staff will use the fixed margin methodology established in the *2009 Integrated Energy Policy Report*
- Both fuels will use natural gas projections consistent with those used by other offices.

CNG

- Henry Hub to CA Citygate margins of $.051 (high) and $.023 (low) per therm
- PG&E's transportation CNG cost margin of $1.624 per therm
- Federal road excise tax of $.184 cents per GGE and 8.25% California sales tax

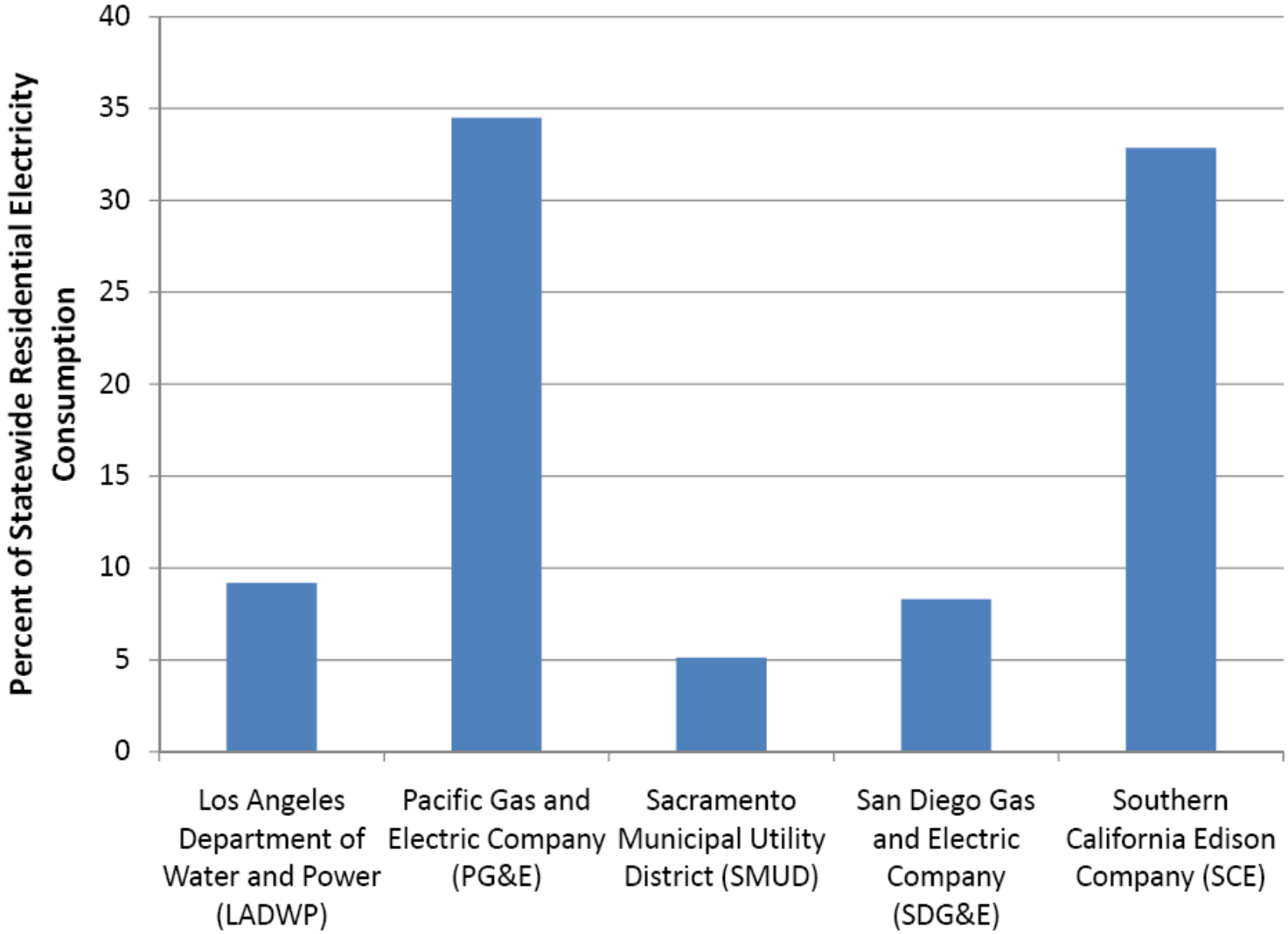
Hydrogen

- Same CA Citygate price cases as CNG
- Refining and retail margin of $1.25 per GGE
- Reforming cost of 24% of Citygate price
- 8.25% California sales tax

Transportation Electricity Prices Methodology

- Rate structures for alternative fuel vehicles were used when available
- Marginal analysis was performed to develop the forecast and includes the addition of transportation electricity consumption
- Uses weighted average pricing of evaluated California MOUs and IOUs based on 2009 statewide consumption levels
- Generation and non-generation costs were increased over forecast period using the same method in electricity evaluation for the 2009 IEPR

Utilities Analyzed



Evaluation of EV, PHEV, and CNG Electricity Consumption

- Data from FERC (PG&E, SCE, and SDG&E)
- Bottom-up calculation of annual miles and aggregate vehicle efficiency
- Assumption regarding all electric miles for PHEVs
- Additional 188 KWh a month (does not represent the final electricity consumption value from model)

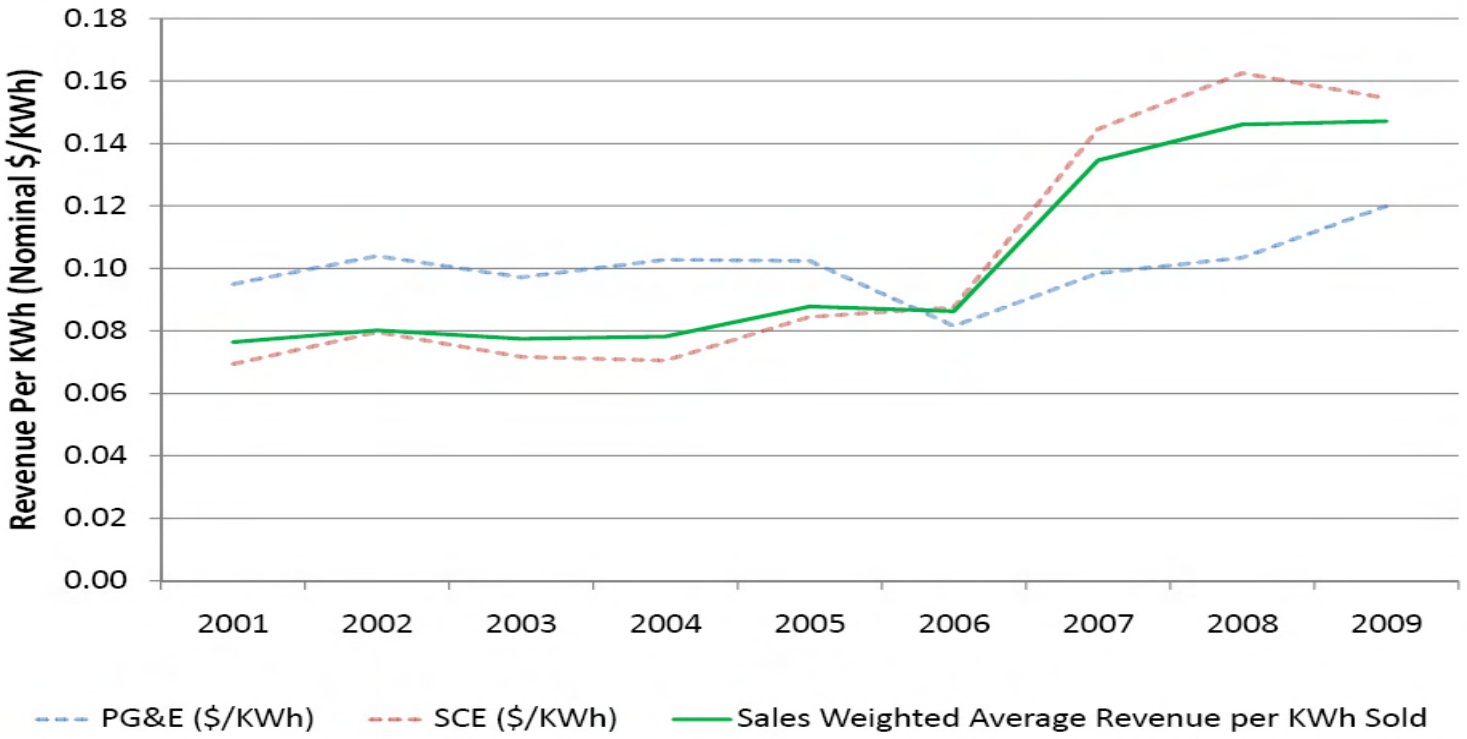
Additional Monthly Household Electricity Consumption

- Range of VMT
- Range of Efficiencies
- Monte Carlo estimated a mean added consumption of 175 KWh per month
- Adjusted for seasonal differences in VMT (±3.5 percent) and applied to monthly Summer and Winter consumption values

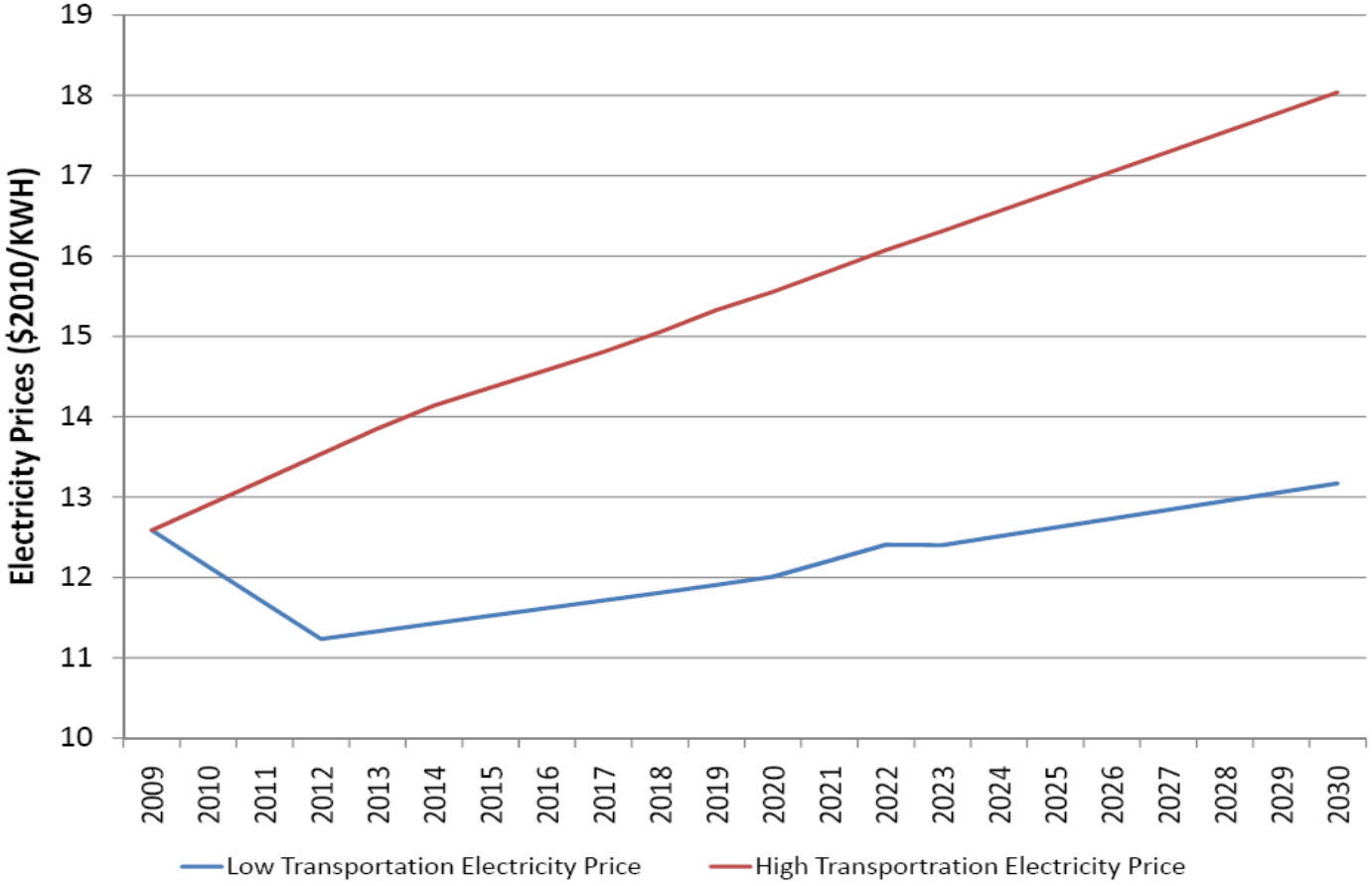
Seasonality, Peak/Off-peak, and Dual Metering Assumptions

- Seasonal differences in price and VMT were incorporated into the marginal price calculation
- The load profile was consistent with last IEPR and came from an old PG&E EV study, 88 percent off-peak, 8 percent partial peak, and 4 percent on peak
- Counties prohibiting dual metering were single metered (from staff survey)

FERC Revenue per KWh



Proposed Electricity Residential Retail Prices



Commercial Electricity Retail Prices

- Staff is considering applying a different price for commercial retail rates.
- The basis of the commercial rate would be a General Service rate for a parking structure or similar facility
- Base year commercial rate would be grown by the same growth rate used for residential sector

Assumptions or Significant Simplifications

- Single family home rates were emphasized, therefore multifamily dwelling consumption patterns were not included in staffs evaluation
- Free or significantly subsidized public charging was not considered
- Third-party EVSE rates were not included in evaluation
- RPS compliance in 2020
- No additional subsidization of residential electricity rates with corresponding impact to non-residential sectors

Next Steps

- Finalize inputs to demand forecasts
- Hold 2nd workshop on transportation energy infrastructure issues (May)
- Prepare demand scenarios and import requirements projections in draft staff report
- Hold 3rd workshop on staff's proposed transportation energy scenarios (August)
- Finalize staff report
- Integrate into IEPR transportation chapter

Fossil Fuels Office Contacts

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