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Additional submitted attachment is included below.

Public Comment:

An Analysis of the Cost-Effectiveness of Serial Number Tracking and Enforcement Alternatives

Submitted to CEC by Bruce Severance, Compliance Engineer, Mitsubishi Electric US, November 15, 2018

Executive Summary: Is Serial Number Tracking a Practical Enforcement Strategy?

In his August 20, 2018 paper entitled "Improving Energy Compliance of Central Air-Conditioning and Heat Pump Systems, Mr. Eads of CalCerts, makes some notable, but unpersuasive arguments in favor of serial number tracking. These are worthy of comment and careful examination. Although Mr. Eads has admirable commitment to addressing quality installation (QI) issues, he admits to painting only broad brush strokes of how such a system would work: "The fine details have not been fully vetted, but a foundation is set for a solid base of action." He appropriately asks how compliance with HVAC testing requirements can be achieved "with the least amount of cost and the most dramatic results". Mitsubishi Electric US agrees with the goal of identifying and vetting the most cost-effective enforcement strategies, however, Mr. Eads unfairly suggests that manufacturers are contributing to "the obstacles cast by those that … may have ulterior motives to quash the hope (of an equipment tracking system) and remain in the ranks of those that profit from the very problem that we are striving to combat." Mitsubishi Electric US, as most manufacturers, has a corporate culture of "continuous improvement" and it is consistent with our commitment to quality to genuinely support compliance with QI standards to assure a high degree of customer satisfaction and delivered efficiency.

Since Mr. Eads doesn't compare his proposed serial number tracking system to other enforcement alternatives in his discussion, he neglects his own invitation to evaluate which enforcement options will achieve our common goals "with the least amount of cost and the most dramatic results". His paper clearly operates from the presumption that serial number tracking systems are the only viable enforcement alternative. Similarly, he makes no attempt to actually quantify the cost of a tracking system versus other seemingly more cost-effective solutions. The argument against tracking systems are not as Mr. Eads suggests, made by manufacturers because we are profiting "from the very problem that we are striving to combat." Mitsubishi Electric US opposes tracking systems because there are more direct and far less costly methods to identify broader patterns of violation that target actual violators. There are clear reasons why a tracking system represents the least cost-effective enforcement option, and we will challenge Mr. Eads to refute our well-founded concerns. This paper will pick up where his left off by: a) identifying relative advantages and disadvantages of various investigative techniques and enforcement strategies; b) comparing the relative costs of these strategies and; c) identifying the significant data management and data entry challenges of a tracking system which prove to be far less "simple" than Mr. Eads asserts. These comments are meant to be respectful and not an attack on Mr. Eads' character, good intentions or his commitment to compliance which Mitsubishi Electric US in fact shares.

The cost effectiveness of any investigative tool such as the proposed tracking system is directly linked to the labor and overhead required to investigate the many leads it may generate to achieve deterrence. So an investigative system that identifies one unit of equipment that may be the subject of a violation, but which requires that each "missing" unit be investigated by means of a site visit one unit at a time (by Mr. Eads admission, pg.8), may result in 20 to 30 times the enforcement costs compared to a system that can use statistical methods to identify patterns of violation. Furthermore, if enforcement agencies are not

given an adequate budget to investigate the leads that are generated by the tracking system, or if they find the tracking system data to be less effective than many other methods of enforcement, all of the money invested into the tracking system becomes a sunk cost – a high stakes gamble with no pay-off. To avoid this financial risk, no money should be invested in creating a tracking system unless: a) enforcement agencies agree that it will be an indispensable investigative tool and they will actually use it; b) there are no unresolved questions about jurisdictional authority; c) sufficient budgets will be allocated to use tracking system data to achieve a sufficient deterrence to meet the compliance objectives. Failure to meet any one of these necessary conditions puts the success of any tracking system proposal at serious risk or dooms it to failure.

If those contractors that currently circumvent the permit requirements, and who are determined to "fly under the radar" simply continue to do so by buying their equipment online or through an underground economy, it is also highly likely that the time and money invested in the tracking system will become a sunk cost. Even if online sales were somehow also registered into the system, a small minority of contractors would find ways to obtain equipment through channels outside the registration system. This unfair competition would continue to drive installation quality down to a low price rather than up to a quality standard. The investigative tool that tracking system proponents believe is "fool proof" is actually only a tall wall that can be easily circumvented. Only those contractors who are complying by buying their equipment through sources that register the equipment will show up on the tracking system's "radar screen". So the compliant and semi-compliant contractors are more likely to be inconvenienced or penalized while the worst violators slip into the shadows. This is a critical and fatal flaw of any tracking system proposal presented to date. Without an obvious way to prevent unregistered sales, the system is likely to result in an even more tilted playing field, increasing the disparity between those that comply with the law, and the unfair advantage held by those that don't. The "unintended" effects of such developments have not been fully explored to their logical conclusion by tracking system proponents, and it is likely that one such effect would be a very negative impact on sales at distributor warehouses and the training infrastructure they provide.

Unfortunately, privacy laws greatly limit the amount of homeowner data that can be included in a tracking system that has numerous access points, which are vulnerable to hacks despite security measures. There is good reason for current privacy laws and imperative that they are fully followed, but the inability to include permit and client data in the serial number tracking database greatly reduces its utility as an investigative tool. Simply stated, the tracking system would be inhibited from correlating permit and addresses with serial numbers and could not analyze whether a particular contractor had pulled the number of permits they should have in a given period of time. As Mr. Eads admits, the inability to automatically correlate a specific unit number with a homeowner address necessitates inspection of contractor facilities to confirm uncertain hunches that a single unit ***may*** have been installed without a permit. For this and other reasons, tracking systems inherently have limited ability to generate unit numbers that are ***known*** to be in violation and they require high-cost inspections of contractor facilities (looking for "missing" equipment) which distracts from a building inspectors role of inspecting jobsites.

The suggestion that inspectors would need to verify equipment location to prove culpability is not a strength but a weakness of Mr. Eads tracking system proposal. According to his logic, the contractor is innocent if the equipment is in their shop and guilty if it is not, which presumes it has been installed illegally. But this this logic does not account for all possible scenarios, and further investigation would be needed to determine exactly where the missing serial numbers were installed illegally. The cost of sending inspectors to contractor facilities to verify that they have not installed equipment illegally sounds simple, but given the uncertainty of the hunches produced by the tracking system, this is in fact quite expensive, and it raises questions of jurisdictional authority: Do building inspectors have the right to perform

inspections of contractor facilities? What if a contractor refuses to allow entry for an inspection? Would CSLB inspectors be required? Would they need to have more widely distributed CSLB offices in order to accommodate the quantity of inspections required? What quantity of facility inspections would create a deterrence? Would a court ordered search warrant be required to search for materials that were legally obtained? There is no clear path forward if the contractor refuses to comply with these facility inspections, and these questions of jurisdictional rights may very well end up in court because there is no legal precedent for unwarranted searches for legally obtained materials.

Furthermore, it is not clear that building inspectors would be willing to perform such inspections when inspecting a contractor facilities is so far out of their normal scope of work, and their jurisdictional authority is questionable. Many currently do not feel it is within their jurisdiction to knock on the door of any jobsite where permits have not been filed, so there may be resistance to a change in traditional roles and inspectors may be very hesitant to search for legally obtained materials. This clearly distracts from their role inspecting jobsites.

Such "wild goose chasing" is expensive, unproductive and does nothing to advance quality installation. Better alternatives exist: A single online permit application portal for all HVAC contractors that was also the sole source of business licenses would not violate privacy laws and would facilitate statistical ranking of the worst permit violators. Permitting agencies already gather homeowner data and adding contractor data to the same database violates no existing privacy law requirements. If online business license applications additionally require reporting on the number of installers and the ratio of residential and commercial work performed by the contractor, it is actually very simple to statistically predict the total number of permits the contractor should be filing on an annual basis and compare that to the total actually filed across several jurisdictions. If for example, a contractor has only filed 60 permits per quarter and they have 20 installers, or at least 6 crews, the math is fairly simple to determine that they should be filing closer to 400 permits per quarter (minimum), and they are highly likely to be performing unpermitted work. Otherwise, there business would not sustain so many employees. Such statistical calculations could be performed automatically to produce lists of the contractors that have more than a 95% probability to be engaged in a pattern of permit violation, and it allows enforcement to target the worst violators by ranking them. A statistical approach that can not only identify permit violations, but also rank the worst violators would allow enforcement resources to be focused where the resources are needed most. In contrast, serial number tracking systems have no ability to see broader patterns of violation and are inherently myopic and likely to require many times the enforcement budget.

Not only are statistical investigative tools less expensive, the cost approaches zero because it is an addendum to the online permitting software that is necessary for any compliance strategy to work. The identification and ranking of the worst violators could be performed by an algorithm, and automatically send emails to local jurisdictions notifying them of the worst violators. All of the money that would have been spent on a tracking system, should be spent to support this regionalized enforcement effort. Jurisdictional rights are less likely to be an issue, especially if in filing for the business license, contractors are asked to DocuSign a statement agreeing to comply with all performance testing requirements, load calc requirements as required by code and further authorizing in advance an audit of their books by a bookkeeper at any time if such an audit becomes necessary for the enforcement of the building code and contractor law.

Compared to such statistical methods, serial number tracking would be riddled with process control problems. It is not reasonable to expect hundreds of warehouse personnel to enter or just confirm data flawlessly, and the high level of traffic that a tracking system would experience every weekday between 7am and 9am is likely to cause some system crashes or queuing problems. If such issues cause holes or

inaccuracies in the data, will the quality of the information be sufficient to meet the standards of enforcement personnel who would be charged with using this data as the basis of investigations, citations and penalties? Serial number tracking systems, in whatever form, do not lend themselves to QC cross checks, and correcting the database once data entries or expecting warehouse staff to go back and verify "checkpoints" that missed is especially difficult if the system crashes for an extended period. There is no way for database maintenance staff to confirm if "missed entries" were later corrected.

Going through the math is fairly simple, and the conservative estimates demonstrate the high-volume of online traffic and IT challenges will impact the tracking system cost. The system is likely to be expensive because of the scope of the data entry and the need to avoid scenarios wherein system crashes frequently occur due to online traffic congestion. Such potential system failures pose a significant investment risk, especially given that there are no precedents for tracking systems anywhere in the world, and there is not adequate data to accurately predict how "peaky" actual peak online traffic will be. Mr. Eads' high-altitude fly-over asserting every problem has a simple solution avoids the detail that any feasibility analysis would require. While the tracking system is projected to require entry of 1.5 million serial numbers per year and "verify" them along an average of five points of tracking in the supply chain (7.5 million entries), much smaller databases that have only 30,000 to 40,000 entries per year already frequently crash and have data traffic and queuing problems. There is not, as Mr. Eads suggests, an easy way, to solve many of the inherent challenges of such a huge data management system. Inaccuracies and "system crashes" will inevitably arise. Simply suggesting that it will be an easy system to implement, and that it will be a strategically advantageous investigative tool, does not make it so.

The Magnitude and Complexity of Serial Number Tracking

Mr. Eads suggests any serial number tracking system would consists of no more than "simplistic data input", but the scope and magnitude of the system should not be underplayed. The sheer number of items being tracked, the need to check them into the system at multiple "checkpoints", and the multiple points of contact thousands of personnel will have with the tracking system at various points in the supply chain should not be downplayed. Here are some preliminary projected numbers and assumptions underlying an initial cost estimate for a tracking system focused only on the residential replacement market. In the absence of public sales data, many of these figures are projected from the rough data that is known, such as the total numbers of households and the expected equipment lifetime, etc. Burdened labor rates are estimated in order to project primary costs of warehouse data entry, system maintenance costs that may be viewed as speculative by some, but which are nevertheless probable. The admission that many of these estimated costs are projected based on safe assumptions and incomplete data highlights the need for a more detailed feasibility study to verify this preliminary analysis.

Study assumptions that provide basis of tracking system scale, online traffic and cost impacts are as follows:

- Tracking system "bandwidth" and data entry costs are based on the number of households and average equipment life. Every home with a split DX system (gas furnace with AC unit) has three serial numbers (minimum). A multi-split or multi-zoned home (more than one air handler) may have more serial numbers (4-8 total) but these are less common configurations in the current market and we will exclude them. We shall assume for these preliminary calculations the following: a) HVAC systems are replaced every 18 years (some studies suggest 15 years, others

closer to 20); b) There are approximately 12 million households, including single-family, multi-family, apartments and mobile homes; c) the vast majority (assumed 90%) have gas, propane or heat pump space heating systems that are central ducted systems (approximately 10.8 million); d) Approximately 75% (assumed) of the state's population live in high cooling load climates, i.e., the Southland, deserts and the Central Valley. The other 25% live in moderate climates or with predominately heating requirements in which homes may have only a furnace and no air conditioner (North Coast and alpine areas).

- If there are 12 million homes in California, and 10.8 million are assumed to have central ducted systems of some kind, either gas, propane or heat pump systems, and 75% of the total number of ducted systems have three units (furnace, AC coil and condenser), this works out to about 1.5 million units of equipment with serial numbers per year: (10.8 million x .75% /18 years x 3 serial numbers = 1.35 million serial numbers per year for cooling load climates) + (10.8 million x .25% /18 = x1 furnace = 150,000 furnace only systems per year) = 1.35 + .15 million = 1.5 million serial numbers per year for split DX, ducted furnaces and HP central systems. (NOTE: This "back of the napkin" calculation would need to be verified by a full tracking system feasibility analysis.)
- The total number of counter sales in California are projected as follows: If 1.5 million units are divided into 261 working days there would be 5747 unit sales each working day, and up to 70% of those sales are assumed to occur during peak warehouse sales traffic periods between 7am and 9am, for a total of 4022 unit sales (round to 4000) during peak at a rate of roughly 2000 per hour. This works out to a rate of .55 online logins to the tracking system portal entries per second: (2000/60 minutes/60 seconds = .55 entries per second, or about one login every 2 seconds).
- To project the number of people attempting to access the system during these peak traffic periods, we must assume a login duration period. If the shortest (most optimistic) data entry period is 3 minutes and the longest is 5 minutes, this would give us a high and low estimate of system online traffic during peak sales periods: (A 3-minute duration =180 seconds, 5-minute duration = 300 seconds X .55 people accessed per second = a range of 99 to 165 counter sales staff accessing the system at the same time, (rounded to 100 to 160). This is the base number of tracking system entries accessing the system at any one moment (statewide), and it does not account for seasonal variations or a baseline of system entries other than at point of sale (calculated below).
- Although there are clear peak traffic sales periods inherent in the nature of the HVAC warehouse business, there is no data to support how "peaky" these peak traffic patterns would be. To encompass the range, we need to evaluate worst case scenarios as well: Most contractors are loading trucks and buying equipment at warehouses at the beginning of the day between 7am and 9:00am. It is possible that half of all daily unit sales occur between 7:30am and 8:30am. This possibility raises uncertainty and increases the statistical probability that high traffic during peak sales periods may overwhelm portal resources.
- If peak sales are more peaky than less, than the worst case for online traffic on the tracking system portal increases as follows: If 50% of the total number of units sold daily statewide are selling during a 1-hour morning peak traffic period: 1.5 million / 261 average number of work days per year = 5747 daily statewide sales. If 50% of sales total daily sales sell during a single peak hour in the morning, then 5747 X .50%= 2873 (round up to 2900) sold in California every morning during "peakiest" 1-hour period. Dividing 2900 units (in peak hour)/3600 seconds amounts to .8 warehouse verifications per second, and again assuming login durations of 3 to 5 minutes (best case scenario), the total counter sales traffic volume equals .8 x 180 seconds = 144 simultaneous

system entries (at 3-minute login time) to 240 simultaneous system entries (at 5-minute login duration).

- While the number of serial numbers entered into the database approaches 1.5 million per year, the point of the system is to track location of the equipment and this would have to be done at 4 to 6 "checkpoints" along the supply chain. Projected checkpoints include: a) the manufacturer's dock; b) at major distribution hubs; c) at the transfer to regional distribution warehouses (at least one in every city of 100,000 people); d) at the point of sale to contractor and; e) with the HERS inspector or final verification by building inspector at jobsite. In some cases there may be more checkpoints in the supply chain but rarely fewer.
- Including point of sale entries and all other "checkpoints", the total number of system "logins", data entries, or serial number verifications, approaches 7.5 million per year. (1.5 million serial numbers x 5 data entries or "checkpoints" = 7.5 million total system logins including all checkpoints along the way.) However, to calculate total system peak traffic, counter sales checkpoints and other supply chain checkpoints must be calculated separately. Checkpoint entries other than point of sale can be roughly calculated as follows:
- Given that there are 60 seconds in a minute, 60 minutes in an hour, 8 hours in a working day and 261 average working days in a year, there are 7.516 million working seconds during usual business hours in a year. The total number of system logins other than counter sales, amounts to approximately 6 million (1.5 million units X 4 checkpoints). If performed evenly throughout the course of the typical 8-hour work day throughout the year this amounts to one entry every 1.25 seconds (7.5/6=1.25 seconds, also equals a rate of .8 units per second) This baseline system traffic must be added to the peak traffic high and low estimate to of .55 units per second to .8 per second to yield 1.35 to 1.6 serial numbers verified through the system per second during peak hours. This figure provides a reasonable prediction of peak traffic on the online tracking system portal.
- If each login goes smoothly and there are no data filtering or system traffic delays, the process of logging in and verifying serial numbers at these "checkpoints" should not take more than 3 to 5 minutes. So, if there are 180 to 300 seconds in the optimal checkpoint data entry, there will on average be 243 to 480 users logged on to the online portal simultaneously. (180 seconds X 1.35 low access rate =243 is the low total / 300 seconds X 1.8 highest traffic per second = 480 high total) NOTE: This calculation still doesn't factor seasonal peaks or longer data entry login times, either of which could easily double actual system traffic. This peak traffic "bandwidth" has a direct bearing on projected system cost (see below).
- To calculate warehouse overhead labor dedicated to tracking system data entry at the point of sale (only regional warehouse to contractor) we assume login duration times of five minutes each, the total man-hours per year for just warehouse staff is 125,000 man-hours per year: (1.5 million units/ 60 minutes/5 minutes (same as dividing 12 entries per hour= 125,000 man-hours).
- At a low burdened labor rate of $30/hour (assumed figure), 125,000 man hours adds up to about $3.75 million per year – and that is if it works smoothly and seamlessly and every entry takes no more than five minutes. This only counts point-of-sale data entry at the warehouse sales counter.
- The man-hour cost of checking shipments into the system at distribution hubs or at manufacturing facilities can be calculated similarly assuming a more optimistic 3-minute data entry time to account for some grouped data sets: (1.5 million X 4 checkpoints/60 minutes/3 minutes (20/hr.) = 300,000 man-hours X $30 per hour rate = $9 million per year in data entry time.

- These figures do are based on best case scenarios and do not factor time to correct data entry errors, system maintenance time or lost time due to system crashes. This is only data entry labor if the system works smoothly.
- The state's own estimate of annual IT maintenance and operations costs to be $1.3 million. Given the high risk of system queuing problems resulting from high peak traffic rates, the system cost is difficult to project and this figure must be confirmed with an RFQ to software companies. But we can roughly estimate warehouse data entry will amount to around $12.75 million per year plus IT system maintenance costs estimated at $1.3 million, (based on the assumptions above.) If "peak traffic periods" cause delays, system crashes or that require greater system "bandwidth", these costs also increase.
- Any system queuing problems will result in longer lines for customer service at peak hours of business. The cost impact to contractors for longer wait times at the warehouse counter may be significant and would cause stress for warehouse personnel as well as contractors. At an average burdened labor rate for HVAC installers of $100/hour per man and $200/hour for the average two-man HVAC crew, a fifteen minute delay per system sold would amount to a loss of $50 per unit sold to the HVAC business owner. If your average two-man crew is installing 2 systems (without ducts) per day, the cost to the small HVAC contractor would be $26,000 per year. (261-work days per year x $100 = $26,000) (This is a conservative estimate.) The cost to a contractor with ten crews working may be as much as $260,000 per year. That is assuming a fifteen-minute delay, per crew, per system sold. There is no way to say that these costs would actually be incurred, but given considerable potential for system crashes and database access delays, it is clear that even short delays can add up to significant cost impacts if they occur routinely. Impatience by system users due to delays caused by system crashes are likely to lead to disuse and further system inaccuracies.
- If we can analyze and break down the likely cost of creating the system based on comparable databases that exist within government agencies, the estimate would range from $800,000 to $1.1 million just to customize software, set up servers capable of handling 8 million entries per year and 80 to 90 million entries over a ten year period. (This is based on 7.5 million total entries per year projected above.) This system cost is a "soft number" based on the following cost comparison. A company that disclosed approximate costs for setting up online HVAC permitting software has stated that setting up such a system would cost about $200,000 in labor, plus $50,000 to $100,000 in software and hardware costs, plus per entry hosting service fees and IT admin costs that may add up to $1 per transaction or up to $800,000 per year (excludes data entry labor by warehouse personnel accounted for separately above). But this database was not in regard to serial number tracking, it was for issuing online permits that would handle about 800,000 HVAC permits per year and would not be subject to the same peak traffic challenges. Serial number tracking would involve 5 logins for each of 1.5 million serial numbers or about 7.5 million entries - ten times the amount of online traffic each year compared to an online permitting database. Based on the difference in magnitude, one would expect a serial number tracking system to have at least as high a cost if not double that amount, ($1.1 million to $2 million) Until a specification has been written for precisely how the proposed serial number tracking system will work, it would be difficult to issue a request for quotes to obtain hard cost estimates.

Tracking System Impacts on the Scope of Enforcement and Associated Costs

Enforcement costs as well as tracking system costs must be considered together when evaluating the true cost of tracking systems, because the tracking system proposal assumes there will be an adequate enforcement budget for a specialized "permit task force" that specifically uses the tracking data to catch permit violators. The tracking system by itself, does not perform enforcement; it only offers an investigative tool. If enforcement agencies such as CSLB and building departments do not find it to be a convenient tool for locating violating contractors or they find other tools more convenient, and if there are not budgets allocated to prosecuting and imposing fines on violators, the entire tracking system is a sunk cost producing zero penalties and no deterrence effect. There is significant risk that building departments will not find it to be a convenient investigative tool and that they will not dedicate enforcement specifically to using the tracking system data. If this were to occur, all investment in the tracking system is a total loss, including all of the system initial and maintenance costs and warehouse staff time. The enforcement costs can be projected based on a few conservative assumptions, but these costs are admittingly speculative:

- In theory, building directors or CSLB officials would use the tracking system data to identify possible permit violators, impose fines and create deterrence. To create deterrence, we would want to impose fines and penalties on enough of the worst violators to make contractors feel the risk of being caught is real and formidable.
- If the current total number of HVAC system replacements per year is 600,000 per year (10.8 million homes with central systems/18 year replacement cycle = 600,000) and at least 80% of the systems are currently installed without permits (low estimate based on DNVGL data) then the first year that the tracking system is in place there would be around 480,000 actual permit and HERS violations. To provide deterrence we need to fine or penalize at least 1% of them or 4,800 actual prosecutions, an average of 82 per county or about 10 per city jurisdiction per year. If enforcement is handled at the county level, one would need sufficient enforcement staff to convict 7 cases a month (82 / 12 = 6.8 = 7 conviction per month). There is no data to substantiate the assumed 1% conviction rate will provide deterrence, and it is further not clear that two enforcement personnel would be sufficient to catch and penalize 7 cases per month, per county, but we will project costs on this basis just to project some number for enforcement.
- A building official from the City of Davis has indicated that the cost of having one building inspector is no less than $125k per year and as much as $145k per year (includes a vehicle, admin overheads, health insurance, retirement, office overheads, etc.). If the state had to budget for just two enforcement agent per county to investigate 82 leads into serial numbers associated with possible violations each year per county, the cost to the state would be around $250,000 per county and $14.5 million per year for all 58 counties. This cost break down is entirely projected and is not based on any CSLB data as to the actual cost to prosecute a sufficient number of violations per county to act as a deterrence. However, it is likely to be less expensive to prosecute violations if enforcement is stationed in each county as opposed to centralized in Sacramento.
- These projected enforcement costs are a conservative estimate based on best-case assumptions that only two enforcement officers stationed in each county can provide deterrence. It is likely that $14.5 million needs to be invested in enforcement by the state regardless of whether serial number tracking or other statistical methods are used to identify permit violators. Without such an investment in enforcement, other investments in online permitting, training programs and investigative analytics are all sunk costs if they are unable to bring about 95% compliance with QI standards. Enforcement and the deterrence it provides are critical components of any compliance strategy. Given these minimum enforcement costs, it is all the more important that the investigative tools used by enforcement are both affordable and effective.

- Given that these projected cost are based on numerous assumptions, this analysis cannot predict with any precision the relative success of such an enforcement effort if they are primarily using serial number tracking as the principal investigative tool, as this has no known precedent. However, this analysis does make clear that serial number tracking is many times more expensive to implement, and offers substantially more limited analytical capabilities than the alternative statistical tools.
- For a frame of reference, CSLB board members reported at a recent WHPA meeting in Sacramento that CSLB executed about 2500 actions against all classes of contractors statewide last year. These included penalties and fines, and some of them may have been violations that resulted in suspension of license. Evaluation of the CSLB's investigative and enforcement budgets and the enforcement cost per prosecution is not herein provided (data not available), but may be relevant to a more accurate estimation of the projected enforcement budget. Any in-depth feasibility study offered in support of serial number tracking should investigate the cost-effectiveness of CSLB's enforcement relative to perceived threat and the desired deterrence effect.

According to research submitted by Kristin Heinemeier to CEC in August 2018, nearly 80% of all contractors think unpermitted work is unlikely to be prosecuted. Only 5% of think there is a probability or possibility of getting caught. She supports some form of tracking system, but also admits "*that even if an HVAC Registry (tracking system) is created, it will not solve the problem unless there is a mechanism in place to punish the people who are caught.*" A significantly increased enforcement budget is clearly a necessary ingredient of any compliance plan. Some of tracking system enforcement expenses may be recovered through fines that are imposed. However, it is important to note, that if the investigative and enforcement team finds more cost-effective ways to achieve the desired deterrence, and they do not use the tracking system database, the enforcement budget is not a sunk cost, but all of the tracking system costs ARE sunk costs. This amounts to a loss of $12 million a year for implementation of serial number tracking, (based on the above best-case calculations). So if the tracking system was abandoned as an ineffective experiment at the end of the second year, $24 million in revenue will have been lost, mostly by state agencies and distributors.

Interstate Transfers of Equipment Will Compromise Tracking Accuracy

The nature of interstate and regional distribution networks adds a layer of complexity to the entire tracking system concept. In most instances equipment arriving in California will have been on a truck that made multiple stops on its way across the country, and the inventory will come into a West Coast distribution hub that will transfer equipment to other regional warehouses. If twenty of a given model of product are loaded onto a truck bound for California, warehouse personnel will have to identify specific boxes that are "tracked serial numbers" and distinguish them from those that are not tracked bound for other states. This would require every person involved in offloading product at warehouses across the country to be aware that specific serial numbers destined for California cannot be offloaded even if they are the same model number as others. This would also require that trucks be loaded in a manner that accommodates this product distribution, not an impossible task, but one that requires retraining warehouse staff nationwide. California-bound packages and pallets would need to be distinctively labeled.

The supply chain structure will vary from company to company so that some have distribution hubs just outside California serving regional warehouses within the state and some may have hubs in California that transfer large amounts of equipment to regional warehouses outside the state. There is no actual data on the precise manner through which this equipment flows through these differing corporate networks and such information is proprietary. Even if we assume that 80% of the product that ships into California does not again cross state lines into surrounding states (no data available), that implies that 300,000 units commonly crosses state lines after the initial shipment from the manufacturer arrives in California and the extent to which this occurs will vary from manufacturer to manufacturer.

Based on regional demand, seasonal demand differences and product inventory, at least 15% to 20% (no hard data available) of the product shipped into California will ship back out to distributor warehouses in other states, most likely surrounding states in the West Coast region. However, the product could literally end up anywhere and there is anecdotal evidence of product that originated on the East Coast, shipping to the West Coast, and due to a specific demand, being shipped back to the East or Mid-West. So what exactly happens to the tracking system during such scenarios? Mr. Eads says: "If the equipment is shipped out of California, and then back, the entity shipping the equipment back into California is required to acknowledge the transfer on the equipment registration database." This sounds simple, but it would require the shipper to open the packaging to verify the serial number of the product they are shipping, and this goes against warehouse protocols. Distributors don't want to disturb packaging for liability reasons, and serial numbers are often concealed within the equipment and would require some disassembly to access. There is no obvious or workable solution to this problem.

Furthermore, the interstate nature of supply chains would require distributors in surrounding states to also participate in the tracking system and have access to the database. The further the shipper is from California, the less familiar they will generally be with the tracking system protocols. Learning curves would be an ongoing problem. Is it reasonable to expect distribution warehouses all over the country to train their staff on an annual or ongoing basis on how to execute and maintain a California-specific tracking system? The cost of training are likely to be higher further away from California, simply due to the infrequency of tracking system use and learning curve issues. Who will pay for these tracking system overheads in states outside of California jurisdiction (training, data entry, data corrections and system maintenance)? Is it reasonable to expect warehouse workers – who are not in California – and are not within the jurisdiction of the CEC – to diligently comply with such an out-of-state requirement?

Given the variability of warehouse inventory systems and software, there is no way to build in quality control checks such as "pop-up messages" and automated reminders in the existing warehouse software, and there is no independent way to verify quality control of the data. If warehouse staff simply failed to verify a serial number that was shipping into California, that equipment could be sold and never appear on the tracking system radar. Without such cross-checks, there is no way to verify compliance with the tracking requirements and no IT system manager would ever be able to prove if such data entry errors or failures happened or not. Such a scheme could never be foolproof.

The Inherent Fallibility of the Database and its Inability to Stop Circumvention

So what does the limited accuracy of the system mean in practical terms regarding the ability of enforcement officials to use this database to isolate and pinpoint which contractors in the state are

violating? The answer is obvious. There is no way to know if the tracking system data is 50% accurate or 98% accurate, and database accuracy is likely to degrade over time as frustration with the requirement and any delays it causes grows. Because equipment may be easily bought through the internet and installed inside California, or may be bought in Oregon and trucked across the state line, or may be bought at an in-state warehouse but may be erroneously reported as having left the state, there will be large amounts of equipment that do not enter the tracking system and is therefore "under the radar". If the same "bad actors" that currently circumvent permit and QI requirements wish to keep doing so, they just need to order equipment online, or rent a box truck and drive it across the state line themselves, and there is no way to stop such activity. So the tracking system offers no safeguards against "bad actors" circumventing the requirement entirely, and what is worse, has no way to catch even honest mistakes in data entry.

Consequently, the building department or CSLB official charged with using the data to flag and identify potential violators may never see 20% or 40% of the equipment that has come into the state without being entered into the tracking system. The contractors who are most likely to violate permit and HERS requirements, will never show up on the "radar". This means that those that do show up in the tracking system will primarily be those contractors who are complying or mostly complying with legal requirements, and not the worst violators. What is most concerning about the entire tracking system proposal is the false sense of security it creates. Law abiding people seldom imagine all of the creative ways violators dream up to save money and compete unfairly – and they don't imagine such violations of law will occur. It is easy to imagine this tracking system will provide this infallible database that will offer laser accuracy for identifying "bad actors" but this is rather illusory. It will not take "bad actors" long to identify a scheme for getting around the inconveniences in order to continue business as usual. For this reason, the worst possible outcome is likely: tracking system requirements will tilt the market in favor of bad actors even more than is currently the case, and it will punish compliant contractors and distributors. Human nature being what it is, circumvention is easy to foresee. It is clear that this regulatory requirement would punish compliant distributors and contractors more so than the violators – the opposite of the intended purpose of the tracking system.

Privacy Laws Inhibit Investigative Analytics of Serial Number Tracking Systems

To avoid violation of know privacy law constraints, Mr. Eads suggests that there is no need to tie or correlate the equipment serial numbers with the building permit number. This is itself a highly questionable assertion. If a serial number tracking were to be optimized, you would want the same database to "see" both serial numbers and the jobs, addresses, permit numbers and associated contractors that installed the units. Correlating and comparing the number of permits each contractor files would be a useful way for the system to filter for potential patterns of violation, but privacy laws restrict the nearly public access to the data required to create such a system – and with good reason. Privacy concerns are justified given the frequency of data hacks and the impact on consumers. However, these protections prevent any tracking system from becoming the optimized tool everyone imagines it would be. **Manufacturers have a valid concern of being required to comply with one law that results in them violating another.** Furthermore, if the state were to operate or host the serial number tracking system, these data breach costs would become a liability for taxpayers.

If, as Mr. Eads suggests, the permit numbers are not correlated to the serial number tracking system database (to meet privacy law requirements), there is much more legwork for an investigator to filter the data and inspect contractor's premises to verify compliance with the tracking requirements. The privacy law restrictions that inhibit entering the client address and contractor number, also prevent enforcement from having access to the information that would be most helpful to their investigations: which contractors are associated with the greatest number of serial numbers that drop off the tracking system "radar". The actual utility of the database is greatly reduced without this correlation of data. When Mr. Eads suggests "no personal information is required on the database, no installing contractor information, no homeowner information is required", he is operating under the assumption that the database would be used in one fairly limited way: Specifically, the software may use filters to narrow the "suspect equipment list" down to a list of units sold to a specific contractor in the last 90 days and compare that data to the list of serial numbers that has shown up in the HERS directory as "installed and verified". If there are many serial numbers sold to a contractor that are not showing up in HERS verifications, that may indicate a pattern of violation, but each missing number would have to be investigated and inspected to prove each violation. Naturally, there is an intervening lag time between sale and final inspection. The longer the lag time, the more suspect the equipment. But this creates doubt about any actual pattern of violation because the tracking system cannot differentiate between an actual violation and inventory that may sit in a contractor's storage facility longer than usual. The fact that the tracking system would specifically be prevented from including actual permit data, also make it completely blind to positive identification of actual violators. Mr. Eads analysis admits this when he suggests that any single serial number suspected of being installed illegally because of a long lag time between the sale to the contractor and the verification by a HERS rater would have to be verified by site inspections, one unit at a time. The tracking system would actually provide no definitive information about whether or not the "suspect" serial number is or is not associated with an actual violation. The fact that privacy laws eliminate this functionality, greatly increases the cost of tracking system enforcement over other alternatives.

The cost of investigating the location of a specific piece of equipment with a specific serial number that is only "suspected" to be the subject of a violation is implicitly higher and less cost-effective than a system that is capable of looking for broader patterns of violations by contractors. The difference is one of scale. Chasing the location of one piece of equipment that by itself reveals no pattern of violation is inherently more limited in scope than an investigative tool that could reveal which contractors have not filed half the permits you would expect a company with a determined number of installers to have filed. Attempting to find the worst violators while limited to finding one violation at a time is clearly a myopic investigative tool. A list of actual or probable violators is never magically revealed by the tracking system software.

The Higher Cost of Tracking System Enforcement Compared to Other Alternatives

Mr. Eads argument in favor of tracking systems admits to blindness of the database due to privacy laws requirements. In his line of reasoning, if a serial number hasn't appeared in the HERS registry, it *should* still be at the contractor's office, *unless* it has been illegally installed elsewhere. That appears at face value to be logical. But the logic of Mr. Eads argument breaks down precisely because these are false assumptions that lead us to numerous plausible explanations that don't fit within the few alternative possibilities he offers: It *seems* safe to presume, but it is not. Evaluating what Mr. Eads actually says: "The Equipment Registration database tracks possession of equipment. Report queries by enforcement

personnel will be able to verify if an installer has possession of the equipment that has been transferred to him/her. If the equipment is not in his possession, and it has not been verified as permitted and installed by the HERS process, then penalties and/or fines can be imposed." (Submitted comments, 08/20/18, Pg.8)

This statement suggests that in order for enforcement officials to catch the permit violators, all they must do is query the tracking data to see if an installer has purchased equipment that has not been installed, then inspect the contractor's office or warehouse to determine if the equipment is there. If it is there, they haven't done anything illegal. If it isn't there, and it is not in the HERS registry, they have done something illegal and "penalties and/or fines can be imposed". The black and white absolutes with which this assertion is made are very dangerous. Mr. Eads suggests that, as a precaution against unsubstantiated charges, building department investigators should check to verify that there have been no break-ins or thefts of HVAC equipment reported to local authorities as theft would be a conceivable excuse for missing equipment. But this doesn't begin to cover the range of other possibilities that could explain suspiciously "missing" equipment.

Many other explanations are possible: Numerous contractors have more than one place of business or have an office and shop separate from a storage unit. Should the tracking protocols require them to register the equipment into the registry every time they move it from one address to another? Would HERS raters be expected to always conduct on-site inspections on the same day of the equipment install to avoid any lag times between install and appearance of the serial number in the HERS registry? It is reasonable to have a lag a week or more between the installation, HERS testing and entry into the HERS registry. Mr. Eads' presumption of guilt is an obvious overextension and it is one that is more than likely to antagonize the very stakeholders that we want to co-invest in compliance. Clearly, an inspection of a contractor's shop that reveals equipment "missing" cannot be presumed to imply guilt of installing without a permit. If such contractor facility inspections require follow up visits, follow-up investigations, inspections of the jobsites that the contractor says are associated with the missing serial numbers, the tracking system will send inspectors to chase many ghosts before a single violation is found.

The Questionable Constitutionality of Contractor Facility Inspections without Warrants

In this context, even larger privacy invasion and constitutional questions arise: Are such contractor facility inspections going to occur without prior notice? Will contractors have to grant permission to enforcement staff to gain entry to the facility? Would inspection without consent require a warrant? Most search warrants require court approval and are obtained when there is probable cause to believe illegal materials, such as weapons, drugs or other criminal activity are suspected. Ironically, in the case of Mr. Eads' specific version of an equipment tracking system, a contractor unwilling to voluntarily consent to an inspection would require a search warrant, which would probably have to be obtained in order to determine guilt in the event that a legally obtained product *is not there that should be.* There is no legal precedent for obtaining a warrant to prove that legally obtained goods are not in a contractor's facility. The irony and novelty of this situation should not be underplayed. Would any court grant a warrant to verify that equipment that the contractor purchased legally, is now missing from his facility and consider that proof of guilt? Such assertions would likely be disputed in court. Without knowing where the system was installed, there is no actual proof of an illegal permit violation. The logic of a tracking system dissolves into chaos at this point precisely because the tracking system focuses on an obtuse method of obtaining clues about permit violations. There are far more cost-effective alternatives. We don't actually need to know

where equipment is every day as it migrates from factory to homeowner in order to figure out who the violating contractors are.

Serial Number Tracking Is Incapable of Positive Identification of Violators

Breaking this down confirms exactly what manufacturers and distributors object to. There is no way to look at the data comparing 'serial numbers shipped' against 'serial numbers installed' through an auto-search function which produces a clear subset of numbers that MUST represent illegal or unpermitted installs with any degree of certainty. If such certainty existed, then the tracking system software could also automatically generate warning letters and send emails to the known violators – a wonderful dream if it were just a perfect world, but nowhere near realistic. Uncertainty is pervasive in every possible iteration and functionality of the tracking system design. It includes issues from data entry accuracy to using filters to identify "suspects", to the cost effectiveness and the legality of the contractor facility inspections that it would require. The inconvenience, invasiveness and impact on contractor revenue are highly likely to create reticence and motivate circumventing strategies.

The tracking system costs a great deal of money to institute, but by itself does not accomplish anything toward the goals of compliance and improved enforcement. A separate enforcement budget is still required, as is the case with any enforcement strategy. So we must return to Mr. Eads original question: Is this the most cost effective method to improve compliance? Is it the most cost-effective way to positively identify the worst violators? Even if the tracking system data entry were near perfect, if we are limited to using the tracking data, there is no way to positively identify violators without performing unsolicited inspections of contractor offices. The tracking system can only tell us within a range of probability where equipment with specific serial numbers should be and can never tell us where it has actually been installed illegally. When we consider all of the analytical possibilities that the tracking system could employ to compare lists of numbers, these lists of serial numbers would inform us of nothing more than a list of equipment numbers associated with a "possible" violation, and not probable violations.

Inaccuracies in the Database Would Require Inventory Verification

The more fatal flaw of the tracking system is that the comparison of units sold to units installed loses sight of units that the system 'thinks' are still in a warehouse but are not – a notable and critical data gap. Short of performing a physical inventory check of an entire warehouse (as every warehouse dreads doing at the first of the fiscal year), there is no way to confirm that there are not thousands of units that have been sold that were erroneously misreported "in inventory" or "sold out of state". Such an inventory process would have to not only count exact quantities of every make and model in house, but also note the serial numbers of each unit – an inherently tedious and expensive task that would result in significant lost revenue. The CEC would be hesitant to impose such impractical measures because of the obvious and exorbitant cost and would most likely live with the database inaccuracies. Typical warehouse inventory record accuracy is in the 90% to 95% range, so even this inventory verification process cannot eliminate uncertainties in the accuracy of the data. (See: https://cybra.com/average-retailer-inventory-accuracy/)

Additionally, there is no way to define culpability on the part of the warehouse staff. Simply stated, there is no way to confirm intention. Do you penalize them for an inventory "error"? Does the enforcement

agency demand that the warehouse staff person be reprimanded? The more you discuss the detail of any proposed serial number tracking system, what appears to be rational and controllable at the outset is in fact an exercise in futility. Inaccuracies in the database are inevitable and we end up having to enforce compliance with the enforcement system itself. There is no legal precedent for demanding such an overlay of government bureaucracy and there is simply no clear path to resolve all of the open-ended problems getting staff to comply with tracking system protocols at every checkpoint in the supply chain.

Strategies to Circumvent the Tracking System Will Obstruct the Intended Goals of Compliance

There is a very high likelihood that many, if not most contractors will view tracking systems as government overreach and those subjected to inspections of their facilities are likely to experience this as an unwelcome "governmental invasion of privacy". Contractors will be particularly antagonistic if they believe they are innocent but are nevertheless subjected to multiple inspections. Contractor back-lash is probable for a number of reasons; among them are: a) Most HVAC contractors already resent permit requirements; b) contractors will defend their perceived "rights to privacy" and resist inspections of their facilities; c) the system is inherently presumptuous and does not target the worst violators and it is likely to punish many contractors who are innocent. If contractors resent the compliance requirements, they will be far less inclined to participate in HVAC optimization training and quality control testing. The CEC will lose the battle for the "hearts and minds" of the very contractors who we all want to commit to excellence. If compliance requires a balanced blend of carrots and sticks, this is clearly the wrong stick.

Given contractor disposition as a group, the optics of contractor facility inspections will not play well for the CEC. The cause of energy efficiency, quality installation and the intended climate change mitigation underlying this strategy are likely to suffer as a result. This approach risks greater resistance to compliance with permitting requirements because it sets up adversarial relationships with both violators as well as the law abiding contractors in the field - punishing both equally. Indiscriminate punishment will only make the desired objectives more difficult: quality installs with a transparent, incorruptible process control.

The Disruptive Impact of Serial Tracking Systems on Current Distribution Networks

Any tracking system plan creates an adversarial environment rather than the collaborative environment needed to make performance goals and QI standards happen. Just as the internet has driven Sears into near extinction, a serial number tracking system would inevitably create an underground economy that would threaten the very existence and livelihood of the distribution companies currently doing business in California. This is contrary to the objectives the CEC seeks to accomplish and would seriously damage a major stakeholder that provides a vital service. Perhaps the biggest blind spot of the tracking system strategy is the illusion of certainty - that there is no way to circumvent the bureaucracy – which of course there is. Black markets and unconventional supply chains will, within months, replace traditional distribution hubs, completely circumventing the tracking system and permit requirements. One may say these impacts are speculative, but contractor non-compliance is the prevailing pattern, and it is logical that if there is a way to circumvent the tracking system the worst "bad actors" will find it in short order. The following unintended effects should be anticipated:

1) Serious near-term fiscal impacts on in-state distributors and their employees, would likely result in adversarial relationships between distributors and state agencies.
2) Distributors who have suggested support for training programs and who have regional training centers that could facilitate CEC's QI objectives are likely to withdraw from any participation in state mandated continuing education requirements for HVAC contractors.
3) Contractors will be reticent against compliance with CEC requirements rather than embrace the "new school" thinking on HVAC and quality installation.
4) Contractors will refuse opportunities to participate in advanced training if distributor training centers are closed and more remote training locations require more travel time and hotel stays.
5) Compliant contractors will eventually not be able to compete against non-compliant contractors unless they also participate in underground economies and non-conventional supply chains.
6) If warehouses are replaced by internet sales and underground market suppliers, valuable tech support and training infrastructure will be lost.

The More Cost-Effective Alternative Enforcement Strategies:

Most stakeholders seem to agree that enforcement agencies need to be given "teeth", and that any compliance strategy, with or without a tracking system, will need better enforcement to create real deterrence for violators. However, there are other more cost-effective investigative tools that directly target and rank the worst violators and these offer the promise of making the enforcement budget stretch to do more with less. These enforcement alternatives reduce enforcement labor, and avoid the significant "stranded asset" risks inherent to tracking systems. All of these alternative strategies also do a better job of "winning hearts and minds" in order to transform the industry to a paradigm of "selling up to a quality standard rather than down to a price". Given that introduction, the CEC's thoughtful consideration of the cost and effectiveness of the following "equivalent" alternative enforcement strategies is appreciated:

1) **ALTERNATIVE ONE: Time of Sale Inspections:** The City of Davis has had a model program for conducting mandatory time of sale inspections on all home improvements performed by the homeowner or their contractors during their ownership. The current Davis time-of-sale inspection covers *all* home improvements at a cost of $430 per home. A system that required only review of HVAC equipment and HVAC permit history would cost only $125 per residence and would be easy to perform without any impact on escrow or delay of sale. (Data based on conversations with City of Davis staff). The Davis program, instituted about 40 years ago, is unique in the state and has resulted in a 100% compliance by all HVAC contractors operating within the city and near 100% compliance with contractors based in surrounding cities. (Reference Greg Mahoney's testimony during CEC Compliance Workshops and follow up conversations.) This program not only has a relatively low cost to the homeowner requiring no state enforcement budget. The seller pays the entire cost of the investigation at time of sale. Therefore this model has neutral impact on local jurisdiction budgets (fees cover costs). It minimizes risk by using a proven enforcement method and offers a much less invasive enforcement strategy than invading contractor facilities. It is worthy of careful consideration.

2) **ALTERNATIVE TWO: Statistical Analysis of Probable Violators:** If HVAC contractors were required to disclose the number of installers they had on their business license applications as well as the

ratio of residential and commercial work they perform, investigators could easily project the approximate number of residential HVAC jobs that the contractors perform in the course of a year. A computer algorithm could mathematically predict with great accuracy, the number of permits in each category of work for which the contractor would be expected to file permits. If a statewide online permit application process also handled business licenses, the statewide system could compare projected numbers of permits to the actual permits filed by each contractor and automatically identify *patterns of violation* on the part of individual contractors. Because this system is not accessed in any way by warehouse workers or even building inspectors, there are no privacy infringement issues. **This system would do what a tracking system cannot: automatically generate actual lists of contractors that have a high statistical probability of having engaged in patterns of non-compliance and it would do so for a fraction of the cost.** Provided that the CEC's databases can query how many permits of a given type each contractor has filed, the data is already at their fingertips. Centralizing online permitting and business licenses at a CEC portal that forwards permit applications to jurisdictional building departments would allow one IT system investigator in Sacramento to search data for probable violators and automatically rank the worst violating contractors.

Legislation would not be required to give building departments the authority to send an "accounts auditor" in to review contractor invoices. Contractors would be required to sign or DocuSign a statement on their business license application agreeing to comply with permit, testing and workman's comp requirements, and authorizing any local jurisdiction to conduct audits of their books in order to verify compliance. Auditors would need the qualifications of a bookkeeper rather than those of an inspector, so hourly overheads would be lower. Any contractor subject to such audits would be a known violator because they have half or a quarter of the permits that they should have on file. In the cases targeting the worst violators, it would not be difficult for an auditor to walk in and find invoices for jobs that did not have corresponding permits. Such audits may take 2 to 4 hours, and every one would yield actionable proof of a violation.

The CEC has already been given legislative authority (SB1414) to create policy "as necessary" to bring the state into compliance. However, if there is any doubt about "jurisdictional authority to audit accounts", the online business license applications could have terms and conditions that stipulate: "*Completion of this business application constitutes acceptance and authorization to all enforcement agents who may require review of your books upon request given 24-hours' notice. By applying for this business license, the contractor hereby agrees to periodic audits of its accounts to confirm conformity with the terms and requirements of this business application, including but not limited to permit applications, HERS performance testing, and system and duct sizing in accordance with ACCA manual D, J and S on every HVAC system replacement and on duct replacements over 40 feet, as required by state building codes".* Such language would actually provide a deterrent effect. The only way that contractors could circumvent such a system requirement would be to stop complying with business license requirements and ceasing to use any computer generated estimates, both of which are highly unlikely.

This system of using statistical methods to target violators for auditing combined with escalating fines for non-compliance would create a strategy far more likely to "break even" between staff

costs and fines imposed (penalty revenues cover auditing and prosecution expenses). The part time overhead of the auditor would be less than $50,000 per year per building department and the daily revenue from fines to cover the cost of this enforcement could be as little as $140 per day peer jurisdiction. This relatively low overhead is far more likely to be covered by fines and penalties collected and is far more likely to locate and prioritize the worst violators.

3) **ALTERNATIVE THREE: Mandating Enforcement of Current Contractor Law plus Escalating Fines:** Work performed by unlicensed contractors could be greatly reduced by requiring and enforcing the existing legal requirement that all contractor vehicles be identified with company name and contractor license number AND requiring that all purchases at distributors warehouses be loaded only into contractor vehicles that are marked as required by law. Distributors could easily ask for copies of current contractor licenses on a quarterly basis and keep copies of these documents scanned as pdf files on their computer systems. This would deter distributors from selling to unlicensed contractors, and make unlicensed contractors far less likely to attempt to buy equipment in this way. Signs advising contractors of licensing, permitting and HERS testing requirements could be posted at warehouse sales counters.

   Another requirement that all contractor vehicles at residential replacement jobs post the job permit on the windshield of the truck parked on the street or driveway would facilitate drive-by compliance verification. Any building inspector driving by can immediately see if the job is permitted and being performed by a licensed contractor without calling the office to verify the permits on file and without knocking on the door and impeding work in progress. Deterrence would be complete if there was a statewide policy requiring ALL building inspectors to knock on EVERY door where there is no marked vehicle with a permit posted on it at the driveway. Surprisingly, many inspectors do not feel they have a right to enter unless there is a permit on file. They should be given a clear right to inquire, and if they are not granted permission to enter, and no permit is displayed, they should have the right to issue a citation to the contractor. If this in-home inspection was performed only when inspectors happen to be driving by, the time taken would still be only minutes per jobsite and would likely not take much time or overhead.

   A third requirement imposing uniform, escalating fines for unpermitted and unlicensed work combined with these other policies would act as a serious deterrence. The City of Davis has an administrative ordinance requiring escalating fines for unpermitted work which increase from $100, $200, $500 to $1000 for each additional violation. They instituted this ordinance without an act of the legislature over 30 years ago, so there is a precedent for such escalating fines to become uniform statewide without legislation. They have zero HVAC permit violations in their jurisdiction - that is a notable track record. There are negligible additional inspection overhead costs associated with this requirement, as it is assumed that inspectors are randomly stopping as they are driving by a site and are not going out of their way to find violators. If burdened labor rates for inspectors are in the neighborhood of $70/hour, the average of 15 minutes a day dedicated by one or two inspectors that were passing by and stopped to check permits will cost $16-$20/day. This strategy literally poses little to no risk, may cost building departments less than $4,000 a year in costs while bringing in ten to twenty times that in revenue in the form of fines and penalties. If the pilot of such a program proved to be cash-positive, additional man-hours

could be assigned to specifically patrolling and randomly inspecting homes that have unmarked trucks parked out front with HVAC ducts and equipment all over the driveway. This may sound like a risky investment, but it could be expanded slowly over time with minimal risk. This scenario would not require state funding to the tune of $12 million per year as the serial number tracking enforcement staff would seem to require. It eliminates higher overheads and increases the probability of that the enforcement strategy will cover its own costs with fines and increased permit fee revenue.

Conclusion: Why We Should Put Tracking System Proposals to Rest Once and For All

A tracking system that depends on hundreds of warehouse staff to verify serial numbers at numerous checkpoints all over the nation is inherently subject to uncertainties. This analysis has illustrated how there is no way that any tracking system can positively identify violators or even probable violators. If they are designed to comply with current privacy laws, tracking systems will not have the capability to identify patterns of misconduct on the part of the worst violating contractors. They can only create long lists of "suspected serial numbers" which by Mr. Eads admission would still have to be verified with contractor facility inspections. The contractor facility inspections that Mr. Eads says are "the compelling element" are actually unlikely to identify or prioritize the worst violators, where other methods of statistical analysis offer better tools to identify highly probable violators. If enforcement budgets are not allocated to specifically use tracking system data to catch violators, all of the investment in setting up and maintaining the tracking system become "sunk costs", making any tracking system a high-risk investment.

Closer analysis of how a tracking system would be implemented, point to probable online traffic congestion that is highly likely increase tracking system costs. System access delays due to high peak online traffic rates may cause lost revenue. The minority of contractors who systematically and repeatedly commit permit and HERS violations will find ways to continue doing so, and are likely to buy equipment online or drive across state lines to circumvent the tracking system. If they are able to succeed in circumventing QI requirements, the additional bureaucratic burden and schedule impacts on compliant contractors only works to tilt the playing field in favor of violators even more. The rest of the HVAC contractor community will be hard pressed to survive if they can't compete against unfair practices.

The proposed tracking system is also likely to create an adversarial relationship with the same contractors we are trying to bring into compliance through training and QI testing. It will take a collaborative approach where all stakeholders are working together to streamline permitting and HERS compliance and train contractors and their employees on higher quality installation. Without contractor buy-in, they will not commit resources to advanced training, QI testing or any of the other necessary conditions to reaching QI standards. Whatever enforcement strategy is eventually adopted, it must not punish both compliant and violating contractors alike. There should not be negative impacts on distributors who also provide the most widely disseminated training facilities. The proposed serial number tracking system fails these critical tests. We need to step back and compare the relative costs of the alternative enforcement strategies outlined in this analysis, which deserve consideration. The cost-effective alternatives are attractive for several reasons. Specifically they are lower risk, lower cost, simpler to implement, they offer more convenient automated investigative tools, they are more likely to target the worst violators, and they are more likely to result in cooperation with permit and testing requirements. In its evaluation of these critical trade-offs, the CEC must carefully consider both fiscal impacts as well as the optics. The carrots and sticks must be chosen carefully to facilitate the desired outcomes.