Recommendation #1: Utilities should sum the heating and cooling savings values together prior to weighting rather than only weighting the cooling savings and adding the heating savings after the fact.

Key Finding #2: The PY2021 TRM 8.0 includes an *envelope* measure allowance for customers participating in HTR or LI programs to claim reduced heating savings for homes cooled by one or more space heaters. This allowance is made by applying an adjustment to deemed savings specified for homes with electric resistance heat. The EM&V team found that, in some cases, this adjustment factor was not applied consistently.

Recommendation #2: Update the PY2023 TRM 10.0 to incorporate guidance to clarify how to apply the adjustment factors.

Key Finding #3: Although there is no full-load efficiency (EER) requirement specified in the current federal standard for air conditioners and heat pumps, the intent of the programs is only to incentivize high-efficiency equipment. Therefore a minimum EER of 12 is set forth in the TRM based on the Consortium for Energy Efficiency minimum requirements. However, the programs may allow systems that comply with *Seasonal Energy Efficiency Ratio* (SEER) and *Heating Seasonal Performance Factor* (HSPF) requirements but do not comply with the *Energy Efficiency Ratio* (EER) requirements to claim heating and cooling energy savings and winter demand savings but not summer demand. The EM&V team found that, in some cases, summer demand savings were claimed for air conditioners where the EER fell below 12.

Recommendation #3: Demand savings should not be claimed for air conditioner systems where the EER is less than the minimum standard EER. Additionally, only winter demand savings should be claimed for heat pump systems where the EER is less than the minimum standard EER[18].

Key Finding #4: The Department of Energy (DOE) has implemented the Energy Independence and Security Act (EISA) 2020 backstop requiring general service lamps (GSL) to meet 45 lumens-per-wattage efficacy, making incandescent and halogen lamps non-compliant for manufacturing and retail sales. Enforcement of the standard at the retail level will begin on January 1, 2023. However, the EM&V team understands there are a substantial number of halogen and incandescent lamps currently operating in LI and HTR homes.

Recommendation #4: Update the PY2023 TRM 10.0 to allow for early retirement of incandescent and halogen lamps baseline, at the utility's discretion, for LI and HTR programs with direct-install-LED-delivery, given documentation requirements are met.

4.2.2 Low-Income Verification Process Assessment

Starting in 2020, the EM&V team, PUCT staff, and utilities began collaborating to improve the verification process for the LI programs. This work culminated as part of the PY2021 EM&V effort to start implementation in PY2022. It was agreed that the objective of the process assessment was to "*Revise low-income/hard-to-reach eligibility verification to increase the confidence program services are going to intended customers, improve program outreach, address participation barriers, and develop efficient administration processes.*" This objective was presented at the March 2021 EEIP meeting, and resulting TRM changes were presented at the October 2021 EEIP meeting. This section summarizes the process assessment

[18] A new federal standard for air conditioners and heat pumps will take effect January 1, 2023 and the PY2023 TRM 10.0 will be updated with the new minimum standard EER.

recommendations, which utilities began implementing in PY2022. The PY2022 EM&V effort will provide feedback on lessons learned from the first year.

4.2.2.1 Background

Texas utilities provide energy efficiency services to LI customers through a combination of HTR and LI programs as specified in 16 Tex. Admin. Code (TAC) § 25.181, relating to the energy efficiency goal. All regulated Texas electric utilities are required to achieve no less than five percent of their total demand reduction goal through programs serving HTR customers (16 TAC § 25.181(e)(3)(F)). In addition, the Electric Reliability Council of Texas (ERCOT) utilities are required to spend no less than 10 percent of each program year's energy efficiency budget on a targeted low-income efficiency program (16 TAC § 25.181(r)). The qualifying income level of 200 percent of the federal poverty level is the same for HTR and LI programs though the programs are implemented differently.

The utilities use program-eligibility certification forms maintained by the PUCT on their website. The forms differ for single-family and multifamily, but both include a way to qualify for the programs through other LI programs and services (Category 1) as well as through self-reported income (Category 2). The multifamily form requires documentation for qualifying programs under Category 1, but this documentation requirement is not included in the single-family form Category 1 instructions. On both forms, Category 2 self-reported income is signed by the customer under penalty of perjury and is subject to a PUCT audit.

The PUCT has revised the income eligibility annually based on updated federal poverty level information, but the forms have not had major changes for over a decade. Due to the importance of these forms in determining program eligibility, PUCT staff and the EM&V team agreed to incorporate the forms into Volume 5 of the PY2022 TRM 9.0. As part of integrating the eligibility certification forms into the TRM, PUCT staff and the EM&V team worked with the utilities to perform an in-depth review of the forms and certification processes. The research and recommendations in this section are part of this in-depth review that informed the TRM additions.

4.2.2.2 Key Findings and Recommendations

Interviews with the utilities, comparisons of current practices with other LI programs, and a study commissioned by Oncor and conducted by the Texas Energy Poverty Research Institute (TEPRI) indicated an opportunity to increase the confidence level that the program services are going to the intended LI recipients. These activities also identified that verification requirements should be as streamlined as possible to avoid negatively affecting participation.

Key Finding #1: Revising the income-eligible verification forms with additional qualifying programs and services for Category 1 would provide more options to qualify for the program. These could include additional program options already part of the PUCT Lifeline program and other programs identified by the utilities or other stakeholders for single-family households, for example.

Recommendation #1: Expand Category 1 qualifying programs and services.

Key Finding #2: Only individually-metered multifamily units have been eligible for HTR and LI programs since master-metered multifamily units are included in the commercial rate class. All parties agree that the programs can increase their reach to LI customers by revising the income-eligible verification forms to include all multifamily units with qualifying residents regardless of whether they are individually- or master-metered. Costs and benefits of master-metered projects would accrue to the commercial sector but can be applied to applicable LI and HTR goals.

Recommendation #2: Revise multifamily individual-meter-eligibility criteria to allow master-metered projects to count toward LI and HTR goals.

Key Finding #3: An option to streamline participation requirements would be to allow participants to qualify via geographic location through US Housing and Urban Development (HUD) LI information.

Recommendation #3: Include geographic qualification in the TRM.

Key Finding #4: Many community action agencies and social services organizations throughout Texas are already qualifying LI programs for other services. These third parties could verify they have checked eligibility in compliance with Texas Administrative Code, TEXAS DEPARTMENT OF HOUSING AND COMMUNITY AFFAIRS, CHAPTER 6, COMMUNITY AFFAIRS PROGRAMS, SUBCHAPTER A GENERAL PROVISIONS, RULE § 6.4 Income Determination.

Recommendation #4: Add an option for community action agency or other social service agency certification.

Key Finding #5: Without verification of self-reported income for those participating through Category 2, there is the potential for program services to go to non-LI customers. Each utility is encouraged to develop a process that verifies income eligibility documentation, similar to the Lifeline program. The verification can be done individually by the utilities or through a hired third-party vendor. The process for single-family and multifamily may vary; for example, in property manager interviews, we found that landlords typically complete and store income documentation on-site and could be audited. Non-ERCOT utilities may have additional options to verify customer eligibility internally if they already qualify customers for LI rates or receive energy assistance payments for customers. ERCOT utilities do not have access to this information, but there may be a possibility of coordinating with retail electric providers to identify and qualify LI customers.

Recommendation #5: Verify Category 2 self-reported income before program approval.

4.3 PARTICIPANT SURVEYS

4.3.1 Overview

The EM&V team conducted a residential participant telephone survey to inform the evaluation effort. A list of PY2020 participating Residential SOP and Residential Solutions participants was obtained from the eight utility companies who received measures in the following measure categories: HVAC equipment, air infiltration services, and insulation. The team targeted 205 completed surveys from a total number of 26,707 participants. A total of 223 surveys were completed, as shown in Table 36 below. The estimated length of the telephone survey was 15 minutes.

Table 36. Texas PY2020 Residential Study Response Rate

	AEP Texas	Center Point	El Paso Electric	Entergy	Oncor	SWEPCO	TNMP	Xcel Energy	Overall
Sample	**225**	**125**	**100**	**150**	**200**	**100**	**96**	**100**	**1,096**
Business line	0	0	0	0	0	0	0	0	0
Affiliated with utility	0	0	0	0	0	0	0	0	0
Eligible sample	**225**	**125**	**100**	**150**	**200**	**100**	**96**	**100**	**1,096**
Does not recall participating	8	9	5	5	4	5	5	11	52
Ineligible—Other1	0	0	0	0	0	0	0	0	0
Ineligible—Other2	2	2	1	2	3	0	1	1	12
Refusal	2	10	5	6	9	5	2	4	43
Incompletes (partial surveys)	0	0	0	1	0	0	0	0	1
Language barrier	7	7	1	2	0	2	5	5	29
Bad number	12	7	5	6	3	7	6	5	51
Called out	0	0	0	0	0	0	0	0	0
Not completed	156	72	63	97	130	58	54	55	685
Completed	**38**	**18**	**20**	**31**	**51**	**23**	**23**	**19**	**223**
Response rate									
Response rate (completed/eligible sample)	16.9%	14.4%	20.0%	20.7%	25.5%	23.0%	24.0%	19.0%	20.3%

The EM&V team designed the survey around key researchable topics aimed at measure verification, customer awareness and experiences, and customer decision-making. An advance notification letter was mailed to customers on October 22, 2021. All phone surveys were then completed in Tetra Tech's in-house Survey Research Center (SRC) beginning on October 28, 2021, with all surveys completed by November 16, 2021.

4.3.2 Key Findings and Recommendations

Key Finding #1: Customer satisfaction with the program is high.

Most respondents said they were *satisfied* or v*ery satisfied* with the program overall (89 percent). Out of 181 respondents, 77 percent said they were *very satisfied* with their project(s). There were no responses of respondents being *very dissatisfied*.

Recommendation #1: Continue implementing the program as-is.

Key Finding #2: Although residential customers are *satisfied* with the program, the majority of program improvement feedback pointed to a need for additional advertising, education, and awareness directly from the utility.

Sixty-one percent of all respondents indicated they would change nothing about the program. Of those that did provide feedback, more program marketing and receiving more information and education during participation were the most mentioned. Having more types of eligible equipment, increased quality control, and increased incentive amounts were next. A few other suggestions included having a checklist the participant can use to follow as the contractor explains each step, faster rebate processing, and one mentioned more stringent leakage requirements.

Recommendation #2: Review marketing materials and handouts to identify potential areas for additional information.

Key Finding #3: The customers' most popular source of awareness is through their energy efficiency service provider (EESP)/contractor and word of mouth.

Over one-half of respondents (54 percent) said they learned of the program through their contractor or someone they know; social media followed. Bill inserts and brochures were two of the least mentioned sources.

Recommendation #3: Continue to utilize EESPs to market the program.

4.3.3 Process Results

Detailed findings from the process surveys completed with PY2020 Residential SOP and Residential Solutions participants who received HVAC measures and infiltration and insulation services are summarized below for firmographics, demographics, program awareness, program satisfaction, and program influence.

4.3.3.1 Firmographics

Figure 23 shows the number of measure-level survey responses by utility.[19] Oncor represents the largest percentage of respondents, making up 19 percent of the survey responses, with Entergy at 18 percent and AEP TCC at 16 percent.

[19] AEP TCC and AEP TCN shown separately in all PY2020 Residential survey result graphics. Starting in PY2021, the two divisons are consolidated and represented as AEP Texas.

Figure 23. Total Number of Measure Responses Represented by Utility Company (n=280)

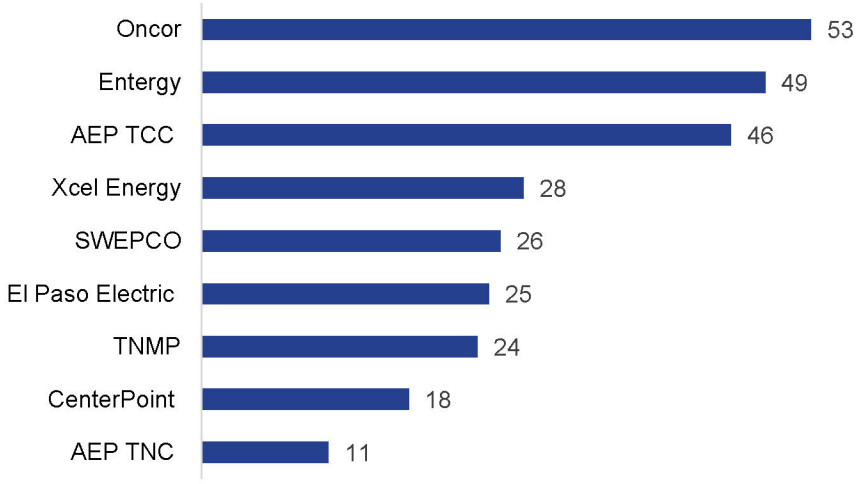
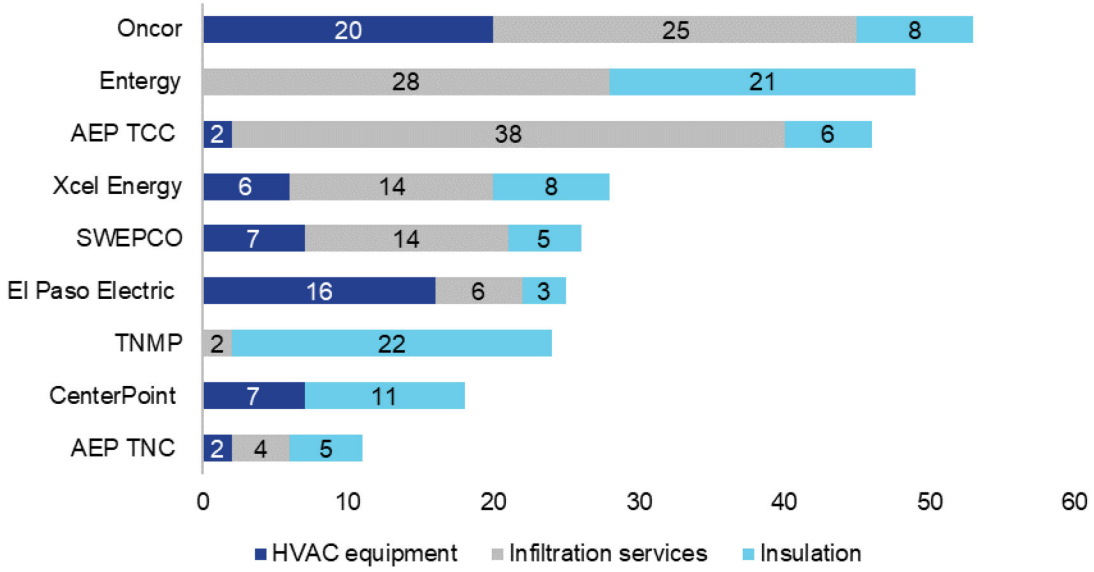


Figure 24 below represents the total energy efficient measures and services installed by the eight Texas utility companies[20], broken out by the three measure categories: HVAC equipment, infiltration services, and insulation.

Figure 24. Energy Efficient Measures and Services by Measure Category Reported by Utility Company (n=280)

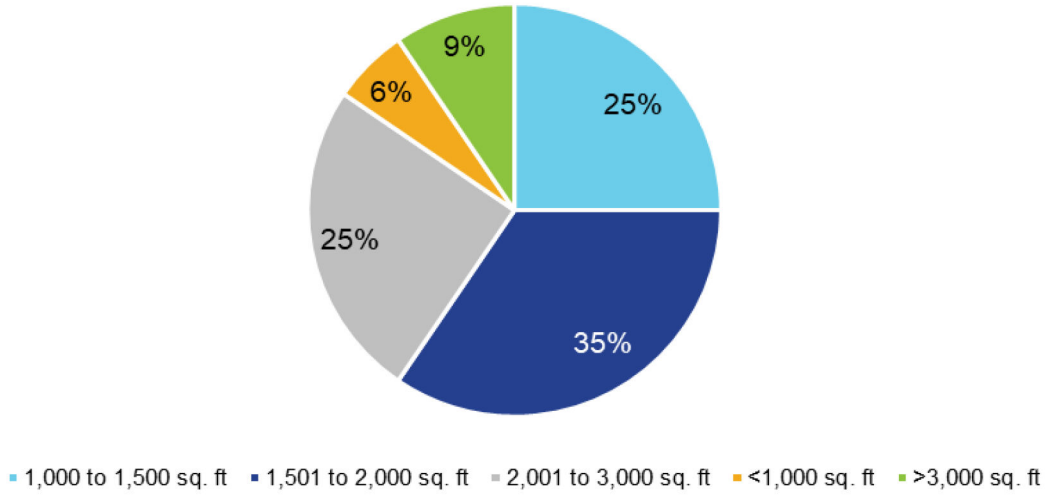


[20] Ibid

4.3.3.2 Demographics

Most of the respondents lived in homes with square footage between 1,000 square feet and 3,000 square feet (85 percent). Homes sized between 1,501 square feet and 2,000 square feet were the most mentioned (35 percent). Figure 25 shows the breakout in housing square footage.

Figure 25. Housing Square Footage of Residential Respondent Dwelling (n=168)



*Source: SOP/Res Solution Survey Question D1. *Don't Know* or *Skipped Question* responses have been excluded

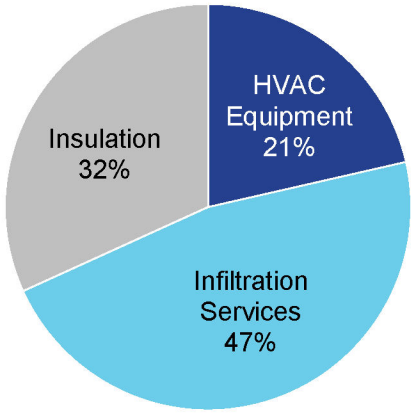
As shown in Table 37, most respondents reported owning their homes (85 percent); 9 percent indicated they were either a landlord or property manager at the participating location. Of the 227 respondents, only five (two percent) have sold their properties since participating in the programs.

Table 37. Home Ownership Status of Respondents

Respondent status	Count	Percentage
I own my home or apartment	192	85%
I am a landlord at this location	12	5%
I rent my home or apartment	10	4%
I am a property manager at this location	8	4%
Sold property	5	2%
Grand total	**227**	**100%**

Figure 26 shows that, overall, the *infiltration services* measure makes up about one-half (47 percent) of the energy-efficient measures and services implemented; *insulation* is 32 percent, and *HVAC equipment* is 21 percent.

Figure 26. Overall EE Measure Categories Represented by Respondents

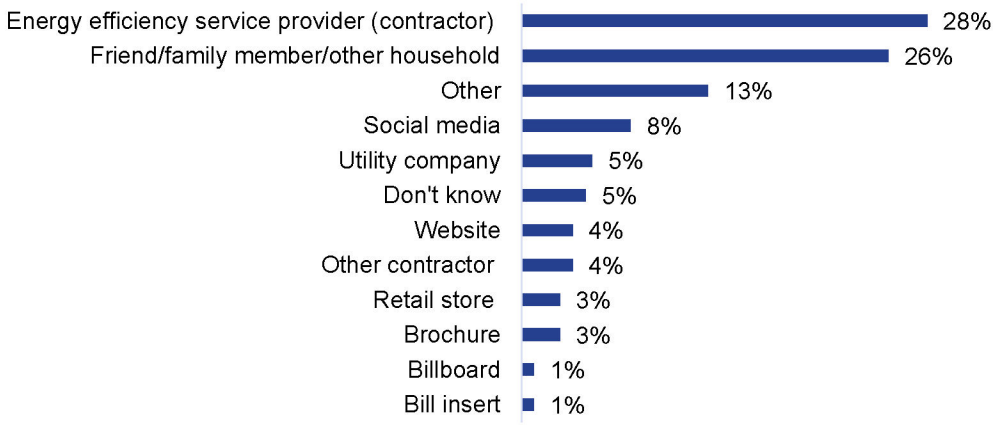


Within the three measure categories, survey questions focused on six high-efficiency equipment and/or services, including *energy-efficient air conditioners*, *energy-efficient heat pumps*, *ceiling insulation*, *evaporative coolers*, *duct sealing*, and *air infiltration services*.

4.3.3.3 Program Awareness

Survey respondents were asked how they became aware of the energy savings program. Respondents were able to indicate multiple sources (see Figure 27); the most popular source of awareness was through an *energy efficiency service provider (EESP)/contractor* (28 percent) and through word of mouth (*friend/family member/other household*) (26 percent). Thirteen percent of respondents indicated *other*, with the most specified responses being through their realtor, door-to-door salesperson, or participation in another program.

Figure 27. Respondent Source of Awareness (n=222)

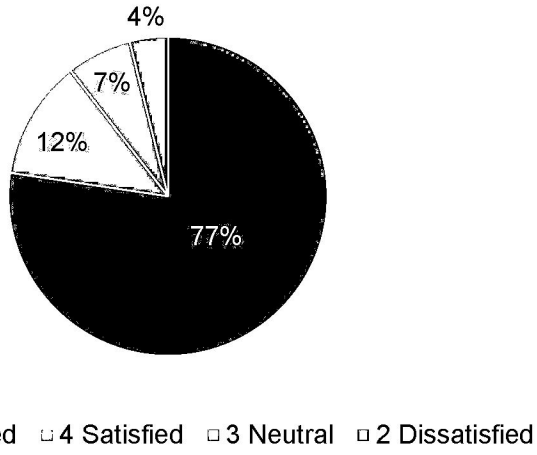


* Source: SOP/Res Solution Survey Question P1. *Skipped* responses are not included. Respondents were able to indicate all that applied.

4.3.3.4 Program Satisfaction

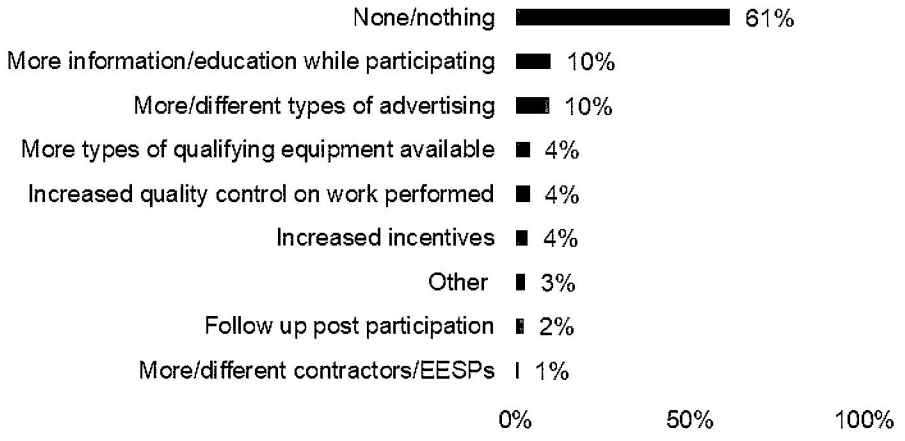
Respondents were asked to rate their project satisfaction using a 1–5 scale, with *1* being *very dissatisfied* and *5* being *very satisfied.* Out of 181 respondents, 77 percent said they were *very satisfied* with their project(s); none of the respondents indicated they were *very dissatisfied,* as shown in Figure 28.

Figure 28. Overall Project Satisfaction Results



In addition to rating their satisfaction with the program, customers were also asked what they would change about the program. Sixty-one percent of respondents indicated they would change nothing about the program. More program marketing and receiving more information and education during participation were the most mentioned suggestions (both ten percent). Having more types of eligible equipment, increased quality control, and increased incentive amounts followed at four percent each, as shown in Figure 29 below. A few other suggestions included having a checklist the participant can use to follow along as the contractor explains each step, faster rebate processing, and one mentioned more stringent leakage requirements. They felt the amount of leakage they had that was deemed acceptable was too high.

Figure 29. Suggestions for Program Changes



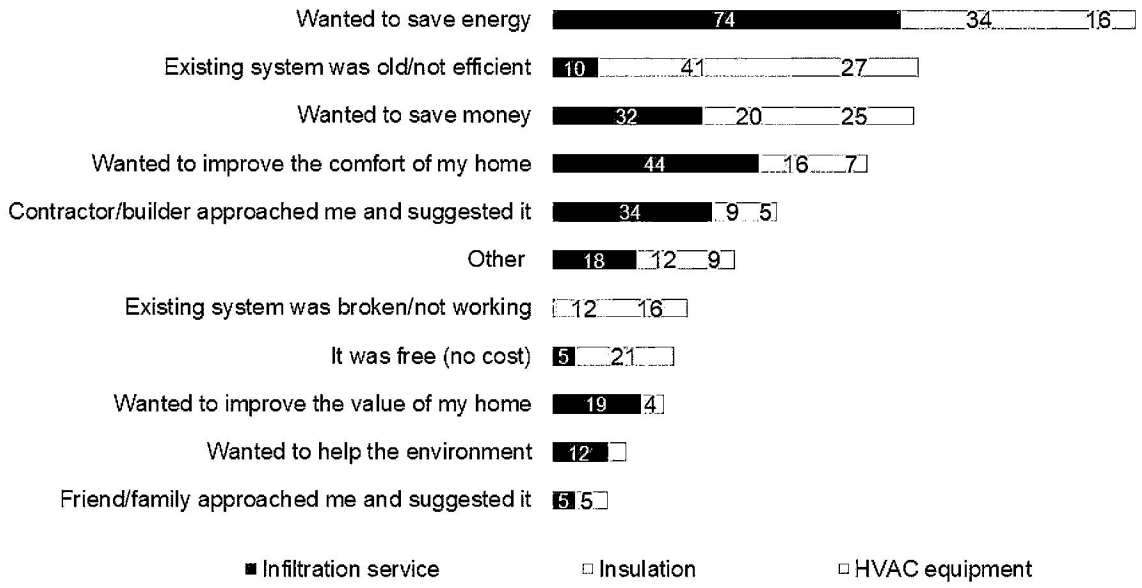
* Source: SOP/Res Solution Survey Question SAT2.

Given the COVID-19 pandemic of 2020, it is worth noting that, in addition to asking about general program satisfaction, surveyors asked if customers were satisfied with their EESP/contractor's safety precautions and cleanliness, using the same satisfaction scale. Almost all (98 percent) of respondents said they were *satisfied* or *very satisfied.* Of the remaining two percent, only one respondent said they were *very dissatisfied,* with no indication as to what could have been done differently.

4.3.3.5 Program Influence

Respondents were asked why they decided to install the energy efficiency measures and/or services; most indicated multiple motivations, which is reflected in the total number of responses. *Wanting to save energy* was the most mentioned reason for participation (124 responses, or 23 percent), with *old/not efficient equipment* and *wanting to save money* as the next two most-mentioned motivators. Figure 30 below shows the number of responses by reason and measure.

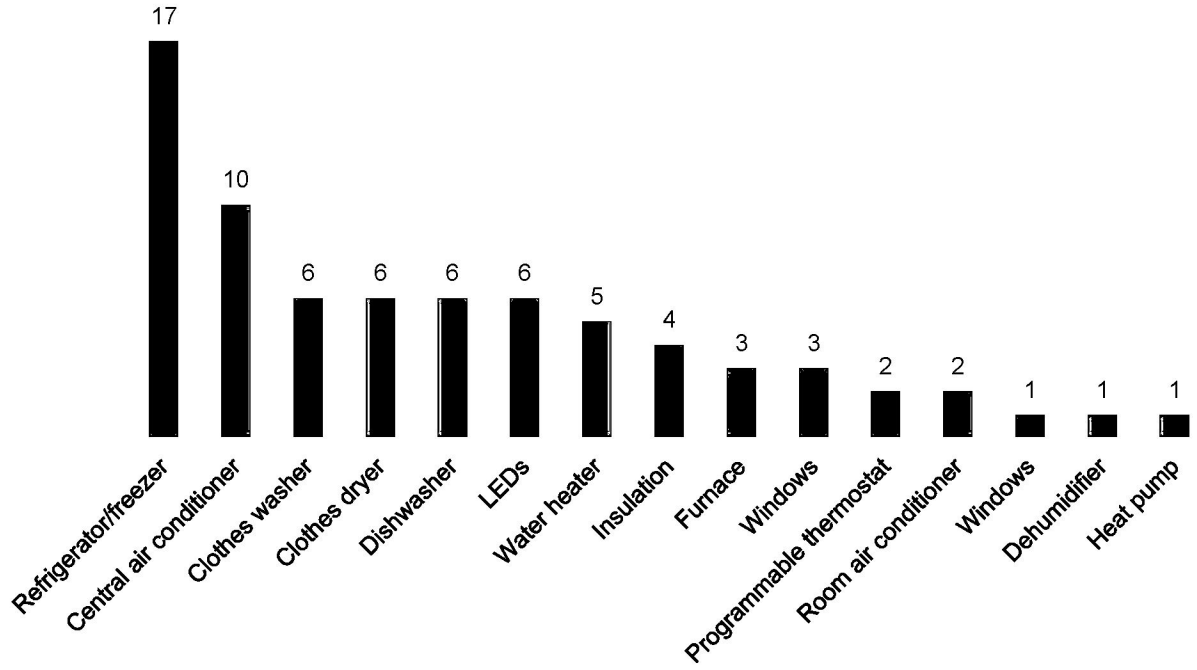
Figure 30. Customer Motivation (n=540)



*Source: SOP/Res Solution Survey Question M2. *Don't Know and Refused* responses have been excluded

Customers were asked if they have purchased any other type of energy efficient or ENERGY STAR-rated equipment since implementing their energy efficiency project through the program. Of the 223 respondents, 54 respondents (24 percent) indicated they had purchased additional energy-efficient equipment. Figure 31 shows the equipment they have purchased. Energy-efficient *refrigerators/freezers* were the most mentioned purchases, 17 respondents (23 percent), followed by *central air conditioners*, 10 respondents (14 percent). Customers were also asked to indicate how they knew the equipment was energy efficient. The most-mentioned answer was that *the appliance was ENERGY STAR-rated and had a large yellow sticker on it.*

Figure 31. Additional Energy Efficient or ENERGY STAR-Rated Equipment Purchased (n=73)



*Source: SOP/Res Solution Survey Question SPA2. *Skipped* responses have been excluded

4.3.4 Net-to-Gross Results

This section presents a summary of the methodology and key findings from the Residential SOP net-to-gross (NTG) research.

The EM&V team used a self-report approach (SRA) implemented through customer surveys to collect responses for use in calculating free-ridership and spillover, the components of NTG. The NTG results in this report used both PY2020 program participants—primarily because, in PY2021, the pandemic introduced an atypical environment—and interviews with EESPs in PY2018 to better inform the HVAC free-ridership.

The self-report survey sample was designed to meet the industry standard of ±10 percent precision at 90 percent confidence. Table 38 documents the number of customer surveys used for calculating the Residential SOP NTG ratio. Note that free-ridership was only asked for one measure to limit respondent burden. Cases are also weighted by the measure's demand reduction (kilowatt) and energy savings (kilowatt-hour) to account for differences in the size of projects represented in the survey.

Table 38. RSOP NTG Research Primary Data Collection Completes

Utility	Number of measure completes[21]
AEP Texas	32
Center-Point	12
El Paso Electric	10
Entergy	28
Oncor	38
SWEPCO	17
TNMP	23
Xcel Energy	8
Total	**170**

4.3.4.1 Free-Ridership

Free-ridership analyses attempt to estimate the proportion of savings that stem from customer actions that would have happened in the absence of the program. Customers who would have completed the same project at the same time without the program's intervention are considered free riders. Typically, free-ridership is calculated using the self-report surveys; however, because residential customers do not fully understand the efficiency levels of HVAC equipment to know what they would have done absent the program, we use results from interviews with EESPs in place of the participants. For PY2021, the HVAC free-ridership results from PY2018 were used in place of PY2020 participant self-reports. The EM&V team will conduct another round of EESP interviews in PY2022 and update the NTG. In PY2018, the EM&V team spoke with 63 EESPs who participated in one or more utilities' RSOPs. The EESP responses were weighted by the kilowatt-hour and kilowatt contributions from measures installed by that EESP to account for different levels of participation by different EESPs.

The PY2020 participant self-report surveys for non-HVAC equipment resulted in free-ridership of 10 percent kilowatt and 11 percent kilowatt-hour, with both weighted by savings; this is a reduction from PY2018, 17 percent kilowatts and 16 percent kilowatt-hours. The PY2018 EESP interviews resulted in free-ridership of 24 percent kilowatt and 25 percent kilowatt-hour, weighted. Combined, the residential SOP free-ridership is 17 percent kilowatt and 19 percent kilowatt-hour.

[21] The number of completes used to calculate NTG does not equal the total number of completed surveys in the participant survey effort because not all surveys obtained the data necessary to calculate NTG.

4.3.4.2 Spillover

Spillover refers to additional energy-saving equipment that was installed in the utilities' service areas without receiving an incentive or direct intervention from the utility. For PY2021 reporting, the EM&V team used deemed spillover savings from the PY2018 evaluation[22] for *HVAC* measures and used PY2021 program tracking data for *non-HVAC* measures. The spillover results for non-HVAC equipment were <1 percent kilowatt and 1 percent kilowatt-hour. The EESP spillover results from PY2018 used for HVAC is 19 percent for both kilowatt and kilowatt-hour. The weighting did not result in different spillover estimates by savings type. Combined, the statewide spillover for RSOP is ten percent kilowatt and ten percent kilowatt-hour.

The spillover result is reasonable for two reasons. First, EESPs are in a better position to understand the influence of the utilities' programs on the overall HVAC market and can speak to the programs' effect on overall efficient HVAC sales. Second, the spillover result reflects that EESPs have changed their sales practices due to program influence, even in cases where the utility does not directly incentivize a project.

4.3.4.3 Net-to-Gross Ratio

The NTG ratio was calculated using the following formula; the resulting ratio can be applied to the population to determine the final net savings value:

$$NTG\ Ratio = (1 - Free\text{-}ridership\ Rate) + Spillover\ Rate$$

The final NTG ratio, accounting for free-ridership and spillover, is 93 percent weighted by kW (up from 89 percent in PY2018) and 91 percent weighted by kWh (a slight decrease from 93 percent in PY2018). Table 39 shows the RSOP statewide free-ridership rate, spillover rate, and NTG ratio.

Table 39. PY2021 RSOP Statewide NTG Ratio

Savings type		Free-ridership	Spillover	NTG ratio
Non-HVAC	kW	10%	0%	90%
	kWh	11%	1%	90%
HVAC	kW	24%	19%	95%
	kWh	25%	19%	94%
Total	kW	17%	10%	93%
	kWh	19%	10%	91%

[22] NTG will be updated again in PY2022 using results from a new round of EESP interviews.

5.0 LOAD MANAGEMENT PROGRAMS

5.1 SUMMARY RESULTS

This section summarizes the key findings and recommendations from the program year (PY) 2021 (PY2021) evaluation of commercial and residential load management programs. Load management programs were designated as *medium* evaluation priorities in PY2021 due to their significant contribution to capacity (kilowatt, kW) savings. The recommendations are to be considered by the utilities for PY2023 implementation and will also be incorporated into the PY2023 Texas Technical Reference Manual (TRM) 10.0 as appropriate.

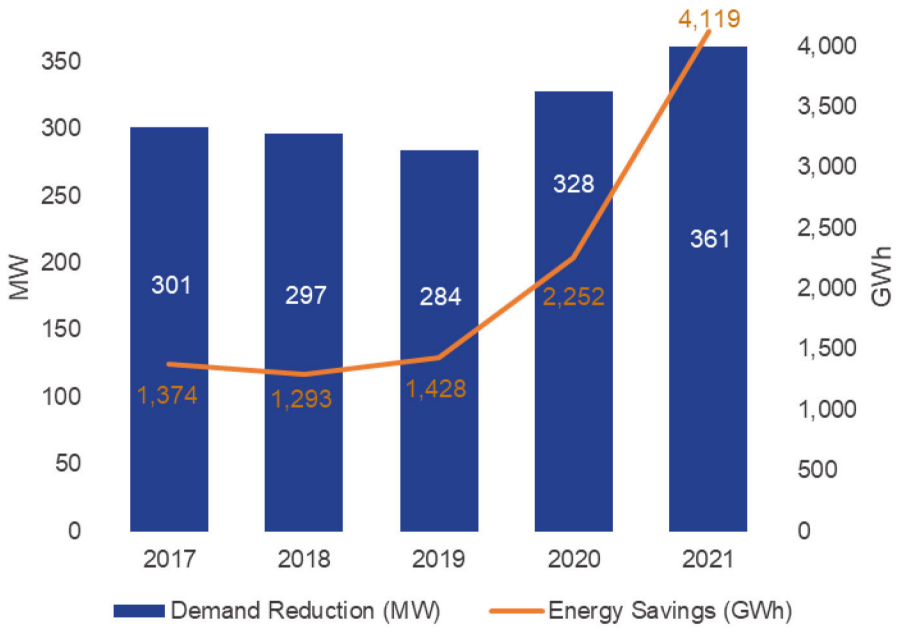
5.1.1 Savings

The total evaluated gross savings of the programs were:

- 361,152 kW (demand reduction), and
- 4,119,283 kilowatt-hours (kWh) (energy savings).

These results show a significant increase compared to PY2020, by roughly 33 megawatts (MW). Figure 32 summarizes the evaluated megawatt and megawatt-hour savings of all load management programs from PY2017 to PY2021.

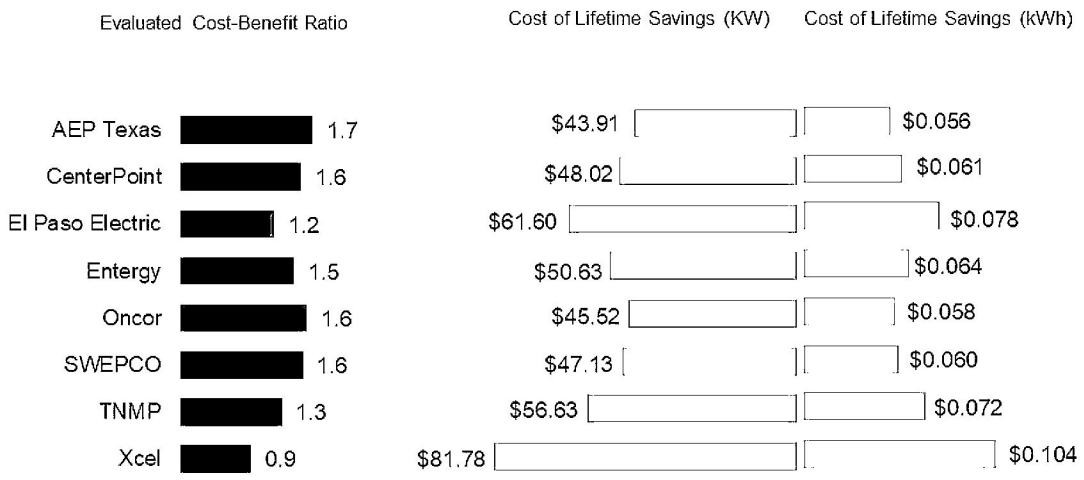
Figure 32. Total Statewide Evaluated Gross Demand Reduction and Energy Savings by Program Year—Load Management Programs PY2017–PY2021



5.1.2 Cost-Effectiveness

Figure 33 summarizes the cost-effectiveness of each utility's energy efficiency portfolio based on evaluated savings of all load management programs in PY2021. Most portfolios were cost-effective, ranging from 0.9 to 1.7. The cost per kilowatt ranged from $43.91 to $81.78, and the cost per kilowatt-hour ranged from $0.056 to $0.104. These costs provide an alternate way of describing the cost-effectiveness of a portfolio of programs. Those portfolios with a higher cost-effectiveness ratio will have a lower cost to acquire savings and vice versa.

Figure 33. Evaluated Cost-Benefit Ratio and Cost of Lifetime Savings—Load Management Programs PY2021



5.2 COMMERCIAL LOAD MANAGEMENT

This section summarizes the key findings and recommendations from the PY2021 evaluation of the commercial load management programs offered by the eight Texas utilities.

The EM&V team applied the savings calculation methodology prescribed in PY2021 TRM 8.0 on a census of records to calculate energy savings and demand reductions from interval meter data.

5.2.1 Programs Overview

Commercial load management programs are designed to manage kilowatt usage during summer peak demand periods. These periods are defined in most utility programs as 1:00 p.m. to 7:00 p.m., weekdays, June through September. These programs are based on performance and offer incentive payments to participating customers for voluntarily curtailing electrical load on notice.

While each utility operates a unique load management program, there are many similarities among them. In general, a dispatch event may be called at the utility's discretion 30 to 60 minutes in advance of a curtailment event, which generally lasts one to four hours. In most cases, the utility reserves the right to call a certain number of curtailment events per season, ranging from 5 to 15, based on the utility. Customers must meet several eligibility requirements,

including but not limited to (1) taking service at the distribution level, (2) meeting minimum demand requirements, and (3) being equipped with interval data recorder metering. Customers cannot participate in other load management programs using the same curtailable loads simultaneously (i.e., *double-dipping*).

Participants can either curtail their contracted load during a load control event or opt-out if they wish not to participate. Participants receive an incentive based on the kilowatts they curtail during the event. Savings for kilowatts and kilowatt-hours are calculated by following the methodology described in PY2021 TRM 8.0, and an incentive is given to a participant based on the amount of kilowatts saved. This incentive amount is specified in an agreement with the utility when enrolling in the program and ranges from $15 to $50 per kilowatt saved.

5.2.2 Key Findings and Recommendations

Key Finding #1: Texas commercial load management programs continue to increase commercial load participants effectively and have maintained high levels of cooperation (about 90 percent) with curtailment events.

As measured by the number of customers, participation has fluctuated annually in years prior to PY2018 but remained relatively stable, with about 600 commercial participants. Participation has been steadily increasing since PY2018, reaching 825 participants in PY2021, thus, resulting in higher savings. Of these participants, the majority (about 90 percent) curtailed load when requested for a curtailment event (739 of the 825 participants). The ratio of enrolled participants compared to participants that were able to curtail was comparable to pre-pandemic levels.

Recommendation #1a: Continue to assess the role of commercial load management programs as part of the utility's overall energy efficiency portfolio.

Recommendation #1b: Consider using the results of the annual test event to modify program-contract estimates of available demand reduction and the test and actual events to identify any non-performers that should not be future participants.

Key Finding #2: There is considerable stakeholder interest in utility load management programs; information on the programs and participants could be improved for easier public consumption.

Not all utilities have program manuals detailing the program processes on their websites, and not all program manuals are updated annually.

Recommendation #2: To foster a clear understanding of the program operations, provide easy online access to program manuals and update these manuals annually and consider a summary of key metrics.

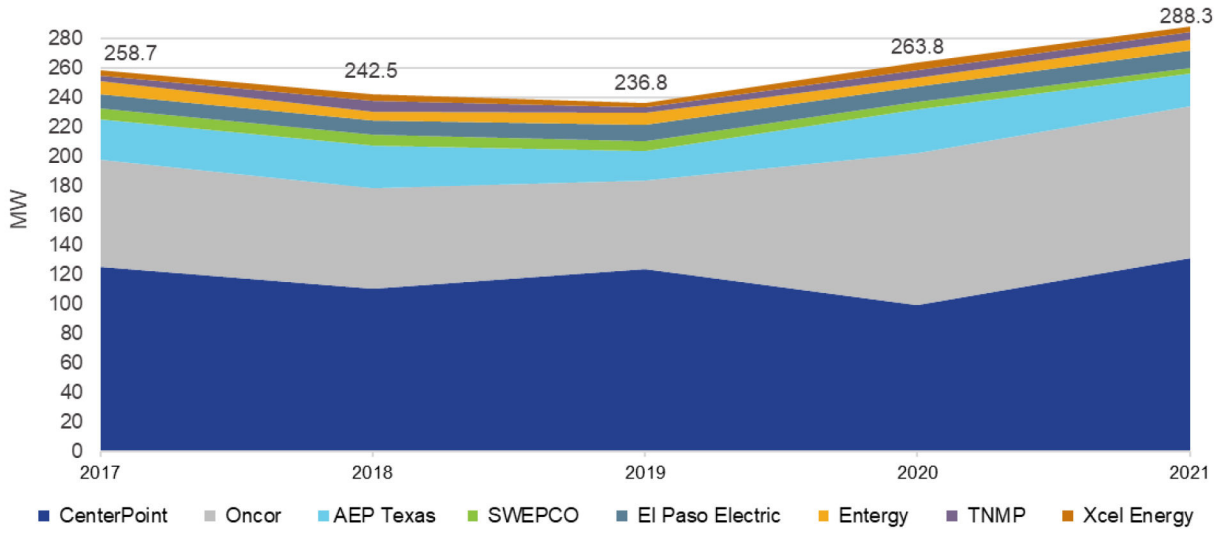
5.2.3 Impact Results

The total PY2021 evaluated savings of all eight commercial load management programs were:

- 288,304 kW (demand reduction), and
- 1,220,194 kWh (energy savings).

The PY2021 evaluated savings show a continued increase from PY2020 by roughly 25 MW. CenterPoint has the most significant savings among the utilities' commercial load management programs, followed by Oncor. Figure 34 shows total kilowatt savings from commercial load management programs by program year.

Figure 34. Evaluated Demand Savings of Commercial Load Management Programs PY2017–2021



Demand savings calculations from each utility were mainly calculated the same as the evaluation calculations. There were no cases in which adjustments had to be made to individual meter savings calculations; this result supports the fact that both the EM&V team, the implementer, and utilities follow the TRM algorithm for savings calculation similarly. While all utilities followed the TRM methodology correctly, the realization rates for commercial load management programs were not 100 percent in PY2020. The reason for this discrepancy is that, when comparing individual meter savings for one of the commercial load management programs, it was found that the utility was following a conservative approach by not setting savings to zero in cases where the calculation methodology produced negative savings. Per PY2019 TRM 6.0, in cases where the savings algorithm produces negative savings, the negative savings can be set to zero. As a result, commercial load management programs received a realization rate of 100.2 percent for kilowatts and 100.1 percent for kilowatt-hours.

5.2.4 Winter Load Management Results

Oncor launched its winter load management pilot on December 1, 2021, which was open through February 2022; the results of this pilot will be included in the PY2022 EM&V report. The EM&V team conducted three in-depth interviews with participants in this pilot; interviews are informing a participant survey for all PY2022 load management programs. However, one key finding from the interviews is that those using backup generation are concerned that a program test-event outside of the allowable window could make them in non-compliance with the Texas Commission on Environmental Quality (TCEQ) Rule §117.2030[23].

5.3 RESIDENTIAL LOAD MANAGEMENT

This section summarizes the key findings and recommendations from the PY2021 evaluation of three Texas utilities' residential load management programs (Oncor, CenterPoint Energy, and El Paso Electric). Other utilities did not offer a residential load management program.

Two utilities calculated savings using interval meter data following the *high 3 of 5* method; the third utility used *deemed savings* method from PY2021 TRM 8.0.

5.3.1 Program Overviews

Residential load management programs are designed to manage kilowatt usage during summer peak demand periods. Three of the eight Texas utilities offer their customers a residential demand response program. Of the three, two programs utilize a smart thermostat control strategy, and the other utilizes direct load control devices. Incentives for these programs differ by whether the utility's service territory is part of the Electric Reliability Council of Texas (ERCOT) market or not. Utilities in the ERCOT market receive an incentive based on the evaluated kilowatt savings achieved during the load control season; in contrast, non-ERCOT utilities pay a flat enrollment incentive and a flat incentive per program year. Participants are allowed to opt out of a load control event.

Participants in two of the three residential programs are evaluated individually with the *high 3 of 5* method described in PY2020 TRM 7.0. In contrast, the other is evaluated using the new deemed savings value for residential demand response smart thermostat programs. The availability of advanced metering infrastructure meters dictates a utility's methodology to calculate savings.

All utilities define their control seasons as June 1 to September 30, with possible load control events happening within the window of 1:00 to 7:00 p.m. on non-holiday weekdays for ERCOT utilities and 2:00 to 8:00 p.m. on non-holiday weekdays for non-ERCOT utilities.

Residential programs in Texas have seen dramatic increases in evaluated kilowatt savings over the past few years as participation has steadily increased. This increase in participation and savings can be attributed to the adoption and successful marketing of programs that utilize smart thermostats.

[23] Texas Administrative Code (state.tx.us)https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=117&rl=2030.

5.3.2 Key Findings and Recommendations

Key Finding #1: Texas residential load management programs continue to increase demand savings and participation effectively. While a relatively low number of meters to date have had missing data, The TRM does not provide a detailed approach to handling missing data for baseline or event days.

Two different approaches are used to deal with missing data: (1) the average for each provider or (2) zeroing out those days. To date, the difference has not impacted the evaluation because only a few devices with small savings had this issue; however, it is worth discussing further and clarifying language in the TRM if these programs continue to grow or if they expand to other devices like water heater controls.

Recommendation #1: Discuss updates to the TRM that clarify how to handle missing data.

Key Finding #2: TRM language related to the *deemed savings* method has been worked through in the past few years, and there is now a mutual understanding of the approach. The utility, implementer, and EM&V team agreed on final demand savings calculations, although documentation for participating thermostat devices may be improved.

Due to the unique aspect of the *deemed savings* method (using runtime data and a deemed savings value instead of interval data), the approach used to identify participating devices is critical. Providing ample documentation of the calculation approach supported by a clear definition of each data field for each smart thermostat manufacturer would be helpful.

Recommendation #2: The files provided to identify participating smart thermostat devices for the *deemed savings* method should include a description of the data fields and the calculation approach. A calculation approach should also be provided for the devices enrolled through the online marketplace.

Key Finding #3: For the *deemed savings* method, there was some confusion in PY2020 on how to claim savings for smart thermostat devices sold through the online marketplace and enrolled in the residential load management program at the point of purchase. The TRM was updated to provide more guidance and enhance overall accuracy and transparency.

In general, customers that receive incentives for purchasing a thermostat device through an energy efficiency program may be able to enroll in the load management program offered by the utility at the point of purchase. Deemed demand savings can only be claimed for those customers if they enroll and participate during the summer season. Otherwise, these devices are only eligible for the deemed energy efficiency savings.

Recommendation #3: Continue to claim savings for smart thermostat devices that did not enroll during the summer season through the smart thermostat or retail MTPs.

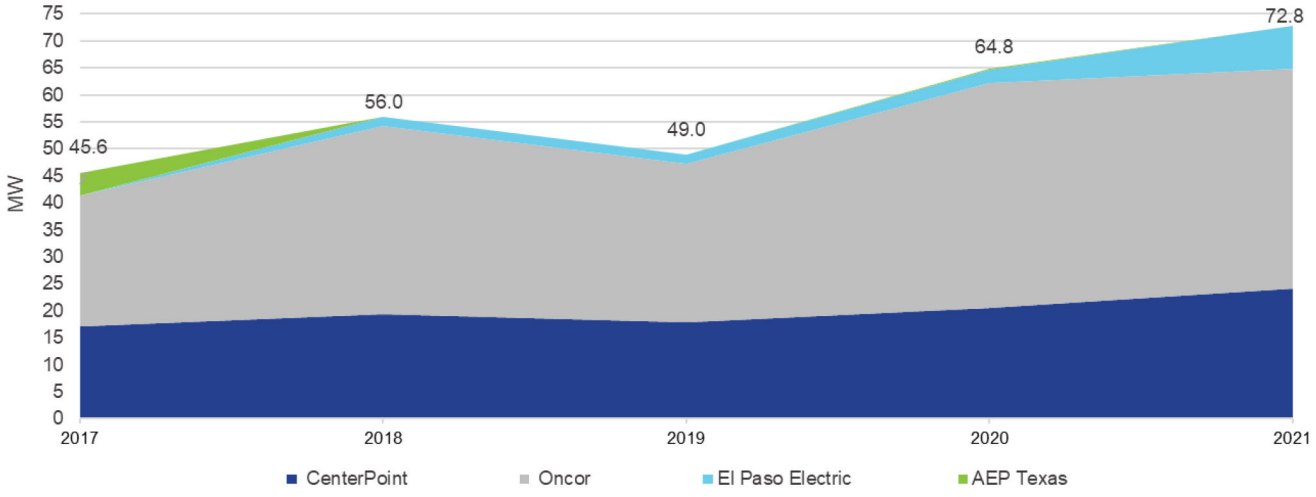
5.3.3 Impact Results

The total PY2021 evaluated savings for the four utilities (CenterPoint, Oncor, El Paso Electric, and AEP Texas) were:

- 72,848 kW (demand reduction), and
- 2,899,088 kWh (energy savings).

These results show a continued increase in savings since PY2019, increasing roughly by 9 MW from PY2020. Figure 35 shows total megawatt savings from residential demand response programs by program year (note that AEP Texas discontinued its residential load management program after 2017). Since PY2019, Oncor has the most significant savings amongst the utilities' residential programs, followed by CenterPoint.

Figure 35. Evaluated Demand Savings of Residential Load Management Programs PY2017–2021



TECHNICAL APPENDIX A: COMMERCIAL CONSUMPTION ANALYSIS

The EM&V team completed a commercial consumption analysis with the evaluation of the electricity consumption data for the savings claimed in the Commercial Standard Offer Program (CSOP) and Commercial Market Transformation Program (CMTP) in Program Year (PY) 2020. The PY2020 consumption analysis focused on the lighting measure category, which provides the most energy savings in the Commercial sector. The detailed research plan provided a framework for the consumption data analysis; however, the methodology was dynamic throughout the evaluation in response to data needs and interim analysis findings. This appendix details the steps taken and the outcomes of the analysis.

The primary goal is to inform future updates to the Technical Reference Manual (TRM). Findings from this analysis indicate that the TRM is doing a reliable job of estimating lighting project savings; therefore, we do not recommend updates to the lighting measure in the TRM at this time.

A.1 SUPPLEMENTAL INFORMATION ON WEATHER DATA

All the meters analyzed required a process to weather normalize the consumption results to isolate the energy savings associated with the lighting retrofit. The weather normalized electricity consumption was created from the observed weather data from January 2019 through March 2021 and the actual consumption. Below we give details about the data, weather stations, and missing data.

Collection

Weather data for all ASOS stations were downloaded from Iowa State University's Mesonet[24] and added to our database. The ASOS network is a collection of automated airport weather observations worldwide, with 208 stations in Texas. The data contains hourly temperature readings, and we downloaded data from January 1, 2018, to March 31, 2022. In some cases, there is more than one temperature reading per hour. In these situations, we average the temperature during that hour to come to one temperature for that hour.

Station Selection

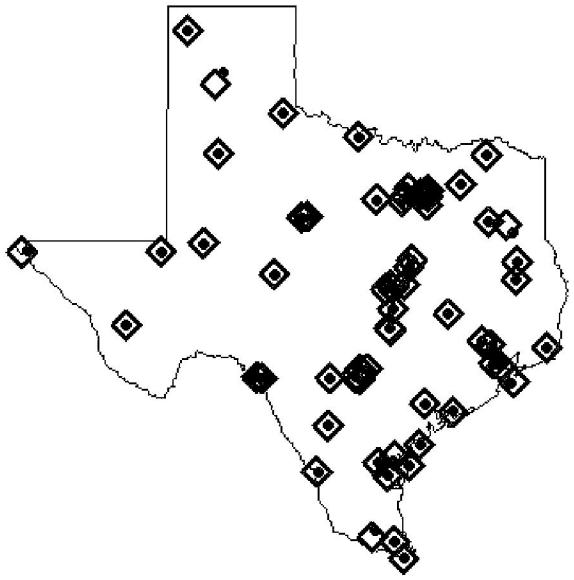
60 of the 214 ASOS stations in Texas were used to collect the weather data. Each ASOS station was matched to one of the 61 TMY3 stations in Texas. Most TMY3 and ASOS stations are co-located, and all TMY3 stations are within 20 miles of their matched ASOS stations.

The matching used the closest ASOS Station to the TMY3 station. Distance between stations is a straight-line measurement, often referred to as "*as the crow flies*." There is one fewer (60) ASOS station used for the analysis because station ATT (Austin) is the closest ASOS station to two different TMY3 stations (Austin Mueller Airport and Camp Mabry).

Figure 36 displays a map of the stations, with the ASOS stations represented by the blue dots and the TMY3 stations represented by the red squares.

[24] https://mesonet.agron.iastate.edu/.

Figure 36. Map of Texas ASOS Weather Stations and TMY3 Weather Stations



Filling Gaps

All 60 ASOS stations used for the analysis were missing some data. To complete the hourly weather observations needed to run hourly regression models, when data were missing, they were imputed from the nearest weather station, the distance measured in a straight line. When imputing data, we open our search to all ASOS stations to get weather data from the closest available station. The final observed weather dataset has contributions from 137 stations.

When filling missing observations with the closest station proves insufficient to complete data for a given station, we use the second closest station to fill the missing data, and so on, until as much missing data as possible are eliminated through data of nearby stations. We go as far as the fourth station for some locations, provided the distance is reasonable, generally less than 30 miles.

We filled missing observations with nearby stations until there were no more nearby stations to impute weather data. After borrowing from nearby stations, we dropped stations with more than 14 consecutive missing values. The screening dropped 16 stations and created a final list of 44 stations.

At this point, the distance to borrow from the next station becomes further than we feel accurate. To fill in the remaining gaps, we create a linear interpolation using the observations immediately before and following the stretch of missing hourly data to estimate the temperature during each hour with missing data. Doing this for short streaks of 14 hours or less keeps the estimations reasonable, and some visual inspection of the data has shown periods of approximation to work well.

For example, if June 20 had a reading of 74 degrees at 3:00 p.m. and 78 degrees at 6:00 p.m. with missing data in between, our data imputation procedures would impute those hours as 75.3 and 76.6 for the missing observations at 4:00 p.m. and 5:00 p.m. The data are always filled linearly, representing a gradual increase or decrease in temperature throughout the missing observations. Approximated temperature readings make up less than 0.3 percent of all observations for every station and, on average, represent under 0.1 percent of a station's hourly weather observations.

A.2 SCREENING CRITERIA DETAILS

This section describes the screening criteria employed to choose accounts for the PY2020 retrofit consumption analysis. This analysis focused on the lighting measure category, which provides the most energy savings in the Commercial sector. We review the rules applied to exclude accounts from the analysis step by step, stating the exclusionary condition and reasoning that informed the decision. Table 41 at the end of this section summarizes the screening steps and the number of accounts affected. Table 42 and Table 43 show the number of accounts by building type and consumption category.

Defining the Pre- and Post-Periods

Before enumerating the screening steps, we clarify the pre- and post-periods for measurement. The participant group includes customers who received lighting incentives between 1/1/2020 and 12/31/2020. The comparison group is defined as non-participants between 1/1/2017 and 12/31/2020. The past participant group includes customers who received lighting incentives between 1/1/2017 and 12/31/2019. The analysis period has two defined data sets for all accounts in the participant and comparison group. The pre-period is 12 months prior to the participant impact date (if available, otherwise 1/1/2020), while the post-period is 12 months after the participant impact date (if available, otherwise 1/1/2021).

Account Screening

The interval data includes 103,005 total accounts before any accounts are excluded. Table 40 presents the number of accounts by utility before the screening.

Table 40. Number of Accounts by Utility

AEP	CenterPoint	EPE	Oncor	TNMP	Total
26,343	12,469	101	34,532	29,560	103,005

Step 1: Meter Data Begins Later Than Required. We examine the minimum and maximum date that meter data was recorded for an account. As mentioned in the introductory notes, the pre-period is from 1/1/2019 to 1/1/2020 or the participant impact date. The account is screened out if the meter data begins later than 1/1/2019.

Step 2: Meter Data Ends Earlier Than Required. We examine the minimum and maximum date that meter data was recorded for an account. As mentioned in the introductory notes, the post-period is from 1/1/2021 or the participant impact date to 12/31/2021. The account is screened if the meter data ends earlier than 12/31/2021.

Step 3: Solar Interconnect Agreement. We exclude accounts that have a solar interconnect agreement. These accounts are removed from the analysis because their consumption may be misleading since they generate some or all of their own power. All utilities provide data on accounts with solar interconnect agreements.

Step 4: Gaps in Meter Data During the Pre- or Post-Period. We exclude accounts that are missing more than 8 hours of consecutive data (i.e., 32 15-minute intervals).

Step 5: Meters with Multiple Negative kWh Readings. We exclude accounts with more than one kWh interval value below -1. Those values between 0 and -1 are assumed to be rounding errors, while those less than -1 indicate a data issue.

Step 6: Total Usage in the Pre- or Post-Period is Drastically Below the Average Consumption. We exclude accounts that consumed less than 15,000 kWh for the calendar year 2019 or 2020. Consumption under these levels is not representative of typical commercial consumption.

Step 7: Geolocation successfully complete for accounts. The business name was used to geolocate accounts and assign a building type. We exclude accounts that did not successfully return geolocation or a listed building type.

Step 8: Map building type to analysis groups. The building types included in the consumption analysis are limited to warehouses, wholesale goods, retail food sales (grocery), vehicle sales, financial, and medical outpatient. The building types were selected based on two main criteria: the percentage of electricity consumption attributed to lighting and the likelihood of continuing similar operations after the start of the COVID-19 pandemic. Consumption analysis requires savings to be a statistically significant percent change from overall pre-install consumption to identify and isolate the effects of improvements. The analysis will begin by identifying operating and consumption patterns. The targeted building types are expected to have electric consumption patterns that support lighting isolation. The start of the COVID-19 pandemic in March 2020 created an event in the analysis period that uniquely impacts the energy consumption of each C&I customer. Some of the impacts were short-term, such as a decreased building capacity, and others were longer lasting, such as adjusting restaurant operations to focus on take-out business. To increase the likelihood that the post-period analysis is most similar to the pre-period analysis, businesses that are expected to be least affected by the COVID-19 pandemic adjustments were identified.

Final Number of Accounts

Table 41 presents the final number of accounts for each screening step described above. Our remaining percentage of about 36 percent of starting accounts is reasonable, and with the total number still included in the analysis, we are confident in the key findings from the analysis. However, given the high attrition due to insufficient data for some utilities, a process improvement for the next consumption analysis will be for the EM&V team to work upfront with utilities with high attrition to identify if any additional data can be provided and more accounts kept in the analysis. Meters for facilities outside the ideal building types and with low electricity consumption were most likely to be screened out. This is important to ensure that the lighting analysis maintains the focus on the lighting improvements and can eliminate variables from the results.

Table 41. Model Screening Steps by Utility

Step		AEP	CNP	EPE	Oncor	TNMP	Total	Percentage affected
	Starting	26,343	12,469	101	34,532	29,560	103,005	
1	Data started late	5359	541	25	1,196	89	7,210	7.0%
2	Data ended early	252	355	0	18,118	4	18,729	18.2%
3	Solar	106	98	0	79	48	331	0.3%
4	Gap in data	1115	712	57	353	137	2,374	2.3%
5	Negative kWh values	28	0	0	0	0	28	0.0%
6	Low average consumption	14,423	2961	3	3,437	17,776	38,600	37.5%
7	Unsuccessful geolocation	1,770	1764	2	2,650	1,758	7,944	7.7%
8	Not targeted building type	4,134	4249	6	9,800	6,919	25,108	24.4%
Count after screening		**2,396**	**3,991**	**19**	**35**	**2,996**	**9,437**	

After screening, the El Paso Electric accounts were dropped from the analysis. We only had data for 19 accounts, and there were difficulties matching them with the available tracking data for participants with the account numbers. The number of accounts in each selected building group is shown in Table 42. The groups did not have enough participant accounts to perform analysis at the building group level.

Table 42. Counts of Accounts in Each Building Group

Building group	Participant	Comparison	Past participant	Total
Convenience store	9	666	69	744
Finance	5	719	6	730
Grocery	9	550	28	587
Hardware	0	119	6	125
Health	0	84	1	85
Home goods	0	180	8	188
Laundry	0	198	8	206
Medical outpatient	2	1,363	13	1,378
Parking	0	10	0	10
Uncertain	43	3,947	294	4,284
Vehicle	8	524	27	559
Warehouse	3	515	4	522

Because analysis at a building group level wasn't possible, we grouped the businesses by consumption size, measured by the pre-retrofit annual normalized consumption.

Table 43. Counts of Accounts in Each Consumption Group

Consumption group	Participant	Comparison	Past participant	Total
Under 100,000 kWh	13	4,600	182	4,795
100,000–300,000 kWh	23	2,325	113	2,461
300,000–1 million kWh	26	1,394	75	1,495
Over 1 million kWh	17	556	94	667
Total	**79**	**8,875**	**464**	

A.3 MODEL SPECIFICATIONS, DETAILS, AND RESULTS

The following model was used to estimate weather-normalized consumption in the pre- and post-period for each account. This model was run for each meter, with a separate model performed for the pre- and post-period. For each facility, the model was run with every possible combination of cooling degree hour (65-85 degrees) and heating degree hour setpoints (45-65 degrees), for a total of 441 regressions run for each account in both the pre- and post-period. Once all 441 models were complete, model coefficients were saved for the model with the most explanatory power (highest R^2).

Equation 1. Individual Weather Normalization Model

$$Hourly\ Consumption_{it} = \alpha_i + \beta_1 HDH_{it} + \beta_2 CDH_{it} + \beta_3 Hour\_1_{it} + \cdots + \beta_{25} Hour\_23_{it}$$

Where for each customer 'I' and hour of the year' t':

$Hourly\ Consumption_{it}$ = Actual hourly consumption in the pre- or post-program period

α_i = The participant intercept, representing the kWh baseload at hour 0 of the day

β_1 = The model heating slope, representing the average change in hourly usage resulting from an increase of one HDH

HDH_{it} = The base 45-65 HDH for the nearest weather station is calculated as:

$$HDH_{it} = Base_{45-65} - Temperature_{it}$$

Where HDH_{it} is greater than 0, else $HDH_{it} = 0$

β_2 = The model cooling slope, representing the average change in hourly usage resulting from an increase of one CDH

CDH_{it} = The base 65-85 CDH for the nearest weather station calculated as:

$$CDH_{it} = Temperature_{it} - Base_{65-85}$$

Where CDH_{it} is greater than 0, else $CDH_{it} = 0$

β_{3-25} = Additional intercepts for each hour of the day, representing the kWh baseload at Hour 1 through Hour 23 of the day

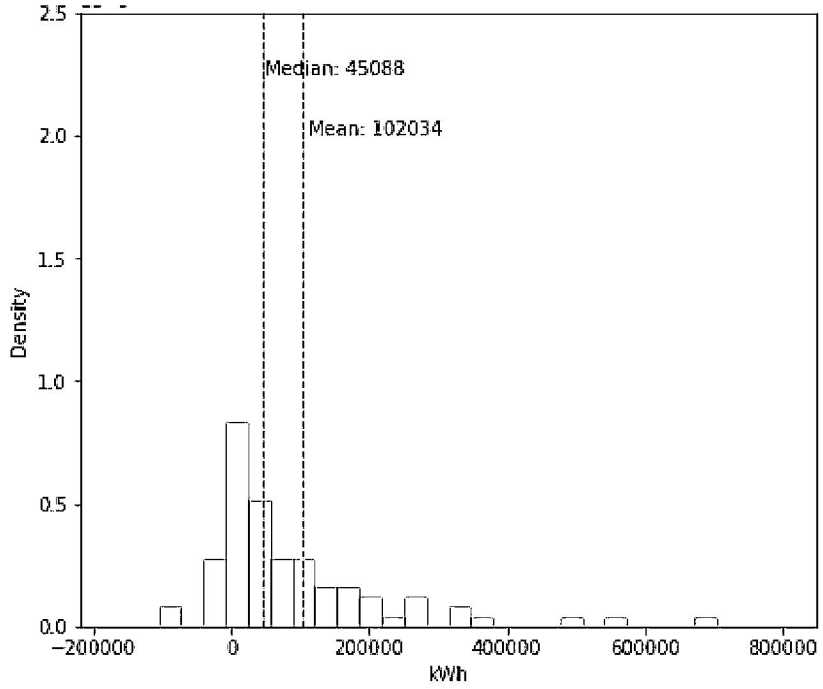
$Hour\_1_{it}$ = Dummy variable indicating the hour of the day. There are variables for Hour_1 through Hour_23

The models were weather normalized using the *CDH*, *HDH*, and *hour_1-23* coefficients for each account in the pre- and post-period and the same values for the matched TMY3 station. CDH and HDH are calculated based on the optimal cooling and heating setpoint determined in the model. The model created a weather normalized consumption estimate for every hour of the pre- and post-period for each account. The difference between the pre- and post-period normalized annual consumption identified operational changes and the savings associated with the lighting retrofit.

A.4 MODELED ANNUAL CONSUMPTION

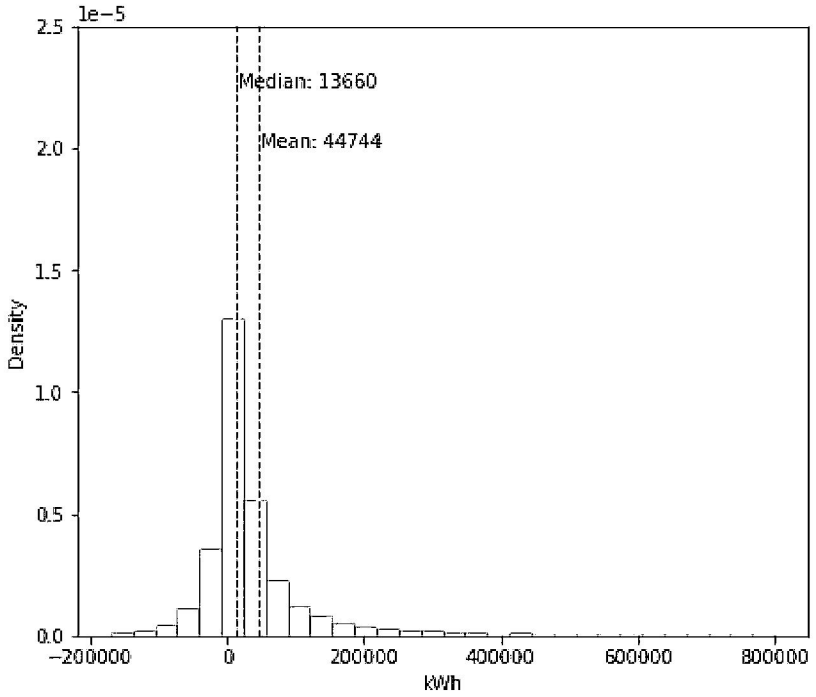
The differences in pre- and post-period normalized consumption for all analyzed accounts are displayed below. For the participant group, the annual mean pre/post difference in consumption was 102,034 kWh and the median difference was 45,088 kWh. The standard deviation was 163,914 kWh. The full distribution of pre/post differences is shown in Figure 37. The mean is larger than the median here because of the spread of larger positive values.

Figure 37. Participant Group Pre- and Post-Period Difference



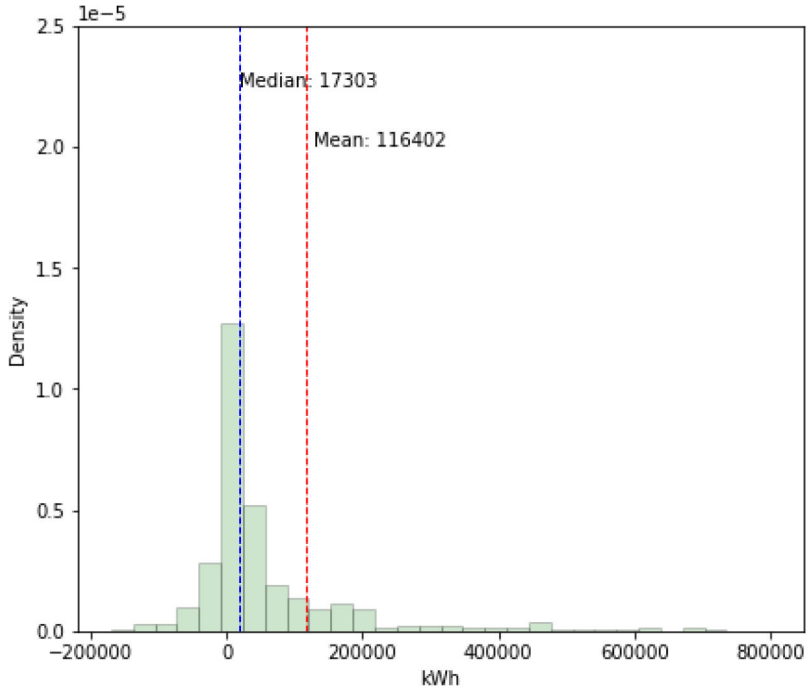
For the comparison group, the annual mean pre/post difference was 44,744 kWh and the median was 13,660 kWh. The full distribution of comparison group pre/post differences is shown in Figure 38. The mean and the median are closer here because the distribution is more evenly centered because the comparison group had many more participants.

Figure 38. Comparison Group Pre- and Post-Period Difference



For the past participant group, the annual mean pre/post difference was 116,402 kWh and the median was 17,303 kWh. The standard deviation was 672,220 kWh, indicating large variability. The full distribution of past participant group pre/post differences is shown in Figure 39.

Figure 39. Past Participant Group Pre- and Post-Period Difference



The past participant group determined the participants that had previously received a lighting upgrade operated similarly to the comparison group. The groups look similar, but the small number of meters creates a much less consistent distribution than the larger comparison group. The consumption analysis removed the past participant group once this was confirmed.

Table 44 below shows the overall average energy savings as a percentage of the pre-treatment consumption. The comparison and participant groups showed a reduction in energy consumption in the post-treatment period. The reduced consumption is expected because of the uncertain market conditions surrounding the pandemic, which adjusted many facilities' operation hours. Overall, the participant group reduced energy consumption by 17 percent compared to 12 percent for the comparison group. The reduction percentage broken down by group is inconsistent because of the small number of participants in each category.

Table 44. Analysis and Consumption Group Model Results Compared to Pre-Treatment

	Analysis group	n	Average normalized energy consumption, pre-treatment (kWh)	Average model savings (kWh)	Savings as percentage of pre-treatment consumption
Below 100k	Participant	13	45,728.30	6,734.85	14.73%
	Comparison	4600	48,615.86	5,897.54	12.13%
	Participant	23	187,026.20	28,852.15	15.43%

	Analysis group	n	Average normalized energy consumption, pre-treatment (kWh)	Average model savings (kWh)	Savings as percentage of pre-treatment consumption
100k–300k	Comparison	2325	174,526.71	31,786.29	18.21%
300k–1M	Participant	26	546,990.56	86,681.13	15.85%
	Comparison	1394	536,431.47	80,959.05	15.09%
Over 1M	Participant	17	1,608,498.97	297,399.47	18.49%
	Comparison	556	3,680,616.02	329,529.60	8.95%
Grand total	**Participant**	**79**	**588,130.48**	**102,033.58**	**17.35%**
	Comparison	**8875**	**385,759.49**	**44,744.47**	**11.60%**

A.5 MODELED SAVINGS AND EX-ANTE SAVINGS

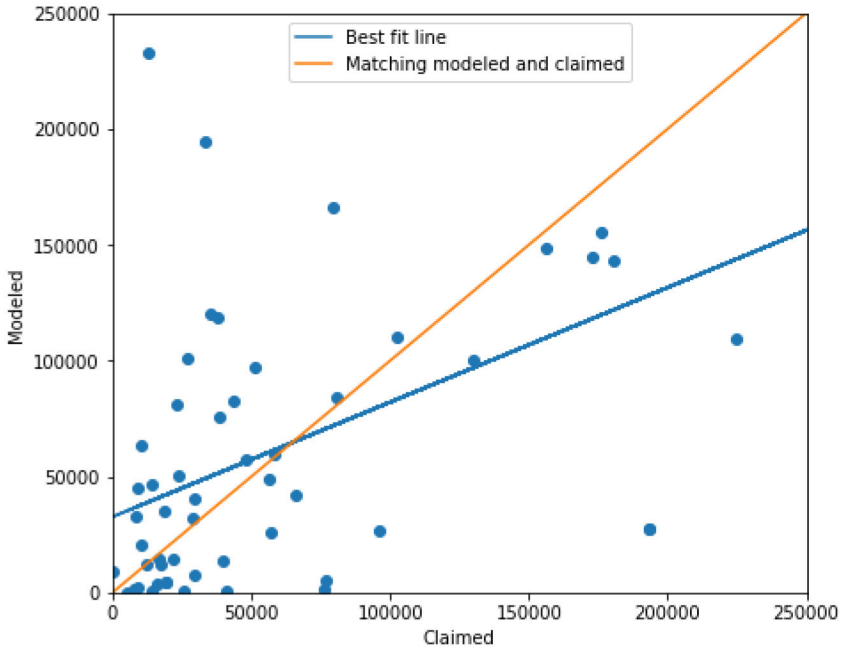
The claimed savings from these lighting retrofit projects are calculated based on the equipment removed and the upgraded equipment installed. The claimed savings normalize the energy savings and identify the reduction in the annual energy consumption. To compare the reduced consumption to the claimed energy savings, the participant group determined the average annual savings for each project from the combined energy modeling results and the combined claimed savings in the programs. The analysis found that the energy consumption model savings are lower than the claimed savings, as shown in Table 45; however, the confidence interval is significant, and matching the claimed savings is possible.

Table 45. Comparison of Consumption Model Results

Analysis group	n	Average model savings (kWh)	Average claimed savings (kWh)	Savings as percentage of claimed	90% confidence interval
Below 100k	13	6,734.85	29,202.84	23.06%	14.63%
100k-300k	23	28,852.15	50,739.67	56.86%	67.0%
300k-1M	26	86,681.13	180,048.13	48.14%	45.13%
Over 1M	17	297,399.47	285,654.66	104.11%	380.25%
Grand total	**79**	**102,033.58**	**140,304.18**	**72.72%**	**89.83%**

Figure 40 shows the relationship between modeled and ex-ante savings for the participant group. This plot shows the modeled savings correlate to the claimed savings, although there are many outliers. There is a general trend in the relationship between modeled savings estimates and ex-ante savings estimates.

Figure 40. Modeled and Ex-Ante kWh Savings for Participant Group



A.6 UTILITY LEVEL RESULTS

Grouping the results by utility, the participant group shows consistent performance. But the comparison group varied by utility. Table 46 shows the modeled savings for both the comparison and participant groups by comparing the savings to the pre-treatment consumption.

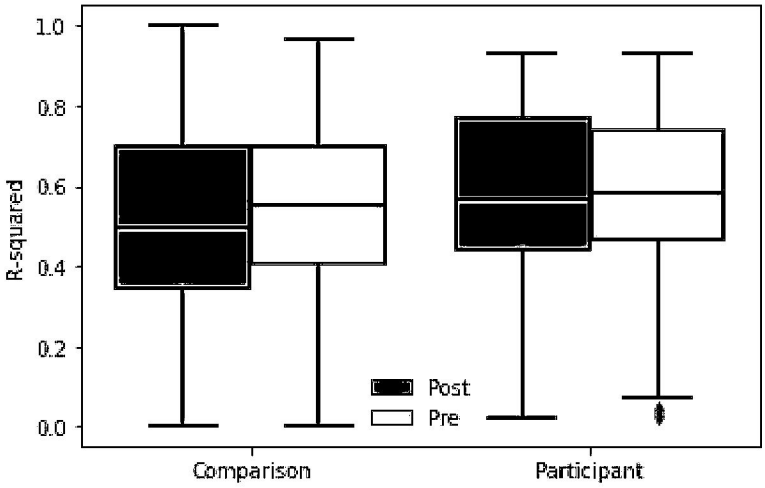
Table 46. Analysis and Consumption Group Model Results by Utility

	Analysis group	n	Average normalized energy consumption, pre-treatment (kWh)	Average model savings (kWh)	Savings as percentage of pre-treatment consumption
AEP	Participant	17	246,713.39	48,736.03	19.75%
	Comparison	2236	160,160.19	13,049.01	8.15%
CenterPoint	Participant	0			
	Comparison	3909	454,932.16	73,860.38	16.24%
Oncor	Participant	35	639,772.24	108,677.41	16.99%
	Comparison	0			
TNMP	Participant	27	736,153.75	126,978.93	17.25%
	Comparison	2730	471,489.92	29,014.40	6.15%

A.7 COEFFICIENT OF DETERMINATION (R^2)

The average R^2 was about 0.57 for the participant group and about 0.54 for the comparison group in both the pre- and post-treatment periods. Figure 41 below shows the distribution of R^2 values for these groupings. There is very little difference in R^2 distributions between pre- and post-periods or participant groups compared to the comparison group. Both groups included a wide range of R^2 values, almost covering the entire range of potential values.

Figure 41. R^2 Distributions



A.8 MODEL HEATING AND COOLING BALANCE TEMPERATURES

Each model uses a heating and cooling balance temperature to identify when heating or cooling is typically used in the facility. The model is developed to test various balance temperatures, with the highest coefficient of determination selected for the analysis. The selected heating and cooling balance temperatures were strongly skewed toward 65 degrees Fahrenheit, as shown in Figures 10 and 11. Sixty-five degrees is the lowest value for the cooling range and the highest value for the heating range. The skewed results are concerning when considering applying the final results of the analysis. However, the different cooling and heating balance temperatures also had similar R^2 values across the whole range, as shown in Figure 42 and Figure 43. This similarity suggests that the individual selection of heating and cooling balance temperatures for commercial buildings is not critical to the overall applicability of the results.

Figure 42. Cooling Setpoint Distribution

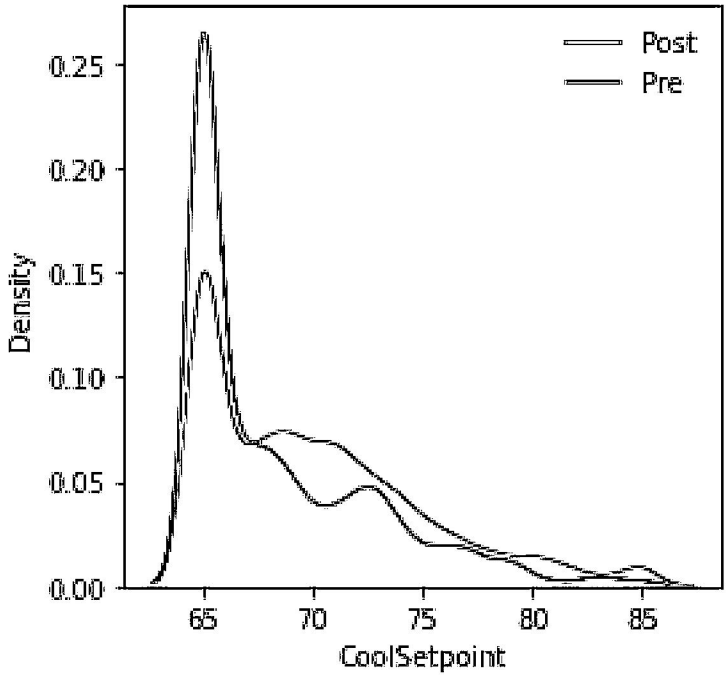


Figure 43. Heating Setpoint Distribution

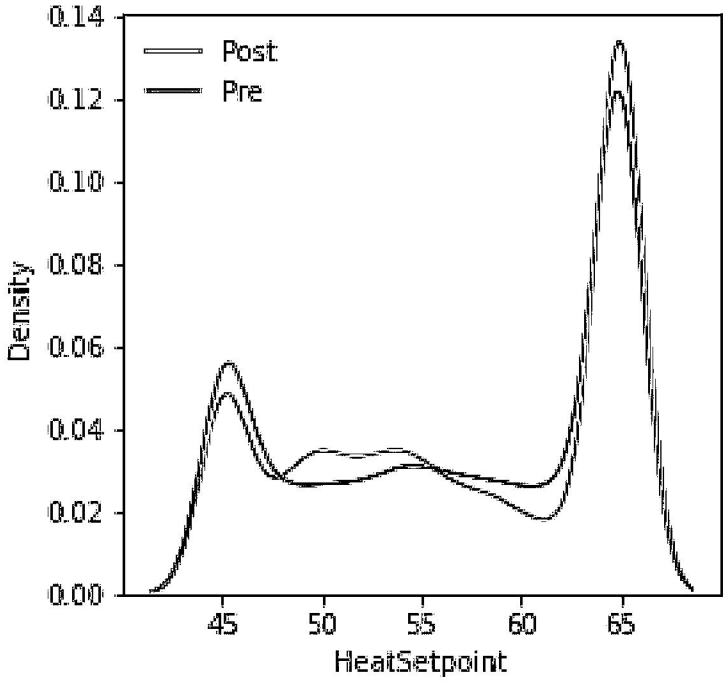


Figure 44. R^2 Distribution by Cooling Setpoint

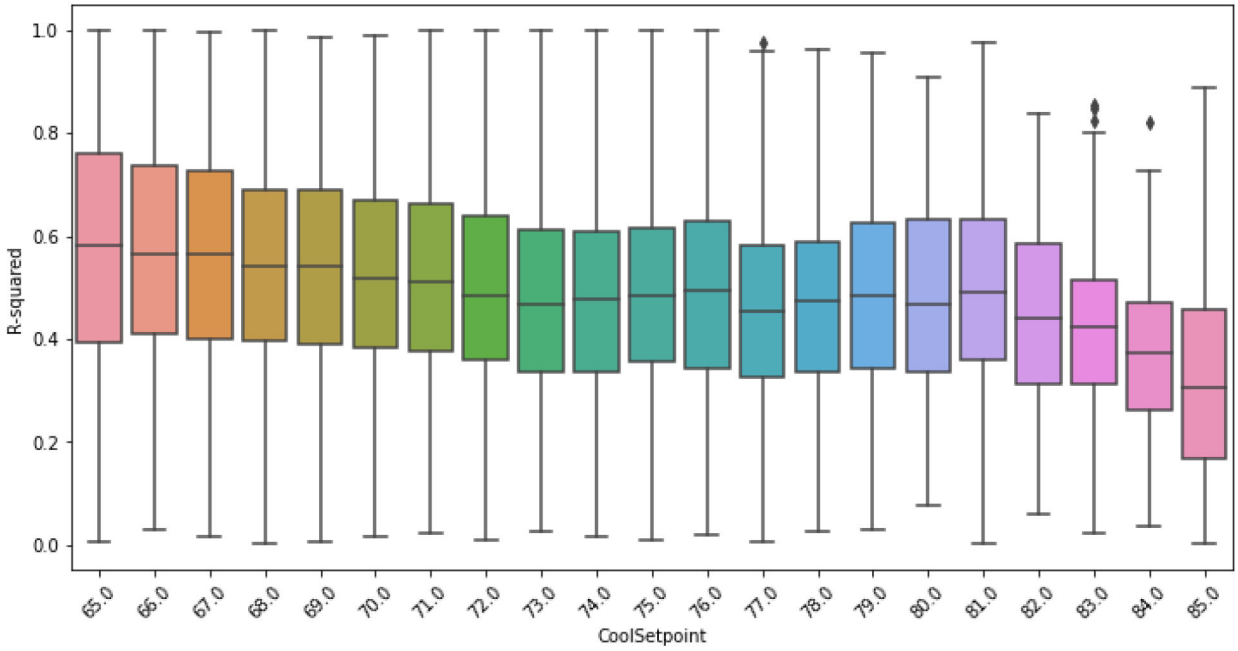
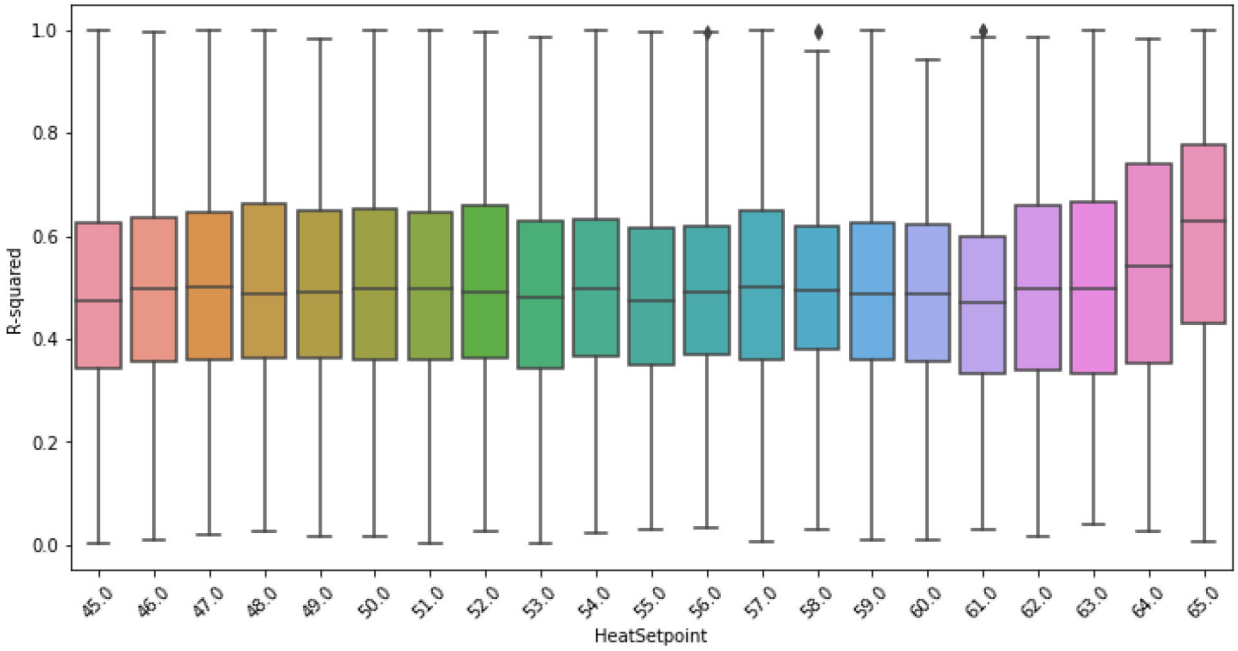


Figure 45. R^2 Distribution by Heating Setpoint



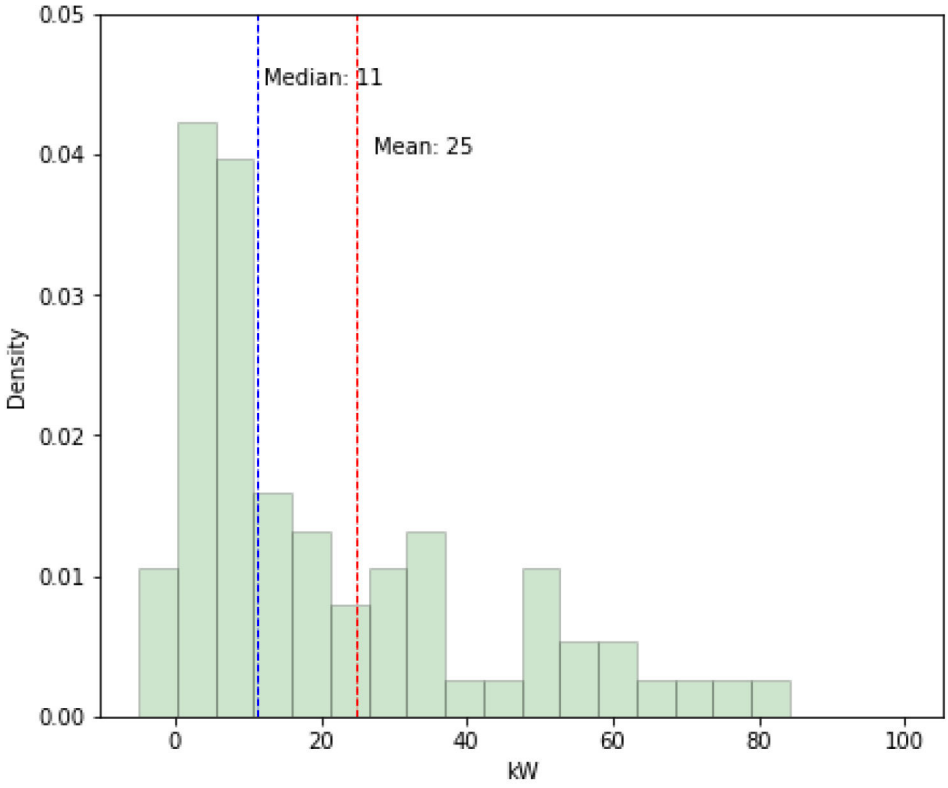
A.9 MODELED PEAK DEMAND

The peak demand weather-normalization models are used to estimate hourly demand impacts. The key difference between this model and the annual consumption weather-normalization models is that rather than fitting the model to the whole year of TMY3, only the top 20 hours from the Peak Probability (PPA) Tables in the TRM Volume 1 are determined by the model. The model is developed to identify both the weather variables and a unique factor for each hour (1-23). This results in a model that can identify the hourly demand estimate for the top 20 hours in winter and summer for the pre- and post-periods in the climate zone of the meter location.

The hourly demand estimates for the pre- and post-period for the top 20 hours followed the TRM methodology. First, the modeled peak demand is multiplied by each hour's peak demand probability factor (PDPF). Next, the sum of these terms is divided by the sum of the PDPF values. This process is repeated for both the pre- and post-period, providing an estimate of peak demand in the pre-period and the post-period for both summer and winter peak periods. We finally subtract the post-estimate from the pre-estimate, with the difference being our reduction in peak demand for that account. The modeled peak demand reduction is the greater of the winter or summer peak demand reduction.

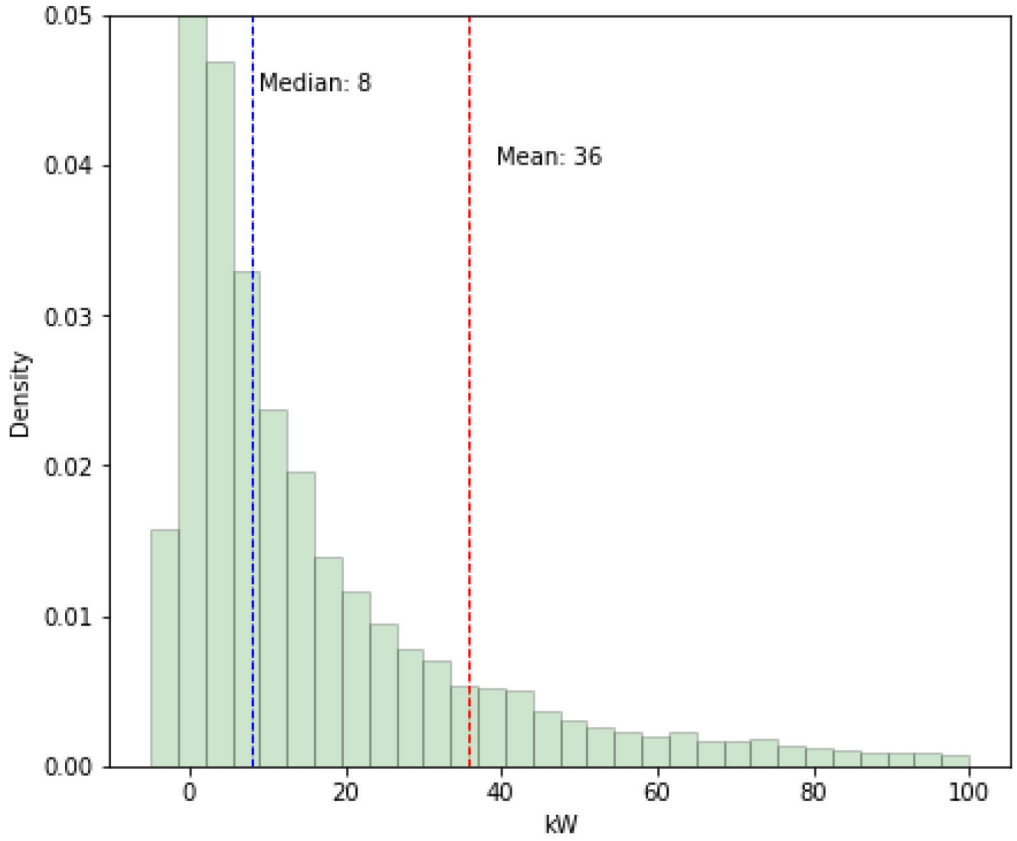
However, the peak reduction in the analysis of the participant group is apparent. The annual mean pre/post difference in demand was 25, and the median difference was 11. The standard deviation was 33. The distribution of pre/post differences up to 100 kW is shown in the figure below. The mean is larger than the median here because of the spread of larger positive values and the high density of smaller reductions.

Figure 46. Participant Group Pre- and Post-Period Difference



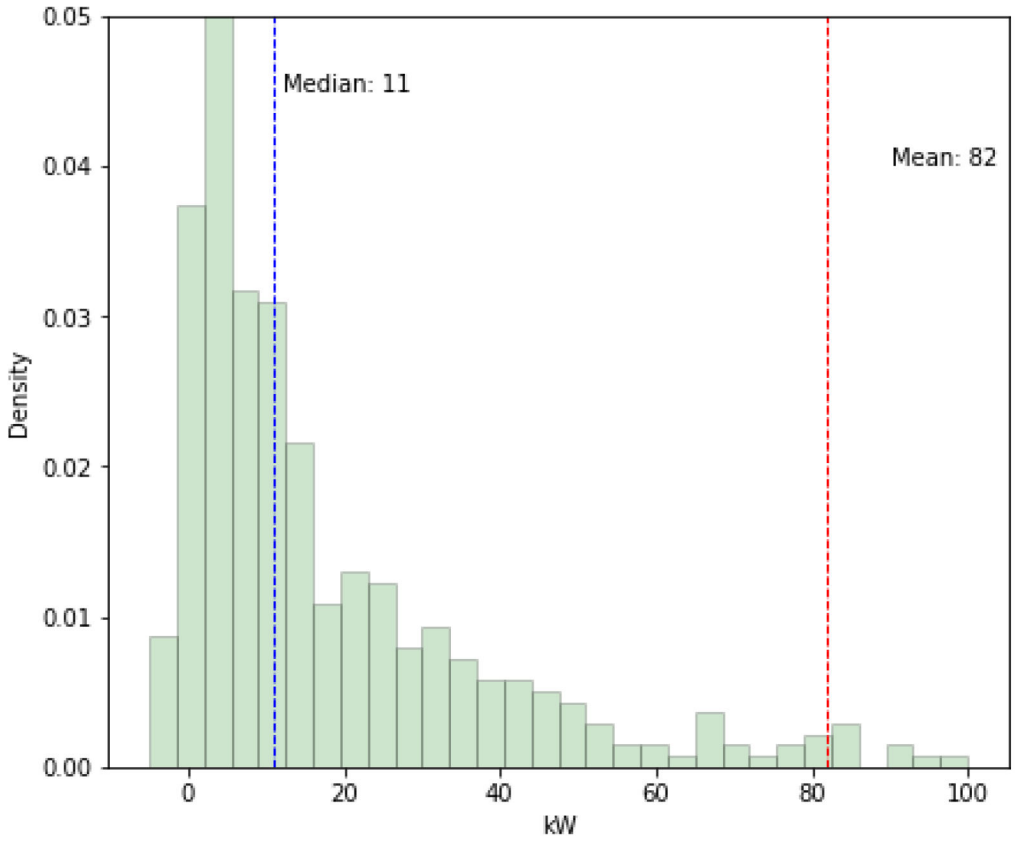
For the comparison group, the annual mean pre/post difference was 36, and the median was 8, with a standard deviation of 237. The distribution of comparison group pre/post differences up to 100 kW is shown in the figure below. The mean and the median are further apart here because of the long tail of high savings accounts over 100 kW. These facilities may have incurred shutdowns during peak demand hours, resulting in a peak demand reduction from non-operation as opposed to energy efficiency during operation.

Figure 47. Comparison Group Pre- and Post-Period Difference



The past participant group had an annual mean pre/post difference of 82, and the median was 11. The standard deviation was 609, indicating large variability similar to the comparison group and exacerbated because of the small number of meters in the analysis group. The distribution of past participant group pre- and post-differences up to 100 kW is shown in the figure below. Again there is a long tail of high savings above 100 kW that indicates past participants may have incurred shutdowns during the peak demand hours, creating a peak demand reduction resulting from non-operation as opposed to energy efficiency during operation.

Figure 48. Past Participant Group Pre- and Post-Period Differences



Similar to the annual KWh consumption analysis of the past participant group, this group showed similar results to the comparison group with more significant variability. Therefore this group was removed from the consumption analysis.

The figures above show that the participant group had a lower mean peak demand reduction than the comparison group. However, the comparison group was skewed by large peak demand reduction indicative of shutdowns over the peak demand period. The distribution of the participant group is much more compact and with a much lower density on zero peak demand reduction, indicating the peak demand reduction of the participant group is a result of energy-efficient treatment during operation. In contrast, the comparison group results include a higher proportion of facilities that showed a peak demand reduction because of non-operation. These two conditions show that the comparison and participant groups likely reacted differently to the market conditions.

Table 47 provides a more detailed review of the peak demand savings for the participants divided by meter peak demand. The participants consistently showed peak demand reduction equal to about 24 percent of the pre-treatment summer demand. Facilities with a smaller load show a higher proportion of demand reduction because the lighting is a larger portion of their overall demand. Therefore, the project will reduce a higher percentage of the peak demand load.

Table 47. Comparison of Modeled PDPF Peak Demand Savings for Participants

Participant analysis group (pre-treatment summer kW)	n[25]	Average normalized peak energy demand		Average model savings (kW)	Savings as a percentage of summer pre-treatment
		Pre-treatment summer (kW)	Pre-treatment winter (kW)		
Under 20 kW	11	9.04	6.18	3.13	34.6%
20 kW to 200 kW	53	81.96	58.02	21.73	26.5%
Over 200 kW	8	389.71	207.53	82.66	21.2%
All groups total	**72**	**105.01**	**66.71**	**25.66**	**24.4%**

A.10 MODELED SAVINGS AND EX-ANTE PEAK DEMAND SAVINGS

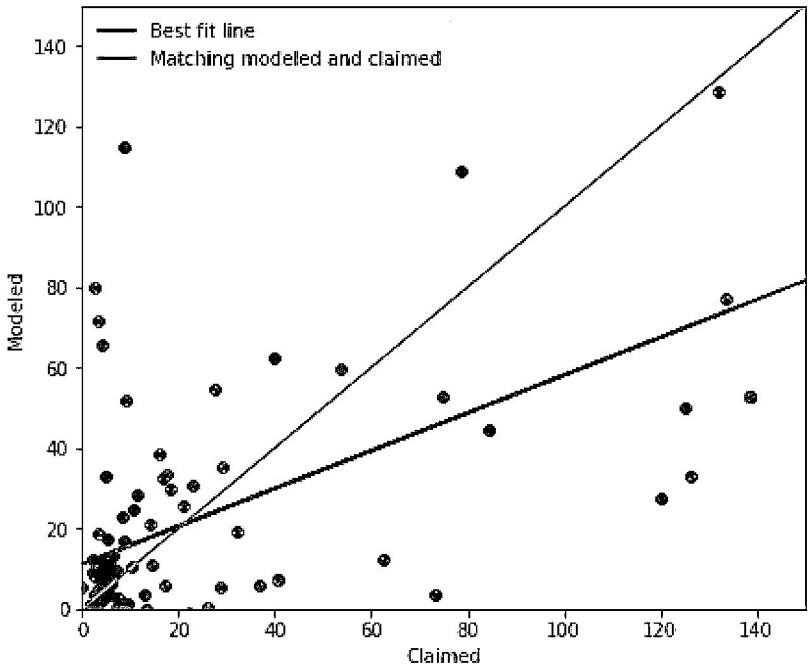
The peak demand is challenging to compare modeled demand reduction to claimed because the claimed value is a sum of the winter or summer periods determined at each lighting fixture and is not available in the tracking data. Therefore, some projects will claim summer or winter savings, but many claim a mix of summer and winter demand. The modeled demand measured the combined impact of all light fixtures in either summer or winter.

The analysis approached the peak demand savings to identify the peak demand reduction between the participants' pre-install and post-install measurement periods. Figure 49 compares the modeled peak demand reduction and the ex-ante claimed peak demand. The modeled savings are below the matching line because of the mismatch between the claimed peak demand process and the consumption measurement.

However, the modeled savings for projects that claimed less than 20 kW demand reduction was greater than expected. As project size increased, the projects became less likely to meet the peak demand. This finding matches the expected pattern of results because the larger projects are more likely to mix summer and winter peak demand in the claimed savings, whereas a smaller project will be more consistent between lighting fixture claims.

[25] The *n* in the participant group is lower for the peak demand analysis because there were several meters where the post-treatment demand model did not provide a viable result.

Figure 49. Modeled and Ex-Ante kW Savings for Participant Group



Public Utility Commission of Texas

FINAL Volume 2. Utility-Specific Energy Efficiency Portfolio Report Program Year 2021

TETRA TECH

TEXAS ENERGY ENGINEERING SERVICES, INC. (www.teesi.com)

November 2, 2022

TETRA TECH

720 Brazos Street, Suite 210, Austin, TX 78701

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GLOSSARY: ACRONYMS/ABBREVIATIONS/DEFINITIONS

Acronym	Description
AC	Air conditioner
AEP Texas	American Electric Power Texas
AHRI	Air Conditioning, Heating, and Refrigeration Institute
CF	Coincidence factor
C&I	Commercial and industrial
CMTP	Commercial market transformation program
CNP	CenterPoint Energy Houston Electric, LLC
CSOP	Commercial standard offer program
DHP	Ductless heat pump
DLC	DesignLights Consortium
DI	Direct install
ECM	Energy conservation measure
EECRF	Energy efficiency cost recovery factor
EEIP	Energy Efficiency Implementation Project
EEPR	Energy Efficiency Plan and Report
EESP	Energy efficiency service provider
EISA	Energy Independence and Security Act of 2007
EM&V	Evaluation, measurement, and verification
Entergy	Entergy Texas, Inc.
EPE	El Paso Electric Company
ER	Early replacement
ERCOT	Electric Reliability Council of Texas
ERS	Emergency Response Service
ESCO	Energy service company
ESIID	Electric service identifier ID
ESNH	ENERGY STAR® New Homes
EUL	Estimated useful life
EUMMOT	Electric Utility Marketing Managers of Texas
GSHP	Ground-source heat pump
HCIF	Heating/cooling interactive factor
HOU	Hours of use

Acronym	Description
HPwES	Home Performance with ENERGY STAR®
HTR	Hard-to-reach
HVAC	Heating, ventilation, and air conditioning
IECC	International Energy Conservation Code
IPMVP	International Performance Measurement and Verification Protocol
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light emitting diode
LI	Low-income
LI/HTR	Low-income/hard-to-reach
LM	Load management
mcf	1,000 cubic feet
MF	Multifamily
MTP	Market transformation program
M&V	Measurement and verification
NTG	Net-to-gross
Oncor	Oncor Electric Delivery Company LLC
PUCT	Public Utility Commission of Texas
PV	Photovoltaics
PY	Program year
QA/QC	Quality assurance/quality control
QPL	Qualified Products List
RCx	Retro-commissioning
RFP	Request for proposal
RMTP	Residential market transformation program
ROB	Replace-on-burnout
RSOP	Residential standard offer program
SIR	Savings-to-investment ratio
SOP	Standard offer program
SRA	Self-report approach
SWEPCO	Southwestern Electric Power Company
TMY	Typical meteorological year
TEESI	Texas Energy Engineering Services, Inc.
TNMP	Texas-New Mexico Power Company

Acronym	Description
TRM	Technical reference manual
WACC	Weighted average cost of capital
Xcel Energy SPS	Xcel Energy Southwest Public Service, Inc.

1.0 INTRODUCTION

This document presents the utility impact evaluation results from the third-party evaluation, measurement, and verification (EM&V) results for energy efficiency portfolios implemented in program year (PY) 2021 (PY2021). It is a companion document to Volume 1 of the Statewide Energy Efficiency Portfolio Report. A summary report, *2021 Energy Efficiency Accomplishments*, is also available at www.puc.texas.gov.

PY2021 is the tenth program year evaluated as part of the statewide EM&V effort. The PY2021 scope is targeted impact evaluations for the savings areas of the highest uncertainty identified in the prior EM&V results or changes in programs or technologies. The targeted impact evaluations are concentrated on particular commercial and residential programs and end-uses. At the same time, a combination of interval meter data analysis and tracking system reviews provides a due diligence review of claimed savings for each utility portfolio.

The reviews provided an independent assessment of claimed savings and the accuracy of the program data. Documentation reviewed were tracking data, interval meter data, project files, energy savings calculations (including a review of input assumptions and algorithms to verify claimed program savings), and utilities' existing measurement and verification (M&V) information.

The PY2021 EM&V plans[1] are based on the prioritization for the EM&V effort. To briefly summarize, the EM&V team identified program types across utilities that have similar program design, delivery, and target markets. We reviewed each program type and prioritized (*high*, *medium*, *low*) based on the following considerations:

- magnitude of savings—the percentage of contribution to the portfolio of programs' impacts,
- level of relative uncertainty in estimated savings,
- level and quality of existing quality assurance/quality control (QA/QC) and verification data from on-site inspections completed by utilities or their contractors,
- stage of the program or programmatic component (e.g., pilot, early implementation, mature),
- importance to future portfolio performance and PUCT and Texas utilities' priorities,
- prior EM&V results, and
- known and anticipated changes in the markets in which the programs operate.

[1] Public Utility Commission of Texas EM&V Plans for Texas Utilities' Energy Efficiency and Load Management Portfolios—Program Year 2021, June 2021.

1.1 REPORT ORGANIZATION

Section 1.2 summarizes the evaluation approach; Sections 2.0 through 9.0 detail the EM&V results for each utility's portfolio.

This report contains several appendices. A visual representation of the EM&V database import, review, and validation process can be found in Appendix A. The calculations used for the program administrator cost test (PACT) (also known as the utility cost test) cost-effectiveness methodology are in Appendix B. The EM&V team's quality assurance plan for the reported evaluated savings is in Appendix C.

Detailed desk reviews are provided to utilities in separate documents.

1.2 EVALUATION APPROACH

This section discusses the PY2021 EM&V methodology. The foundation of the evaluation process was to create a statewide EM&V database with a streamlined data request process and a secure retrieval system. Complete PY2021 program data were requested from utilities and integrated into the database. A visual representation of the EM&V database import, review, and validation process can be found in Appendix A.

The EM&V database allowed the EM&V team to complete:

- due diligence reviews of claimed savings,
- program tracking system reviews; and
- efficient sampling across utilities and programs.

Next, the impact evaluation approach is summarized.

1.2.1 Implementing Impact Evaluations

The impact evaluations are used to calculate realization rates. The realization rate is determined by dividing the evaluated savings by the utility claimed savings. Utility-claimed savings are verified in the EM&V database from the tracking systems.

The EM&V team performed a tracking system review and a series of desk reviews for an initial assessment of the reasonableness of the claimed savings. Primary data were then collected for sampled projects to assess the accuracy of the claimed savings further.

Demand-side management (DSM) program evaluations routinely employ 90 percent confidence intervals with ±10 percent precision as the industry standard ("90/10"). A confidence interval is a range of values believed to contain the true population quantity with some stated level of confidence. The confidence level is the probability that the interval includes the target quantity. Precision provides a convenient shorthand for expressing the interval believed to contain the estimator; for example, if the estimate is 530 kWh, and the relative precision level is ten percent, then the interval is 530 ±53 kWh.

It is essential to provide both the precision and corresponding confidence levels in reporting estimates from a sample. In general, high confidence levels can be achieved with wider intervals, while narrower, more precise intervals permit less confidence. In other words, when all else is held constant, there is a trade-off between precision and confidence. As a result, any precision statement without a corresponding confidence level is incomplete and impossible to interpret. For example, assume the average savings among participants in an appliance program is estimated as 1,000 kWh per year. It is determined this estimate has 16 percent relative precision at the 9 percent confidence level. The same dataset and the same formulas may be used to estimate 10 percent relative precision at the 70 percent confidence level. If the confidence level is not reported, the second formulation would appear less uncertain when the two are identical.

The estimators commonly used in DSM evaluations generally have sampling errors that are approximately normal in distribution. In Texas, EM&V activities were designed to achieve 90/10 confidence and relative precision for gross evaluated savings estimates at the utility portfolio level. This level was achieved via the sampling process used to select a random sample of commercial participants that received desk reviews and census reviews of residential deemed savings and load management savings.

1.2.1.1 Tracking System and Desk Reviews

The EM&V team reviewed the program tracking system and its linkage to any deemed savings tools or methods used to estimate savings at the measure and site level for each residential program. Then for each *medium-* or *high*-priority program, the EM&V team reviewed a sample of applications entered into the utilities' tracking systems for accuracy and completeness.

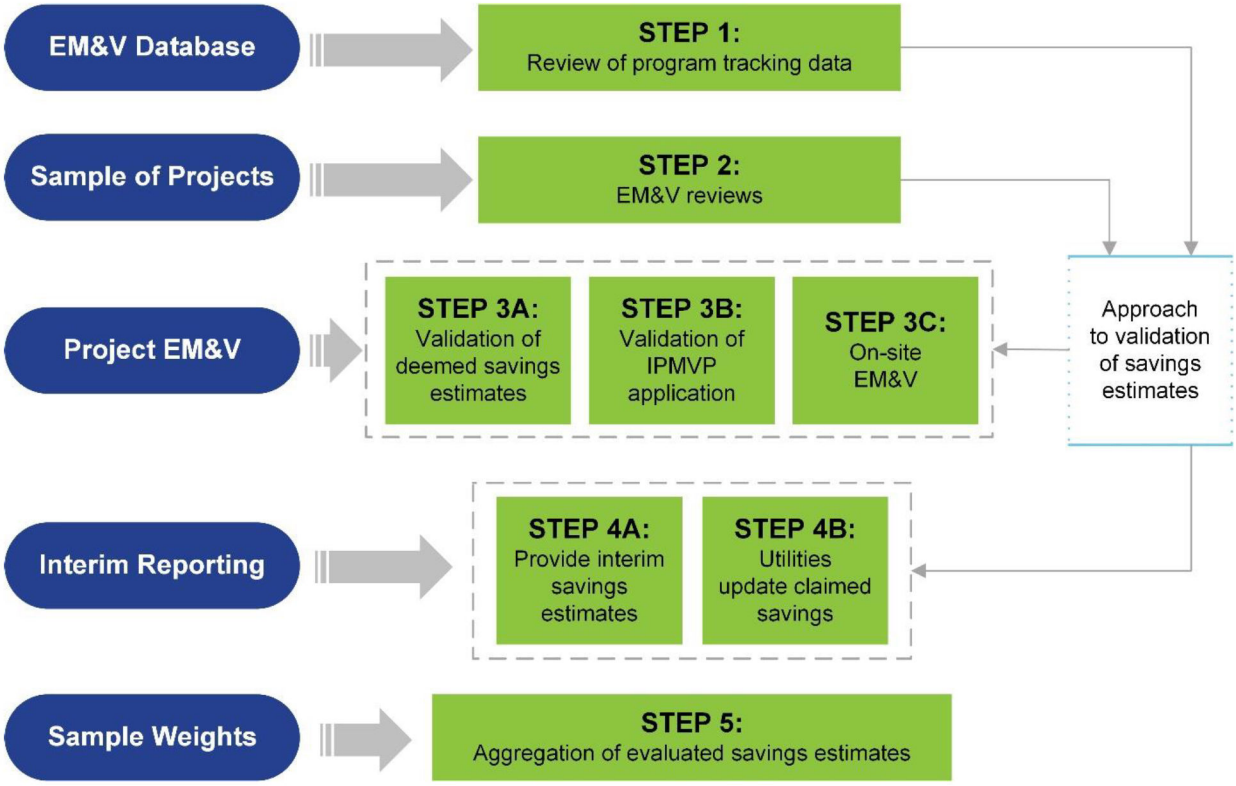
Our review accomplished two primary objectives. First, it ensured that the measures installed were consistent with those listed in the tracking system. Second, the desk reviews verified that the savings estimates in the tracking system were consistent with the savings calculated in the deemed calculation tools, tables, or M&V methods used to estimate project savings.

The desk reviews included a review of the assumptions used for the savings assumptions and, when available, utility M&V reports gathered through the supplemental data request for sampled projects.

1.2.1.2 Realization Rates

The evaluated savings are based on project-level realization rate calculations that are then weighted to represent program-, sector-, and portfolio-level realization rates. These realization rates incorporate any adjustments for incorrect application of deemed savings values, any equipment details determined through the tracking system, desk reviews, and primary data collected by the EM&V team. For example, baseline assumptions or hours of use may be corrected through the evaluation review and thus affect the realization rates. Utilities have the opportunity to adjust claimed savings based on interim findings on their evaluation savings, thereby providing an opportunity for realization rates to be close to 100 percent. A flow chart of the realization rate calculations is provided in Figure 1.

Figure 1. Realization Rate Flowchart



1.2.1.3 Program Documentation Score

The EM&V team assigned a program documentation score of *good*, *fair*, or *limited* based on the level of program documentation provided to complete a third-party due diligence review of claimed savings.

Program documentation scores were assigned as follows:

- **Good:** at least 90 percent of sampled projects have sufficient documentation.
- **Fair:** 70–89 percent of sampled projects have sufficient documentation; the remaining sampled projects had limited or no documentation.
- **Limited:** less than 70 percent of the sampled projects have sufficient documentation.

Sufficient documentation is defined as the necessary information required to verify savings. The documentation included completed savings calculators, customer invoices, pre- and post-inspection reports, and equipment cut sheets for nonresidential programs. The documentation provided all inputs needed to replicate the savings calculations based on the deemed savings manual or the approved calculation method and supporting materials for programs.

Limited documentation is defined as the documentation provided to verify some, but not all, key inputs to savings calculations.

No documentation is defined as only the savings calculator or measure attributes were provided, with no supporting materials.

1.2.2 Cost-Effectiveness Testing

The EM&V team conducted cost-effectiveness testing using the PACT method using PY2021 actual results, except for low-income programs, as discussed below. Cost-effectiveness tests were run using a uniform model for all utilities. The EM&V team collected required inputs for the model from several sources, including program tracking data, deemed savings, the PUCT, and utilities. Table 1 lists the required inputs to the cost-effectiveness model and the sources of information.

Table 1. Cost-Effectiveness Model Inputs and Sources

Model input	Measurement level	Source
Reported energy and demand savings	Measure type	EM&V database
Summer and winter peak coincidence factors (CF)	Measure type	Deemed savings
Effective useful life	Measure type	Deemed savings
Incentive payments	Program	Energy Efficiency Plan and Report (EEPR)
Administrative and research and development (R&D) costs	Program/portfolio	EEPRs
EM&V costs	Program/portfolio	EM&V team budgets
Performance bonus earned in the program year[2]	Portfolio	Energy efficiency cost recovery factor (EECRF)
Avoided costs	Statewide	PUCT (utilities)
Weighted average cost of capital (WACC)	Utility	Utilities
Line loss factor (non-ERCOT[3] utilities only)	Utility	Utilities
Realization rates	Program	Evaluation results

The EM&V team conducted PY2021 cost-effectiveness tests separately using claimed gross savings and evaluated gross savings. The model produces results at the portfolio, program category[4], and program levels.

All benefits and costs are expressed in program year dollars. Benefits resulting from energy savings occurring in future years are net to PY dollars using the utility's WACC as the discount rate.

[2] Performance bonuses as an input into cost-effectiveness testing came into effect in 2012.
[3] Electric Reliability Council of Texas.
[4] Program categories are currently defined as nonresidential, residential, low-income, load management, and pilot.

When running program-level tests, if only portfolio or other grouped information was available, the EM&V team allocated data proportionate to costs (§ 25.182 (e)(6)). For example, the performance bonus was calculated for the overall portfolio and allocated to individual programs proportionate to the programs' costs associated with meeting demand and energy goals. These program costs include program administrative and incentive costs. Portfolio-level costs include the performance bonus, EM&V, administrative, and R&D costs.

Low-income programs were evaluated using the savings-to-investment ratio (SIR). This model only includes net incentive payments under program costs. The SIR methodology is only used when specifically testing the low-income programs.

Portfolio-level cost-effectiveness analyses are based on the PACT and are shown, including and excluding low-income and low-income/hard-to-reach customers.

The calculations used for the PACT cost-effectiveness methodology are in Appendix B.

Also, the EM&V team reported the cost-per-lifetime kilowatt-hour and kilowatt. Cost per lifetime is calculated by attributing costs to energy savings and avoided demand based on their portion of total benefits and applying that proportion to the total program costs.

1.2.3 Reporting

There are two EM&V report deliverables per PY: (1) impact evaluation reports and (2) the Annual Statewide Portfolio Report. There are also a number of status reports, ad hoc reports, data collection and sampling deliverables, and interim results.

The impact evaluation reports are delivered separately for each utility and discussed with the PUCT and each utility before drafting the Annual Statewide Portfolio Report. The impact reports allow the EM&V team to discuss the impact results with the PUCT and utilities, receive their input, and conduct supplemental analysis if needed prior to the Annual Statewide Portfolio Report. The Annual Statewide Portfolio Report is a comprehensive report across all utility portfolios.

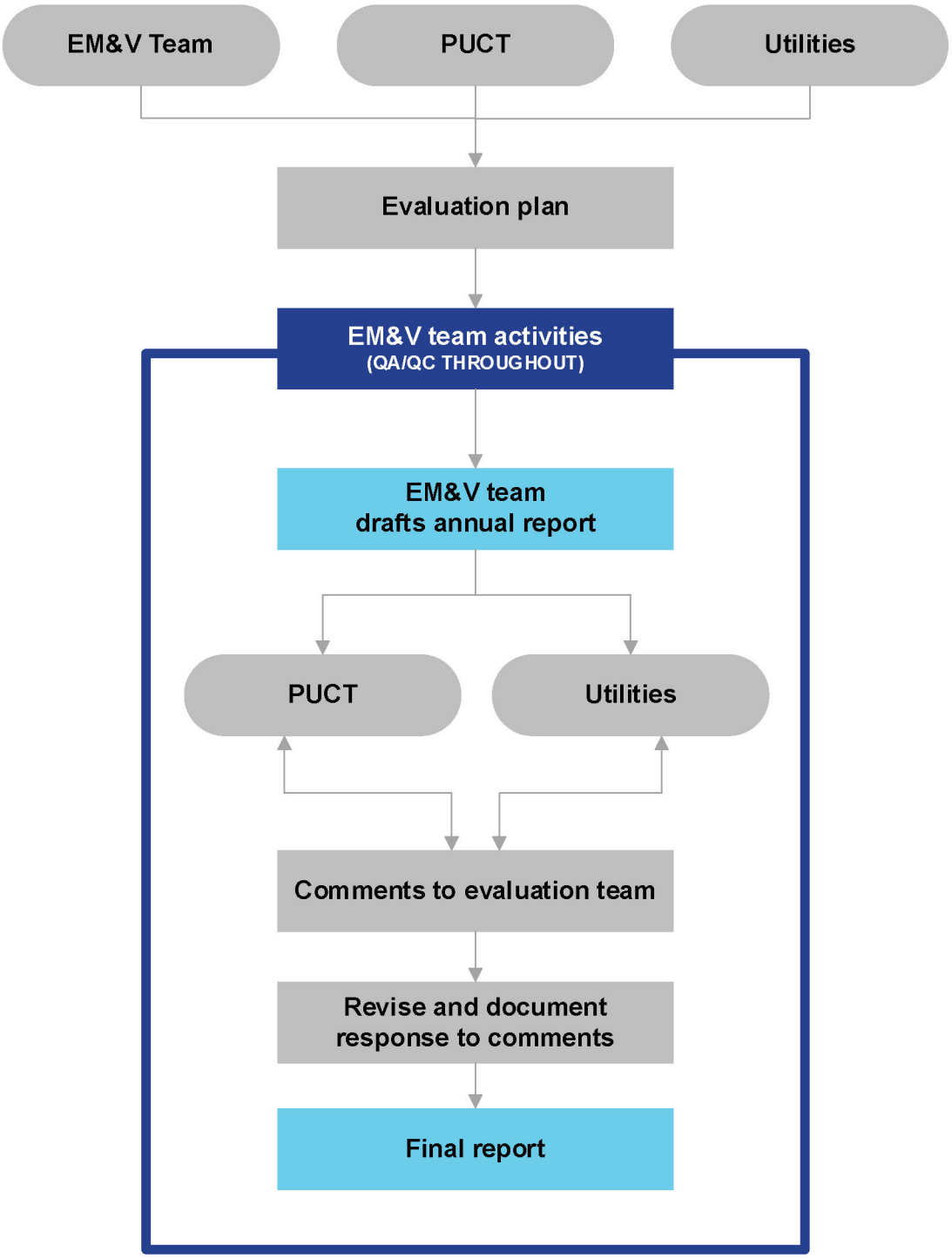
For PY2021, the metrics to be used as the basis for recommendations in the reports are the programs' gross savings realization rate and associated program documentation score; tracking system and interval meter data reviews; desk reviews; on-site M&V findings, including site-specific realization rates; and the programs' cost-effectiveness.

The EM&V database is at the core of reporting results; it houses the claimed and evaluated savings. The database allows structured queries to provide results by utility, program categories and types, measure types, or sectors. QA and QC are conducted to ensure that results entered into and extracted from the database are accurate. The EM&V team's QA/QC plan for the reported evaluated savings is in Appendix C.

The EM&V team encourages feedback and comments on EM&V reports; the EM&V team reviews feedback and documents how it was taken into consideration in finalizing deliverables. While the interim impact reports are distributed and reviewed separately for each utility, the EM&V team seeks input from a larger group of stakeholders on the Annual Statewide Portfolio Report. These are presented and discussed at Energy Efficiency Implementation Project (EEIP) meetings between draft and final versions.

The flow chart in Figure 2 describes the general reporting process flow.

Figure 2. Reporting Flowchart



2.0 AMERICAN ELECTRIC POWER TEXAS IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for American Electric Power Texas's (AEP Texas) energy efficiency portfolio. The key findings are summarized first, followed by details for each portfolio program with a *high* or *medium* evaluation priority. Finally, a list of the *low* evaluation priorities for which claimed savings were verified through the evaluation, measurement, and verification (EM&V) database is included.

2.1 KEY FINDINGS

2.1.1 Evaluated Savings

AEP Texas' evaluated savings for program year (PY) 2021 were 45,307 in demand (kilowatt, kW) and 83,701,765 in energy (kilowatt-hour, kWh) savings. The overall kilowatt and kilowatt-hour portfolio realization rates are approximately 100 percent. AEP Texas was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (see Table 5), supporting healthy realization rates.

Table 2 shows the claimed and evaluated demand savings for AEP Texas's portfolio and broad customer sector and program categories. Load management results are based on census reviews, and therefore precisions calculations are not applicable (N/A).

Table 2. AEP Texas PY2021 Claimed and Evaluated Demand Savings

Level of analysis	Percentage portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Precision at 90% confidence
Total portfolio	**100.0%**	**45,311**	**45,307**	**100.0%**	**N/A**
Commercial	28.8%	13,068	13,068	100.0%	N/A
Residential	20.5%	9,273	9,273	100.0%	N/A
Low-income	2.9%	1,309	1,309	100.0%	N/A
Load management*	47.8%	21,647	21,644	100.0%	N/A
Pilot	0.0%	14	14	100.0%	N/A

*The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

Table 3 shows the claimed and evaluated energy savings for AEP Texas' portfolio and broad customer sector and program categories for PY2021.

Table 3. AEP Texas PY2021 Claimed and Evaluated Energy Savings

Level of analysis	Percentage portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Precision at 90% confidence
Total portfolio	**100.0%**	**83,701,769**	**83,701,765**	**100.0%**	**N/A**
Commercial	60.6%	50,685,236	50,685,236	100.0%	N/A
Residential	36.3%	30,418,168	30,418,168	100.0%	N/A
Low-income	2.9%	2,396,531	2,396,531	100.0%	N/A
Load management*	0.0%	21,647	21,644	100.0%	N/A
Pilot	0.2%	180,186	180,186	100.0%	N/A

* The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

Program-level realization rates are discussed in the detailed findings subsections. However, it is important to note that these results should only be viewed qualitatively due to the small sample sizes at the utility program level.

A program documentation score of *good*, *fair*, or *limited* is included in program-level realization rates, as discussed in Section 1.2.1.3. For the overall utility program documentation score, the score of *good* was given if 90 percent or more of the evaluated savings estimates received a score of *good* or *fair* due to program documentation received as indicated in detailed program findings. A score of *fair* was given if 70 percent to 89 percent of the evaluated savings estimates received a score of *good* or *fair*. A score of *limited* was given if less than 70 percent of savings received a score of *good* or *fair*. In general, a score of *good* indicates the utility has established processes to collect sufficient documentation to verify savings. A score of *fair* also indicates established processes with some areas of improvement identified. A score of *limited* indicates program documentation improvements across more individual programs or high savings programs have been identified. AEP Texas received *good* documentation scores for all evaluated programs, except the Open MTP and Hard-to-Reach SOP, which received a *fair* documentation score.

2.1.2 Cost-Effectiveness Results

AEP Texas' overall portfolio had a cost-effectiveness score of 3.5, or 3.8 excluding low-income programs.

The more cost-effective programs were the SCORE/CitySmart MTP and the Commercial Standard Offer Program (SOP); the less cost-effective programs were the Load Management SOP and the Residential Pool Pump Pilot Market Transformation Program (MTP). All of AEP Texas' programs were cost-effective in 2021.

The lifetime cost of evaluated savings was $0.018 per kWh and $14.49 per kW.

Table 4. AEP Texas Cost-Effectiveness Results

Level of analysis	Claimed savings results	Evaluated savings results	Net savings results
Total portfolio	**3.48**	**3.48**	**3.12**
Total portfolio excluding low-income programs	**3.80**	**3.80**	**3.39**
Commercial	**5.13**	**5.13**	**4.59**
Commercial Solutions MTP	5.30	5.30	4.66
Commercial SOP	6.13	6.13	5.56
SCORE/CitySmart MTP	5.59	5.59	4.92
CoolSaver℠ A/C Tune-Up MTP	5.47	5.47	4.37
SMART Source℠ Solar PV MTP	4.31	4.31	4.35
Open MTP	2.88	2.88	2.73
Residential	**2.81**	**2.81**	**2.48**
Hard-to-Reach SOP	2.55	2.55	2.55
SMART Source℠ Solar PV MTP	5.17	5.17	5.22
Residential SOP	2.36	2.36	2.15
CoolSaver℠ A/C Tune-Up MTP	3.09	3.09	2.47
High-Performance New Homes MTP	3.83	3.83	2.68
Low-income	**1.92**	**1.92**	**1.92**
Targeted Low-Income Weatherization*	1.92	1.92	1.92
Load management	**1.71**	**1.71**	**1.71**
Load Management SOP	1.71	1.71	1.71
Pilot	**1.12**	**1.12**	**0.94**
Residential Pool Pump Pilot MTP	1.12	1.12	0.94

* The low-income program is evaluated using the savings-to-investment ratio (SIR).

2.2 CLAIMED SAVINGS ADJUSTMENTS

As discussed above, utilities are provided the opportunity to adjust savings at the project level based on interim EM&V findings. Table 5 summarizes claimed savings adjustments recommended by the EM&V team. Realization rates assume the following adjustments will be included in AEP Texas' June 1 filing. There may be differences between evaluated and claimed savings that did not result in a recommended adjustment because the difference is less than five percent.

Table 5. Evaluation, Measurement, and Verification Claimed Savings Adjustments by Program (Prior to EECRF[5] Filing)

Program	EM&V demand claimed savings adjustments (kW)	EM&V energy claimed savings adjustments (kWh)
Commercial Solutions MTP	-5.40	-17,998.30
Commercial SOP	-1.20	-10,488.00
Open MTP	-0.20	-2,912.30
SCORE/CitySmart MTP	-80.00	70,946.00
Hard-to-Reach SOP	0.00	171.40
Targeted Low-Income Weatherization	0.20	-46.90
Residential SOP	0.10	17.00
Total	**-86.50**	**39,688.90**

2.3 DETAILED FINDINGS—COMMERCIAL

2.3.1 Commercial Solutions Market Transformation Program (MTP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
3.6%	1,650	1,650	100.0%	9.1%	7,631,163	7,631,163	100.0%	Good

Completed desk reviews*	On-site M&V visit
8	4

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Commercial Solutions MTP evaluation efforts focused on desk reviews and on-site M&V visits. This program's sample of completed desk reviews and on-site M&V visits is listed above.

The EM&V team adjusted the claimed savings for four of the projects. Two projects had less than five percent adjustments, while two projects had adjustments of greater than five percent compared to the originally claimed savings. AEP Texas accepted the evaluated results and matched the claimed savings to those of the evaluations for the four projects; therefore, the final program realization rate is 100 percent for kilowatt and kilowatt-hour. Further details of the EM&V findings are provided below.

[5] Energy efficiency cost recovery factor.

Participant ID 1387850: The energy efficiency project included interior LED lighting retrofits of a retail store. During the desk review and on-site M&V visit, the EM&V team adjusted the air conditioning type for a few line items from *refrigerated air* to *none,* based on on-site observations. Several adjustments to lighting quantities were also made, along with the wattage of one light to match the DesignLights Consortium (DLC) Qualified Products List (QPL). These adjustments decreased peak demand (kilowatt) savings slightly and resulted in a realization rate of 99 percent. The adjustments also decreased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Participant ID 1388570: The energy efficiency project included interior and exterior LED lighting retrofits of a retail store. During the desk review, the EM&V team adjusted the air conditioning type for the walk-in cooler areas from *refrigerated air* to *medium temperature refrigeration*, based on the post-retrofit photographs. This adjustment increased peak demand (kilowatt) savings slightly but resulted in a realization rate that rounded to 100 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 101 percent.

Participant ID 1477936: The energy efficiency project included interior and exterior LED lighting retrofits of a retail store. During the desk review and on-site M&V visit, the EM&V team adjusted the wattages of one light to match the DLC QPL and the quantities of exterior lighting fixtures based on on-site observations. These adjustments increased peak demand (kilowatt) savings and resulted in a realization rate of 104 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 108 percent.

Participant ID 1478080: The energy efficiency project installed and optimized controllers and a building automation system at an office. During the desk review, the EM&V team identified that the participant installed a prescribed energy efficiency project in the post-install measurement period and removed the pro-rated energy savings claimed by that project from the identified measured savings. Also, the analysis of the energy savings was adjusted to a custom calculation method which better estimated savings than the measurement and verification method in Volume 4 of the TRM. These two adjustments decreased peak demand (kilowatt) savings and resulted in a realization rate of 88 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 22 percent.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, Qualified Products List (QPL) qualifications) for the eight projects that had desk reviews completed because sufficient documentation was provided for the sites. These were regular lighting projects where documentation included invoices, QPL qualifications, equipment specifications, pre-install and post-install inspection notes, project savings calculators, and photographic documentation of existing and new equipment. The measurement and verification project provided sufficient documentation to identify energy savings through alternate methods. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of *good*.

2.3.2 Commercial Standard Offer Program (SOP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate(kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
7.0%	3,184	3,184	100.0%	22.0%	18,413,777	18,413,777	100.0%	Good

Completed desk reviews*[6]	On-site M&V visit
8	4

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Commercial SOP evaluation efforts focused on desk reviews and on-site M&V visits. This program's sample of completed desk reviews and on-site M&V visits is listed above.

The EM&V team adjusted the claimed savings for four projects. All four projects had less than five percent adjustments compared to the originally claimed savings. AEP Texas accepted the evaluated results and matched the claimed savings to those of the evaluations for both projects; therefore, the final program realization rate is 100 percent for kilowatt and kilowatt-hour. Further details of the EM&V findings are provided below.

Participant ID 1472346: The energy efficiency project involved the installation of LED lighting and HVAC equipment at a new construction K–12 school. During the desk review, the EM&V team adjusted the cooling capacities of the installed HVAC units to match the capacities on the Air Conditioning, Heating, and Refrigeration Institute (AHRI) certifications QPL. The fixture wattages for lighting fixtures within the building were also adjusted to match the DLC QPL. These adjustments slightly increased peak demand (kilowatt) savings but in a realization rate that rounded to 100 percent. The adjustments decreased energy (kilowatt-hour) savings and resulted in a realization rate of 99 percent.

Participant ID 1472625: The energy efficiency project included interior and exterior LED retrofits at a distribution center. During the desk review and on-site M&V visit, the EM&V team adjusted the fixture wattages for two light fixtures to match the DLC QPL. These adjustments slightly increased peak demand (kilowatt) savings but in a realization rate that rounded to 100 percent. The adjustments also slightly increased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Participant ID 1488669: The energy efficiency project included interior and exterior LED retrofits at a warehouse facility. During the desk review and on-site M&V visit, the EM&V team adjusted the fixture wattages for two light fixtures to match the DLC QPL. In addition, lighting controls were adjusted based on on-site observations. These adjustments decreased peak demand (kilowatt) savings and in a realization rate of 98 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 97 percent.

[6] Two projects were located on the same campus and were sampled separately, although are reported under one EM&V participant.

Participant ID 1489610: The energy efficiency project installed LED lighting and energy-efficient HVAC equipment at a new construction school and soccer facility. During the desk review, the EM&V team adjusted the full-load and part-load efficiency ratings to match AHRI certifications. In addition, the lighting wattages for one lighting fixture were adjusted to match the DLC QPL. These adjustments slightly decreased peak demand (kilowatt) savings but in a realization rate that rounded to 100 percent. The adjustments increased energy (kilowatt-hour) savings and resulted in a realization rate of 101 percent.

Documentation Score

The EM&V team verified key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications) for both projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation at these sites included invoices, QPL qualifications, pre-install and post-install inspection notes, project savings calculators, and photographic documentation of existing and new equipment. Complete documentation enhances the accuracy and transparency of project savings along with ease of evaluation. Overall, the EM&V team assigned a program documentation score of *good*.

2.3.3 SCORE/CitySmart Market Transformation Program (MTP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
5.0%	2,284	2,284	100.0%	11.5%	9,645,175	9,645,175	100.0%	Good

Completed desk reviews*	On-site M&V visit
6	3

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 SCORE/CitySmart MTP evaluation efforts focused on desk reviews and on-site M&V visits. This program's sample of completed desk reviews and on-site M&V visits is listed above.

The EM&V team adjusted the claimed savings for two projects. One project had an adjustment of greater than five percent, while the other project had an adjustment of less than five percent compared to the originally claimed savings. AEP Texas accepted the evaluated results and matched the claimed savings to those of the evaluations for the projects with significant adjustments. Therefore, the final program realization rate is 100 percent for kilowatt and kilowatt-hour. Further details of the EM&V findings are provided below.

Participant ID 1387915: The energy efficiency project was the second claim on a project to adjust the thermostats and building automation system programming at a junior high school. During the desk review and on-site M&V visit, the EM&V team found that the installed project saved energy, although not as much as originally expected. The EM&V team identified energy (kilowatt-hour) savings which increased the energy savings from zero to 70,775 kWh. The PY2020 claimed peak energy savings equaled the maximum savings calculated; therefore, the PY2021 peak demand (kilowatt) savings was reduced to zero kW, resulting in a zero percent realization rate.

Participant ID 1501000: The energy efficiency project included interior and exterior LED retrofits at an elementary school and administration office. During the desk review, the EM&V team adjusted the air conditioning type for an interior fixture in a walk-in cooler from *refrigerated air to medium temperature refrigeration (33 to 41ºF)* to match the building area descriptions. These adjustments slightly increased peak demand (kilowatt) savings but in a realization rate that rounded to 100 percent. The adjustments also slightly increased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, Air Conditioning, Heating, and Refrigeration Institute (AHRI) certifications) for all the projects that had desk reviews because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications, equipment specifications, pre-install and post-install inspection notes, project savings calculators, and photographic documentation of existing and new equipment, which are significant efforts by the utility to verify equipment conditions and quantities. The M&V data was easily identified and supported with reporting to determine the impact of various activities. Complete documentation enhances the accuracy and transparency of project savings along with ease of evaluation. Overall, the EM&V team assigned a program documentation score of *good*.

2.3.4 Open Market Transformation Program (MTP) (Medium Evaluation Priority)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
2.7%	1,216	1,216	100.0%	6.1%	5,117,185	5,117,185	100.0%	Fair

Completed desk reviews*	On-site M&V visit
8	4

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Open MTP evaluation efforts focused on desk reviews and on-site M&V visits. This program's sample of completed desk reviews and on-site M&V visits is listed above.

The EM&V team adjusted the claimed savings for six projects. One project had adjustments of greater than five percent, while five projects had adjustments of less than five percent compared to the originally claimed savings. AEP Texas accepted the evaluated results and matched the claimed savings to those of the evaluations for the projects with significant adjustments. Therefore, the final program realization rate is 100 percent for kilowatt and kilowatt-hour. Further details of the EM&V findings are provided below.

Participant ID 1385222: The energy efficiency project included interior and exterior LED lighting retrofits at a dental facility. During the desk review and on-site M&V visit, the EM&V team adjusted the building type from *office* to *health care: outpatient* because the dental office has diagnostic and laboratory equipment. This adjustment decreased peak demand (kilowatt) savings and in a realization rate of 87 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 92 percent.

Participant ID 1385334: The energy efficiency project included interior LED lighting retrofits at a retail enclosed strip mall and warehouse. During the desk review, the EM&V team adjusted the building type from *warehouse: non-refrigerated* and *retail: all non-24 hour retail excluding mall and strip* to *service: excluding food* based on the photos showing the warehouse was a service facility to refurbish trailers, and the office was supporting the service area. This adjustment increased peak demand (kilowatt) savings and resulted in a realization rate of 109 percent. The adjustments decreased energy (kilowatt-hour) savings and resulted in a realization rate of 97 percent.

Participant ID 1387841: The energy efficiency project included interior LED lighting retrofits at an office and industrial warehouse. During the desk review, the EM&V team adjusted the wattage of light fixtures to match the DLC QPL. These adjustments slightly decreased peak demand (kilowatt) savings but resulted in a realization rate that rounded to 100 percent. The adjustments also slightly decreased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Participant ID 1388321: The energy efficiency project included air infiltration measures at a retail strip mall. During the desk review and on-site M&V visit, the EM&V team adjusted the gap widths and door seal lengths based on on-site observations. These adjustments slightly decreased peak demand (kilowatt) savings but resulted in a realization rate that rounded to 100 percent. The adjustments also slightly decreased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Participant ID 1388427: The energy efficiency project included interior LED lighting retrofits at a retail store. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of one light fixture to match the DLC QPL. This adjustment increased peak demand (kilowatt) savings and resulted in a realization rate of 101 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 101 percent.

Participant ID 1477673: The energy efficiency project included interior LED lighting retrofits at a retail store. During the desk review, the EM&V team adjusted the wattage of one light fixture to match the DLC QPL. These adjustments slightly decreased peak demand (kilowatt) savings but in a realization rate that rounded to 100 percent. The adjustments also slightly decreased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Documentation Score

The EM&V team was unable to verify key inputs and assumptions for several projects in this program. Missing documentation included post-install inspection notes, equipment specification sheets, and DLC certifications. The building shell projects also were missing the calculation sheets and key assumptions and received a limited documentation score. Overall, the photo quality was acceptable, although one project had poor photos, which made verification difficult in the absence of post-inspection notes. Complete documentation enhances the accuracy and transparency of project savings along with ease of evaluation. Overall, the EM&V team assigned a program documentation score of *fair*.

2.4 DETAILED FINDINGS—RESIDENTIAL

2.4.1 Residential Standard Offer Program (SOP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
6.5%	2,963	2,963	100.0%	16.8%	14,095,317	14,095,317	100.0%	Good

Completed desk reviews*
8

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Residential SOP evaluation efforts focused on desk reviews. The number of completed desk reviews for this program is listed above. Six desk reviews were completed to check that measure data and documentation collected by contractors aligned correctly with that in the tracking system, and savings were calculated in accordance with the TRM.

The EM&V team adjusted the claimed savings for two projects. Both projects had less than five percent adjustments compared to the originally claimed savings. AEP Texas accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects. Therefore, the final program realization rate is 100 percent for kilowatt and kilowatt-hour. Further details of the EM&V findings are provided below.

Participant ID 1470518: The project included the installation of a low-flow showerhead, LED lighting, air purifier, advanced powerstrip, and duct sealing. During the desk review, the EM&V team found that the tracked 1 gallon per minute (GPM) flow rate did not match the 1.5 GPM flow rate in the documentation. The EM&V team adjusted the flow rate resulting in a decrease in savings. Overall, the adjustments resulted in project-level realization rates of 96.0 percent and 97.1 percent for demand and energy savings, respectively.

Participant ID 1489702: The project included the installation of a new central air conditioner system. During the desk review, the EM&V team found that the tracked age of equipment, 18 years, did not match the 16 years in the documentation. The EM&V team adjusted the age of existing equipment resulting in a slight increase in savings. Overall, the adjustments resulted in project-level realization rates of 104.6 percent and 103.4 percent for demand and energy savings, respectively.

Documentation Score

The EM&V team was able to verify key inputs and assumptions, including the project scope, baselines, and equipment specifications for all sampled projects that had desk reviews. Project documentation included customer agreement, photos, specification sheets, certifications, and field notes. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of *good*.

2.4.2 Hard-to-Reach Standard Offer Program (SOP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
5.0%	2,277	2,277	100.0%	5.9%	4,931,719	4,931,719	100.0%	Fair

Completed desk reviews*	Completed on-site M&V
6	3

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Hard-to-Reach SOP evaluation efforts focused on desk reviews and on-site M&V. The number of sampled and completed desk reviews and site visits for this program are listed above.

Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

- For a sample of projects, desk reviews were completed to ensure that data and documentation collected by contractors aligned correctly with that in the tracking system, and savings were calculated per the TRM.
- On-site M&V was completed for a sample of projects to verify that measures remained installed and matched project documentation.

The EM&V team adjusted the claimed savings for one project. The project had less than five percent adjustments compared to the originally claimed savings. AEP Texas accepted the evaluated results and matched the claimed savings to those of the evaluations for the one project. Therefore, the final program realization rate is 100 percent for kilowatt and kilowatt-hour. Further details of the EM&V findings are provided below.

Participant ID 1489296: The project included the installation of LED lighting, advanced power strip, air infiltration, and duct sealing. During the desk review, the EM&V team found that the tracked 5 watts lighting efficiency did not match the 9 watts lighting efficiency in the documentation. The EM&V team adjusted the wattage and resulting in an increase in savings. Overall, the adjustments resulted in project-level realization rates of 102.3 percent and 106.7 percent for demand and energy savings, respectively.

Documentation Score

With desk reviews, the EM&V team verified some key inputs and assumptions, including the project scope, baselines, and equipment specifications for all sampled projects. Project documentation included customer agreement, photos, and field notes. There was limited documentation for direct installs such as LEDs and low-flow showerheads. Overall, the EM&V team was mostly satisfied with the project documentation provided and assigned a program documentation score of *fair.*

2.5 DETAILED FINDINGS—LOW-INCOME

2.5.1 Targeted Low-Income Energy Efficiency Program

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
2.9%	1,309	1,309	100.0%	2.9%	2,396,531	2,396,531	100.0%	Good

Completed desk reviews*	Completed on-site M&V
3	2

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Target Low-Income evaluation efforts focused on desk reviews and on-site M&V. The number of sampled and completed desk reviews and site visits for this program are listed above.

Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

- For a sample of projects, desk reviews were completed to ensure that data and documentation collected by contractors aligned correctly with that in the tracking system, and savings were calculated per the TRM.
- On-site M&V was completed for a sample of projects to verify that measures remained installed and matched project documentation.

The EM&V team adjusted the claimed savings for three projects. The projects had less than five percent adjustments compared to the originally claimed savings. AEP Texas accepted the evaluated results and matched the claimed savings to those of the evaluations for all three projects. Therefore, the final program realization rate is 100 percent for kilowatt and kilowatt-hour. Further details of the EM&V findings are provided below.

Participant ID 1454745: The project included the installation of a new central heat pump system. During the desk review, the EM&V team found that the tracked age of equipment, 11 years, did not match the 10 years in the documentation. The EM&V team also found that the tracked SEER and HSPF efficiencies did not match the documentation. The EM&V team adjusted the age of existing equipment resulting in a slight increase in savings and efficiency of new equipment resulting in a slight decrease in savings. Overall, the adjustments resulted in project-level realization rates of 104.1 percent and 99.6 percent for demand and energy savings, respectively.

Participant ID 1454746: The project included the installation of a new central heat pump system. During the desk review, the EM&V team found that the ex-ante savings were calculated using the default remaining useful life value for an existing heat pump system. However, when the existing system is an air conditioner, the default remaining useful life for an air conditioner system should be used. The EM&V team adjusted the remaining useful life in the ex-post calculation resulting in a slight increase in savings. Overall, the adjustments resulted in project-level realization rates of 100.0 percent and 101.2 percent for demand and energy savings, respectively.

Participant ID 1454780: The project included the installation of a new central heat pump system. During the desk review, the EM&V team found that the tracked age of equipment did not match the age of equipment in the documentation. The EM&V team adjusted the age of equipment in the ex-post calculation resulting in a slight decrease in savings. Overall, the adjustments resulted in project-level realization rates of 100.0 percent and 98.7 percent for demand and energy savings, respectively

Documentation Score

The EM&V team was able to verify key inputs and assumptions, including the project scope, baselines, and equipment specifications for all sampled projects that had desk reviews. Project documentation included customer agreement, photos, specification sheets, certifications, and field notes. Documentation also included low-income certification. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of *good.*

2.6 DETAILED FINDINGS—LOAD MANAGEMENT (MEDIUM EVALUATION PRIORITY)

2.6.1 Load Management Standard Offer Program (SOP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
47.8%	21,647	21,644	100.0%	0.0%	21,647	21,644	100.0%	Good

Completed desk reviews*
N/A

*The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

The EM&V team evaluated the AEP Texas Load Management SOP by applying the technical reference manual (TRM) calculation methodology to interval meter data. The meter data was supplied in 30-minute increments. Load management events in PY2021 occurred on the following dates and times:

- May 27, 2021, from 3:30 p.m. to 4:30 p.m. (scheduled);
- August 20, 2021, from 1:00 p.m. to 2:00 p.m. (scheduled); and
- August 20, 2021, from 5:30 p.m. to 6:30 p.m. (scheduled).

The EM&V team received the interval meter data and a spreadsheet that summarized the event-level savings for the ten sponsors across 89 sites. Thirteen sites did not have any load data associated with them across the scheduled events. All sponsors had at least one site that curtailed during each event.

Since no unscheduled events were called in PY2021, AEP Texas calculated kilowatt savings for each site by applying the kilowatt reduction during the scheduled or test event (each site participated in only one scheduled event). After the EM&V team applied the High 5 of 10 baseline calculation method, it was found that the evaluated savings matched the savings TNMP provided for all sites. The kilowatt savings for each participating site corresponded to the energy reduced during the scheduled event. The kilowatt-hour savings for each participating site were calculated by multiplying the kilowatt reductions by the total number of event hours. Program-level savings were calculated by adding all site-level savings.

The table above shows both the EM&V team (evaluated) and AEP Texas's (claimed) calculated kilowatt and kilowatt-hour savings. No adjustments were made to the program savings; however, a negligible difference in kilowatt and kilowatt-hour was a result of different rounding practices during calculations. Evaluated savings for the TNMP Load Management SOP are 21,644 kW and 21,644 kWh. The realization rate for both kilowatt and kilowatt-hour is 100 percent, with a documentation score of *good*.

2.7 SUMMARY OF LOW EVALUATION PRIORITY PROGRAMS

Table 6 summarizes claimed savings for AEP Texas' *low* evaluation priority programs in PY2021, including the programs' overall contribution to portfolio savings. *Low*-priority programs' claimed savings were verified against the final PY2021 tracking data provided to the EM&V team for the EM&V database.

Table 6. PY2021 Claimed Savings (Low Evaluation Priority Programs)

Program	Contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)
CoolSaver℠ A/C Tune-Up MTP (Commercial)	9.9%	4,497	4,497	100.0%	10.8%	9,015,723	9,015,723	100.0%
SMART Source℠ Solar PV MTP (Commercial)	0.5%	237	237	100.0%	1.0%	862,214	862,214	100.0%
High-Performance New Homes MTP	5.0%	2,266	2,266	100.0%	3.9%	3,248,011	3,248,011	100.0%
CoolSaver℠ A/C Tune-Up MTP (Residential)	2.9%	1,299	1,299	100.0%	7.8%	6,540,544	6,540,544	100.0%
SMART Source℠ Solar PV MTP (Residential)	1.0%	468	468	100.0%	1.9%	1,602,578	1,602,578	100.0%
Residential Pool Pump Pilot MTP	0.0%	14	14	100.0%	0.2%	180,186	180,186	100.0%

3.0 CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for CenterPoint Energy Houston Electric, LLC's (CenterPoint) energy efficiency portfolio. The key findings are summarized first, followed by details for each program in the portfolio that had a *high* or *medium* evaluation priority. Finally, a list of the *low* evaluation priorities for which claimed savings were verified through the evaluation, measurement, and verification (EM&V) database is included.

3.1 KEY FINDINGS

3.1.1 Evaluated Savings

CenterPoint's evaluated savings for program year (PY) 2021 were 211,967 in demand (kilowatt, kW) and 235,257,088 in energy (kilowatt-hour, kWh) savings. The overall kilowatt and kilowatt-hour portfolio realization rates are approximately 100 percent. CenterPoint was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (see Table 10), supporting healthy realization rates.

Table 7 shows the claimed and evaluated demand savings for CenterPoint's portfolio and broad customer sector and program categories. Residential and Load management results are based on census reviews, and therefore precisions calculations are not applicable (N/A).

Table 7. CenterPoint PY2021 Claimed and Evaluated Demand Savings

Level of analysis	Percentage portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Precision at 90% confidence
Total portfolio	**100.0%**	**211,966**	**211,967**	**100.0%**	**N/A**
Commercial	11.4%	24,177	24,177	100.0%	N/A
Residential	13.2%	27,987	27,987	100.0%	N/A
Low-income	2.2%	4,765	4,765	100.0%	N/A
Load management*	73.1%	155,037	155,038	100.0%	N/A
Pilot	0.0%	0	0	0.0%	N/A

* The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

Table 8 shows the claimed and evaluated energy savings for CenterPoint's portfolio and broad customer sector and program categories for PY2021.

Table 8. CenterPoint PY2021 Claimed and Evaluated Energy Savings

Level of analysis	Percentage portfolio savings (kWh)	Claimed energy savings(kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Precision at 90% confidence
Total portfolio	**100.0%**	**235,257,091**	**235,257,088**	**100.0%**	**N/A**
Commercial	51.2%	122,173,308	122,173,308	100.0%	N/A
Residential	45.2%	103,085,644	103,085,644	100.0%	N/A
Low-income	3.2%	9,068,201	9,068,201	100.0%	N/A
Load management*	0.4%	929,938	929,935	100.0%	N/A
Pilot	0.0%	0	0	0.0%	N/A

* The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

Program-level realization rates are discussed in the detailed findings subsections. However, it is important to note that these results should only be viewed qualitatively due to the small sample sizes at the utility program level.

A program documentation score of *good*, *fair*, or *limited* is included in program-level realization rates, as discussed in Section 1.2.1.3. For the overall utility program documentation score, the score of *good* was given if 90 percent or more of the evaluated savings estimates received a score of *good* or *fair* due to program documentation received as indicated in detailed program findings. A score of *fair* was given if 70 percent to 89 percent of the evaluated savings estimates received a score of *good* or *fair*. A score of *limited* was given if less than 70 percent of savings received a score of *good* or *fair*. In general, a score of *good* indicates the utility has established processes to collect sufficient documentation to verify savings. A score of *fair* also indicates established processes with some areas of improvement identified. A score of *limited* indicates program documentation improvements across more individual programs or high savings programs have been identified. CenterPoint received *good* documentation scores for all evaluated programs, except the Smart Source Solar PV MTP, which received a *fair* documentation score.

3.1.2 Cost-Effectiveness Results

CenterPoint's overall portfolio had a cost-effectiveness score of 4.2, or 4.5 excluding low-income programs.

The more cost-effective programs were Advanced Lighting (both commercial and residential) and CenterPoint Energy High Efficiency Home MTP; the less cost-effective programs were Multi-Family MTP Hard-to-Reach and Commercial High Efficiency Foodservice MTP (Pilot). All of CenterPoint's programs were cost-effective in 2021.

The lifetime cost of evaluated savings was $0.015 per kWh and $12.48 per kW.

Table 9. CenterPoint Cost-Effectiveness Results

Level of analysis	Claimed savings results	Evaluated savings results	Net savings results
Total portfolio	**4.19**	**4.19**	**3.39**
Total portfolio excluding low-income programs	**4.53**	**4.53**	**3.62**
Commercial	**4.69**	**4.69**	**4.17**
Commercial Standard Offer Program	6.18	6.18	5.61
Commercial High Efficiency Foodservice MTP (Pilot)	1.09	1.09	0.87
Commercial MTP (SCORE, Healthcare, Data Center)	3.97	3.97	3.48
Retro-Commissioning MTP	2.10	2.10	1.89
REP MTP (Commercial CoolSaver)	4.34	4.34	3.48
Advanced Lighting Commercial MTP	13.41	13.41	6.71
Residential	**5.55**	**5.55**	**3.85**
Residential & Small Commercial Standard Offer Program	4.44	4.44	4.03
Smart Thermostat Program	4.46	4.46	3.75
Advanced Lighting Residential MTP	13.41	13.41	6.71
Midstream MTP (HVAC and Pool Pump Distributor)	3.37	3.37	2.69
REP MTP (Residential CoolSaver and Efficiency Connection)	2.19	2.19	1.76
Multi-Family MTP Market Rate	4.31	4.31	3.45
CenterPoint Energy High Efficiency Home MTP	6.59	6.59	4.61
Hard-to-Reach Standard Offer Program	2.01	2.01	2.01
Multi-Family MTP Hard-to-Reach	1.07	1.07	1.07
Low-income	**3.06**	**3.06**	**3.06**
Targeted Low-Income MTP (Agencies in Action)*	3.06	3.06	3.06
Load management	**1.56**	**1.56**	**1.53**
Commercial Load Management Standard Offer Program	1.69	1.69	1.69
Residential Load Management Standard Offer Program	1.11	1.11	0.96
Pilot	**-**	**-**	**-**
Smart Home Energy Management System (Pilot)	0	0	0

* The low-income program is evaluated using the savings-to-investment ratio (SIR).

3.2 CLAIMED SAVINGS ADJUSTMENTS

As discussed above, utilities are provided the opportunity to adjust savings at the project level based on interim EM&V findings. Table 10 summarizes claimed savings adjustments recommended by the EM&V team. Realization rates assume the following adjustments will be included in CenterPoint's June 1 filing. There may be differences between evaluated and claimed savings that did not result in a recommended adjustment because the difference is less than five percent.

Table 10. Evaluation, Measurement, and Verification Claimed Savings Adjustments by Program (Prior to EECRF[7] Filing)

Program	EM&V demand claimed savings adjustments (kW)	EM&V energy claimed savings adjustments (kWh)
Commercial MTP (SCORE, Healthcare, Data Center)	-172.01	-924,060.00
Commercial SOP	-108.00	-606,112.00
Targeted Low-Income MTP (Agencies in Action)	0.00	-1,624.28
Residential & Small Commercial SOP	-1.58	225.00
Total	**-281.59**	**-1,531,571.28**

3.3 DETAILED FINDINGS—COMMERCIAL

3.3.1 Commercial Market Transformation Program (MTP) (SCORE, Healthcare, Data Center)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
3.5%	7,365	7365	100.0%	17.9%	42,072,018	42,072,018	100.0%	Good

Completed desk reviews*	On-site M&V visit
20	10

* Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Commercial MTP evaluation efforts focused on desk reviews and on-site M&V visits. This program's sample of completed desk reviews and on-site M&V visits is listed above.

[7] Energy efficiency cost recovery factor.

The EM&V team adjusted the claimed savings for 13 projects. Six adjusted projects had adjustments of greater than five percent compared to the originally claimed savings, while seven projects had minor adjustments of less than five percent compared to the originally claimed savings. CenterPoint accepted the evaluated results and matched the claimed savings to those of the evaluations for the projects with significant adjustments; therefore, the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1440444: The energy efficiency project included the installation of new lighting controls, new LED lighting fixtures, HVAC controls, and HVAC equipment at a middle school. During the desk review, the EM&V team adjusted the calculation methodology to use monthly regression equations for energy savings. In addition, the demand calculation method was adjusted to the *PDPF Top 20 Hours* method in PY2021 TRM 8.0 Volume 1 for demand savings. These adjustments slightly decreased peak demand (kilowatt) savings and resulted in a realization rate of 82 percent. The adjustments increased energy (kilowatt-hour) savings and resulted in a realization rate of 266 percent.

Participant ID 1440451: The energy efficiency project included interior LED retrofits at a high school. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of one light to match the DesignLights Consortium (DLC) Qualified Products List (QPL). This adjustment slightly increased peak demand (kilowatt) savings but resulted in a realization rate that rounded to 100 percent. The adjustments also slightly increased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Participant ID 1440452: The energy efficiency project included interior LED retrofits at a high school. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of one light to match the DLC QPL. This adjustment slightly increased peak demand (kilowatt) savings but resulted in a realization rate that rounded to 100 percent. The adjustments also slightly increased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Participant ID 1534600: The energy efficiency project was installing energy-efficient chillers and computer room air handlers (CRAHs) at a data center. During the desk review, the EM&V team adjusted the cooling load estimate to match the installed equipment. This adjustment decreased peak demand (kilowatt) savings and resulted in a realization rate of 53 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 48 percent.

Participant ID 1534601: The energy efficiency project installed energy-efficient chillers, uninterrupted power units, and computer room air handlers (CRAHs) at a data center. During the desk review, the EM&V team adjusted the estimated cooling load to match the installed equipment. This adjustment decreased peak demand (kilowatt) savings and resulted in a realization rate of 84 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 84 percent.

Participant ID 1534674: The energy efficiency project included interior and exterior LED retrofits at an in-patient hospital. During the desk review, the EM&V team removed several line items of one LED fixture because the post-inspection could not locate the lights. This adjustment decreased peak demand (kilowatt) savings and resulted in a realization rate of 99 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 99 percent.

Participant ID 1534685: The energy efficiency project included central chilling plant optimizations at a large hospital. During the desk review, the EM&V team adjusted the calculation methodology to use the TMY3 data file to determine wet bulb temperature from the relative humidity. This adjustment increased peak demand (kilowatt) savings and resulted in a realization rate of 106 percent. The energy (kilowatt-hour) savings were not adjusted.

Participant ID 1534688: The energy efficiency project included interior LED retrofits at an in-patient hospital. During the desk review, the EM&V team adjusted lighting fixtures from *non-qualified* to *qualified* because they were listed on the DLC QPL. This adjustment decreased peak demand (kilowatt) savings and resulted in a realization rate of 98 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 98 percent.

Participant ID 1536312: The energy efficiency project included the installation of interior and exterior LED lighting at a new construction school auditorium. During the desk review and on-site M&V visit, the EM&V team reduced the gross lighted area to match site observations. The predominant building type was also adjusted from *Education: K-12 with Summer Session, College, University, Vocational, and Day Care* to *Education: K-12 without Summer Session*, based on the post-inspection notes and the site representative. Finally, two fixture wattages were adjusted to match the DLC QPL. These adjustments decreased peak demand (kilowatt) savings and resulted in a realization rate of 65 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 51 percent.

Participant ID 1548524: The energy efficiency project included LED retrofits and HVAC upgrades at a high school. During the desk review, the EM&V team adjusted the calculation methodology to use monthly regression equations for energy savings and to match the *PDPF Top 20 Hours* method in PY2021 TRM 8.0 Volume 1 for demand savings. This adjustment increased peak demand (kilowatt) savings and resulted in a realization rate of 110 percent. The energy (kilowatt-hour) savings was not adjusted.

Participant ID 1548568: The energy efficiency project included interior and exterior LED retrofits at a parking garage. During the desk review, the EM&V team adjusted the lighting controls from *multiple controls* to *occupancy* because documentation of daylight on/off sensors with the occupancy sensors could not be located, and post-install inspection photos showed lighting fixtures being on during the daytime. This adjustment decreased peak demand (kilowatt) savings and resulted in a realization rate of 97 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 97 percent.

Participant ID 1548583: The energy efficiency project included exterior LED retrofits at a school district transportation facility. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of one light to match the DLC QPL. This adjustment slightly increased peak demand (kilowatt) savings but resulted in a realization rate that rounded to 100 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 104 percent.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications) for the 20 projects that had desk reviews because sufficient documentation was provided for the sites. Project documentation included M&V plans, invoices, QPL qualifications, pre-inspection and post-inspection notes, project savings calculators, and photographic documentation of existing and new equipment, which are significant efforts by the utility to verify equipment conditions and quantities. There were a few projects where lighting quantities differed between the post-inspection, invoice, engineering drawings, and/or the calculation file. Complete documentation enhances the accuracy and transparency of project savings along with ease of evaluation. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of *good*.

3.3.2 Commercial Standard Offer Program (SOP)

Program contribution to Portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
5.9%	12,474	12,474	100%	26.7%	62,724,963	62,724,963	100.0%	Good

Completed desk reviews*	On-site M&V visit
26	13

* Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Large Commercial SOP evaluation efforts focused on desk reviews and on-site M&V visits. The sample of completed desk reviews and on-site M&V visits for this program is listed above.

The EM&V team adjusted the claimed savings for nine projects. Four projects had adjustments of greater than five percent compared to the originally claimed savings. Five projects had adjustments of less than five percent compared to the originally claimed savings. CenterPoint accepted the evaluated results and matched the claimed savings to those of the evaluations for the nine projects; therefore, the final program realization rate is 100 percent for kilowatt and kilowatt-hour. Further details of the EM&V findings are provided below.

Participant ID 1435952: The energy efficiency project included interior and exterior LED retrofits at a metal cutting facility. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of one light fixture to match the DLC QPL. In addition, the lighting controls were adjusted from *daylighting multiple-step dimming* to *occupancy* based on on-site observations. This adjustment decreased peak demand (kilowatt) savings and resulted in a realization rate of 99 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 99 percent.

Participant ID 1435958: The energy efficiency project included interior and exterior LED retrofits in a distribution warehouse. During the desk review and on-site M&V visit, the EM&V team adjusted the air conditioning type from *refrigerated air* to *none* based on on-site observations. This adjustment decreased peak demand (kilowatt) savings and resulted in a realization rate of 92 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 96 percent.

Participant ID 1478168: The energy efficiency project included interior LED retrofits at a used car dealership and shop. During the desk review and on-site M&V visit, the EM&V team adjusted the wattages for a light fixture to match the DLC QPL. The air conditioning type for one building area was also adjusted from *refrigerated air* to *none* based on on-site observations. These adjustments increased peak demand (kilowatt) savings and resulted in a realization rate of 104 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 104 percent.

Participant ID 1478203: The energy efficiency project included interior and exterior LED retrofits at an auto body shop. During the desk review and on-site M&V visit, the EM&V team added additional LED tubes and replaced fluorescent lamps since the post-inspection was completed. The air conditioning type for the shop was also adjusted from *refrigerated air* to *none* based on on-site observations. These adjustments increased peak demand (kilowatt) savings and resulted in a realization rate of 122 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 119 percent.

Participant ID 1478211: The energy efficiency project included interior and exterior LED retrofits at an auto body shop. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage for one light to match the DLC QPL. Post retrofit quantities of LED tubes were also adjusted based on on-site observations. Finally, the air conditioning type for the wash bay and paint areas was adjusted from *refrigerated air* to *none* based on on-site observations. These adjustments increased peak demand (kilowatt) savings and resulted in a realization rate of 109 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 109 percent.

Participant ID 1478227: The energy efficiency project included interior and exterior LED retrofits at a commercial office and non-refrigerated warehouse. During the desk review, the EM&V team adjusted the wattage of lighting fixtures to match the DLC QPL. One lamp is adjusted from *non-qualified* to *Energy Star-qualified* based on the provided ENERGY STAR® certification. These adjustments increased peak demand (kilowatt) savings and resulted in a realization rate of 103 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 103 percent.

Participant ID 1478246: The energy efficiency project included interior and exterior LED retrofits at a retail store. During the desk review, the EM&V team adjusted the wattage for one light fixture to match the DLC QPL. This adjustment slightly increased peak demand (kilowatt) savings but resulted in a realization rate that rounded to 100 percent. The adjustments also slightly increased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Participant ID 1534553: The energy efficiency project involved the installation of LED lighting and energy-efficient air conditioning units and heat pumps on a new construction distribution center. During the desk review, the EM&V team added one additional heat pump to the inventory, adjusted HVAC units from *air conditioning units* to *heat pump* based on their equipment nameplate photos, and adjusted the cooling capacity, cooling full-load, and cooling part-load efficiencies for one unit to match its AHRI certification. In the lighting project, the building exterior zone was adjusted from three to two because satellite images showed the surrounding area to be rural with an intention to build up to light industrial. One light fixture was adjusted to be *non-qualified* because it was not identified on the DLC QPL. One light fixture wattage was adjusted to match the DLC QPL. Finally, the Cool Roofs energy efficiency measure was removed because the building is a new construction building and not a commercial retrofit. These adjustments decreased peak demand (kilowatt) savings and resulted in a realization rate of 96 percent. The adjustments also slightly decreased energy (kilowatt-hour) savings and resulted in a realization rate of 91 percent.

Participant ID 1534554: The energy efficiency project included interior and exterior LED retrofits at a retail store. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage for several lights to match the DLC QPL. These adjustments slightly decreased peak demand (kilowatt) savings but resulted in a realization rate that rounded to 100 percent. The adjustments also slightly decreased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Documentation Score

The EM&V team mostly verified key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications) for the 26 projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation at these sites included invoices, QPL qualifications, pre-install and post-install inspection notes, project savings calculators, specification sheets, and photographic documentation of existing and new equipment. A few projects had discrepancies in lighting quantities between inspection sheets and invoices. Complete documentation enhances the accuracy and transparency of project savings along with ease of evaluation. Overall, the EM&V team assigned a program documentation score of *good.*

3.3.3 Retro-Commissioning Market Transformation Program (MTP) (Medium Evaluation Priority)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
0.3%	665	0	0.0%	4.3%	10,039,396	0	0.0%	Unranked

Completed desk reviews*
0

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Retro-Commissioning MTP evaluation efforts were allocated to other high and medium priority commercial programs due to delays in the availability of project data and limited program participation.

The EM&V team did not adjust the claimed savings or review the documentation to provide realization rates or documentation scores.

3.4 DETAILED FINDINGS—RESIDENTIAL AND SMALL COMMERCIAL

3.4.1 Residential and Small Commercial Standard Offer Program (SOP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
0.1%	277	277	100.0%	0.4%	897,261	897,261	100.0%	Good

Completed desk reviews*
6

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Residential and Small Commercial SOP evaluation efforts focused on desk reviews. Six desk reviews were completed to check that measure data and documentation collected by contractors aligned correctly with that in the tracking system, and savings were calculated in accordance with the TRM.

The EM&V team adjusted the claimed savings for four projects. The four projects had adjustments of greater than five percent compared to the originally claimed savings. CenterPoint accepted the evaluated results and matched the claimed savings for the four projects with significant adjustments; therefore, the final program realization rates are 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1440557: The project included the installation of a new central air conditioner system. During the desk review, the EM&V team found that the installed unit's full load efficiency, EER, was below the required EER by the TRM. The EM&V team adjusted accordingly, resulting in a decrease in demand savings. Overall, the adjustments resulted in project-level realization rates of zero percent and 100 percent for demand and energy savings, respectively.

Participant ID 1440561: The project included the installation of a new central air conditioner system. During the desk review, the EM&V team found that the installed unit's full load efficiency, EER, was below the required EER by the TRM. The EM&V team also found that the capacity of the installed system was higher than the capacity in the tracking data used to calculate ex-ante savings. The EM&V team adjusted accordingly, resulting in a decrease in demand savings and an increase in energy savings. Overall, the adjustments resulted in project-level realization rates of zero percent and 114.2 percent for demand and energy savings, respectively.

Participant ID 1440563: The project included the installation of a new central air conditioner system. During the desk review, the EM&V team found that the installed unit's full load efficiency, EER, was below the required EER by the TRM. The EM&V team adjusted accordingly, resulting in a decrease in demand savings. Overall, the adjustments resulted in project-level realization rates of zero percent and 100 percent for demand and energy savings, respectively.

Participant ID 1482053: The project included the installation of a new central air conditioner system. During the desk review, the EM&V team found that the installed unit's full load efficiency, EER, was below the required EER by the TRM. The EM&V team also found that the capacity of the installed system was higher than the capacity in the tracking data used to calculate ex-ante savings. The EM&V team adjusted accordingly, resulting in a decrease in demand savings and an increase in energy savings. Overall, the adjustments resulted in project-level realization rates of zero percent and 120.1 percent for demand and energy savings, respectively.

Documentation Score

The EM&V team was able to verify key inputs and assumptions, including the project scope, baselines, and equipment specifications for all sampled projects that had desk reviews. Project documentation included customer agreement, photos, specification sheets, certifications, and field notes. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of *good.*

3.4.2 Hard-to-Reach Standard Offer Program (SOP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
0.3%	656	656	100.0%	0.4%	918,309	918,309	100.0%	Good

Completed desk reviews*	Completed On-site M&V
3	3

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Hard-to-Reach SOP evaluation efforts focused on desk reviews and on-site M&V. The number of sampled and completed desk reviews and site visits for this program are listed above.

Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

- For a sample of projects, desk reviews were completed to check that measure data and documentation collected by contractors aligned correctly with that in the tracking system, and savings were calculated in accordance with the TRM.

- On-site M&V was completed for a sample of projects to verify that measures remained installed and matched project documentation.

The EM&V team did not have any adjustments from the desk reviews resulting in 100 percent realization rates.

Documentation Score

The EM&V team was able to verify key inputs and assumptions, including the project scope, baselines, and equipment specifications for all sampled projects that had desk reviews. Project documentation included customer agreement, photos, and field notes. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of *good.*

3.5 DETAILED FINDINGS—LOW-INCOME

3.5.1 Targeted Low-Income Market Transformation Program (Agencies in Action)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
2.2%	4,765	4,765	100.0%	3.2%	7,626,224	7,626,224	100.0%	Fair

Completed desk reviews*	Completed on-site M&V
3	2

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Targeted Low-Income MTP evaluation efforts focused on desk reviews and on-site M&V. The number of sampled and completed desk reviews and site visits for this program are listed above.

Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

- For a sample of projects, desk reviews were completed to ensure that data and documentation collected by contractors aligned correctly with that in the tracking system, and savings were calculated per the TRM.
- On-site M&V was completed for a sample of projects to verify that measures remained installed and matched project documentation.

The EM&V team adjusted the claimed savings for all three projects. Two projects had less than five percent adjustments compared to the originally claimed savings. One project had adjustments of greater than five percent compared to the originally claimed savings. CenterPoint accepted the evaluated results and matched the claimed savings for the projects with significant adjustments; therefore, the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1484615: The project included the installation of a new central heat pump system. During the desk review, the EM&V team found that the tracked ex-ante heating efficiency, HSPF, and capacity of the installed unit did not match the HSPF and capacity found in the documentation from the AHRI certificate. The EM&V team adjusted accordingly, resulting in a decrease in energy savings. Overall, the adjustments resulted in project-level realization rates of 100 percent and 79.4 percent for demand and energy savings, respectively.

Participant ID 1483464: The project included the installation of a new central heat pump system. During the desk review, the EM&V team found that the ex-ante early retirement calculation methodology slightly differed from the EM&V team's ex-post early retirement calculation methodology. The EM&V team sums the heating and cooling savings first before calculating weighted first-year savings, while the ex-ante savings were calculated using cooling savings only then adding heating savings to the weighted cooling savings. Weighted first-year savings should include both heating and cooling savings, and the EM&V team adjusted accordingly, resulting in a slight decrease in energy savings. Overall, the adjustments resulted in project-level realization rates of 100 percent and 99.2 percent for demand and energy savings, respectively.

Participant ID 1484316: The project included the installation of a new central heat pump system. During the desk review, the EM&V team found that the ex-ante early retirement calculation methodology slightly differed from the EM&V team's ex-post early retirement calculation methodology. The EM&V team sums the heating and cooling savings first before calculating weighted first-year savings, while the ex-ante savings were calculated using cooling savings only then adding heating savings to the weighted cooling savings. Weighted first-year savings should include both heating and cooling savings, and the EM&V team adjusted accordingly, resulting in a slight decrease in energy savings. Overall, the adjustments resulted in project-level realization rates of 100 percent and 99.2 percent for demand and energy savings, respectively.

Documentation Score

The EM&V team was able to verify some key inputs and assumptions, including the project scope, baselines, and equipment specifications for some sampled projects that had desk reviews. The EM&V team could not easily match the tracking data to one project's documentation. Project documentation included customer agreement, photos, and field notes. Documentation also included low-income certification. However, the TRM requires additional documentation to claim electric resistance heating, which was not included in the documentation. The absence of electric resistance documentation could result in savings adjustments in the future. Overall, the EM&V team was satisfied with the provided project documentation and assigned a fair program documentation score.

3.6 DETAILED FINDINGS—LOAD MANAGEMENT (MEDIUM EVALUATION PRIORITY)

3.6.1 Commercial Load Management Standard Offer Program (SOP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
61.8%	130,971	130,973	100.0%	0.3%	785,823	785,823	100.0%	Good

Completed desk reviews*
N/A

*The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

The EM&V team evaluated the CenterPoint Commercial Load Management SOP by applying the TRM calculation methodology to interval meter data. The meter data was supplied in 15-minute increments. Load management events in PY2021 occurred on the following dates and times:

- June 16, 2021, from 2:00 p.m. to 5:00 p.m. (scheduled); and
- July 29, 2021, from 2:00 p.m. to 5:00 p.m. (scheduled).

The EM&V team received interval meter data and a spreadsheet summarizing the event-level savings for the 30 sponsors across 303 sites. Twenty-two sites did not participate in the first event, and 14 sites did not participate in the second event. Three sites did not have any load data associated with them as they did not participate in any event. All sponsors had at least one site that curtailed during each event.

After the EM&V team applied the High 5 of 10 baseline calculation method, it was found that the evaluated savings matched the savings CenterPoint provided for all sites. The kilowatt savings for each participating site corresponded to the average of energy reduced across both events. If a site participated in only one event, the kilowatt savings corresponded to the energy reduced during that event. The kilowatt-hour savings for each participating site and event were calculated by multiplying the kilowatt reductions by the total number of event hours. Program-level savings were calculated by adding all site-level savings.

The table above shows both the EM&V team (evaluated) and CenterPoint's (claimed) calculated kilowatt and kilowatt-hour savings. No adjustments were made to the program savings; however, a negligible difference in kilowatt and kilowatt-hour was a result of different rounding practices during calculations. Evaluated savings for the CenterPoint Large Commercial Load Management SOP are 130,973 kW and 785,825 kWh. The realization rate for both kilowatt and kilowatt-hour is 100 percent, with a documentation score of *good.*

3.6.2 Residential Load Management Standard Offer Program

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
11.4%	24,067	24,065	100.0%	0.0%	144,115	144,111	100.0%	Good

Completed desk reviews*
N/A

*The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

The EM&V team evaluated the CenterPoint Residential Load Management SOP by applying the TRM calculation methodology to interval meter data. The meter data was supplied in 15-minute increments. Demand response events in PY2021 occurred on the following dates and times:

- June 16, 2021, from 2:00 p.m. to 5:00 p.m. (scheduled); and
- July 29, 2021, from 2:00 p.m. to 5:00 p.m. (scheduled).

The EM&V team received the interval meter data and spreadsheets detailing the CenterPoint calculated baseline load, event load, and savings results for each service provider and meter. After a follow-up, CenterPoint provided documentation for meters with no meter data available during the event but were confirmed as having participated by the service provider and meters with partial meter data for the baseline days. These meters totaled 0.02 percent of the program population.

After the EM&V team applied the High 3 of 5 baseline calculation method, it was found that the evaluated kilowatt savings matched the kilowatt savings CenterPoint provided for most participating meters. Differences were a result of calculating the kilowatt savings for meters with partial or no data during the event of baseline days. The EM&V team included those meters for each service provider by applying the average savings (per the TRM, savings may still be calculated for less than two percent of meters that fail to record data sufficient to apply the High 3 of 5 calculation method). However, CenterPoint zeroed out the load for the days with partial or no meter data. The kilowatt savings for each participating meter corresponded to the average of energy reduced across both events. If a meter participated in only one event, the kilowatt savings corresponded to the energy reduced during that event.

The kilowatt-hour savings for each participating meter were calculated by multiplying the kilowatt reductions for each event by the total number of event hours. Program-level savings were calculated by adding all meter-level savings.

The table above shows both the EM&V team (evaluated) and CenterPoint's (claimed) calculated kilowatt and kilowatt-hour savings. No adjustments were made to the program savings as the difference was negligible. Evaluated savings for the CenterPoint Residential Load Management SOP are 24,065 kW and 144,111 kWh. The realization rate for both kilowatt and kilowatt-hour is 100 percent, with a documentation score of *good*.

3.7 SUMMARY OF LOW EVALUATION PRIORITY PROGRAMS

Table 11 summarizes claimed savings for CenterPoint's low evaluation priority programs in PY2021, including the programs' overall contribution to portfolio savings. *Low*-priority programs' claimed savings were verified against the final PY2021 tracking data provided to the EM&V team for the EM&V database.

Table 11. PY2021 Claimed Savings (Low Evaluation Priority Programs)

Program	Contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)
REP MTP (Commercial CoolSaver)	1.7%	3,556	3,556	100.0%	2.0%	4,725,671	4,725,671	100.0%
Commercial High Efficiency Foodservice MTP (Pilot)	0.1%	117	117	100.0%	0.3%	813,510	813,510	100.0%
Advanced Lighting Residential MTP	3.0%	6,448	6,448	100.0%	15.3%	35,955,005	35,955,005	100.0%
Smart Thermostat Program	0.0%	0	0	100.0%	1.9%	4,571,320	4,571,320	100.0%
REP MTP (Residential CoolSaver and Efficiency Connection)	0.8%	1,677	1,677	100.0%	2.7%	6,387,410	6,387,410	100.0%
Midstream MTP (HVAC and Pool Pump Distributor)	1.6%	3,485	3,485	100.0%	5.7%	13,329,650	13,329,650	100.0%
CenterPoint Energy High Efficiency Home MTP	6.4%	13,598	13,598	100.0%	15.7%	36,818,260	36,818,260	100.0%
Multi-Family MTP Market Rate	0.8%	1,775	1,775	100.0%	2.9%	6,924,488	6,924,488	100.0%
Multi-Family MTP Hard-to-Reach	0.0%	71	71	100.0%	0.2%	523,668	523,668	100.0%

4.0 EL PASO ELECTRIC COMPANY IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for El Paso Electric Company's (El Paso Electric) energy efficiency portfolio. The key findings are summarized first, followed by details for each program in the portfolio that had a *high* or *medium* evaluation priority. Finally, a list of the *low* evaluation priorities for which claimed savings were verified through the evaluation, measurement, and verification (EM&V) database is included.

4.1 KEY FINDINGS

4.1.1 Evaluated Savings

El Paso Electric's evaluated savings for program year (PY) 2021 were 27,325 in demand (kilowatt, kW) and 27,951,497 in energy (kilowatt-hour, kWh) savings. The overall kilowatt and kilowatt-hour portfolio realization rates are approximately 100 percent. El Paso Electric was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (see Table 15), supporting healthy realization rates.

Table 12 shows the claimed and evaluated demand savings for El Paso Electric's portfolio and broad customer sector and program categories.

Table 12. El Paso Electric PY2021 Claimed and Evaluated Demand Savings

Level of analysis	Percentage portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Precision at 90% confidence
Total portfolio	**100.0%**	**27,325**	**27,325**	**100.0%**	**N/A**
Commercial	13.7%	3,753	3,753	100.0%	N/A
Residential	9.7%	2,655	2,655	100.0%	N/A
Load management*	74.6%	20,388	20,388	100.0%	N/A
Pilot	1.9%	529	529	100.0%	N/A

*The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

Table 13 shows the claimed and evaluated energy savings for El Paso Electric's portfolio and broad customer sector and program categories for PY2021.

Table 13. El Paso Electric PY2021 Claimed and Evaluated Energy Savings

Level of analysis	Percentage portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Precision at 90% confidence
Total portfolio	**100.0%**	**27,951,497**	**27,951,497**	**100.0%**	**N/A**
Commercial	63.4%	17,717,514	17,717,514	100.0%	N/A
Residential	19.3%	5,384,206	5,384,206	100.0%	N/A
Load management*	9.5%	2,645,103	2,645,103	100.0%	N/A
Pilot	7.9%	2,204,674	2,204,674	100.0%	N/A

* The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

Program-level realization rates are discussed in the detailed findings subsections. However, it is important to note that these results should only be viewed qualitatively due to the small sample sizes at the utility program level.

In program-level realization rates, we have also included a qualitative rating of good, fair, and limited associated with the level of program documentation received from the utility. El Paso Electric received *good* documentation scores for all evaluated programs, except the Small Commercial Solutions Market Transformation Program (MTP) and the Residential Load Management Program, which received a *fair* documentation score.

4.1.2 Cost-Effectiveness Results

El Paso Electric's overall portfolio had a cost-effectiveness score of 3.9.

The more cost-effective programs were the Large C&I Solutions MTP and the Marketplace Pilot MTP (residential and commercial); the less cost-effective programs were the Residential Load Management MTP and Commercial Load Management SOP. All of El Paso Electric's programs were cost-effective in 2021.

The lifetime cost of evaluated savings was $0.017 per kWh and $13.97 per kW.

Table 14. El Paso Electric Cost-Effectiveness Results

Level of analysis	Claimed savings results	Evaluated savings results	Net savings results
Total portfolio	**3.85**	**3.85**	**3.38**
Commercial	**5.73**	**5.73**	**5.11**
Small Commercial Solutions MTP	4.63	4.63	4.40
Large C&I Solutions MTP	7.39	7.39	6.48
Texas SCORE MTP	3.48	3.48	3.08
Residential	**2.68**	**2.68**	**2.48**

Level of analysis	Claimed savings results	Evaluated savings results	Net savings results
Residential Solutions MTP	3.79	3.79	3.42
LivingWise® MTP	1.94	1.94	1.55
Texas Appliance Recycling MTP	1.79	1.79	1.79
Hard-to-Reach Solutions MTP	2.49	2.49	2.49
Load management	**1.21**	**1.21**	**1.21**
Residential Load Management MTP	1.06	1.06	1.06
Commercial Load Management SOP	1.40	1.40	1.40
Pilot	**9.83**	**9.83**	**4.92**
Residential Marketplace Pilot MTP	9.08	9.08	4.54
Commercial Marketplace Pilot MTP	21.99	21.99	10.99

4.2 EVALUATED SAVINGS DIFFERENCES

As discussed above, utilities are provided the opportunity to adjust savings at the project level based on interim EM&V findings. Table 15 summarizes savings differences identified by the EM&V team, which El Paso Electric also used to adjust their claimed savings. The EM&V team requests that utilities make adjustments to projects when evaluated, and claimed savings differ by more than five percent. El Paso Electric adjusted claimed savings for all projects with any differences found by the EM&V team and will include these adjustments in their May 1 filing.

Table 15. Evaluated and Claimed Savings Adjustments by Program

Program	EM&V demand claimed savings adjustments (kW)	EM&V energy claimed savings adjustments (kWh)
Large C&I Solutions MTP	1.80	3,830.00
Residential Load Management MTP	-704.10	-7,047.00
Small Commercial Solutions MTP	-0.50	26,265.00
Texas SCORE MTP	1.10	7,442.00
Total	**-701.70**	**30,490.00**

4.3 DETAILED FINDINGS—COMMERCIAL

4.3.1 Large Commercial and Industrial (C&I) Solutions Market Transformation Program (MTP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate(kW)	Program contribution to portfolio savings (kWh)	Claimedenergy savings(kWh)	Evaluated energy savings (kWh)	Realizationrate (kWh)	Program documentation score
7.5%	2,043	2,043	100.0%	42.8%	11,952,274	11,952,274	100.0%	Good

Completed desk reviews*	On-site M&V visit
6	3

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Large C&I Solutions MTP evaluation efforts focused on desk reviews and on-site M&V visits. This program's sample of completed desk reviews and on-site M&V visits is listed above.

The EM&V team adjusted the claimed savings for three projects. Two projects had less than five percent adjustments compared to the originally claimed savings, and one was larger than five percent. El Paso Electric accepted the evaluated results and matched the claimed savings to those of the evaluations for the projects with significant adjustments; therefore, the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1475262: The energy efficiency project included interior and exterior LED lighting retrofits and HVAC upgrades at a commercial grocery store. During the desk review, the EM&V team made adjustments to the wattages of several lights to match the DesignLights Consortium (DLC) Qualified Products List (QPL). These adjustments increased peak demand (kilowatt) savings and resulted in a realization rate of 103 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 102 percent.

Participant ID 1477571: The energy efficiency project included interior LED lighting retrofits at a retail store. During the desk review and on-site M&V visit, the EM&V adjusted the quantity of one light. The adjustment increased peak demand (kilowatt) savings and resulted in a realization rate of 101 percent. The adjustment also increased energy (kilowatt-hour) savings and resulted in a realization rate of 101 percent.

Participant ID 1485286: The energy efficiency project included HVAC upgrades at a department store. During the desk review and on-site M&V visit, the EM&V adjusted the savings to match the amount claimed on the post-inspection calculator, which was different than the claimed energy savings. The adjustments decreased energy (kilowatt-hour) savings and resulted in a realization rate of 87 percent. There was no adjustment to the peak demand, and the realization rate is 100 percent.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity; equipment capacity; QPL qualifications; Air Conditioning, Heating, and Refrigeration Institute (AHRI) certifications) for the six projects that had desk reviews because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications or AHRI certifications, pre-inspection and post-inspection notes, project savings calculators, and photographic documentation of existing and new equipment, which are significant efforts by the utility to verify equipment conditions and quantities. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of *good*.

4.3.2 Texas SCORE Market Transformation Program (MTP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate(kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
3.6%	982	982	100.0%	10.0%	2,810,405	2,810,405	100.0%	Good

Completed desk reviews*	On-site M&V visit
4	2

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Texas SCORE MTP evaluation efforts focused on desk reviews and on-site M&V visits. This program's sample of completed desk reviews and on-site M&V visits is listed above.

The EM&V team adjusted the claimed savings for two projects. Both projects had less than five percent adjustments compared to the originally claimed savings. El Paso Electric accepted the evaluated results and matched the claimed savings to those of the evaluations for the projects with significant adjustments; therefore, the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1477669: The energy efficiency project included HVAC tune-ups for a school district. During the desk review, the EM&V adjusted the cooling capacity to the nominal capacity to the capacity based on AHRI conditions. This adjustment increased peak demand (kilowatt) savings and resulted in a realization rate of 101 percent. This adjustment also increased energy (kilowatt-hour) savings and resulted in a realization rate of 101 percent.

Participant ID 1478082: The energy efficiency project included interior LED lighting retrofits at a university administrative building. During the desk review and on-site M&V visit, the EM&V team made adjustments to the wattages of several lights to match the DLC QPL. These adjustments increased peak demand (kilowatt) savings and resulted in a realization rate of 103 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 102 percent.

Documentation Score

The EM&V team verified key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications) for the four projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation at these sites included invoices, QPL qualifications, pre-install and post-install inspection notes, project savings calculators, and photographic documentation of existing and new equipment. Complete documentation enhances the accuracy and transparency of project savings along with ease of evaluation. Overall, the EM&V team assigned a program documentation score of *good*.

4.3.3 Small Commercial Solutions Market Transformation Program (MTP) (Medium Evaluation Priority)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realizationrate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings(kWh)	Evaluated energy savings(kWh)	Realizationrate (kWh)	Program documentation score
2.7%	728	728	100.0%	10.6%	2,954,835	2,954,835	100.0%	Fair

Completed desk reviews*	On-site M&V visit
8	4

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Small Commercial Solutions MTP evaluation efforts focused on desk reviews and on-site M&V visits. This program's sample of completed desk reviews and on-site M&V visits is listed above.

The EM&V team adjusted the claimed savings for all eight projects. Two projects had adjustments of greater than five percent compared to the originally claimed savings, and the remaining six had adjustments of less than five percent. El Paso Electric accepted the evaluated results and matched the claimed savings for the projects with significant adjustments; therefore, the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1473918: The energy efficiency project included interior LED lighting retrofits at a religious facility. During the desk review, the EM&V team adjusted the wattage of one light to match the DLC QPL. This adjustment increased peak demand (kilowatt) savings and resulted in a realization rate of 101 percent. The adjustments also increased energy (kilowatt-hour) savings and resulted in a realization rate of 102 percent.

Participant ID 1474710: The energy efficiency project included interior LED lighting retrofits at a strip mall. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of a few lights to match the DLC and ENERGY STAR® QPLs. These adjustments increased energy (kilowatt-hour) savings and resulted in a realization rate of 101 percent.

Participant ID 1484768: The energy efficiency project included exterior LED lighting retrofits at a commercial parking lot. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of one light to match the DLC QPL. This adjustment increased peak demand (kilowatt) savings but resulted in a realization rate that rounded to 100 percent. The adjustments also increased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Participant ID 1484769: The energy efficiency project included exterior LED lighting retrofits at an office. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of one light to match the DLC QPL. This adjustment increased peak demand (kilowatt) savings but resulted in a realization rate that rounded to 100 percent. The adjustments also increased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Participant ID 1485250: The energy efficiency project included interior LED lighting retrofits at a warehouse. During the desk review, the EM&V team corrected a data entry error in the tracking system. This adjustment also increased energy (kilowatt-hour) savings and resulted in a realization rate of 504 percent. The peak demand did not change, and the realization rate is 100 percent.

Participant ID 1499215: The energy efficiency project included interior and exterior LED lighting retrofits at an outpatient clinic. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of multiple lights to match the DLC QPL. One light was also disqualified because the model number was not located in the DLC QPL, and the invoice was not itemized to determine if this was an abbreviated listing of the model number. These adjustments decreased peak demand (kilowatt) savings and resulted in a realization rate of 97 percent. The adjustments also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 97 percent.

Participant ID 1499256: The energy efficiency project included the installation of air infiltration measures at a multifamily complex office. During the desk review, the EM&V team disqualified the door sweep portion of the weatherization because it did not meet the high-efficiency condition specified by the TRM. This adjustment decreased peak demand (kilowatt) savings and resulted in a realization rate of 73 percent. This adjustment also decreased energy (kilowatt-hour) savings and resulted in a realization rate of 73 percent.

Participant ID 1499554: The energy efficiency project included the installation of LED lighting at a new construction commercial warehouse/distribution center. During the desk review, the EM&V team updated lighting quantities to match the post-inspection form. In addition, the EM&V team removed one light because it was decorative lighting that does not count against new construction lighting density. This adjustment decreased peak demand (kilowatt) savings but resulted in a realization rate that rounded to 100 percent. This adjustment also decreased energy (kilowatt-hour) savings but resulted in a realization rate that rounded to 100 percent.

Documentation Score

The EM&V team partially verified key inputs and assumptions for the eight projects that had desk reviews. Project documentation included final calculation files, inspection photos, inspection forms, specification sheets, invoices, and QPL certifications. However, several projects had missing documentation, including post-inspection notes, calculator files, and invoices that were not itemized, making it difficult to verify quantities, specific parameters (e.g., air conditioning type), or proof of purchase. Complete documentation enhances the accuracy and transparency of project savings along with ease of evaluation. Overall, the EM&V team assigned a program documentation score of *fair*.

4.4 DETAILED FINDINGS—RESIDENTIAL

4.4.1 Residential Solutions Market Transformation Program (MTP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
4.1%	1,115	1,115	100.0%	6.9%	1,932,842	1,932,842	100.0%	Good

Completed desk reviews*
4

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Residential MTP evaluation efforts focused on desk reviews. The number of sampled and completed desk reviews for this program is listed above. Four desk reviews were completed to check that measure data and documentation collected by contractors aligned correctly with that in the tracking system, and savings were calculated in accordance with the TRM.

The EM&V team did not have any adjustments from the desk reviews resulting in 100 percent realization rates.

Documentation Score

The EM&V team verified most key inputs and assumptions, including the project scope, baselines, and equipment specifications for all sampled projects, with desk reviews. Project documentation included customer agreements, invoices, and certifications. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of *good.*

4.4.2 Hard-to-Reach Solutions Market Transformation Program (MTP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
4.1%	1,117	1,117	100.0%	5.6%	1,562,495	1,562,495	100.0%	Good

Completed desk reviews*	Completed on-site M&V
4	2

*Confidence intervals are not reported at the utility program level as these results should only be viewed qualitatively due to the small sample sizes.

The PY2021 Hard-to-Reach MTP evaluation efforts focused on desk reviews and on-site M&V. The sample of completed desk reviews and on-site M&V projects for this program are listed above.

The EM&V team did not have any adjustments from the desk reviews or the on-site M&V resulting in 100 percent realization rates.

Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

- For a sample of projects, desk reviews were completed to ensure that data and documentation collected by contractors aligned correctly with that in the tracking system, and savings were calculated per the TRM.
- On-site M&V was completed for a sample of projects to verify that measures remained installed and matched project documentation.

Documentation Score

The EM&V team verified most key inputs and assumptions, including the project scope, baselines, and equipment specifications for all sampled projects with desk reviews. Project documentation included customer agreements, invoices, income eligibility forms, and certifications. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of *good.*

4.5 DETAILED FINDINGS—LOAD MANAGEMENT (MEDIUM EVALUATION PRIORITY)

4.5.1 Commercial Load Management Standard Offer Program (SOP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
45.2%	12,344	12,344	100.0%	0.0%	12,344	12,344	100.0%	Good

Completed desk reviews*
N/A

*The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

The EM&V team evaluated the El Paso Electric Commercial Load Management SOP by applying the technical reference manual (TRM) calculation methodology to interval meter data. The meter data was supplied in 30-minute increments. In PY2021, only one load management event occurred on June 11, 2021, from 4:00 p.m. to 5:00 p.m. (scheduled).

The EM&V team received the interval meter data and a spreadsheet that summarized the event-level savings for the nine sponsors across 26 sites. All sites had load data associated with them for the event.

After the EM&V team applied the High 5 of 10 baseline calculation method, it was found that the evaluated savings matched El Paso Electric's savings for all sites. The kilowatt savings for each participating site corresponded to the energy reduced during the scheduled event. The kilowatt-hour savings for each participating site were calculated by multiplying the kilowatt reductions by the total number of event hours. Program-level savings were calculated by adding all site-level savings.

The table above shows both the EM&V team (evaluated) and El Paso Electric's (claimed) calculated kilowatt and kilowatt-hour savings. No adjustment was made to the kilowatt and kilowatt-hour savings. For the kilowatt savings, the EM&V team matched the rounding practice utilized by El Paso Electric since it is also used for invoicing. For the kilowatt-hour savings, El Paso Electric and the EM&V team followed the practice recommended in the TRM. Evaluated savings for the El Paso Electric Load Management SOP are 12,344 kW and kWh. The realization rate for both kilowatt and kilowatt-hour is 100 percent, with a documentation score of *good*.

4.5.2 Residential Load Management Market Transformation Program (MTP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
29.4%	8,044	8,044	100.0%	9.4%	2,632,759	2,632,759	100.0%	Fair

Completed desk reviews*
N/A

*The review for the load management program included a census review of equations and interval meter data to estimate the baseline usage and the resulting level of load curtailment achieved for each event for all participants.

The EM&V team evaluated the El Paso Electric Residential Load Management MTP by applying the deemed savings value from the TRM. Load management events in PY2021 occurred on the following dates and times:

- June 11, 2021, from 4:00 p.m. to 5:00 p.m. (unscheduled),
- August 10, 2021, from 3:00 p.m. to 5:00 p.m. (unscheduled),
- August 23, 2021, from 3:00 p.m. to 5:00 p.m. (unscheduled),
- August 25, 2021, from 3:00 p.m. to 5:00 p.m. (unscheduled), and
- September 14, 2021, from 3:30 p.m. to 5:30 p.m. (unscheduled).

The EM&V team received a list of participants in the program for each device type and event, the PY2021 list of devices purchased through the Marketplace with incentives received, and a savings summary report. After a first review of the files, the EM&V team met with El Paso Electric to understand the approach used to determine the number of participating devices for each device type and event. The kilowatt savings for each event was calculated by multiplying the deemed savings value from the TRM by the number of participating devices. The kilowatt-hour savings for each event were calculated by multiplying the kilowatt reductions by the total number of event hours. Program-level savings were calculated by adding all event-level savings. After a second review of the files, the EM&V team adjusted the number of participating devices, decreasing the kilowatt and kilowatt-hour savings.

In addition to savings from the load management events, El Paso Electric claimed savings from new thermostat devices purchased through their Marketplace website that enrolled in the load management program at the time of the purchase. Only thermostat devices that enrolled in the program before September 30 were included in the savings calculation. No adjustment was made to this portion of the program savings.

The table above shows both the EM&V team (evaluated) and El Paso Electric's (claimed) calculated kilowatt and kilowatt-hour savings. Evaluated savings for the El Paso Electric Residential Load Management program are 8,044 kW and 2,632,759 kWh, with realization rates of 92.0 percent kilowatt and 99.7 percent kilowatt-hour. El Paso Electric accepted the evaluated results and matched the claimed savings to those of the evaluated savings; therefore, the final program realization rate for both kilowatt and kilowatt-hour is 100 percent. Overall, the EM&V team assigned a program documentation score of *fair*. The EM&V team understands that the program is still in its early stages and has undergone an implementer change in 2020. The