SCE Codes & Standards Process and Market Assessment Study

Project No: 0701g Codes & Standards Process and Market Assessment Study

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1. INTRODUCTION

As requested by Southern California Edison (SCE), the HESCHONG MAHONE GROUP, INC. (HMG) conducted a process and market assessment study for the Codes and Standards (C&S) program. This study has been conceived as a special-purpose market assessment study and limited scope process evaluation, to address four strategic issues about which the C&S program managers need market and technical answers in order inform their program activities for the 2009-11 cycle.

The C&S program managers have asked that this study address three topic areas:

1. **Process Study** - Provide a limited scope evaluation of the C&S program based on staff and stakeholder feedback.
2. **Compliance Research** - Develop a better understanding of the reasons for non-compliance in order to better craft program activities to improve code compliance.
3. **Market Assessment of Case Study Opportunities** - Develop a process for developing market intelligence and data to address normal market adoption, incremental cost, and compliance issues that will help Edison to produce maximum savings opportunities in their C&S efforts and CASE study development.

To meet the study topic areas, five reports were completed. They include:

1. C&S Logic Model for the initial PY2006-2009 program plan
2. C&S Program Process Study
3. Compliance Roundtable Report
4. Market Assessment: C&S Enhancement Process Recommendations
5. 2011 C&S Enhancement Commentary

2. PY2006-2008 SCE C&S PROGRAM LOGIC MODEL

California has a history of strong standards for the efficiency of appliances and buildings. They are a very important part of the state's strategy to make efficiency a central part of its energy strategy, and they also play an important role in the SCE's energy efficiency program portfolio.

California's Title 20 appliance standards govern the sale of energy-using equipment, and they apply to manufacturers and vendors, preventing the sale of less efficient products. California's Title 24 standards govern the construction of new buildings, mandating efficient building design. Standards are part of the later stages of the technology adoption cycle, coming after efficient technologies have been developed and proven effective, and have been introduced into the market through energy efficiency incentive and rebate programs. Standards provide very cost effective energy savings to California.

Efficiency standards are recognized as an important component of California's energy policy and its ability to meet aggressive goals to reduce energy consumption and demand. The CPUC, in setting savings goals for the California investor owned utilities' energy efficiency portfolios for 2006 and beyond, established very ambitious targets for energy efficiency. In its decision, the CPUC has laid the groundwork for counting the energy savings that will result from the utilities' C&S programs as part of their portfolio achievements: "In order to meet today's adopted goals, program administrator(s) should aggressively pursue programs that support new building and appliance standards…"

In Mahone et al,[1] a methodology was created for the California statewide C&S program uses in supporting standards development. It proposed an evaluation framework for estimating and crediting C&S program energy savings, and discussed the technical issues that must be addressed in preparing such estimates. The process of estimating savings for C&S programs begins with a calculation of the single year energy savings that can be expected from implementation of the new standards. That done, one can then project those savings forward to derive a lifetime savings estimate.

In a CPUC decision[2], it was decided that the attribution of savings for the California statewide C&S program is to be based on the percentage of each utilities' electricity sales. Accordingly, SCE will be credited with 32% of the statewide C&S savings. Given this large savings potential, SCE has put a greater emphasis on its own C&S program to increase its contribution to the standards-making process. Recently, a revised attribution methodology was presented by the CPUC[3].

This document provides a program conceptualization model for Southern California Edison's PY2006-2008 Codes & Standards Advocacy Program. The Codes & Standards

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[1] Heschong Mahone Group, Inc (HMG), Mahone, Douglas; Brown, Marian; Hall, Nick; Keating, Ken; Megdal, Lori; Ridge, Rick. 2005. Codes and Standards White Paper on Estimating Savings. Prepared for Marian Brown, Southern California Edison Co. in support of the Statewide Nonresidential New Construction Market Assessment and Evaluation activity. Available at www.calmac.org, Study ID SCE0240.01.

[2] CPUC Decision 04-09-060 September 23, 2004, Interim Opinion: Energy Savings Goals for Program Year 2006 and Beyond

[3] The Cadmus Group, The Proposed Cadmus Attribution Methodology (Revised) Memo, March 9, 2009

(C&S) program directs initiatives that will enhance building and appliance standards to codify cost effective, reliable and verifiable demand side measures in support of maximizing portfolio energy and demand savings.

To support the C&S program, a logic model, also known as program theory model, was developed to provide a succinct and useful program conceptualization. A program theory model was created describing (1) the explicit and implicit assumptions made by program stakeholders about the actions required to obtain greater energy efficiency, and (2) how these actions will lead to specific outcomes that result in the program accomplishing its goals. Chen (1990)[1] first described program theory as "a specification of what must be done to achieve the desirable goals, what other important impacts may also be anticipated, and how these goals and impacts would be generated. A discussion of program theory and logic models can be found in Chapter 4 of the *California Evaluation Framework* (The TecMarket Works Team, 2004)[2].

2.1 Program Description

1. Projected Program Budget	**$**	**5,672,011**
2. Projected Program Impacts		
MWh		n/a
MW (Summer Peak)		n/a
3. Program Cost Effectiveness		
TRC		n/a
PAC		n/a

Saving energy and capturing resource and societal benefits are the primary reasons behind all energy efficiency programs. The Codes and Standards program achieves these results by assisting the regulatory agencies in modifying existing standards or setting new codes into law. Enhancements to codes and standards lead to significant electric and gas energy savings and electric demand reduction in two ways; by advancing the identification and early adoption of innovative technologies, and by establishing building and appliance standards for technologies that for economic or demographic reasons are no longer suitable for utility sponsored energy efficiency programs.

2.2 Market Barriers

Previous research studies point to a number of challenges for ensuring program success. These studies have revealed the following critical difficulties that have hindered program success:

- Code compliance rates are widely variable in both Title 24 and Title, leading to lowered program savings. Code compliance barriers include complexity of the code, lack of industry training/awareness, variable code enforcement activities, and insufficient product availability.

[1] Chen, Huey-Tsyh. *Theory-Driven Evaluations.* Sage Publications, Inc. 1990.

[2] TecMarket Works Framework Team. *The California Evaluation Framework.* Southern California Edison Company. 2004

- Past program research studies have not always directly translated into code change proposals since studies were not always structured as CASE studies in which discussion of action towards standards adoption is included.
- The lack of transparency in the link between SCE C&S studies and enacted standards makes it difficult for others to accept SCE's C&S program claims in savings contributions.
- Coordination with other C&S stakeholders has limited effectiveness of the program. Not maintaining relationships with industry, code-making bodies (such as US DOE and the CEC), and the C&S statewide group fosters friction and/or ambivalence to program activities
- There is a shortage of awareness and knowledge about standards requirements and the compliance process. Trainings do not reach majority of the industry and many training efforts go unrealized because participants fail to attend. While they have good intentions and often plan to be there, higher priority matters inevitably arise and, since many trainings are free, they don't regret not showing up.

2.3 Program Goals

The C&S program is designed to enhance state and federal appliance and building energy efficiency codes, standards and guidelines. In 2006 through 2008, the Codes and Standards program specifically supports the rule-making process for the California Energy Commission's Title 24 Building Energy Efficiency Standards and Title 20 Appliance Efficiency Standards. Desired results include the following:

- Adoption of code enhancement proposals by the CEC that maximize cost effective customer energy savings potential
- Improved compliance with appliance standards that increase energy savings
- Effective monitoring and participation in US DOE rulemakings that directly impact California standards through preemption
- Effective participation in code setting and ratings organizations that potentially impact California standards
- Evaluation of 8 CASE studies that support future code enhancements
- Conduct 5 training courses. Each course shall address enhancements to the standards or efficiency guidelines that customers may use to construct code compliant buildings and install appliances, respectively.

2.4 Program Strategies and Activities

The C&S program is designed to overcome these issues by incorporating the following elements:

- Greater transparency of SCE's contribution to the C&S process will be undertaken by developing and documenting its role in the codes making process

- Program staff will solicit greater collaboration with the other IOUs to create a more effective standards-making process, C&S training approach, and C&S compliance activities
- SCE will continue to work closely with CEC staff personnel to insure that our work is timely and relevant to their needs. Specifically, this takes the form of frequent meetings at the CEC, workshops with other interested stakeholders and conference calls as needed to either plan activities or provide status updates. This has been a successful tactic that will continue to be employed.
- SCE will continue to offer training and seminars to engineers, architects and specifiers. The courses will provide information to help them better understand the codes and standards and how to incorporate them into their designs.

2.5 External Influences

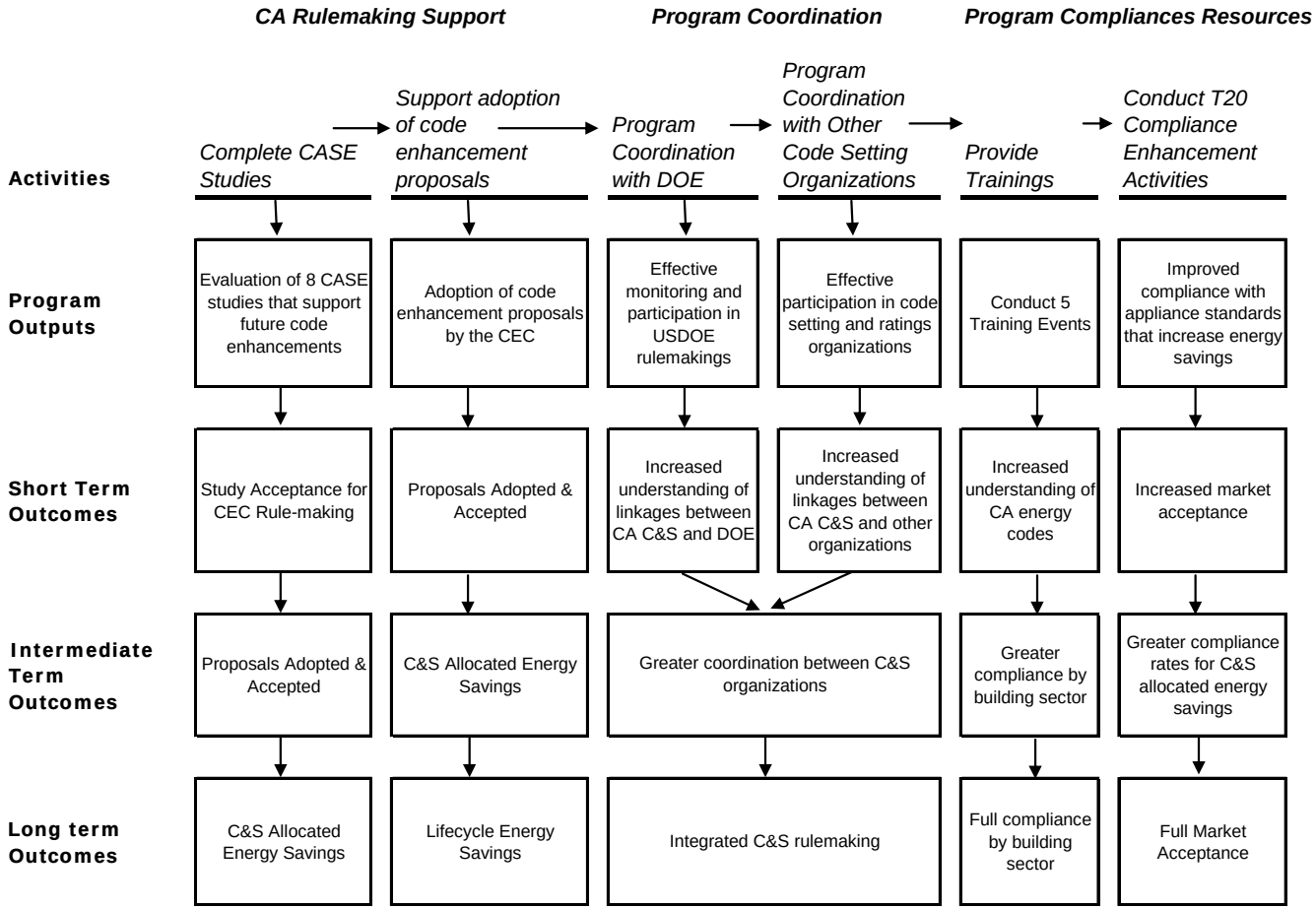
Presently, IOU statewide C&S programs are an integral and crucial part of the Title 24 and Title 20 standard-making process. The CEC is dependent on the utilities to provide code change proposals, along with all the necessary research and support associated with the proposals. Funding for code-change proposals is heavily dependent on public benefit monies due to the CEC limited staffing and funds. The number of C&S proposals are restricted due to CEC limitations and IOU coordination is crucial in order to effectively utilize CEC resources.

2.6 Relationship to Other Programs and Activities

SCE's C&S program has been organizationally placed in the SCE's Design and Engineering Services (D&ES) group The D&ES group provided expert testing, design, and economic analysis services through the C&S, Emerging Technologies, and Education & Training programs. In addition, the C&S program also directly impacts SCE's new constructions programs - Savings By Design, Advanced Homes, and Sustainable Communities. Because their incentive structures are tied directly to Title 24, new construction programs are highly impacted by code efforts.

2.7 Program Logic Model

The following figure portrays the program theory of how the activities, outputs, short and long term outcomes expected for the SCE's PY2006-2008 C&S program.



2.8 Program Indicators

Performance indicators for the program have been identified and are presented in this section. The table below provides anticipated success criteria, its relevant program goal, and potential indicators.

Program Goals	Potential Indicators	PY06-08 Success Criteria
Supporting the rule-making process for the CEC's Title 24 and Title 20	Number of CASE studies completed	Evaluation of 8 CASE studies that support future code enhancements
	Number of CASE studies accepted and adopted into code	Adoption of (#) SCE supported code proposals by the CEC
Effective monitoring and participation in US DOE rulemakings that directly impact California standards through preemption	Attendance to DOE rulemaking meetings	Attendance to 1 or more DOE rulemaking meetings
	Reporting DOE rulemaking process, and how it pertains to CA	Completion of report on current DOE C&S status and how it pertains to CA
Effective participation in code setting and ratings organizations that potentially impact California standards	Attendance to other code setting and ratings organizations meetings	Attendance to 1 or more other code setting and ratings organization meetings
	Reporting to other code setting and ratings organizations, and how it pertains to SCE	Completion of report on current other code setting and ratings organizations status and how it pertains to SCE C&S program
Increasing industry awareness and knowledge of C&S	Implementation of training courses addressing enhancements to the standards or efficiency guidelines that customers may use to construct code compliant buildings and appliances.	Conduct 5 training courses
Improved compliance with appliance standards that increase energy savings	Conducting market penetration studies on appliance compliance	Completion of Title 20 market penetration compliance study
	Conducting education and outreach activities to appliance supply chain actors on Title 20	Sending Title 20 education materials to selected manufacturers, retailers, and distributors

2.9 Researchable Issues

Potential research issues and questions can be derived from the program logic model, and many have been identified. The questions are separated by whether they would be addressed by an impact or a process evaluation.

Process Evaluation

1. Are SCE CASE studies effective? Do they pass code acceptance and adoption?

2. Did the program hold 5 C&S training events? How many participants were in each training? Are participants satisfied with training? Do participants show greater knowledge about C&S?
3. Have or are screening tools effective in identifying successful CASE studies?
4. Do industry stakeholders show an increased awareness, knowledge and attitude toward code compliance?
5. Are there changes in knowledge and positive attitudes associated with other C&S stakeholders - IOUs, CEC, DOE, and other rule-making bodies?

Impact Evaluation

6. Are the savings estimates reasonable and correct?
7. Are the compliance rates reasonable and correct? Are changes in awareness, knowledge and attitudes associated with the program?

3. SCE C&S PROCESS STUDY

To assist the SCE C&S program in achieving program goals, the HESCHONG MAHONE GROUP, INC. (HMG) completed a limited scope process study of the Codes & Standards program based on staff and stakeholder feedback.

The C&S program underwent a major development, converting from a non-resource program to a resource program during the PY2006-2008 program cycle. The management of the program also changed from Steve Gallanter to Randall Higa starting from (date).

The major focus of the process study was to identify opportunities for enhancing coordination and sharing of best practices among all of the statewide utility program managers. The intention was to take into consideration Edison's unique strengths, and to identify opportunities for leveraging them further based on identification and dissemination of best practices among the statewide team. The outcomes of this research are recommendations on program processes in support of program planning and implementation goals, and of plans for the '09-'11 program cycle.

Because the C&S program study does not involve traditional program participants, this process study focused on interviewing key stakeholders. A total of 12 interviews were conducted. They include SCE C&S program staff (2), SCE staff from other programs (2), C&S statewide group members (2), the CEC C&S staff (4), and a selected group of stakeholders (2) who have been involved with Edison's C&S program activities.

Based on the interviews we conducted, three consistent themes emerged that helped define recommendations for ways to enhance the statewide program. Our conclusions and recommendations are presented below. We also note that some of the recommendations may have already been implemented or are underway. In these cases, conclusions from our research can further justify such program revisions.

1. From a comparative perspective, out of all the utility energy efficiency statewide programs, the Codes and Standards Program has made major strides in coordinating their efforts at the statewide level. The statewide team has made strong efforts to build a foundation for cooperation through regular meetings, frequent consultation, and a strong desire to achieve their mandate to work as a unified statewide program. These efforts are to be commended and set a strong example for other statewide programs to follow. However, differences in corporate culture, organizational structure, competitive strategy, and differing customer needs amongst the respective IOU's has been a past source of difficulty at times for the statewide team in being able to administer the program on a consistent basis across all three utilities. However, they continue to build upon the foundations they have established, and openly recognize the need to continue to improve in this area.
2. During the 2006-2008 program cycle the statewide program made the transition from a non-resource program to a resource program after receiving approval from the California Public Utility Commission to claim energy savings based on a savings attribution methodology first developed by the Heschong Mahone Group. The savings attribution methodology measures C&S program savings as a statewide total, not by individual utility program efforts. This decision was made

to insure that stakeholder incentives were in alignment to facilitate cooperative working relationships among the statewide group. However, changing the program to a resource program mid-cycle led to a retrospective evaluation of each utilities contribution to the code making process based on the criteria established in the savings attribution model. Because each respective utility had a separate mandate for the focus of their program prior to the development of the attribution model, this situation led to differences in perceived contributions to energy savings since not all program activities carried out in the past were able to be counted as contributions towards energy savings. However, throughout the planning phase preparing for the 2009-2011 program cycle, the statewide team has forged a forward looking focus while working on their program implementation plans.

3. For the 2009-2011 program cycle, SCE will be focusing more of its efforts on CASE development efforts in alignment with the other utilities. It has been collaborating closely with the other IOU team members to jointly develop strategies that build off of their respective areas of expertise and create synergies to maximize program impact. This approach puts the focus of their joint efforts on optimizing the contribution potential from all the IOU's in the development of future CASE studies that are complementary to one another's efforts.

3.1 Background & Introduction

Efficiency standards are recognized as an important component of California's energy policy and its ability to meet aggressive goals to reduce energy consumption and demand. They are a very important part of the state's strategy to make efficiency a central part of its energy strategy, and they also play an important role in the SCE's energy efficiency program portfolio for over ten years. SCE program efforts in building and appliance standards include the Statewide Codes & Standards Advocacy program and in prior program years, the Local Codes and Standards program. The Statewide Codes & Standards Advocacy program assisted in enhancements to codes and standards which would lead to significant electric and gas energy savings and electric demand reduction by advancing the identification and early adoption of innovative technologies. Following this progression, Codes and Standards activities create synergies with other programs, such as Emerging Technologies, energy efficiency equipment rebates, and energy audits. The local Codes and Standards program sought to improve code administration and enforcement through improved outreach and education, and through professional certification and development. A listed of past CASE studies are provided in the Section 3.6.

The major focus of this process study was to identify opportunities for enhancing coordination and sharing of best practices among all of the statewide utility program managers. The intention was to take into consideration Edison's unique strengths and identify opportunities for leveraging them further based on identification and dissemination of best practices among the statewide team. As this process study is not part of a normative impact evaluation, the emphasis was on developing actionable formative and forward-looking findings.

3.2 Methodology

Because the C&S program study does not involve traditional program participants, this process study focused on the program staff, the other utility members of the statewide C&S group, the CEC C&S staff, and a selected group of stakeholders who have been involved with Edison's C&S program activities. A total of 12 interviews were conducted. They include SCE C&S program staff (2), SCE staff from other programs (2), C&S statewide group members (2), the CEC C&S staff (4), and a selected group of stakeholders (2) who have been involved with Edison's C&S program activities.

The interviewee list was based on stakeholders chosen because of their level of expertise and experience with the program, based upon recommendation and approval of the C&S program manager. Each respondent has knowledge and understanding of SCE's C&S program over multiple program years and Title 24/20 code cycles.

It should be noted that despite the fact that the 12 respondents had familiarity and knowledge of SCE's Codes and Standards Program, due to the small sample size, the information from the report cannot be generalized to the program overall. The views presented here as a result of respondent interviews are only reflective of those respondents interviewed.

The primary data gathering tools were in-depth telephone interviews. Rather than a set list of questions, the interviewer used an interview guide to ensure that the same topics were discussed with each of the interviewees. Informal conversational interviews allow questions to emerge from the immediate context and to be asked in their natural context. This approach increases the salience and relevance of questions, and the interview can be matched to individuals and circumstances.

Each interview lasted approximately twenty minutes and consisted of open-ended questions. The interview guide is provided in the Appendix. The interview questions explored respondents' views on issues of interest to Edison's program manager which included the following:

- Progress made by the statewide team with inter-utility coordination efforts,.
- Recommendations on enhancing coordination efforts
- Recommendations on how SCE should contribute to the standards making process
- Suggestions for SCE CASE study opportunities (measure, sector, regulation)

Upon completion of the interviews, responses were analyzed by topic. Using the responses as our guide, we looked for themes and patterns across the multiple interviews. Finally, we added our interpretation by theorizing the development of the interview patterns and meanings.

3.3 Results & Findings

3.3.1 Program Value

In this section, we first provide a summary of the history of the Codes and Standards program, and then we summarize the responses given by the interviewees on the value given by the statewide C&S group and SCE's C&S program to the codes and standards-making process.

The respondents included:

- SCE program staff
  - Staff who coordinated past SCE C&S efforts
  - Staff from other SCE energy efficiency programs
- Other utility members of the statewide C&S group
- CEC C&S staff
- Other stakeholders
  - Industry leaders involved with California's standards-making process
  - Contractors involved in past SCE C&S efforts

Statewide IOU C&S Programs

Upon passage of the first California energy efficiency standards, the primary responsibility and effort in developing standards changes was taken on by the California Energy Commission (CEC) staff. This process started to change in the late 1990s when the California investor owned utilities' codes and standards (C&S) programs, including Southern California Edison, started to invest substantially in improving the standards, using public benefits monies allocated by the California Public Utilities Commission (CPUC). As public benefit monies were increasing to support codes and standards, the CEC staffing and funding towards codes and standards became more limiting. Many of the standards changes were further supported by efforts made through the utilities' on-going market transformation programs; some were only possible because of the familiarity with the technology that utility programs developed.

The utilities' C&S programs are considered a statewide effort because program outcomes occur across utility service territories. Unlike incentives programs where program benefits are limited to only the customers of a given utility, accepted codes and standards changes resulting from the C&S programs affect the entire state. In support of statewide coordination of new codes and standards, the Statewide Codes and Standards Program operates to leverage their joint resources and complimentary skill sets to maximize program impact. The statewide nature of the C&S benefits were further reinforced when Mahone et al[1] developed a savings methodology for the California statewide C&S

[1] Heschong Mahone Group, Inc (HMG), Mahone, Douglas; Brown, Marian; Hall, Nick; Keating, Ken; Megdal, Lori; Ridge, Rick. 2005. Codes and Standards White Paper on Estimating Savings. Prepared for Marian Brown, Southern California Edison Co. in support of the Statewide Nonresidential New Construction Market Assessment and Evaluation activity. Available at www.calmac.org, Study ID SCE0240.01.

program. It proposed an evaluation framework for estimating and crediting C&S program energy savings, and discussed the technical issues that must be addressed in preparing such estimates. In a CPUC decision[1] it was decided that the attribution of savings for the California statewide C&S program are to be based on the percentage of each utilities' electricity sales. Recently, a revised attribution methodology was presented by the CPUC[2]. Thus, it became increasingly important for the utilities to coordinate program efforts to achieve energy savings.

Presently, IOU statewide C&S programs are an integral and crucial part of the Title 24 and Title 20 standard-making process - a position acknowledged by all respondents. The CEC is dependent on the utilities to provide code change proposals, along with all the necessary analysis and support associated with the proposals. Funding for code-change proposals is heavily dependent on public benefit monies due to the CEC limited staffing and funds. In fact, CEC respondents indicate the number of C&S proposals that can be effectively processed may face restrictions in the future due to CEC staff limitations, therefore, IOU coordination will be particularly crucial in order to effectively optimize their coordination with the CEC along with utilization of CEC resources.

SCE C&S Program

SCE's C&S program is organizationally placed in SCE's Design and Engineering Services (D&ES) group which is part of Edison's Business Customer Division. In addition to the Codes and Standards Program, the D&ES Group also includes the Emerging Technologies Program, Energy Related Services, and Education and Training (ETO). The D&ES group provides technical support to SCE's energy efficiency programs, including the development of work papers, expert testing, design, and economic analysis services through the C&S, Emerging Technologies, and Education & Training programs. The overall emphasis of the D&ES group has been focused on market and technology assessment. The D&ES group also includes the following facilities:

1. Refrigeration and Thermal Test Center (RTTC) - As described on the SCE, website, the RTTC is "an applied research and educational facility that combines state-of-the-art research capabilities with staff expertise and educational programs to promote energy efficiency in refrigeration, air conditioning, and other thermal technology applications"[3]
2. Southern California Lighting Technology Center (SCLTC) - As described on the SCE, website, the SCLTC is "a technology assessment and education center" that provides: state-of-the-art lighting and daylighting applications, development and testing facilities, and lighting efficiency training and educational programs"[4]

Due to its position within the D&ES group, the C&S program closely mirrors the D&ES specialties of refrigeration and lighting, and its focus on technical and analytic expertise.

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[1] CPUC Decision 04-09-060 September 23, 2004, Interim Opinion: Energy Savings Goals for Program Year 2006 and Beyond

[2] The Cadmus Group, The Proposed Cadmus Attribution Methodology (Revised) Memo, March 9, 2009

[3] http://www.sce.com/b-sb/design-services/RTTC/questions.htm

[4] http://www.sce.com/b-sb/design-services/socal-lighting/

Thus, the program's CASE studies generally resembled technology assessments, providing information on various technologies. Not surprisingly, these assessments, especially testing information, were noted by respondents as the value provided by SCE's C&S program in the standards-making processes for California, federal, and ASHRAE standards.

However, while SCE's technical guidance has been noted in prior code cycles, the program studies have not always directly translated into code change proposals – which was perceived as a problem noted by a few respondents[1]. We attribute this perspective to a lack of understanding of the mandate SCE's Codes and Standards program was given by SCE management to focus on code compliance enhancement activities while the program existed as a non-resource program, whereas PG&E's C&S program emphasized CASE development. Technically, the SCE C&S studies were not always structured as CASE specific reports in which discussion of action towards standards adoption was included. However, it should be noted that the information provided from these efforts supported the development, implementation, and verification of effective energy codes and standards indirectly (Refer to Section 3.6) .

Currently, SCE is placing a much greater emphasis on CASE study development in ongoing strategic planning meetings with the statewide team. Highly experienced consultants have been hired to support this effort. In addition, a dedicated and growing group of project managers within Design and Engineering Services will be jointly supporting the Codes and Standards, Emerging Technologies and Demand Response programs.

In the following section, we looked at the ability of Edison's C&S program to coordinate with other SCE programs, the IOU C&S group, the CEC, and other stakeholders.

Within Southern California Edison

While the C&S program has coordinated efforts within the D&ES group, a few respondents from the other SCE energy efficiency programs felt greater coordination could occur between C&S and the other energy efficiency programs within Edison. In particular, greater formal coordination is needed between C&S and the new constructions programs - Savings By Design, Advanced Homes, and Sustainable Communities. Because their incentive structures are tied directly to Title 24, new construction programs are highly impacted by code efforts. As the energy standards continually become more stringent, two simultaneous effects occur; 1) Codes and Standards serve to level the playing field because everyone is subject to the same standards, and 2) it becomes more difficult for new construction programs to incent some customers to design to efficiency levels significantly better than code due to perceived cost constraints. On the other hand, some recent research has indicated that in some instances the builder community perceives buildings designed above code to provide them with a competitive advantage. The Codes and Standards Program takes an active role in providing case studies, guest speakers and other education and training opportunities to help prepare constituents of the new construction programs deal with upcoming code changes. Additionally, the Codes and Standards Program is considering a pilot program with local jurisdictions to provide

[1] Many respondents had difficulty in citing particular enacted standards in which SCE was considered a primary sole sponsor. This included respondents from other utilities, the CEC, and industry stakeholders.

training and incentives to lower the non-compliance rate across geographically contiguous regions which should help lower impact of new code changes on the other construction programs.

The C&S program can also better utilize the new construction programs by taking advantage of the programs' insight into and contacts within the building community to better inform CASE studies and code change proposals. At the time the interviews were conducted for this study, one respondent who is part of C&S program staff indicated such efforts are done on an informal basis, other non-C&S program staff believed further informal sessions between the two groups would be useful.
As a result of strategic planning meetings in preparation for the 2009-2011 PIP (Program Implementation Plan) filing that took place after interviews were complete, the C&S program subsequently developed a focused set of action items that they will be carrying out to integrated with the new construction programs.

IOU C&S Group

In most instances, the Statewide IOU C&S group operates on a highly coordinated effort. Compared to other statewide energy efficiency program groups, the C&S group meets frequently, organizes many of their responses to CPUC inquiries, and often co-funds research studies. In addition, savings are based on the effectiveness of overall statewide C&S program efforts.

The program theory for the Codes and Standards program is based on the premise that inter-organizational effectiveness will be optimized by rewarding efficiency and effectiveness of the statewide group as a whole. It assumes that this reward structure would encourage working together to achieve greater savings for all. The shared savings attribution model was developed based on the assumption that it would facilitate greater coordination, cooperation and collaboration between the utilities to maximize statewide savings potential and reaching statewide strategic plan goals.

However, differences in corporate culture, organizational structure, competitive strategy, and differing customer needs amongst the respective IOU's has been a past source of difficulty at times for the statewide team in being able to administer the program on a consistent basis across all three utilities. Current coordination efforts between the utility members have been strengthened recently due to better communication efforts between the group members.

CEC, DOE, and Industry

The general observation by respondents indicated that SCE has good communications and relationships with the CEC, DOE, and with major industry stakeholders. Some respondents (from other SCE programs) suggested SCE use its resources to reach out to other stakeholders not usually involved in the standards-making process, such as vendors and distributors, to gain their interest and feedback on future code change proposals. However, the program manager stated that the SCE program carries out a significant amount of this type of activity, suggesting a lack of awareness by some on SCE's efforts in this area.

3.4 Program Opportunities

3.4.1 CASE Opportunities

In exploring future CASE opportunities, respondents indicated that SCE should follow its technical strength in lighting and refrigeration and also expand into areas not yet impacted by Title 24 or Title 20.

In terms of technologies, the following study suggestions were given:

- Transportation signage
- IT virtualization projects
- Smart plug/panel load usage
- Power factors and power/conversion losses

In terms of sectors, the following study suggestions were given:

- Technology firms, specifically server farms
- Water and energy savings relationship

In terms of regulation, the following study suggestion was given:

- Federal pre-emption issues

It should be kept in mind that the above suggestions from the process evaluation interviews were conducted prior to the development of the 2009-2011 Statewide Codes and Standards Program Implementation Plan. Subsequent to the interviews, intensive planning meetings were carried out among the Statewide Codes and Standards Program Managers, and key stakeholders within the CPUC which resulted in a detailed plan for inter-utility cooperation and IOU specialization in support of the code development process. Currently this plan is under view by the CPUC and awaiting final feedback and approval.

3.4.2 Code Compliance

While the compliance research study (please reference in a footnote a brief explanation of the roundtable meeting and what chapter number it will have when it appears in the final report) conducted in coordination with this process study delved into code compliance topics in greater detail, respondents were asked for suggestions for compliance enhancement activities.

Suggestions given include:

- Provide more training and support for building officials
- Increase education provided to industry stakeholders
- Mirror new construction program “touch-points” to better track building design at initial design phase, final design phase, and commissioning type inspection
- Work new construction program “touch-points” into code regulation to improve greater likelihood of code compliance

3.5 Conclusions and Recommendations

Based on the interviews we conducted, themes emerged that helped define recommendations for ways to enhance the programs. Our conclusions and recommendations are presented below. We also note that some aspects of the recommendations may have already been implemented or are underway. In these cases, conclusions from our research can further justify such program activities.

3.5.1 Consistency in Program Administration

The Statewide Codes and Standards Program team has been working diligently to establish a set of common goals as they move forward to prepare for the 2009-2011 program cycle. The program planning process has provided them with the opportunity to closely cooperate in forging together a complimentary set of goals to focus on as they move forward to take the program to it's next stage of development. A key challenge for the statewide team will be to find ways to administer the program on a consistent basis to the extent possible within the broader context of differing corporate cultures, organizational structures, competitive strategy and respective customer needs.

3.5.2 Create and document program strategy

Each utility partner needs to work towards creating a common framework on how they plan to work together in the future in the development of CASE studies. Organizational issues that have been incorporated for PY2009-2011 include determining areas of specialization (ie. Title 20 vs. Title 24 code change proposals), methodologies for CASE selection criteria (quick, cost effective opportunities vs. long term savings opportunities) and a framework for collaboration in joint efforts for CASE study development.

A greater focus on how each of the utilities can complement one another's research towards C&S efforts will create a more effective working relationship between the C&S statewide team.

3.5.3 Consider program opportunities

In Section 3.4.1, we list recommendations provided by the respondents in terms of CASE and compliance program opportunities. The topic is covered in more detail in Section 6, Market Assessment:
Codes & Standards Enhancement Process Recommendations

3.6 SCE CASE Studies

1	Single Zone Staged Volume - Phase V
2	Compressed Air Dryers - Phase II
3	Closed Front Vending Machine - Phase III
4	Glass Front Vending Machine – Phase II
5	Commercial Kitchen Ventilation Guide IV: Selecting Exhaust Fans for Commercial Kitchen Ventilation Systems
6	Commercial Kitchen Ventilation Guide III: Integrating Kitchen Ventilation Systems with Building HVAC
7	Daylighting Metrics Scoping Study
8	Controlling Exterior Signs
9	Performance Evaluation of Standard and High Efficiency Ice Machine
10	Glazing Performance Modeling – Phase I

Table 1: Codes and Standards Enhancement PY2005 Studies

1	Lighting Design Guidelines
2	Closed Front Vending Machine (Phase II)
3	Glass Front Vending Machine (Phase I)
4	Dairy Industrial Guide
5	Dairy Farm EE Guide (Part II)
6	Sidelighting Photocontrols Study
7	Staged-Volume Testing (Phase 3)
8	Streaming Video for eQuest
9	Whole Building Energy Tool-Benchmark
10	DR Impacts for Code Compliance
11	EER/SEER as Performance Predictor

Table 2: Codes and Standards Enhancement PY2004 Studies

1	Vending Machines
2	Design Guideline for Compressed Air
3	Testing for Hospitality Segment
4	AgTAC GSHP project
5	Skylight Efficacy Test
6	Advanced Lighting Systems
7	High Efficacy Signage
8	Advanced Building Design Guidelines
9	T-5 High Output Fluorescent
10	Natural Ventilation Design Guidelines
11	Automated Weather Processor
12	Testing of Economizers for 5-Ton A/C
13	TDV Version of eQuest
14	Field Test for Unitary HVAC Equipment
15	Advanced Lighting Guidelines

Table 3: Codes and Standards Enhancement PY2003 Studies

3.7 Process Study Interview Guide

Hello, this is Cynthia Austin from the Heschong Mahone Group. I'm calling to ask you some questions about SCE's Codes and Standards Program which should take 20-25 minutes. Is now a good time? If not, when should I call you back?

The answers you give may be used in the report we submit, but your answers will be anonymous.

Personal Details

First I'd like to confirm some details about you:

3. Please confirm your job title?

4. What do your job duties typically involve?

5. Please summarize your experience with Codes and Standards process for California and the federal government.

Program Value

6. What aspects of the Edison Codes and Standards Program do you think are really working well?

7. What aspects of the program are not working very well or need improving?

8. Is there anything that the Edison program could learn from the other utility programs to help them improve upon these areas that you just mentioned?

9. What aspects of Southern California Edison's program-do you think provides unique value to the standards-making process for building and appliance regulatory groups?
   a. State of California
   b. U.S. Dept. of Energy
   c. Other states or agencies (ASHRAE)

~~10.~~ What do you see as unique aspects provided by the other utility Codes and Standards programs to the standards making process?

11. Do you feel that these unique sources of value are being leveraged on a statewide basis to create positive synergies between the utilities for the program to operate effectively at the statewide level?

12. How can SCE's Codes & Standards program improve their coordination efforts?
   a. With other SCE programs
   b. With IOU C&S group
   c. With the California Energy Commission
   d. With builders and manufacturers groups
   e. With the U.S. Dept. of Energy

Program Opportunities

13. Besides the items we've already discussed, are there any other suggestions that you can provide for SCE's Codes & Standards program?
   a. For study opportunities (measure, sector, regulation)
   b. For improving compliance enhancement activities

4. CODE COMPLIANCE ROUNDTABLE REPORT

HMG performed a literature review of previous code compliance studies and their findings in order to better understand the challenges to successful code compliance strategies. We then organized and facilitated a roundtable meeting of experts and market actors to pinpoint specific areas within each of the barriers that need to be addressed, which market actors should be targeted, and what might be the most cost-effective ways to do so. We focused on Title 24 standards and those Title 20 regulations that are subject to permitting by building departments. Roundtable participants consisted of a diverse group of individuals including those familiar with the body of knowledge and research documentation on the issue of non-compliance, practitioners in the development community, building code officials, building owners, and other key stakeholders.

The roundtable discussion started with an overview of the reasons for noncompliance to ensure everyone shared a common factual basis. These became the items we focused on finding solutions for and the base for the core discussion on improving compliance rates.

Taking the roundtable's suggested compliance solutions and recommendations into account, we developed a strategic roadmap that identifies the most important opportunities for compliance enhancement during the 2009-11 program cycle and how to pursue them. These include:

- Modifying the CASE study analysis process to include assessment of the realistic ability for new codes and standards to be enforced
- Forming a regular statewide work group, comprised of a similar subset of experts and stakeholders as those considered for participation at the roundtable
- Creating a public information and awareness program that emphasizes the importance of energy standards for the state and its important energy efficiency policies.
- Increasing cooperation and coordination with stakeholder groups as follows:
    c. Work with the other utilities to increase coordination
    d. Work with the California Energy Commission to provide support and oversight
    e. Work with city governments and building code officials to provide them with tools and resources
    f. Work with various practitioners to provide more effective training and support services

Detailed descriptions, reasoning, and explanations for the challenges and barriers as well as the recommended solutions and strategic roadmap are provided in the following document.

4.1 Introduction

This research is part of a larger study performed by the HESCHONG MAHONE GROUP, INC. (HMG) for Southern California Edison (SCE) as a special-purpose market assessment study and limited scope process evaluation for their Codes and Standards

(C&S) program. The goal is to address those strategic issues, as identified by the C&S program managers, most in need of market and technical answers to inform program activities for the 2009-11 cycle. The three areas covered in the larger scope are: a process study of the C&S program, compliance research to better understand noncompliance, and a program process framework study.

As the second and final phase of the compliance research project, HMG organized and conducted a roundtable meeting of experts and market actors. This event utilized the knowledge and skills of leading authorities in the field to engage a thorough and well-rounded discussion of solutions for program activities that might improve standards compliance. It was conceived as a strategic planning exercise where a roundtable of individuals, selected for their expert knowledge on the topic, convened to further discuss the literature review findings, in addition to others they provided, and identified what areas of noncompliance can be most improved through utility program activities that yield the highest possible energy savings outcomes.

4.2 Logistics

The roundtable was held at Sacramento Municipal Utility District's (SMUD) Campus in their Headquarters Conference Room. The location, in Sacramento, was centrally located, convenient for the majority of the participants, and free parking was provided. SMUD graciously provided lunch for all attendees.

Amy Barr and Cathy Chappell facilitated the roundtable, with background and wrap-up provided by Douglas Mahone. All three observed, taking notes, and occasionally pressed for clarification. An agenda and discussion guide were prepared in advance and used by the facilitator to ensure all topics of interest were discussed. The agenda is provided below (see Section 4.12 for a copy of the guide). The conversation, however, was generally allowed to flow naturally between and among participants. The facilitator intervened at key junctures to ask leading questions or redirect the discussion to a new topic area.

FROM	TO	TOPIC
10:00am	10:15am	Introductions
10:15am	10:45am	Background & Utility Reports
10:45am	11:00am	Identification of Challenges & Barriers
11:00am	12:00pm	Compliance Enhancement Discussion
12:00pm	12:30pm	Lunch Break
12:30pm	1:30pm	Compliance Enhancement Discussion (cont.)
1:30pm	2:30pm	Recommended Compliance Enhancement Activities
2:30pm	3:00pm	Action Items & Next Steps, Wrap-up, & Adjourn

Table 4: Roundtable Agenda

This document presents our observations and analysis of the overall roundtable findings as well as recommendations for next steps and follow-up, based on the discussion. The appendix contains detailed notes from the roundtable, which provide the reader with a more complete illustration of the dialogue that took place among attendees. Finally, a copy of the guiding questions the facilitators had on-hand to guide the discussion when needed is provided to further illustrate the topics we wanted to bring out of the discussion.

4.3 Purpose & Discussion Topics

The goal of the roundtable was to stimulate discussion and consensus on noncompliance problems with California's building energy efficiency standards, in order to determine strategies for improving compliance rates. The literature review previously conducted identified a number of major challenges and barriers to compliance, as well as past findings on potential compliance activities and suggestions for how to best address noncompliance problems. Based on those recommendations, we brainstormed the following topics, focusing on Title 24 standards and those Title 20 regulations that are subject to permitting by building departments, in addition to others that arose based on the experiences and expertise of the roundtable participants. The discussion served to pinpoint specific areas within each topic group that need to be addressed, which market actors should be targeted, and what might be the most cost-effective ways to do so.

4.3.1 *Inspections, Enforcement, and Permitting*

The effectiveness of compliance efforts is largely dependent on subsequent enforcement. Permitting, document checking, and inspections are key points in the building process that can serve to ensure projects meet standards. The goal of the discussion was to identify those aspects that would be most likely to improve these procedures and mechanisms for successful implementation. Additionally, we wanted to discuss what roles are appropriate for the utilities, the Energy Commission, and local jurisdictions in this process.

- Permitting requirements
- Verification of inspections
- Compliance enforcement mechanisms
- HERS raters

4.3.2 Training and Education

Training can be a cost-effective way for utilities to increase the market's awareness and understanding of energy standards, so long as the training and education materials are reaching the right market in an effective way. The goal of the discussion was to identify training topics that need to be addressed, the best mechanisms for doing so, and ways to successfully outreach to the correct industry sectors.

- Standards knowledge and awareness
- Building owner, practitioner, and consumer awareness
- Training for individual trades
- Outreach

4.3.3 Product Development and Availability

A lack of product availability, high first cost, competitive bidding, narrow offerings, and substitutions are challenges practitioners face in successfully integrating standards-compliant products and systems. The goal of the discussion was to identify the most effective mechanisms for increasing reasonably priced products into the market and ways to increase information dissemination about standards-compliant products and systems.

- Cost-effective products entering the market
- Energy standards information availability

4.3.4 Tools, Guides, and Examples

Similar to training and education, improving building enforcement and practitioners' awareness and knowledge of standards is vital to their adoption and integration. Providing this information in a simple, easily accessible, and intuitive format will increase the likelihood of them being successfully understood and applied. The goal of the discussion was to identify those ways in which standards complexity can best be addressed, the most effective formats for the tools, and mechanisms for ensuring they are received by the appropriate market sectors.

- Matrices and checklists of key features
- Case studies highlighting best practices
- Simplified plan check and field inspection guides
- Economical and easy-to-use software

4.3.5 Financial Incentives

Incentives and rebates have shown to be a persuasive mechanism for behavior modification. While they are extrinsic and very rarely prove to change mindsets or points of view, they can be an effective short-term method for change. The goal of the discussion was to identify potential financial mechanisms for incentivizing standards compliance, looking at both rewards and penalties.

- Tax credits and incentives
- Fines for not meeting standards

4.4 Roundtable Participants

Roundtable participants consisted of a diverse group of individuals including those familiar with the body of knowledge and research documentation on the issue of non-compliance, practitioners in the development community, building code officials, building owners, and other key stakeholders. Representatives from the following types of organizations were integral to a successful discussion session about improving compliance rates:

- State Government Agencies and Enforcement Groups
- Utilities
- Compliance Research Organizations
- City Governments and Building Code Officials
- HERS Raters and Energy Consultants
- Practitioners
- Energy Software Engineers

Name	Company	Name	Company
Mike Bachand	CalCERTS	Scott Johnson*	Institute of Heating & Air Conditioning Industries
Amy Barr	Heschong Mahone Group	Rick Kallett	SMUD
Doug Beaman*	Douglas Beaman Assoc.	Mark Kamrath	Bell Products
Lynn Benningfield	The Benningfield Group	Aleisha Khan*	Building Codes Assist. Project
Misti Bruceri	Misti Bruceri & Assoc.	Allen Lee	Cadmus
Bruce Ceniceros	SMUD	Doug Mahone	Heschong Mahone Group
Cathy Chappell	Heschong Mahone Group	Jill Marver	PG&E
Tav Commins	CA Energy Commission	Jim Meacham	CTG Energetics
Lance DeLaura	Sempra	Ayat Osman	CPUC
Erik Emblem	SMACNA/Sheet Metal Workers Assoc.	Jim Parks	SMUD
Susie Evans*	Institute of Heating & Air Conditioning Industries	Anne Premo	CPUC
Eurlyne Geiszler	CA Energy Commission	Amy Rominger	PG&E
Ron Gorman	Sempra	Robert Scott	CHEERS
Bob Guenther	Int'l Code Council, Architectural & Engineering Services	Charles Segerstrom	PG&E
Kathleen Gumbleton	SCE	Dan Suyeyasu	Architectural Energy Corp.
Randall Higa	SCE	Hadi Tabatabaee*	CALBO GBC
Mike Hodgson	ConSol	Lois Wright	SMUD
David Jacot	SCE		

Table 5: Roundtable Attendees (denotes those who participated via phone call-in)*

4.5 General Observations and Themes

To better understand the most effective recommendations and solutions for noncompliance, we need to first understand why relevant parties are not observing these energy standards. The roundtable discussion started with an overview of the reasons for noncompliance to ensure everyone shared a common factual basis. These became the items we focused on finding solutions for and the base for the core discussion on improving compliance rates.

4.6 Major Challenges and Barriers

Previous research studies point to a number of challenges for ensuring both Title 20 regulations and Title 24 standards compliance. These major barriers were consistent with those discussed in the roundtable, although specific details for some of these broad categories were introduced by participants. These supplementary topics primarily focused on the lack of plan checking by and motivation from building departments, which occurs for a number of reasons as described below. To further illustrate the complexity of the code compliance process, we developed a graphic that links together the various stages of

and players in the compliance chain. See Appendix 4.11 for the complete Compliance Matrix.

4.6.1 Complexity/Inconsistent Interpretation

In general, despite the wide range of skill/resources of local building departments, variability in local compliance rates across the State are not well understood. Additionally, there is a lack of information at the impact and process evaluation level to illustrate and provide details about where exactly the process is breaking down. In order to know what efforts should be made to improve compliance with energy standards, it is necessary to know what aspects of the standards are and are not actually being enforced, to what degree, and where. Most of the information on compliance rates is derived from limited scope evaluation studies and from anecdotal evidence. Nevertheless, evidence consistently suggests that these problems are real and the lost energy savings are substantial.

Furthermore, California's energy standards are written in such a way that they are complex and subject to variation in interpretation by individuals and local governments. There can be different ways of reading the standards and understanding what it's referring to – builders, developers, engineers, architects and manufacturers sometimes have to re-apply the standards when they work with a different jurisdiction. This large amount of discontinuity across the state results in an inconsistent enforcement process. To make matters worse, Title 24 is structurally different from other building codes in the state, making it even more difficult for building departments to properly and accurately interpret it.

Adding to the complexity of the standards themselves is the actual permitting process. Many architects, engineers, and contractors choose to risk forfeiture of their license by not going through the hassle of getting their projects permitted because of the costs associated with complying, both in terms of direct monetary costs for permits and verification and indirect costs such as project delays, plan revisions, and inspection time. They have to spend time pulling the permit, often having to go to the jurisdiction in person to apply for the permit and possibly even filing for a business license in that new area if they have not worked there before, then wait for the inspector once the project is close to completion. Additionally, they are frequently required to make seemingly unnecessary changes for items not even in the standards because the official has his/her own way of interpreting and prioritizing those parts of the standards of the most import to him/her. An alternate result to the complexity of this process is that many do pull permits, but never call for the inspections, thus saving themselves the time and hassle of the verification process. These problems are worse for small projects, where compliance efforts can become a significant part of the project work; for large projects, compliance efforts are relatively insignificant compared to all of the other aspects of the job. Thus far, there has been a low level of risk for anyone not complying with the energy standards and regulations since enforcement is correspondingly low.

4.6.2 Education

In general, there is a shortage of awareness and knowledge about standards requirements and the compliance process. Trainings seem to be too brief to cover all the necessary

topics and are heavily weighted to focus on new construction and recent standards changes. The primary obstacle in improving compliance rates through training is reaching the majority of the industry whom are not attending. Many training efforts go unrealized because participants fail to attend. While they have good intentions and often plan to be there, higher priority matters inevitably arise and, since many training sessions are free, they don't regret not showing up.

There are many other ways to address this problem of an insufficient level of awareness and knowledge besides training alone. However, outreach to inform market actors about their compliance responsibilities, potential penalties for noncompliance, and relevant tools is a challenge. Jurisdictions that have achieved the highest levels of compliance spend considerable resources improving the expertise of builders and officials through various tools. Manuals, summary brochures, checklists, websites, hotlines, and circuit riders are just some of other mechanisms available to inform those in the industry about standards requirements and the compliance process.

4.6.3 Enforcement

Compliance is largely dependent on enforcement; many times the value of the effort put forth to improve compliance rates is undermined by incomplete enforcement by building departments. While it appears that the system was built right to begin with, the challenge lies in ensuring that it is actually being followed. In California, the Energy Commission has given local jurisdictions, of which there are about five hundred of throughout the State, each with varying sizes, capabilities, skills and resources, the authority and responsibility of enforcing local compliance. Many of these local jurisdictions are not adequately plan checking Title 24 measures, sufficiently checking compliance documents, or conducting complete inspections. Building officials are often not aware of all the forms required for compliance and many have not been sufficiently trained, especially in remote areas, to know about the importance of these standards. Turnover and a lack of adequate resources within building departments result in further challenges for successful enforcement procedures, because of the ensuing training it requires for new employees. Additionally, the energy standards requirements are a subset of the code regulations for which building officials are accountable; they are responsible for staying current and knowledgeable about many codes besides the energy standards, making it less likely that they will be experts and know every nuance of one subset.

The lack of motivation by local governments to enforce energy standard compliance, especially as compared to those codes more commonly associated with health and safety (such as fire, structural, and accessibility), is a major challenge with energy standards enforcement. There is not enough of a priority placed on building departments to enforce energy standards within their jurisdictions. Furthermore, there has been a lack of effort by the Energy Commission to audit and perform other means of direct verification to ensure that local jurisdictions are enforcing energy standards compliance. For example, a large number of typical retrofit projects are not permitted. Over 90% of residential HVAC change-outs don't submit for permits with the local building department. While some believe it is the responsibility of the IOUs to ensure compliance, they in fact do not have the authority, nor the desire, to do so. These conflicting interpretations about who is in fact responsible for enforcement only compounds matters.

4.6.4 Product Availability

The ready availability of reasonably priced products options that meet or exceed standards is integral to their adoption into new and existing building construction. A lack of product availability, high first cost, competitive bidding, narrow offerings of option packages, and builder substitutions of standards-required features are major challenges affecting compliance rates. In theory, standards-required products are market-ready by the time new standards take effect, and the problem diminishes with time, but new or specialty products can be difficult to obtain at competitive prices and without ordering delays. These problems discourage their use and cause missed opportunities when less efficient products are installed. If sympathetic building officials allow substandard products to be installed, this further delays market provision of the new products. These problems apply generally to all new products, but their solutions can be quite different between different products, which complicates solving product availability delays.

4.7 Utilities' Current Activities

Before engaging participants in an in-depth standards compliance discussion, we wanted to be sure all attendees were on the same page in terms of their background and knowledge of what activities are currently being undertaken by the utilities and the Energy Commission in terms of standards compliance. As a whole, the utilities' efforts at reducing noncompliance rates seem to primarily be focusing on education and training, which is historically where their efforts have been, because it is such a cost-effective way for them to reach large portions of the population affected by standards regulations.

- PG&E has divided their standards compliance efforts into Title 24 and Title 20. On the Title 24 side, they are focusing on expanding their standards education and training programs to include more compliance emphasis. Their goal is to escalate the outreach and education programs offered through their Stockton Training Center and Pacific Energy Center, especially those that target the measures with the highest opportunity for savings such as:

    a. Residential hardwired lighting

    b. HVAC change-outs

    c. Nonresidential daylighting acceptance testing

    On the Title 20 side, PG&E is again concentrating their resources on educating the different manufacturing, distribution, and installation groups about the energy standards that apply to them and how best to comply. They plan to target pools and spas first.

- SCE has expanded their efforts beyond solely education and training; however, it remains a strong focus of their compliance efforts, specifically in their training of electrical and mechanical contractors on acceptance testing. Additionally, SCE hosted this initial code compliance study and roundtable, has been funding CASE studies, and continues to work with local government partnerships on compliance improvements. They also commissioned the Quantec noncompliance study.

- Sempra is largely in line with the other IOUs. They are trying to better understand the barriers to standards compliance. While their resources are constrained, they are also

focusing on getting out into the field and concentrating their active pursuits on good training programs.

- SMUD has been focusing their compliance efforts on research and gaining insight into the compliance rates of their various market areas. According to one of their studies on existing ducts for residential HVAC systems, about 27% of non- program participants complied with standards (as compared with about 90% for participants).
- As the lead in compliance and enforcement, the California Energy Commission has created a development and implementation team to specifically outreach to building departments and work closely with them on a regular basis, providing encouragement and support in their energy standards compliance processes. This effort is limited, however, to those building departments that are interested in cooperating; many are not. Since the mid-nineties, the Energy Commission has discontinued auditing of building departments or compliance accuracy. Additionally, the Energy Commission is coordinating with CALBO to develop online distance learning programs to educate building departments.

4.8 Potential Compliance Activities

4.8.1 Coordination is Key

A common theme discussed throughout the roundtable is the need for better coordination and collaboration amongst all parties involved in the compliance process. This includes: building departments, utility programs, the California Energy Commission, equipment suppliers, standards developers, CABEC, HERS raters and other third party verifiers, local government councils and management, the Contractors State Licensing Board (CSLB) and other professional licensing boards, and CALBO, among others. Helping to encourage synchronized and complementary efforts amongst these entities would be a huge step towards ensuring compliance rates improvement throughout the state. According to participants, utilities can:

- Help the Energy Commission conduct outreach to building departments and assist in emphasizing the importance of enforcement to California's energy problems. Encourage the Energy Commissioners and management to put some enforcement teeth behind their energy standards.
- Form partnerships and work directly with equipment manufacturers, suppliers, retailers, etc.
- Help the compliance community understand the credits available and clarify the language.
- Work with CABEC, CSLB and CALBO to strengthen the licensure or certification processes.
- Work with HERS raters and building departments to streamline the verification process.
- Encourage, through local government partnership programs, building departments to be more aggressive in enforcing energy standards.

As exemplified in this roundtable, there are many stakeholders working towards the same goal of improving compliance. By intentionally combining those efforts and working as a team, each individual effort will be that much more effective and productive. Moreover, the most effective solutions for improving compliance require the coordination of multiple parties. This is not a problem that can be solved by one entity, so a concerted effort on behalf of everyone involved should be made to collectively find solutions and implement them.

4.8.2 Clarification of the Standards and the Compliance Process is Critical

The complexity of both the energy standards and the compliance process is a challenge continuously raised throughout the roundtable. The simplification of all ordinances could play an important role in increasing compliance rates. The more difficult it is for building departments and practitioners to understand and accurately interpret the standards, the more difficult it is for them to actually adhere to those standards. Additionally, a complex compliance process has developed in response to the complex standards, which increases the difficulty for practitioners in observing, and building officials in enforcing the standards.

That said, simplification of the standards sounds easy and desirable, but it could be very difficult. It's analogous to simplifying the Internal Revenue Service regulations: the requirements have developed incrementally over time, they are technical, and they are highly interrelated. Changing energy standards requires re-evaluating the energy savings, the interactions between measures, the cost effectiveness, the standards language, the compliance software, the standards language, the manuals, and the compliance forms. Additionally, it would be necessary to educate all affected partied on the new standards. If the assumption is that the standards' stringency would not change (the new standards would be energy neutral), then the only energy savings that would result from all of this effort would be due to improved compliance rates. But it can be very difficult to demonstrate energy savings due to improved compliance. Furthermore, it could take years before the new standards worked as well as the current ones that everybody is familiar with, so there might actually be lost energy savings during the transition. The overall goal of simplification, nevertheless, is desirable and may warrant all of this effort, if the resources can be found to undertake it.

Clarifying the current standards, however, can be done incrementally and in short order. By working together with building departments and practitioners, utilities can help to clarify the compliance and verification process by designing a consistent set of diagrams, checklists, and mini-manuals that are targeted to specific trades, building systems, and enforcement procedures. Plan checkers and inspectors should be provided simple yet complete lists of all the things they need to verify, specific to each stage of the construction process, and provided training that explains the importance of each of the areas on that checklist. Alternatively, this kind of clarification could be provided in the form of an integrated top-to-bottom software application that serves all affected parties (building departments, inspectors, HERS raters, etc), possibly even linking to a central State database (similar to that of Smog Checks), to ensure that proper procedures and documentation are being followed through each step of the process. This could ensure that building officials will be more likely to enforce the energy standards, and

practitioners will know exactly what is expected of them, regardless of the jurisdiction they are working in.

4.8.3 Consumers, Practitioners, and Building Departments Need More Motivation

One of the first topics introduced by roundtable participants, and one that continued to be a central theme of the discussion, is the need for more energy standards buy-in by consumers, practitioners, contractors, suppliers, and building departments. The proper motivation and tools do not appear to be currently available, or they are not reaching the right parties. Utilities could work towards conditioning consumers to insist on energy efficiency and think of it as a health and safety issue. Contractors will provide consumers with what they want, so consumers need to start demanding energy efficiency services in order to shift the building industry. Homeowners and building owners need to start insisting on hiring licensed contractors that obtain building permits (especially for retrofits and remodels), and insisting their projects are inspected and comply with energy standards. Utilities can address consumer awareness and educate the public through bill inserts, for example. Another possible angle for reaching homeowners is through insurance agencies. Unpermitted projects are often not covered by their homeowners insurance. Additionally, contractors need to understand the energy impacts of what they are doing and shown the effects of failure to comply with Title 24. Building departments should expand the understanding of their local officials to broader energy issues and appoint energy champions to keep their enforcement efforts on target. The key is not only to create more public awareness and civic responsibility around standards compliance, but also individual motivators for each party in the compliance process.

4.8.4 Outreach Should be More Focused

Many attendees remarked about how outreach for trainings and general information dissemination often fails to reach the appropriate parties. Training, especially, seems to be targeting a certain subset of the industry that is often already aware of and involved in energy efficient building production. The key is focusing efforts on reaching the people that represent the most savings, identified in the roundtable as supervisors, because they are often the ones training new hires, and building officials, because they have the ability to directly influence every project throughout the state. In addition to ensuring the right people are being trained, the trainings themselves must be more focused towards the specific audience represented to ensure attendees understand and can apply the material they learn. There should be specific and separate energy standards trainings for individual trades, raters, manufacturers, and building departments, especially as they relate to plan checking and building inspections.

4.8.5 Information Dissemination Must be Refined

In ensuring the right people are targeted to receive focused information relevant to them, it is also important that the way they receive that information is effective at encouraging a better understanding of the standards. Documenting and distributing information on best practices, and other tools and resources for clarifying the standards, were a common topic amongst roundtable attendees. While there is a substantial amount of information available about energy standards, it is not always in a format conducive to understanding

and improved compliance. For design practices and systems integration, examples of common compliance solutions and designs would be useful to designers. The creation of a database of energy efficient products could be extremely useful to builders and building departments. Utilizing the knowledge and experience of HERS raters in creating and updating that tool would make it even more effective. Coordinating the efforts of all utilities in providing information about new and emerging products and design strategies could also help in disseminating information to the public. They could share the information they gather in technology reports for certified products, and document the results in a central location as a resource for customers and manufacturers. As noted by practitioner representatives at the roundtable, trade publications, case studies, and design guidelines are also valuable tools for disseminating information in an efficient manner.

4.8.6 Appropriate and Effective Penalties and Rewards Are Essential

A topic roundtable participants kept returning to throughout the event was how to effectively reward or punish parties for their compliance efforts, or lack thereof. This debate on the proper way to strengthen the enforcement process was a struggle for attendees. While everyone agreed that it is essential to have a system in place that strengthens and encourages compliance enforcement, it was undecided as to the most effective form that process should take. The most prevalent ideas revolved around methods to ensure compliance through professional licensing requirements, which would strongly influence contractors, engineers, and architects. For example, Title 24 documents require the signatures of the responsible design team members. The applicable licensing authorities need to enforce the compliance intent by holding those professionals responsible for accurately representing a standards compliant design. If a practitioner is repeatedly associated, through their signature compliance in the plans for that structure, with buildings that fail to comply with the standards, then that individual should be penalized (and ultimately lose his/her license for repeated violations. Alternatively, the idea of requiring members of other trades that contribute to a building's design to be certified and licensed, such as energy consultants, was frequently mentioned by those present. According to many participants, however these punishments should go along with positive rewards for those individuals or business that are a step above the rest and consistently comply with the standards, such as visibly identifying practitioners' businesses (for example, with labels, similar to the ENERGY STAR® system). Not only would this make their efforts public, but it could also give them an advantage through market differentiation and help consumers to make the right choice about which companies to use in their projects. Similarly, practitioners who consistently comply with standards requirements could be granted expedited approvals or less onerous inspection requirements. The goal is to provide effective carrots AND sticks.

A similar set of rewards and penalties could be applied by the Energy Commission to local jurisdictions and their building departments. State law gives the Energy Commission authority to take over the issuance of building permits from jurisdictions that fail to properly enforce the Title 24 standards. They have never exercised this authority, though, preferring to emphasize training and information support for building departments. It is likely that even a modest effort at enforcement of building department mandates could have a large impact on energy savings. Simply auditing compliance at a random selection of building departments, and publishing the enforcement effectiveness

of those jurisdictions, would remind all building departments that they have a responsibility to enforce the energy standards, and would put them on notice that somebody is watching how they carry out that responsibility. Of course, the Energy Commission should also publicly praise those building departments that do a consistently good job of standards enforcement.

The utilities, of course, do not have any actual authority over either the licensing or enforcement processes, but they do have a strong interest in the effectiveness of energy standards. They could use their central role in energy efficiency to raise the issues of enforcement, and to educate policymakers on the importance of effective enforcement to meeting their (and the state's) aggressive energy efficiency goals.

4.9 Strategic Roadmap

Taking the roundtable's suggested compliance solutions and recommendations into account, we have developed a strategic roadmap that identifies the most important opportunities for compliance enhancement during the 2009-11 program cycle and how to pursue them. We have three recommendations for Southern California Edison to pursue on its own. Additionally, we have presented next steps actions that require SCE to outreach to others, divided by stakeholder category.

4.9.1 Next Steps Actions: Within SCE

Immediate: The first, and most immediate, action SCE should take is modifying the CASE study analysis process to include assessment of the realistic ability for new codes and standards to be enforced. The ease and likelihood that practitioners will be able to comply with new standards, as well as the ability of building departments and inspectors to enforce new standards, should be given a weight and given strong consideration in the critique of CASE studies. This is a low-cost change SCE can do immediately to ensure future standards are simple and easy to implement. Of course, this goal will not always be consistent with the goal of aggressive new energy savings, but both need to be considered.

Short-term: In the short-term, SCE should form a regular statewide work group, comprised of a similar subset of experts and stakeholders as those considered for participation at the roundtable. This work group should meet on a regular basis to continue the discussion initiated in the roundtable about how to improve standards compliance throughout the State. Since this challenge is one that affects every subset of the building and energy industries, it is not one that a single solution can solve. It requires the input, cooperation, and coordination of many parties. Because a group has already been organized by SCE that fits the criteria necessary for a group of this type, it would be relatively easy for SCE to use the roundtable's momentum to arrange an ongoing meeting of participants (probably including financial support for participation, as not all public officials and private practitioners will be able to donate time and expenses).

Long-term: In the long term, SCE should create a public information and awareness program that emphasizes the importance of energy standards for the state and its important energy efficiency policies. This program would have components addressed to local governments and their enforcement agencies, to designers and builders, and to homeowners and other building owners. The goal is to overcome the barriers of

misunderstanding and ignorance about the role of energy efficiency standards. It can have a very positive tone:

- For local governments and enforcement agencies - emphasize that they are protecting their constituent's comfort, energy bills, and long-term energy security, and that their constituents are relying on them to level the playing field by holding all builders accountable to produce efficient buildings.
- For designers and builders - emphasize that they are the construction experts who can ensure that their customers get a quality product, and that the utilities stand ready to help them do a good job through education, technical assistance and rebates
- For homeowners and building owners - emphasize that the energy standards help to ensure that their buildings are efficient, comfortable, and inexpensive to power over the life of the building, that their local government is helping to ensure this happens, and that their utility offers energy expertise and rebates to help make their buildings efficient.

All of this can be linked to the utilities' public service announcements, to raise the general level of awareness of energy standards and their importance.

4.9.2 Next Steps Actions: Outreach Required

The following describes the actions we recommend as next steps for SCE that involve the cooperation and collaboration of outside parties, divided by stakeholder category.

Utilities

Overall Goal: Increase coordination

- Research studies (permitting requirements, compliance rates, compliance actors, trends, etc)
- Require permits and certified energy consultants to participate in programs
- Outreach to residential customers through notices in bill inserts, etc to educate public
- Partner with equipment suppliers to increase awareness of compliant products
- Develop standards change proposals that are enforceable or improve enforcement
- Support standards education and training to all levels of the building community
- Provide high level policy support for energy standards to local government elected officials, managers and building officials

California Energy Commission

Overall Goal: Provide support and oversight

- Develop simplified Title 24 guides and manuals
- Develop targeted and intuitive tools and resources for practitioners and building departments

- Outreach and support to building departments; consider creation of a statewide software and database support system to facilitate building department enforcement processes, collect compliance data, and promote consistency
- Conduct random, mandatory audits of building departments' enforcement effectiveness.
- Provide policy support to local government officials, with information about the value of energy standards and their importance to constituents

City Governments and Building Code Officials

Overall Goal: Provide tools and resources

- Strengthen carrot and stick of energy standards enforcement; provide support and training to local design/construction community, while upping enforcement scrutiny
- Update project tracking procedures to ensure effective and thorough energy standards compliance and inspections
- Consider recognition of local designers/builders who consistently do a good job of compliance, while applying more pressure to those who do not
- On-going in-service energy standards trainings specific to plan checkers and inspectors
- Support local government policymakers in achieving their mandatory AB32 and other energy-related policy goals through energy standards compliance
- Local government policymakers provide more support to building departments for enforcement of energy standards, through fees, training, hiring, and public support of their efforts. Building departments provide more support to elected officials and management, with information about energy standards enforcement, benefits and value to constituents.

Practitioners

Overall Goal: Provide more effective training and support services

- Produce and distribute simple and effective tools and resources for use in trainings (case studies, design guides, checklists, etc)
- Update trainings to incorporate onsite and classroom work as well as follow-up to ensure are following compliance guidelines
- Facilitate discussions between HERS raters and building departments to help streamline inspection process

4.10 Detailed Roundtable Discussion Notes

The following pages provide copies of the detailed notes taken by the roundtable moderators. They are not meant to be verbatim transcripts, but they do capture the major points brought out in the focus group discussions.

Challenges & Barriers

- Lots of projects not permitted (e.g.>90% of res HVAC change-outs)
- Cost - costs more to comply
- Motivation of local governments to enforce energy (vs. health & safety) - increase priority for enforcement, don't siphon off bldg dept revenues to general fund
- Lack of interest in bldg depts. - the Energy Commission stopped auditing
- Permit & verification costs - not spending

Convergence of Interests in Energy Efficiency

- Can we streamline processes of utilities, bldg depts., Energy Commission, compliance consultants, to reduce duplication of effort?
- Tools - can we provide better tools that will be more persistent than direct $$?
- Contractors' Board for enforcing contractor behavior
- ARB connection
- Public service: content of manuals
- Ground-up rewrite
- Subset of entire code/annual
- Above code issues, shouldn't matter to structure
- Top-level buy-in
- Inconsistent interpretation

Energy Commission Enforcement Issues

- Dealing with complaints from field (non-enforcement type?)
- Explaining 'why' of requirements (else won't enforce)
- Form of code differs from other codes
- Need a hammer - need to do audits, need to have non-compliance consequences
- Run a lot of pilot tests to find best points of improvement
- Emphasis on building relationships with bldg depts. and chapters, but only 5 staff so can't cover entire state

Local Governments

- Lack of resources problem
- Staff turnover problem
- Local enforcement improvement before above code ordinances
- Inconsistency within local government: develop best practices, etc

Working with Building Departments

- Going to them (they're not coming to us)
- Help pay cost of permits to increase numbers? Perhaps provide a coupon to reimburse permit cost if comply?
- Help bldg depts. do more with less resources - focus on motivators for savings, help with prioritizing on biggest savings
- Partner utility programs with bldg depts. (recruitment, enforcement)
- Inspect on a sampling basis (more depth, less breadth)
- Help to increase consistency among jurisdictions (what they ask for, how they prioritize, make practices more uniform)
- Uniformity of software
- Motivation: $100-200M statewide for just retrofit HVAC (back of envelope)
- Uniformity of software: makes scalability doable

Training & Education

- Effective approach combines classroom, field work, feedback, and follow-through several weeks later
- Utilities & industry link-ups on training
- Embed training within contractors organizations so it will persist internally; but still have problem with small practitioners
- Lots of training resources, but aren't reaching 90% of market that's not interested
- Consumers not being reached with standards awareness - perhaps a role for utilities in bill stuffers.
- Help consumers know which contractors are doing the right permitting, complying with code
- Homeowners concerned about insurance lapse if non-permitted work is done
- Problems not as great for non-residential, but national review found similar problems as for residential
- Motivate homeowners & push consumers to ask for T24 - create a pull
- Energy branding for contractors
- Tied to enforcement
- Required continued education for folks working in these fields
- Preliminary brainstorming for all ways to motivate homeowners to ask for permits and do focus groups

Product Development & Availability

- Database of cost complying equipment - HERS for existing homes will be making recommendations on costs/savings
- Use cable companies (local franchisees) to inform consumers
- HVAC - right sizing - educate consumers so as to reduce liability - resolve tech issues with assumptions, adequacy of cooling service, insurance (E&O issue)
- Serial number tracking - List of complying equipment and tracking equipment by serial numbers - carry through to inspection - contractors see it as a way to level playing field.
- Get products to work correctly (e.g. res bathroom motion sensors); get suppliers and supply chain to provide the info.
- Emerging tech - proper timing for adopting into code, role of utility programs? Publish library of test and field experience reports. Publicize through trade magazines

Tools, Guides & Examples

- Simplified checklists for bldg depts. to focus efforts at plan check, inspectors - what's the most important thing to look for?
- Mandatory certification of T24 docs - can pull certification if docs incorrect - CABEC supportive
- Software could help with the entire process, to help bldg depts. do their jobs more efficiently, linked with HERS provider data registries - standardize data and methods
- Duct sizing is often ignored and difficult to enforce (in the mechanical code)
- Utilities could beef up support to HERS raters (training, equip, certif., etc.). Build on precedent for bldg dept to hire deputy enforcement/inspection experts. Bldg depts. can make better use of third-party certified agencies (especially on nonres). Not all enforcement can be done by third parties.
- Integrated software system for bldg depts.? Different bldg depts. do business different ways (e.g. some don't do e-mail or fax). Could help continuity and consistency. Integrate into existing software and procedures.
- Point-of-sale HERS certification (both new & existing)
- Convergence of design tools and compliance software tools
- Certification of people completing T24 documents

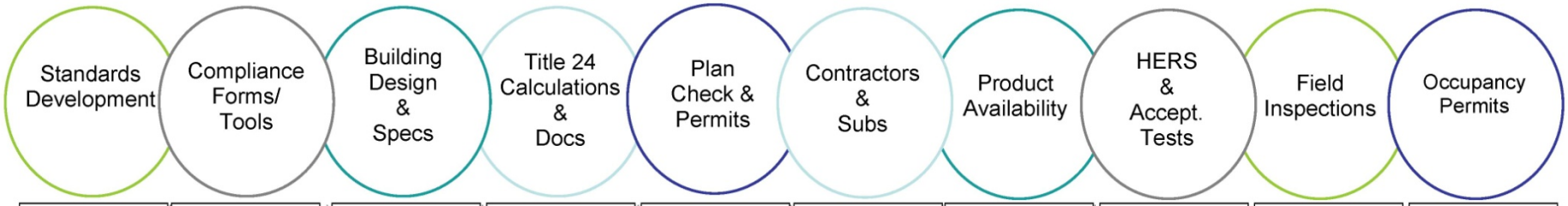
Financial Incentives

- Contractors can lose licenses for not taking out permits - license board not enforcing
- Sampling - reward contractors with lower sampling rates if good compliance.
- Pull permit for utility programs - kicker to other programs

4.11 Compliance Chain Matrix Exercise

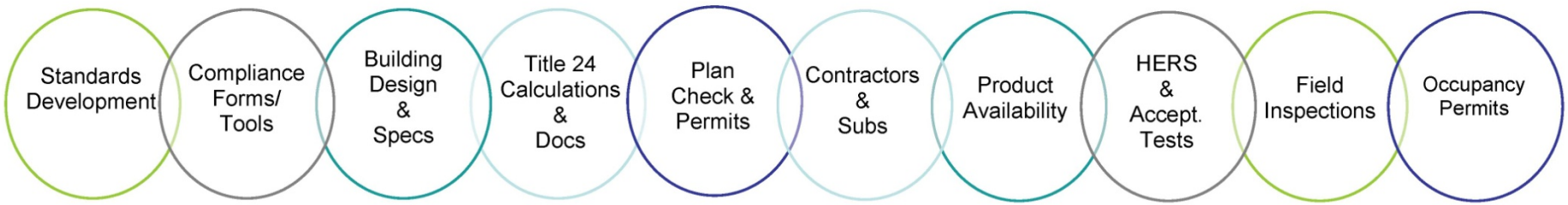
See following two pages for comments received during this exercise.

The Compliance Chain



	Standards Development	Compliance Forms/ Tools	Building Design & Specs	Title 24 Calculations & Docs	Plan Check & Permits	Contractors & Subs	Product Availability	HERS & Accept. Tests	Field Inspections	Occupancy Permits
Res	- Lobby for support of governor/ legislature to address compliance as a sustainability issue - Educate consumers about risk of work done without permits: insurance coverage, real estate transfer disclosure	- Develop standardized training models for in-field training that can be tailored for each builder	- HVAC right-sizing case study	- Standard data format for T24 forms: CF-1R, CF-6R, CF-4R	- Focus group of homeowners to determine what would motivate them to ask contractor to pull permits for retrofit work - Work with industry to increase consumer awareness of permit/inspection reqs. - Develop simple plan and field check tools - Bring CSLB and CALBO to table to brainstorm solutions to improve enforcement. Ask: What are your chief constraints & barriers? What would motivate you to enforce T24? - Equipment serial number tracking through permit and possible rebates	- Get State Contractors Licensing Board to enforce requirement that contractor pulls permit and have inspection conducted at framing stage, etc (when improper installation can be corrected cost-effectively, particularly with HVAC ductwork)		- Single point of contact with HERS rater collecting fee, applying for building permit with verification: HERS provider submits to building department		
NonRes		- Sponsor training across the state on the non-residential acceptance form requirements and proper instrument calibration requirements			- Facilitate consistency across jurisdictions: permit doc requirements, software/data tracking	- Have the utilities provide a list of contractors that they have evaluated and are known for doing code compliant work	- Options for compliance should be transparent and simple for customers to understand and verify	- Encourage code authorities to utilize TABB, NEBB, or AABC certified independent verifiers of T24 compliance - Include TABB & AABC as certified 'raters/verifiers' for non-res	- Help building departments take advantage of technology advances: online processes, more electronic documentation and data tracking, field availability of reference material (e.g. via cell phone data storage cards)	

The Compliance Chain (cont.)



	Standards Development	Compliance Forms/ Tools	Building Design & Specs	Title 24 Calculations & Docs	Plan Check & Permits	Contractors & Subs	Product Availability	HERS & Accept. Tests	Field Inspections	Occupancy Permits
Both	- Solicit info from/listen to bldg officials & other mkt actors - Perform both a process and impact evaluation of code compliance to identify, for buildings that were non-compliant, where specifically the process chain broke down - Review how T24 compares to other codes (i.e. mechanical, structural, fire, etc) & determine how presentation might be made more consistent with those - Bring usability engineers into all aspects of designing the compliance process - Rewrite the code, appendices, and manuals. With good editing, they could be 30-50% shorter with the same substantive content; would be a substantial and semi-traumatic undertaking, but a good long-term investment. - Get CSLB & CALBO to the table	- Standardize computer-generated outputs for compliance, with simplified, highlighted sections for action by each player - Collaborate with HVAC industry training programs already in place (SMACNA, SMWIA programs) to further contractor knowledge of codes & enforcement	- Develop mechanisms for utilities to engage the market earlier. Expand incentive programs to include just-above code compliance if they participate, including inspection (which can in turn supply EE/DR programs). Enhance coordination between utilities and jurisdictions with respect to permitting & inspection - Whole building approach & cost-effective options visible to consumers	- Require certification of energy doc preparation - Audits of building departments and builders by CEC - Utility incentive programs require calculations (1st step toward certification) - Support training/testing/ licensing of CABEC certified energy analysts - Train the champions. Benefits: local/regional expertise, consistent development, and distribution of best practices	- Drop the hammer on those that don't comply/pull permits (make examples) - Simplify plan check and inspection to specific 'calls to action': what are top 5 things if complied with would get the majority of savings -Team with ARB to piggyback on GHG emissions reductions activities at the jurisdictional level: combination of GHG reporting/ mitigating & compliance enforcement to reprioritize EE enforcement, leading to new staffing, training, etc - Work with regional public agency councils to standardize & streamline retrofit permit process & fees - Hold forum with local government leaders to link EE & T24 compliance with climate change goals & potential reqs. - If CEC & CSLB can't do strong enough enforcement, ask attorney general to do so. Must bust someone for credibility - How to identify baseline at building depts. so when improvements made in compliance it can be measured & then how can that improvement be quantified so counted in AB32 goals - IOUs support CEC in auditing bldg depts. - IOUs shouldn't spend on permits - Simplify permit requirements across regions		- Increasing fines and penalties for not complying - Equipment serial tracking - Track equipment sales vs. permits	- Support HERS industry as special EE inspector as standard, not exception	- Training /checklists for plan check and inspection - Develop procedures for sampling T24 compliance to allow more in-depth analysis on each permit, allow time to find those not pulling permits, and reduce the time meeting with inspectors in the field. This would need to be better paired with penalties for non-compliance - IOU audits of customer facilities at time of service connection, and identification of compliance deficiencies to customer and/or contractor. If corrections are made, savings could be claimed	- CEC enforcement of local building department - Continuity at building departments: software, training, accountability - CEC should devote 2-5 staff to auditing building departments

4.12 Roundtable Discussion Guide

The following outline was used by the roundtable moderators as a guide to the discussion. In general, the conversation was allowed to flow naturally, so this guide was used more as a backup in the event attendees needed an extra push as well as to ensure that all of the topics of interest were covered in the course of the discussion. When necessary, the moderator would interject specific questions to redirect the conversation if it was wandering off-topic. For the most part, the group was very good at covering the issues of interest and allowing all participants to have their say.

1) Reasons for Noncompliance

To better understand what the most effective recommendations & solutions are to noncompliance, need to understand why standards not being complied with. Based on past research and studies of the subject, these are the most common reasons.

a) Enforcement process – lack of permit and plan check requirements, insufficient compliance document checking, inadequate inspections by building departments and HERS raters

   i) Who's supposed to be doing it? Who's actually doing it?

   ii) Any other actors who could do it more effectively?

   iii) What else plays into this? Awareness of requirements? Turnover? Large number of codes?

b) Lack of effective awareness and training – too short, focus on new construction and recent standards changes

   i) Who is being trained? Who should be trained?

   ii) What are the biggest challenges with training?

   iii) What material is being covered?

c) Lack of compliance insight – local compliance rates not well understood

   i) What parts of the standards are being complied with? What are not?

   ii) What parts of the standards are being enforced? What are not?

   iii) Who's complying (and not)?

   iv) Who's enforcing (and not)?

d) Lack of product selection – not enough products available, high first costs, competitive bidding, narrow offerings of option packages, and builder substitutions of standards-required features

   i) What products are out there that comply?

   ii) What products most commonly get value engineered out?

   iii) Who makes the decisions about what products are installed?

   iv) Who makes the final decisions about what products are installed?

   v) How much is perception & how much is real?

e) Standards complexity – open to interpretation by individuals & local governments
   i) Who writes the standards?
   ii) Who reads the standards?
   iii) What parts are most commonly misunderstood?
   iv) What parts are most well-understood? Why?
   v) Can we simplify them? What would that entail?

What else have you noticed?

Which market actors represent the weakest links in the compliance chain?

2) Recommended/Suggested Compliance Activities

Primary effort taken to reduce noncompliance is training and education because so cost-effective. Some recommendations are:

- Showing utility customers that enforcement protects their interests
- Showing local governments importance of increasing energy efficiency in their jurisdictions
- Working with building departments to encourage strict enforcement
- Software system to improve permitting, data recording, compliance checking
- User-friendly manual to increase uniform standards interpretation

What else? What others do you think would be effective in addressing compliance challenges? We've broken down recommendations/suggestions into the following topic areas. Be thinking about: What are the costs and benefits for each of the activities? What specific changes do you think would be most effective for each activity?

How could we gather better data on compliance rates?

a) Inspections, enforcement, & permitting
   i) How can we encourage the requirement and proper use of permits?
   ii) How can we encourage more strict inspection processes for measures?
   iii) How can we encourage better compliance enforcement?
   iv) How can we encourage the certification of more qualified raters?

b) Training and education
   i) How do we let the people that should be trained know about it?
   ii) What material should be covered in trainings? How do we make them more effective?
   iii) How can we encourage a better understanding and more awareness of standards amongst all affected parties?
   iv) How influential is expert assistance? Design assistance? Utility construction assistance? Commissioning assistance? Project coordination?

c) Product development and availability

i) How can we encourage less expensive products to enter the market?

ii) How can we encourage more cost-effective products to enter the market?

iii) How do we deal with this challenge if it's more of a perception issue than a real one?

d) Tools, guides, and examples

i) How can we encourage a better understanding of standards?

ii) How influential is energy savings software? Energy savings spreadsheets?

iii) How useful are websites? Design guidelines? Briefs & case studies? Demonstration projects?

iv) How influential is recognition? Professional recognition for designers? Bldg. and community recognition for owners & developers?

e) Financial incentives

i) How can we help to increase demand?

ii) What incentives have you used in the past? The most successful? Most unsuccessful?

iii) Are rewards or punishments better? Which is more effective?

iv) How influential are incentives? The incentive structure? To owners to offset first cost? To owners for additional effort required? To designers for additional effort required

4.13 Code Compliance Literature Review

This literature review is an initial examination of the major challenges and barriers to code compliance. Additionally, we look at potential compliance activities, specifically detailing the recommendations and suggestions past research and studies have determined through personal interviews and surveys. Finally, it concludes with how this information has shaped the discussion topics and key participant list for the next stage of the project, a roundtable meeting of experts and market actors. This initial document generalizes the research performed by past studies, providing a preliminary exploration into the background and history of compliance to better understand those efforts that have previously been investigated, considered, proposed, or studied for both Title 20 and Title 24 energy codes. The final phase will house the true substance of the feedback by utilizing the knowledge and skills of the leading authorities in the field to thoroughly dissect and analyze the most cost-effective solutions for program activities that improve code compliance.

Compliance with existing code requirements is important for ensuring the savings anticipated are actually achieved in the field. Studies of noncompliance have found that there are widely varying rates depending on the nature of a given measure. They have also shown that the code enforcement process has multiple steps, and weaknesses at any point in that process can compromise the ultimate rate of compliance.

Compliance research develops a better understanding of opportunities for its enhancement, which can lead to better crafted program activities that improve code

compliance. There is little specific information about which are the weakest links in the enforcement chain for each of the various measures. Currently, California leads the nation in code definition and enforcement; however, as is the case throughout the nation, the level of compliance stated by the design community is greater than what is actually found on finished jobs. A 2004 study found that 27% of homes were not compliant with Title 24, having a compliance margin of 5% or less.[1] In general, builders participating in utility-sponsored Residential New Construction (RNC) programs, though, tend to have a higher frequency and level of compliance than nonparticipant builders. An impact evaluation of PG&E, SCE, SoCalGas, and SDG&E's 2004 and 2005 ENERGY STAR® New Homes Programs, for instance, found that the compliance margin statewide for participating homes was more than double that of nonparticipants.[2]

SCE can make the most impact on their savings goals by focusing compliance efforts on those measures they sponsor. However, this review will be speaking generally to the overall code enforcement process and weaknesses that apply generally to the entire code. Without becoming a policy-maker or law-enforcer, the primary role utilities can have in increasing code compliance is education and training. This poses an especially difficult challenge when working with Title 20, however, because it applies directly to the manufacturers and sellers of equipment, who are less amenable to influence solely through training and education. It should be noted that a statewide effort is required in order to have any real effect, regardless of the code being addressed, implying partnerships and collaboration with other utilities throughout California to effectively reach all affected parties and ensure that efforts are maximized.

4.13.1 Major Challenges and Barriers

Previous research studies point to a number of challenges for ensuring both Title 20 and Title 24 code compliance. The major barriers are:

Complexity: California's energy codes are written in such a way that they are complex and subject to variation in interpretation by individuals and local governments. Everyone has a different way of reading the code and understanding what it's referring to – builders, developers, engineers, architects and manufacturers sometimes have to re-understand the code when they work with a different jurisdiction.

Awareness & Training: In general, there is a lack of awareness about code requirements and the compliance process. Trainings seem to be too short to cover all the necessary topics and are heavily weighted to focus on new construction and recent code changes. Additionally, outreach to inform market actors about their compliance responsibilities, potential penalties for noncompliance, and relevant trainings are a challenge. Jurisdictions that have achieved the highest levels of compliance spend considerable resources improving the expertise of builders and officials through training and education.

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[1] Itron, Inc. Residential New Construction Baseline Study of Building Charactersitics Homes Built After 2001 Codes. Pacific Gas and Electric. 2004. Calmac ID: PGE0181

[2] RLW Analytics, Inc. Evaluation, Measurement, and Verification of the 2004 & 2005 California Statewide ENERGY STAR® New Homes Program. California Public Utilities Commission. 2007. Calmac ID: PGE0218

Enforcement: The effectiveness of compliance efforts is largely dependent on subsequent enforcement and many times their value is undermined by incomplete enforcement by building departments. There is currently a lack of permit and plan check requirements for many Title 24 measures, insufficient compliance document checking, and inadequate inspections by building departments and HERS raters. Building officials are often not aware of all the forms required for compliance and many have not been actively trained, especially in remote areas, to let them know about the importance of these standards. Turnover, especially within building departments, results in further challenges for successful enforcement procedures, because of the ensuing training it requires for new employees. Additionally, the energy code requirements are simply a subset of the code regulations for which building officials are responsible; they are responsible for staying current and knowledgeable about many codes besides Title 24, making it less likely that they will be experts and know every nuance of one subset.

Compliance Insight: Variability in local compliance rates across the state are not well understood. In order to know what efforts should be made to improve compliance with energy codes, it is necessary to know what aspects of the codes are and are not actually being enforced and to what degree.

Products: The availability of a diverse range of reasonably priced products that meet or exceed code is integral to their adoption into new and existing building construction. A lack of product availability, high first cost, competitive bidding, narrow offerings of option packages, and builder substitutions of code-required features are a major challenges affecting compliance rates.

4.13.2 Potential Compliance Activities

The primary effort that has been taken to reduce noncompliance by utilities throughout the state is training and education. Because this is such a cost-effective way for them to reach large portions of the population affected by code regulations, it is essentially the only option tried so far. Other efforts can be effective, however, when done in conjunction with training and education and through a solid partnership of all utilities throughout the state. Within the literature, the most commonly referred to mechanisms for increasing compliance are:

- Showing utility customers that energy code enforcement protects their interests
- Demonstrating the importance of local governments in increasing energy efficiency within their jurisdictions
- Working with building departments to encourage strict Title 24 enforcement
- Focusing on compliance issues for all Title 24 measures, not just those measures sponsored by the utilities' C&S programs
- Creating a software system to improve permit application, data recording, and compliance checking for HERS raters and local governments
- Developing a more user-friendly and easy-to-understand Title 24 manual that increases uniform interpretation of the code

4.13.3 Recommendations, Suggestions, and Findings

Past research and studies have revealed a number of recommendations targeting noncompliance problems. Additionally, many other suggestions have come about from interviews, surveys, and discussions performed over the years by utilities, the CEC, and private organizations looking to reduce noncompliance rates and better understand the behaviors and decision-making motivations of those parties working directly with energy codes on a daily basis. While the majority are specifically relevant to California and its unique energy codes, there is research about compliance on a national or international level. In an attempt to conduct a thorough and unbiased review of prior noncompliance studies, recommendations and findings from studies throughout the state, country, and world have been explored. We have extracted the most prevalent suggestions and useful information for achieving a final outcome of increased compliance for all buildings and classified them into the following categories, however are not advocating or necessarily in support of any in particular. It should be noted that not all are specifically applicable for use in California – some recommendations are already being done or are not relevant to the challenges and barriers currently facing the market in this state.

Inspections, Enforcement, and Permitting

Helping to encourage requirements for obtaining permits, more strict inspection processes for measures, better compliance enforcement, and the certification of more qualified raters

- Mandatory state-approved certification of energy plan reviewers and energy analysts for certain building or occupancy types
- Design simple and uniform testing protocols
- Establish a standardized certification process to train and certify both acceptance testing and commissioning agents
- Create a library of testing equipment for builders and their acceptance testing and commissioning agents to borrow
- Establish energy champions within building departments

The following suggestions are either currently in effect or supposed to be in effect in California. We felt it important to include them, however, because they arose during the course of the literature review, suggesting that their efforts are either not being implemented effectively and require improving or that people don't know about them and should be marketed differently.

- Require compliance inspections before issuing certificates of occupancy
- Local authorities review specifications before plans are approved and follow through to make sure products that are installed meet applicable energy codes for the project
- Availability of design review (before permit application) by the local authority that has jurisdiction
- Develop positive interactions between the building industry and code-making bodies to exchange information about code updates, compliance options,

innovative construction techniques, and provide them with adequate notice regarding any code changes. These communications can happen at training sessions, meetings of home builders or contractor associations, building industry conferences, etc.

- Promote energy efficiency to city councils in an effort to create partnership programs with local governments
- Improve permit application forms to help increase compliance document accuracy

Training and Education

Helping to encourage a better understanding and more awareness of codes amongst all affected parties

- Create a minimum yearly training requirement for builders and practitioners
- Shift some of the focus to retrofit projects of existing homes and small commercial construction.
- Design trainings specific for individual trades to ensure attendees understand and can apply the material they learn
- Create more public awareness and civic responsibility around code compliance
- Support industry conferences and workshops
- Survey current industry practices to create training and outreach programs and show support for non-IOU trainings and outreach efforts. Training and education programs should be targeted to building departments, inspectors, manufacturers and distributors, and raters

The following suggestions are either currently in effect or supposed to be in effect in California. We felt it important to include them, however, because they arose during the course of the literature review, suggesting that their efforts are either not being implemented effectively and require improving or that people don't know about them and should be marketed differently.

- Educate about the code, compliance process, and encouraged or required equipment
- Provide education and training, initially and ongoing, for building code planning and inspection staff and building industry professionals, especially contractors who are installing insulation, ducting, and HVAC units
- Organize high quality and regular educational and training sessions for building code officials and building industry professionals. Sessions should be held at local or statewide meetings as well as onsite for builders, their employees, and contractors
- Plan training programs at building departments for all employees, as opposed to just the few who the local government can afford to send, and focus on the direct needs of the building departments, separate from general training for practitioners
- Make a large effort to outreach and spread the word about upcoming events because utilities are a credible source for training class advertising

- Provide an overview about the importance of energy code compliance in both a national and global energy management context
- Highlight the benefits of energy efficiency in support of building energy codes to help make them more appealing to builders and turn them into allies

Code Consistency and Simplicity

Helping to encourage better compliance enforcement and a better understanding of codes

- Develop a national energy policy based on a tax on carbon sources of energy
- Standardize information related to code interpretations between various building officials
- Create short and concise written articles defining code requirements and potential solutions for compliance with links to various manufacturers supplying resources or products
- Clarify interpretations and the savings potential of various measures
- Simplify enforcement regulations and Title 24 documentation
- Incorporate fewer trade-offs in the code

The following suggestion is supposed to be in effect in California. We felt it important to include it, however, because it arose during the course of the literature review, suggesting that its efforts are either not being implemented effectively and requires improving or that people don't know about it and should be marketed differently.

- Apply code requirements consistently throughout various code jurisdictions

Product Development and Availability

Helping to encourage more cost-effective products to enter the market

- Set up partnerships with retailers and distributors on enforcement strategies to educate them and provide them with positive publicity
- Manufacturers and the California Energy Commission should work together to supply software about products for completing energy analyses
- Design more products to meet the energy code

The following suggestions are either currently in effect or supposed to be in effect in California. We felt it important to include them, however, because they arose during the course of the literature review, suggesting that their efforts are either not being implemented effectively and require improving or that people don't know about them and should be marketed differently.

- Manufacturers should make product energy code information more readily available and clearer
- Create partnerships with manufacturers and distributors to expand outreach and training

Tools, Guides, and Examples

Helping to encourage a better understanding of codes

- Provide information on best practices

The following suggestions are either currently in effect or supposed to be in effect in California. We felt it important to include them, however, because they arose during the course of the literature review, suggesting that their efforts are either not being implemented effectively and require improving or that people don't know about them and should be marketed differently.

- Create a step-by-step matrix guide or a table of energy code requirements for designers
- Develop a website outlining code requirements and providing examples of successful compliance challenges met
- Compose a simple, clear, and well-written plan check and field inspection guide for building departments that provides them with direction for items that are generally the most important
- Publish project case studies and real-life applications that demonstrate effective solutions in professional literature with reference materials
- Document energy efficiency products to create lists available to the public

Financial Incentives

Helping to increase demand

- Offer state tax credit to builders, consumers, and building owners for tested and verified energy efficient and green buildings

The following suggestions are either currently in effect or supposed to be in effect in California. We felt it important to include them, however, because they arose during the course of the literature review, suggesting that their efforts are either not being implemented effectively and require improving or that people don't know about them and should be marketed differently.

- Provide increased tax credits and incentives for buildings that comply (or establish punishment for those that don't)
- Make compliance enforcement mandatory to a certain level, with fines associated for not meeting that standard

As noted at the beginning of this section, many of these general recommendations, suggestions, or finding from the literature are not directly applicable to California's Title 24, or may only be partially applicable because the suggestions are implemented in Title 24 to some degree. In translating these items into improvements to Title 24, there will need to be specific adjustments and adaptations.

4.13.4 Resources

2007 Commercial Energy Code Compliance Study: A Study of U.S. Architects, Electrical Engineers, Lighting Designers and Building Contractors. Architectural Products Magazine and the Lighting Controls Association. Calgary, AB: ZING Communications, Inc., 2007. 23-77. 26 June 2008 <http://www.aboutlightingcontrols.org/education/pdfs/2007%20Commercial%20Energy%20Code%20Compliance%20Study.pdf>.

This research was completed to study attitudes and compliance rates among architects, electrical engineers, lighting designers and building contractors concerning commercial energy codes in the United States. It is a descriptive study, answering who, what, where, when, how questions. It contains both quantitative and qualitative research, focusing on quantitative research and using qualitative research for 'nice to know' information and to add deeper understanding of attitudes.

DiLouie, Craig. "Energy Code Survey Suggests 80% Compliance Rate." Lighting Controls Association. Feb. 2007. Lighting Controls Association. 25 June 2008 <http://www.aboutlightingcontrols.org/education/papers/energycode_study.shtml>.

An article geared towards the professional building design, construction, and management communities in the Lighting Controls Association eNewsletter that summarizes ZING Communications' 2007 Commercial Energy Code Compliance Study.

Douglas Beaman Associates, Inc. *Codes and Standards Enhancement Initiatives: Strengthening Title 24 Code Enforcement for Residential and Nonresidential New Construction*. Pacific Gas & Electric Company. 2004.

This CASE study focuses on identifying the elements that affect the building official's role in enforcing the energy standards and determining strategies for strengthening Title 24 code enforcement for residential and non-residential new construction. The report summarizes the findings of the research components of the project and presents a Performance Intervention Strategy developed based upon the research. From the survey, literature review, and face-to-face interactions with code officials, they identified a number of areas where enforcement of Title-24 Energy Standards can be enhanced.

Freeman, Sullivan & Co. *Residential Retrofit Market Training Needs Assessment: Market Size & Training Opportunities*. Pacific Gas & Electric. 1999.

This study focuses on the part of the housing construction market served by PG&E's Residential Retrofit and Renovation Program. It attempts to estimate the size of the residential retrofit and renovation market for building professionals and identify opportunities for training. It finds significant opportunities to provide customized training for the estimated 37,000 general contractors and employees. There are also significant opportunities for training 1,200 HVAC contractors and employees and the 1,800 building Code officials regarding Title 24 Compliance.

www.calmac.org, StudyID: PGE0097.01;3326

Heschong Mahone Group. *Title 24 Training Interviews: Effectiveness of Codes and Standards Training in Improving Compliance*. Pacific Gas & Electric. 2007.

This document describes the work of the HESCHONG MAHONE GROUP, INC. for supporting PG&E Title 24 Energy Efficiency Standards Market Research and Compliance Support. HMG attempted to cover all the significant Title 24 trainings being provided in the state of California in this study instead of just one training program. They then identified and interviewed all of the major Title 24 training providers of these trainings about the efficacy of training and the content, resources and marketing of the training programs.

Khawaja, M. Sami, Allen Lee, and Michelle Levy. *Statewide Codes and Standards Market Adoption and Noncompliance Rates*. Southern California Edison. Quantec, 2007.

The California Statewide Codes and Standards Program is implemented by the state's investor-owned utilities and seeks to improve energy efficiency by influencing the periodic updates to the Title 20 and Title 24 standards. The goal of the study was to refine the original estimates made of noncompliance, initial market penetration, and naturally occurring market adoption rates by researching and analyzing the factors contributing to each parameter and to test the 2006 California Energy Efficiency Evaluation Protocols as it applies to determining net savings resulting from program activities. This study was not intended to be an evaluation of the program and did not revise the gross savings estimates or any savings inputs into the Savings Estimate Spreadsheet.

www.calmac.org, Study ID: SCE02 24.01;1134-04

Mattinson, Bill, and Michael Gabel. Letter to Commissioner Jackalyne Pfannenstiel and Commissioner Arthur Rosenfeld. 17 Feb. 2006. 2008 Building Energy Efficiency Standards – Implementation and Enforcement.

Letter from CABEC to the California Energy Commissioners about problems with the 2005 standards, enforcement problems around plan review and field inspection, and a brief evaluation for implementation and enforcement of the 2008 standards in an attempt to start a dialogue about the development of the 2008 standards.

Pacific Consulting Services, Davis Energy Group, and Eley Associates. *MA&E Study in Support of Codes & Standards - Volume I: Project Description and Results*. Pacific Gas & Electric Company. 2000.

This study develops recommendations on how to improve the new construction industry's effectiveness in installing energy efficiency products commonly used to demonstrate compliance with California's Title 24 energy efficiency standards. It includes characterization and development of ideas on how to improve the construction industry's effectiveness in installing key energy efficiency measures and an assessment of opportunities to use existing public goods charge funded energy efficiency programs to identify and develop potential revisions to Title 24. They gathered, assessed, and synthesized data, reviewed literature, and conducted in-depth interviews with 57 industry experts (two residential construction industry groups, two nonresidential construction industry groups and one insurance industry group) covering all of California.

www.calmac.org, Study ID: PGE0081.01;441

Pacific Gas & Electric, San Diego Gas & Electric Company, Southern California Edison, and Southern California Gas Company. *California Energy Efficiency Strategic Plan.*

California Public Utilities Commission. 2008. 26 June 2008 <http://www.californiaenergyefficiency.com/docs/California_Energy_Efficiency_Strategic_Plan_June.pdf>.

This plan was prepared by California's four investor-owned utilities: PG&E, SDG&E, SCE, and SoCal Gas. It reflects the IOUs' consideration and synthesis of extensive input received from fourteen working groups and thirty six stakeholder workshops involving more than 1,100 participants, convened by the CPUC. Input was collected into sector and cross-cutting reports by staff of the CPUC and IOUs and their consultants. The ideas are a first attempt at a broad long-term vision for energy efficiency efforts in California.

Regional Economic Research, Inc. *Residential New Construction Study, Project Year #2*. Pacific Gas & Electric Company. 2002.

This summarizes the second-year (July 1999 - June 2000) findings of the Residential New Construction – Year #2 Study conducted by Regional Economic Research, Inc. (RER) under PG&E management. This study is designed to investigate energy efficiency practices of newly constructed homes. It also determines builder compliance to the 1998 energy code. Since this is the second Builder Compliance Study, it compares the baseline and compliance results of both studies. The methodology of this study includes on site audits of 800 newly constructed homes that were first occupied between July 1, 1999 and June 30, 2000.

www.calmac.org, Study ID: PGE0104.01;3334

Schlegel, Jeff, and Beth Troncone. *Building Energy Codes in Arizona: Best Practices in Code Support, Compliance, and Enforcement*. North American Insulation Manufacturers Association. 2007. 25 June 2008 <http://www.energycodes.gov/implement/pdfs/az_compliance_sweep_2007.pdf>.

The Southwest Energy Efficiency Project (SWEEP) conducted this study by interviewing building code officials in municipalities that currently have an energy code in place. By learning how these departments adopt and implement the building energy code, SWEEP identified and documented the best practices for energy code support, compliance, and enforcement. The interviews with local building officials provided insight into how the departments adopted and enforced the building energy code.

Vine, Ed. "Residential Building Code Compliance: Recent Findings and Implications." CBS Newsletter (1997): 6. 25 June 2008 <http://eetd.lbl.gov.newsletter/CBS_NL/nl13/code.html>.

An article in the Center for Building Science Newsletter, a publication of the Environmental Energy Technologies Division for consumers, professionals, students and news media that discusses the findings from an analysis of six studies on building compliance in the Pacific Northwest and California.

5. 2011 C&S ENHANCEMENT COMMENTARY

The material in this report was developed in conjunction with the HMG report to Edison entitled, *"Market Assessment: Codes & Standards Enhancement Process Recommendations"*. It was prepared primarily by George Turnbull, writing from the perspective of European standards and practices, with additional suggestions and edits by Douglas Mahone. It has been extracted from the original draft document because IOU C&S Program plans for the 2009-2011 program cycle, and the CEC's plans for the next standards upgrade cycle, have been evolving rapidly in parallel to this effort. Consequently, some of the material in this document may be outdated or superceded.

This material is provided in stand-alone form with the expectation that it may be useful to the C&S program planners and staff as they enter 2009.

5.1 2011 C&S Proposals - Comments & Suggestions

This document looks to identify high priority C&S proposals for development in the next phase of standards enhancements. It offers a commentary on current ideas and their potentials as CASE studies, as viewed from a high level and a European perspective.

The CEC and the IOUs has already compiled a "wish list" of proposals for the 2011 round of codes and standards enhancements. Parts of this list have been used as the basis of the following review of potential proposals for 2011. The CEC list has some of the themes extrapolated or modified.

The list can be classified as follows:

- Electric Lighting
- Envelope, including daylighting
- HVAC
- Refrigeration
- Water
- Operational compliance
- Appliances and plug loads
- Currently not regulated

Each is discussed in further detail in this section.

5.2 Electric lighting

Electric lighting efficiency improvements are driven by technology change. The advances in lamp efficacy have resulted in increasingly low allowances of installed lighting power and this is reflected in some of the potential proposals. These have been

extended to outdoor lighting and illuminated signage. New areas for development are opening up with advances in LEDs and controls.

5.2.1 Light emitting diodes (LEDs)

LED technology has the potential for high energy savings, particularly in sign lighting and outdoor lighting applications. In applications such as signs, LED technology has an inherent performance advantage over other lighting sources that are better at spreading light rather than concentrating it into a luminous beam. In broader applications, however, the lumen/watt metric does not work well with LED's due to their angular nature.

Technical developments are necessary to improve color rendering, conversion efficiency to reduce heat output, and fixture design to amplify the output characteristics of arrays of LEDs that will allow them to compete with other indoor lighting solutions. Direct replacements for T8 and T12 fluorescent fittings are available but need to be further investigated for proper applicability. The general intention is to find suitable applications for point source fixtures whether individually or in small arrays.

There should be a gradual improvement in efficiency that will make LEDs suitable for outdoor lighting and signs, where their robustness and reliability is an advantage.

5.2.2 Lighting controls

Occupancy and illumination control with natural lighting are used for a variety of applications. There are some good control measures already within the codes and there are 2011 potential proposals to look at temporal changes in graded illumination, based on calendar and daily external conditions.

The potential code change proposal focusing on increasing occupants' control over internal lighting is interesting because it is a different design approach to conventional automation. Within the restrictions set, it would be interesting to see how occupants actually use this capability, as against merely expressing a preference for it. This will give indications of ways to improve behavioral design for lighting that would be energy efficient. Such issues as the behavioral response to periodic automatic reset of ambient conditions would be useful research topics, as they would also have application for demand response.

5.3 Envelope including daylighting

The performance standards for envelope have been increased steadily and are nearing the limits of economic justification. However, as the envelope is immobile and unlikely to change, then passive envelope improvements have better LCCs than active equipment or measures. There are no new innovations in this area; rather the need is to better define some of the long-standing issues that require clarification of intent. Thus, the proposals combine direct measures with design advice:

5.3.1 Glazing and solar gain

The envelope and daylighting areas of the code are well developed. However, the necessarily complex requirements for proper daylighting systems may result in piecemeal compliance rather than a systematic examination of the energy efficiency potential in the whole design. Additional research and analysis can assist in developing ways to require or encourage a more holistic approach to daylighting system design.

For example, there is a residential proposal to shift the prescriptive maximum glazing area away from a window-to-floor area ratio (WAR) metric to a window-to-wall ratio (WWR) metric that will improve designs, while removing the advantage given to larger dwellings by the WFA metric. However, WWR optimization involves blending daylighting, electric lighting and thermal performance by considering an annual energy balance. This proposal provides an interesting approach, but it needs to demonstrate that WWR gives consistently better annual energy balances (accounting for demand as well as energy) for various sizes of buildings.

Associated with annual energy balance is how solar heat gain coefficients (SHGC) are modeled. There is a proposal to review incident angle heat transfer. At the same time it would be good to review how solar gain is distributed through internal heat exchanges, to ensure that the modeling reflects current practice. An improvement to the modeling of heat gains would allow the impact of external shading, another potential proposal, to be re-assessed for thermal performance. This can be linked to another proposal to assess the impact of overhangs on daylighting performance.

European design compliance includes a calculation for summer envelope performance that looks to reduce peak summer day overheating. The calculation includes solar gains, internal gains and thermal response factors. This provides an opportunity for the designers to explore glazing orientation, shading and thermal mass issues within a peak day overheating constraint.

There is an argument for overall envelope performance metrics (integrating the behavior of glazing, opaque surfaces, sun shades, etc.), so that a limit on the envelope performance metric, such maximum calculated summertime temperature by climate zone, can be stipulated and achieved. This would improve designs and professional expertise in energy efficiency. This is a possible alternative to detailed prescriptive proposals such as WWR. This argument suggests that many of the envelope design issues can be put together as interlinked decisions, which could ensure that the envelope design is optimized before the HVAC plant is selected. This more open design approach may encourage designers to approach compressorless cooling in buildings (or very low energy comfort), as suggested by another potential proposal.

For the future, the development of smart glass/high performance glazing or integrated solar shading can keep some of the short wave radiation out at specific incident angles and can allow long-wave radiation to escape. The development of systems designed to allow solar gains at specific incident angles will provide an impetus to passive solar design/compressorless cooling. The introduction of high performance glazing and fenestration designs will improve overall building thermal performance. There will also

be consequences for internal lighting amenity, which would also need to be addressed, perhaps as a second phase.

5.3.2 Roof

Low sloped roofs with generous overhangs and porches have occasionally been a feature of Californian residential design. The high sun angles in summer, clear night skies and the prevalence of low-rise residential designs means that the roof can be the key envelope element of building performance. Its performance in terms of reflectance, rate of absorption, rate of transmission, rate of re-emission and rate of internal heat transfer are modeled with the CEC approved software. Proposals to improve the quality of attic insulation, duct sealing, duct insulation and radiant barrier installation will give improved life cycle cost (LCC) to these measures.

The passive components in a residential roof assembly have been treated with the recently improved modeling of heat flows in the attic. The next step would be improved characterization and modeling of the active components of residential roof assemblies, leading to an understanding of the optimum arrangement and operational regime of attic exhaust fans and whole house fans. Again, an annual energy balance is required for operation to ensure that fan electrical consumption is saving air conditioning consumption.

5.3.3 Thermal mass

Thermal mass can be a complicating factor for energy efficiency, especially cooling energy efficiency, in California buildings unless construction practice changes dramatically. The floor is the only element that normally has significant thermal mass in many California constructions, but this can be easily covered with decorative flooring so that its thermal characteristics cannot be assumed in a design calculation. The use of heavy walls is being expanded, through SIPS and ICF technologies, which may add to costs for seismic protection and be less sustainable than wood framing. Those caveats stated, thermal mass could be a necessary component in zero energy buildings, and could provide a good way to work with, rather than against, California climate conditions.

The potential proposal for pre-cooling heavyweight buildings can be achieved by night air purging or mechanical cooling. Night purging is dependent on a large diurnal temperature range to be effective. Weather data will indicate when and where this can consistently be expected within the California climate regions. With air conditioning and heavyweight buildings, it requires careful design to ensure that the thermal mass effects work with, and not against, the mechanical cooling. A hybrid approach would be to run ventilation only, and then step to air conditioning when necessary. All approaches need robust control systems to maintain operational efficiency.

5.3.4 Natural ventilation design

In Europe windows are designed for ventilation and daylighting. That is, lights and sash are smaller, and allow for finer adjustment of airflow in mild weather. Permanent

ventilation is often designed into the transoms of windows and they have sprung blades that flex shut at higher wind speeds to curb drafts. Horizontal sliders are rare because they give poor control of airflow. Passive stack ventilation is already accepted in some countries as an alternative to exhaust fan ventilation in bathrooms and kitchens.

Design for natural ventilation requires a more detailed analysis of air flows and heat gains to achieve reasonable energy performance with comfort. In that sense, it entails greater design risk. In milder California climate zones, particularly in coastal zones, natural ventilation works well. In urban areas or in hot inland climate zones, there can be problems with high airborne pollution levels and difficult temperature conditions. Even in those locations, however, natural ventilation is desirable during the milder conditions in spring and autumn. Under adverse natural ventilation conditions, the fallback is mechanical ventilation, filtering of the air, and mechanical temperature modulation, with accompanying energy costs. Larger buildings can operate with natural ventilation for parts of the year, the length of time varying with climate zone. Accepting and planning for a mix of mechanical and natural ventilation may be more realistic than striving for full natural ventilation. That is, optimize a design for natural ventilation during milder weather and only move to comfort cooling when necessary. Obviously, this has implications for peak periods. Determining (and possibly requiring) the optimum mix will require improved modeling and design methods.

5.3.5 Indoor air quality, infiltration and tightening buildings

IAQ is a tricky issue that transcends energy efficiency. There is no accepted IAQ metric for Europe, although P.O. Fanger did attempt to introduce one into European Standards. This was resisted because the fieldwork underpinning the Standard was disputed and because of the impact that the standard would have had on required ventilation rates (and the accompanying energy costs). The result is that Europe retreated back to the standard comfort dilution rates that have been accepted for many years. In the UK, where buildings have been substantially tightened, there must still be a minimum free area to outside for fresh air ingress, to comply with public health (IAQ) requirements. Exhaust ducts are not designated as fresh air paths.

Tight buildings are generally associated with cold climate design or fully conditioned buildings. Sealing smaller buildings in mild climates, as in much of California, seems counter-intuitive and works against improving indoor air quality, though the possibility of excessive infiltration or outdoor air leakage imposes a penalty in terms of energy consumption. A review that looks to carefully balance IAQ and energy efficiency may be desirable, in order to improve practice and energy efficiency in this complex area.

5.4 Heating, Ventilation, and Air-conditioning

The latest potential proposals for heating ventilation and air conditioning (HVAC) are mainly concerned with improving air conditioning system performance. The energy efficiency of the air conditioning unit for compliance is currently specified by the Appliance Standards (Title 20), and there are additional requirements/compliance credits

for thermostatic expansion valve (TXV), refrigerant charge indication and checking, temperature controls, outside air quantities, etc.

5.4.1 Residential AC design

Equipment standards for both the AC unit and the furnace apply to residential single fan recirculation units with DX cooling coil and furnace. There are some 2011 potential proposals to reduce standby energy consumption of both pieces of equipment and to improve the performance of ductwork distribution systems.

Rules about duct testing and tightening are in place, but systems with extensive flexible ductwork are frail and are not durable nor as easily cleaned as rigid ductwork. The potential proposal to compare rigid and flexible ductwork performance is interesting as it will impact on installation practice and first costs, but could potentially improve long-term performance and reliability of the duct system.

Efficiency improvements have also been sought in distribution and control. Currently there is some interest in parallel path, ducted return air systems, as against using the corridors as the return path for the system. The former can be designed to give better air distribution and control if correctly balanced. The latter is cheaper and will give a slightly negative pressure to the residence. The ventilation air to either is usually through a fixed aperture in the AC unit or by infiltration. Time-clock and internal thermostats are typical for control.

An alternative approach to residential air conditioning may also be considered as a potential proposal. This is to achieve cooling with a multi split systems. This would entail the piping of refrigerant throughout the house, rather than ductwork, and would separate the comfort air from the fresh air. Placing terminal units in each main room allows the units to be programmed to occupancy rather than having to cool the whole house. By separating conditioning and ventilation, it allows DR strategies to be employed. This approach will need to be complemented with a dedicated ventilation system that includes exhaust for pollution sources and supply pre-conditioning, which can either be by local supply adjacent to or through the terminal units or by a separate central system.

5.4.2 Commercial AC design

There are some 2011 potential proposals to improve efficiency, to reduce standby energy consumption of both pieces of equipment, and to improve the performance of ductwork distribution systems. There are also proposals to improve equipment efficiencies and fault diagnosis and detection (FDD) along with acceptance testing.

The prevalence of different types of air conditioning systems should be examined, as the most popular are often not the easiest to fault diagnose and maintain. Most types are essentially cooling systems that are suitable for buildings with level loads across the floor plates. In operation, it must be supplemented with perimeter heating or terminal unit reheat to cope with cold morning and winter conditions, or with cold supply air going to mild temperature zones. They have problems when there are differentiated internal loads

or concurrent heating and cooling. Room airflow in heating mode is affected and the overall system balance can be erratic. This is recognized in the potential proposal to eliminate variable air volume (VAV) system reheat by considering separate systems in the perimeter zones. In terms of the building codes, providing credits for system choice is not easy, but it remains one of the greatest areas for potential energy savings.

An alternative for medium sized buildings is a direct expansion system that has independent terminal units and variable refrigerant flow (VRF). This potential proposal is described as "ductless systems" in the 2011 list. The most popular are VRF heat recovery systems, for example those manufactured by Daikin. They can accommodate concurrent heating and cooling in adjacent zones and can redirect the energy from zone to zone. The condensing unit has integrated inverter control, so the full system is technically advanced, and therefore beyond normal maintenance practice. These are complex systems, with which the industry has some suspicion, because they are generally supplier designed and maintained. The sophistication of these systems should be matched by on-board fault diagnosis. The ventilation system is separate, and various options can be considered to see the best matches for various applications. Certainly, for non-uniform occupancy and conditions, VRF with ventilation can provide better local conditions. Whether this results in energy savings needs to be proven, and the issues of industry practices for maintenance and fault detection/repair need to be resolved.

Larger buildings that have high occupancy can also be designed with ventilation and cooling as separate systems. Introducing cool, low velocity, ventilation supply into the occupied space at floor level displaces polluted air from bodies and equipment. Correctly balancing supply and exhaust allows the polluted air to stratify above the occupied zone giving good comfort conditions. Complementary cooling is from chilled beams or panels that must not disturb the stratification of the ventilation system. The high cooling loads in California may not allow this to happen. These systems are selected in Europe because of their comfort effectiveness and are not guaranteed to save energy. Nevertheless, they should be studied for use in California conditions.

The potential proposal for reviewing the economics of evaporatively cooled condensers is promising. It should possibly be expanded to include hybrid condensers that can switch between dry and wet modes depending on the load and the approach conditions. Such condensers could help to offset some of the disadvantages (water usage, maintenance, corrosion, etc.) associated with evaporatively cooled equipment.

5.4.3 HVAC controls

The poor energy efficiency performance of many air conditioning systems is generally known; for example, there are proposals to look at small commercial unit economizer controls to improve function and reliability. The 2008 introduction of specific control strategies for zones within a commercial HVAC system with a direct digital control (DDC) system will provide useful information on how more extensive control can be expected to save energy and provide reliability.

Diagnosing poor performance that wastes energy, rather than outright failure, is the important consideration with control design. Control strategies that are layered between

terminal control and central plant can be daunting to analyze, especially when the control interactions are unclear and the data on systems operational details are sketchy or hard to decipher. The implementation and benefits of these new DDC-to-zone requirements should to be assessed to see whether they show the benefits anticipated, or whether they become too complicated for the trades to operate and maintain.

5.5 Refrigeration

There are a number of potential proposals for examining larger refrigeration systems in refrigerated warehouses, supermarkets etc. The introduction of the new requirements for refrigerated warehouses is in 2009 and it will be interesting to see how that industry responds to having need for load control with dynamic conditions within the evaporator, compressor and condenser system. This should be a spur to technical development, and the effectiveness of such proposed potential measures, such as floating head control of condensing pressure, can and should be judged.

5.6 Water and Energy

The embodied energy in water metric is being developed, and this may assist in improving assessments that involve water services.

5.6.1 Service hot water

Currently there are several PIER projects that are investigating service hot water systems, to improve modeling and identify usage parameters. There are also 2011 potential proposals to investigate improved service hot water. While this has traditionally been treated solely as an energy heating matter, there is increasing concern for the embodied energy in water supply, as well as for water conservation itself.

In the UK, hot water efficiency is addressed as a water conservation issue by limiting the length of specific diameters of piping supplying single appliances. This results in water distribution being more compact, with greater use of instantaneous water heaters or combined heating and service hot water heaters (combi-boilers). There are also requirements for electronic time controls for residential usage.

Also in the UK, larger circulating systems have storage tanks with connections about half way up the hot water tank. This allows warm return water to mix with the warm tank water that is half way up the tank, and this stabilizes the circuit temperature. It avoids issues around using the drain cock as a return connection and of using the cold feed/makeup line as a return, both of which mix warm return water with the coldest water in the tank. There is also a requirement for electronic time programmers to ensure that the water is heated only for periods when it is needed.

The single storey extended plans of many California homes result in long water draw lengths and time delays. A retrofit that is sometimes installed is to create pumped circulation using the cold water line as a return. The use of mixing valves at the end of a

long draw length should be examined for inadvertent use of energy by wasting small amounts of hot water continually through cross-over leakage with the cold water line.

All of these issues could be studied using an embodied energy metric, in additional to the water heating energy metric. This would allow hot water measures to be evaluated for additional embodied energy savings. The result would be to favor measures that reduce water usage as well as reduce water heating energy. We are presently awaiting policy guidance, and the results of statewide studies of embodied energy in water supply, before this analysis can proceed.

5.6.2 Solar thermal collectors

The 2011 list includes potential proposals for solar service hot water heating and pool heating.

The development of solar homes initiatives and incentives for photovoltaic panels has had some consumer take-up. Solar hot water collectors are rare in California following bad experiences with installations in the past, but these systems are still more likely to be cost effective than solar electric (photovoltaic or PV) systems.

There have been some developments in recent years with combined PV and flat plate solar thermal collectors that heat water as well as produce electricity. They have the advantage of space saving and improved PV performance because the water stabilizes the PV surface temperatures and so improves conversion efficiency. The effectiveness and load matching become more difficult with two energy sources, and the added costs of these combined systems make the demonstration of cost effectiveness more difficult. Nevertheless, advances in these systems should be watched closely, and as the cost effectiveness becomes more favorable they should be considered for standards development.

5.7 Operational compliance

As buildings age, their usage changes, minor faults go uncorrected and demands on the systems change. This can lead to adjusting basic operational regimes and degrading overall system performance. It can take skill to diagnose where and why this has occurred and how it can be corrected. In Europe, the concerns about operational issues have led to the introduction of legislation aimed at maintaining effective operations and efficiency. The California standards provide no direct reward for improving persistence of energy efficiency, so the role of the IOUs in this area is unclear, though there are some potential proposals for the compliance process in the 2011 list. Utility retrocommissioning programs are directed toward solving these problems, and can provide the market experience and precedents for addressing them in standards.

5.7.1 Energy performance in Europe

In Europe, the construction, sale or renting of property triggers a requirement for an energy performance certificate supported by a detailed audit to define the building's relative energy performance against a reference building. In Europe, a version of the

building code compliance software is used to rate a property's energy performance. The certificate must be issued by accredited auditors who will use approved software to calculate performance and produce the documentation. The certificate is valid for ten years and is accompanied by recommendations for upgrading the energy performance of the property.

There are also legal requirements for displaying public buildings' annual energy rating in the form of a pictorial comparison to a typical performance range. The rating is based on energy use intensity and requires an audit by an accredited assessor. The display certificates are valid for seven years. The annual energy rating must also have accompanying advisory recommendations for improving energy efficiency. The latter is also valid for seven years.

Requirements for annual inspections of air conditioning equipment are being phased in between now and 2011 in Europe. Accredited inspectors must carry out "regular" inspections (initially every five years) of air conditioning systems and report to the owners on component performance, load matching, controls, and give advice on improving energy performance.

It should be noted that the system in place concerns information and there are no requirements as yet to act upon poor energy efficiency identified in the reports being produced.

This goes well beyond the new AB 1103 requirement for benchmarking commercial buildings at time of sale, lease or refinancing. California benchmarking efforts point in the same direction, but currently are not as thoroughly developed or implemented. The CEC is sponsoring research on the development of an advanced benchmarking tool. None of these efforts, however, envision the thorough analysis and building auditing that is required in Europe. There is potential for increasing the California efforts to catch up with the European practices.

5.7.2 Energy management by tracking

Energy management can be greatly assisted if HVAC equipment has capabilities to allow simple performance tracking. Sub-metering of larger power and HVAC sub-circuits would aid tracking and fault diagnosis. The task of compiling performance data becomes easier because, for example, weather normalization can be applied to that proportion of consumption used for conditioning the internal spaces. Sub-system performance can be checked against norms using stochastic techniques that indicate malfunction so that operations and energy efficiency are blended. The European building codes have requirements for sub-metering on all larger energy distribution circuits, which go well beyond California requirements.

Efforts in California to produce advanced HVAC system diagnostics, and even automated fault detection, have not advanced beyond the research stage except in a limited number of advanced facilities operated by sophisticated engineering personnel. The large potential for improving energy management, and for using energy tracking systems for

fault diagnostics and continuous commissioning, should be kept in mind as the science and practice advance and become more reliable and cost-efficient.

5.7.3 Acceptance testing and continued monitoring

As mentioned above, plant "tune-ups" give an indication of how equipment is operated in the field. Acceptance tests should ensure that adequate fixed gauges and measuring points are available to ensure that data on performance is available. The nature of this equipment needs to be specified for calibration. This falls under the general term of maintainability which includes sufficient hardware to assess performance, and systems for micro-tracking for large plant items.

Associated with maintainability is identifying systems that show the same operational failures in the same systems across different types of buildings. If research can identify common failure modes for various system types, then acceptance testing and monitoring can be directed to the issues that affect ongoing energy performance.

Of course, establishing mandatory measures for maintainability may or may not result in any actual energy savings, depending on how well the equipment is operated and maintained. Like retrocommissioning, the practical potential for energy savings (and cost savings) from having these monitoring capabilities is likely to be substantial. Demonstrating cost-effectiveness of the requirements, however, may be challenging.

5.8 Appliances and plug loads

Plug loads are a major new area for regulation, and the introduction of onboard facilities that block operation during peak periods should be considered for appliances such as dishwashers, washing machines and clothes dryers.

Currently some Federal standards fall short of the potential energy efficiency of some appliances. California has seen that some technical developments could allow higher efficiency standards to be required, but this is being held back by the preemption powers of the Federal regulations. The change in the political administration in Washington could mean that it's appropriate to re-address the issue of Federal pre-emption for some of the appliance standards, and to extend efficiency requirements to include DR and operational efficiency provisions.

5.9 Currently not regulated

The 2011 list suggests that beyond-code standards can be furthered by reach codes that promote green building and high performance design. To this can be added renewable energy.

The introduction of a renewable technology displaces consumption in a way that is more acceptable because it does not deplete natural resources. The C&S program is based on reducing energy usage over and above existing standards, so the format is not geared to recognizing renewable energy substitution as an energy saving. The original Warren-Alquist Act provided for renewable energy as a replacement for conventional energy in

performance trade-offs, but this has not been implemented in the standards out of concern that people would use trade-offs to make inefficient buildings to which renewables were appended. The New Solar Homes Initiative is addressing this problem by requiring substantially improved energy efficiency BEFORE renewables are installed.

Europe has had to adapt its construction compliance model to accommodate renewable energy generation. The base budget is based on average carbon emissions of supply, rather than on energy, and thus avoids some issues with energy-based budgets. There is no weighting of the carbon budget for peak load, although this would be better still.

The budget can be met from improving efficiency or installing renewables or both. As in California, there are some suggestions that designers will specify renewables as an easy route to compliance, and that this is leading to unsatisfactory designs. This may divert resources away from efficiency. If renewal energy requirements are introduced into code and appliance standards, then Title 24 compliance methodology and the unit of energy assessment may have to be adjusted. There are some suggestions of basing energy efficiency in California on carbon budgets, but little has actually been done in this direction.

A major objective of the development of the latest European codes was to reduce the costs of amending the code but still keep pace with technical developments that improve building energy efficiency. The European compliance model is deliberately simple but there is some user behavior calibration to make it representative of the building population. The model has base budgets defined by the 2002 compliance standards and the codes are revised by redefining the percentage reduction on the original budgets. Technical specifications are contained in supporting documentation and this is where most of the technical changes are made.

6. MARKET ASSESSMENT: CODES & STANDARDS ENHANCEMENT PROCESS RECOMMENDATIONS

This report has been commissioned by Southern California Edison (SCE) as a market assessment study in support of its Codes and Standards (C&S) Program. It makes recommendations for improving Code and Standards Enhancement (C&S) process that contributes to the standards-setting activities of the California Energy Commission (CEC) (and potentially other standards bodies).

6.1 The C&S Program Advocacy Process

This section describes and explains the complex process employed by the C&S program in its advocacy of advanced building and appliance standards.

6.1.1 Overview

The SCE C&S program for code and standards enhancements has evolved over the last decade, using a combination of ratepayer and shareholder dollars to help modify and enhance regulations that govern buildings, equipment and appliance energy efficiency in California. The work is carried out in close partnership with the California Energy Commission, the agency responsible for development and adoption of the Title 24 Building Energy Efficiency Standards and of the Title 20 Appliance Efficiency Standards, and with the other IOUs' C&S programs. The C&S program efforts are complementary to the utilities' voluntary efficiency programs (typically involving incentives and/or rebates), and support the overarching statewide goals of advancing energy efficiency for buildings and products.

The methodology of the program has been developed in part by IOUs' own C&S teams and also by the specialist consultancies that they employ for the C&S efforts. The CEC looks to collaborate with the utilities and other stakeholders during each round of standards enhancements, and the exact duties can vary from wholly CEC-developed to wholly IOU-developed enhancements, where the latter would have the CEC in a supervisory role. The IOUs' C&S efforts place no direct financial burden on the CEC or the State except for the management of the standards adoption process. C&S measures that are successfully adopted are reviewed by the CPUC, and the amount of energy saving attributable to the State's IOUs' efforts is used to determine earnings for the IOU shareholders. The CEC has come to value and rely upon the IOU's C&S program contributions to their standards enhancement efforts, and a true partnership has emerged.

For a typical cycle, the C&S process would have some key stages:

1. **Initial Measure Screening.** Identification of potential standards for initial screening with the CEC. Suggestions for potential standards can come from the CEC, from an IOU, from publicly funded energy efficiency research, or from outside parties that have an interest in energy efficiency. A thorough screening

process identifies those proposals for development. These are then allocated to a CEC or IOU team to develop a Codes and Standards Enhancement (CASE) study proposal that will promote the energy efficiency standard.

2. **CASE Study Development.** Development and presentation of the CASE (Codes and Standards Enhancement) study for a proposal to the CEC to move towards code adoption. The report sets out the code language or standard for adoption into California law. It includes technical reviews of the measure(s), and input by stakeholders and those potentially affected by the new standard. The CEC requires that enhancements to the State's codes and standards must be cost effective, meaning that the energy cost benefits must exceed the incremental costs of the measure. The CASE study also describes the market impact and the savings potential of the measure(s). The latter forms the basis of the standard's contribution to the IOU's shareholder earnings.
3. **Adoption Process.** Following acceptance of the CASE study proposal by the CEC, a formal adoption process commences that opens the proposals to the public scrutiny through CEC hearings and public comment. There is also concurrent development of supporting documentation to the proposals, such as changes to the Alternative Calculation Methodology (ACM) manual and the supporting compliance manuals that interpret the new code language in a user-friendly manner.
4. **Standards Take Effect.** Final adoption of the code change language and completion of changes to the ACM and the compliance manuals follow. There is a grace period following adoption of the new or revised energy efficiency requirements to modify existing compliance software and promote the changes by training and publicity. After this period the new standards take effect, and the savings start to be realized as new buildings and products come on line.

The following sections look in detail at the screening, development and adoption phases of the C&S process.

6.1.2 Identification and screening

Initial proposals for standards enhancements or measures are developed in outline form by the CEC drawing on supported research, by suggestions from the IOUs, and by other stakeholders. The CEC provides a template which asks proposers to sketch out the nature of each potential code change, and to assess its attributes (magnitude of potential savings, likely cost effectiveness, technical or political issues, etc.). Proposals are collated by the CEC and they then assess the feasibility of the code changes, likelihood of adoption, and the level of interest within their organization and with their IOU C&S partners. The CEC selects the proposals to go forward and produces a timetable through to the code adoption dates. The CEC allocates each proposal to the IOU that has promoted the idea or which has the expertise and resources in that particular subject area. Other standards proposals may be developed by the CEC or by other stakeholders. Together, the combined measures are publicly identified for inclusion in the CEC's formal rulemaking process, so that all stakeholders are put on notice of potential changes to the standards.

The approach to Title 24 code revisions is flexible and tries to take advantage of recent technical and design advances. The identification process usually focuses on those proposals that are most developed, and that have the greatest potential to save energy. These will usually be technology led and have some previous interest within the CEC, either from publicly funded efficiency research or legacy proposals from previous enhancement rounds.

Advancing the level of savings for the standards has required broadening the scope of the standards, and enhancing the depth and technical sophistication of the requirements. These changes can resonate through the code language and associated documentation, and it is here that the CEC is placing increasing resources to ensure consistency and alignment. The CEC has worked to consolidate the requirements so that the overall look and feel of the code has generally been retained in recent cycles. The resources required to achieve this, and promote a logical structure within the documentation, will increase with the expansion of the building energy code scope and stringency.

The Title 20 appliance standards development process is more straightforward than for the building standards, in that appliance standards are generally independent standards that can be revised without the problems of integration with a wider standards context.

6.1.3 CASE study report

The screening process identifies individual C&S proposals for development and initiates the writing of a full CASE report that explores the technical and market impact issues. The report is the vehicle for the CEC to assess the efficacy of the proposed measure and for deciding whether it should be adopted.

The CASE report must provide a convincing argument for adopting a proposal for regulating or increasing the energy performance of an appliance (Title 20) or a requirement of the Building Energy Efficiency Standards (Title 24). The report proposes the code language for adoption along with the technical and market analysis for evaluation by the CEC and stakeholders. The key contents of a CASE report are:

1. **Technical Assessment.** The technical description of the product or method that is being proposed. This will describe the existing technology or standard and the proposed enhanced version, as well as associated issues such as technical interactions with other products or systems. The defined existing base condition and the new performance standard for the proposal are stated so that the incremental improvement in energy efficiency per unit can be calculated. The proposals' annual operational regime or application is assessed to give an annual savings potential per unit.
2. **Market Assessment.** The market conditions for each of the proposals are described, to assess market readiness, and the annual statewide savings that may be expected. This must include the rate of market penetration for products or relevant construction permits, along with computations for different California climate zones and by application of Time Dependent Valuation (TDV) of savings.

Cost effectiveness is demonstrated on a lifecycle basis, using CEC specified economic parameters.

3. **Implementation Potential.** The review of implementation issues such as longevity and performance over time, along with possible commissioning acceptance requirements. The existing status of each measure is reviewed, to ensure that the industry infrastructure can meet new requirements and that these are enforceable. The acceptability of the proposals is studied so that any market or industry resistance to the proposals is anticipated and resolved and any transition measures can be identified.
4. **Code Language.** The report will conclude with a draft of the proposed new or revised code or standard language along with calculations, testing, acceptance requirements, and modification to associated documentation such as the calculation forms, users' manuals, descriptive appendices and lists of approved equipment and appliances.

The CASE study is an investment by the IOUs in the C&S program and there is a risk of delay or rejection. CASE studies are sometimes postponed to a later enhancement cycle but the C&S process rarely rejects a proposal entirely. When this does occur, it is usually due to an economic or implementation issue raised by stakeholders. The resulting product is typically a white paper that summarizes the activity and the issues surrounding the code proposal rejection or delay.

Each of these aspects of the CASE study report is explained in greater detail in the following sections.

6.1.4 Technical description and energy performance

The technical description sets out the proposal within the context of the building energy efficiency code or an appliance standard. Appliances will be identified in terms of their function and application. Building energy efficiency measures will be categorized as mandatory or prescriptive compliance requirements, as giving alternatives to existing compliance requirements or as changes to the method of savings calculation. Any issues of technology, reliability, interaction with other systems, human response, durability of savings, etc. are identified and addressed. In short, the proposal must be shown to be technically feasible.

The incremental unit energy savings of the proposal are calculated. The first step is to establish the base performance:

- For an appliance, this will generally require a market survey to identify equipment in common usage, their capacity and their efficiency, in order to determine an average base performance level.
- For a building compliance requirement, this will require establishing the base energy performance of the current standard, if it exists, or compiling an average base performance level from surveys.

The next step is to calculate (supported by measurement if possible), the energy use of the base performance, and then to compare this to that of the new proposed standard. This then allows the incremental energy efficiency improvement per typical unit of appliance sales, or per typical building, to be calculated.

6.1.5 Market issues

The typical unit energy efficiency improvement has to be expanded into a statewide energy estimate to gauge the proposal's overall impact. Cost effectiveness is demonstrated, to meet the statutory requirement for standards' adoption, and to demonstrate economic viability of the proposal. For an appliance, compiled retail sales or trade organization survey data can be used to define the statewide annual installation numbers by type. For construction-related measures, this requires information on construction rates or permits issued, by building type and by size, to establish the impact of the new measure across the state.

The energy savings calculation is disaggregated by appliance or measure type, by climate zones, and by application of Time Dependent Valuation (TDV) to hourly calculated savings to build up the statewide savings. There is a statement of statewide energy savings and any associated peak demand reduction, aggregated up to the statewide level according to market size. The measure, installation and maintenance costs, and life cycle savings, are calculated, following economic guidelines established by the CEC. The measure must be demonstrably cost effective, from a societal point-of-view (it may not be completely cost effective from a short-term payback perspective). The figures are estimated and are compiled using best estimates for energy unit savings, market impact and take up.

Industry stakeholders are involved closely with the development of the market information. The proposers must show that the measure is sufficiently available in the market, from sufficient numbers of suppliers, to meet anticipated demand if the measure is adopted into code. Manufacturers, trade associations and lobbyists are invited by the IOUs and the CEC to examine the CASE report and supporting research. Formal and informal meetings and workshops provide the opportunity to test all aspects of the technical, economic and practical aspects of the proposals as set out in the CASE reports.

6.1.6 Implementation issues

The examination of each of the proposals is expanded to consider how well they will perform when implemented: longevity or persistence, variations in performance over time and appropriateness as a required measure. The effective useful life of the measure is identified. Any issues affecting the reliability of the savings estimates are identified and solved (or mitigated as best possible). This could include the development of installation requirements, acceptance testing, labeling, or other mechanisms to ensure practice lives up to theory.

The study looks for evidence from stakeholders of any practical issues that require overcoming in order to implement the measure. Trade allies (installers, contractors,

distributors, etc.) must be capable of providing the necessary support and services to ensure that the measure will be reliably installed or sold. The availability of the proposed product or technique is described in terms of manufacturers, product ranges or techniques employed, test or performance standard, and distribution across the state. The proposal's product or technology must be achievable and available in the market when the code is implemented. In other words, the measure must be demonstrably "ready for prime time" as a new standard.

If there are additional requirements needed to ensure that measures are properly implemented, such as testing, field verification, labeling, special calculations, etc., these are identified and described.

6.1.7 Code language

The development of draft standards language is the final step in the written CASE study. The language is written to be compatible and consistent with the existing standards, in both organization and style. This may include revision or creation of supporting definitions, specification of test or performance standards, creation of exceptions or exclusions, cross references to other parts of the standards, development of supporting tables or values, etc. If necessary, calculation methods may be needed to enable users to demonstrate compliance with the standard.

Because the code language is central to the adopted regulations, it will typically undergo several drafts and refinements, which either preserve or clarify the intent. In addition, supporting documentation is developed, including calculation forms and compliance documentation, users' manual language with examples of standards application, procedures for acceptance testing or verification that the measure is performing as intended, etc. For appliance standards, this may include requirements for manufacturer certification and listing, for labeling, for testing procedures, etc.

6.1.8 Adoption and Enactment

Once the CASE study is developed, the proposed standard is ready to enter the adoption phase. The CEC's adoption process is focused on assessing the adequacy of all the information developed in the CASE study, and on formally reviewing the building energy efficiency or appliance standard language to ensure that it reflects the intention of the proposals. The adoption process is strictly defined by the CEC's enabling legislation and regulations, and involves multiple stages of review and refinement of the standards language before formal adoption by the Commissioners. The formalities of the adoption process ensure that proposals are legal and that they are also aligned with other state regulations, such as the California Building Code (CBC) and associated codes. Hearings and workshop proceedings are transcribed and published on the Commission's website and invitations are made for public comments of the proceedings. During this process, the IOUs participate as presenters and advocates in the public forums, and in less formal discussions and revisions of the standards. This work is focused in perfecting the CASE proposals, on addressing and overcoming objections from third parties, and on arriving at a standard that will be effective and can be adopted into regulations.

Occasionally, there will be political forces introduced into the adoption process. For example, sometimes an industry group which opposes a measure will focus their opposition on political tactics rather than on addressing the technical or economic merits of the case. This strategy usually fails, because the CEC's authority and charge is to adopt all cost effective measures that save energy. Unlike consensus standards (ASHRAE 90.1, for example), the CEC is only required to determine the technical validity of a proposed standard, not whether there is consensus to adopt it. Of course, the CEC prefers standards that are both technically sound and achieve widespread support, but the latter is not always necessary. There have been cases, however, where the Commissioners encountered such fierce political opposition to a proposed standard that they decided to defer adoption to a future date, hoping the main sources opposition could be addressed and satisfied. In these situations, the IOUs need to engage a political as well as a technical process in order to achieve adoption of their proposed CASE study standards.

The resulting regulations, after formal adoption, do not take effect for a period of (typically) nine to twelve months, which allows a transition period for the construction and appliances industries to prepare for the new rules. During this grace period the standards supporting documents will be revised to incorporate the new standards requirements. Appliances and equipment will have to be tested to the new standard and approved. The CEC publishes lists of appliances, by category, which meet the California energy standards. Within buildings, some equipment will need to satisfy appliance standards and will also fall within the requirements of the building energy efficiency code.

The building code changes are incorporated into compliance software and documents. The majority of Building Energy Efficiency Standards (Title 24) compliance is achieved by the performance method that allows lower efficiency in areas to be balanced with higher efficiency in others, provided that overall the energy budget meets that of a base building meeting all the prescriptive code requirements. The compliance software, along with supporting technical documents, must be revised and updated to reflect the new standards requirements. In addition, the grace period allows for training of the building industry, their code compliance consultants and building code enforcement officials, so that all parties understand the new standards.

All of these efforts are ultimately directed at saving energy in the field. The savings begin to take effect with the construction and operation of new buildings or appliance installations, beginning with issuance of building permits, or new equipment purchases, on the effective date of the standards (in the case of building standards), or with the manufacture of new equipment subject (in the case of appliance standards). As a result, it may be many months before the new buildings or equipment go into service. However, from that time forward, the savings will spread out into the market and will generate savings into the future for the life of the building or equipment.

6.2 Recommendations for Improving C&S Program Effectiveness

This chapter provides a set of general recommendations for making the C&S program efforts more orderly and effective.

6.2.1 Utilize the CEC's check list

Considering that potential proposals are many and diverse, it is useful to employ procedures to quickly rate and rank them early in each code upgrade cycle. This allows groupings of measures with the same types of issues and allows more efficient management of the C&S program resources. This may not lead to picking every "winner" but it should improve the chances.

The recommendation is that the CEC's Candidate Opportunities Report template be utilized and enhanced. This organizes the initial assessment of potential standards measures. The template sections are as follow:

1. Description
2. Technical feasibility issues
3. Market issues
4. Economic issues
5. Political feasibility issues
6. Level of effort

The template requires that each of the above categories is ascribed a numerical value between 1 and 7, with 7 having the greatest potential for success. The total for the six categories gives each proposal a ranking. This, then, allows the proposals to be compared with others so that those with the best chances for successful progression and adoption are selected. The Candidates Opportunities Report template is shown in the **Error! Reference source not found.**.

6.2.2 Assess CASE opportunities from IOU portfolio perspective

In addition to the technical merits of an individual CASE proposal, the C&S program must also assess the ability of a proposal to generate energy savings that will contribute to meeting the IOU portfolio savings goals. This is because the program is using ratepayer and shareholder dollars to produce reliable energy savings (electric and gas, as well as demand reductions), and it will ultimately be judged on its ability to claim credit for verifiable savings.

Not all types of CASE studies are valuable from this perspective. For example, there has been a lot of discussion about simplifying the standards, or about developing new compliance software. These types of changes could make the standards easier to apply and to enforce, which might produce energy savings over the long haul. They might, however, prove to be energy neutral. At best, they could produce savings in standards application, but it could be difficult to demonstrate cause and effect, and so difficult to rely on savings credited to the C&S program.

The C&S program could well judge the risk/reward parameters of this sort of code change to be negative, and not worth program effort to pursue.

Another example of this might be the development of Reach Codes. These would be next tier requirements which could be adopted by local jurisdictions to encourage higher levels of efficiency in their buildings. Reach Codes could have a lot of energy savings potential, but that potential might never be realized if nobody adopts or enforces them.

A countervailing consideration for the IOU portfolio might be advanced CASE proposals that address the long-term strategic goals for efficiency programs in California, such as the goal of zero energy residences by 2020. Achieving this goal will require aggressive new approaches to energy efficiency, and these might be most effectively implemented through advanced standards, new analytical approaches, and new areas of regulation through standards (e.g. residential plug loads, which must be reduced to achieve zero energy buildings). The IOUs have accepted these long-term strategic goals, and have pledged to advance building practices toward meeting these goals. The C&S program could contribute substantially toward meeting the goals, but through CASE proposals that might not produce savings as quickly or reliably as other, short-term CASE objectives. In such a situation, the C&S program might well choose to invest a portion of its CASE efforts toward the longer-term objectives.

Other considerations for the IOUs, in selecting CASE studies to pursue, are based on the program evaluation criteria that will be applied by CPUC evaluators in judging program accomplishments. The C&S programs should focus on CASE studies that will maximize their share of the resulting savings. These evaluation criteria include:

2. Compliance and Enforceability - standards with which users will have difficulty in compliance, or which officials will find difficult to enforce, should be judged less favorably than those which are easier to comply or enforce. Similarly, measures which may be unreliable in practice or in providing persistent savings should be less interesting to the IOUs than more reliable measures.
3. Naturally Occurring Market Adoption (NOMAD) - measures which are already widely used in the market, and so will be assigned a large NOMAD deduction, should be less favorably judged than measures which have a much larger potential to grow in market application after standards adoption.
4. Attribution - standards which are already highly associated with others' CASE efforts should be judged less favorable than measures which will require strong utility sponsorship to be adopted. For example, if an industry group is pushing its own favorite measure, the IOUs might be well advised to let them run with it, and to focus IOU resources elsewhere. This will result in a higher IOU attribution score, and thus a greater proportion of the ultimate savings. Of course, attribution score is not the sole determinant of C&S program savings; a high attribution score for a measure with small statewide savings could be less valuable than a lower attribution score on a high savings measure.

The recommendation is to apply these strategic portfolio considerations in the selection of CASE studies, and to do so explicitly. This will reinforce the multi-year strategic

dimensions of the C&S program efforts, and will allow the C&S program to be deliberate in balancing its suite of CASE studies between the needs for short term savings and for long term changes in how California builds its buildings. It will also focus the IOUs' CASE efforts on those measures for which they can claim maximum attribution.

6.2.3 Develop team strategies

It is believed that the C&S program will remain substantially the same for the 2011 round of standards upgrades as in the preceding two rounds. Since the late 1990s, the CEC's role has increasingly been to provide management and oversight of the standards development and adoption process, including overall editing of the complete Title 20 and Title 24 language and supporting documents and calculations. In the 2008 code update cycle, the IOUs provided the majority of the main proposals, as the C&S programs have devoted increasing resources to new standards development. This trend is expected to continue and it is therefore desirable that the IOUs refine their approaches to developing energy efficiency proposals for the C&S program.

The CEC and the IOUs should examine the whole C&S program's expertise and resources to see whether there is merit in allocating areas of specialism to the different IOU members of the statewide team. The examination can consider technical strengths and interests; facilities such as testing labs, design and energy modeling resources; the end use of savings (gas vs. electricity), and each organization's C&S program resources and capacity.

The recommendation is that C&S teams be identified, and that these be associated with particular areas of code development. A team is taken to include combinations of IOU staff, and the consultant expertise that they employ. The intention is to focus on greatest efficacy in identifying potential CASE studies and in improving the development and integration of codes and standards enhancements. This team approach can avoid duplication of effort, and can maximize the potential achievements of the IOUs, both individually and on a statewide basis.

For example, SCE has been actively engaged in daylighting requirements for glazing and photocontrols, both in program development and code change proposals. It follows, that SCE could take the lead on daylighting code change proposals for the 2011 cycle. Complementary proposals can be brought forward by the other utilities, but SCE could incorporate the larger picture and coordinate the efforts of the utilities as a group.

6.2.4 Pursue groups of proposals

The expanded editorial role that was adopted by the CEC for the 2005 and 2008 code enhancement cycles is an indication that the size and complexity of the current building energy code has increased. The diversity of proposals within a single code cycle means that CEC resources are likely to focus on maintaining logic and alignment within the documentation.

This recommendation is that each group of enhancements within the C&S program should have a core theme or sector that links proposals for Title 24 code revision and

Title 20 standards. The grouping of proposals within a theme or sector would concentrate efforts and reduce the extent of the revising and aligning the codes, standards and supporting documentation. It would look to anticipate any conflicts between code and standard requirements, and reduce overlap on associated proposals.

A corollary advantage of this recommendation is that it should simplify the CEC staffs' role in vetting and adopting CASE proposals. Given the worrisome limitations on state employee resources, this could become a significant consideration in CASE success.

This recommendation does not envision that unique individual proposals should be abandoned. Rather, it is suggesting that proposals should be brought together as bundles so that major sectors of energy efficiency can be developed simultaneously. This will facilitate coordination between the CEC and its IOU partners, and should result in more efficient use of resources and more effective CASE proposals.

For example, the list of daylighting proposals should all be brought forward as a group of proposals. The requirements for sidelighting glazing, toplighting glazing and photocontrols should be considered, reviewed and revised as a group, so that the requirements and language are consistent and complementary.

6.2.5 Utilize placeholder standards and multi-year approach

There are codes and standards proposals that generate immediate stakeholder resistance to adoption. In this situation, the code requirement or test standard is often adopted as a trade-off credit, so that compliance is energy budget neutral (Title 24) or at a threshold that ensures all existing products comply (Title 20). This is termed a placeholder standard, and allows the requirements to be tightened in subsequent code cycles. It also allows the industry to become accustomed to new standards requirements and may expose some of the issues that can constrain future development. The downside, of course, is that savings may be deferred for three or more years, but sometimes this may be the preferred compromise (when the alternative is no progress at all). This means that the particular standard will not contribute to current program cycle energy savings, but there could be a large pay-off is future program cycles. For those future cycles, the standards change might produce very large energy savings with minimal program effort, because the basic standard would already be in place and only the performance levels would need adjusting. (Evaluation note: this multi-year approach should be clearly documented in program filings and records.)

This recommendation supports this strategic, multi-year approach. The qualification is that placeholder standards be developed within grouped proposals (see preceding recommendation above).

For example, the daylighting proposals may include requirements for effective aperture, improved lighting quality or reduced glare with the goal of establishing a new metric for defining effective daylighting and estimating resulting energy savings. For effective code implementation, the proposal would also have to establish the standards for compliance tools to produce these metrics. It is likely that the development of a new metric and development of compliance tools to effectively model the new metric would not be

completed in a three-year code change cycle. Instead, the basis for the metric - effective aperture, glare index, daylight availability, seasonal energy savings, etc. would have to be established and included as a placeholder for further revision in a future code.

6.2.6 Develop statewide coordinated market intelligence

Population, market or design impact data are rarely available at the detailed level required for a CASE study, and often data has to be assembled on an *ad hoc* basis from industry information. The CEC and the IOUs do compile detailed end use studies that provide solid data for developing savings calculations, but front-end sponsorship of studies to support code development is rare. The IOUs do provide some useful information derived from energy efficiency incentive and rebate programs. However, there is an opportunity for developing coordinated market information that can be made available across the board for all those engaged in C&S work.

This recommendation envisages collaboration between the IOUs and the CEC in developing coordinated, statewide market information, which is forwarding looking. It is proposed that the IOUs pool resources to develop market intelligence to support identified topics for the next enhancement round, and then begin to develop a full array of inter-related survey information to identify gaps and outdated surveys. There can be specific exercises to reconcile inconsistencies and contradictions in the market information that are available, building on the existing evaluation and baseline studies. This work can also be extended to cover the naturally occurring adoption rates, measure implementation rates and compliance rates.

The benefit from this recommendation is that it provides supporting information for proposals that are in the process of being developed for the C&S program, and also that it provides analysis tools for identifying the market for products and construction measures that can be addressed by developing new codes and standards.

Following the example above, the development of a solid daylighting proposal would benefit from market intelligence on the current practice of window and skylight designs, the prevalence of photocontrols and the quality of daylighting systems currently being installed. Market intelligence data on current daylighting practices could be used by several of the code change proposals.

6.2.7 Incentivize stakeholder involvement

The C&S program is open to public scrutiny and the CEC tries to ensure that stakeholders are fully represented in the standards development process. However, there is a risk that issues that are critical to achieving acceptability can remain hidden until near adoption or even afterwards. In the former case, there can be late compromises to the proposals that amend the technical description and savings calculations. In the latter case, the Title 24 descriptions in the explanatory manuals may have to be stretched to accommodate a slightly different interpretation of the code. In extreme cases the proposal is dropped prior to its taking effect.

This recommendation tries to address the above issues by suggesting that critical stakeholders' participation be supported, either financially or by having an expert advocate retained to support the issue raised. The intent is that, by accelerating the development of CASE study criticism, the issue can be identified and resolved more quickly and to the benefit of all. This avoids the worst case, where a proposal is abandoned at the last minute because time has run out to resolve important issues. The incentives suggested should be used with discretion, to ensure that frivolous stakeholder objections are not supported.

6.2.8 Promote energy efficient building metrics

Building energy metrics can be useful in support of code compliance in providing norms for building types. In a sense, energy metrics exist in the compliance process as prescriptive requirements. There are other metrics, however, which can be used to inform building design and systems selections. For example, HVAC designers typically use sq.ft./ton as a rule of thumb on HVAC system sizing, and lighting designers use typical fixture spacing for typical ceiling heights as a guide to ceiling layouts. Work is underway to develop improved daylighting metrics to guide system design and efficiency. Such metrics could be incorporated as supplemental information in the compliance process, or could be reported back by the compliance software, as aids to identifying system efficiency and opportunities for optimizing designs.

The development of additional performance yardsticks and end-use breakdowns could help to disseminate and improve the practices of energy efficiency into the design professions. While not strictly a standards development issue, this recommendation is directed toward improving the design and compliance processes of the building industry.

This recommendation is that additional design guidance be developed that looks at building types and gives performance breakdowns in the form of metrics associated with energy efficient design, both for the whole building and for the individual system components. Having performance metrics that are correlated to typical compliance solutions can promote a better understanding and adoption of compliance requirements.

The development will require data from compliance solutions by building type and sub-type for typical climatic conditions. The development can be related to other statewide programs such as benchmarking, providing added normalization factors for analyzing consumption data.

6.2.9 Next steps

Applying the preceding recommendations, the next step for the IOUs' C&S program efforts, for the immediate 2011 standards revision cycle and beyond, would be to:

4. Each IOU should identify its best CASE proposal ideas, and decide which will be most likely to produce verifiable savings. Groups of similar measures should be assembled, to build on synergies and use resources most efficiently. At the same time, each should build their teams of staff and outside experts.

5. The CEC should hold its initial public meetings to hear all ideas for standards upgrades. The IOUs may find additional ideas and/or allies for their CASE efforts
6. Each IOU's CASE proposal ideas should be fleshed out using the Candidate Opportunities Report template. Each should then set its own priorities and strategies for ranking and pursuing CASE opportunities, considering program resources and abilities.
7. The IOUs and the CEC should meet to rank CASE ideas, coordinate who will do which, and agree on the strategy for the next and future rounds of standards adoption.
8. Each IOU should then organize its team and their assignments for the development of CASE studies, for the recruitment of stakeholders, and for their participation in the CEC's adoption proceedings. This should include both near-term CASE efforts, as well as long-term strategic efforts (e.g. market studies).

6.3 Candidate Opportunities Report Template

CANDIDATE OPPORTUNITIES REPORT: [NAME OF TOPIC]

Description

One paragraph description of the topic. Be clear if it's a CASE or an EMA. Describe how it's currently handled in Title 24 and what the improvement would accomplish.

Technical Feasibility Issues

List the technical problems that must be addressed for the topic to be adopted by Title 24.

Market Issues

Describe how the topic applies in the nonresidential market (building types, locations, applications, etc.) how ripe the market is for the topic's proposed changes, and whether there are any market problems that must be overcome, such as competition between manufacturers, or advances in technology or product availability. Describe roughly how big the market is which would be affected (e.g. all buildings, some types of buildings, some system types, how much of the market, etc.).

Economic Issues

Describe the economics of the topic. How cost effective is it? What is the nature of the energy and the demand savings? How quantifiable will the savings be? How persistent will the measure be?

Political Feasibility

Describe the likely supporters and opponents of the topic for Title 24 adoption. What is the likelihood of adoption?

Level of Effort

Describe the efforts that will be needed to prepare the report for this topic - compiling existing research, doing new analysis, writing new algorithms, etc.

Rankings

Fill out the following table:

Rankings are on a scale of 1-7, with 1 being the worst value and 7 the best. The overall ranking is simply the sum of the other rankings.

Technical feasibility	*Market readiness*	*Economic benefits*	*Political feasibility*	*Level of effort*	*Overall ranking*