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California Energy Commission

STAFF REPORT

TRANSPORTATION FUEL PRICE CASES AND DEMAND SCENARIOS:

Inputs and Methods for the

2011 Integrated Energy Policy Report

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CALIFORNIA ENERGY COMMISSION

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ABSTRACT

For the *2011 Integrated Energy Policy Report*, California Energy Commission staff has documented methods and inputs to be used for preparing long-term transportation energy demand scenarios. Price forecast cases were developed for crude oil, gasoline, diesel, railroad diesel, jet fuel, propane, ethanol, and biodiesel, and methods were identified for estimating future prices for transportation electricity, natural gas, and hydrogen. Additionally, staff has proposed methods for constructing policy scenarios based around plausible high and low petroleum demand levels, taking into account potential future economic growth, population and demographic changes, and planned and potential future transportation energy policies, standards, and regulations. Staff has also provided information on the modeling tools that will be used for the demand analysis, as well as methods for other qualitative and quantitative analysis undertaken to estimate the impacts of existing policies and to assess progress toward petroleum reduction and alternative fuel penetration goals of the state.

Keywords: California fuel price forecasts, transportation energy, gasoline, diesel, jet fuel, ethanol, E85, propane, biodiesel, transportation fuel demand, demand models, Low-Carbon Fuel Standards, Renewable Fuel Standards, petroleum and renewable fuel markets, CNG, LNG, hydrogen, crude oil, electricity

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EXECUTIVE SUMMARY

Senate Bill 1389 (Bowen, Chapter 568, Statutes of 2002) requires the California Energy Commission to conduct "assessments and forecasts of all aspects of energy industry supply, production, transportation, delivery and distribution, demand, and prices to develop policies for its *Integrated Energy Policy Report*." As part of these assessments, Energy Commission staff develops long-term projections of California transportation energy demand to establish the quantitative baseline that will support analysis of petroleum reduction and efficiency measures, commercialization of alternative fuels, integration of energy use and land use planning, and transportation fuel infrastructure requirements. Structured transportation fuel price forecast cases and other assumptions about economic and population growth and energy and environmental policies are essential inputs for preparing transportation energy demand scenarios. Staff has presented brief synopses of additional assessments and policy analyses that will augment its demand scenarios, including analyses of the federal Renewable Fuel Standards, the Low-Carbon Fuel Standard, and state progress toward petroleum reduction goals. Infrastructure needs assessments have also been outlined to gauge the implications of the demand scenarios on crude oil, petroleum product, and renewable and alternative fuels import and distribution infrastructure requirements.

This report summarizes staff's transportation fuel price forecasts and the methods used to form them. Price forecasts cases were generated for gasoline, diesel, jet fuel, propane, biodiesel, and ethanol. Analysis indicates that most transportation fuels are linked to crude oil prices, so existing crude oil price forecasts are a primary element of the transportation fuel price forecasts. Crude oil prices in 2030 are forecast to be about $135 per barrel in 2010 dollars (adjusted for inflation) in the High Price Case and $78 per barrel in the Low Price Case. Gasoline prices in 2030 are forecast to be $4.70 per gallon in 2010 dollars in the High Price Case and $3.22 per gallon in the Low Price Case. In nominal terms, gasoline prices in 2030 will reach $6.77 per gallon and $4.60 per gallon, respectively, in the High and Low Price Cases.

The report also discusses methods for developing retail transportation compressed natural gas (CNG), hydrogen, and electricity prices, consistent with and pending further information from the Energy Commission's Electricity Supply Analysis Division. In its analyses, staff assumes that fuel price margins and taxes will remain at historical levels in real terms over the forecast period and that historical price relationships found between petroleum fuels and emerging fuels will characterize future relative prices.

These topics will be discussed at a workshop at the Energy Commission on February 24, 2011. Further workshops are scheduled for May 11, 2011, (Transportation Energy Infrastructure Issues) and August 16, 2011, (Presentation of Draft Transportation Energy Scenarios and Policy Analyses Report).

CHAPTER 1: Overview

Purpose of Transportation Fuel Price and Demand Forecasts

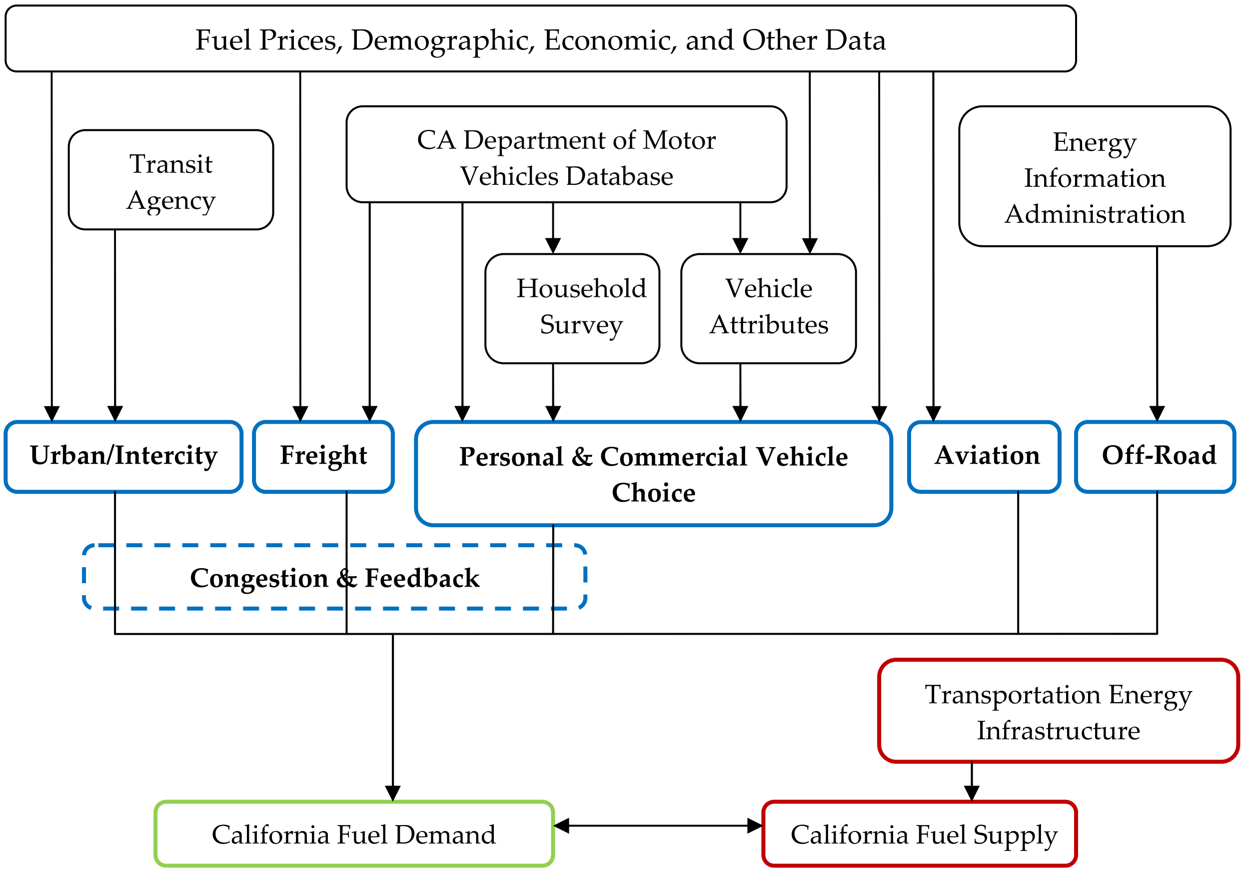
The Fossil Fuels Office of the Fuels and Transportation Division develops forecasts and analyses of the transportation fuels industry and related markets to support policy development at the California Energy Commission. The cases and scenarios defined in this report, which will be used for the *2011 Integrated Energy Policy Report* (*2011 IEPR*), will result in a range of potential demand forecasts and are intended to represent bounds of potential future demand for transportation fuels. The conditions at these boundaries provide the context for additional assessments performed by staff relating to Energy Commission Alternative and Renewable Fuels and Vehicle Technologies Program (ARFVTP) activities, California petroleum reduction goals, transportation fuel diversification, energy security, and transportation fuel infrastructure requirements.

The cases and scenarios described in this document are intended to provide the foundation for further analyses and are essential for long-term assessments of California's petroleum and alternative transportation energy infrastructure. Fuel demand forecasts will be conditioned on two market outcomes the staff has determined to be plausible. These conditional forecasts are intended to aid with the development of public policy, not define the most likely future.

As with prior transportation energy demand forecasts, the inputs include transportation fuel price forecasts, economic and demographic projections, surveys of vehicle purchase and use by households and commercial fleet owners, California vehicle counts, projections of vehicle manufacturer offerings and attributes, public transit agency data, goods movement data, and air transportation data. The Energy Commission makes assessments of future transportation fuel demand, refinery processing capacity, and rates of crude oil production decline in California. Additionally, the production capacity, location, and carbon content of alternative and biofuel products will be incorporated into staff's analyses of climate change-related policy analyses.

A general overview of the inputs and data flow through the forecasting models is presented in Figure 1. The flow chart highlights the main categories of inputs and models used by staff in developing the IEPR transportation energy demand forecasts. The black boxes represent inputs, the blue boxes represent models, the red boxes reflect supply side assessments, like the transportation fuel supply/demand balance and infrastructure and policy analyses, and the green box indicates the final transportation fuel demand estimates developed from the modeling and other analytical assumptions.

Figure 1: Transportation Energy Data Flow Diagram



Source: California Energy Commission

Organization of this Report

This staff report provides information on the *2011 IEPR* work products and methods to solicit public input and comments. The report includes summaries of methods for producing the transportation fuel demand scenarios, including related inputs and assumptions, but with a particular emphasis on transportation fuel price assumptions. The Energy Commission will present and discuss these and other related materials at the February 24, 2011, Joint IEPR, Transportation, and Electricity and Natural Gas Committee workshop to be held at the Energy Commission. A second workshop is scheduled in May 2011 to discuss infrastructure issues affecting transportation fuels supply in California, including methods to estimate fuel import projections, assess infrastructure needs, and measure progress toward petroleum reduction goals. A final workshop will be conducted in August 2011 to present staff's proposed transportation fuel demand and import requirements forecasts and other related analyses. Chapters 2 and 3 of the report briefly reviews the models and methods used for demand analysis and the assumptions of the proposed scenarios. Chapter 4 presents assumptions, methods, and price cases for crude oil and transportation fuels, which include gasoline, diesel, jet fuel, E85 (a blend of 85 percent ethanol and 15 percent gasoline), biodiesel, electricity, compressed natural gas, hydrogen, and propane. Chapter 5 discusses staff assessments of transportation energy demand in the context of state and federal policies and future infrastructure requirements.

CHAPTER 2: Long-Term Fuel Demand Forecast Methods

As part of the *2011 IEPR*, Energy Commission staff will produce long-term annual transportation fuel demand forecasts using a set of integrated forecasting models. These models cover four distinct transportation sectors: light-duty vehicle (LDV) demand, personal ground travel (urban and intercity), goods movement, and aviation travel. A new congestion module also interacts with both urban travel and freight movement. Each model forecasts fuel demand for different transportation sectors and, with the exception of aviation and congestion, they are updates of models and methods used in previous years' forecasts. In some cases, the models have been changed to allow for new input values, but the forecasting methods have remained consistent with previous forecasts. Significant changes have been made to the past Transit Models, which are now transformed into Urban and Intercity Travel, and the Aviation model has been significantly redesigned. Additionally, various inputs and assumptions to the models have been updated.

The following is a general description of each of these models to be used for the *2011 IEPR* transportation fuel demand forecast.

Light-Duty Vehicle Fuel Demand Models

LDVs are primarily used for personal and commercial people movement. LDV demand is captured by two models: personal vehicle choice (PVC) and commercial vehicle choice (CVC). PVC and CVC forecasting models generate forecasts of vehicle stock and average fuel economy by vehicle and fuel types. There are 105 vehicle classes in these models, composed of 15 vehicle styles and 7 fuel types. The 7 fuel types include gasoline, diesel, E85, CNG, hybrid, full electric, and plug-in hybrid electric vehicles (PHEV).

The CVC model also generates vehicle mileage forecasts for the commercial LDV sector; however, the personal vehicle miles travelled forecast for household vehicles is generated in the urban and intercity travel demand models.

PVC and CVC are discrete choice models, and their dynamic nature is defined by the impact of vehicle stock in one year on the vehicle stock of the following year. The coefficients for these models were estimated using the Energy Commission 2009 California Household and Commercial Vehicle Survey (2009 California Vehicle Survey) conducted by Abt SRBI. ICF International is the source for key model inputs including projections of vehicle attributes. The U.S. Census Bureau American Community Survey, California Department of Finance, and Moody's Economy.com are the sources of household demographic and economic data inputs in the models. Other key inputs include California Department of Motor Vehicles registered on-road vehicle counts and transportation fuel prices estimated by staff.

California Travel Demand Models

There are two models used to develop forecasts for California travel demand, intercity and urban. Urban and intercity travel demand models generate projections of transit ridership, passenger miles, and vehicle miles traveled (VMT) for public transit and personal automobile vehicle use, as well as fuel consumption estimates. Urban travel revolves around choices among personal automobile, bus, and rail modes, while intercity travel requires choice among personal auto, bus, rail, and air travel modes. These models estimate the effects on transit energy consumption of changes in transit fares, service policies, automobile fuel economy, fuel prices, population, employment, and income. The urban travel model can also estimate the effectiveness of policies designed to save energy by promoting diversions from automobiles to transit.

Economic and demographic data used in these models are consistent with the vehicle choice models. Urban transit specific data inputs to the models are derived from the Federal Transit Administration's National Transit Database, an Energy Commission staff survey of public transit agencies in California, and the California Department of Transportation's 2000 California Household Travel Survey.

California Freight Energy Demand Model

The California Freight Energy Demand Model projects the volume of ground freight transported by medium/heavy-duty vehicles and rail, medium/heavy duty vehicle stock, vehicle miles traveled, and fuel consumption for four types of fuels used in this sector. These outputs are driven by fuel price projections, growth projections for 42 commodities, and growth projections of industrial activity in 14 economic sectors. Industrial activities projections are used to account for on-road medium and heavy-duty vehicle activities that are not directly related to commodity movement, such as mining, construction, and public utility trucks.

The California Freight Energy Demand Model forecasts good movements using disaggregated base year data that includes vehicle miles traveled, ton-miles, truck stock, average payload, commodity growth, economic activity projections, and fuel price inputs. These inputs are then distributed to different modes by a modal diversion model. The modal diversion model allocates the transportation of these goods to either rail or road vehicle modes based on transportation costs and travel time.

California Civil Aviation Jet Fuel Demand Model

Staff used two aviation models: one for freight aviation and another for passenger travel. Freight aviation's main drivers are gross domestic production and jet fuel prices. The passenger aviation model generates forecasts of intrastate, interstate, and international air travel demand for both personal and business passengers. Inputs to the model that generates the jet fuel demand forecast include:

- Economic and demographic projections.
- Bureau of Transportation Statistics base year data on passenger and aircraft origin and destination travel.
- Passenger load factor.
- Aircraft capacity for aircraft classes.

General aviation fuel consumption, both jet fuel and aviation gas, is projected in proportion to population growth.

Congestion Module

The congestion module uses a Road Congestion Index published by the Texas Transportation Institute, alongside vehicle miles of travel from the urban and freight modules to produce a forecast year Travel Time Index. This index is used to compute travel times in forecast years to subsequently influence both personal travel in the urban module and ground goods movement in the freight module.

CHAPTER 3: Proposed California Transportation Demand Scenarios

The California transportation fuel demand forecast estimated by the Energy Commission may be used for many purposes, so it is prudent to develop a set of scenarios that reflect a range of plausible future fuel demand outcomes. In addition, there are uncertainties inherent in the projections of crude oil and transportation fuel prices, economic growth, and state population growth. Fuel demand forecasting models use these projections as inputs, and hence these uncertainties are transmitted into the fuel demand estimates. To account for these uncertainties, staff will develop two demand scenarios, each defined by different projected growth paths for these inputs, to frame the upper and lower boundaries of a range of petroleum demand outcomes. These scenarios incorporate different projections of transportation fuel prices that are linked to crude oil prices (gasoline, diesel, E85, B5 [a blend of 5 percent biodiesel and 95 percent traditional diesel] and propane), transportation fuel prices that are not linked to crude oil (natural gas and electricity), and economic growth. Uncertainties in population growth may also be considered in defining these high and low petroleum demand scenarios. Table 1 presents the draft set of price cases to be associated with the high and low demand scenarios.

Table 1: Scenario Descriptions

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

Source: California Energy Commission

Maximum and minimum transportation activity occurs when all fuel prices are low or high, given that all other conditions are the same. The two petroleum demand scenarios are defined by a mixture of price cases; therefore, they do not result in the maximum and minimum transportation demand. Staff intends for these petroleum demand scenarios to provide a reasonable range of transportation fuel demand projections for California, not specifically representing a likely future. The set of price and economic growth cases used for the forecast will result in the largest range of alternative fuel vehicles and fuels being consumed in California.

The staff is also considering a set of regulations and policies for inclusion in these demand scenarios. The regulations and standards under consideration for inclusion in these scenarios are divided into two groups: those that are implemented, and the ones that have been proposed.

Implemented Regulations

- Pavley Assembly Bill 1493 (Pavley, Chapter 200, Statutes of 2002)
- Environmental Protection Agency (EPA) Greenhouse Gas (GHG) Regulations
- National Highway Traffic Safety Administration (NHTSA) Corporate Average Fuel Economy (CAFE) standards
- California Zero Emission Vehicle (ZEV) Program
- California Low-Carbon Fuel Standard (LCFS)
- Renewable Fuel Standard (RFS) (I and II)

Proposed Regulations

- EPA and NHTSA Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles
- EPA and NHTSA Future Greenhouse Gas and Fuel Economy Standards for Passenger Cars and Light Trucks
- Pavley II (2017 through 2020)
- Low-Emission Vehicle (LEV) III (will include ZEV mandate)

The effect of these regulations on scenario outcomes may be evaluated within the model or outside the model through post-processing of forecasting model results. For instance, as discussed in Chapter 5, staff anticipates evaluating the impact of LCFS and RFS regulations outside of the discussed demand models.

Policies and regulations that will not be included in this analysis are:

- Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006) Regional Transportation-Related GHG Targets, Vehicle Efficiency Measures, Good Movement, Medium- and Heavy-Duty Vehicle Hybridization, and California's High Speed Rail
- Senate Bill 375 (Steinberg, Chapter 728, Statutes of 2008)
- National Ambient Air Quality Standards
- Regional Air Quality Criteria and Regulations

These policies and regulations have not been included due to time and resource limitations. In some instances the current forecasting models are not amenable to simulating the impact of these policies. Future model updates, including incorporating modeling work by regional transportation planning agencies, as well as research into the impacts of regional transportation plans, may allow staff to perform analyses of these policies.

As in past *IEPR* workshops, staff seeks comments on the likely mix of transportation energy prices, economic growth, and policies that may occur together. Staff would like comments and input on the policies proposed for inclusion in the analysis. In particular, staff is interested in learning about interpretations and expectations regarding these policies. Additionally, if there are other policies that would be of value to consider, staff would like specific suggestions regarding their applicability and importance in the attainment of California's petroleum and emission reduction goals.

CHAPTER 4: Proposed California Transportation Fuel Price Cases

Summary

Staff has developed draft high and low petroleum transportation fuel price forecast cases for California based on the U.S. Energy Information Administration (EIA) *2009 Annual Energy Outlook (AEO)* Reference crude oil price case and the 2010 IHS Global Insights, Inc., crude oil price forecast, respectively. The Energy Commission's resulting High Fuel Price Case starts at $3.67 per gallon for gasoline and $3.72 for diesel in 2011, increases to $4.28 and $4.37, respectively, in 2015, and then continues to rise to $4.70 and $4.82 by 2030 (all prices are reported in 2010 dollars).[1] The Energy Commission's Low Fuel Price Case starts at $3.24 per gasoline gallon and $3.27 per diesel gallon in 2011, climbs to $3.39 and $3.43 in 2015, and then declines gradually to $3.20 and $3.22 per gallon, respectively, by 2030. Staff has also prepared price cases for other transportation fuels, including railroad diesel, jet fuel, E85, biodiesel (B5), propane, electricity, compressed natural gas, and hydrogen.

Crude Oil Price Cases

In June 2008, the West Texas Intermediate (WTI) spot price rose to a record monthly average high of $137.36, while the Imported Refiner Acquisition Cost (RAC) of crude oil reached its monthly record high of $131.09 in the following month, in 2010 dollars. Neither of these values proved sustainable as the WTI average spot price and the Imported RAC fell to $42.19 and $36.51, respectively, by December 2008. This precipitous drop in crude oil prices in less than six months was largely due to the weakening world economy that set in during the fourth quarter of 2008. Figure 2 shows historic imported RAC prices from the EIA.

Since the wild crude oil price swings of 2008, the imported RAC rose to $75.63 in November 2009 and continued to increase to a monthly average of $80.86 in November 2010 (a 7 percent jump over the 12-month period). The EIA Reference Price Case projects an average growth rate of about 4 percent per year from 2011 to 2015 and an average growth rate of about 3 percent per year through the entire 2011 to 2035 forecast period (Figure 2). EIA, IEA, and Deutsche Bank[2] crude oil price forecasts (Figure 3) project a steady growth in crude oil prices. Staff does not expect another rapid increase in crude oil prices to be sustainable without a strong recovery in the overall world economy.

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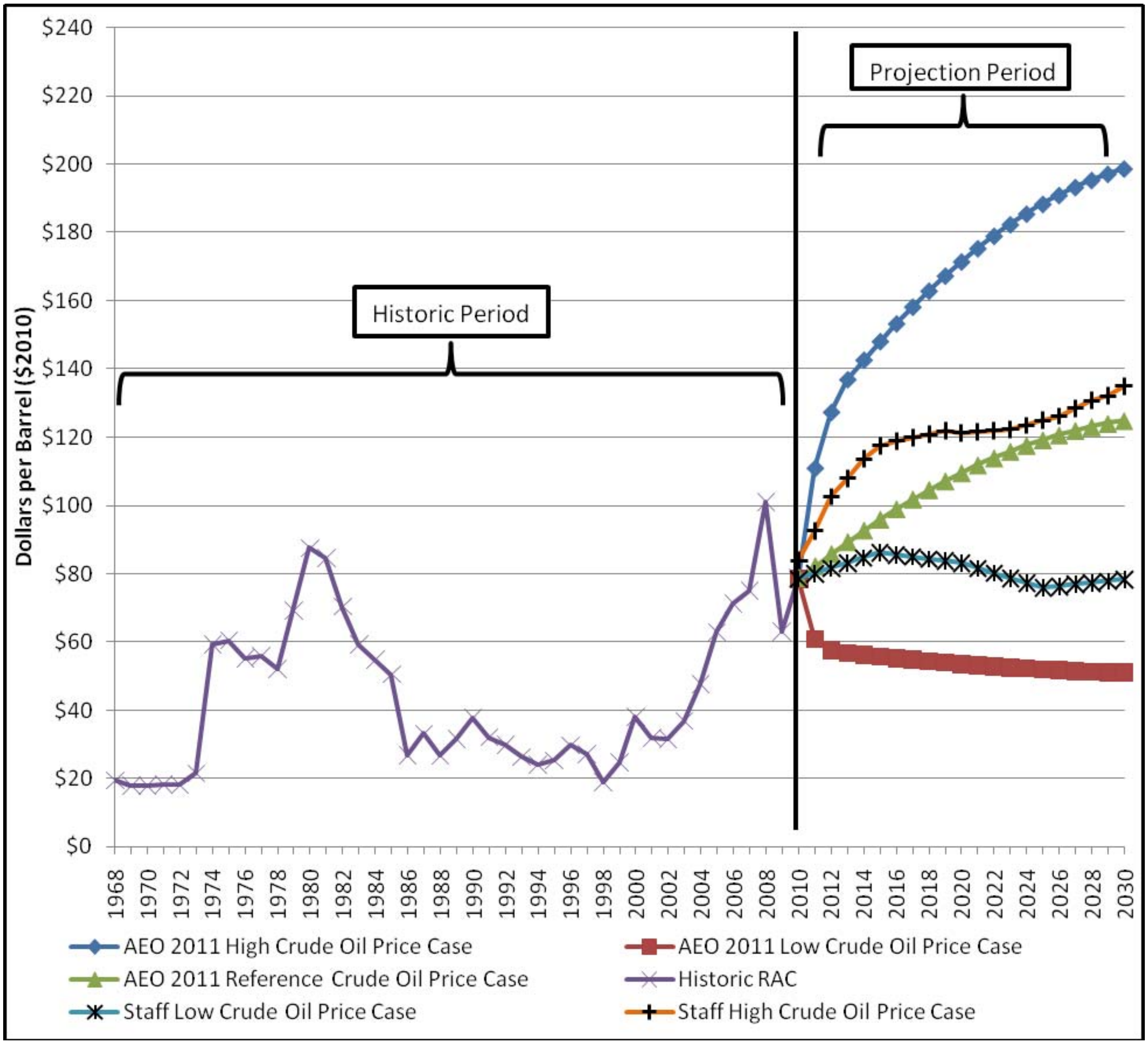
1 All real prices used in this work are in 2010 dollars, using the December 2010 EIA deflator series reported in the *2011 AEO Early Release*. Nominal prices, prices at the pump or reported in the media will be significantly higher, especially in later of the forecast.

2 Forecasts of crude oil by the EIA are for imported RAC, while forecasts for the other agencies presented in this document are for the WTI.

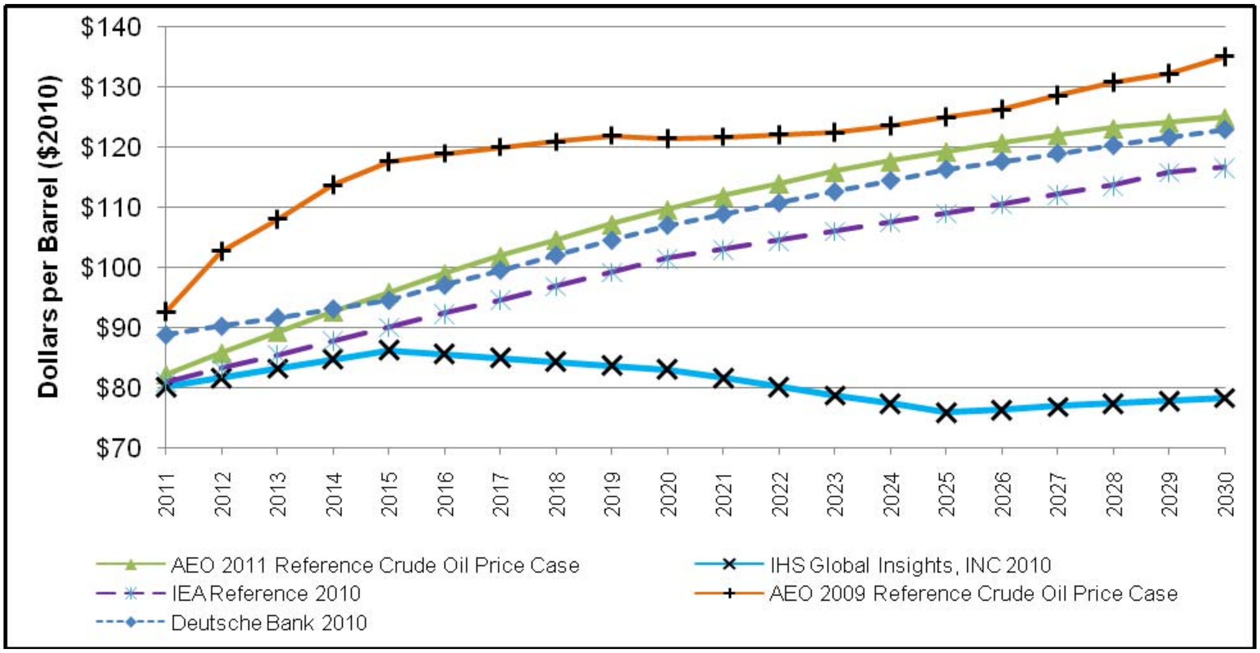
Figure 2: Energy Commission Staff and EIA *AEO 2011* Crude Oil Price Cases and Historical Prices (in 2010 dollars)



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

Staff proposes adopting the EIA *2009 AEO* Reference Case crude oil price forecast as the *2011 IEPR* High Crude Oil Price Case and a modified version of the 2010 IHS Global Insight, Inc., price forecast[3] as the *2011 IEPR* Low Crude Oil Price Case. The Low Crude Oil Price used the same $ per barrel values as the IHS forecast but substituted the RAC index for the WTI index, effectively raising the forecast by the difference between average imported crude oil prices and WTI prices. Note again that staff uses EIA's measure of the United States refiner acquisition cost (RAC) of imported crude oil, which is the sales weighted average price of all imported crude oil and is roughly $3 to $10 per barrel less than the average for higher-quality imported light sweet oil.[4] Figure 3 and Table 2 compare recent EIA crude oil price cases with those of other leading agencies.

Figure 3: Crude Oil Price Forecasts by Agency (in 2010 dollars)



Source: U.S. Energy Information Administration.

3 Forecast obtained via the EIA's *2010 AEO Comparison with Other Projections* report, Table 10. Linear extraction was then applied to each point reported in the table to create a yearly forecast.

4 The subset of premium light sweet oil constitutes a relatively small percentage of the oil actually refined in the United States or California, but prices for it are those most commonly referred to in the media.

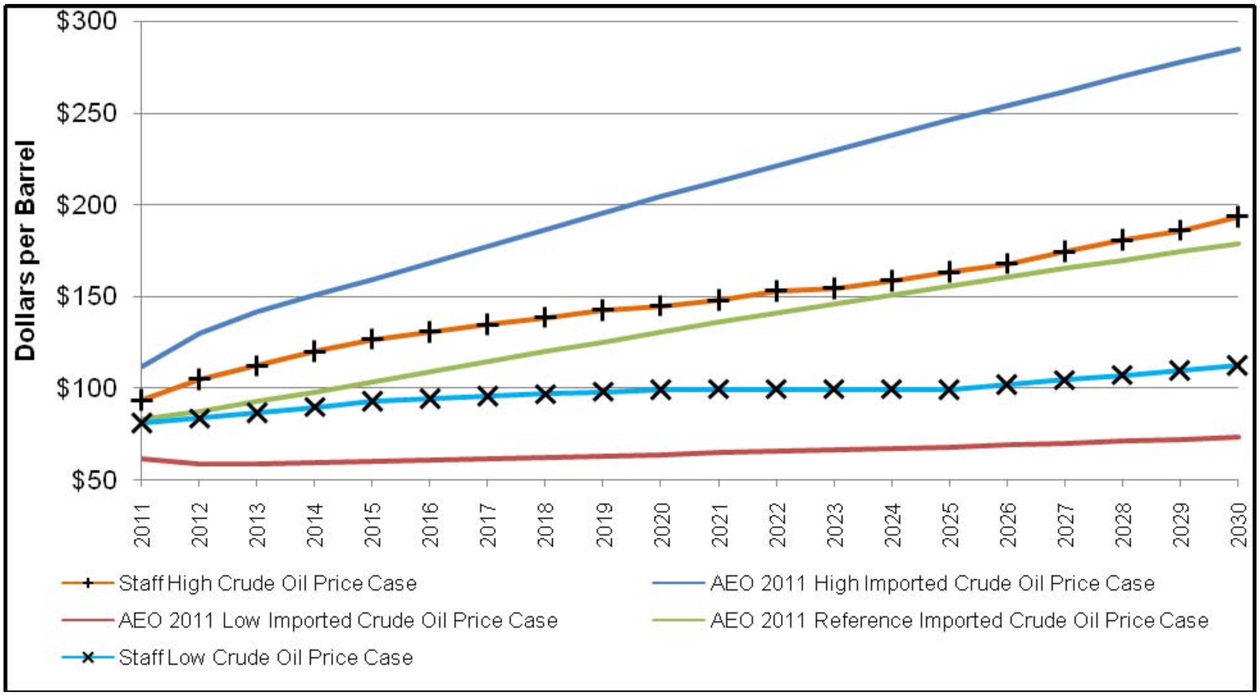
Table 2: EIA *2011 AEO* Crude Oil Price Cases, Energy Commission 2011 Price Cases, and EIA *2010 WEO* Oil Price Projections (2010 dollars per barrel)

Year	*2011 AEO* Reference Price Case	*2011 AEO* High Price Case	*2011 AEO* Low Price Case	Energy Commission High Price Case	Energy Commission Low Price Case	2010 EIA Reference Price Projection
2011	$82.13	$110.86	$60.84	$92.20	$79.71	$80.86
2012	$85.68	$127.31	$57.66	$102.18	$81.23	$83.14
2013	$89.23	$136.88	$56.78	$107.48	$82.76	$85.43
2014	$92.62	$142.61	$56.25	$113.09	$84.29	$87.71
2015	$95.84	$148.07	$55.74	$116.93	$85.82	$89.99
2016	$98.91	$153.27	$55.25	$118.27	$85.18	$92.27
2017	$101.81	$158.21	$54.79	$119.31	$84.55	$94.55
2018	$104.56	$162.89	$54.36	$120.22	$83.91	$96.83
2019	$107.14	$167.32	$53.94	$120.47	$83.28	$99.11
2020	$109.56	$171.48	$53.56	$120.73	$82.65	$101.40
2021	$111.82	$175.38	$53.19	$121.03	$81.22	$102.92
2022	$113.92	$179.02	$52.85	$121.37	$79.80	$104.44
2023	$115.85	$182.40	$52.54	$121.72	$78.37	$105.96
2024	$117.63	$185.52	$52.25	$122.86	$76.94	$107.48
2025	$119.24	$188.38	$51.98	$124.26	$75.52	$109.00
2026	$120.69	$190.98	$51.74	$125.51	$76.00	$110.52
2027	$121.98	$193.33	$51.52	$127.84	$76.49	$112.04
2028	$123.11	$195.41	$51.33	$130.06	$76.97	$113.56
2029	$124.08	$197.23	$51.16	$131.41	$77.46	$115.84
2030	$124.89	$198.79	$51.01	$134.26	$77.95	$116.60

Source: U.S. Energy Information Administration, California Energy Commission, and the International Energy Agency

Figure 4 shows EIA and staff price cases in nominal dollars, using the EIA's inflation forecast found in the *2011 Annual Energy Outlook Early Release*.

Figure 4: Energy Commission Staff Proposed Crude Oil Prices Cases and EIA *2011 AEO* (in nominal dollars)



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

Petroleum-Based Transportation Fuel Price Projection Method

For projection purposes, staff used the period between January 2003 and December 2010 to estimate the fuel price margins used in this analysis, due to MTBE-free reformulated gasoline becoming the dominant gasoline refined and used in the state during this time. To estimate these margins, staff first determined the historical differences between EIA's monthly refiner acquisition cost of imported crude oil and the EIA's monthly California sales-weighted regular-grade gasoline and diesel retail prices. This difference is referred to as the "crude oil-to-retail" price margin (that is, combines what are often referred to as refiner and dealer margins) and since 2003 has varied between $0.40 and $1.40 in 2010 dollars for regular gasoline, and between $0.39 and $1.35 for diesel. The seasonal component of these fluctuations, however, is averaged out in the annual price margin forecasts. Annual average crude oil to retail price margins have ranged from $0.51 to $0.91 per gallon for regular gasoline, and from $0.44 to $1.05 per gallon for diesel in 2010 dollars, since January 2003.

The last step in generating a final retail price forecast for each of the fuels is to add excise and sales taxes and fees. In the case of regular-grade gasoline, combined federal and state excise taxes (including fuel use and underground storage tank levies) totaled $0.557 per gallon, and sales tax was estimated at 3.25 percent (2.25 percent state sales tax with a 1 percent local sales tax).[5] For diesel, the federal excise taxes are $0.244 and the state excise taxes $0.156. In the case of diesel, however, $0.136 of the state excise tax is not subject to sales tax and therefore was added after sales tax was computed and included. Sales tax to be used for diesel price is estimated at 10 percent, composed of 9 percent state and 1 percent local sales taxes.

Table 3 summarizes the High and Low Fuel Price Case crude oil-to-retail margins and the taxes included with staff's High and Low Crude Oil Price Cases. All prices are in 2010 cents and were averaged annually in all cases. The Low Fuel Price Case margins were based on recent years of lower margins (2008–2010 data) and the High Fuel Price Case on higher margin values of the entire span of years (2003–2010 data). Figure 5 depicts the yearly averages of these margins.

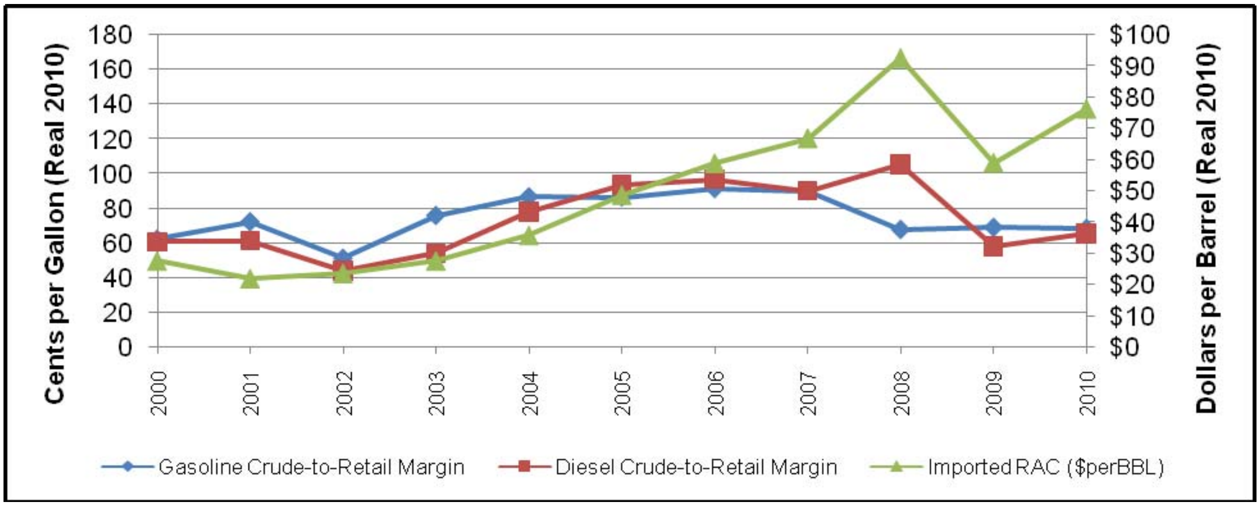
Table 3: Price Margins and Taxes Used in Fuel Price Cases (2010 cents per gallon)

Fuel Price Case	Crude-to-Retail Margin	Federal Excise Tax	State Excise Tax	Underground 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%

Source: California Energy Commission

5 Sales tax rate reflects recent changes in the fuel tax structure due to the California Gas Tax Swap that started July, 1 of 2010. The diesel tax structure is scheduled to change on July 1, 2011. Both changes are intended to be revenue neutral and excise tax rates will be changed in future years based on gasoline and diesel consumption.

Figure 5: Imported Refiner Acquisition Cost (RAC), Gasoline and Diesel Crude-to-Retail Price Margins (in 2010 dollars)

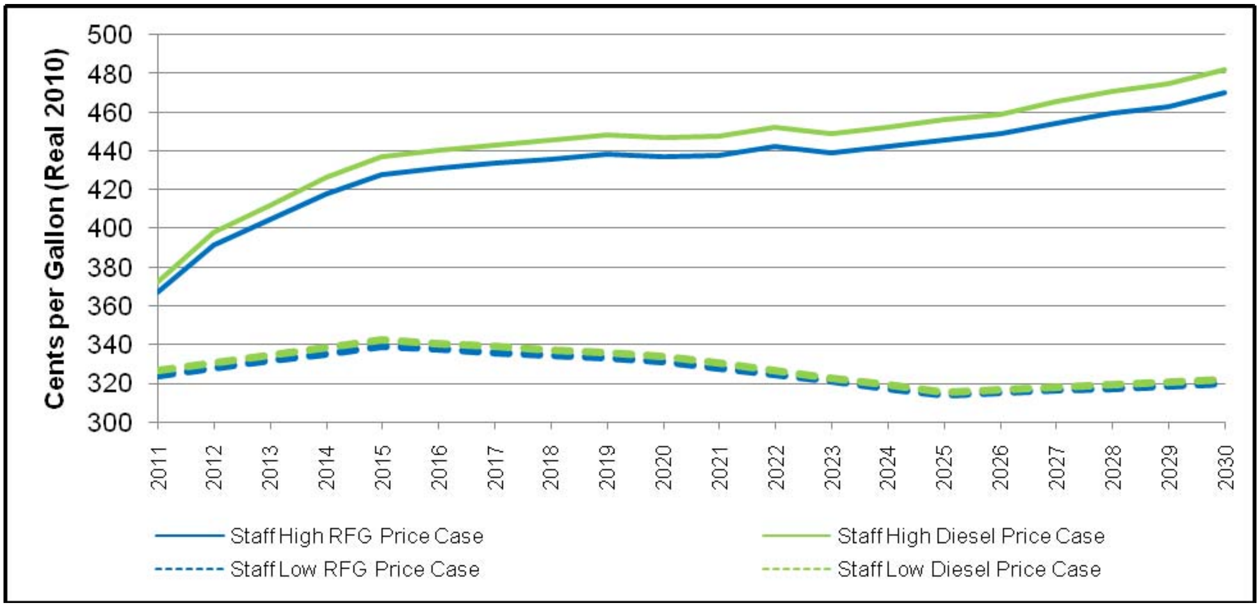


Source: U.S. Energy Information Administration and the California Energy Commission

California Gasoline and Diesel Price Cases

Figure 6 and Table 4 show the proposed California retail fuel price cases in 2010 cents per gallon for regular-grade California gasoline and California diesel fuel using the assumptions outlined above. These retail price cases are generated by adding the price margin and the corresponding tax estimates for each fuel type to the corresponding imported crude oil price cases. The High Crude Oil Price Case estimates were used to generate the Energy Commission's High Fuel Price Case. Likewise, for the Low Fuel Price Case, the Low Crude Oil Price Case was used. Figure 7 shows these proposed retail fuel price cases in nominal dollars.

Figure 6: California Gasoline and Diesel Price Cases (2010 cents per gallon)



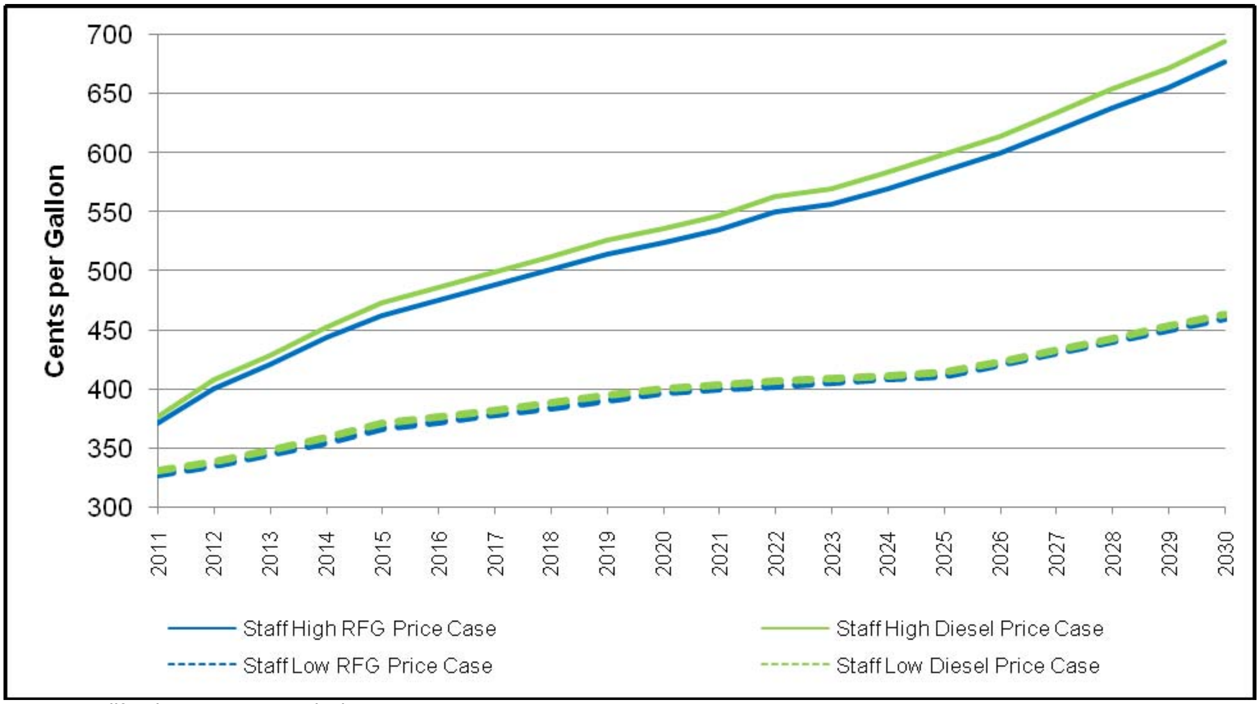
Source: California Energy Commission

Table 4: Retail Gasoline and Diesel Price Cases (2010 cents per gallon)

Year	Regular Gasoline		Diesel	
	High Price	Low Price	High Price	Low Price
2011	367	324	372	327
2012	391	328	398	331
2013	404	332	412	335
2014	418	335	427	339
2015	428	339	437	343
2016	431	338	440	341
2017	433	336	443	339
2018	436	335	445	338
2019	436	333	446	336
2020	437	331	447	334
2021	438	328	447	331
2022	438	324	448	327
2023	439	321	449	323
2024	442	317	452	319
2025	446	314	456	316
2026	449	315	459	317
2027	454	316	465	318
2028	460	317	471	319
2029	463	319	475	321
2030	470	320	482	322

Source: California Energy Commission

Figure 7: California Gasoline and Diesel Price Cases (Nominal cents per gallon)



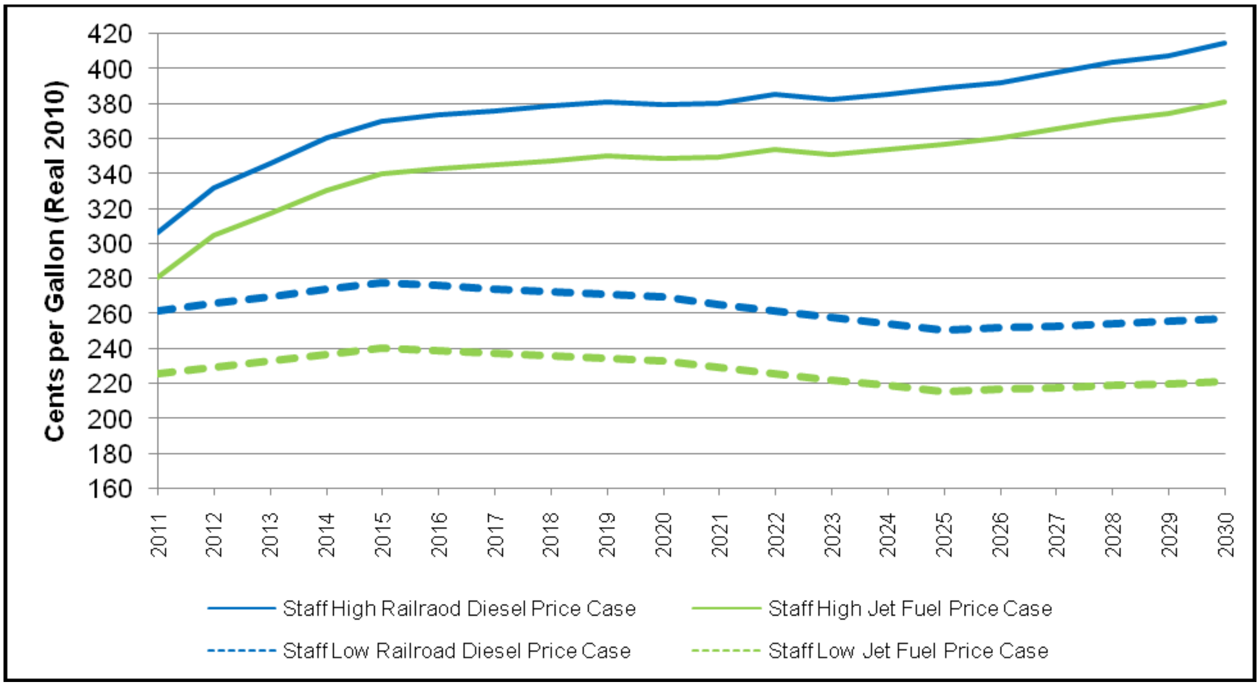
Source: California Energy Commission

Railroad Diesel and Jet Fuel Price Cases

Railroad diesel and jet fuel purchased by "common carrier" airlines are two of the more common fuel purchases in California that are not subject to specific fuel taxes. Railroad diesel is not subject to on-road excise taxes due to its off-road use, but it is subject to sales tax. "Common carrier" airlines purchasing jet fuel have specific waivers in both the federal and state tax codes exempting them for all taxes on fuel purchases. Therefore, no taxes are added in generating jet fuel price cases. Using diesel fuel crude oil-to-wholesale price margins and the two Energy Commission crude oil price cases, staff has developed High and Low Railroad Diesel and Jet Fuel Price Cases from 2011 to 2030. For railroad diesel, staff estimated crude oil-to-wholesale price margins of $0.63 (2003-2010 average) and $0.52 (the 2008-2010 average) for the high and low price margins used to generate the presales tax price estimates. Sales tax of 8.25 percent is then added to raise railroad diesel to its final price estimates. Wholesale diesel price information was obtained from the Oil Price Information Service (OPIS). For jet fuel, a crude oil-to-"common carrier" jet fuel price margin of $0.61 (2005-2009 average) and $0.36 (1991-2009 average) for the high and low price margins were used to generate the final jet fuel price cases. Common carrier jet fuel prices were obtained from the U.S. Department of Transportation's Research and Innovative Technology Administration database[6] on aviation fuel costs and use.

Staff fuel price cases assume future margins constant in real terms. Table 5 and Figure 8 show the High and Low Price Cases for railroad diesel and jet fuel.

Figure 8: California Railroad Diesel and Jet Fuel Price Cases (2010 cents per gallon)



Source: California Energy Commission

6 http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0

Table 5: Railroad Diesel and Jet Fuel Price Cases (2010 cents per gallon)

Year	Railroad Diesel		Jet Fuel	
	High Price	Low Price	High Price	Low Price
2011	307	262	281	226
2012	332	266	305	229
2013	346	270	317	233
2014	360	274	330	237
2015	370	278	340	240
2016	374	276	343	239
2017	376	274	345	237
2018	379	273	347	236
2019	379	271	348	234
2020	380	269	349	233
2021	381	266	349	229
2022	382	262	350	226
2023	383	258	351	223
2024	386	255	354	219
2025	389	251	357	216
2026	392	252	360	217
2027	398	253	366	218
2028	404	255	371	219
2029	408	256	374	220
2030	415	257	381	222

Source: California Energy Commission

Alternative Transportation Fuel Price Cases

In the *2009 IEPR* cycle, staff forecasted prices for the following alternative transportation fuels: E85, B20, transportation electricity rates, CNG, LNG, hydrogen, and propane. These price cases were used as inputs in scenarios for vehicle manufacturer offerings and for fuel demand for that IEPR cycle. For the *2011 IEPR* cycle, estimates for B20 have been changed to B5 because it is the more common fuel supplied in the California market. Moreover, there is a high percentage of diesel vehicle offerings with warranties that do not cover a diesel fuel with more than 10 percent biomass derived diesel. LNG price cases have been dropped because of an insignificant share of LNG-fueled vehicles in the California transportation market and the uncertainty on how the fuel will be brought to market.[7] High and Low Price Cases were developed after consultation with the other offices within the Energy Commission regarding all of these fuel types.

Propane and Renewable Fuels

High and Low Price Cases for E85, B5, and propane for transportation use are based on the corresponding High and Low Price Cases for crude oil. The E85 price cases are based on its gasoline gallon equivalency (price divided by 1.37), thus effectively making it the same price as gasoline on an energy-content basis. This assumption was made since flex-fuel vehicles can also use gasoline and thus E85 is a substitute for gasoline for these consumers. Since E85 is directly competing with gasoline, consumers will eventually base their purchasing decisions on the fuel economy realized per gallon, driving the price to this energy content equivalency.

In the case of B5, analysis of OPIS' renewable fuel reports indicates that B5 has been sold at values similar to that of regular diesel prices on the West Coast. Given the short period of available data (February 2008 to November 2010) to determine if consumers place a premium or discount on this product, staff has determined that for forecasting purposes it can be priced at the same value as the regular diesel due to the high degree of substitution between the two fuels.

Transportation propane prices were projected based on the price link assumption between EIA's Petroleum Administration for Defense District V (PADD V) wholesale propane price and the RAC of crude oil. From 2003 to 2008, the wholesale propane prices averaged 84 percent of RAC. This ratio was applied to the High Crude Oil Price Cases to develop the high estimates of wholesale propane prices.

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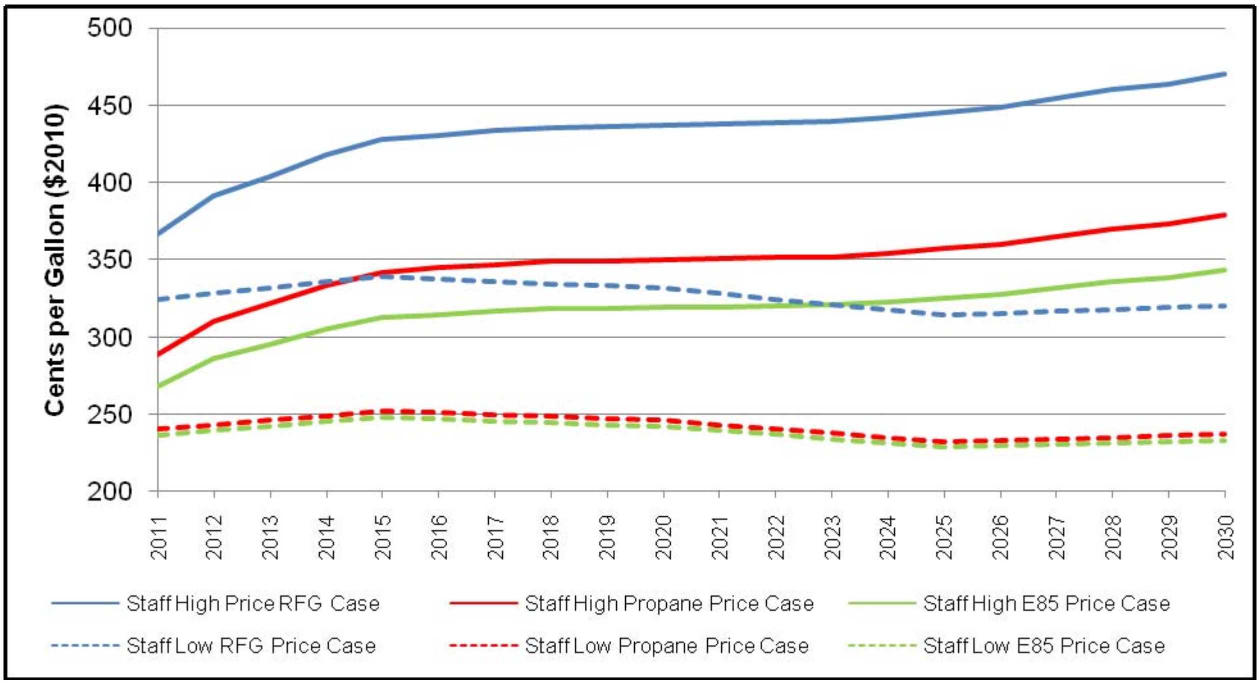
7 EIA estimates less than 2,000 LNG vehicles operated in California in 2008. This would represent only roughly 6 percent of the total natural gas fleet per Energy Commission estimates of natural gas vehicles in California. http://www.eia.doe.gov/cneaf/alternate/page/atftables/afv_atf.html#inuse

Staff used a similar method to develop the low price estimates but based it on the 2008 to 2010 average propane wholesale to RAC price ratio of 73 percent. This ratio was applied to the Low Crude Oil Price Case to obtain the low estimates of wholesale propane prices. EIA data on the PADD V wholesale-to-retail price margins were then used to estimate a price margin of $0.58 (2003 to 2005 data, in 2010 dollars). Only one wholesale-to-retail margin will be used for both high and low cases due to non-reported years in the EIA data. Table 6 and Figure 9 display E85, B5, and propane retail transportation price cases for 2011 to 2030.

Figure 9: California RFG, E85, and Propane Fuel Price Cases (2010 cents per gallon)



Source: California Energy Commission

Table 6: California Petroleum-Related Alternative Transportation Fuel Retail Price Cases (2010 cents per gallon)

Year	E85		B5		Propane	
	High Price	Low Price	High Price	Low Price	High Price	Low Price
2011	268	237	372	327	289	240
2012	286	239	398	331	310	243
2013	295	242	412	335	322	246
2014	305	245	427	339	334	249
2015	312	248	437	343	342	252
2016	315	246	440	341	345	250
2017	316	245	443	339	347	249
2018	318	244	445	338	349	248
2019	318	243	446	336	350	247
2020	319	242	447	334	350	246
2021	319	239	447	331	351	243
2022	320	237	448	327	351	240
2023	321	234	449	323	352	238
2024	323	232	452	319	355	235
2025	325	229	456	316	358	232
2026	327	230	459	317	360	233
2027	332	231	465	318	365	234
2028	336	232	471	319	370	235
2029	338	233	475	321	373	236
2030	343	233	482	322	379	237

Source: California Energy Commission

Natural Gas-Based Transportation Fuels

Using the fixed margin methodology established in the *Transportation Fuel Price and Demand Forecasts: Inputs and Methods for the 2009 Integrated Energy Policy Report*, staff will develop final High and Low Price Cases for transportation-use compressed natural gas (CNG) and hydrogen using Henry Hub natural gas price cases provided by the Energy Commission's Electricity Supply Analysis Division. Like the other fuels, margins have been updated to reflect current conditions.

For CNG, the High Price Case margin was calculated from the historical 1997-2009 cost differential between California Citygate natural gas prices and Henry Hub natural gas prices, which was $0.051 per therm. The Low Price Case margin was calculated from the 2003-2009 period and was $0.023 per therm. The current Pacific Gas and Electric (PG&E) transportation cost margin of $1.338 per therm would then be added to the Citygate price to produce an ex-tax therm price for transportation CNG. PG&E's Public Purpose Program surcharge of $0.027 per therm, and local CNG fuel taxes of $0.259 per therm are then added to allow for the therm price to be converted to a gasoline gallon equivalent (GGE) price. The therm to GGE conversion used by staff is 93,000 Btus per therm and 110,200 Btus per GGE.[8] The federal excise tax of $0.183 per GGE and sales tax are then added to create the final retail price. See Table 7 for margin and tax values.

With regard to hydrogen, natural gas is the primary feedstock needed for manufacturing hydrogen and is the basis for the price cases. The price of natural gas is the only cost that is variable over time in this forecast. All other costs presented will be held constant in real terms over the forecast period for both the high and low price cases. There is currently no standardized way to sell transportation use hydrogen for retail purposes at a per-unit level in California. To address this issue, the Energy Commission is funding a three-year $4 million interagency contract with the California Department of Food and Agriculture's Division of Measurement Standards. The contract will ultimately lead to fuel quality standards for transportation use hydrogen and approved means for measuring/dispensing hydrogen for sale in California.

Starting with the same Citygate natural gas price forecast used in the CNG analysis, staff estimates the hydrogen production costs associated with the reforming of the natural gas. Production costs are summed together on a million British thermal units (mBtu) basis and are as follows: natural gas (variable forecast), variable non-fuel operation and maintenance costs ($0.11 per mBtu), reforming costs (24 percent of natural gas forecast), fixed operating costs ($0.56 per mBtu), capital recovery costs ($1.78 per mBtu), and electricity for production costs ($0.31 per mBtu). The next step of the price forecast is to add compression and transportation costs. These costs total $25.52 and include compression capital recovery ($7.92 per mBtu), electricity costs for compression ($8.60 per mBtu), general maintenance ($5.06 per mBtu), and over-the-road delivery costs ($3.95 per mBtu). Retail costs are then added, which include retail dispenser capital recovery ($1.22 per mBtu) and a general retail markup ($1.00 per mBtu). Production costs, compression costs, and retail costs are then summed, and an 8.25 percent sales tax[9] is included for the final hydrogen fuel price. No state or federal excise taxes are included in the price estimates. Currently these taxes are not imposed on hydrogen vehicle fuel, but future market penetration of this fuel could lead to the inclusion of these fair-use taxes.

8 This simplifies to 1.185 multiplied by the therm price converts CNG to a GGE price.

9 State sales tax of 7.25 percent and 1 percent local sales tax.

Table 7: Natural Gas Based Transportation Fuel Margins and Taxes Used in Price Scenario Cases (2010 cents per gasoline gallon equivalent)

	CNG High Margin (GGE)	CNG Low Margin (GGE)	Hydrogen (GGE)
Wholesale Margin	$1.65	$1.61	$1.25
Retailer Margin & Excise Taxes	$0.52	$0.52	$3.06
Sales Tax	8.25%	8.25%	8.25%

Source: California Energy Commission

Residential Transportation Electricity Prices

Transportation electricity prices are based on the current residential electric vehicles rates for PG&E, Sacramento Municipal Utilities District, San Diego Gas & Electric, Los Angeles Department of Water & Power, and Southern California Edison (SCE). In 2009, these utilities comprised nearly 90 percent of all California residential electricity consumption and are the largest based on consumption. Using the current utility rate structures and the assumptions described in the section below, the consumption weighted average transportation electricity price for California is 12.6 cents per kilowatt hour (kWh) in 2010. This value will be increased by at least two annual growth rates that will be consistent with the Energy Commission's other electricity price scenarios. Staff anticipates at least one growth rate will include compliance with the California Renewables Portfolio Standard.

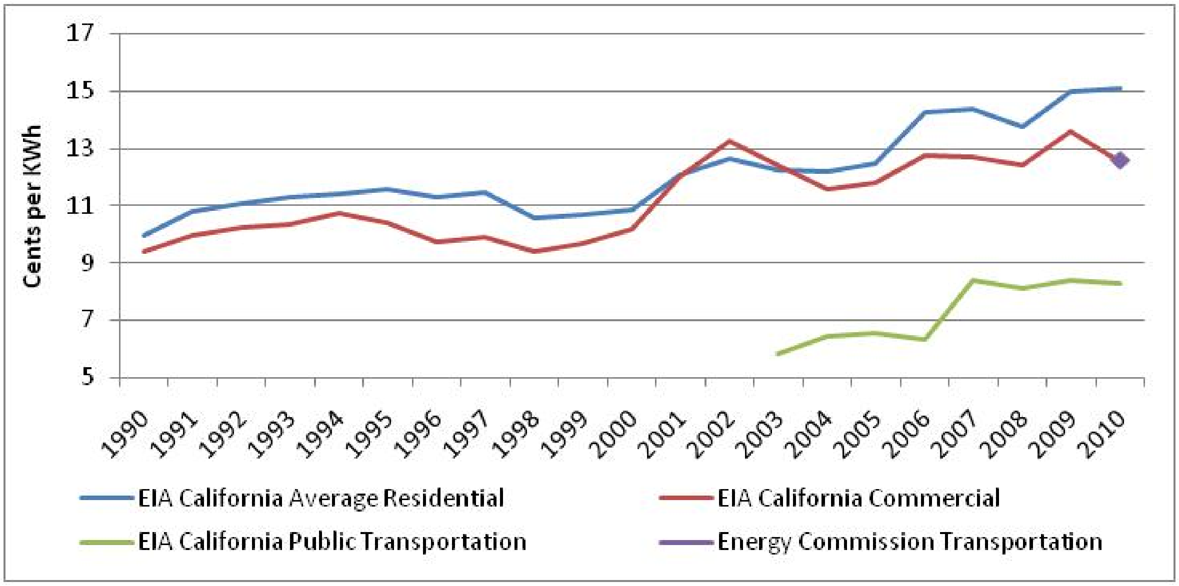
As with past *IEPR* analyses, updated rate schedules will be used for all utilities. In the case of tiered rates, PG&E and SCE, only PG&E had a single meter rate, residential schedule E-9 Rate A. For the E-9 Rate A rate schedule, all additional electricity consumption due to electric vehicle charging will be assumed to increase the overall household electricity consumption. This will lead to a higher electricity rate since the electric vehicle consumption will be charged in a higher price tier. For the dual meter rates, electric vehicle consumption will be charged separately from other household consumption but use the same monthly baseline allotment. For this evaluation, the additional monthly consumption for the electric vehicle is estimated to be 181 kWh for summer months and 169 kWh for winter months due to California seasonal driving patterns. Additionally, the following assumptions were made in the development of staff's estimated price for 2010 and may be changed as updated information becomes available.

- The electric vehicle charging profile will be the same for all plug-in electric vehicles and will be 88 percent off-peak, 8 percent partial-peak, and 4 percent on-peak. This charging profile will not be influenced by changes or differences in rate structures.
- For PG&E, average household consumption is the simple average of overall consumption divided by the number of customers in the climate zone.

- Based on data collected by Energy Commission staff, approximately 70 percent of households in PG&E's service area will use PG&E's E-9 Rate B. The remaining 30 percent of households will use PG&E's Rate A.
- The final statewide transportation electricity price will be weighted using historical electricity consumption trends and seasonal driving trends.

Historically, California residential electricity prices are significantly higher than commercial and general public transportation end uses. Figure 10 presents the EIA California average prices for electricity for residential, commercial, transportation end-use sectors, and the Energy Commission's weighted average electricity rate calculated for 2010.

Figure 10: California Annual Average Electricity Prices by End-Use Sector



Source: EIA and California Energy Commission analysis

CHAPTER 5: Policy and Infrastructure Analyses Structured on the Demand Scenarios

Developing transportation fuel demand scenarios is an essential first step in producing related policy and infrastructure analyses. For its final report, staff intends to prepare analyses of the impacts of the federal RFS2, E15 waiver, and the state LCFS on transportation energy demand. The levels of future demand estimated with these scenarios and policy analyses:

- Are measures of progress toward petroleum reduction and alternative fuel penetration goals established by the state.
- Become inputs into transportation fuel infrastructure needs assessments.
- Have implications for energy security assessments.

Staff intends to provide policy and infrastructure assessments in the following areas.

Transportation Energy Demand – State and Federal Policies

Transportation Fuel Demand Impacts of Federal Policies – RFS2 and E15 Waiver

The initial High and Low Petroleum Fuel Demand Scenarios results will undergo post-processing analysis to quantify the impact on demand that might be expected from increased use of renewable fuels, mandated by the Federal Renewable Fuels Standard (RFS2). Staff assumes that obligated parties in California (primarily refiners) will use their "fair share" portion of the national target goals. The incremental amount of ethanol and biodiesel required will be estimated in total and reported by fuel type (cellulosic, advanced and corn-based). This assessment will identify how much more E85 will be necessary assuming that California gasoline will not have an ethanol concentration greater than 10 percent by volume, despite the recent partial waiver by the U.S. Environmental Protection Agency (EPA) to allow up to 15 percent by volume ethanol in Model Year 2007 and newer light-duty vehicles.

Transportation Fuel Demand Impacts of California Policies – LCFS

The initial High and Low Petroleum Fuel Demand Scenarios results will undergo additional post-processing analysis to quantify the effect on demand that might be expected from increased use of renewable fuels necessary to achieve compliance with California's Low-Carbon Fuels Standard or LCFS. Staff's analysis will quantify how much additional ethanol and biodiesel may be required beyond RFS2, as well as an identification of specific types of these renewable fuels. Potential impact scenarios will include compliance with and without excess credits. Supply availability of various types of ethanol, biomass-derived diesel, and renewable diesel will include scenarios of expanded adoption of substantially similar LCFS regulations in other states and/or regions of the United States to determine if renewable fuel resources will be sufficient to meet the increased demand.

Progress to Petroleum Reduction and Alternative Fuel Penetration Goals

The state has established petroleum reduction goals and targets for levels of penetration of alternative and renewable fuels in transportation energy markets. The transportation energy demand scenarios, including the estimated impacts of the RFS2 and LCFS, enable progress toward these goals to be measured. Staff will report the magnitude of any resulting shortfalls identified by these projections, identify and prioritize additional analytical tasks to evaluate attainment of state goals, and provide policy recommendations for attainment of state goals.

Neighboring States Transportation Fuel Demand, RFS2 Impacts, Pipeline Balances, and E15 Waiver

The neighboring states of Nevada and Arizona are linked to California via petroleum product pipelines that create a regional supply and demand hub. As such, the demand outlook for gasoline, diesel, and jet fuel in these states is important to determine what level of pipeline exports from California might be required over the forecast period. As is the case with the California transportation fuel demand forecasts, staff will perform post-processing analysis of the initial neighboring state demand forecasts to better understand how "fair share" compliance with the federal RFS2 regulations will affect the need for traditional and renewable fuels. In addition, potential changes to the Longhorn petroleum product pipeline operations will be assessed to see how deliveries of transportation fuels from Texas to Arizona could shift and to what extent fuel shipments from California could be impacted. Another recent development has been the UNEV pipeline project that is designed to transport gasoline and diesel fuel from Salt Lake City to distribution terminals in southern Utah and northern Las Vegas. The pending completion and operation of this new pipeline delivery capability will be assessed to estimate the potential impact on the need to export transportation fuels to the Las Vegas market from Southern California. The final portion of the neighboring states analysis will include a determination to what extent, if any, the E15 waiver could be used in Nevada and Arizona.

Transportation Energy Demand – Infrastructure Assessments

Historical Imports, Forecasted Demand, and Infrastructure Issues

Based on the post-processing analysis of federal and state policy impacts on California transportation fuel demand, the need for imports of transportation fuels and their blending components is expected to become increasingly diversified. A quantification of historical imports will be presented, along with a forecast of incremental increases or decreases by type of transportation fuel over the forecast period. The type of capacity of transportation fuel import infrastructure is expected to evolve, and staff will highlight the primary issue of concern that could emerge as California's dependence on petroleum continues to be reduced.

Renewable Fuels Historical Data, Forecasted Demand, and Potential Availability Limitations

Use of traditional renewable fuels like ethanol and biodiesel have continued to increase in California and the rest of the United States primarily as a result of various federal and state regulations. Staff will document historical use in California and the United States of these renewable fuels, accompanied by a quantification of historical petroleum displacement. Projected demand over the forecast period will include a breakdown by type of renewable fuels, an assessment of their supply potential, and the identification of any potential barriers or limitations that could occur over the next several years. Historical use of traditional feedstocks such as corn and soybeans will be presented, along with their respective forecasted demand levels. Non-traditional feedstock uses and projected supply potential will be discussed.

Renewable Fuel Infrastructure – Current Capability and Forecast Needs

California's existing infrastructure to produce, import, store and dispense renewable fuels will be examined. Recent expansion developments inside and outside the state will be highlighted, and the state's progress toward meeting in-state renewable fuel production goals will be assessed. Based on the Energy Commission's transportation demand forecasts and post-processing analysis to incorporate the incremental impacts associated with other federal and state policies, the renewable fuels infrastructure needs will be projected, along with associated cost estimates and necessary timing to ensure adequacy of distribution capability. Of particular interest will be the anticipated expanded use of E85 that will be quantified along with the number of flex-fuel vehicles (FFVs) that would be required, an estimated number of additional E85 dispensers and the associated infrastructure costs. In addition, differences in infrastructure requirements will be highlighted between traditional renewable fuels and renewable hydrocarbon fuels.

Advanced Technologies for Renewable Fuels – Status, Projections, and Limiting Factors

Progress continues to be made on use of non-traditional feedstocks to produce renewable transportation fuels. Cellulosic ethanol production is increasing, albeit at a slower-than-expected pace. However, advances in other areas of research for algal and renewable hydrocarbon transportation fuels are accelerating and will be examined to quantify potential supply limits, production cost estimates, and timing of commercial introduction.

Crude Oil Historical Statistics, Import Forecasts, and Infrastructure

California's crude oil production, quantity and source of imports will be provided for the years 1980 through 2010. The crude oil production capacity and annual usage rates for California's refineries will also be provided on a regional basis (Northern and Southern California).

Two factors primarily determine the quantity of crude oil imported into California: the declining production from California crude oil fields and the level of refining operations in the state. Staff will develop a forecast of crude oil imports for the state by analyzing trends for both of these factors over approximately the last decade and by making some assumptions going forward over the forecast period. This approach yields a Low and High Case for crude oil imports.

Staff will provide Low and High estimated rates of future California crude oil production decline. Refinery operational assumptions will include refinery crude oil processing capacity levels and utilization rates. An additional analysis will include a scenario with some degree of refinery consolidation (closure) in the state to determine impact on crude oil imports. This additional analysis may also include an assessment of potential job losses.

LCFS Crude Oil Screening Preliminary Assessment

The staff of the California Air Resources Board has proposed a crude oil screening element associated with the Low-Carbon Fuel Standard (LCFS) intended to constrain the use of crude oil types with high carbon indexes due to associated production techniques, such as thermal-enhanced recovery or natural gas flaring. Energy Commission staff has been analyzing this proposal and will provide results of that work that will include a list of marketable crude oil names, identification of those that have been imported to California between 2006 and 2010, an assessment of which crude oil types could be excluded under this Crude Oil Screening process, and an assessment of potential crude oil availability impacts that could occur, including potential implications for energy security.

Other Topical Issues of Interest – New Ozone Standards, Macondo Oil Spill, Renewable Fuel Tariffs, and Blending Credits

Other recent developments that have the potential to impact supply and costs of transportation fuels will be addressed in this section. Recently adopted federal ozone standards will be examined to determine what potential fuel regulation modifications could result in California and the neighboring states of Arizona, Nevada, and Oregon. The temporary extension of the ethanol import tariff, excise tax blenders credit, and the biofuel blending subsidy will be assessed to see how their elimination at the end of 2011 might affect the cost and availability of those traditional renewable fuels. The largest accidental oil spill in history will be reviewed, along with an assessment of how new drilling and access regulations could affect domestic and international activities.

GLOSSARY

AB 32	Assembly Bill 32: Global Warming Solutions Act, 2006
AB 118	Assembly Bill 118: Alternative and Renewable Fuel and Vehicle Technology Program, 2007
AEO	Annual Energy Outlook
B5	Diesel with 5 percent biodiesel content
B20	Diesel with 20 percent biodiesel content
Btu	British thermal unit
CAFE	Corporate Average Fuel Economy
CNG	Compressed natural gas
CVC	Commercial Vehicle Choice model
DMS	Division of Measurement Standards
DMV	California Department of Motor Vehicles
E15	Retail gasoline that contains 15 percent ethanol by volume
E85	Fuel with 85 percent ethanol content, 15 percent gasoline
EIA	United States Energy Information Administration
EISA	Energy Independence and Security Act of 2007
EPA	U.S. Environmental Protection Agency
FFV	Flex-fuel vehicles
GGE	Gasoline gallon equivalent
IEA	International Energy Agency
IEPR	*Integrated Energy Policy Report*
LCFS	Low-Carbon Fuel Standard
LDV	Light-duty vehicle
LEV III	Low-Emission Vehicle Program
LNG	Liquefied natural gas
mBtu	Million British thermal units

MMS	Minerals Management Services
MTBE	Methyl-tertiary-butyl-ether
NHTSA	National Highway Traffic Safety Administration
OPIS	Oil Price Information Service
PADD V	Petroleum Administration for Defense District V
Pavley AB 1493	Assembly Bill 1493: California Light-Duty Vehicle Greenhouse Gas Standards
Pavley II	Future Light-Duty Vehicle Greenhouse Gas Standards rulemaking for Model Year 2017 to 2020 vehicles
PG&E	Pacific Gas and Electric
PVC	Personal Vehicle Choice Model
RAC	Refiner acquisition cost
RFG	Reformulated gasoline
RFS	Renewable Fuel Standard
RFS2	Renewable Fuel Standard 2
SB 375	Senate Bill 375: Sustainable Communities Strategy and Climate
	Protection Act, 2009
VMT	Vehicle miles traveled
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
WTI	West Texas Intermediate
ZEV	Zero emission vehicle