

Water and Electricity Usage in Southern California

Summary

Table 1 summarizes annual electricity, water, and water-related energy usage in Southern California. For the residential sector, electricity usage was 7,300 kWh/yr/household (or 20 kWh/day/household) in 2007. On average, each household uses 110,000 gallons of water annually in 2000 (or 300 gallon/day/household). It costs 1,280 kWh of energy (or 3.5 kWh/day/household) to provide this much water and the associated wastewater treatment for each Southern California household. For the commercial sector, only statewide data were found and used in the calculation. Annual average commercial electricity usage is 13.63 kWh/ft². Annual commercial water usage is 123 gallon/ft² and it costs 1.56 kWh/ ft² to provide and treat the water.

Table 1. Electricity, Water and Water-Related Energy Usage in Southern California

Sector	Electricity (kWh/yr)	Water (gallon/yr)	Water-Related Energy (kWh/yr)
Residential (per household)	7,300	110,000	1,280
Commercial (per ft ²)	13.63	123	1.56

Data Sources

Raw data used in the calculation are mainly from the following five categories. Their sources and applicable assumptions used in the calculation are presented below.

Southern California Household

Household data were retrieved from the U.S. Census Bureau's 2005-2007 American Community Survey (http://factfinder.census.gov/home/saff/main.html?_lang=en) and summarized in Table 2. There are **5,375,532** households within Los Angeles, Orange, Riverside, and San Bernardino Counties.

Table 2. Household Data in Southern California

County	Household Population (A)	Average Household Size (B)	Number of Household (A/B)
Los Angeles	9,691,367	3.05	3,177,497
Orange	2,950,328	3.04	970,503
Riverside	1,973,219	3.10	636,522
San Bernardino	1,938,512	3.28	591,010
Total: Southern California (LA+Orange+Riverside+SB)			5,375,532

Southern California Residential Electricity

Residential electricity data were exported from the California Energy Consumption Data Management System (ECDMS <http://ecdms.energy.ca.gov/elecbycounty.asp#results>). In 2007, there were 39,128 Millions of kWh used for residential electricity usage within the four counties in Southern California.

Table 3. Residential Electricity Consumption Data in Southern California in 2007

County	Electricity (Millions of kWh)
Los Angeles	20,636
Orange	6,907
Riverside	6,770
San Bernardino	4,815
Total Southern California	39,128

California Commercial Electricity

As mentioned in the summary, only statewide commercial electricity data were found. There were 4,920,114 kft² of floor stock for all commercial in California^a. The average electricity usage reported was 13.63 kWh/ft²^d.

Water Consumption

California urban water consumption data were obtained from a report published by the Pacific Institute and summarized in Table 4. Only statewide data were reported in that document. To find water consumption data for Southern California, we assumed Southern California urban water use accounts for 48% of the state's urban residential applied water based on data published by the California Energy Commission (CEC)^c. However, no comparable data were found for the commercial sector. Conversion factor of 1 acre foot (AF) = 325 851.433 26 gallon, and 1 MG = 1 million gallon were used to convert California data to Southern California.

Table 4. Southern California Urban Water Use in 2000^{b, c}

Urban Water Use by Sector	California (2000) (AF/year) ^b	Southern California (MG/year) ^c
Residential Indoor	2,300,000	359,740
Residential Outdoor	1,450,000	226,793
Commercial	1,850,000	n/a

Water-Related Energy

Electricity used for water supply, treatment, distribution, as well as wastewater treatment were obtained from the same CEC report and presented in Table 5. We assume water used for residential indoor and commercial sector requires wastewater treatment whereas water used for residential outdoor doesn't.

Table 5. Electricity Use in Urban Southern California Water Systems^d

Function	Southern California (kWh/MG) ^d
Water Supply and Conveyance: (1)	8,900
Water Treatment: (2)	100
Water Distribution: (3)	1,200
Wastewater Treatment: (4)	2,500
Residential Indoor: (1+2+3+4)	12,700
Residential Outdoor: (1+2+3)	10,200
Commercial Sector: (1+2+3+4)	12,700

Calculations

$$\text{residential electricity} = \frac{39,128 \text{ Millions of kWh / yr}}{5,375,532 \text{ household}} = 7,300 \text{ kWh / yr / household}$$

$$\text{residential water usage} = \frac{(359,740 + 226,793) \times 10^6 \text{ gallon / yr}}{5,375,532 \text{ household}} = 110,000 \text{ gallon / yr / household}$$

$$\begin{aligned} \text{residential water - related energy} &= \frac{(359,740 \times 12,700 + 226,793 \times 10,200) \text{ kWh / yr}}{5,375,532 \text{ household}} \\ &= 1,280 \text{ kWh / yr / household} \end{aligned}$$

$$\text{commercial electricity} = 13.63 \text{ kWh / yr / ft}^2 \text{ (see ref }^a\text{)}$$

$$\text{commercial water usage} = \frac{1,850,000 \text{ AF / yr} \times 325,851.43326 \text{ gallon / AF}}{4,920,114 \times 10^3 \text{ ft}^2} = 123 \text{ gallon / yr / ft}^2$$

$$\text{commercial water - related energy} = 123 \times 12,700 / 10^6 = 1.56 \text{ kWh / yr / ft}^2$$

Limitations

Only statewide data were available for the commercial sector. Data were obtained from different years and may not represent current values. For example, household data were from years 2005-2007, while, urban water usage data were from year 2000. Numbers in Table 1 only represent a historical snapshot, new homes and buildings are likely to be more energy efficient and consume less water than Table 1 predicts.

References

^a California Commercial End-Use Survey, Consultant Report, Table 8-1 Page 150. Prepared For: California Energy Commission, Prepared By: Itron, Inc. March 2006.

<http://www.energy.ca.gov/2006publications/CEC-400-2006-005/CEC-400-2006-005.PDF>

^b Peter H. Gleick, Dana Haasz, Christine Henges-Jeck, Veena Srinivasan, Gary Wolff, Katherine Kao Cushing, and Amardip Mann, "Waste Not, Want Not: The Potential for Urban Water Conservation in California", Executive Summary, Table ES-1, Pacific Institute, November 2003.

http://www.pacinst.org/reports/urban_usage/waste_not_want_not_full_report.pdf

^c California's Water – Energy Relationship, Page 110, California Energy Commission, Final Staff Report, CEC-700-2005-011-SF, November 2005.

<http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF>

^d California's Water – Energy Relationship, Table 1-3, Page 11, California Energy Commission, Final Staff Report, CEC-700-2005-011-SF, November 2005.

<http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF>