DOCKETED	
Docket Number:	17-EBP-01
Project Title:	Improving Energy Compliance of Central Air-Conditioning and Heat Pump Systems
TN #:	224769
Document Title:	Statewide Utility Codes and Standards Team Comments Statewide Codes & Standards Program Compliance Improvement Support
Description:	N/A
Filer:	System
Organization:	Statewide Utility Codes and Standards Team
Submitter Role:	Public
Submission Date:	9/21/2018 2:16:22 PM
Docketed Date:	9/21/2018

Comment Received From: Statewide Utility Codes and Standards Team
Submitted On: 9/21/2018
Docket Number: 17-EBP-01

Statewide Codes & Standards Program Compliance Improvement Support

The Statewide Codes and Standards Team is pleased to provide work products that the Energy Commission may use to support HVAC code compliance. These products include:
â€¢ Papers written by industry experts in which compliance solutions are presented ,
â€¢ Courses specifically designed for HVAC contractors,
â€¢ Job aides designed to help easily communicate code triggers and requirements,
â€¢ Outreach campaign materials piloted in West Sacramento
â€¢ Focus group results

Additional submitted attachment is included below.

REGARDING: Improving Energy Compliance of Central Air-conditioning and Heat Pump Systems
Docket number 2017-EBP-01

September 21, 2018

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Sincerely,

2016 Title 24 Part 6 Essentials

Residential Standards

AC Quality Installation Contractors

Instructor Guide

January 2017

Energy Code Ace offers traditional classroom courses for AC Contractors at IOU training centers or in the field upon request. These trainings are designed to increase knowledge and skill related to Part 6 compliance.

Energy Code Ace™
HELPING YOU PLAY YOUR CARDS RIGHT

SDGE A Sempra Energy utility · SoCalGas A Sempra Energy utility · Southern California Edison · Pacific Gas and Electric Company

This program is funded by California utility customers under the auspices of the California Public Utilities Commission and in support of the California Energy Commission

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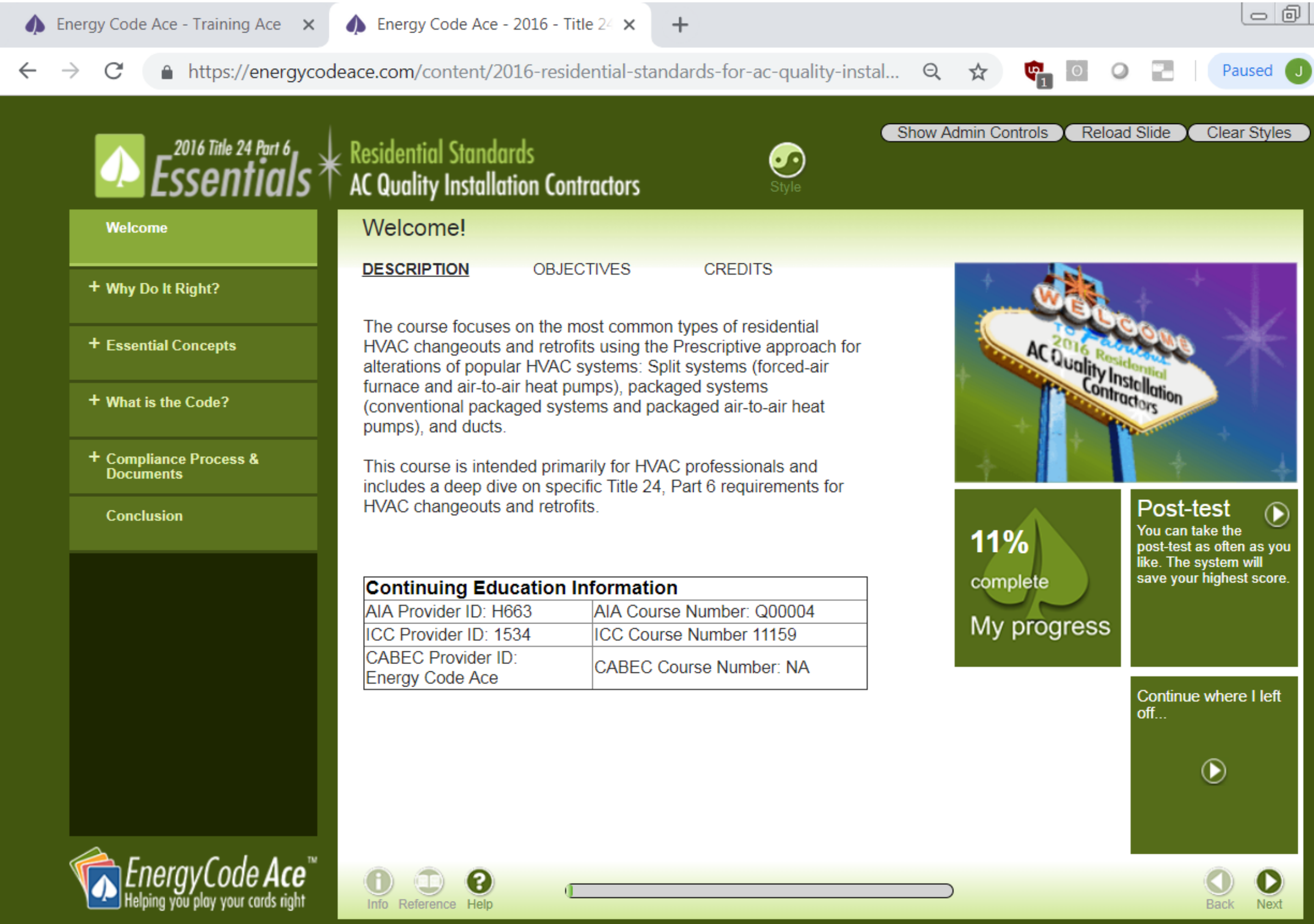
On-line self-study course offers Residential AC Contractors convenience of completing training anytime, anywhere



Where to find the self-study course on EnergyCodeAce.com

Step 1: Click on the Training tab

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Training Ace

Energy Code Ace free training courses target a wide range of "hot topic" measures and audience groups, and are provided in a variety of formats. Use the filters on this page to find the perfect class to help you "decode" the California building and appliance energy efficiency standards.

Can't find what you are looking for?
Click here to see the complete list of courses and delivery options we offer.
Click here to request one of our traditional classroom courses.

Title 24, Part 6 2016 Standard

2016 Title 24 Part 6 Essentials - Residential Standards for AC Quality Installation Contractors

This course is designed to help HVAC contractors standout from the competition, and help their customers stay cool and save money by complying with the 2016 Title 24 building energy standards. It addresses when the standards do and do not apply to a residential HVAC project, which requirements are triggered when you're just changing part of the system, when you need to involve a HERS Rater, and what compliance forms the building department will require.

Take Online Self Study

Filter Available Training

LIST | CALENDAR

Event Type: On-line Self-Study

Standards & Regs: 2016 Standard

Topics: HVAC & Ducts

Building Types: Residential

Roles: HVAC

Accreditation (CEUs)

Step 2: Set the filters as shown here

PERMITS CAN SAVE!

Energy Code Ace partnered with the City of West Sacramento to do an outreach campaign to raise awareness regarding the benefits of permitted work. The campaign included posters, flyers, mailers, bumper stickers and online web banners.

Be legit. Pull a permit.

Unpermitted home improvements may not retain their full value when you sell. Protect your investment.

You can pull a permit at:

CITYOFWESTSACRAMENTO.ORG/BUILDINGPERMITS

This program is funded by California utility customers and administered by California's Investor Owned Utilities under the auspices of the California Public Utilities Commission.

PERMITS CAN SAVE ENERGY!

Be legit. Pull a permit.

Complying with building code can
make your home more energy efficient.
Be green to save green with lower
monthly energy bills.

You can pull a permit at:

CITYOFWESTSACRAMENTO.ORG/BUILDINGPERMITS

This program is funded by California utility customers and administered by California's Investor Owned Utilities under the auspices of the California Public Utilities Commission.

PERMITS CAN SAVE REPUTATIONS!

Be legit. Pull a permit.

Failure to obtain a building permit is a violation of the law and can cost you your contractors license.
Don’t take chances.

You can pull a permit at:

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This program is funded by California utility customers and administered by California’s Investor Owned Utilities under the auspices of the California Public Utilities Commission.

Be legit. Pull a permit.

CITYOFWESTSACRAMENTO.ORG/BUILDINGPERMITS

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I PULL PERMITS!

YOU CAN TOO at CITYOFWESTSACRAMENTO.ORG/BUILDINGPERMITS

This program is funded by California utility customers and administered by California's Investor Owned Utilities under the auspices of the California Public Utilities Commission.

STATEWIDE C&S PROGRAM COMPLIANCE IMPROVEMENT

Creating Incentives for Contractors to Comply with Energy Codes

Developed by Steve Burger, Russ King, Mike Bachand, Bob Wiseman and Brian Selby

Energy Code Ace worked with market actors who participate in the compliance process to identify compliance roadblocks and solutions, and document them in white papers. This acted as an ongoing needs assessment and played an important role in designing user-centered solutions.

October 22, 2012

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Problem Statement

Contractors have little incentive to comply with the Building Energy Efficiency Standards (Standards), particularly for alterations and small new construction projects. It can be said that there is even a disincentive to pull permits for these types of projects. Evidence indicates that there is often little chance that a contractor will suffer any significant harm for performing an alteration without pulling a permit.[1] The time, cost and inspection requirements involved in pulling a permit can give those who do not do so a competitive advantage. The primary focus of this whitepaper will be to consider ways to increase permit volume for these types of projects. The energy benefits of doing so will also be discussed. In addition, this paper will look at other typical problems with code compliance from the contractor's perspective and will discuss ways to provide incentives to improve compliance.

A frequent complaint among contractors is that the energy code compliance process is too complex. There is also a lot of confusion as to what forms are required and who is required to complete them.[2] This perceived complexity and confusion could lead to contractors choosing not to obtain a permit in order to avoid the hassle of dealing with the building department and the compliance process. In some cases, contractors choose not to inform homeowners of the requirements to pull a permit. In other cases homeowners often don't feel the need to pay extra for the experience of dealing with the local building department and all the related requirements, potential delays and inspections.

The recent downturn in the economy may have exacerbated any existing problems with energy code enforcement. Many local building departments have been forced to reduce their staff. This reduction further depletes resources needed to adequately enforce the Standards on permitted projects. It also limits the capability to identify and rectify permit violations in the community. With more and more demand to inspect life/safety, accessibility and structural requirements, inspectors may choose to put energy efficiency lower on their priority list.

These market conditions have created an "underground economy" that encourages noncompliance, ultimately undermining the California Energy Commission's (CEC) goals of compliance with the Standards. Existing efforts at education and enforcement have not been enough to significantly improve the permit avoidance behavior. If permits are not obtained and codes are not enforced, there is no way to verify compliance with the Standards or meet the state's goal of reducing building energy usage. The best codes in the world mean nothing if they are not enforced.

Proof the Problem Exists

WHPA Compliance Committee

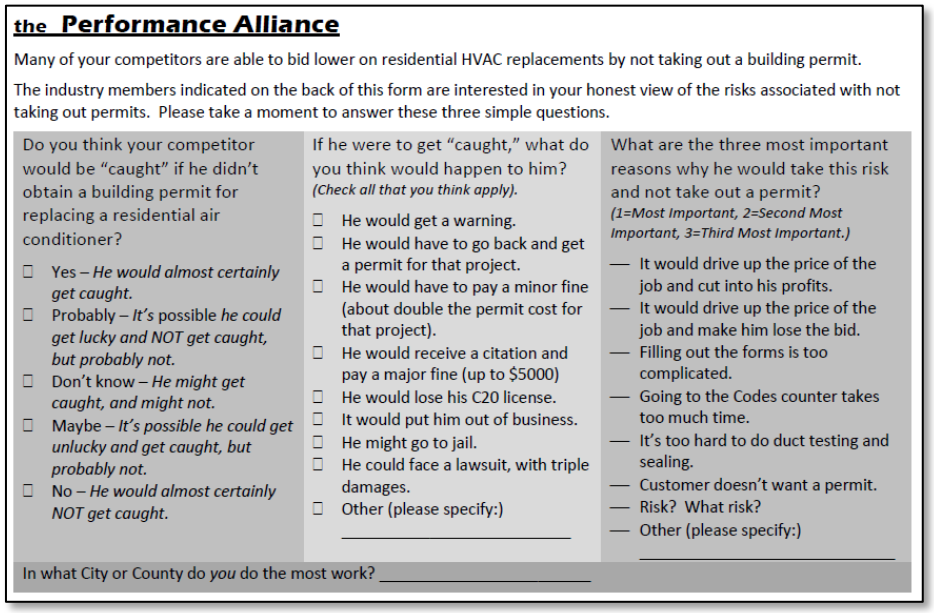
The Western HVAC Performance Alliance (WHPA) Compliance Committee conducted a survey in order to better understand how contractors assess the risk of not obtaining permits.[3] The survey was available in two formats: online and postcard-sized response forms (see Figure 1). It was sent to several union and non-union contractor associations, the California Building Official's organization (CALBO), and the distributor trade group. These groups circulated the survey to their members and 268 responses were received (64 postcards and 204 online). The survey focused on residential HVAC replacements, which according to the WHPA, represents approx. 80% of residential HVAC projects in

[1] Western HVAC Performance Alliance Compliance Committee contractor survey 2010

[2] Evaluation of Title 24 Acceptance Testing Enforcement and Effectiveness, California Commissioning Collaborative, September 2011

[3] Contractors Walk on the Wild Side: Why? Kristin Heinemeier, University of California- Davis

California. Since the survey participants were selected from trade associates the survey did not represent a random sample of California contractors.



the Performance Alliance

Many of your competitors are able to bid lower on residential HVAC replacements by not taking out a building permit.

The industry members indicated on the back of this form are interested in your honest view of the risks associated with not taking out permits. Please take a moment to answer these three simple questions.

Do you think your competitor would be "caught" if he didn't obtain a building permit for replacing a residential air conditioner?

- ☐ Yes – *He would almost certainly get caught.*
- ☐ Probably – *It's possible he could get lucky and NOT get caught, but probably not.*
- ☐ Don't know – *He might get caught, and might not.*
- ☐ Maybe – *It's possible he could get unlucky and get caught, but probably not.*
- ☐ No – *He would almost certainly NOT get caught.*

If he were to get "caught," what do you think would happen to him? *(Check all that you think apply).*

- ☐ He would get a warning.
- ☐ He would have to go back and get a permit for that project.
- ☐ He would have to pay a minor fine (about double the permit cost for that project).
- ☐ He would receive a citation and pay a major fine (up to $5000)
- ☐ He would lose his C20 license.
- ☐ It would put him out of business.
- ☐ He might go to jail.
- ☐ He could face a lawsuit, with triple damages.
- ☐ Other (please specify:) _____

What are the three most important reasons why he would take this risk and not take out a permit? *(1=Most Important, 2=Second Most Important, 3=Third Most Important.)*

- — It would drive up the price of the job and cut into his profits.
- — It would drive up the price of the job and make him lose the bid.
- — Filling out the forms is too complicated.
- — Going to the Codes counter takes too much time.
- — It's too hard to do duct testing and sealing.
- — Customer doesn't want a permit.
- — Risk? What risk?
- — Other (please specify:) _____

In what City or County do *you* do the most work? _____

Figure 1 – Postcard sized survey response form

The findings were presented at the 2010 Institute of Heating and Air Conditioning Industries, Inc. (IHACI) show. With an estimated rate of less than 10% of HVAC system change-outs pulling permits, the survey illustrates a large problem with enforcement of California's energy code. [4]

The survey asked three questions to assess the risk of not pulling a permit. The graph below illustrates that there is a low expectation of any detection of wrongdoing for those who don't obtain the permit.

Figure 2 - Would your competitor get caught for not taking out a permit?

[4] California Energy Efficiency Strategic Plan, January 2011 update

The second question was equally as revealing. The majority responses indicate that there would be no punitive effect expected. The offending contractor would just likely need to rectify the situation and would likely receive a warning not to do it in the future.

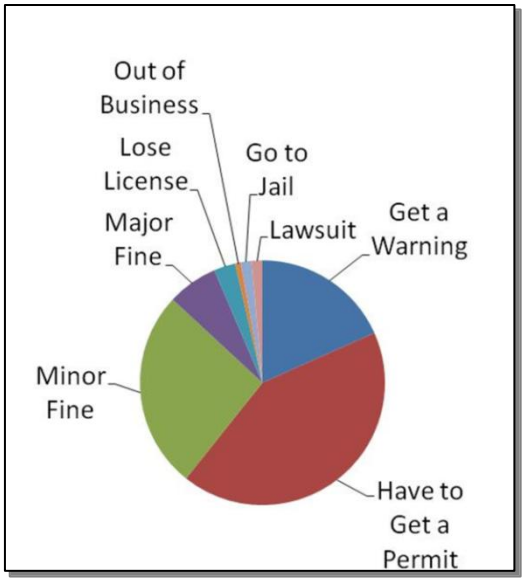


Figure 3: What would happen to him if he got caught?

The third question directly asks about the contractor's perception of the risk. The responses reveal that there is a significant number who would feel competitively disadvantaged for following the rules.

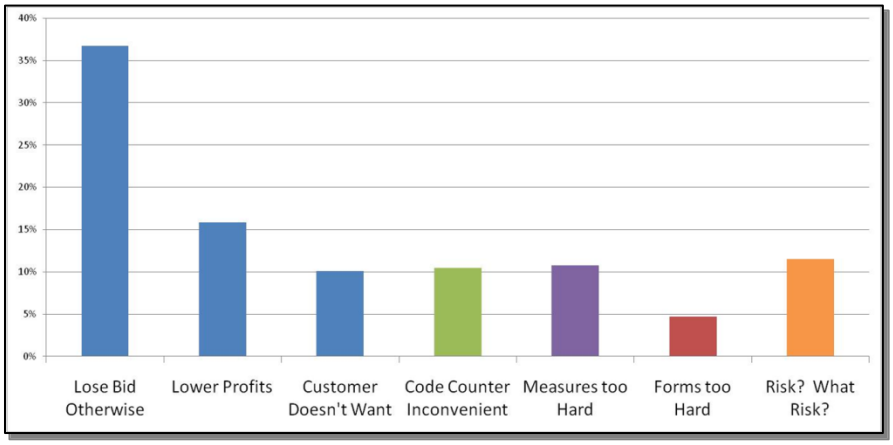


Figure 4: Why would you take the risk?

CSLB Sting Operations

In January of 2010, at the direction of its board members, the Contractor's State License Board (CSLB) increased their efforts to enforce permit violations through undercover sting operations. They initially sent letters directly to HVAC contractors informing them that the CSLB was increasing its code enforcement efforts, specifically the Standards. Shortly after the letters went out, they targeted large HVAC contractors in multiple areas throughout California. In three rounds of sting operations, 119 contractors were targeted, 26 citations and more than 32 warning letters were issued. Due to this initial success in finding violations, CSLB plans to start a fourth round sometime in 2012.

Although fines are not usually imposed for first offenders, cited violations are disclosed and available to the public through CSLB's "Check-A-License" online contractor search. The citation stays with the contractor for five years. Contractors who break these laws are subject to disciplinary action by CSLB. The contractor may be subject to civil penalties of up to $5,000 per citation and/or suspension or revocation of their license. The contractor's complaint history and seriousness of the violation are factors considered when determining the appropriate level of discipline.[5] It is rumored that many contractors write these fines off as part of the cost of doing business. The CSLB spends as much or more to identify violations, cite, and collect fines, than they receive, but their goal is to change contractor behavior.

California Commissioning Collaborative

The California Commissioning Collaborative recently evaluated Title 24 acceptance testing requirements and enforcement procedures to characterize the challenges, limitations, and opportunities for achieving the intended minimum standards of energy efficiency. Acceptance tests are required for projects involving certain HVAC or lighting components. These tests are triggered based on the scope of the permit and the specific equipment installed. The results and certification are communicated to the building department via special compliance forms. Researchers interviewed many of the major stakeholders in the compliance process: design engineers, building officials, testing contractors and building owners. They sought to better understand the ways the compliance procedure breaks down, is misunderstood, or becomes onerous from their viewpoints of these key market actors. The interviews revealed two main causes for a breakdown in the compliance process; 1) the difficulty of interpreting the requirements and the associated forms, and 2) a lack of clarity about who is responsible for key parts of the process.[6]

Key research findings included:

- Building departments are understaffed due to funding constraints. As a result, the acceptance forms receive little to no review.
- There are too many acceptance forms that complicate the process and add to industry confusion.
- The "Responsible Party" is very often not specified on the forms. This lack of clarity about who is responsible to execute tests often results in omission of the tests.
- The lack of clarity in the chain of responsibility potentially leads to a disincentive for including testing costs in project bids. Contractors who include those costs increase their risk of being underbid by a competitor who has excluded the costs.

Potential Solutions

Solving the compliance problem is a tricky proposition. Typically there has to be a value proposition (carrot) and a punitive consequence (stick) to create change. The proper balance varies depending on many factors. The carrot (or reward) can be as simple as "I get to keep doing business as usual." It does not necessarily need to involve money but must be rewarding in some clear, definitive way. The stick (or punishment) on the other hand, must deliver a swift consequence. Strict reliance on "sticks," i.e., more rigorous standards and stricter enforcement, is increasingly seen as inadequate to change the behavior of noncompliance.[7] When the balance is off, one way or the other, it encourages people to

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[5] Contractors State License Board Alerts Contractors to Renewed Enforcement of Building Permits in January 2010 - CSLB Industry Bulletin - 11/30/2009

[6] Evaluation of Title 24 Acceptance Testing Enforcement and Effectiveness, California Commissioning Collaborative, September 2011

[7] Carrots or Sticks? Policy Options for Building Energy Standards, 2000 ACEEE Summer Study on Energy Efficiency in Buildings

either get away with something that they know is not being enforced or to completely avoid the difficulty of complying. In the case of pulling permits, this imbalance between reward and punishment has created a market condition that encourages noncompliance.

Research suggests that, by and large, rewards succeed at securing one thing only: temporary improvement. When it comes to producing lasting change in attitudes and behavior, however, rewards, like punishments, are strikingly ineffective. Once the rewards run out, people revert to their old behaviors.[8] When considering potential solutions, the goal is to establish an effective balance between rewards and punishment, while creating a culture that encourages long-term compliance. Long term, lasting improvements can come from making the process as easy, transparent, native to the normal business processes, and as automated as possible. The core problems that we have heard from key market actors (time, complexity, hassle and to a lesser degree, money) must ultimately be addressed within the existing process.

The following potential solutions list was developed by the CIAG to address these core problems. Each potential solution represents an idea or concept that CIAG members agree could provide a viable solution to some of the energy code compliance and permit avoidance issues. The list has been categorized into four main topics: Rewards, Punishments, Education and Technology.

Reward Solutions

- Create a statewide "Champions in Energy Code Compliance" award program that would publicly recognize contractors and building departments who demonstrably and consistently comply with the energy code. This award could be given annually at key events to leaders in the industry and could be presented by utilities, CSLB, CEC, or other state agencies involved in compliance. This award could provide positive models of individuals and jurisdictions that embrace the culture of compliance and lead the industry by example.
- Develop a regional "whitelist" of contractors who consistently comply with the code. The criteria for inclusion in this list could be tied to the "Champions in Energy Code Compliance" award nomination criteria. The list could be promoted through existing channels. For example, it could be circulated through building department publications and bulletins, the CSLB website or email blasts, and the CEC blueprint. These publications could also be leveraged to recognize jurisdictions with high compliance rates. Success stories illustrating effective practices and quantifying benefits to the local community could be written and distributed through these same channels.
- Provide some type of monetary incentive to contractors who prove that they meet building department-defined compliance thresholds. These incentives could include a discount on future permits or multiple discounts for different levels of achievement. This idea is similar to a sandwich loyalty card; purchase so many permits at the regular price and receive the next one at a reduced price, provided you're a 'member'. This concept could also be used to encourage contractors to attend training or enroll in utility-sponsored quality assurance programs. This solution could possibly be funded by the Investor Owned Utilities (IOU) Statewide Codes and Standards Team in conjunction with the IOU's Local Government Programs as part of a compliance improvement program. The challenge to design a fair, equitable, objective and measureable set of criteria and an effective ongoing support mechanism would require a good deal of planning. To be effective, this planning must utilize any and all existing processes and must involve all affected market actors.
- Simplify the whole process from application to issuance of a permit, through use of (1) fewer or customized forms (2) electronic permit submittal and inspection request when possible or (3) a

[8] Why Incentive Plans Cannot Work: Harvard Business Review, by Kohn, Alfie

provision to allow contractors to purchase bulk quantities of certain over-the-counter permits, such as HVAC or water heater replacement, at a discounted price. Bulk permits could be purchased by contractors in advance then filled-out individually for each install. In theory they would then submit electronically along with the appropriate compliance forms.

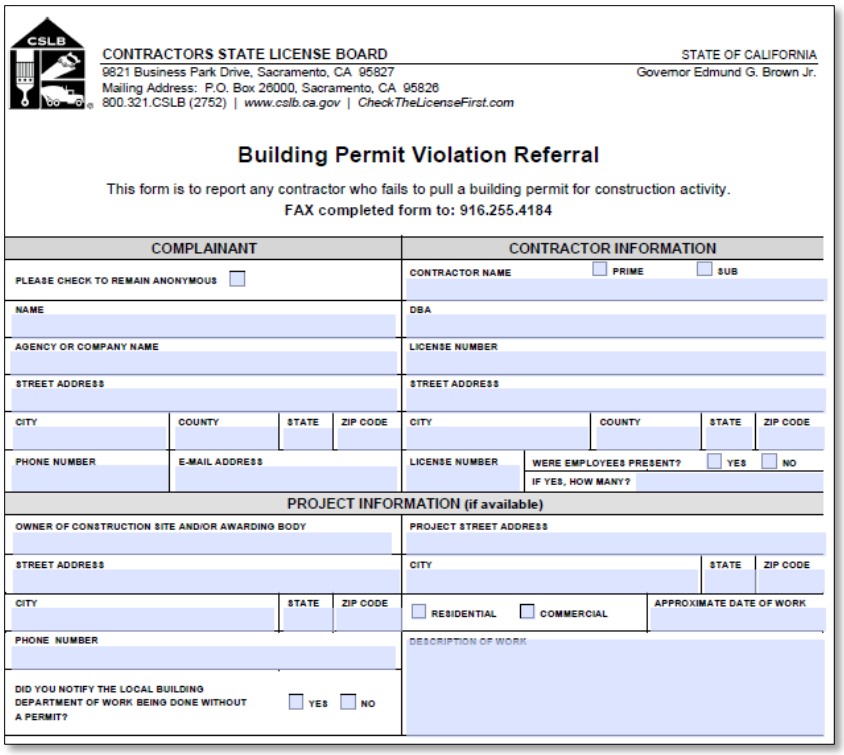
In order for these types of process improvements to occur, support systems and tools must be developed. Web-based applications such as a dynamic forms generator or a design and permit tool can assist contractors in making and documenting compliance in the context of their project scope. It is possible for these applications to tie into related systems, such as government process management systems. With remote login and e-commerce functionality, these solutions could motivate contractors who do large quantities of installations in a particular jurisdiction to pull permits, since it saves them time and simplifies the process. Since traditional counter permits do not generally require a plan review, the process could save time and expense for both the contractor and the building department.

- Develop a process that would enable more collaboration between building departments and utility programs. There are many incentives available now for building owners to improve the energy efficiency of their buildings by replacing equipment and/or making improvements that trigger compliance with the energy code. Currently, building owners are required to sign a disclosure stating that they obtained a permit for the improvement for which they are receiving an incentive. This new process would require that owners obtain building department approval of a project before the utility program administrator pays an incentive for the improvement.

Punishment Solutions

- Levy larger penalties and fees on both the contractor and the building owner when permits are not obtained. If they are caught doing work without a permit, currently CSLB's maximum fine by for the contractor for this violation is $5000. In many cases, violations rarely escalate to this level. Most contractors who get caught just receive a warning letter. There is usually no repercussion to the building owner other than the inconvenience of work being interrupted and having to get a permit. Establishing a minimum fine for first offenders, rapidly escalating the fine, and suspending repeat offenders licenses for escalating periods of time could motivate the industry to complying with the law. The most difficult part of this type of solution is identifying buildings where violations have occurred and the person(s) who performed the work. This problem could potentially be overcome by developing a bounty program, where any person who reports a violation that leads to a successful conviction would receive a reward. A portion of the larger fee, as mentioned before, could be used to provide the reward.

  CSLB has recently created a building permit violation referral form that can be downloaded from CSLB's website (see Figure 5). This process has had some success. But one report of little or no follow through has caused that contractor who would normally use the form to believe the effort is futile. To some extent, the eventual utilities of this form lies in establishing confidence within those who use it.



CONTRACTORS STATE LICENSE BOARD
9821 Business Park Drive, Sacramento, CA 95827
Mailing Address: P.O. Box 26000, Sacramento, CA 95826
800.321.CSLB (2752) | www.cslb.ca.gov | CheckTheLicenseFirst.com

STATE OF CALIFORNIA
Governor Edmund G. Brown Jr.

Building Permit Violation Referral

This form is to report any contractor who fails to pull a building permit for construction activity.
FAX completed form to: 916.255.4184

COMPLAINANT				CONTRACTOR INFORMATION			
PLEASE CHECK TO REMAIN ANONYMOUS ☐				CONTRACTOR NAME ☐ PRIME ☐ SUB			
NAME				DBA			
AGENCY OR COMPANY NAME				LICENSE NUMBER			
STREET ADDRESS				STREET ADDRESS			
CITY	COUNTY	STATE	ZIP CODE	CITY	COUNTY	STATE	ZIP CODE
PHONE NUMBER	E-MAIL ADDRESS			LICENSE NUMBER	WERE EMPLOYEES PRESENT? ☐ YES ☐ NO IF YES, HOW MANY?		
PROJECT INFORMATION (if available)							
OWNER OF CONSTRUCTION SITE AND/OR AWARDING BODY				PROJECT STREET ADDRESS			
STREET ADDRESS				CITY		STATE	ZIP CODE
CITY		STATE	ZIP CODE	☐ RESIDENTIAL ☐ COMMERCIAL		APPROXIMATE DATE OF WORK	
PHONE NUMBER				DESCRIPTION OF WORK			
DID YOU NOTIFY THE LOCAL BUILDING DEPARTMENT OF WORK BEING DONE WITHOUT A PERMIT? ☐ YES ☐ NO							

Figure 5: Building Permit Violation Form

Possible improvements to this form include:

- Online submittal of the form
- Posting the link to the form on local jurisdiction websites
- Notification of violations sent directly to the jurisdiction in which the violation occurred
- Swift follow-up on all violation referrals

- Develop a regional "blacklist" of contractors who violate codes. This solution is similar to the "whitelist" mentioned in the previous section. It could be published and circulated through building department bulletins, CSLB emails directly to contractors, and in the CEC Blueprint. Using both the whitelist and blacklist in concert could be more powerful than using either one separately providing a balance of carrot and stick to help change behavior.
- Make it a liability to not pull a permit. This solution could be accomplished by insurance companies notifying building owners that claims will not be paid in the event of damage resulting from an alteration or addition done without a permit. This could motivate building owners to request that permits be pulled for work done on their properties, ultimately increasing compliance. Likewise, building departments could notify insurance companies that there was a permit violation on a property their company insured, though it could prove to be very difficult to identify the relevant insurer on most properties.
- Notify the State Board of Equalization (BOE) of possible sales tax evasion by contractors who don't pull permits. There is a possibility that contractors who avoid pulling permits for unitary equipment change-outs, such as HVAC systems and water heaters, may also avoid paying sales tax on that equipment. Some contractors elect to defer paying sales tax through the use of a seller's permit. Seller's permits are issued by the BOE and allow the holder to purchase items, meant for resale, without paying the sales tax at time of purchase. When the item is resold to a customer, the contractor is obligated to collect the sales tax from the customer, then report and pay it to BOE.

This solution could be accomplished by having CSLB notify the BOE of permit violations when they occur.

Education Solutions

- Inform the public about the consequences of not obtaining a permit. This is a simple concept but tricky in execution; how do you reach building owners before they make a decision to alter or improve their property? This could be accomplished by developing ads, flyers, and radio or TV Public Service Announcements (PSAs) that would educate building owners of the problems and liabilities that arise from not pulling a permit. This material could also contain illustrations showcasing the energy impact of noncompliance. Utilities and government agencies could run ads in newspapers and local magazines. Flyers could be circulated at home improvement centers and building departments or in utility bill envelopes.

  The CSLB produces a series of PSA television commercials which depict the consequences of a homeowner not hiring a licensed contractor. This concept could be adapted to communicate the consequences of not pulling a permit. The challenge with all of these possible solutions is cost. Advertising is expensive and only a small portion of the target market is ever reached with this type of outreach information. Further, ads viewed today may have a negligible effect a year from now when a homeowner is faced with an alteration for which they should pull a permit.

- Provide homeowners education about the benefits of obtaining a permit at "big box" home improvement centers on weekends. Include coupons or incentives to obtain permits for future additions or alterations. The educational material could contain a case study (or even hypothetical examples) to indicate the potential long-term cost of running a building with noncompliant equipment. This solution could be accomplished by utilizing local energy consultants or HERS raters to provide the education in exchange for the exposure their company would receive.

- Educate enforcement staff and installers on the process and the online tools available for them to use. Current training exists to educate plans examiners and building inspectors on the essentials of the Standards. This training could be adapted in the future to include training for online compliance tools that may be developed in order to streamline and simplify the compliance process. Additionally, an "Energy Code Expert" information hotline could be developed to answer energy code questions and provide guidance on the compliance process. This could be accomplished by enlisting energy consultants and building officials who have many years of experience with the energy code to answer the hotline calls. Careful planning and collaboration with the existing CEC hotline would be needed to make this option successful.

- Develop a case study on a HVAC contracting firm who has successfully incorporated Title 24 compliance and testing as a core strategy to distinguish their firm in the marketplace. This would encourage other contractors to view acceptance testing as a marketing tool. Contractors could use these case studies as part of their bid presentation to a potential client. Officially endorsed documentation by the CEC or CSLB could encourage owners to look favorably on those bids and would help highlight situations where a low bid competitor has omitted HERS verifications or acceptance testing.

- Develop and deliver joint interactive training for building inspectors and contractors to better understand the compliance process and what forms are required. This could prove to be very helpful in improving the understanding of the process from different perspectives and encouraging constructive dialog between the parties.

Technology Solutions

- Work with manufacturers to design a system that will track water heater and HVAC equipment serial numbers from the manufacturers through distribution points to permits and addresses. Products that cannot be tied to a permit could at least by tied to a regional distribution point. This

information could help provide regional targets for noncompliance. Manufacturers and distributors are not required to release proprietary information like serial numbers of their products when they are sold, but they could potentially be motivated to provide it through an upstream incentive that could help establish a tracking system. Tracking equipment from manufacture to installation could provide a significant increase in compliance and ease the burden on enforcement.

- Develop technology that would limit HVAC or water heater equipment operation until the proper compliance process was completed. This technology would be similar to registering software. The equipment could be installed, tested and remain operational for a number of days then require an access code be entered before it becomes fully operational. Access codes would be generated after the installer first obtains a permit, properly installs the equipment, completes the required testing and verification and provides the appropriate compliance forms. The technology could be built into the equipment and require a specific thermostat be used that could communicate with the equipment and the registration location through the internet. Smart meter technology may also play a role.

Impact on Compliance

Pulling a permit for alterations and additions does not ensure that compliance with the Standards. However, permits are the key trigger for Standards application. Without them, there would be no means to track whether or not buildings and measures were built or installed to meet code requirements. Creating incentives to motivate contractors to obtain permits helps reinforce the process that provides some level of assurance that code is addressed. This behavioral change is a critical step to create a culture that recognizes the importance of energy performance as a key building design element.

Impact of Compliance

There are many benefits in pulling permits and complying with the Standards. The primary benefit is the energy savings guarantee provided by the Standards themselves. When permits are required and obtained consistently, contractors who rely on the bidding process for obtaining new work could include the cost of compliance in their bids without the fear of competitors undercutting them. Increasing permit volume also increases revenue for each jurisdiction, providing a level of stability, consistency and reliability that serves contractors and homeowners.

The improvement of compliance with the Standards plays a key role in meeting the State's energy efficiency goals. Existing buildings represent the largest market for potential energy savings (see Figure 6).[9] Improving the estimated low compliance rates for alterations in these markets will have a large impact in reducing energy use in California.

[9] Assistance in Updating the Energy Efficiency Savings Goals for 2012 and Beyond, Itron, Inc. 2007

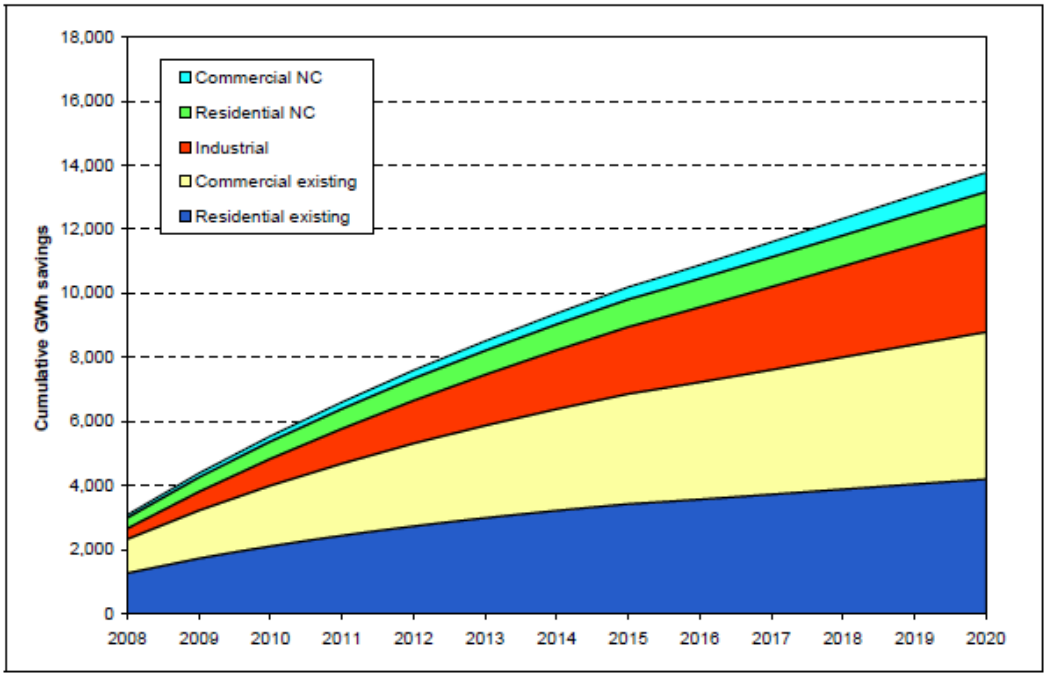


Figure 6: Base market potential by sector and vintage (gross savings)

Next Steps

No single solution suggested in this paper will provide the necessary amount of change to overcome the behavior of permit avoidance on its own. These ideas and concepts, along with others, will need to be done in concert with one another in order to create a culture of compliance that all market actors will embrace. These solutions will need to be prioritized and coordinated by various stakeholders who are in a position to create effective change.

A multi-agency taskforce with could be created to assess the feasibility and implementation of possible compliance improvement solutions outlined in CIAG whitepapers. This taskforce could be comprised of representatives from the CEC, Housing and Community Development (HCD), CPUC, CSLB, IOUs Codes and Standards Team, CALBO, CIAG, WHPA and other organizations directly involved in improving the compliance process. The CIAG could facilitate the new taskforce by providing the organizational structure and management.

One of the largest benefits of this taskforce would be to provide the forum for open communication between all agencies represented, ensuring that existing efforts are not duplicated and the overarching goal of compliance improvement is achieved. In addition, the taskforce could provide the necessary guidance and implementation of measuring compliance rates to meet the requirements of AB758. Although progress towards compliance improvement has been made by individual agencies, an organized effort by all could be a key factor shaping the future of energy code compliance in the state.

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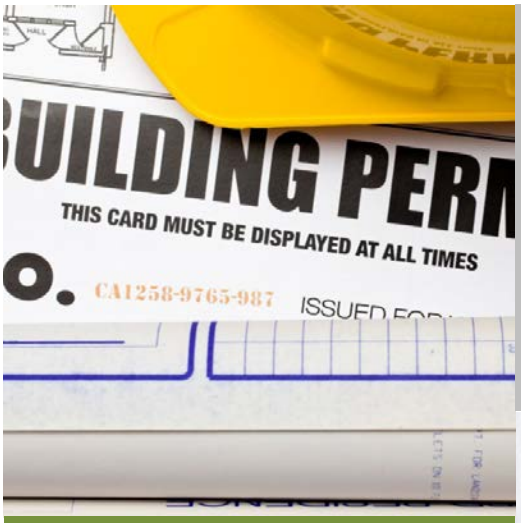

Tracking Sales and Permit Volume

Developed by: Bob Wiseman, Casey Bigelow, Russ King, Erik Emblem and Nehemiah Stone

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PROBLEM STATEMENT

Non-compliance with building codes takes many forms. One of the largest areas of non-compliance with California's Building Energy Efficiency Standards (Title 24, Part 6) is failure to even start the process by pulling a permit for retrofit, replacements, or alteration work. The CEC, the California Investor-Owned Utilities (IOUs), and their industry partners have been making significant efforts to increase compliance through training, outreach, checklists and other tools, best practices reports, and guidance documents. However, they are currently unable to tell which regions or building department jurisdictions have the greatest problems with non-compliance in retrofit work and change-outs, and which can be tapped as positive examples. By itself, tracking permit volume does not reveal how much work occurs without permits. What is needed is a way to identify localities where a relatively high volume of non-permitted work takes place.

Conversely, if there are jurisdictions where sales and permit tracking indicates that a particularly high percentage of work is performed with a permit, then those jurisdictions are excellent candidates for further "best practices" research.

This paper explores the option of gathering the necessary data to track or estimate sales of HVAC equipment and water heaters from the manufacturers to distribution points and possibly at the zip code of the installation, and then comparing those data to actual permit volume and installations for the same jurisdiction or region. The permit data will be most easily obtained not from building departments, but from HERS Providers or, when it is fully functional, the CEC's HERS Repository[1].

The comparison would help identify localities with low compliance rates, so that the CEC and IOUs could develop targeted solutions to increase compliance in those areas. This approach may also provide a means of measuring the effectiveness of compliance improvement solutions, either over time, or between jurisdictions where a solution is implemented and jurisdictions where it is not.

Research

[1] This method may not capture projects that gain a permit but never submit data to the HERS Provider, either because the building department is not enforcing the HERS verification requirement, or because after gaining the permit the contractor does not complete the process. This is not problematic since those are both non-compliant situations, and arguably should not be included in the "permitted" category.

Research conducted in support of this paper was focused on determining how to design and implement a program to track sales data for replacement HVAC equipment or water heaters and compare those data to permit data for the same jurisdictions. We interviewed mechanical contractors, members of the Western HVAC Performance Alliance (WHPA), a representative of Heating Air-conditioning and Refrigeration Distributors International, representatives of the Air-conditioning, Heating and Refrigeration Institute, the Wisconsin Energy Center (WEC), and the California Energy Commission. We also consulted several WHPA documents, newsletters and reports from the Contractors State License Board (CSLB), and several data sources. The following pages provide a summary of what we learned.

Distributors made their data available in exchange for the report which showed aggregate sales data…

From the late 1990s until 2010, WEC ran a program to track sales data on air-conditioning (AC) equipment through the distributors in Wisconsin. The purpose was to monitor the quantities of AC equipment of different efficiency ratings. Distributors made their data available in exchange for the report which showed aggregate sales data, by region of the state, and by SEER (Seasonal Energy Efficiency Rating). The information was useful to the distributors because it gave them a better understanding of macro trends.

When the program began, the distributors accounted for over 60% - 80% of the state sales of AC equipment, with the bulk of the remainder being direct sales to "dealers" (which refers to large HVAC contractors). By 2010, the market had changed so much that less than half of AC sales went through the distributors. They lost the incentive to participate, and the program ended. But while it ran, it provided a demonstration that if there is a way to structure the program so that it is in the distributors' and dealers' best interest to participate; it may be possible to get sales data from them. Other interviews provided evidence for why it might not be possible, and if it is, what some of the major policy issues are that would have to be addressed.

Unlike what was reported for Wisconsin, in California virtually all HVAC equipment is sold through a distributor. Even if a manufacturer and dealer negotiate the terms of volume sales, the sales are still routed through the distributor. It is not in the manufacturer's interests to sell directly to a contractor, going around the distributor,

since those distributors are key to much of the manufacturer's business. Therefore, any program to compare sales data with building permit data will almost certainly have to include, if not start with, data from distributors. However, that alone will not result in sufficiently granular data.

Granularity of the data is clearly an important consideration. National level sales data is easy to get. State level sales data is even possible to get without too much difficulty. But to be useful for identifying the exemplary building departments and those that can use more resources, the sales data will need to be at least at the county level, or ideally, at the building department jurisdiction level. Manufacturers cannot provide that granularity.

To get the needed granularity, data will need to come from the distributors. However, there will still be some level of uncertainty. A distributor may only know where the contractor's warehouse and other facilities are, not where the contractor eventually installs the equipment when it is part of a replacement project. This currently only appears to be a problem with a relatively small number of large contractors. The majority of contractors do not take on replacement work very far from their facilities, so the amount of equipment "leaking" from that locality will be fairly small. But once the initial tracking system is working well and it becomes important to plug that data hole, it may be necessary to obtain those data from the contractors.

In accordance with California's Appliance Standards, the CEC collects data on equipment performance specifications and ratings for a wide range of equipment, including water heaters and HVAC equipment. These data are uploaded into the State's Appliance Efficiency Database so that appliance information is accessible by efficiency, manufacturer, model number, or any of several other fields. For equipment such as HVAC systems that can be sold in multiple configurations (e.g., various coil possibilities for one compressor), manufacturers report the combination that represents their highest sales volume and what percentage of the total sales that represents, but manufacturers are not required to report what their sales volumes are. In fact, the CEC would have to go through a public process to

determine how the authority granted them in State law[2] could be interpreted to require manufacturers, distributors, and/or contractors to report sales data. The CIAG recommends that the Commission undertake that public process with the goal of establishing a reliable, secure, accurate, and mandatory reporting process for manufacturers, distributors, and eventually even contractors. As noted above, it is unlikely that manufacturers' data would be granular enough to be of use without data from distributors and contractors.

There are a number of important issues that the Commission will need to grapple with in the rule-making and implementation phases of this process.

One of the strongest reasons given for why contractors/dealers (large contractors), small contractors, or even distributors would be reluctant to give up their sales data is that they do not want their competitors gaining insights into their businesses: the volume of their sales, the types of equipment being sold, the ratio of labor costs to material costs, or the regional concentrations of their sales. If the data could be gathered and held by a trusted neutral third party, and only released in an aggregated form that would not allow competitors any windows into any specific company's business, this would provide the necessary safety. However, the party would have to truly be trusted by the industry because, as one contractor put it, once you hand over your proprietary information to someone else, its security is out of your hands.

Another reason for contractors to resist sharing the necessary data is also related to business fairness. If there is no robust enforcement of the reporting requirements and policing of process integrity, then it is effectively a punishment for the compliant and a reward for the scofflaws. In essence, it would exacerbate the competitive disadvantage that lawful contractors feel they are at relative to those who bid work cheaper without the cost of a permit. Contractors will need convincing proof that the reporting requirements would be enforced evenly and robustly across the industry.

A related objection stems from the cost of keeping the records and reporting to the CEC or trusted third party. Although much of the information that would be required is already housed within a contractor's files, it is most often not kept in a way that

[2] Warren Alquist Act Sections 2521 & 25216.5, and California Government Code Sections 11180-11181.

would facilitate generating a report of units installed by jurisdiction. Contractors would either have to change the way they keep records or hire additional staff to transcribe individual project data into a unit-by-jurisdiction report. With the objections noted in the previous two paragraphs, and little promise of a direct benefit from taking on the additional work, it may be too much to expect most contractors to comply.

In addition to potential difficulties with obtaining sufficiently granular sales data to identify the volume of installations within a jurisdiction, there are potential issues with developing an accurate tally of the permits for residential equipment replacements. For example, some HVAC or water heater sales in a jurisdiction will be for commercial properties, and some will be for new residential construction. The number of permits in those categories of activity would need to be subtracted from the total sales of relevant equipment to obtain an estimate of sales that truly would be for residential replacements.

The amount and kind of data that a contracting firm or distributor must collect, record, keep and report to a host of agencies can sometimes seem overwhelming to both large and small companies.

Therefore, in addition to gathering data from HERS Providers on permitted residential replacement projects, it may also be necessary to determine the number of additions that include HVAC equipment. However, summary data that building departments keep on additions and alterations permits do not always make it apparent whether a project did include installation of a new HVAC unit or water heater. Those details are captured in the permits themselves, but it could take significant staff time to pull those data from individual permits into a useful report. The resource constraints being experienced by many building departments, therefore, create a significant barrier.

Finally, if a building department suspects that the result of comparing sales data to permit data may publicly present them as an under-performing building department, that would act as a significant disincentive to cooperation.

POTENTIAL SOLUTIONS

There are some potential policy solutions to the primary objections raised to tracking sales data, and there are some alternative solutions to achieving the same end as having distributors and contractors report their sales data.

Policy Solutions

The amount and kind of data that a contracting firm or distributor must collect, record, keep and report to a host of agencies can sometimes seem overwhelming to both large and small companies. It has a direct impact on staff time and the cost of doing business, and adding to that could lead some firms to resist or refuse to cooperate. One way to overcome that resistance is to give reporting companies something of value that they could not get without cooperating. The CEC or IOUs could convene a working group with strong representation from HVAC (C-20) Contractors and equipment distributors, with the intent of identifying how the collected, aggregate data could be analyzed and presented to provide something of value for distributors and contractors[3].

The CIAG recommends the creation of a database run by an independent third party with the purpose of collecting model and serial numbers of equipment sold directly from distributors. These data would then be compared against the HERS database or CEC data repository and contractors' license information. In this option, the only time contractors will know they are being tracked is if they are registered as purchasing equipment from a distributor and a matching serial number does not exist in the HERS or CEC data registry. This database would need to be kept confidential, and not enter the public record.

Another partial solution to some of the barrier issues would be creation of an online reporting system that would seamlessly interface with contractors' record-keeping systems. This would likely be very helpful for the contractors who have already migrated their project records almost entirely to an electronic database, but it would provide almost no benefit to the firms who still rely predominantly on paper files.

The strongest objection contractors or distributors will raise is likely going to be the need to protect their proprietary information from their competitors. Therefore,

[3] Note that most contractors feel that just tackling the issue of rogue contractors not obtaining permits is a high value to them because that would help to level the playing field.

strong policies would need to be developed to ensure that an individual firm's data would be safe; that sales data would not be available to potential competitors except in the aggregate. For example, a data management or analytics firm whose parent company also has a branch that offers services in competition with C-20 contractors (such as HVAC maintenance contracts) would need to be completely excluded from access to the sales data. Policies would have to give contractors and distributors confidence that their data will never "leak," and that might even mean that government agencies could only access it in the aggregate.

Alternatives

One alternative that the CEC or IOUs could employ at least to gain a first-order approximation of how much HVAC or DHW equipment is replaced each year, would not require distributors or contractors to release any information about their sales. The process would instead rely on dividing the number of households in a jurisdiction by the average life of the equipment of interest, in this case, HVAC or water heaters, and then comparing that to the number of permits for installation of the equipment. The following is an example of how this estimation is achieved.

According to research by the National Association of Home Builders, the average life of a central air conditioner is 15 years[4]. Average furnace life is a bit longer at 18 years, and gas water heaters a bit shorter at 11 – 13 years.

Heating, ventilation and air conditioning (HVAC)	Life in years
Central air conditioning unit (newer units should last longer)	15
Window unit	10
Air conditioner compressor	15
Humidifier	8
Electric water heater	14
Gas water heater (depends on type of water heater lining and quality of water)	11-13
Forced air furnaces, heat pump	15
Rooftop air conditioners	15
Boilers, hot water or steam (depends on quality of water)	30
Furnaces, gas- or oil-fired	18

Figure 1: Average Life of the Equipment

[4] http://www.oldhouseweb.com/how-to-advice/life-expectancy.shtml

According to the U.S. Census Bureau, there are 510,976 households in Sacramento County[5]. That means that there should have been just over 34,000 residential central air conditioners replaced in Sacramento County in 2012.

Equipment	Avg. Life	Est. Annual Replacements
Water Heater (low)	11	46,452
Water Heater (high)	13	39,306
Air Conditioner	15	34,065
Furnace	18	28,388

Figure 2: Estimated Number of Annual Equipment Replacements

If between Sacramento County, Sacramento City, Galt, Folsom, Citrus Heights, Elk Grove, and Rancho Cordova building departments (all of the building departments in Sacramento County), only 12,000 permits[6] were issued that could account for AC replacements, then an estimated 22,000 (65%) of the installations were done without a permit. Conversely, this would mean that only 35% of AC replacements were done under permit.

It is unclear whether this hypothetical compliance rate for Sacramento County would place it on the list of jurisdictions with relatively high compliance or low compliance. WHPA's research indicated that less than 10% of HVAC replacements are permitted, while data from CSLB's early 2010 sting operation indicated that up to 70% of replacements are permitted[7]. If WHPA's data is more accurate, then hypothetically, the building departments in Sacramento County would be significantly better than average.

A second alternative approach that would also not require distributors or contractors to provide any sales data they do not already provide, would rely on sales tax information. All firms, including contractors, have to collect and forward sales taxes to counties and some cities, and that sales tax data may provide a path into an estimate of unit sales data. When manufacturers sell to distributors, and sometimes when distributors sell to contractors, local sales taxes are deferred, though the sales

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[5] http://quickfacts.census.gov/qfd/states/06/06067.html

[6] This figure is only hypothetical, because the required survey of the subject building departments was not completed for this paper.

[7] CSLB Accomplishments and Activities Report, 2010. Reported results from CSLB's second sting operation in 2010 do not include the percentage of permitted or unpermitted installations, but CSLB noted that only 6 of 71 contractors responding to the sting invitation to bid had obtained any permits within the previous twelve months.

are reported along with associated manufacturers', distributors', and contractors' tax ID numbers. Once the equipment is sold to an end-user, sales taxes are collected and remitted to the state and county. Those data are available as a public record at local jurisdictions' tax offices. It would mean coordinating data retrieval with (a) the State Board of Equalization, (b) the tax agencies from California's 58 counties, and (c) the tax division of the 115 California cities that have local sales taxes. Unfortunately, many contractors prefer to pay the sales tax to the distributor, rather than collect it from the customer, so their sales tax data won't help.

Additionally, turning these data into estimates of unit sales would require figuring out how much of the sales are accounted for by replacement parts, how much is for assorted other parts, and how much is likely to actually represent replacement equipment that should trigger a permit. Although there might not be any way to make that process provide exact numbers, the results might be good enough for identifying exemplary jurisdictions and those to whom more resources need to be directed.

It is important to remember that the goal of a program for comparing sales data to permit data is to identify areas/jurisdictions where (a) compliance improvement efforts are needed most, and (b) where local practices are working well and can serve as guidance to other jurisdictions. The goal should not be to identify individual property owners who are out of compliance, find and punish non-compliant contractors, nor even to draw negative attention to jurisdictions with low permit compliance rates. Potentially, the results of the solution could be also used to provide evidence of the effectiveness of the IOU Statewide C&S Team's other efforts to improve compliance rates, by tracking changes over time in the percentage of permitted installations.

Just obtaining a permit does not in itself mean greater energy savings.

IMPACT ON COMPLIANCE

As noted earlier, estimates of the percentage of HVAC replacement installations that include a building permit range from under 10% to over 70%. Regardless of what the actual percentage is, CSLB found that in all but one of those jurisdictions where they ran a sting operation and cited contractors for

failing to pull a permit[8], the volume of permits issued to C-20 contractors increased at an overall average of over 20% (see Figure 3 below). In a follow-on sting operation in other jurisdictions with a larger number of "participating" contractors, the post-sting increase in permits pulled by C-20 contractors was nearly 50%.

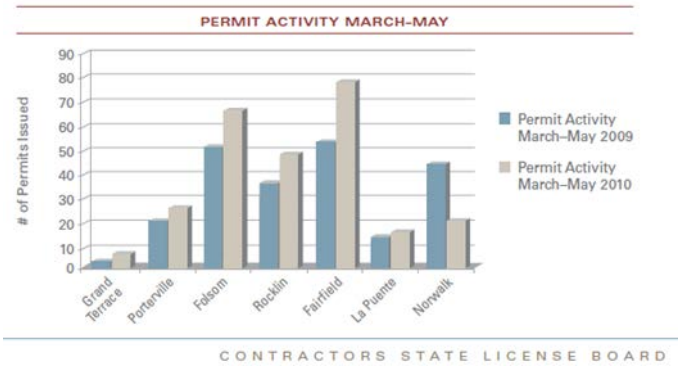

Figure 3: CSLB Permit Activity 2009-2010

Just obtaining a permit does not in itself mean greater energy savings. The savings result from the work being done correctly, and all of the auxiliary requirements being met, such as; insulating hot water pipes when a water heater is replaced, duct sealing, heat load/sizing calculations[9], and refrigerant charge and air flow verification on installation of a new HVAC system. These energy saving measures will often not be addressed, and will certainly not be verified if there is no permit. At an HVAC Industry Public Forum conducted by WHPA in November of 2012, contractors stated that they "are seeing savings in excess of 30% to 60%" from their work. It is unclear how much less the savings might be for contractors not testing systems thoroughly as required under a permit, but it is certainly significant.

In estimating the potential energy savings of increasing the percentage of permits just for replacement AC equipment, we use the following data, estimates, and assumptions:

[8] The actual violation was for advising the homeowner that they would do the work without a building permit.

[9] Although the Building Energy Efficiency Standards do not require contractors to size HVAC equipment according to load calculations, the Green Code (Title 24, Part 11) does.

Category	Number	Calculation, Estimate, or Data	Source or Basis
California Households	12,433,172	data	U.S. Census Bureau
Average AC Life (conservative)	17	estimate	per NAHB and *This Old House*, the true average is 15 years.
Estimated No. of Replacements/Year	731,363	calculation	12,433,172 / 17
Estimated Percentage w/o Permit	85%	estimate	studies have estimated the percentage to be 60% - 94%
Estimated Number w/o Permit	621,659	calculation	85% X 731,363
Estimated *Avg. Annual* kBtu/sf for Residential Cooling	30	estimate	BGI estimate, but the range from a Fresno apartment to a San Francisco house is very large
Average Size of Residences (s.f.)	2000	estimate	again, the range is large enough that the average is only valid for a first order estimate
Annual Per-Unit Cooling Energy (kBtu)	60,000	calculation	30 X 2,000
Annual Per-Unit Energy Savings Potential (kBtu)	9,000	estimate	conservative estiimate of energy savings from steps taken under a permit (15%)
Statewide Energy Wasted from Non-Compliance (kBtu)	5,594,927,400	calculation	621,659 X 9,000
Statewide Energy Wasted from Non-Compliance (kWh)	490,951,924	calculation	source Btu to kWh conversion
Statewide Energy Wasted from Non-Compliance (GWh)	490.95	calculation	kWh to GWh conversion

From this, we estimate that the potential savings from converting the permit compliance rate for AC replacements from the current estimate of 15% to a rate of 100%, would result in first-year energy savings of about 490 GWH. Given that 100% compliance is unlikely to ever materialize, this should be seen as an upper limit to the potential savings, at least for replacements of residential HVAC equipment.

NEXT STEPS

The CIAG makes the following recommendations:

First, the California Energy Commission would open a proceeding to establish a process by which:

a) Manufacturers must report to the Commission, data on equipment sales to local distributors who sell equipment in California.

b) Distributors who sell equipment in California must report to the Commission, data on equipment sales to contractors who work in California, as well as non-contractors who take delivery of equipment (e.g., retail stores, unlicensed contractors). Initially, these sales data could be reported at the zip code level where the equipment is delivered, instead of reporting the contractor or other buyer's identity.

c) Eventually, contractors must report to the Commission, data on sales of residential replacement equipment. These data need only be reported at a level aggregated by zip code; no customer names or addresses would be required.

d) At a later time, the same process would apply to commercial replacement sales.

Second, the Commission would receive data from HERS Providers on all replacement work verified by their Raters. The Commission would compare these data at the zip code or building department jurisdictional level, identify the jurisdictions where the ratio of unpermitted to permitted work is low, and work with the IOUs to determine what practices from those jurisdictions contribute to that success, so that the lessons can be shared with other jurisdictions. The Commission could establish the HERS Repository it plans to develop with the capability of automatically aggregating data by building department jurisdiction.

The data on sales of equipment should then be compared with the HERS or CEC repository data by serial number and location (zip code level). If equipment is found to be sold to a contractor, and there is no corresponding entry in the HERS registry, the contractor should be asked to provide evidence of where the equipment was installed.

Third, using these comparisons, the Commission and the IOUs could identify those jurisdictions that need the most help, and work with them to increase the percentage of permitted projects.

All of these steps should be taken with the goal of increasing collaboration and cooperation, and expressly voiding the specter of punitive outcomes.

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About the CIAG

The Compliance Improvement Advisory Group (CIAG) is funded by the Investor-Owned Utilities Statewide Codes and Standards Team. It supplies a "boots on the ground" perspective of current energy code compliance issues and potential solutions. This is accomplished by identifying issues, exploring potential solutions and documenting them in the form of white papers. These white papers are then used by the Investor-Owned Utility Code and Standards Team in their efforts to improve energy savings delivered from the Standards.

For more information about the CIAG or to view other white papers, please visit us online at: www.caciag.com

STATEWIDE C&S PROGRAM
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9/17/2013

Help Consumers Realize the Value of Compliance

Developed by: Steve Burger, Kristin Heinemeier and Brian Selby

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PROBLEM STATEMENT

Consumers are often unaware of, or are unwilling to comply with, Title-24, Part 6 Building Energy Efficiency Standards (Standards) and permit requirements when it comes time to replace appliances or make home alterations. Compliance with the Standards is a critical element in saving energy, meeting state and federal requirements, and assuring that claimed energy savings are met. Although state law requires all licensed contractors to pull permits when required by local jurisdictions, the Contractors State License Board (CSLB) investigators are still finding that many appliance installations and alteration projects are being performed without the required permits or the accompanying inspections and testing.

Compliance with the Standards is a critical element in saving energy

Permits alone do not ensure compliance with the Standards. However, permits trigger the process for Standards enforcement. Without them, there would be no means to track whether or not buildings and measures were built or installed to energy code requirements. Permits do ensure that the process is initiated for verifying installed measures and that equipment is working properly and delivering the desired energy efficiency and comfort to the consumer. A recent survey conducted by Building Codes Assistance Project[1] indicates that consumers care about energy efficiency and want their new homes to comply with energy codes, but when it comes to compliance with energy codes and proper appliance installations and alterations this is not necessarily true.

Consumers place a significant trust in their contractor when making decisions about home improvements, and rely on the contractor to inform them about code and permit requirements. For example, when presented with a bid from a licensed contractor for improvements or alterations, consumers may trust that the contractor is installing equipment and materials according to code, and not question whether or not permits are required. Moreover, consumers who do ask about permits may be instructed, falsely, by contractors that they are not required.

Potential barriers to energy code compliance for consumers include misinformation from contractors regarding the requirements for compliance, and the cost and hassle

[1] Energy Codes Messaging Test, Building Codes Assistance Project and Consumers Union, August 2011

of obtaining permits and the related testing and verification for compliance. These barriers, among others, have presumably created a behavior of noncompliance among consumers. This behavior of noncompliance begs the question, "Do consumers realize the value of compliance with energy codes?" If so, then why would someone make improvements and alterations without a permit? The supposition of this paper is that, generally, consumers do not realize the value of compliance regardless of the conditions. This paper explores barriers to compliance and presents potential solutions in overcoming them.

PROOF THE PROBLEM EXISTS

As a result of undercover sting operations conducted by the CSLB over the past few years, investigators have found a growing trend of licensed contractors who are violating state law by telling consumers that building permits are not required to install residential HVAC systems. Up to 40 percent[2] of the contractors who were invited to give project bids at sting locations told investigators that a building permit isn't necessary. This was simply untrue; in fact, the project scenario presented to contractors did require a permit. Whether the contractor was truly unaware of the permit requirement, and therefore misinformed the consumer, or it was just a strategy to provide the lowest possible bid to the consumer is difficult to answer without further investigation.

…one of the most common compliance barriers for consumers is cost

Interviews with building officials[3] revealed that one of the most common compliance barriers for consumers is cost. Building officials reported that when consumers were cited for permit violations, the most common excuse for not obtaining a permit was "the contractor said it would be more expensive to obtain a permit and comply with all the requirements and procedures". In other cases, the consumer instructed the contractor not to obtain permits because it was too expensive. These findings support the theory that some consumers are aware of the code requirements, but choose not to comply due to the cost.

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[2] CSLB Press Release – November 16, 2011 "Changing Your HVAC System? Don't Forget Permits"

[3] Steve Burger, Chief Building Official City of Folsom; Doug Oliver, Chief Building Official Tuolumne County; Bill Nagel, Chief Building Official, City of Redding

In most cases, the average cost of a permit to install a new residential HVAC system is less than $150, which is insignificant when compared to the installed price of the system. However, when you total the additional costs to meet the compliance requirements, such as duct testing, refrigerant charge, airflow and fan watt draw HERS verifications the costs can exceed $500. This is roughly 10% of the average total installed cost, a significant additional expense to consumers.

In addition to the HERS verification costs, there are occasionally "extra" costs that must be borne by the consumer. One example is the expense of installing an entire system when only a part of it needed to be replaced. These often significant "extra" costs can put a bid entirely out of the price range of the consumer. It should be noted that while the measures required by the Standards are generally expected to be cost effective, and presumably include the processing transaction and verification costs, these "extra" costs are not necessarily cost-effective.

Another barrier to compliance is that modifications may have been made in the house that are not up to code, and the consumer is afraid of being "caught". This is a legitimate concern to consumers whose homes have code violations; if an inspector sees any "life safety" issues "in plain sight" they are required to notify the owner to get them corrected. Inspectors do not go through the whole house, attic, or yard, but if they notice a fence down around a pool or some unsafe electrical work in the house or garage while doing a routine inspection, they are obligated to inform the homeowner of the violation. This condition is reason enough for a consumer to avoid compliance and obtaining a permit.

Additionally, recent amendments to the California Civil Code[4] will require homeowners who acquire a permit to make other non-related home improvements to replace their non-compliant plumbing fixtures with water-conserving fixtures. This amendment will go into effect January 1, 2014 and includes toilets that use more than 1.6 gallons of water per flush, showerheads manufactured to have a flow capacity of more than 2.5 gallons of water per minute, and faucets that emit more than 2.2 gallons of water per minute. Although this amendment will save water, it will add to the existing barriers of energy code compliance.

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[4] Civil Code of the State of California; ARTICLE 1.4. Installation of Water Use Efficiency Improvements [1101.1. - 1101.8.]

Interviews with building officials also revealed common complaints among consumers when they were required to comply with the energy code. Complaints include "What's in it for me?", "Why should I have to pay someone to make sure the contractor is doing his job correctly?" and "I bought high efficiency equipment, isn't that enough?" Statements like these indicate that consumers don't understand the importance of compliance.

POTENTIAL SOLUTIONS

Consumers are often unaware of energy codes and related permit requirements when replacing appliances or making home alterations. The Standards are complex, making it difficult for consumers to know what's required and how the requirements apply to their project. It is also true that some consumers are aware of energy code requirements and their responsibility to obtain permits, but choose not to comply for other reasons. There is no hard evidence to support that one condition is more prevalent than the other, and each condition is unique and requires a different approach to correct it.

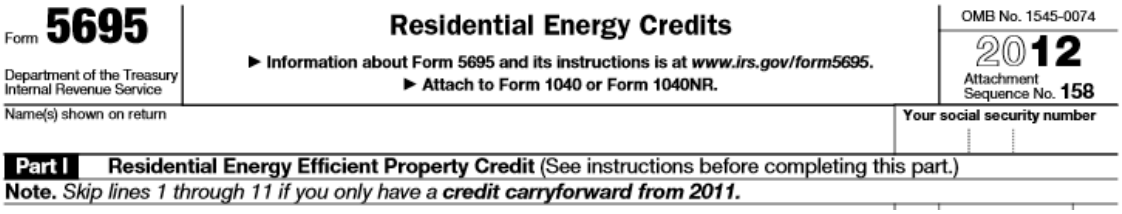
Consumers are more likely to comply with energy codes when it brings them value.

Increasing compliance with energy codes requires input, support and buy-in from a large group of stakeholders, including consumers. Each of these stakeholders has different interests and motivations for compliance. To successfully increase compliance among any of these stakeholders, barriers must first be identified, and then a value proposition must be delivered which will compel changes in behavior. The barriers to compliance identified in the previous section include: uninformed and misinformed consumers, cost, hassle and fear. Delivering a value proposition compelling enough to overcome these barriers is a difficult challenge with consumers.

A value proposition is a promise of value to be delivered and a belief from the customer that value will be experienced. If it is true that consumers are more likely to comply with energy codes when it brings them value, the question is how will this be achieved? This paper will explore potential solutions to address these barriers. Each potential solution represents an idea or concept that CIAG members agree could provide a viable solution to some of the energy code compliance and permit avoidance issues. The list is divided into three categories: incentives, outreach and education, and enforcement.

Incentive Solutions

- Develop a state tax credit for consumers who purchase permits, HERS verifications, and/or spend money on "extra" installation fees for projects that trigger the Standards and require permits. This tax credit or deduction could be similar to the Federal Residential Energy Efficiency Tax Credit, form 5695 (see figure 1). The federal tax credit allows up to 30 percent of the cost of all qualifying improvements with a credit limit of $1,500 for improvements placed in service.



Form **5695**

Department of the Treasury
Internal Revenue Service

Residential Energy Credits

► **Information about Form 5695 and its instructions is at *www.irs.gov/form5695*.**
► **Attach to Form 1040 or Form 1040NR.**

OMB No. 1545-0074

2012

Attachment Sequence No. **158**

Name(s) shown on return

Your social security number

Part I **Residential Energy Efficient Property Credit** (See instructions before completing this part.)

Note. *Skip lines 1 through 11 if you only have a* ***credit carryforward from 2011.***

Figure 1: 2012 Residential Energy Credits, Form 5695

A California Residential Energy Compliance tax credit could provide sufficient value to compel consumers to comply with the Standards and obtain permits. The tax credit could either provide the total amount of qualifying permit fees, HERS verifications and "extra" installation fees or a percentage of the total installed equipment (or measure) cost up to a determined amount. Additionally, a tax credit like this could demonstrate to consumers that California is committed to raise compliance levels throughout the state.

- Develop a utility sponsored rebate program to incentivize obtaining a permit, HERS verifications, and/or "extra" installation cost expenditure. This solution could provide consumers with a financial incentive for projects that trigger the Standards and require permits. A flat rate incentive schedule for residential energy compliance could be developed for different types of qualifying installation and alteration projects. The incentive could be based on the total average permit and HERS verification fee relative to the type of project.

  Sonoma County recently submitted a proposal to develop a Duct Testing and Sealing Rebate Program that addresses the competitive issues by offering an incentive to offset the cost of permitting and testing, and to design and publish

robust marketing materials that inform the customer of the benefits, thus motivating the customers to obtain permits and implement duct testing and sealing. This proposal could be developed into a pilot program as a test case for the concept of a utility sponsored compliance incentive program.

- Develop an amnesty program for consumers who have made previous improvements to their homes without a permit. This incentive could address the fear of being caught for making improvements without a permit. If a consumer discloses the violation during the permit application process for the current improvement, the fees would be waived for the previous violation. Inspections for the previous un-permitted work could be done at the same time as the new work inspections. This approach has the advantage of ensuring that both the current improvement and any previous non-permitted improvements will go through the compliance process. This incentive would most likely work best in conjunction with the rebate or tax credit incentive described above.

Outreach and Education Solutions

- Develop a checklist, based on ACCA Standard 5 (see figure 2 below), showing what the consumer will get for their money. The checklist would include permit and HERS verification fees as well an area to define any "extra" installation costs required to meet the Standards. Part of this checklist would be a performance report that will be filled out after the equipment is placed in service indicating what tests were performed and the results. Development of performance metrics is crucial to the success of this approach and research for this type of outreach is currently underway at UC Davis.

Figure 2: ACCA Standard 5, HVAC Quality Installation Specification

- Develop a fact sheet on protection from nondisclosure liability. Nondisclosure of un-permitted work is the basis of many lawsuits in California. If a home owner

fails to disclose that un-permitted work was done on their home it could be a potential liability for them in the future. A fact sheet could focus on the misconceptions and liability for not disclosing un-permitted work at the time a home is sold. The fact sheet could also inform consumers about the value of complying with the Standards by obtaining a permit at the start of a project.

It takes more than knowledge to change behavior because change can be uncomfortable

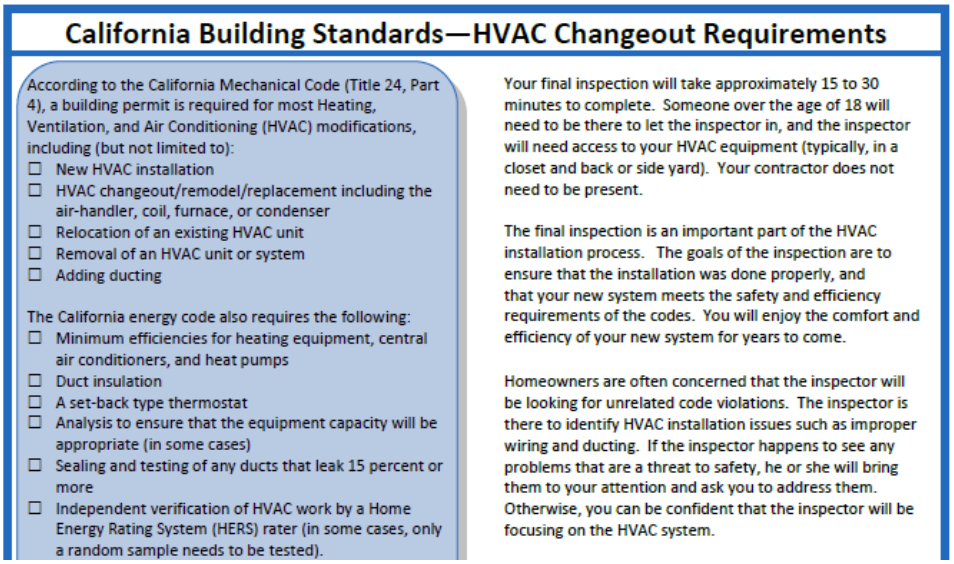
- Develop a consumer awareness campaign for energy code compliance similar to the "Wasting Water is Weird" (see figure 3 below) video campaign developed by Suzanne Shelton from the Shelton Group. The goal of this campaign was to reset consumer behavior by making consumers aware of how much water they use. Research discovered that in many cases people do know that they need to conserve water – but that fact alone didn't change their behavior. Shelton said, "Shorter showers are not awesome." It takes more than knowledge to change behavior because change can be uncomfortable.

Figure 1: Car Wash www.wastingwaterisweird.org

Developing a similar campaign to promote energy code compliance would need to focus on the following outcomes:

- Move people from automatic behaviors to conscious choices
- Make the problem visual
- Make consumers uncomfortable about making the wrong choice
- Give people a specific simple action

- Develop a series of flyers promoting energy code compliance, similar to the flyer developed by the Western HVAC Performance Alliance Compliance Committee (see figure 4, below). The flyers could be distributed through contractors to consumers when bidding on work and address specific types of installations and improvements that focus on the value of complying with the Standards and the benefits of obtaining permits. Ideally, these flyers could be branded by the Energy Commission to give added credibility to contractors who encourage compliance.



California Building Standards—HVAC Changeout Requirements

According to the California Mechanical Code (Title 24, Part 4), a building permit is required for most Heating, Ventilation, and Air Conditioning (HVAC) modifications, including (but not limited to):

- ☐ New HVAC installation
- ☐ HVAC changeout/remodel/replacement including the air-handler, coil, furnace, or condenser
- ☐ Relocation of an existing HVAC unit
- ☐ Removal of an HVAC unit or system
- ☐ Adding ducting

The California energy code also requires the following:

- ☐ Minimum efficiencies for heating equipment, central air conditioners, and heat pumps
- ☐ Duct insulation
- ☐ A set-back type thermostat
- ☐ Analysis to ensure that the equipment capacity will be appropriate (in some cases)
- ☐ Sealing and testing of any ducts that leak 15 percent or more
- ☐ Independent verification of HVAC work by a Home Energy Rating System (HERS) rater (in some cases, only a random sample needs to be tested).

Your final inspection will take approximately 15 to 30 minutes to complete. Someone over the age of 18 will need to be there to let the inspector in, and the inspector will need access to your HVAC equipment (typically, in a closet and back or side yard). Your contractor does not need to be present.

The final inspection is an important part of the HVAC installation process. The goals of the inspection are to ensure that the installation was done properly, and that your new system meets the safety and efficiency requirements of the codes. You will enjoy the comfort and efficiency of your new system for years to come.

Homeowners are often concerned that the inspector will be looking for unrelated code violations. The inspector is there to identify HVAC installation issues such as improper wiring and ducting. If the inspector happens to see any problems that are a threat to safety, he or she will bring them to your attention and ask you to address them. Otherwise, you can be confident that the inspector will be focusing on the HVAC system.

Figure 4: HVAC Change-Out Requirements Flyer

Enforcement Solutions

- Increase enforcement and consequences for consumers not obtaining permits. One example of a potential enforcement measure targeting consumers is attaching a lien or judgment to the property title until the violation is resolved. Enacting penalties for end consumers is more problematic than penalizing the contractor, since it is often difficult to prove whether the consumer completed the work with full knowledge of the permit requirement, or was ignorant of it. At this time, the consequences for homeowners who do their own work on a project and fail to obtain a permit are light. For example, in the City of Folsom, if the homeowners are “caught”, they are simply required to get a permit for the work that was done. If a licensed contractor is doing the work without a permit, the job stops until a permit is obtained, and the permit fee is doubled for a first offense and tripled for a second offense.

- Develop home warranties that require a permit number and/or permit fee receipt and/or a final inspection report to be submitted by the consumer. Most warranty policies cover the replacement of appliances which trigger the energy code and permits, like HVAC systems and water heaters. Permit fees are typically covered under home warranty policies, but most companies who offer them do not require verification of the permit nor do they cover additional fees like HERS verifications. This solution, although very simple in concept, may be very difficult to implement. Requiring proof of a permit for warranty claims would put a burden of enforcement on the warranty provider which is not necessarily their responsibility.

IMPACT ON COMPLIANCE

There is little doubt that compliance with the Standards will have a positive impact on saving energy, reducing utility bills and ensuring that claimed energy savings are being met. Stakeholders see these as the primary benefits of compliance. But, from a consumer standpoint, these benefits alone do not provide enough value to change their behavior of non-compliance. Developing effective methods of helping consumers realize the value of compliance is essential if we are going to see a lasting behavior change.

When permits are obtained and the compliance process is accomplished, consumers will not only save money on their utility bills, they may also experience increased comfort and indoor air quality in the home, and be assured that the equipment or measure was installed correctly and is operating safely. These added benefits, among others, may offer the consumer additional value needed to change their behavior.

NEXT STEPS

Whether the problem is that people don't want to comply due to various barriers, or that they don't realize that compliance is required, we don't have enough information to determine where exactly the problem lies. Additional research is needed to help identify all the barriers to compliance for consumers, and then develop solutions that offer a value proposition that will compel consumers to change their behavior.

Market research is necessary to help identify the drivers that affect consumers when making decisions about home improvements. Identifying compliance costs is a

critical step towards developing potential solutions to the problem. Research could be conducted by surveying building departments and HERS raters throughout the state to develop average costs for the various situations that trigger the Standards and require permits. Gathering information from building departments to identify the most common complaints and barriers among consumers when required to comply with the energy code would also help in developing lasting solutions.

Research is also needed to determine the cost of not complying. Consumers understand the value of installing efficient appliances and measures but do not understand that non-compliance can potentially cost them more in the long run. This research could provide valuable information for developing a convincing argument for energy code compliance.

The CIAG is facilitated by:

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400 Plaza Dr., Suite 120
Folsom, CA 95630

Send Comments or Questions to:
info@caciag.com or call: (916) 221-3110

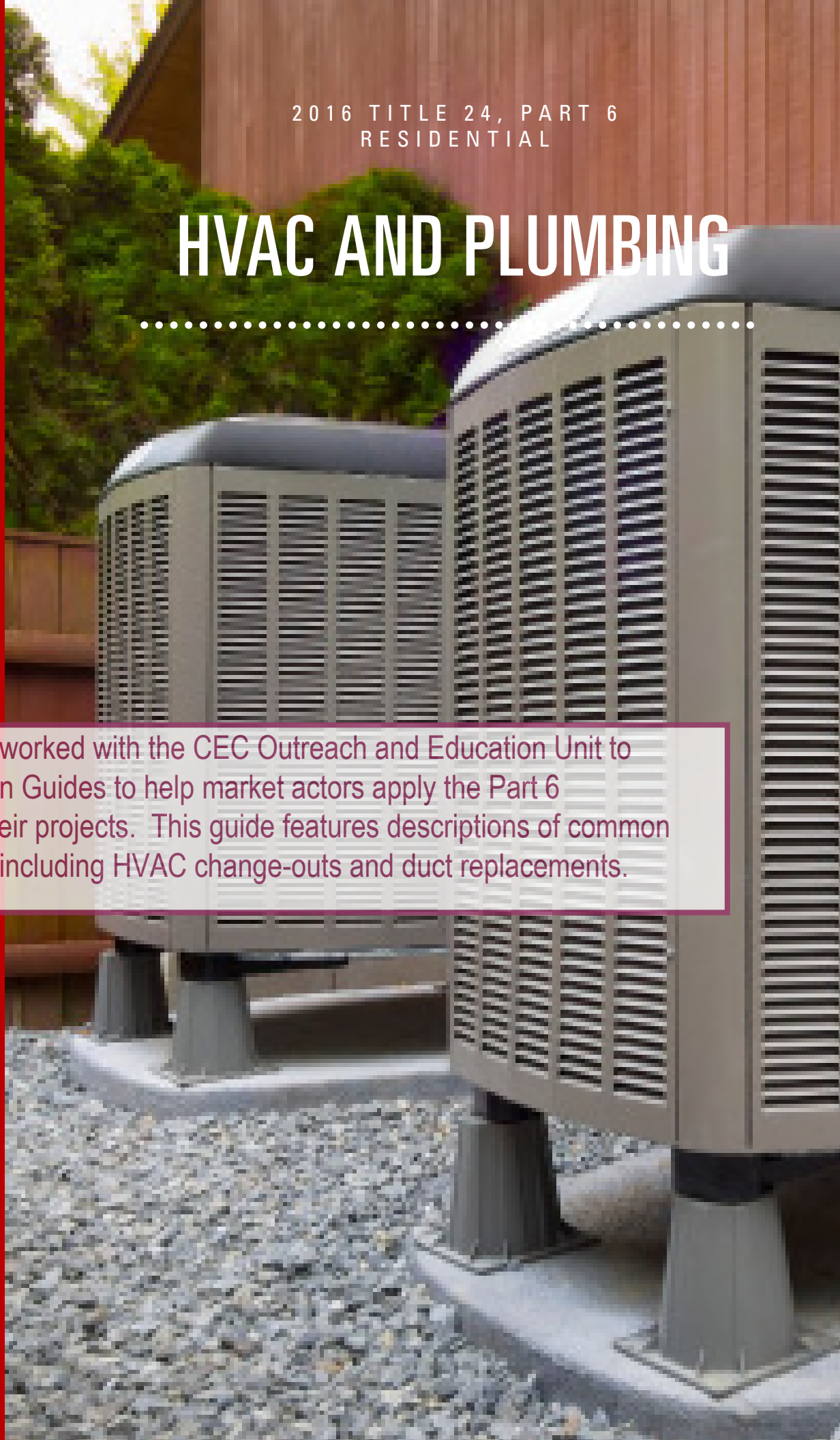
About the CIAG

The Compliance Improvement Advisory Group (CIAG) is funded by the Investor-Owned Utilities Statewide Codes and Standards Team. It supplies a "boots on the ground" perspective of current energy code compliance issues and potential solutions. This is accomplished by identifying issues, exploring potential solutions and documenting them in the form of white papers. These white papers are then used by the Investor-Owned Utility Code and Standards Team in their efforts to improve energy savings delivered from the Standards.

For more information about the CIAG or to view other white papers, please visit us online at: www.caciag.com

2016 TITLE 24, PART 6
RESIDENTIAL

HVAC AND PLUMBING



Energy Code Ace worked with the CEC Outreach and Education Unit to develop Application Guides to help market actors apply the Part 6 requirements to their projects. This guide features descriptions of common project scenarios, including HVAC change-outs and duct replacements.

Energy Code Ace™
HELPING YOU PLAY YOUR CARDS RIGHT

RESIDENTIAL
HVAC AND PLUMBING
APPLICATION GUIDE

CONTENTS

2016 ENERGY CODE

Ace Resources | Title 24, Part 6 Triggers

Residential

HVAC – Alterations

Split Systems and Packaged Systems

	Mandatory Requirements					Prescriptive Requirements	
Change This ***(and nothing else)***	Setback Thermostat §110.2(c), §150.2(b)1Fi	Cooling Load Calcs §150.0(h), §150.2(b)1C	Heating Load Calcs §150.0(h), §150.2(b)1C	HERS: Duct Seal and Test §150.0(m)1-3 & 11 §§150.2(b)1C, D, & E	Air Filtration and HERS: Cooling Coil Airflow and Fan Watt Draw §§150.2 (b)1C, D	Duct Insulation §150.2(b)1D	HERS: Refrigerant Charge §150.2(b)1F
Whole Split or Packaged System *(no ducts added or replaced)*	**YES**	no	no[C]	**YES**[D]	no	no	**YES**[H, I, J]
Evaporator Coil (cooling coil), Condenser Coil, or Outdoor Condensing Unit	**YES**	no	no[C]	**YES**[D]	no	no	**YES**[H, I, J]
Furnace *(air handler)*	no	no	no[C]	**YES**[D]	no	no	**YES**[H, I, J]
Compressor, Refrigerant Metering Device	**YES**	no	no[C]	no	no	no	**YES**[H, I, J]
Some Ducts >40 feet of new or replacement	no	maybe[B]	maybe[C, B]	**YES**[E]	no	**YES**[G]	no
"All New" Ducts[A]	no	maybe[B]	maybe[C, B]	**YES**[E]	**YES**[F]	**YES**[G]	no
Whole Split or Packaged System and All New Ducts	**YES**	**YES**[B]	**YES**[C, B]	**YES**[E]	**YES**[F]	**YES**[G]	**YES**[H, I]

Note:
- Replacing the blower wheel fan is considered a repair and does NOT trigger the Energy Standards.
- All new HVAC equipment must meet minimum federal efficiency requirements
- Cooling line insulation is triggered if the line set (cooling system, suction line) is replaced or repaired. Line sets ≤1.5" in diameter must have 0.75" thick insulation.

A The system is considered to have "all new" ducts when 75% or more of the ducts are new material and up to 25% reused parts from the existing duct system (e.g., registers, grilles, boots, air handler, coil, plenums, duct material) if the reused parts are accessible and can be sealed to prevent leakage.

B Cooling and heating load calculations are required when ducts are added to serve new conditioned space, such as an addition.

C Heating equipment must meet CBC minimum capacity requirements.

D In duct systems 40 feet or longer, duct leakage must be ≤15% in total, or ≤10% to the outside. Or, if unable to meet the sealing requirements, [illegible] §150.2(b)1E applies.

E Unless exceptions apply, duct systems must be sealed and verified if >40 feet of new or replacement ducts are installed. In all climate zones, when new duct systems are installed in unconditioned space, [illegible]

F When new duct systems are installed, cooling coil airflow must be >350 CFM per ton, and fan watt draw must be ≤0.58W/CFM. Alternatively, the system can meet the requirements in Table 150.0-B or Table 150.0-C (Return Duct Sizing and Filter Sizing).

G When adding or replacing >40 feet of ducts in unconditioned space: CZ 1-10 and 12-13: R-6; CZ 11 and 14-16: R-8. HERS verification is required for insulated ducts in conditioned space. Mandatory duct insulation requirements (R-4.2) apply to all new or replacement ducts (not existing or unaltered ducts).

H HERS verification of refrigerant charge is required in climate zones 2 and 8–15 only when a refrigerant containing component of an air conditioner or heat pump is replaced or installed in an existing building. [illegible] HVAC systems with approved Fault Indicator Displays (FID) devices at the time of [illegible] CEC-approved FID should such equipment become available during the 2016 code cycle.

I HERS verification of minimum system airflow greater than or equal to 300 cfm per ton, or alternate approved procedure, is required.

For More Information

Primary Sources

- Energy Standards Section 110.2 – Mandatory Requirements for Space-Conditioning Equipment
  energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1102mandatoryrequirementsforspaceconditioningequipment.htm
- Energy Standards Section 150.0 – Mandatory Features and Devices
  energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1500mandatoryfeaturesanddevices.htm
- Energy Standards Section 150.1 – Performance and Prescriptive Compliance Approaches for Newly Constructed Residential Buildings
  energycodeace.com/site/custom/publicreference-ace-2016/index.html#!Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.htm
- Energy Standards Section 150.2 – Energy Efficiency Standards for Additions and Alterations in Existing Buildings that Will Be Low-Rise Residential Occupanices
  energycodeace.com/site/custom/public/reference-ace-2016/Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm

California Energy Commission Information & Services

- Energy Standards Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
  energy.ca.gov/title24/orc/
  - The Energy Commission's main web portal for Energy Standards, including information, documents, and historical information

Additional Resources

- Energy Code Ace:
  EnergyCodeAce.com
  - An online "one-stop-shop" providing free resources and training to help appliance and building industry professionals decode and comply with Title 24, Part 6 and Title 20. The site is administered by California's investor-owned utilities.
    Of special interest: 2016 Fact Sheet on Residential HVAC Alterations
    energycodeace.com/content/resources-fact-sheets
    Please register with the site and select an industry role for your profile in order to receive messages about all our free offerings!

This program is funded by California utility customers and administered by Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E®), Southern California Edison Company (SCE), and Southern California Gas Company (SoCalGas®) under the auspices of the California Public Utilities Commission.

What is a Residential HVAC Alteration?

A residential HVAC alteration is any change to a home's space-conditioning system that is regulated by Title 24, Part 6, which include systems that provide heating, or cooling within or associated with conditioned spaces in a home. The 2016 Building Energy Efficiency Standards (Energy Standards) Title 24, Part 6 include requirements for alterations affecting residential space-conditioning systems, which are generally categorized in the following three groups:

- Altered or Replaced Duct Systems
- Altered Space-Conditioning System
- Entirely New or Complete Replacement Space-Conditioning System

Why?

As much as half of the energy used in a typical home goes to heating and cooling. Ensuring that HVAC systems are as efficient as possible can result in significant energy savings.

Relevant Code Sections

Title 24, Part 6 Building Energy Efficiency Standards:

- Section 110.2 – Mandatory Requirements for Space-Conditioning Equipment
- Section 150.0 – Mandatory Features and Devices
  - 150.0(h) – Space-Conditioning Equipment
  - 150.0(i) – Thermostats
  - 150.0(m) – Air-Distribution and Ventilation System Ducts, Plenums, and Fans
- Section 150.1 – Performance and Prescriptive Compliance Approaches for Newly Constructed Residential Buildings
- Section 150.2 – Energy Efficiency Standards for Additions and Alterations to Existing Low-Rise Residential Buildings
  - 150.2(b)1C – New or Complete Replacement Space - Conditioning System
  - 150.2(b)1D – Altered Duct Systems - Duct Sealing
  - 150.2(b)1E – Altered Space-Conditioning System - Duct Sealing
  - 150.2(b)1F – Altered Space-Conditioning System - Mechanical Cooling

Altered or Replaced Duct Systems (Duct Sealing)

- Extension of Existing Ducts
  - >40 ft of extended duct system
- Entirely New or Replacement Ducts
  - ≥75% of new duct system
  - Up to 25% existing duct system components may be reused, if accessible and can be sealed
  - [illegible] of duct system [illegible] compliance documentation or duct leakage testing
  - It must meet mandatory HERS inspection only.

Table 150.2-A Duct Insulation R-Value

Climate Zone	1 through 10, 12 & 13	11, 14 through 16
Duct R-Value	R-6	R-8

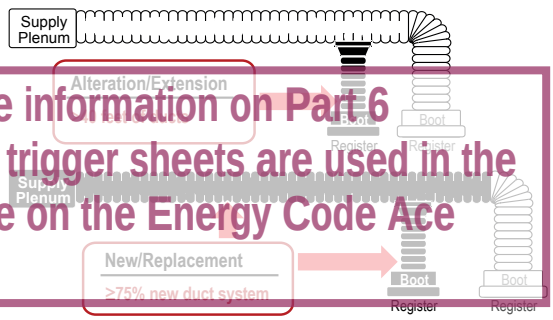


Figure 1: Altered or Replaced Duct Systems (Duct Sealing): §150.2(b)1D

Altered Space-Conditioning System

Not entirely new or complete replacement space-conditioning system and any of the following components is installed or replaced:

- Any refrigerant-containing component, including:
  - Cooling coil
  - Condenser coil
  - Compressor Refrigerant piping
  - Refrigerant metering device
  - Outdoor condensing unit

  OR
- Air handler

  OR
- Heat exchanger

Replacing other components is considered a repair - not an alteration. For example, replacing the blower wheel fan, but not the heat exchanger or air handler in the furnace, is a repair.

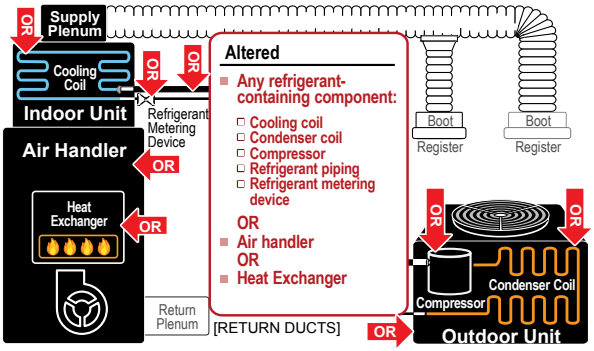


Figure 2: Altered Space-Conditioning System: §150.2(b)1E,F

Entirely New or Complete Replacement Space-Conditioning System

All of the following are installed or replaced:

- All the system heating/cooling components
- >75% new duct material

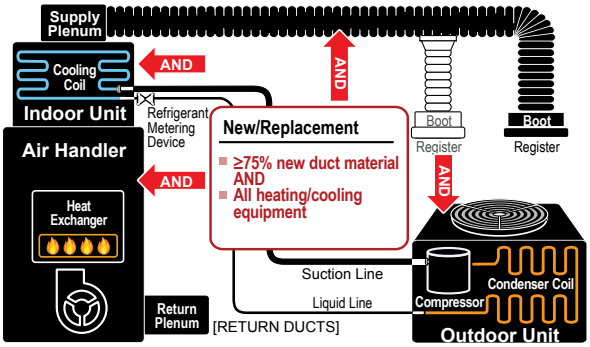


Figure 3: Entirely New or Complete Replacement Space-Conditioning System: §150.2(b)1C

Duct Sealing and Testing (HERS measure)

Duct Sealing and Testing (HERS measure) is required for both altered duct systems and new/replacement duct systems.

- **Extension of Existing Ducts >40 ft:** The measured leakage must be ≤15% of system air handler air flow. (There are alternatives to meeting the maximum 15% leakage. Consult your Building Department or Section 150.2(b)1Diib).
- **Altered Space Conditioning System:** The measured leakage must be ≤15% of system air handler air flow. (There are alternatives to meeting the maximum 15% leakage. Consult your Building Department or Section 150.2(b)1E). In addition, the system must have a cooling coil airflow >300 CFM per ton of nominal cooling capacity and verified by the HERS Rater. Refrigerant Charge verification is Prescriptively required for Climate Zones 2 and 8-15.
- **New/Replacement Space Conditioning System:** The Duct Sealing and Testing (HERS measure) must demonstrate a leakage rate ≤5% of the system air handler airflow. In addition, verification of Cooling Coil Airflow and Fan Watt Draw (HERS measure) is required. The system must have cooling coil airflow >350 CFM per ton of nominal cooling capacity, and an air-handling unit fan efficacy ≤0.58 W/CFM. Refrigerant Charge verification is Prescriptively required for Climate Zones 2 and 8-15.

Setback Thermostats: §110.2

Only altered or new/replacement cooling systems trigger installation of setback thermostat. It is not required for heating-system-only replacements.

Equipment Efficiency: §110.2

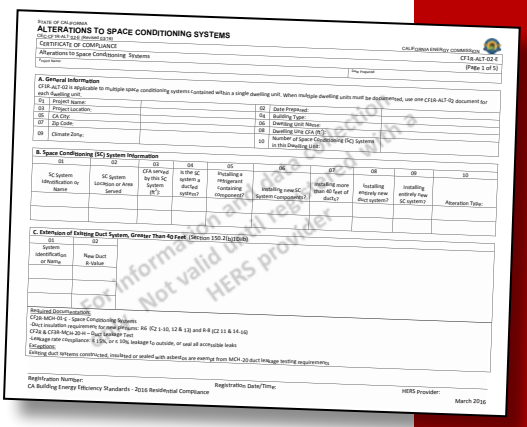
Most heating and cooling equipment installed in California homes is regulated by the National Appliance Efficiency Conservation Act (NAECA) and/or the California Appliance Efficiency Regulations (Title 20)

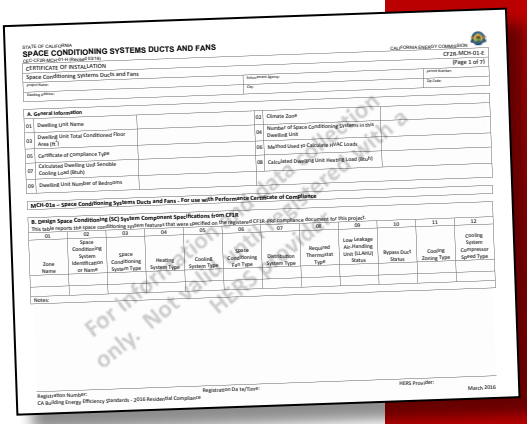
Forms: Which & When

In addition to a permit, typically HVAC alterations require the following:

- CF1R: Certificate of Compliance: Alteration to an HVAC System
  - CF1R-ALT-02-E
    - Completed and signed by the installing contractor
    - Must be registered with a HERS Provider prior to permit application
  - CF1R-ALT-03-E
    - For Climate Zones 1, 3-7, 16
    - May be filled out by hand, but must be registered with a HERS Provider prior to final inspection
  - CF1R-ALT-04-E
    - For Climate Zones 2, 8-15
    - May be filled out by hand, but must be registered with a HERS Provider prior to final inspection
- CF2R-MCH-01*-E: Certificate of Installation for Space Conditioning Systems, Ducts and Fans
  - Completed and signed by the installing contractor, and made available for final inspection by building department
  - Must be registered with a HERS Provider prior to final inspection
- CF3R-MCH Forms: Certificate of Verification
  - CF3R-MCH-20*-H: Certificate of Verification for Duct Leakage Diagnostic Test
    - Completed by the HERS rater and made available for final inspection by building department
    - Must be registered with a HERS Provider prior to final inspection
  - CF3R-MCH-22*-H: Certificate of Verification for Fan Efficacy
    - Completed by the HERS rater and made available for final inspection by building department
    - Must be registered with a HERS Provider prior to final inspection
  - CF3R-MCH-23*-H: Certificate of Verification for Airflow Rate
    - Completed by the HERS rater and made available for final inspection by building department
    - Must be registered with a HERS Provider prior to final inspection
  - CF3R-MCH-25*-H: Certificate of Verification Refrigerant Charge
    - Completed by the HERS rater and made available for final inspection by building department
    - Must be registered with a HERS Provider prior to final inspection

* Correct version (e.g., "a", "b", "c") varies depending upon the project scope and approach used to demonstrate compliance


ALTERATIONS TO SPACE CONDITIONING SYSTEMS
CERTIFICATE OF COMPLIANCE
Alterations to Space Conditioning Systems
CF1R-ALT-02-E
(Page 1 of 5)
A. General Information
B. Space Conditioning (SC) System Information
C. Extension of Existing Duct System, Greater Than 40 Feet
Registration Number:
Registration Date/Time:
HERS Provider:
CA Building Energy Efficiency Standards - 2016 Residential Compliance
March 2016


SPACE CONDITIONING SYSTEMS DUCTS AND FANS
CF2R-MCH-01-E
(Page 1 of 7)
CERTIFICATE OF INSTALLATION
Space Conditioning Systems Ducts and Fans
A. General Information
MCH-01a – Space Conditioning Systems Ducts and Fans - For use with Performance Certificate of Compliance
B. Design Space Conditioning (SC) System Component Specifications from CF1R
Registration Number:
Registration Date/Time:
HERS Provider:
CA Building Energy Efficiency Standards - 2016 Residential Compliance
March 2016


DUCT LEAKAGE DIAGNOSTIC TEST
CF3R-MCH-20-H
(Page 1 of 3)
CERTIFICATE OF VERIFICATION
Duct Leakage Diagnostic Test
A. Systems Information
MCH-20a - Completely New Duct System
B. Duct Leakage Diagnostic Test
Registration Number:
Registration Date/Time:
HERS Provider:
CA Building Energy Efficiency Standards - 2016 Residential Compliance
March 2016

For More Information

Primary Sources

- Energy Standards Section 110.2 – Mandatory Requirements for Space-Conditioning Equipment
  energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1102mandatoryrequirementsforspaceconditioningequipment.htm
- Energy Standards Section 150.0 – Mandatory Features and Devices
  energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1500mandatoryfeaturesanddevices.htm
- Energy Standards Section 150.1 – Performance and Prescriptive Compliance Approaches for Newly Constructed Residential Buildings
  energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.htm
- Energy Standards Section 150.2 – Energy Efficiency Standards for Additions and Alterations to Existing Low-Rise Residential Buildings
  energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm
- Residential Compliance Manual, Chapter 4: HVAC Building Requirements
  energy.ca.gov/2015publications/CEC-400-2015-032/chapters/chapter_4-Building_HVAC_Requirements.pdf

California Energy Commission Information & Services

- Energy Standards Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
  energy.ca.gov/title24/orc/
  - The Energy Commission's main web portal for Energy Standards, including information, documents, and historical information

Additional Resources

- Energy Code Ace:
  EnergyCodeAce.com
  - An online "one-stop-shop" providing free resources and training to help appliance and building industry professionals decode and comply with Title 24, Part 6 and Title 20. The site is administered by California's investor-owned utilities.
    Of special interest:
    - 2016 Trigger Sheet on Residential HVAC Alterations:
      energycodeace.com/content/resources-trigger-sheets/

    Please register with the site and select an industry role for your profile in order to receive messages about all our free offerings!

Roadblock: Lack of Consumer Demand

Energy Code Ace held a focus group with members of the Compliance Improvement Advisory Group who were involved in the compliance process for HVAC changeouts. The group identified compliance roadblocks, all market actors involved, and potential solutions, documented here.

Market Actors

Homeowners
Neighbors
Manufacturers
Distributors
Building Departments
Raters
City Council
Technicians
Contractors
CSLB
CEC
Legislators
Real estate agents
Utilities
Insurance Companies

Factors Contributing to Roadblock

	Additional detail
Need	Customers don't find value in permit
	No clear financial benefit
Homeowner Incc	Emergency situation (urgency)
	Appt. window for inspection
	Have to meet inspector at home
Fear of Regulatio	Inspector will find unrelated not permitted work
Cost Factors	To code measures
	Permit Fees
	Installation cost
	HERs rater
	Unintended code consequences
	Finaling permit
	Inability to verify cost
Cost effectivenes	Payback can be long
Homeowner does not know code requirements/triggers	
Skepticism about global warning	
Realtors not communicating EE value	
Inability for homeowners to verify costs (when receiving bids)	
Mistrust in contractor	

Potential Solutions

Homeowner education
Payback analysis for contractor to present to homeowner
Sampling of inspections & Bulk (ie Statewide) Permits
Flex hours for Bldg Dept. to cover 7 days per week
Tighten appointment windows through more detailed communication between contractor and BI
Option for HERS/contractor or homeowner to meet inspectors
Homeowner education
Financing: OBF (option) or Independent Lender or Manufacturers; financing program needs to be simple to understand
Bulk (ie Statewide) Permits
Turn-key Package
Payback analysis for contractor to present to homeowner
Proof of permit for utility incentive
Tool to estimate costs (so homeowner knows if the bids they are getting are fair market value)
Turn-key package
Homeowner education
Turn-key package
"Pre-selected" Contractors (vouched for by known or trusted entity to homeowners)
Whitelist recognition: Angie's List >> IOU Quality Care Contractor
"Pre-selected" Contractors (vouched for by known or trusted entity to homeowners)

Roadblock: Equipment Point-of-Sale Not Involved in Compliance Process

Market Actors

Raters: Submits data to HERs database
Providers
Contractors: Hire HERs rater, apply for incentives
Distributors: Reports serial # & contractor at POS; applies for incentive during pilot (incentive could be replaced by legislation)
Building Departments: Enforce CF-4R forms
CSLB: Outreach campaign (enforcement outside this program)

CEC: Possibly keeps database and performs cross-checks; informs legistlation
PG&E: Provide training to contractors, outreach campaign, incentives for distributors & contractors
Legislation: Could replace incentives after pilot, or initial market transformation

CALBO: Outreach
CPUC: Data to establish compliance baseline gained

Potential Solution: Process for Equipment Tracking

1. Distributors participating in the trial program record manufacturer serial # and contractor for each equipment sale and report to program database accessible by HERS providers. (Database structure, location and maintenance to be determined)
2. Distributors apply for incentive from implementer (incentive for gathering information on units sold)
3. Contractor takes equipment from distributor
4. Contractor goes to building department & applies for permit
5. Contractor installs equipment
6. Contractor hires HERs rater for testing & confirms serial # at the same time
7. HERs rater submits the correct form under the 2013 T24 standards to HERs registry, including serial # from equipment and contractor makes final the permit
8. Serial # goes from HERs registry to statewide database managed by Program implementer
9. Serial # from distributor gets cross-checked with serial # from HERs raters, to find matches
10. Program may pay incentive when there is a match between a completed HERS inspection and equipment in database. (amount and recipient to be determined)

General Notes:

17000 mechanical contractors registered as C-20

Info graphic
Gathers baseline data
Supports process including bldg permits, HERs etc.
Double incentive baseline Initiative

Helps buy down cost of HERs
RFP for implementer who gets data from HERs registry and matches to distributor info
NDA with distributions defining how data can/can't be used
Matches prompt rebates to contractor with annual awards
1st leg: Incentives to contractors helps buy down HERs costs
2nd initiative focuses on distributors
3rd leg of the stool focuses on Best Practices tools to building depts and contractors

Related Issues to be considered

Ownership of information: will the data be public? If so, how do we protect proprietary product information? Can the data entry be a serial #, but the database assign a random tracking # to it?

This process provides compliance benchmarking data, and uses incentives to instigate market transformation, it is not focused on policing
Good cop/bad cop strategy -- PG&E stays on good cop side using incentives and data tracking for compliance baseline
If CSLB wants to use the data for enforcement or punitive action, that is completely outside this program
Confidentiality clause for distributors
Distributor fear: can we work with a distributor to understand how this process may be able to work for them? What incentive would they require to participate?
With what organization does this database reside? CEC? Do they have the resources to maintain it?
What role does CALBO have in this?

Initiatives as outcome from mind mapping:

Tools for Contractors

Bulk permits
Sampling for inspections
Online permitting (statewide)

The main issue is inspection after online permit is pulled because it's a huge inconvinience to the consumer. If inspection can be a sample, then this eliminates this issue. If a contractor doesn't pass inspection, there could be required training or other remediation that's required to be able to participate in sampling again. This would motivate contractors to get it right because they would be at a competitive disadvantage in the market if they can't offer their customers no inspection. City of LA is example of this.

Outreach to Consumers

Create outreach packet for contractors to educate consumers, distribute through other public channels as well including:
- Payback analysis to demonstrate value
- Cost breakdown by EEM
- Non-energy benefits (ie comfort)
- Case studies, testimonials

Whitelist for contractors (IOU Quality Care Contractors?) NATE?

Compliance Process

Flex hours for inspections
Appointments for inspections
Third party inspectors for weekends or after hours

All of these relate to reducing the consumer inconvenience related to inspections. Inspection sampling would address the same issues.

Incentives (monetary)

Financing (OBF or not)
Proof of permit for existing IOU incentives
Turn-key package solution
Tiered incentives
- Air flow correction
- Duct sealing?
- Evap coil change?
- HERS?
- Roll into QM program

Training

Support "pre-selected" or QCC
Must be trained (or QCC) to revieve rebates
Focus on tools and technical training