California Energy Efficiency Potential Studies

May 2006

Summary

The primary objective of these studies was to produce estimates of remaining potential energy savings for the near (2006-2008) and foreseeable (2009-2016) future through publicly funded energy efficiency programs in the existing and new residential, industrial, and commercial sectors.

The findings will be used by the four California IOUs to focus utility program offerings by technology, sector, and climate zone. The results will help determine where potential savings remain and which technologies offer the most efficient opportunities for energy savings. The results will also help the utilities assess and meet the energy saving goals set by the CPUC.

This study incorporates the results of two other studies: an analysis of gross energy efficiency potential in existing industrial buildings conducted by KEMA, Inc., and a study of gross potential in residential, commercial, and industrial new construction conducted by Itron, Inc. under a separate contract.

Background

These studies assess the remaining electric and natural gas savings potential in existing and new buildings in California until 2016 for the four California IOUs. In 2003 the CPUC set aggressive new energy and demand savings goals for the four IOUs based largely on the savings estimates from the 2002 and 2003 KEMA-Xenergy Potential Studies. These studies were designed to build on the previous studies, assessing the remaining potential using newly available input data on measure saturations, costs, and impacts; new building and appliance standards; and increased geographical disaggregation. They were intended to help program planners determine measures, building segments, and climate zones with remaining cost-effective savings potential.

Approach

These studies estimated measure-specific remaining technical, economic, and market energy efficiency potential. Market potential was estimated under three scenarios relating to incentive levels. One scenario reflects the continuation of current incentives in effect during 2004. The results were calibrated to measure-specific actual program accomplishments for the 2004 program year. Another scenario assumed that incentives are increased to cover full incremental measure costs. A third scenario was developed to reflect a scenario in which incentives are equal to the average between current (2004) incentives and full incremental costs.

The analysis uses climate zones specified in the CEC Title 24 Standards. The disaggregated, weather-sensitive nature of these climate zones provides diversity for the impacts of weather-sensitive measures. The analysis was further segmented into three housing types for existing residential, 12 building types for existing commercial, 16 categories for existing industrial, five housing types for residential new construction, 11 building types for the commercial new construction, and four categories for industrial new construction. This degree of disaggregation, in conjunction with newly updated input data, addresses uncertainty in the remaining potential by measure, climate zone, and building category.

Key Findings

All results relate to the gross annual savings obtained from measure adoptions through 2016. Savings are in gross form, as they are not adjusted for naturally occurring adoptions. Savings are net of known changes in standards, in the sense that they incorporate improvements in base measure definitions, changing the base measure incremental savings in years when standards change.

Electric Energy Potential

Technical potential for annual electric energy savings is estimated to be 63,814 GWh by 2016 (Figure 1). Of this, 53,150 GWh is economic. The market potential for electric energy savings depends on incentive levels. Under the current scenario, which assumes incentives stay at 2004 levels, market potential is 16,226 GWh by 2016. With incentives half way between 2004 values and full incremental costs (the average scenario), market potential would be 20,065 GWh. Under the full scenario, where incentives cover full incremental measure costs, potential is 23,974 GWh.

Current market potential for PG&E in 2016 is 6,251 GWh, while SCE's and SDG&E's current market potentials are 8,069 GWh and 1,905 GWh, respectively. With incentives set to full incremental measure costs, potential is 9,675 GWh for PG&E, 11,687 GWh for SCE and 2,615 GWh for SDG&E. Technical potential for PG&E is 28,467 GWh, 28,842 GWh for SCE and 6,505 GWh for SDG&E.

Figure 2 shows that 53% of market potential under current incentives relates to existing residential construction. Another 18% is associated with existing commercial buildings, followed by 14% in industrial buildings. Emerging technologies account for another 7%, and new construction accounts for the remaining 8%.

Figure 1: Annual Electric Energy Potential (GWh) by IOU – 2016

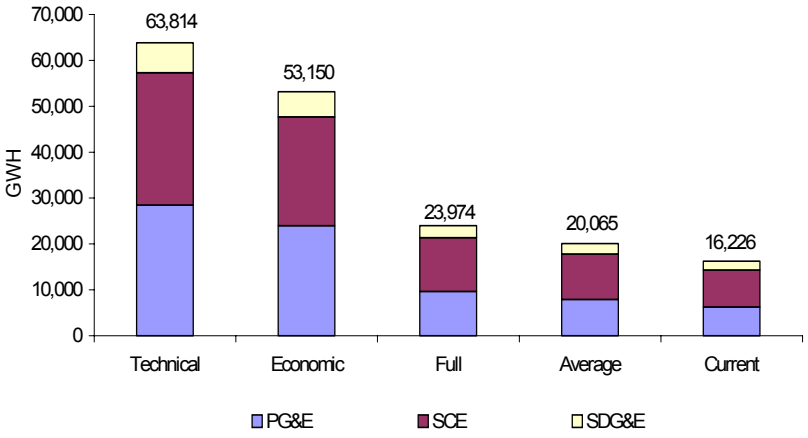
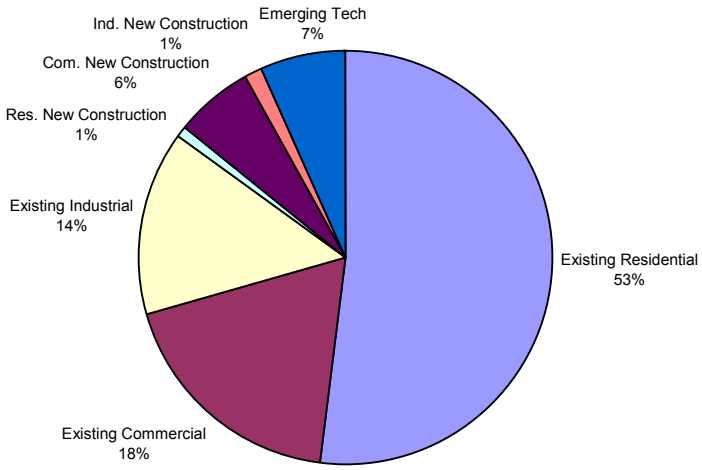


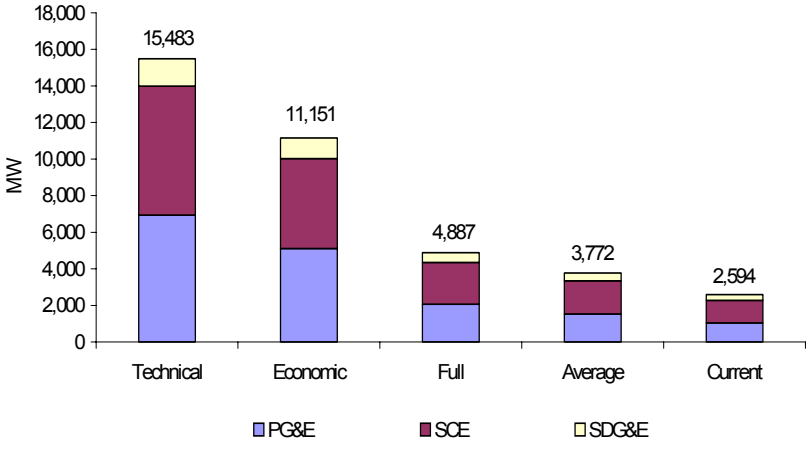
Figure 2: Distribution of Electric Energy Market Potential, Current Incentives – 2016



Peak Demand Potential

Figure 3 shows that the total technical potential for peak demand reductions is 15,483 MW in 2016. The corresponding economic potential is 11,151 MW. Market potential ranges from 2,594 to 4,887 MW across the three incentive scenarios. Forty-five percent of the market potential for demand savings is associated with measures installed in existing residential homes, with another 18% and 11% relating to the existing commercial and industrial sectors, respectively. Another 5% of market demand potential is due to residential new construction, with 8% and 2% relating to commercial and industrial new construction, respectively.

Figure 3: Annual Electric Peak Demand Potential (MW) by IOU – 2016



Natural Gas Potential

Figure 4 depicts the potential for natural gas savings by 2016. As shown, the total technical and economic potential for annual gas savings is 2,336 million therms and 1,453 million therms by 2016, respectively. The market potential for natural gas savings ranges from 247 million therms under the current incentive scenario to 622 million therms under the full incremental cost incentive scenario. As illustrated in Figure 5, 36% of the market potential for natural gas savings under the current incentives market scenario comes from existing residential construction. Share of commercial and industrial existing construction are 11% and 27% respectively. Emerging technologies account for another 15%, with the rest being attributable to new construction.

The current market potential for PG&E in 2016 is 116 million therms, while SCG's and SDG&E's current market potentials are 102 and 20 million therms, respectively. With incentives set to full incremental measure costs, potential is 267 million therms for PG&E, 304 million therms for SCG and 58 million therms for SDG&E. Technical potential for PG&E is 975 million therms, 1,177 million therms for SCG and 185 million therms for SDG&E.

Figure 4: Natural Gas Potential (Million Therms) by IOU – 2016

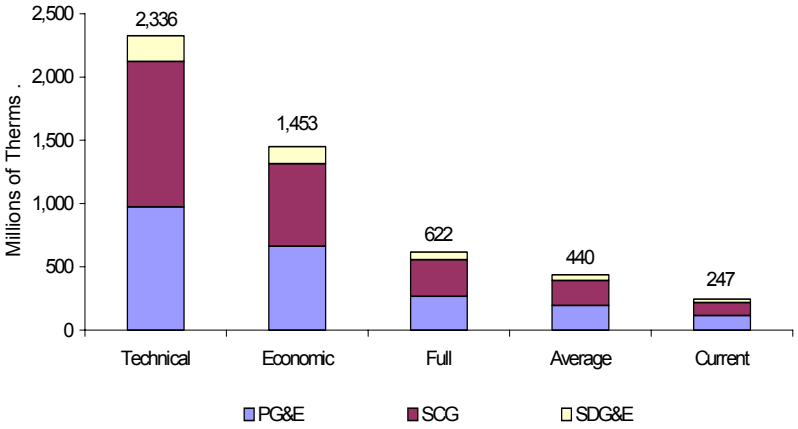
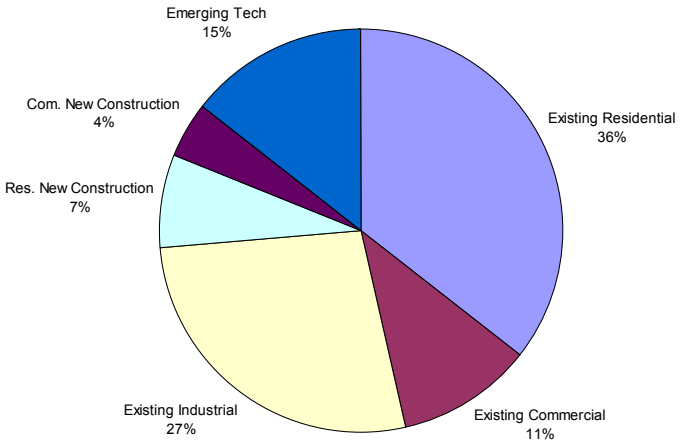


Figure 5: Distribution of Natural Gas Market Potential, Current Incentives – 2016



Cost Benefit Analysis

Table 1 lists the total cost and benefits for the potential studies. Looking at all utility programs, these estimates show that the current market program is cost effective, with a TRC of 1.38. The net avoided cost benefit of these programs in $6.8 billion. Increasing incentives to full incremental costs, lowers the TRC value to slightly less than 1, while increasing the avoided cost benefits to $11 billion.

The existing residential gas and existing commercial gas programs have lower TRC values. If these programs are excluded from the cost and benefit results, the TRC values are above one for the current and the full scenarios.

Table 1: Cost and Benefit Results – 2016 ($ Millions)

All Sectors Electric and Gas	Current Incentives	Full Cost Incentives
Gross Program Costs	$243	$429
Net Measure Costs	$4,682	$12,892
Net Avoided Cost Benefit	$6,793	$11,006
TRC	**1.38**	**0.83**
Excludes Existing Residential and Commercial Gas	**Current Incentives**	**Full Cost Incentives**
Gross Program Costs	$195	$321
Net Measure Costs	$3,028	$7,625
Net Avoided Cost Benefit	$6,444	$10,180
TRC	**2.00**	**1.28**

Comparison to Previous Potential Studies

Individuals comparing the potential estimates of these studies to the potential estimates from the KEMA-Xenergy studies (2002 and 2003) are warned to be extremely cautious. The previous studies differed from the current studies in several ways including different periods (most importantly different starting points), availability of different data on key factors (e.g., current saturations of energy efficiency technologies, or end-use load shapes), different emphases, calibration to different program results, and so on.

The current studies present gross estimates of savings for seven sectors while the previous studies presented net estimates for the largest two sectors. The current studies benefited from new saturation, cost, and impact data. These data often increased the existing high efficiency saturation thereby reducing the remaining potential. Recent lighting logger studies have reduced assumed lighting run times, cutting the impact of high efficiency lighting measures. The current studies also incorporated recent, and known future, changes in federal appliance and state building energy efficiency standards. These changes in standards reduce the remaining technical, economic, and market savings potential relative to the pre-standards potential.

Conclusions

There is substantial remaining potential for California over the next 13 years. The largest electricity savings are likely to be obtained in residential lighting, followed by residential miscellaneous, commercial lighting and industrial pumps.

Each simulation of market potential presented in this report reflects a specific set of assumptions about incentive levels. None of these scenario-specific simulations should be considered a forecast of what is likely to occur over time, since program designs, incentive levels, rates, and rebated measures are constantly evolving and adapting to the existing context. In a sense, energy efficiency markets in California can be expected to be a blend of the various scenarios, and energy efficiency accomplishments can be expected to reflect elements of each of the scenario simulations. Given the blending of these various elements, with the major increase in program budgets in the 2006-2008 period, we can probably expect program accomplishments over these years to more closely resemble the simulated results of the average incentives or full incentives scenarios, rather than the current incentives scenario.

The completion of this research has significantly increased our understanding of the remaining energy efficiency potential and has led to suggestions for additional research. Key areas needing further study include (1) the sensitivity of these results to economic assumptions concerning retail rates, avoided costs, and floorspace growth, (2) the impact of appliance and building standards on potential estimates and the energy savings attributable to standards changes, and (3) the influence of measure costs, incentives, and retail rates on consumers' adoption behaviors.

Sponsor
Pacific Gas and Electric Company
245 Market Street
San Francisco, California 94105

Conducted by
Itron, Inc.
11236 El Camino Real
San Diego, California 92130-2650
(858) 724-2620

Additional Contributors
KEMA-Xenergy, Inc.
RLW Analytics, Inc.
Architectural Energy Corporation

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