

Workforce Training that Changes Behavior and Improves Outcome

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ABSTRACT

Energy codes are complex. Workforce turnover happens. Time constrains effectiveness. Motivation is a major driver for competency. These barriers and others create a situation where the energy savings delivered from building energy codes often fall short of expectations. The most ambitious code accomplishes little if the process undermines its implementation. Implementation strategies rely on each market actor playing their role effectively. Any weak link in the compliance chain diminishes or eliminates the energy savings at the meter. The California Investor Owned Utilities' (IOUs) Statewide Codes and Standards (C&S) Program is moving away from the traditional energy code training approach and replacing it with a fully integrated system that moves toward measurable outcomes. Our new direction helps ensure we:

- 1) Move beyond information-based training delivered in lecture format to action-based training that transfers to each market actor's job performance
- 2) Employ a role-based training approach through which all market actor groups in the compliance supply chain are equipped with the knowledge and tools they need to do their job
- 3) Extend beyond the classroom to provide on-the-job training, observe market actors' performance and processes, and assess additional performance improvement opportunities
- 4) Require key stakeholders to establish and communicate expected performance standards and measure actual performance

Compliance Improvement as a Resource Program

As established in the "Standards Education and Training as a Resource Program" paper presented at the 2008 ACEEE Summer Study on Energy Efficiency in Buildings, codes and standards compliance enhancement is emerging as a compelling resource program strategy that provides significant low-cost energy savings. Since 2001, the California Energy Commission (CEC) has adopted numerous changes to California's 2008 Building Energy Efficiency Standards, Title 24, Part 6 (Standards), advancing existing standards and significantly increasing the scope of California's regulations. This widened scope created a critical need to support key stakeholders and market actors by helping them to understand not only the technical aspects of code changes, but also to understand their role in compliance. As a result, California's C&S Program expanded to include a new compliance improvement subprogram in the 2010-2012 energy efficiency program portfolio. Through the new subprogram, C&S is leveraging existing and developing new education and outreach activities to equip residential and nonresidential building industry market actors with the knowledge, skills, and tools they need to improve their

effectiveness and overall compliance with California's building energy efficiency code. Expanding the C&S Program to include the Compliance Improvement subprogram will help ensure that the full potential of the IOU's C&S advocacy efforts are realized and thereby result in a comprehensive C&S Program.

The Complexity of California Building Energy Efficiency Standards

By most standards of measure, California boasts the most stringent and complex building energy efficiency code worldwide. The Standards encourage use of all cost effective commercially available products, measures, and techniques in new construction, addition, and alteration. Because not all measures are feasible or cost effective statewide, the code requirements are broken down via climatic conditions and contain many exceptions and alternatives. In addition, a separate compliance path, the performance method, provides designers the flexibility to demonstrate that their proposed building uses the same or less energy than the prescriptively built building would use. The code encourages adoption of newly emergent technologies by providing compliance credits for including these technologies in the building design. Finally, there are installation and verification requirements that require the use of third-party inspectors. These inspections require preparation and submission of standardized reports to centralized provider registries and to a centralized repository.

Compliance with the code is demonstrated through the compilation and submittal of design documents, energy compliance forms, building models, plans, and specifications. The architect, building owner, or general contractor will frequently hire an energy consultant who acts as the code expert and will advise the design team on which features must or may be installed and provide the greatest benefit to the building performance. These energy consultants must be able to ascertain and communicate the requirements and options in the context of any and all building permit scenarios. They must also be able to build an accurate model to demonstrate compliance via the performance method.

The task of enforcing the code falls largely on the more than 400 individual city and county building departments, because the issuance of a building permit is the trigger event for the code. In California, permits are required for most types of construction, even for simple window or HVAC change outs or reroofing and other types of alterations. Of course permits are required for all types of new construction from residential roof additions to high-rise office buildings. Publicly funded schools follow a similar but separate path. Hospitals and prisons must follow a different set of institutional requirements and are exempt from the building energy efficiency standards.

Because building department personnel are also required to enforce other codes, particularly those involving life and safety, the building energy codes can sometimes take a lower time priority. With very little time to enforce a very complex energy efficiency code, building department personnel are expected to review plans and energy documents to ensure compliance. They are then expected to verify that the required components are installed properly in the field and that the required installation and acceptance testing forms are present on the job site and completed properly.

Without proper compliance and enforcement, the energy savings delivered by the requirements will fall short of expectations. Because the potential savings are so high, it is in the utilities' and ratepayers' best interest to improve compliance by providing effective training and job support to energy consultants and building department personnel.

Potential Savings

In 2006, the C&S Program transitioned from being classified as an information-only program to a resource program; that is, a program that creates quantifiable energy savings. As part of that transition, the California Public Utilities Commission (CPUC) undertook several efforts to estimate the savings generated by the C&S Program's advocacy activities. Program evaluators conducted a study to estimate compliance rates for a handful of high impact measures that the utility's C&S Program advocated for inclusion in the building energy standards. Evaluators visited ten building departments representing a mix of typical weather conditions; reviewed 400 building records, including permits and plans/drawings; and performed on-site inspections of 100 sample projects. In addition to determining the compliance rates for the selected measures, evaluators also attempted to identify broken links in the compliance chain. Findings included the following:

1. In some cases, the field inspection showed that the building was built to code requirements, even though the plan review process or field inspection process was documented to be less than ideal. Although compliance was high, the supporting process was broken so sustainable energy savings could not be predicted with much confidence. Without a good, consistent enforcement process, compliance with the code relies almost entirely on the good will of the design community.
2. In other cases, the building department enforced the code, yet compliance review via plan check and field inspection still revealed discrepancies and errors in enforcement.
3. In yet other cases, the energy code appeared to be ignored altogether.

Overall, evaluators found that compliance varied tremendously and on average, ranged from zero percent to 72%, depending on the measure investigated (see Chart 1 below).

Chart 1

Measures	Initial Compliance Rate* (2007)	Compliance Rate Target (2011)
Residential Hardwired Lighting	72%	81%
Residential Duct Improvement	27%	50%
Lighting Controls Under Skylights	56%	70%
Ducts, Existing Commercial Buildings	0%	31%
Ducts, New Commercial Buildings	0%	31%

Because the transition to a resource program is so recent, the C&S Program evaluation methodology is still evolving and has changed since the original evaluation in 2007. The most recent evaluation, conducted in 2009, used a different methodology than the original, thus making it impossible to compare the reported results directly. The findings from both studies reinforced the commonly held, yet mostly anecdotal, belief that the savings expected from building energy standards improvement must be matched with a concerted effort to improve the

understanding, application, implementation, and enforcement in order to achieve the energy savings predicted by the building energy standards improvement models.

Each time the CEC updates the Standards, it increases the stringency by approximately 15% compared to the previous requirements. The initial evaluation results revealed that improving compliance rates for the five highest impact measures by an average of 20%, could save up to: 8.4 GWh, 2.5 MW, and 0.38 MTh, and reduce emissions by 4,600 tons CO₂ and 0.6 tons NO_x. With a non-compliance rate equal to approximately 17%, C&S staff recognized that we must consider how much energy we can save and greenhouse gas emissions we can avoid by simply improving the enforcement of existing energy codes. Optimizing enforcement of the existing requirements could actually result in more savings more quickly than we would achieve through advocating for changes in the upcoming triennial code change cycle. It became clear that we must expand and enhance the existing education offerings to help improve compliance and realize the full savings generated by the code.

Although the program only claims savings for the specific measures for which it advocated adoption, C&S realized that the education activities must address the standards in their entirety. C&S prepared a forecast of the potential savings that could result through training and outreach activities over a span of approximately six years. The forecast considered the potential impact each market actor typically has in the compliance cycle, the percent of those market actors the Program education and outreach efforts could reach, and, ultimately, estimated how those efforts might change the compliance rate for a particular measure. As discussed above, the compliance chain is complex, thus, several factors were included in the original forecast. For example, the first year after a new standard becomes effective; the compliance rate tends to climb quickly, with diminishing returns in the following years. Also, if the compliance rate is already high, identifying and influencing the remaining market actors will be more difficult. In addition, if there are a large number of widely dispersed actors, education activities must flow along multiple parallel paths to create a change.

Needs Assessment Identifies Performance Barriers and Solutions and Preferred Learning Styles

As a first step in determining how to improve compliance rates, we conducted a scoping study to identify the true barriers to compliance and solutions we may employ to improve compliance across the supply chain. We interviewed various market actors, including: Energy Consultants, Plan Checkers, Field Inspectors, Third Party Verification Providers, Commercial and Residential Contractors, Installers, and Builders. **Overall, we learned increasing training and support for local building code officials is the primary key to improving compliance.** Scoping study participants reported:

- Compliance often isn't expected or enforced
- The building energy standards and manuals are complex
- Plan checkers and field inspectors have limited time available to verify compliance documentation and to inspect energy conservation features in both residential and nonresidential buildings
- Building energy standards change frequently (are updated) requiring people to maintain understanding of both current and past building energy standards as many projects are completed under grandfathered building energy standards

- Many building departments have insufficient budgets, staffing and lack of time for travel and training; builders/contractors who do comply with the code often lose business to those who don't comply
- Compliance documentation submitted to building departments is often inaccurate

We concluded that we could have the biggest near-term impact by equipping the market actors who kick off the compliance supply chain—including energy consultants, plans examiners, and field inspectors—with the knowledge, skill, and tools they need to more quickly and easily focus their time on important, high-value energy efficiency issues.

We then conducted an online survey of these market actors to learn more specific information regarding their primary job focus, credentials, familiarity with various aspects of the building energy standards, and their desire and ability to attend energy code training. The survey was distributed to the key market actors listed above: building department staff (plans examiners, building inspectors, and supervisors), and to energy consultants that regularly prepare Standards compliance documentation. Nearly all respondents expressed an interest in attending a wide variety of energy efficiency courses, almost 80% indicated they are able to participate in a half-to full-day course approximately twice annually and that they prefer classroom-based training. The majority of respondents work on both residential and nonresidential projects, and more than 90% agree that understanding the principles and engineering behind the Standards helps them to perform their jobs more effectively. It appears that this audience is eager for education related to the Standards that will improve their skill set.

We also asked respondents to provide logistical information regarding their ability to participate in training sessions, their preferred format, frequency, and location. Respondents were asked several questions about whether specific activities or conditions are important to effectively perform their duties. In most cases, the majority indicated it was very important to have a good working knowledge of the Standards, access to and awareness of resources to obtain expert help, adequate time to complete their work, and processes that allow them to adequately track permit status and a project's energy efficiency features. Notably, in almost every case, respondents rated their own expertise or work conditions slightly lower than the importance of the activity. This again confirmed the potential students' desire for more information.

Finally, in follow-up interviews, we asked plans examiners, building inspectors, and energy consultants how we could improve upon traditional energy code training offerings. We heard:

- Emphasize hands-on training over lecture-based classes.
 - Don't use just PowerPoint slides with bullet points!
 - Provide hands-on practice, use equipment, props and demos.
 - “Building Inspectors love to touch and poke stuff. And debate! Let them search for and find [using actual equipment samples] where the [energy] labels are hidden by the manufacturer.”
 - “Include lots of questions related to one or more sets of [actual] building plans [in the classroom].”
 - Have activities where plans examiners use real plans and “cheated calcs” so they can learn to find the wrong data.
- Keep it simple, straightforward. Forget the fluff. Just teach what students must know.
 - “Right now, folks are coming out of classes overwhelmed, with their brains spinning with information overload. And then when they get back to work, they can't always

immediately apply what they think they heard in class, so they forget it. And then the class seems like a waste of time except for getting off work and getting continuation education credits!”

- Offer modeling classes for beginners that walk students through building T24 from beginning to end, using specific software and real plans/blueprints.
 - Start with basic, simple building plans, and then go on to a bit more complex plans.
 - Include lots of demos and time for hands-on practice and time for all the questions students want to ask.
- Be creative with training.

“Training needs to be fun. Some comedy. Some excitement.”

A New Training Approach

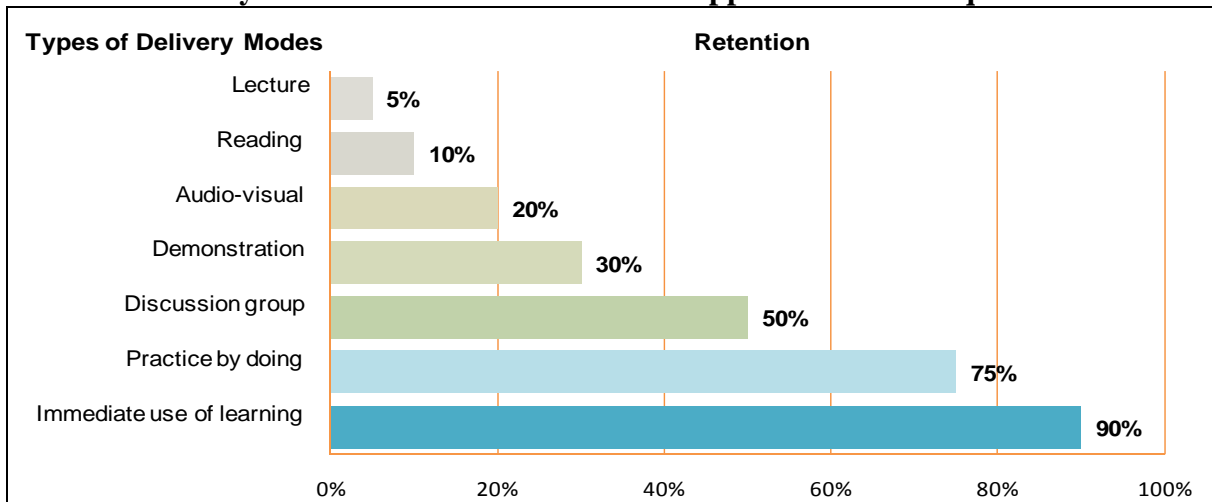
With this feedback in mind, C&S is designing and implementing a new training curriculum that responds to plans examiners’, building inspectors’ and energy consultants’ preferred learning style while targeting specific gaps in knowledge and behavior. The following six new courses are currently under development and scheduled to roll out as indicated:

1. Residential Standards Essentials for Plans Examiners and Building Inspectors (available in July)
2. Nonresidential Standards Essentials for Plans Examiners and Building Inspectors (available in July)
3. Residential Standards Essentials for Energy Consultants (available in September)
4. Nonresidential Standards Essentials for Energy Consultants (available in September)
5. Best Practice Residential Performance Modeling (available in December)
6. Best Practice Nonresidential Performance Modeling (available in December)

The new curriculum will depart from the lecture-based approach typically used throughout the building energy code industry.

Numerous studies indicate, as our own needs assessment confirmed, that people learn best — and are more likely to retain and apply their learning — when the learning experience includes a variety of teaching styles and methods. The figure below clearly shows the positive impact that actively involving participants has on the long-term effect of the training.

Why the Traditional Lecture-Based Approach Isn't Adequate



Source: ftp://ftp-fc.sc.egov.usda.gov/NEDC/isd/methods_media.pdf

The new curriculum:

- Focuses on the role-based performance requirements for key market actors.
- Accommodates the preferred learning styles of the various target audiences (market actor roles).
- Reflects the principles of effective adult learning to provide training experiences that are more likely to have a positive impact on participants' "real world" behavior.
- Provides ample practice opportunities so training participants can check their understanding of new content and concepts and receive corrective feedback and coaching as appropriate.
- Uses pre- and post-testing to measure gains in knowledge as a result of a training experience.
- Employs job aids and "quick reference" material to support on-the-job performance.

Additionally, the new curriculum will:

- Use a consistent look, feel, and message to provide participants who attend multiple classes with a coherent, consistent learning experience.
- Complement the CEC's online training offerings to maximize training efficiency and effectiveness.
- Include consistent messages and linkages to: 1) the effective training historically provided by the IOUs' energy training centers to other compliance supply chain market actors including: business, residential and multifamily architects, engineers, contractors and builders, and 2) the training provided to Home Energy Rating System (HERS) Raters by HERS Providers.

Some of the ways in which we are applying these best practices and responding to market actor's needs in the new courses we're designing, include the following:

- **Role-based courses**
 - Distinct courses are being designed for specific roles, meaning they are being designed for a specific market actor. Most role-based classes will be modular — people take just the training they need based on their experience level, their role, and their area/subject of interest. Using this approach will help avoid situations where instructors “teach to the lowest common denominator” and don’t do justice to more advanced participants in more advanced courses.
 - The terminal performance objectives and enabling objectives for each module of instruction, for each role, reflect the on-the-job requirements and realities identified in our needs assessment and follow-on interviews. These objectives form the cornerstone for all presentation, practice, and testing.
- **A variety of learning activities that parallel the on-the-job performance requirements**
 - Case-Study-Based Practice Opportunities: Classes provide hands-on practice, using actual forms and plans based on a real-world case study scenario. For example:
 - We’ll provide training participants with sample plan sets and compliance forms and have them highlight the top five items they would pay attention to when examining plans and performing field inspections.
 - Using a description of a subdivision, for a specified model in the subdivision participants will identify which of the model variants represent the “worst case” for energy efficiency and check against that worst case.
 - Using a plan showing skylights, have energy analysts determine daylight zones in an office building. Have plan checkers review the calculations and demarcations
 - We’ll ask training participants to compare the plan sets to the compliance forms and confirm that the energy data on the plans is equal to, or better than, what’s on the compliance forms. Training participants will be invited to report out on the activity results to gain feedback, correct misunderstandings, and share ideas and experience — and “cross pollinate.”
 - Treasure Hunt/Diving Exercises: Using a description of a customer question or situation, participants will locate the information in the Standards that resolves the issue or answers the question.
 - Role Play Exercises: Volunteers from the class will be invited to play the role of a plans examiner and customer. Given a customer at the building department counter scenario (and any appropriate checklists or information sheets that are available), participants will explain the relevant procedures, requirements, and other information and provide the appropriate form(s) so that the customer knows what is needed to comply with the energy efficiency requirements for the situation.
 - Group Work to Help Prioritize Time and Attention: After reviewing key codes concepts, we’ll break plans examiners and field inspectors into groups and ask them to identify what they could focus their time on if they only had 15 minutes to devote to energy code compliance. Given a sample Title 24 compliance report for new construction, and given a description of a time limit, plans examiners and building inspectors will prioritize where he or she would most effectively and appropriately focus their attention based on the content of the report.

- Cross Pollination Opportunities: Have a plans examiner and building inspector work together in a pair. This is not to teach the building inspector how to plan check but to build appreciation for the tasks of the plans examiner, to share understanding of the requirements, and to address what the building inspector needs from the plans examiner in order to be more efficient in the field during inspection of energy efficiency matters. For example:
 - Verify that all the required documents are included in the application packet. If they are not, describe the corrective action/procedure needed.
 - With all required documents included, select the appropriate CEC checklist needed for the plan review. Proceeding line by line through the appropriate checklist:
 - Specify where in the packet the relevant information is located (where do you find it on the plans, CF-1R or other document/form).
 - Describe the importance or purpose of the information being requested. For example, why are you being asked to look for it, and what makes it so important that it is on the checklist?
 - After reviewing the information in the plans or form, place a checkmark in the appropriate box on the checklist.
 - Highlight “flag” the important efficiency items that the building inspector needs to check during inspection.
 - Determine, based on the plan review, whether or not the applied-for permit would be granted. State why or why not, and describe the relevant next steps in the permit process.
 - Describe considerations for conducting building inspections that focus on the areas/issues noted. For example, timing in the construction cycle, amount of time allocated for inspection, etc.
 - During the debrief session, each team could describe some of the key points of what they learned from the collaborative activity.
- **Job aids.** In addition to receiving a comprehensive workbook that can serve as training participants’ primary go-to resource, participants receive other job aids, such as: external lists, diagrams, worksheets, or other references that summarize information, processes, or approaches that support an individual’s activities by directing, guiding, structuring, or otherwise informing performance.

On-the-Job Support

The C&S Program will supplement the new role-based training by providing on-the-job training and support to select local building department personnel. The Program will launch a performance improvement effort with several local governments during which we’ll investigate performance expectations and rewards, knowledge and skill gaps, and code enforcement processes in detail, in order to identify performance improvement opportunities to streamline enforcement practices and improve consistency across jurisdictions. Results of these research efforts will inform the total package of performance improvement solutions the Program will implement to help improve code compliance rates.

The Program will conduct a detailed review of existing building energy code permitting, tracking and inspection processes and practices, including staff interviews. Program personnel will also use the information gathered during their review to identify and create tools to simplify enforcement (i.e., electronic forms, checklists, a code manual help system, etc.) or possibly a permit tracking and management system to streamline permit applications and data recording. In addition, they will provide the new role-based training, resources, and support for staff and local market actors, in addition to supporting market studies and tracking compliance status in participating and nearby jurisdictions. Effective implementation of the on-the-job support effort will require at multiple levels including the Chief Building Officials, Mayors, or City Councils in participating jurisdictions.

Partnering with Industry Stakeholders

The Program will collaborate with the numerous stakeholders in the industry who have the potential to impact compliance in order to: present a unified front and consistent message to each market actor group, harmonize the numerous disparate compliance improvement activities underway, and improve the performance of all market actors in the compliance supply chain.

The Program will invite stakeholders from each market actor group in the building energy code compliance supply chain to participate in an Energy Code Compliance Advisory Group. Overall, C&S will strive to develop a group that is comprised of people who can help create the push/pull strategy required to effectively move all market actors in the building energy code compliance supply chain through the changes that are necessary to improve compliance. For example, initial members of the compliance advisory group may include: the CEC, California Association of Building Energy Consultants, California Building Officials, California State License Board, the International Code Compliance chapters, contractor associations, CPUC Energy Division, Standards experts, other compliance related taskforces, etc.

We must call upon the group's collective knowledge and ability to improve the performance of all market actors in the compliance supply chain to ensure one actors' performance doesn't negatively impact those on either side of the chain. For example, when a customer who is replacing their air conditioner accepts a bid from a contractor that does not include a permit, an unlevel playing field is created amongst HVAC contractors; when compliance forms are ignored or improperly filled out by contractors or builders, building inspectors' jobs are impacted; an energy consultant's work may be rejected by plans examiners who aren't sure how to interpret the information on Standards reports; etc.

As working members of the advisory group, compliance stakeholders will be encouraged to draw upon their combined knowledge, experience and capabilities to guide and coordinate the implementation of effective compliance improvement solutions thereby helping to: ensure judicious and cost effective use of ratepayer and taxpayer funds; avoid duplication of efforts; provide market actors with consistent direction, instruction and tools; establish and communicate consistent performance expectations and metrics; etc.

Summary

While the new role-based curriculum is being developed, training requests from building departments continue to flow in that C&S must fulfill. The training development team developed a "stop-gap measure" by taking the existing course material and augmenting it by: 1)

creating separate residential and nonresidential courses designed specifically for plans examiners and building inspectors, 2) organizing the material into distinct modules with clear learning objectives, 3) inserting “Check Your Understanding” sections at the end of each module which give participants and instructors a chance to pause and see if gaps need to be filled or information needs to be clarified, and 4) providing participants with a comprehensive workbook that some building department personnel are now referring to as their first “go-to” resource. Additionally, the classes have been restricted to include only plans examiners and building inspectors, rather than a larger gathering of people with diverse roles such as designers, contractors and builders. Simply structuring the courses in a new way, making the classes more interactive, and restricted to specific roles, has already had an impact as indicated in course evaluations.

Time will tell how effective the new role-based curriculum will be. While pre- and post-test results will enable the C&S to evaluate knowledge swing as courses are delivered in the near term, the real results will appear as evaluators appointed by the CPUC measure compliance rates at the end of the program cycle and attribute energy savings to the training effort.