Statewide Energy Demand

This Tracking Progress Update on Statewide Energy Demand presents forecasts of electricity consumption and peak electricity demand for California for 2018-2030. In odd-numbered years, the California Energy Commission provides 10-year forecasts for electricity demand in California as part of the Integrated Energy Policy Report (IEPR) process, with an update in even-numbered years. Forecast updates are relatively limited in scope, intending only to refresh economic and demographic projections, incorporate newly acquired historical data, and update forecasts for critical demand modifiers such as behind-the-meter photovoltaics (PV) and plug-in electric vehicles (PEVs).

These forecasts are used in various proceedings, including the California Public Utility Commission's (CPUC) Integrated Resource Planning process and the California Independent System Operator's (California ISO) Transmission Planning Process. The IEPR forecast consists of two parts: a baseline forecast, which includes energy efficiency savings from initiatives already in place or approved; and forecasted energy efficiency savings, referred to as additional achievable energy efficiency savings. Together, these two parts yield a "managed" forecast for resource planning.

The *California Energy Demand 2018-2030 Forecast* (*CED 2017*)[1] includes three scenarios: a high-energy demand case, a low-energy demand case, and a mid-energy demand case. The high-energy demand case is characterized by relatively high economic/demographic growth and climate change impacts, and relatively low electricity rates and self-generation impacts. Lower economic/demographic growth, higher assumed rates, and higher self-generation impacts are included in the low-energy demand case. The mid case input assumptions are between the high and low cases.

California continues to demonstrate that it is possible to grow the economy with only a small increase in energy consumption. From 2016 to 2017, electricity consumption in California grew 1.3 percent, totaling 288,613 gigawatt-hours (GWh). With this slight increase in electricity consumption, job growth increased almost 2 percent, gross state product grew 3 percent, and population increased 1 percent.[2] Between 2000 and 2017, job growth increased nearly 15 percent, while electricity consumption increased by 12 percent. Between 2000 and 2017, California's gross state product grew by almost 46 percent — nearly four times as fast as

1 Kavalec, Chris, Asish Gautam, Mike Jaske, Lynn Marshall, Nahid Movassagh, and Ravinderpal Vaid. 2018. California Energy Demand 2018-2030 Revised Forecast. California Energy Commission, Electricity Assessments Division. Publication Number: CEC-200-2018-002-CMF.

2 Jobs data are from the Employment Development Department and reflect civilian employment growth, June 2018. Gross state product data are from U.S. Bureau of Economic Analysis (BEA) and Moody's Analytics, June 2018. Population data are from California Department of Finance, December 2017.

electricity consumption. Meanwhile, the state's population grew roughly 17 percent from about 34 million in 2000 to 39.6 million in 2017.

Results of the 2017 Revised Demand Forecast

The *CED 2017* baseline electricity forecast for selected years is compared with the *California Energy Demand Updated Forecast 2017-2027* (*CEDU 2016*) mid-demand case in **Table 1**. *CED 2017 Revised* adds a historical year for consumption (2016) and for peak demand (2017). Forecast consumption in the *CED 2017* mid-demand case starts below the *CEDU 2016* mid case as additional utility efficiency program impacts are included for the 2016 and 2017 program years. Illustrated in **Figure 1** below, consumption in the new mid-case rises above *CEDU 2016* by 2020 and remains higher thereafter due to four factors:

- Significantly higher projections for the number of light-duty electric vehicles (EVs)
- A higher forecast for manufacturing electricity consumption
- The decay in savings from the 2016-2017 efficiency programs
- A change in how residential lighting savings are accounted for in the forecast

Table 1: Comparison of *CED 2017 Revised* and *CEDU 2016* Mid-Case Demand Baseline Forecasts of Statewide Electricity Demand

Consumption (Gigawatt-hours [GWh])				
	CEDU 2016 Mid-Energy Demand	*CED 2017* High-Energy Demand	*CED 2017* Mid-Energy Demand	*CED 2017* Low-Energy Demand
1990	227,606	227,593	227,593	227,593
2000	261,036	260,941	260,941	260,941
2016	285,434	284,060	284,060	284,060
2020	294,474	299,836	295,773	292,519
2025	312,223	329,724	320,375	311,266
2027	319,256	339,863	328,215	317,491
2030	--	354,209	339,160	326,026
	Average Annual Growth Rates			
1990-2000	1.38%	1.38%	1.38%	1.38%
2000-2016	0.56%	0.53%	0.53%	0.53%
2016-2020	0.78%	1.36%	1.02%	0.74%
2016-2027	1.02%	1.64%	1.32%	1.02%
2016-2030	--	1.59%	1.27%	0.99%

Noncoincident Net Peak (Megawatts [MW])				
	CEDU 2016 Mid-Energy Demand	*CED 2017* High-Energy Demand	*CED 2017* Mid-Energy Demand	*CED 2017* Low-Energy Demand
1990	47,123	47,123	47,123	47,123
2000	53,529	53,530	53,530	53,530
2016	60,543	62,117	62,117	62,117
2017*	60,739	60,713	60,713	60,713
2020	61,444	62,970	61,295	59,730
2027	63,501	71,142	66,037	61,890
2030	--	73,844	67,704	63,118
	Average Annual Growth Rates			
1990-2000	1.28%	1.28%	1.28%	1.28%
2000-2016	0.77%	0.93%	0.93%	0.93%
2017-2020	0.39%	1.22%	0.32%	-0.54%
2017-2027	0.45%	1.60%	0.84%	0.19%
2017-2030	--	1.52%	0.84%	0.30%
Actual historical values are shaded.				
*Weather normalized: the forecasts use a weather-normalized peak value derived from the actual 2017 peak for calculating growth rates during the forecast period.				

Source: California Energy Commission, Energy Assessments Division, 2017.

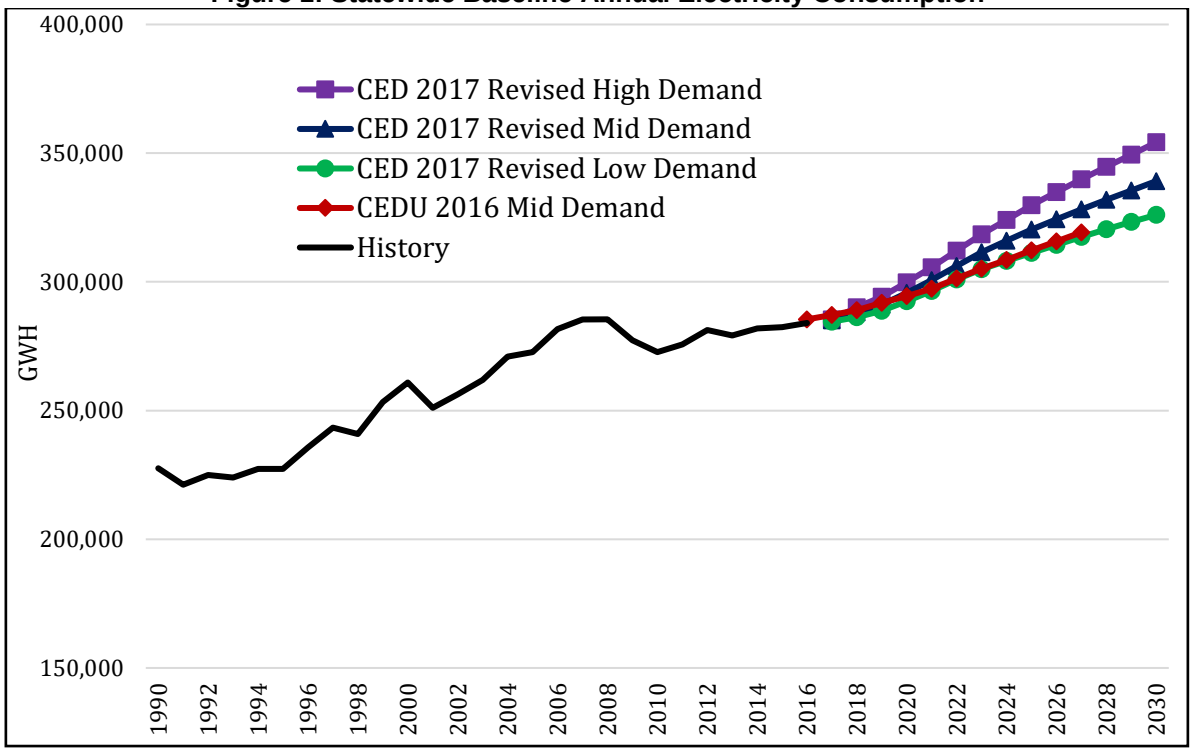
CED 2017 statewide noncoincident[3] peak demand—also grows at a faster rate in the mid case compared to *CEDU 2016*, a result of higher projected consumption and the impacts of incorporating the peak shift,[4] which overcome the effect of a higher PV forecast. PV impacts in the low-demand case are enough to drive average annual growth in peak demand negative from 2017 — 2020.

In 2027, consumption in the new mid case is projected to be almost 3 percent higher than the *CEDU 2016* mid case, which roughly matches the new low case. Annual growth from 2016 — 2027 for the *CED 2017 Revised* forecast averages 1.64 percent, 1.32 percent, and 1.02 percent in the high, mid, and low cases, respectively, compared to 1.02 percent in the *CEDU 2016* mid case.

3 Noncoincident peak demand is the sum of planning area peaks, which may occur at different hours.

4 A shift in the timing of the system peak (from midday to early evening) brought about by significant penetrations of demand-modifying resources such as behind-the-meter PV and energy efficiency.

Figure 1: Statewide Baseline Annual Electricity Consumption



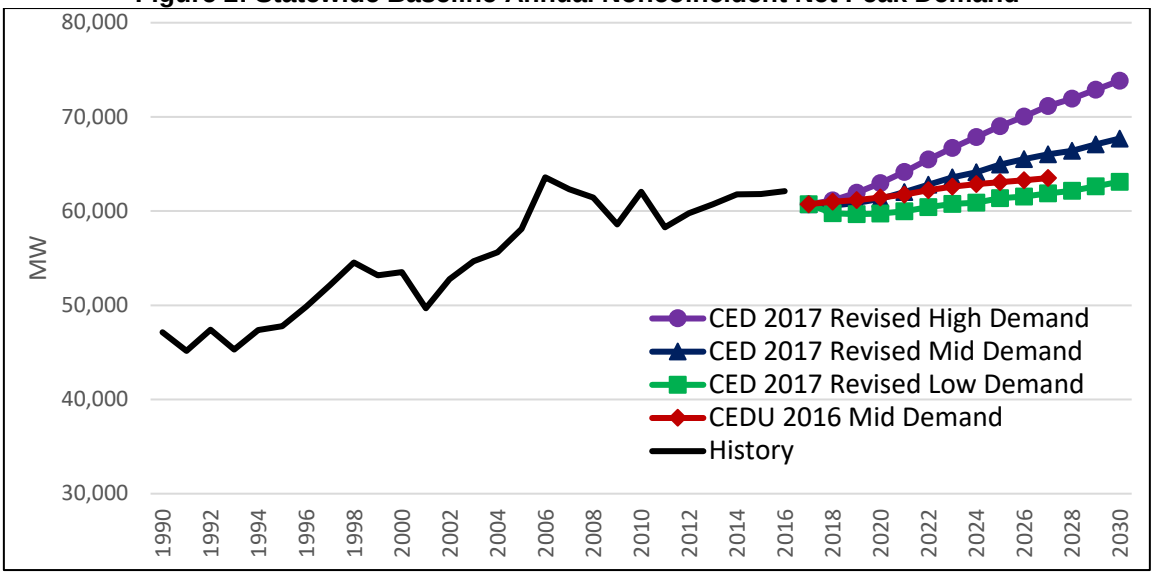
Source: California Energy Commission, Energy Assessments Division, 2017.

Projected *CED 2017* noncoincident net peak demand[5] for the three baseline cases, adjusted by the peak shift impact for the investor-owned utilities (IOUs), and the *CEDU 2016* mid-demand peak forecast are shown in **Figure 2**. By 2027, statewide peak demand in the *CED 2017* mid case is projected to be around 4 percent higher than the *CEDU 2016* mid case. Annual growth rates from 2017-2027 for *CED 2017 Revised* average 1.60 percent, 0.84 percent, and 0.19 percent in the high, mid, and low cases, respectively, compared to 0.45 percent in the *CEDU 2016* mid case. The higher projections for EVs have relatively less impact on peak demand than on consumption, as most recharging occurs in off-peak hours.

The impact of the peak shift for the IOU planning areas on statewide noncoincident net peak demand for the *CED 2017 Revised* mid case is shown in **Figure 3**. By 2030, the peak shift impact reaches more than 3,000 MW and increases the average annual growth rate for net peak from 0.65 percent to 1.00 percent over 2017 – 2030. Peak shift impacts in the high and low demand cases reach 1,000 MW and 6,100 MW, respectively, by 2030.

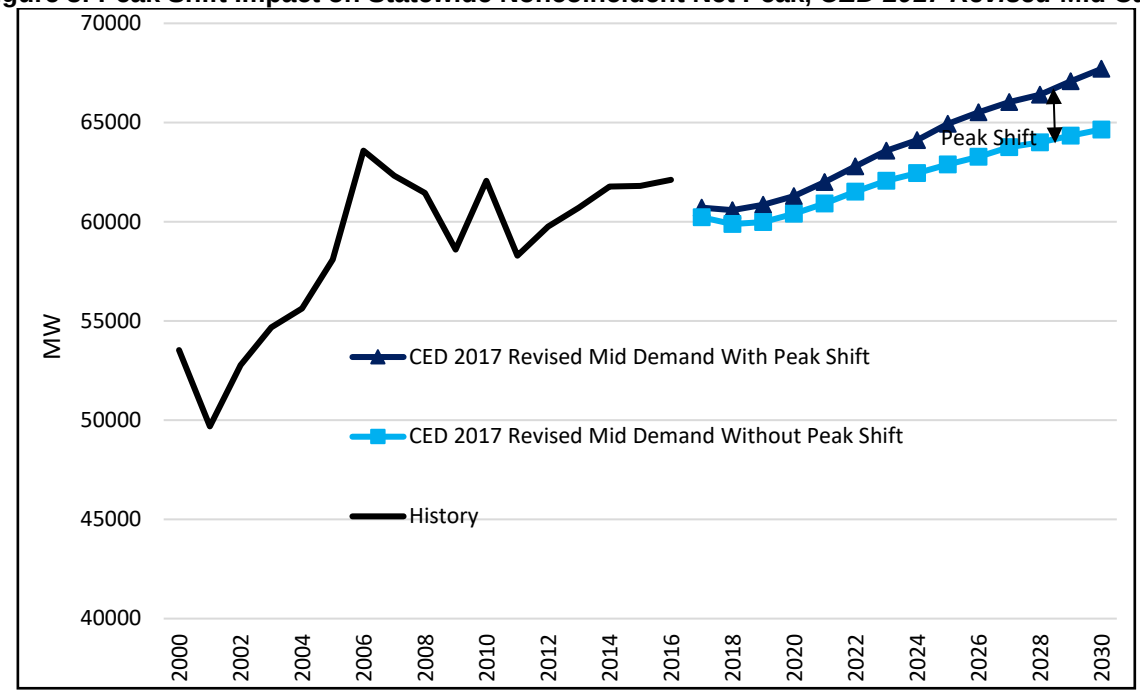
5 Noncoincident net peak demand is the noncoincident peak demand minus self-generation.

Figure 2: Statewide Baseline Annual Noncoincident Net Peak Demand



Source: California Energy Commission, Energy Assessments Division, 2017.

Figure 3: Peak Shift Impact on Statewide Noncoincident Net Peak, *CED 2017 Revised* Mid Case

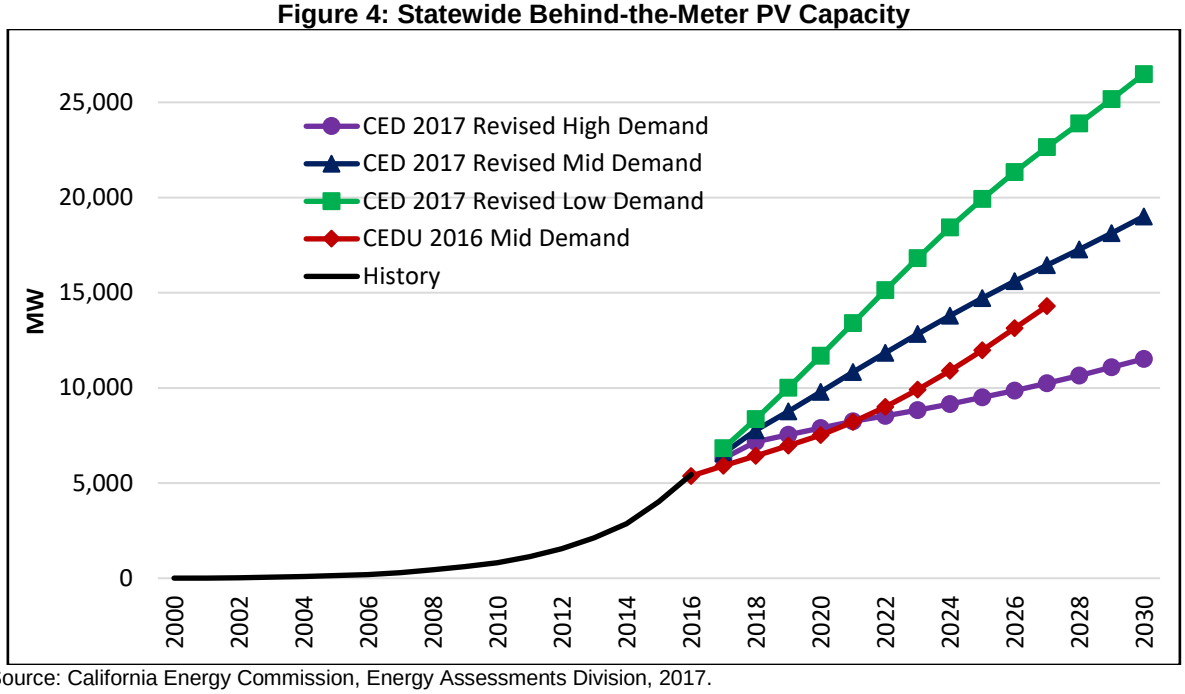


Source: California Energy Commission, Energy Assessments Division, 2017.

The key driver behind the peak shift is increasing expected adoptions of behind-the-meter PV systems. Historical and projected PV capacities for the three *CED 2017 Revised* demand cases and the *CEDU 2016* mid case are shown in **Figure 4**. Projected behind-the-meter PV capacity reaches about 26,500 MW, 19,000 MW, and 11,500 MW in the low, mid, and high demand baseline cases, respectively, by 2030 (note that the CED 2017 "Low Demand" scenario includes assumptions which tend to drive down electricity demand, including high levels of

behind-the-meter PV. Similarly, the “High Demand” case assumes a low penetration of behind-the-meter PV.)

Figure 4: Statewide Behind-the-Meter PV Capacity



Source: California Energy Commission, Energy Assessments Division, 2017.

Projected baseline annual electricity consumption in each *CED 2017 Revised* case for the three major economic sectors — residential, commercial, and industrial (industrial includes manufacturing, construction, and resource extraction) — is compared with the *CEDU 2016* mid demand case in **Table 2**. As in past recent forecasts, residential consumption is projected to grow fastest among the sectors, a result of steady growth in the miscellaneous sector, which includes “plug-in” appliances such as cell phones and other electronics, and is bolstered by EVs. Commercial consumption growth is also boosted by the higher EV forecast, but to a lesser degree than in the residential sector, so the difference in percentage annual growth between the residential and commercial sectors in *CED 2017 Revised* increases over the forecast period.

Despite additional efficiency programs targeting the industrial sector, industrial consumption grows at a faster pace in the new mid case compared to *CEDU 2016* due to higher projected growth in manufacturing output. Still, forecast industrial consumption growth is flatter than in the residential and commercial sectors, a product of recent historical trends in consumption combined with industrial output projections.

Table 2: Baseline Electricity Consumption by Sector

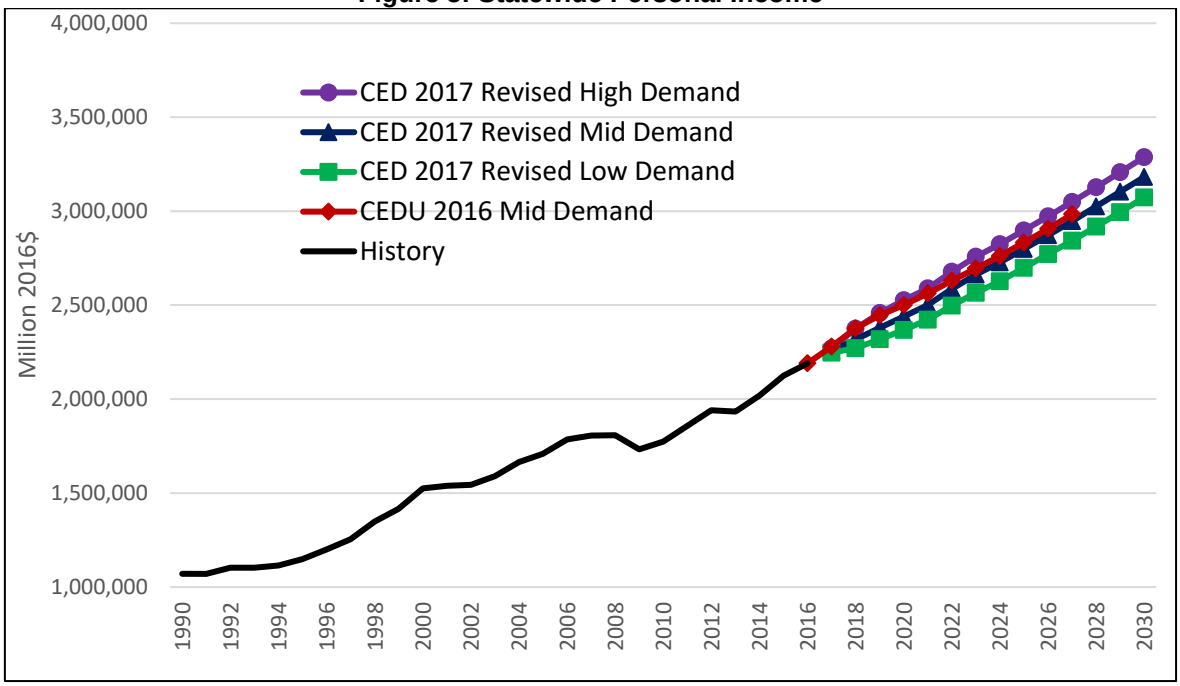
Residential Consumption (GWh)				
	CEDU 2016 Mid Energy Demand	*CED 2017 Revised* High Energy Demand	*CED 2017 Revised* Mid Energy Demand	*CED 2017 Revised* Low Energy Demand
2016	89,394	90,886	90,886	90,886
2020	92,985	98,343	96,998	96,517
2025	103,383	113,237	109,333	107,143
2027	107,993	118,754	113,640	111,236
2030	--	127,461	120,409	117,647
Average Annual Growth, Residential Sector				
2016-2020	0.99%	1.99%	1.64%	1.51%
2016-2027	1.73%	2.46%	2.05%	1.85%
2016-2030	--	2.45%	2.03%	1.86%
Commercial Consumption (GWh)				
	CEDU 2016 Mid Energy Demand	*CED 2017 Revised* High Energy Demand	*CED 2017 Revised* Mid Energy Demand	*CED 2017 Revised* Low Energy Demand
2016	108,531	104,986	104,986	104,986
2020	112,718	111,261	110,286	109,252
2025	118,473	122,439	120,167	116,775
2027	120,272	125,739	122,904	118,714
2030	--	129,665	126,077	120,661
Average Annual Growth, Commercial Sector				
2016-2020	0.95%	1.46%	1.24%	1.00%
2016-2027	0.94%	1.65%	1.44%	1.12%
2016-2030	--	1.52%	1.32%	1.00%
Industrial Consumption (GWh)				
	CEDU 2016 Mid Energy Demand	*CED 2017 Revised* High Energy Demand	*CED 2017 Revised* Mid Energy Demand	*CED 2017 Revised* Low Energy Demand
2016	49,612	50,308	50,308	50,308
2020	49,725	51,474	50,143	48,647
2025	49,902	53,763	51,444	48,432
2027	50,009	54,434	51,760	48,249
2030	--	55,233	52,050	47,798
Average Annual Growth, Industrial Sector				
2016-2020	0.06%	0.57%	-0.08%	-0.84%
2016-2027	0.07%	0.72%	0.26%	-0.38%
2016-2030	--	0.67%	0.24%	-0.36%
Actual historical values are shaded.				

Source: California Energy Commission, Energy Assessments Division, 2017.

Personal Income

Historical and projected personal income at the statewide level for the three *CED 2017 Revised* cases and the *CEDU 2016* mid demand case is shown in **Figure 5**. The new mid case is slightly lower than the *CEDU 2016* mid case at the end of the forecast period (around 1.2 percent in 2027), although the difference is greater from 2018-2022. Annual growth rates from 2016-2027 average 3.05 percent, 2.73 percent, and 2.40 percent in the *CED 2017 Revised* high, mid, and low cases, respectively, compared to 2.85 percent in the *CEDU 2016* mid case.

Figure 5: Statewide Personal Income

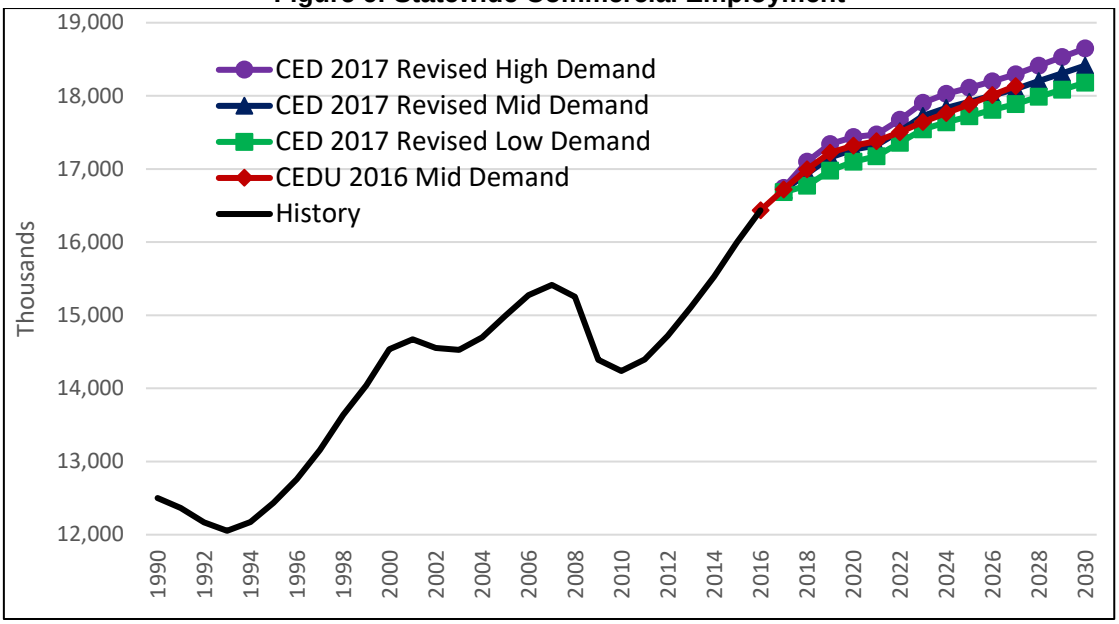


Source: Moody's Analytics, 2016-2017.

Commercial Employment

Historical and projected statewide commercial employment for the three *CED 2017 Revised* cases and the *CEDU 2016* mid-demand case is shown in **Figure 6**. The *CED 2017 Revised* mid case is almost identical to *CEDU 2016* throughout the forecast period, with the difference between the new and old mid cases around 0.2 percent in 2027. Annual growth rates from 2016-2027 average 0.98 percent, 0.88 percent, and 0.70 percent in the *CED 2017 Revised* high, mid, and low cases, respectively, compared to 0.90 percent in the *CEDU 2016* mid case.

Figure 6: Statewide Commercial Employment

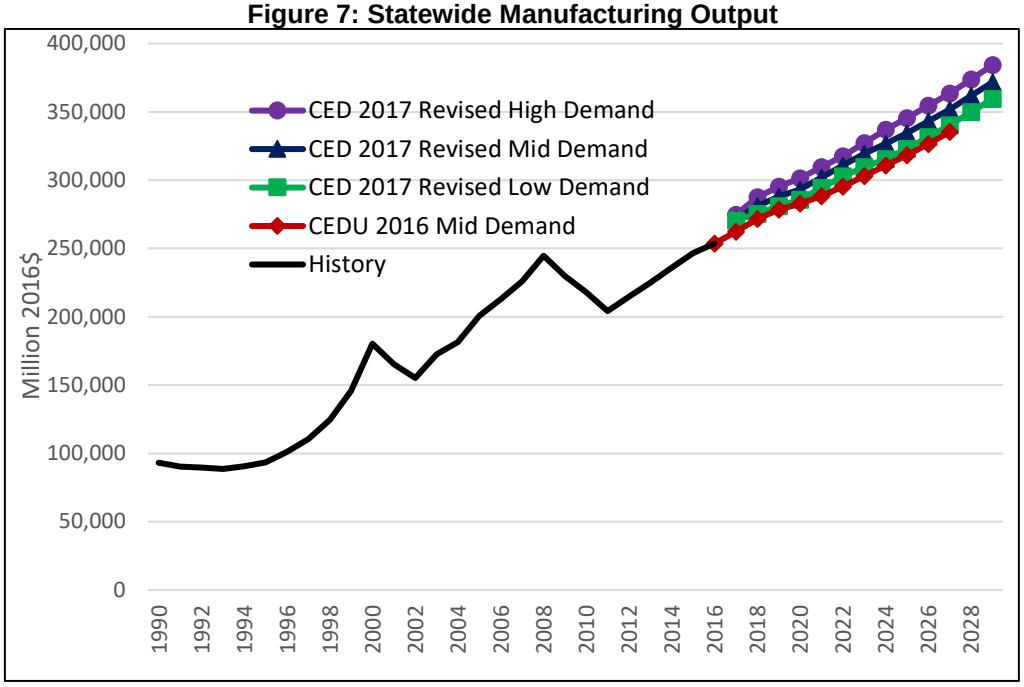


Source: Moody's Analytics, 2016-2017.

Manufacturing Output

Statewide manufacturing output for the three *CED 2017 Revised* cases and the *CEDU 2016* mid-demand case is shown in **Figure 7**. The *CED 2017 Revised* mid case is above *CEDU 2016*, which is closer to (and slightly below) the new low case. Annual growth rates from 2016 — 2027 average 3.32 percent, 3.02 percent, and 2.71 percent in the *CED 2017 Revised* high, mid, and low cases, respectively, compared to 2.57 percent in the *CEDU 2016* mid case.

Figure 7: Statewide Manufacturing Output



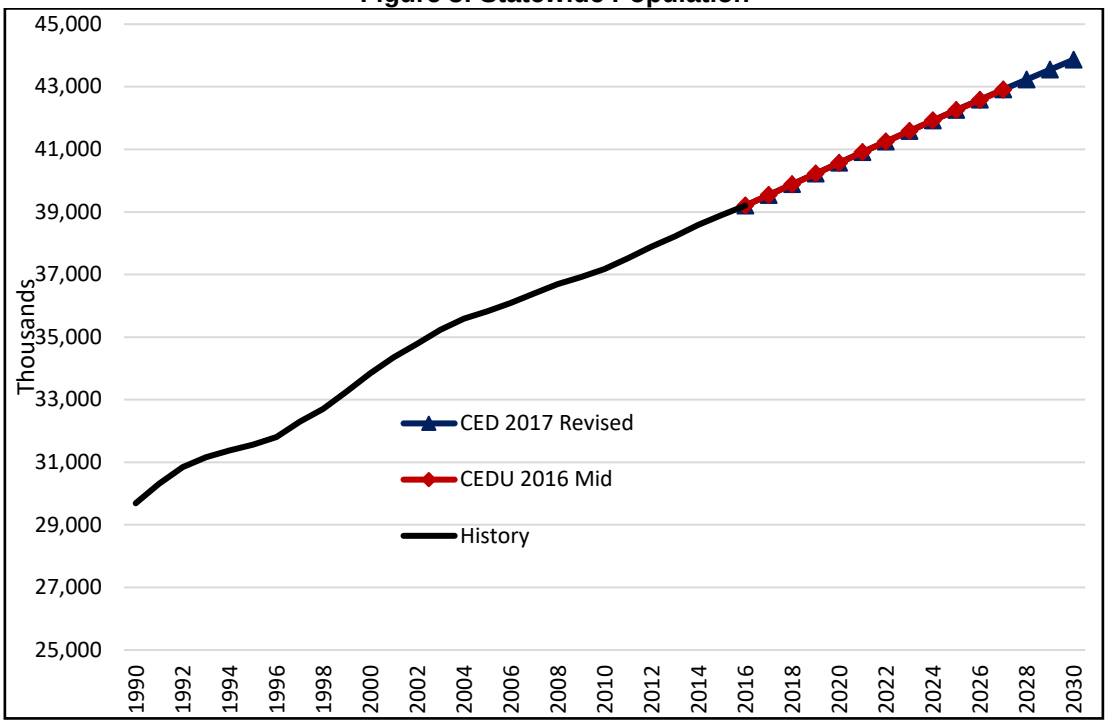
Source: Moody's Analytics, 2016-2017.

Population Growth

Projections for population are shown in **Figure 8**. The single *CED 2017 Revised* scenario projects almost identical growth compared to the *CEDU 2016* mid case throughout the forecast period. In 2027, the difference amounts to around 8,000 persons. Over the period 2016 – 2027, population growth averages around 0.82 percent for both *CED 2017 Revised* and the *CEDU 2016* mid case.

With the exception of the industrial sector, where higher manufacturing output pushes the new mid and high forecasts above *CEDU 2016* mid, the economic/demographic drivers overall do not significantly change the *CED 2017 Revised* mid case compared to *CEDU 2016*. Rather, the key demand modifiers, including PV and EVs, as well as the accounting for residential lighting savings, have a more important role in forecast differences.

Figure 8: Statewide Population



Sources: California Department of Finance, 2017, and Moody's Analytics, 2016.

Electricity Consumption and Economic Growth by County

Table 3 shows the change from 2016 to 2017 in economic growth per county and electricity consumption. In several counties, the economy grew while electricity consumption decreased. For example, Fresno County's economy grew by 2.4 percent while its electricity consumption decreased by 2.2 percent. Los Angeles County's economy grew by 2.1 percent while its electricity consumption decreased by almost 2.7 percent. San Francisco County's economy increased by 5.3 percent while its electricity consumption decreased by 0.3 percent. Also, King's County's economy grew by 2.0 percent while its electricity consumption decreased by

15.4 percent. This decrease in electricity consumption for King's County was mainly in the agricultural sector, specifically water pumping.

Table 3: Electricity Consumption and Gross County Product for California Counties, 2016 and 2017

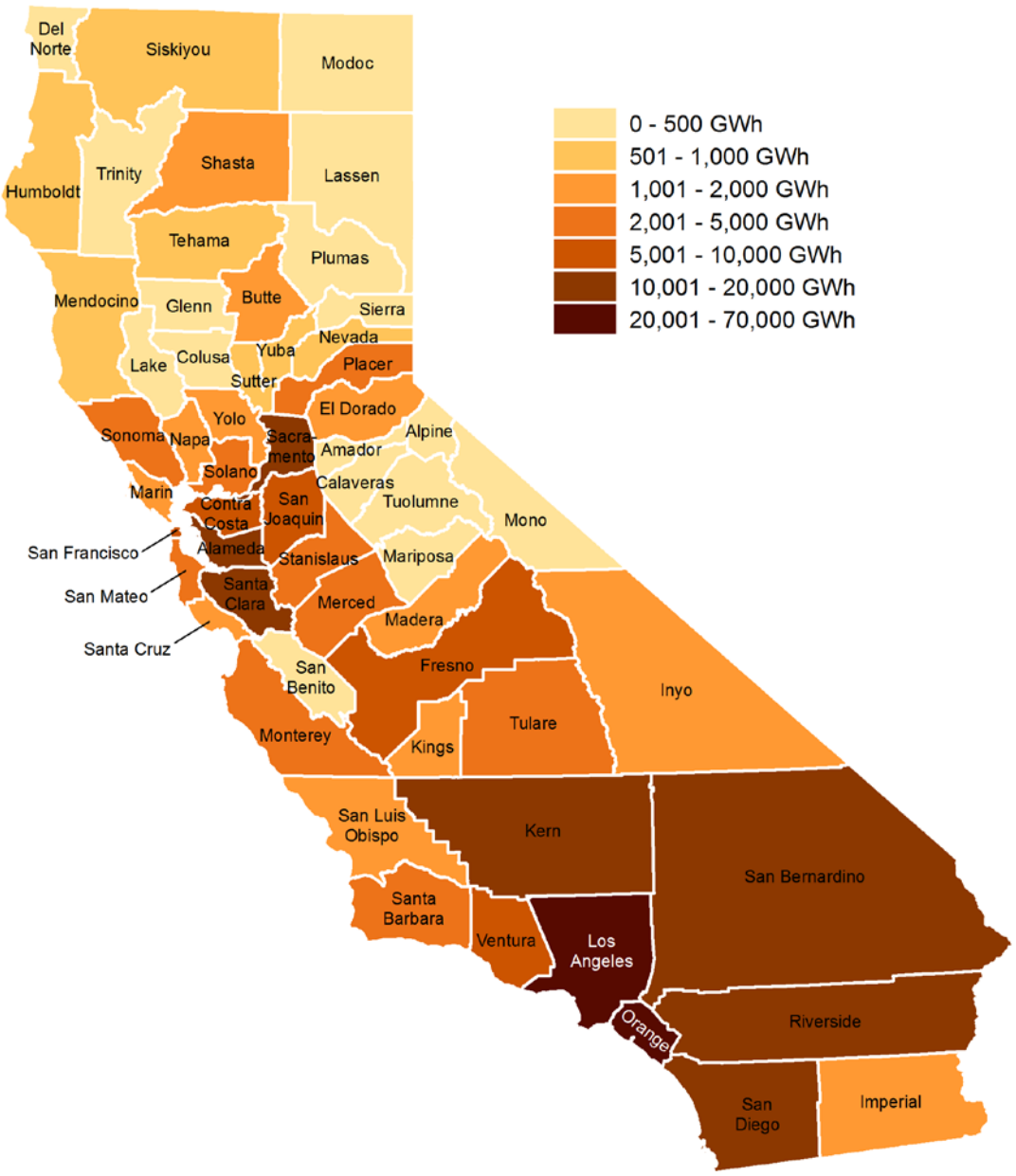
County	2016 GWh Consumption	2017 GWh Consumption	% Change	2016 GCP	2017 GCP	% Change
Alameda	10,815	11,113	2.8%	120.8	125.2	3.6%
Alpine	17	19	9.2%	0.2	0.2	1.9%
Amador	310	315	1.9%	1.7	1.7	2.6%
Butte	1,487	1,545	3.9%	11.6	11.8	1.8%
Calaveras	316	352	11.5%	1.2	1.3	2.3%
Colusa	299	296	-1.1%	2.0	2.0	1.3%
Contra Costa	9,644	9,778	1.4%	64.4	65.2	1.4%
Del Norte	204	216	5.9%	1.2	1.2	2.0%
El Dorado	1,215	1,272	4.7%	7.8	8.0	2.5%
Fresno	7,625	7,461	-2.2%	51.0	52.3	2.4%
Glenn	367	392	6.7%	2.1	2.1	2.4%
Humboldt	808	831	2.8%	6.6	6.8	2.8%
Imperial	1,419	1,421	0.2%	7.8	7.6	-2.6%
Inyo	230	1,552	574.2%	1.1	1.1	2.9%
Kern	16,530	18,440	11.6%	46.6	46.2	-1.0%
Kings	1,792	1,516	-15.4%	5.9	6.0	2.0%
Lake	441	471	6.7%	2.3	2.3	2.1%
Lassen	422	386	-8.7%	1.7	1.7	1.6%
Los Angeles	69,471	67,569	-2.7%	735.8	751.4	2.1%
Madera	1,610	1,602	-0.5%	6.0	6.1	1.4%
Marin	1,343	1,395	3.9%	18.2	18.3	0.8%
Mariposa	108	113	4.8%	0.7	0.7	2.0%
Mendocino	581	593	2.2%	4.7	4.8	2.4%
Merced	3,472	3,987	14.8%	9.7	9.9	2.6%
Modoc	152	152	0.4%	0.5	0.6	2.3%
Mono	192	200	3.9%	1.3	1.3	1.9%
Monterey	2,587	2,587	0.0%	23.3	23.5	0.7%
Napa	1,058	1,065	0.7%	9.6	9.9	3.2%
Nevada	661	750	13.5%	4.8	4.9	2.7%

County	2016 GWh Consumption	2017 GWh Consumption	% Change	2016 GCP	2017 GCP	% Change
Orange	20,140	20,031	-0.5%	275.9	284.5	3.1%
Placer	2,939	2,985	1.6%	24.8	25.4	2.4%
Plumas	232	227	-2.1%	1.0	1.0	2.6%
Riverside	15,473	15,906	2.8%	91.8	95.4	3.9%
Sacramento	10,850	11,526	6.2%	91.9	94.2	2.5%
San Benito	382	379	-0.6%	3.7	3.8	3.5%
San Bernardino	14,950	15,273	2.2%	94.7	98.4	3.9%
San Diego	19,694	19,346	-1.8%	238.0	245.5	3.1%
San Francisco	5,759	5,741	-0.3%	128.2	134.9	5.3%
San Joaquin	5,457	5,665	3.8%	31.4	32.9	4.7%
San Luis Obispo	1,739	1,779	2.3%	16.9	17.4	2.7%
San Mateo	4,340	4,368	0.6%	78.0	82.5	5.8%
Santa Barbara	2,858	2,799	-2.1%	30.5	30.6	0.3%
Santa Clara	16,824	17,190	2.2%	212.1	224.6	5.9%
Santa Cruz	1,224	1,230	0.5%	15.0	15.3	1.8%
Shasta	1,560	1,604	2.8%	8.6	8.8	2.3%
Sierra	26	22	-15.3%	0.1	0.1	1.6%
Siskiyou	487	500	2.7%	2.1	2.2	2.1%
Solano	3,207	3,203	-0.1%	20.1	20.7	3.0%
Sonoma	2,965	3,039	2.5%	30.1	31.4	4.1%
Stanislaus	4,764	4,601	-3.4%	24.2	24.6	1.8%
Sutter	632	650	2.9%	4.2	4.3	2.0%
Tehama	497	523	5.3%	2.9	2.9	1.6%
Trinity	129	138	7.0%	0.4	0.4	2.1%
Tulare	4,373	4,258	-2.6%	19.6	19.5	-0.2%
Tuolumne	448	465	3.8%	2.7	2.8	2.7%
Ventura	5,462	5,520	1.1%	50.2	51.2	1.9%
Yolo	1,705	1,749	2.6%	15.0	15.3	1.9%
Yuba	483	508	5.2%	2.2	2.3	2.5%
California Total	**284,773**	**288,613**	**1.3%**	**2,667**	**2,747**	**3.0%**

Source: California Energy Commission Staff using data from the Quarterly Fuel and Energy Report, U.S. Bureau of Economic Analysis, and Moody's Analytics

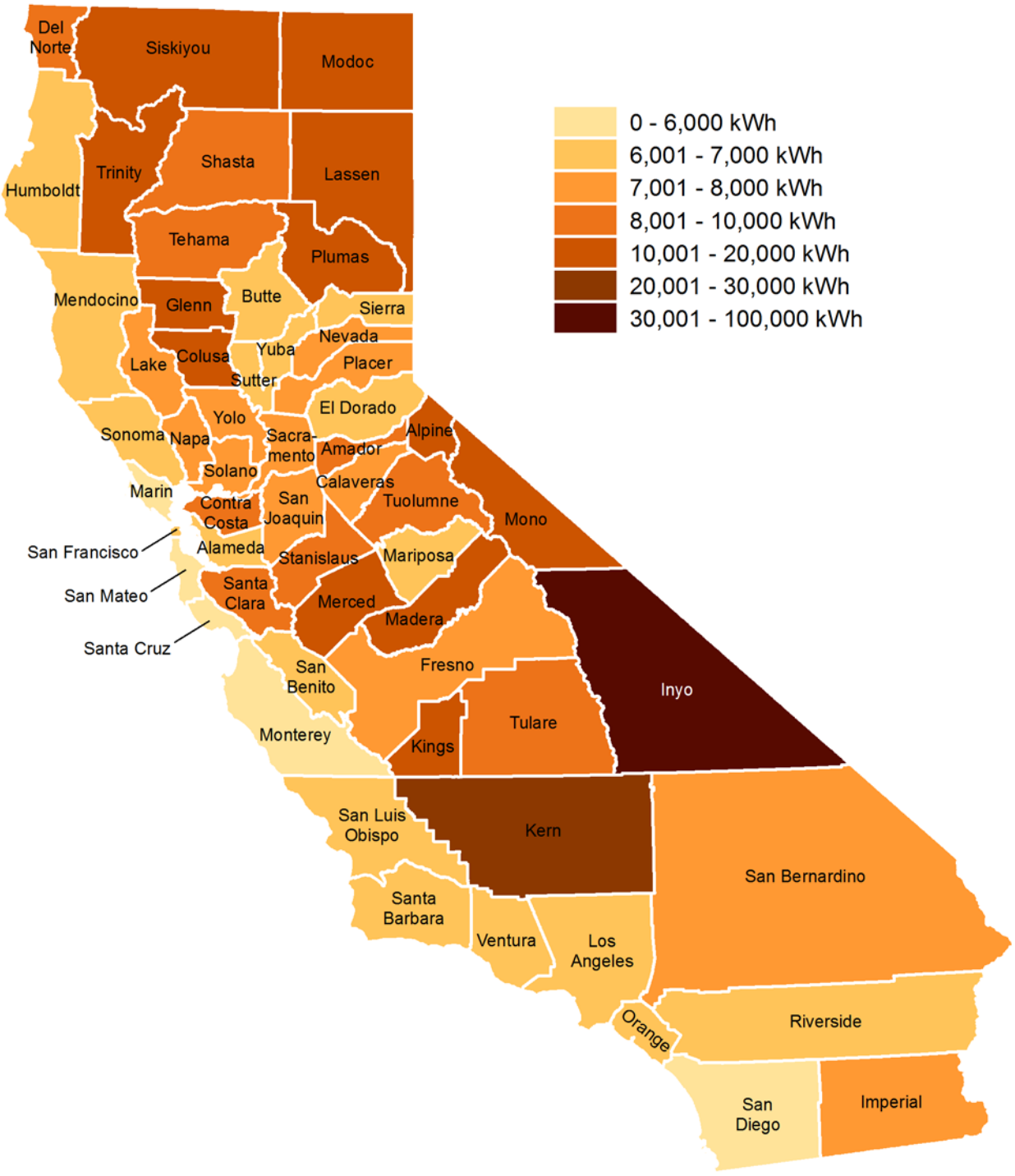
Figure 9 shows electricity consumption by county for residential and nonresidential consumers in 2017. Residential consumption increased from 90,573 GWh in 2016 to 94,495 GWh in 2017 while nonresidential consumption decreased slightly from 194,200 GWh in 2016 to 194,119 GWh in 2017. **Figure 10** shows 2017 electricity consumption per capita for each county.

Figure 9: 2017 Electricity Consumption (Residential and Nonresidential) by County



Source: California Energy Commission staff, http://ecdms.energy.ca.gov/.

Figure 10: Total 2016 Electricity Consumption Per Capita by County



Source: California Energy Commission staff, http://ecdms.energy.ca.gov/.

Additional References:

Information regarding California energy consumption is available at http://www.ecdms.energy.ca.gov.

Information regarding U.S. energy consumption is available at http://www.eia.gov/.

Information on electricity consumption can be found in the California Energy Almanac, available at http://energyalmanac.ca.gov/electricity/index.html.

Sources:

Kavalec, Chris, Asish Gautam, Mike Jaske, Lynn Marshall, Nahid Movassagh, and Ravinderpal Vaid. 2018. California Energy Demand 2018-2030 Revised Forecast. California Energy Commission, Electricity Assessments Division. Publication Number: CEC-200-2018-002-SD. https://efiling.energy.ca.gov/getdocument.aspx?tn=223244.

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