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New Science on Bio-Toxin Infiltration Calls for Contractor Training and Enforcement

August 22, 2018 re: Mitsubishi Electric US
Additional Compliance Comments
Dear CEC Staff,

The attached is a follow-up on our previous comments to CEC prepared for posting on the docket.

I know that you are all committed to efficiency, but have heard some reservations from staff about mandatory training and certification requirements for both contractors AND their staff. If we make such training voluntary, compliance with permits and HERS verification requirements will evade us for yet another decade.

I am impressed that we are at a crossroads, installed efficiency and permit compliance are very low and bold action is required to achieve a high degree of compliance in the State of California. There are significant indoor air quality and health and safety impacts that call for bold action. Requiring training will be like medicine for contractors. They wonâ€™t like the taste at first, but they will see that it makes them much better, and only afterwards will appreciate the added value that a QI training program can offer.

I have spoken to many industry leaders about the attached outline and the ideas contained therein, and there is general support for this approach. Industry and HARDI can get behind restricting sales only to licensed contractors, and for making warranties contingent upon licensing, permitting and HERS testing. They agree on finding a reasonable method to achieve higher quality installs on a nationwide basis, and are equally opposed to serial number tracking because they see that as nearly impossible to implement given the decentralized nature of such a system.

We are looking for a reasonable compromise and effective solutions that promote 95% compliance in California within a few years with significant impacts on customer satisfaction, including comfort, energy savings, and improved indoor air quality. Thank you for including industry in this dialogue. We are desirous of a collaborative effort that will produce measurable results.

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Additional submitted attachment is included below.

HVAC QUALITY INSTALL AND COMPLIANCE STRATEGIES SUMMARIZED:

Addendum #2 to Comments Submitted to CEC Publication Docket

by Bruce Severance, Mitsubishi Electric US – Cooling and Heating 8-21-18

The following document outlines the key components of a program to moving the needle from 5% compliance to 95% compliance with permit and HERS verification requirements within a few years. It embodies proposals for which several major manufacturers and HARDI, the distributors association have expressed general support. It is our belief that this plan will exceed the 30-40% efficiency increase that can be achieved by meeting 2019 code requirements, because it embraces system optimization that exceeds current code, namely Chitwood's installation methodology. Manufacturers are very desirous of improving enforcement and contractor training in order to bring the "installed efficiency" of the average HVAC system in line with the rated efficiency of the equipment. Substandard installation work in the field is commonplace, and it compromises energy savings, comfort, indoor air quality and customer satisfaction. The industry is already committing significant resources to contractor training, tech support, and continuous improvement of the product with an eye on minimizing environmental impacts – only to have these efforts negated by poor installation work performed illegally without permits or the required HERS testing to verify installation quality. The following multi-pronged strategy aims to address a self-sustaining enforcement program, conflicts of interest in HERS and home inspections, and expanded contractor and inspector training for all contractors, their employees and building inspectors.

If any of these key strategies is ignored, the current rate of 5% to 7% compliance with permit requirements will most likely continue. Given recent peer reviewed medical research on bio-toxin related illness, and the mechanics of how duct leakage drives bio-toxin infiltration into the home, there should be no hesitation on the part of regulators to impose penalties that are sufficient to support the cost of enforcement and provide a real deterrence. Failure to act boldly on enforcement, and hesitation to collaborate with industry on requiring contractor training and ending unlicensed work will significantly compromise efficiency and indoor air quality impacts through another decade. Half measures are not enough, and we want to partner to achieve actual results. With the legislative mandate of SB1414, and recent bio-toxin research, the time is ripe to get serious about cracking down on unpermitted and unlicensed work. In light of the serious effects of bio-toxin infiltration, the public is justified to demand that contractors deliver quality installations and the healthy living environments that homeowners deserve. Industry should not lose this opportunity to get ahead of the duct-leakage/bio-toxin story that is likely to go mainstream in the coming months. There has always been a dedication among industry leaders to be true to the public good and the public trust.

Manufacturers and distributors seem to be generally enthusiastic about supporting compliance efforts through a number of effective measures and they are working hard to build consensus. Clearly, none supports serial number tracking, which they see to be fruitless and costly. They are universally supportive of improved installation quality, as substandard installs negatively impact energy savings, comfort, indoor air quality customer satisfaction, warranty liabilities, reputation and dealer loyalty. The following document will attempt to outline a strategy through which all parties, regulators, contractors, manufacturers, distributors, HERS providers and utilities can come together to bring about a "miraculous" transformation of the industry through a doubling of "installed efficiency" so that the installation quality maximizes the rated efficiency of the equipment sold. A handful of major

manufacturers and a key distributor association seem to agree with most of the following suggestions and would support this proposed collaboration, provided however that discussion of serial number tracking is off the table. This is seen as a white elephant with no return on investment or benefit to manufacturers, and no possible single-party control of the process. This document attempts to demonstrate the shortcomings of serial number tracking, and the inevitability of an inaccurate database that will result. The challenges of trying to actually find coherent clues in that database would be costly and difficult to trace when there are insufficient enforcement budgets among the building departments and CSLB offices to do such investigative work. There are much more direct and cost-effective measures that industry can enact through their corporate and warranty policies that will be nearly impossible for the few bad actors in the field to circumvent. Collaboration is key.

A financially self-sustaining enforcement program that instills some respect for code requirements is the essential to compliance in California. Currently, enforcement is so sparse and the CSLB warning system is so lax that contractors know there are no consequences to non-compliance. There is virtually no deterrence. The CSLB has rightfully defended that it does not have the budget to execute a broad enforcement plan and it has focused on performing a handful of "sting" operations to arrest a few unlucky violators. Despite widely publicizing their arrest in an effort to deter others, the warning systems and limited sting operations are ineffective. The problem is that the vast majority of contractors know the system lacks "teeth" and they have cavalier disregard for permit and code requirements. The CSLB also has a very courteous system for issuing two warnings for violations that gives contractors plenty of time and space to make excuses for code violations and argue their innocents, despite the health and safety implications of their violations. Some proudly admit that they haven't "filed a permit in 30 years" and see no reason to do so even though they are aware of the requirements. In short, it's the Wild West. Contractors know what the permit requirements are, but refuse to perform the required load calculations, duct design, and proper commissioning which results in average installed efficiency on system replacements hovering at around 58% of the rated efficiency of the equipment. Most alarming, there is a public health crisis brewing because the high duct leakage rates in existing homes drives fiberglass, asbestos and bio-toxin infiltration into the homes resulting in widespread illnesses and indoor air quality that is ten times worse than outdoor air in most homes.

The average HVAC system installation quality is remarkably low, lacks job planning, system design, or an understanding of the key variables that impact efficiency and indoor air quality. A case in point: a home I inspected last night had an AC system replacement performed by a big-box retailer four years ago under a subcontract by an HVAC contractor in the San Fernando Valley. The home owner paid top dollar for the AC system and duct replacement. The licensed contractor broke off the tops of the old duct boots that had been asbestos covered, but left the old registers open to the interior after disturbing the asbestos in the attic. The attic air was flowing freely into the house through six-inch holes that had loose asbestos fibers around them. There was a permit that the client believes was finaled but the CF3R indicated that the house was part of a sampling and was "not tested". The existing 5-ton air handler in the attic was 25 years old and due for a replacement, but was not replaced. It was hooked up to new supply and return ducts, but there was only an 18" duct leading to a 14x30" filter grill in the hallway. Clearly, the air-handler required more than three times that amount of air-flow. The filter was so stressed by the volume of air going through it that it was completely bowed upwards and the air was whistling past it. Obviously, the house did not comply with ACCA manual D, J and S, and the HERS rater

did not even visually inspect the system for compliance with flow requirements. The duct leakage on the supply side was significant enough that you could feel the hot air pour in through the old grills that remained open to the attic when the AC was turned on, the result of pressurization of the attic combined with depressurization of the conditioned space. Because of the low-pitch hip roof and poor venting, the attic was over 140 degrees in mid-summer heat, transferring that heat directly to the home through open 6" holes all over the house, adding significantly to cooling loads and more than doubling the energy bills over what could have been achieved. The attic was also littered with asbestos, an indication that some past contractor removed the chrysotile asbestos wrapped ducts without performing the required certified abatement process. To make matters worse there were numerous other code violations including violation of the drywall firewall separating the residence attic from the garage attic to run ducts to the drywall ceiling in the garage. A hollow core door with a 2" gap below it was located where the fire door to the garage should have been. The ducts supplying conditioned air to the garage were causing potential CO to return to the conditioned space from vehicles that may be driven into it. There were no CO detectors in the house. The inspector who finaled the permit did not cite any of these code violations, did not take note that there were no load calcs or duct design submitted with the job and did not cite or notice the fire door missing, or the garage becoming incorporated into conditioned space with significant potential CO poisoning hazards.

Although the HVAC contractor was out of business, I spoke to the HERS rater a few days later who informed me that he was pressured by the big box store to pass houses regardless of their performance or he would lose his contract. He admitted that he had to pass some houses and look the other way under pressure, but that eventually he lost his contract. At that time, the box store had over 80 homes that were not passing HERS on permits that were never closed, and they fired him to avoid going back to fix any of them. He had never entered the home in this case study to complete even a visual inspection and was not aware that the 5-ton system had a fraction of the airflow required, and was surprised to hear of the degree and scope of code violations. All of this points to the way that conflict of interest inherent to the HERS system utterly compromises safety, the health of the occupants, and the efficiency of the system.

The problem with this nightmare scenario is that it is horrifically below standard with disastrous asbestos, CO poisoning and bio-toxin hazards for the occupants (The wife is showing symptoms of bio-toxin related illness). However, this extremely poor quality work is not exceptional at all. It is more the norm than not, to find such unhealthy and inefficient conditions in homes: at least half of the homes have rodents in the attic, leaky attic planes and some degree of duct leakage. Having performed BPI certified inspections on hundreds of homes, I can bear witness to it. Contractors and their crews lack the building science understanding to recognize the health impacts of their substandard work; they lack the humility to admit they could use additional training; and they lack the diligence to comply with known code, testing and permitting requirements. The contractor with any understanding of the variables playing out in this scenario, would have started by vacuuming out the R-5 insulation while the ducts were out of the way, rodent proofing and air-sealing the floor of the attic, adding vents to the roof to reduce attic temperature and reinstalling a minimum of R-38 completely burying the ducts. All of this would have allowed significant downsizing of the AC system and air handler and would have protected the inhabitants from significant health hazards and cut their energy bills in half while assuring them improved air quality. Where this substandard work borders on fraud for its total disregard of known

standards, the client in the above case paid over $10,000 for a new condenser and new ducts including permits. The contractor didn't deliver proper duct design and testing as required and at that price they could have easily included a new furnace and still had profit in the job. Such negligence stems from greed and conscious disregard for good will toward the client. The vast majority of contractors are not crooked. They are just not taking in these variables when they first inspect the home and write the estimate. They have neither the building science training, nor are they aware that the new bio-genetic research indicates that a full quarter of the occupants in these homes have a genetic pre-disposition to bio-toxin related illness which has now been linked with asthma, bronchitis, edema, arthritis, heart disease, and possibly Alzheimer's. Without the background of new building science, new technological developments, new standards, and the health impacts, it is not possible for them to do their jobs. Without also training inspectors on duct design review and load calculations, and giving building departments a required checklist, they are not empowered to do their jobs. Without also eliminating conflict of interest in the HERS system, these inspections fail to protect residents. Clearly, a paradigm change is needed including widespread retraining of the workforce, a self-sustaining enforcement plan and elimination of HERS conflicts of interest. Such a plan is outlined below, but would need to be vetted and articulated in greater detail.

There is clear bio-toxin and genetic research that has been peer reviewed in the last few years that elevates the public health ramifications of duct leakage to a public health "crisis" level. It is now clear that 24% of the population caries the genetic predisposition to Chronic Inflammatory Response Syndrome (CIRS) and there is now a simple test to identify people who carry the genetic predisposition as well as a clear diagnostic protocol for identifying patience. The range of associated illnesses include several forms of inflammatory response associated with "Sick Home Syndrome": edema, arthritis, chronic bronchitis, flu symptoms, headaches, fatigue, asthma, various heart conditions, and neurological dysfunction. In acute patients the symptoms are disabling and in many they are misdiagnosed by conventional diagnostic methods. (See survivingmold.com for latest peer-reviewed research). The debilitating effects of these illnesses, and the fact that it affects nearly a quarter of the population makes the need for contractor training and a paradigm shift in the typical HVAC business model absolutely necessary. In addition to this, CARB and Cal EPA have published papers on so called "UV scrubbers" which claim to kill bio-toxins passing through air-handlers, but which fail to provide protection from most bio-toxins while introducing harmful "free-radical" molecules associated with increased heart and lung disease, particularly in the elderly. Manufacturers and contractors need to be made aware of new building science research, and compliance with national ACCA quality installation (QI) and quality maintenance programs should be mandatory. The poor state of installation quality nationwide justifies mandatory trainings for both contractors and inspectors on these public health and building science issues. CEC should not back down from a strict enforcement plan and mandatory contractor training for both current license holders and their crews. The public health issues are to great.

While industry is generally supportive of more stringent permit, training and commissioning requirements, they remain steadfastly opposed to serial number tracking as the method to achieve compliance. The best argument against serial number tracking is that it requires multiple parties and agencies to enter data into a system and does not offer a path to fix the actual hazards to the occupants. There are 13 million households in California. Major HVAC equipment replacement happens in close to

one million of them each year. If in a best case scenario, two theirs of those installs obtained permits five years from now, that would leave over 300,000 unaccounted serial numbers each year. Of those, some will have been shipped out of state, but because tracking is not required in other states, tracking would depend on distributors to record every unit that left their warehouses, and there would be no independent way to confirm how many had left the state. Given the serial numbers on the permitted 700,000 units, (assuming they were recorded by the contractor), some agency would have to compare permitted serial numbers with those that are unpermitted to generate a list of unpermitted units that could be referenced by whomever is looking at a unit in an attic to determine if it was installed with or without a permit.

A number of questions arise from this description of a hypothetical tracking system: 1) What central enforcement agency or "system administrator" is going to enforce record keeping by hundreds of warehouse employees, manufacturer employees and contractors both within and outside of the state? 2) What enforcement agency is going to then compare the serial numbers of nearly a million units per year to numbers recorded with building departments or HERS providers in order to glean a list of potential unpermitted serial numbers? 3) How do you know a particular serial number isn't just stored high on a shelf for years at a time? How long does it sit on a shelf before you add it to the list of "unpermitted" serial numbers? 4) Will every warehouse employee track every sale and record the serial number on every invoice? If so, who would audit or attempt to correlate this data with permits? 5) Will such a record, if performed reliably, result in a clear method of revealing which contractors in an area engage routinely in unpermitted contracts, or will this only prove a pattern of violation among those who happen to get caught for other reasons? 6) How do you determine which of the "potential unpermitted serial numbers" was actually installed without a permit rather than still in inventory, re-shipped out of state or misreported due to the failure of any one of thousands of people responsible for sale or transport of equipment? 7) How can any single "system administrator" actually manage such a decentralized system that is dependent on so many actors? 8) If manufacturers and distributors are so reticent to implement such a decentralized plan with no database QA, are they going to be motivated to comply? 9) Who would develop the network of computers and the software to manage such a tracking system? 10) How long would it take to develop this software and how much would that cost? 11) Is the CSLB, a building department or a HERS provider have the budget to figure out where the unpermitted units went? (925,000 units per year as of today at are current low compliance levels), 12) Does a list of possibly unpermitted serial numbers offer any clues as to addresses where the unpermitted work was performed? 13) Short of random audits of contractors' records or random inspections of any house on the street to verify serial numbers, how do you get from a list of potentially unpermitted serial numbers to actual addresses where the work was done? 14) How does the database actually protect residents and improve the quality of installations? 15) Are city and county building department inspectors going into the attic to check the serial numbers of all the installed units of the jobs that are permitted? 16) If a building inspector does this randomly, or at point of sale why wouldn't he just check for permits rather than referring to this database? 17) If you are sending a city inspector to randomly check systems that have not been permitted, is that constitutional? 18) If an inspector finds an unpermitted job ten years after the fact, but the client has suffered air-quality hazards, is that effective? 19) If a home or city inspector is looking at a huge database of unpermitted serial numbers (would number in millions over the years), would the accuracy of this database erode over time? 20) If serial numbers are submitted to the HERS provider, does this solve the question of where the unpermitted equipment actually went?

Clearly, such a system raises more questions than it answers. The problem with serial tracking is that it would spend significant human resources and money creating an inaccurate database and there is no assurance that enforcement agencies would have the budgets to do the investigation required to locate violators by using this imperfect data. The task of figuring out where the serial numbers for unpermitted jobs went is not actually facilitated by the database. The database by itself does nothing to protect residents from very real hazards associated with substandard work. City and county building departments are universally underfunded and spread thin, and there is a relative certainty that they would not have the resources to use such a database to catch permit violators; there are simply easier and less expensive ways to achieve measurable results, like pulling over unmarked pick-ups with HVAC equipment in the back, or requiring time of sale safety inspections as the City of Davis has so successfully implemented. Given the complexity of administering a tracking system and the uncertainties and inaccuracies that would inevitably arise, inspectors and code enforcement would learn that the data is flawed precisely because it depends on 1000 people to track data, and there is no single agency responsible for its accuracy. After untold expense, this "tracking system would fall into disrepair and become a "lesson in futility" and the time invested would be a loss. The money is infinitely better spent creating a sustainable program of code enforcement and the contractor training that would solve the quality problems in the field in the near term and with some predictability.

The following outlines the key components of a winning strategy to achieve 95% permit and verification compliance within four years. This is particularly important to manufacturers, because we are committed to continuous improvement of delivered efficiency, and all the incremental changes we can make to improve equipment efficiency are negated by poor installation quality that undermines reliability, performance, comfort, safety and customer satisfaction.

1) **Public Education:** Use public service announcements to educate public, but don't expect them to process the details of quality installs or drive the demand for compliance.
    a. Thirty-second TV and radio PSAs on health, IAQ, efficiency, permits and verification would direct traffic to a public education website.
    b. Online Website Resources: Create a user friendly website on IAQ & sick home syndrome, HVAC design process (software load calc requirements, benefits of even temperatures, comfort, etc.), typical duct issues, asbestos, whole house approach, advantages of air-sealing and re-insulating the attic, rebate programs, install requirements, advantages of permits and verification, electrification options, cost trade-offs, impacts, etc.
    c. Manufacturers selling equipment in the state could support this effort by posting a sentence on their home pages about the importance of having the install performed by a licensed contractor. "Rated efficiency is not the same as installed system efficiency", with a warning about IAQ impacts, like the warning on a pack of cigarettes.
2) **Change the HVAC Business Model:**
    a. Reduce unfair competition from underpriced, untrained, uninsured, and unlicensed contractors by empowering building departments to issue citations and enforce violations of permit requirements and HVAC compliance.

b. Distributors should be prohibited from selling to unlicensed contractors and hardware stores prohibited from selling non-UL tapes in the HVAC department.
c. Require ACCA certification training on QI in three levels for HVAC contractors, crew foremen and crews. Educate contractors on air-quality and bio-toxin impacts of duct leakage and how to interview for bio-toxin illness, testing procedures and remediation. "Do no harm" is the prevailing rule. Make quality an imperative.
d. Change CSLB rules to allow HVAC contractors to perform emergency furnace replacements, but defer the duct replacements for up to three months, allowing work to be deferred to the slower season when attic temperatures are milder.
e. Contractors should be required to have duct replacement contracts signed and accept a $100 deposit at time the emergency furnace replacement occurs, so clients are motivated to follow up with them. This deferral plan would help keep crews busy in the off season.
f. HERS verification would also need to be deferred, because flow requirements could not be verified until then.
g. Expand CSLB definition of "incidental" work to increase scope of work allowed under HVAC contract, so HVAC contractors can act as primary contractor for attic insulation replacement and deeply bury ducts to improve efficiency following Chitwood's Method to double energy savings on ducted systems.
h. HVAC contractors should be easily qualified to for a "home performance certification" or "BPI-certification" allowing them to apply directly for energy upgrade rebates and incentivize them to perform Chitwood optimization methods.
i. Greatly simplify and streamline Energy Upgrade Program process to enhance participation. HVAC contractors are far better positioned to sell attic upgrades when they get the phone call for HVAC system replacement as a method to maximize HVAC energy savings.
j. Provide homeowner educational materials (pdf files) to HVAC contractors with CEC logo on it explaining the health issues associated with duct leakage that justify the state's new requirements, as well as explaining the benefits: energy savings, ROI, comfort, indoor air quality. Hazards such as asbestos, bio-toxins, combustion safety, and back-drafting appliances should also be explained. This will validate that the HVAC contractor is not just selling a "bill of goods" and that the State requires proper system design and QI, and recommends Chitwood optimization.
k. Teach contractors to use these educational tools to sell up to a quality standard rather than down to a price. Train them on Chitwood's Method of system optimization as well as how to sell it to the homeowner.
l. Strongly encourage all manufacturers to offer warranties only on equipment installed by a licensed contractor, and to offer free extended warranties (5-15 years) to licensed contractors who have additional ACCA certifications for themselves and their crews and who verify system commissioning.

3) Enforcement- Key Strategies to Deter Non-compliance with Permits and Testing Requirements:

a. Mandatory fines and penalties need to be consistent across county lines and enforced statewide. They should not vary across jurisdictions.

b. If fines are not mandatory, they won't be implemented due to local politics. (Boards of Supervisors and local agencies don't like to appear to be hard on business).
c. Building departments should be given "seed money" to add one to three staff people and vehicles that issues "tickets" for unpermitted and unlicensed work. Each of these staff only needs to issue about $400 a day in citations to cover the overheads of their salary and the vehicle. This additional enforcement staff should be self-sustaining and not strain state or local budgets. Courts and judges need to be briefed on the public health issues so they understand the gravity of the offenses. This model works to sustain police departments and can offset enforcement costs.
d. There could easily be a plan for repayment of "seed money" from the state, so that the cost of increased enforcement does not create an ongoing burden to the state.
e. All HVAC contractor trucks that are unmarked or missing CSLB license numbers should be ticketed. (At a level to provide a reasonable deterrence). Proof of license, liability insurance, workman's comp and bond must be shown at time of payment in person. If any of these insurance requirements are not met, an additional fee would apply. It should be stated that failure to pay fees, even on a payment plan, can result in impound of the vehicle. (Basic truck lettering only costs $150-$175.)
f. All supply houses should be prohibited from selling to unlicensed contractors that can be identified by their unmarked trucks. All employees picking up for companies should be listed on a register at the distributor's office, or listed on the CSLB license listing as authorized to purchase equipment for the contractor. All such employees should also be covered by workman's compensation insurance for the protection of the homeowner. Dealers should verify that CSLB licenses and insurance are current on a monthly basis. This process takes seconds online at the CSLB database. Distributors should also post signs that there are "No sales to unlicensed contractors or homeowners."
g. Without this restriction, distributors would be tempted to sell to unlicensed and uninsured contractors. (Ferguson Heating and Cooling already restricts sales and only sells equipment to C-20s). This support from distributors and their association is a reasonable alternative to tracking equipment serial numbers.
h. All HVAC repair greater than 40' of ducting requires a permit and HERS testing. All permitted duct, furnace or AC/HP equipment work should have a copy of the permit and CF1R ALT in a Ziploc under the windshield of the vehicle while the crew is on site. This makes their compliance obvious for any "permit cops" that patrol the street.
i. CSLB should remove the under $600 allowance for unlicensed HVAC work. All repairs, duct repairs, equipment repairs should be performed by a licensed contractor.
j. The fines for unlicensed HVAC work should be raised to $1000, and if not paid within 90 days, their vehicle should be impounded. A payment plan could be

offered as an alternative. It is critical that the State is serious about stopping unlicensed work to protect clients and to prevent unfair competition.

k. Empower inspectors to issue $800 tickets for unpermitted work by licensed contractors, plus "Red Tags" to stop unpermitted work immediately. If permits can be obtained online in 15 minutes for an emergency furnace replacement, it is fairly easy to obtain a permit by 10am on the day of the install. In addition, fine the homeowner $150, but allow them to apply that $150 toward a permit application if they file within 30 days. Fines need to be as high as the cost of permits and HERS verification to deter violations.
l. Online permit applications for furnace replacement should be one page, but requires a CF1R as well as a preliminary building shell load calc. Building load calcs (without room by room load calcs) **can** be performed in less than an hour, and could be performed more quickly if the state provided several typical models with different square footages and envelope measures. This is just so the equipment is sized to the building shell loads. Ducts could be designed, installed, repaired or upgraded days or weeks after the emergency equipment replacement.
m. Do not allow systems to be more than 30% oversized for the structure or over 15% oversized for the existing duct capacity if existing ducts are to be retained.
n. Duct leakage should always be tested prior to repair or replacement of the air handler to verify if the ducts need to be replaced.
o. HVAC contractors should all own their own duct-test equipment, and should not count on the final HERS test to get to the required 6% duct leakage rates. All ducts that are going to be concealed within walls, chases or soffits should be metal ducts sealed with mastic and wrapped in R-8 FSK because they will not be serviceable or accessible. Otherwise, duct leakage, eventual system degradation and health issues are inevitable.
p. CEC should develop or furnish the system to make all HVAC permits filed through one permitting website which automatically forwards them (and payment) to local building departments. The state needs a uniform system, and if successful, it could be licensed to other states to recover some of the development costs.
q. Building departments should be versed in new-school install practices and duct design. (Many plan checkers don't know what they need to know to review duct design drawings. Some building departments require ducts hung high resulting in unwanted heat gain.)
r. Require that HVAC contractors add or hire another contractor to provide adequate ventilation in the attic to reduce summer attic temperatures to below 120° F. Solar attic fans with 200 cfm capacity usually do the trick. This greatly reduces duct losses and also reduces heat gain even in homes that have no ducts in attic.
s. Abatement of chrysotile asbestos should be required when it is found on ducts. (May require legislation and rebates for affordable housing). Real estate home inspectors must be required to identify chrysotile asbestos on HVAC ducting at time of sale. Most currently do not and claim that they are not qualified to identify it which is ridiculous. They are just trying to avoid souring the deal for the

realtor that recommended them to the homeowner, an all-too-common conflict of interest scenario which allows the seller to pass the health crisis onto the unsuspecting buyer. All real estate inspectors should be trained to identify asbestos and required to identify it, stating that "a sample should be tested for positive identification".

t. Occupancy inspections should be required when property is sold and all health and safety issues addressed by the seller prior to sale. UK now requires this.
u. By some accounts, there is an epidemic of HERS verification fraud in the state. HERS raters should be required to sign a pledge and agreement that if they ever are found to falsify documents or engage in a pattern of fraud they will be permanently barred from the industry.
v. HERS raters should not be hired by contractors or clients, but assigned by CalCerts and other providers at the outset of a job. HVAC contractors would make the initial contact to the provider, and then be assigned a HERS rater, avoiding conflict of interest and preferential treatment. Otherwise, the HERS rater that does his job correctly is not hired again. This has been reportedly a widespread problem that has caused many HERS raters to lower their standards.
w. HERS "sampling" in either new construction or retrofits is an inadequate substitution for testing every home and results in a validation of substandard work. Testing every 5th home is not a valid HERS verification, and it easily results in negligent work and unhealthy conditions that are far worse consequences than the lost energy savings that are compromised. If the client pays for QA, they deserve to get actual quality assurance through testing.

4) Contractor Training:

a. ACCA standards should provide the vehicle for uniform quality design, installation and maintenance practices because it is nationally recognized and universally respected.
b. The CEC and IOUs should endorse ACCA and require that vocational schools seek ACCA accreditation. ACCA wrote the manuals on system design.
c. The utility owned energy training centers, manufacturer training centers and vocational schools should have three tiers of training: Contractor, Foreman, and Apprentice with a text and test for each level.
d. Contractor training should be free for early adopters that sign up within the first six months. Although there are energy training centers run by the IOUs across the state, training should be taken to the communities in which contractor's work to avoid lost work time and hotel costs during the first few months of training. This convenience would act as a further incentive for them to show up early in the training cycle.
e. Early attendance of load-calc software classes should be incentivized with discounts on the classes and the software.
f. Manufacturers could cover some of the basics in a "review" section of all of their equipment specific trainings.
g. Regional contractor associations can assist with outreach and announce classes to their email lists.

h. Manufacturers could voluntarily support vocational scholarships for high school candidates followed by free advanced equipment training that gives those apprentices opportunity for advancement. These scholarship programs could be additionally supported by the IOUs Energy Training Centers and offered to two or three senior students at each high school within 15 minutes of the Contractor Training Centers. As a matter of energy equity, the scholarships could target families in need.
i. IOUs and manufacturers can use this as a goodwill advertising campaign that also brings awareness to energy efficiency and "creating green jobs".

5) Creation of New Contractor Categories and Certifications- GC's Dislike Energy Upgrades:

a. General contractors are too distracted by high-profit and high-profile remodels and new construction to focus on building performance work. In good times they are not motivated to do hard attic work and in bad times customers don't have the money to do them.
b. The lack of BPI-certified general contractors has caused an incredibly low conversion rate on deep retrofits of existing buildings and at our current rate of 11,000 projects per year it will take about 900 years to retrofit the 10.5 million households that need these energy upgrades.
c. We need an army that is motivated to do this unglamorous and thankless work. We need a new CSLB category of home performance license: "home performance contractor" that can be qualified *without 4 years of apprenticeship*. To recruit the number of professionals in this category, the state needs to create a two-month program teaching BPI and energy analysis, basic use of tools, air sealing, testing, insulation, attic and crawl space work and only require a mechanical and power tool proficiency exam to enter the training program. Handymen could be trained and licensed. This classification could include duct repairs but only if all attic upgrades are performed and specific quality standards are followed.
d. In general HVAC contractors are much better positioned to inform clients about other attic upgrades than a general contractor because they have the client calling them when an HVAC system failure has triggered and emergency install.
e. It is very difficult for general contractors to convince a client to fix ducts or replace an old HVAC system when it hasn't failed yet, or even worse, was recently installed but grossly over-sized or poorly installed. If they arrive after a sub-standard HVAC contractor, the client already has sunk costs, can no longer afford to fix the system a second time and they are inclined to discredit or question the severity of the problem.
f. If the attic upgrades are performed when the HVAC replacement occurs, it allows HVAC contractors to downsize the system and bury ducts to improve performance.
g. If they were also allowed by CSLB rules to hire home performance contractors as their subcontractors to clean attics, remove insulation, air seal and do needed framing (insulation dams, platforms, hatches, etc.), HVAC contractors would have easier access for installing new ducts and could streamline and broaden their most profitable tasks and profit centers. HVAC contractors should be given easy qualification for this home performance license if they prefer to have their own

crews perform this work. They should also be allowed to act as primary contractors to have insulation removed and replaced and air-sealing performed as incidental to the HVAC and duct work. This is critical given their point of sale opportunities.

h. Insulation companies generally have high turnover and insufficient margins to sufficiently train their staff. Batt insulation is often installed to look good for the inspector, but when you remove any of it or feel behind it there are large gaps which reduce effective R-value by 15% to 30%. Blown insulation and deeply buried ducts should be the standard in in new attics, as well as in old attics with new ducts. Batt insulation is substandard and contractors are not aware of the problem. The CEC's insistence on remaining technology neutral is taken to the extreme and should be reconsidered in light of new building science published by BPI and other organizations.
i. Insulation crews also need a bilingual training brochure and videos to teach QA with lots of pictures and illustrations for both insulation and air sealing techniques.

6) Don't Expect Consumers to Drive Demand for Higher Quality Installs:

a. Consumers are utterly confused by the complexities of HVAC and they think they want the lowest price because they don't understand the impacts of poor install quality. It is far more difficult to educate the general population than to train contractors to educate them and validate their reasoning with substantial brochures published by the CEC and provided to contractors.
b. Homeowners don't want to be the watchdogs and are scared of being duped.
c. It will take 20 years for the entire consumer market to fully understand the reasons for "quality installs".
d. Given the educational challenges, only greater enforcement of permit requirements can drive compliance. Licensed contractors need to be free of unfair competition.
e. Unlicensed contractors need to be deterred because they are misinforming clients, are not qualified to do the work, and causing unhealthy conditions - a form of fraud.

7) Eliminate HERS and Real Estate Conflict of Interest:

a. Move to a system wherein contractors can apply for a permit and a CF1R ALT for an air handler/equipment replacement in minutes and the HERS rater is assigned by HERS provider (CalCerts) automatically rather than hired by the contractor.
b. The current system creates implicit conflicts of interest and numerous HERS raters report being driven out of business if they perform their jobs diligently.
c. There is widespread abuse of home buyers who are not definitively told that they have asbestos wrapped ducts at point of sale. All real estate inspectors have a disclaimer that it is not there job to identify chrysotile asbestos ducts, but this material is unmistakable. They should be trained and required to identify it and held liable if they intentionally do not include it in their reports.
d. Real estate inspectors should also be required to note mold and report musty odors, with a note that a quarter of the population is genetically predisposed to illness and residents should perform tests under these conditions.

e. Real Estate inspectors are generally referred to buyers by realtors. This is an implicit conflict of interest and should not be allowed. Inspectors fear that if they report anything that will complicate the sale they will not be re-hired.
f. In most counties, the realtor referral system in place limits competition to a handful of inspectors that get all of this work.

8) Incentivize manufacturers to develop FDD (fault detection and diagnostic indicators):

a. FDDs can alert HVAC contractor wirelessly to a service call need.
b. Assures that efficiency will be maintained over time
c. Prevents catastrophic system failures
d. Reduces warranty liabilities
e. Offer rebates for FDD feature as well as DR capability that could be bundled with it.
f. Within ten years, it is likely that manufacturers will move toward "virtual verification" as a method to assure quality installation without the possibility of tampering with the commissioning data. This provides value added QA that benefits all parties concerned.

Given the national statistic that the average "installed efficiency" of a system is only 58% of its rated efficiency, it is clear that improved installation quality is the key that would allow us to double the efficiency of ducted systems in the U.S. whether they are furnaces or heat pump air-handlers. From the manufacturer's perspective, it is unreasonable to demand costly improvements to equipment efficiency only to have it negated by the very low quality standards and poor contractor training in the field. Manufacturers are universally committed to 'customer satisfaction' and 'continuous improvement' of our products as fundamental principles of competitiveness. However, the very poor quality of the average system replacement hurts the entire industry and prevents the state from meeting its climate targets. Not only are contractors hurting their credibility, they do serious injury to manufacturers if their substandard work results in poor energy efficiency, uneven indoor temperatures, and compromised indoor air quality. The recently peer-reviewed bio-toxin research from Dr. Shumaker at survivingmold.com offers a clear justification for stringent measures, including mandatory training and continuing education for contractors and their crews in order to bring about compliance. If training is "voluntary", we will never get the quality, efficiency and improved health that homeowners deserve. Manufacturers are and should be motivated to help the state create incentives for market transformation, like prohibiting sales to unlicensed contractors, requiring that all systems be installed with permits and HERS verification to qualify for basic warranties, and free extended warranties for contractors that commit to continuing technical education programs for their entire crews. Given the average life of HVAC equipment is 15-18 years, it will take that long to replace most of the current systems with improved technology installed to higher quality standards. California has a legislative mandate that empowers the CEC to achieve higher quality installations and compliance by whatever means necessary. Bold action and a total paradigm change is required. We better get started tomorrow. We don't want to lose another decade just talking about it.