

RTR Appendix

Southern California Edison, Pacific Gas and Electric, Southern California Gas, and San Diego Gas and Electric (“Joint Utilities” or “Joint IOUs”) developed Responses to Recommendations (RTR) contained in the evaluation studies of the 2010-2012 Energy Efficiency Program Cycle. This Appendix contains the Responses to Recommendations in the report:

Baseline Characterization Market Effects Study of Investor-Owned Utility Residential and Small Commercial HVAC Quality Installation and Quality Improvement Programs in California (Work Order 054) (2015, NMR Group, Inc, Calmac ID# CPU0102.01)

The RTR reports demonstrate the Joint Utilities’ plans and activities to incorporate EM&V evaluation recommendations into programs to improve performance and operations, where applicable. The Joint IOUs’ approach is consistent with the 2013-2014 Energy Division-Investor Owned Utility Energy Efficiency Evaluation, Measurement and Verification (EM&V) Plan (version 3) ¹ and CPUC Decision (D.) [07-09-043](#) ².

Individual RTR reports consist of a spreadsheet for each evaluation study. Recommendations were copied verbatim from each evaluation’s “Recommendations” section. ³ In cases where reports do not contain a section for recommendations, the Joint IOUs attempted to identify recommendations contained within the evaluation. Responses to the recommendations were made on a statewide basis when possible, and when that was not appropriate (e.g., due to utility-specific recommendations), the Joint IOUs responded individually and clearly indicated the authorship of the response.

The Joint IOUs are proud of this opportunity to publicly demonstrate how programs are taking advantage of evaluation recommendations, while providing transparency to stakeholders on the “positive feedback loop” between program design, implementation, and evaluation. This feedback loop can also provide guidance to the evaluation community on the types and structure of recommendations that are most relevant and helpful to program managers. The Joint IOUs believe this feedback will help improve both programs and future evaluation reports.

¹ Page 336, “Within 60 days of public release of a final report, the program administrators will respond in writing to the final report findings and

recommendations indicating what action, if any, will be taken as a result of study findings. The IOU responses will be posted on the public document website.” The Plan is available at http://www.energydataweb.com/cpucFiles/pdaHomeDocs/2/2013-2014_Energy_Efficiency_EMV_Plan.zip (visited on 10/1/14).

² Attachment 7, p.4, “Within 60 days of public release, program administrators will respond in writing to the final report findings and recommendations indicating what action, if any, will be taken as a result of study findings as they relate to potential changes to the programs. Energy Division can choose to extend the 60 day limit if the administrator presents a compelling case that more time is needed and the delay will not cause any problems in the implementation schedule, and may shorten the time on a case-by-case basis if necessary to avoid delays in the schedule.”

³ Recommendations may have also made to the CPUC, the CEC, and evaluators. Responses to these recommendations will be made by Energy Division at a later time and posted separately.

EM&V Impact, Process, Market Assessment Study Recommendations

Study Title: Baseline Characterization Market Effects Study of Investor-Owned Utility Residential and Small Commercial HVAC Quality Installation and Quality Improvement Programs in California (CPU0102.01); Published August 28, 2014

Program: Residential and Small Commercial HVAC

Author: NMR Group, Inc.

Item #	Page	Findings	Best Practice / Recommendations	Recommendation Recipient	Disposition (Accepted, Rejected, or Other)	Disposition Notes (e.g. Description of Specific Program Change or Reason for Rejection or Under Further Review)
1	76-78,83	<p>QI awareness among customers is fairly low. Fewer than one-fifth of residential respondents (16%) and small commercial respondents (17%) had heard of the term quality installation. Even after it was described to them, about a quarter of all customers (25% residential; 28% small commercial) said they had heard of QI, and almost none of those customers could identify any QI guidelines or programs. When asked about the specific QI and rebate programs offered by their IOU, 10% to 21% of residential customers and 8% to 16% of small commercial customers said they had heard of particular IOU programs. Not surprisingly, contractors report the greatest barrier to QI is customers not wanting to pay for it (63% residential; 66% small commercial).</p> <p>As in the case of QI, the baseline for Quality Maintenance (QM) in California is also relatively low. A minority of contractors (45% residential; 34% small commercial) are aware of ACCA Standard 4 or ANSI/ASHRAE/ACCA Standard 180 and a small minority said they adhere to all of the appropriate specifications (10% of all residential contractors; 7% of all small commercial contractors). Thirty percent of residential contractors and 22% of small commercial contractors said they were currently participating or had ever participated in an IOU QM program. However, only 16% of residential contractors and 6% of small commercial contractors said they are currently participating in such a program. As in the case of QI, this self-reported participation rate is likely to be overstated by contractors responding to the survey since only a small percentage of maintenance contractors, ranging from 1% to 10%, depending on the IOU, have been trained and/or qualified by the IOUs. Program training, generally to the ANSI/ACCA Standard 4 (residential) or ANSI/ASHRAE/ACCA Standard 180-2008 (commercial), is a prerequisite for participation.</p>	<p>Focus on educating customers about the value of QI and QM. "Quality" is a generic term; many contractors will claim that they provide "quality" services. Customers need to be educated about the specifics (in lay terms) of QI and QM and the resulting energy savings. Customer education may also be targeted to those who are changing out HVAC systems, such as through major renovations, and to encourage the scheduling of regular maintenance visits.</p>	All IOUs	Accept	<p>The IOUs recognize that the market transformation aspects of HVAC QI/QM, are important but have not yet achieved traction. A strategy that shifts resources toward greater customer education and that ties HVAC QI/QM to energy and financial savings could drive demand for QI/QM programs and have broader market effects. NMR Group is correct to point out that contractors and technicians are also necessary targets for a market transformation approach. Leading into 2016 we will engage our Customer Insights team in an effort to identify branding and education strategies that will drive customer education and demand and will tie monetary savings through QI/QM to the programs. We are also interested in identifying and leveraging new data from the 2015 EMI studies on customer priorities, such as ensuring system reliability (commercial) and low cost services (residential) to drive the QI/QM programs. As noted to responses to recommendations already submitted for other reports, we are also willing to explore more effective nomenclature to differentiate the QI/QM services from standard maintenance. Finally, we will request and welcome consultation with the CPUC to explore a program strategy with more effective market transformation approaches.</p>

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2	78,83	<p>When asked about other certifications, more than one-half (55% residential; 56% small commercial) of maintenance contractors said their technicians were not certified by any organization. Note that about two-fifths (39%) of residential and three out of ten (30%) small commercial maintenance contractors hold NATE certifications, which are promoted by the IOU programs.</p>	<p>Collaborate with industry leaders to train contractors so that they have their NATE certifications in place. Industry leaders may also help promote IOU program qualification requiring more stringent ACCA/ASHRAE/ENERGY STAR standards to contractors and educate customers about the value of QI and QM program qualified contractors.</p>	All IOUs	Other	<p>CQM currently requires that in addition to program requirements for fully credentialed technicians (level 2) EPA 608, and 5 years in the field, a 'to credential' pathway for supporting technicians (level 1) is also required. Level 1 technicians must hold an EPA 608 card and commit to a "to credential" track such as IHAC NATE series, (NATE/HVAC Excellence), CTE program (trade/college), or Apprenticeship program. SCE funds the majority of these WE&T scaffolds. The CQM program tracks the progress of these technicians from level 1 to level 2. The 5 years experience requirement for full transition to level 2 is a factor to keep in mind when considering the delay to full status. NATE issued a supporting article on SCE's program requirements and communications were sent out to ARCA/MCA contractors also in support of these efforts.</p> <p>The residential QM and QI programs have specific training to ensure that the technicians are competent to do the work according to the program standards. However, the program is not aware of any industry certification that focuses on ACCA 4 and ACCA 5 standards that would fully prepare them to successfully participate. Program staff have found that paper-based technician certification is inadequate to ensure technicians will perform well in the field. New research from EMI also indicates that technicians rate in field training by far the most important and effective element of their overall training and we note that the technicians require field training and certification as well. The Residential HVAC programs offer free training that can prepare the technicians for BPI and NATE certification, and gives them continuing education credit to apply to BPI and NATE. Until an industry certification is available that fully covers everything in ACCA 4 / ACCA 5, both theory and hands-on application in the field, the current certifications are not sufficient to fulfill technician qualification.</p> <p>Finally, we agree that the lack of certification and standard practices in the field is a major issue. We note that our program bandwidth is narrow relative to the broader market with only on the order of 5% of contractors and technicians participating. Furthermore, many contractors and technicians are unlicensed, potentially well over 50%, which creates significant challenges to recruitment and participation and puts pressure on participating contractors to do lower cost, lower quality work in order to maintain market share. For these reasons, we again note that a strategy with more market transformation elements coupled with resource QI/QM programs may provide the best opportunity to drive savings in the long term.</p> <p>The CQM program requires NATE certification or other similar credentials or education pathways. In the redesign of our HVAC maintenance programs, a separate RFP will be issued for Inspections and Training in attempt to increase the skill level and the acceptance of ACC 180 standards.</p>
3	76,83	<p>An important barrier to QI (which also applies to QM) is the presence of unlicensed HVAC contractors. According to the California Contractors State License Board (CLSB), there are between 12,000 and 16,000 contractors who have C-20 licenses. However, the CLSB estimates that there may be as many as 60,000 unlicensed contractors operating in California. The presence of such high volumes of unlicensed contractors who do not pull the necessary building permits for HVAC installations or who perform shoddy, low-cost maintenance jobs places cost pressures on all contractors and likely undercuts adherence to QI and QM.</p>	<p>Step up efforts to have contractors participate in the IOU training programs. Agreeing on a common definition across IOUs of what by program qualification requirements entail is a first step. Without this, it will be difficult to sell the value of "program qualified contractors" to consumers.</p>	All IOUs	Accept	<p>All CQM contractors must complete ACCA 180 technician training as well as sales training prior to full acceptance into the program.</p> <p>As long as QM and QI are resource programs, budget will be limited by deemed savings and scalers such as GSIA (Installation Rate). Note that most licensed C-20 contractors do not pull permits for replacement units, nor do they need to if equipment incentives are primarily paid to their distributors. From multiple interviews with contractors about QI adoption, we know that the contractor only pulls permits if required by the customer or the general contractor. Customer education is necessary to drive permitting and the recognized value of program qualified contractors.</p> <p>In the residential programs, contractors must meet program requirements and technicians must complete program training to be accepted into the program. The program will work with the Statewide IOU group to further discuss the requirements for contractors (companies) and their technicians to participate in these programs.</p>

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Program: **Residential and Small Commercial HVAC**

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4	76,83	<p>An important barrier to QI (which also applies to QM) is the presence of unlicensed HVAC contractors. According to the California Contractors State License Board (CLSB), there are between 12,000 and 16,000 contractors who have C-20 licenses. However, the CLSB estimates that there may be as many as 60,000 unlicensed contractors operating in California. The presence of such high volumes of unlicensed contractors who do not pull the necessary building permits for HVAC installations or who perform shoddy, low-cost maintenance jobs places cost pressures on all contractors and likely undercuts adherence to QI and QM.</p>	<p>The IOUs may also offer to qualify contracting companies once all of their technicians have completed training. To maintain their program qualification, companies could be required to have all new employees complete training during the first six months on the job.</p>	All IOUs	Other	<p>Presently, all CQM contractors must complete ACCA 180 technician training as well as sales training prior to full acceptance into the program. These contractors are then listed on the CQM website as qualified CQM contractors.</p> <p>We note that different technicians perform different jobs so it is not feasible to require training for all employees. All qualifying work in the CQM programs must be compliant. Technicians performing program work must complete all qualifying training for advanced measures must be completed and approved prior to performing the work (e.g.. ADEC DCV).</p> <p>Branding QI/QM programs through the IOUs could support customer recognition, establish trust and facilitate promotions. However, with limited funding, taking over the roll of qualifying contractors may be outside the bandwidth of our capabilities.</p>
5	75,83-84	<p>Market shares of energy-efficient HVAC equipment sold to residential and small commercial customers in 2011 and 2012 in California were significant especially for single-phase air cooled systems which was the dominant HVAC type. Overall nearly one-half (46%) of the units sold were single-phase air cooled and four out of every ten of these (40%) met Tier 1 or better efficiency standards. The next largest market share (23%) was for air cooled three-phase packaged and split equipment; more than one-half of these units (56%) met Tier 1 or better efficiency standards. Just over eight out of ten (81%) of the remaining unit types met Tier 1 or better efficiency standards.</p> <p>The California Energy Efficiency Strategic Plan calls for 15% of HVAC equipment shipments optimized for California's climate by 2015 and 70% by 2020. The market transformation indicator of progress toward this goal is annual sales of climate-appropriate air conditioning. Using Tier 1 or better as a proxy for indicating climate appropriate AC, this study estimates that overall 57% of HVAC units sold to residential and small commercial customers in 2011 and 2012 met the criterion. Thus, based on a Tier 1 standard, the current estimate of sales exceeds the goal set by the California Energy Efficiency Strategic Plan for 2015 and approaches the more ambitious goal for 2020. Only 13.5% of HVAC units sold in 2011 and 2012 would meet a higher climate-appropriate standard of Tier 2 or better.</p>	<p>Seek to increase the market share of more efficient systems by educating customers about the energy savings and other benefits associated with more efficient HVAC systems and the rebates available. Again, customer education should be targeted at those changing out their HVAC systems as well as those building or buying new homes; as with the first recommendation above, effective strategies and messages should be explored with customer focus groups or surveys prior to launch.</p>	All IOUs	Other	<p>The IOUs employ various incentive structures to promote the sale of new energy efficient units. For example, the IOUs are running a Residential HVAC upstream program to incentivize the distributors to stock higher efficiency equipment in order to upsell to the contractors. The IOU upstream programs encourage customers to purchase higher efficiency systems through a higher incentive structure based on equipment efficiency.</p> <p>We agree that energy efficiency starts at the sale of new units and are encouraged by these findings. We plan to continue our incentive programs to promote rapid uptake of climate appropriate and/or Tier 1 or better systems. The point of sale can also be an effective moment to engage and educate customers as well as drive program participation. We are interested in tying the purchase of a new energy efficient unit to QI/QM maintenance plans.</p>

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6	84		<p>Specific recommendations from the field assessments include the following:</p> <ul style="list-style-type: none"> - Require installers to use digital scales to weigh in refrigerant charge and report charge amounts. - Continue to promote the use of software to perform system sizing calculations to reduce oversizing. - Research approaches to measure refrigerant charge and develop diagnostics that are more reliable for maintenance. - Perform duct sealing as the primary residential maintenance measure. - Research approaches to repair or replace commercial economizers, reduce rooftop unit leakage (unit and economizers), and optimize fan efficiency. 	All IOUs	Reject	<p>Evacuation and weigh-in may be reasonable for QI, but many manufacturers are resistant to invasive procedures on new units. In addition to warranty concerns, this procedure will be unnecessary for most packaged units pre-charged at the factory. For QM, the weigh-in method poses implementation issues and increased risk of refrigerant leakage or release, contamination and/or the introduction of non-condensibles to the system.</p> <p>Many of these recommendations are controversial and should be further researched and/or vetted by industry stakeholders including manufacturers, professional associations and the WHPA.</p> <p>Further research is also needed to quantify deemed savings for these new measures. Current allowable savings for airflow improvements are very small (CQM Workpaper Disposition May 2013) and do not support significant incentives for airflow adjustment via fan maintenance, sealing or other measures.</p> <p>Proper superheat and sub cooling procedures should be used to evaluate charge. When duct sealing is performed airflow measurement and verification is necessary as duct sealing will increase the static pressure of the system and potentially change airflow rates. Duct sealing or replacement should be viewed as a repair measure, but should be promoted in conjunction with QI and QM of AC systems.</p> <p>We accept that the use of software to ensure proper system sizing is important and note that software training is part of standard program practice.</p> <p>We have started to look at digital diagnostic equipment, such as the iManifold to promote in our programs. These tools provide standardized diagnostics, instant data capturing, (which could ensure accurate savings claims and streamline evaluations) and troubleshooting procedures. We welcome potential lab testing to investigate equipment functionality and accuracy as well as to identify the best among competing products. We welcome consultation with the ED to develop these ideas and determine if these tools offer more reliable troubleshooting and diagnostics.</p>
7	79,84	The study developed a proposed market share tracking system that would recruit distributors to provide quarterly data. The proposed system was modeled largely along the lines of the Energy Center of Wisconsin's (ECW) successful Furnace and Air Conditioning Tracking System (FACTS). Our proposed approach would provide systematic process for periodic reporting of market share by efficiency level and sales.	Implement a market share tracking system based on the model developed by this study so that a systematic process for periodic reporting of market shares by efficiency level and sales is in place going forward.	All IOUs	Other	We agree with this recommendation and encourage the CPUC to adopt standardized market share tracking approach to establish accurate baselines, track important market data, and inform programs and EM&V studies. We note that distributors have been reluctant to share sales data due to terms and conditions of AHRI membership.
8	81-82,84	<p>Table 6-3 provides Market Transformation Indicator Baseline Values and Suggested Tracking to Assess HVAC Subprograms Progress</p> <p>Table 6-4 provides Baseline Values and Suggested Tracking of Secondary Indicators assessing HVAC Subprograms Progress</p>	Periodically assess the market transformation indicators and secondary indicators suggested by this study through contractor and customer interviews and on-site assessments of HVAC installations and maintenance, as suggested in Table 6 3 and Table 6 4.	All IOUs	Other	We agree with this recommendation. WO_054 clearly shows that by most measures, the HVAC QI/QM market is in its infancy. To inform successful programs, especially market transformation efforts, it will be essential to track both primary and secondary metrics at regular intervals. We encourage the CPUC to continue these characterizations and offer our support where possible.

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9	82,84	Table 6-4 provides Baseline Values and Suggested Tracking of Secondary Indicators assessing HVAC Subprograms Progress	Create more secondary indicators that can be measured through field assessments. Examples are increasing the number of systems properly sized within one-half ton of design load, increasing fan airflow (CFM per ton) and efficiency (Watts per CFM), and reducing duct leakage to the outside in existing ducts and number of new ducts in conditioned space. These indicators could be assessed through on-site assessments every four years.	All IOUs	Other	We agree with this recommendation and would welcome a collaborative effort with the CPUC to adopt a variety of relevant market transformation indicators. We draw attention to the Contractor and Technician Behavior Phase II study by EMI that includes assessment of the feasibility of measuring and using certain market indicators. We welcome the opportunity to work with the CPUC to develop additional secondary indicators and to adjust current indicators to make them the most effective and most easily tracked. Both the primary and secondary indicators should be agreed upon by industry professionals and program staff to direct efforts towards items that can be used to assess savings The program can work with the WHPA and Statewide IOU team to determine what additional field metrics would be appropriate to track in the program.
10	ES-2,84	A survey of 245 residential and small commercial contractors from the California HVAC Contractor & Technician Behavior Study, conducted by Energy Market Innovations for Southern California Edison and Pacific Gas & Electric. The study also included field observation of 16 technicians on service or maintenance visits for a residential system with intentionally-implemented faults.	The on-site observations of maintenance work on a system with intentionally implemented faults provided invaluable information about the state of maintenance services available to most customers and should be repeated regularly.	All IOUs	Other	We tend to agree with this recommendation but would like more examples of the 'invaluable information' these technician tests uncovered. Efforts may be better directed by training contractors, instead of determining if non-QM contractors are doing a good or bad job.

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11	76-77,84	<p>QI awareness among customers is fairly low. Fewer than one-fifth of residential respondents (16%) and small commercial respondents (17%) had heard of the term quality installation. Even after it was described to them, about a quarter of all customers (25% residential; 28% small commercial) said they had heard of QI, and almost none of those customers could identify any QI guidelines or programs. When asked about the specific QI and rebate programs offered by their IOU, 10% to 21% of residential customers and 8% to 16% of small commercial customers said they had heard of particular IOU programs. Not surprisingly, contractors report the greatest barrier to QI is customers not wanting to pay for it (63% residential; 66% small commercial).</p> <p>QM awareness among customers is also fairly low. Just over one-fifth of residential respondents (21%) and small commercial respondents (22%) had heard of the term quality maintenance. Even after it was described to them, fewer than one-half of all customers (40% residential; 36% small commercial) said they had heard of QM, and almost none of those customers could identify any QM guidelines or programs. When asked about specific QM programs, 10% to 21% of residential customers and 13% to 16% of small commercial customers said they had heard of the particular programs offered by their IOU (PG&E and SDG&E programs include both QI and QM). As in the case of QI, contractors reported that the greatest barrier to QM is customers not wanting to pay for it (52% residential; 64% small commercial).</p>	Further focus group research may be required to assess the extent to which customers (and contractors) are able to differentiate "Quality Installation" and "Quality Maintenance" from the generic term "quality" to which all contractors would lay claim. This research could explore alternative terms and messaging, to determine those to which customers are more responsive.	All IOUs	Other	<p>The IOUs are open to potentially rebranding programs to emphasize the difference between our program offerings and standard practice. Focus groups may be one effective way to gauge the benefit of other possibilities. We also note that more effective branding could hold contractors and technicians to a higher standard if they perceive a difference between improved service demanded by the programs compared to standard service they may already consider 'quality.'</p> <p>PG&E's redesign of the Commercial HVAC maintenance programs will include rebranding in order to encompass the different programs within. The SCE CQM program has been branded as HVAC Optimization and has only been highlighting the term quality maintenance since 2014.</p>
12	ES-5,85	When asked about other certifications, more than one-half (53% residential; 59% small commercial) of installation contractors said their technicians were not certified by any organization. Note that only two-fifths (40%) of residential and just over one-fourth (27%) of small commercial installation contractors hold NATE certifications, which are promoted by the IOU programs.	Continue to study differences in the performance of installed or maintained HVAC units between HVAC contractors who participate in IOU programs and/or are NATE certified, and HVAC contractors who do not participate in IOU programs and/or are not NATE certified.	All IOUs	Other	We generally agree with this recommendation. However, agreeing upon the metrics by which service work should be gauged will be essential. Reliability (EUL) of measures and units is arguably just as important and is more directly related to the goals of maintenance (vs. tune-up, retrocommissioning, retrofits).
13	ES-5,85	An important barrier to QI (which also applies to QM) is the presence of unlicensed HVAC contractors. According to the California Contractors State License Board (CSLB), there are between 12,000 and 16,000 contractors who have C-20 licenses. However, internal the CSLB estimates that there may be as many as 60,000 unlicensed contractors operating in California. The presence of such high volumes of unlicensed contractors who do not pull the necessary building permits for HVAC installations or who perform shoddy, low-cost maintenance jobs places cost pressures on all contractors and likely undercuts adherence to QI and QM.	Further focus group research may be required to assess the extent to which customers (and contractors) are able to differentiate "Quality Installation" and "Quality Maintenance" from the generic term "quality" to which all contractors would lay claim.	All IOUs	Other	We agree with this recommendation and are willing to collaborate. Efforts are under way to determine the best method to track and assess this data.