

**2004-2005**

**Database for Energy Efficiency  
Resources (DEER) Update Study**

**Final Report**

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# Executive Summary

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## ES.1 Introduction

The Database for Energy Efficient Resources (DEER) provides information on a comprehensive group of energy efficiency measures commonly installed in the residential and nonresidential market sectors. The database contains estimates of a measure's natural gas and electrical gross impacts, incremental cost, and effective useful life. The savings estimates are based on either engineering calculations, building simulations, measurement studies and surveys, econometric regressions, or a combination of approaches. The DEER data serves as a starting point in the planning and forecasting of the impacts and cost-benefits analysis of energy efficiency programs in California.

The DEER Update project has been jointly developed by the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC), with support and input from the Investor-Owned Utilities, and other interested stakeholders. It is funded by California ratepayers under the auspices of the CPUC. The project was completed in two phases. The first phase began in 2003 under the management of San Diego Gas & Electric. Under this phase, estimates for non-weather sensitive data were developed, an interactive website was developed for accessing the DEER data, and analysis software developed for estimating impacts from weather sensitive DSM measures. The second phase began in late 2004 under the management of Southern California Edison. Within this phase, non-weather sensitive measure analyses and results were enhanced and expanded, savings estimates for weather sensitive measures were created, and the DEER website was fully populated with both weather sensitive and non-weather sensitive data and made available to the public on August 31, 2005.

The DEER includes nearly 133,000 unique energy efficiency measure savings estimates representing just over 400 energy efficiency measures. The 133,000 records provide energy savings estimates for different California climate zones, building types, and building vintages. The data is accessible on the DEER website (<http://eega.cpuc.ca.gov/deer/>) through a database search tool. In addition, the entire DEER dataset can be downloaded from this website as a Microsoft Access database file<sup>1</sup>

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<sup>1</sup> The Access database is about 2.4 MB in size.

For most of the 133,000 records, two types of measure energy savings estimates are provided depending on whether any energy-related Codes or Standards affect the installation of those measures: Customer Savings and Above-Code Savings. How an energy efficiency program is designed and implemented affects which baseline and hence which energy savings estimate is most appropriate to use for program planning. The customer saving estimates use the typical baseline technology found in each building vintage as identified by building survey data. An example would be older vintage homes with central A/C systems that are 8.5 SEER. Above-Code saving estimates depend on whether there are any energy-related Codes or Standards affecting the installation of those measures. The California Building Energy Code, Title 24, and the Federal Appliance Standards are examples of specific codes and standards that set the minimum code baselines. An example would be central A/C systems that are replaced at time of burnout, and must meet a minimum Standard mandate of 13 SEER. Thus, SEER 13 is the above-code baseline. All of the DEER weather sensitive measures include both customer and above-code energy savings estimates.

Many of the non-weather sensitive measures do not have customer-based impacts. This is because the non-weather sensitive measure impacts were developed during Phase 1 of this update and only minimal modifications were funded under Phase 2. The data development mandate at the time of Phase 1 was to use only code baselines in all cases unless there was no code or standard in place for the technology.

Parallel to the DEER Update project, an update to the DEER measure cost dataset was performed by Summit Blue Consulting under a separate contract. The measure cost information includes costs for the basecase, measure case, and installation labor.

## **ES.2 Methodology**

The methodologies used to estimate the measure savings from weather sensitive measures differs from the methodology used to estimate non-weather sensitive measure savings. For weather sensitive measures, both in the residential and non-residential sectors, the building energy simulation model DOE-2 was used to estimate the measure savings. The DOE-2 model utilizes building prototype and measure characterization information by building type, vintage, and climate zone in its estimation of measure savings. Non-weather sensitive measure savings, for both the residential and non-residential sectors, utilized engineering calculations and assumptions and results from Measurement and Verification (M&V) studies.

## **ES.3 Website**

The DEER is available on-line through the CPUC website (<http://eega.cpuc.ca.gov/deer/>). The DEER internet interface provides on-line read access to all elements of DEER as well as

the ability to download the entire dataset as an Access database, download portions of the dataset as Excel spreadsheets, or print measure Run ID specific detailed information. Access to the data on the site does not require any kind of username or login account. Anyone browsing to the location of the home page for the site will be able to view the data.

The web site provides easy access to the data, as well as supporting information and documents. There are four main groups of data: residential and non-residential sectors; and within each sector, weather sensitive and non-weather sensitive. A User's Guide to the website is provided in Section 13.

#### **ES.4 Available DEER Information**

This most recent update of the DEER is designed to provide users the opportunity to not only access the data both on-line and in downloadable datasets, but also access to many of the assumptions and supporting documents. There are also documents available through the building simulation model website at [www.DOE2.com/Download/DEER](http://www.DOE2.com/Download/DEER).

Expected future documents that will be available through the DEER website include a copy of this final report as well as electronic copies of literature references, as identified in Appendix F of this report. It is expected that the links to the literature references will be made through a bibliography listing of each reference.

On the DEER website, a survey link allows users to provide feedback and suggest ways to improve and enhance the database and the website interface. Also provided on the website is a notification link to provide any updated information to users of DEER 2.01.

The DOE2 website is the prime information source for the weather sensitive assumptions and analysis. The actual DOE2 software used to develop the weather sensitive measures is available on the DOE2 website as well as the input assumptions needed for the DOE2 analysis.

#### **ES.5 Study Issues and Recommendations**

An important element of the 2004-05 DEER update was inclusion of Tasks designed to help plan for future DEER updates in the light of issues faced by the current and past efforts, how to insure that future Evaluation Measurement and Verification (EM&V) studies support the DEER, and what measures should be added in future updates. Section 14 discusses each of these issues.

The approach used to meet these objectives included interviews with key DEER stakeholders, a review of EM&V studies and plans, and a review of lessons learned from current and past DEER update studies. While there are several issues and recommendations that emerged from this Task, key issues and recommendations include the following:

- Comprehensive DEER updates should be carried out at least every 3 years; however, given the number of outstanding issues in the current DEER, the next comprehensive update should be completed before the end of 2007. In addition, interim DEER updates should be enabled and carried out more frequently (e.g., every 6 months or year).
- DEER should have a clear orientation to aid and guide its decision-making. In general, DEER should strive toward an expected value orientation, neither purposefully conservative nor optimistic. In the face of significant uncertainty, however, DEER should tend toward a more conservative orientation.
- New EM&V efforts are needed for many measures to reduce uncertainties and resolve differences of opinion over measure specification, baseline parameters, and savings measurement. In addition, future evaluation studies should be designed and implemented with DEER applications also in mind. This means more attention to measure-level measurement of savings and associated parameters, as well as explicit reporting of results in DEER-friendly formats.
- Additional baseline calibration activities are needed. Key parameters in commercial sector calculations and simulations should be compared and, as appropriate, calibrated to the CEUS when it becomes available. There is also a critical need to calibrate DEER load shapes to ensure that they do not systematically over or underestimate peak and other hourly loads, and appropriately capture population diversity effects.
- DEER measure costs and measure savings projects should be integrated or conducted in parallel to ensure upfront agreement on measure specifications. Adequate time should be incorporated into project schedules to allow for thorough quality control of cost and savings integration. Future DEER projects should address custom measures (this could include verification and analysis of custom cost data collected by the program administrators). Future DEER cost studies should also address design-related new construction measures or bundles.
- Future DEER projects should continue to expand and improve documentation, particularly, electronic documentation.
- A central purpose of DEER has been, and should continue to be, maximizing the accuracy and consistency of per unit, ex ante measure data used in program planning, filings, tracking systems, cost effectiveness analyses, and energy efficiency forecasting. This is crucial to both the CPUC and utilities' processes for conducting quality control analyses of ex ante data. Both utility

and third party program proposals often contain hundreds or even thousands of ex ante values.

- To the extent that DEER is accurate and complete, it is appropriate to require its use. However, the accuracy and completeness of DEER, like any source, will likely continue to vary somewhat across measures, due to limitations in available data to support DEER and prioritization of DEER resources across measures. For these reasons, it may be appropriate to allow some deviations from DEER if certain conditions are satisfied. In cases where deviations from DEER are proposed, DEER data and documentation should be used as a benchmark to assess whether the deviations should be permitted.
- DEER used a range of methods to develop savings estimates that we organized into three broad categories (Engineering Calculations, Simulation Models, and Field and Laboratory Measurements) and discussed some of their strengths and weaknesses. Historically, all of these methods have been utilized in DEER; however, the weight of the effort in DEER has been on engineering calculations for non-weather sensitive measures and building simulation modeling for measures that are weather sensitive. Our primary recommendation is not to eliminate either of these methods but rather to increase the use of field measurement results in DEER.
- Future DEER projects should provide flexibility by offering segmented results *if differences in savings by market segment are defensible* (both in terms of savings estimation and marketing and program participation requirements) and *well documented*. Where segmented results are presented, efforts should be made to include statistically reliable population weights to indicate what fraction of the market is represented by each of the segments and provide a default weighted average result to allow users to obtain average impacts across segments if so desired.
- Traditionally, the DEER has only included energy and peak demand impact estimates along with measure costs. The 2004-05 DEER update has added effective useful life (EUL) by measure to the DEER. Future DEER should continue to focus on per unit inputs to measure-level cost-effectiveness analysis. Core per unit inputs include incremental costs and savings, including energy, peak demand, and load shape impacts, as well as effective useful lives.