PROCESS EVALUATION OF 2003 STATEWIDE CODES AND STANDARDS PROGRAM

CALMAC Study ID SCE0212.01

Final Report

Final Version, Revised

June 2006

Prepared for:

Southern California Edison Company
Purchase Order V3084904
Managed by The Deringer Group

Prepared by:

ADM Associates, Inc.
Sacramento, CA

Innovologie LLC
Rockville, MD

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

This report provides results of a process evaluation of the Statewide Codes and Standards Program. The objectives for the process evaluation were as follows:

- To describe the general energy code revision and advocacy procedure used in California;
- To describe the how the role of the investor-owned utilities in the procedure is evolving and emerging;.
- To document the Codes and Standards Enhancement (CASE) methodology;
- To verify that the CASE initiatives were completed and delivered into the Title 24 revision process; and
- To identify the strengths and weaknesses of the CASE methodology and provide recommendations for improvements.

Information addressing these objectives was obtained through interviews conducted with stakeholder representatives with interests in the revision of the buildings and appliance energy efficiency standards and codes. The information gathered has been used to describe the code advocacy procedure in general and the utilities role in the procedure. In particular, information has been developed showing how the C&S Program operates within the existing context for making changes to California's buildings and appliance standards. The major impacts of the Codes and Standards Program are realized when possible code improvements developed through the program are actually adopted into the buildings and appliances codes. Such proposals for code enhancements are developed by the C&S Program through Codes and Standards Enhancement initiatives, with the energy savings and cost effectiveness of selected enhancements analyzed by contractors hired by the IOUs.

Energy codes and standards are of course also developed by agencies and organizations outside of California. Information on the process by which codes and standards are developed by these other organizations was therefore gathered in order to compare and contrast the California process with processes used elsewhere. Generally accepted criteria for formulating codes and standards were identified by reviewing the criteria set out by the American National Standards Institute (ANSI) and by examining how these criteria are used by organizations setting energy standards and codes, including the U.S. Department of Energy, the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), the International Code Council (which develops the International Energy Code), and the National Fire Protection Association (NFPA).

The information collected on the processes used by the CEC and the U. S. DOE has been organized through the preparation of program logic models. In particular, the program logic model for each group has been used for the following:

- Identifying the group(s) that are involved in the process;

- Identifying the resources being allocated to the process;
- Describing those activities or action steps that are being used to achieve outcomes;
- Defining the outcomes or objectives for a process, where outcomes are those changes or benefits that result from activities; and
- Determining whether the objectives are being achieved.

Drawing on the materials developed for preparation of the program logic models, several issues associated with the role of the C&S Program in the code revision process were addressed. These issues pertained to the following

- Selecting topics for CASE studies;
- Reviewing technical quality of CASE studies; and
- Obtaining public participation in CASE study preparation.

Based on the analyses of these issues, some recommendations for changes or improvements to the C&S Program were developed. These recommendations are discussed more fully in Chapter 7. Also, an independent review panel developed recommendations, which are provided in Appendix A..

1. INTRODUCTION

Under contract with Southern California Edison Company (CEC), ADM Associates, Inc. (ADM) conducted a process evaluation of the Statewide Codes and Standards Program.[1] Innovologie, LLC was a subcontractor to ADM for this study. This document is the final report for the study.

1.1 BACKGROUND AND OBJECTIVES

There are four investor-owned utilities (IOUs) in California: Pacific Gas and Electric, Southern California Edison, San Diego Gas and Electric, and Southern California Gas.[2] The Codes and Standards (C&S) Program of these IOUs is a continuation of the effort begun in 1998 to identify technologies and practices that are ready for code adoption, to document their readiness for adoption in the buildings or appliances standards, and to advocate for their adoption. In addition, the C&S Program provides for informing and training market actors (building code officials, designers, builders, and affected facilities personnel) on the new code provisions when they are adopted.

Each utility's C&S program consists of two types of activities: those that may be coordinated with other utilities and the CEC and those that may be unique to each utility's service territory and customer base. The first type of activities pertains primarily to the work on prospective code adoptions, which the utilities try to coordinate to make most effective use of funding. The second type of activity pertains to studies of technologies that may be important within a given utility's service area.

The California Energy Commission uses a process whereby it assesses and, if appropriate, adopts proposed changes in the codes for buildings and appliances. (The CEC process has evolved over time and continues to do so.) The C&S Program operates within this context for making changes to California's buildings and appliance standards. Historically, most code change proposals were generated and developed by CEC staff.

The C&S program provides substantial new resources to the CEC code revision process in the form of technical expertise, research data, and analysis. Because of their experience in administering EE programs, the IOUs bring market expertise and understanding to the code revision process. They can contribute to proposals of others by providing comments and, sometimes, analysis, and IOU initiatives provide the basis for other advocates to get involved. IOU involvement can significantly affect the code adoption setting.. For example, IOU involvement provides leverage for the CEC to use in negotiating with industry. IOUs also bring their goodwill and political support into the process.

[1] The study was managed by Southern California Edison. It was funded through the public goods charge (PGC) for energy efficiency that is administered by the California Public Utilities Commission. An electronic version of the report is available for download at www.calmac.org.

[2] Of these, PG&E and SCE are the largest and have the most public moneys available for designated energy efficiency efforts intended for the public welfare.

There were several objectives for the process evaluation of the 2003 Statewide Codes and Standards Program:

- To describe the code advocacy procedure in general and the utilities role in the procedure;
- To document the CASE methodology;
- To verify that the CASE initiatives were completed and delivered into the Title 24 revision process; and
- To identify the strengths and weaknesses of the CASE methodology and provide recommendations for improvements.

1.2 OVERVIEW OF STUDY METHODOLOGY

To establish the context for the process evaluation, information was collected to compare and contrast the processes used to develop code enhancement proposals by various parties, including the following:

- C&S Program and its contractors;
- CEC and its contractors;
- CBIA and its contractors; and
- Other parties (e.g., consultants, manufacturers).

The information gathered has been used to describe the code advocacy procedure in general and the utilities role in the procedure. In particular, information has been developed showing how the C&S Program operates within the existing context for making changes to California's buildings and appliance standards. The major impacts of the Codes and Standards Program are realized when possible code improvements developed through the program are actually adopted into the buildings and appliances codes. Such proposals for code enhancements are developed by the C&S Program through Codes and Standards Enhancement initiatives, with the energy savings and cost effectiveness of selected enhancements analyzed by contractors hired by the IOUs.

In an earlier study of the impacts of the C&S Program in affecting the 2005 Title 24 code change cycle[3], ADM assumed that the CEC and the C&S Program divided up responsibility for the investigation of their respective measures and then worked somewhat independently on the investigation. However, others have expressed the opinion that:

> "In reality, there was substantial interaction and extensive vetting of the C&S funded initiatives with the [California Energy] Commission, and CEC staff believes this simple division of credit does not accurately reflect either the process or the appropriate attribution. The division of labor

[3] ADM Associates, Inc., *Evaluation of 2002 Statewide Codes and Standards Program*, Report prepared for Southern California Edison, June 2004.

was not nearly so clear cut in the 2001 cycle, and this attribution method would have even less plausible … . "[4]

Heeding this critique, the CASE methodology is treated in this process evaluation as being interwoven into the CEC code change process.

A major objective of this process evaluation has been to assess how well the CASE initiative methodology works by examining the CASE reports and the procedures used to develop them. However, the CASE initiative methodology is put into perspective by examining how other players in the code revision process develop and promote code revision proposals.

The information with which to compare and contrast the processes used to develop code enhancement proposals was collected through literature review and through interviews with individuals from the following groups:

- C&S Program and its contractors;
- CEC and its contractors;
- Other stakeholders (e.g., consultants, manufacturers).

Through the interviews with representatives from these groups, information was collected on the procedures they used in developing code enhancement proposals. Topics addressed included the following:

- How is the code enhancement process funded?
- Did they use contractors? If so, how did they select the contactors they use?
- What procedures are used to review the work as it proceeds?

Energy codes and standards are of course also developed by agencies and organizations outside of California. Information on the process by which codes and standards are developed by these other organizations was therefore gathered in order to compare and contrast the California process with processes used elsewhere. Criteria for formulating codes and standards were identified by reviewing the criteria set out by the American National Standards Institute (ANSI) and by examining how these criteria are used by organizations setting energy standards and codes, including the U.S. Department of Energy, the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), the International Code Council (which develops the International Energy Code), and the National Fire Protection Association (NFPA).

The information collected on the processes used by the CEC and the U. S. DOE has been organized through the preparation of program logic models. Logic models and program theory have been widely used in education and social service circles for a number of years but have only just recently started to make in-roads into the energy services and energy efficiency arena. The

[4] Heschong-Mahone Group, *Code and Standards White Paper on Methods for Estimating Savings,* Report prepared for Southern California Edison, April 2005, p. 20.

program logic models have been used to identify gaps in programs, to develop measures for assessing progress, to develop evaluation plans, to identify critical issues that need attention, and to communicate with stakeholders about the program and program outcomes. In broadest terms, a program logic model shows how resources are used in activities to produce outputs that yield outcomes. However, each group's logic model will provide a clear description of the process used by that group to develop code enhancement proposals. Essentially, the logic models show *what* the process is supposed to do, with *whom* and *why*.

The program logic models are used to address the critical questions for the evaluation of the C&S Program and how its structure and effectiveness compare to other groups' procedures and processes. In particular, the program logic model for each group has been used for the following:

- Identifying the group(s) that are involved in the process;
- Identifying the resources being allocated to the process;
- Describing those activities or action steps that are being used to achieve outcomes;
- Defining the outcomes or objectives for a process, where outcomes are those changes or benefits that result from activities; and
- Determining whether the objectives are being achieved.

The program logic models have also been used to determine where the processes differ and where resources or activities used in other processes can be brought into the C&S Program process to improve it. The bottom line for evaluating the processes is to determine what important outcomes the process has produced (i.e., what results or changes have occurred because of the process's efforts). Outcomes to be considered will fall along a continuum from immediate (initial; short-term) to intermediate (medium-term) to final outcomes (long-term).

Drawing on the materials developed for preparation of the program logic models, several issues associated with the role of the C&S Program in the code revision process were addressed. These issues pertained to the following

- Selecting topics for CASE studies;
- Reviewing technical quality of CASE studies; and
- Obtaining public participation in CASE study preparation.

1.3 ORGANIZATION OF REPORT

This report is organized as follows.

- Chapter 2 discusses the California energy code revision process and the role of the C&S Program in that process. This discussion is based on information gathered through interviews with stakeholders and regulators.
- Chapter 3 discusses the results of the effort to characterize the processes by which other organizations or agencies develop energy codes and standards.

- Chapter 4 evaluates the CASE study process with respect to the selecting of topics for CASE studies.
- Chapter 5 addresses the issue pertaining to the technical quality of CASE study reports.
- Chapter 6 addresses the issue of public participation in the preparation of CASE studies.
- Chapter 7 provides recommendations for changes or improvements to the CASE methodology.
- Appendix A contains recommendations made by a panel of reviewers.
- Appendix B provides an annotated bibliography of papers and reports related to the research effort.
- Appendix C is a glossary.

2. PROCESS USED IN CALIFORNIA TO DEVELOP BUILDING AND APPLIANCE ENERGY EFFICIENCY STANDARDS AND CODES

This chapter provides a description of the process used in California to develop building and appliance energy efficiency standards and codes and the role of the C&S Programs in that process.

2.1 PROCESS USED TO DEVELOP BUILDING AND APPLIANCE ENERGY EFFICIENCY STANDARDS AND CODES

In California, building energy efficiency standards are incorporated in Title 24 of the California Code of Regulations, while appliance standards are embodied in Title 20. Although the California Building Standards Commission is charged with administering the California Building Standards Code, the California Energy Commission is the agency responsible for developing and adopting the building and appliance energy efficiency standards that go into the code.

Because the CEC is a regulatory agency charged by the legislature through the Warren Alquist Act in 1976 to adopt standards that are cost effective, it is not compelled to follow an ANSI-style consensus process. Although this means the CEC can adopt code provisions that would not achieve consensus, in the ANSI sense, the Commission does follow a process through which it seeks to build substantial buy-in from affected stakeholder groups. This is partly for practical reasons (e.g., objectionable provisions would be hard to enforce). There are also political reasons (e.g., not alienating powerful stakeholders).

The first version of Title-24 that was adopted in 1978 has of course been subsequently updated and revised over time. The CEC has agreed with the building community not to update the standard more often than once every three years, although in practice the time period for revisions has been from three to five years.

Basic CEC Energy Code Revision Process. The process that the CEC uses in revising the standards has evolved over time. (A timeline of key Title 24 and Title 20 actions is shown in Table 2-1.) However, there are several objectives that underlie all code revisions:

- To adapt the Standards to emphasize energy efficiency measures that save energy at peak periods and seasons (particularly for the 2005 and 2008 code revision cycles);;
- To encourage improvements in the quality of installation of energy efficiency measures; and
- To adopt requirements based on recent publicly funded building science research, although research outputs must usually go through a commercialization process before they become code ready.

Table 2-1. Timeline of Key Actions for Codes and Standards Programs

Year	Event
1973	Oil shock
1976	Warren-Alquist Act
1977	CEC created
1978	Title 24, 1st version
1984	AB 163 Standards
85-88	Standards for separate occupancies
1988	Custom budget approach adopted for residential buildings
1992	Nonresidential standards reorganized and updated
1995	Minor changes to standards
1995	CBEE emphasizes market transformation
1998	PG&E proposes C&S Program
1998	CPUC approves C&S Program
98-99	PG&E prepares CASE studies
2000	AB 970 Emergency Rulemaking
2001	1st utility C&S program using CASE
2001	Title 24 2001 Emergency version
02-03	2nd utility C&S Program
2003	Title 24 2005 version adopted
2004+	Title 24 2008 version under development
2005	Title 24 2005 version in effect

Steps Used: After some evolution over time, the code revision process now being followed by the CEC has the steps shown in Figure 2-3.

California's process for setting energy efficiency standards begins with a public announcement by the CEC that it intends to open a docket for a new proceeding. This announcement indicates what may be subject to new or revised standards in the proceeding. Stakeholders are invited to provide input with respect to the identified as well as other potential standards opportunities. CEC staff with the help of public input begins crafting conceptual standards proposals. One or more official workshops are then noticed and held by the Commission to allow interested parties to comment on the conceptual standards proposals. Following these workshops, substantive comments from stakeholders are received, more data is collected, and the Commission staff refines the conceptual proposals into a more complete draft standards proposal referred to as the "Express Terms of the Proposed Regulations--45 day language". Prior to releasing the express terms, the Commission must officially file its intention to set standards and address other administrative requirements required by the State.

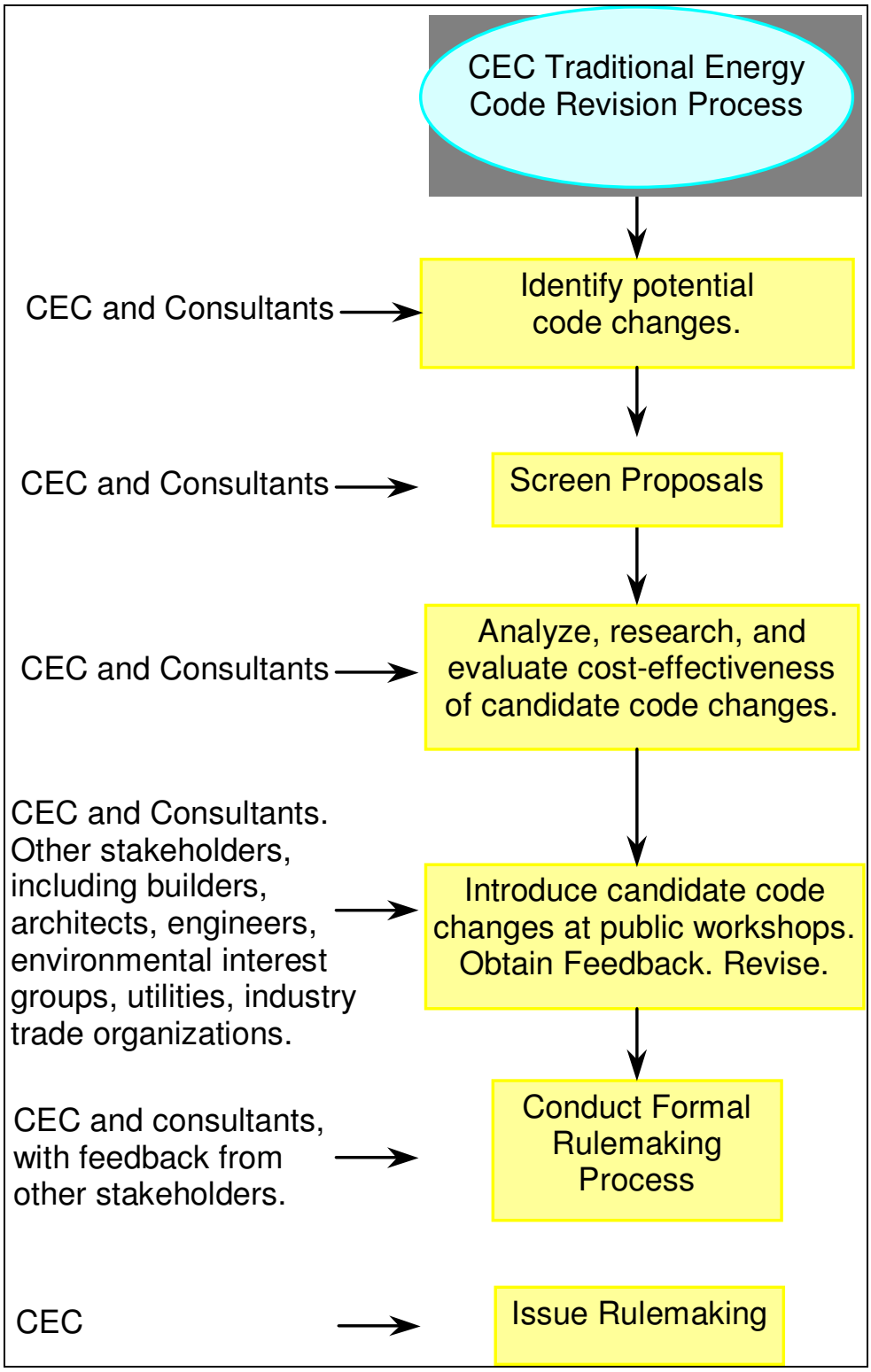


Figure 2-1. CEC Process for Title 20 and Title 24 Code Revisions

Within 45 days of posting of the 45-day language, the Commission will hold a hearing presided over by the Efficiency Committee of the Commission to obtain feedback from stakeholders. Substantive changes are made, and the regulations are released again as "15-day language". Within 15 days of publicly posting the 15-day language, the Efficiency Committee will hold another public hearing to hear additional comments from stakeholders. If no additional substantive changes are made to the draft regulations, the regulations will be voted on by the full Commission at a subsequent business meeting. Certain internal Commission processes occur fairly soon after adoption, leading to review by the Office of Administrative Law. Soon after approval by Office of Administrative Law, new standards become law and can be implemented.

The work to identify possible measures to include in the standards has traditionally been performed by CEC staff and a team of consultants that the CEC hires to contribute technical work that evaluates and supports any proposed code revisions. The CEC staff and consultant team identify, analyze and research measures that are candidates for adoption into the building or appliance energy efficiency codes, including economic criteria gauging the cost-effectiveness of the measures.

The work of the CEC staff and its consultants are introduced for public review and comment primarily through numerous public workshops. Through these workshops, the CEC endeavors to involve builders, architects, engineers, environmental interest groups, and industry trade organizations in the development of the building or appliance energy efficiency standards. The CEC staff has developed extensive mailing lists over time of people who have interest or involvement in the code revision process. The staff uses these lists to alert and inform stakeholders about the code revision process.

Following exposure of the draft standards in the public review workshops, the CEC goes through the formal rulemaking stage of the process as specified by the Building Standards Commission.

2.2 ROLE OF UTILITY C&S PROGRAMS

One important role of the IOUs' C&S Programs is to provide research that can be used as input to the CEC's process of revising Title 20 or Title 24 code provisions. The literature on the impacts of policy research on policy making suggests that policy-oriented research such as that conducted through the C&S Programs can be assessed by considering the ways in which the research results are used.

- A first use of research knowledge in policy making is when research findings are used directly to design a policy.
- A second use of research knowledge is to justify a course of action already decided on (i.e., advocacy research).
- A third use is when research findings lead to a gradual change in the framing and understanding of an issue for which policy needs to be formulated. The way a problem issue is defined often determines how it will be addressed. In this context, research has been

argued to serve an 'enlightenment' function in getting people to see new problems or to see old ones in new ways.

The research produced through the C&S Program has been used primarily in the first and third ways. That is, it has been used to directly guide policy decisions on which code change provisions to adopt and also to provide new information that can better inform the development of energy efficiency standards and codes. In addition, the C&S Program has provided support for informing and training market actors (building code officials, designers, builders, and affected facilities personnel) on the new code provisions when they are adopted. The most visible thrust of the utility C&S Program has been to identify technologies and practices that are ready for code adoption, to document their readiness for adoption in the buildings or appliances standards, and to advocate for their adoption.

2.2.1 History of Utility C&S Program Involvement in Code Revision Process

Early Process. The utilities had relatively minor input to the early cycles of the CEC codes and standards revision process. Utility input was limited primarily to the participation of utility observers to these early revision cycles. These observers might participate in code changes of interest, but CEC staff members and their contractors were the main players responsible for developing the codes and standards changes.

Emerging Utility C&S Program. In the early 1990s, PG&E developed a body of evidence relating to the efficacy of its energy efficiency efforts and the technologies it was promoting. From time-to-time, PG&E program managers would share some of this information with the CEC to assist them in their efforts to develop codes and standards. This sharing was evidently a staff initiative rather than a conscious PG&E policy directive. The staff effort was modest and did not involve extensive PG&E funding. Due to the limitation of PG&E staff resources, these efforts were quite modest. One observer noted that because the efforts were so modest, they may not have come to the attention of PG&E management, which might have raised a question about the financial implications.

The advent of the California Board for Energy Efficiency (CBEE) in the mid-1990s led to a shift in the policies underlying energy efficiency program from favoring resource acquisition to favoring market transformation and a de-coupling of shareholder earnings from the results of energy efficiency programs. In this new context, some PG&E program staff saw codes and standards as an important element of a multifaceted market transformation effort. Rather than continuing PG&E's *ad hoc* efforts of the early 1990s to support the energy codes revision process, in 1998 PG&E staff submitted a filing to the California Public Utilities Commission for a more focused and disciplined approach for PG&E's involvement in the code revision process that involved PG&E conducting CASE studies for the purposes of enhancing or upgrading the codes and standards and for conducting some workshops that might facilitate agreement among stakeholders. The California Public Utilities Commission approved the filing and extended it to all IOUs.

Thus, starting in the late 1990s, the California investor-owned utilities (IOUs) began collaborating with the CEC to coordinate standards updates with publicly-funded market incentives programs that have demonstrated that specific technologies are appropriate for incorporation into standards. At the time this work began, the CEC had decided to bypass the 2001 standard update. In early 2000, the IOU C&S CASE initiative identified a number of measures that might be possible code changes. These would be analyzed and proposed to the CEC for possible inclusion in the 2004 CEC codes and standards revision cycle.

Response to the Electricity Crisis of 2000 Reactivates 2001 Revision Cycle. However, the summer of 2000 brought much higher electricity prices to California plus widespread blackouts across significant areas across the state. In response the state legislature urged the emergency acceleration of the codes and standards revision cycle

Assembly Bill 970 (AB970), enacted in August 2000, authorized the CEC to adopt new building and appliance standards in an emergency rulemaking within 120 days. The role of the C&S Program in the code revision process first took on prominence as a result of the Assembly Bill 970 (AB970) Emergency Rulemaking in 2000. Because of work that the IOUs' C&S Programs had been sponsoring through the Codes and Standards Enhancement (CASE) Project for over a year, the C&S Program was able to provide significant support to the CEC during this rulemaking. The CASE project had been initiated with the idea of identifying and analyzing energy efficiency measures that could later be adopted into the Title 20 or Title 24 codes. When the AB970 Emergency Rulemaking began, the C&S Program was able to provide the CEC with information from the CASE work that identified measures that were ready for code adoption. Because AB970 Rulemaking was being done under time pressure, the work of proposing and developing code revisions was done more collectively among the CEC staff, utility staff, and other stakeholders.

After the AB970 Rulemaking, the CEC immediately undertook work on additional code revision that could be adopted in 2001. Very quickly, CEC issued a public request for possible code change proposals to be included in the 2001 adoption cycle. For this effort, the IOU C&S program offered CASE initiatives that appeared at the time to be ready for adoption. Of the initiatives offered by the IOU C&S program, 14 proposals were adopted. The Title 24 building standards were revised quickly and were adopted in January 2001; the Title 20 appliance standards were not revised as quickly and were adopted a bit later in 2003.

2005 Revision Cycle for Building Standards. Further revisions to the Title 24 building energy efficiency standards were developed during the 2005 code revision process. The development work for these revisions began in early 2001, right after the work on the 2001 standards cycle was completed. These "2005" standards were adopted in 2003, to take effect 2 years later in 2005. The major objectives addressed in the 2005 code revision process were as follows:

- To respond to California's energy crisis to reduce energy bills, increase the reliability of the energy system, and contribute to an improvement in California's economic condition.

- To respond to the AB 970 emergency legislation to adopt and implement updated and cost-effective building energy efficiency standards. This ensured maximum reductions in wasteful, uneconomic, inefficient or unnecessary consumption of electricity at the earliest feasible date.
- To respond to the SB 5X (Statutes of 2001) emergency legislation to adopt energy efficiency building standards for outdoor lighting.

Significant Differences of the 2005 Building Standards Process. The process used for the 2005 code revisions differed in several significant ways from the process used for previous versions. For the 2005 code revision process, the CEC used a formal process for identifying, screening, and adopting code changes. Because of this process, individual stakeholders had the opportunity to take "ownership" of particular code revision proposals by developing the proposal and the materials to support inclusion of that proposal in the code. There was of course some collective work among the CEC staff, IOU C&S program staff, and various other stakeholders (e.g. CBIA), but this collective work was not as extensive as during the preceding AB970 proceedings. However, the C&S Program did submit 28 proposals for changes to the code, of which 11 were accepted for further analysis and adoption into Title 24. In addition, the methodology for Time Dependent Valuation that had been developed through the C&S Program's CASE Project was also accepted.

2006/2007 Revision Cycle for Appliance Standards. The IOU C&S Program also supported the updating of the Title 20 Appliance Standards that occurred during the 2001–2004 time period. In particular, the C&S program provided CASE reports that supported the upgrade or adoption of 27 appliance standards. The updated appliance standards were adopted on December 15, 2004, covering appliances that included refrigerators, lighting equipment, air conditioners, boilers, clothes washers, etc. The effective dates vary by equipment type, but generally begin on the first day of either 2006 or 2007.

Historical Summary of the IOU C&S Program. As this short narrative demonstrates, since 2001 the California Energy Commission has been able to issue numerous new revisions to the building and appliance standards. During this period of time, a division of labor between the CEC and the utilities appears to have emerged from the process of developing these updated codes and standards. The CEC has been responsible for managing the formal process and, as one respondent pointed out, has tended to use its limited resources to develop upgrades to existing requirements within the codes and standards. The utility CASE studies, on the other hand, tended to focus on creating new requirements that extend the coverage of the existing codes and standards (e.g., prescriptive requirements for non-residential buildings that include cool roof requirements for certain roof configurations).

Utility support through the Codes and Standards Program has enabled the CEC to produce a larger number of new code provisions. According to one observer, it is likely that the CEC would have been able to establish fewer than 10 new requirements within the Title 24 and 20 standards without the utility CASE study support. As one observer noted, it has been estimated

that PG&E's CASE study process has resulted in codes and standards that will produce savings of 1,000 megawatts at a cost of about $1 million.[5]

2.2.2 Differences between Utilities in C&S Program Approaches

Among the California IOUs, there have been differences in the relative emphasis that they have given to producing research through the C&S Program for different uses. In discussions with C&S program managers and other observers, several interviewees commented upon the fact that the utilities have approached the CASE study process and the codes and standards in different ways. There are differences in resource allocation to the component of the C&S Programs, and the approach to producing CASE studies appears to vary substantially.

As discussed in Section 2.2.1, PG&E initiated the approach for preparing CASE studies and has emphasized research that could be used directly to define specific changes or extensions to existing code provisions. One person interviewed described the approach PG&E has taken as a "tactical approach." This type of approach focuses directly on:

- Identifying enhancements to Title 20 and Title 24,
- Developing proposed changes to the codes,
- PG&E involvement in sometimes contentious relations with trade allies and stakeholders; and
- Promoting and advocating changes in public hearings.

In comparison to PG&E, the other IOUs have been less directly involved in addressing stakeholders and trade allies in the codes and standards process.

In contrast to PG&E's approach, SCE's approach for its C&S Program has been described as "strategic." SCE has been less involved in the CEC code change process and more focused on research aimed at facilitating implementation of the standards (e.g., methods for applying TDV; validating e-Quest), working with stakeholders to identify efficient alternative technologies that can become agreed upon as a basis for standards (e.g., testing and designing more efficient bottling machines), and/or facilitating the development of technology and its adoption as voluntary standards (e.g., helicopter fan for dairy barns). Thus, SCE has provided support through its C&S Program to activities that can be considered to be aspects of the "enlightenment" function of the research. In a sense, the distinction made between the approaches of PG&E and SCE is similar to that often made between "applied" research and "basic" research. While the results of applied research can often be tied to specific outcomes, basic research produces results that are more generally supportive of the research environment.

The two Sempra utilities (i.e., SDG&E and SoCalGas) have been involved in Title 24 issues in several respects.

[5] Presumably this was the cost of the CASE studies and the savings for the changes to the 2005 standards.

- The Sempra utilities have supported work that pertains particularly to gas cooling for both residential and nonresidential applications. Their activities have included working alongside the CEC and undertaking CASE studies to validate the engineering formulas for gas cooling. As a result, gas cooling is now an option. Because gas cooling is more efficient than electric cooling, the availability of the gas cooling option increases opportunities for builders to offer a broader range of features like windows and vaulted ceilings than would not otherwise be possible.
- SoCalGas provided funding for a contractor to evaluate the impact of TDV on gas water heating and furnaces versus electric water heating and heat pumps. The results indicated gas water heating obtained a better margin of compliance with TDV and that gas space heating resulted in better energy efficiency under initial TDV when compared to heat pumps.
- SoCalGas retained a contractor to conduct an in-depth analysis of the impact of TDV on the compliance of furnaces and gas water heaters. The results indicated that with the proposed (final) TDV values, both appliances would be highly competitive with wide margins of compliance when compared to their electric counterparts under TDV methodology.

The utilities have interacted with each other with respect to the CASE studies. For example, PG&E reviewed the gas cooling studies. Although all of the utilities have participated in the formal part of the code development process that is conducted by the CEC, an outside party who is anxious to have broader utility participation in the codes and standards setting process described SCE's participation in the process as more like that of a stakeholder. More than one informant commented upon the desirability of a more coordinated approach among the utilities and on the desirability and the likelihood that SEMPRA and SCE are moving more in the direction of greater tactical involvement. However, the CPUC recognizes the differences in the approaches between the utilities and continues to support them.

2.2.3 Evolving the Process at PG&E

As the codes and standard program became increasingly visible and resource acquisition became more of a concern, management at PG&E asked the staff why it should be involved in the program. In addition to the shareholder issue, PG&E management also raised the issue of why the utility should be involved in formulating codes and standards that were the responsibility of the CEC. Management was also concerned about whether the program would divert claimed savings from other programs. Finally, there was a concern about PG&E being able to claim savings from codes and standards activities.

Initial estimates have suggested that the savings attributable to the C&S Program are significant. PG&E staff feel very strongly that the CPUC should permit the utilities to claim such savings. One interviewee suggested that being allowed to claim savings is more of a problem of process (i.e., how to measure the savings) than of principle (i.e., whether the utility should be allowed to claim such savings). This person pointed out that there have been no developed methods for measuring and attributing savings to the utilities, effectively preventing the utilities from claiming the savings.

The issue of how to measure savings from the C&S programs is now being addressed.[6] One interviewee suggested that if the CPUC allows the utilities to claim the savings from the codes and standard process, other IOUs may standardize their Codes and Standards Programs around a process that is similar to PG&E's.

In discussions with PG&E staff, they saw their codes and standards efforts evolving into being part of a continuum of activities that are designed to promote energy efficiency. A representation of this continuum is depicted in Figure 2-2.

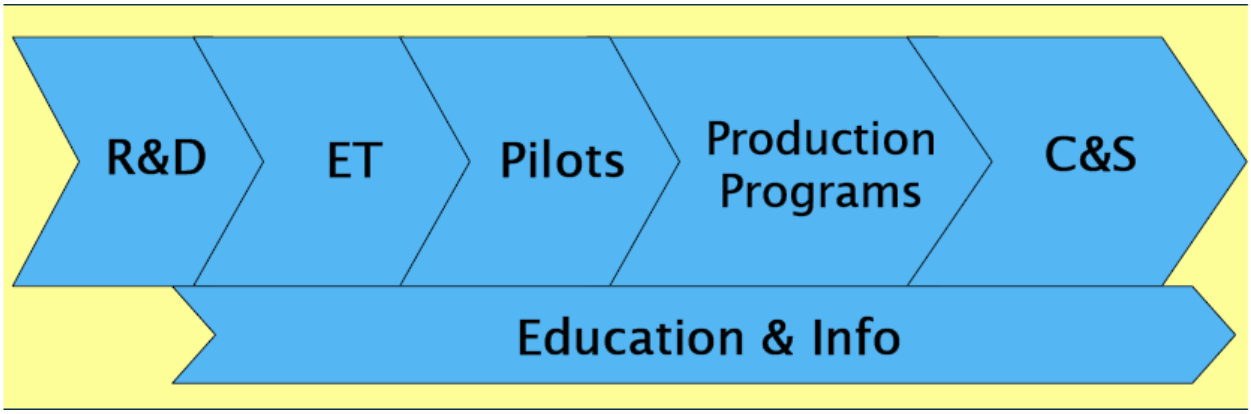


Figure 2-2. Continuum of Activities to Promote Energy Efficiency[7]

At one end of the continuum, applied research activities are used to develop and refine new energy efficiency technologies and practices. These and other practices and technologies may become a part of pilot projects and demonstrations that are used to assess the suitability of energy efficiency practices and technologies for diffusion to broader target audiences in California. Promising practices and technologies become a part of PG&E efficiency offerings where they are promoted and can gain traction in the market place. This aids in preparing for and making adoption of codes and standards easier. At the end of the continuum are the codes and standards efforts that result in widest use of efficiency practices and technologies. It is PG&E's view that there needs to be balance along a full continuum of energy efficiency program activities, perhaps with additional resources applied to the codes and standards effort but without abandoning other energy efficiency programs.

2.3 PROGRAM LOGIC MODEL FOR CALIFORNIA CODES AND STANDARDS PROCESS

A more formal way to look at the code revision process, as well as the role of the C&S Programs in that process, is through the use of a program logic model. Section 2.3.1 discusses the

[6] Heschong-Mahone Group, "Codes and Standards White Paper on Methods for Estimating Savings", Report prepared for Southern California Edison, April 13,2005.

[7] Eilert, P., Livingston, J., and Turnbull, P., "How to Catch More Flies with Honey and Vinegar: Integrating Voluntary Programs with Codes and Standards in California", Presentation at ACEEE Summer Study, August 2004.

theoretical concepts for a program logic model, while Section 2.3.2 provides a program logic model specific to the Title 24 and Title 20 code revision process.

2.3.1 Theory for a Program Logic Model

The purpose of a logic model is to provide a description of a program that shows how the resources, activities, outputs, intermediate and long term-outcomes associated with a program result in the program achieving its goal. In essence, a logic model is a two dimensional diagram with two logics, either of which can be displayed in either dimension.

The first logic typically identifies a logical sequence of six to ten program activities. This dimension is sometimes called the *performance path*. The sequence is logical or causal in the sense that the first activity must occur before the second activity and the second before the third, and so forth. For example, one must plan before one can develop materials and tools. Tools and materials are needed before one can promote a program. A program must be promoted before an idea can be accepted, and an idea must be accepted before it can be implemented or tried. While this is a linear formulation of activities, users of logic models implicitly understand that feedback occurs between activities. Examples of activities for a codes and standards program are identifying and screening ideas, doing an analysis of the proposal to substantiate the value of a proposal, etc.

The second dimension in a logic model describes the *performance spectrum*. The performance spectrum represents the logic of the performance of an activity. The logic of the performance of an activity is that resources or inputs are required in order for a program implementer to undertake an activity. The activity results in outputs that induce partners and target audiences to take action. These actions lead to additional actions on the part of the target audiences that lead to desired impacts or goals.

More specifically, in order to perform a given activity one needs resources or inputs, for example, money, expertise, staff, equipment, etc. Performing an activity (e.g., market research) results in an output such as knowledge of product requirements or target segments. Outputs are the direct result of the program activity. Program outputs cause partners and target audiences to take action. Target audiences may train staff or they may investigate how much something costs, they may decide to do something, or they may take direct action. These are outcomes. Program implementers can influence outcomes but it is the target audiences that act. As a result of the actions of target audiences, there are usually further actions that lead to additional outcomes. Those outcomes result in the long-term or ultimate outcomes or impacts or meeting the goals of the program.

Another way of thinking about the performance spectrum is to start with the ultimate goal and work backwards. In order to save energy or reduce demand, one needs to get target audiences to perform certain actions. In order for target audiences to perform certain actions they need to be induced or required to take actions. In order to have that occur a program needs to undertake

certain activities that cause certain circumstances. In order for the program activities to occur resources are needed.

Logic models are valuable because they require one to identify all necessary steps in order for a program to work. As a result, logic models can be used to:

- Track progress in two dimensions;
- Identify steps that are left out;
- Identify steps that are unneeded;
- Describe to others how a program works;
- Identify key steps that are essential for program success;
- Identify measures to track performance; and
- Identify market and evaluation questions

2.3.2 Logic Model for the California Codes and Standards Process

Drawing on the interviews with C&S Program managers and review of extant documentation, a logic model was prepared that describes the process by which the 2005 codes and standards were developed. This model, which describes the activities of both the CEC and the IOUs, is shown in Figure 2-3.

Resources and Inputs. Resources and inputs are identified at the top of Figure 2-3. One resource or input is the legislation that enables the State of California to establish codes and standards. In response to the legislation, the California Energy Commission has established a set of procedures by which it formulates codes and standards. There are other important resources, such as California Energy Commission's codes and standards development budget and the Public Goods Charge funds that the CPUC allows the IOUs to apply to codes and standards CASE studies. As noted later in this study, one of our respondents suggests that access to the Public Goods Charge Funds effectively tripled the ability of the CEC to deliver codes and standards.

Staff expertise at the CEC as well as at the utilities is yet another resource. There are several dimensions to this expertise, part of which is institutional memory. Some of the participants in the process have been involved in codes and standards work for 20 to 30 years. There is also technical expertise, administrative expertise, political expertise, and significant knowledge of the networks of players in the fields that are likely to be impacted by codes and standards. As one of our respondents put it, "What equals success is a team of people. …There is no substitute for a good, long, and broad technical background." This informant noted that members of the utility teams and the CEC staff have worked in energy efficiency for the past 20 to 30 years.

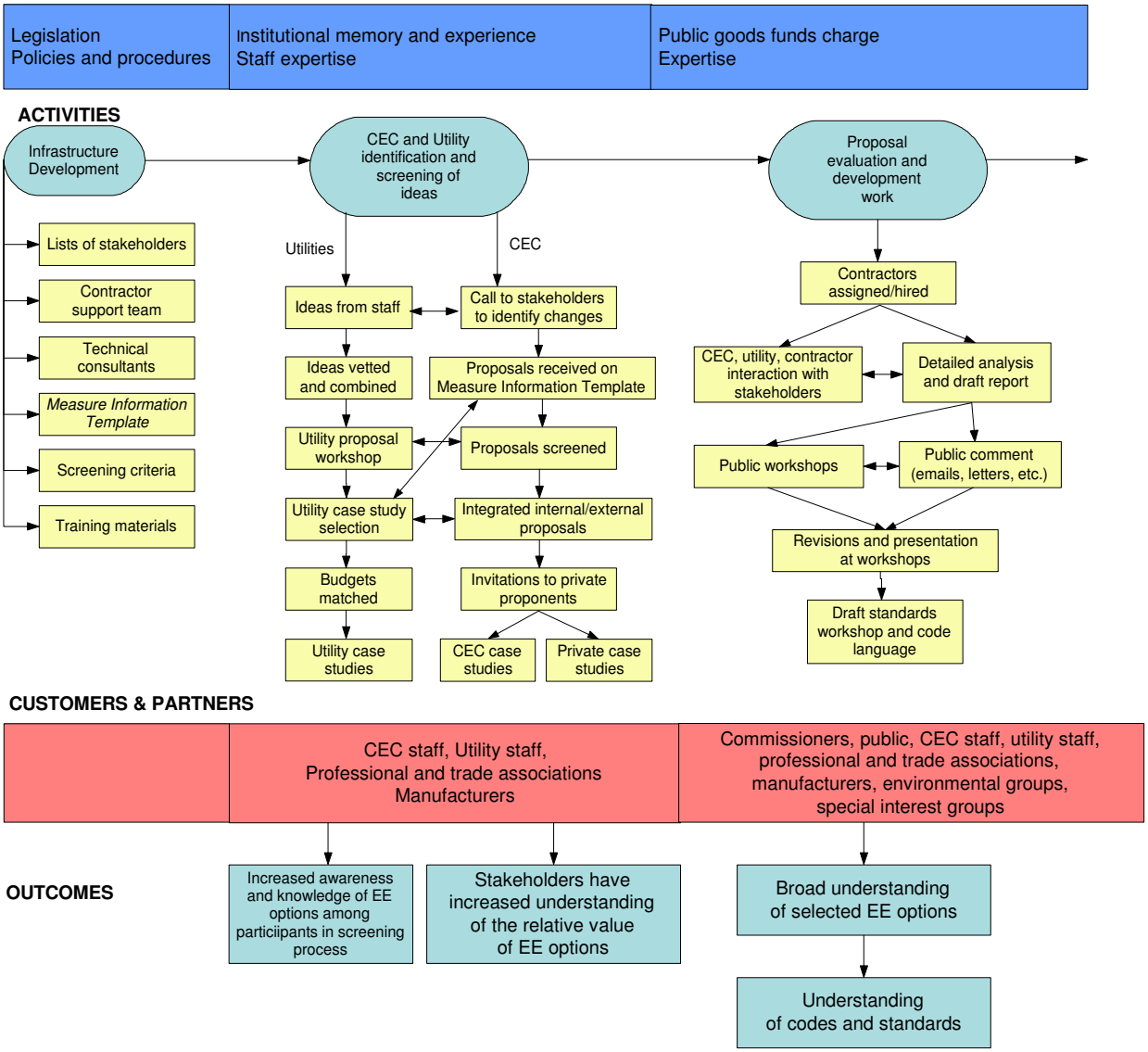


Figure 2-3. Logic Model for CEC Code Revision Process

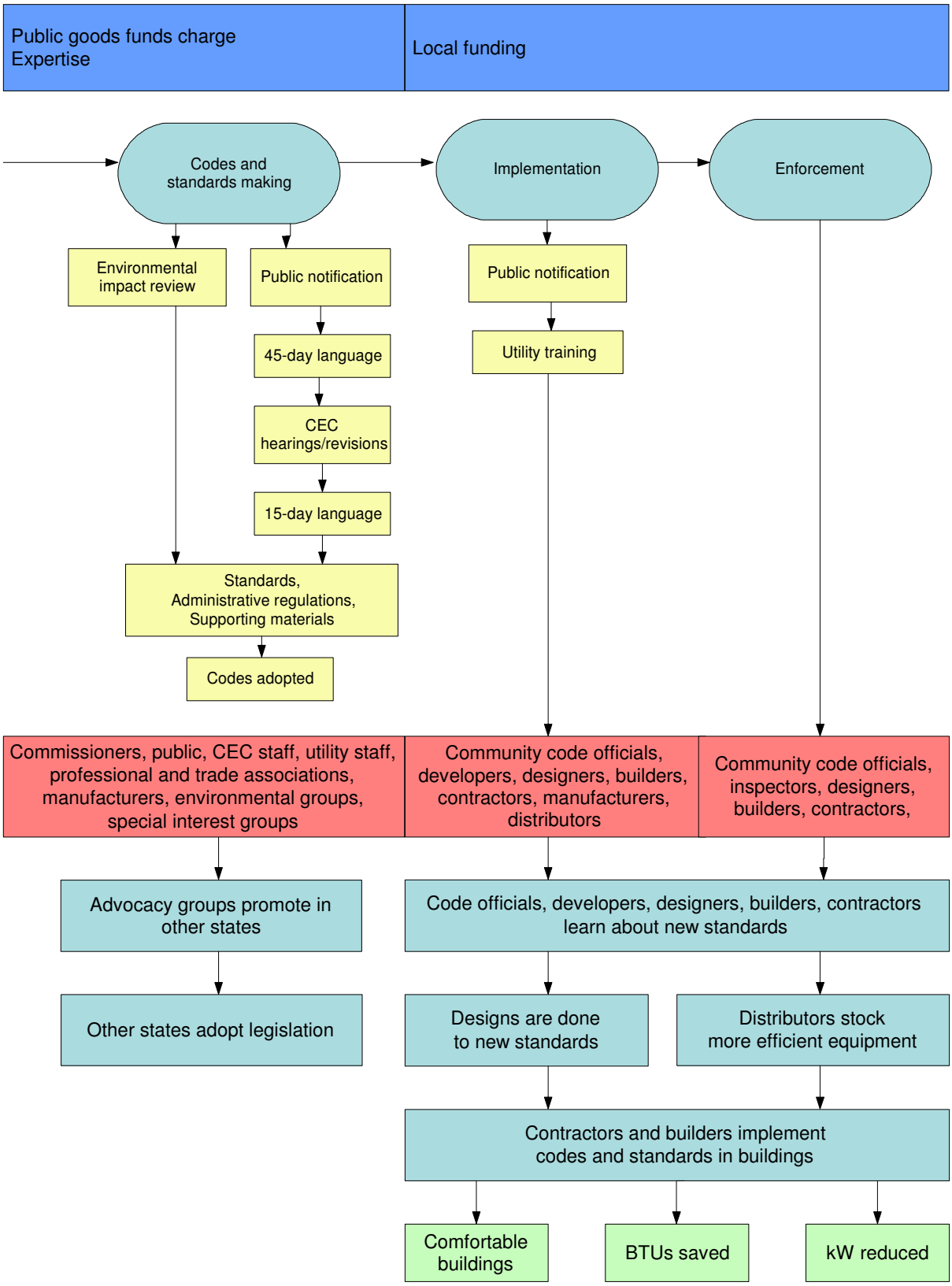


Figure 2-3, continued. Logic Model for CEC Code Revision Process

2.3.2.1 Activities and Outputs

Figure 2-3 shows that the codes and standards program involves six activities:

- Infrastructure development;
- Initial proposal solicitation and screening;
- Proposal evaluation and development work;
- Codes and standards rule-making;
- Standards implementation; and
- Enforcement.

Our primary interests in this report are the early activities and the role that the utilities play in them. Because the activities and the outputs associated with the activities are closely linked we will discuss them together.

Infrastructure Development. Activities pertaining to infrastructure development are shown in Figure 2-4. These activities involve establishing the administrative and support activities essential to developing codes and standards. This infrastructure development is an on-going and evolving effort that started with the introduction of the first energy standards in California in 1978. As noted above, the development of codes and standards is both a technical and a political process. The CEC maintains contact lists and contacts with technical consultants who are an important resource for the analysis required to set codes and standards. The tracking, maintenance, and use of stakeholder contacts throughout the process are important for obtaining the range and diversity of input needed to make the process politically acceptable. For example, in preparation for rulemakings, the IOUs begin conducting these administrative activities sometimes one year in advance of the CEC's public process.

The CEC developed and uses a *Measure Information Template* to standardize data and to ensure the data that are needed are systematically collected. The CEC uses some basic screening criteria to identify candidates for upgrades or new codes and standards. The criteria used for the 2005 round of standards and codes updates were:

- Expected energy savings and demand reductions from the proposed revision;
- CEC commitments in previous rounds of updates to address the proposed revision; and
- Extent of public funds invested to develop the proposed revision for inclusion in the current round.

Another important aspect of the codes and standards program is training. The utilities traditionally conduct training, therefore as part of the infrastructure development the utilities must continue to develop the training and identify the trainers.

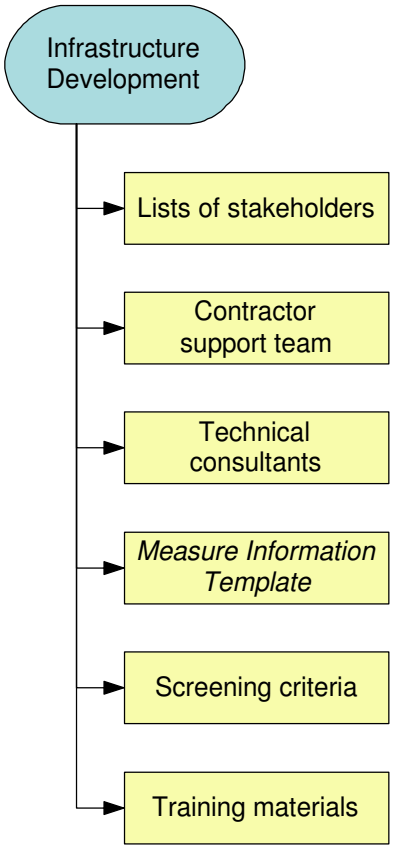


Figure 2-4. Activities in Infrastructure Development

Proposal Solicitation and Screening. As Figure 2-5 shows, there are two sets of outputs emanating from the initial proposal solicitation and screening activity—one for the utilities and one for the CEC.

The utilities conduct their own proposal screening processes and coordinate those activities with the CEC. Further, there are differences between the utilities in how they do their screening. This part of the process is evolving and occurs over a period of time so that the descriptions provided below intermix more recent and older elements. The utilities generate their own lists.

- PG&E' CASE study selection process occurs well in advance of the CEC call to stakeholders. PG&E holds workshops at which proposals are presented and additional proposals are received. PG&E hires contractors to contribute ideas to these brainstorming workshops, with invitees to the workshops including a range of organizations. After conducting a workshop, PG&E will have additional discussions with consultants or CEC staff to develop a better understanding of proposals and will discuss administrative and regulatory barriers with the CEC. Following an airing of the proposals, senior PG&E staff reduce the number of proposals to those that (1) have the most potential and (2) can be matched with available resources. Further screening of the proposals is conducted at the beginning of a project based on several criteria. Further refinement of the CASE study scope occurs during development of CASE study work plans.

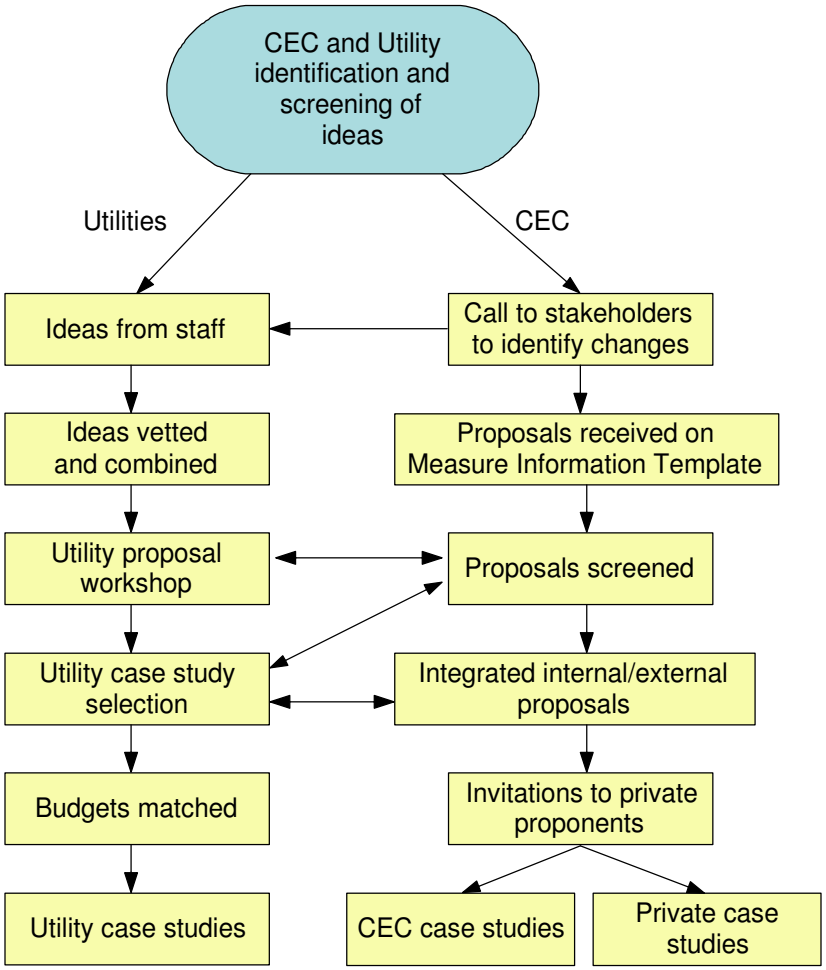


Figure 2-5. CEC and Utility Identification and Screening of Ideas

- SCE encourages their staff and contractors to submit ideas while undertaking a brainstorming process to vet and reduce the set of ideas. At this point, SCE interacts with the CEC and other utilities to eliminate redundancy. Champions are appointed to make the best case for a proposal, and chosen proposals are matched to the resources. At SCE, the champion is likely to become the manager of the CASE study.

As discussed in Section 2.2.2, PG&E's efforts are mostly focused on proposals that will be implemented in Title 20 and Title 24. SCE's approach is broader, as they also include proposals that may result in voluntary standards or working with manufacturers to refine products.

The CEC created a solicitation inviting interested parties and stakeholders to recommend changes to the existing codes and standards. Interested parties include the utilities, advocacy groups (e.g., ACEEE, NRDC), professional and trade organizations, manufacturers, and others.

Those responding to the solicitation are asked to provide information using the *Measure Information Template*. The data provided by *Template* contributors range from sketchy to quite detailed. For the 2005 code revision cycle, some 270 proposed code changes were received.

The CEC and its contractors used the screening criteria identified above to reduce the number of proposals so they may be effectively evaluated. In some instances proposals dealt with the same, similar, or complementary issues. Where feasible, suggestions from proposals that did not make the final list were drawn into the proposals that were to receive more extensive evaluation. In some instances there may be CASE studies that go beyond the expertise of the CEC and the utilities. In these instances, the CEC may invite third parties to submit CASE studies (e.g., WattStoppers for lighting controls).

Throughout this process there are substantial interactions between the utilities and the CEC. The result is the designation of a set of CASE studies to be completed by the utilities, a set by the CEC, and CASE studies that third parties are invited to contribute.

Proposal Evaluation and Development. A detailed process of proposal evaluation and development begins after the CASE studies are selected. The steps in this process are shown in Figure 2-6.

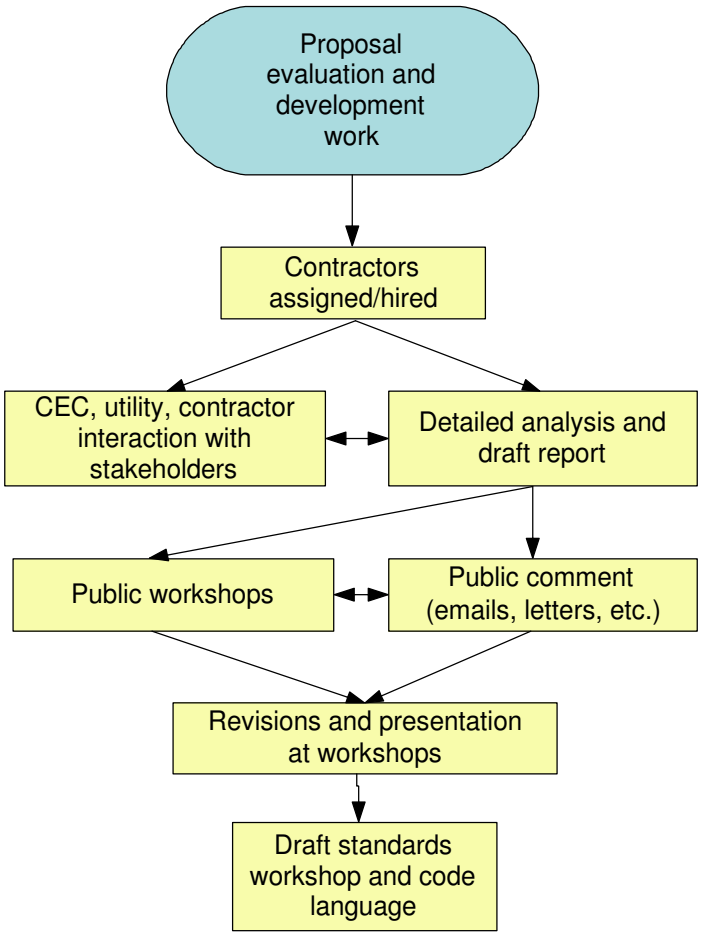


Figure 2-6. Proposal Evaluation and Development

Some of this work is done in-house by CEC or utility staff, but contractors also complete a good portion. The CEC has funds with which it hires a team of consultants/contractors to provide support. The utilities are allowed by the CPUC to use Public Goods Charge funds. While the studies by the CEC and the utilities receive public funding, at the present time there is no independent mechanism for public funding of third party CASE studies. Contractors are selected because of their expertise and the contacts that they have with stakeholders.

The evaluation effort revolves around completing the *Measure Information Template*. This typically involves:

- Collecting additional information (e.g., *via* the internet, contacts within the stakeholder community);
- Conducting an analysis of energy use associated with the proposed standard or technology;
- Assessing the economics (cost effectiveness) of each product; and
- Developing a draft report.

The goal is to build on pre-existing analyses and then to fill the gaps. Information is sought from stakeholders, and contractors may engage in a broad range of data collection activities. Examples include identifying the technologies in the market, assessing the market share of technologies, obtaining product pricing, and checking pricing in stores.

The draft detailed analyses describes the technologies or practices and the rationale for adopting the standard. An economic analysis is provided and a recommendation as to what the code or standard should be is given.[8] The initial drafts of the reports are shared with the CEC staff for their immediate review. Once this has been completed, the draft reports are made public. For example, PG&E places its CASE reports on a PG&E website where they can be accessed by stakeholders, at which time stakeholders are encouraged to comment on the reports. Stakeholders may provide comment through e-mail or letters, etc.

The next step in the process is a series of public workshops in which the CASE studies are presented and there is opportunity for comment. The various contactors respond to the comments making revisions. Once again, these are posted for comment.

The final step is the presentation of draft code language at a draft standards workshop. The CEC uses this language as the basis for the formal process.

[8] For example, PG&E's CASE report on whole-house fans came to the recommendation that no standards level be set for whole-house fans because of the "relatively small projected savings and the lack of robust data on typical operating schedules." Davis Energy Group and Energy Solutions, *Analysis of Standards Options for Whole-House Fans.* CASE Report prepared for Pacific Gas and Electric Company, April 2004.

Codes and Standards Rulemaking. Following the draft standards workshop(s), the formal process of adopting codes and standards begins. The steps in this process are shown in Figure 2-7. This formal process is managed almost entirely by the CEC and includes the completion of an environmental impact review. This part of the process occurs in parallel with the formal adoption proceedings.

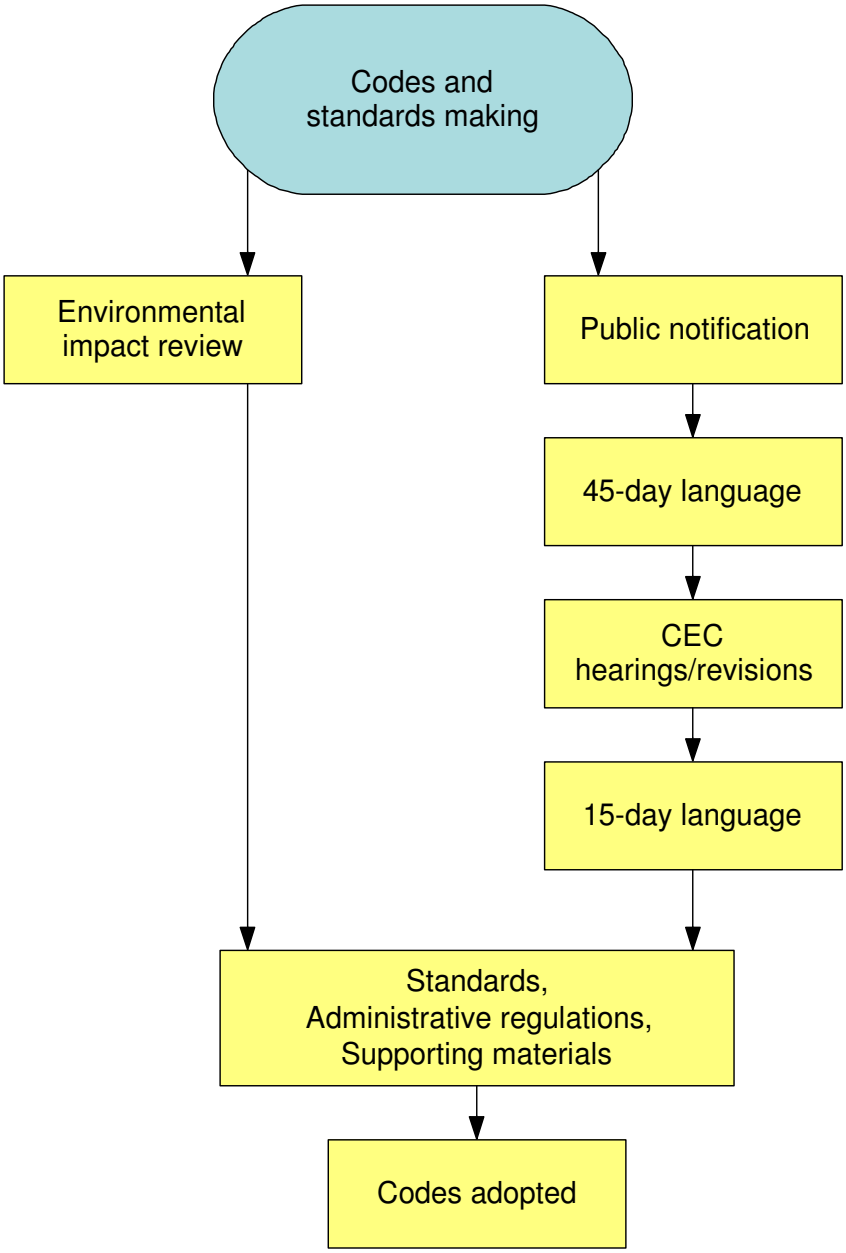


Figure 2-7. Codes and Standards Rule Making

The CEC releases a public notification of the intent to adopt the standards. Along with the notification is the release of the language to be used. After 45 days, the CEC holds hearings on the proposed standards and stakeholders are given the opportunity to provide formal comments on the codes and standards. Some stakeholders choose not to participate in the process until this point in the proceedings. These stakeholders typically raise questions about language and the supporting data, while others object to the need for the standards. According to observers, those who first object at this stage tend to make more general objections and tend not to provide alternative ideas or language.

Based on the feedback from these hearings, revisions may be made to the language and revisions are made publicly available. The CEC then schedules a new set of hearings at which the final changes are deferred, adopted, or determined not to be in the best interests of stakeholders.

Implementation. Once the codes are adopted, the public is notified of the effective date for the codes and standards. At this point, many stakeholder groups begin preparation for the implementation of the standards. Through the Public Goods Charge funds, the investor owned utilities develop and offer training on the adopted standards. For the standards to be adopted in 2005, PG&E offers training through the Pacific Energy Center and the Stockton training centers, SCE offers training through its training center, and SoCalGas and SDG&E develop and conduct training seminars to inform building community on changing codes and standards. SoCalGas offered training through it Energy Resource Center, and SDG&E conducted a number of in-house and offsite training seminars.. The utilities may use contractors to develop and conduct the training or may use in-house staff that have been involved in helping to establish the codes and standards. Training is needed for many stakeholder groups including local building officials, inspectors, architects, engineering firms, developers, contractors, and a host of others.

The training provided by the utilities is not necessarily limited to training provided by the codes and standards groups. For example at SCE, local officials can receive training through the Local Government Initiative. Professional associations and trade groups also provide their membership with training. For example, the California Association of Building Energy Consultants (CABEC) holds seminars on updates to the T-24/T20 energy standards.

Code Enforcement. Enforcement of the new codes and standards is largely left to local jurisdictions that approve plans and do the inspections. Various C&S Program staff interviewed expressed some concern regarding the extent to which measures are implemented as specified. For instance, although plans are certified as meeting Title 24 requirements, a number of people said that inspectors in many jurisdictions do not determine if equipment is installed to specifications and that developers or builders may substitute equipment. There was general agreement that this is an area that needs attention.

2.3.2.2 Outcomes

Figure 2-8 shows the outcomes of the various activities. The major types of outcomes can be classified as immediate, intermediate, and long-term:

- Immediate and intermediate outcomes (as shown by the five boxes in the top row of Figure 2-8) represent the short-term responses to the activities and the outputs; and
- Long-term outcomes or impacts (as shown by the boxes in the lower two rows of Figure 2-8) represent the ultimate goals of the program or effort.

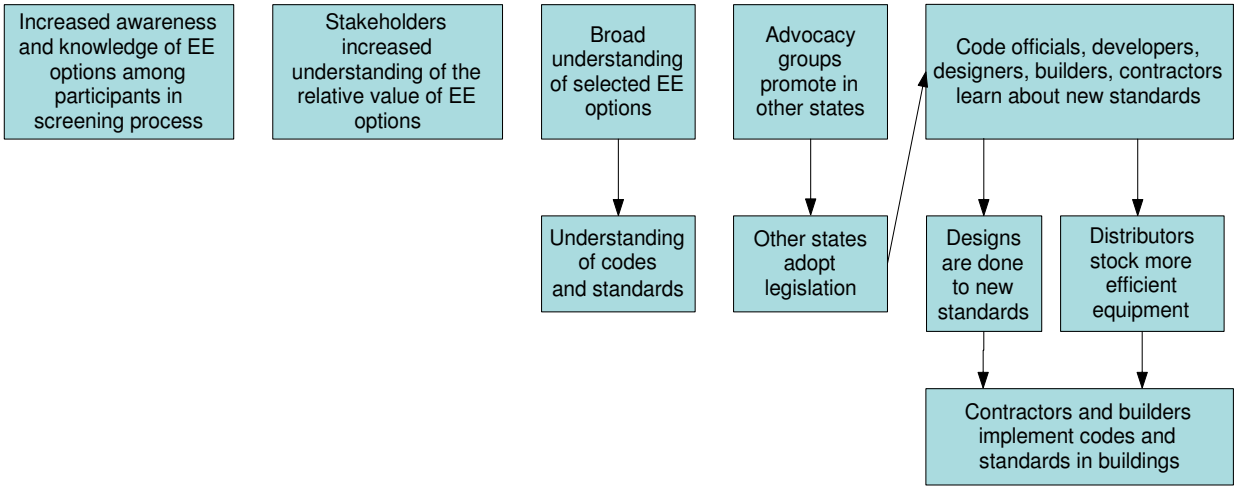


Figure 2-8. Outcomes of Code Revision Process

There are a number of outcomes from the codes and standards CASE study process. Starting from the left in the intermediate outcome space, the process results in increased awareness and knowledge of energy efficiency options among utility staff, contractors, CEC staff, and others. The screening process increases the understanding of the relative value of the various energy efficiency options among this same group of people. The proposal development and evaluation work, especially the process review, leads to a broader understanding within the community on the codes and standards.

The adoption of the codes and standards results in several outcomes.

- A first outcome is that the various affected parties learn about the codes and standards and then begin to implement them.
- A second outcome is that buildings are designed to the new, more energy efficient standards and equipment distributors stock and sell energy-using equipment that is more efficient.
- A third outcome is that stakeholders and third parties leverage the California standards to encourage the adoption of more stringent codes and standards in other states and at the Federal level. (This is discussed in more detail in Chapter 3.)

2.3.2.3 Impacts

The long-term or ultimate impacts of the process include the following:

- Energy is saved.
- Energy demand is reduced.
- Greenhouse gas emissions are avoided.
- People thrive in more comfortable buildings.

3. PROCESSES FOR SETTING ENERGY EFFICIENCY STANDARDS

As part of the effort in assessing the impacts of the Codes and Standards Program on the process by which building and appliance efficiency standards are developed in California, it is useful to consider the processes that are used by standards setting agencies and organizations outside of California.

3.1 ANSI PRINCIPLES FOR SETTING STANDARDS

The process to be followed in setting standards has been a topic of interest since the early part of the 20th century, as evidenced by the founding of the American National Standards Institute (ANSI) in 1918. ANSI acts as an administrator and coordinator of the voluntary standardization system followed by the private sector in the United States. In that role, ANSI has developed a set of procedures that it recommends that standards developers follow. In order to maintain ANSI accreditation, developers of standards are required to adhere consistently to these procedures and requirements.

Although developed for processes whereby private industry develops voluntary standards, ANSI's procedures also provide a benchmark against which to gauge public sector standards development. ANSI stresses that the standards development process be open and fair, ensuring that all interested and affected parties have an opportunity to participate.

ANSI believes that due process requires that standards be developed in an environment that is equitable, accessible, and responsive to the requirements of various stakeholders. The process by which standards are developed is expected to include the following:

- Consensus on any proposed standard by a *consensus body* that includes representatives from materially affected and interested parties;
- Broad-based public review and comment on draft standards;
- Consideration of and response to comments submitted not only by members of the relevant consensus body but also by public review commentators; and
- Incorporation of approved changes into a draft standard.

There are several major agencies or organizations outside of California that adhere to the ANSI principles in developing energy standards and codes. In addition, the U.S. Department of Energy follows a non-ANSI but well-specified process in developing nationwide standards for appliances. The processes used by these agencies or organizations are described in the following sections.

3.2 SETTING BUILDING EFFICIENCY STANDARDS

There are three national organizations involved in setting standards for building energy efficiency:

- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE);
- International Code Council (ICC); and
- National Fire Protection Association (NFPA).

Each organization emphasizes the ANSI principle of consensus in developing standards. For example, ASHRAE standards are often submitted as potential American National Standards. This requires that the procedures used to develop the standards (but not the technical content) be subject to review by ANSI.

3.2.1 ASHRAE's Process.

The ASHRAE energy efficiency standards are Standard 90.1 for nonresidential buildings and Standard 90.2 for residential buildings. The essential features of consensus were applied in developing these standards. As defined in the ASHRAE Manual for Processing ASHRAE Standards (ASHRAE 1994), consensus is:

> "Substantial agreement, in the judgment of a duly appointed authority, reached by directly and materially affected interest categories. Substantial agreement means more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution. It does not require that each separate interest subcategory reach consensus on the standard. For ASHRAE standards projects and any jointly sponsored standards projects that use ASHRAE procedures, the project committee is the consensus-forming body.

For developing consensus on Standards 90.1 and 90.2, ASHRAE:

- Includes various interest categories as members of ASHRAE's Standing Standards Project Committee (SSPC);
- Allows extensive public review of draft requirements and supporting analyses;
- Revises draft requirements in response to comments, provides for debate and presentation of opposing viewpoints during committee meeting times; and
- Requires final approval by various technical subcommittees, the full SSPC, various ASHRAE Standards subcommittees, ASHRAE Standards Committee, ASHRAE Technology Council, and the Boards of Directors of ASHRAE and IESNA.

ASHRAE's SSPC 90.1 has for years been divided into several subcommittees covering the major technical requirement sections:

- Envelope
- Mechanical (HVAC and service water heating)
- Lighting (and electrical power)

As a rule, these subcommittees have had relatively little interaction with each other. Each subcommittee has focused primarily on revising energy requirements for the specific building system for which it was responsible.

Additional subcommittees have included an Energy Cost Budget subcommittee and a Format and Compliance subcommittee.

ASHRAE has broad stakeholder participation in its SSPCs for 90.1 and 90.2. ASHRAE's process includes this broad participation of stakeholders not just in the review of completed products at the end of the development process, but also in the complete development process of each code cycle from the earliest stages onward. These stages include:

- Planning process of each code cycle;
- Identification of potential measures;
- Evaluation and preliminary screening of measures for further development;
- Detailed evaluation and assessment of measures, often including cost-effectiveness analyses.
- Review of all drafts, from earliest to final, of proposed changes or extensions to the energy standards.

In recent years, two SSPC 90.1 subcommittees accomplished additional outreach to stakeholders via use of email list serves. Both the envelope and energy cost budget subcommittees used the list serves to distribute most routine subcommittee correspondence. Any interested person could sign up and receive a copy of the subcommittee correspondence. This permitted interested stakeholders to join the list serve and to stay current with ongoing committee plans, activities, and products. The use of these lists serves has not been required by ASHRAE or ANSI but has been at the discretion of the subcommittee chairs.[9]

As of August 2005 the envelope subcommittee had about 16 members, and the list serve distribution reached about 100 participants. The energy cost budget subcommittee had 6 members and its list serve distribution reached 109 participants. Very recently, the new chair of the mechanical subcommittee has begun using a comparable list serve.

ASHRAE 90.1 and 90.2 requirements must be economically justified**.** Beginning with the 1999 version of 90.1, the economic justification for many requirements is based on life cycle cost (LCC) analysis. As with other aspects of 90.1, this varies across subcommittees, building systems, and compliance paths.

- For the building envelope, virtually all prescriptive requirements since those in 1999 have been set using a consistent LCC-based methodology.

[9] The list serves have been maintained by GARD Analytics of Chicago as a no-cost service to the committee. When GARD first started providing this service, they were receiving funding from GRI for analyses they were conducting. That funding ceases after awhile but GARD has absorbed the cost itself of maintaining the service.

- Likewise, many HVAC requirements are based on LCC analyses using the same economic parameters as the envelope requirements.[10]
- The lighting requirements, however, have used a well-defined procedure based on professional judgment rather than economic analyses to set the lighting requirements. This procedure has been developed over time by the IESNA and is described on its website.

The Energy Cost Budget (ECB) method used for whole-building compliance with 90.1 has also used a cost-based compliance approach that is different from that used for the prescriptive envelope and HVAC requirements. The ECB compliance compares energy costs of a building design against the energy costs of a "budget" building; however, construction costs are not considered in this compliance approach.

Within ASHRAE, ICC and NFPA are viewed as important code-producing "client" users of 90.1 and 90.2 standards products. Thus, ASHRAE has established a Code Interaction Subcommittee (CIS) of the Standards Committee. The activities of this subcommittee include interacting with model codes organizations, such as the International Code Council (ICC) and the National Fire Protection Association (NFPA), to ensure proper reference to ASHRAE standards and other documents in building codes. The subcommittee coordinates communication and coordination between the organizations. For example, the CIS coordinates a review within ASHRAE of code change proposals coming before the ICC. Typically, the 90.1 SSPC will vote on its position towards each proposed change, and the CIS will communicate these positions to the ICC. ASHRAE sends a representative (e.g., Director of Technology) to the ICC Code Change Hearings each spring.

ASHRAE has also formed a Code Development Committee. This committee, which reports to the existing Code Interaction Subcommittee, is tasked with preparing consensus-developed recommendations on proposed revisions to various codes, primarily those of the International Code Council. It will also allow ASHRAE to develop positions on code changes that affect members, but where ASHRAE does not have a standard. The committee is responsible for considering proposed code changes suggested by Society members. Such changes are first put out for internal public review by ASHRAE members. Once consensus has been reached within ASHRAE, the proposed changes are submitted to the appropriate model code group.

In the past several years, ASHRAE and the US Green Building Council (USGBC) have established a closer working relationship. This has been perceived as important because the USGBC's Leadership in Energy and Environmental Design (LEED) certification process allocated energy points to buildings that surpass 90.1 in energy savings. The ASHRAE 90.1-1999 ECB rules proved to be very restrictive for use with the LEED point system. As a result, the new 90.12004 version contains a new Appendix G with a special set of rules that are more appropriate

[10] A summary of the similarities and differences in economic parameters between ASHRAE 90.1-1999 and the California non-residential standards is contained on pp. 2-3 of the CEC report entitled "2001 Update, California Nonresidential Energy Efficiency Standards, *Task 1 – Measure Identification and Analysis Plan,"* August 21, 2000, Eley Associates and Taylor Engineering

and balanced when applied to LEED certification procedures. Also, it is possible in the future that LEED certified buildings might provide a proving ground for advanced technologies to enter the market place sufficiently to be considered for incorporation into future versions of 90.1.

3.2.2 ICC's Process

The International Energy Conservation Code (IECC) is published and maintained by the International Code Council (ICC). The IECC contains energy efficiency standards for new residential and commercial buildings and additions to existing buildings. These standards pertain to a building's ceilings, walls, and floors/foundations and the mechanical, lighting, and power systems.

The process that ICC uses for setting standards for the IECC (and other codes) involves the following steps:

1. Appoint members for code committees;
2. Solicit proposals for code changes;
3. Publish a monograph containing proposed changes to codes;
4. Hold code development hearings;
5. Publish report on public hearings;
6. Receive public comments;
7. Publish public comments and final action agenda;
8. Hold final action hearings; and
9. Publish new edition of codes with accepted changes.

Within the ICC process, state building code officials play a major role. In the past, the ICC process in fact excluded significant input from anyone other than code officials. Now, however, the ICC allows all members, including building owners, manufacturers and trade groups, to suggest changes and vote on them at the initial code hearings. Previously only code officials could vote.

Initial votes at the ICC are often advisory in nature. The final decision-making body in the ICC reflects the majority membership, which is building code and fire officials.

3.2.3 NFPA's Process

Established in 1896, the National Fire Protection Association (NFPA) serves as the leading advocate of fire prevention and is an authoritative source on public safety. The mission of this international nonprofit organization is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically-based consensus codes and standards, research, training, and education.

The standards-setting process of NFPA is based on providing considerable opportunities for public participation in the development of codes and standards. All NFPA codes and standards are revised and updated every three to five years in Revision Cycles that begin twice each year and take approximately two years to complete. Each Revision Cycle proceeds according to a published schedule that includes final dates for all major events. The process contains five basic steps that for developing both new codes and standards and for new editions for existing codes and standards. These five steps are:

- Call for Proposals;
- Report on Proposals (ROP);
- Report on Comments (ROC);
- Technical Report Session of the NFPA Annual Meeting; and
- Standards Council Consideration and Issuance.

NFPA emphasizes that its process is a consensus one, sanctioned by the American National Standard Institute (ANSI). ANSI requires that all code-writing committees not have more than one-third of the members represent a particular interest. Major interests represented within NFPA include manufacturers, trade groups and fire officials carry much of the responsibility. The final decision-making body at NFPA is comprised mainly of contractors and fire officials.

3.2.4 Pros and Cons of Consensus Process Used by ASHRAE, ICC, and NFPA.

The consensus process used by these organizations in setting and updating building energy efficiency standards has advantages and disadvantages.

- The main advantage is that the resulting standard theoretically reflects broad agreement among the stakeholders. Consensus is taken to mean more than a simple majority, but not necessarily unanimity.
- One disadvantage is that the levels agreed to are essentially least common denominator values. Equipment manufacturers can wield considerable influence on the process and can oppose efficiency advocates seeking more stringent provisions.
- Another disadvantage is the extremely long period of time it can take to come to consensus. For example, it took a decade to come to consensus on ASHRAE Standard 90.1-1999, which was twice as long as projected.

3.3 SETTING APPLIANCE ENERGY EFFICIENCY STANDARDS

Energy efficiency standards for appliances are set by the U.S. Department of Energy and by some states. The processes followed in setting appliance energy efficiency standards are reviewed in this section.

3.3.1 DOE Process for Setting Appliance Energy Efficiency Standards

The U. S. Department of Energy (DOE) has been given the authority to set energy efficiency standards for standards under several legislative acts.

- DOE was first authorized to set mandatory energy efficiency standards for 13 household appliances and products under the National Energy Conservation and Policy Act (NECPA), which was enacted in 1978.
- The NECPA was amended and updated in 1987 by the National Appliance Energy Conservation Act (NAECA). NAECA superseded existing state requirements and actually set the first national efficiency standards for several types of home appliances, including refrigerators and freezers, furnaces, and air conditioners. NAECA also established a schedule for possible updates of the standards.
- The Energy Policy Act of 1992 (EPAct) added lamps (incandescent and fluorescent), small electric motors, office equipment, and plumbing products as products for which DOE was to set energy efficiency standards.

By the mid 1990s, DOE was falling behind in developing appliance energy efficiency standards. Congress advised DOE to correct the standards-setting process and to bring together stakeholders (such as manufacturers and environmentalists) for assistance. To resolve this problem, DOE in September 1995, announced a formal effort to consider further improvements to the process used to develop appliance efficiency standards, calling on energy efficiency groups, manufacturers, trade association, state agencies, utilities and other interested parties to provide input to guide the Department. On July 15, 1996, the Department published a *Final Rule: Procedures for Consideration of New or Revised Energy Conservation Standards for Consumer Products* (61 FR 36974). The rule describes the process DOE now uses in setting appliance energy efficiency standards.

Figure 3-1 is a logic model for this process. This model links inputs, outputs, outcomes and impacts for the five main types of activities that are involved in the DOE's process for setting appliance energy efficiency standards.

3.3.1.1 Activities

As the model in Figure 3-1 shows, there are five basic activities in DOE's standards setting process:

- Priority setting,
- Advanced notification of a rule making,
- Notice of rule making,
- Final rule making, and
- Enforcement.

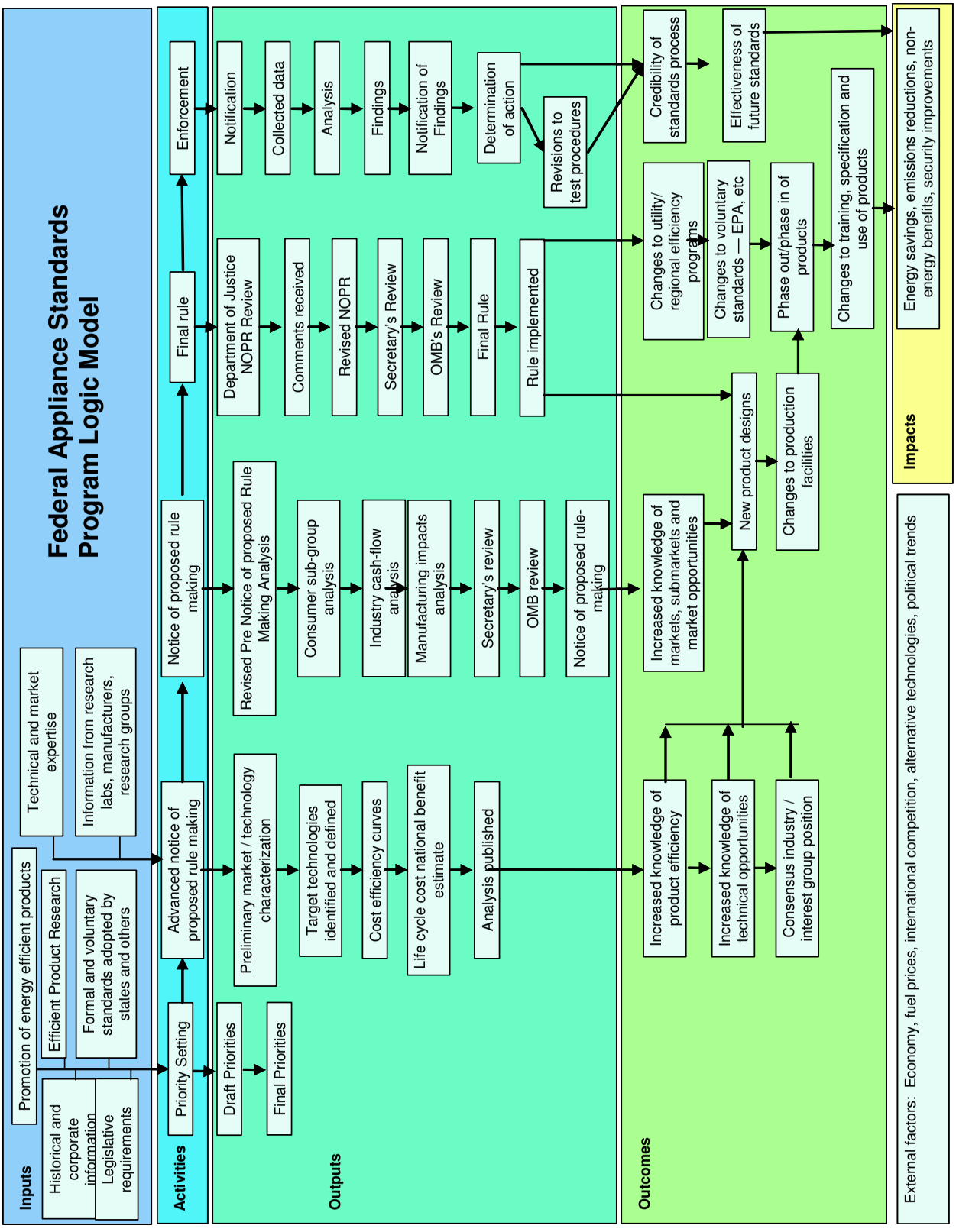


Figure 3-1. Program Logic Model for U. S. DOE Standards Setting Process

Annual priority setting. DOE has an annual priority setting process. In the spring, DOE presents a draft planning document in which it announces a draft set of regulatory priorities for the subsequent year. The document takes the form of a memorandum spelling out the priorities and a set of appendices with supporting analyses. The priorities identify the products and test procedures to which DOE will be giving active regulatory attention. This list of draft priorities is sent to DOE's mailing list and posted on the DOE Website. The public is invited to comment on the draft priorities. In the fall, sometime in December and sometimes as late as February, DOE will publish the final planning document.

In identifying products for the priority list, DOE considers products that are identified in legislation, for example, the National Appliances Energy Conservation Act (NAECA), that require a standard or updates to a standard. In addition, DOE staff may identify products not included in legislation that they believe would be a good candidates for the program. DOE may also considers suggestions received during the comment period.

Candidate technologies and products are screened for inclusion in the priority list on the basis of a number of criteria, as shown in Table 3-1. Energy savings and cumulative regulatory burden are key criteria.

Table 3-1. Product Priority Setting Criteria

Product Priority Setting Criteria
Energy savings potential
Potential economic benefits / burdens
Potential environmental or energy security benefits
Applicable deadlines for rule making
Incremental DOE resources required to complete the rulemaking process
Evidence of market-driven or voluntary efficiency improvements
Status of required changes to test procedures
Impact of potential regulation on product innovation
Fuel neutrality
Impact on peak demand for electricity
Impact on small businesses
Cumulative regulatory burden

The cumulative regulatory burden addresses the extent to which manufacturers may be severely impacted by having to improve the efficiency of a product in the same time frame that they are addressing the efficiency of other products and perhaps while having to address regulatory burdens imposed by other agencies including the California Energy Commission.

A good example of priority setting and cumulative burden is dishwashers. The original standard was effective in 1988 and the first update was effective in 1994. The law (NAECA) requires a second update that has not been done. The energy savings would appear to give this a relatively high priority. However, the manufacturers who manufacture dishwashers also manufacture

refrigerators, clothes washers, and air conditioners and those same manufacturers have had to address EPA regulations related to HCFCs and CFCs as well. The manufacturers have limitations of capital and staff. Thus, dishwashers have been accorded a lower priority because of the cumulative regulatory burden.

DOE's staff limitations are also considered in priority setting, both in terms of program and legal staff to review the rules. Thus, priority setting is a way to legitimize what the law requires.

DOE staff note that under the best of circumstances the standards development process takes about 40 months. Thus, in any annual cycle there will be standards in different stages of developments. Because of the length of the Federal process, DOE has a number of standards at various stages of development at any one time. The priority setting identifies new efforts that are needed and helps to affirm the priorities for the use of resources for existing projects.

ANOPR (Advanced Notice of Proposed Rulemaking) Development Process. The Advanced Notice of a Proposed Rulemaking (ANOPR) is where most of the detailed analysis for the Federal standard setting process is done. The ANOPR is intended to establish the factual basis on which a policy decision can be based. The ANOPR phase does not result in a proposed rule. In this sense it is probably different than the California process in which the analysis and the proposed rule are released as part of the case study. The ANOPR phase mainly consists of six steps.

- Preliminary Market and Technology Characterization: DOE staff examines current product lines in the market and identifies the features of a technology that may influence energy efficiency. The characterization includes that will emerge from research laboratories. Technologies are examined with respect to safety, manufacturability, reliability, health and other characteristics. As this phase, procedures for conducting the screening analysis are developed.
- Screening Analysis: In this step, the technologies that are to be dealt with are identified and niche products are screened away. The key issue here is to establish a clear definition of the subject of the standard. This process results in the identification of the baseline models, product classes, and design options that are to be addressed through the standard.
- Engineering analysis: A cost versus efficiency curve is developed. The idea is to project the costs of producing a product at different levels of efficiency. Manufacturer, distributor, and retailer mark-ups are included in the analysis to adjust the cost to a price that the consumer is willing to pay. This analysis also produces a maximum technical (MAXTECH) achievable energy efficiency level. These costs feed the life cycle analysis.
- Life cycle cost analysis: For life cycle cost and payback analysis, DOE uses a distribution analysis. For example, for a product such as an air conditioner where usage is a function of geography, a distribution of usage hours is developed representing national usage. Payback is simulated under a large number of trials. In this example, DOE might use EIA's Residential Energy Consumption Survey (RECS) as the data source. Utility tariff data is introduced to evaluate regional variations in energy costs. Also, regional variations in product prices are

examined. Based on this, a distribution of estimated time to payback is developed for each level of efficiency, for example, a distribution of paybacks for an 11.0 EER air conditioner. These analyses are completed on spreadsheets to make them more transparent for stakeholders.

- National benefits estimate: The lifecycle analysis feeds a national benefits estimate. Annual equipment price changes resulting from the standard are compared to annual national operating savings with the result being the annual net present value of the changes resulting from the standard. The result is a set of curves that show the net present value across a range of efficiencies and savings.
- Advanced Notice of Rule Making: The analysis is then reported as the Advanced Notice of Proposed Rule Making. At this point all parties are asked to comment on whether the methodologies and the spreadsheets are appropriate and correct. Formal meetings are held as part of the public comment process. The Advanced Notice of Proposed Rule Making does not include any proposed policies or standards for comment. Rather, interested parties are invited to respond to the definitions, the screening analysis, the engineering analysis, and the life-cycle cost analysis.

Public input to the process. During the interviews, DOE personnel were asked specifically about the amount of input from stakeholders. Given its 25 hears of history, the program has developed program and product specific mailing lists. All of the various interest groups are represented in those lists. DOE does extensive mailings and e-mailings. In addition, there is constant interchange between DOE and the various parties involved in the process.

DOE is attempting to increase the level of informal input. Drafts of analyses and spreadsheets that are developed, especially at the ANOPR phase, are now posted on the website which permits early and informal consultation. There are informal meetings and numerous one-to-one contacts about the analyses.

In addition, DOE is making use of informal meetings for other purposes. In one example, DOE addressed the safety of certain furnace design options that cause condensation that might potentially result in corrosion. Using it mailing lists and other methods but not a Federal Register announcement, DOE informally invited parties to attend a meeting to discuss safety issues.

The separation of the analysis phase and the rule phase definitely lengthens the process. It is unclear if the separation contributes significantly to reaching consensus because of an agreed upon set of data.

Notice of Proposed Rule. In this phase of the process, DOE develops the proposed rule. Additional analyses are conducted to determine the effects on consumer subgroups and other parties. The propose rule is also examined for its effects on competition among manufacturers and on utilities.

- Revised Pre-ANOPR Analyses — At the close of the comment period for the advanced notice of rule making, the comments that are received are analyzed and the methods and spreadsheets may be adjusted if errors are detected or improved analysis techniques are identified.
- Consumer subgroup analysis — The impacts are then examined with respect to subgroups, for example, low-income households or perhaps manufactured homes.
- Industry cash-flow analysis —The goal of this analysis is to examine the changes in the cost of manufacturing a product and examining how quickly manufacturers might recoup those costs given the likely pricing of the product. This is the net present value for the industry.
- Other manufacturer impacts — This set of analyses focus on what impacts the standards might have on employment, capacity, competitiveness, and cumulative impacts from other standard setting and regulatory activities.
- Utility impacts and environmental analysis — The effects of the changes are examined in relation to emission rates and utility load factors to see what effect the proposed standards are likely to have on peak demand, utility revenues, and emissions reductions.
- Secretary of Energy's Review — The proposed rule is presented for final internal review by the Secretary of Energy.
- OMB Review — The Notice of Proposed Rule is sent to the Office of Management and Budget. In effect, the Office of Management and Budget reviews the rule for the White House. The Secretary's and OMB reviews can occur in parallel.
- Publish the NOPR — Once these steps have been concluded, there is a Notice of the Propose Rule Making (NOPR). The NOPR spells out the proposed policy changes. Supporting documentation is published on the DOE Website.

In comparison to the California process, it appears that the Federal process is more involved. This may be particularly true with respect to the impact on manufacturers with respect to cash flow and other impacts such as employment impacts. The impacts on consumers may be more closely examined in the Federal process compared to the California process.

Final rule. Before a rule can become final, there are several types of final review.

- The Department of Justice reviews the NOPR for language, to ensure that the proposed rule is consistent with current statutes, and to assess whether the proposed rule will reduce competition.
- Comment period — In parallel with the DOJ NOPR review there is an additional public comment period. Public hearings are held to receive comment.
- Revise the NOPR Analysis — The NOPR and the NOPR Analysis are revised in light of comments received during the public comment period and from the DOJ.
- Secretary's Review — There is a Secretarial review of the revised final NOPR.

- OMB Review — OMB conducts a review in parallel with the Secretarial Review
- Publish Final Rule — The final rule is published in the Federal Register.

These steps leading to a final rule have parallels in the California Process.

Enforcement. From time to time, DOE finds itself in the position of needing to enforce the standards that it has implemented. In some instances there may be ways in which manufacturers are able to take advantage of the certain features of test procedures to avoid the intent of the standards. In these instances, DOE may need to redesign test procedures and to establish a new rule for the test procedures. There are also situations in which equipment is designed such that it does not meet the standard although it may actually pass the test procedures. In order to protect the standard and the credibility of the standards process, DOE may have to take enforcement action.

When DOE becomes aware of a situation in which a product may not be meeting the standard, it will notify the manufacturer. DOE will then conduct testing and/or analysis to confirm that the standard is not being met. If the testing and analysis indicates that a product is not meeting the standards, then DOE will take action to have the manufacturer cease manufacturing the product or bring the product into compliance.

3.3.1.2 Inputs to Activities

The model shows a range of inputs to the activities. For example, legislative mandates such as the National Appliances Energy Conservation Act (NAECA) spell out categories of appliances for which standards are to be developed. As we noted in our discussion of the California Standards, some parties are interested in using standards developed in California to leverage the standards process in other states and thence to leverage the standards setting process at the Federal level. The theory is that when confronted with the potential for a variety of standards, manufacturers will be more amenable to national standards. Thus, state standards are an input to the Federal process.

Voluntary standards influence the process as well as represent a source of information. For example, the Energy Star program, which is heavily promoted by energy efficiency groups, utilities, manufacturers, and state and local governments, encourages widespread adoption of more efficient technologies, encourages the development and diversification of appliance technologies, helps to make equipment prices more affordable, and results in technology trickle down that helps to facilitate the adoption of standards.

The Federal process relies heavily on historical and corporate (DOE) information. Neither the annual priority setting process nor the standards setting process start from scratch but build upon information that has been developed over time as well as new information that is collected. This corporate memory is important to facilitating the process.

The Federal process is designed to make certain that there has been adequate opportunity for public input. In this sense, the Federal process appears to have more steps and perhaps more

requirements for notification than does the California process. DOE is required by law to publish certain types of notifications in the Federal Register. It also relies on extensive corporate knowledge of markets and players. DOE has an extensive list of contacts that it is has developed over the years and to whom it mails or e-mails notifications of pending actions. In recent years it has also begun to make substantial use of the Internet to post information to keep potential participants informed.

Other inputs include information about the development of efficient new products, the state of the art in product research, and information about the degree to which efficient products have entered and penetrated the market and the degree of saturation that has been achieved.

3.3.1.3 Outcomes.

The Federal appliance standard setting process generates a number of outcomes. Outcomes are actions taken by those outside the program in response to program outputs or in response to other outcomes.

In Figure 1 there are three outcomes associated with the ANOPR activity: increased knowledge of product efficiency, increased knowledge of technical opportunities, and the development of a consensus industry/interest group position. One effect of the technical analysis should be to focus the attention of manufacturers on specific products and technical opportunities. It is quite likely as a result of the ANOPR, that manufacturers will begin to examine how they might meet the new standards and, if they do not already have compliant products, begin to develop new products or approaches. These activities may have spin-offs to materials development, equipment research and other activities.

The Department is increasingly attempting to front load the analysis. Completing most of the analysis in the ANOPR phase and prior to the NOPR phase makes it possible for the various stakeholders to come to the table with a consensus proposal to recommend to the Department. By doing this, it may be possible to streamline the process and move directly to a final rule making with an abbreviated NOPR process.

In the case of the commercial air conditioners and heat pumps. The Air-conditioning and Refrigeration Institute, its members, and efficiency advocates including the CEC, submitted a joint comment recommending a package of standards levels. After reviewing the comment, the decision was made to publish a notice of comment in the Federal Register indicating that the Department was considering moving to a direct final rule. The notice also established a comment period.

Because the trade association and most of the major players in the industry were among those submitting the comment, the need for extensive industry cash flow analysis and analysis of manufacturing impacts was unnecessary. Further, there were only a few responses received during the comment period that reduced the need to respond to the comments. The comments mostly indicated that the commentators had no objections.

Consensus may be aided when manufacturers have or anticipate having more efficient technologies in hand. For manufacturers who produced efficient equipment early, the standards may represent an opportunity to reduce the number of models across their product line cutting costs and reducing capital requirements.

There are other outcomes as well. For instance, the NOPR phase may result in increased understanding of markets, sub-markets and opportunities. It is also likely that there will be new product designs and changes to production facilities or at least plans for changes in production facilities.

The actual implementation of the standards causes additional outcomes. Manufacturers may position premium efficiency products at the high end of their line. Utilities and regional efficiency programs may have to adjust their offerings to take account of the new standard equipment which is more efficient. Voluntary standards such as Energy Star may need to be adjusted upward to reflect the fact that more products either meet or come close to meeting the Energy Star Standard.

There are market effects, especially as the effective date grows close. Some manufacturers or distributors may encourage customers to buy before the new standards to avoid the "cost-increase". Others, potentially those who may have shifted production early, may tout the benefits of efficient models before the transition pointing out that the efficient models will soon be the standard.

There are also likely to be numerous outcomes with respect to training, specifying, and using the new products.

Finally, with respect to enforcement, there are outcomes with respect to the credibility of the standards process and how that plays in to the effectiveness of future standards efforts.

3.3.1.4 Impacts

The impacts of the process are energy savings, emission reductions, non-energy benefits, energy security and others.

3.3.2 Setting Appliance Energy Efficiency Standards at the State Level

While a number of states develop their own versions of building energy efficiency standards, only two states—California and Connecticut—have established bodies that can set and update appliance energy efficiency standards.[11] As noted by at least two informants, most states do not have the institutional framework, budget, or personnel resources to undertake a standard setting process in the same way California does. One potential exception is the New York State Energy Research and Development Authority (NYSERDA), which has an institutional setting and perhaps the resources to institute a standards process.

[11] Personal discussion with Andrew deLaski of the Appliance Standards Awareness Project.

Although other states do not have the same formal apparatus for setting appliance energy efficiency standards as does California, in most, if not all, states, legislation can be introduced that sets appliance standards. Indeed, several organizations (e.g., ACEEE, Appliance Standards Awareness Project) have been intensely interested in leveraging results from California in order to set standards in other states through legislation. These organizations have promoted the adoption of some subset of the California appliance standards. States that have legislated standards for appliances and the number of appliances having such standards are shown in Table 3-2.

Table 3-2. States with Appliance Efficiency Standards

State	*Number of Appliances with Standards*
California	17
Rhode Island	14
New York	14
Washington	13
Arizona	12
Maryland	9
Connecticut	9
New Jersey	8

The Appliance Standards Awareness Project and the ACEEE have produced a document that describes 18 potential standards, many of which are based on work in California.[12] The document includes a table estimating the impacts in all states. In addition, the Appliance Standards Awareness Project has model state energy legislation that includes 20 products, 15 of which come from the California Standards.

ACEEE and other advocacy groups are also using the California standards as a basis for promoting legislation setting Federal standards. Manufacturers do not like state-by-state standards, which make it difficult to comply. Organizations such as ACEEE have been successful in leveraging appliance standards from California and elsewhere to create agreed-upon standards with the manufacturers that can then be placed into federal legislation. According to ACEEE, they have a dozen agreements with manufacturers that rest at least in part on the California standards that are or will be written into pending national legislation.

Moreover, having a standard adopted in California can be used to influence the adoption of the standard in other states, which would extend the standard's influence beyond California. For example, the Maryland and Connecticut legislatures drew on California standards (as well as Energy Star specifications) in enacting efficiency standards on several types of appliances in

[12] Nadel Steven, Andrew deLaski, Jim Lleisch, and Koru Tobu, *Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards*, Report A4, Boston: Appliance Standards Awareness Project, January 2005. http://www.standardsasap.org/a051.pdf

2004. Advocacy groups also use the fact that a standard has been adopted in California to urge its adoption by other states. For example, the Southwest Energy Efficiency Project used the adoption of certain appliance energy efficiency standards in California, Connecticut and Maryland as evidence in early 2005 to urge the Colorado legislature to pass an appliance energy efficiency bill.[13] In this respect then, the California process for setting appliance energy efficiency standards plays a role in getting appliance standards adopted in other states. This link was made explicit by the Appliance Standards Awareness Project in writing to CEC Commissioners Pfannenstiel and Rosenfeld regarding revisions to the Title 20 appliance standards:

> "…the impacts of your new standards will reverberate far beyond California's borders. First, because of the size of the California market, your standards are likely to influence what gets sold in neighboring states and, in some cases, beyond. Second, your standards become the model for other states and the federal government when they consider new standards."[14]

3.4 COMPARISONS OF THE CALIFORNIA AND FEDERAL PROCESSES FOR SETTING ENERGY EFFICIENCY STANDARDS

It appears that the Federal process takes somewhat longer that the California process. If all goes well, the timeline for the Federal appliance standard rulemaking process requires about 40 months for the full process starting with the ANOPR phase to the final rule. As one observer noted, it takes a lot of technical, but equally important, political management to complete the process in 40 months. In some instances the process takes much longer. California is essentially on a three-year cycle for revisions to its standards. This includes the planning, the analysis and drafting of standards, and the formal adoption process.

As noted above, there are a number of reasons why the process may take longer. There are formal legislative requirements that DOE must address that do not exist in the California setting. A second reason for the extended time period is the separation of the analysis and rule making phases. In California, the analysis and rule making appear to be more intertwined allowing the process to move forward more rapidly. A third reason for what appears to be a lengthier process appears to be the more detailed analysis associated with the Federal process as compared to California. There are differences of opinion with respect to the value of the more thorough analysis that may support a more stringent standard and a less thorough analysis which might lead to a less stringent standard but that might lead to earlier adoption.

A number of questions might be addressed with respect to this.

- A first question is whether the amount of analysis results in any difference in the stringency of the standards.

[13] Southwest Energy Efficiency Project, SWEEP Fact Sheet in Support of (Colorado) HB1162. (2005).

[14] DeLaski, Andrew, Letter to CEC Commissioners Pfannenstiel and Rosenfeld, October 22, 2004.

- If a less stringent standard is created, the question is then one of what the trade-offs are between a less stringent standard and a more stringent standard that might take a year longer to implement.
- A third issue is whether a less thorough analysis may result in the early need to revise the standard.
- Finally, there is the question of whether there are differences in the amount of public input that is received between the two processes. The more formal Federal process clearly has many announced opportunities for public input. The California process has formal opportunities for input but appears to be more informal in the early stages, to rely more on the contractors to gain input from relevant actors, and to have a more compressed timeframe for input. It is not clear whether this limits the inputs, the quality of the inputs, and the consideration of the inputs that are received.

The California priority setting process appears to be quite a bit less formal than the Federal process and perhaps not quite as open. The Federal process gives substantial notice to all parties as to what the Department of Energy will be doing. It also presents preliminary calculations and a justification for the priorities.

In the utility portion of the California codes and standards process, the utilities have identified priorities internally and coordinated them among themselves and with the CEC. In this last round, the CEC and the utilities did hold a public meeting to discuss potential projects. However, it is unclear whether the analytic priorities and the responsible parties have been identified or comments received about the priorities prior to the conduct of the analysis.

In the advanced stages of the analysis phase, the California utilities and the CEC produce draft documents that are placed on websites and the availability of that analysis is announced to the public. The intent of this is to obtain early feedback on the supporting analysis for the proposed standards. This informal process appears to be somewhat analogous to the Federal ANOPR process. However, unlike the Federal process, the analysis that is done in California is not presented separately for formal comment. The value of presenting the analysis separately is that it provides an opportunity for establishing a common factual basis before entering into a discussion and interpreting the facts with respect to what the standard should be. That does not mean that there are not "political" discussions that focus on what is in the analysis and how the analysis is completed. What it does do is establish a factual basis upon which the various proponents have agreed.

4. EVALUATING THE CASE STUDY PROCESS: SELECTING TOPICS FOR CASE STUDIES

Codes and Standards Enhancement (CASE) studies are an important part of the overall C&S Program. Chapters 4, 5, and 6 provide evaluative discussions of the CASE study process and methodology as it has been applied to the 2001 and 2005 energy standards updates. This chapter addresses issues related to how the goals for CASE studies are set and how topics are chosen. Chapter 5 addresses the issue of technical review of CASE study work. Chapter 6 addresses issues related to public participation in the CASE study process.

4.1 SETTING CASE STUDY GOALS

As part of their dealings with the CPUC, the IOUs must establish goals for the CASE studies they prepare through the C&S Program. In the past, these goals have been annual program goals. For example, SCE's most recent annual goal was six CASE studies and four codes and standards training seminars. It is important to keep in mind that many of the CASE study activities are multi-year efforts and the actual number of on-going efforts may exceed that annual goal. SCE reported that starting in 2006 the programs will be on a three-year cycle, as will the funding and the goals.

The SCE Program Manager described the logistics of their process. Utility goals are submitted to the CPUC as part of the Program Implementation Plan (PIP) that establishes program goals and funding levels. Once the spending is authorized by the CPUC, CASE study activities are initiated. Monthly reports of activities are sent to the CPUC. A major activity during the year is to define future activities. Near the end of the budget year the CASE studies for the subsequent year are clearly identified.

Defining goals in terms of CASE studies and the number of training seminars is significant. The goal only requires the utility to complete the requisite CASE studies. The goals have not identified levels of savings that must be met. Even with careful selection, there is no a priori guarantee that the practices or technologies being examined in a CASE study will produce results that warrant inclusion of the practice or technology in the codes and standards. Further, the results of some CASE studies point to the need for additional research. Such additional research may delay or even prevent the inclusion of the CASE study results into the codes and standards. Formulating the goals in terms of CASE studies allows for uncertainty of the research outcomes. Allowing the utilities to claim the savings will help to focus the activities on measures that produce greater savings.

There are consequences of failing to meet CASE study goals. One respondent pointed out that failure to identify and/or to complete the requisite number of CASE studies results in leaving money on the table. This is because, to date, money for a CASE study cannot be shifted between years. According to this respondent, management gives careful attention to defining the goals and to managing the process so that all funding is utilized.

4.2 PROCESS FOR GENERATING AND SELECTING TOPICS FOR CASE STUDIES

According to various respondents, the process for generating and selecting topics for CASE studies has changed considerably over the years and continues to evolve. There are on-going interactions among the utilities and between the utilities and the CEC with respect to the CASE studies. A considerable amount of this is informal and done via e-mail and telephone. However, key managers from the utilities do meet on a quarterly basis to review progress on existing studies, discuss common issues, and brainstorm future directions.

As described by personnel from both PG&E and SCE, the processes they use for generating ideas for code enhancements are similar. The process has three basic stages:

- Generating ideas,
- Culling and refining the ideas, and
- Selecting the final set of CASE studies.

There has been and still is a fair bit of art in selecting CASE studies. Nearly everyone agreed that additional rigor would enhance the process, although it was also agreed that art is still required. Interviewees identified a wide variety of criteria that were used to select technologies or energy efficiency measures as topics for CASE studies. Key criteria mentioned included the following:

- Is the technology or measure available?
- Is it reliable?
- Is there infrastructure (manufacturing, distribution, operations and maintenance) to make it work?
- Is it not being preempted by federal appliance standards?
- What is the magnitude of the savings?
- What is the first cost impact of the code change proposal if the proposal results in mandatory requirements? (This is especially important to CBIA since code changes tend to increase home prices.)
- Is it cost-effective (i.e., the cost of the change is justified by the resulting savings)?
- What amount of research has already been done?
- What amount of research will be required to complete a CASE study?
- What is the political landscape in terms of feasibility in agreement on a standard?

A proposal is likely to be dismissed early if a technology or measure is not available, is not reliable, and if the infrastructure for it does not exist. In some instances, a dismissed proposal might occasion the identification of research projects.

PG&E Process. From the perspective of PG&E personnel, the identification of CASE studies has become increasingly sophisticated. In the early years PG&E staff, with some support of consultants, made the decisions. In the 2005 update round, PG&E generated ideas and then held a workshop attended by interested parties to identify CASE studies for future rounds of changes. That meeting involved the IOUs, contractors from the previous process, CEC personnel, representatives from key advocacy groups (NRDC and ACEEE), and industry representatives. Prior to the meeting a list of 50–60 technologies was e-mailed to the attendees. During the meeting, a very summary presentation was made for each identified technology, with one minute allocated to present each technology. In addition, 20 or so other practices or technologies were brought up and discussed during the meeting. The result from the meeting was an expanded list of technologies that was subject to further screening. Subsequent to the workshop, a small group of PG&E staff further reviewed and culled the ideas, reducing the topics for CASE studies to a manageable number.

SCE Process. SCE has used staff meetings to generate ideas for CASE studies that are then checked with other utilities. Each potential CASE study topic identified is assigned to a SCE staff member who is the champion to advocate it during internal reviews. The topics for CASE studies are winnowed to a manageable number based on the advocacy for the cases.

SEMPRA Process. Within SEMPRA, SoCalGas has conducted some CASE studies, but SDG&E has not. SoCalGas has supported CASE study efforts on gas-using technologies (e.g., gas cooling) and has participated in the TDV evaluation and reviewed the TDV model.

4.3 EFFECTIVENESS OF PROCESS FOR GENERATING CASE STUDY TOPICS

PG&E reported that most of its CASE studies have resulted in additions or revisions to Title 20 and Title 24. This is confirmed by examining the degree of success with which technologies or measures that were the topics of utility CASE studies were actually adopted into Title 24 code.

As discussed above in Section 2.1, for its 2005 cycle of the code revision process, the CEC used a formal process for identifying, screening, and adopting code changes. Because of this process, individual stakeholders could and did take ownership of particular code revision proposals by developing the proposal and the materials to support inclusion of that proposal in the code. There was some collective work among the CEC staff and various stakeholders, but the workload was not as heavy as during the preceding AB970 proceedings.

Because of the formality of the 2005 code revision process, a set of data was produced that provides empirical evidence with which to determine the contribution of the C&S Program to the adoption of code improvements. In particular, as part of the process for revising the standards, the CEC received 271 templates and ideas proposing code changes. Analysis of this information from the 2005 code revision process indicated that support from C&S Program CASE studies had at least two effects on the probable adoption of the technologies or measures. The first effect was that a proposed code revision that was also the topic of a CASE study had a higher probability of being accepted for further analysis. The second effect was that a proposed code

revision accepted for analysis had a higher probability of being recommended for inclusion in the code.

The numbers of proposals from different sponsors are shown in Table 4-1. CEC sponsored 47 of the code revision proposals independently and 1 in association with PG&E. Three utilities (PG&E, SCE, and SoCalGas) sponsored 27 code revision proposals through the C&S Program.

Table 4-1. Number of Proposals for 2005 Title 24 Code Revisions from Different Sponsors

Sponsor	***Number of Proposed Code Changes Submitted***
CEC	47
CEC, PG&E	1
PG&E	20
SCE	6
SoCalGas	1
J.J. Hirsch	12
Watt Stopper	10
NAIMA	8
Cardinal Glass	7
Other	159
Total	271

Table 4-2 provides evidence of how code revision proposal sponsorship affected a proposal's probability of acceptance for further study. From the 271 proposed changes, the Commission staff selected 28 ideas for further analysis. (Some of these 28 represented combinations of multiple suggestions from the 271.) As can be seen, higher proportions of the proposals sponsored by either the CEC or by one of the utilities were accepted for study than were proposals submitted by other parties.

Table 4-2. Acceptance Rates for Code Revision Proposals from Different Sponsors

Type of Sponsor	***Number of Proposals Submitted***	***Number of Proposals Accepted for Further Analysis***	***Percentage of Proposals Accepted for Further Analysis***
CEC	48*	14*	29.2%
Utilities	28*	11*	39.3%
Other	196	4	2.0%

*Includes proposal submitted jointly by CEC and PG&E.

Besides type of sponsorship, there were other factors that affected whether a code revision proposal was accepted for further analysis. These factors were:

- Some of the C&S code revision proposals submitted by utilities were accepted to ensure that resources were allocated to give the highest probability of success for the highest number of

code changes. For example, developing standards for hardwired lighting in houses was of high priority to the CEC. Because the utilities submitted a proposal for hardwired residential lighting, the CEC could accept that proposal for further analysis and use its own resources on other topics. Had the utilities not made this proposal, however, the CEC would have gone ahead with its own proposal to further analyze lighting code revisions for the residential sector.

- Some CEC proposals were accepted because the CEC had made a commitment during the AB970 Standards proceeding to address the proposed revision in the 2005 round of Title 24 changes.

The accepted proposals were to go through a thorough investigation that included development of cost information, energy modeling and analysis, and evaluation of the cost effectiveness of measures proposed as new mandatory, prescriptive and standard design requirements. The CEC focused its contract and staff resources on investigating the 14 proposals that it had submitted and accepted. (The CEC uses a single contract team to provide support for its code revision work. This team is chosen through a competitive bid process.) The utilities used resources from the Codes and Standards Program to investigate the 11 proposals they had submitted that were accepted for further analysis. Such utility support was crucial in moving code revision proposals from the study phase into active consideration for adoption.

Out of the 28 proposals that were accepted for further study, there were four that required funding from a source other than the CEC or the utilities. Some industry-sponsored proposals were not actually studied because the industry sponsor did not feel capable of funding the required research. For example, WattStopper's proposal for using automatic controls to shed load was accepted for further study. However, WattStopper could not fund the research that would have been required to move the proposed change into the code.

There are some stakeholders who have been able to work with the CEC staff on the code revision process under their own funding. The most obvious example is the approach the California Building Industries Association (CBIA) has taken. CBIA has been involved in the code setting process since the 1970s. Over time, however, CBIA has gone from playing a role that was somewhat adversarial to the CEC to one that has them being involved in the development of proposed code revisions. In the mid 1990's, CBIA approached CEC staff before the formal code revision process began and worked with the staff on reviewing and developing code revision proposals. The goal was to identify which code revisions were workable for builders and which ones were not. As part of this process, CBIA now funds energy analyses of code revision proposals and provides results of those analyses to CEC staff. Moreover, in cooperation with the Natural Resources Defense Council (NRDC), CBIA has hosted key player workshops where staff from CBIA, NRDC and other key players review potential code revision proposals for their feasibility and efficacy.

Within the larger context of the equitable and effective use of funds from the public goods charge, it would seem that some provision should be made such that proposed code changes that

pass technical screening (e.g., the proposal by WattStoppers) not be discarded because of funding constraints. Depending on the cost of preparing a CASE study, it may be appropriate to set aside CASE study funding to support ideas for which their sponsors are not able to fund further research.

It can be expected that topic selection for CASE studies and the funding of the research on those topics will be of more concern in the future. It can of course be argued that the relatively high rates of success that PG&E has enjoyed with its past CASE studies are due to the intense screening of candidate practices and technologies as part of the CASE study selection process. However, the success rate may also be due to the large number of potential technologies and practices that were available for study when the C&S Program began and that the practices and technologies addressed in the 2001 and 2005 cycles largely represent what one respondent repeatedly referred to as *low hanging fruit*.

In the future, the low-hanging fruit may no longer exist, the utilities may have to seek higher in the trees for equivalent cost-effective savings, and diminishing returns may set in. There was agreement among the utilities that there is a need to more systematically examine markets for opportunities. SCE indicated that it expected to do more of this. In this same vein, PG&E representatives talked about the need for surveys to fill the information gaps and for developing a statistical basis for understanding what is happening in one area, such as outdoor lighting. They discussed the need for information about skylighting, such as how much energy is saved from skylighting and sidelighting. The lack of information is impeding the ability for code enhancements in these areas.

5. EVALUATING THE CASE STUDY PROCESS: TECHNICAL REVIEW OF CASE STUDY ANALYSES

This chapter addresses the issue of technical review of CASE study work. The discussion is organized to address the following questions:

- How are CASE study analyses conducted?
- How much independent Technical Review occurs of CASE study analyses?
- Is technical review of CASE Study analyses needed?

The chapter concludes by (1) describing an example peer review process and (2) listing a set of principles potentially applicable to conducting peer review of the technical work in CASE studies.

5.1 HOW ARE CASE STUDY ANALYSES CONDUCTED?

As noted above, the CEC generally uses a single contract team to provide support for its code revision work. A contract team is generally chosen that provides the support work over a two- or three-year period. The contract team is chosen through a competitive bid process following state government procurement procedures. On the other hand, utilities have generally chosen several contractors to perform CASE studies. During interviews with PG&E and SCE personnel involved in the C&S Programs, interviewees from both utilities indicated that they used various contractors to complete the technical analyses for their CASE studies. SCE reported that internal staff also does some of the technical analysis.

Because utilities have somewhat more flexibility in their procurement processes than the CEC, they are better able to pick experts to conduct studies of particular types of specialized energy efficiency measures. For examples, PG&E chose staff from Lawrence Berkeley National Laboratory who had considerable experience in researching, respectively, cool roofs and duct sealing to prepare CASE studies on those technologies. Similarly, an independent contractor with considerable experience in research on high performance windows was chosen to prepare the CASE study on that technology.

The CASE studies prepared for the 2005 cycle of Title 24 code change showed some variation in approach and reporting because of differences among the contractors selected. However, for the most recent cycle of Title 20 code changes, PG&E used a small group of contractors to prepare the CASE reports. As a result, these reports show a common form in terms of topics addressed and content included.

Example of a CASE Study Technical Analysis by a Contractor. PG&E assigned the American Council for an Energy Efficient Economy (ACEEE) to conduct CASE study projects for technologies about which ACEEE had prior knowledge and expertise. Thus, ACEEE staff were the lead staff to conduct CASE studies of commercial refrigerators, freezers, and ice makers;

large commercial air conditioners; and metal halide lamps. They were also responsible for conducting technical analyses on furnace fans. Although ACEEE generally advocates for energy efficiency standards, they have also worked with manufacturers and other parties in collecting and analyzing data relevant to setting appropriate standards.

Discussions with ACEEE staff provided information for an example of how the CASE study analyses are conducted by contractors. As the lead consultant for its studies, ACEEE used a *Measure Information Template* provided by PG&E to establish the framework for collecting and analyzing relevant information. The *Measure Information Template* collects and analyzes the following types of information:

- Description of the measure;
- Description of the energy and non-energy benefits (e.g., comfort, environmental, indoor air quality, health and safety, productivity benefits, reduced maintenance costs, and increase property value);
- Description of how Time Dependent Valuation (TDV) affects benefits;
- Potential adverse environmental impacts;
- Type of proposed change (e.g., mandatory measure, prescriptive requirement, compliance option, or modeling procedure);
- Market availability of the measure and estimated cost of the measure;
- Useful life, persistence, and maintenance implications of the measure;
- Procedure for verifying the proper installation and performance of the measure;
- Requirements for evaluating measure cost effectiveness;
- Analysis tools needed to quantify energy and demand reductions and whether current tools can be used to complete the analysis;
- Relationship of the measure either to other measures already in the standards or to new measures being considered to be added to the standards; and
- Research studies, reports, and other information that provide background on the proposed change, including current research and additional research.

When asked to evaluate the *Measure Information Template,* ACEEE staff indicated that they found the template to be fairly functional, although there were times when it was necessary to make judgment calls. According to ACEEE, PG&E was fairly flexible about resolving issues arising from trying to use the template.

Example of Case Study Analysis Process. ACEEE staff indicated that they typically followed the following steps in preparing the CASE study analyses:

- Collect additional information via the internet and professional contacts;
- Conduct an analysis of energy use associated with the proposed standard or technology;

- Assess the economics (cost effectiveness) of each product;
- Prepare a draft report for review by PG&E and others;
- Post the draft on the PG&E website so that all manufacturers could comment;
- Refine the draft based on the comments that are received; and
- Revise and publish the CASE study report after a public hearing and the receipt of new or additional information.

5.2 HOW MUCH INDEPENDENT TECHNICAL REVIEW OF CASE STUDY ANALYSES BY OTHER STAKEHOLDERS?

When interviewed, CEC staff stated that their perception was that CASE studies prepared through the C&S Program were of high quality and thereby raised the threshold for participation in the code revision process for other stakeholders. Also, CEC staff felt that other stakeholders participating in the process had to become more constructive because of the technical quality of the analytical work on the CASE studies. That is, discussions about proposed code changes would become oriented more to technical rather than political reasoning as to why a proposed code change was "good" or "bad".

Independent Review Was Limited. Although the CASE study reports were published and disseminated, there is some evidence that the independent review by stakeholders of some of the CASE study reports was limited. Interviews with various stakeholders in the CEC's code revision process showed that most felt the process was open. However, most also felt that, given the volume of material to be reviewed and the number of workshops being held, the process was time-consuming. Scheduling within the process created difficulties as time allowed for reviewing materials was often short. Some interviewees pointed out that their staff did not always have an opportunity to review materials within the shortened time frames.

Large Volume of Proposed Changes Posed a Problem. Another factor that apparently constrained the extent of independent review was the large volume of proposed code changes and the volume of CASE study evaluation documents produced in the code revision process. This meant that the volume of code revision proposals to review and digest was greater, imposing a burden on other stakeholders, particularly those with limited time, staff, and funding. One interviewee observed that it is likely that the CEC would have been able to establish fewer than 10 new standards for the 2005 revision cycle without the utility CASE study support. However, with utility participation the volume of materials to review was so great that even the CBIA, which explicitly budgets for conducting analyses of code revision proposals, remarked that the volume of proposals for the 2005 Revision Cycle for Title 24 was somewhat intimidating.

Most IOU proposals for code changes are adopted and go into effect without problems. However, some stakeholders interviewed indicated that they thought some CASE study reports aggressively pushed for the inclusion of some energy efficiency measures in the code. Other stakeholders regarded some proposed code changes as severely hampering a particular

technology's role in the marketplace. Some examples of stakeholders expressing these concerns are as follow:

- Manufacturers of metal roofs were concerned about the effects that the code revision proposals for cool roofs would have on their product.
- The Consumer Electronics Association (CEA) has argued that the standards the CEC adopted regarding the energy efficiency of consumer electronics products "artificially limit the power usage of consumer audio and video equipment, oddly requiring, in some cases, the use of products that are not yet technologically possible."[15]
- The National Electrical Manufacturers Association has argued that the new Title 20 requirement that all MH luminaires using a lamp rated 150-500 watts and operating in a vertical burning position not contain a probe-start metal halide ballast is premature, considering the limited availability in the market of products that could satisfy the requirement.[16]
- A review of the requirements for hardwired lighting by CBIA has suggested that the code requirement for hardwired lighting can be perceived as not being fully attuned to the realities of the technology when actually applied. The feeling expressed by a CBIA representative was that some of the lighting technology needed to meet the code requirements did not yet have significant market penetration. It was felt that advance efforts were needed to make homebuilders more conversant and comfortable with the lighting technologies they must use to meet the code requirements.
- In response to industry requests, the CEC delayed adoption of the second tier standards for three appliance standards: General Service Incandescent, Pulse Start Metal Halide Luminaires, and the Incandescent Reflector Lamp standards. (The Commission indicated that these standards would be considered for adoption during 2005.)[17]

5.3 IS TECHNICAL REVIEW OF CASE STUDY ANALYSES NEEDED?

If the perception of CEC staff is accurate and the quality of the technical analysis in CASE studies is indeed high, then the constraints on the ability of other stakeholders to perform independent technical reviews would be of little concern. However, with the utilities now proposing to the CPUC that they be given credit for savings that result from code revisions attributable to the C&S Program, it is useful to review the analyses used to estimate savings for the code revisions proposed in CASE studies and adopted for the 2005 Title 24 standards. This will help determine whether there was a need for technical review of the analyses.

[15] Brugge, Parker "Sound Energy Policy Requires Partnership", Appliance Design, July 1, 2005.

[16] National Electrical Manufacturers Association, Letter to CEC, October 29, 2004.

[17] Energy Solutions, "Codes and Standards Enhancement Initiative For PY2003 - 2005: Title 20 Standards Development: Final Project Report", June 2005, p. 7.

Estimates of the energy savings from the code changes developed for implementation in 2005 were prepared by Eley Associates and are reproduced in Table 5-1.[18] Note that although Time Dependent Valuation (TDV) was a major code revision for which the C&S Program provided support, estimates of the savings that will result from using TDV were not prepared for the impact report.

Table 5-1. Savings Estimates from Impact Report for Proposed Changes to 2005 Energy Efficiency Standards Attributable to C&S Program

Sector/Code Revision	***Estimated Savings***		
	Electricity (GWh)	***Peak (MW)***	***Natural Gas (Therms)***
Residential			
Hardwired lighting	64.60	2.97	
Duct improvement	35.14	24.30	2,719,430
Window replacement	6.34	2.40	295,646
Multifamily water heating	0.0	0.0	1,500,000
Subtotal, Residential	*106.08*	*29.67*	*4,515,076*
Nonresidential			
Lighting controls under skylights	n/a	n/a	n/a
Ducts in existing commercial buildings	9.73	7.36	1,035,000
Cool roofs	14.60	9.50	n/a
Relocatable classrooms	3.10		n/a
Subtotal, Nonresidential	*27.43*	*16.86*	*1,035,000*
Total, Residential and Nonresidential	*133.51*	*46.53*	*5,550,076*

The proportions of the savings estimated for all 2005 code revisions associated with C&S Program code revisions are as follows:

- For the residential sector, data from Eley Associates' *Impact Report* show code revisions supported by the C&S Program as accounting for over three-fourths of the kWh savings estimated for all 2005 code revisions, for roughly one-third of the kW reductions and just over half of the therm savings.
- For the nonresidential sector, the data from the *Impact Report* show code revisions supported by the C&S Program as accounting for about 8% of kWh savings estimated for all 2005 code revisions and for about 19% of the kW reductions. This accounts for more than the overall therm savings because other revisions increased gas usage.

Table 5-1 illustrates that three code revisions supported with CASE studies and adopted into the 2005 Title 24 code account for most of the savings attributable to the C&S Program. Savings

[18] Eley Associates, *Impact Analysis: 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings,* Report prepared for California Energy Commission, June 2003.

estimated for these revisions—time dependent valuation, residential hardwired lighting, and residential duct improvement—are therefore reviewed here to see whether more technical review of the CASE studies would have been useful.

5.3.1 Review of Savings Estimates for Time Dependent Valuation

Time Dependent Valuation (TDV) is a major change to the standards that will come into effect in 2005 and will affect all building types covered by the standards, for it will replace source energy for performance trade-off accounting in the standards. When source energy is used for trade-off accounting, the value of energy used does not differ across hours in the year. The assumption underlying the use of time dependent valuation is that energy saved at different hours of the year should be valued differently. For example, electricity used during peak periods costs more, and therefore reducing electricity use during those hours should be valued more highly. TDV is an effort to bring more appropriate valuation of energy use into consideration when decisions are being made designing and equipping newly constructed buildings.

While the theoretical advantages of TDV were discussed in the TDV CASE study reports, estimates of the impacts TDV will have on new construction practices and in saving energy by reducing peak demand were not addressed in the TDV CASE study reports or in the *Impact Report* prepared by Eley Associates. What is known is that TDV essentially changes the calculus by which builders can make trade-offs to comply with the code requirements. As in the past, this will require a trial-and-error process as builders evaluate the costs and benefits of different combinations of measures to comply with the code. At this point in time, there is a myriad of combinations, but which combinations are best is still being determined. Energy savings and demand reductions will depend on the particular combinations of measures that are finally chosen.

Development of TDV was conducted over a 5 year period with extensive internal review. Moreover, the TDV methodology was presented in workshops. However, a search of the literature does not reveal any reports or papers providing independent technical review of the TDV methodology.

That TDV was adopted for Title 24 with relatively little independent technical review contrasts noticeably with the review given to another avoided cost methodology, the *Methodology and Forecast of Long Term Avoided Costs for the Evaluation of California Energy Efficiency Programs* that had been prepared by Energy and Environmental Economics, Inc. (E3) for the CPUC. The timeline for technical review of E3's methodology shows a nine-month period for independent technical review after the initial draft was prepared.[19] There were at least three workshops devoted solely to the methodology, and several periods for comments and reply comments from utilities and other interested parties. There is no evidence that the TDV methodology received the same degree of independent scrutiny during the C&S process.

[19] E3's avoided cost website is at http://www.ethree.com/cpuc_avoidedcosts.html

5.3.2 Review of Savings Estimates for Hardwired Lighting in Residences

Another code revision adopted for 2005 Title 24 is that high efficacy luminaries will be required for single family and multi-family dwellings, including some exceptions that allow automatic controls in some spaces. A PG&E CASE report was developed for hardwired lighting in residences, but no estimates were made of the aggregate savings likely to result from making this a code revision. For the overall 2005 code revision *Impact Report*, Eley Associates prepared estimates for savings that will result from hardwired lighting. As cited in the *Impact Report*, an independent review of the estimated per-residence lighting use showed them to be consistent with estimates from other studies. The conclusion was that there was thus no reason to revise the aggregate savings estimates developed in the *Impact Report*.

As noted above, CBIA has expressed the opinion that some of the lighting technology needed to meet the code requirements for hardwired lighting did not yet have significant market penetration. It was felt that advance efforts were needed to make homebuilders more conversant and comfortable with the lighting technologies they must use to meet the code requirements. Such market penetration concerns were not addressed in this particular CASE study, although market penetration will necessarily affect the savings that are actually achieved.

5.3.3 Review of Savings Estimates for Duct Improvements in Existing Homes

Under the 2005 standards, duct systems for houses in Climate Zones 2 and 9 through 16 will have to be tested and sealed at the time that an air conditioner, heat pump, or furnace is replaced or installed in an existing residential building. Also, new or replacement duct systems in existing residential buildings will be required to (1) have an insulation level equivalent to the prescriptive requirements for newly constructed buildings, (2) be tested, (3) and be sealed.

Estimates of aggregate annual savings from duct sealing were reported in a PG&E CASE report and in the *Impact Report* prepared by Eley Associates. These aggregate saving estimates are shown in Table 5-2.

Table 5-2. Estimates of Aggregate Savings from 2005 Duct Sealing Requirement

Savings Estimates	***PG&E CASE Report***	***Eley Associates Impact Report***
Houses Affected	255,000	50,000
Aggregate Annual GWH Savings	200 GWh	35.142 GWh
Aggregate Annual Peak Demand Reduction	160 MW	24.3 MW
Aggregate Annual Therm Savings	20,000,000 therms	2,719,430 therms

As can be seen in Table 5-2, there are significant differences between the aggregate savings estimates in the PG&E CASE report and in the *Impact Report* prepared by Eley Associates. Because of these differences, the estimates of the aggregate annual savings impact of the duct sealing requirement were reviewed by examining: (1) savings per house and (2) number of houses affected. As the following discussion will show, review of these factors as reported in different studies indicates that the actual savings from duct sealing are open to further research.

Consider first the savings per house that will result from duct sealing. The savings per house can be inferred from the aggregate estimates in Table 5-2 by dividing the aggregate savings estimates by number of houses. The inferred estimates of savings per house are shown in Table 5-3.

Table 5-3. Estimates of Savings per House from Duct Sealing as Inferred from PG&E CASE Study and Eley Associates' Impact Report

Savings Estimates	***PG&E CASE Study***	***Eley Associates Impact Report***
Inferred kWh Savings per house	784.3 kWh	702.8 kWh
Inferred kW reduction per house	0.627 kW	0.486 kW
Inferred therm saving per house	78.4 therms	54.4 therms

Compared to other estimates of savings from duct sealing, the savings per house for both electricity and natural gas shown in Table 5-3 are relatively high. For example, Table 5-4 reproduces the estimates of savings from duct repair that are reported in the Database on Energy Efficient Resources (DEER).[20] As can be seen, even for houses built before 1978, the DEER estimates of savings per house in all zones are considerably lower than the estimates of savings per house reported in Table 5-4.

Table 5-4. DEER Estimates of Savings per House from Duct Repair

Type of Savings Estimate	***Vintage of House***	***CEC Forecasting Climate Zones***									
		1	***2,6***	***3,7***	***4***	***5***	***8,11***	***9,12, 16***	***10***	***13***	***15***
Energy kWh/house	Pre-1978	38.5	136.0	270.1	98.5	49.4	91.7	145.8	201.8	83.2	585.3
	1978-1992	23.4	128.9	258.4	68.7	28.7	67.3	118.8	148.0	59.3	451.6
	1992-1998	18.9	97.2	231.0	75.0	38.4	76.0	92.3	114.1	76.1	260.0
	Post-1998	14.0	83.6	203.2	67.8	33.3	74.3	100.1	148.5	79.0	312.4
Peak KW/house	Pre-1978	0.00	0.21	0.30	0.18	0.12	0.16	0.23	0.24	0.16	0.32
	1978-1992	0.00	0.15	0.21	0.14	0.10	0.15	0.20	0.21	0.14	0.28
	1992-1998	0.00	0.15	0.25	0.13	0.10	0.08	0.15	0.16	0.18	0.17
	Post-1998	0.00	0.13	0.22	0.12	0.10	0.11	0.16	0.20	0.17	0.18
Gas Therms per house	Pre-1978	42	40	32	29	36	21	26	30	16	16
	1978-1992	23	22	20	15	17	8	11	11	7	4
	1992-1998	12	15	12	8	10	4	3	4	3	1
	Post-1998	11	12	10	7	8	3	2	3	2	1

In terms of technical review, the point to be made here is that estimates of savings from duct sealing that were significantly different from those reported in the CASE report existed in DEER, a major public data base, but were not mentioned or referenced in the CASE report. Use of the DEER savings estimates for the CASE study would have dramatically changed the evaluation of the cost effectiveness of duct sealing.

[20] The climate zones used for DEER are the zones that the CEC has defined for forecasting purposes, not for Title 24 compliance purposes.

Similarly, Table 5-2 shows that there were significant differences between the CASE report and the *Impact Report* with respect to the number of houses affected by the duct sealing requirement. However, the CASE report provided no information that might suggest a considerably lower estimate of the number of houses that would be affected.

5.4 PRINCIPLES FOR PEER REVIEW OF TECHNICAL WORK IN CASE STUDIES

The discussion in Section 5.2 showed that there are constraints on the amount of independent technical review that other stakeholders can give to CASE study reports, while Section 5.3 provides several examples from the 2005 Title 24 code revision process that suggested that technical review of the CASE reports might be useful. An example is provided below of a peer review process used nationwide by US DOE.

A good example of how a peer review process for CASE reports could be structured is provided by the peer review work of technologies supported by the DOE's Office of Science and Technology (OST). The American Society of Mechanical Engineers (ASME) and the Institute for Regulatory Science (RSI) have performed this work since 1996. Based on their experience, they have identified the following principles as the most important requirements for an independent peer review program:

- **Principle 1:** The selection of reviewers and the outcome of the peer review are the result of the consensus of a group rather than the decision of an individual.
- **Principle 2:** Clear and unambiguous policies ensure that conflict of interest is avoided or at least minimized.
- **Principle 3:** The findings and recommendations of the review panel address unambiguous and clear questions (sometimes called review criteria or lines of inquiry) identified by the sponsoring organization.
- **Principle 4:** The findings and recommendations responding to the review criteria are constructive and helpful rather than being adversarial.
- **Principle 5:** The participation of appropriately-selected stakeholders significantly enhances the credibility and acceptability of the results of peer review.

Each year the ASME/RSI team peer applies these principles in reviewing an average of 31 technologies. A Review Panel is assembled from government, academia, industry, and other segments of society. This panel prepares a review journal, entitled *Technical Peer Review Reports,*. The objective of the Peer Review Program is to provide an unbiased, independent, and timely review of developing technologies supported through a DOE/OST program .

Under this model, the review of specific technologies or energy efficiency measures is performed by a review panel that consists of a small group (e.g., three to five) of knowledgeable individuals with in-depth experience in the technologies being reviewed. The review panel members have signed appropriate conflict-of-interest and non-disclosure forms. Under the procedures used by RSI, members of peer review panels are not paid or receive modest honorariums. A review panel

is generally expected to make its findings and recommendations available within six weeks, with the preparation and printing of a full report requiring an additional six to eight weeks.

The review panel is provided with the following criteria to be used in their review:

- Technical Validity Criteria
  - Are proponents of the technology under review aware of state-of-the-art of science and engineering relating to that technology and of relevant published scientific and engineering information?
  - Is the technology as designed consistent with established scientific and engineering principles and standards?
  - Is there adequate technical documentation for the technology, such as publication of results in peer-reviewed journals?
- Relevancy Criteria
  - Does promoting the technology meet an identified need?
  - Is the proposed technology superior to existing technologies that address this identified need?
- Risk-Related Criteria
  - Have human health risks been adequately addressed?
  - Have ecological risks been adequately addressed?
  - Have occupational health and safety issues been adequately addressed?
  - Has sufficient data been collected, responding to regulatory and stakeholder concerns?
- Overall Assessment Criteria
  - Based on the technical merit, is the likelihood of its broad implementation of the technology reasonably high?
  - Based on identified needs, is the likelihood of the technology's implementation reasonably high?
  - Based on the overall assessment of the technology, should promoting it for inclusion in the standards be continued?
- Economic Criteria.
  - Is the use of the technology cost effective as demonstrated by life cycle assessment or other appropriate quantitative methods?

Further details on setting up and running a peer review program are provided in the *Handbook of Peer Review* by the Institute for Regulatory Science. This *Handbook* includes three items:

1. ASME Manual for Peer Review;[21]

[21] The ASME Manual for Peer Review and the Procedures Manual are available at http://www.nars.org/. The DOE Guidance Document is available at http://www.riskcenter.doe.gov

2. Procedures Manual containing information on procedures pertaining to various aspects of the peer review; and
3. DOE Guidance Document.

6. EVALUATING THE CASE STUDY PROCESS: PUBLIC PARTICIPATION IN THE CASE STUDY PROCESS

In SB 1488 (passed in 2004), the California Legislature has gone on record for encouraging meaningful public participation and ensuring open decisionmaking in the proceedings of the CPUC. It is logical to believe that they also desire similar public participation and open decisionmaking in the regulatory proceedings of the CEC.

Both the PG&E and SCE processes for preparing CASE studies attempt to involve stakeholders. All interviewees affirmed the importance of gaining input from stakeholders, but mentioned two main issues:

- The first issue is the extent to which stakeholders are informed about the process and are able to participate in the CASE study effort.
- The second issue is the extent to which the parties are willing to participate.

These issues are explored in Section 6.1 and 6.2.

6.1 INFORMING STAKEHOLDERS ABOUT THE PROCESS

There was widespread agreement among those interviewed for this process evaluation that it was unlikely that parties that were interested in participating in the CEC's code revision process were being excluded because they were not invited to the table. Several respondents indicated that they have lists of key players from previous efforts, and that either the CEC or the utilities and utility consultants are aware of the key players. Substantial efforts are made to notify potential players of the process.

ACEEE, a consultant during the process, said that they were specifically asked by PG&E to involve third parties, and that they took a number of actions to do so. They checked with manufacturers and trade associations for existing research.

- In cases such as lighting (not lighting equipment), they talked to all major manufacturers, distributors, and others in the field. And in the case of pulse metal halide lamps, they talked with the top five manufacturers.
- Rather than using cold calling as part of air conditioning standards development, they talked to people that they knew and to people within the trade association. With respect to refrigeration, ACEEE indicated that comments came mostly from the American Refrigeration Institute, the trade association for the industry.

The judgment of a non-utility participant in the process was that information mostly got to the people who needed to have input. The respondent commented that smaller manufacturers who were not a part of the trade associations or and not well connected to the trade associations may have fallen through the cracks.

Another non-utility participant who was familiar with the process said that PG&E did a tremendous outreach through consultants to reach cooperative manufacturers. This person commented that when working through trade associations, one tends to get the lowest common denominator. If is single member is complaining that the standards are too high, the trade association will oppose the standard.

6.2 WILLINGNESS TO PARTICIPATE IN THE PROCESS

The various parties interviewed indicated that stakeholders vary in the degree to which they are willing to be a part of the process. Stakeholder responses ranged along a continuum of active cooperation, cooperation, passive resistance, or full resistance. Several examples can be given to demonstrate this range.

6.2.1 Examples of Cooperative Manufacturers

Several examples can be given of how manufacturers were cooperative in the CASE work.

For the CASE study of NEMA Type 1 dry transformers, the manufacturers cooperated in facilitating agreement on a standard. In the case of pool pumps, PG&E had good contacts within the industry. The industry had some concerns and made some recommendations. Some changes were developed that represented a small compromise that worked to the benefit of both groups. Changes were developed outside the formal process and, to the knowledge of our informant, representatives of the industry did not subsequently attend the formal hearings.

SCE examined the use of electricity in dairy operations and found significant potential for a large helicopter fan. Diary cattle produce more milk if their core temperature is managed. Traditionally, farmers use fans installed in dairy buildings to force air laterally across the livestock. This requires numerous fans to effect good coverage. The overhead fan has a very large blade span and circulates air from overhead. A single overhead fan can replace up to 20 sidewall fans and may reduce horsepower requirements by 70 percent while producing the same amount of cooling. In addition to energy reduction, the fan allows better management of core temperature, resulting in improved milk production.

In this case, SCE worked with the Dairyman's Association and with the manufacturer to evaluate the potential of the overhead fan. The Dairyman's Association is now promoting the fan as a best practice. This is an example of a voluntary standard that is being implemented outside of the formal appliance standards, and according to SCE this practice is diffusing from California to other parts of the country as well.

As a recent example at the national level, commercial refrigeration manufacturers and energy efficiency advocacy groups negotiated an agreement whereby the signatories are jointly recommending to Congress a minimum efficiency standard for most self-contained refrigeration equipment and beverage coolers. In addition, the agreement calls for legislation requiring that the U.S. Department of Energy establish efficiency standards for ice-cream freezers, self-contained cabinets without doors, and remote condensing products (solid door, transparent door and

cabinets without doors). The manufacturers and energy efficiency advocates will attempt to develop consensus recommendations that address all of the statutory criteria that the U. S. DOE is required to take into account in promulgating energy efficiency standards for covered equipment.22

Another of SCE's CASE projects was to improve the efficiency of vending machines of two major bottling companies, Coca-Cola and Pepsi Co., and their manufacturers. A two-tiered Energy Star standard governs the efficiency of vending machines: Tier 1 machines are required to be 45 percent more efficient than the current standard appliance, while Tier 2 machines will be required to be 55 percent more efficient by 2007. The Energy Star standard focuses on a more efficient compressor and fan, and on more efficient lighting. There is also a low power control option that reduces lighting and refrigeration during low activity periods.

In this case, SCE worked with Coke and Pepsi to obtain vending machines that could be tested in an environmental chamber. Testing revealed that the metal chute through which drink containers are delivered shields the storage chamber from the flow of cold air. It was determined that some redesign of the machine would reduce or eliminate the obstruction and increase the efficiency of the cooling, resulting in a 40% reduction in energy. Working with Coke and Pepsi, SCE was able to get the manufacturer to redesign a machine for testing. Implementation of the redesign by the manufacturers will reduce energy use for vending machines beyond the savings from Energy Star compliance.

6.2.2 Examples of Manufacturers' Resistance

There are also several examples of manufacturers resisting proposed code changes.

A first example where there was some reluctance on the part of the industry pertains to when, a standard for a more efficient type of incandescent service lamp was proposed. The proposal was for a 3% improvement in efficacy to be implemented in 2006, which has already been met by much of the industry, and an 8 to 10% improvement to be implemented in 2008. The PG&E CASE study team (led by Energy Solutions) had pointed out that manufacturers would mostly meet the 2008 requirement. During the process, the industry asked how the CASE study team knew this, to which they responded that they had examined the watts and lumens on the lamp packaging. The industry replied that the labels were inaccurate, which, as our respondent pointed out, is a somewhat bizarre argument for the industry to make. The upshot was that a sample of bulbs were collected in stores and sent for testing at Rennsaelear Polytechnic Institute. The test

[22] "Consensus Agreement on Commercial Refrigeration Efficiency Standards Reached", ACEEE Press Release, April 5, 2005. The agreement was negotiated over a fifteen-month period by commercial refrigeration manufacturers, represented by their trade association, the Air-Conditioning and Refrigeration Institute (ARI), and by energy efficiency supporters, represented by the American Council for an Energy-Efficient Economy (ACEEE), a non-profit organization. Other signatories to the agreement are nine commercial refrigeration manufacturers, the California Energy Commission, the Natural Resources Defense Council, the Alliance to Save Energy, the Northeast Energy Efficiency Partnerships, the Environment Northeast, and the Appliance Standards Awareness Project.

results mostly bore out the labeling information. However, the testing resulted in additional costs and in a delay in final consideration of the proposed code change.

The trade association and a major manufacturer also raised issues about the 8 to 10% standard. Although there are a variety of ways to meet this standard, our respondent pointed out that perhaps the best way is to substitute krypton for the Argon gas currently used in the envelope. The industry raised the question of the price of krypton gas; a question that the study addressed. The industry also raised the question of whether the standard should result in a 60-watt bulb that provided more lumens or a 54-watt bulb. The intent of the CASE study process was obvious (i.e., a 54-watt bulb), but since the industry had raised an issue the proposed standard was held over. Negotiations are underway that have so far resulted in adjusting the proposed standard and in an agreement that the utilities will advertise the efficiency of the 54-watt bulb.

In some instances, several industries (e.g., lighting equipment, walk-in refrigeration, motors, and consumer electronics) would not talk to PG&E or the codes and standards advocacy groups. They instead preferred to talk only with the CEC. According to the CASE study sources, PG&E sent them all of the available material, but they did not respond because they did not want to recognize PG&E and the advocacy groups. During the hearings, they faulted the CASE study work but offered no alternatives. In response to this, the CASE study teams had to respond to the criticisms.

According to a non-utility participant, a representative of the Consumer Electronics Association (CEA) did attend a meeting or two outside of the formal process but was never able to recommend changes. According to this observer the CEA has resisted standards for consumer electronics since the 1980s, and has not been regulated. In the end, CEA participated in the formal process, making general criticisms of the proposed standard and arguing that there should be no standard rather than participating in an effort to set a standard.

6.3 MARKET PENETRATION AND THE EFFECT ON COOPERATION

Market penetration is used as one criterion in assessing whether to address a particular issue in the code. There is a widespread assumption that higher levels of penetration may facilitate stakeholder acceptance for the inclusion of a technology or practice into the codes and standards. While this generalization may be true for some or even many technologies, the reality is much more complex.

One of the interviewees pointed out that NEMA Type One dry transformers probably had less than 5% market share when the standard was adopted. Yet as noted above, the manufacturers were very cooperative in setting the standard. In this case, it is likely that manufacturers already had a dry type transformer product available (the interviewee didn't discuss the reasons why the manufacturers cooperated). However, among other things, agreeing to a standard and hewing to it would mean that manufacturers and their distributors could simplify their product lines and reduce stocking costs. Also, the differential between standard and premium stock may not be high.

This same interviewee pointed out that there are other cases, such as lighting, where there is continued stakeholder opposition to a standard even with high levels of product penetration. The interviewee cited the case of a large duct tape manufacturer who had tape that would meet the standard, but who was still adamantly opposed to the standard. The interviewee hypothesized that in this and similar instances, the technology targeted for a standard is a premium product with higher profit margins and that manufacturers may resist a standard that would result in a commoditization of the product.

The bottom line is that stakeholder readiness is not so much a matter of market penetration but whether stakeholders have a product, how the standards might affect the number of products to be stocked and managed, the degree to which higher profits can be extracted from a premium product, and the trade-off between the latter two.

7. SUMMARY AND RECOMMENDATIONS

The preceding chapters described the code advocacy procedure in general and the role of the utilities in the procedure and documented and examined the CASE methodology. This chapter draws on the work from the previous chapters to provide recommendations for improvements to that methodology.

The processes associated with the Codes and Standards Program and the interactions of the program with regulators, stakeholders, and the buildings-related communities were described in Chapter 2 using information gathered through review of program documentation and interviews with various stakeholders in the process. Chapter 3 then provided brief descriptions of the procedures that are used by other agencies and organizations to set energy efficiency codes and standards. The information presented in these two chapters show that the role of the C&S Program in the setting of energy efficiency codes and standards in California is relatively unique. There was general agreement among those interviewed that beginning with the AB970 Emergency Rulemaking, the C&S Program has played a central role in the process for revising Title 20 and Title 24 codes. Because of the C&S Program, more proposals for code revisions have been examined for possible adoption than would otherwise have been considered, the depth of research on these proposals has been greater, and more code revisions have been adopted.

Those interviewed generally felt that the CEC code revision process was open. Moreover, although most saw that the C&S Program now has a central role in the CEC's code revision process, only a few really knew what was being produced through the C&S Program. In CASE study reports, it may be useful to document more fully the outreach process used in preparing the CASE studies, how early in the process such outreach was started, what steps were taken for outreach, what comments were received, what steps were taken to revolve the comments, and what was the disposition of the comments (i.e., were they resolved or not).

The past achievements of the C&S Program have come with it operating as an information-only program; savings from program accomplishments were not counted towards meeting utilities' energy efficiency goals. However, the CPUC has now ruled that starting in 2006 utilities can begin counting savings from their C&S Programs as part of the achievements of their energy efficiency portfolios. Accordingly, the question arises as to whether the procedures used for their C&S Programs in previous years need to be changed to accommodate the new circumstances.

The process by which topics for possible code revisions have been identified was discussed in Chapter 4. As noted there, the utilities generally have identified CASE topics through internal staff work. However, in preparing their programs for 2006-2008, utilities have used a process in which input and suggestions from the public were solicited. One recommended change to the CASE methodology therefore would be for the utilities similarly to develop and apply a more structured approach for identifying potential code changes. This change would be consistent with the approach that PG&E is proposing to integrate the C&S Programs with other programs. (See the discussion above in Section 2.2.3.) Moreover, since there is some perception that the

"low lying fruits" for code revision proposals have now been picked, a wider process for soliciting code revision proposals would help in identifying a broader range of revisions.

At a minimum, a method would be used to identify technologies and ideas now at various stages of development and market penetration within the Emerging Technologies, Pilot, and Production Programs of the IOUs that can potentially move into C&S identification and evaluation. A more expanded method might also examine non-IOU sources for new technologies/ideas, such as LEED certifications, federal lab R&D programs, programs by non-CA utilities (e.g., Pacific Northwest, NEEP, etc.) The formal process would build upon the process used for 2005 and what is now being used or planned for 2008. The formal process would be set up to identify technologies/ideas that might enter at least at two future C&S cycles (e.g., 2008, 2011, 2014).

Chapter 4 also discussed funding issues concerning third party proposals that pass technical screening but do not proceed for lack of funding from the proposer. Within the larger context of the equitable and effective use of funds from the public goods charge, it would seem that some provision should be made such that proposed code changes that pass technical screening not be rejected because of funding constraints. Depending on the cost of preparing a CASE study, it may be appropriate to set aside CASE study funding to support ideas for which their sponsors are not able to fund further research."

Chapter 5 addressed the question of whether further technical review of CASE studies is needed. It is not clear that the CEC code revision process as currently structured allows sufficient time for independent technical review of code revision proposals. A number of the individuals interviewed regarding the CEC process indicated that the process was time-consuming, particularly given the volume of material to be reviewed and the number of workshops being held. Scheduling within the process was perceived as creating difficulties because the time allowed for reviewing materials was often too short. Accordingly, future CASE energy code revision work might be structured to produce CASE study reports earlier and thereby to increase the review time available to reviewers. Report production might also be staggered so that review periods (if possible) are also staggered to provide relief to reviewers.

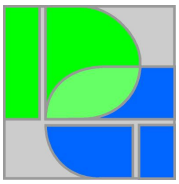
The review in Chapter 5 identified some issues and problems with the technical quality of several CASE studies. Some steps could be taken to ensure that technical input to the CASE study analyses is balanced and of high quality.

- For key or controversial CASE studies, funding might be provided for reviews by independent and knowledgeable experts. More generally, if CASE analyses by advocates are funded, then it might be appropriate to fund independent reviews or evaluations to ensure that they can address an equivalent level of detail being addressed in the CASE study analyses. Providing funding for participation in some or all CASE studies by independent and knowledgeable experts could ensure that the methods and assumptions used are balanced, appropriate, and publicly available on the timeliest possible basis.

- The procedures used to communicate CASE study could be refined to ensure that the entire process is as transparent and public as possible, from the very beginning of each CASE study process.

With savings from the C&S Program being counted in the future towards achieving utilities' energy efficiency portfolio goals, the information provided in the CASE studies will come under greater scrutiny as part of the independent evaluation of program results that CPUC procedures require. As currently proposed by the CPUC, evaluation of the C&S Program (as well as of other utility energy efficiency programs) will be conducted by an organization not beholden to any IOU and not routinely involved either in a consulting capacity to the IOUs or in a consulting capacity to the code revision process. Taking steps to ensure the technical quality of the CASE studies will facilitate the independent evaluations of the C&S Program that will be performed in the future. In this respect, more attention should be given in the CASE studies to develop more detailed information on the market penetration rates and aggregate savings of the measures being proposed for inclusion in the codes.

APPENDIX A: RECOMMENDATIONS FROM REVIEW PANEL



The Deringer Group Inc, Berkeley
CTG Energetics, Irvine
Gable Associates, Berkeley
The Weidt Group Inc, Berkeley

A review panel formed by The Deringer Group Inc reviewed the final draft of this report and developed an independent set of recommendations.. The reviewers were Joseph Deringer (TDG), Tom Lunneberg (CTG), Mike Gable (GA), and Prasad Vaidja (TDG). Mike Gabel focused on recommending a few pragmatic ways to improve the CASE study methodology. Prasad Vaidja focused on recommending more explicit methods for using products from Savings by Design and related programs. Tom Lunneberg and Joseph Deringer made recommendations across a number of topics.

As a review team we see the possibility of several actions to improve the IOU C&S program in addition to those recommended in the report. We summarize below our preliminary thoughts about these additional recommendations.

A.1 BALANCE BETWEEN "STRATEGIC" (SCE) AND "TACTICAL" (PG&E)

See Section 2.2.2 of the report. The report implies that the future funding balance might tip in the future toward the more tactical approach taken by PG&E partly because of the ease of measuring benefits from the tactical approaches. We think it would be unfortunate if a strong balance between the strategic and tactical is not maintained.

For example, one member of our review team has been a subscriber to the BLDG-SIM list serve, a free discussion group service provided by GARD (see page 3-3 of the report). This list serve currently has some 1000 members and has daily communications about questions and advice concerning energy modeling of building projects not only in California but nationally and internationally. The availability of this tool, a result of the "Strategic" approach, clearly has a major positive impact on the energy efficiency assessments of many building design projects. Perhaps statistical, or interview, methods could be developed to improve the ability to estimate energy impacts of the availability of this valuable tool, and tools like it.

A.2 PROCESS OVERSIGHT.

We recommend that the C&S program consider developing a Program Advisory Group to ensure that all technologies are given due diligence. This Program Advisory Group would provide independent oversight of key program activities including such items as methodology development, outreach efforts, infrastructure development, identification of measures, selection of measures, selection of consultants, documentation of analysis, assessment of projected savings, potential monitoring of compliance and enforcement program outcomes. This recommendation is related to one of the recommendations in Chapter 7 of the report. What is suggested here is a more detailed independent program oversight than is implied in the evaluation discussion presented there. This Program Advisory Group might also have a role in designating and/or directing independent reviews of key CASE studies.

A.3 FORMALIZE OPENNESS OF EARLY STAGES OF IOU C&S CASE STUDIES.

The report indicates that there is general agreement that the California C&S process is open. The openness does seem to occur more in the later stages of the C&S code revision process. The report indicates that the California early priority setting process appears to be less formal and perhaps less open than the Federal (US DOE) process. The early priority setting stages in California also appear less open than the ASHRAE process. Conversely, the recent PG&E procedures used for the C&S CASE study process provided an excellent example of front-loading stakeholder outreach and involvement. We recommend that such front-loaded outreach approached not only be better documented as suggested in paragraph 3 of page 7-1 of the report but also that early stakeholder outreach activities be more formally adopted as part of future IOU C&S CASE studies.

A.4 DESIGN ASSISTANCE OUTCOMES AS POTENTIAL C&S INPUTS.

The report does not explicitly mention possible inputs to the C&S Program from Energy Design Assistance efforts such as the Savings By Design Program. There is a huge amount of information generated in this program regarding new technologies and strategies tested on buildings and subsequent verification of successful implementation and operation. Building projects that go through Design Assistance are generally ahead of the rest of the market in their aggressive approach towards energy conservation. Moving some of the successful strategies into successive Code improvements seems like a natural process for market transformation. Thus, we recommend support for the efforts to develop a methodology to identify and capture for C&S applications appropriate results from the Savings By Design Program and related programs.

A.5 POSSIBLE IMPROVEMENTS TO CASE STUDY METHODOLOGY.

One recommendation to improve the CASE methodology is to include a small percentage (e.g., 5%) of code revision consulting contracts to be allocated to independent peer reviewers throughout the contract process. This would ensure a high quality of objective critiques of methods and conclusions of the contract work.

Another recommendation for improving the CASE methodology would be to include, as part of the development of code revision proposals, an analysis of implementation, compliance, plan review, and field inspection issues. Often specific but crucial details of such implementation and enforcement issues are overlooked until code revision language has already been adopted.

A.6 CODE COMPLIANCE AND ENFORCEMENT.

The report indicates that inconsistent or incomplete compliance and enforcement are an issue and that there is general agreement among those interviewed that this needs attention. However, the recommendations in Chapter 7 do not address this issue directly. We see this issue as a limit on the ability to assess the actual effectiveness of new C&S energy efficiency impacts in buildings rather than just on paper not only in California but also throughout the country. We recommend that the emerging IOU C&S methodology include explicit steps to assess the effective compliance and enforcement of new measures, especially key ones with substantial estimated energy impacts.

An innovative new "Acceptance Testing" feature of some new Title 24 requirements may provide a mechanism for helping to exploring such compliance and enforcement practices in more detail for those measures that require such testing. We assume that such acceptance testing is likely to spread to additional measures in future versions of Title 24.

APPENDIX B: ANNOTATED BIBLIOGRAPHY

This appendix provides a bibliography of the materials drawn on for the process evaluation of the Codes and Standards Program.

Materials on Design, Administration and Evaluation of Utilities Codes and Standards Program:

The resources listed here are background materials regarding the design and development of the Codes and Standards Program, the administration of the program, and the evaluation of its results. The study by Pacific Consulting Services provided initial information on what the Codes and Standards Program could do. The five ACEEE papers summarize the design and administration of the program. Several studies provide the first estimates of the savings impacts resulting from the Codes and Standards Program. The last two papers by Heschong-Mahone Group address the theoretical and practical issues that arise in developing estimates of savings for the Codes and Standards Program.

Pacific Consulting Services, et al. (1999) *Market Assessment & Evaluation Study in Support of Codes and Standards, Final Report.*

Eilert, P., Horowitz, N., Fernstrom, G., Mahone, D., Stone, N. (2002) "A Strategic Framework for PGC Planning: Strategic Linkages Between Codes and Standards and Resources Acquisition" *Proceedings from the 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy Efficient Economy.

Mahone, D., Blanc, S., Eilert, P., Fernstrom, G., Hunt, M. (2002) "Upgrading Title 24: Residential and Nonresidential Building Energy Standards Improvements in California", *Proceedings from the 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy Efficient Economy.

Pope, T, Rainer, L., Fernstrom, G., and Eilert, P. (2002) "Minimizing Investments by Investing in Minimums: Energy Savings Through Appliance Standards" *Proceedings from the 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy Efficient Economy.

Stone, N., Mahone, D., Eilert, P., and Fernstrom, G. (2002) "What's a Utility Codes and Standards Program Worth, Anyway?" *Proceedings from the 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy Efficient Economy.

Eilert, P., Livingston, J., and Turnbull, P., (2004) "How to Catch More Flies with Honey and Vinegar: Integrating Voluntary Programs with Codes and Standards in California", *Proceedings from the 2004 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy Efficient Economy.

Heschong Mahone Group. (2001) *CA IOU Codes and Standards Earnings Claims Framework, Final Report.* Prepared for Pacific Gas and Electric Company.

Jacobs, P., and D. Roberts. (2001) "Estimated Impacts of the Non-Residential and Appliance Standards" in *CA IOU Codes and Standards Earnings Claim Framework Final Report.* San Francisco, CA: Pacific Gas and Electric Company.

Nittler, K., Wilcox, B. (2001) "Estimated Impacts of the Residential and Appliance Standards" in *CA IOU Codes and Standards Earnings Claim Framework Final Report.* San Francisco, CA: Pacific Gas and Electric Company.

Heschong-Mahone Group, (2005) *Codes and Standards White Paper on Methods for Estimating Savings,* Report prepared for Southern California Edison Company, April 13, 2005.

Heschong-Mahone Group, (2005) *Codes and Standards Program Saving Estimate: For 2005 Building Standards and 2006/2007 Appliance Standards*, Report prepared for Southern California Edison Company, Revised Version of August 1, 2005.

CEC Materials for Update of 2005 Energy Efficiency Buildings Standards:

Recent activities of the Codes and Standards Programs have been directed at supporting the 2005 Update to the energy efficiency building standards and the 2006/2007 update to the appliance energy efficiency standards. The California Energy Commission, which is in charge of the updating, has posted documents and presentations for these updates at: http://www.energy.ca.gov/.

CASE Studies Prepared for Codes and Standards Program:

One main thrust of the Codes and Standards Program is to prepare studies that evaluate the feasibility and appropriateness of including different energy efficiency enhancements into the Title 24 or Title 20 energy efficiency codes. Examples of these CASE studies are listed below.

CASE studies for revisions to building energy efficiency standards:

Pacific Gas and Electric Company (PG&E). (2000) *Energy Efficient Exit Signs Codes and Standards Enhancement (CASE) Study.*

Pacific Gas and Electric Company (PG&E). (2000) *Dry-type Transformers Codes and Standards Enhancement (CASE) Study.*

Pacific Gas and Electric Company (PG&E). (2001) *Code Enhancement Initiative For the AB 970 Emergency Rulemaking - Commercial Clothes Washers.*

Pacific Gas and Electric Company (PG&E). (2002) *Code Enhancement Initiative For PY2001: Title 20 Standards Development - Portable Room Air Cleaners.*

Pacific Gas and Electric Company (PG&E). (2002). *Code Enhancement Initiative For PY2001: Title 20 Standards Development - Water Dispensers.*

Pacific Gas and Electric Company (PG&E). (2002) *Code Enhancement Initiative For PY2001: Title 20 Standards Development - Low-Voltage Wall Transformers.*

Pacific Gas and Electric Company (PG&E). (2002) *Code Enhancement Initiative For PY2001: Title 20 Standards Development - Consumer Electronic Equipment Standby Losses*.

New Buildings Institute, Eley Associates, and Heschong Mahone Group. (2000) *Lighting Controls: Codes and Standards Enhancement (CASE) Study.*

New Buildings Institute, Eley Associates, and California Institute for Energy Efficiency. 2000) *High Albedo (Cool) Roofs: Codes and Standards Enhancement (CASE) Study.*

New Buildings Institute and Eley Associates. (2000) *Dry-type Transformers: Codes and Standards Enhancement (CASE) Study.*

New Buildings Institute, Eley Associates, and Heschong Mahone Group. (2000) *Energy Efficient Exit Signs: Codes and Standards Enhancement (CASE) Study.*

New Buildings Institute, Eley Associates, Architectural Energy Company, and Don Felts Energy Consulting. (2000) *Heating, Ventilation, and Air Conditioning (HVAC) Controls: Codes and Standards Enhancement (CASE) Study.*

PG&E CASE studies for revisions to appliance standards:

Commercial refrigerators and freezers with doors

Open case commercial refrigerators and freezers

Walk-in refrigerators and freezers

Refrigerated bottled and canned beverage vending machines

Automatic commercial ice makers

Water dispensers

Large packaged air-cooled commercial air conditioners (240,000 – 760,000 Btu/hour)

Evaporative coolers

Ceiling fans

Whole house fans

Residential exhaust fans

Unit heaters and duct furnaces

Residential pool pumps

Portable electric spas

Dishwasher pre-rinse spray valves

State-regulated general service incandescent lamps

State-regulated incandescent reflector lamps

Traffic signal modules for pedestrian control

Luminaires for metal halide lamps

Under-cabinet fluorescent luminaire ballasts

Commercial hot food holding cabinets

External power supplies

Audio and video Equipment

Context for Codes and Standards Program: Advantages of Using Building and Appliances Codes and Standards to Promote Energy Efficiency

Additional context for the assessment of the Codes and Standards Program is provided by studies that have examined the advantages of using building and appliances codes and standards to promote energy efficiency. Several of these studies are listed below.

Geller, H. and D. Goldstein. (1998) "Equipment Efficiency Standards: Mitigating Global Climate Change at a Profit." Washington, D.C.: American Council for an Energy-Efficient Economy and San Francisco, CA: Natural Resources Defense Council.

Jones, T., Norland, D., and Prindle, B. (1998) *Opportunity Lost: Better Energy Codes for Affordable Housing and a Cleaner Environment.* Washington, D.C.: Alliance to Save Energy.

Moyes, R., (1999) *Standards in the Residential Construction Industry: Key Issues.* Report prepared for Canadian Home Builders' Association.

Appliance Standards Awareness Project (ASAP) (2000) "Opportunity Knocks: Capturing Pollution Reductions and Consumer Savings From Updated Appliance Efficiency Standards." Washington, DC: American Council for An Energy-Efficient Economy

Johnson, J., Nadel, S. (2000) "Commercial New Construction Programs: Results from the '90s, Directions for the Next Decade" in *Proceedings from the 2000 ACEEE Summer Study on Energy Efficiency in Buildings*. Washington, D.C.: American Council for an Energy Efficient Economy.

The Allen Consulting Group (2002) *Cost-Benefit Analysis of New Housing Energy Performance Regulations: Impact of Proposed Regulations.* Report for The Sustainable Energy Authority and The Building Commission (Australia).

Nadel, S. et al., (2004) *Powerful Priorities: Updating Energy Efficiency Standards for Residential Furnaces, Commercial Air Conditioners, and Distribution Transformers*, ACEEE Report Number ASAP-4/ACEEE-043.

Economists Looking at Impacts of Codes and Standards for Buildings and Appliances:

Some studies by economists look at the resulting impacts of achieving environmental goals through regulation and use of codes and standards rather than market-based approaches. In the two papers by Hahn and the one paper by Oates and Portney, overviews of the issues that economists view as important in regulatory activities are provided.

The other studies listed represent efforts to give empirical evidence on the impacts of regulations affecting energy use in housing. The papers by Quigley report on the impacts of the building energy efficiency codes enacted in California during the 1980's, while the paper by Jaffe and Stavins examines how building code regulations affected the choice of insulation level to use in houses. The paper by Newell, Jaffe and Stavins looks at the role energy efficiency standards *vis-à-vis* changing energy prices and other factors leading to improvements in energy-using appliances over time. The paper by Hammitt, et al. does not look at energy *per se*, but it does suggest that regulation of housing through tightened building codes can have adverse effects. The papers by Fischer, Stavins, and Sutherland provide economic analyses of the impacts of energy efficiency standards.

Eilert, P., Livingston, J., and Turnbull, P., "How to Catch More Flies with Honey and Vinegar: Integrating Voluntary Programs with Codes and Standards in California", *Proceedings from the 2004 ACEEE Summer Study on Energy Efficiency in Buildings*. Washington, D.C.: American Council for an Energy Efficient Economy..

Hahn, R. (1990) "The Political Economy of Environmental Regulation: Towards a Unifying Framework". *Public Choice.*

Hahn, R. (1998) "Government Analysis of the Benefits and Costs of Regulation". *Journal of Economic Perspectives.*

Hammitt, J. K., Belsky, E., Levy, J., and Graham, J. (1999) *Residential Building Codes, Affordability, and Health Protection: A Risk-Tradeoff Approach.* Working Paper W99-1. Harvard University: Joint Center for Housing Studies.

Jaffe, A. and Stavins, R. (1994) "Dynamic Incentives of Environmental Regulations: The Effects of Alternative Policy Instruments on Technology Diffusion." *Journal of Environmental Economics and Management.*

Newell, R., Jaffe, A. and Stavins, R. (1998) "The Induced Innovation Hypothesis and Energy-Saving Technological Change,**"** *Quarterly Journal of Economics.*

Oates, W. and Portney, P. (2001) *The Political Economy of Environmental Policy*. Discussion Paper 01–55, Resources for the Future.

Quigley, J. (1984) "Residential Energy Standards and the Housing Market: A Regional Analysis," *Papers of the Regional Science Association.*

Quigley, J. and P. Varaiya, (1989) "The Dynamics of Regulated Markets: Construction Standards, Energy Standards and Durable Goods," in *Advances in Spatial Theory and Dynamics*, edited by A. Andersson.

Quigley, J. (1991) "Market Induced and Government Mandated Energy Conservation in the Housing Market: Econometric Evidence from the U.S." *Review of Urban and Regional Development Studies.*

Fischer, C. (2004) "Who Pays for Energy Efficiency Standards?", Resources for the Future Discussion Paper 04-11.

Stavins, R. N., (2005) "Vintage-Differentiated Environmental Regulation", Paper prepared for *Stanford Environmental Law Journal*, Revised version of September 22, 2005.

Sutherland, Ronald J. (2003) "The High Costs of Federal Energy Efficiency Standards for Residential Appliances," *Policy Analysis,* No. 504. Cato Institute.

APPENDIX C: GLOSSARY

American National Standards Institute (ANSI) - A private, non-profit organization that administers and coordinates the U.S. voluntary standardization and conformity assessment system. ANSI was founded in 1918 and is headquartered in Washington, DC. *American Society of Heating refrigeration and Air Conditioning Engineers (ASHRAE)* - An international membership organization founded to advance the arts and sciences of heating, ventilation, air conditioning, refrigeration and related issues.

American Society of Mechanical Engineers (ASME) - Founded in 1880, ASME is a 120,000-member professional organization focused on technical, educational and research issues of the engineering and technology community. ASME conducts one of the world's largest technical publishing operations and sets internationally recognized industrial and manufacturing codes and standards that enhance public safety.

Assembly Bill 970 (AB970) Emergency Rulemaking - Enacted in August 2000, authorized the CEC to adopt new building and appliance standards in an emergency rulemaking within 120 days.

AB970 Standards – Revisions to energy efficiency codes in California enacted in response to Assembly Bill 970.

Building Standards Commission (BSC) - Established in 1953 as an independent commission within California's State and Consumer Services Agency. BSC's mission is to produce sensible and usable state building standards and administrative regulations that implement or enforce those standards.

California Board of Energy Efficiency - Advisory board on energy efficiency established by California Public Utilities Commission in mid-1990s.

California's Building and Appliance Standards - Governed by the California Energy Commission and includes Title 24 and Title 20.

California Building Industry Association (CBIA) - Statewide trade association representing more than 6,300 companies including homebuilders, trade contractors, architects, engineers, designers, suppliers, and other industry professionals.

California Energy Commission (CEC) - Created by the Legislature in 1974 and located in Sacramento, the CEC is the state's primary energy policy and planning agency. The Commission's role includes overseeing funding programs that support public interest energy research; advance energy science and technology through research, development and demonstration; and provide market support to existing, new and emerging renewable technologies.

California Public Utilities Commission (CPUC) - The PUC regulates privately owned electric, telecommunications, natural gas, water and transportation companies, in addition to household goods movers and rail safety. CPUC is headquartered in San Francisco.

Climate Zones - Climatically distinct areas defined by long-term weather conditions affecting the heating and cooling loads in buildings.

Codes and Standards (C&S) Program – A program of investor-owned utilities (IOUs) to identify technologies and practices that are ready for code adoption, to document their readiness for adoption in the buildings or appliances standards, and to advocate for their adoption. Responsible for informing and training market actors (building code officials, designers, builders, and affected facilities personnel) on the new code provisions upon their adoption.

Consumer Electronics Association (CEA) – Trade association for consumer electronics manufacturers.

Database on Energy Efficient Resource (DEER) - This database contains extensive information on selected energy-efficient technologies and measures. It provides estimates of the average cost, market saturation, and energy-savings potential for these technologies in residential and nonresidential applications. Created and maintained by the California Demand-Side Measurement and Evaluation Committee (CALMAC). Data for DEER 4.0 was collected between 1991 and 1995 and is aggregated geographically by counties, and service territories.

Energy Star – Started in 1992 by the US Environmental Protection Agency (EPA), this program helps businesses and individuals protect the environment through superior energy efficiency. Through its partnerships with more than 8,000 private and public sector organizations, ENERGY STAR delivers the technical information and tools that organizations and consumers need to choose energy-efficient solutions and best management practices.

GWH - A unit of measure for one gigawatt hour.

Institute for Regulatory Science (RSI) - Non-profit organization established in 1985 in response to the need of the society to ensure that the decisions of Congress, regulatory agencies, and the courts are based on the best available scientific (BAS) information. RSI conducts studies; assesses the scientific validity of regulatory actions; evaluates the results of studies performed by others through the peer review process; interacts with learned organizations; conducts training courses; and provides services to all segments of the society including governments at the Federal, State, and local level.

International Energy Conservation Code (IECC) - Standards pertaining to a building's ceilings, walls, and floors/foundations and to the mechanical, lighting, and power systems.

International Code Council (ICC) - Responsible for developing the International Energy Code.

Investor-Owned Utilities (IOUs) - Publicly traded utilities.

KW - A unit of measurement based on kilowatt of electricity per hour.

Lumen - A measurement of light output. One lumen is equal to the amount of light emitted by one candle that falls on one square foot of surface located one foot away from one candle.

Market penetration - The share of a given market that is provided by a particular good or service at a given time, often represented as a percentage.

National Fire Protection Association (NFPA) - Established in 1896, NFPA serves as the leading advocate of fire prevention and is an authoritative source on public safety. The mission of this international nonprofit is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically-based consensus codes and standards, research, training, and education.

National Resources Defense Council (NRDC) – Non-profit environmental protection advocacy organization.

Public Goods Charge (PGC) - A mandatory surcharge imposed on all retail sales to fund public goods research, development and demonstration, and energy efficiency activities. Public Goods Charge (PGC) funds draw from this public account.

SB 5X (Statutes of 2001) - This bill established authority in PRC Section 25402.5 (3)(c) for the California Energy Commission to adopt lighting standards for outdoor lighting. Adopted by Governor Davis In April of 2001, in response to the California energy crisis.

Stakeholders - California Energy Commission staff, Utility staff, professional and trade associations, manufacturers, Commissioners, the general public, environmental groups, and special interest groups.

Standing Standards Project Committee (SSPC) - ASHRAE committee primarily responsible for directing the ASHRAE standards and guidelines program. Also responsible for the processes of continually developing new standards and guidelines and in revising current ones to reflect technical advances in the areas they cover.

Therms - natural gas

Time Dependent Valuation (TDV) - A method for valuing energy in the performance approach in the 2005 Building Energy Efficiency Standards. Under TDV the value of electricity differs depending on time-of-use, and the value of natural gas differs depending on season. TDV is based on the cost for utilities to provide the energy at different times.

Title 24 – California Code section for building energy efficiency standards

Title 20 – California Code section for appliance energy efficiency standards

Warren Alquist Act - State Energy Resources Conservation and Development Act, establishing California Energy Commission.