DOCKETED

Docket Number:	15-IEPR-03
Project Title:	Electricity and Natural Gas Demand Forecast
TN #:	207438
Document Title:	California Energy Demand 2016-2026 Revised Electricity Demand Forecast, Volume 2: Electricity Demand by Utility Planning Area
Description:	Staff Report: California Energy Demand 2016-2026 Revised Electricity Demand Forecast, Volume 2: Electricity Demand by Utility Planning Area
Filer:	Raquel Kravitz
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	1/15/2016 3:22:23 PM
Docketed Date:	1/15/2016

California Energy Commission

STAFF REPORT

California Energy Demand 2016-2026 Revised Electricity Demand Forecast

Volume 2: Electricity Demand by Utility Planning Area

California Energy Commission

Edmund G. Brown Jr., Governor

January 2016 | CEC-200-2016-001-V2

California Energy Commission

Chris Kavalec
Nick Fugate
Cary Garcia
Asish Gautam
Primary Authors

Chris Kavalec
Project Manager

Elise Brown
Office Manager
DEMAND ANALYSIS OFFICE

Sylvia Bender
Deputy Director
ENERGY ASSESSMENTS DIVISION

Robert P. Oglesby
Executive Director

ACKNOWLEDGEMENTS

The demand forecast is the combined product of the hard work and expertise of numerous staff members in the Demand Analysis Office and Energy Assessments Division. In addition to the contributing authors listed previously, Mark Ciminelli provided the transportation, communications, and utilities and street lighting forecasts. Mohsen Abrishami prepared the commercial sector forecast, Mehrzad Soltani Nia prepared the industrial forecast, and Ted Dang, Tom Gorin, and Glen Sharp contributed to the residential forecast. Ravinderpal Vaid provided the projections of commercial floor space, and Steven Mac, Cam Nguyen, and Andrea Gough prepared the historical energy consumption data. Elena Giyenko developed the energy efficiency program estimates, and Doug Kemmer prepared the estimates for demand response impacts. The electricity rate scenarios were developed by Lynn Marshall and the natural gas price scenarios by Leon Brathwaite, Chris Marxen, and Malachi Weng-Gutierrez. Nancy Tran developed the economic and demographic projections. Miguel Cerrutti developed weather normalized peak estimates for 2015. Aniss Bahreinian, Jesse Gage, and Bob McBride provided the transportation forecasts. Malachi Weng-Gutierrez allocated the electric vehicle forecasts to planning area and forecasting zone. Mike Jaske developed estimates of the impact of federal distribution transformer standards. Ted Dang ran the summary model and Mitch Tian prepared the peak demand forecast.

ABSTRACT

The *California Energy Demand 2016-2026, Revised Electricity Forecast, Volume 2: Electricity Demand by Utility Planning Area* describes the California Energy Commission's revised 10-year forecasts for electricity consumption and peak demand for each of the five major electricity planning areas and for the distinct forecast zones within those planning areas. This forecast supports the analysis and recommendations of the *2014 Integrated Energy Policy Report Update*. The forecast includes three demand cases: a high energy demand case, a low energy demand case, and a mid energy demand case.

The high energy demand case incorporates relatively high economic/demographic growth and climate change impacts and relatively low electricity rates and self-generation impacts. The low energy demand case includes lower economic/demographic growth, higher assumed rates, and higher self-generation impacts. The mid case uses input assumptions at levels between the high and low cases. In addition, this forecast incorporates estimates for additional achievable energy efficiency and provides adjusted, or managed, forecasts designed for resource planning purposes. Forecasts are provided at both the planning area and climate zone level.

Keywords: Electricity, demand, consumption, forecast, weather normalization, peak, self-generation, conservation, energy efficiency, climate zone, electrification, light-duty electric vehicles, distributed generation.

Please use the following citation for this report:

Kavalec, Chris, Nick Fugate, Cary Garcia, and Asish Gautam, 2016.*California Energy Demand 2016-2026, Revised Electricity Forecast.* California Energy Commission. Publication Number: CEC-200-2016-001-V2.

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

EXECUTIVE SUMMARY

Introduction

This California Energy Commission report describes 10-year forecasts of electricity consumption and peak electricity demand for each major utility planning area within the state for 2016-2026. The *California Energy Demand 2016-2026, Revised Electricity Forecast, Volume 2: Electricity Demand by Utility Planning Area* supports the analysis and recommendations of the *2014 Integrated Energy Policy Report Update*, including electricity system assessments and analysis of progress toward increased energy efficiency and distributed generation.

California Energy Demand 2016-2026, Revised Electricity Forecast, Volume 2: Electricity Demand by Utility Planning Area includes three baseline cases designed to capture a reasonable range of demand outcomes over the next 10 years. The high energy demand case incorporates relatively high economic/demographic growth, relatively low electricity, and relatively low self-generation and climate change impacts. The low energy demand case includes lower economic/demographic growth, higher assumed rates, and higher self-generation impacts. The mid case uses input assumptions at levels between the high and low cases.

Staff also developed estimates of additional achievable energy efficiency impacts for the investor-owned utilities and the largest publicly owned utilities that are incremental to (do not overlap with) committed efficiency savings included in the *California Energy Demand 2016-2026, Revised Electricity Forecast, Volume 2: Electricity Demand by Utility Planning Area* baseline cases. Forecasts adjusted to reflect these additional savings are presented in this report.

Volume 2 presents forecasts of electricity consumption and peak electricity demand for each of five utility planning areas: Los Angeles Department of Water and Power, Pacific Gas and Electric, Southern California Edison, San Diego Gas and Electric, and Northern California Non-California Independent System Operator.

Electricity Forecast Results

In an effort to make the demand forecast more useful to resource planners, *California Energy Demand 2016-2026, Revised Electricity Forecast* uses a revised geographic scheme for planning areas and climate zones, more closely based on California's balancing authority areas. *California Energy Demand 2016-2026, Revised Electricity Forecast* includes 20 climate zones, compared to 16 in previous forecasts. The new scheme is described in more detail in Chapter 1, Volume 1; future forecasts may incorporate further refinements to geographic granularity.

California Energy Demand 2016-2026, Revised Electricity Forecast includes estimated efficiency impacts not included in *California Energy Demand Updated*

Forecast, 2015-2025, from 2015 investor-owned utility programs and 2014 programs administered by publicly owned utilities as well as from new federal and state appliance standards. Projected additional achievable energy efficiency impacts for the investor-owned utilities have been updated, based on the California Public Utilities Commission's *2015 California Energy Efficiency Potential and Goals Study*. This forecast also includes estimates of additional achievable energy efficiency savings for the two largest publicly owned utilities.

Pacific Gas and Electric

Chapter 1 describes the Pacific Gas and Electric planning area and forecast results. Notable features of this forecast include the following:

- Electricity consumption is projected to reach between 110,695 gigawatt-hours in the low demand case and 120,374 gigawatt-hours in the high demand case by 2026.
- Peak electricity demand is projected to reach between 20,063 and 23,491 megawatts by 2026.
- The most significant growth in both consumption and peak demand over the forecast period is projected to be in the Central and Southern Valley, Climate Zones 4 and 5.
- Self-generation is expected to reduce peak demand by nearly 3,000 megawatts in the mid demand case by 2026, more than 1,800 megawatts of which is due to photovoltaic systems.
- Electric vehicles are expected to increase electricity consumption by roughly 2,700 gigawatt-hours in the mid demand case by 2026.

Southern California Edison

Chapter 2 describes the Southern California Edison planning area and forecast results. Notable features of this planning area forecast include the following:

- Electricity consumption is projected to reach between 113,399 gigawatt-hours in the low demand scenario and 123,828 gigawatt-hours in the high demand case by 2026.
- Peak electricity demand is projected to reach between 21,491 and 24,701 megawatts by 2026.
- The most significant growth in both consumption and peak demand occurs in the Big Creek East, in Climate Zone 9.
- Self-generation is expected to reduce peak demand by 3,037 megawatts in the mid demand case by 2026, more than 1,700 megawatts of which is due to photovoltaic systems.
- Electric vehicles are expected to increase electricity consumption by roughly 2,000 gigawatt-hours in the mid demand case by 2026.

San Diego Gas and Electric

Chapter 3 describes the San Diego Gas and Electric planning area and forecast results. Notable features of this planning area forecast include the following:

- Electricity consumption is projected to reach between 22,926 gigawatt-hours in the low demand case and 24,962 gigawatt-hours in the high demand case by 2026.
- Peak electricity demand is projected to reach between 4,294 and 5,021 megawatts by 2026.
- Self-generation is expected to reduce peak demand by 741 megawatts in the mid demand case by 2026, of which 504 megawatts is due to photovoltaic systems.
- Electric vehicles are expected to increase electricity consumption by 2,298 gigawatt-hours in the mid demand case by 2026.

Northern California Non-California Independent System Operator

Chapter 4 describes the Northern California Non-California Independent System Operator planning area and forecast results. Notable features of this planning area forecast include the following:

- Electricity consumption is projected to reach between 20,514 gigawatt-hours in the low demand case and 22,151 gigawatt-hours in the high demand case by 2026.
- Peak electricity demand is projected to reach between 5,356 and 5,965 megawatts by 2026.
- The most significant growth in consumption occurs in the Northern California Non-California Independent System Operator Service Territory, Climate Zone 13. Peak demand growth is most significant in Climate Zone 15, the remainder of Balancing Authority of Northern California Control Area.
- Self-generation is expected to reduce peak demand by 191 megawatts in the mid demand case by 2026, almost all of which is due to photovoltaic systems.
- Electric vehicles are expected to increase electricity consumption by roughly 325 gigawatt-hours in the mid demand case by 2026.

Los Angeles Department of Water and Power

Chapter 5 describes the Los Angeles Department of Water and Power planning area and forecast results. Notable features of this planning area forecast include the following:

- Electricity consumption is projected to reach between 25,425 gigawatt-hours in the low demand case and 28,385 gigawatt-hours in the high demand case by 2026.
- Peak electricity demand is projected to reach between 5,799 and 6,662 megawatts by 2026.

- The most significant growth in consumption is in Climate Zone 16, Coastal. Peak demand growth is most significant in Climate Zone 17, Inland.
- Self-generation is expected to reduce peak demand by more than 438 megawatts in the mid demand case by 2026, nearly 201 megawatts of which is due to photovoltaic systems.
- Electric vehicles are expected to increase electricity consumption by roughly 678 gigawatt-hours in the mid demand case by 2026.

CHAPTER 1:
Pacific Gas and Electric Planning Area

In an effort to make the demand forecast more useful to resource planners, *California Energy Demand 2016-2026, Revised Electricity Forecast* (*CED 2015 Revised*) uses a new geographic scheme for planning areas and climate zones that is more closely based on California's balancing authority areas. For Pacific Gas and Electric (PG&E), the planning area includes:

- PG&E bundled retail customers.
- Customers served by energy service using the PG&E distribution system to deliver electricity to end users.
- Customers served by community choice aggregators using the PG&E distribution system, including Marin Clean Energy and Sonoma Clean Power.
- Customers of Calaveras Public Power Agency, the Cities of Alameda, Biggs, Gridley, Healdsburg, Hercules, Lodi, Lompoc, Palo Alto, San Francisco, Ukiah, the California Department of Water Resources (North), Island Energy/Pittsburg, Lassen Municipal Utility District, Plumas-Sierra Rural Electric Cooperation, Port of Oakland, Port of Stockton, Silicon Valley Power, Tuolumne County Public Power Agency, and Western Area Power Administration (WAPA) California Independent System Operator (California ISO).

To support electricity and transmission system analysis, staff uses historical consumption and load data to develop individual forecasts for all medium and large utilities in the planning area. Those results are presented in Forms 1.5a through 1.5c in the statewide forms accompanying this forecast report.[1] The results in this chapter are for the entire PG&E transmission planning area.

This chapter is organized as follows. First, forecasted consumption and peak loads for the PG&E planning area are discussed; both total and per capita values are presented. Second, the chapter presents sector consumption and peak load forecasts. Third, the chapter discusses the forecasts of electric vehicles (EVs), self-generation, and the impacts of conservation and efficiency programs, including additional achievable energy efficiency (AAEE). Finally, forecasts of electricity consumption and peak demand are presented for each climate zone within the PG&E planning area.

1 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Baseline Forecast Results

For this forecast, three demand cases were developed. The high demand case includes high economic and demographic projections, low energy price projections, and low-efficiency impact assumptions. The low demand case includes low economic and demographic projections, high energy price projections, and high-efficiency impact assumptions. The mid demand case uses assumptions that fall between the low and high cases. Volume 1 provides more detail on the construction of the demand cases.

Table 1-1and **Table 1-2** show the *CED 2015 Revised* high, mid, and low demand cases for electricity consumption and peak demand, respectively, for selected years. The base year for these peak cases is 2015, so **Table 1-2** shows both the recorded peak and the weather normalized peak values for that year. Comprehensive results are available electronically as a set of forms posted alongside this report.[2]

Table 1-1: PG&E Planning Area Baseline Consumption

	Recorded Consumption (GWh)	Forecast (GWh)		
		CED 2015 Revised **High**	***CED 2015 Revised*** **Mid**	***CED 2015 Revised*** **Low**
1990	83,401			
2000	95,793			
2010	99,974			
2014	103,426			
2020		110,728	108,867	106,543
2026		120,374	116,259	110,695
Average Annual Growth Rates				
1990 - 2000	1.39%			
2000 - 2010	0.43%			
2010 - 2014	0.85%			
2014 - 2020		1.14%	0.86%	0.50%
2014 - 2026		1.27%	0.98%	0.57%

Source: California Energy Commission, Demand Analysis Office, 2015

2 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Table 1-2: PG&E Planning Area Baseline Peak Demand

	Recorded Peak (MW)	Forecast (MW)		
		***CED 2015 Revised* High**	***CED 2015 Revised* Mid**	***CED 2015 Revised* Low**
1990	15,899			
2000	18,980			
2010	21,042			
2015	20,704			
2015*		20,839	20,839	20,839
2020		21,792	21,345	20,595
2026		23,491	22,065	20,063
Average Annual Growth Rates				
1990-2000	1.79%			
2000-2010	1.04%			
2010-2015	-0.32%			
2015*-2020		0.90%	0.48%	-0.24%
2015*-2026		1.09%	0.52%	-0.34%

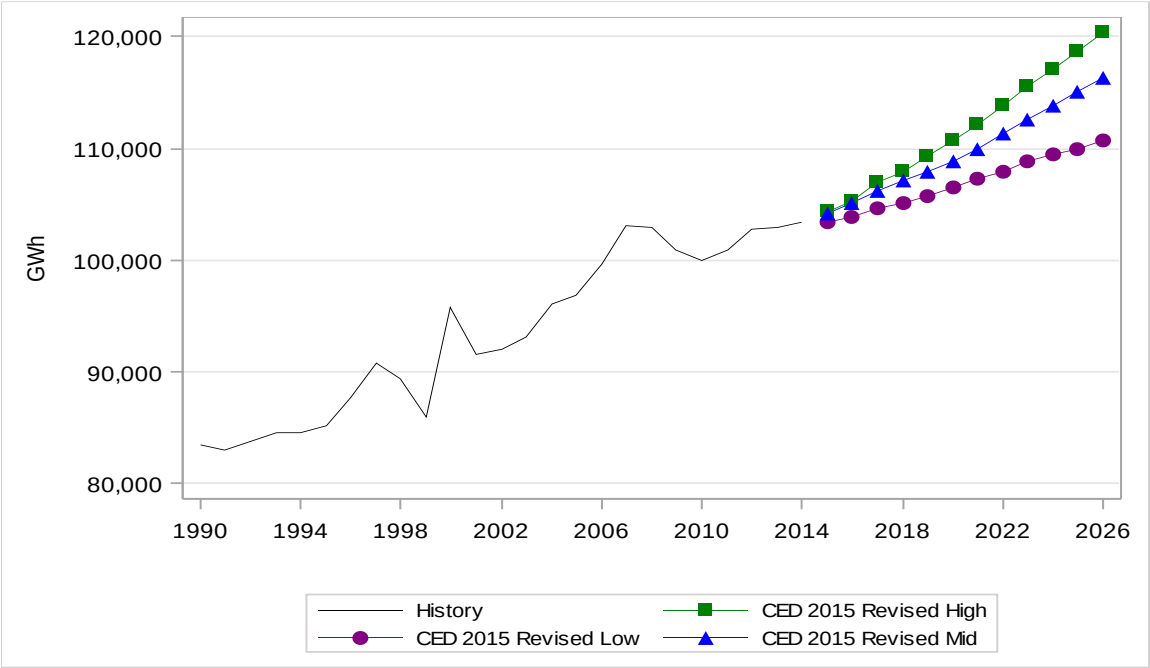
Source: California Energy Commission, Demand Analysis Office, 2015

Figure 1-1 illustrates electricity consumption for the three cases, each of which grows continuously over the forecast period. Growth in the mid and high cases increases in the latter years of the forecast as EVs add significant levels of consumption. By 2026, the *CED 2015 Revised* high demand level is 3.5 percent higher than the mid case, while the low demand case is 4.8 percent lower.

The peak demand projections, shown in **Figure 1-2**, exhibit a much wider spread than the consumption forecast. This is due to the impact of photovoltaic (PV) adoption in the different cases, which vary considerably for *CED 2015 Revised*. Since EVs are assumed to be charged mostly off-peak, they do not exert the same upward pressure on peak demand, which is instead driven down by PV adoption in the latter half of the forecast period.

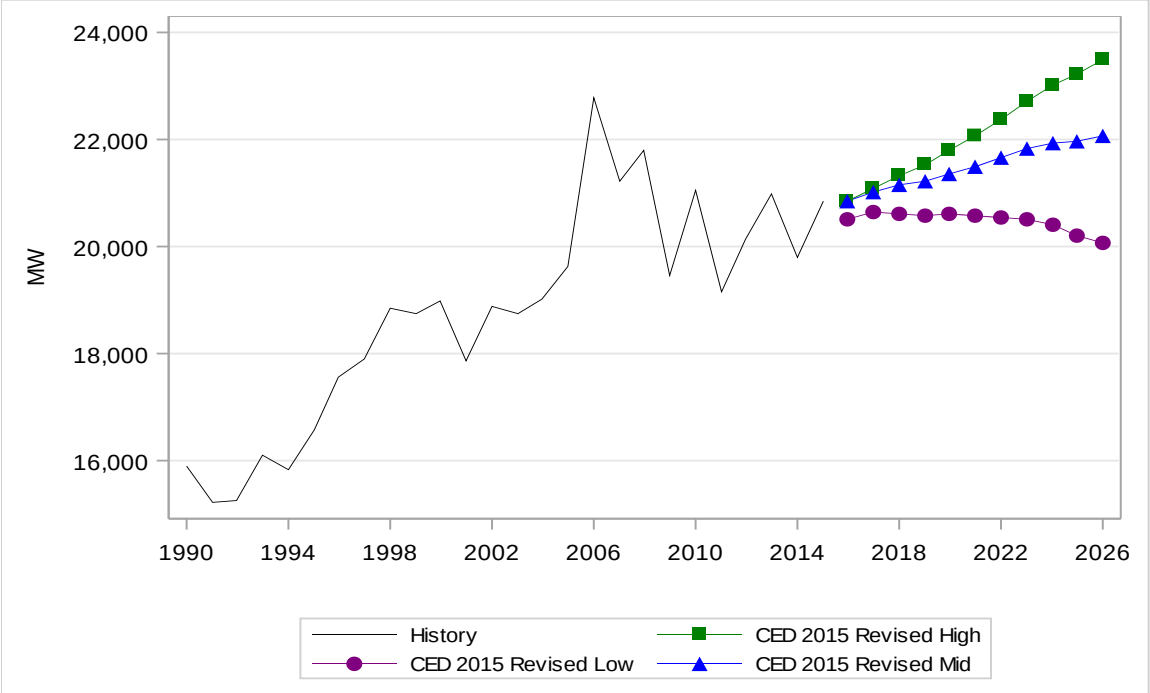
The high and low case peak demand projections are 6.5 percent higher and 9.1 percent lower, respectively, than the mid case by 2026. The PG&E planning area did not experience particularly extreme high temperatures in 2015, so the recorded peak load was actually 135 megawatts (MW) less than the weather normalized estimate of 20,839 MW.

Figure 1-1: PG&E Planning Area Baseline Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

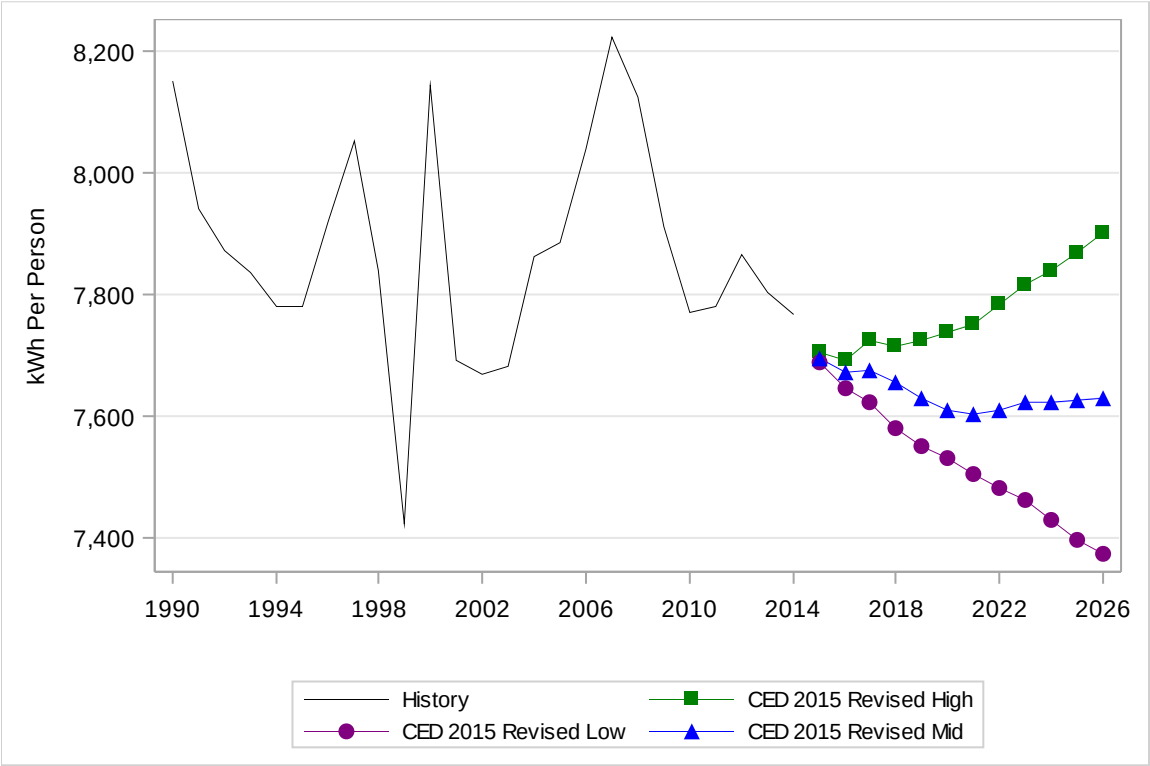
Figure 1-2: PG&E Planning Area Baseline Peak



Source: California Energy Commission, Demand Analysis Office, 2015

Per capita consumption is illustrated in **Figure 1-3**. The pattern is similar to that seen in total consumption, with growth in the mid and high cases increasing in the latter half of the forecast period due to increasing EV penetration and plug load. The mid case is relatively flat, which is in line with recent history.

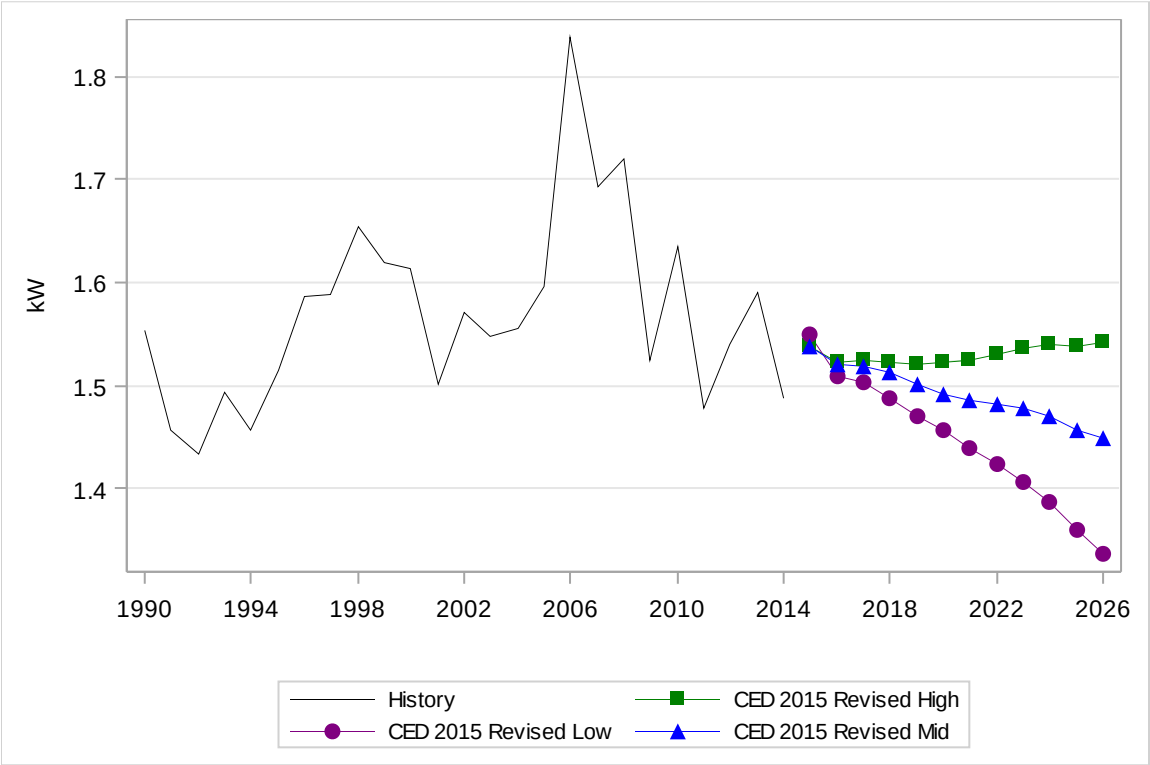
Figure 1-3: PG&E Planning Area Baseline Annual per Capita Electricity Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 1-4 shows per capita peak demand. *CED 2015 Revised* mid and low values are projected to decline over the forecast period, with PV adoption in the low case pushing estimates of per capita peak below recent historical values.

Figure 1-4: PG&E Planning Area Baseline per Capita Peak Demand



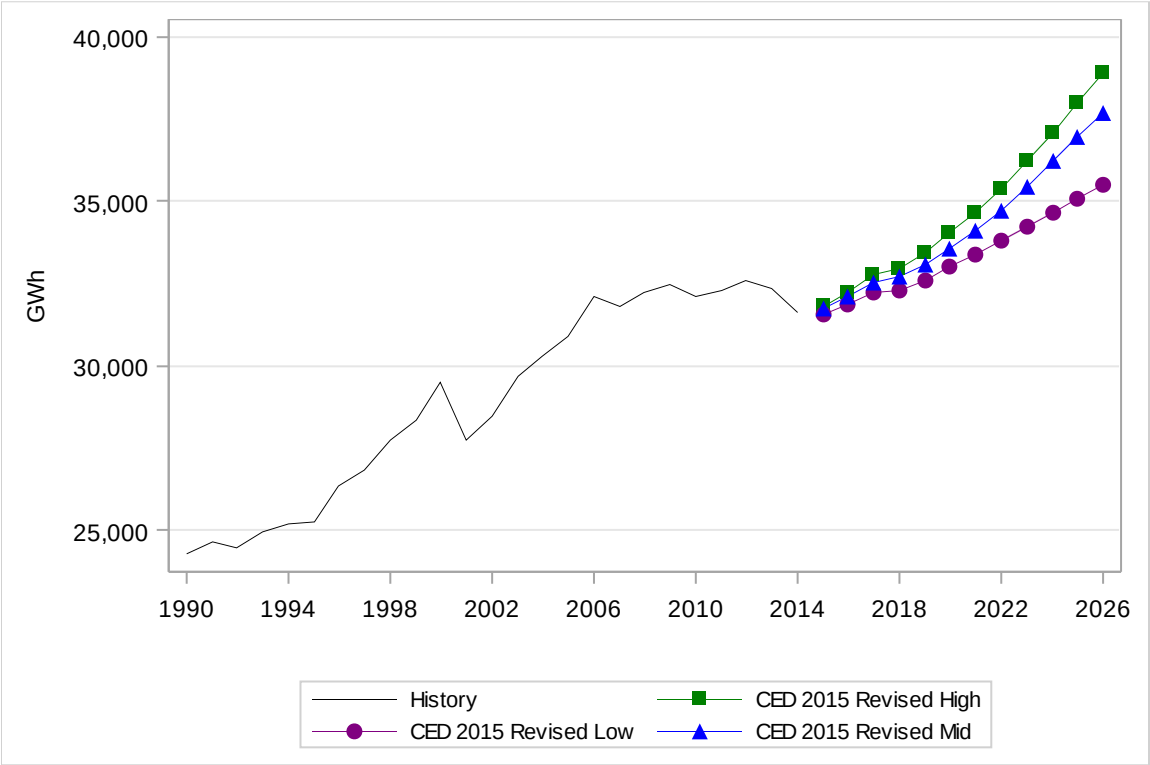
Source: California Energy Commission, Demand Analysis Office, 2015

Sector Level Baseline Results and Input Assumptions

Residential Sector

Total residential consumption for the PG&E planning area is shown in **Figure 1-5.** Of all the customer sectors modeled in *CED 2015 Revised*, the residential sector exhibits the strongest growth. This is due to high levels of personal EV adoption and increasing plug load projected to occur over the forecast period.

Figure 1-5: PG&E Planning Area Baseline Residential Consumption

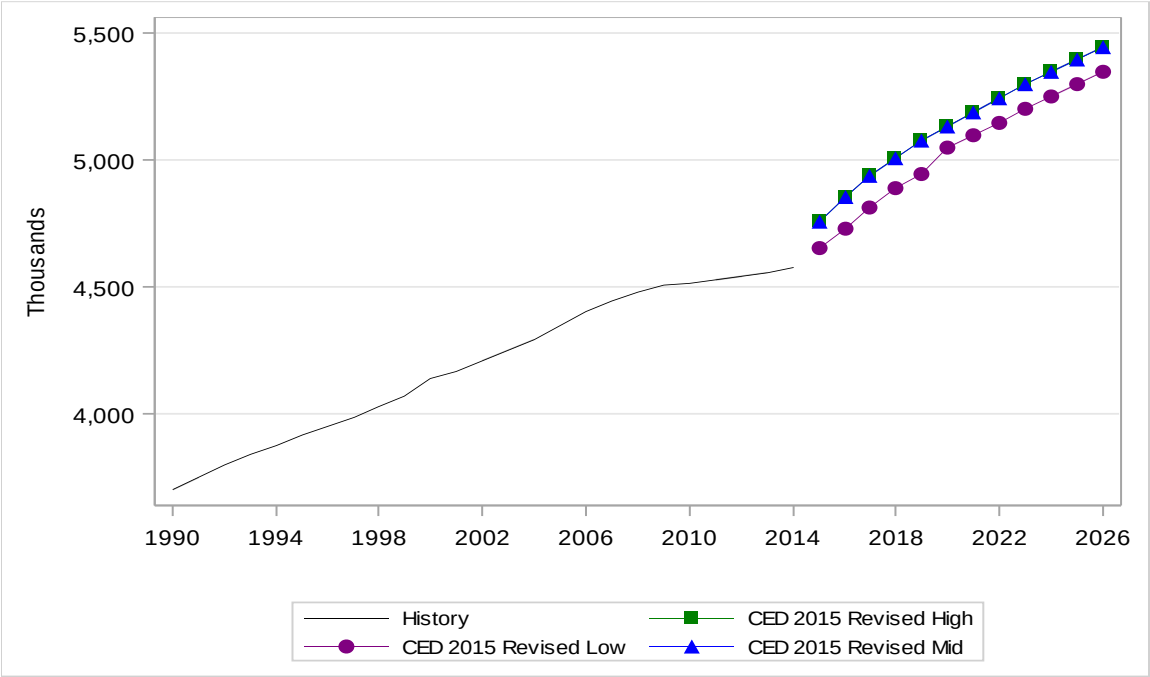


Source: California Energy Commission, Demand Analysis Office, 2015

Figure 1-6 and **Figure 1-7** show the household and persons-per-household projections used to drive the *CED 2015 Revised* residential forecasts. Each figure shows only two distinct cases. This is because the IHS Global Insight *Optimistic* scenario and the Moody's Analytics *Baseline* scenario were very similar, so the latter was used to represent both the high and mid cases. The low household and persons-per-household scenarios were provided by the California Department of Finance (DOF).

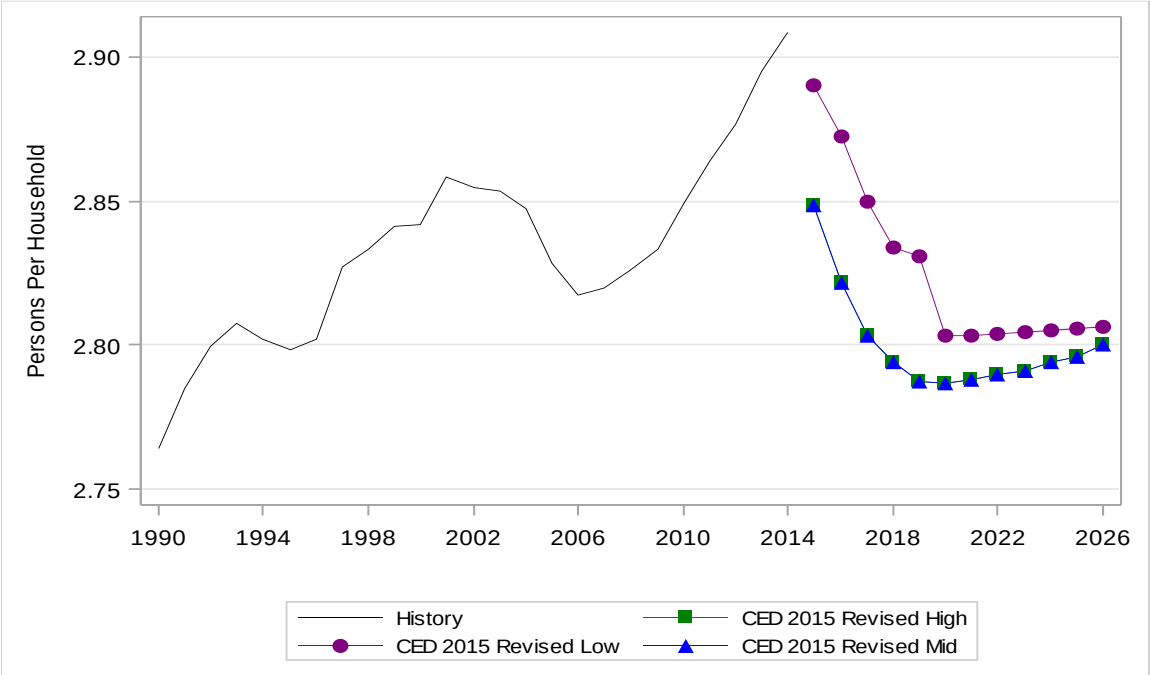
As illustrated by **Figure 1-6**, household formation has been slow in the last few years and is projected to be relatively high in the first years of the forecast period. This is due to the large population of young adults who continued to live with their parents in response to the harsh economic conditions that followed the Great Recession. Recently improved prospects for employment and personal financing will enable this group to form their own individual households in the coming years. **Figure 1-7** shows a corresponding drop in persons-per-household.

Figure 1-6: PG&E Planning Area Residential Household Projections



Source: California Energy Commission, Demand Analysis Office, 2015

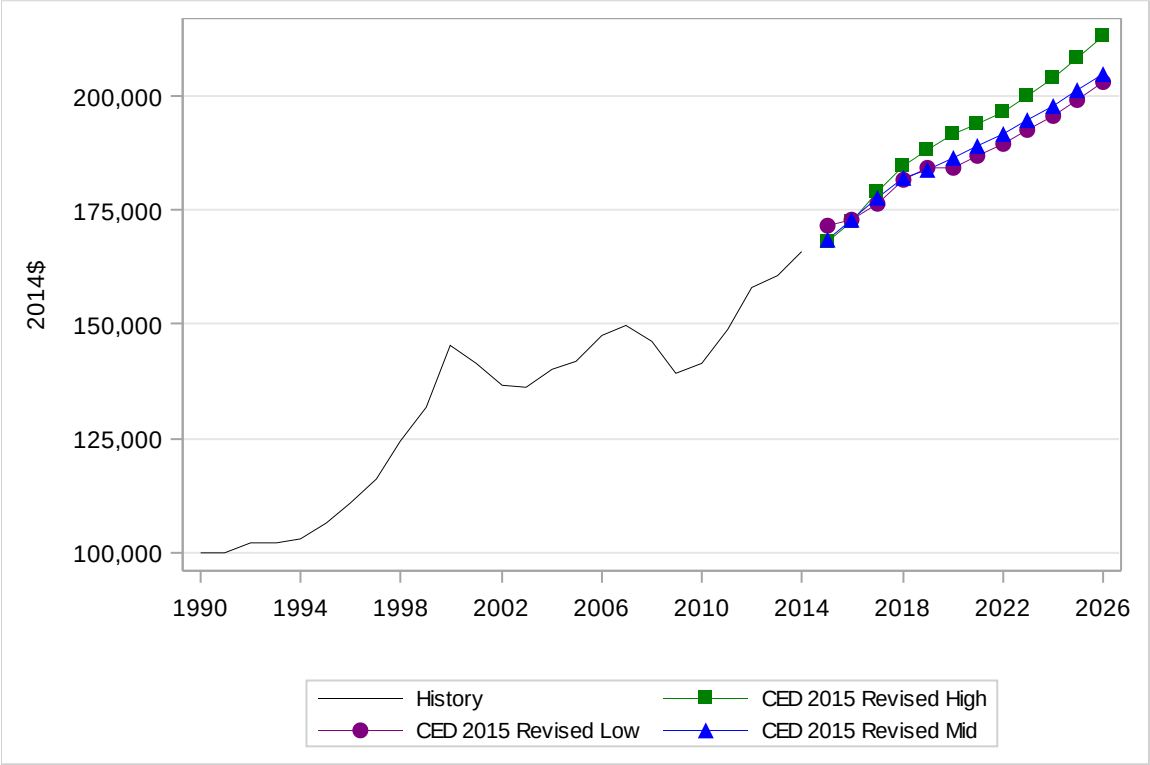
Figure 1-7: PG&E Planning Area Persons per Household Projections



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 1-8 shows the average household income projections used in *CED 2015 Revised*. Personal income is not much lower in the low demand case than in the mid. However, the number of households does differ significantly between the two cases, even in the initial years of the forecast period. This narrows the spread between the average household income cases, and even causes the low case to cross the mid and high cases.

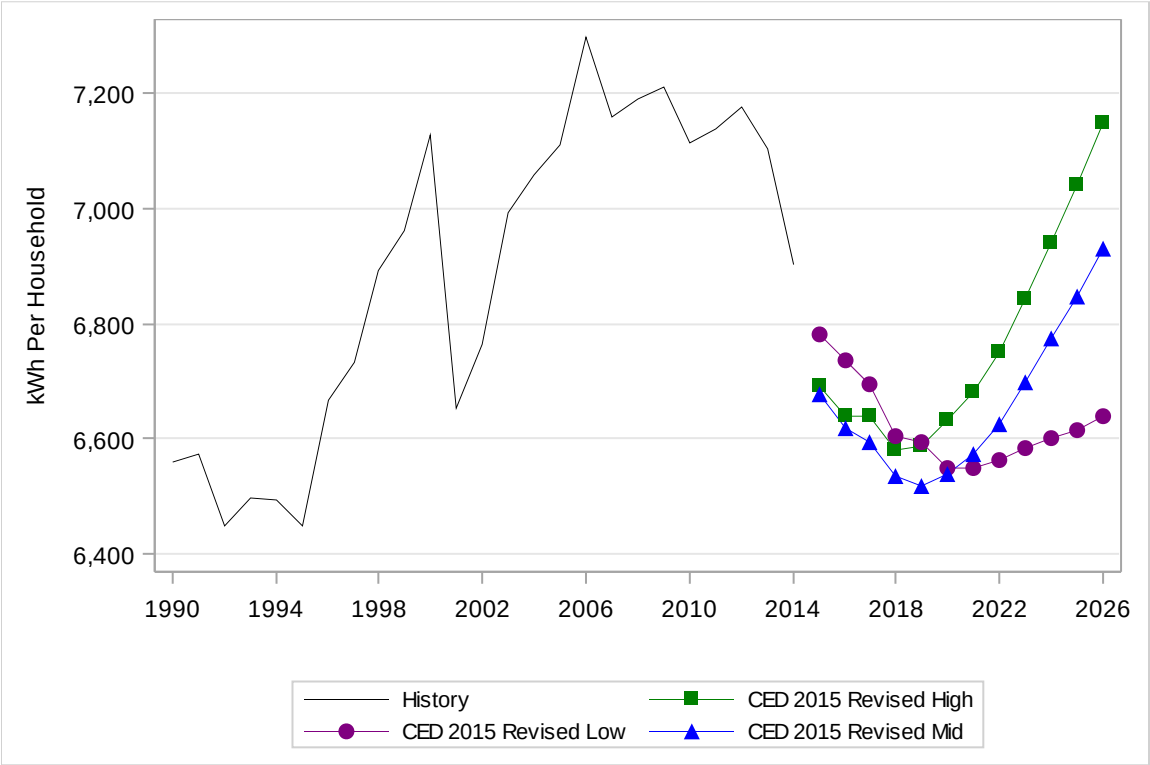
Figure 1-8: PG&E Planning Area Average Household Income Projections



Source: California Energy Commission, Demand Analysis Office, 2015

Electricity consumption per household is shown in **Figure 1-9**. Since the low demand case has a higher number of persons-per-household, it begins at a higher level than either the mid or high case. However, the mid and high cases have significantly greater levels of EV adoption, which drives household consumption well over the low case in the second half of the forecast period.

Figure 1-9: PG&E Planning Area Baseline Consumption per Household

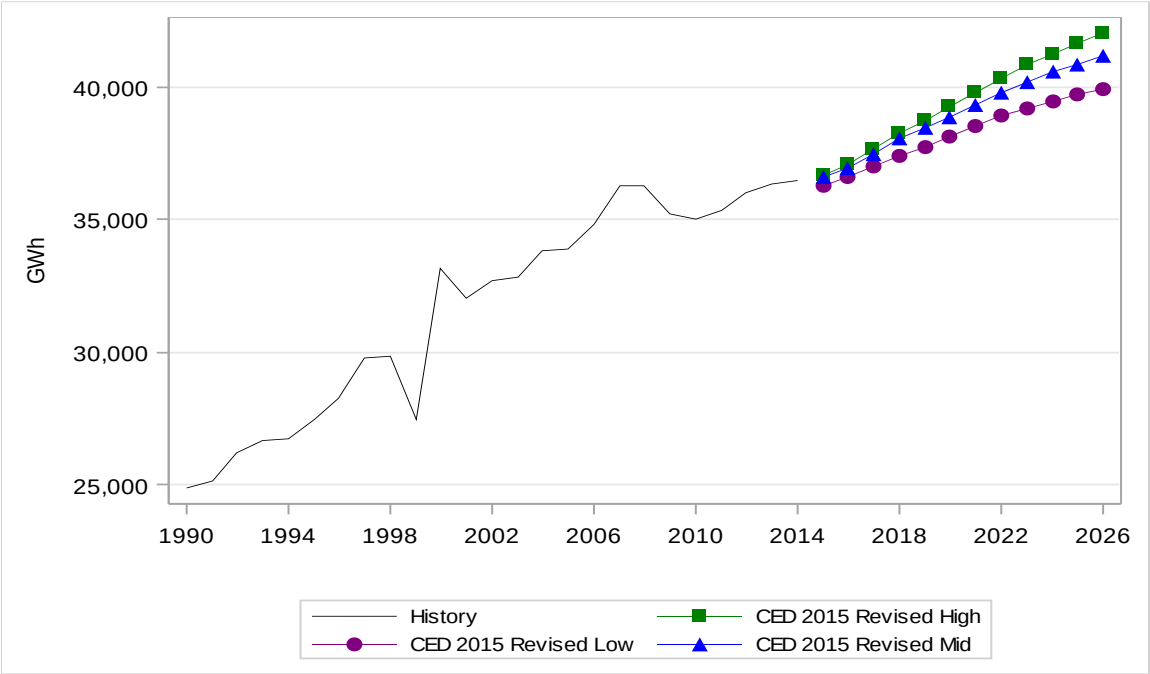


Source: California Energy Commission, Demand Analysis Office, 2015

Commercial Sector

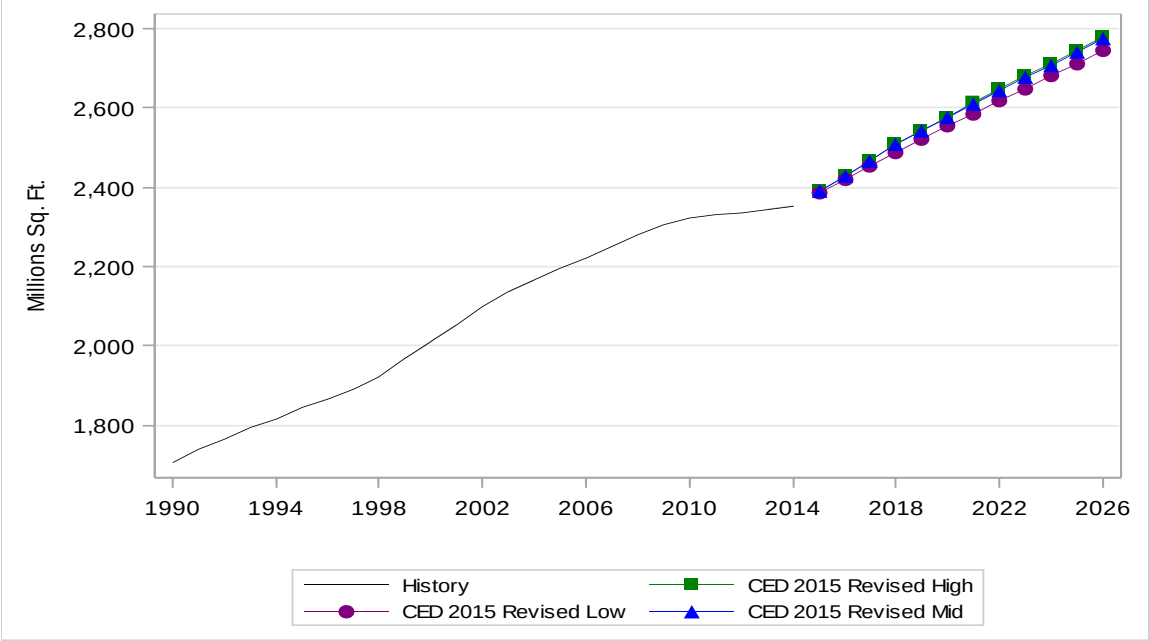
Figure 1-10 compares the PG&E commercial sector electricity consumption forecasts. Commercial floor space is a key input to the commercial end use model demand model. The relatively narrow spread between the three cases reflects the even narrower band of commercial floor space projections, shown in **Figure 1-11**.

Figure 1-10: PG&E Planning Area Baseline Commercial Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 1-11: PG&E Planning Area Commercial Floor Space

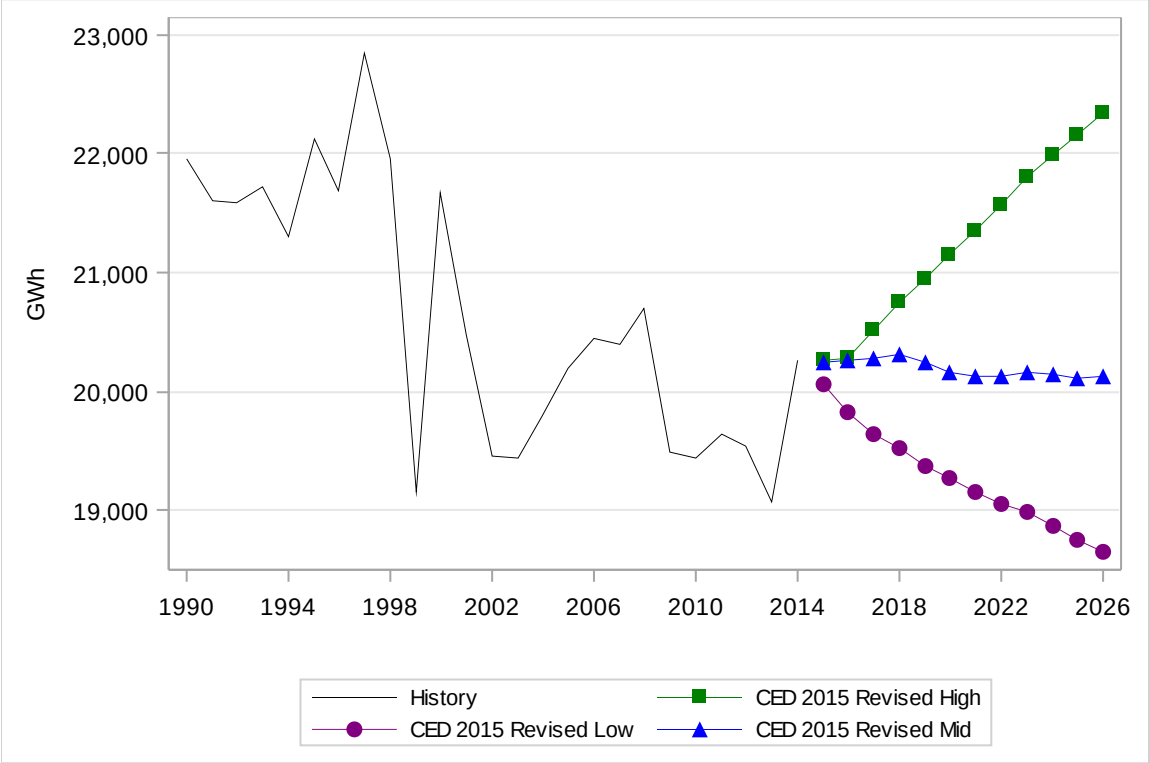


Source: California Energy Commission, Demand Analysis Office, 2015

Industrial Sector

Figure 1-12 shows the PG&E planning area industrial sector electricity consumption forecasts. The Energy Commission uses an industry specific econometric model to project electricity consumption in this sector. For the PG&E planning area, historical consumption in this sector is highly variable. This is reflected in the high and low cases, which reach nearly historic highs and lows, respectively, by the end of the forecast period. The mid case remains flat throughout the forecast.

Figure 1-12: PG&E Planning Area Baseline Industrial Consumption

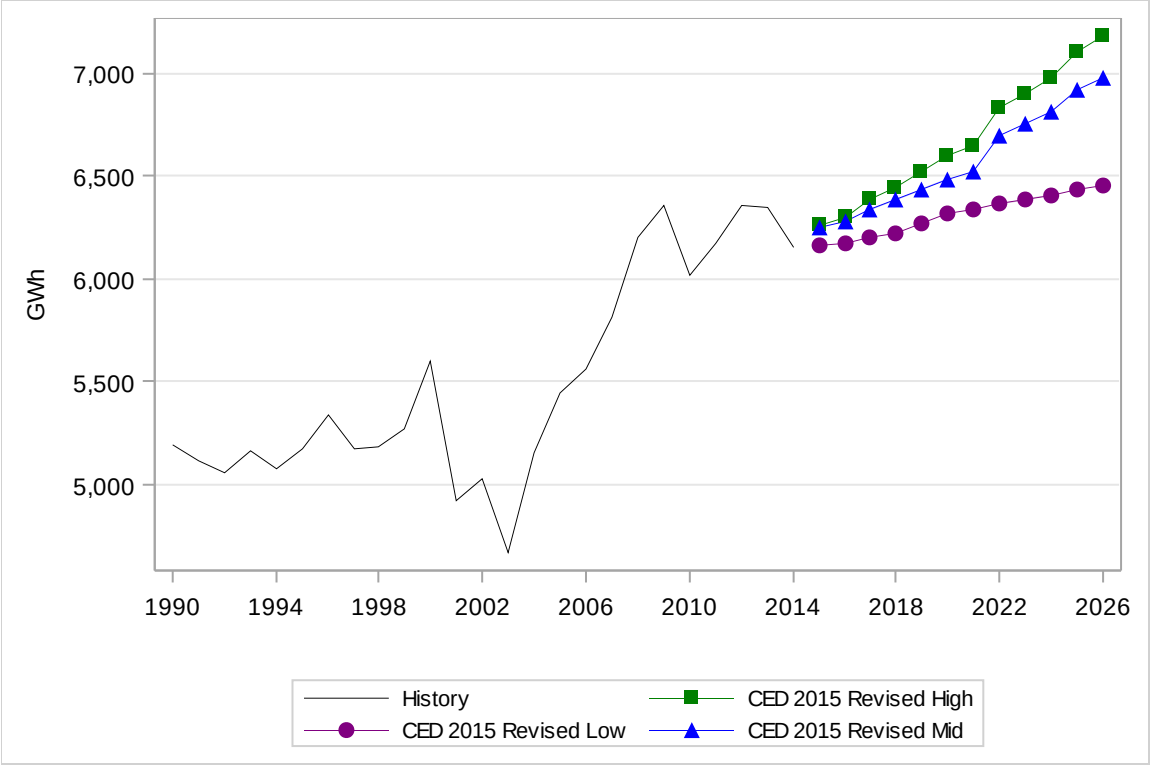


Source: California Energy Commission, Demand Analysis Office, 2015

Other Sectors

Figure 1-13 shows the electricity consumption forecasts for the transportation, communications, and utilities (TCU) sector, which also includes street lighting. This relatively small and eclectic sector shows growth in all three cases, with the largest contributions coming from urban transit, telecommunications, and electric power generation, transmission, and distribution.

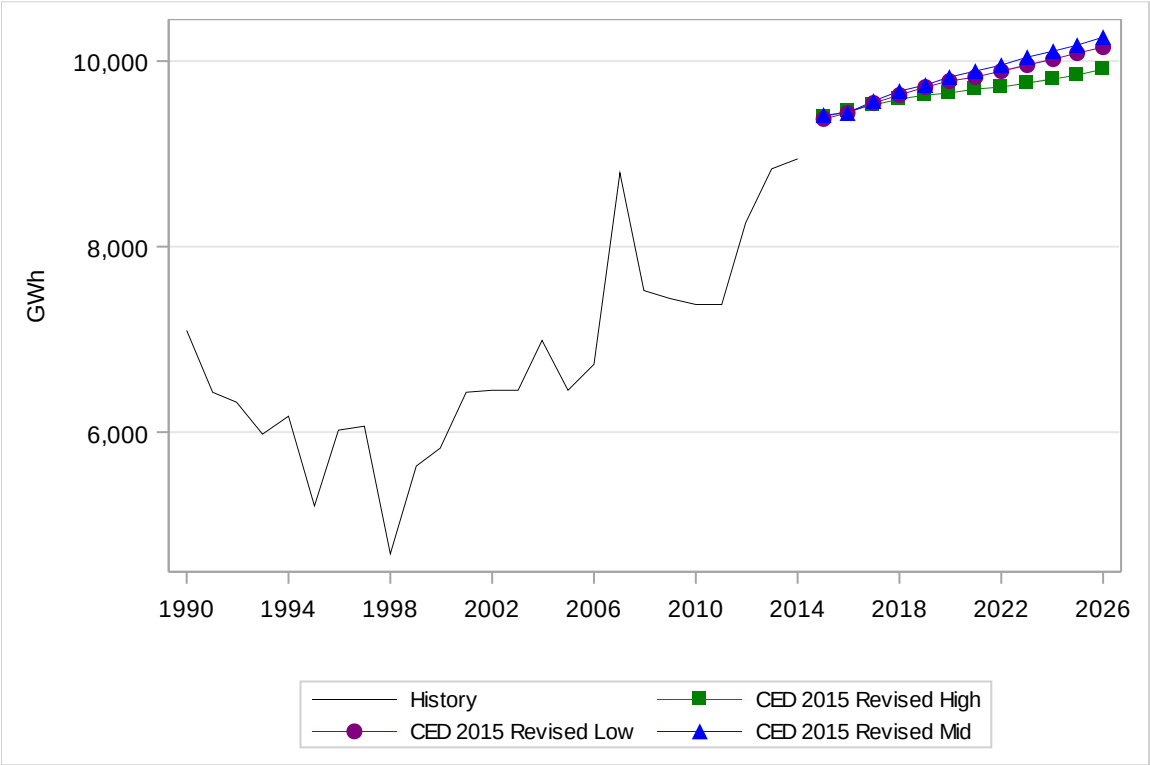
Figure 1-13: PG&E Planning Area Baseline Transportation, Communication, Utilities, and Street Lighting Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 1-14 shows the electricity consumption forecasts for the agriculture and water pumping sectors. For PG&E, this sector includes electricity used by the California Department of Water Resources (DWR) to deliver water. Due to persistent drought conditions, DWR water deliveries were drastically reduced in 2014. Since *CED 2015 Revised* holds DWR loads constant at an average of the last five years, the projections shown below begin at a point noticeably higher than the base-year value.

Figure 1-14: PG&E Planning Area Baseline Agriculture and Water Pumping Consumption



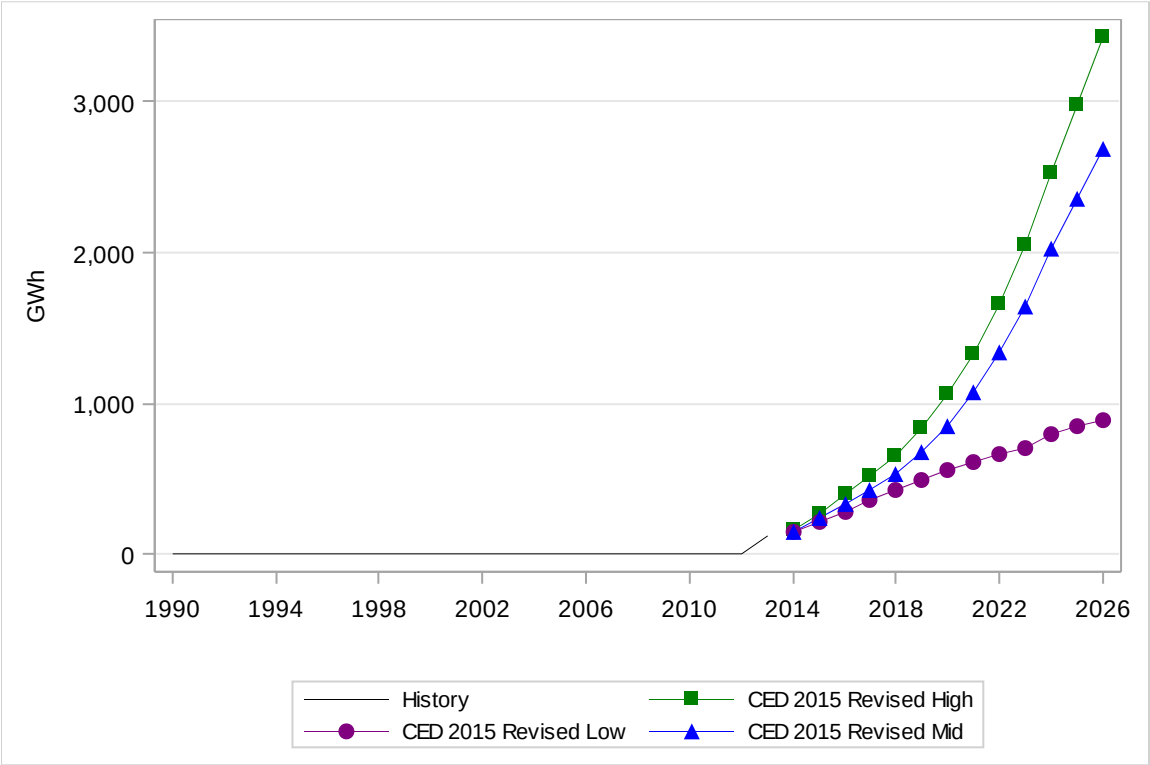
Source: California Energy Commission, Demand Analysis Office, 2015

Electric Vehicles

Electricity consumption by PEVs in the PG&E planning area is expected to increase significantly over the forecast period, as illustrated by **Figure 1-15**. The mid and high demand cases are similar as they both assume the PEV prices will decline (at different rates in each case) and consumer preference will increase enough over the forecast period to meet and exceed the California Air Resources Board's (ARB) Zero-Emission Vehicle (ZEV) Mandate. Alternatively, the low demand case assumes that current PEV prices (relative to gasoline vehicles) and consumer preferences will remain unchanged over the forecast period.

Staff assumes most recharging will occur during off-peak hours, so peak impacts are expected to follow a similar pattern, though they should be relatively small in comparison.

Figure 1-15: PG&E Electricity Consumption by Electric Vehicles



Source: California Energy Commission, Demand Analysis Office, 2015

Self-Generation

The peak demand forecast is reduced by the projected impacts of distributed solar PV, solar thermal, and combined heat and power (CHP) systems serving on-site customer load. Customer adoption of these technologies is forecast based on a combination of installation trend analysis and predictive modeling, the details of which are described in Appendix B to Volume 1. **Table 1-3** shows the forecast of peak impacts from PV and non-PV self-generation. Staff projects between 1,217 and 2,502 MW of peak reduction from PV systems by 2026, a wide spread that reflects varied assumptions about technology cost, the future of net-energy metering (NEM) conditions, and rate escalation.

Table 1-3: PG&E Planning Area Self-Generation Peak Impacts (MW)

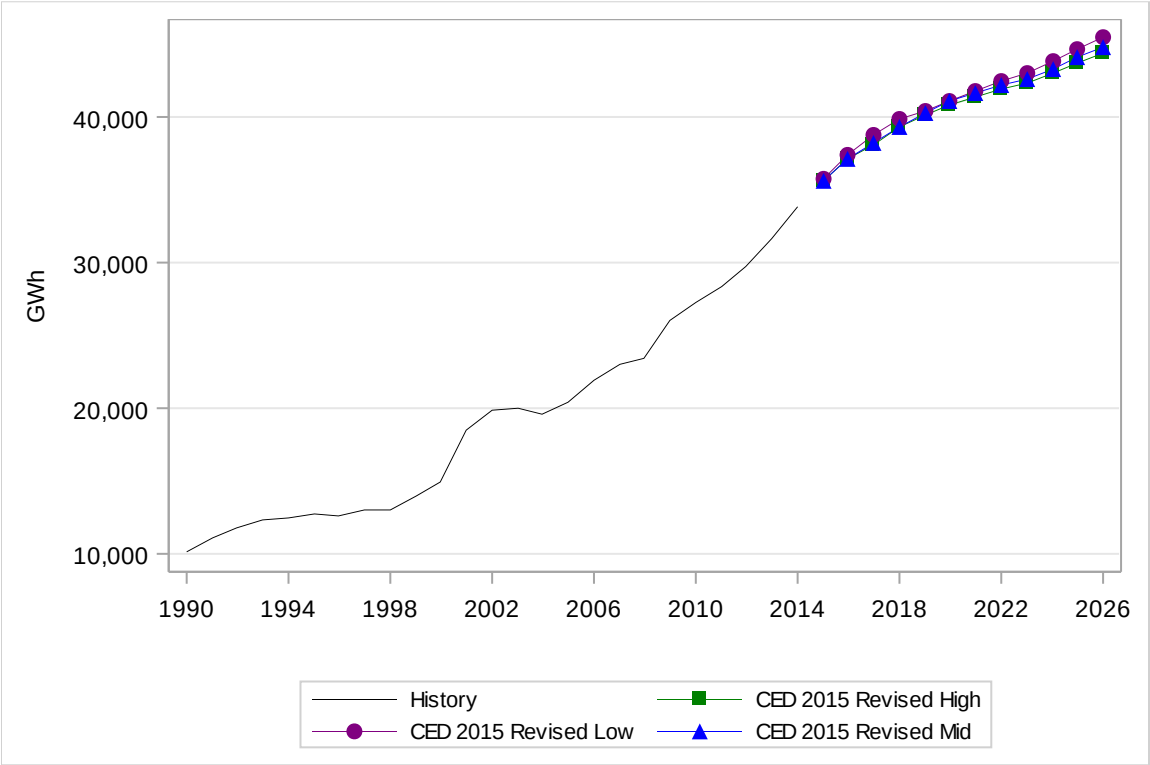
	***CED 2015 Revised* High Demand**		***CED 2015 Revised* Mid Demand**		***CED 2015 Revised* Low Demand**	
	Non-PV	PV	Non-PV	PV	Non-PV	PV
1990	597	-	597	-	597	-
2000	620	0	620	0	620	0
2010	800	198	800	198	800	198
2015	858	576	858	579	858	579
2020	1,025	899	1,022	1,026	1,021	1,173
2026	1,127	1,217	1,128	1,818	1,125	2,502

Source: California Energy Commission, Demand Analysis Office, 2015

Conservation/Efficiency Impacts

Figure 1-16 shows committed electricity consumption savings estimates from all sources, including building and appliance standards; utility programs implemented through 2015; and price and other effects, or savings associated with rate changes and certain market trends not directly related to programs or standards. Projected savings impacts are highest in the low demand case, since price and program effects are inversely related to the demand outcome. Within the demand cases, higher demand yields more standards savings since new construction and appliance usage increase, while lower demand is associated with more program savings and higher rates (and therefore more price effects). The net result is that savings totals among the cases are very similar.

Figure 1-16: PG&E Planning Area Baseline Electricity Consumption Savings Estimates



Source: California Energy Commission, Demand Analysis Office, 2015

Table 1-4 presents estimated savings for building and appliance standards in the mid demand case for selected years. The standards savings estimates include some federal standards and all Title 20 and Title 24 updates through 2016. Savings are measured against a baseline before 1975, so they incorporate more than 30 years of impacts. Volume 1, Chapter 2 provides more detail on staff work related to energy efficiency and conservation, including an itemized list of all building and appliance standards that have been explicitly considered in estimating these cumulative savings.

Table 1-4: PG&E Planning Area Baseline Standards Savings Estimates

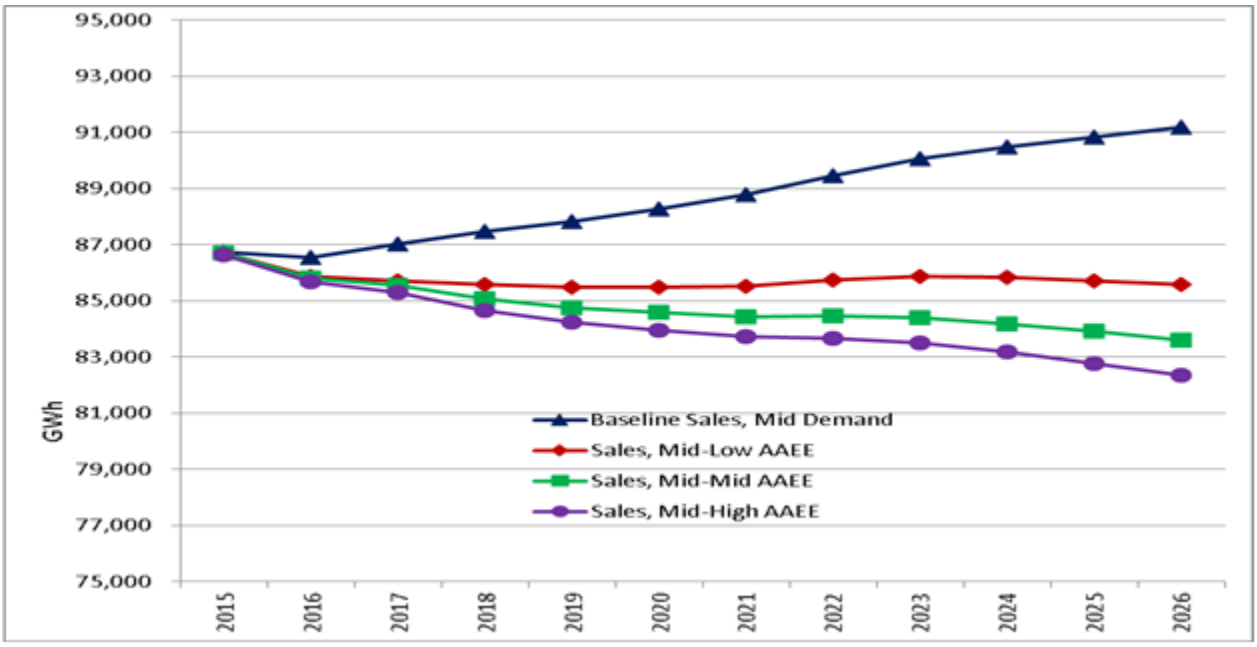
Electricity Consumption Savings (GWh)							
	Residential			Commercial			
	Building Standards	Appliance Standards	Total	Building Standards	Appliance Standards	Total	Total Standards
1990	837	940	1,777	458	205	663	2,440
2000	1,836	2,891	4,727	1,041	563	1,604	6,331
2010	2,520	5,843	8,363	2,201	1,017	3,217	11,580
2014	2,885	8,161	11,046	2,829	1,319	4,147	15,193
2020	3,659	11,524	15,183	4,951	2,470	7,420	22,603
2026	4,283	13,356	17,639	6,921	3,357	10,277	27,916
Electricity Peak Demand Savings (MW)							
	Residential			Commercial			
	Building Standards	Appliance Standards	Total	Building Standards	Appliance Standards	Total	Total Standards
1990	277	311	588	115	51	166	754
2000	570	898	1,468	240	130	370	1,838
2010	847	1,965	2,812	615	284	899	3,711
2014	1,035	2,928	3,963	737	335	1,072	5,035
2020	1,286	4,052	5,339	1,294	621	1,915	7,253
2026	1,467	4,575	6,042	1,809	849	2,658	8,700

Source: California Energy Commission, Demand Analysis Office, 2015

For *CED 2015 Revised*, staff estimated AAEE savings for the PG&E service territory. Spreadsheets posted with this report[3] provide AAEE savings estimates for the PG&E service territory by sector and savings type (programs, standards) for energy and peak for each of the five scenarios. **Figure 1-17** shows the impact on service territory sales in the mid demand case of three AAEE savings scenarios designed to be consistent with input assumptions for the mid case. In all three scenarios graphed, sales decline for all or most of the forecast period. Similar results are shown in **Figure 1-18** for service territory peak demand. See Chapter 2 of Volume 1 of this report for details on these AAEE scenarios.

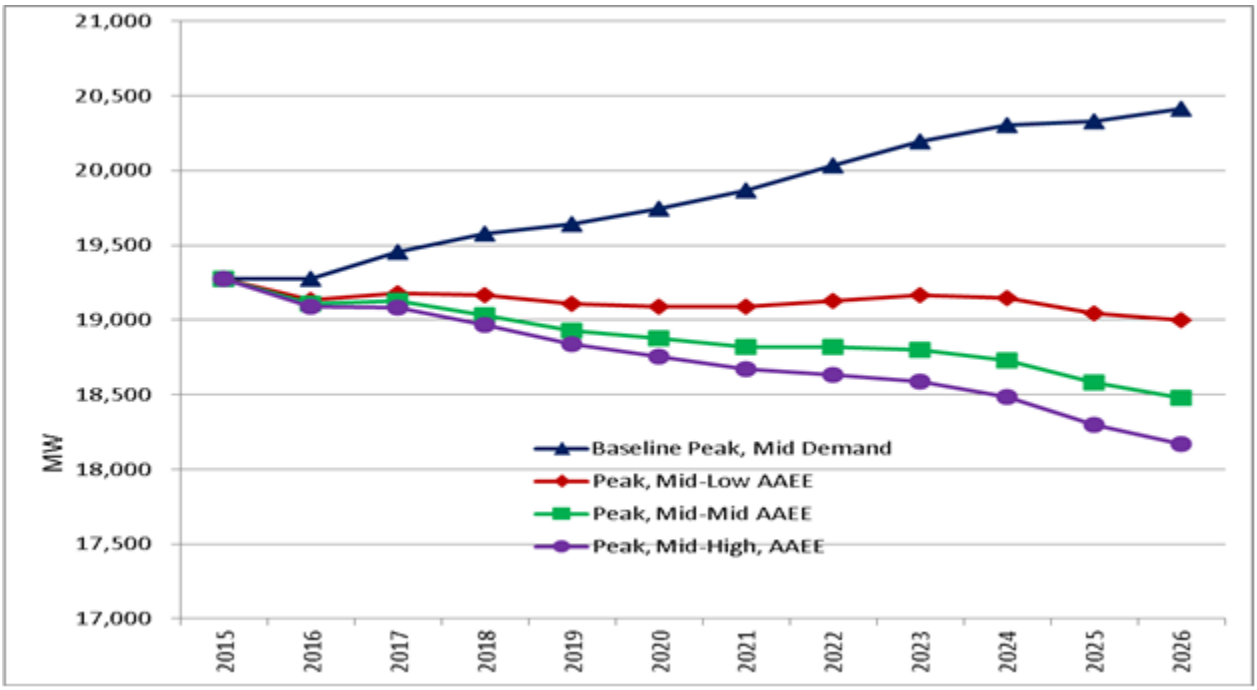
3 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Figure 1-17: PG&E Service Territory Baseline and Adjusted Sales



Source: California Energy Commission, Demand Analysis Office, 2015

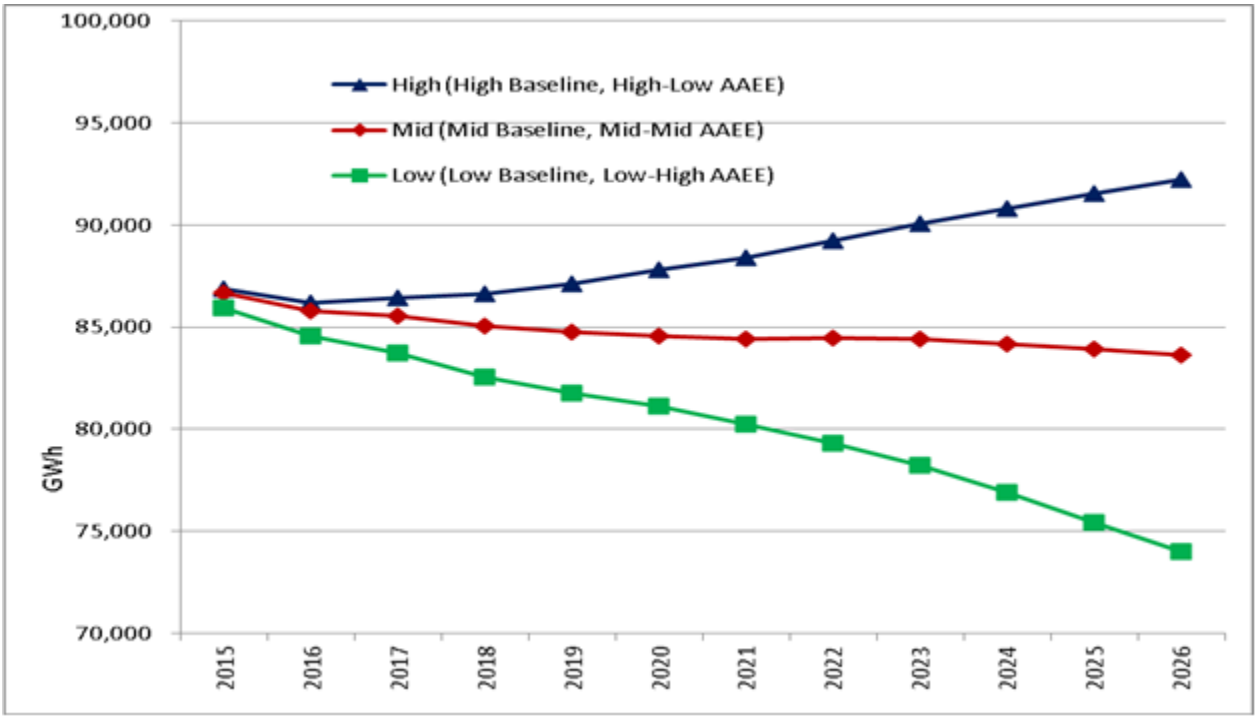
Figure 1-18: PG&E Service Territory Baseline and Adjusted Peak Demand



Source: California Energy Commission, Demand Analysis Office, 2015

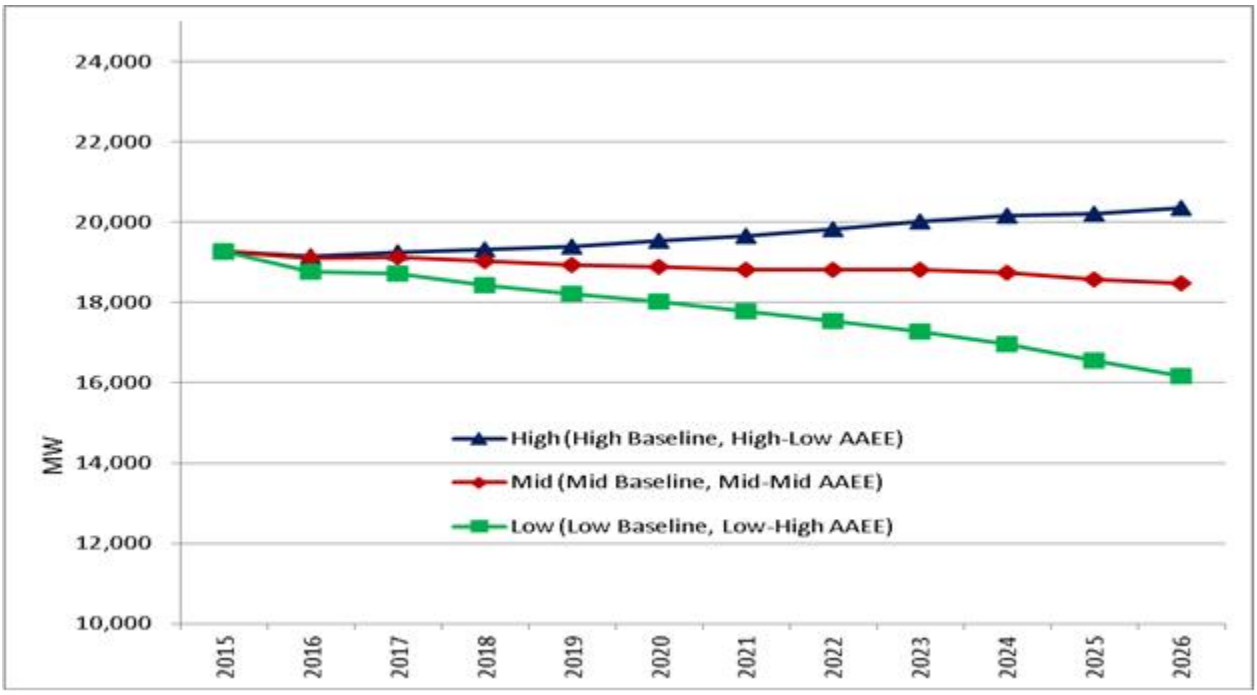
Figure 1-19 shows the low baseline sales forecast adjusted by a high AAEE savings scenario consistent with the assumptions of the low demand case (low-high), the mid baseline adjusted by a consistent mid AAEE scenario (mid-mid), and the high baseline adjusted by low AAEE savings (high-low). These parings were chosen to produce the maximum spread among potential managed sales forecasts for the PG&E service territory. **Figure 1-20** shows a similar set of adjusted peak demand forecasts.

Figure 1-19: PG&E Service Territory Adjusted Sales



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 1-20: PG&E Service Territory Adjusted Peak Demand



Source: California Energy Commission, Demand Analysis Office, 2015

Electrification

Potentially significant increases in electricity use in California are expected to occur through electrification in the commercial, industrial, and transportation sectors. **Table 1-5** shows, for select years, the portion of these impacts that are anticipated in the PG&E planning area. For more details, see Volume 1, Chapter 1.

Table 1-5: PG&E Planning Area Electrification Impacts

	Additional Consumption (GWh)		
	CED 2015 Revised **High Demand**	***CED 2015 Revised*** **Mid Demand**	***CED 2015 Revised*** **Low Demand**
2016	40.0	25.4	8.6
2020	217.0	128.1	30.6
2026	469.2	233.0	44.0

Source: California Energy Commission Staff

Climate Zone Forecasts

For *CED 2015 Revised*, staff developed electricity consumption and peak demand forecasts for each climate zone. (See Volume 1, Chapter 1 for more details.) The PG&E planning area now has six climate zones, as shown in **Table 1-6**.

Table 1-6: PG&E Planning Area Climate Zones

Forecast Zone	Counties Included
1. Greater Bay Area	Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara
2. North Coast	Lake, Humboldt, Marin, Mendocino, Napa, Sonoma
3. North Valley	Butte, Glenn, Lassen, Plumas, Shasta, Sierra, Siskiyou, Tehama, Trinity
4. Central Valley	Alpine, Amador, Calaveras, Colusa, El Dorado, Nevada, Placer, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, Tuolumne, Tulare, Yolo, Yuba
5. Southern Valley	Fresno, Kern, Kings, Madera, Mariposa, Merced
6. Central Coast	Monterey, San Benito, San Luis Obispo Santa Barbara, Santa Cruz

Source: California Energy Commission, Demand Analysis Office, 2015

Table 1-7 shows the forecast results for electricity consumption and peak demand by climate zone for each demand case. Full climate zone results are shown in the forms posted alongside this report.[4]

The most significant growth in both consumption and peak demand occurs in the Central and Southern Valley (climate zones 4 and 5) due to inland migration and greater climate change impacts. The Greater Bay Area (climate zone 1) sees high growth in consumption due to its disproportionate share of electric vehicle adoption, but also low growth in peak demand due to high PV penetration.

4 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Table 1-7: PG&E Planning Area Climate Zones

		Consumption by Forecast Zone (GWh)						Peak Demand by Forecast Zone (MW)					
		1	2	3	4	5	6	1	2	3	4	5	6
***CED 2015 Revised* High Demand**	2014	47,021	7,275	3,660	16,124	21,767	7,580	6,905	1,249	1,055	4,288	5,032	1,277
	2015	47,775	7,258	3,655	16,263	21,865	7,586	7,267	1,317	1,111	4,511	5,290	1,344
	2020	51,074	7,564	3,802	17,264	23,043	7,981	7,431	1,360	1,130	4,809	5,700	1,361
	2026	55,959	8,127	4,029	18,725	25,016	8,518	7,996	1,436	1,190	5,191	6,243	1,436
	Annual Growth 2014 - 2020	1.39%	0.65%	0.64%	1.15%	0.95%	0.86%	1.23%	1.42%	1.15%	1.93%	2.10%	1.07%
	Annual Growth 2014 - 2026	1.46%	0.93%	0.80%	1.25%	1.17%	0.98%	1.23%	1.17%	1.00%	1.61%	1.81%	0.98%
***CED 2015 Revised* Mid Demand**	2014	47,022	7,275	3,660	16,124	21,766	7,580	6,905	1,249	1,055	4,288	5,032	1,277
	2015	47,673	7,243	3,648	16,236	21,870	7,575	7,267	1,317	1,111	4,511	5,290	1,344
	2020	49,953	7,458	3,738	16,958	22,908	7,853	7,250	1,341	1,112	4,723	5,585	1,335
	2026	53,518	7,891	3,902	18,088	24,604	8,255	7,400	1,372	1,132	4,920	5,885	1,356
	Annual Growth 2014 - 2020	1.01%	0.41%	0.35%	0.84%	0.86%	0.59%	0.82%	1.19%	0.87%	1.62%	1.75%	0.73%
	Annual Growth 2014 - 2026	1.08%	0.68%	0.54%	0.96%	1.03%	0.71%	0.58%	0.78%	0.59%	1.15%	1.31%	0.50%
***CED 2015 Revised* Low Demand**	2014	47,022	7,275	3,660	16,124	21,766	7,580	6,905	1,249	1,055	4,288	5,032	1,277
	2015	47,289	7,190	3,619	16,111	21,711	7,517	7,267	1,317	1,111	4,511	5,290	1,344
	2020	48,510	7,336	3,676	16,671	22,626	7,723	6,933	1,307	1,078	4,571	5,416	1,289
	2026	50,216	7,564	3,776	17,453	23,745	7,941	6,499	1,274	1,056	4,561	5,434	1,239
	Annual Growth 2014 - 2020	0.52%	0.14%	0.08%	0.56%	0.65%	0.31%	0.07%	0.76%	0.36%	1.07%	1.24%	0.15%
	Annual Growth 2014 - 2026	0.55%	0.33%	0.26%	0.66%	0.73%	0.39%	-0.50%	0.17%	0.01%	0.52%	0.64%	-0.26%

Source: California Energy Commission, Demand Analysis Office, 2015

CHAPTER 2:
Southern California Edison Planning Area

In an effort to make the demand forecast more useful to resource planners, *CED 2015 Revised* uses a new geographic scheme for planning areas and climate zones that is more closely based on California's balancing authority areas. The Southern California Edison (SCE) planning area includes:

- SCE bundled retail customers.
- Customers served by energy service providers using the SCE distribution system to deliver electricity to end users.
- Customers served by community choice aggregators using the SCE distribution system, including Lancaster Choice Energy.
- Customers of the various Southern California municipal and irrigation district utilities with the exception of Imperial Irrigation District and the cities of Los Angeles, Glendale, and Burbank. Also excluded from the SCE planning area are San Diego County and the southern portion of Orange County, served by San Diego Gas and Electric (SDG&E).

To support electricity and transmission system analysis, staff uses historical consumption and load data to develop individual forecasts for all medium and large utilities in the planning area. Those results are presented in Forms 1.5a through 1.5c in the statewide forms accompanying this forecast report.[5] The results in this chapter are for the entire SCE transmission planning area.

This chapter is organized as follows. First, forecasted consumption and peak loads for the SCE planning area are discussed; both total and per capita values are presented. Second, the chapter presents sector consumption and peak load forecasts. Third, the chapter discusses the forecasts of EVs, self-generation, and the impacts of conservation and efficiency programs, including AAEE. Finally, forecasts of electricity consumption and peak demand are presented for each climate zone within the SCE planning area.

Baseline Forecast Results

For this forecast, three demand cases were developed. The high demand case includes high economic and demographic projections, low energy price projections, and low-efficiency impact assumptions. The low demand case includes low economic and demographic projections, high energy price projections, and high-efficiency impact

5 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

assumptions. The mid demand case uses assumptions that fall between the low and high cases. Volume 1 provides more detail on the construction of the demand cases.

Table 2-1 and **Table 2-2** show the *CED 2015 Revised* high, mid, and low demand cases for electricity consumption and peak demand, respectively, for selected years. The base year for these peak cases is 2015, so **Table 2-2** shows both the recorded peak and the weather normalized peak values for that year. Comprehensive results are available electronically as a set of forms posted alongside this report.[6]

Table 2-1: SCE Planning Area Baseline Consumption

	Recorded Consumption	Forecast		
		CED 2015 Revised **High**	***CED 2015 Revised*** **Mid**	***CED 2015 Revised*** **Low**
1990	89,041			
2000	100,816			
2010	104,195			
2014	106,590			
2020		115,621	113,250	110,304
2026		123,828	119,226	113,399
Average Annual Growth Rates				
1990 - 2000	1.25%			
2000 - 2010	0.33%			
2010 - 2014	0.57%			
2014 - 2020		1.36%	1.02%	0.57%
2014 - 2026		1.26%	0.94%	0.52%

Source: California Energy Commission, Demand Analysis Office, 2015

6 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Table 2-2: SCE Planning Area Baseline Peak Demand

	Recorded Peak	Forecast		
		***CED 2015 Revised* High**	***CED 2015 Revised* Mid**	***CED 2015 Revised* Low**
1990	17,970			
2000	19,829			
2010	23,283			
2015	22,983			
2015*		22,738	22,738	22,738
2020		23,500	23,006	22,523
2026		24,701	23,171	21,491
Average Annual Growth Rates				
1990-2000	0.99%			
2000-2010	1.62%			
2010-2015	-0.26%			
2015*-2020		0.66%	0.23%	-0.19%
2015*-2026		0.76%	0.17%	-0.51%

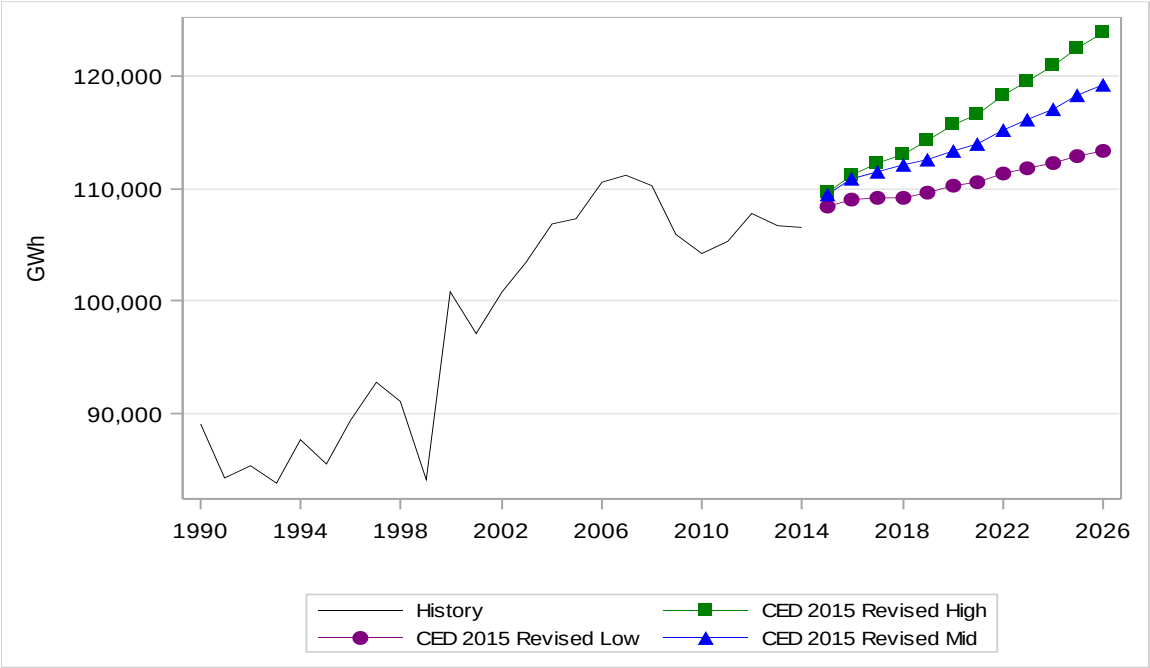
Source: California Energy Commission, Demand Analysis Office, 2015

Figure 2-1 illustrates electricity consumption for the three cases, each of which grows continuously over the forecast period. Growth in the mid and high cases increases in the latter years of the forecast as EVs add significant levels of consumption. By 2026, the *CED 2015 Revised* high demand level is 3.9 percent higher than the mid case, while the low demand case is 4.9 percent lower.

The peak demand projections, shown in **Figure 2-2**, exhibit a much wider spread than the consumption forecast. This is due to the impact of PV adoption in the different cases, which vary considerably for *CED 2015 Revised*. Since EVs are assumed to be charged mostly off-peak, they do not exert the same upward pressure on peak demand, which is instead driven down by PV adoption in the latter half of the forecast period.

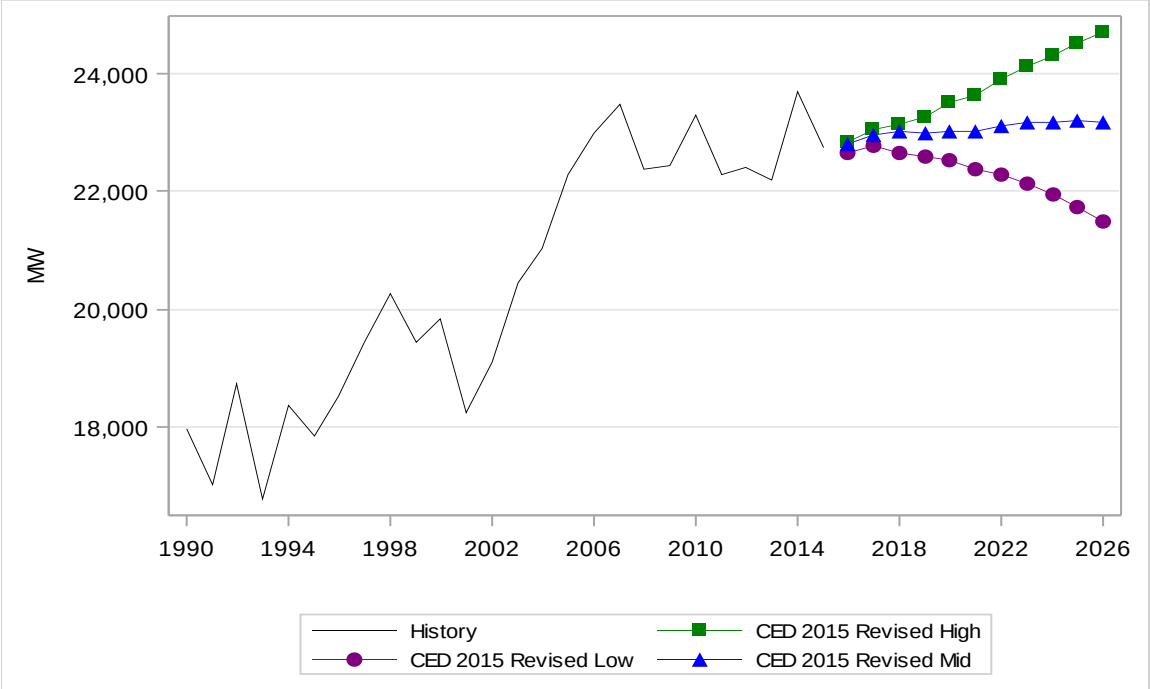
The high and low case peak demand projections are 6.6 percent higher and 7.3 percent lower, respectively, than the mid case by 2026. The SCE planning area experienced higher than average extreme temperatures in 2015, so the recorded peak load was 245 MW higher than the weather normalized estimate of 22,738 MW.

Figure 2-1: SCE Planning Area Baseline Electricity Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

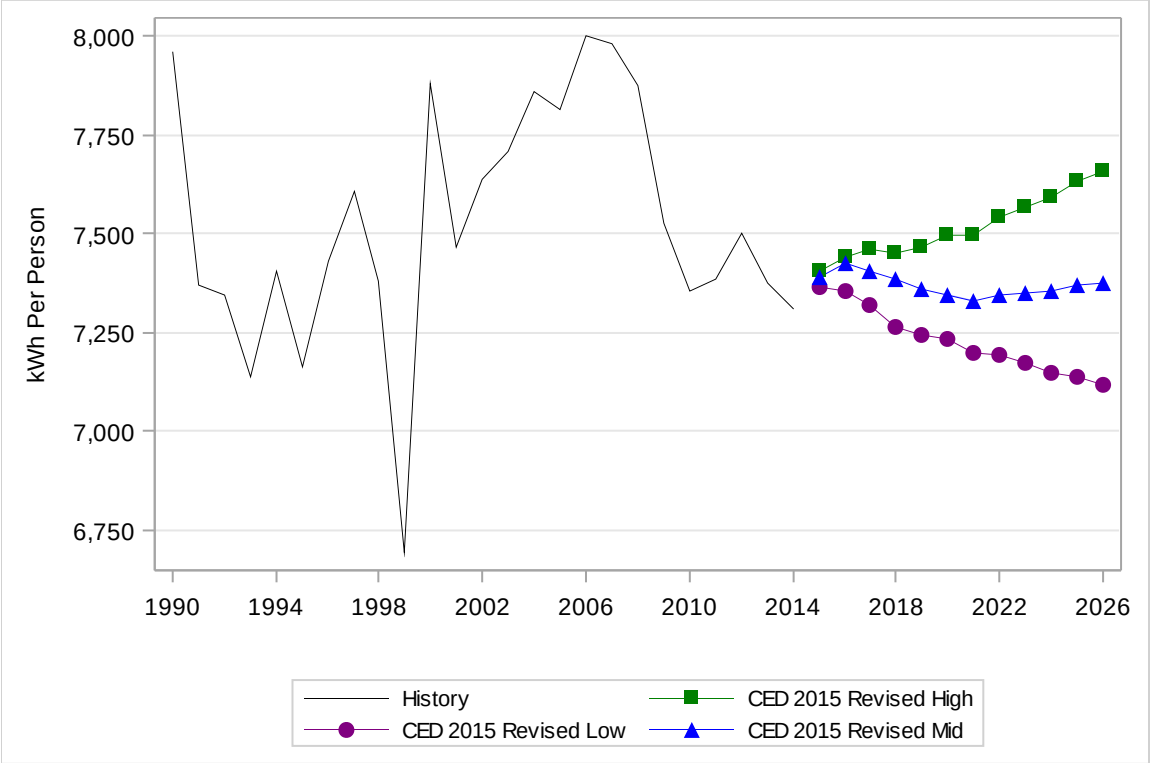
Figure 2-2: SCE Planning Area Baseline Peak



Source: California Energy Commission, Demand Analysis Office, 2015

Per capita consumption is illustrated in **Figure 2-3**. The pattern is similar to that seen in total consumption, with growth in the mid and high cases increasing in the latter half of the forecast period due to increasing EV penetration and plug load. The mid case is relatively flat, which is in line with recent history.

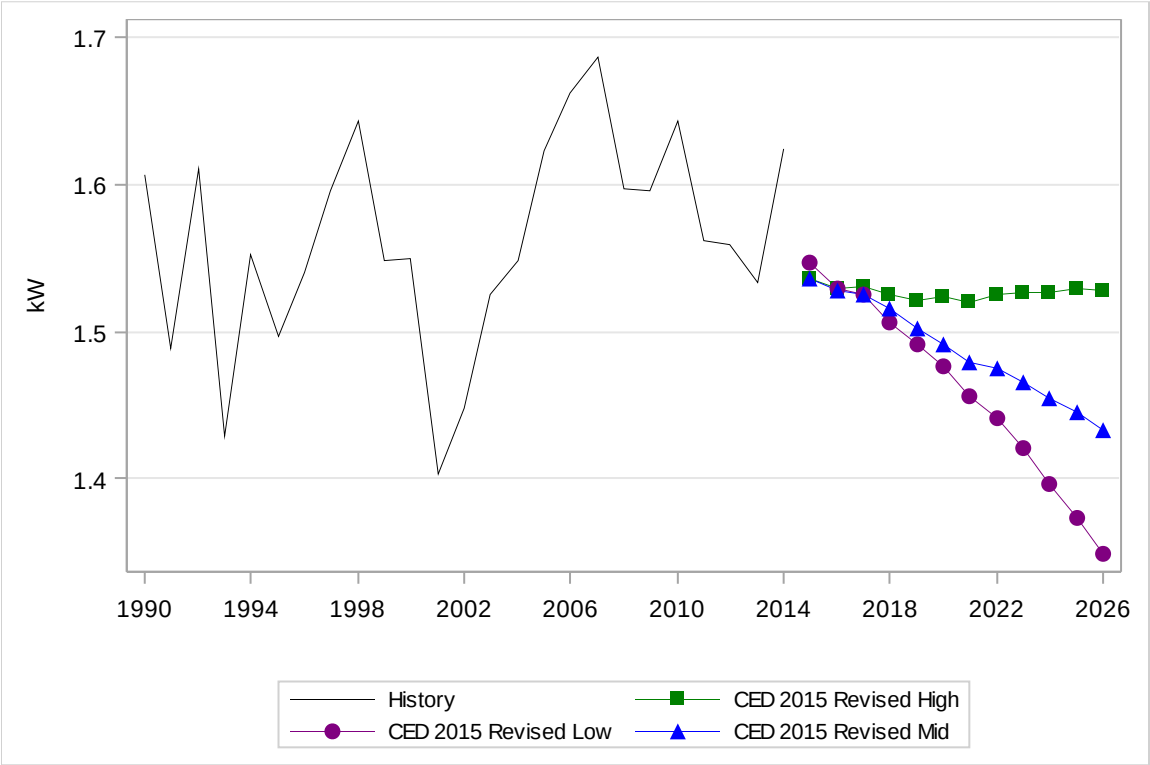
Figure 2-3: SCE Planning Area Baseline Annual per Capita Electricity Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 2-4 shows per capita peak demand. *CED 2015 Revised* mid and low values are projected to decline over the forecast period, with PV adoption in the low case pushing estimates of per capita peak below recent historical values.

Figure 2-4: SCE Planning Area Baseline per Capita Peak Demand



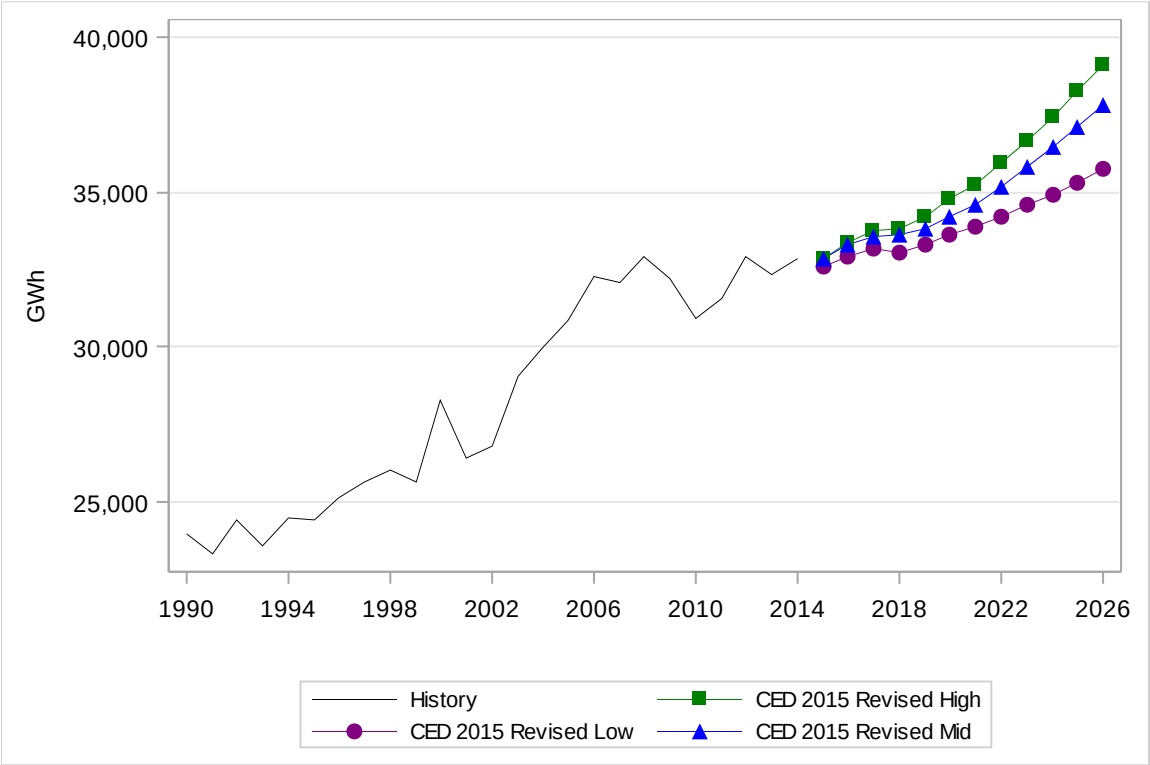
Source: California Energy Commission, Demand Analysis Office, 2015

Sector Level Baseline Results and Input Assumptions

Residential Sector

Total residential consumption for the SCE planning area is shown in **Figure 2-5.** Of all the customer sectors modeled in *CED 2015 Revised*, the residential sector exhibits the strongest growth. This is due to high levels of personal electric vehicle adoption and increasing plug load projected to occur over the forecast period.

Figure 2-5: SCE Planning Area Baseline Residential Consumption

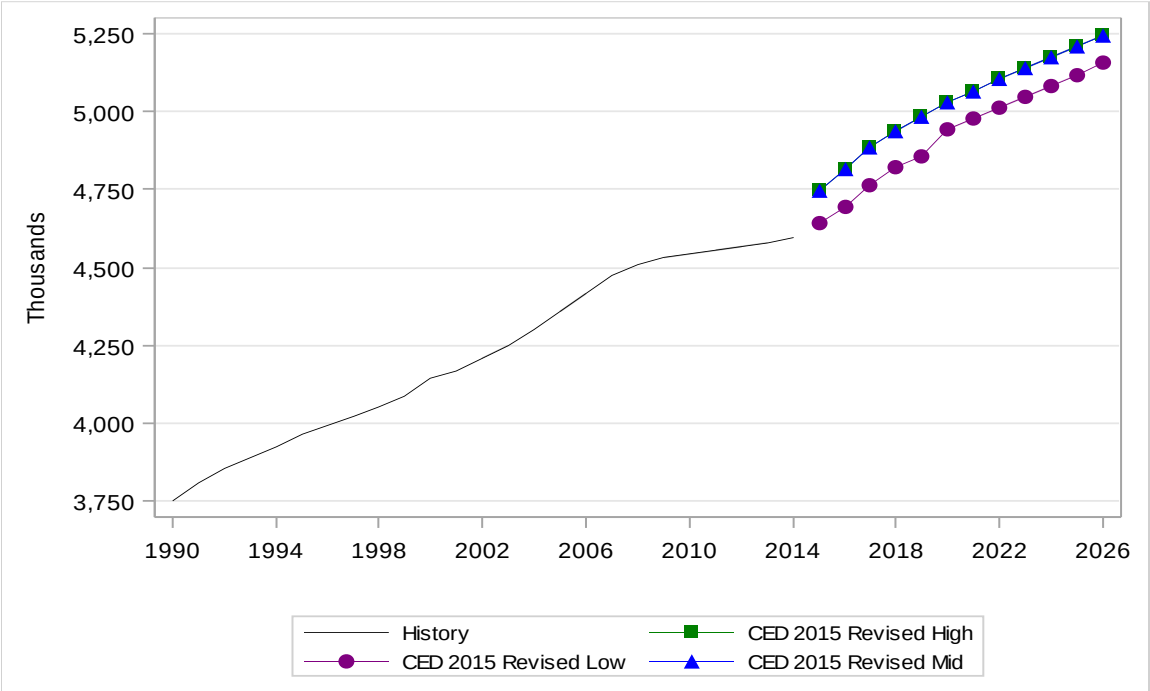


Source: California Energy Commission, Demand Analysis Office, 2015

Figure 2-6 and **Figure 2-7** show the household and persons-per-household projections used to drive the *CED 2015 Revised* residential forecasts. Each figure shows only two distinct cases. This is because the IHS Global Insight *Optimistic* scenario and the Moody's Analytics *Baseline* scenario were very similar, so just the latter was used to represent both the high and mid cases. The low household and persons-per-household cases were provided by the DOF.

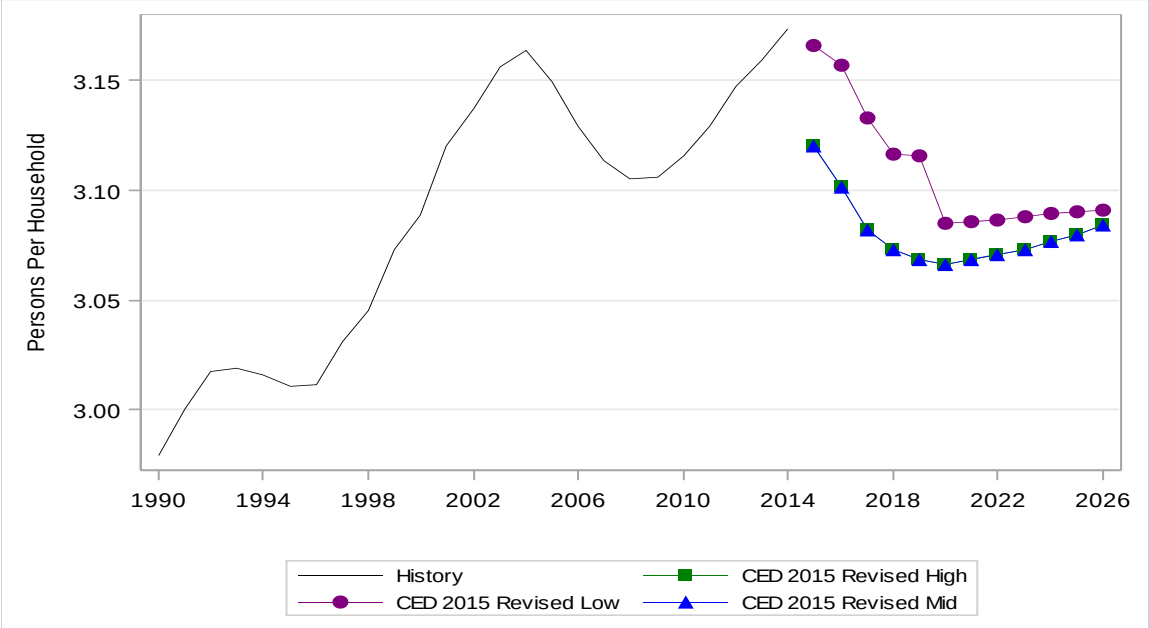
As illustrated by **Figure 2-6**, household formation has been slow in the last few years and is projected to be relatively high in the first years of the forecast period. This is due to the large population of young adults who continued to live with their parents in response to the harsh economic conditions that followed the Great Recession. Recently improved prospects for employment and personal financing will enable this group to form their own individual households in the coming years. **Figure 2-7** shows a corresponding drop in persons-per-household.

Figure 2-6: SCE Planning Area Baseline Residential Household Projections



Source: California Energy Commission, Demand Analysis Office, 2015

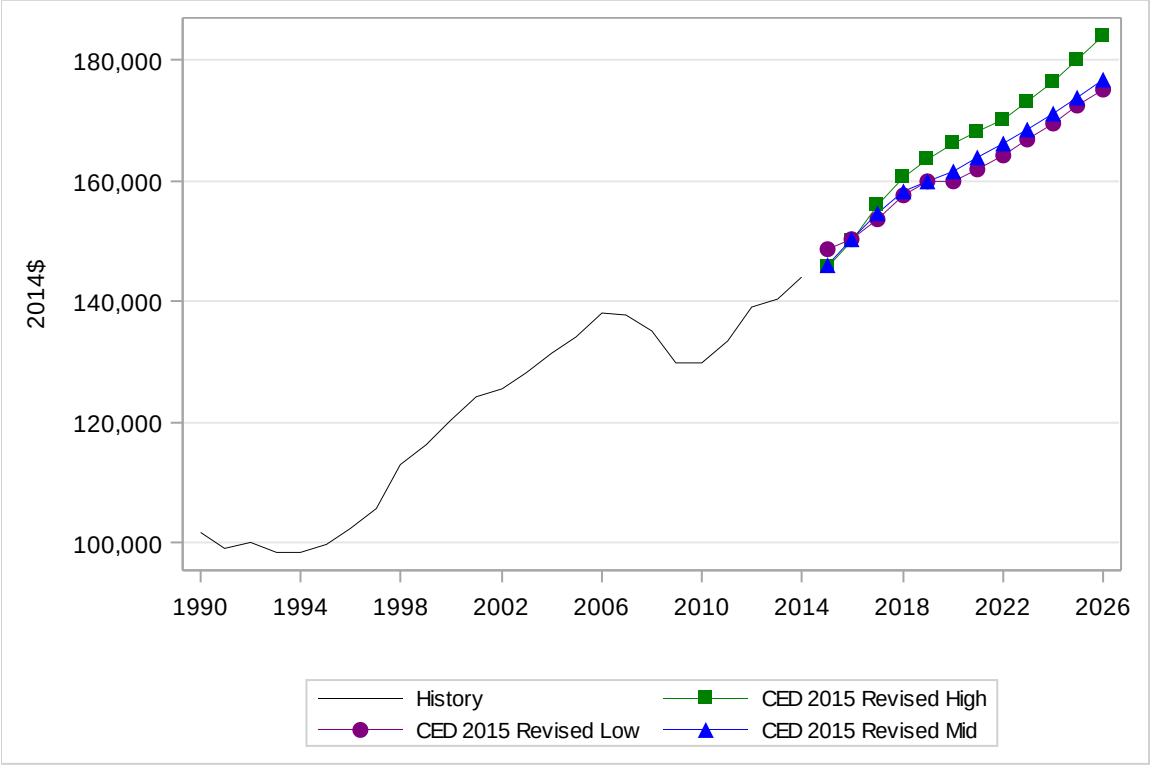
Figure 2-7: SCE Planning Area Persons per Household Projections



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 2-8 shows the average household income projections used in *CED 2015 Revised*. Personal income is not much lower in the low demand case than in the mid. However, the number of households does differ significantly between the two cases, even in the initial years of the forecast period. This narrows the spread between the average household income cases, and even causes the low case to cross the mid and high cases.

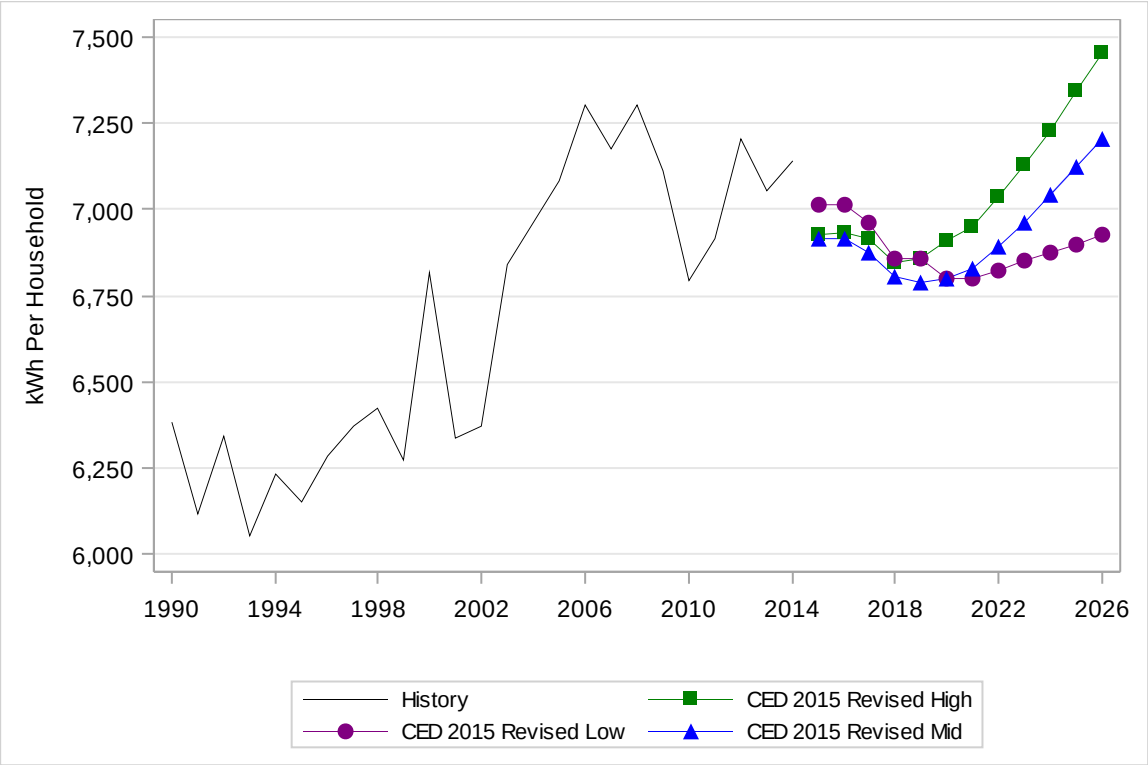
Figure 2-8: SCE Planning Area Average Household Income Projections



Source: California Energy Commission, Demand Analysis Office, 2015

Electricity consumption per household is shown in **Figure 2-9**. Since the low demand case has a higher number of persons-per-household, it begins at a higher level than either the mid or high case. However, the mid and high cases have significantly greater levels of EV adoption, which drives household consumption well over the low case in the second half of the forecast period.

Figure 2-9: SCE Planning Area Baseline Consumption per Household

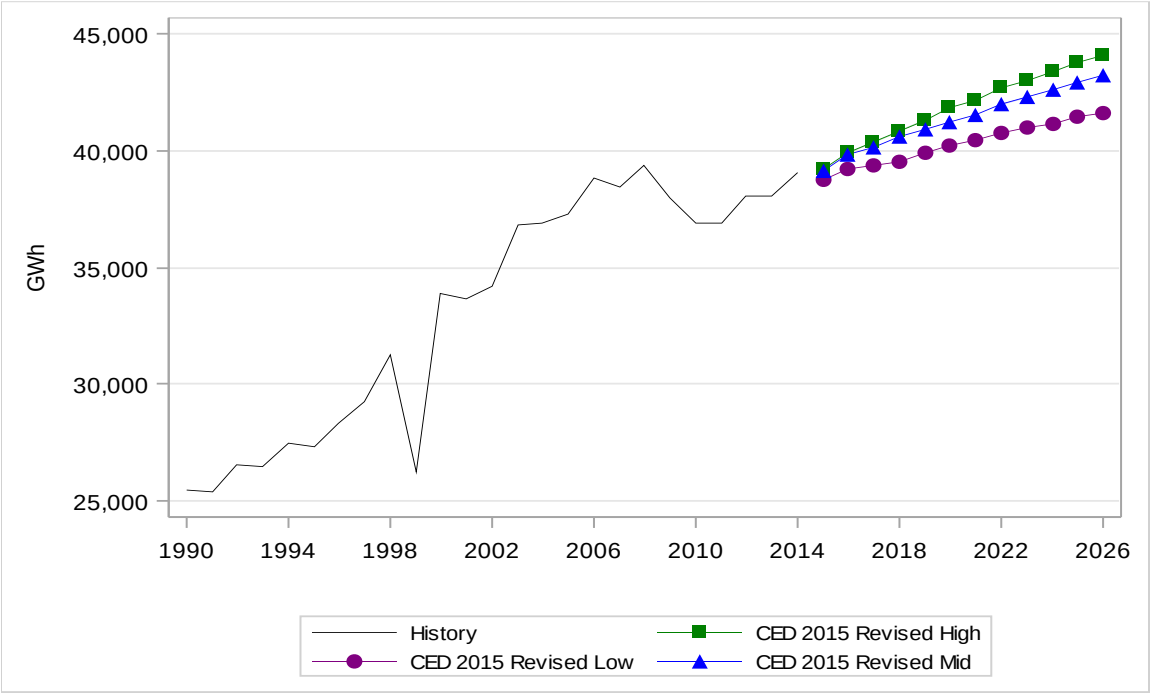


Source: California Energy Commission, Demand Analysis Office, 2015

Commercial Sector

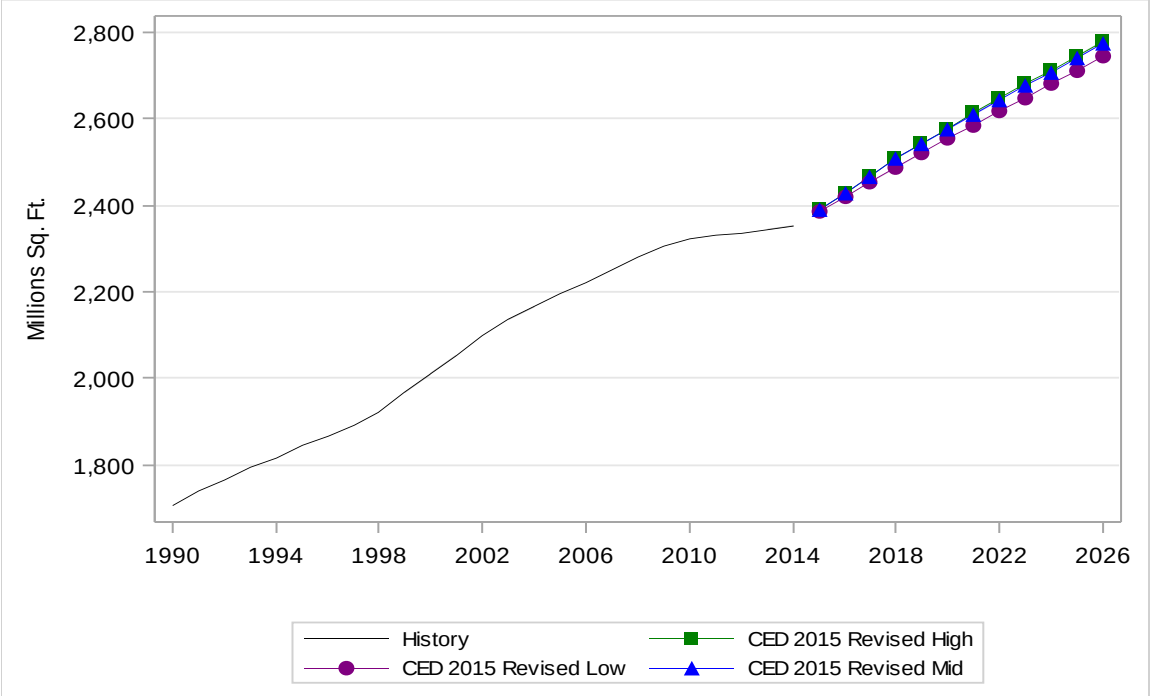
Figure 2-10 illustrates the SCE commercial sector electricity consumption forecasts. Commercial floor space is a key input to the commercial end use model demand model. The relatively narrow spread between the three cases reflects the even narrower band of commercial floor space projections, shown in **Figure 2-11**.

Figure 2-10: SCE Planning Area Baseline Commercial Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 2-11: Commercial Floor Space

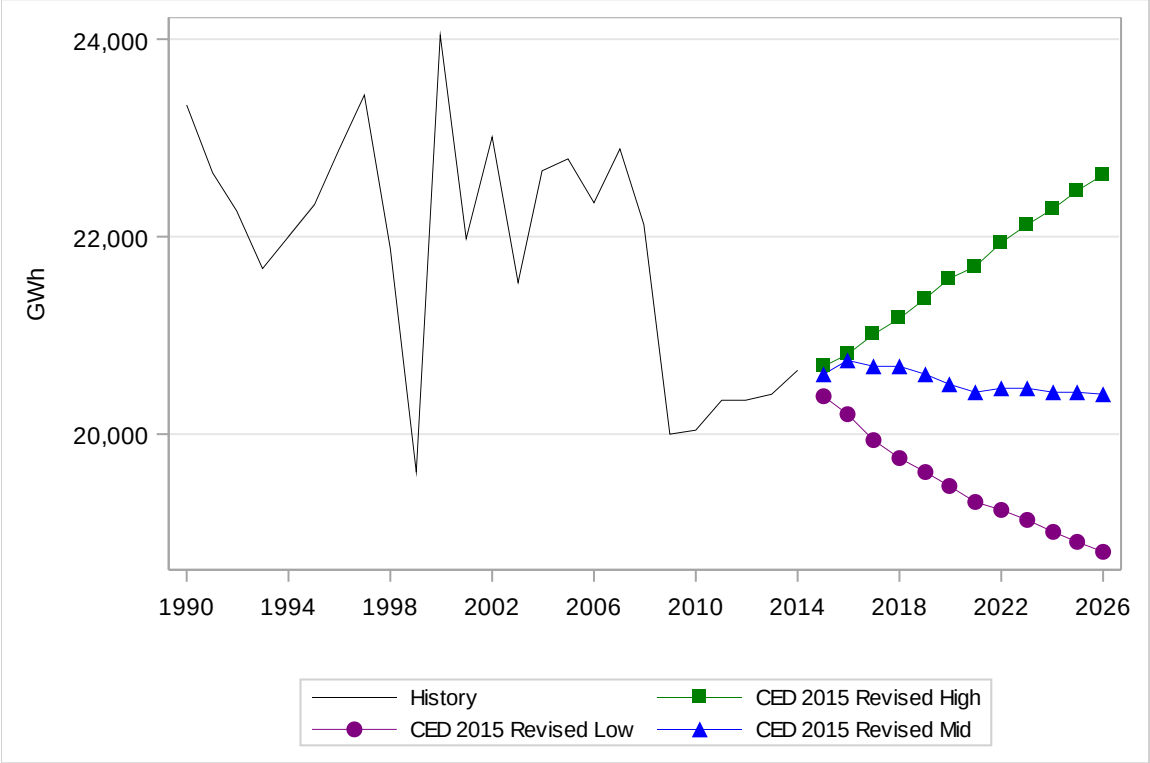


Source: California Energy Commission, Demand Analysis Office, 2015

Industrial Sector

Figure 2-12 shows the SCE planning area industrial sector electricity consumption forecasts. The Energy Commission uses an industry specific econometric model to project electricity consumption in this sector. For the SCE planning area, historical consumption in this sector is highly variable. This is reflected in the high and low cases, which, by the end of the forecast period, approach or exceed the highest and lowest levels seen in recent history. The mid case remains flat throughout the forecast.

Figure 2-12: SCE Planning Area Baseline Industrial Consumption

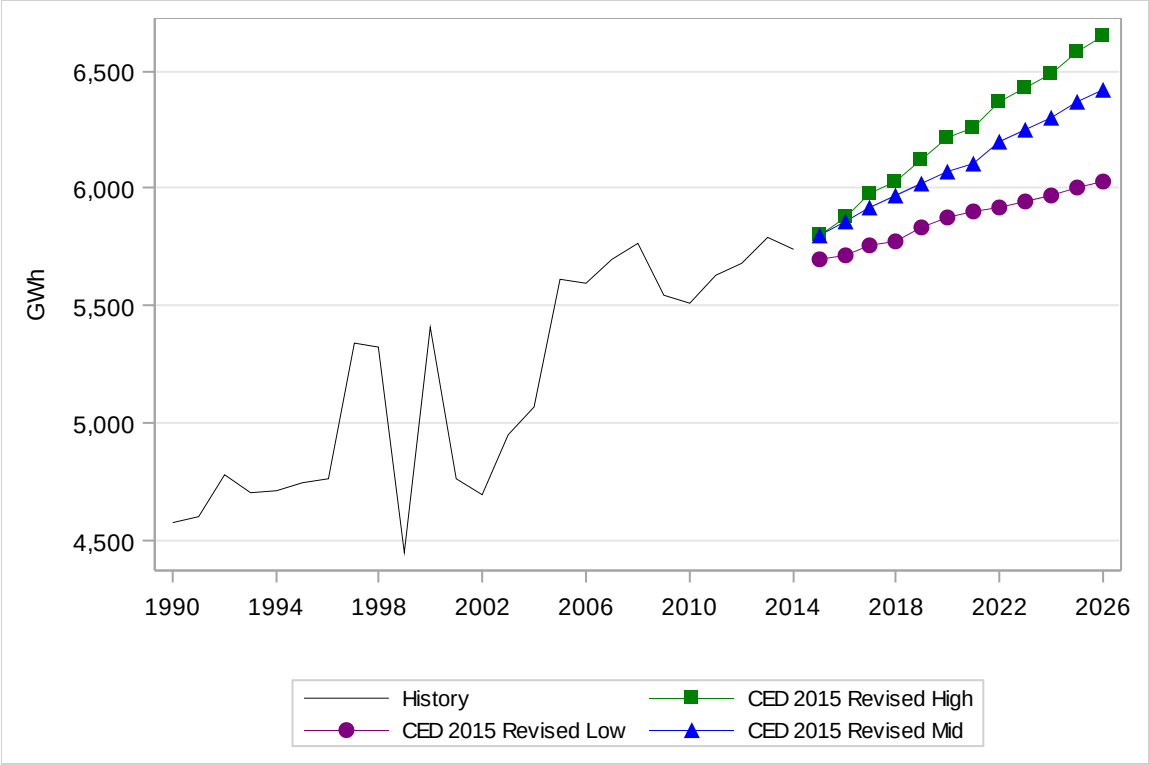


Source: California Energy Commission, Demand Analysis Office, 2015

Other Sectors

Figure 2-13 shows the electricity consumption forecasts for the TCU sector, which also includes street lighting. This relatively small and eclectic sector shows growth in all three cases, with contributions coming from all sub-sectors, save for street lighting, waste management, and national defense, which are held constant over the forecast period.

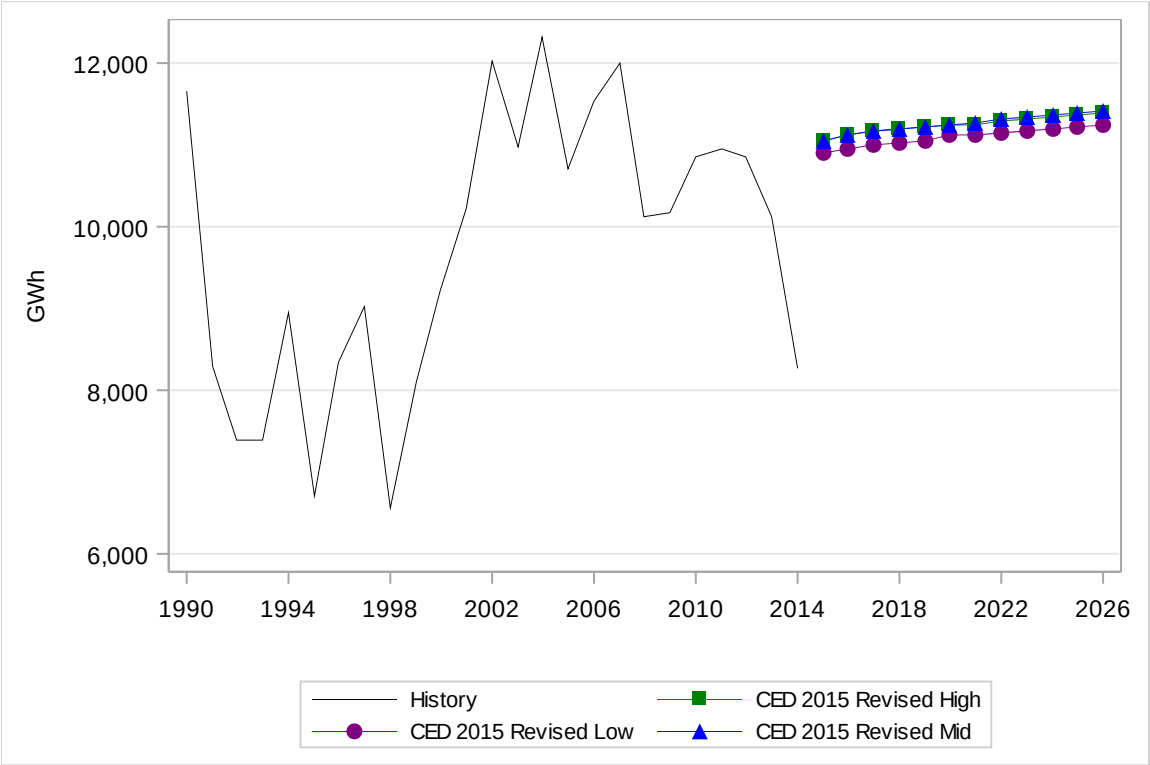
Figure 2-13: SCE Planning Area Baseline Transportation, Communication, Utilities, and Street Lighting Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 2-14 shows the electricity consumption forecasts for the agriculture and water pumping sectors. For SCE, this sector includes electricity used by DWR to deliver water. Due to persistent drought conditions, DWR water deliveries were drastically reduced in 2014. Since *CED 2015 Revised* holds DWR loads constant at an average of the last five years, the projections shown below begin at a point significantly higher than the base year value.

Figure 2-14: SCE Planning Area Baseline Agriculture and Water Pumping Consumption



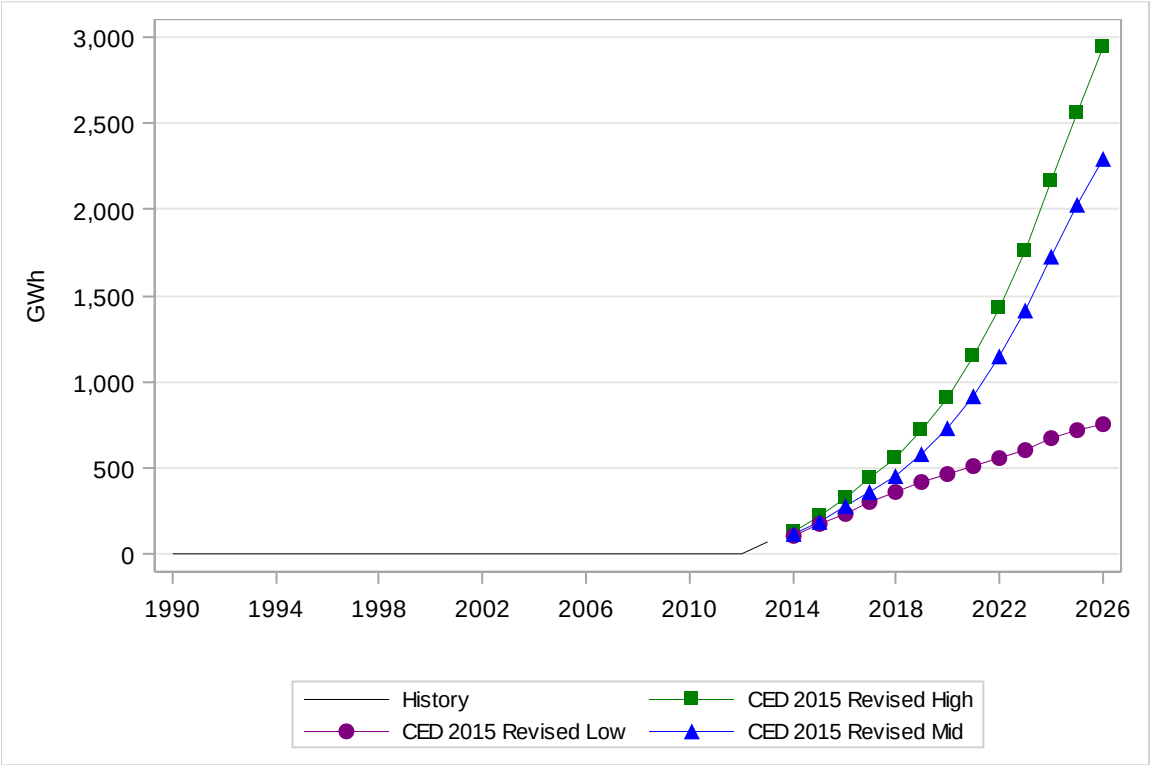
Source: California Energy Commission, Demand Analysis Office, 2015

Electric Vehicles

Consumption by EVs in the SCE planning area is expected to increase significantly over the forecast period, as illustrated by **Figure 2-15**.The mid and high cases are similar—both assume the EV prices and consumer preference will change enough over the forecast period that the ARB's ZEV Mandate will be met (mid case) or exceeded (high case). Alternatively, the low case assumes that current EV prices (relative to other vehicles choices) and consumer preferences will remain relatively unchanged.

Staff assumes most recharging will occur during off-peak hours, so peak impacts are expected to follow a similar pattern, though they should be relatively small in comparison.

Figure 2-15: SCE Electricity Consumption by Electric Vehicles



Source: California Energy Commission, Demand Analysis Office, 2015

Self-Generation

The peak demand forecast is reduced by the projected impacts of distributed solar PV, solar thermal, and CHP systems serving on-site customer load. Customer adoption of these technologies is forecast based on a combination of installation trend analysis and predictive modeling, the details of which are described in Appendix B to Volume 1. **Table 2-3** shows the forecast of peak impacts from PV and non-PV self-generation. Staff projects between 1036 and 2,497 MW of peak reduction from PV systems by 2026, a wide spread that reflects varied assumptions about technology cost, the future of NEM conditions, and rate escalation.

Table 2-3: SCE Planning Area Self-Generation Peak Impacts (MW)

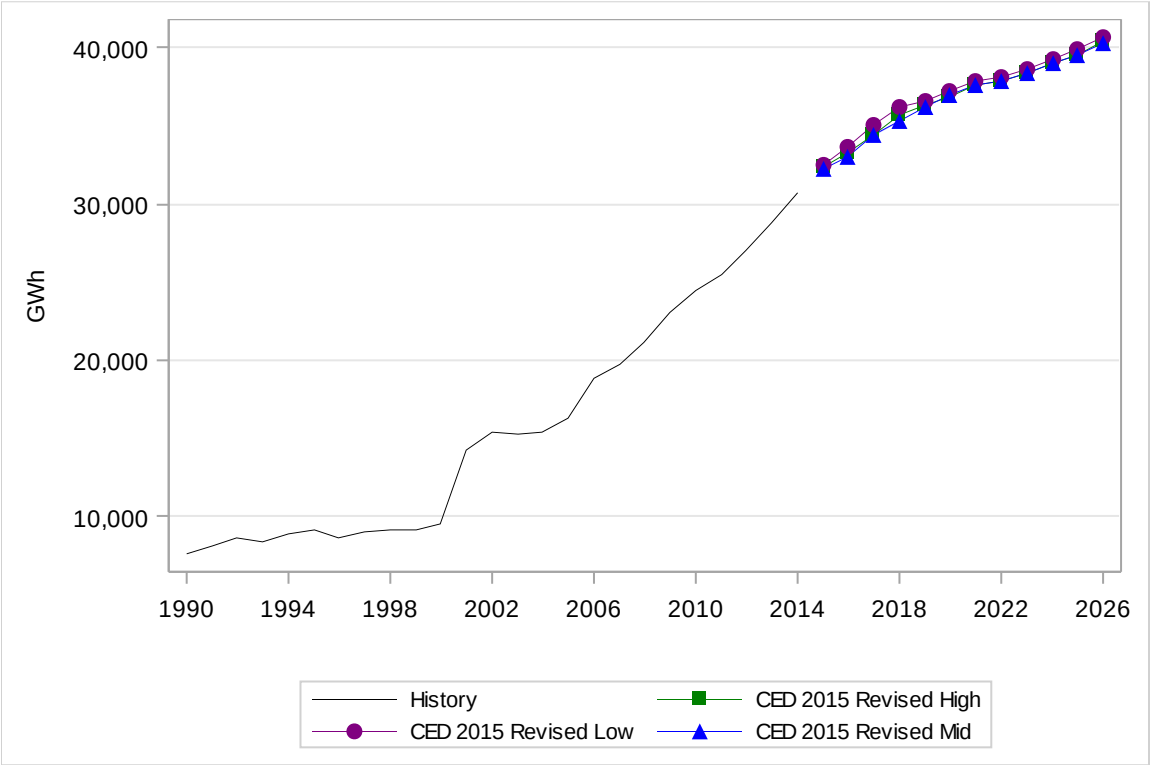
	***CED 2015 Revised* High Demand**		***CED 2015 Revised* Mid Demand**		***CED 2015 Revised* Low Demand**	
	Non-PV	PV	Non-PV	PV	Non-PV	PV
1990	490	-	490	-	490	-
2000	518	0	518	0	518	0
2010	722	109	722	109	722	109
2015	759	439	759	441	759	443
2020	1,053	757	1,051	896	1,052	1,042
2026	1,305	1,036	1,298	1,739	1,300	2,497

Source: California Energy Commission Staff

Conservation/Efficiency Impacts

Figure 2-16 shows committed electricity consumption savings estimates from all sources, including building and appliance standards; utility programs implemented through 2015; and price and other effects, or savings associated with rate changes and certain market trends not directly related to programs or standards. Projected savings impacts are highest in the low demand case, since price and program effects are inversely related to the demand outcome. Within the demand cases, higher demand yields more standards savings since new construction and appliance usage increase, while lower demand is associated with more program savings and higher rates (and therefore more price effects). The net result is that savings totals among the cases are very similar.

Figure 2-16: SCE Planning Area Baseline Electricity Consumption Savings Estimates



Source: California Energy Commission, Demand Analysis Office, 2015

Table 2-4 presents estimated savings for building and appliance standards in the mid demand case for selected years. The standards savings estimates include some federal standards and all Title 20 and Title 24 updates through 2016. Savings are measured against a baseline before 1975, so they incorporate more than 30 years of impacts. Volume 1, Chapter 2 provides more detail on staff work related to energy efficiency and conservation, including an itemized list of all building and appliance standards that have been explicitly considered in estimating these cumulative savings.

Table 2-4: SCE Planning Area Baseline Standards Savings Estimates

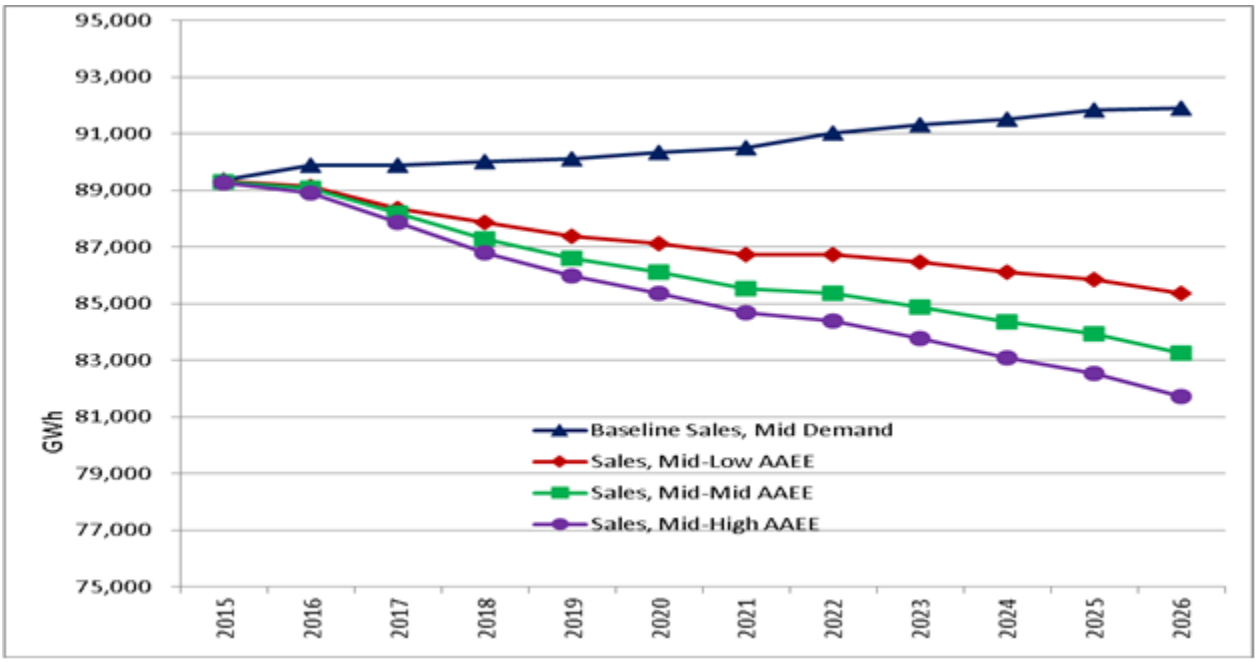
Electricity Consumption Savings (GWh)							
	Residential			Commercial			
	Building Standards	Appliance Standards	Total	Building Standards	Appliance Standards	Total	Total Standards
1990	990	1,026	2,016	647	389	1,036	3,052
2000	1,510	2,725	4,235	1,696	1,019	2,715	6,950
2010	2,381	5,889	8,270	3,606	1,833	5,439	13,709
2014	2,835	8,117	10,953	4,327	2,192	6,520	17,472
2020	3,653	11,412	15,066	7,122	3,599	10,721	25,787
2026	4,324	13,194	17,518	9,634	4,688	14,321	31,839
Electricity Peak Demand Savings (MW)							
	Residential			Commercial			
	Building Standards	Appliance Standards	Total	Building Standards	Appliance Standards	Total	Total Standards
1990	186	193	379	299	180	479	858
2000	263	474	737	660	397	1,057	1,794
2010	497	1,228	1,725	1,687	858	2,545	4,270
2014	586	1,678	2,263	1,941	958	2,899	5,163
2020	755	2,358	3,113	3,164	1,507	4,671	7,784
2026	879	2,683	3,562	4,254	1,950	6,204	9,766

Source: California Energy Commission, Demand Analysis Office, 2015

For *CED 2015 Revised*, staff estimated AAEE savings for the SCE service territory. Spreadsheets posted with this report[7] provide AAEE savings estimates for the SCE service territory by sector and savings type (programs, standards) for energy and peak for each of five scenarios. **Figure 2-17** shows the impact on service territory sales in the mid demand case of three AAEE savings scenarios designed to be consistent with input assumptions for the mid case. In all three cases, sales decline throughout the forecast period. Similar results are shown in **Figure 2-18** for service territory peak demand. See Chapter 2 of Volume 1 of this report for details on these AAEE scenarios.

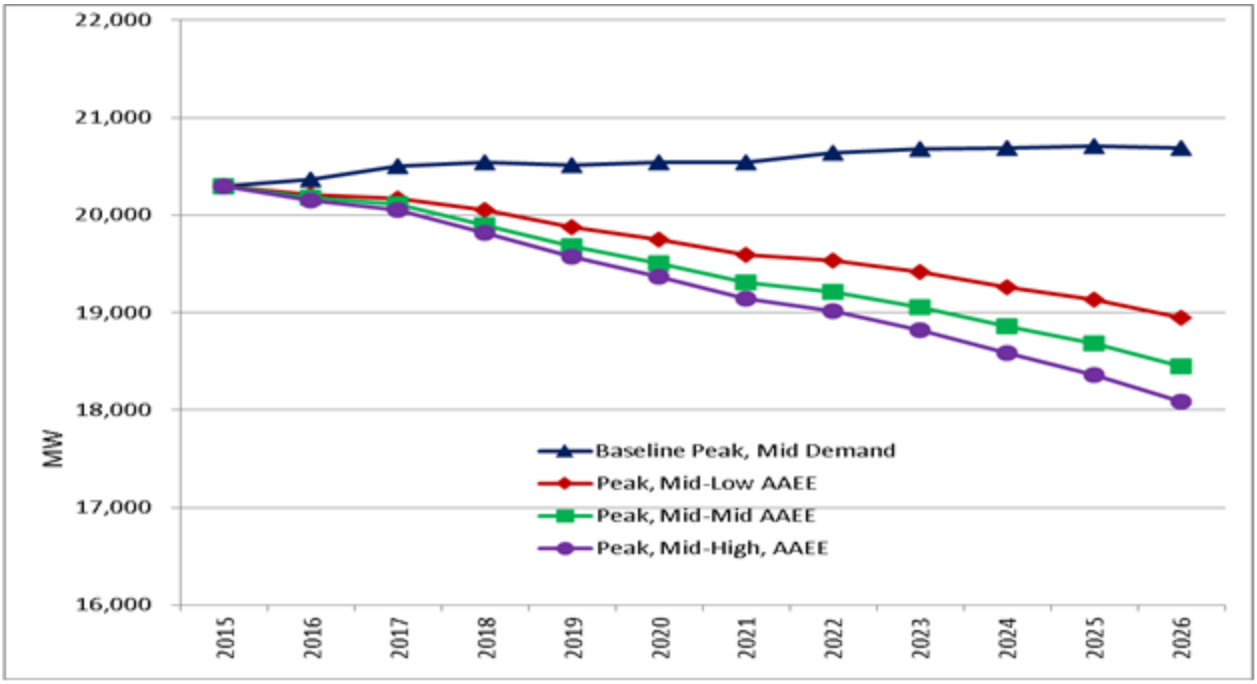
7 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Figure 2-17: SCE Service Territory Baseline and Adjusted Sales



Source: California Energy Commission, Demand Analysis Office, 2015

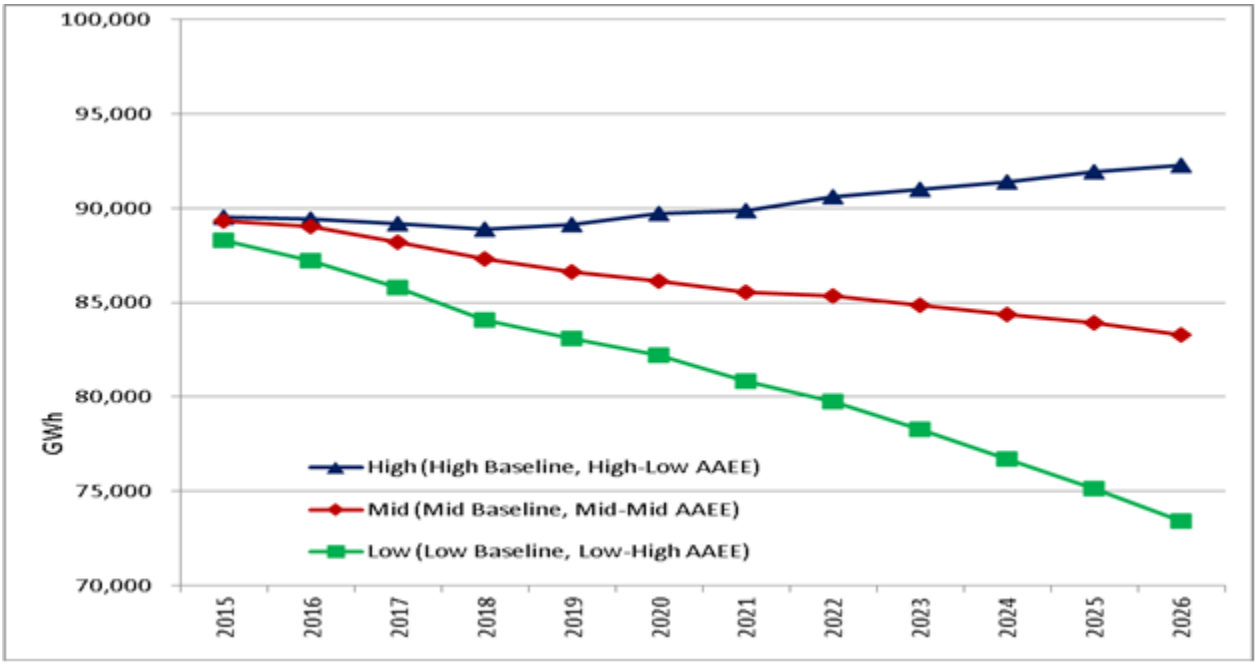
Figure 2-18: SCE Service Territory Baseline and Adjusted Peak Demand



Source: California Energy Commission, Demand Analysis Office, 2015

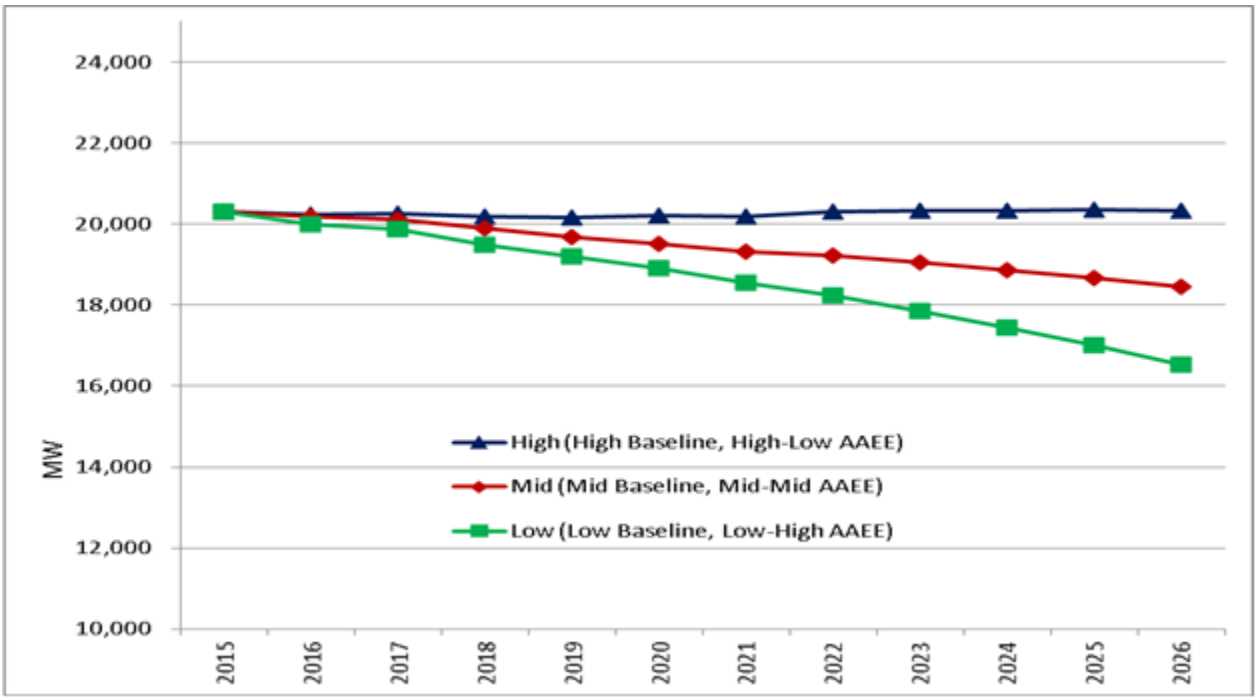
Figure 2-19 shows the low baseline sales forecast adjusted by a high AAEE savings scenario consistent with the assumptions of the low demand case (low-high), the mid baseline adjusted by a consistent mid AAEE scenario (mid-mid), and the high baseline adjusted by low AAEE savings (high-low). These parings were chosen to produce the maximum spread among potential managed sales forecasts for the SCE service territory. **Figure 2-20** shows a similar set of adjusted peak demand forecasts.

Figure 2-19: SCE Service Territory Adjusted Sales



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 2-20: SCE Service Territory Adjusted Peak Demand



Source: California Energy Commission, Demand Analysis Office, 2015

Electrification

Potentially significant increases in electricity use in California are expected to occur through electrification in the commercial, industrial, and transportation sectors. **Table 2-5** shows, for select years, the portion of these impacts that are anticipated in the SCE planning area. For more details, see Volume 1, Chapter 1.

Table 2-5: SCE Planning Area Electrification Impacts

	Additional Consumption (GWh)		
	CED 2015 Revised **High Demand**	***CED 2015 Revised*** **Mid Demand**	***CED 2015 Revised*** **Low Demand**
2016	50.8	33.7	16.1
2020	268.9	161.9	56.3
2026	557.8	284.0	79.0

Source: California Energy Commission Staff

Climate Zone Forecasts

For *CED 2015 Revised*, staff developed electricity consumption and peak demand forecasts for each climate zone. (See Volume 1, Chapter 1 for more details.) The SCE planning area now has five climate zones, as shown in **Table 2-6**.

Table 2-6: SCE Planning Area Climate Zones

Forecast Zone	Counties Included
7. LA Metro	Orange, Los Angeles
8. Big Creek West	Santa Barbara, Ventura
9. Big Creek East	Fresno, Kern, Kings, Tuolumne, Tulare
10. Northeast	Inyo, Mono, San Bernardino
11. Eastern	Imperial, Riverside

Source: California Energy Commission Staff

Table 2-7 shows the forecast results for electricity consumption and peak demand by climate zone for each demand case. Full climate zone results are shown in the forms posted alongside this report.[8]

The most significant growth in both consumption and peak demand occurs in the Big Creek East area (climate zone 9) due to inland migration and a greater sensitivity to climate change. The other four climate zones in the SCE planning area are expected to see modest growth in consumption over the forecast period and little or even negative growth in peak demand.

8 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Table 2-7: SCE Planning Area Climate Zone Forecast Results

		Consumption by Forecast Zone (GWh)					Peak Demand by Forecast Zone (MW)				
		7	**8**	**9**	**10**	**11**	**7**	**8**	**9**	**10**	**11**
***CED 2015 Revised* High Demand**	2014	61,721	7,448	8,779	14,987	13,655	12,868	1,505	1,418	5,437	2,460
	2015	62,168	7,328	11,346	15,047	13,747	12,358	1,443	1,362	5,220	2,356
	2020	65,490	7,787	11,813	15,819	14,712	12,478	1,467	1,519	5,511	2,524
	2026	69,782	8,433	12,563	16,922	16,127	12,854	1,545	1,660	5,888	2,754
	Annual Growth 2014 - 2020	0.99%	0.74%	5.07%	0.90%	1.25%	-0.51%	-0.42%	1.15%	0.23%	0.43%
	Annual Growth 2014 - 2026	1.03%	1.04%	3.03%	1.02%	1.40%	-0.01%	0.22%	1.32%	0.67%	0.94%
***CED 2015 Revised* Mid Demand**	2014	61,721	7,448	8,779	14,987	13,656	12,868	1,505	1,418	5,437	2,460
	2015	62,032	7,322	11,336	15,015	13,728	12,358	1,443	1,362	5,220	2,356
	2020	63,963	7,657	11,690	15,439	14,501	12,217	1,436	1,486	5,399	2,467
	2026	66,893	8,140	12,301	16,201	15,691	12,048	1,448	1,566	5,547	2,563
	Annual Growth 2014 - 2020	0.60%	0.46%	4.89%	0.50%	1.01%	-0.86%	-0.77%	0.78%	-0.12%	0.04%
	Annual Growth 2014 - 2026	0.67%	0.74%	2.85%	0.65%	1.16%	-0.55%	-0.32%	0.83%	0.17%	0.34%
***CED 2015 Revised* Low Demand**	2014	61,721	7,448	8,779	14,987	13,656	12,868	1,505	1,418	5,437	2,460
	2015	61,368	7,247	11,246	14,855	13,592	12,358	1,443	1,362	5,220	2,356
	2020	62,189	7,385	11,506	15,024	14,200	11,972	1,398	1,457	5,289	2,408
	2026	63,412	7,578	11,876	15,445	15,087	11,187	1,323	1,454	5,181	2,347
	Annual Growth 2014 - 2020	0.13%	-0.14%	4.61%	0.04%	0.65%	-1.20%	-1.22%	0.45%	-0.46%	-0.36%
	Annual Growth 2014 - 2026	0.23%	0.14%	2.55%	0.25%	0.83%	-1.16%	-1.07%	0.21%	-0.40%	-0.39%

Source: California Energy Commission Staff

CHAPTER 3:
San Diego Gas and Electric Planning Area

In an effort to make the demand forecast more useful to resource planners, *CED 2015 Revised* uses a new geographic scheme for planning areas and climate zones that is more closely based on California's balancing authority areas. The new scheme does not affect the SDG&E planning area, which includes both SDG&E bundled retail customers and customers served by various energy service providers using the SDG&E distribution system to deliver electricity to end users.

To support electricity and transmission system analysis, staff uses historical consumption and load data to develop individual forecasts for all medium and large utilities in the planning area. Those results are presented in Forms 1.5a through 1.5c in the statewide forms accompanying this forecast report.[9] The results in this chapter are for the entire SDG&E transmission planning area.

This chapter is organized as follows. First, forecasted consumption and peak loads for the SDG&E planning area are discussed; both total and per capita values are presented. Second, the chapter presents sector consumption and peak load forecasts. Third, the chapter discusses the forecasts of electric vehicles, self-generation, and the impacts of conservation and efficiency programs, including AAEE. Since the SDG&E planning area is not further divided into climate zones at this time, no climate-zone-specific results are presented in this chapter.

Baseline Forecast Results

For this forecast, three demand cases were developed. The high demand case includes high economic and demographic projections, low energy price projections, and low-efficiency impact assumptions. The low demand case includes low economic and demographic projections, high energy price projections, and high-efficiency impact assumptions. The mid demand case uses assumptions that fall between the low and high cases. Volume 1 provides more detail on the construction of the demand cases.

Table 3-1 and **Table 3-2** show the *CED 2015 Revised* high, mid, and low demand cases for electricity consumption and peak demand, respectively, for selected years. The base year for these peak cases is 2015, so **Table 3-2** shows both the recorded peak and the weather normalized peak values for that year. Comprehensive results are available electronically as a set of forms posted alongside this report.[10]

9 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

10http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Table 3-1: SDG&E Planning Area Baseline Consumption

	Recorded Consumption	Forecast		
		***CED 2015 Revised* High**	***CED 2015 Revised* Mid**	***CED 2015 Revised* Low**
1990	14,857			
2000	18,784			
2010	20,403			
2014	21,442			
2020		23,024	22,572	21,995
2026		24,962	24,165	22,926
Average Annual Growth Rates				
1990 - 2000	2.37%			
2000 - 2010	0.83%			
2010 - 2014	1.25%			
2014 - 2020		1.19%	0.86%	0.43%
2014 - 2026		1.27%	1.00%	0.56%

Source: California Energy Commission, Demand Analysis Office, 2015

Table 3-2: SDG&E Planning Area Baseline Peak Demand

	Recorded Peak	Forecast		
		***CED 2015 Revised* High**	***CED 2015 Revised* Mid**	***CED 2015 Revised* Low**
1990	2,978			
2000	3,485			
2010	4,687			
2015	4,812			
2015*		4,602	4,602	4,602
2020		4,772	4,654	4,503
2026		5,021	4,705	4,294
Average Annual Growth Rates				
1990-2000	1.58%			
2000-2010	3.01%			
2010-2015	0.53%			
2015*-2020		0.73%	0.23%	-0.43%
2015*-2026		0.79%	0.20%	-0.63%

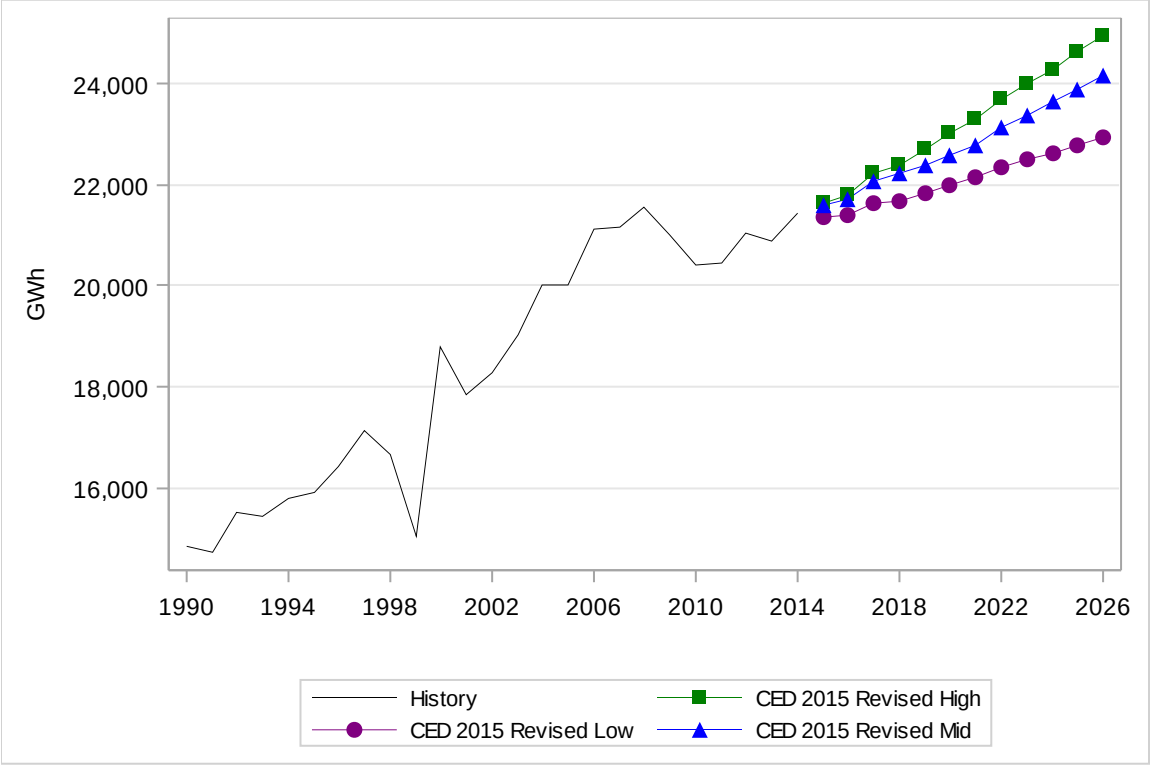
Source: California Energy Commission, Demand Analysis Office, 2015

Figure 3-1 illustrates electricity consumption for the three cases, each of which grows continuously over the forecast period. Growth in the mid and high cases increases in the latter years of the forecast as EVs add significant levels of consumption. By 2026, the *CED 2015 Revised* high demand level is 3.3 percent higher than the mid case, while the low demand case is 5.1 percent lower.

The peak demand projections, shown in **Figure 3-2**, exhibit a much wider spread than the consumption forecast. This is due to the impact of PV adoption in the different cases, which vary considerably for *CED 2015 Revised*. Since EVs are assumed to be charged mostly off-peak, they do not exert the same upward pressure on peak demand, which is instead driven down by PV adoption in the latter half of the forecast period.

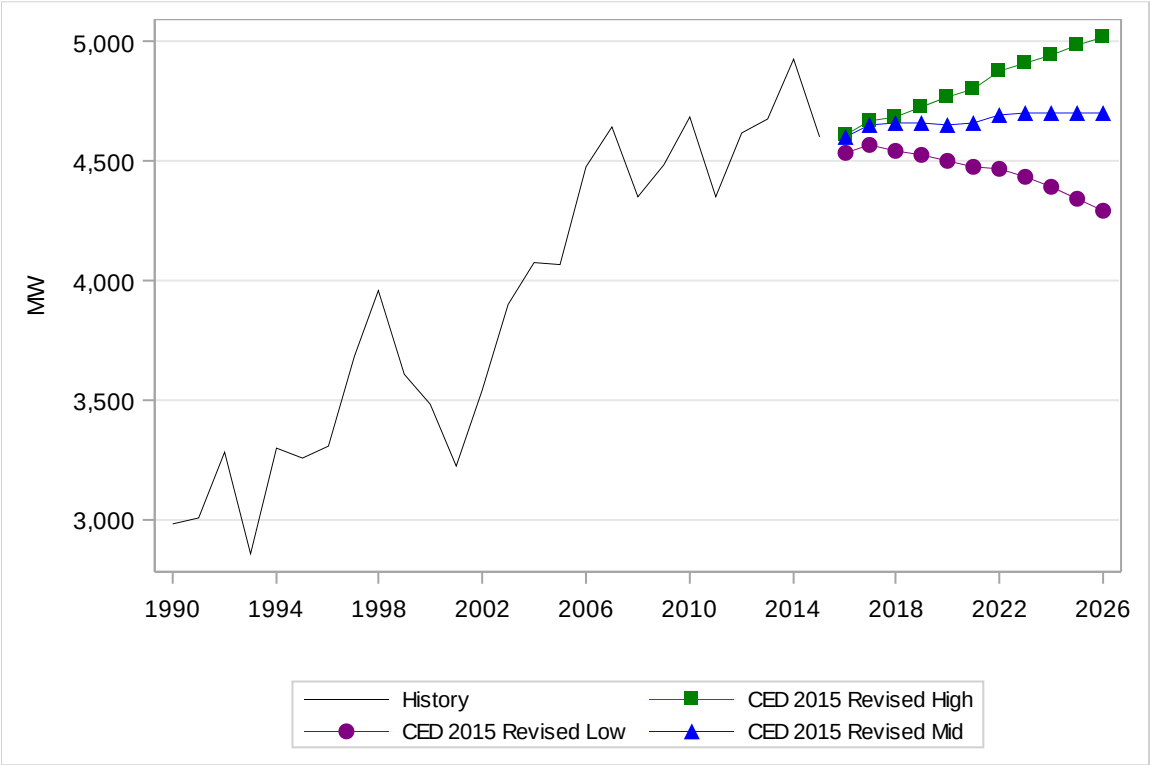
The high and low case peak demand projections are 6.7 percent higher and 8.7 percent lower, respectively, than the mid case by 2026. The SDG&E planning area experienced higher than average extreme temperatures in 2015, so the recorded peak load was 210 MW higher than the weather normalized estimate of 4,602 MW.

Figure 3-1: SDG&E Planning Area Baseline Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

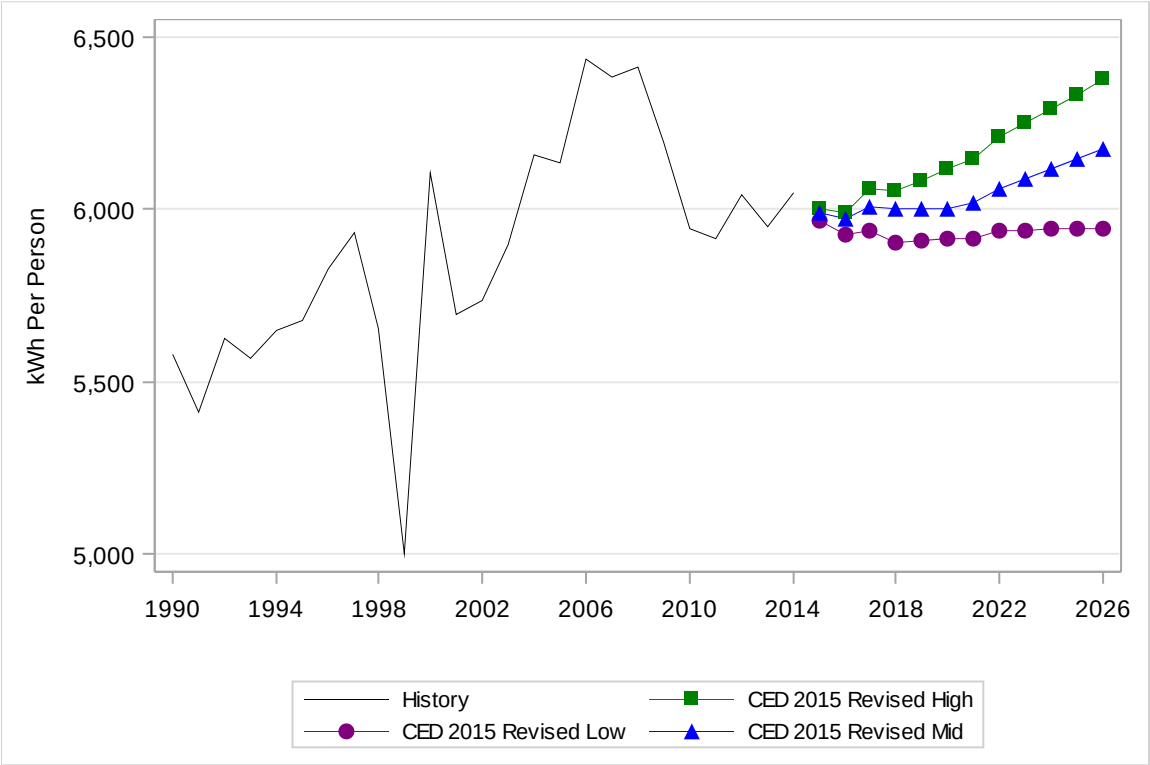
Figure 3-2: SDG&E Planning Area Baseline Peak



Source: California Energy Commission, Demand Analysis Office, 2015

Per capita consumption is illustrated in **Figure 3-3**. The pattern is similar to that seen in total consumption, with growth in the mid and high cases increasing in the latter half of the forecast period due to increasing EV penetration and plug load. The mid case grows slightly over the forecast period, which is in keeping with the historical trend for the SDG&E planning area.

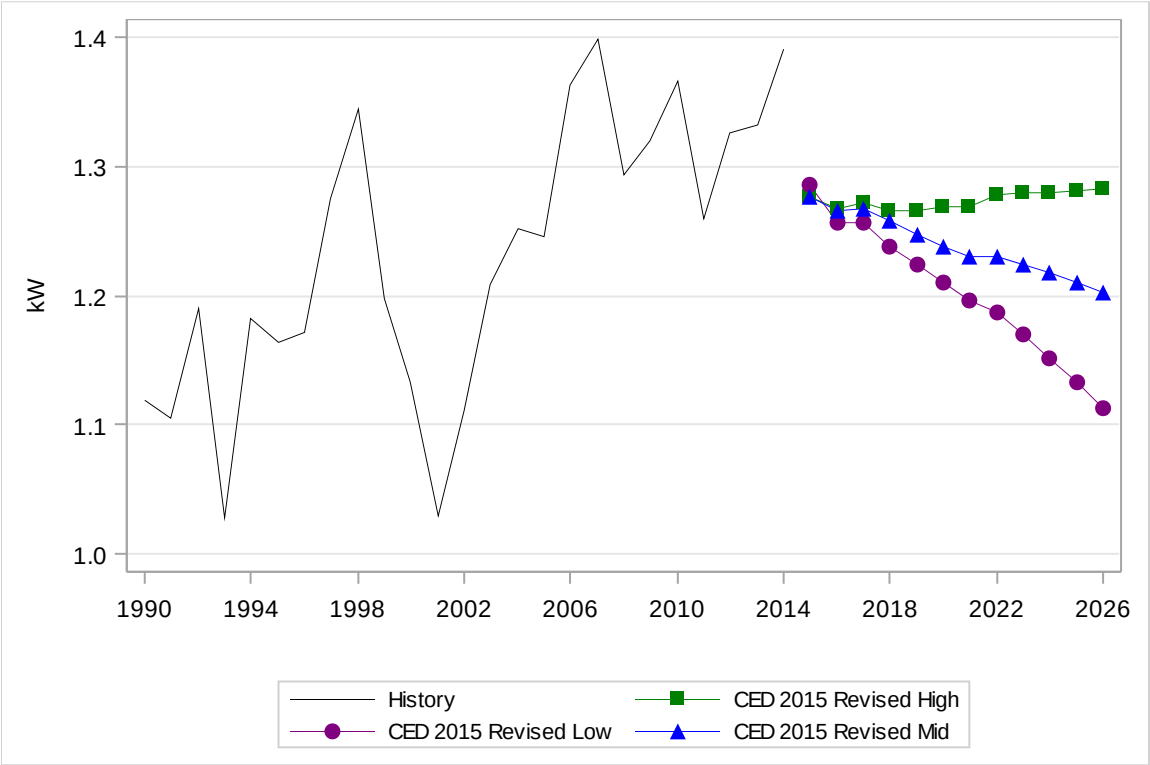
Figure 3-3: SDG&E Planning Area Baseline Annual per Capita Electricity Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 3-4 shows per capita peak demand. *CED 2015 Revised* mid and low values are projected to decline over the forecast period, with PV adoption in the low case pushing estimates of per capita peak well below recent levels.

Figure 3-4: SDG&E Planning Area Baseline per Capita Peak Demand



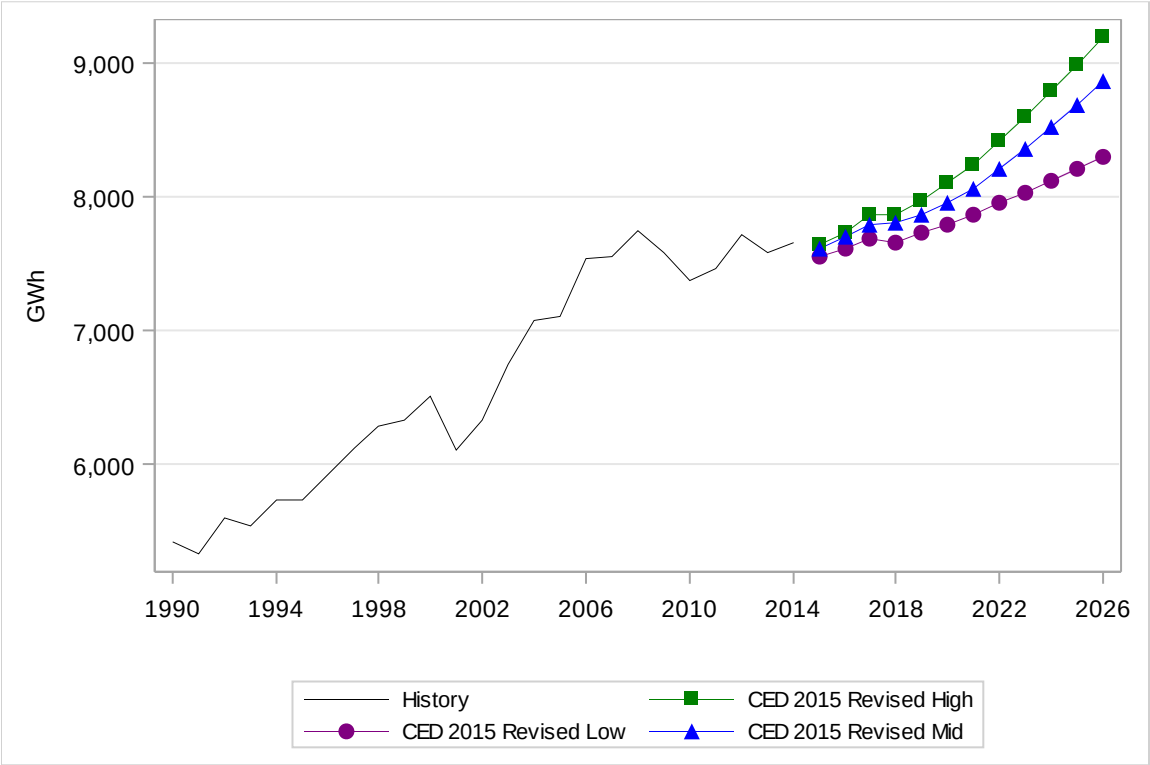
Source: California Energy Commission, Demand Analysis Office, 2015

Sector Level Results and Input Assumptions

Residential Sector

Total residential consumption for the SDG&E planning area is shown in **Figure 3-5.** Of all the customer sectors modeled in *CED 2015 Revised*, the residential sector exhibits the strongest growth. This is due to high levels of personal electric vehicle adoption and increasing plug load projected to occur over the forecast period.

Figure 3-5: SDG&E Planning Area Baseline Residential Consumption

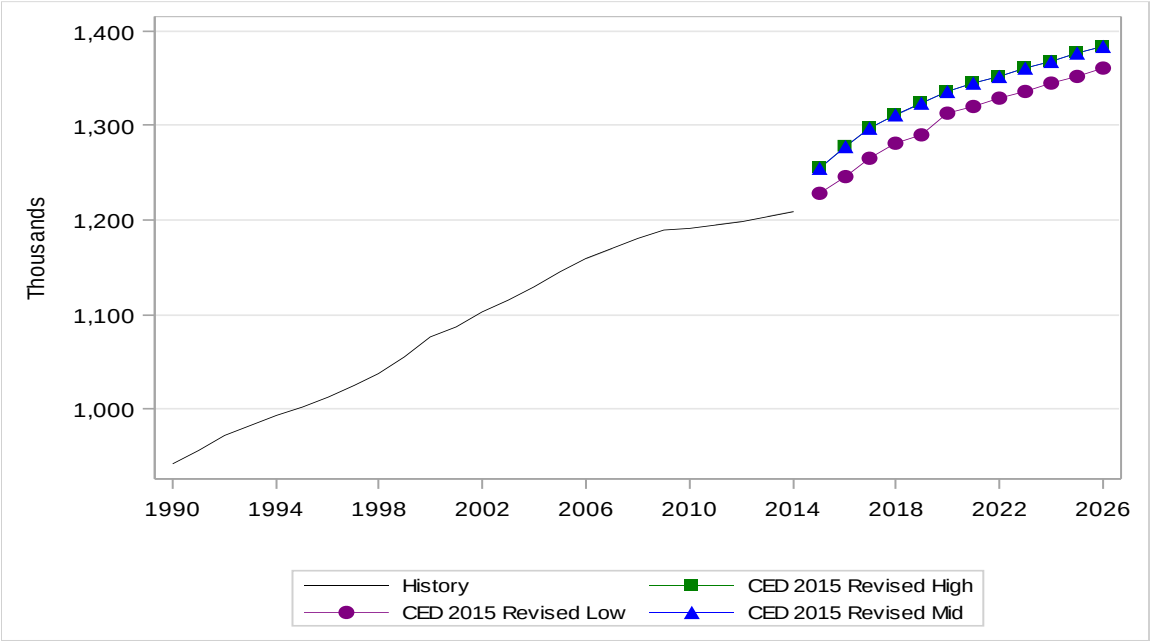


Source: California Energy Commission, Demand Analysis Office, 2015

Figure 3-6 and **Figure 3-7** show the household and persons-per-household projections used to drive the *CED 2015 Revised* residential forecasts. Each figure shows only two distinct cases. This is because the IHS Global Insight *Optimistic* scenario and the Moody's Analytics *Baseline* scenario were very similar, so just the latter was used to represent both the high and mid cases. The low household and persons-per-household cases were provided by the DOF.

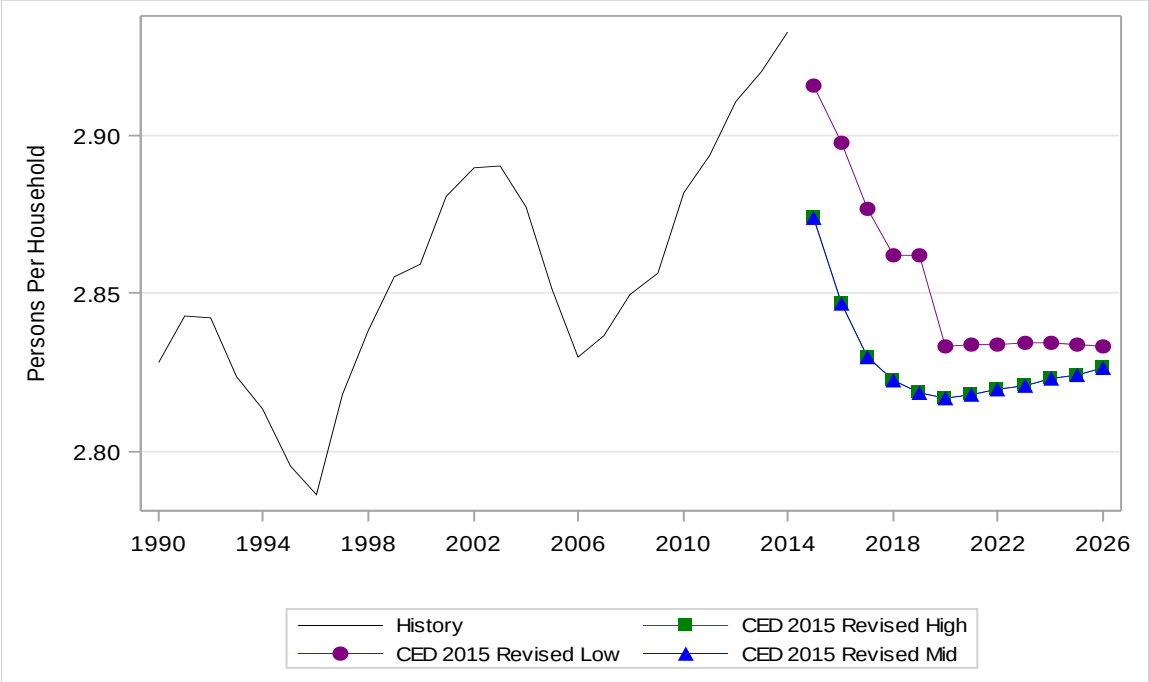
As illustrated by **Figure 3-6**, household formation has been slow in the last few years and is projected to be relatively high in the first years of the forecast period. This is due to the large population of young adults who continued to live with their parents in response to the harsh economic conditions that followed the Great Recession. Recently improved prospects for employment and personal financing will enable this group to form their own individual households in the coming years. **Figure 3-7** shows a corresponding drop in persons-per-household.

Figure 3-6: SDG&E Planning Area Household Projections



Source: California Energy Commission, Demand Analysis Office, 2015

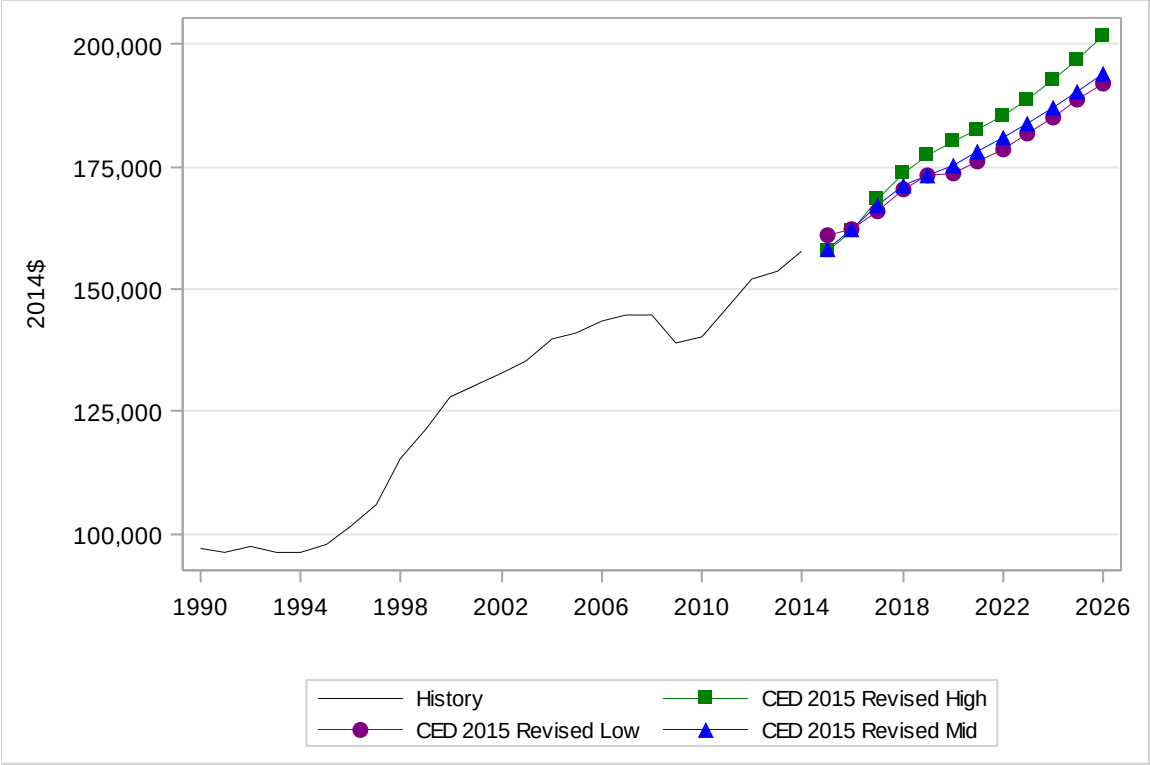
Figure 3-7: SDG&E Planning Area Persons per Household Projections



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 3-8 shows the average household income projections used in *CED 2015 Revised*. Personal income is not much lower in the low demand case than in the mid. However, the number of households does differ significantly between the two cases, even in the initial years of the forecast period. This narrows the spread between the average household income cases, and even causes the low case to cross the mid and high cases.

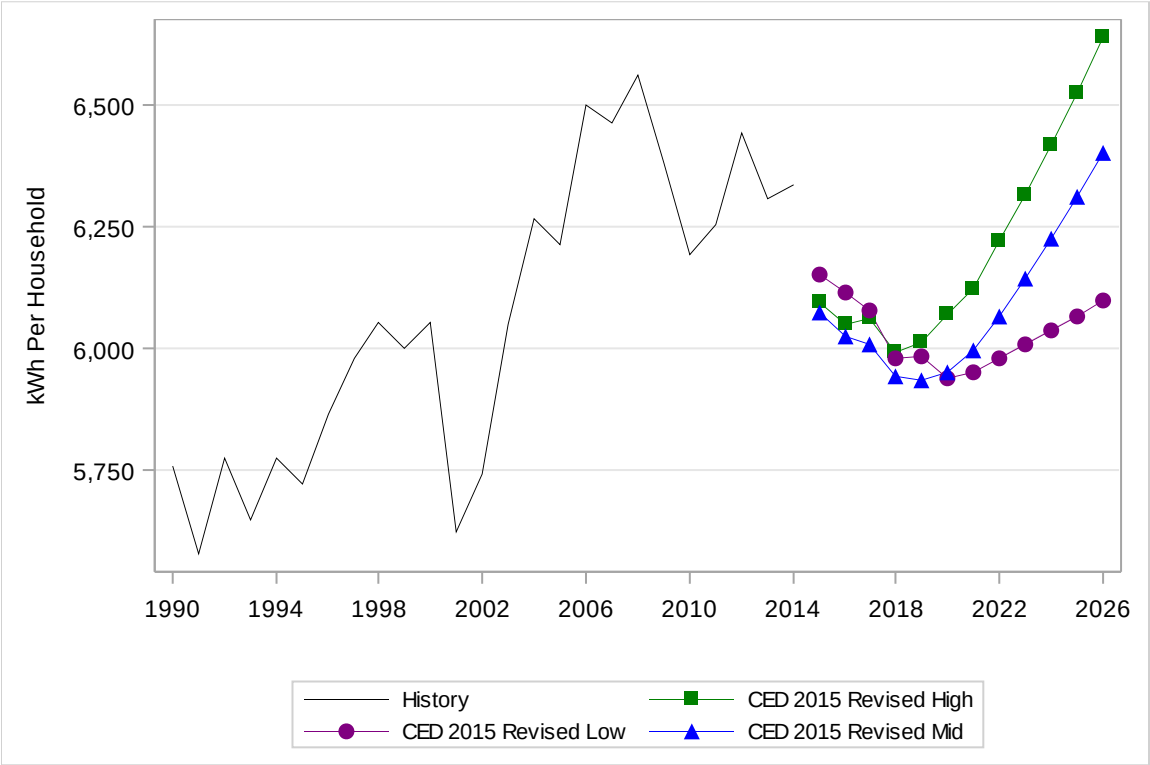
Figure 3-8: SDG&E Planning Area Average Household Income Projections



Source: California Energy Commission, Demand Analysis Office, 2015

Electricity consumption per household is shown in **Figure 3-9**. Since the low demand case has a higher number of persons-per-household, it begins at a higher level than either the mid or high case. However, the mid and high cases have significantly greater levels of EV adoption, which drives household consumption well over the low case in the second half of the forecast period.

Figure 3-9: SDG&E Planning Area Baseline Consumption per Household

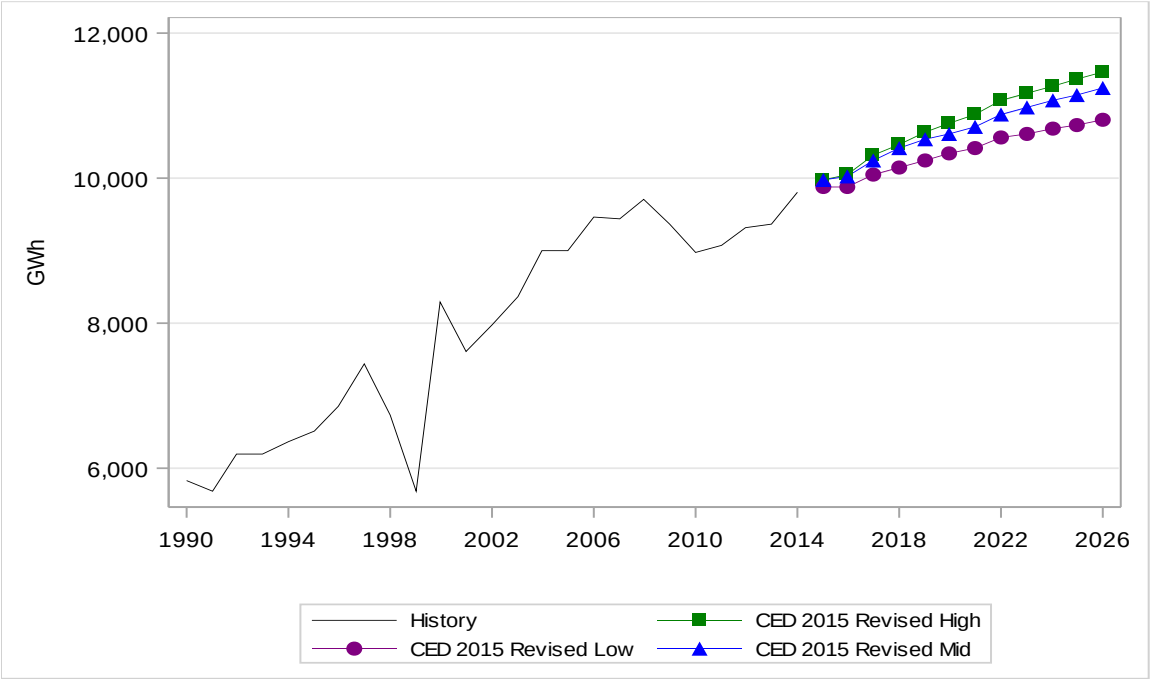


Source: California Energy Commission, Demand Analysis Office, 2015

Commercial Sector

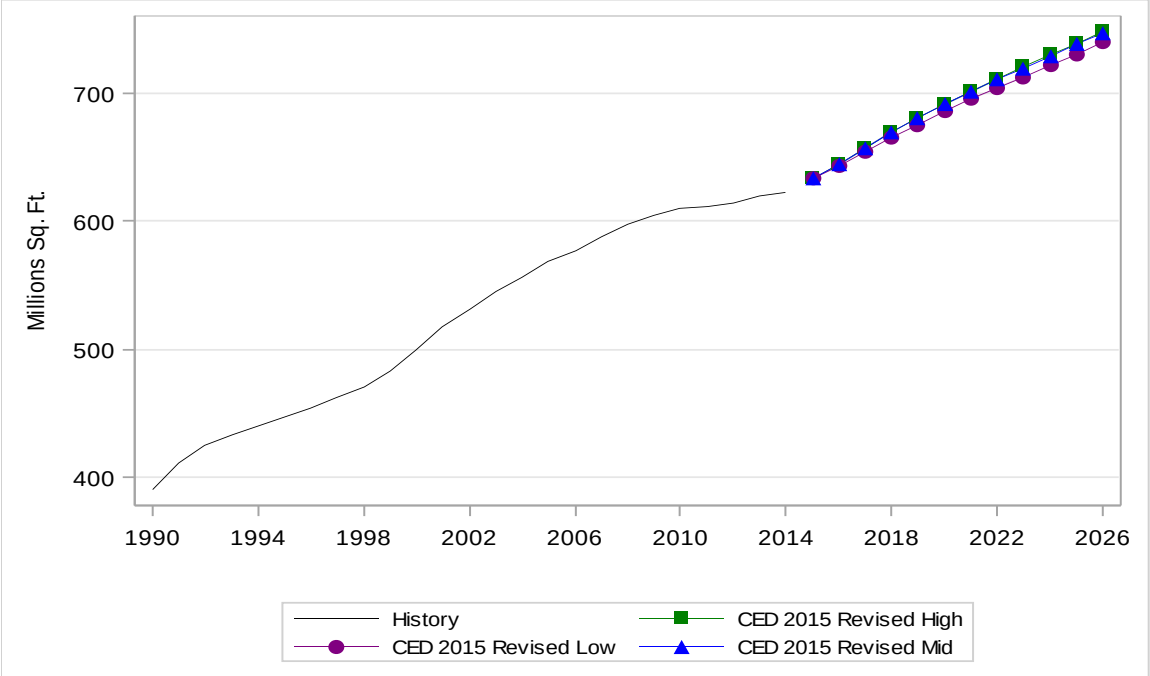
Figure 3-10 compares the SDG&E commercial sector electricity consumption forecasts. Commercial floor space is a key input to the commercial end use model demand model. The relatively narrow spread between the three cases reflects the even narrower band of commercial floor space projections, shown in **Figure 3-11**.

Figure 3-10: SDG&E Planning Area Baseline Commercial Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 3-11: SDG&E Planning Area Commercial Floor Space

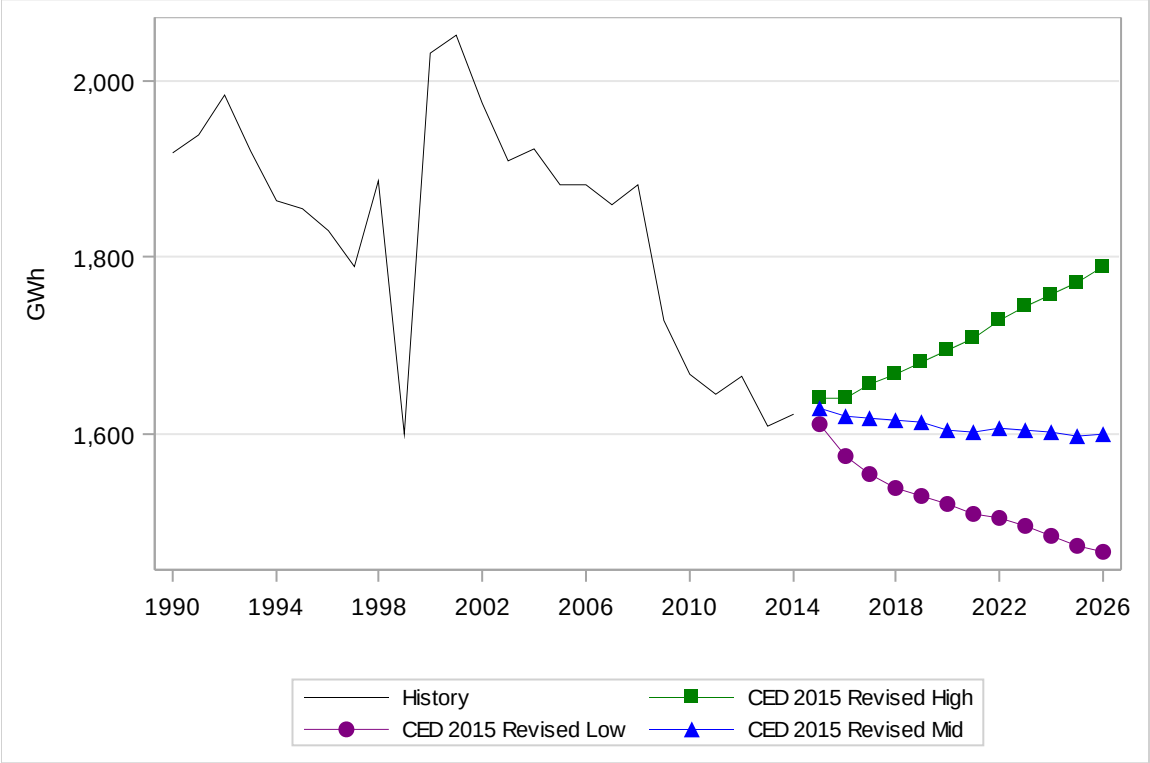


Source: California Energy Commission, Demand Analysis Office, 2015

Industrial Sector

Figure 3-12 shows the SDG&E planning area industrial sector electricity consumption forecasts. The Energy Commission uses an industry specific econometric model to project electricity consumption in this sector. The low demand case continues the historical downward trend. Alternatively, the mid case remains relatively flat throughout the forecast period and the high case approaches pre-recession levels.

Figure 3-12: SDG&E Planning Area Baseline Industrial Consumption

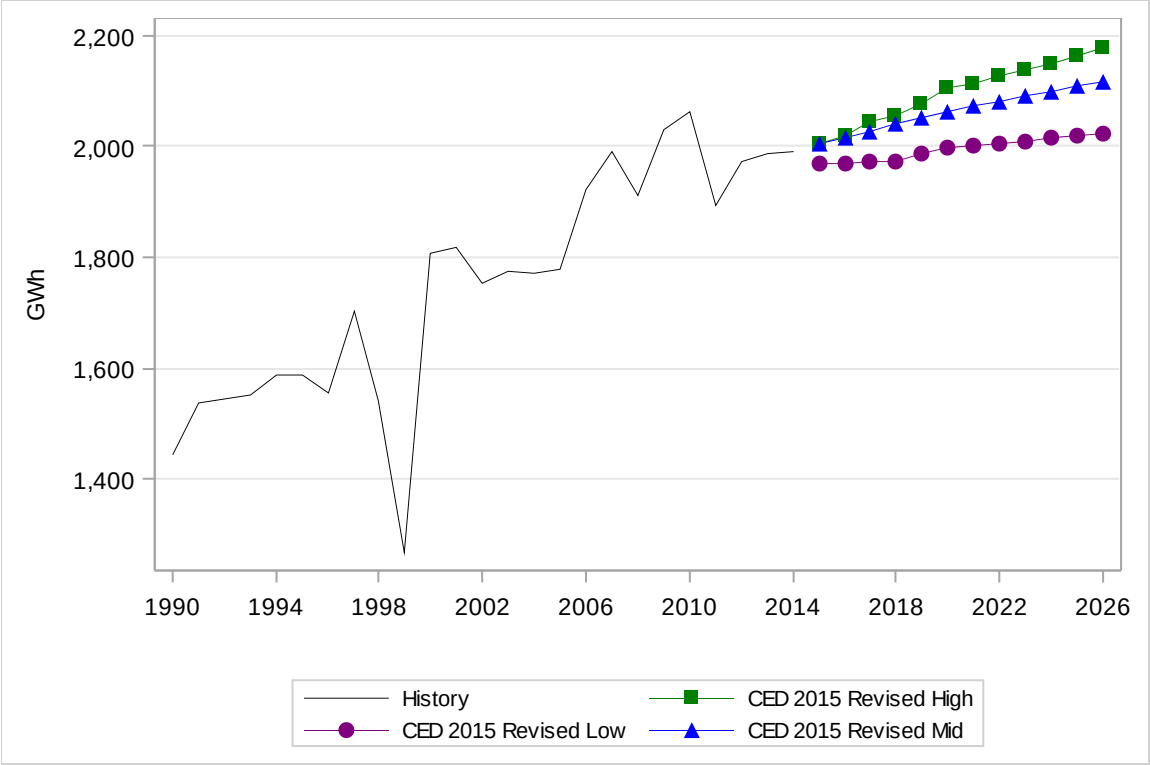


Source: California Energy Commission, Demand Analysis Office, 2015

Other Sectors

Figure 3-13 shows the electricity consumption forecasts for the TCU sector, which also includes street lighting. This relatively small and eclectic sector shows growth in all three cases, with contributions coming from all sub-sectors, save for street lighting, radio/television broadcasting, and national defense, which are held constant over the forecast period.

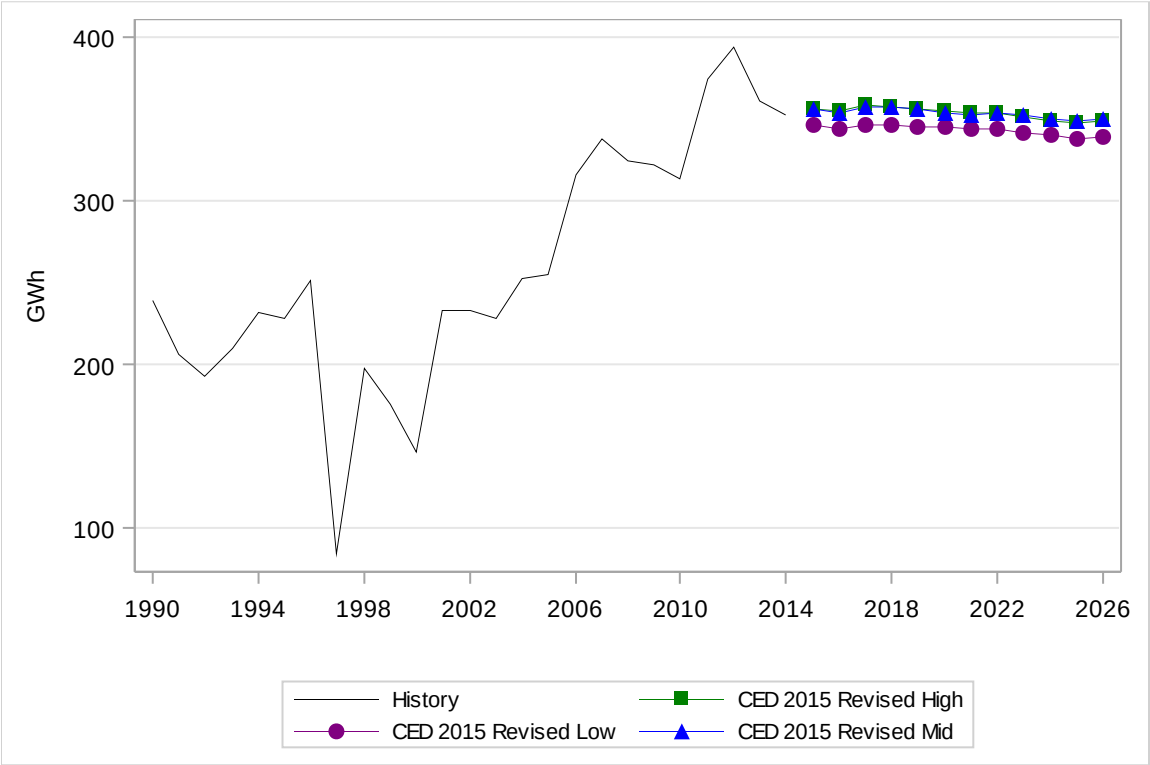
Figure 3-13: SDG&E Planning Area Baseline Transportation, Communication, Utilities, and Street Lighting Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 3-14 shows the electricity consumption forecasts for the agriculture and water pumping sectors. For the SDG&E planning area, growth in water pumping is tied more closely to residential use than agricultural. The nearly identical mid and high cases mirror the demographic projections presented in earlier sections of this chapter.

Figure 3-14: SDG&E Planning Area Baseline Agriculture and Water Pumping Consumption



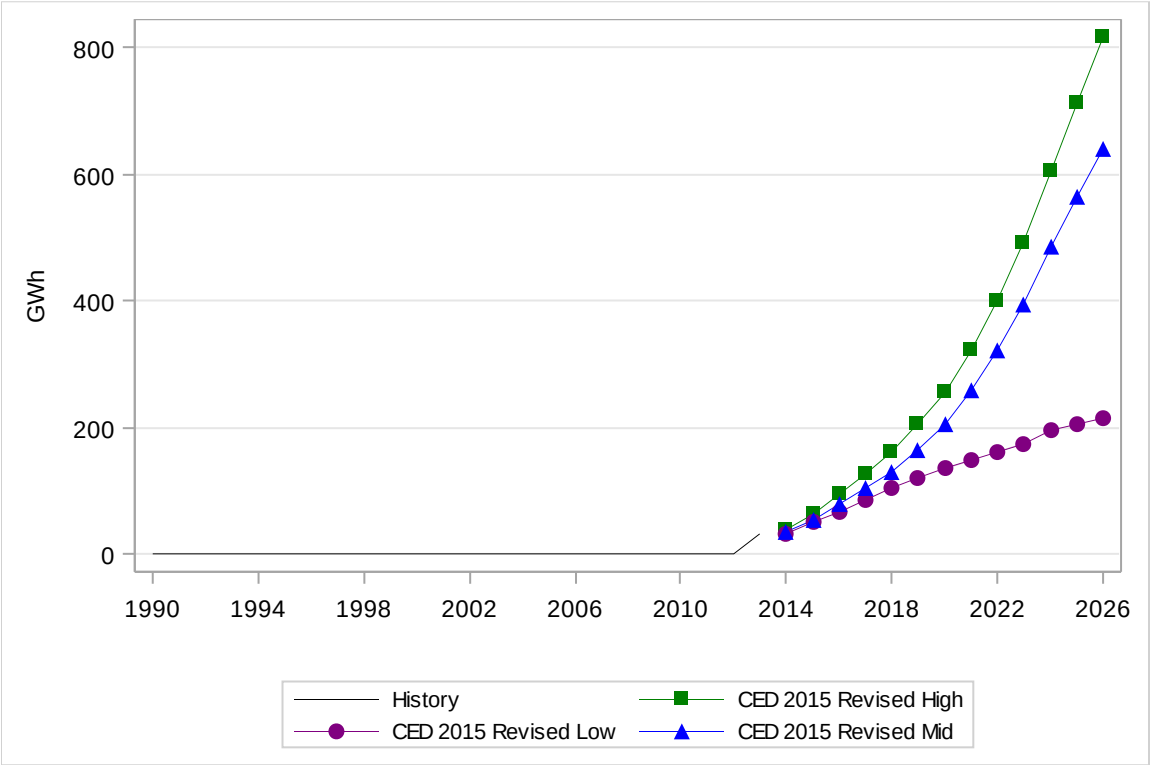
Source: California Energy Commission, Demand Analysis Office, 2015

Electric Vehicles

Consumption by EVs in the SDG&E planning area is expected to increase significantly over the forecast period, as illustrated by **Figure 3-15**. The mid and high cases are similar—both assume the EV prices and consumer preference will change enough over the forecast period that the ARB's ZEV Mandate will be met (mid case) or exceeded (high case). Alternatively, the low case assumes that current EV prices (relative to other vehicles choices) and consumer preferences will remain relatively unchanged.

Staff assumes most recharging will occur during off-peak hours, so peak impacts are expected to follow a similar pattern, though they should be relatively small in comparison.

Figure 3-15: SDG&E Electricity Consumption by Electric Vehicles



Source: California Energy Commission, Demand Analysis Office, 2015

Self-Generation

The peak demand forecast is reduced by the projected impacts of distributed solar PV, solar thermal, and CHP systems serving on-site customer load. Customer adoption of these technologies is forecast based on a combination of installation trend analysis and predictive modeling, the details of which are described in Appendix B to Volume 1. **Table 3-3** shows the forecast of peak impacts from PV and non-PV self-generation. Staff projects between 342 and 676 MW of peak reduction from PV systems by 2026, a wide spread that reflects varied assumptions about technology cost, the future of NEM conditions, and rate escalation.

Table 3-3: SDG&E Planning Area Self-Generation Peak Impacts (MW)

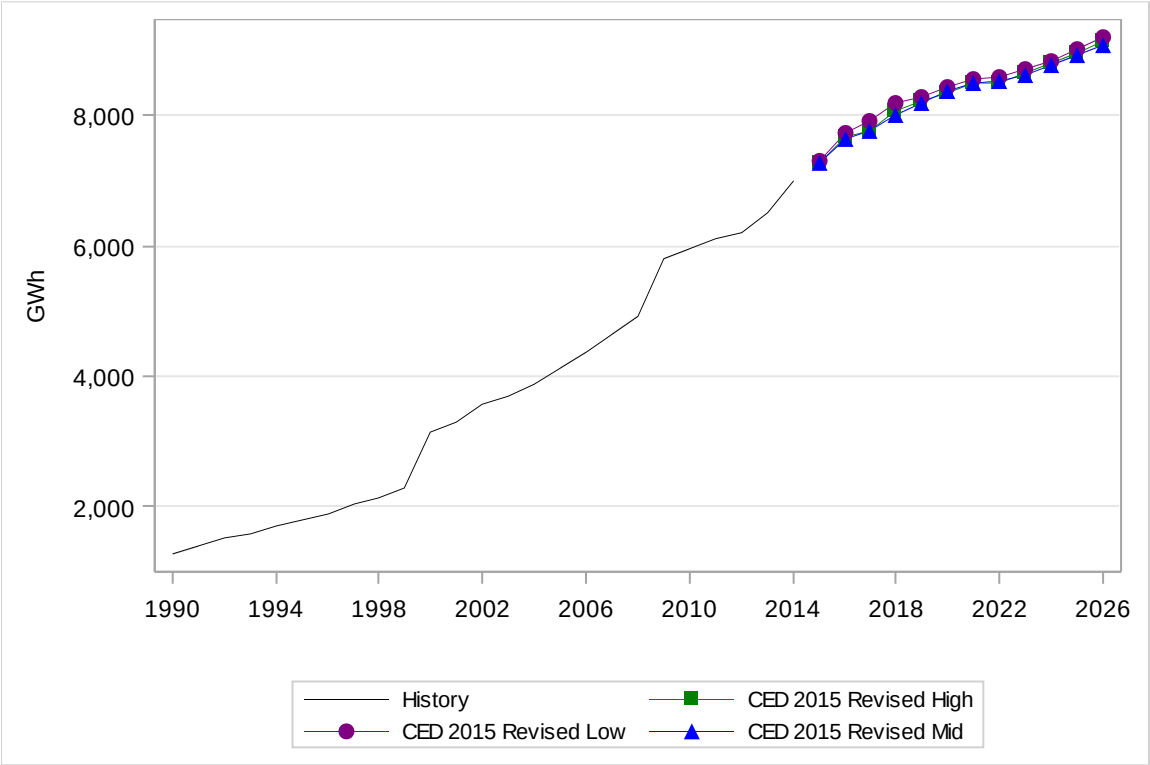
	***CED 2015 Revised* High Demand**		***CED 2015 Revised* Mid Demand**		***CED 2015 Revised* Low Demand**	
	Non-PV	PV	Non-PV	PV	Non-PV	PV
1990	78	-	78	-	78	-
2000	60	0	60	0	60	0
2010	122	40	122	40	122	40
2015	138	154	138	154	138	154
2020	195	254	195	302	195	343
2026	234	342	236	504	237	676

Source: California Energy Commission, Demand Analysis Office, 2015

Conservation/Efficiency Impacts

Figure 3-16 shows committed electricity consumption savings estimates from all sources, including building and appliance standards; utility programs implemented through 2015; and price and other effects, or savings associated with rate changes and certain market trends not directly related to programs or standards. Projected savings impacts are highest in the low demand case, since price and program effects are inversely related to the demand outcome. Within the demand cases, higher demand yields more standards savings since new construction and appliance usage increase, while lower demand is associated with more program savings and higher rates (and therefore more price effects). The net result is that savings totals among the cases are very similar.

Figure 3-16: SDG&E Planning Area Baseline Electricity Consumption Savings Estimates



Source: California Energy Commission, Demand Analysis Office, 2015

Table 3-4 presents estimated savings for building and appliance standards in the mid demand case for selected years. The standards savings estimates include some federal standards and all Title 20 and Title 24 updates through 2016. Savings are measured against a baseline before 1975, so they incorporate more than 30 years of impacts. Volume 1, Chapter 2 provides more detail on staff work related to energy efficiency and conservation, including an itemized list of all building and appliance standards that have been explicitly considered in estimating these cumulative savings.

Table 3-4: SDG&E Planning Area Baseline Standards Savings Estimates

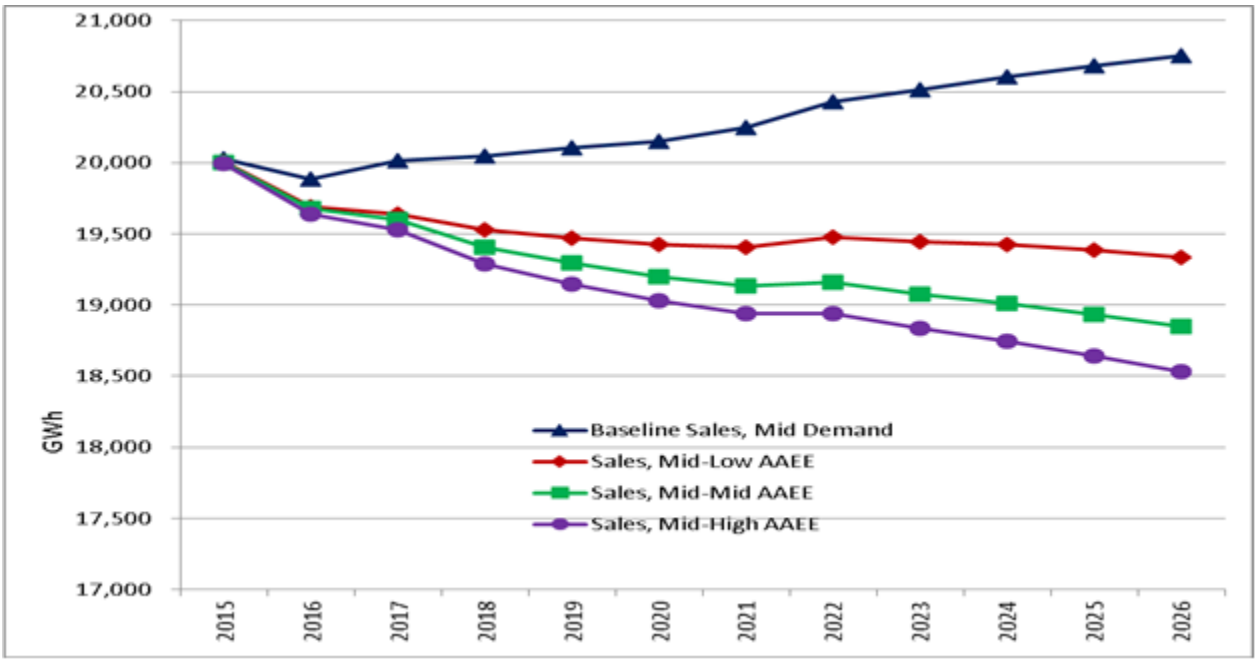
Electricity Consumption Savings (GWh)							
	Residential			Commercial			
	Building Standards	Appliance Standards	Total	Building Standards	Appliance Standards	Total	Total Standards
1990	255	254	509	168	92	260	769
2000	277	705	983	453	236	689	1,672
2010	254	1,447	1,701	964	423	1,387	3,088
2014	312	2,040	2,352	1,143	508	1,652	4,004
2020	417	2,876	3,293	1,835	813	2,647	5,941
2026	494	3,293	3,788	2,454	1,049	3,503	7,290
Electricity Peak Demand Savings (MW)							
	Residential			Commercial			
	Building Standards	Appliance Standards	Total	Building Standards	Appliance Standards	Total	Total Standards
1990	58	57	115	42	23	65	180
2000	62	159	221	109	57	166	387
2010	61	349	410	260	114	374	784
2014	78	512	590	285	125	410	1,000
2020	104	719	824	459	197	657	1,481
2026	121	807	928	615	254	869	1,797

Source: California Energy Commission, Demand Analysis Office, 2015

For *CED 2015 Revised*, staff estimated AAEE savings for the SDG&E service territory. Spreadsheets posted with this report[11] provide AAEE savings estimates for the SDG&E service territory by sector and savings type (programs, standards) for energy and peak for each of five scenarios. **Figure 3-17** shows the impact on service territory sales in the mid demand case of three AAEE savings scenarios designed to be consistent with input assumptions for the mid case. In all three cases, sales decline for all or most the forecast period. Similar results are shown in **Figure 3-18** for service territory peak demand. See Chapter 2 of Volume 1 of this report for details on these AAEE scenarios.

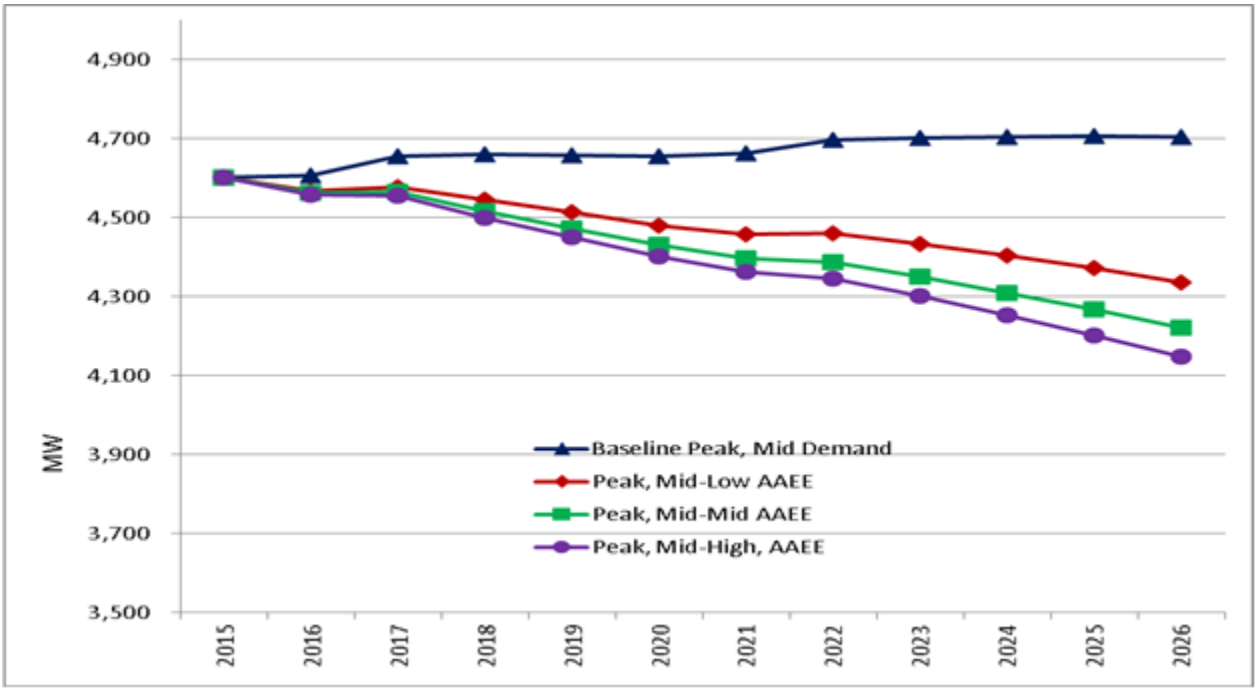
11 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Figure 3-17: SDG&E Service Territory Baseline and Adjusted Sales



Source: California Energy Commission, Demand Analysis Office, 2015

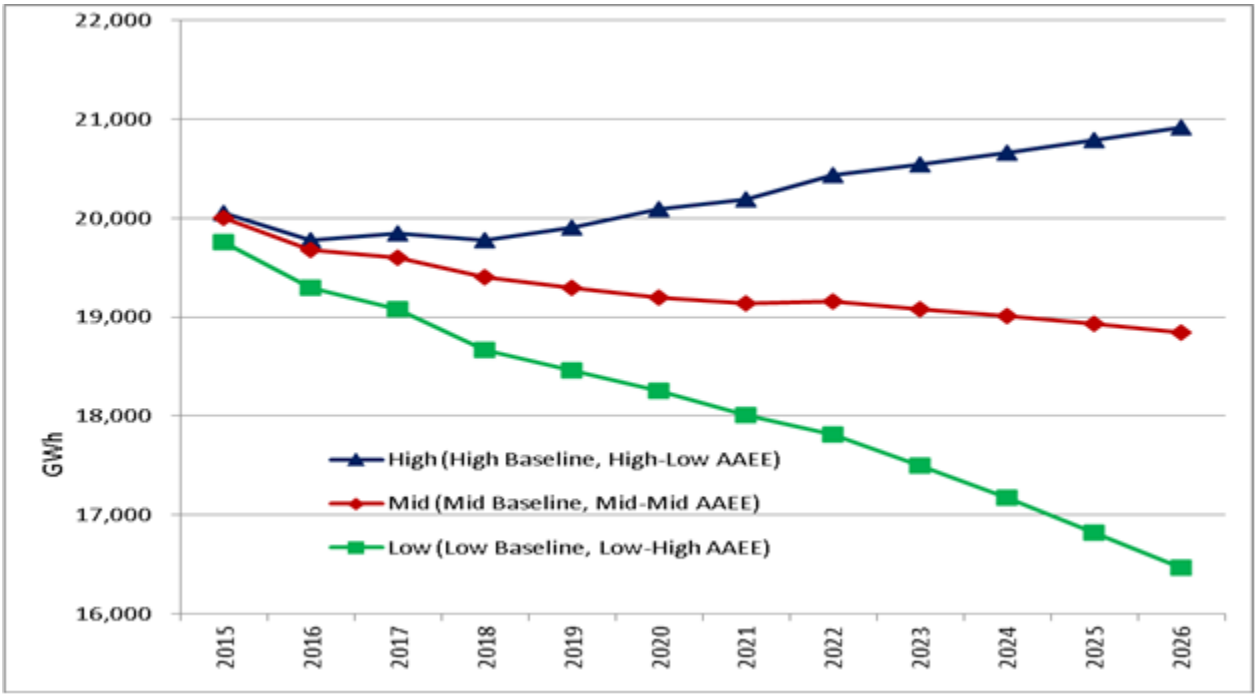
Figure 3-18: SDG&E Service Territory Baseline and Adjusted Peak Demand



Source: California Energy Commission, Demand Analysis Office, 2015

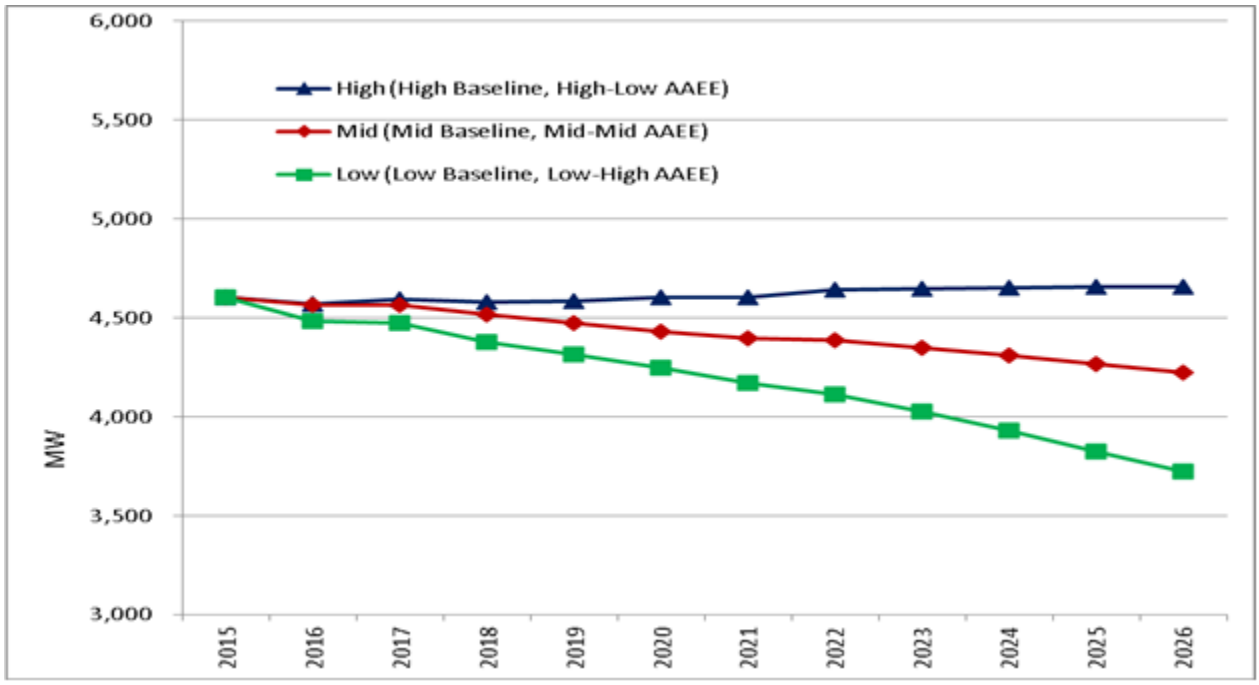
Figure 3-19 shows the low baseline sales forecast adjusted by a high AAEE savings scenario consistent with the assumptions of the low demand case (low-high), the mid baseline adjusted by a consistent mid AAEE scenario (mid-mid), and the high baseline adjusted by low AAEE savings (high-low). These parings were chosen to produce the maximum spread among potential managed sales forecasts for the SDG&E service territory. **Figure 3-20** shows a similar set of adjusted peak demand forecasts.

Figure 3-19: SDG&E Service Territory Adjusted Sales



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 3-20: SDG&E Service Territory Adjusted Peak Demand



Source: California Energy Commission, Demand Analysis Office, 2015

Electrification

Potentially significant increases in electricity use in California are expected to occur through electrification in the commercial, industrial, and transportation sectors. **Table 3-5** shows, for select years, the portion of these impacts that are anticipated in the SDG&E planning area. For more details, see Volume 1, Chapter 1.

Table 3-5: SDG&E Planning Area Electrification Impacts

	Additional Consumption (GWh)		
	CED 2015 Revised **High Demand**	***CED 2015 Revised*** **Mid Demand**	***CED 2015 Revised*** **Low Demand**
2016	6.5	4.1	1.5
2020	35.5	21.0	5.2
2026	77.0	38.3	7.5

Source: California Energy Commission Staff

CHAPTER 4:
Northern California Non-California Independent System Operator Planning Area

The Northern California Non-California ISO (NCNC) planning area includes two balancing authorities separate from the California ISO, Turlock Irrigation District, and the Balancing Authority of Northern California (BANC). By far the largest utility in this new planning area is the Sacramento Municipal Utility District (SMUD) residing within BANC. Although this chapter will only focus on the NCNC planning area as a whole, demand forms are provided for both NCNC and the SMUD service area.

This chapter is organized as follows: First, forecasted consumption and peak loads for the NCNC planning area are discussed; both total and per capita values are presented. Second, the chapter presents sector consumption forecasts. The residential, commercial, industrial, and "other" sector forecasts are discussed. Third, the chapter discusses the forecasts of electric vehicles, self-generation, the impacts of conservation and efficiency programs, and additional achievable energy efficiency. Finally, forecasts of electricity consumption and peak demand are presented for each forecast zone within the NCNC planning area.

Baseline Forecast Results

For this forecast, three demand cases were developed. The high demand case includes high economic and demographic projections, low energy price projections, and low efficiency impact assumptions. The low demand case includes low economic and demographic projections, high energy price projections, and high efficiency impact assumptions. Volume 1 provides more detail on the construction of the demand cases.

Table 4-1 compares *CED 2015 Revised* high, mid, and low demand cases. Comprehensive results are available electronically as a set of forms posted alongside this report.[12]

In the NCNC planning area, the *CED 2015 Revised* mid demand electricity consumption is growing 1.4 percent annually out to 2020. This is growth is largely due to the projected increase in population and the number of households in the Sacramento and San Joaquin Valleys. By 2026, the *CED 2015 Revised* high demand level is .25 percent higher than the mid case, while the low demand case is .39 percent lower. For peak demand shown in **Table 4-2**, the *CED 2015 Revised* high and low cases are .31 percent

12 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015.

higher and .68 percent lower, respectively, than the mid case by 2026. Weather-normalized peak demand for 2015 is 5,064 MW. By 2026, mid demand peak will increase by almost 14 percent to reach 5,767 MW of peak demand.

Table 4-1: NCNC Planning Area Baseline Consumption

	Recorded Consumption (GWh)	Forecast		
		***CED 2015 Revised* High**	***CED 2015 Revised* Mid**	***CED 2015 Revised* Low**
1990	13,279			
2000	16,812			
2010	18,353			
2014	18,433			
2020		20,313	20,033	19,568
2026		22,151	21,507	20,514
Average Annual Growth Rates				
1990 - 2000	2.39%			
2000 - 2010	0.88%			
2010 - 2014	0.11%			
2014 - 2020		1.63%	1.40%	1.00%
2014 - 2026		1.54%	1.29%	0.90%

Source: California Energy Commission, Demand Analysis Office, 2015

Table 4-2: NCNC Planning Area Baseline Peak Demand

	Recorded Peak (MW)	Forecast		
		***CED 2015 Revised* High**	***CED 2015 Revised* Mid**	***CED 2015 Revised* Low**
1990	3,731			
2000	4,516			
2010	5,031			
2015	5,094			
2015*		5,064	5,064	5,064
2020		5,492	5,430	5,253
2026		5,965	5,767	5,356
Average Annual Growth Rates				
1990-2000	1.93%			
2000-2010	1.09%			
2010-2015	0.25%			
2015*-2020		1.63%	1.40%	0.73%
2015*-2026		1.50%	1.19%	0.51%

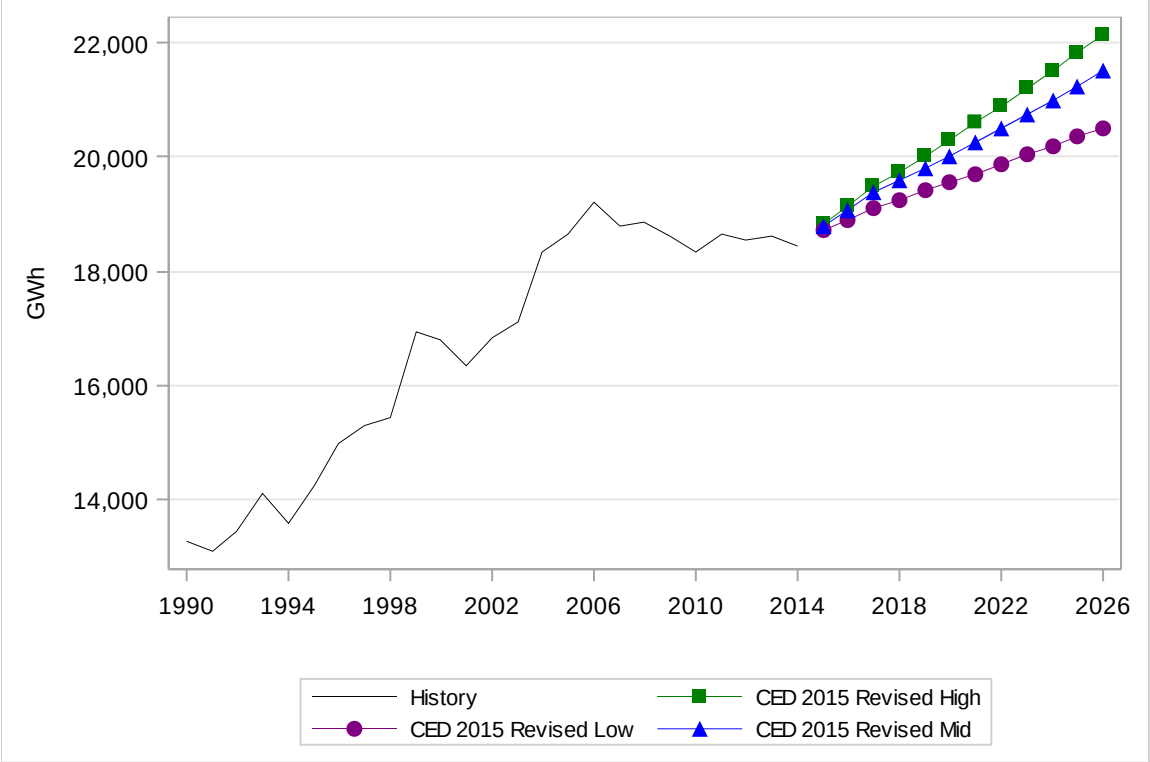
*Weather normalized historical 2015 peak demand

Source: California Energy Commission, Demand Analysis Office, 2015

As shown in **Figure 4-1**, *CED 2015 Revised* electricity consumption forecasts for the mid and high demand cases remain close in the near term but begin to deviate more after 2017. The low demand case on the other hand begins to grow at a distinctly lower rate due to the lower economic and demographic growth assumptions and higher electricity rates compared to the other two cases.

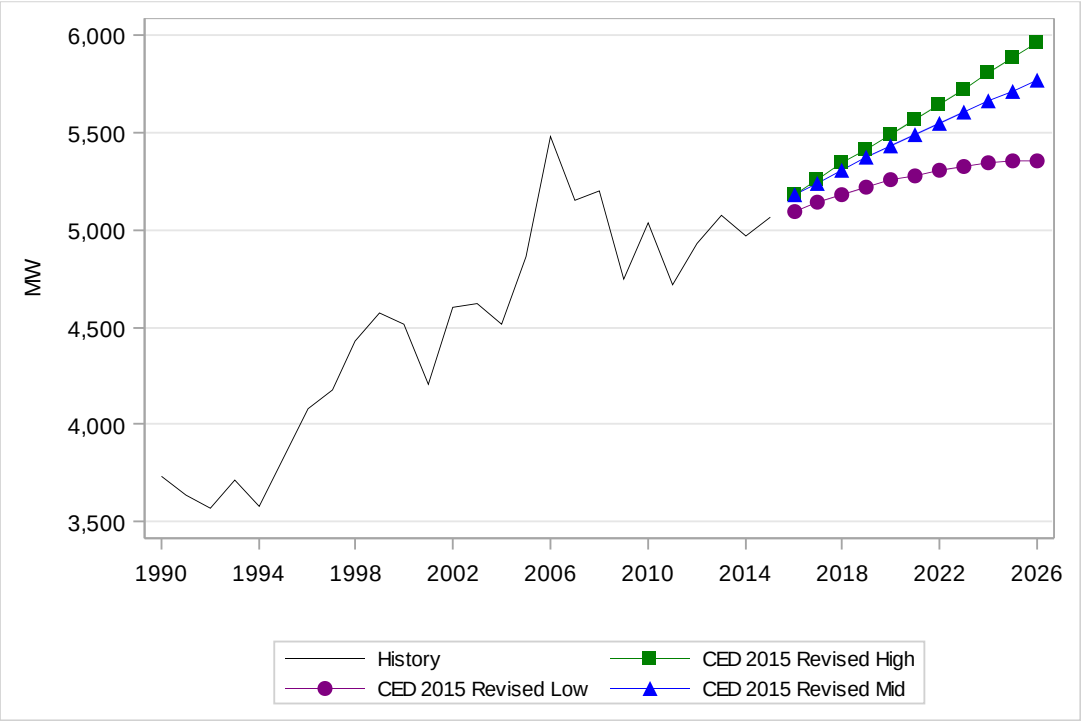
The relationship between peak demand cases, shown in **Figure 4-2**, follows a similar pattern as the consumption forecast. In the case of peak demand we begin the forecast period for the three cases from a weather-normalized historical value for 2015. In contrast with consumption the low demand case flattens moving towards 2026. The high electricity rates assumed for this case lead to greater adoption of solar PV in comparison with the other demand cases and thus flatter demand over the long-term.

Figure 4-1: NCNC Planning Area Baseline Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

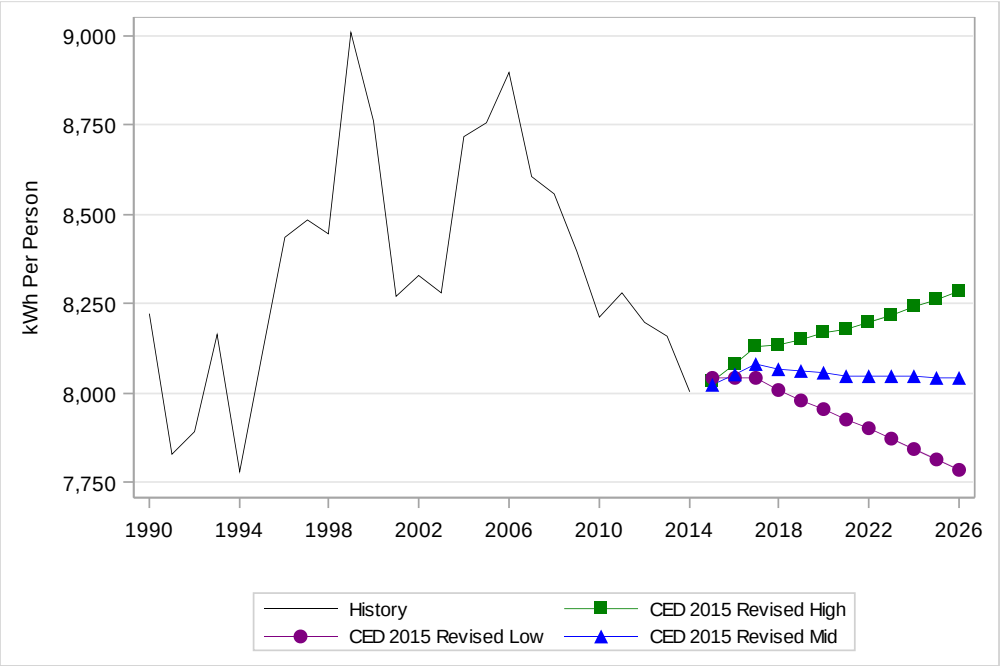
Figure 4-2: NCNC Planning Area Baseline Peak



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 4-3 shows per capita electricity consumption for the *CED 2015 Revised* demand cases throughout the forecast period. Although this figure highlights the three demand cases, the population projections for the high and mid demand cases are identical with slower growth in population projected for the low demand case. Therefore the distinction between the high and mid demand cases is due to differences in consumption projected for each case. The significant decline in per capita consumption in the low demand case is due the interaction of slower growth for consumption as well as population.

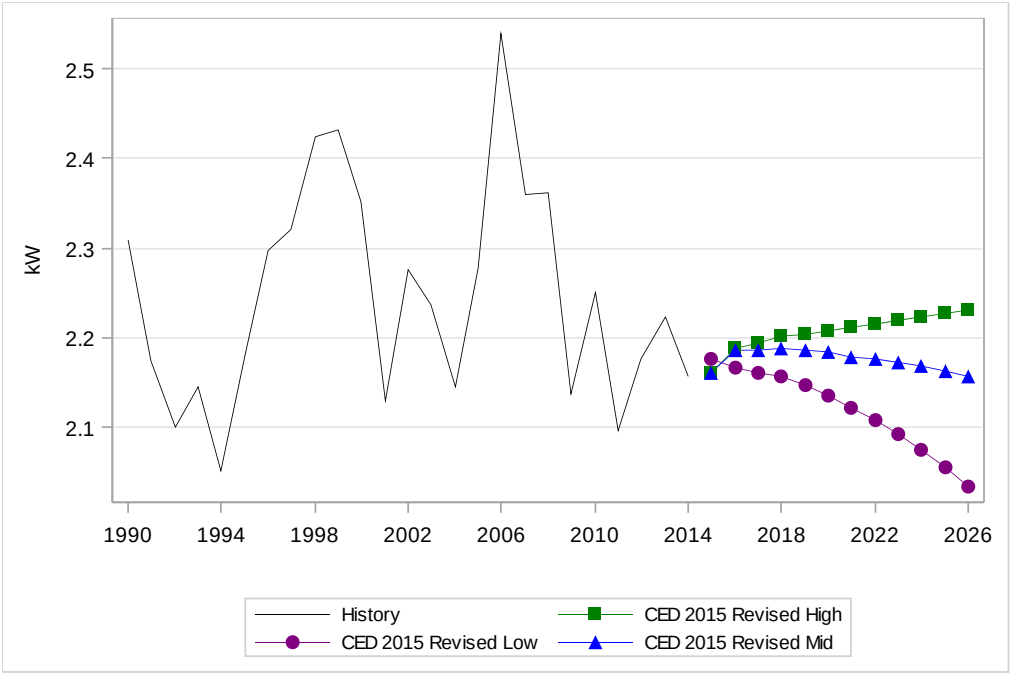
Figure 4-3: NCNC Planning Area Baseline per Capita Electricity Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 4-4 shows per capita peak demand. *CED 2015 Revised* per capita peak cases follow a similar pattern as the per capita consumption cases.

Figure 4-4: NCNC Planning Area Baseline per Capita Peak Demand



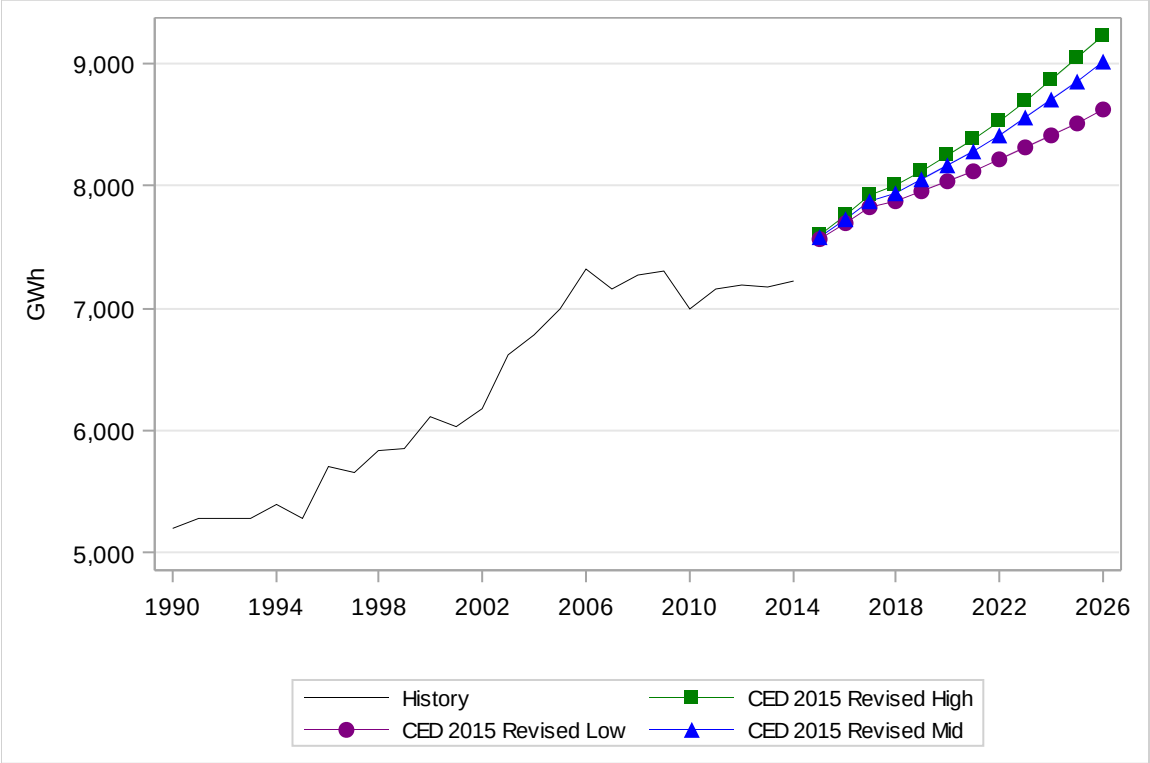
Source: California Energy Commission, Demand Analysis Office, 2015

Sector Level Results and Input Assumptions

Residential Sector

Figure 4-5 compares *CED 2015 Revised* residential demand forecasts for NCNC. In the early part of the forecast from 2014 to 2016 average annual growth exceeds 3 percent for each demand case. By 2026 the high and mid cases are projected to have grown at an average annual rate of about 2 and 1.9 percent, respectively. Average annual growth for the low case is close to 1.5 percent over the same period.

Figure 4-5: NCNC Planning Area Baseline Residential Consumption



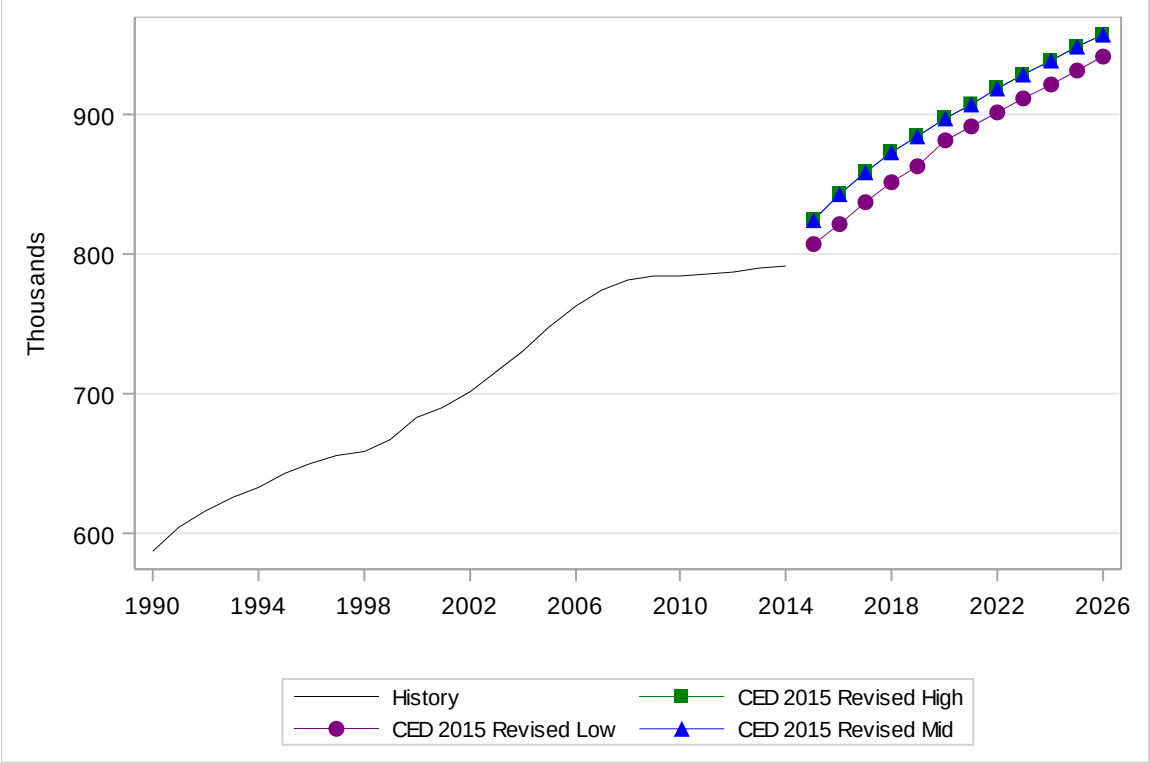
Source: California Energy Commission, Demand Analysis Office, 2015

Figure 4-6 and **Figure 4-7** show the household and persons-per-household projections used to drive the *CED 2015 Revised* residential forecasts. Each figure shows only two distinct cases. This is because the IHS Global Insight *Optimistic* scenario and the Moody's Analytics *Baseline* scenario were very similar, so the latter was used to represent both the high and mid cases. The low household and persons-per-household scenarios were provided by the California Department of Finance (DOF). The *CED 2015 Revised* high and mid demand cases are growing at an average annual rate of 1.6 percent

from 2014 through 2026. The low *CED 2015 Revised* case is growing at 1.4 percent over the same period.

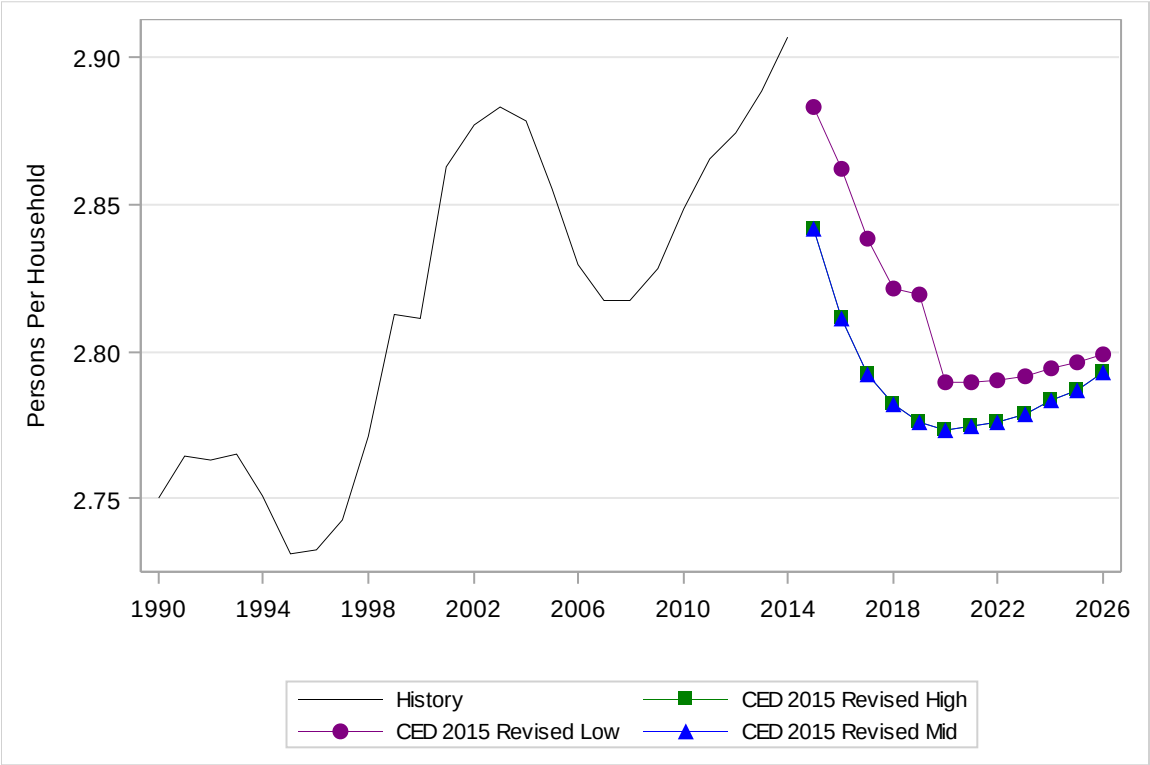
Due to the identical population and household growth for the high and mid demand cases we also arrive at identical high and mid cases for persons per household projections. The combined high and mid demand cases show declining persons per household projections beginning with 2.9 persons per household in 2014 and 2.77 persons per household by 2020. By 2026 these cases are projected to be near 2.8 persons per household. In comparison to the high and mid demand cases the low demand case begins at a higher point but with similar near term decline and growth near the end of the forecast period. The higher projection for the low case is due to slower household growth relative to population growth assumed for the low demand case.

Figure 4-6: NCNC Planning Area Residential Household Projections



Source: California Energy Commission, Demand Analysis Office, 2015

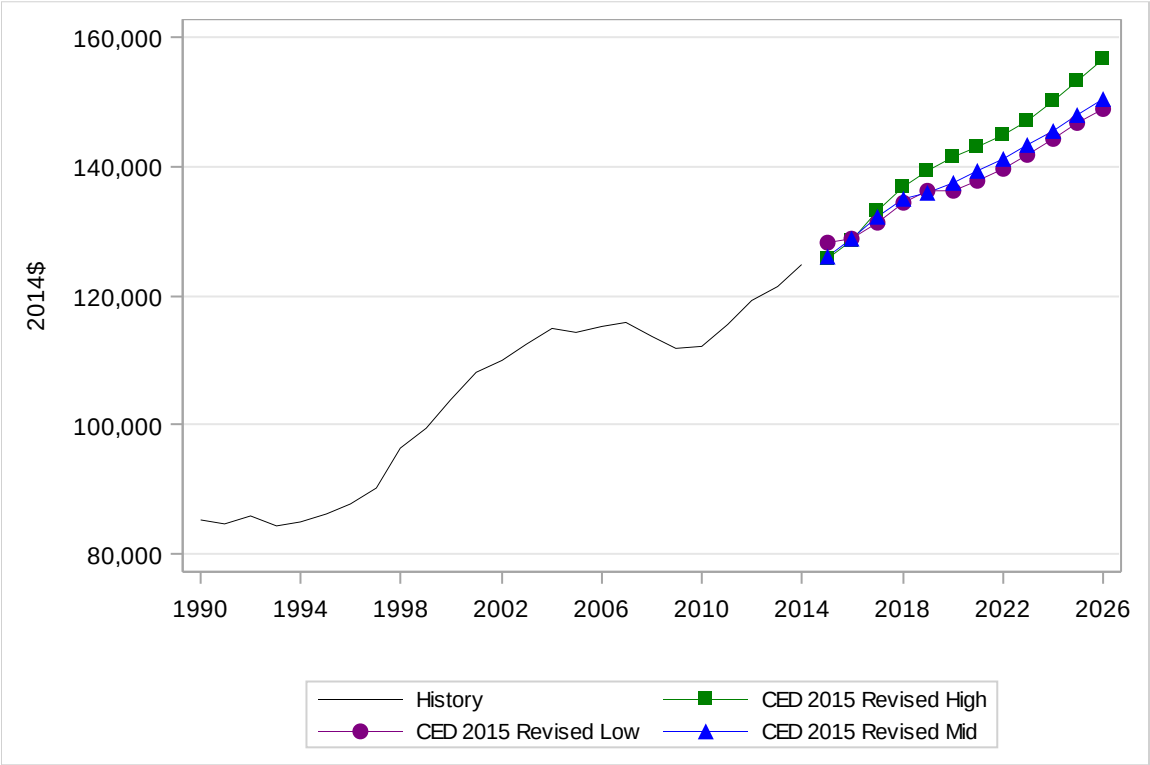
Figure 4-7: NCNC Planning Area Persons per Household Projections



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 4-8 compares average household income in the three demand cases. Due to the higher persons per household projection in the low demand case, the low case for household income exceeds the high and mid case at the beginning of the forecast period in 2015. Over the entire forecast period from 2014 to 2026 though the high, mid and low cases grow at average annual rates of 1.9, 1.6 and 1.5 percent per year, respectively.

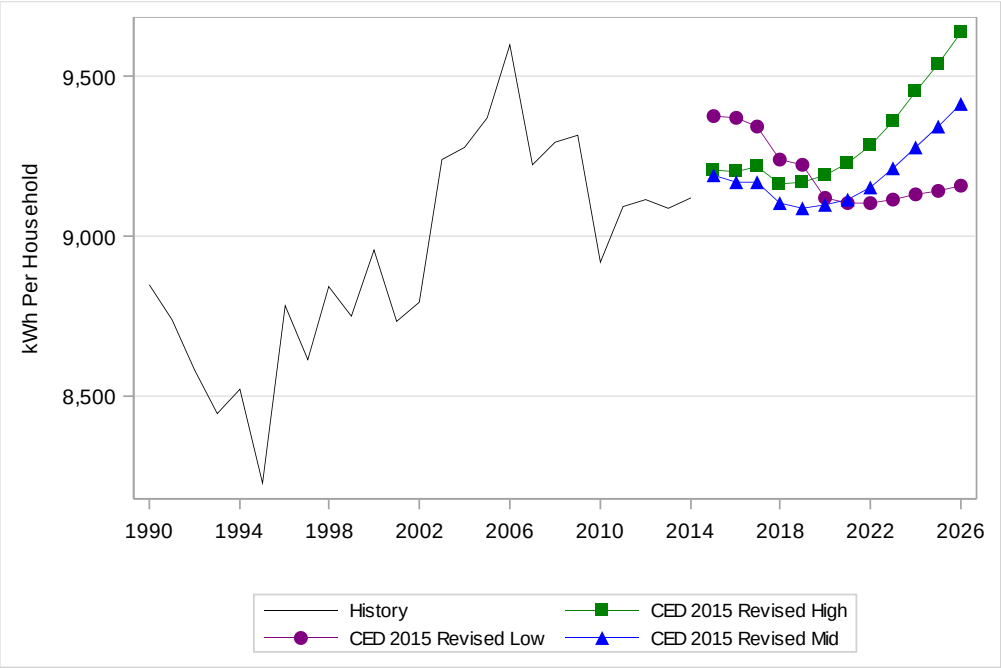
Figure 4-8: NCNC Planning Area Average Household Income Projections



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 4-9 compares electricity consumption per household for the three demand cases. The high and mid demand cases show similar trends though they are starting at different levels. In comparison to high and mid cases the low case uses a higher person per household projection. This difference is enough to result in higher consumption for the low case in the beginning of the forecast period. As the difference between the persons per household projected for the high, mid and low cases decreases later in the forecast, the increasing number of EVs causes consumption per household to increase in the high and mid cases. In contrast, the low case assumes a much smaller number of electric vehicles and thus consumption per household remains flat for this case at the end of the forecast period.

Figure 4-9: NCNC Planning Area Baseline Electricity Use per Household

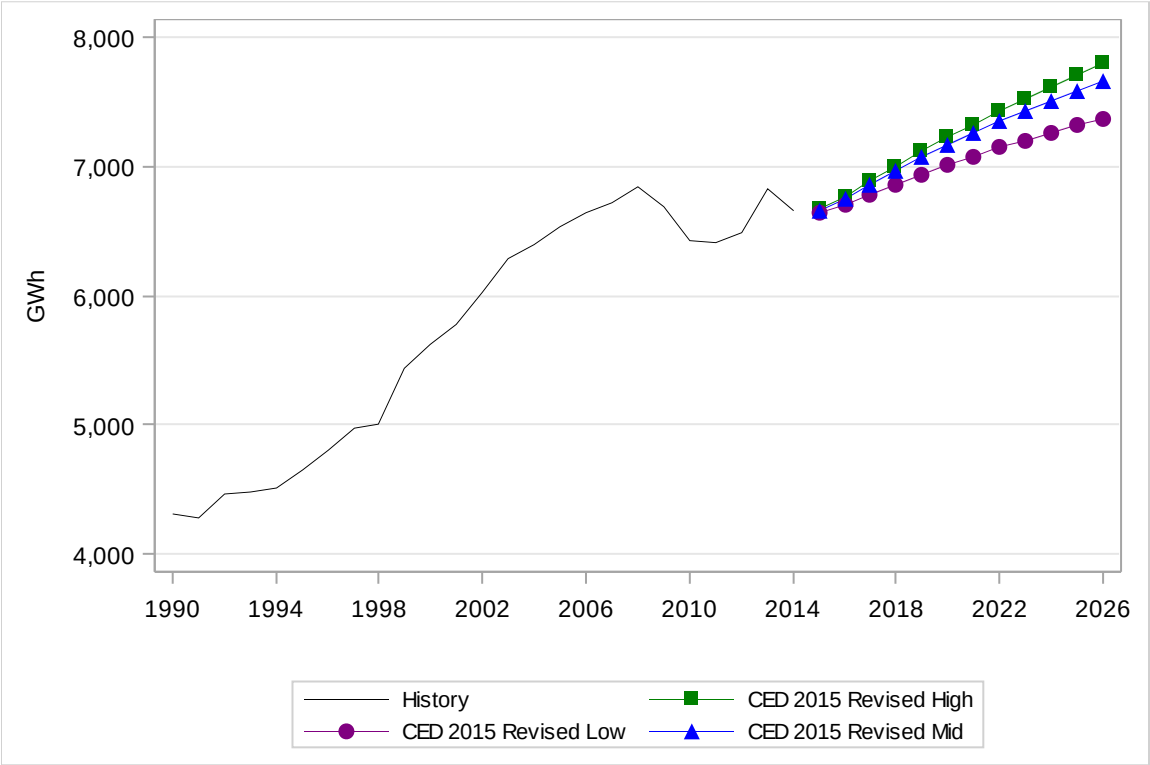


Source: California Energy Commission, Demand Analysis Office, 2015

Commercial Sector

Figure 4-10 compares the NCNC commercial sector electricity consumption forecasts. The differences between the cases are primarily driven by the differing assumptions for commercial floor space growth across the three demand cases. From 2014 to 2026 the high, mid, and low demand cases are growing at an average annual rate of 1.3, 1.2 and .9 percent, respectively.

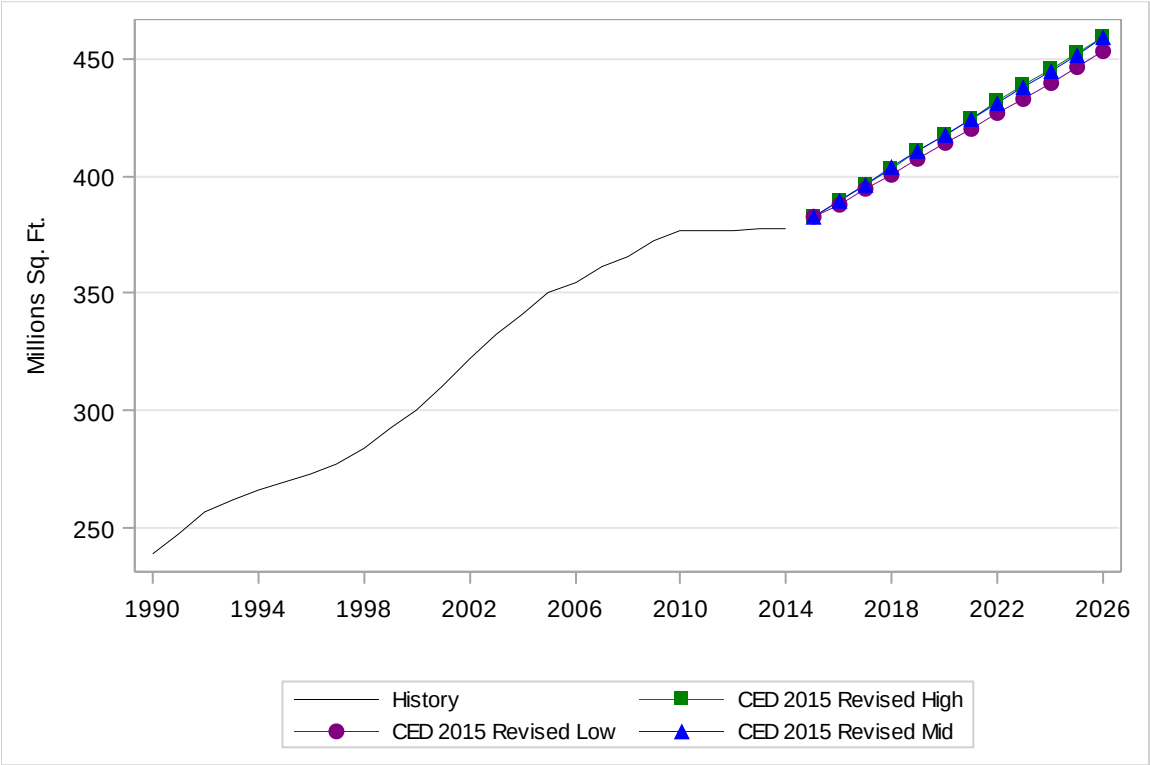
Figure 4-10: NCNC Planning Area Baseline Commercial Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

In staff's commercial building sector forecasting model, floor space by building type (such as retail, offices, and schools) is the key driver. **Figure 4-11** compares NCNC commercial floor space projections for each of the demand cases. The economic drivers in the high, mid, and low cases produced very similar results when projecting commercial floor space. The high and mid cases grow at an average annual rate of 1.6 percent from 2014 to 2026. The low cases grow at an average annual rate of 1.5 percent over the same period.

Figure 4-11: Commercial Floor Space

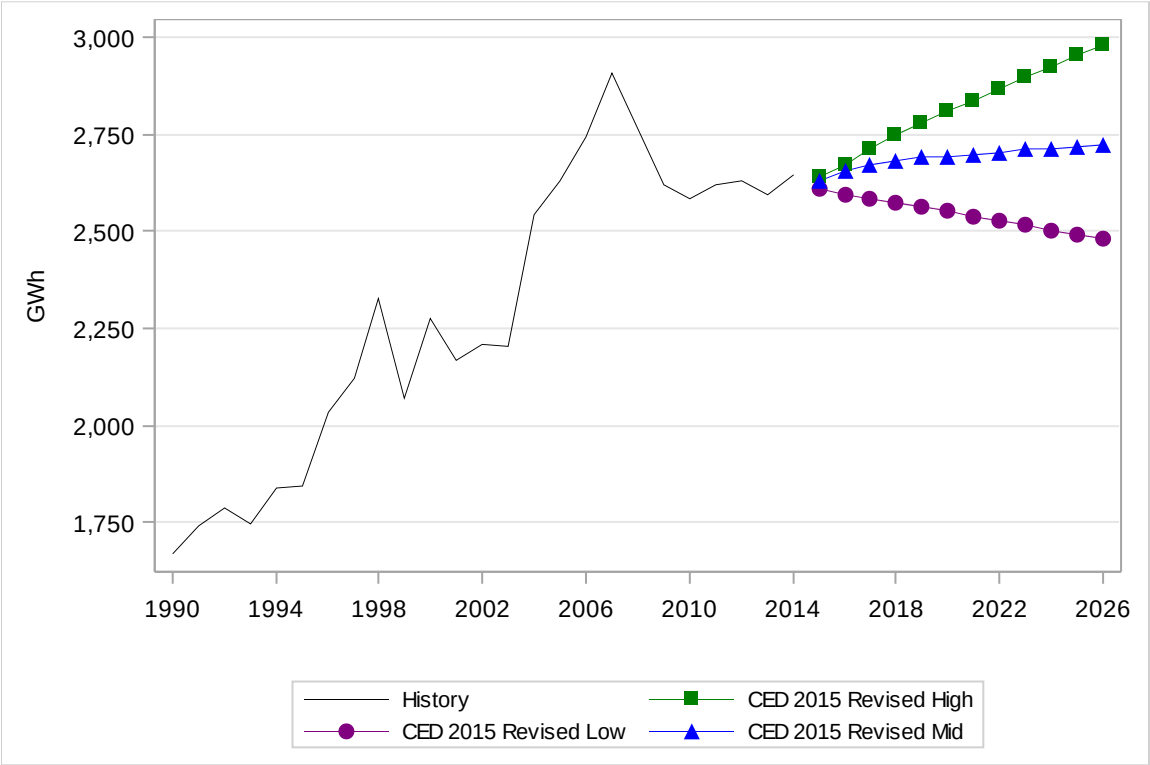


Source: California Energy Commission, Demand Analysis Office, 2015

Industrial Sector

Figure 4-12 compares the NCNC planning area industrial sector electricity consumption forecast cases. The high and mid demand cases have positive growth through 2026. Beginning in 2014, the projected average annual growth rates for the high and demand cases to the end of the forecast period are 1.0 and 0.2 percent, respectively. In comparison, the low demand case projects negative growth at an average annual rate of -0.5 percent over the same period. The differences in consumption cases are mainly driven by differences in economic output.

Figure 4-12: NCNC Planning Area Baseline Industrial Consumption

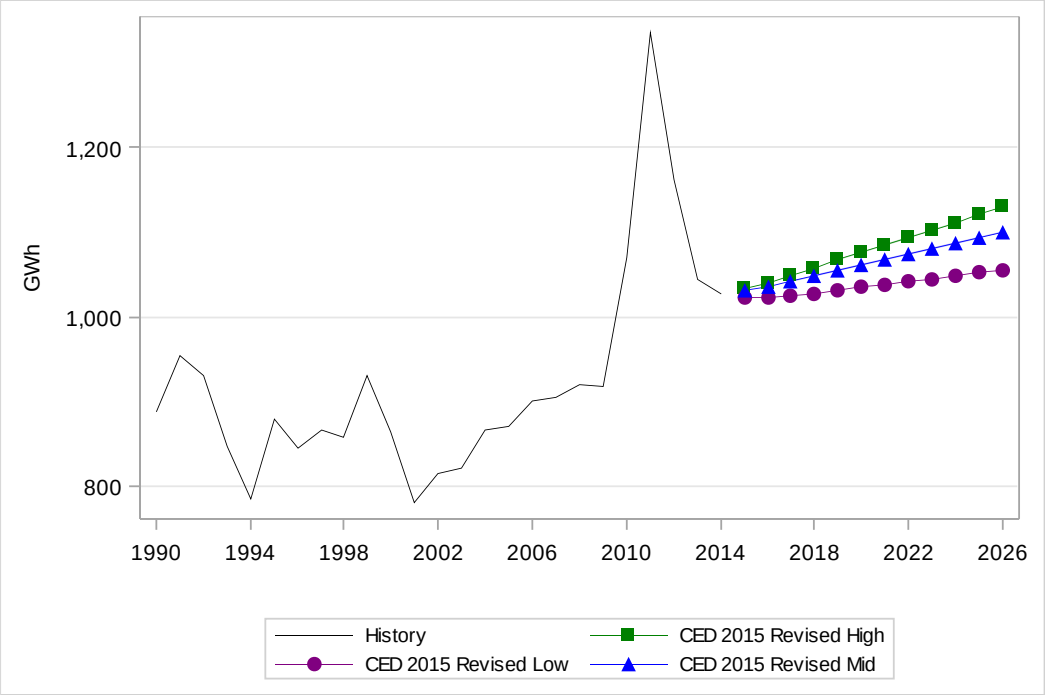


Source: California Energy Commission, Demand Analysis Office, 2015

Other Sector

Figure 4-13 compares the electricity consumption demand cases for the TCU sector, which includes street lighting. Differences in demand cases are primarily driven by assumptions for economic growth and employment. From 2014 to 2026 the high, mid and low demand cases grow at average annual rates of 0.8, 0.6, and 0.2 percent, respectively.

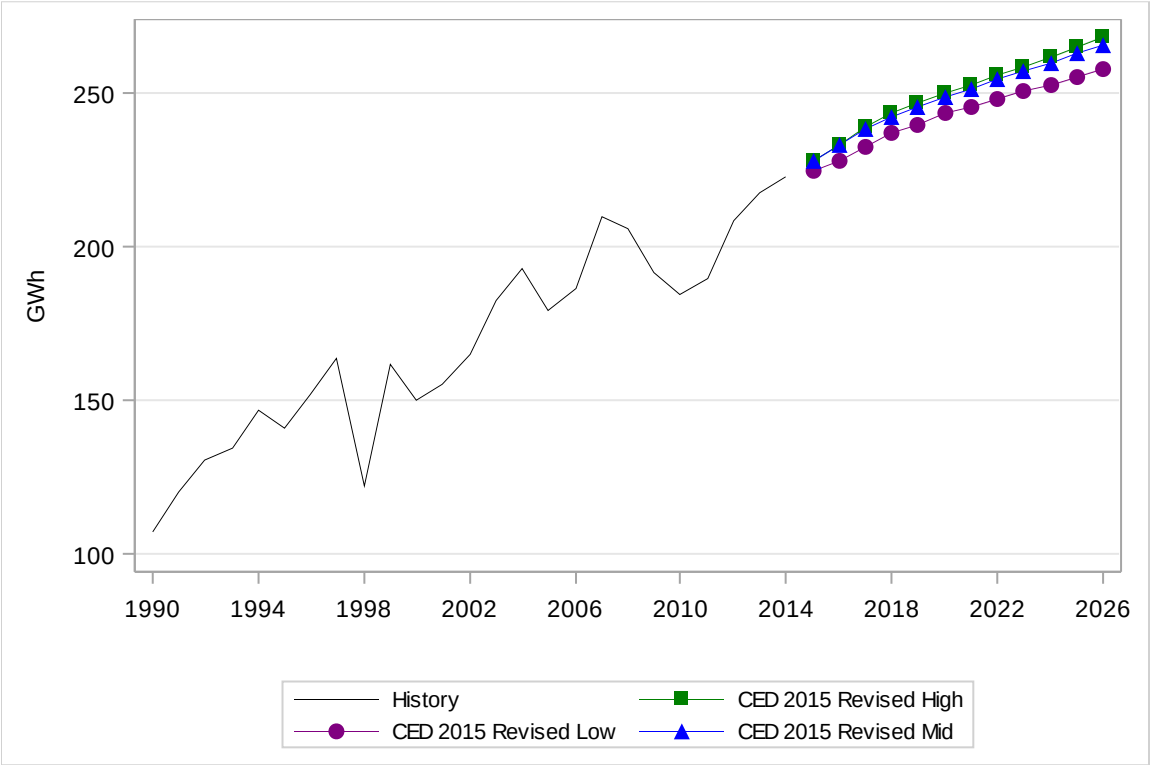
Figure 4-13: NCNC Planning Area Baseline Transportation, Communication, Utilities, and Street Lighting Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 4-14 compares the electricity consumption demand cases for the agriculture and water pumping sectors. All three demand cases are projected to grow over time, primarily because of a projected increase in groundwater pumping. From 2014 to 2026 the high and mid demand cases are projected to grow at an average annual rate of 1.3 and 1.2 percent, respectively. The low demand case on the other hand is projected to grow at a rate of 1 percent annually over the same time period.

Figure 4-14: NCNC Planning Area Baseline Agriculture and Water Pumping Consumption

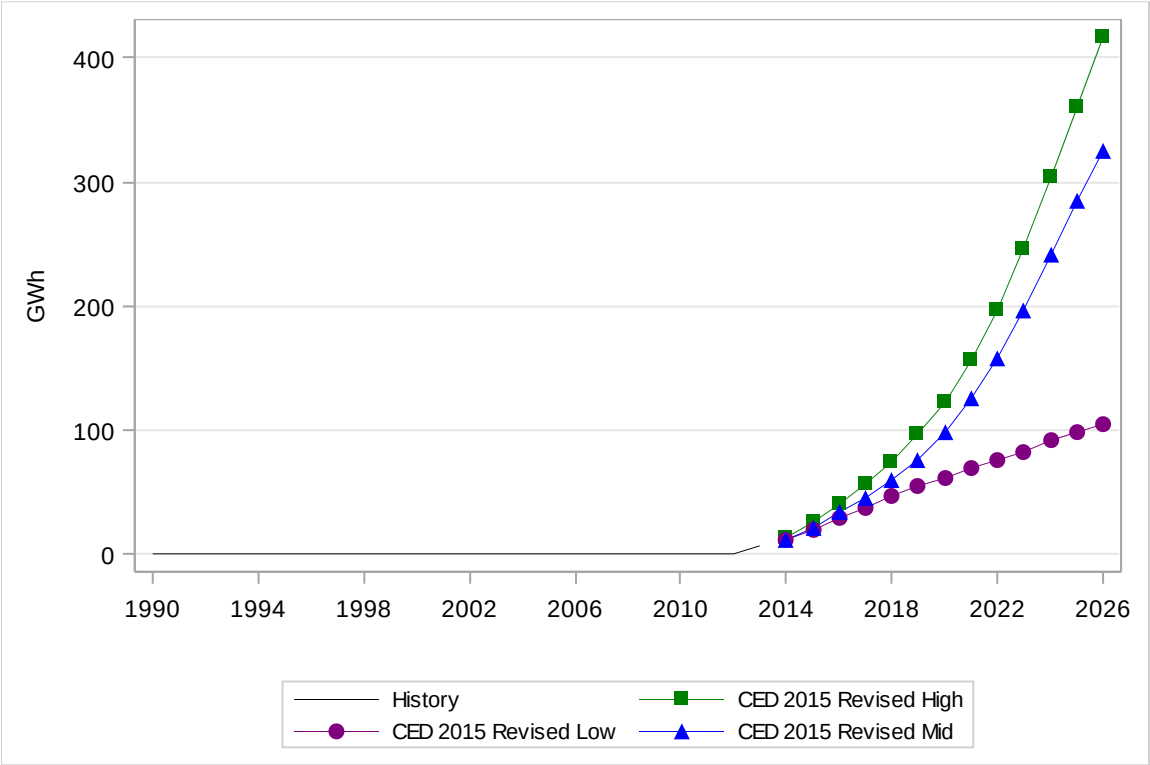


Source: California Energy Commission, Demand Analysis Office, 2015

Electric Vehicles

Consumption by EVs in the NCNC planning area is expected to increase to more than 98 gigawatt-hours (GWh) in the mid demand case by 2020. By the end of the forecast, consumption by EVs is projected to reach more than 104 GWh in the low demand case and nearly 417 GWh in the high demand case. **Figure 4-15** presents the NCNC planning area EV consumption forecast for each of the demand cases. More detail about the electric vehicle consumption demand cases is provided in Chapter 1 of Volume 1 of this report.

Figure 4-15: NCNC Electricity Consumption by Electric Vehicles



Source: California Energy Commission, Demand Analysis Office, 2015

Self-Generation

The peak demand forecast is reduced by the projected impacts of distributed PV, solar thermal, and CHP systems, including the effects of the Self-Generation Incentive Program (SGIP), California Solar Initiative (CSI), and other programs, as discussed in Volume 1. The effects of these programs are forecast based on a combination installation trend analysis and predictive modeling. **Table 4-3** shows the forecast of peak impacts from PV and non-PV self-generation. Staff projects between 117 and 316 MW of peak reduction from PV systems by 2026. NCNC peak reductions are based on installed PV capacity which is largely driven by SMUD. SMUD's installed capacity ranges from 200 to 584 MW.

Table 4-3: NCNC Planning Area Self-Generation Peak Impacts (MW)

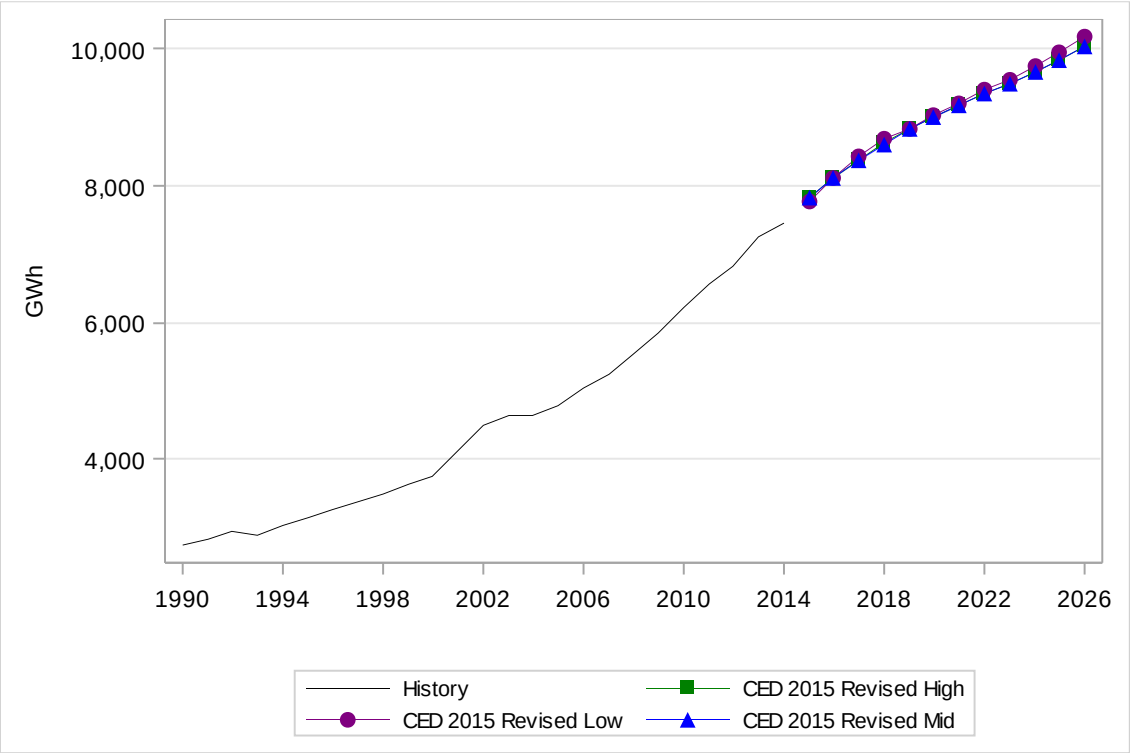
	***CED 2015 Revised* High Demand**		***CED 2015 Revised* Mid Demand**		***CED 2015 Revised* Low Demand**	
	Non-PV	PV	Non-PV	PV	Non-PV	PV
1990	-	-	-	-	-	-
2000	-	1	-	1	-	1
2010	0	20	0	20	0	20
2015	0	63	0	63	0	64
2020	2	89	2	103	2	128
2026	2	117	1	190	1	316

Source: California Energy Commission, Demand Analysis Office, 2015

Conservation/Efficiency Impacts

Figure 4-16 shows committed electricity consumption efficiency savings estimates from all sources, including building and appliance standards; utility programs implemented through 2015; and price and other effects, or savings associated with rate changes and certain market trends not directly related to programs or standards. Projected savings impacts are highest in the low demand case, since price and program effects are inversely related to the demand outcome. Within the demand cases, higher demand yields more standards savings since new construction and appliance usage increase, while lower demand is associated with more program savings and higher rates (and therefore more price effects). The net result is that savings totals among the cases are very similar. Though not shown here peak efficiency savings projections produce comparable results. Projected peak savings for NCNC ranges from 2,534 to 2,565 MW by 2026.

Figure 4-16: NCNC Planning Area Baseline Electricity Consumption Savings Estimates



Source: California Energy Commission, Demand Analysis Office, 2015

Table 4-4 presents estimated savings for building and appliance standards in the mid demand case for selected years. The standards savings estimates account for the 2016 appliance standards and recently approved federal standards that include standards for distribution transformers. Savings are measured against a baseline before 1975, so they incorporate more than 30 years of impacts. Volume 1, Chapter 2 provides more detail on staff work related to energy efficiency and conservation.

Table 4-4: NCNC Planning Area Baseline Standards Savings Estimates

Electricity Consumption Savings (GWh)							
	Residential			Commercial			
	Building Standards	Appliance Standards	Total	Building Standards	Appliance Standards	Total	Total Standards
1990	457	232	689	105	49	154	843
2000	732	607	1,339	274	119	392	1,731
2010	941	1,156	2,097	595	217	812	2,909
2014	1,049	1,669	2,718	696	262	958	3,676
2020	1,232	2,384	3,616	1,117	444	1,562	5,178
2026	1,391	2,762	4,153	1,524	590	2,115	6,268
Electricity Peak Demand Savings (MW)							
	Residential			Commercial			
	Building Standards	Appliance Standards	Total	Building Standards	Appliance Standards	Total	Total Standards
1990	173	88	262	29	14	43	305
2000	212	176	387	58	25	83	471
2010	288	354	643	149	54	203	846
2014	316	502	818	149	56	205	1,023
2020	368	711	1,079	242	93	335	1,413
2026	405	805	1,210	330	124	454	1,663

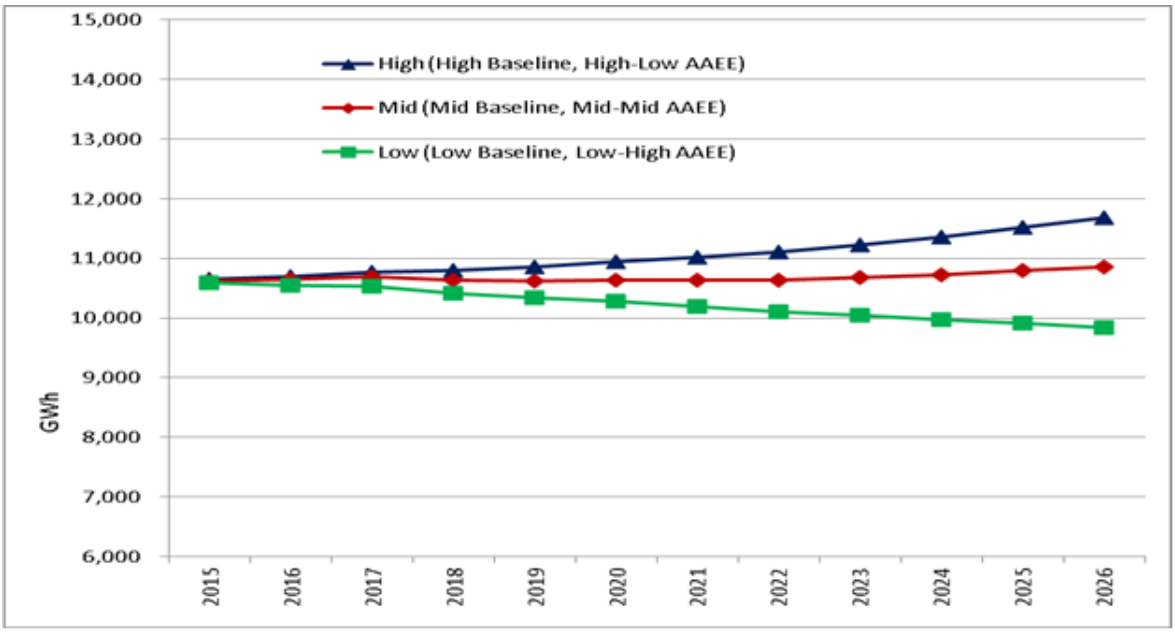
Source: California Energy Commission, Demand Analysis Office, 2015

Additional Achievable Energy Efficiency

For *CED 2015 Revised*, staff estimated AAEE savings for the SMUD service territory, the largest component of NCNC. Spreadsheets posted with this report[13] provide AAEE savings estimates for the SMUD service territory by sector and savings type (programs, standards) for energy and peak for each of three cases. **Figure 4-17** shows the low baseline sales forecast adjusted by a high AAEE savings scenario consistent with the assumptions of the low demand case (low-high), the mid baseline adjusted by a consistent mid AAEE scenario (mid-mid), and the high baseline adjusted by low AAEE savings (high-low). These parings were chosen to produce the maximum spread among managed sales forecasts for the SMUD service territory. **Figure 4-18** shows a similar set of adjusted peak demand forecasts. See Chapter 2 of Volume 1 of this report for details on these AAEE scenarios.

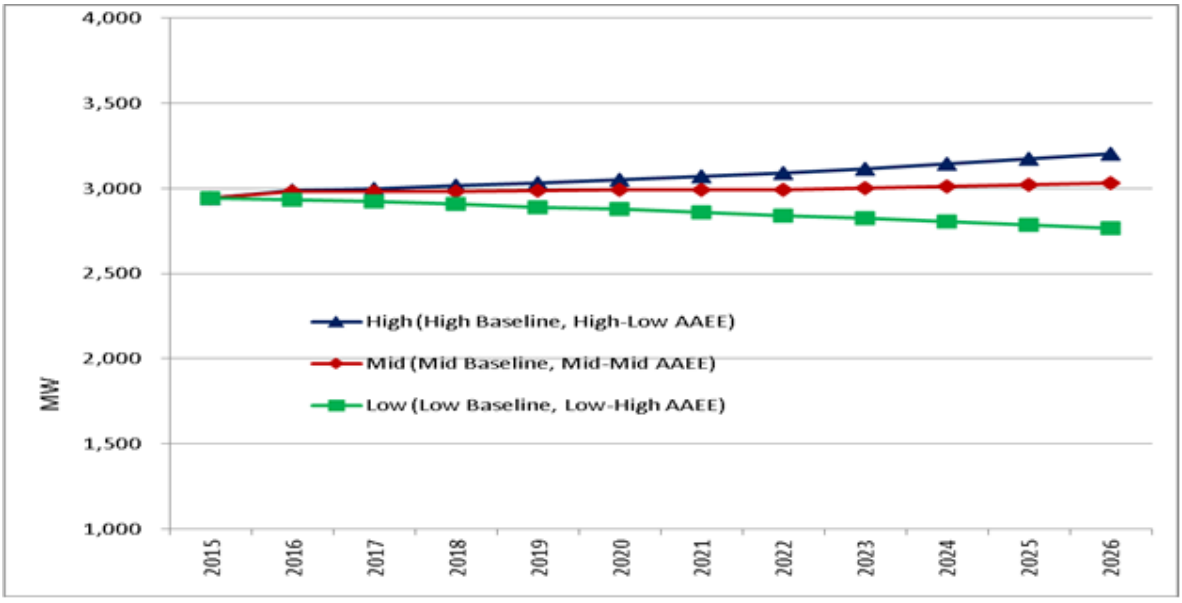
13 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Figure 4-17: SMUD Service Territory Adjusted Sales



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 4-18: SMUD Service Territory Adjusted Peak Demand



Source: California Energy Commission, Demand Analysis Office, 2015

Electrification

Increases in electricity use in California are expected to occur through electrification in the commercial, industrial, and transportation sectors. **Table 4-5** shows, for select years, the portion of these impacts that are anticipated in the NCNC planning area. For more details, see Volume 1, Chapter 1.

Table 4-5: NCNC Planning Area Electrification Impacts

	Additional Consumption (GWh)		
	CED 2015 Revised **High Demand**	***CED 2015 Revised*** **Mid Demand**	***CED 2015 Revised*** **Low Demand**
2016	4.6	2.7	0.1
2020	26.6	15.0	0.7
2026	63.2	29.8	1.7

Source: California Energy Commission, Demand Analysis Office, 2015

Forecast Zone Forecasts

For *CED 2015 Revised*, staff developed electricity consumption and peak demand forecasts for individual climate zones (see Volume 1, Chapter 1 for more details). The NCNC planning area has three climate zones, each with a designated weather station, as shown in **Table 4-6**.

Table 4-6: NCNC Planning Area Forecast Zones

Forecast Zone	Counties Included
13. SMUD Service Territory	Sacramento
14. Turlock Irrigation District	Merced, Stanislaus, Tuolumne
15. Rest of BANC Control Area	Merced, Placer, San Joaquin, Shasta, Stanislaus,

Source: California Energy Commission, Demand Analysis Office, 2015

Table 4-7 shows the forecast results for electricity consumption and peak demand by forecast zone for each demand case. Full forecast zone results are shown in the forms posted alongside this report.[14]

The fastest growth in for consumption is expected in the SMUD service territory, due to more population and household growth relative to the other components of NCNC. Forecast Zone 15, which is BANC excluding SMUD and Turlock Irrigation District, is expected to have the slowest growth. As for peak demand, Forecast Zone 15 is expected to have the highest growth in peak demand resulting from less solar PV adoption in comparison to the other two NCNC forecast zones.

14 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Table 4-7: NCNC Planning Area Climate Zone Forecast Results

		Consumption by Forecast Zone (GWh)			Peak Demand by Forecast Zone (MW)		
		13	**14**	**15**	**13**	**14**	**15**
***CED 2015 Revised* High Demand**	2014	10,728	2,495	5,210	3,003	609	1,354
	2015	10,976	2,552	5,297	2,943	623	1,498
	2020	11,911	2,740	5,661	3,185	686	1,621
	2026	12,970	3,000	6,181	3,450	753	1,763
	Annual Growth 2014 - 2020	1.76%	1.57%	1.39%	0.98%	1.99%	3.05%
	Annual Growth 2014 - 2026	1.59%	1.55%	1.43%	1.16%	1.78%	2.22%
***CED 2015 Revised* Mid Demand**	2014	10,728	2,495	5,210	3,003	609	1,354
	2015	10,958	2,547	5,288	2,943	623	1,498
	2020	11,758	2,692	5,584	3,150	676	1,603
	2026	12,611	2,892	6,003	3,335	723	1,709
	Annual Growth 2014 - 2020	1.54%	1.27%	1.16%	0.80%	1.75%	2.85%
	Annual Growth 2014 - 2026	1.36%	1.24%	1.19%	0.88%	1.44%	1.96%
***CED 2015 Revised* Low Demand**	2014	10,728	2,495	5,210	3,003	609	1,354
	2015	10,924	2,529	5,259	2,943	623	1,498
	2020	11,506	2,615	5,446	3,044	653	1,556
	2026	12,039	2,744	5,731	3,083	667	1,607
	Annual Growth 2014 - 2020	1.17%	0.79%	0.74%	0.23%	1.15%	2.34%
	Annual Growth 2014 - 2026	0.97%	0.80%	0.80%	0.22%	0.75%	1.44%

Source: California Energy Commission, Demand Analysis Office, 2015

CHAPTER 5:
Los Angeles Department of Water and Power

The Los Angeles Department of Water and Power (LADWP) planning area includes LADWP bundled retail customers and customers served by energy service providers using the LADWP distribution system to deliver electricity to end users.

This chapter is organized as follows. First, forecasted consumption and peak loads for the LADWP planning area are discussed; both total and per capita values are presented. Second, the chapter presents sector consumption and peak load forecasts. The residential, commercial, industrial, and "other" sector forecasts are compared. Third, the chapter discusses the forecasts of electric vehicles, self-generation, the impacts of conservation and efficiency programs, and additional achievable energy efficiency. Finally, forecasts of electricity consumption and peak demand are presented for each climate zone within the LADWP planning area.

Baseline Forecast Results

For this forecast, three demand cases were developed. The high demand case includes high economic and demographic projections, low energy price projections, and low efficiency impact assumptions. The low demand case includes low economic and demographic projections, high energy price projections, and high efficiency impact assumptions. Volume 1 provides more detail on the construction of the demand cases.

Table 5-1 compares *CED 2015 Revised* high, mid, and low demand cases. Comprehensive results are available electronically as a set of forms posted alongside this report.[15] In the LADWP planning area, the *CED 2015 Revised* high and mid demand cases for electricity consumption are growing at average annual rates of 0.75 and 0.36, respectively, out to 2020. The low demand case in contrast is growing at a negative rate of .14 percent over the same seven-year period. When comparing case growth out to 2026 though, all cases maintain positive growth. By 2026, high, mid, and low demand cases project 28,385, 27,188, and 25,425 GWh of energy consumption, respectively.

Peak demand projections shown in **Table 5-2** begin with a weather-normalized value of 5,999 MW in 2015. Peak demand growth patterns are similar to consumption, except for the low demand case. Peak demand in the low case is expected to decrease by 0.31 percent annually over the forecast period from 2015 to 2026, resulting in 5,799 MW of

15 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

peak demand. The high and mid demand cases are expected to reach 6,662 and 6,373 MW of peak demand, respectively, by 2026.

Table 5-1: LADWP Planning Area Baseline Consumption

	Recorded Consumption (GWh)	Forecast		
		***CED 2015 Revised* High**	***CED 2015 Revised* Mid**	***CED 2015 Revised* Low**
1990	23,038			
2000	24,014			
2010	24,304			
2014	24,937			
2020		26,076	25,487	24,734
2026		28,385	27,188	25,425
Average Annual Growth Rates				
1990 - 2000	0.42%			
2000 - 2010	0.12%			
2010 - 2014	0.64%			
2014 - 2020		0.75%	0.36%	-0.14%
2014 - 2026		1.09%	0.72%	0.16%

Source: California Energy Commission, Demand Analysis Office, 2015

Table 5-2: LADWP Planning Area Baseline Peak Demand

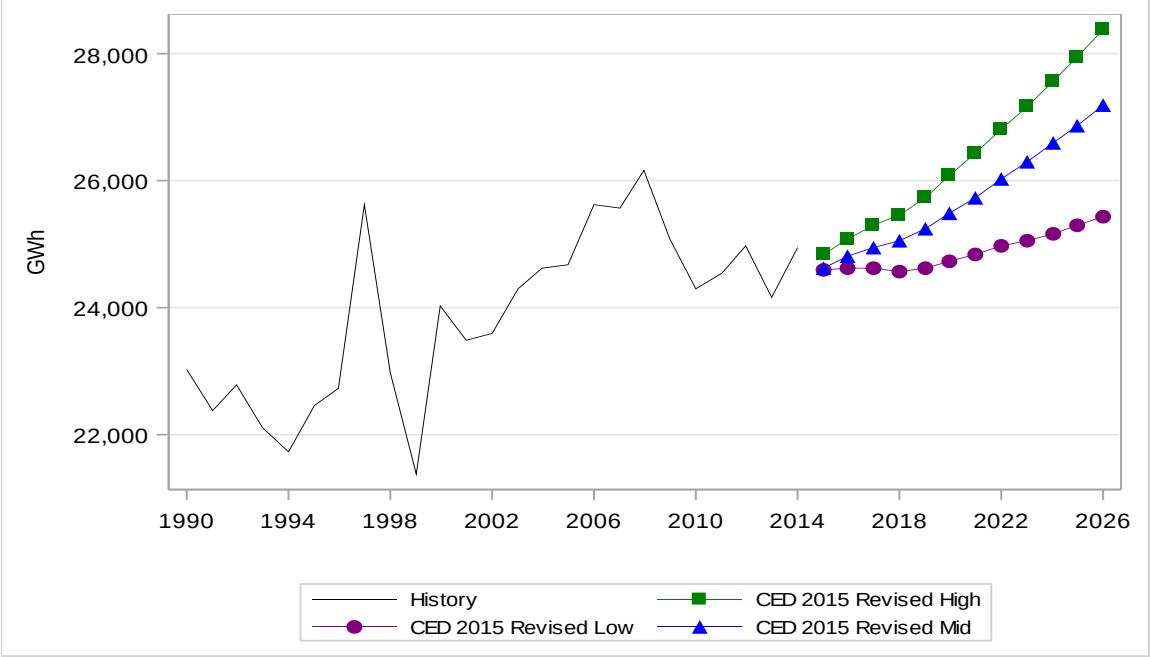
	Recorded Peak (MW)	Forecast		
		***CED 2015 Revised* High**	***CED 2015 Revised* Mid**	***CED 2015 Revised* Low**
1990	5,341			
2000	5,344			
2010	6,142			
2015	6,234			
2015*		5,999	5,999	5,999
2020		6,261	6,163	5,909
2026		6,662	6,373	5,799
Average Annual Growth Rates				
1990-2000	0.01%			
2000-2010	1.40%			
2010-2015	0.30%			
2015*-2020		0.86%	0.54%	-0.30%
2015*-2026		0.96%	0.55%	-0.31%

*Weather Normalized 2015 Historical Peak Demand

Source: California Energy Commission, Demand Analysis Office, 2015

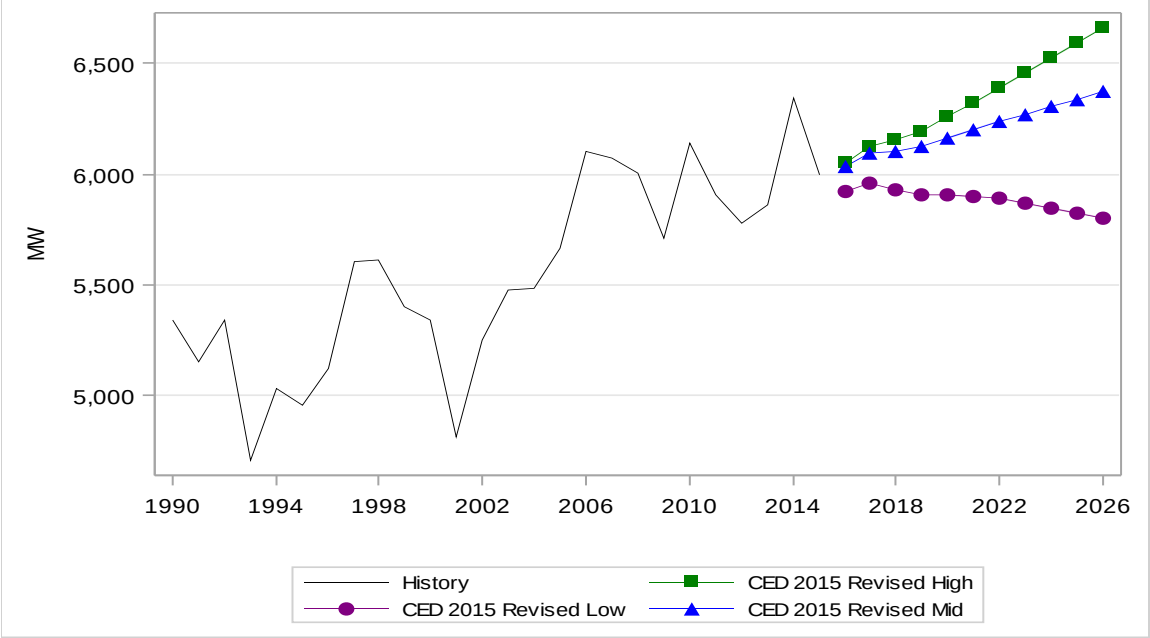
A graphical comparison of the three demand cases for LADWP consumption is shown in **Figure 5-1**.The relationship between peak demand cases, shown in **Figure 5-2**, follows a similar pattern as the consumption forecast, except for the decreasing peak demand apparent in the low demand case.

Figure 5-1: LADWP Planning Area Baseline Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

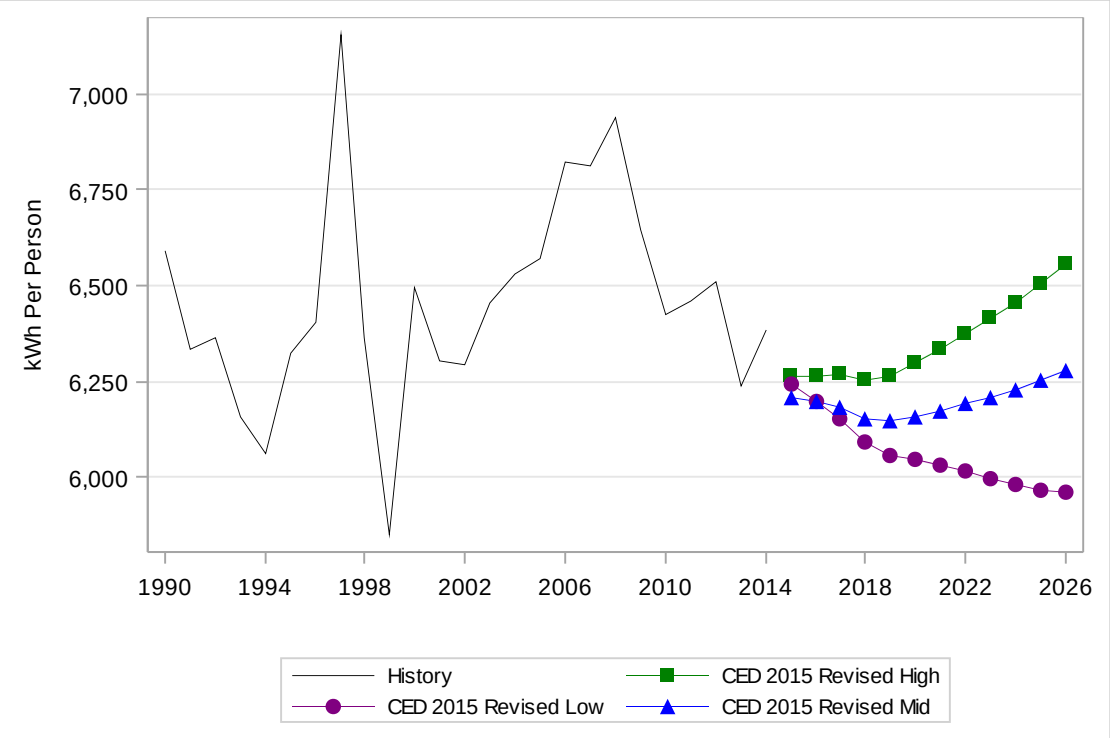
Figure 5-2: LADWP Planning Area Baseline Peak



Source: California Energy Commission, Demand Analysis Office, 2015

As **Figure 5-3** shows per capita electricity consumption in the high and mid demand cases show similar growth patterns due to the identical population projections but differing assumptions for consumption growth for these cases. Although by 2020 there is positive growth for both cases, the average annual rate of growth for the high and mid demand cases are .22 and -.14 percent, respectively, from 2014 to 2026. By 2026, high case results in nearly 6,600 kilowatt-hours (kWh) per person and the mid case results in just less than 6,300 kWh per person. In comparison to the high and mid cases, the low demand case assumes lower population growth and lower consumption. Therefore, the low demand case maintains negative growth at an annual rate of about -0.6 percent over the forecast period, projecting almost 6,000 kWh per person by 2026.

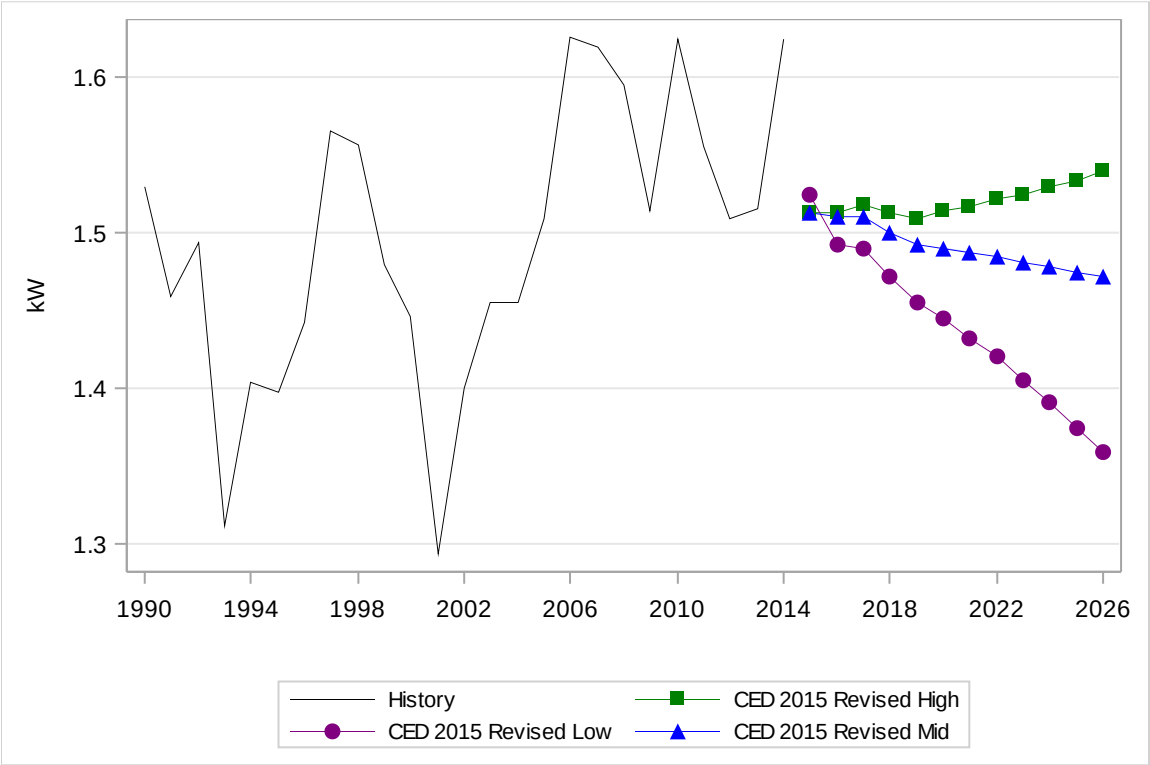
Figure 5-3: LADWP Planning Area Baseline per Capita Electricity Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 5-4 shows per capita peak demand. *CED 2015 Revised* per capita peak cases are calculated similar to consumption per capita. The high and mid demand cases assume the same population growth and differing peak demand growth assumptions while the low demand case assumes less growth for both population and peak demand in comparison. By 2026, the high and mid cases are both near 1.5 kilowatt (kW) per person while the low cases is just under 1.4 kW per person.

Figure 5-4: LADWP Planning Area Baseline Per Capita Peak Demand



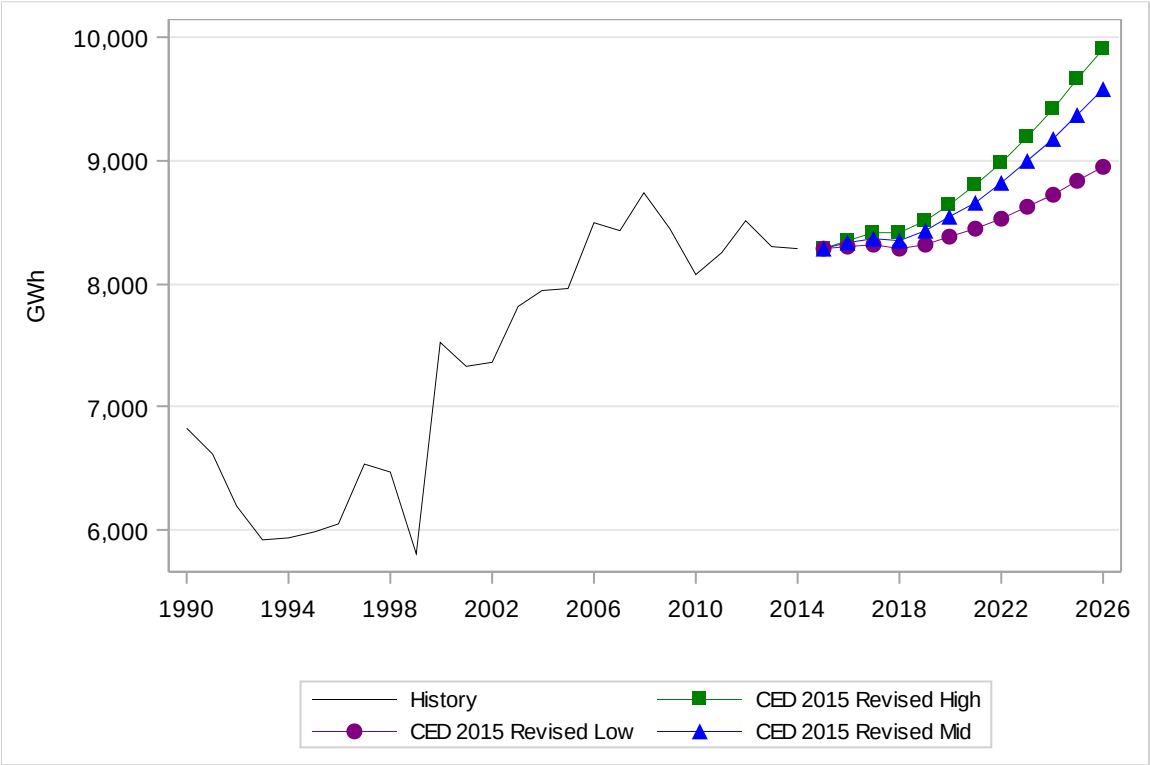
Source: California Energy Commission, Demand Analysis Office, 2015

Sector Level Results and Input Assumptions

Residential Sector

Figure 5-5 compares the *CED 2015 Revised* demand cases for LADWP. In the early part of the forecast period growth remains slow in all demand cases but by 2018, stronger positive growth is expected. From 2014 to 2026 average annual growth rates are expected to be 1.5, 1.2, and 0.6 percent for the high, mid, and, low demand cases, respectively. By 2026, the mid demand case reaches about 6,500 GWh of residential consumption.

Figure 5-5: LADWP Planning Area Baseline Residential Consumption

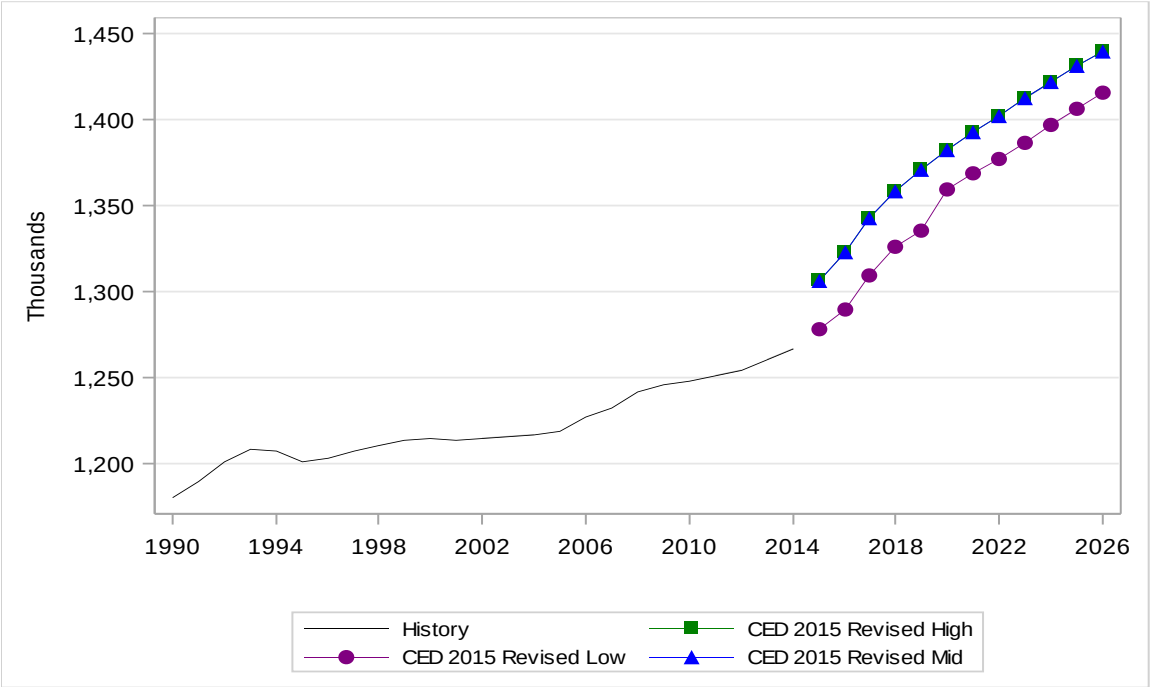


Source: California Energy Commission, Demand Analysis Office, 2015

Figure 4-6 and **Figure 4-7** show the household and persons-per-household projections used to drive the *CED 2015 Revised* residential forecasts. Each figure shows only two distinct cases. This is because the IHS Global Insight *Optimistic* scenario and the Moody's Analytics *Baseline* scenario were very similar, so the latter was used to represent both the high and mid cases. The low household and persons-per-household scenarios were provided by the California Department of Finance (DOF). The *CED 2015 Revised* high and mid demand cases are growing at an average annual rate of 1.1 percent from 2014 through 2026. The low *CED 2015 Revised* case is growing at 0.9 percent over the same period.

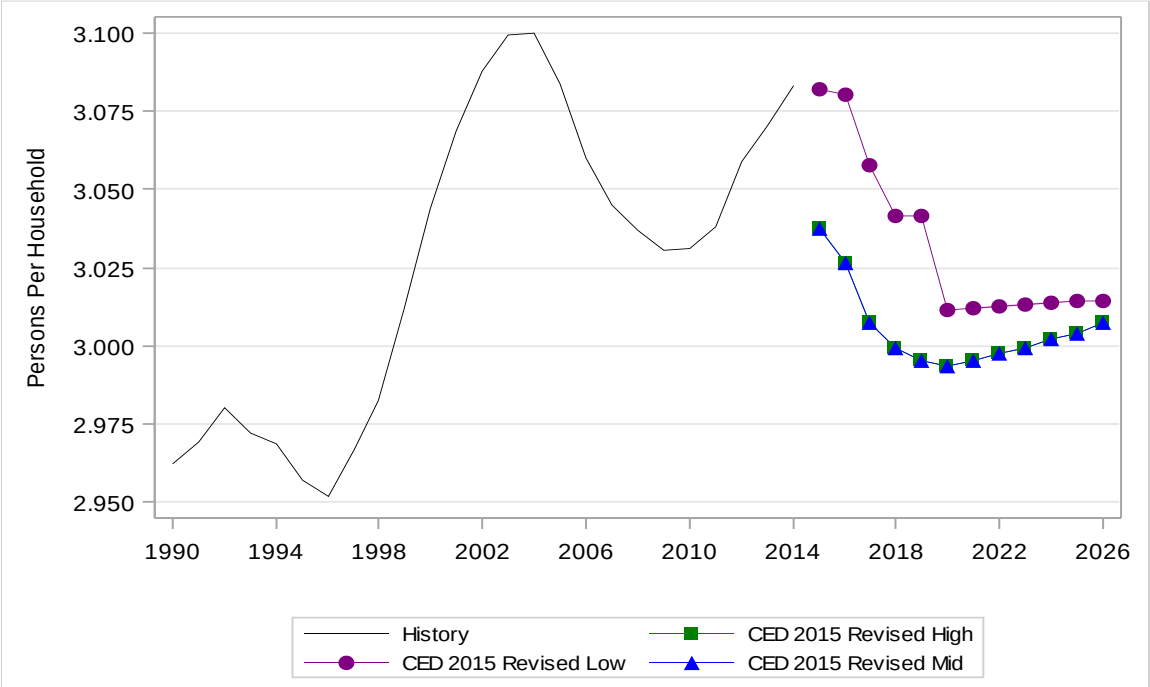
Due to the identical population and household growth for the high and mid demand cases, staff also arrives at identical high and mid cases for persons per household projections. The combined high and mid demand cases show declining persons per household projections beginning with 3.1 persons per household in 2014 and 3.0 persons per household by 2020. By 2026 these cases are projected to be near 3.0 persons per household. In comparison to the high and mid demand cases, the low demand case begins at a higher point but with similar near term decline and growth near the end of the forecast period. The higher projection for the low case is due to slower household growth relative to population growth assumed for the low demand case.

Figure 5-6: LADWP Planning Area Residential Household Projections



Source: California Energy Commission, Demand Analysis Office, 2015

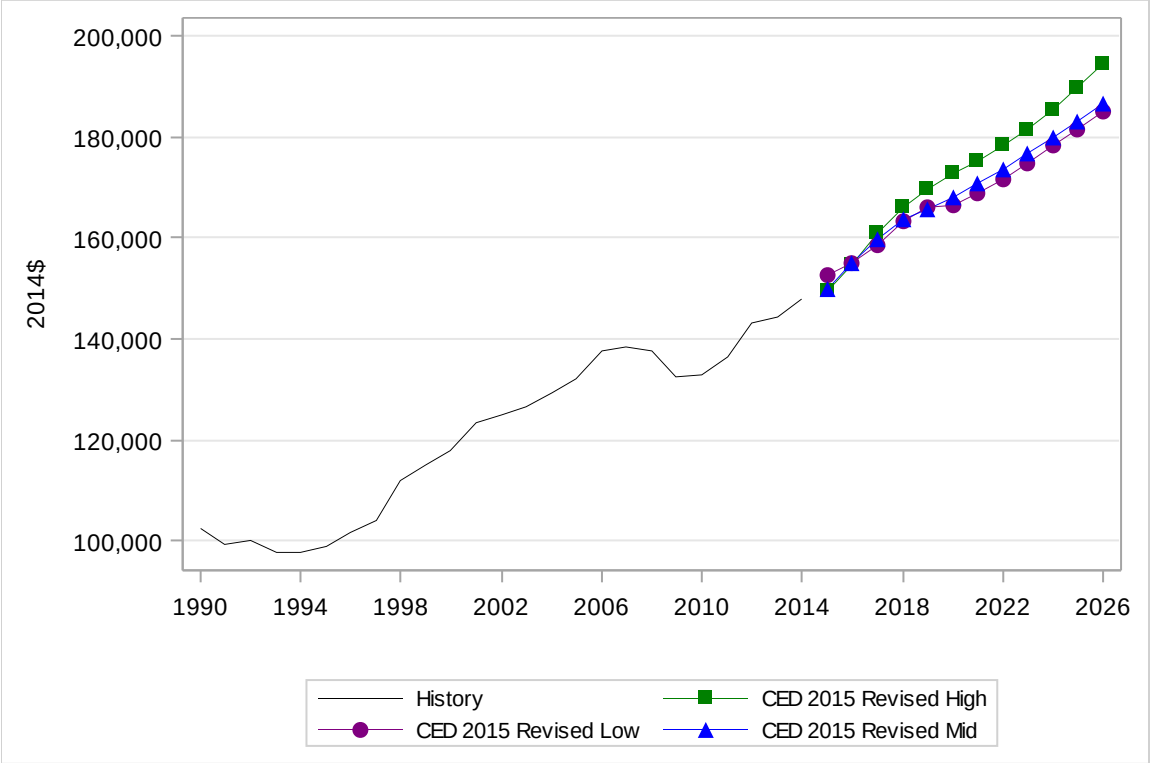
Figure 5-7: LADWP Planning Area Persons per Household Projections



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 5-8 compares average household income in the three demand cases. Due to the higher persons per household projection in the low demand case, the low case for household income exceeds the high and mid case at the beginning of the forecast period in 2015. Over the entire forecast period from 2014 to 2026 though, the high, mid and, low cases grow at average annual rates of 2.3, 2.0 and 1.9 percent, respectively.

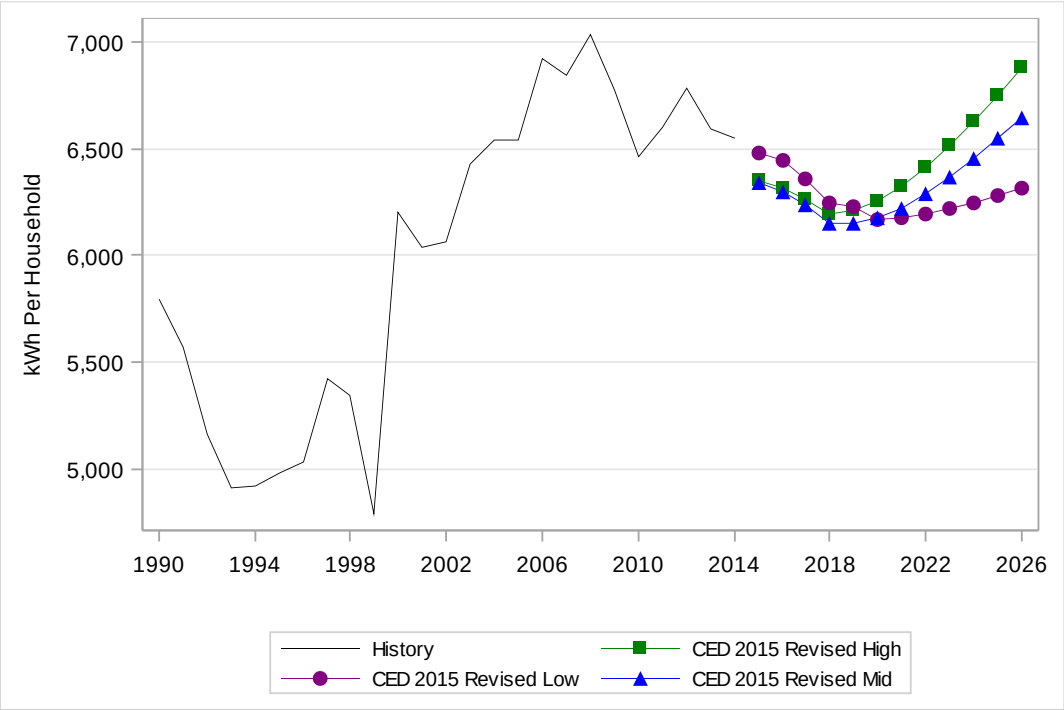
Figure 5-8: LADWP Planning Area Average Household Income Projections



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 5-9 compares electricity consumption per household for the three demand cases. The high and mid demand cases show similar trends though they are starting at different levels. In comparison to high and mid cases the low case uses a higher person per household projection. This difference is enough to result in higher consumption for the low case in the beginning of the forecast period. As the difference between the persons per household projected for the high, mid and, low cases decreases later in the forecast, the increasing number of electric vehicles causes consumption per household to increase in the high and mid cases. In contrast, the low case assumes a much smaller number of electric vehicles and thus consumption per household remains flat for this case out to 2026.

Figure 5-9: LADWP Planning Area Baseline Electricity Consumption per Household

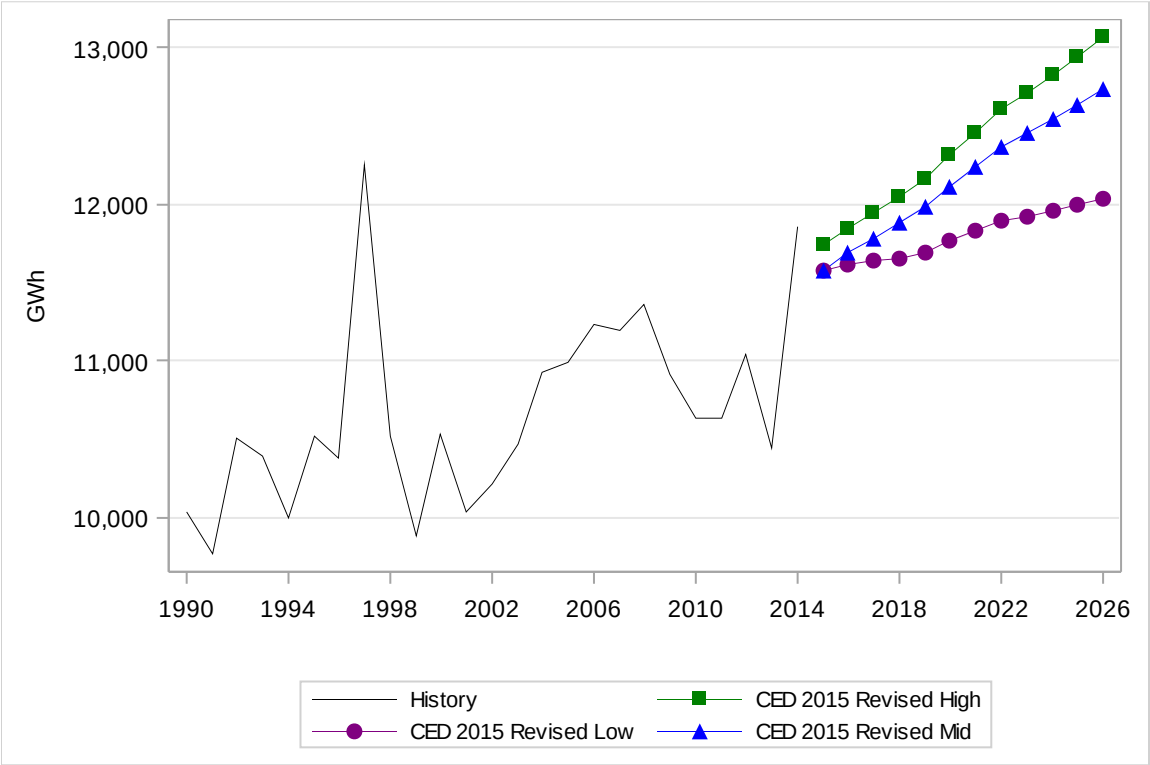


Source: California Energy Commission, Demand Analysis Office, 2015

Commercial Sector

Figure 5-10 compares the LADWP commercial sector electricity consumption forecast cases. The differences between the cases are primarily driven by the differing assumptions for commercial floor space growth across the three cases. From 2014 to 2026 the high, mid, and low demand cases are growing at an average annual rate of 0.8, 0.6 and .1 percent, respectively. Mid demand commercial consumption is projected to exceed 12,700 GWh by 2026.

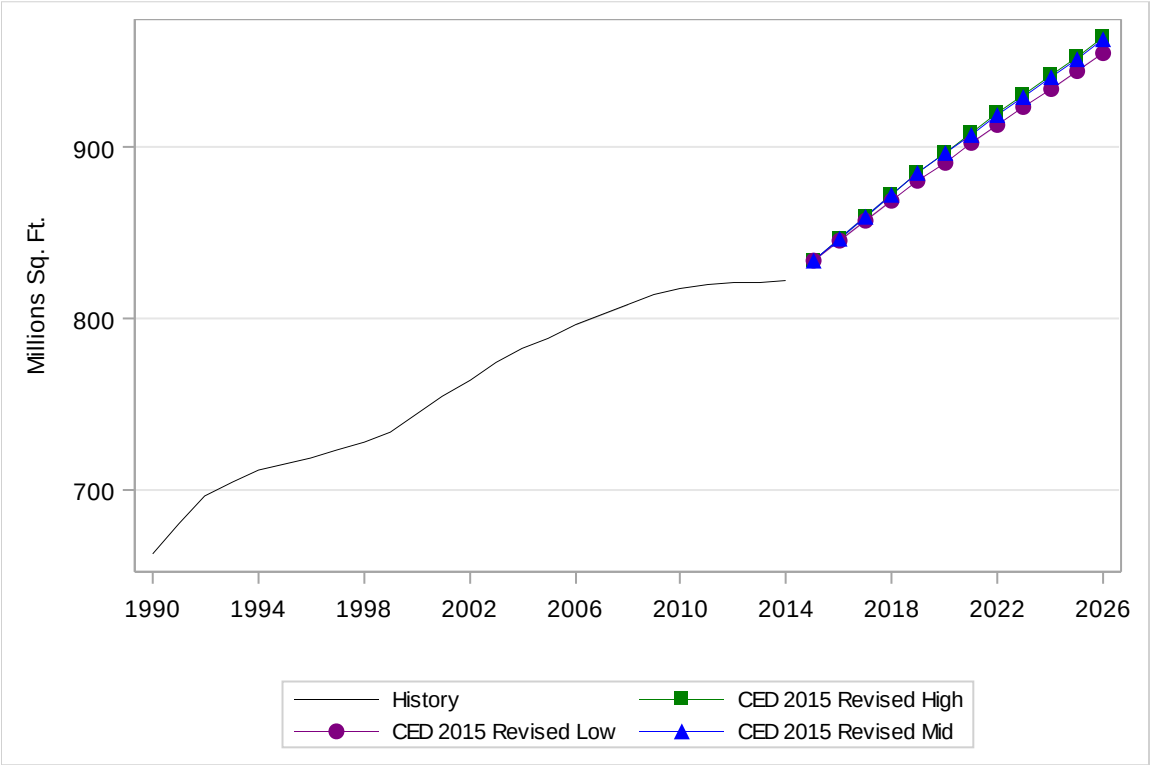
Figure 5-10: LADWP Planning Area Baseline Commercial Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

In staff's commercial building sector forecasting model, floor space by building type (such as retail, offices, and schools) is the key driver. **Figure 5-11** compares LADWP commercial floor space projections for each of the demand cases. The economic drivers in the high, mid, and low cases produced very similar results when projecting commercial floor space. Across the three cases the average annual growth rates from 2014 to 2026 range from 1.26 to 1.34 percent. Commercial floor space in the mid demand cases is expected to reach over 960 million square feet by 2026.

Figure 5-11: LADWP Planning Area Commercial Floor Space

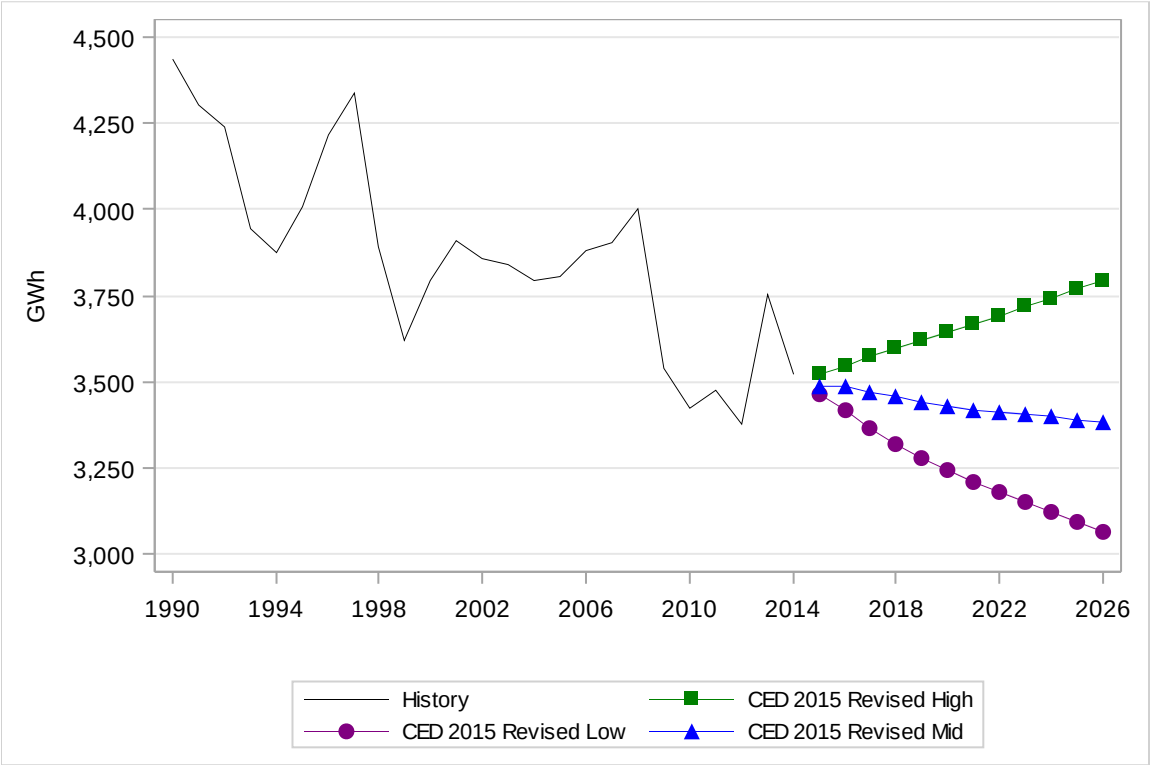


Source: California Energy Commission, Demand Analysis Office, 2015

Industrial Sector

Figure 5-12 compares the LADWP planning area industrial sector electricity consumption forecast cases. The mid and low demand cases have negative growth through 2026. Beginning in 2014, the projected average annual growth rates for the mid and low demand cases to the end of the forecast period are -0.3 and -1.2 percent, respectively. The mid demand case forecast projects roughly 3,400 GWh of industrial consumption by 2026. In comparison, the high demand case projects positive growth at an average annual rate of 0.6 percent, resulting 400 more GWh of consumption by 2026. The differences in consumption cases are mainly driven by differences in economic output.

Figure 5-12: LADWP Planning Area Baseline Industrial Consumption

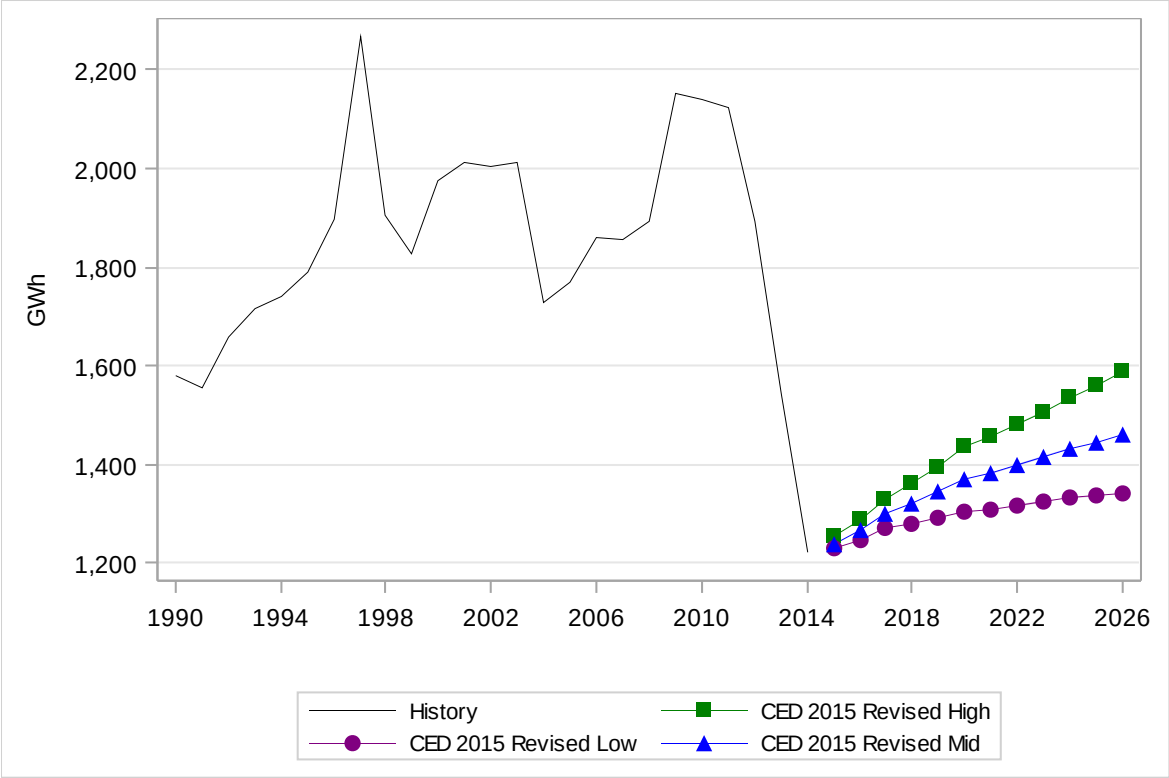


Source: California Energy Commission, Demand Analysis Office, 2015

Other Sectors

Figure 5-13 compares the electricity consumption demand cases for the TCU sector, which includes street lighting. Differences in demand cases are primarily driven by assumptions for economic growth and employment. From 2014 to 2026 the high, mid and low demand cases grow at average annual rates of 2.2, 1.5, and 0.8 percent, respectively. By 2026, the mid demand case projects about 1,500 GWh of consumption for the TCU sector including street lighting. Although there is a reduction in street lighting consumption due to light-emitting diode (LED) conversion, LADWP has reported Quarterly Fuel and Energy Report (QFER) data issues that likely influence the significant drop in consumption for this sector. Therefore, these cases are best estimates given this issue.

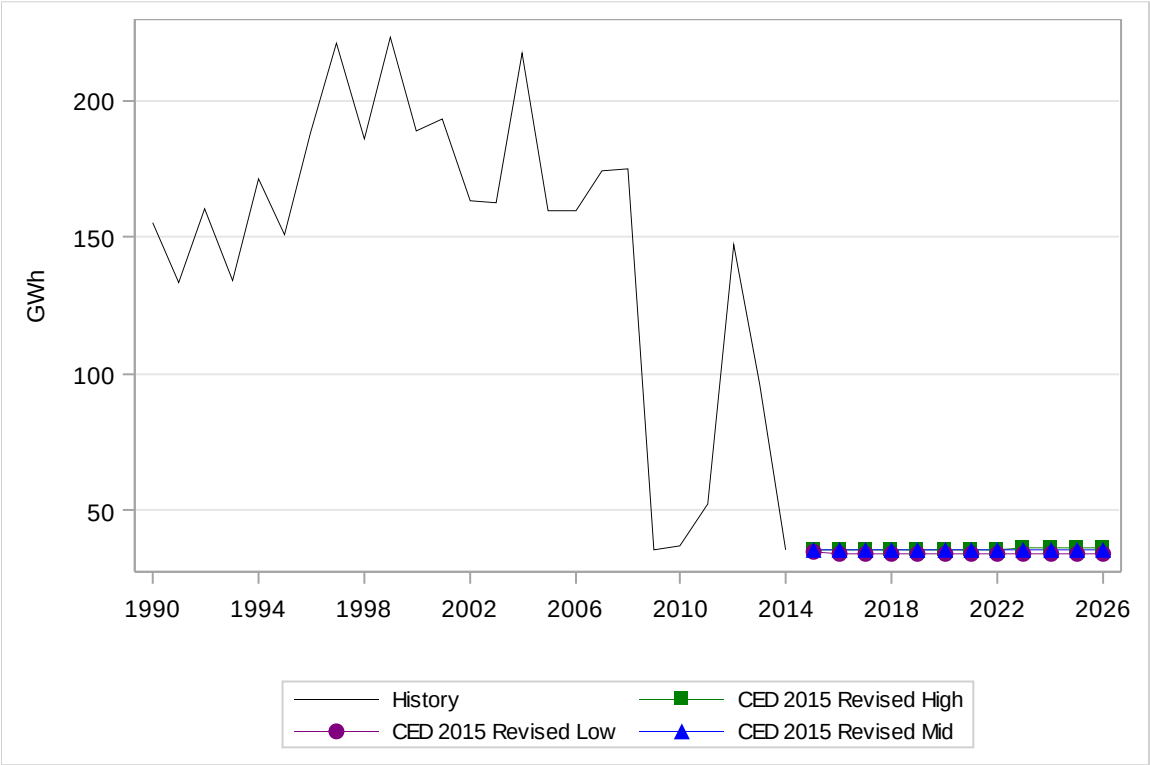
Figure 5-13: LADWP Planning Area Baseline Transportation, Communication, Utilities, and Street Lighting Consumption



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 5-14 compares the electricity consumption demand cases for the agriculture and water pumping sectors. All three demand cases are projected to remain flat out to 2026. Agriculture and water pumping consumption is expected to range from 34 to 36 GWh by 2026. As mentioned earlier, LADWP has reported some QFER data issues; therefore, these cases are best estimates.

Figure 5-14: LADWP Planning Area Baseline Agriculture and Water Pumping Consumption

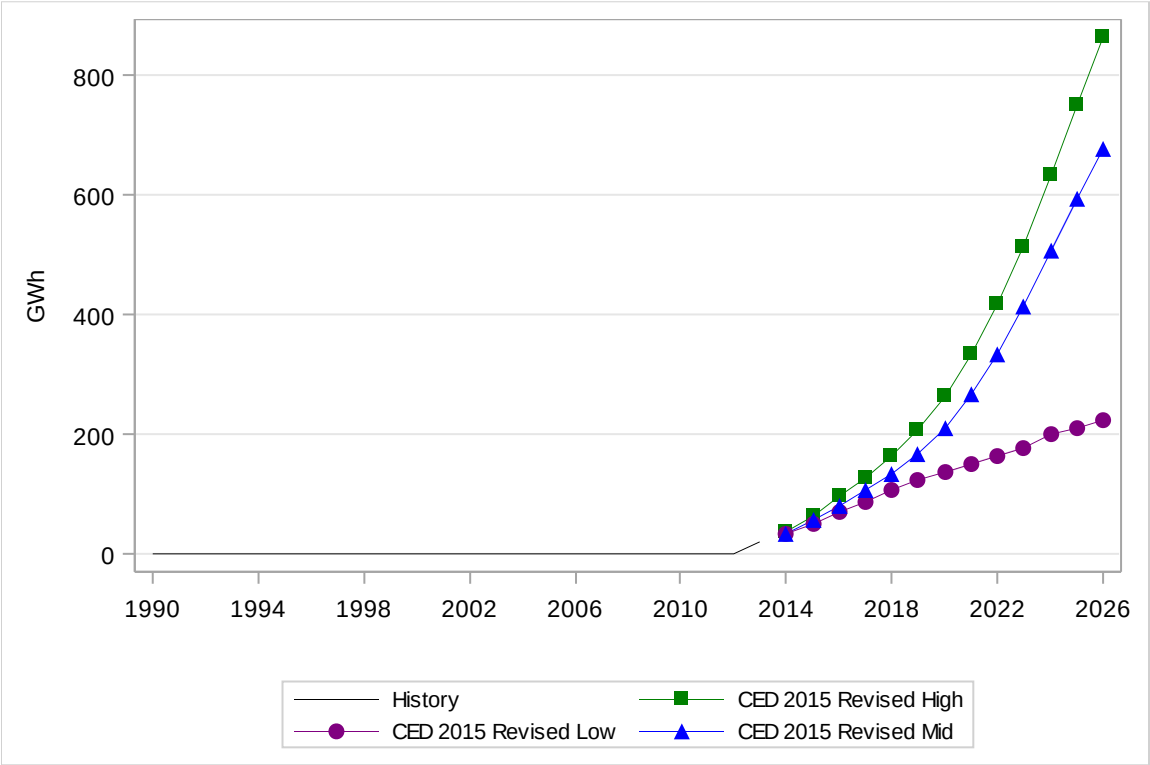


Source: California Energy Commission, Demand Analysis Office, 2015

Electric Vehicles

Consumption by EVs in the LADWP planning area is expected to increase to more than 213 GWh by 2020. By the end of the forecast period, consumption by EVs is projected to reach more than 137 GWh in the low demand case and nearly 265 GWh in the high demand case. **Figure 5-15** presents the LADWP planning area EV consumption forecast for each of the demand cases. More detail about the electric vehicle consumption demand cases is provided in Volume 1, Chapter 1 of this report.

Figure 5-15: LADWP Electricity Consumption by Electric Vehicles



Source: California Energy Commission, Demand Analysis Office, 2015

Self-Generation

The peak demand forecast is reduced by the projected impacts of distributed PV, solar thermal, and CHP systems, including the effects of the SGIP, CSI, and other programs, as discussed in Volume 1. The effects of these programs are forecast based on a combination installation trend analysis and predictive modeling.

Table 5-3 shows the forecast of peak impacts from PV and non-PV self-generation. Staff projects between 124 and 338 MW of peak reduction from PV systems by 2026. Peak reductions are based on installed PV system capacities ranging from 293 MW by 2026 in the high demand case to 778 MW by 2026 in the low demand case.

Table 5-3: LADWP Planning Area Self-Generation Peak Impacts (MW)

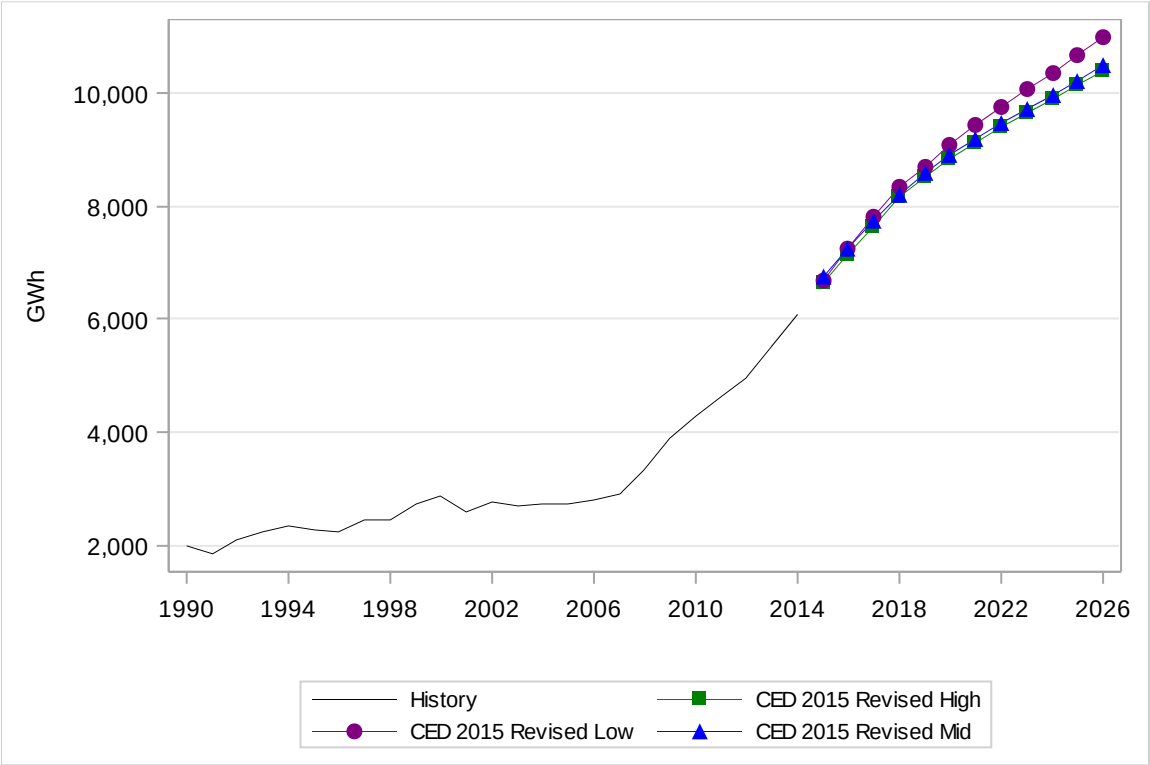
	***CED 2015 Revised* High Demand**		***CED 2015 Revised* Mid Demand**		***CED 2015 Revised* Low Demand**	
	Non-PV	PV	Non-PV	PV	Non-PV	PV
1990	148	-	148	-	148	-
2000	197	0	197	0	197	0
2010	214	15	214	15	214	15
2015	211	57	211	58	211	59
2020	231	85	231	102	230	135
2026	238	124	237	201	235	338

Source: California Energy Commission, Demand Analysis Office, 2015

Conservation/Efficiency Impacts

Figure 5-16 shows committed electricity consumption efficiency savings estimates from all sources, including building and appliance standards; utility programs implemented through 2015; and price and other effects, or savings associated with rate changes and certain market trends not directly related to programs or standards. Projected savings impacts are highest in the low demand case, since price and program effects are inversely related to the demand outcome. Within the demand cases, higher demand yields more standards savings since new construction and appliance usage increase, while lower demand is associated with more program savings and higher rates (and therefore more price effects). The net result is that savings totals among the cases are very similar. Though not shown here peak efficiency savings projections produce comparable results. Projected peak savings for LADWP ranges from 2,265 to 2,361 MW by 2026.

Figure 5-16: LADWP Planning Area Baseline Electricity Consumption Savings Estimates



Source: California Energy Commission, Demand Analysis Office, 2015

Table 5-4 presents estimated savings for building and appliance standards in the mid demand case for selected years. The standards savings estimates account for the 2016 appliance standards and recently approved federal standards that include standards for distribution transformers. Savings are measured against a baseline before 1975, so they incorporate more than 30 years of impacts. Volume 1, Chapter 2 provides more detail on staff work related to energy efficiency and conservation.

Table 5-4: LADWP Planning Area Baseline Standards Savings Estimates

Electricity Consumption Savings (GWh)							
	Residential			Commercial			
	Building Standards	Appliance Standards	Total	Building Standards	Appliance Standards	Total	Total Standards
1990	233	253	487	170	96	266	753
2000	292	711	1,002	337	192	530	1,532
2010	262	1,312	1,575	711	338	1,049	2,624
2014	336	2,015	2,351	905	434	1,338	3,689
2020	461	2,961	3,422	1,591	762	2,353	5,776
2026	558	3,398	3,957	2,239	1,022	3,262	7,218
Electricity Peak Demand Savings (MW)							
	Residential			Commercial			
	Building Standards	Appliance Standards	Total	Building Standards	Appliance Standards	Total	Total Standards
1990	57	61	118	30	17	47	165
2000	72	176	249	67	38	105	353
2010	66	332	398	136	65	201	599
2014	89	533	622	168	80	248	869
2020	122	787	909	296	141	436	1,345
2026	146	888	1,033	417	189	606	1,639

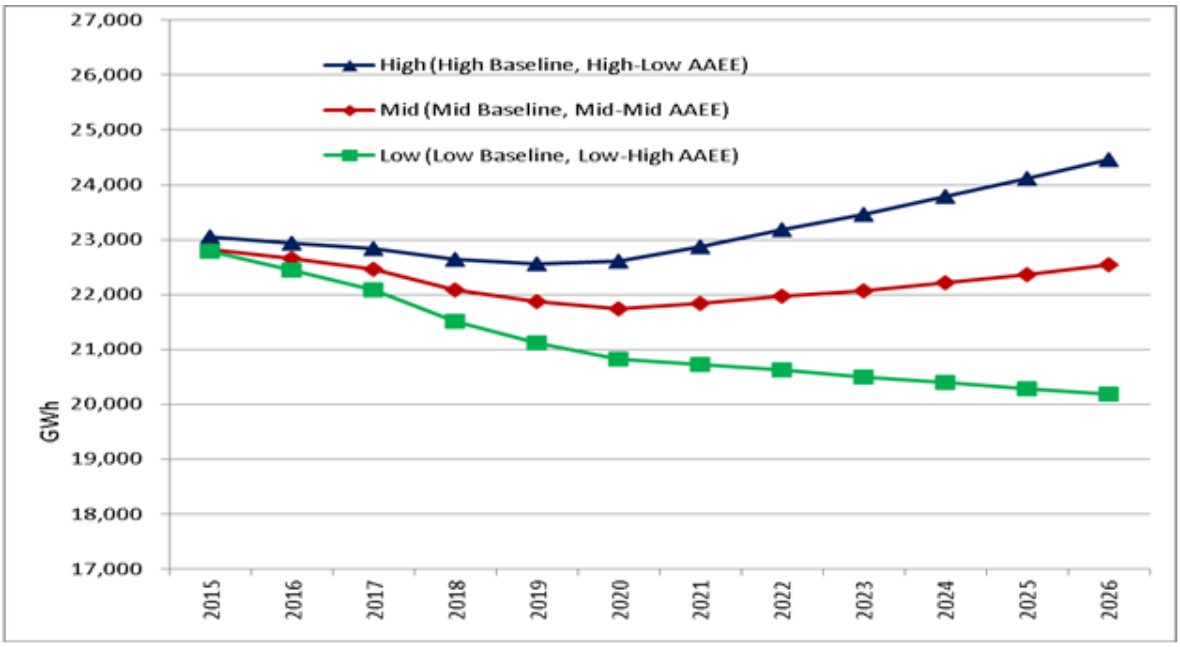
Source: California Energy Commission, Demand Analysis Office, 2015

Additional Achievable Energy Efficiency

For *CED 2015 Revised*, staff estimated AAEE savings for the LADWP service territory. Spreadsheets posted with this report[16] provide AAEE savings estimates for the LADWP service territory by sector and savings type (programs, standards) for energy and peak for each of three cases. **Figure 5-17** shows the low baseline sales forecast adjusted by a high AAEE savings scenario consistent with the assumptions of the low demand case (low-high), the mid baseline adjusted by a consistent mid AAEE scenario (mid-mid), and the high baseline adjusted by low AAEE savings (high-low). These parings were chosen to produce the maximum spread among managed sales forecasts for the LADWP service territory. **Figure 5-18** shows a similar set of adjusted peak demand forecasts. See Chapter 2 of Volume 1 of this report for details on these AAEE scenarios.

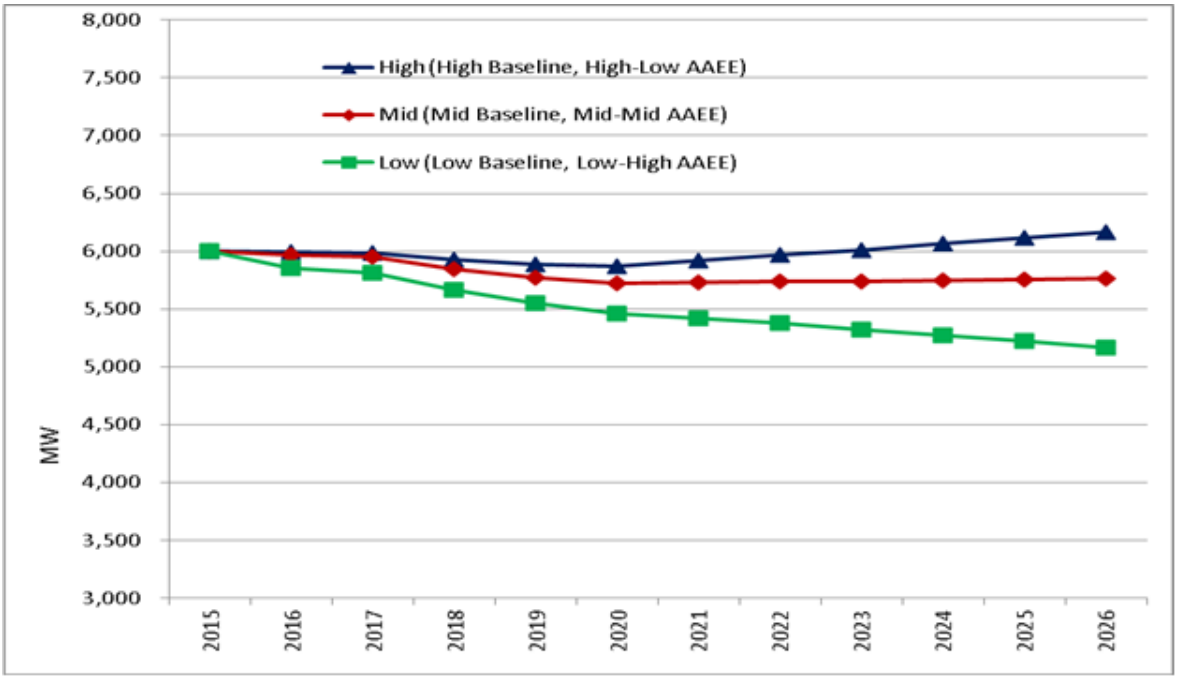
16 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015

Figure 5-17: LADWP Service Territory Adjusted Sales



Source: California Energy Commission, Demand Analysis Office, 2015

Figure 5-18: LADWP Service Territory Adjusted Peak Demand



Source: California Energy Commission, Demand Analysis Office, 2015

Electrification

Increases in electricity use in California are expected to occur through electrification in the commercial, industrial, and transportation sectors. **Table 5-5** shows, for select years, the portion of these impacts that are anticipated in the LADWP planning area. For more details, see Volume 1, Chapter 1.

Table 5-5: LADWP Planning Area Electrification Impacts

	Additional Consumption (GWh)		
	CED 2015 Revised **High Demand**	***CED 2015 Revised*** **Mid Demand**	***CED 2015 Revised*** **Low Demand**
2016	31.2	23.2	18.7
2020	158.6	102.2	66.4
2026	293.6	165.8	94.3

Source: California Energy Commission, Demand Analysis Office, 2015

Forecast Zone Forecasts

For *CED 2015 Revised*, staff developed electricity consumption and peak demand forecasts for individual forecast zones (see Volume 1, Chapter 1 for more details). The LADWP planning area has two climate zones, as described in **Table 5-6**.

Table 5-6: LADWP Planning Area Forecast Zones

Forecast Zone	Counties Included
16. Coastal	Los Angeles
17. Inland	Los Angeles, Inyo

Source: California Energy Commission, Demand Analysis Office, 2015

Table 5-7 shows the forecast results for electricity consumption and peak demand by forecast zone for each demand case. Full climate zone results are shown in the forms posted alongside this report.[17]

The fastest growth in consumption over the forecast period is projected to be inland, in Climate Zone 17. These results reflect migration to the inland areas of Los Angeles County and Inyo County. Peak demand growth in both zones sees little growth out to 2026 due to PV adoption.

17 http://www.energy.ca.gov/2015_energypolicy/documents/index.html#12172015.

Table 5-7: LADWP Planning Area Baseline Climate Zone Forecast Results

		Consumption by Forecast Zone (GWh)		Peak Demand by Forecast Zone (MW)	
		16	**17**	**16**	**17**
***CED 2015 Revised* High Demand**	2014	8,503	16,434	1,704	4,639
	2015	8,441	16,392	1,658	4,341
	2020	8,877	17,198	1,699	4,562
	2026	9,627	18,759	1,822	4,840
	Annual Growth 2014 - 2020	0.72%	0.76%	-0.04%	-0.28%
	Annual Growth 2014 - 2026	1.04%	1.11%	0.56%	0.35%
***CED 2015 Revised* Mid Demand**	2014	8,503	16,434	1,704	4,639
	2015	8,366	16,254	1,658	4,341
	2020	8,636	16,851	1,667	4,496
	2026	9,153	18,036	1,732	4,641
	Annual Growth 2014 - 2020	0.26%	0.42%	-0.36%	-0.52%
	Annual Growth 2014 - 2026	0.62%	0.78%	0.14%	0.00%
***CED 2015 Revised* Low Demand**	2014	8,503	16,434	1,704	4,639
	2015	8,351	16,232	1,658	4,341
	2020	8,349	16,384	1,589	4,320
	2026	8,518	16,906	1,555	4,244
	Annual Growth 2014 - 2020	-0.30%	-0.05%	-1.16%	-1.18%
	Annual Growth 2014 - 2026	0.01%	0.24%	-0.76%	-0.74%

Source: California Energy Commission, Demand Analysis Office, 2015

Acronyms and Abbreviations

Acronym/Abbreviation	Original Term
2015 IEPR	*2015 Integrated Energy Policy Report*
AAEE	Additional achievable energy efficiency
ARB	California Air Resources Board
BANC	Balancing Authority of Northern California
California ISO	California Independent System Operator
CED	*California Energy Demand*
CED 2015 Revised	*California Energy Demand 2014 – 2024 Revised Forecast*
CHP	combined, heat, and power
CPUC	California Public Utilities Commission
CSI	California Solar Initiative
DWR	California Department of Water Resources
Energy Commission	California Energy Commission
EV	Electric vehicle
GW	Gigawatt
GWh	Gigawatt-hour
IEPR	Integrated Energy Policy Report
kW	Kilowatt
kWh	Kilowatt hour
LADWP	Los Angeles Department of Water and Power
LED	Light-emitting diode
MW	Megawatt
MWh	Megawatt hour
NCNC	Northern California Non-California ISO
NEM	Net energy metering
PG&E	Pacific Gas and Electric Company

PV	Photovoltaic
QFER	Quarterly Fuel Energy Report
SCE	Southern California Edison Company
SDG&E	San Diego Gas and Electric Company
SGIP	Self-Generation Incentive Program
SMUD	Sacramento Municipal Utility District
TCU	Transportation, Communication, and Utility
WAPA	Western Area Power Administration
ZEV	Zero-emission vehicle