**DISPOSITION FOR Residential Smart Thermostat Workpapers**

**California Public Utilities Commission, Energy Division**

November 8th, 2016

# Review Scope

This disposition updates the July 2016 disposition for Residential Smart Thermostats (Appendix B).[[1]](#footnote-1) **Requirements within this disposition shall extend to all program administrators (PA) who adopt deemed residential smart thermostat measures.**

Also, with regard to SoCalGas’s Residential Smart Thermostat workpaper ID WPSCGREHC160624A revision 2, all proposed cost effectiveness values are passed through without review. Subject to the eligibility requirements noted below, the SoCalGas workpaper is approved through June 30th, 2017.

This disposition includes five sections:

1. SoCalGas’s Additional Eligibility Requirements: effective starting 1/1/2017
2. General Eligibility Requirements
3. Sales Data Submission Requirements
4. Effective Useful Life
5. Future Work

## SoCalGas’s Additional Eligibility Requirements

SoCalGas’s program eligibility requirements have been clarified since the original June 2016 submittal (revision 0). The ex ante review (EAR) team finds that the program requirements for customer eligibility remain insufficient. For SoCalGas to claim savings for this program**,** they mustrevise their rebate program, no later than January 2017, to confirm the following items for every customer application:

1. Prior to paying a natural gas rebate, SoCalGas shall confirm that the thermostat is installed and controlling a natural gas space heating furnace in the home of the SoCalGas customer account for which the application is submitted.
2. Prior to paying an incentive, SoCalGas shall confirm that the customer has a NEWLY PURCHASED, not just newly registered, thermostat. At minimum, SoCalGas shall obtain a copy of the thermostat sales receipt and SoCalGas shall confirm the purchase date is on or after the date that SoCalGas incentives were first made available. At this time, CPUC staff believes that SoCalGas first started offering the incentives on July 6, 2016; SoCalGas shall confirm or correct this date of initial offering.

For incentives paid prior to the date that revised eligibility requirements take effect, SoCalGas shall adjust claimed savings as follows:

1. For Gas-only measures in SoCalGas territory: use RASS data to assume 89% of homes have gas heat. The remaining 11% of sales may not be claimed as RASS indicates that they are installed in homes that do not have primary natural gas heating.
2. Claims may only be made for thermostats purchased after the program launch date noted above. This program must be limited to homeowners who are replacing a thermostat as part of the rebate program. Customers who have already installed a qualifying thermostat are not eligible for this rebate. In other words, homeowners who registered previously purchased or installed thermostats and received a SoCalGas rebate were already receiving the energy efficiency benefits; therefore, any incentives paid by SoCalGas for these existing thermostats did not lead to any new energy savings. These units may not be claimed.
3. SoCalGas shall adjust 2016 claims as follows:

* If 2016 Q3 claims have already been submitted, adjust 2016 Q3 claims within the 2016 annual report to reflect the above requirements. Otherwise adjust 2016 Q3 claims prior to submitting them.
* Adjust 2016 Q4 claims prior to submitting them.
* Submit a narrative to the workpaper project archive within the Residential Smart Thermostat project folder[[2]](#footnote-2) by March 31, 2017 explaining how Q3 and Q4 claims have been adjusted to meet the above requirements.

### Discussion

Commission staff and consultants have engaged in numerous phone calls and meetings regarding this topic. Also, we have conducted research on how this program is represented to the public within SoCalGas’s territory and other service territories. We have attempted to sign up for the rebate on the thermostat manufacturer’s website in order to understand what information is provided to customers regarding incentive eligibility. We find that the rigor applied to determine eligibility is lacking. We find that the third party provider is being allowed to promise an incentive without determining if the thermostat registration is associated with natural gas space heating or whether it is a new purchase. Both of these elements are required for SoCalGas to claim savings in 2017.

## General Eligibility Requirements

Energy Division expects that other PAs will choose to pursue deemed measures for this technology[[3]](#footnote-3). Pursuant to the July 2016 disposition and this document, all deemed Residential Smart Thermostat shall meet the intent of the following eligibility requirements:

1. Every PA shall employ QA/QC procedures to ensure that the thermostat is installed in an eligible home and is attached to the type of HVAC equipment that is being incentivized, whether it is for natural gas or electricity savings.
2. Every PA shall confirm that the customer has a NEWLY PURCHASED smart thermostat. At minimum, the PA shall obtain a copy of the thermostat sales receipt and the PA shall confirm the purchase date is on or after the program’s start date.
3. Customer eligibility shall be determined by each PA prior to paying rebates. Upon request, all data associated with determining eligibility shall be provided to Energy Division. PAs shall extend this requirement to any third party vendors in who assist PAs with determining customer eligibility. To the extent that they are used to determine eligibility, data regarding dates of purchase, location of home, customer HVAC equipment type, pre-installation HVAC energy use, and etcetera shall be made available.

## Sales Data Requirements to Inform Program Lift and Net-Savings Analysis

At this time, CPUC staff approves the use of the DEER default NTG value of 0.55 for this program. However, the actual NTG must be determined based on the “lift” in total sales, and subsequent installation and registration that can be attributed to the incentives of the program. An increase in rebate applications above the historical average for the SCE demand response program, for example, is not an indication of lift. SoCalGas notes that they have received thousands of rebate applications since the incentive offer began. However, a similar total sales trend occurring after the SoCalGas incentives were offered compared to the total sales trend prior to the offering would indicate that most, and perhaps nearly all, of those rebate applicants are free riders. Free ridership includes home owners who would have bought the thermostat without the incentive, homeowners who had previously purchased the thermostat and had not registered it with the DR program, etc.

Program administrators are required to submit manufacturer sales data, collaborate with Energy Division’s EAR team, and revise residential smart thermostat workpapers to reflect a program specific net-to-gross value informed by the total sales trend data. To avoid a gap in the program, the EAR team suggests that the sales data be provided by March 31st, 2017 and that revised work papers be submitted by May 15th, 2017 in order to be effective by July 1st. If a new work paper is submitted that will replace the SoCalGas work paper, vendor total sales data shall be submitted with the new work paper, not delayed until March 31st.

SoCalGas and other adopting PAs shall submit thermostat manufacturer’s sales data for 2014, 2015, and 2016 to the Workpaper Archive under the Smart Thermostat project folder. PAs shall collaborate with the ex ante review team to analyze and document how the SoCalGas/SCE thermostat rebate has affected sales of new smart thermostats. Submit the following information:

1. Total units sold in California per month (36 months)
2. For each PA adopting smart thermostat measures, provide the following additional level of detail:
   1. Sold via retailers: number of units sold by retailers in PA’s service territory, per month
   2. Sold via manufacturer’s website: Zip code that unit was shipped to within PA’s service territory, per month
3. Customer data
   1. Number of California homes that contain a thermostat registered with the manufacturer
   2. Number of California homes that contain more than 1 thermostat registered with the manufacturer
   3. The number of homes within the each adopting PA’s service territory for (a) and (b), above.

## Effective Useful Life

The energy savings associated with smart thermostats is less tangible than the Effective Useful Life (EUL) of 11 years for a “programmable thermostat”. Programmable thermostats include electronic components as well as nascent logic algorithms such as “optimum start”. Smart thermostats are the next generation of programmable thermostat; they depend on their software for energy savings. Much more than programmable thermostats, smart thermostats are both hardware and software. The savings which are considered in this disposition are based entirely on software that must be activated and accepted by the residents. Smart thermostats also depend upon continued wireless internet (wifi) connection for updates to fix problems and/or adjust software. Additionally, this new generation of thermostats seeks to be user friendly. One key feature of these thermostats is the ability for users to quickly and easily change how the software works, including enabling and disabling the energy efficiency algorithms. **Therefore, we consider the smart thermostat technology to be an Operational Measure**.

No data has been provided by the PAs or other interested parties regarding the persistence of smart thermostat energy savings algorithms. Instead, the existing EUL of 11 years for a programmable thermostat is assumed. The EAR team finds that there is not enough evidence to accept the notion that the smart thermostat’s software algorithms and user settings will both persist in “energy efficiency mode” for 11 years.

The 2016 commission decision directed that the EUL of non-residential operational measures to be established as 3 years[[4]](#footnote-4). For a number of reasons, commercial operational measures would be expected to be more stable than residential measures, especially residential measures that are explicitly designed to be easily changed. While that decision excludes the residential sector, the EAR team finds that 3 years is a more reasonable assumption than 11. Therefore, the EUL of residential smart thermostats shall change to 3 years starting July 1st, 2017. Additionally, any new residential smart thermostat workpaper submitted prior to July 2017 shall assume a 3 year EUL for an Operational Measure.

Energy Division encourages PAs to gather data and present an analysis which demonstrates the persistence of energy savings mode within installed residential smart thermostats.

## V. Future Work

Detailed collaboration occurred in the spring and summer of 2016 between various PAs, the energy division’s EAR team, and other interested parties. Partial notes from those discussions are provided in Appendix A and some references for recommended future work are provided in Appendix B. For the most part, the technical concerns regarding research methods, energy savings calculation strategies, and market adoption / standard practice are not address in SoCalGas’s workpaper and, to date, the concerns have not been addressed by other PAs. Therefore, it remains unclear whether any mass market, deemed energy savings may be attributed to residential smart thermostats.

Further work to determine energy savings and calculate cost effectiveness for a deemed Residential Smart Thermostat program shall consider and follow the guidance and direction indicated in Appendices A and B. SoCalGas’s pilot study and the subsequent data analysis have undergone extensive review and comment by the Energy Division’s ex ante review team. The intent and direction of EAR team comments shall be incorporated into future residential smart thermostat workpaper submissions. In particular, the EAR team is concerned that analysts are ignoring smart thermostat installations which show increases in energy use compared with preexisting conditions. **Therefore, any studies, calculation methodologies, etc. which fail to consider the large spread in energy savings (both increases and decreases) associated with smart thermostat installations may not be used to determine deemed energy savings**. Studies and calculations methodologies must include the entire range of thermostat installations.

Note that the Appendices include data and analysis requirements that are specific to the methods employed by SoCalGas in the development of their workpaper. To be considered a complete submission, future workpapers shall directly respond to each of the concerns listed within the Appendices**.** Where a PA’s particular methods differ from SoCalGas’s, workpaper authors should consider how requirements in the Appendices apply to the methods employed for their workpaper. For example, any study that involves a pre-post or match pair analysis should attempt to identify any significant changes in occupant usage or behavior that may cause energy use to increase or decrease irrespective of the thermostat type.

# Appendix A. Notes from Smart Thermostat Discussion

The notes below were submitted with the workpaper and illustrate the reasons why the ex ante review (EAR) team did not accept the unit energy savings values that were proposed in SoCalGas’s June 2016 submission (revision 0). These notes illustrate the type of technical concerns regarding both the data used to calculate energy savings and the calculation methodologies. This data was requested by the ex ante review team prior to the submission of the workpaper. Although some of these items were provided and explained within the submission, not enough data was presented to give confidence that the results are reliable. All text below is taken directly from a file embedded within workpaper revision 0.

## EAR TEAM / SoCalGas Meeting Notes from May 25th, 2016

Ex-Ante Review Team requests the submission of following information/data in tables:

Account level data (additions to existing site list tab or new tab)

* Add all accounts to data tab – control and treatment group. Supply addresses for each account (# street and unit # if applicable, city, zip). Add column that indicates control or treatment group member for each site;
* An indication of “matching” between control and treatment group site (perhaps a unique number assigned to the control and treatment members determined to be “matched” or some other kind of indication;
* Add gas use (monthly data) of each site/account for pre & post periods – for treatment site indicate date of installation (best if there are fixed columns for the full range of months of entire data sample, say 24 or 36 columns);
* Any analysis done on individual site savings (perhaps none was done, so this is not available);
* Add columns for any demographic data for each site (home size sqft, # stories, # occupants, # children, # working adults, # elderly, pool/spa, etc) including the information referenced below in the survey section (no need to duplication, us complete set in one or the other data set)

Pilot Study Surveys

* Participants survey- complete
* Non-Participants survey - to be conducted
* Provide results of completed participants survey (for each site, identify the site so it can be interconnected with the site information listed above)
* Provide questions for non-participants survey
* Provide all available demographic info on survey participants
* Provide EE program participation data for participants (if they participated in any other EE programs, if so what measures and dates)

Weather adjustment (include examples)

* Calculation (show how HDD calculation was performed - example calculation showing DD base and formulae via spreadsheet or other clear method)
* For each location in the control and treatment groups, include the calculated HDD for the associated weather station (we believe this has already been provided, but please confirm) along with reference HDD value used to perform the adjustment. Include the final adjusted gas energy use for each sit in control and treatment groups.
* Weather stations used for each site for pre/post period analysis before HDD adjustment – . Identify if it is a NOAA or CIMIS station. Provide the explicit weather station ID. For NOAA stations the explicit ID will be either: a World Meteorological Organization (WMO) index number, a four letter International Civil Aviation Organization (ICAO) indicator, or a three letter U.S Federal Aviation Administration (FAA) indicator. For NOAA stations, specify if it is a WMO, ICAO or FAA station and include the appropriate indicator. For CIMIS stations, include the station ID number.provide the entire surface observation data set collected for each weather station. It is important to provide the entire data set with all data points, even if some data points were not used in the weather adjustment analysis.
* TMY data used in analysis (DEER weather data – this is the CEC 2013 weather data correct?)

Ex-Ante Review Team requests the inclusion of following information in the pilot study report:

Explain how well the sample represents the population

Add in distribution of sample by climate zone

Summarize opt-in/opt-out/non-eligibility for the pilot study and include sample rejected sites count by reason during the recruiting process

Household info, post-treatment info - describe in report

* What other major changes took place during the post period in the control or treatment groups – remodels, new or replaced appliances (kitchen, laundry, entertainment, computers, lighting – CFLs or LEDs or other changes, pool/spa, etc.)

Sample details

* Describe the analysis done to develop requirements sample size (there was some modeling done – show the models and the results)
* Show the range of variability in the sample
* Describe the details of the matching - parameters (monthly gas consumption) and the results (show the matched sites)

Discuss the issue of non-space-heating component of gas use and how it impacts the results

* Why was the analysis done on full gas use rather than an estimate of thermostatically controlled use? What are the likely effects of including non-thermostat controlled use and support this with data and analysis

# Appendix B. July 2016 Residential Smart Thermostat Disposition



1. SCG submitted workpaper ID# WPSCGREHC160624A revision 2, Residential Smart Thermostat, on October 21st, 2016. This submission proposes natural gas savings and is part of a large, multi-prong effort to understand the overall energy savings potential of this technology. [↑](#footnote-ref-1)
2. The Residential Smart Thermostat project folder is located here: WPA/2013-2014 Cycle/Multi-Entity/Statewide Project Files/Residential/Smart Thermostat [↑](#footnote-ref-2)
3. It is unclear whether SCE plans to claims energy savings for the rebates they paid in Q3 and Q4 of 2016. Since no measures have been submitted for electricity savings, it appears that no savings may be claimed. [↑](#footnote-ref-3)
4. D.1608018, Section 3.11 at page 44 states, “we will still err on the conservative side and allow a two-year life for behavioral programs in non-residential settings, and a three-year life for retrocommissioning and operational programs.” [↑](#footnote-ref-4)