TURN's Responses to Stakeholder Questions
EE History Document: May 16, 2011

Stakeholder Pieces

1. Introduction – EE History: Why is the issue important? – All

This issue is important because we need to understand the real impact of IOU programs in the past if we are to accurately forecast their impact in the future. It is also important because an accurate representation of California's EE history can provide an indication of what other states and/or nations can expect from the implementation of similar EE policies.

2. Which version of the "utility EE program history" information should be used for IOU programs (*ex ante* reported, *ex post* evaluated, an estimate of *ex post* evaluated prepared by CEC, other?) – All

The version of program history that should be used is an estimate of ex-post evaluated savings prepared by the CEC. The CEC has already conducted several rounds of EM&V on the various program cycles and this information should be used to inform the estimates of savings from those and other program cycles. Ex-ante reported savings should not be used because experience demonstrates that these estimates overstate the level of savings from programs and are not an accurate reflection of program history. In particular, some of the earlier reported savings estimates did not take into account either net-to-gross ratios or the limited value of education, information, and audits when it comes to generating savings that are equivalent to supply-side resources.

2a. Should there be additional effort to compile a more refined EE program history beyond that contemplated by CEC staff and described above?

The CEC estimates should reflect adjustments to reported savings that take into account NTGRs and the extent to which IOU reported savings are equivalent to supply-side resources and therefore no additional effort to compile EE program history should be required. The main contention is the extent to which historic reported savings estimates in the first 10 years of EE programs are an accurate reflection of reliable and long-term savings. It is clear in the documents that TURN has already submitted that adjustments to reported savings are necessary for a reliable series of historic savings to be generated. The CEC has made several valuable adjustments to these early savings estimates and created a new series that presents a more reliable picture of historic savings. For the 2002 to 2009 period, the CEC should rely on the results of the various EM&V processes and incorporate the findings from the EM&V studies in its estimates of savings from these program cycles. Since even reported savings from about 1985 to 2003 are relatively flat, and the CEC has estimated the portion of savings that would have occurred in the absence of any IOU programs, there seems to be little point in revisiting the estimates for this period. The key issue is that as long as the CEC incorporates the findings from EM&V studies into its estimates of savings for 2002-2009, as well as adjustments to the reported

savings from 1975-1990, the historic savings series should reflect the best available information. There seems little point in going beyond this.

2b. If yes to 4a how should the information be compiled if it does not already exist? Please be very specific about who should do this work, how will policy decisions about what "counts" or does not "count" be made, estimate how much time it will take (or how much time is appropriate to spend), what sources will be used, how this information would be used in the IEPR and *what the value of additional work beyond that currently contemplated by CEC would be*. *Please describe for each of the following program eras – All*

- Pre-1990
- 1990-1993
- 1994-1998
- 1998-2001
- 2002-2005
- 2006-2008+9

No comment

3. The traditional EE categories for the historic period are: building codes, appliance standards, program effects, and naturally occurring conservation. How specific should the write-up be about attribution between these categories and why? -- All

3a. Which savings categories should be included and why?

All these categories should be included because they provide information on the relative importance of different savings streams. It is particularly important to distinguish naturally occurring savings from program effects because the forecast must contain a good estimate of the extent to which savings will occur in the absence of programs.

3b. Should a new category, "market effects" be included, if so why, and if so, how should these effects be estimated?

No comment

3c. How should the impacts of programs vs. standards be portrayed – in tabular form and visually?

No comment

4. The CEC's proposal is to characterize the effects of the 2006-2008 programs using the CPUC/ED's *ex post* evaluated results. Should the CEC use the *ex post* evaluated results or some other characterization of 2006-2008 programs? If some other characterization is proposed, please describe the characterization and the rationale for using it. – All

The CEC should use CPUC/ED's ex-post evaluated results to characterize the effects of 2006-2008 results. These results derive from an extensive EM&V process that generated information on all measures accounting for 1% or more of IOU program savings. It is unthinkable that the results of the process should be ignored for planning purposes.

5. **CEC is proposing to characterize the current 2010-2012 program cycle in three scenarios to characterize 2010-2012 programs:**
   - **Low EE impacts:** Applying 2006-08 CPUC/ED EM&V "realization rates" to the IOU program plans
   - **Mid EE impacts:** 2009 IEPR adjustments to 2010-2012 programs
   - **High EE impacts:** IOU forecast results for 2010-2012

For 2010-12 and beyond should there be a deterministic estimate or scenarios? If scenarios, should they differ from CEC's proposed scenarios, and if so, how and why – All

The CEC should not use IOU forecast results for any planning purposes. These results have consistently overestimated savings from IOU programs and evaluated savings estimates are consistently lower than reported estimates (see Tables 1 and 2). Table 1 shows reported and evaluated savings as a percentage of goals for three program cycles. In the 2002-2003 program cycle utility reported kWh savings were 118% of the goals for those years, a figure which fell to 104% once the savings were evaluated. This decline from reported to evaluated (14%) is small in comparison to the reduction for the 2006-2008 program cycle. For those years, the utilities reported kWh savings were 151% of their goals, a figure that fell to just 62% of goals once the results of the evaluations were factored in. A similar pattern was evident for kW and therm savings.

Table 1: Reported and Evaluated Net Savings as a Percentage of Goals: California Utilities

Table 3. Reported and Evaluated Net Savings as a Percentage of Savings Goals since 2002*

	kWh		kW		Therms	
Program Cycle	**Reported**	**Evaluated**	**Reported**	**Evaluated**	**Reported**	**Evaluated**
2002-2003	118%	104%	104%	86%	98%	81%
2004-2005	127%	79%	133%	75%	182%	55%
2006-2008	151%	62%	122%	55%	117%	50%

*In this table the 2002-2003 and the 2004-2005 accomplishments are compared to IOU program specific goals; and in 2006-2008 the CPUC adopted goal is the point of comparison.

Source: 2006-2008 Energy Efficiency Evaluation Report, July 2010, page xi: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EM+and+V/2006-2008+Energy+Efficiency+Evaluation+Report.htm Click on Main Report

Table 2 shows information from the 2006-2008 Energy Efficiency Evaluation Report on the realization rates of key electric and gas measures. The realization rate reflects the extent to which reported savings were actually realized once the ex-ante savings estimates were evaluated. A realization rate of less than 100% indicates that reported savings overestimated evaluated savings; conversely a realization rate greater than 100% indicates that reported savings

underestimated evaluated savings. Table 2 shows that only two out of 37 technology groups had net kW or net therm realization rates greater than or equal to 100%, leaving 35 out of 37 technology groups with evaluated savings less than reported savings. For net kWh, all of the relevant technology groups had realization rates less than 100%, some significantly so (e.g. interior screw lighting and refrigerator door gaskets).

Table 2: Realization Rates for Key Measure Groups from the 2006-2008 Evaluations

Table 22. Gross and Net Realization Rates for Key Electric Measure Group

Technology Group	Gross-kWh	Gross-kW	Net- kWh	Net-kW
Interior screw lighting	37%	39%	26%	27%
Linear fluorescent	77%	88%	68%	78%
Recycle refrigerator	66%	69%	73%	74%
Process - unknown	66%	67%	48%	49%
Outdoor CFL Fixture	42%	3336%	41%	3010%
CFL Fixture	55%	52%	53%	49%
Refrigeration strip curtain	57%	32%	38%	27%
High bay fluorescent	69%	62%	57%	51%
Process - other	68%	62%	53%	48%
Lighting - unknown	92%	86%	85%	80%
Linear fluorescent delamping	69%	77%	62%	69%
Pump off controller	48%	48%	28%	28%
Pump	78%	90%	63%	74%
On-site Audit	31%	33%	20%	23%
RCA	47%	42%	46%	41%
WB - NC	99%	93%	83%	82%
Refrigeration Door gasket	19%	21%	16%	17%
Compressed air	65%	65%	55%	54%
Lighting - other	65%	96%	54%	82%
Night light	37%	0%	36%	0%
VFD - application unknown	74%	71%	64%	63%
Chiller	84%	85%	72%	75%
Retro commissioning	68%	65%	66%	60%
Rooftop or split system	61%	82%	59%	81%

Table 23. Gross and Net Realization Rates for Key Natural Gas Measure Group

Technology Group	Gross-Therm	Net-Therm
Process - other	58%	39%
Steam trap	167%	92%
Pipe and tank insulation	22%	15%
Process boiler	70%	39%
Process - unknown	83%	39%
Heat recovery	68%	47%
Clothes washer	56%	28%
Greenhouse heat curtain	64%	42%
Heating Boiler	91%	79%
Water heater control	100%	100%
Insulation	86%	33%
Water heater	92%	52%
Duct sealing and insulation	64%	40%

Source: 2006-2008 Energy Efficiency Evaluation Report, July 2010, page 95: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EM+and+V/2006-2008+Energy+Efficiency+Evaluation+Report.htm Click on Main Report

8. Forecast results for energy efficiency are sensitive to assumptions about "decay" – how energy efficient measures are replaced at the end of their useful life. What percent are replaced with non-efficient technologies? With equally efficient technologies? With more efficient technologies? What additional information would be required to improve treatment of decay in the CEC staff forecast? -- All

No comment

9. Add any additional information desired – All

The Utility Reform Network (TURN) Comments to the California Energy Commission (CEC) Staff Workshop on California's Historic Record on Energy Efficiency (EE) Savings May 25, 2011

TURN appreciates this opportunity to provide the CEC with the following comments with the following comments regarding California's historic record of energy efficiency (EE) savings. In order to resolve the issue of historic savings attribution that has been a consistent theme of recent DAWG ES PUP discussions, it is useful to understand (1) how the CEC came up with the 2003 statement of historic savings, (2) how the CEC 2003 statement was used to influence state and national energy policy, and (3) recent trends in electricity consumption: California and rest of the U.S.

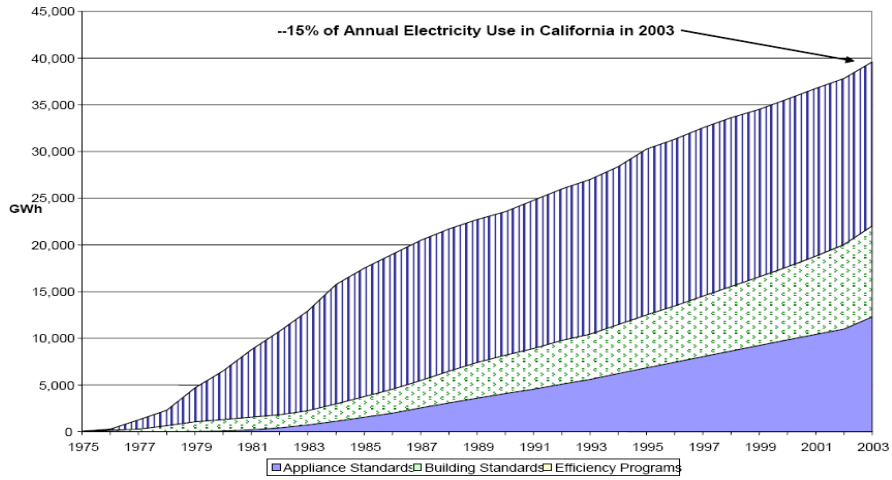
I. The CEC 2003 Statement of Historic EE Savings

The 2003 series (Figure 1), with its attribution of a large level of savings to utility EE programs, was a simple aggregation of utility reported savings from 1975 to 2003. It was based on savings estimates that were not subject to an extensive verification or true-up process.

Figure 1: CEC 2003 Statement of Historic EE Savings[1]

[1] Source: California Energy Commission, Implementing California's Loading Order for Electricity Resources, CEC-400-2005-043, July 2005, Figure 3, page 12: http://www.energy.ca.gov/2005publications/CEC-400-2005-043/CEC-400-2005-043.PDF .

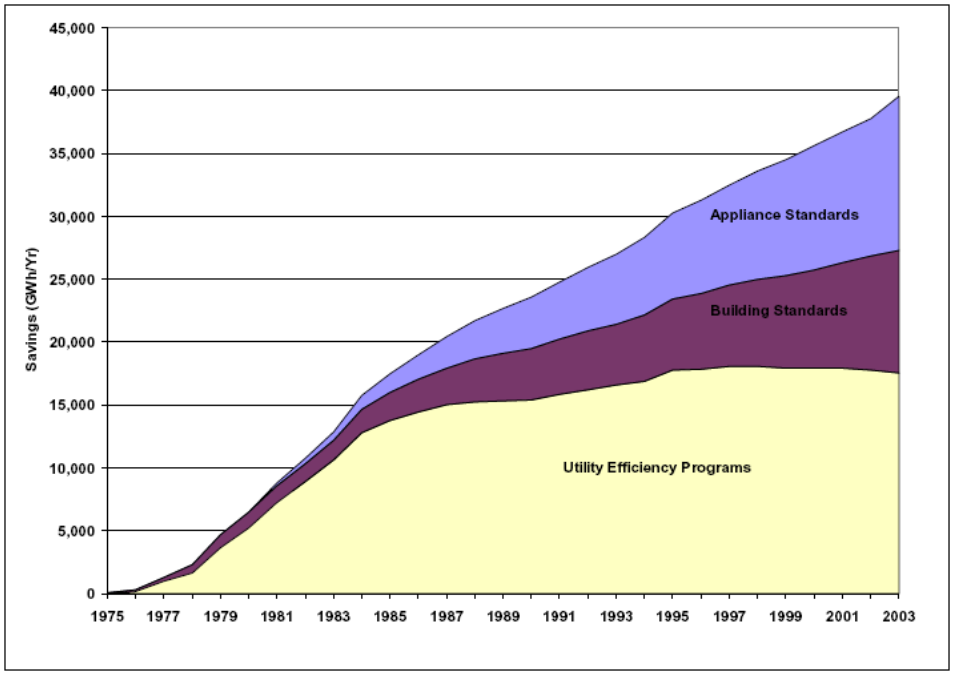
Figure E-1. Cumulative Efficiency Savings



Source: Energy Commission DSM forecast model output

Figure 2, a re-ordering of the savings, makes it easy to see that the bulk of the utility EE savings occurred in the early years, 1975 -1985.

Fig. 2: Re-ordered CA Cumulative Energy GWh Savings: Utility EE Programs and Building and Appliance Standards



CEC documentation suggests that the bulk of savings in the period of most rapid increase in utility reported savings from efficiency programs (from the latter half of the 1970s to about 1985) were ascribed to programs focused on information and audits (Figures 3 and 4). These activities have little

long-term, measured and verified savings associated with them.[2] Cash rebates were not introduced until 1982, and even then programs continued to comprise a mix of information and audits on the one hand and rebates on the other.[3] There is also evidence to suggest that information and audits remained important components of IOU EE programs into the 1990s. For example, the 1993-2013 demand forecast estimated cumulative savings from PG&E's committed conservation and efficiency programs (excluding system efficiency savings) for 1991 to be 4,373 GWh. Of this total, almost one-third (1,430 GWh) is derived from "Energy Management Services."[4] According to PG&E's Annual Summary of DSM Programs for 1992, Commercial Energy Management Services help "commercial customers manage their energy consumption through a wide range of information and evaluation services."[5] The Industrial Energy Management Services Program was similar to the Commercial Program,[6] while in the residential sector "Energy Management Services" included surveys and energy efficiency education services.[7]

Figure 3: Trends in Utility Energy Efficiency Program Effectiveness[8]

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[2] The CPUC's current Evaluation, Measurement, and Verification (EM&V) Protocols, April 2006, near-300 page document that is used to guide the efforts associated with conducting evaluations of California's EE programs, does not recognize EE savings from information and education programs. www.cpuc.ca.gov/energy/energy+efficiency/EM+and+V/. See "California Energy Efficiency Protocols", Page 10: "Information and education programs are examples of programs that do not provide such direct impacts. For these programs, there is a more tenuous link between the program activities and any eventual savings."

This is not to say that a combination of education and information on how to conserve energy, along with direct installation of energy-savings measures, doesn't save energy. For instance, in the mid-1980s there was a landmark residential conservation pilot program "The Hood River Conservation Project" in Hood River, Oregon, intended to test the upper limits of a utility retrofit program. It was proposed by the Natural Resources Defense Council, funded by the Bonneville Power Administration and operated by Pacific Power & Light Company. This five-year, $20 million research and demonstration project installed as many cost-effective conservation measures in as many electrically heated homes in Hood River, Oregon as possible. The measures were aimed at the building shell to reduce electricity use for space heating and at water-heating retrofits. The Hood River Conservation Project, as a demonstration pilot, had a different set of objectives than commonly found in utility education, information, and audit programs, then and now

[3] Mike Messenger, Discussion of Proposed Energy Savings Goals for Energy Efficiency Programs in California, September 2003, CEC 400-03-022D, p.15

[4] California Energy Demand: 1993-2013, Volume XI: Demand Side Planning Program Savings Existing/Committed, California Energy Commission P300-93-014, June 1993, page 3-130-131

[5] PG&E Annual Summary of DSM Programs – March 1992, page II-47

[6] PG&E Annual Summary of DSM Programs – March 1992, page II-48

[7] PG&E Annual Summary of DSM Programs – March 1992, page II-25

[8] Source: Mike Messenger, Discussion of Proposed Energy Savings Goals for Energy Efficiency Programs in California, September 2003, CEC 400-03-022D, figure 5, p.15

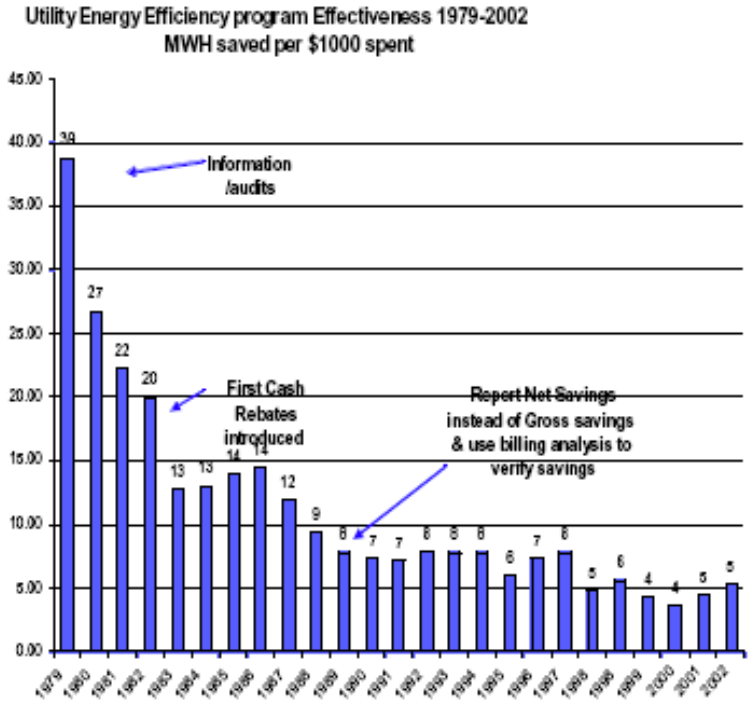
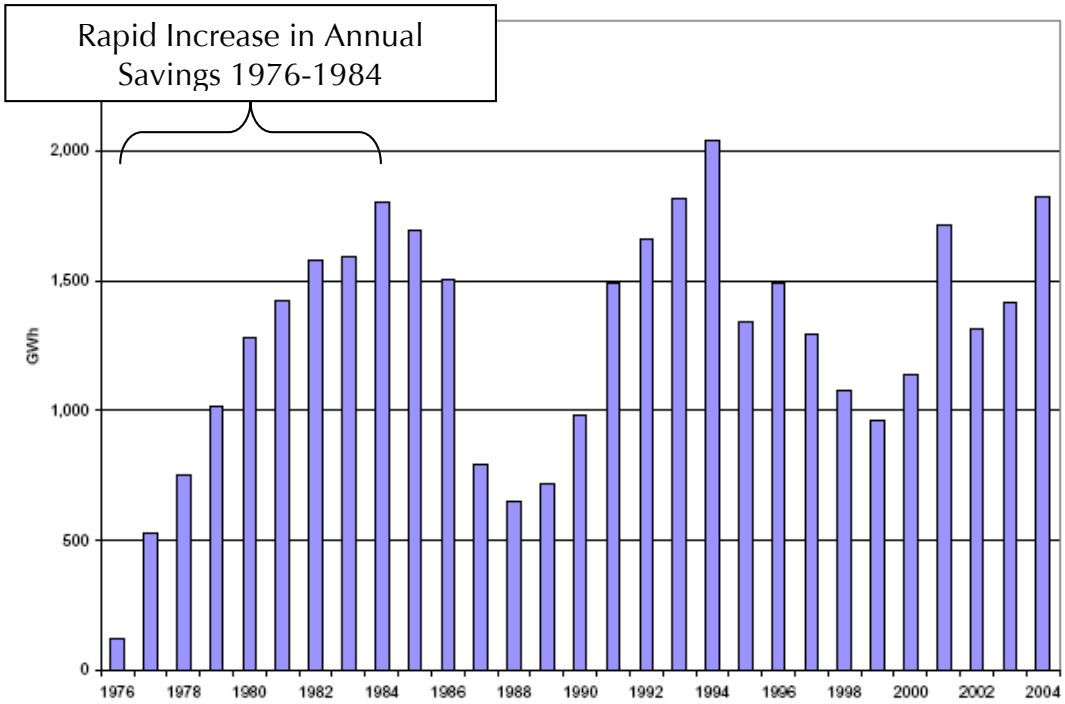


Figure 4: Annual Energy Savings from Utility Efficiency Programs 1975-2004[9]

[9] Source: Implementing California's Loading Order for Electricity Resources, CEC-400-2005-043, July 2005, Figure 4, page 13: http://www.energy.ca.gov/2005publications/CEC-400-2005-043/CEC-400-2005-043.PDF . **Text highlighting period of early, rapid growth added**.



Source: California Energy Commission DSM history files

The first decade of California's energy efficiency programs occurred in a wider national context that is likely to have substantially influenced electricity consumption in the state, prompting consumers to reduce their usage. The 1970s saw two energy shocks (the 1973-74 OPEC Oil Embargo and the 1979 Iranian Revolution) that put strong upward pressure on energy prices, including the price of electricity. In addition, the Iran-Iraq War of the early 1980s also caused major disruptions to the world oil supply.[10] These disruptions to oil supply had an immediate impact on the price of electricity and consumers' utility bills, partly because by the 1970s a relatively high proportion of electricity was generated by petroleum (16%-17%).[11] The real price of electricity in the U.S. increased by 53% between 1973 and 1982 - from a low of 5.7 cents per kWh prior to the impact of the Oil Embargo the price rose to 8.7 cents per kWh in 1982 after the Iranian Revolution and the Iran-Iraq War.[12] As a result, regulators and policy makers instituted a number of education, information, and simple audit activities to try and give consumers a way to reduce utility bills. For example, one national advertising campaign encouraged

[10] Energy Information Administration, *25th Anniversary of the 1973 Oil Embargo*, Slide 2, http://www.eia.doe.gov/emeu/25opec/anniversary.html
[11] Energy Information Administration, *25th Anniversary of the 1973 Oil Embargo*, Slide 14, http://www.eia.doe.gov/emeu/25opec/anniversary.html
[12] Energy Information Administration, *Annual Energy Review 1997*, DOE/EIA-0384(97). (Washington, DC, July 1998), Table 8.13.

consumers to conserve energy by turning out the lights when leaving a room.[13] The combination of high prices and increased awareness is likely to be responsible for the decline in per capita electricity use in California and the rest of the United States between 1973 and 1974.[14] This period of declining per capita usage occurred before the implementation of utility energy efficiency programs but within a context of rising prices and increased state and national action regarding energy conservation issues. The California utility EE information and education programs, which were initiated in the mid-1970s, therefore began after several years of electricity price increases and national discourse and action regarding energy conservation practices.

II. How the CEC 2003 Statement of CA EE Savings Shaped State and National Energy

California is often touted as the national if not international leader in utility EE programs, based in large part on the two graphs below (Figs. 5 & 6) created by the California Energy Commission (CEC) around 2003. Figure 5 (which uses the same data as Figure 1) shows reported utility savings from EE programs as well as the savings attributed to building codes and appliance standards for 1975 to 2003. It shows an upward trend in reported savings. Figure 6 shows that over roughly the same time period (since the 1970s), California's per capita consumption of electricity stabilized relative to the upward trend evident in the US as a whole.

[13] Richard B. Russell Library Exhibits, *Don't be Fuelish: A Discussion on the 1973 United States Oil Embargo,* http://www.libs.uga.edu/russell/exhibits/oil_embargo/main.shtml . There were also a number of state actions - in 1973, Oregon's Governor McCall established an emergency energy conservation program and New York's Public Service Commission prohibited electric utilities from engaging in advertising promoting the use of electricity. (See Oregon Department of Energy, 2011-2013 State of Oregon Energy Plan, page 13: http://www.oregon.gov/ENERGY/docs/reports/legislature/2011/energy_plan_2011-13.pdf?ga=t and http://law.jrank.org/pages/23110/Central-Hudson-Gas-Electric-Corp-v-Public-Service-Commission-NewYork-Significance.html)

[14] Per capita electricity consumption declined from 6,711 kWh per person to 6,208 kWh per son in 1974 in California and from 8,233 kWh per person in 1973 to 8,171 kWh per person in 1974 in the rest of the U.S. Source: Analysis of EIA SEDS data - http://www.eia.doe.gov/emeu/states/_seds.html . On a per capita basis, electricity use also declined during the energy shocks of the 1979-1982 period.

Fig. 5: CA Cumulative Energy GWh Savings: Utility EE Programs and Bldg. & Appliance Standards

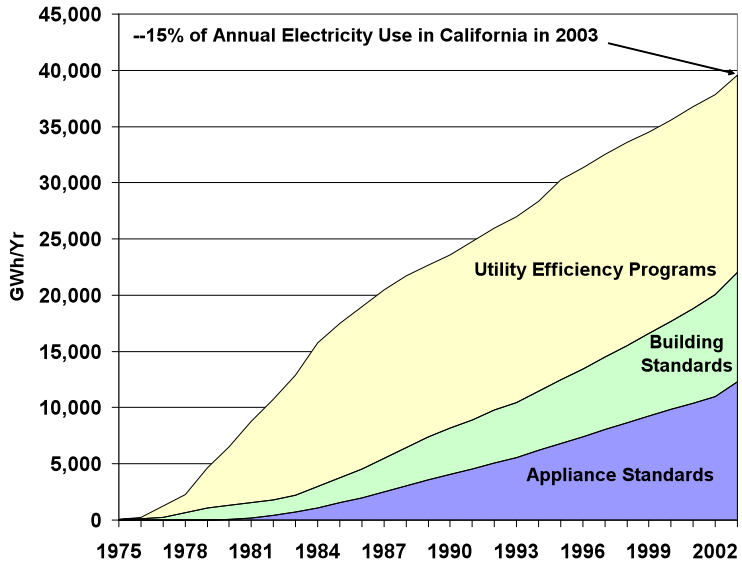
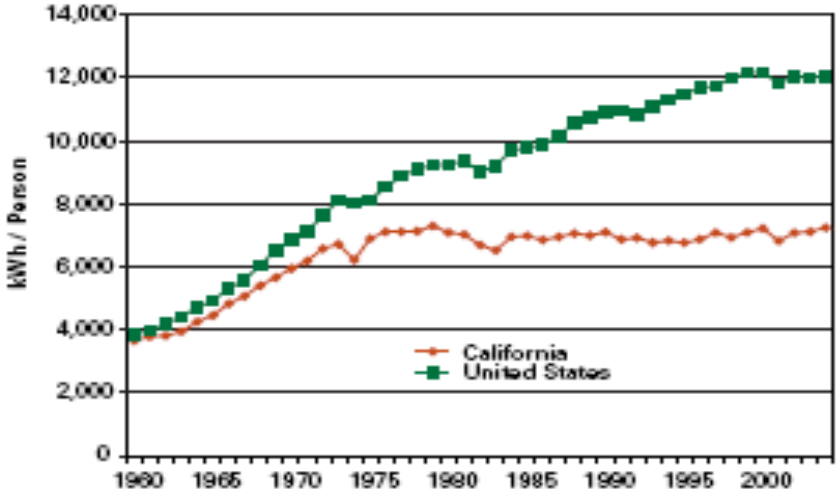


Fig. 6: Per Capita Electricity Use in the U.S. and CA: 1960-2004

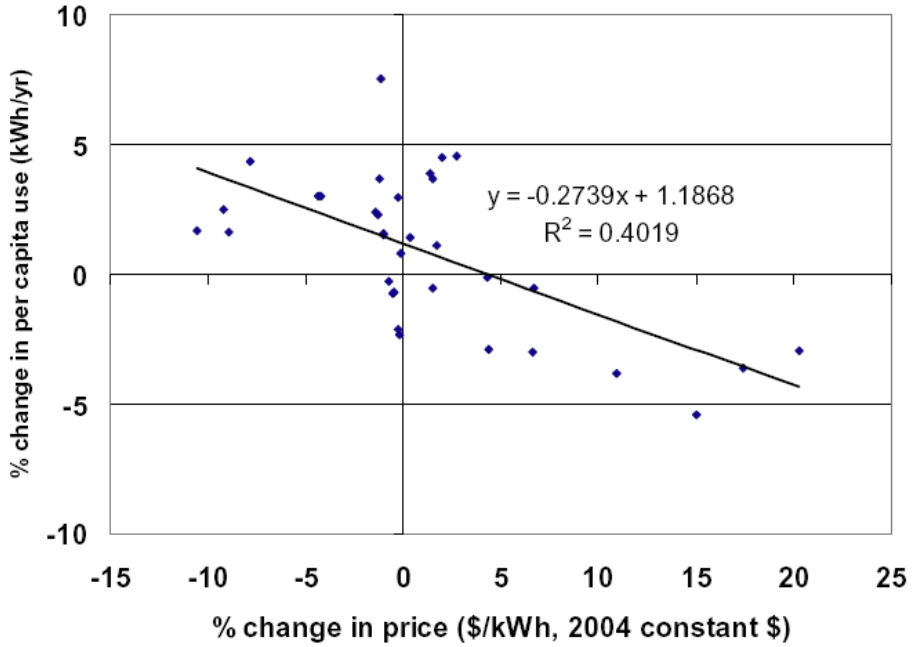


Several widely publicized CEC and CPUC documents from 2003 on, assumed that there was a substantial and causal link between the upward trend in reported savings and the relatively stable pattern in per capita electricity consumption. This assumed connection between the two trends has never been empirically verified, although a study conducted in 2005 did seek to establish the extent to which factors

other than utility EE programs could have contributed to the stabilization of California's electricity consumption on a per capita basis.[15]

At about the same time, Energy Economics, Inc.[16] published a paper in Public Utilities Fortnightly (March 2009) that investigated the relationship between per capita electricity consumption and the price of electricity, among other factors. A simple regression in the study showed that about 40% of the change in California's residential electricity consumption could be correlated with changes in the price of residential electricity (Figure 7).

Fig. 7: Change in CA Per Capita Res Electricity Consumption vs. Change in CA Price of Res Electricity: 1970-2004



[15] Anant Sudarshan and James Sweeney, Deconstructing the 'Rosenfeld Curve', Precourt Institute for Energy Efficiency, Stanford University, June 1, 2008: http://piee.stanford.edu/cgi-bin/docs/publications/Deconstructing_the_Rosenfeld_Curve.pdf . The study concluded that no more than one-quarter of the difference between the US and California could be attributed to utility energy efficiency programs. This study did not directly measure the impact of EE savings on consumption, but examined the "gap" between the pattern of per capita electricity use in CA and the U.S. It established the magnitude of the "gap" and then sought to statistically estimate the contribution of non-policy related factors that could explain it (e.g. demographics, climate characteristics, housing stock characteristics, energy usage patterns, and the characteristics and structure of the CA economy relative to the U.S.). The study assessed the impact of these non-policy related factors on electricity consumption and then subtracted that impact from the total "gap" in consumption between CA and the U.S. The remaining "gap" (i.e. after non-policy impacts had been netted out) provided an upper bound on the contribution of EE policy to the difference between per capita electricity use in CA and the U.S. as a whole. It is important to note, however, that this upper bound estimate of the impact of EE policies could also be partially accounted for by factors other than EE policy that the study did not take into account and therefore did not include in its analysis of the impact of non-policy related influences on electricity use.

[16] See Attachment 1.

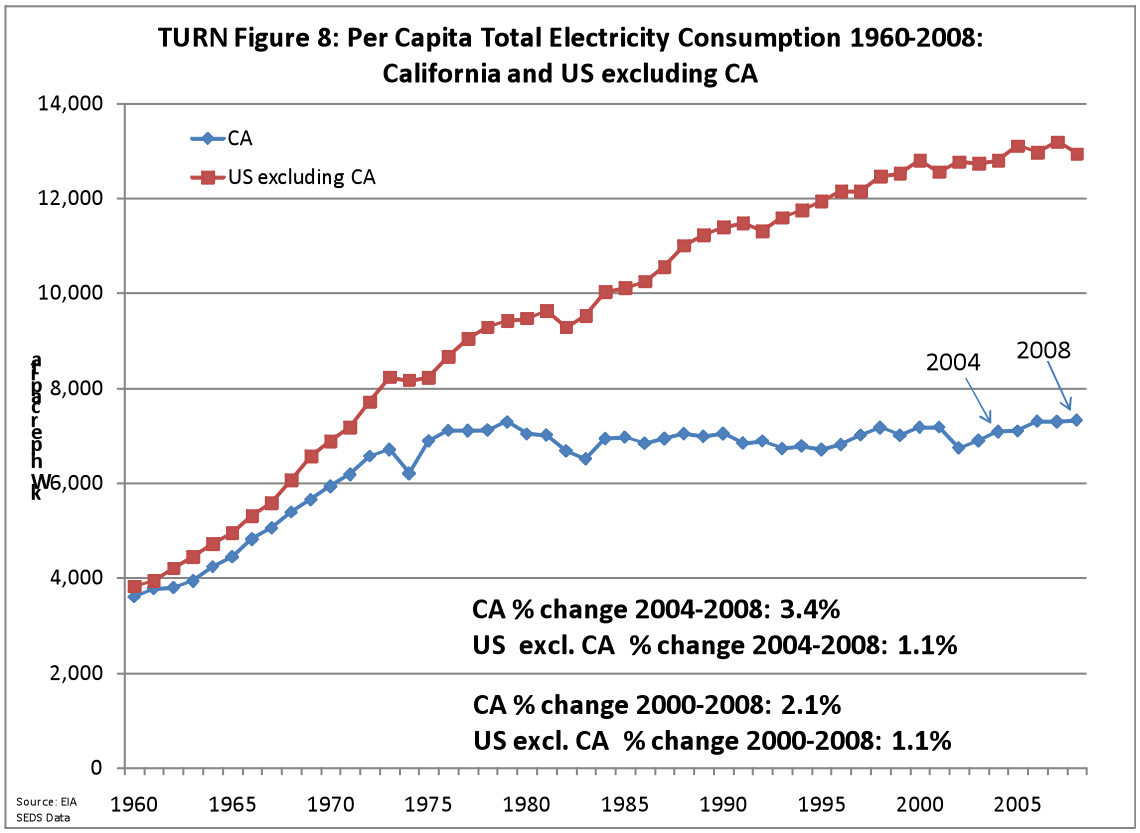
Despite these new findings, a widespread perception remains that California utility EE programs fully explain California per capita electricity consumption trends. This is partly due to the attractive message that the original CEC graphs relayed. It is, however, also due to a misplaced faith in the reliability of utility reported savings from EE programs. California's utilities reported savings without regard to their sustainability or the extent to which they would have occurred in the absence of the programs. The 2009 CEC graph sought to take these factors into account.

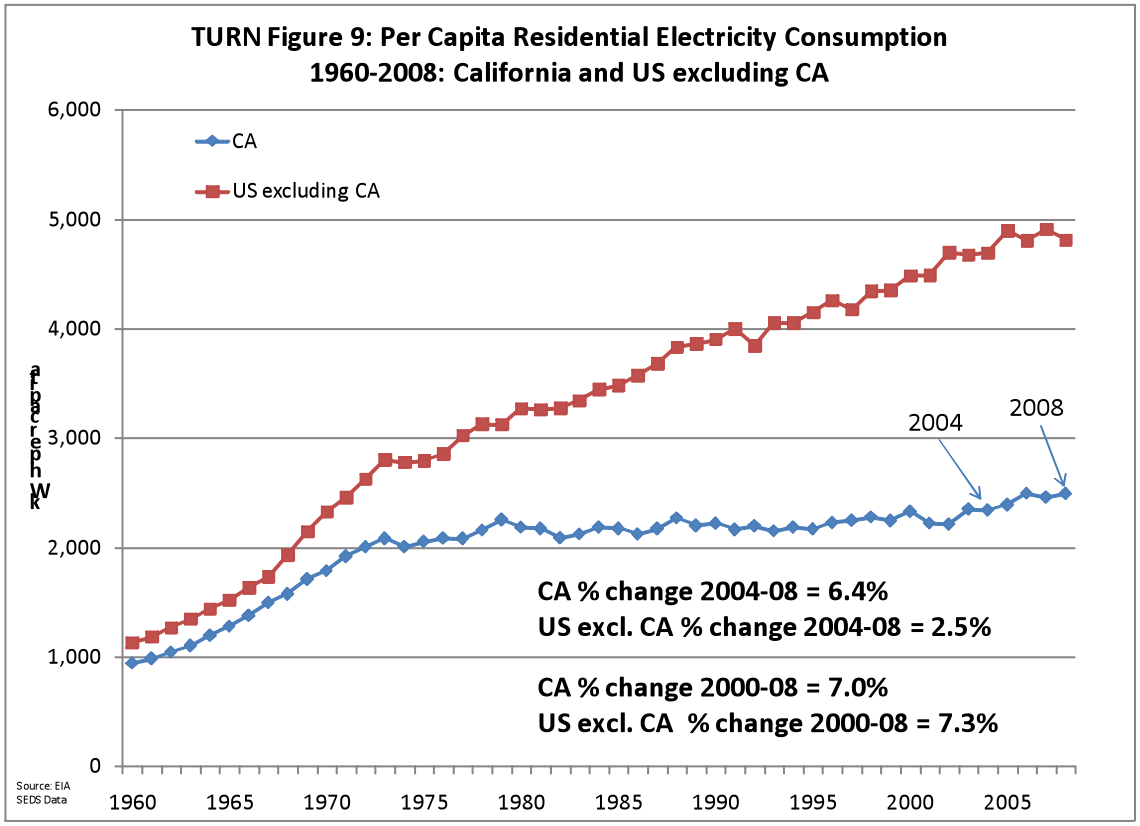
III. Recent Trends in Electricity Consumption: California and Rest of the U.S.

Recent trends in electricity consumption in California provide important information on the impact of recent energy efficiency programs, in particular the expanded programs that were implemented in 2004 and continue until today. California's EE programs are widely viewed as extremely successful when it comes to generating electricity savings, but data on consumption show that the state has continued to see both absolute and relative increases in electricity use. Indeed, between 2004 and 2008 the increase in per capita consumption was higher in California than in the rest of the nation. This is somewhat surprising given the state's leadership role in energy efficiency. Figures 8 and 9 update the per capita consumption data in Figure 6 above to include available data through 2008. Figure 8 shows total electricity consumption per capita. California and the rest of the U.S. followed divergent paths from the 1970s to the beginning of the twentieth century, with California consumption leveling off while the rest of the U.S. continued to increase its per capita electricity use. More recently, however, the rest of the U.S. has slowed its rate of increase in consumption. A similar pattern is evident in Figure 9, which focuses on trends in the residential sector only. In both cases the rest of the U.S. has actually experienced less of an increase in per capita electricity use over the last several years than California:

- For total electricity (Figure 8), per capita consumption increased by 3.4 per cent in California between 2004 and 2008, compared with 1.1 per cent in the rest of the U.S. A similar pattern is evident for the 2000-2008 period, during which California recorded an increase of 2.1 per cent compared to 1.1 per cent in the rest of the U.S.

- For the residential sector (Figure 9), per capita consumption grew by 6.4 per cent in California between 2004 and 2008 and 2.5 per cent in the rest of the U.S. Over the longer 2000-2008 period, both California and the rest of the U.S experienced a similar rate of increase (7 per cent).


TURN Figure 8: Per Capita Total Electricity Consumption 1960-2008:
California and US excluding CA
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
CA
US excluding CA
2004
2008
CA % change 2004-2008: 3.4%
US excl. CA % change 2004-2008: 1.1%
CA % change 2000-2008: 2.1%
US excl. CA % change 2000-2008: 1.1%
Source: EIA
SEDS Data
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005


TURN Figure 9: Per Capita Residential Electricity Consumption
1960-2008: California and US excluding CA
6,000
5,000
4,000
3,000
2,000
1,000
0
CA
US excluding CA
2004
2008
CA % change 2004-08 = 6.4%
US excl. CA % change 2004-08 = 2.5%
CA % change 2000-08 = 7.0%
US excl. CA % change 2000-08 = 7.3%
Source: EIA
SEDS Data
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005