Stabilizing California's Demand

The real reasons behind the state's energy savings.

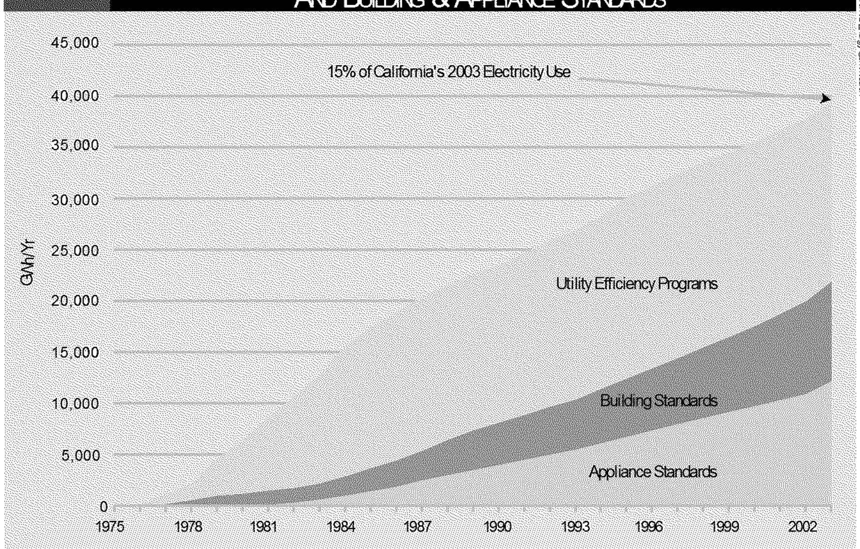
By Cynthia Mitchell, *et al.*

In 2005, California's energy policymakers and regulators established energy efficiency (EE) as California's highest priority resource for meeting future needs in a clean, reliable, and low-cost manner.[1] In 2006, the California legislature and governor positioned energy conservation and efficiency as the cornerstone of the state's Global Warming Solutions Act. The Act mandates a 2020 statewide limit on greenhouse gas (GHG) emissions to 1990 levels. Compliance will be nothing short of Herculean: California will have to reduce per capita energy usage in a manner that accommodates continued brisk population growth and protects the state's economy from economic dislocations and recessionary pressures.

The California Energy Commission (CEC) and California Public Utilities Commission (CPUC) point to California's historical record in saving energy (see *Figure 1*), coupled with its current stable per capita electricity use relative to the balance of the United States (see *Figure 2*), as proof that it is up to this formidable challenge: "Because of its energy efficiency standards and program investments, electricity use per person in California has remained relatively stable over the past 30 years, while nationwide electricity use has increased by almost 50 percent."[2]

The CEC and CPUC take credit for saving, on a cumulative statewide basis from 1975 to 2003, about 40,000 GWh, or the equivalent of 15 percent of annual electricity use, through a combination of utility EE programs and appliance and building standards (see *Figure 2*).[3] Figure 2 illustrates the trend in average per capita total consumption in California and the U.S. between 1960 and 2005. Until the mid-1970s, total electricity use in California and the United States increased at about the same rate. After that, California's usage leveled off, while usage in the United States as a whole continued to increase.[5]

FIG. 1 CALIFORNIA CUMULATIVE GWH SAVINGS: UTILITY EE PROGRAMS AND BUILDING & APPLIANCE STANDARDS



Source: California Energy Commission

California is Different

California's GHG-reduction policy appears in large part premised on the state already having achieved a strong and direct "cause and effect" between energy savings (utility EE programs and building and appliance standards) and energy consumption. As noted above, several documents highlight the role of EE savings in accounting for the different consumption trends evident in California and the rest of the United States.

When we started this project two years ago, we could find no studies that demonstrated the strength of the relationship between EE savings and consumption in California. Since then, some analyses have been undertaken, but, as yet, there has been no analysis that models consumption in California by looking at the specific contribution of changes in the level of EE savings to changes in consumption via multiple regression. Our own attempts to undertake such an analysis, while preliminary (and the best we felt it worthwhile to do given the limitations of the available data) showed that annual changes in the level of EE savings were not associated highly with changes in per capita electricity consumption. Even when many outliers were excluded, simple linear regression showed that the relationship

Cynthia Mitchell *is a principal with Energy Economics Inc., a utility consultancy providing energy efficiency resource-planning services. Email her at ckmitchell1-@sbcglobal.net.* ***Reuben Deumling*** *and* ***Gill Court*** *are associates with the firm.*

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between these two variables was less than 20 percent. In addition, the EE savings variable was not significant within any of the multiple regression models. A major issue we encountered was that on a per capita basis, annual changes in the level of EE savings, were small in relation to the changes in annual electricity consumption. While fully controlling for all other factors that contribute to annual fluctuations in the level of electricity consumption may have allowed us to identify the role of EE savings, we were able to control only for about half of the annual variation in consumption and did not succeed in specifying the role of EE savings[6].

While we have no doubt that EE programs have contributed to the relatively stable[7] pattern of per capita electricity consumption in California, we were interested to see whether there were other factors that distinguish California from the rest of the country that also should be taken into account when explaining the divergence in consumption. We found that California is different from the rest of the United States in several other aspects (*i.e.*, in addition to the scope of its EE programs) that could help account for some of the difference in consumption trends. These are: the price of residential electricity; climate; household size; housing mix; conservation ethic; and the structure of the economy.

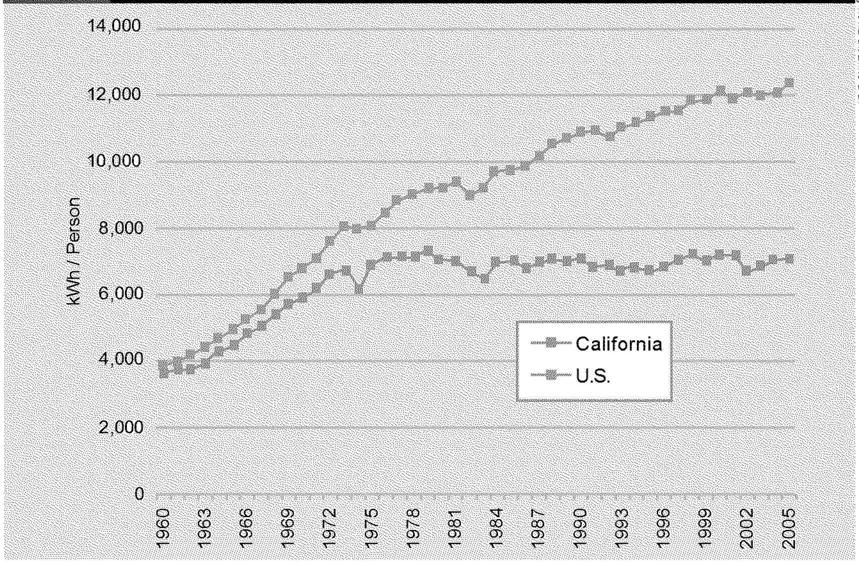
In addition to savings from EE programs, building codes and appliance standards could help account for the different consumption trends evident in California and the rest of the United States over the past 30 years.

✂ **Electricity Prices:** In California, as elsewhere, there is a predictable relationship between electricity prices and the annual variation in residential per capita electricity consumption. On an annual basis, increases in the price of residential electricity are associated with decreases in consumption (*see Figure 3*). For every one mil increase in the price of residential electricity in California, per capita consumption declines by about 6 kWh per capita[8] The data points lie relatively well clustered about the line, with price changes explaining about 40 percent of the annual variability in per capita consumption. These findings are in keeping with the national data on residential energy prices and residential per capita consumption that we analyzed: Those states with higher energy prices have lower per capita consumption and vice versa (*see Figure 4*).[9]

Electricity prices in California are higher than those in the United States as a whole, and the difference in price has become more marked over the past thirty-five years. In 1970, the price of residential electricity in California was 0.0809 cents per kWh, only a little higher than the U.S. average of 0.0806 cents/kWh. By 2005, the price had risen by 37 percent in California, to 0.1109 cents/kWh. In the United States as a whole, however, it had risen by just 4 percent, with the 2005 price, at 0.0838 cents/kWh, substantially lower than in California.[10]

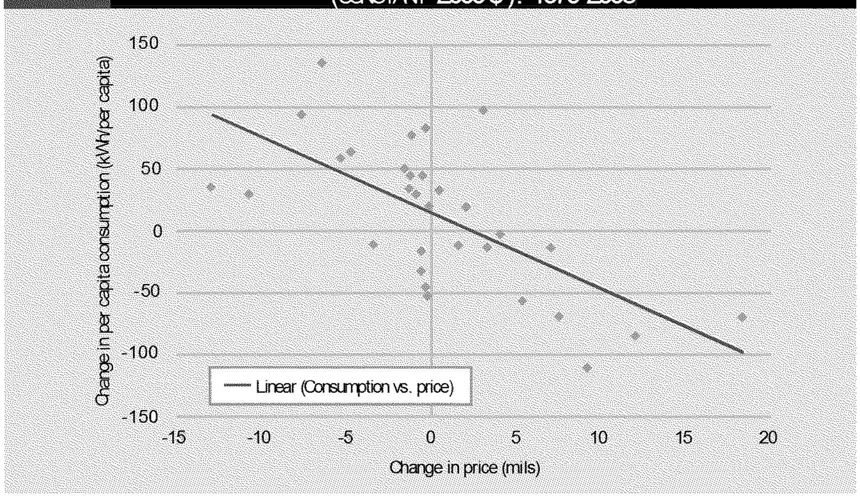
If there is a planetary imperative to

FIG. 2 PER CAPITA ELECTRICITY USE IN THE UNITED STATES AND CALIFORNIA: 1960-2005



Source: Energy Information Administration

FIG. 3 CHANGE IN CALIFORNIA PER CAPITA RESIDENTIAL ELECTRICITY CONSUMPTION VS. CHANGE IN CALIFORNIA PRICE OF RESIDENTIAL ELECTRICITY (CONSTANT 2000 $): 1970-2005



Source: Energy Economics Inc.

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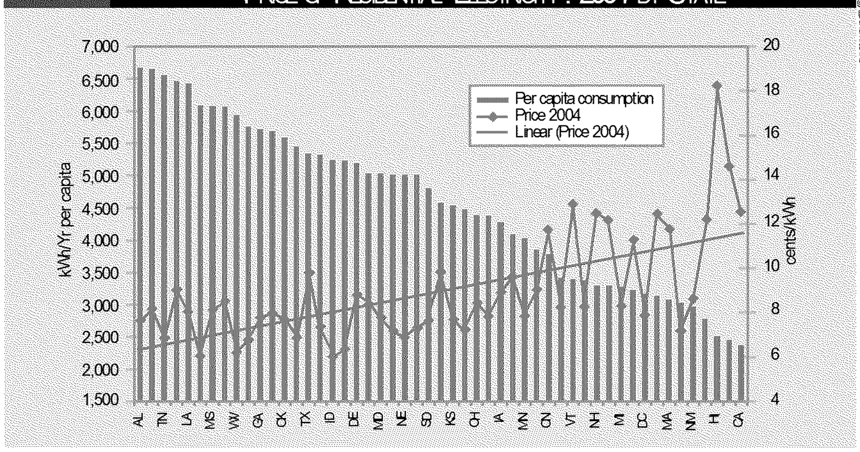
reduce overall energy consumption, and California's marked departure in historical per capita consumption trend in relation to the balance of the United States is in large part, energy price induced, one might ask, why not just raise energy prices further? California energy policymakers and regulators discuss EE as the one component of the state's aggressive GHG-emissions reduction policy that will keep money in state and local economies, while all of the other GHG-reduction strategies will be expensive. In other words, California needs moderate energy prices to help keep the economy going.[11]

Changes in energy-efficiency savings were small compared to changes in California's electricity consumption.

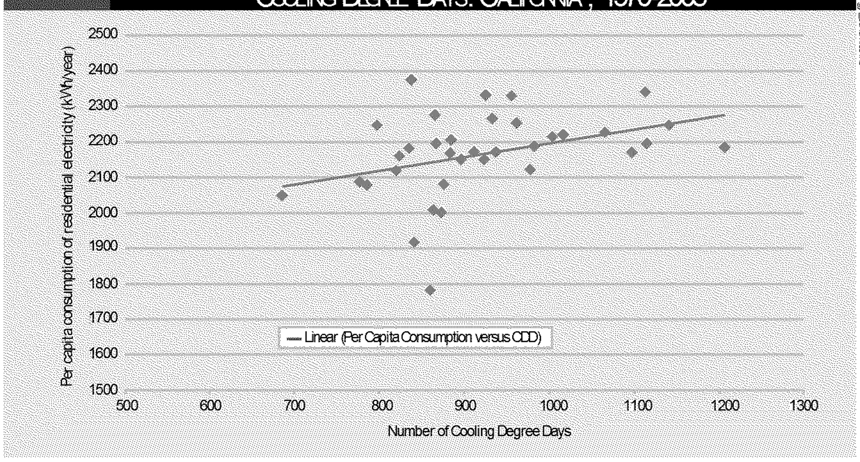
✂ **Climate:** Not surprisingly, the weather also is a strong driver of per capita electricity use. We conducted an analysis of the relationship between the number of cooling degree days (CDDs) in California against per capita residential electricity consumption.[12] This analysis showed that years with higher numbers of CDDs, are associated with higher levels of per capita electricity consumption (*see Figure 5*). This is in large part due to the electricity demands of air conditioners in years with warm summers.

FIG. 4 PER CAPITA RESIDENTIAL ELECTRICITY CONSUMPTION AND PRICE OF RESIDENTIAL ELECTRICITY: 2004 BY STATE



Source: Energy Economics Inc.

FIG. 5 PER CAPITA RESIDENTIAL ELECTRICITY USE VS. NUMBER OF COOLING DEGREE DAYS: CALIFORNIA, 1970-2005



Source: Energy Economics Inc.

We also found that California tends to experience fewer CDDs than the United States as a whole. The state's relatively moderate climate greatly affects the amount of residential electricity that is used for space cooling in the summer. Heating is less of an issue because of the dominance of gas heating in the state. A good summary measure of the difference between California and the United States as regards climate is the annual number of CDDs each experience. For the period between 1975 and 2005, California had an average of 932 CDDs annually. This is substantially less than the U.S. average of 1,274 CDDs, and represents an average difference of 342 CDDs, or 27 percent fewer.[13] While there is limited evidence of a divergence between California and the United States in terms of the number of CDDs over the past 30 years, it is likely that part of the reason for California's relatively low per capita residential electricity consumption is due to the state's lower average number of CDDs. California's relatively mild climate means that the demand for air conditioning is likely to have increased less than in the United States as a whole, despite the rising income levels in the state.

✂ **Household Size:** In explaining the overall trend in consumption, we need to assess the impact of variables such as household size and housing mix. In California, use per household has increased more than electricity use per capita since the introduction of EE programs. California households are larger than average for the United States: In 2006, they contained an average of 2.93 persons compared to 2.61 persons in the United States as a whole.[14]

Household size is important because while each additional person in a household adds to household consumption, they do so by a declining amount.[15] Furthermore, in California, household size has increased since 1980, when there was an average of 2.68 persons per »

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household. This is in contrast to the pattern in the United States as a whole, which has seen household size decline over the same period: In 1980 the average U.S. household size was 2.75, a little higher than for California, whereas by 2006 this figure had fallen to 2.61. Given that larger households consume less electricity per person than do smaller households, these trends in household size may have contributed to the divergence between California and the United States in terms of residential electricity consumption.[16]

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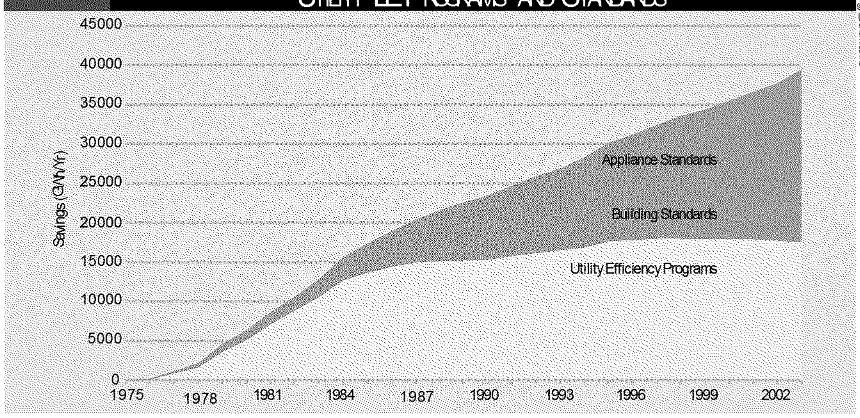
Housing Mix: California has become more highly urbanized with multi-family and attached housing accounting for 39 percent of total units in 2000, compared to an average of 31 percent in the rest of the United States.[17] In addition, the state has diverged from the rest of the United States in this respect: Since 1970 the proportion of total units accounted for by multi-family and attached housing has increased in California (from 33 percent to 39 percent) whereas in the rest of the country it has remained stable. Housing mix is important to understanding per capita consumption of electricity because multi-family and attached housing units generally use less energy than detached structures due to the insulating effects of multiple units.

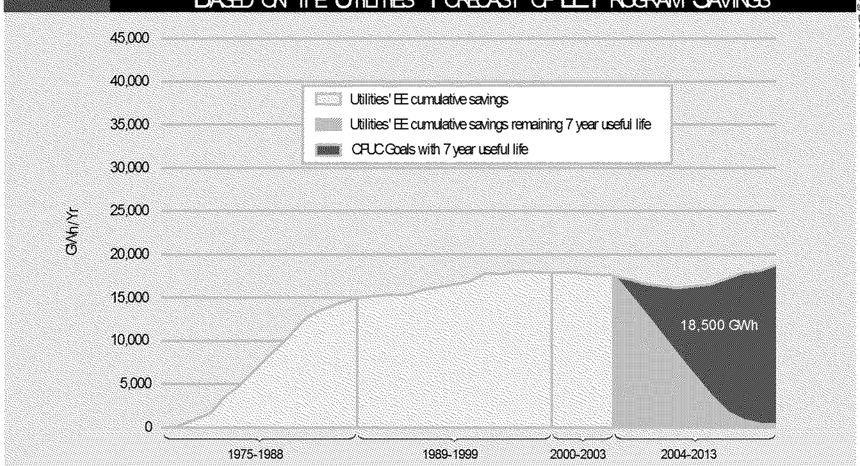
California's Conservation Ethic: While we found that annual changes in savings from EE programs do not well predict changes in per capita consumption of electricity in California, the state's focus on EE and conservation issues, along with the impact of price differentials, may have helped to create a "conservation ethic." Data from the 2001 Residential Energy Consumption Survey (RECS) show that California households are more likely than those in the United States overall to report that they lower their winter temperature settings when no one is at home or during sleeping hours. For example, almost 60 percent of California households reported lowering their winter temperature settings when no one is at home or during sleeping hours, compared to less than 45 percent of all U.S. households.[18] While this does not contribute significantly to reduced electricity usage, it is in keeping with other data that support the idea of a California "conservation ethic." For example, in California a smaller proportion of households report using electricity for heating water and cooking, and fewer households have electric dryers for clothing and a freezer separate from their refrigerator, than is the case nationally.[19] These findings likely reflect the state's efforts with regard to EE and the promotion of energy conservation.

FIG. 6 RE-ORDERED CALIFORNIA CUMULATIVE ENERGY GWH SAVINGS: UTILITY EE PROGRAMS AND STANDARDS



Source: Energy Economics Inc.

FIG. 7 FORECAST OF CALIFORNIA CUMULATIVE GWH SAVINGS 2004-2013 BASED ON THE UTILITIES' FORECAST OF EE PROGRAM SAVINGS



Source: Energy Economics Inc.

Industrial Shift

One of the factors that can influence a state's consumption of energy is the type of industries that dominate the economy. The manufacturing sector is second only to transportation in terms of its share of total energy consumed nationally, and so can heavily influence »

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overall consumption levels. Thus, the mix of industries in California is likely to be a contributing factor to the state's relatively stable electricity consumption trend. Our analysis indicates that the manufacturing sector has contributed both to the relatively low levels of per capita consumption of electricity in California, and the divergence between trends in consumption in the state and those in the rest of the United States. The California manufacturing economy is more heavily dominated by non-energy-intensive industries than is the case nationally, and between 1990 and 2005, employment in energy-intensive industries declined more in California than was the case for the rest of the United States.

In California, energy-intensive manufacturing industries[20] accounted for about 20 percent of total manufacturing employment in 2005 compared to 26 percent in the rest of the United States[21]. In terms of trends over time, in California, energy-intensive manufacturing industries have shown greater reductions in employment than is the case for the rest of the United States. Between 1990 and 2005, employment in the groups of industries characterized by high energy use fell by 20 percent in California compared to 16 percent in the rest of the United States. This helps explain the divergence between California and the rest of the country in terms of overall energy consumption per capita. Trends within the primary metal industries provided additional evidence to suggest that employment in the specific industries that are particularly energy intensive declined to a greater extent in California than nationally. In California, the number of employees in the energy-intensive aluminum industry declined by 40 percent compared to 31 percent in the rest of the United States. Conversely, employment in the less energy-intensive pharmaceutical industry (a sub-industry within the chemicals group) grew more rapidly in California than nationally (by 81 percent compared to 34 percent). In addition, the energy intensity of one of California's most important industries, computer and electronic product manufacturing (which accounts for over one-fifth of both manufacturing employment and manufacturing value added in the state, compared to 10 percent nationally), has declined substantially over the past 20 years. Not only is this industry a relatively low user of energy, but its use of energy per $ value added also has declined.[22]

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Energy-Efficiency Savings

Interestingly, our per capita analysis provides additional insight to our earlier separate analysis concerning the utility EE program savings portion of California's cumulative energy savings (see *Figure 2*).[23] If utility program EE savings are most likely less robust than historically characterized, then it makes sense that California's historical EE savings (see *Figure 1*) cannot fully account for California's per capita consumption (see *Figure 2*).

Since the late 1980s, California's utility EE programs have contributed to only a modest growth in new or incremental savings;[24] building and appliance standards apparently register the lion's share of continued EE savings growth.[25] This is illustrated per Figure 6, which reorders or restacks the CEC's estimate of California's historical cumulative EE savings shown in Figure 1, so that the utility EE program savings are layered in first, followed by building and appliance standard savings.[26]

This is in part because the utilities have relied on EE measures that are short-lived, such as compact fluorescent lamps, (or CFLs). In essence what this means is the California utilities are treading water when it comes to growing cumulative long-term EE savings.[27]

The historical California utility EE program savings data used by the CEC in its DSM forecasting model is as reported by the utilities on an *ex ante* basis—or prior to measurement and verification. Recent preliminary independent analysis of the California utilities' 2006 and 2007 reported EE accomplishments indicate the utilities' claimed savings to be off or high by a significant amount.[28]

Not until 1989 were utility-reported savings adjusted for free ridership or net-to-gross (NTG) ratios. In response to the possible argument that via spillover (or "free drivers"), the California utilities have caused much greater levels of EE than reflected in Figure 1, it is important to note two important facts: The current NTG ratios were in fact derived by the California utilities; and the current NTG values include the effects of free ridership and both participant »

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and nonparticipant spillover.[29]

From 1989 through 1999, some billing analysis also was used to adjust reported savings on an *ex post* basis. Since that time, the EE savings data has reverted to utility-reported *ex ante* savings. Also, for the first decade of run-up in claimed EE savings from zero to close to 15,000 GWh, the utility EE programs largely were home audits and education and information programs, with the first cash rebate given in 1982. Thus, to represent those EE savings as equivalent "steel in the ground" supply-side resources is extremely far-fetched. Further, about 10 percent of the generation and capacity savings are ascribed to utility T&D conservation voltage reduction implemented from 1975 through 1980. Such utility-system efficiency savings, while beneficial, are not generally classified as consumer EE.

If the current trend continues (from 2006 through 2008) in utility EE savings as forecasted by the utilities, there will be little if any new or incremental utility EE savings towards the CPUC's aggressive EE saving targets. That trend can be seen in the forecast of California's cumulative utility EE program savings from 2004 to 2013, based on PG&E, SCE, and SDG&E's forecast of 2006 through 2008 EE portfolio savings (*see Figure 7*).[30] To develop this forecast, a weighted average EE measure (energy useful life) EUL of 7.1 years was used, calculated from the IOUs' forecasts of the mix of EE measures in their 2006 through 2008 EE portfolios. By 2013 there will be little if any gains in new or incremental GWh savings.[31] *(See Fig. 7)*

Restarting Growth

Over the past 20 years, there has been a strong divergence between California and the United States with regard to per capita electricity consumption. This divergence has been attributed to California's ambitious and far-reaching EE programs and standards. However, this school of thought fails to address the fact that California is different from the rest of the United States in multiple respects—many of which influence electricity consumption. To isolate one particular difference between California and the United States (EE savings) and attribute the divergence in per capita use to this one factor, is likely to overstate the impact or import of that variable. While EE programs and standards undoubtedly have contributed to the relatively stable pattern of per capita electricity consumption in California, our analysis found a relatively weak association between California's EE savings and per capita consumption. Rather, these savings have been achieved within a specific socioeconomic context that also acted on electricity consumption trends.

A number of factors distinguish California from the rest of the United States, and may have contributed to keeping the state's electricity consumption relatively stable. Understanding the role of these factors, as well as savings from EE programs and standards, will allow for a better assessment of the extent to which the California model successfully can be transplanted to other states, regions, or countries. Although the California model may offer lessons for other states or countries, its applicability to meeting global warming targets is limited at best, since what's necessary are sustained absolute reductions in energy consumption, something not observed in the state of California as a whole or anywhere else.

Slow growth in California's per capita electricity consumption over the past several decades combined with population growth equals significant (~2 percent p.a.) growth in total electricity consumption for the state. This is the variable that must be tracked—and reversed. ■

Endnotes

1. California's Energy Action Plan II adopted in 2005 by the California Public Utilities Commission (CPUC) and California Energy Commission (CEC) established a "loading order" of preferred resources—placing EE as the state's top priority procurement resource—and set aggressive long-term goals for EE. See CPUC and CEC, *Energy Action Plan II, October, 2005*. Available at: *http://docs.cpuc.ca.gov/word_pdf/REPORT/51604.pdf.*
2. CPUC and CEC, *Energy Efficiency: California's Highest Priority Resource - Lowering Energy Costs, Promoting Growth, and Protecting the Environment*, August 2006. Available at: *www.epa.gov/cleanenergy/documents/calif_cleanenergy.pdf*. See also the CEC's 2007 Integrated Energy Policy Report (IEPR), Executive Summary, p. 2:

   "Largely as a result of these [energy efficiency] policies, California has the lowest electricity use per person in the nation. While the United States has increased by nearly 50 percent over the past 30 years, California's per capita electricity use remained almost flat, demonstrating the success of a variety of cutting-edge energy efficiency programs and cost-effective building and appliance efficiency standards." (emphasis added).

   CEC, *Integrated Energy Policy Report*, CEC-100-2007-008-CMF-ES, December, 2007. Available at: *http://www.energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CMF-ES.PDF*. Further, see CPUC and CEC, *Energy Action Plan: 2008 Update*, February, 2008, Available at *http://www.cpuc.ca.gov/NR/rdonlyres/58ADCD6A-7FE6-4B32-8C70-7C85CB31EBE7/0/2008_EAP_UPDATE.PDF*, February 2008.

   "Below we have included one of California's famous graphics of success in energy efficiency. As Figure 3 indicates [*U.S. v. California Per Capita Electricity Sales*], electricity use per person in California has remained relatively stable over the past 30 years, while nationwide electricity use has increased by about 50 percent.

   While this stabilization of per capita electricity use is something we are proud of, it is not nearly enough to meet our AB 32 goals. To address this emissions reduction challenge for electricity, we will need to bend this curve downward, because, among other reasons, the population of California continues to grow rapidly, causing overall electricity use in the state to continue to rise by between one and two percent every year." (emphasis added) p.7.
3. Data supplied by CEC.
4. See Figure 1 in CPUC and CEC, *Energy Efficiency: California's Highest Priority Resource - Lowering Energy Costs, Promoting Growth, and Protecting the Environment*, August 2006. Available at: *www.epa.gov/cleanenergy/documents/calif_cleanenergy.pdf.*
5. Figure 2 reflects total per capita consumption, which includes, or has embedded in it, economic structural changes over time. To isolate this effect on per capita consumption from EE savings, in our statistical analysis to the extent data was available, we utilized residential per capita »

consumption and residential savings.

6. See Mitchell, Cynthia, Reuben Deumling and Gill Court, "Is Energy Efficiency Enough? An Exploration of California Per Capita Electricity Consumption Trends," presented at ACEEE Summer Study on Energy Efficiency in Buildings, August 17-22, 2008, *http://www.aceee.org/conf.*
7. It is important to note that a relatively stable pattern of per capita electricity consumption in this case translates into a moderate but still exponential growth in total residential electricity consumption of an average 2.1 percent per year between 1985 and 2007 (residential account data for PG&E, SCE, and SDGE supplied by the CEC). Such observed growth, though it may be slower than in the majority of other states, is nevertheless antithetical to the state's global warming goals.
8. Energy Information Administration, *State Energy Consumption, Price and Expenditure Estimates*, various years, available at: *ftp://www.eia.doe.gov/emeu/states/_seds.html*; Energy Information Administration, *State Energy Data 2004*, Appendix C: Resident Population, Tables C1-C5; and Energy Information Administration, *Annual Energy Review*, Appendix D1: Population, U.S. Gross Domestic Product, and Implicit Price Deflator, available at *http://www.eia.doe.gov/emeu/aer/append_d.html.*
9. *Id.* A simple linear regression of 2004 per capita residential electricity consumption against the 2004 price of residential electricity by state indicated that 45 percent of the variability in consumption could be accounted for by the price variable.
10. All prices in constant 2000 $.
11. See page 3, heading "Supports Economic Development and Creates Jobs in California," in CPUC and CEC, *Energy Efficiency: California's Highest-Priority Resource - Lowering Energy Costs, Promoting Growth, and Protecting the Environment*, supra note 2.
12. Energy Information Administration, *Electricity Consumption Estimates by Sector*, various years; Energy Information Administration, *State Energy Data 2004*, Appendix C: Resident Population, Tables C1-C5 Source; and National Climatic Data Center. A cooling degree day (CDD) indicates how heavy the air conditioning needs are under certain weather conditions. One CDD is accumulated for each degree the average temperature for a day is over 65 degrees F (see *http://www.energy.ca.gov/glossary/glossary-c.html and http://www.weather2000.com/dd_glossary.html*). A simple linear regression of California per capita consumption of residential electricity against the number of CDDs for the years 1970-2005 showed that the CDD variable "explained" almost 15 percent of the variability in the per capita consumption variable.
13. Data from the National Climatic Data Center.
14. 1970 data supplied by Reuben Deumling, Energy & Resources Group, UC Berkeley; 2006 data from U.S. Census Bureau, American Community Survey, 2006.
15. See William B. Marcus, Gregory Ruszovan, and Jeffrey A. Nahigian, *Economic and Demographic Factors Affecting California's Residential Energy Use* (West Sacramento, Calif.: JBS Energy, Inc., 2002), Figure 3.
16. This is not simply because larger households have larger houses. A recent study has found that larger houses have higher energy consumption not because there are more people in them but because the people in them consume proportionately more energy than people living in smaller houses. That is, electricity use per household member increases with the size of the house. See Mithra Moezzi and Rick Diamond, *Is Efficiency Enough? Towards a New Framework for Carbon Savings in the California Residential Sector*, CEC, PIER Energy-Related Environmental Research. CEC-500-2005-162.
17. U.S. Historical Census of Housing Tables, Units in Structure, available at: *http://www.census.gov/hhes/www/housing/census/historic/units.html.*
18. Energy Information Administration, *Residential Energy Consumption Survey, Table HC6-7a: Usage Indicators by Four Most Populated States, 2001* Available at *http://www.eia.doe.gov/emeu/recs/recs2001/hc_pdf/usage/hc6-7a_4popstates2001.pdf*
19. Energy Information Administration, *Residential Energy Consumption Survey 1997, Table HC5-7a: Appliances by Four Most Populated States*, Available at: *ftp://ftp.eia.doe.gov/pub/consumption/residential/four_states/appl_4states.pdf*, Energy Information Administration, *Residential Energy Consumption Survey 2001, Table CE4-7c: Water-Heating Energy Consumption in U.S. Households by Four Most Populated States*, *http://www.eia.doe.gov/emeu/recs/recs2001_ce/ce4-7c_4popstates2001.html*
20. These include the following industries: nonmetallic minerals, primary metals, food, paper, petroleum and coal, and chemicals. See Energy Information Administration, *Annual Energy Outlook 2007*.
21. *Current Employment Statistics Survey*, various years, Bureau of Labor Statistics. Available at *http://data.bls.gov*. These data exclude the pharmaceutical industry, which in contrast to "bulk chemical" manufacturing, is not energy intensive. Pharmaceuticals dominate in California, accounting for over 50 percent of employment in the chemical industry in 2005 compared to 31 percent in the rest of the United States.
22. U.S. Department of Energy, *Indicators of Energy Intensity in the U.S.: Industrial Sector Data*, Available at: *http://intensityindicators.pnl.gov/trend_data.stm.*
23. Work of Energy Economics Inc. as consultant to TURN in R.06-04-010 during 2nd and 3rd quarters 2007, *http://www.cpuc.ca.gov/Published/proceedings/R0604010_doc.htm.* Energy Economics Inc. per capita analysis separate and apart from the TURN work.
24. It is important to point out that "a modest growth in [energy] savings" is not the same thing as "an absolute reduction in energy consumption," although this often is implied. The only outcome commensurate with California's global warming policies is unambiguous and sustained declines in total energy/electricity consumption. Slight variations in the positive rate of growth are still movement in the opposite direction of that now mandated.
25. The characterization of California's historical building and appliance standard EE savings is an entirely separate matter worthy of additional detailed analysis, given the fact that the savings are highly dependent on assumed levels of compliance rates. The CEC DSM Forecast assumes relatively high levels of building and appliance standards compliance. The May 2007 "Statewide Codes and Standards Market Adoption and Noncompliance Rates," *Final Report*, CPUC Program No. 1134-04 SCE0224.01 by Quantec Consulting found very high noncompliance rates for residential building measures updated per California's Title 24 standard. *http://www.calmac.org*. Appliance standard compliance rates are easier to estimate because: (1) appliance standards set dates for changes in appliance manufacturing and stocking; and (2) appliance turnover rates can be tracked through retail sales data (with additional consideration needed on whether the replaced appliance enters a secondary market).
26. Data supplied by CEC.
27. *http://docs.cpuc.ca.gov/Published/proceedings/R060410.htm, Decision 07-10-032*, Oct. 18, 2007, Commission Discussion, page 21: "TURN [The Utility Reform Network] correctly notes that an emphasis on measures with savings that decay quickly creates a 'treading water effect' whereby the measures are replaced in the next portfolio cycle with little development towards sustainability programs that do not require continual reinvestments of ratepayer funds."
28. *http://www.cpuc.ca.gov/PUC/energy/electric/Energy+Efficiency/EM+and+V/081117_Verification+Report.htm*, CPUC EE 2006-2007, Verification Report Review Draft prepared by Energy Division Feb. 5, 2009. The California utilities (Pacific Gas & Electric, Southern California Edison, San Diego Gas and Electric, and Southern California Gas) reported 2006 and 2007 EE accomplishments that collectively the utilities had achieved almost 130 percent of the CPUC's electric goal and over 110 percent of the CPUC's gas goal. In contrast, the CPUC's Energy Division Staff has reached a significantly different conclusion on California IOUs' 2006 and 2007 EE accomplishments. Per the CPUC's utility incentive mechanism based on a sharing between ratepayers and shareholders of the net benefits, the California IOUs claimed they were due a shareholder incentive of $236 million. Per the Energy Division's February 5, 2009 *Interim Claim Report*, the California IOUs are collectively at only 78% percent of the CPUC's combined electric and natural »

gas goals. On an individual basis, the thee electrics are entitled to zero shareholder incentives, with SoCalGas entitled to $2.89 million. *www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EM+and+V/081117_Verification+Report.htm*. CPUC *Decision 08-12-059* dated Dec. 18, 2008 authorized interim payments based on utility submitted performance reports subject to a 65 percent hold-back pending the results of Energy Division's ex post measurement and verification results. *http://docs.cpuc.ca.gov/Published/proceedings/R060410.htm.*

29. See Program Elements Attachment A: PG&E, SCE, SDG&E, SCG, Sept. 22, 2000; and CALMAC Public Workshops on PY 2001 EE Programs: Day 1 & 2, Sept. 12 and 13, 2000, Day 3 & 4, Sept. 19 and 20, 2000. California Measurement Advisory Council (CALMAC) Workshop Report 9/25/2000 Proposed NTG Ratios for PY2001. *http://www.calmac.org*

30. Analysis of savings data supplied by the CEC and savings goals data in CPUC *Interim Opinion: Energy Savings Goals for Program Year 2006 and Beyond*, *Decision 04-09-060*, Sept. 29, 2004, Table 1E. Available at *http://docs.cpuc.ca.gov/WORD_PDF/FINAL_DECISION/40212.PDF.*

31. The utilities forecast of savings as shown in Figure 7 is more robust than the CPUC's Energy Division Staff November 2008 *Interim Claim Report* noted above in endnote 27.