**DRAFT Memorandum**

To: California Technical Forum (Cal TF) Savings To Code Subcommittee

 Cal TF Policy Advisory Committee (PAC)

Re: Status of Subcommittee Work

From: Alejandra Mejia, Cal TF staff

Date: May 4, 2015

Throughout the first quarter of this year, the Cal TF Savings Below Code subcommittee has been working on characterizing circumstances where savings below code are not currently being captured. This memorandum documents the subcommittee’s work to date and makes recommendations about how best to proceed with the current work. The recommendations for next steps highlight which measures and approaches are the best candidates for identifying, documenting, quantifying, and claiming below code savings.

**Subcommittee Background**

In January of 2015, the California Technical Forum (Cal TF) launched a Savings Below Code subcommittee in response to a request by a Public Utility Technical Forum member to:

* Identify and document circumstances where savings below code are not currently being captured, including:
	+ Code Noncompliance
		- New Construction—New construction buildings that are permitted but still don’t meet code requirements
		- Alterations—Equipment upgrades that trigger code and may also require a permit, yet don’t meet code in practice. Cases include:
			* Permitted, but not code compliant
			* Not Permitted—Permit required but not secured (typically only for measures that are “behind the wall” or unseen).
	+ Existing Buildings: Potential in existing buildings that have not been significantly altered, which includes:
		- “Repair Indefinitely” Equipment—measures that customers typically repair rather than replace well past their “Expected Useful life.”
		- Code Triggers—actions that are not required by code, but that trigger code (such as when installing a skylight, occupancy sensors must be installed as well). These are instances where a change that is not related to particular equipment’s useful life triggers other requirements.
		- Additions—Existing buildings where owners are not required to upgrade, program incentives or other program activity can cause them to upgrade, and no code is triggered.
* Quantify and claim cost-effective savings from ‘below code’ activities that can be achieved through program intervention such that
	+ PAs and implementers may capture otherwise stranded savings opportunities,
	+ Expenditure of ratepayer dollars on ‘free rider’ activities is minimized, and
	+ Savings claims are not “double counted.”

Part of the work of this subcommittee involves cataloguing the existing literature and researching initiatives from other states on below code savings potential, code compliance, and best practices for capturing savings currently being ‘stranded’ by Title 24 updates. The pertinent resources identified and analyzed by Cal TF staff in the course of the subcommittee’s work are summarized in the attached appendix. The following sections describe key findings made through this research.

The sub-sections immediately following each of the two Key Findings sections contemplate the second possible aspect of the subcommittee’s work: explaining how particular pockets of savings potential stranded by code can be captured without misallocating efficiency resources (paying for efficiency savings that would have occurred even without program intervention). The two Next Steps sub-sections articulate the value that can be created by continued subcommittee work on the different opportunity areas already identified and make recommendations about the best path forward.

**Code Noncompliance: Key Findings**

The majority of the literature that Cal TF staff identified as relevant to the subcommittee related to code non-compliance. Preliminary analysis of these resources allowed Cal TF staff to draw the following overarching conclusions about the current state of code compliance research:

**Code Non-compliance Studies May Not Be Sufficient to Quantify Available Savings From Code Compliance Activities**—In the code compliance literature, code non-compliance can refer to non-compliance with administrative requirements that do not relate to energy usage as well as non-compliance with energy performance requirements. The term can mean anything from ‘pulling a permit,’ undergoing the sometimes lengthy plan check and site inspection process, installation of the correct equipment, posting certificates, or actual building performance. For that reason, when reviewing studies that draw conclusions about percent of code non-compliance to determine potential for energy savings through program interventions, it is important to understand whether non-compliance includes non-compliance with code administrative requirements (such as plan checks) or just non-compliance with energy performance characteristics. If administrative requirements are also considered in the code non-compliance study, it may be very difficult to quantify savings available from additional code enforcement activities.

**The vast majority of code compliance studies estimate compliance with energy codes within a set of new construction or significantly altered buildings that have received permits. However, permitting rates, especially for smaller alterations of existing buildings, remain largely unknown.** Many studies have identified code compliance with permitted new construction buildings. These studies have produced a clear understanding of the new construction performance relative to code. However, there is a relative paucity of information on permitting and code compliance of smaller, ‘behind the wall’ alterations, which are assumed to be permitted at lower rates. Data that exists suggests “behind the wall” alternations, at least in some cases, have low permitting rates.[[1]](#footnote-1) Furthermore, even if a permit is not secured, it is not clear whether the alteration may meet code anyway. Conclusions drawn from one data set may not be accurate in regards to the other.Given the dearth of information on the performance of non-permitted energy upgrades, creative studies designed to help answer this question would be helpful for assessing whether code enforcement strategies for “behind the wall” alterations would yield additional savings. One recent example of such a creative solution was the Department of Energy’s use of plumbing permit records to select a baseline sample in an area of rural Kentucky that does not report energy permitting.[[2]](#footnote-2) DOE plans on using this baseline sample of building where energy codes are presumed to have triggered but not reported to assess actual building performance.

**Next Steps for Subcommittee Work on Code Noncompliance**

As is made clear in the appendix of this document, there is already a large body of existing and ongoing work on estimating compliance with energy codes. In California the CPUC funds regular impact evaluations of the IOU’s Codes & Standards portfolios. In addition, LADWP and Navigant are working on in-depth investigations into savings potential below code. There are also some interesting studies in progress in other states. However, extrapolating from other states to California would be difficult because California has a comparatively longer history of successfully leveraging codes for energy efficiency. Lastly, the issue of compliance in non-permitted alterations is still largely unanswered by statistically robust studies. However, in the absence of its own research budget, the subcommittee should not attempt to independently investigate this issue and only remain available to peer review the work of other groups.

Given that code compliance is such an established area of research, and therefore a very resource-intensive line of inquiry, we recommend that the subcommittee continue to monitor progress on the ongoing California studies, but the work should largely turn its focus to the other, more promising areas of research.

**Existing Buildings: Key Findings**

In explaining their policy of using code as baseline, the CPUC has explained that they “do not want to give tens or hundreds of millions of ratepayer dollars to individual customers to do things that [they]… are already required to do.”[[3]](#footnote-3) However, much of the savings potential that is technically below the efficiency levels mandated by Title 24 does not actually fit this ‘outside the law’ descriptor. **Code requirements only apply to existing buildings when an alteration project involves one or more ‘code trigger’ changes to the structure. Therefore, many of the oldest, least efficient buildings in the state are not outside of compliance with Title 24 energy codes.** Retrofitting these buildings could significantly reduce California’s energy consumption. Since retrofits of existing buildings are not mandatory, program interventions can capture savings below code that would not otherwise happen absent the program activity, and should properly be claimed as program savings.

**The amount of research available to support this line of inquiry is staggeringly small** when compared to the many studies regularly performed to estimate code compliance in new construction. In fact, one of Cal TF staff’s key areas of focus for this subcommittee so far has been to survey the availability of primary data that can be mined and estimate the cost of cataloguing it appropriately for analysis: Cal TF staff has been working closely with Subcommittee Co-Champion Doug Mahone to compile and vet primary sources of equipment age data to support the development of a Repair Indefinitely measure type. The resulting catalog of potential information can be used to validate alternatives for capturing to code savings without misallocating ratepayer funds.

Constructing these alternatives will be a crucial step towards moving from problem definition to problem solving. Furthermore, the process of analyzing draft rule sets will also help ground and steer the discussion away from hypothetical pitfalls. **Yet, perhaps not unexpectedly, the amount of resources that are currently dedicated to designing proactive paths forward for capturing these savings is also very small.** This makes this area of work particularly fruitful for development by the Cal TF subcommittee.

**Next Steps for Subcommittee Work on Existing Buildings**

Following the above reasoning, we recommend that the subcommittee should explore the best possible ways to target savings in existing buildings without using ratepayer funds to subsidize customer for doing what they are already required to do.

The proposed approach for identifying savings from existing buildings is to:

1. Identify Measures: Identify measures and/or strategies in existing buildings that could be upgraded but are not;

2. Quantify Potential: For each measures/strategy, identify savings potential for upgrading to code (measure-level and statewide potential) – this will help identify areas for review that could provide greatest savings.

3. Determine Data Gathering Strategy: Identify data gathering strategy to document that savings are not currently being captured.

4. Develop Rule-Set: The rule set would identify what documentation would be needed to demonstrate, for each measure or strategy, that savings would not have been captured absent program intervention. The rule-set should also address how to identify free riders.

**Conclusion**

Having characterized the five main areas of opportunity for below code savings, the Cal TF Savings Below Code Subcommittee can now hone its focus on creating a work plan for the remainder of the year. As outlined in this document, that path forward should explore the savings opportunity areas where the subcommittee can create the most added value: the three different type of circumstances in existing buildings as characterized by the subcommittee’s initial work.

 

**Appendix: Below Code Resources and Related Efforts**

**Code Noncompliance**

**Compliance in Permitted Buildings**

The descriptions below summarize research to identify code non-compliance in permitted facilities (primarily new construction) and to quantify savings that would result if the facility had complied with code. Program interventions targeting code non-compliance must subtract from their savings claim the percent of buildings that would have achieved compliance absent the program intervention.

* **The Cost of Enforcing Building Energy Codes**

*Alison Williams et. al. (LBNL), 2014*

<http://aceee.org/files/proceedings/2014/data/papers/4-76.pdf>

Literature review found that the cost (on local governments) of enforcing building codes ranges from $50 to $200 per residence and from $150 to $1,000 per commercial building.

[Longer LBNL paper has listing of compliance rates by state. California surveys seem a little dated, but the most recent ones estimate 50% and 25% compliance rates for commercial and residential new construction and retrofits: <http://eetd.lbl.gov/sites/all/files/lbnl-6181e.pdf>]

* **I Want CANDI: Establishing a Utility Code Compliance Program in Illinois**

*MEEA, Nicor Gas, UIC, 2014*

[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB4QFjAA&url=http%3A%2F%2Fwww.mwalliance.org%2Fnode%2F3578&ei=ijgTVdiUIcizogTN1YKQBw&usg=AFQjCNFSa9qyVqPAKy1KrxmG\_o8ksKafbA&sig2=waNxD5WUQLP6mB3Yg6IQZQ&bvm=bv.89217033,d.cGU](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB4QFjAA&url=http%3A%2F%2Fwww.mwalliance.org%2Fnode%2F3578&ei=ijgTVdiUIcizogTN1YKQBw&usg=AFQjCNFSa9qyVqPAKy1KrxmG_o8ksKafbA&sig2=waNxD5WUQLP6mB3Yg6IQZQ&bvm=bv.89217033,d.c)

Roadmap for a statewide energy code compliance program that measures compliance, converts compliance rates into energy usage and savings, attributes savings to programs, allocates costs, and calculates cost effectiveness. The cost effectiveness calculation does not seem to directly address free ridership, but does assume that only 30% of new construction buildings can improve their compliance via the program.

* **Residential New Construction Baseline Study of Building Characteristics Homes Built After 2001 Codes**

*Itron for PG&E, 2014*

<http://www.calmac.org/startDownload.asp?Name=RNC_2003_Final_Report1ES.pdf>

Impact evaluation conducted in 2004. Approximately 27% of sites are identified as non-compliant. A significant percentage (4% to 31% depending on climate zone) was also found indeterminate.

* **Statewide Codes and Standards Program Impact Evaluation Report for Program years 2010-2012**

*DNV GL and Cadmus for CPUC, 2014*

<http://www.calmac.org/publications/CS_Evaluation_Report_FINAL_10052014.pdf>

The study finds over 100% compliance for the new construction and significant alteration segments, but ‘a closer examination shows divergent results for individual codes and standards.’ The evaluation methodology uses a compliance adjustment factor for alteration with a less than precise 90% confidence interval between 26% and 47% and DEER interactive effects when calculating potential goals (potentially underestimating the modeled performance of code compliant buildings).

* **2011 Vermont Market Characterization and Assessment Study**

*Navigant for the Vermont Public Service Department, 2012*

* + New Construction and Major Renovation (C&I)

[http://psb.vermont.gov/sites/psb/files/docket/7676/IOPA/DPS/2011 VT Commercial and Industrial Existing Buildings Market Assessment Draft Final Report.pdf](http://psb.vermont.gov/sites/psb/files/docket/7676/IOPA/DPS/2011%20VT%20Commercial%20and%20Industrial%20Existing%20Buildings%20Market%20Assessment%20Draft%20Final%20Report.pdf)

Finds 88% compliance with applicable code in a set of permitted buildings. Has a helpful table with breakdown of non-compliant features (p. 123-124).

* **BayREN Code Compliance Study**

*The Benningfield Group, BKi, ABAG, 2015*

https://www.bayren.org/sites/default/files/BayREN\_CS\_PROP\_Final\_Report\_2015\_0401.pdf

In 2014 the Association of Bay Area Governments, on behalf of the BayREN, visited fifteen building licensing agencies in its territory and evaluated (via site visits) compliance of construction projects permitted by each of the visited agencies. Key findings from the PROP pilot—including a characterization of what typical errors in permit applications and compliance are—were used to design compliance tools for agencies in the BayREN territory.

* **Driving Innovation, Rewarding Performance: Seattle’s Next Generation Energy Codes and Utility Incentives**

*Seattle City Light, Preservations Green Lab, City of Seattle DPD, 2014*

[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2014%2Fdata%2Fpapers%2F6-496.pdf&ei=szwTVeTxI8bnoASW7IBg&usg=AFQjCNGtHTo42tn3a55dXe48-4nqmae9-Q&sig2=Q88QgPXywK6E0ZGrUeqBDw&bvm=bv.89217033,d.cGU](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2014%2Fdata%2Fpapers%2F6-496.pdf&ei=szwTVeTxI8bnoASW7IBg&usg=AFQjCNGtHTo42tn3a55dXe48-4nqmae9-Q&sig2=Q88QgPXywK)

Describes code compliance incentive calculation method based on building performance demonstrated during a post-occupancy monitoring period. The initial monitoring period was set for 12 months after the building reached 75% occupancy. Could be model for a below code incentive program.

* **Moving beyond ‘Better than Code’: New Market Transforming Zero Net Energy Aligned Residential New Construction Programs**

*TRC, the four CA IOUs, 2014*

[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2014%2Fdata%2Fpapers%2F2-1265.pdf&ei=Oz0TVebUN8broATGwYH4Bg&usg=AFQjCNEOxOP0\_rgizVvzjN8YDa2F9kOCTA&sig2=RU-qeca80f84BROPb49UvA&bvm=bv.89217033,d.cGU](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2014%2Fdata%2Fpapers%2F2-1265.pdf&ei=Oz0TVebUN8broATGwYH4Bg&usg=AFQjCNEOxOP0_rgizVvzjN8YDa2F9kOCTA&sig2=RU-qeca)

New construction program that uses metrics to determine how close energy use is to the floor (ZNE), not how far it is from the ceiling (codes). Could be another model for a below code incentive program.

**Compliance in Non-Permitted Buildings**

Like the cases of noncompliance described in the previous section, the savings opportunities in this section are assumed to be ‘outside the Title 24 law.’ Also like the opportunities in the previous section, these may present very real opportunities for cost-effective energy efficiency to benefit all Californians, However, much less is known about the actual savings potential from completely unpermitted projects. Collecting information about what isn’t being reported to authorities is always difficult and costly. The subcommittee attempted to understand this space and best practices for capturing savings within it as much as possible. The studies below suggest that upgrades that are ‘behind the wall’ have high rates of non-compliance.

* **Contractors Walk on the Wild Side: Why?**

*Kristin Heinemeier, UC Davis, 2013*

<http://wcec.ucdavis.edu/wp-content/uploads/2013/07/Kristin-Heinemeier-ACEEE-2012.pdf>

WHPA survey of over 250 HVAC contractors purports to explain why such few contractors pull permits. The survey found that the majority of contractors believe that there is a low probability of getting caught for not pulling permits and that the costs of getting caught for ‘behind the wall’ or smaller projects is not significant. Furthermore, contractors believe there is a high probability of losing bids if they choose to pull permits. These findings don’t necessarily contradict higher compliance levels found by impact evaluations, since those studies model compliance from a set of permitted buildings.

* **Draft Research Plan for HVAC Permit and Code Compliance Market Assessment**

*DNV GL, 2015*

[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0CCYQFjAB&url=http%3A%2F%2Fwww.performancealliance.org%2FLinkClick.aspx%3Ffileticket=MQTfw0z56y8=%26tabid=200%26portalid=4%26mid=2690&ei=DDkTVcuHI8XpoASZ6oKQBA&h](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0CCYQFjAB&url=http%3A%2F%2Fwww.performancealliance.org%2FLinkClick.aspx%3Ffileticket%3DMQTfw0z56y8%3D%26tabid%3D200%26portalid%3D4%26mid%3D2690&ei=DDkTVcuHI8XpoASZ6oKQBA&)

2014-2016 work will attempt to document permitting and compliance practices for residential HVAC replacements. According to the Background section, California’s Long-Term Strategic Plan set the goal of 50% permitting rate for all HVAC installations by 2015. This suggests discrepancies in assumptions on baseline permitting.

* **HVAC Permitting: A Study to Inform IOU HVAC Programs**

*DNV GL for PGE, 2014*

<http://www.calmac.org/startDownload.asp?Name=FINAL_REPORT_PGE_HVAC_Permitting_for_IOU_Programs_Study_v20141010ES.pdf&Size=258KB>

Preliminary permitting data pulled by PG&E’s Code Compliance program found 38% and 13% permitting rates for residential and commercial change-outs that did not participate in IOU programs.

* **SMUD Residential HVAC Program Evaluation**

*RLW Analytics and Benningfield Group for SMUD, 2008*

[http://www.performancealliance.org/Portals/4/Documents/Committees/EMV/SMUD - RLW Mar 08.pdf](http://www.performancealliance.org/Portals/4/Documents/Committees/EMV/SMUD%20-%20RLW%20Mar%2008.pdf)

Found that 96% of residential HVAC units in territory are below code efficiency. Survey shows that 30% of HVAC replacements (non-participants) are permitted, and 15% of the same set are duct-tested.

* **Navigant Baseline Study**

As a consequence of D.14-10-046 in the ongoing Rolling Portfolio rulemaking, CPUC Staff engaged Navigant to study the feasibility and consequences of using baselines other than code for utility programs. The scope of work for this project hasn’t been finalized yet, but the Commission hopes to have results in time to inform Phase Three of R.13-11-005 in 2016.

* **Center for Sustainable Energy HVAC Permit Compliance Study**

As part of its HVAC Permit Compliance Pilot, CSE conducted a survey or building department officials, contractors, and other actors to cull out current best practices in permitting. The report is currently in draft form.

**Existing Buildings**

**“Repair Indefinitely”**

Cal TF staff found a few studies that document the actual age of equipment, and which demonstrate, in practice, that some equipment is typically in use long after the “expected useful life” contained in DEER.

* **Amnesty for Ancient Boilers**

*Matthew Greco, City and County of San Francisco, 2012*

[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2012%2Fdata%2Fpapers%2F0193-000135.pdf&ei=sD0TVZS\_HsffoASd8IGADA&usg=AFQjCNHAO8GiS7XJOhQkYO8pX1krWh9WZw&sig2=06KjtxPidtCKzCRQg-ZlOA&bvm=bv.89217033,d.cGU](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2012%2Fdata%2Fpapers%2F0193-000135.pdf&ei=sD0TVZS_HsffoASd8IGADA&usg=AFQjCNHAO8GiS7XJOhQkYO8pX1krWh9WZw&sig2=06)

Describes City program that supplemented IOU incentives for boiler replacement in multifamily buildings. May have a good set of data, could be used to compare against boiler replacement with only IOU dollars. Audits performed found that many of the heating systems in existing multifamily buildings were installed right after the 1906 San Francisco earthquake.

* **Recycling, Waste Stream Management, and Material Composition of Major Home Appliances**

*AHAM, RW Beck, Weston, 2005*

Contains statistically significant estimates of EULs for appliances. Many of the sources cited are comparable to those found in DEER.

* **2011 Vermont Market Characterization and Assessment Study**

*Navigant for the Vermont Public Service Department, 2012*

* + Existing Buildings (C&I)

[http://publicservice.vermont.gov/sites/psd/files/Topics/Energy\_Efficiency/EVT\_Performance\_Eval/VT CI Existing Buildings Market Assessment and Characterization\_2012-10-6\_FINAL.pdf](http://publicservice.vermont.gov/sites/psd/files/Topics/Energy_Efficiency/EVT_Performance_Eval/VT%20CI%20Existing%20Buildings%20Market%20Assessment%20and%20Characterization_2012-10-6_FINAL.pdf)

Small sample and doesn’t explicitly look at code compliance, since codes do not apply to existing buildings. However, finds that average HVAC unit age is 24 years, 61% of small units are below code efficiencies, and an even greater percentage do not have economizer (as directed by code if and when retrofitted). The report doesn’t calculate remaining savings potential for this ‘below code’ equipment, but does detail the distribution of equipment in service by efficiencies and ages.

**Other Opportunities in Existing Buildings**

The resources in this section may be helpful as the subcommittee attempts to create a rule set for capturing “savings-to-code” in existing buildings that would not otherwise happen absent program activity.

* **Lessons from the Field for Scaling Up Deep Energy Retrofits**

*ACEEE, NYSERDA, 2014*

<http://aceee.org/files/proceedings/2014/data/papers/1-1095.pdf>

Technical paper on deep energy retrofits in residential spaces, but ends with a quantification of costs and challenges of undertaking deep retrofits. The challenges identify include the need to engage building orders at the precise right time of a planned building improvement process, the difficulty of marketing energy and non-energy benefits to customers, and overcoming high initial costs.

* **“Watts” Where, and Why? Using GIS to Identify Energy Efficiency Opportunities**

*DNV GL, National Grid, 2014*

[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2014%2Fdata%2Fpapers%2F11-354.pdf&ei=7jwTVcuqHIHcoATDnID4CA&usg=AFQjCNGmySFq0Ayoo1-A9dVOzyOsQy4c0g&sig2=\_8m7bxg\_HE9WVa-zXSn-DQ&bvm=bv.89217033,d.cGU](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2014%2Fdata%2Fpapers%2F11-354.pdf&ei=7jwTVcuqHIHcoATDnID4CA&usg=AFQjCNGmySFq0Ayoo1-A9dVOzyOsQy4c0g&sig2=_8m7bxg)

Explores potential of overlaying spatial and utility consumption data to understand savings opportunities. Could be an avenue for identifying and agreeing on pockets of stranded savings in existing buildings. Presents case study of how Massachusetts Program Administrators leveraged spatial aspects of their information to track program penetration, energy savings, and other trends.

* **Coast to Coast: Piloting Multifamily Retrofit Program Delivery Models from the New York Empire to the Golden State**

*Heschong Mahone Group, NYSERDA, 2012*

[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CCEQFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2012%2Fdata%2Fpapers%2F0193-000061.pdf&ei=ZT0TVZmzKte7ogTz5oJI&usg=AFQjCNF5qUOlogmsMhejOB6QGotMfDwBYQ&sig2=z4MqFHrKJxqVhE2-bMVJsg&bvm=bv.89217033,d.cGU](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CCEQFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2012%2Fdata%2Fpapers%2F0193-000061.pdf&ei=ZT0TVZmzKte7ogTz5oJI&usg=AFQjCNF5qUOlogmsMhejOB6QGotMfDwBYQ&sig2=z4Mq)

Mostly program design for deep retrofits, but includes description of tiered delivery strategies programs in California (Energy Upgrade California) and New York (Multifamily Performance Program). These tiered structures pay incentives at various different points (assessment, planning, installation, etc.).

* **Financial Incentives for Energy Efficiency Retrofits in Buildings**

*German Institute for Economic Research, Climate Policy Initiative, 2012*

[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CCQQFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2012%2Fdata%2Fpapers%2F0193-000422.pdf&ei=zz0TVeHyLcvfoASX4oCIBA&usg=AFQjCNHb6M3g7zofrkywLVkNuBpUFh7sUA&sig2=NVKJOIT3CI2NBO8qkGHzXw&bvm=bv.89217033,d.cGU](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CCQQFjAA&url=http%3A%2F%2Faceee.org%2Ffiles%2Fproceedings%2F2012%2Fdata%2Fpapers%2F0193-000422.pdf&ei=zz0TVeHyLcvfoASX4oCIBA&usg=AFQjCNHb6M3g7zofrkywLVkNuBpUFh7sUA&sig2=NV)

International comparison that finds ‘that progressive support of comprehensive retrofits compared to single measures appears to be important.”

* **CEC Draft Existing Buildings Action Plan**

<http://www.energy.ca.gov/ab758/>

In response to AB 758, the CEC published a Draft Existing Buildings Action Plan and will be hosting a series of workshops to solicit and incorporate stakeholder feedback. Strategy 1.5 deals with optimizing Title 24’s Building Efficiency Standards (BES) for existing buildings. Sub-strategy 1.5.2 involves reviewing the cost-effectiveness of BES requirements for existing buildings, including the possibility of code modifications when needed.

1. See DNV GL for PG&E (2014) AND SMUD (2008) in appendix. [↑](#footnote-ref-1)
2. Personal conversation with Jeremy Williams, DOE Building Energy Codes Program, April 21st, 2015 [↑](#footnote-ref-2)
3. D.14-10-046 at 54 [↑](#footnote-ref-3)