## **Code Change Theory and Attribution**

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# ABSTRACT

Among the various energy efficiency program strategies, a Codes & Standards (C&S) Program is one of the most cost-effective methods of achieving energy savings and reducing emissions in pursuit of climate change goals. A state energy code has been in place in California for decades, recently bolstered by the California Investor Owned Utilities<sup>1</sup> (IOUs) inclusion of a C&S Advocacy Program as part of their energy efficiency portfolio. The use of a statewide energy efficiency code to capture savings for utility programs is rapidly spreading across the nation.

The magnitude and persistence of savings that result from a statewide energy code can be larger than many traditional incentive programs. This poses a very different challenge to C&S program managers and evaluators. In addition to the natural challenge of accurately estimating savings, attributing those savings to the parties involved requires careful documentation of activities. This is particularly important for a C&S program in which program activities are often not evaluated until code implementation, several years after the initial activities occurred.

In response to these issues, program implementers in California were tasked with developing code change theory reports that document important program activities for attribution purposes. This paper documents the process of creating the code change theory reports, detailing the challenges faced and the resolutions made to face those challenges.

Based on program experience, we plan to share how a successful C&S program requires careful thought and work to collect data demonstrating effort.

## Introduction

California has a history of strong standards for the efficiency of appliances and buildings, and they are a very important part of the state's approach to make efficiency a central part of its energy strategy. Appliance standards govern the sale of energy-using equipment, preventing the sale of less efficient products. Building standards regulate the minimum building construction requirements for all newly constructed and renovated buildings. As such, these standards play a unique role in the marketplace. The standards have two desirable effects: they bring the late adopters along toward improved efficiency, and they reduce the drag on market transformation efforts to push the efficiency curve forward. Standards are part of the latter stages of the technology adoption cycle, coming after efficient technologies have been developed and proven effective.

In the past, the California Energy Commission (CEC) staff took on the primary responsibility and effort in developing standards changes. This started to change in the late 1990s, when the IOU's

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C&S programs started to invest substantially in improving the standards, using public benefits monies allocated by the California Public Utilities Commission (CPUC). Until 2006, the IOU's C&S Advocacy program was considered a non-resource program with no defined energy savings and/or demand reduction goals. Instead, the program effectiveness was based on studies completed in support of the C&S rulemaking process. Beginning in 2006, the C&S Advocacy program was given authorization by the CPUC to be treated as a resource program in which direct savings could be attributed to the program. This key CPUC decision (CPUC 2005) established many of the ground rules for C&S program evaluation. In addition, C&S program evaluation was included in the CPUC's Evaluation Protocols published in 2006 (the "Evaluation Protocols") and updated in 2009 (Decision 10-04-029, Decision Determining Evaluation, Measurement and Verification Processes for 2010 Through 2012 Energy Efficiency Portfolios (CPUC 2010)).

As a resource program, an impact evaluation (Cadmus et al 2010a) of the C&S Advocacy program was first conducted as part of PY2006-2008 CPUC evaluation efforts. The magnitude and persistence of savings from traditional incentive programs rely on participation, which depends on recruitment efforts. In C&S programs, the magnitude of savings depends on compliance and enforcement of the energy efficiency requirements. This poses a very different challenge to C&S program managers and evaluators.

A critical aspect of the evaluation is determining the attribution factor – the percent of energy savings or peak demand reductions that resulted directly from C&S Advocacy program activities, and therefore should be attributed to the IOUs energy savings claims. To determine the attribution factor, the evaluators must have detailed records of all program activities related to the adoption of new codes and standards at the local, state, national and federal level, since they are not direct witnesses to the processes.

However, for a C&S program, program activities were not evaluated for the initial study until the new code was effective; several years after the initial activities occurred. The evaluation assessed savings for the 2005 and 2008 California building energy codes, while the evaluation study was completed between 2008 and 2010. Code development activities occurred at least two years, and as long as six, prior to the evaluation activities. Compounding matters, during this particular code development period, the program was considered a non-resource program and implementers could not anticipate what type of information to collect for future evaluation studies.

In response to these issues, the evaluators asked program implementers to develop code change theory reports that retrospectively documented important program activities for attribution of the 2006-08 savings. This paper reports on the process of creating the code change theory reports, detailing the challenges faced and the resolutions made to face those challenges. Based on this experience, we also provide recommendations to increase a C&S program's evaluability, which makes it easier for evaluators to determine the attribution of energy savings. A program with high evaluability has a well-defined program theory and design, an established data collection process, and other procedures that will assist evaluators. A main task of an evaluability assessment is to determine if the program is tracking all necessary information for evaluation purposes, in addition to providing recommendations on how to archive information.

#### Background

Before the formal rulemaking process begins, the CEC begins by screening the list of measures to be considered for either updating an existing standard or for adding a new measure not yet covered by California's regulations. The CEC relies on IOU and stakeholder participation at all steps in the process. An overview of the IOU C&S program is presented in Figure 1Figure 1, including advocacy and compliance improvement efforts, shown in the context of industry stakeholders ("market") and CEC

activities. Industry stakeholders provide valuable market data, test methods and feedback on code change proposals (Links 9 and 13 in <u>Figure 1Figure 1</u>). IOUs provide an important energy efficiency advocacy perspective (Links 6, 7, 8, 10, 19 and 20 in <u>Figure 1Figure 1</u>). IOUs often coordinate with industry stakeholders to come up with joint proposals, and occasionally do independent product testing and test method development.



Figure 1. IOU C&S Program Overview

## Methodology

As shown below in Figure 2, the first attempt to document efforts expended for Codes and Standards Enhancement (CASE) studies for the 2005 code cycle began in 2008. The CASE work began as early as 2002, including detailed technical and market studies to demonstrate that the technologies associated with the proposed code changes were cost-effective, reliable, and readily available. From initial assessment to final code adoption, the C&S program team proactively engaged all interested stakeholders, in an effort to seek wide consensus. The stakeholder advocacy was often the most time-consuming and challenging task in the rulemaking process. Additionally, spotty public records and the

time lapse between activities and documentation made it difficult to document information that would be useful to the evaluation effort.



#### Figure 2. Timeline of CASE Efforts, Documentation and Evaluation

Provided below is a partial list of CASE topics that were addressed for the documentation of the 2005 and 2008 code cycle. The complete list includes a large number of studies, covering multiple measures and end-uses.

- Multi-Family Hot Water Heating
- Skylights
- Cooling Towers
- Window Replacement
- Cool Roofs
- Duct Improvement
- Cool Roofs
- Refrigerated Warehouses
- Outdoor Signs
- Site Built Fenestration
- Swimming Pools
- Demand Responsive Indoor Lighting
- Envelope Insulation
- Residential Fenestration
- Indoor Lighting

The Code Change Theory Reports were developed retrospectively in response to the need to document IOU activities and results. The key elements were:

- Market Penetration Rates a description of the methodology used by the specific CASE topic to estimate pre-code adoption rates. The CPUC will conduct Title 24 compliance studies to evaluate market compliance of the adopted Title 24 measures after code adoption.
- Key Stakeholders –a table identifying the key stakeholders, the organizations they represent, and a brief description of their activities/roles in the CASE study development process.

- Program Efforts and Narrative Description a narrative summary of the IOU C&S program efforts for the specific CASE topic, including stakeholder contributions for which there is a record.
- Program Timeline –a timeline of major program events, and the CEC rulemaking workshops and hearings for the CASE topic.
- Program Logic Model –a visualization of the overarching IOU C&S Program Logic. The program logic model reflects the entire progression of the C&S program, from the development of energy-efficient technologies, to their advocacy and adoption, code compliance, and enforcement. The diagram is shown in the context of industry stakeholders ("market") and CEC activities. This diagram is Figure 1Figure 1.
- Appendices a set of supporting details which include specific language associated with the code change revisions, a stakeholder contact listing, a stakeholder communication log summarizing discussions between C&S team members and stakeholders, and an outline of all related CEC workshops and documents, including relevant discussion points extracted from CEC workshop transcripts.

To gather information for the code change theory reports, implementers relied on existing documentation sources, similar to a typical evaluation study process. Data sources included:

- The original CASE report
- CEC workshop transcripts
- Email logs and archives (as available)
- Meeting notes (formal and informal)
- Interviews with the original CASE author

# **Findings**

In preparing C&S program documentation for evaluation purposes, a number of issues arose. Given the time lag between implementation and evaluation activities, documentation sources were mostly archival. In general, the archival data were collected as part of normal business practices, in which their original intended use was for purposes other than evaluation. In addition, while some information was collected systematically, most of the qualitative information was collected in a non-systematic manner. This meant the information was not organized nor designed in a way to permit easy location of important documentation sources. Another complicating factor was the groundbreaking nature of the evaluation study. As the first formal impact evaluation of a C&S program, both the implementers and the evaluators were learning which information contractors were tasked with reviewing and sorting through a number of files and documents to compile the code change theory reports. The process was time-consuming and labor-intensive. The criteria for evaluation were developed simultaneously with the effort to document the effort by the IOUs for purposes of estimating attribution.

The documentation effort began with identifying utility participation in regulatory proceedings. Attendance at CEC pre-rulemaking and rulemaking workshops was documented along with notes from the transcripts of those meetings. The transcript provided a record of the specific proposals and contributions the IOUs put forth with regard to the codes and standards enhancement (CASE) measures.

In an effort to show efforts made by the C&S program to reach out to stakeholders, a log of email communication was compiled, providing summaries of pertinent emails, including the names of key stakeholders and the date range of these digital conversations. The timestamps on these emails

demonstrated the that the IOU C&S team was proactive in reaching out to interested stakeholders, addressing their concerns, and setting the stage for future CASE measures.

## Recommendations

For future implementation and evaluation efforts, a pro-active effort is required to ensure collection and tracking of all necessary information for program evaluation purposes. Also necessary is an approach for how to archive this information in a way that meets the needs of the program managers and their staff and consultants, the Energy Division of the CPUC that oversees the evaluation of this program, as well as their evaluators. With the program effort being undertaken for the 2013 California building and appliance energy efficiency standards, information is now being collected on a monthly basis. By no longer relying mostly on archival information, it is the intent of the program implementers to better demonstrate their efforts in the C&S process. In addition, program implementation contractors are learning which activities provide necessary evaluative information, not only for the evaluators, but also to improve their implementation efforts for the future.

The CPUC evaluation contractor, Cadmus, developed three factors of attribution; compliance, technical, and feasibility [Cadmus et al 2010b]. Certain activities can overlap between factors, and different CASE measures have different proportional importance between factors, but it can be helpful to track the purpose of various activities in order for evaluators to determine their role in the development and adoption of the new codes and standards.

Identifying types of activities, and standardizing their categorization across measure topics or even C&S program efforts, can help increase the ease and clarity with which evaluators can attribute savings to C&S programs. Examples of activity types could potentially include:

- i. Analysis This can include the technical analysis, cost effectiveness, savings estimates, or modeling
- ii. Communications This includes all forms of communication, including emails, phone calls, memos, formal and informal conversations. This can be among C&S members, or with stakeholders.
- iii. Contract/Agreements This includes administrative duties and high-level negotiations. These activities can be difficult to categorize, yet are essential to the success of a C&S program.
- iv. Data collection This includes background research, literature review, surveys, field testing, and any other type of data collection.
- v. Meetings These can be Utility organized stakeholder meetings or official prerulemaking or CEC rulemaking workshops, etc.
- vi. Reports Development of the C&S measure proposal includes report writing, feedback and review.
- vii. Tools Development of a tool (DOE2, SkyCalc, etc) can be an important step in enabling the regulation of a specific end use or increasing compliance.
- viii. Training Developing training materials, training marketing materials, attendee lists, pre or post attendee tests, or training evaluation forms can help improve both compliance and enforcement, depending upon the audience.

ix. Other - There are often activities that do not fit into these sorts of pre-defined options, yet play a vital role in the success of a C&S program. These activities should not be overlooked simply because they are difficult to categorize.

The development of a monthly documentation template can make it easier to collect information that may be of value to the evaluators. In 2010, HMG was asked by SCE to conduct an evaluability assessment to determine if the C&S program was collecting and tracking all necessary information for program evaluation purposes and to provide recommendations on an approach for how to archive this information in a way that meets the needs of the program managers and their staff and consultants, the Energy Division of the CPUC that oversees the evaluation of this program, as well as their evaluators [HMG 2010]. Phase I of that project included the development of a data dictionary that contains the database fields required for archiving program information that will be utilized as part of the program evaluation process. The data dictionary is not in regular use by the IOUs or their contractors, but was developed in consultation with the evaluators and program implementers.

In a parallel effort, HMG developed a tracking template for PG&E to use during the 2009-11 code cycle. The goal of this tracking spreadsheet is to make it easier for the CASE authors to document their efforts in a way that addresses the evaluator's needs. Below are some of the key data fields identified in the documentation template and the data dictionary report:

- 1. **CASE Name (Study Description)** This field documents the specific study related to this activity or document. This is useful information if later on, all entries for a particular CASE study measure need to be found and compiled.
- 2. Specific C&S Subprogram Identify which CPUC defined Codes and Standards subprograms<sup>2</sup> this effort is being conducted under. The example below is for "Building Codes: Advocacy, Extension of Advocacy, and CASE studies." Other categories in California could include: "Appliance standards: Advocacy, Extension of Advocacy, and CASE studies," "Compliance Enhancement Program: Measure-Based and Holistic," "Reach Codes: Local Government Ordinances and Green Building Standards," "Coordination (Statewide, EE Program and External Entities)," "Education and Training (not for improving compliance)," and "Quality Assurance & Program Evaluation Activities." Entry Activity Type This classifies the entry based on the activity for which it was created (Research activities, Stakeholder/CEC Communication & Outreach, CASE Study Planning).
- 3. Entry Description This field serves as a short summary of the activity or document (single or multiple) that has prompted the reason for the data entry.
- 4. **Supporting Files** This is the filename or full path of any document being referenced in support of the entry. For example, if the activity was a meeting, the meeting notes could serve as supporting documentation. If the activity was savings analysis, the spreadsheet used for calculations could be the supporting document. Providing the name of the document allows for it to be found more easily by evaluators at a later date. Based on the system capabilities, documents (either separately or together in a zip file) could be saved directly in the system.
- 5. **CPUC Attribution Category** This field identifies which CPUC attribution model factors should be associated with the documented activity. Choose all attribution categories that apply. Categories include the three major subgroupings; Compliance factors, Technical factors, and Feasibility factors.

<sup>&</sup>lt;sup>2</sup> Based on C&S PY09-11 program implementation plan

- 6. Logic Model Linkage This field identifies which C&S advocacy program logic model link number should be associated with the documented activity.
- 7. **Project Manager (Contact Person)** This field identifies which person to be contacted regarding questions for this entry (author, manager, etc.)
- 8. **Contact Person Affiliated Organization -** This field identifies the company affiliation of the Contact Person (above)
- 9. **Reporting Period (Month Recorded)** This field denotes the date and time at which an entry is recorded.

An example of the monthly tracking template spreadsheet is presented in Figure 3. The overarching categories of "Research Activities," "Stakeholder Outreach," and "CASE Study Planning" help align the tracking activities into categories consistent with the tasks detailed in the C&S program contracts. This allows the template to serve the dual purpose of enabling the C&S program managers to track the progress of C&S topics for monthly reporting, in addition to preparing for evaluation. This was an important alignment increasing the acceptance of the documentation by CASE authors and managers.

Filled by CASE project lead	Filled by Contract Manager				
CASE Name: NR Lighting					
Reporting Period: May 2010					
Project Manager: Josh Rasin	Organization <sup>•</sup> HMG				
					l
Monthly Project	Supporting Documont	Attribution Factors Logic			
A accomplishments	Supporting Document	Compliance	Compliance Technical Eastibility		<u>Logic</u> Model
Accompnishments		Compnance	recinicai	reasibility	<u>Miodel</u>
					LINK
Research Activities					
Data collection, market research, technical, economic, & feasibility analysis, etc.					
Created draft calculation procedures and	InteriorLighting DraftPerforman	Y	Y		8
assumptions used in making performance	ceCalcs070205.xls	-	_		
calculations for IOU review					
Collected detailed technical specs and	CostDatabase072510.mbs		Y	Y	10
costs of high efficiency lighting products					
Developed indoor lighting models to			Y		10
perform TDV energy savings					
Stakeholder/CEC Communication & Outreach					
Date, stakeholder name and organization, issues discussed and corresponding resolutions;					
Please note major positive/negative effe	orts of other stakeholders related	to the CASE s	tudy.		
On May 28, 2010, discussed with John	TeleconferenceNotes071510.doc		Y		
Smith of ABC Property Inc.; presented					
information to address his concerns on					
measure cost effectiveness					
Conducted a PAC meeting to discuss and	LightingPACMeetingNotes 0713	Y	Y	Y	9
resolve outstanding issues related to the	10		_	_	-
proposed changes					
CASE Study Planning					
Activities in CASE topic vetting, initial assessment, coordination with CEC and other IOUs					
Briefed C&S Statewide team on lighting	LightingIOUMeetingNotes 0731		Y	Y	9
designs for big stores and further	10				
discussion with CEC lighting consultant					
Significant Issues or Changes					
Describe any significant technical, fiscal, and contractual issues					
Discussions with [trade organization]	TeleconferenceNotes072210.doc			Y	
indicates the organization will express					
concerns of the stringency of proposed					
process					
process					
Activities and Accomplishments during the next period					
Concise description of major activities and accomplishments expected for the next month					
Will finalize calculation procedures					
Will conduct life cycle cost analysis					
Will meet with CEC staff and NEMA					
spokesperson on industry concerns					

#### Figure 3. Monthly Documentation Template Developed for 2013 Code Cycle

Several of the fields identified in the list and template above are used to identify the measure topic and timeline of the activities being tracked. The dual purpose of these fields are important as they

increase the ease with which entries can be checked for quality by the program manager, as well as providing context for the evaluator.

## Conclusion

A C&S Advocacy program has different data requirements than traditional incentive program evaluations, not only for the evaluator, but also for the implementer. In addition to the challenge of accurately estimating savings, attributing those savings to the parties involved requires careful documentation of activities. A critical aspect of the evaluation is determining the attribution factor through detailed records of all program activities related to the adoption of new codes and standards at the local, state, national and federal level. However, complicating matters is the time lag between program activities and adoption, between adoption and effective date, and between the effective date and evaluation activities. Evaluation follows code implementation, which itself is several years after the initial activities occurred.

In response to these issues, C&S advocacy program implementers were tasked with developing code change theory reports that document important program activities for attribution purposes retrospectively for the 2006-08 cycle. As an archival process for the first evaluation, the effort was time-consuming and labor-intensive. To better meet the challenges for the next evaluation, implementers are striving to increase the program evaluability by tracking all necessary information in an on-going process as part of regular implementation activities. By categorizing activities on a monthly basis, documentation templates facilitate the evaluator's ability to search through a large volume of information relatively quickly to identify what documents are needed during each phase of the evaluation process, thereby increasing the evaluability of the program. It also helps to ensure that the program provides all the necessary documentation to support their energy savings claims to the evaluation. As a secondary benefit, the documentation template streamlines the tracking process for IOU C&S program contributors, by allowing them to record their activities easily, in real time, and in a standardized format.

To further improve upon the process, the California IOU C&S program implementers are designing an even more streamlined evaluative data collection process. A data dictionary is being designed to log and archive program activities based on standardized data entry fields for each type of activity identified in the program logic models. In order to avoid the risk that multiple users entering data may have different definitions or perceptions of what goes into a data field, thereby confounding the data, the database includes a standard list of terms and definitions. The data dictionary will be used to support the future development of a database that will store each entry. By categorizing activities, the data dictionary and its associated database will facilitate the evaluator's ability to search through a large volume of information systematically and relatively quickly to identify what documents are needed during each phase of the evaluation process, thereby increasing the evaluability of the program. It also helps to insure that the program provides all the necessary documentation to support energy savings claims.

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